

WEBSTER UNIVERSITY ISB

Operations and Maintenance Manual

Factory Order #: 37999262

04/28/2017

Distributor:
GRAYBAR ELECTRIC CO 5818836

Contractor/Installer:
GUARANTEE ELECTRIC

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Life Is On



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SWBD - US-1

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METAL-ENCLOSED SWITCHGEAR

Metal-Enclosed Switchgear - Instruction Bulletin

Type HVL Load Interrupter Switch Instruction Bulletin

POWER-DRY TRANSFORMER

Power-Dry II Dry Type Transformers Instruction Bulletin

Model 98A Digital Temperature Controller - Instruction Bulletin

SWITCHBOARD

Power-Style QED-2 Switchboards Instruction Bulletin

NEMA - Instructions for Distribution Switchboards Rated 600 Volts or Less

SurgeLogic Internal Modular Assembly (IMA) Surge Protective Device (SPD) - Instruction Bulletin

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Masterpact NW Low-Voltage Power/Insulated Case Circuit Breaker Installation

Masterpact NW Low-Voltage Power/Insulated Case Circuit Breaker User Guide

Masterpact NT and NW Circuit Breakers Maintenance and Field Testing Guide

Masterpact NW Circuit Breakers Undervoltage Trip (MN), Shunt Trips (MX1 and MX2), and Shunt Clo

Primary High Current Injection Field Test Procedure for MDGF Systems - Instruction Bulletin

Micrologic 2.0A, 3.0A, 5.0A, & 6.0A Trip Units - Instruction Bulletin

Micrologic 2.0, 3.0 & 5.0 Trip Units - Instruction Bulletin

INTEGRATED POWER CENTERS

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SB1

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1EH1 - 1EL1

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LITERATURE

Integrated Power Center 2 (IPC2) - Instruction Bulletin

Integrated Power Center 2 (IPC2) - Application Guide Data Bulletin

I-Line Circuit Breaker Power Distribution Panelboards Information Manual

NF/NFOM Panelboards Information Manual

NQ/NQM Panelboards and QONQ Load Centers Information Manual

NEMA- Instructions for Panelboards Rated 600 Volts or Less

PK27GTA Equipment Grounding Bar - Instruction Bulletin

Dry-Type Transformers 1000 Volts and Below Instruction Bulletin

PANELBOARDS

LITERATURE

I-Line Circuit Breaker Power Distribution Panelboards - Information Manual

NF/NFOM Panelboards - Information Manual

NQ/NQM Panelboards & QONQ Load Centers - Information Manual

Panelboards Rated 600 Volts or Less - NEMA General Instructions

SurgeLogic I-Line Plug-on Surge Protective Device (SPD) - Instruction Bulletin

IMA Surge Protective Device - Instruction Bulletin

SurgeLogic NQ SurgeLoc Brick Assembly Surge Protective Devices (SPDs) - Instructi

CONTACTORS AND STARTERS

LITERATURE

Types SB & SC Combo Starters - Service Bulletin

8502/8536 Type SC, 2 & 3 Pole AC Magnetic Contactors & Starters Instruction Bulletin

Type M & T Series A Manual Starters - Instruction Bulletin

SAFETY SWITCHES

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Safety Switches 30-1200A - Instruction Bulletin

CIRCUIT BREAKER

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EDB, EGB, & EJB Circuit Breakers - Instruction Bulletin

H & J Frame Circuit Breakers AL & CU Lug Kits - Instruction Bulletin

POWER MONITORING AND CONTROL

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PowerLogic Multi-Point Communications Terminator (MCTAS-485 & MCT-485) - Insta



by Schneider Electric

Job Name: WEBSTER UNIVERSITY ISB
Job Location: WEBSTER GROVES, MO

Square D Quotation #: 37999262

Quotation Revision #:

Sales Contact: LNP

Sales Contact Location: 400

Purchaser: GRAYBAR ELECT CO 5818836
Purchaser PO #: 4702257122

Customer: GUARANTEE ELECTRIC

Customer PO #:

User: WEBSTER UNIVERSITY
User Location:

Architect: WILLIAM TAO & ASSOC INC

Cons. Engineer:

Drawing Status: RECORD

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SQUARE D FACTORY ORDER NUMBER: 37999262-001

<u>Equipment Designation</u>	<u>Equipment Type</u>	<u>Drawing Type</u>	<u>Drawing Number</u>	<u>Page</u>	<u>Revision Level</u>
US-1	METAL ENCLOSED SWITCHGEAR	ELECTRICAL BILL OF MATERIAL	T37999262-001-BM	1	-
		ENGRAVED NAMEPLATES	T37999262-001-EP	1	-
		ELEVATION	F37999262-001-01	1	-
		TOP VIEW/FLOOR PLAN	F37999262-001-02	1	-
		GENERAL NOTES	F37999262-001-03	1	-
		DETAIL VIEW	F37999262-001-51	1	-
		ONE LINE DIAGRAM	O37999262-001-01	1	-
		CONTROL SCHEMATIC	C37999262-001-01	1	-
		RATING NAMEPLATE	N37999262-001-01	1	-

Summary Bill of Material

Printed 10/14/16 3:38:02 PM by SESA245059

Find #	Part Number	Qty Per	Total Qty	Function	Supplier	Description	Rev
001	44036-325-50	1.00	1.00	89	SQUARE D COMPANY	SWITCH, TYPE HVL, 15KV, 600A, 40KA, UPRIGHT, GLASS POLYESTER, SILVER PLATED.	
002	55GFMSJD200E	3.00	3.00	FU	SQUARE D COMPANY	FUSE, CURRENT LIMITING, 200E, 5.5KV, 65KAIC, 17.4" CLIP SPACING, SINGLE BARREL, TYPE DIN/E.	
003	44038-249-50	1.00	1.00	89/a,b	SQUARE D COMPANY	10 POLE AUXILIARY CONTACT ASSEMBLY (5a/5b.)	
004	DLA350	2.00	2.00	LUG	CONNECTOR MFG INC.	LUG, SET SCREW, ALUMINUM, TYPE DLA, (2) #6-350 MCM AL/CU, 1 HOLE (1/2") PAD.	
005	YA26A3	3.00	3.00	LUG	BURNDY	LUG, CRIMP, #1-2/0 AL/CU, (2) 1/2" HOLES, OLIVE.	
006	44036-412-02	1.00	1.00	UL LABEL	SQUARE D COMPANY	UL LABEL (U.S. & CANADA).	

Job Name:	WEBSTER UNIVERSITY ISB			Engineer:	IVK
Order Qty:	1	Rev:	0	Order:	017-37999262-001-00-01
Status:	RA	Catalog No:	Metal Enclosed Switchgear	Doc Nbr:	T37999262-001-BM

ENGRAVED NAMEPLATES DATA SHEET

Doc No. 10277
Rev Date 2/15/13

AE: IVK

PRODUCT CODE (MC, ME, MCC) ME

TYPE (TY)	FIELD/ LETTERS		SIZE (S)	NP HEIGHT	NP WIDTH	CHAR HEIGHT	MAX. LINES	MAX. CHAR/LINE
WB	WHITE/BLACK		A	0.75"	4.6"	3/16"	2	26
BW	BLACK/WHITE		B	0.75"	2.0"	1/8"	3	11
RW	RED/WHITE		C	9001 DEVICE		1/8"	3	14
			D	2.0"	6.0"	5/16"	4	19
			E	1.0"	2.5"	1/8"	4	16
			F	0.75"	2.0"	1/8"	3	11

CODES A-E ARE FOR DOOR MOUNTED DEVICES.

CODE F APPLIES TO INTERNALLY MOUNTED DEVICES.

SPECIAL NAMEPLATES ARE CODED SA, SB, SC, ... WITH ASSOCIATED DETAILS NOTED.

SPECIAL NAMEPLATE WITH 2.5" HEIGHT AND GREATER SHALL BE PROVIDED WITH FOUR 0.125" MOUNTING HOLES. 0.25" FROM EACH END (TOP, BOTTOM, LEFT OR RIGHT OF THE EDGE) TO THE CENTER OF THE MOUNTING HOLES.

NP #	TYPE	SIZE	QTY	TEXT CONTENT
1	WB	D	1	US-1

ENGR: IVK

DATE: April 28, 2017

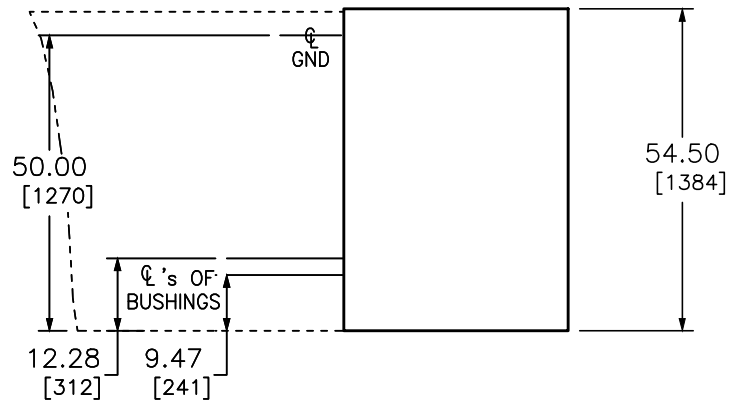
PG 1 OF 1

STATUS: RECORD

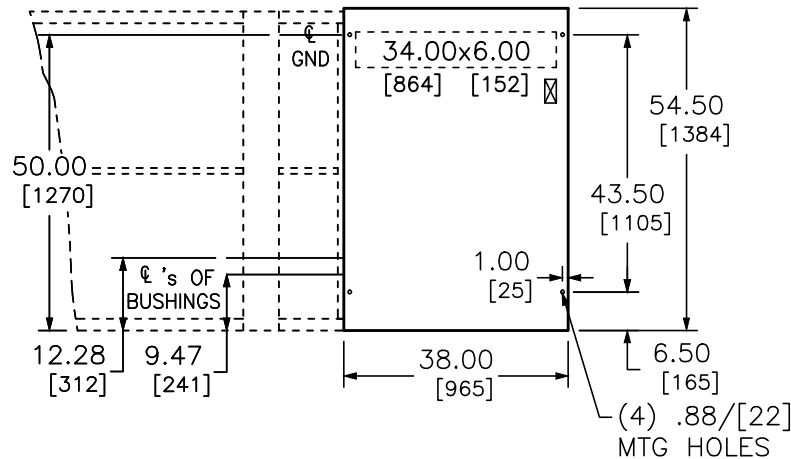
REV: -

DOC #: T37999262-001-EP

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--	-	----	--	--/--/--
-	----	--	--/--/--	-	----	--	--/--/--	-	----	--	--/--/--



TOP VIEW



FLOOR PLAN

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	TOP VIEW/FLOOR PLAN
ENGR:	VINAY KUMAR	Schneider Electric	
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG#	F37999262-001-02
		PG 1	OF 1
		REV	-

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--	-	----	--	--/--/--
-	----	--	--/--/--	-	----	--	--/--/--	-	----	--	--/--/--

GENERAL NOTES:

PRODUCT DESCRIPTION AND RATINGS:

POWER SYSTEM DATA:

4160 VOLTS, 3 PHASE, 3 WIRE WYE SOLIDLY GROUNDED

5.0 kV MAXIMUM VOLTAGE RATING

60 kV BIL, 60 HERTZ FREQUENCY

CONTROL POWER NOT REQUIRED

BUS SYSTEM DATA:

600A COPPER, SILVER PLATED MAIN BUS

GLASS POLYESTER BUS SUPPORTS

SILVER PLATED COPPER GROUND BUS

40 kA Asym (25 kA Sym) MAIN BUS BRACING

ENCLOSURE DATA:

TYPE 1 INDOOR CONSTRUCTION

CATEGORY "B" ENCLOSURE

ANSI #61 FINISH

FRONT AND REAR ACCESS IS AVAILABLE

PADLOCK PROVISIONS

HANDLING:

SWITCHGEAR SECTIONS ARE FURNISHED WITH LIFTING ANGLES AND ARE SHIPPED ON SKIDS.

ROLLERS OR FORKLIFT SHALL ONLY BE USED WITH SKID IN PLACE.

LINEUP WEIGHT 1300.00 LBS/589.68 KG

Shipping Split – 1, 1300.00 LBS/589.68 KG

CODE STANDARDS:

THIS EQUIPMENT BEARS THE UL LISTING MARK FOR THE UNITED STATES.

PRODUCT INFORMATION:

#12 AWG, TYPE SIS CURRENT CIRCUIT WIRING

AIR COOLED TRANSFORMER CLARIFICATION:

PLEASE NOTE: ALL TRANSFORMER CONNECTION

QUOTATIONS ARE BASED ON "AIR COOLED" KVA

RATINGS. "FORCED AIR" RATINGS ARE NOT IN THE

PRODUCT SELECTOR. "FORCED AIR" RATINGS MAY

REQUIRE DIFFERENT FUSE/ENCLOSURE.

CONTACT MVQG OR ORDER ENGINEERING

FOR ADDITIONAL INFORMATION.

INSTRUCTION BULLETIN:

MANUAL HVL INST. MANUAL

OPTIONS/ACCESSORIES:

LIST OF MISC. ACCESSORIES:

1 SET OF CERTIFIED TEST REPORTS

2a/2b AUXILIARY CONTACTS WIRED OUT TO CUSTOMER TERMINAL BLOCK IN Section 1

LIST OF MISC. STRUCTURE OPTIONS:

SEISMIC QUALIFIED.

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	GENERAL NOTES
ENGR:	VINAY KUMAR	UL LISTED	
DATE:	OCTOBER 14, 2016	by Schneider Electric	
DRAWING STATUS:	RECORD	DWG# F37999262–001–03	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE
--	----	--	---/---/---

CONTROL CONDUIT AREA, 2.00 x 4.00 [51] [102]

POWER CABLE CONDUIT AREA 2.00 [51]

4.00 [102]

54.50 [1384]

**34.00x6.00 [864] [152]

*34.00x12.00 [864] [305]

* DENOTES BOTH ENTRANCE AND EXIT IN SAME LOCATION.

** DENOTES SINGLE ENTRANCE OR EXIT.

CONTROL CONDUIT AREA, 2.00 x 4.00 [51] [102]

POWER CABLE CONDUIT AREA 2.00 [51]

4.00 [102]

54.50 [1384]

43.50 [1105]

1.00 [25]

6.50 [165]

38.00 [965]

(4) .88/[22] MTG HOLES

MOUNTING DETAILS

SEE ANCHOR ASSEMBLY

ANCHOR ASSEMBLY

5/8 DIA STEEL BELLEVILLE WASHER
WASHER MUST BE FACED UP
FACTORY TESTED ASSEMBLY - TO
MAINTAIN SEISMIC QUALIFICATION
DO NOT SUBSTITUTE

5/8-11 UNC SAE GRADE 5
ANCHOR FASTENER
(SUPPLIED BY CUSTOMER)

EQUIPMENT BASE

7/8 DIA HOLE

CROWN

TOP

SITE PREPARATION – SWITCHGEAR INSTALLATION

GOOD SITE PREPARATION IS NECESSARY TO ELIMINATE COSTLY, TIME-CONSUMING INSTALLATION PROBLEMS AND ENSURE PROPER SWITCHGEAR OPERATION. COMPARE THE SITE PLANS AND SPECIFICATIONS WITH THE SWITCHGEAR DRAWINGS TO BE SURE THERE ARE NO DISCREPANCIES. CHECK THE SITE TO ENSURE THAT THE EQUIPMENT WILL FIT PROPERLY.

THE FLOOR SHOULD BE FLAT AND LEVEL WITHIN $\frac{1}{16}$ INCH PER FOOT, OR A MAXIMUM OF $\frac{1}{4}$ INCH WITHIN THE AREA OF THE SWITCHGEAR, TO PREVENT DISTORTION OF THE ENCLOSURES. ALLOW AISLE SPACE AT THE FRONT, BACK, AND ENDS OF THE SWITCHGEAR TO PERMIT ACCESS FOR EQUIPMENT MAINTENANCE; USUALLY A MINIMUM OF FIVE FEET IS NEEDED ON ALL SIDES.

PROVIDE AREA VENTILATION AT ALL TIMES TO MAINTAIN THE AMBIENT TEMPERATURE AROUND THE EQUIPMENT BETWEEN -30°C AND $+40^{\circ}\text{C}$.

ADEQUATE LIGHTING AND CONVENIENCE OUTLETS SHOULD BE AVAILABLE NEAR THE SWITCHGEAR. ROUTE SEWER, WATER, AND STEAM LINES AWAY FROM THE EQUIPMENT. PROVIDE FLOOR DRAINS TO PREVENT WATER BUILDUP.

REVIEW THE ASSEMBLY DRAWINGS TO ENSURE THAT THE SWITCHGEAR SECTIONS WILL BE ASSEMBLED IN THE CORRECT ORDER. IF THE SWITCHGEAR WILL CONNECT TO AN EXISTING LINEUP, MOUNT THE CONNECTING SECTIONS FIRST.

MOUNT THE VARIOUS SHIPPING SECTIONS ON THE SAME PLANE AND LEVEL THEM TO ENSURE PROPER CONNECTION. AFTER LEVELING EACH SECTION, BOLT IT TO THE PREVIOUSLY INSTALLED SWITCHGEAR.

EACH SECTION INCLUDES THE NECESSARY MEANS FOR ANCHORING IT TO THE FLOOR. FASTEN INDOOR UNITS TO THE FLOOR USING THE HOLES LOCATED IN THE BOTTOM FLANGES OF THE ENCLOSURE. FASTEN OUTDOOR ENCLOSURES TO THE FOUNDATION USING THE HOLES LOCATED IN THE BOTTOM CROSS CHANNELS.

REMOVE THE LIFTING ANGLES FROM THE SIDE OF THE BASE AND STORE. TO BLOCK ENTRY OF WATER, EXTRANEIOUS OBJECTS, OR WILDLIFE, REPLACE HARDWARE IN THE HOLES WHERE THE LIFTING ANGLES WERE REMOVED. THE BUS CONNECTORS FOR THE SHIPPING SPLITS ARE INCLUDED WITH THE SWITCHGEAR.

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	DETAIL VIEW
ENGR:	VINAY KUMAR	Schneider Electric	
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG#	F37999262-001-51

PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	-	----	---	---/---/---
-	-----	--	---/---/---	-	-----	---	---/---/---

HVL	
LOAD CURRENT INTERRUPTER SWITCH	
FACTORY ORDER NO.	0
SWITCH PART NO.	44036-325-50
MANUFACTURE DATE	
RATED MAXIMUM VOLTAGE	kV 5.0
IMPULSE WITHSTAND (BIL)	kV 60
NORM. FREQ. WITHSTAND	kV 19
FREQUENCY	HZ 60
CONTINUOUS CURRENT	A SYM 600
LOAD INTERRUPTING CURRENT	A SYM 600
MOMENTARY CURRENT	KA ASYM 40
SHORT TIME - CURRENT	KA SYM 25
- TIME	SEC 2
FAULT CLOSING CURRENT	KA ASYM 40
FUSE/RATING	SQ D 200E
FUSE CATALOG NO.	55GFMSJD200E
INTEGRATED SWITCH & FUSE SHORT CIRCUIT CURRENT	KA SYM 65
METAL ENCLOSED SWITCHGEAR	
MAIN BUS AMPACITY	A 600
MAIN BUS BRACING	KA ASYM 40
 SQUARE D COMPANY SMYRNA, TN USA 44036-437-01	

Section 1

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1			
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR			
DRAWN BY:	CAD	DRAWING TYPE:	RATING NAMEPLATE			
ENGR:	VINAY KUMAR					
DATE:	OCTOBER 14, 2016					
DRAWING STATUS:	RECORD	DWG#	N37999262-001-01	PG 1	OF 1	REV -



JOB NAME: WEBSTER UNIVERSITY ISB
JOB LOCATION: WEBSTER GROVES, MO

PURCHASER: GRAYBAR ELECT CO 5818836
PURCHASER PO #:

USER: WEBSTER UNIVERSITY
USER LOCATION:

DRAWING STATUS: RECORD

SQUARE D QUOTATION NUMBER: 37999262
QUOTATION REVISION #:
SALES CONTACT: LNP
SALES CONTACT LOCATION: 400

CUSTOMER: GUARANTEE ELECTRIC
CUSTOMER PO #:

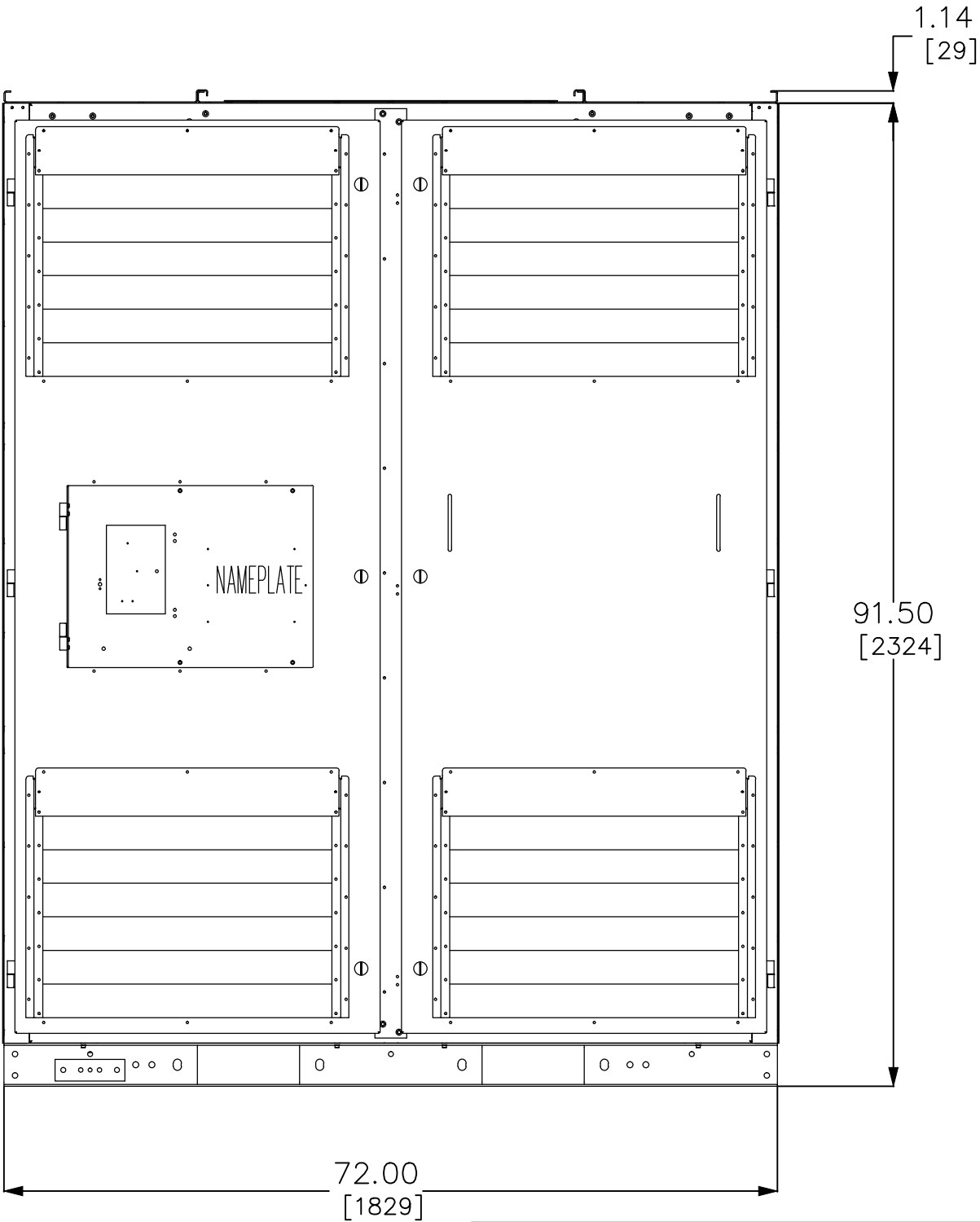
ARCHITECT: WILLIAM TAO & ASSOC INC
CONS. ENGINEER:

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EQUIPMENT					REVISION
DESIGNATION:	EQUIPMENT TYPE:	DRAWING TYPE:	DRAWING NUMBER:	PAGE:	LEVEL:
US-1	UNIT SUBSTATION TRANSFORMER	ELEVATION	F37999262-002-01-1	1	A
		FLOOR PLAN AND NOTES	F37999262-002-01-2	2	A
		LEFT/RIGHT VIEW	F37999262-002-01-3	3	A
		RATING NAMEPLATE	N37999262-002-01-1	1	A
		WIRING DIAGRAM	W37999262-002-01-1	1	A
		WIRING DIAGRAM	-NA-	2	-
		WIRING DIAGRAM	-NA-	3	-
		WIRING DIAGRAM	-NA-	4	-
		WIRING DIAGRAM	-NA-	5	-
		WIRING DIAGRAM	-NA-	6	-
		WIRING DIAGRAM	-NA-	7	-
		WIRING DIAGRAM	-NA-	8	-

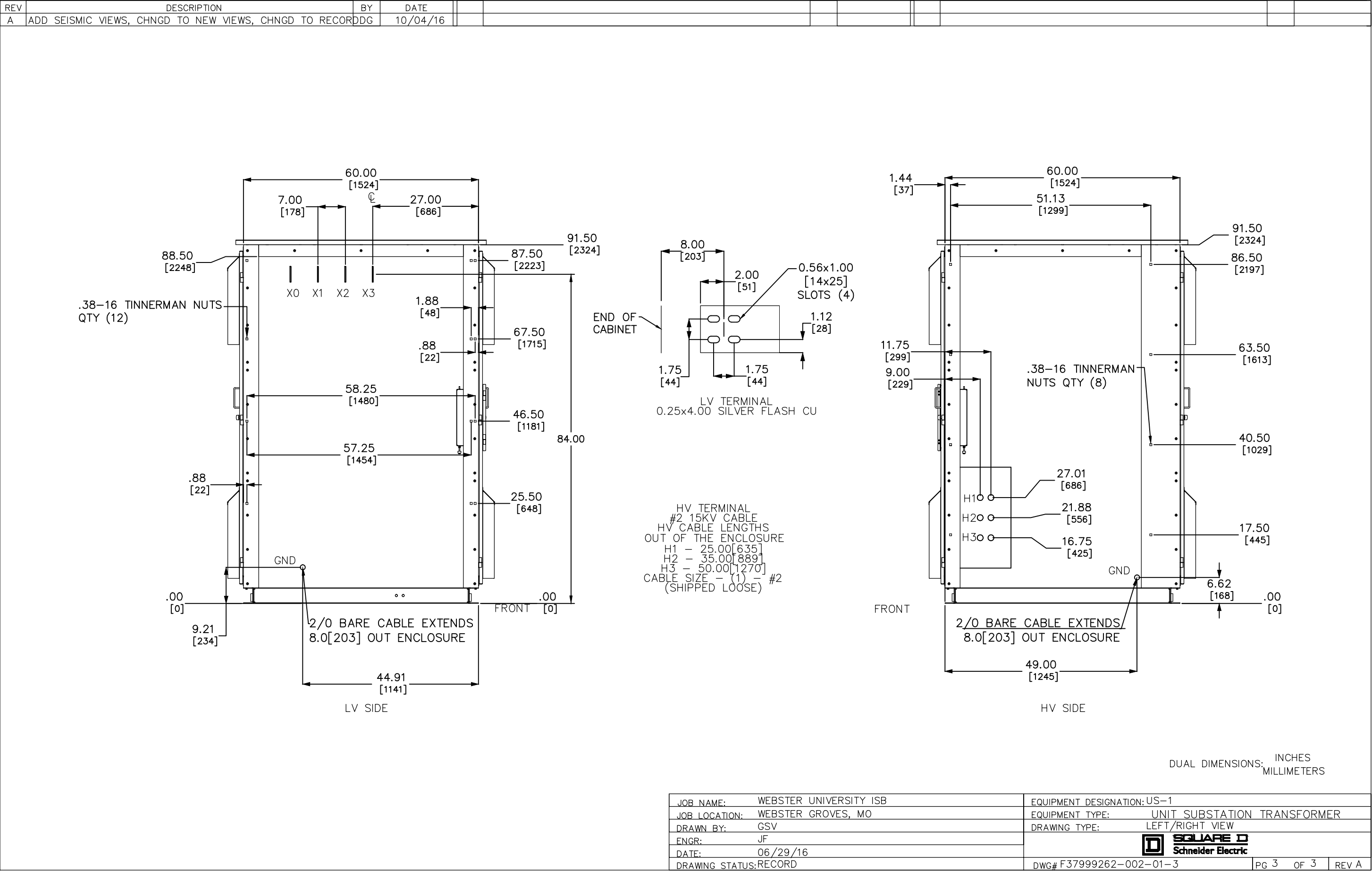
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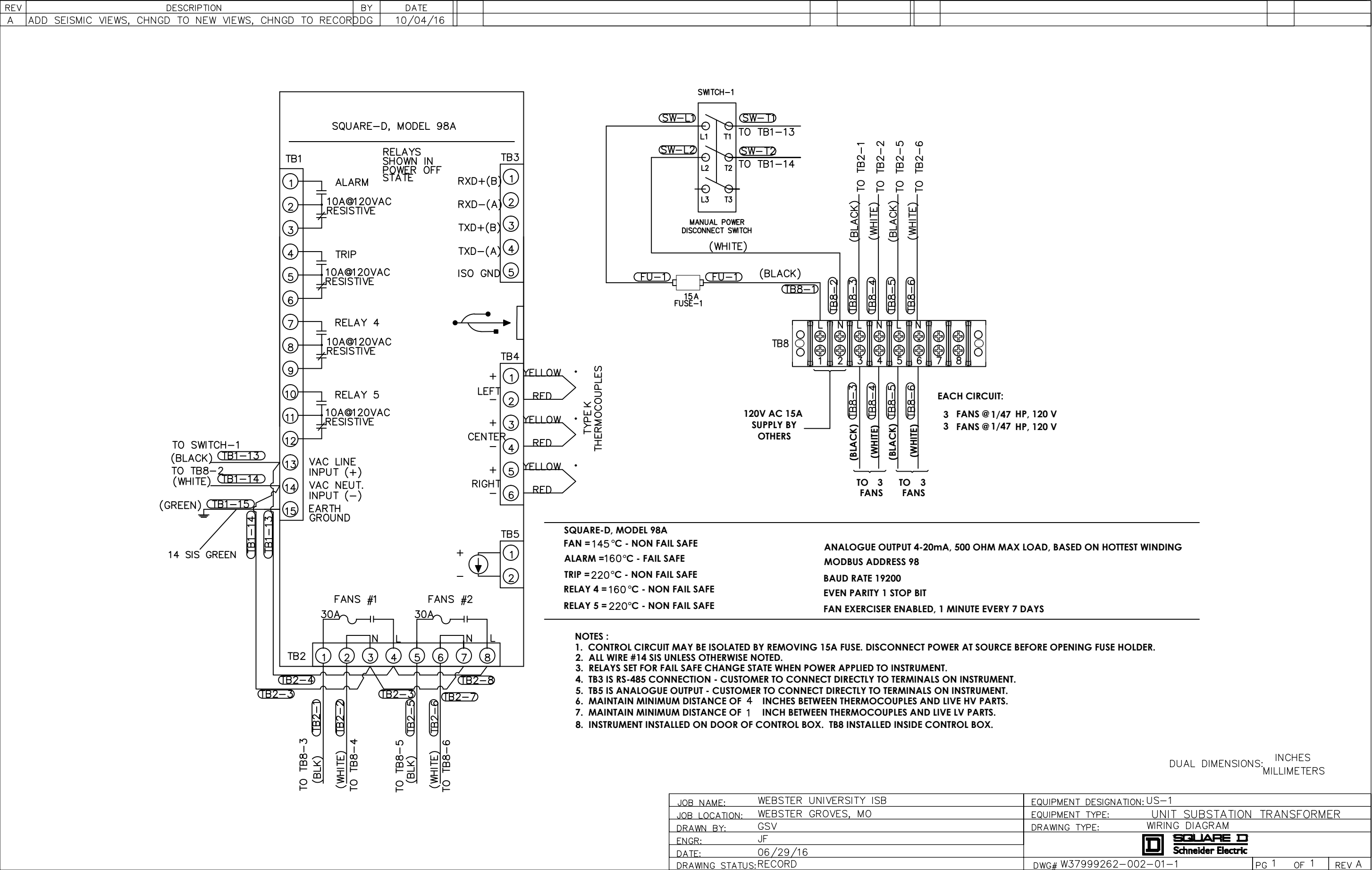
REV	DESCRIPTION	BY	DATE								
A	ADD SEISMIC VIEWS, CHNGD TO NEW VIEWS, CHNGD TO RECORD	DDG	10/04/16								



DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	UNIT SUBSTATION TRANSFORMER
DRAWN BY:	GSV	DRAWING TYPE:	ELEVATION
ENGR:	JF		
DATE:	06/29/16		
DRAWING STATUS:	RECORD	DWG#	F37999262-002-01-1
		PG 1	OF 3
		REV A	





**SQUARE D****by Schneider Electric**

Job Name: WEBSTER UNIVERSITY ISB
Job Location: WEBSTER GROVES, MO

Square D Quotation #: 37999262
Quotation Revision #:
Sales Contact: LNP
Sales Contact Location: 400

Purchaser: GRAYBAR ELECT CO 5818836
Purchaser PO #:

Customer: GUARANTEE ELECTRIC
Customer PO #:

User: WEBSTER UNIVERSITY
User Location:

Architect: WILLIAM TAO & ASSOC INC
Cons. Engineer:

Drawing Status: RECORDL

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SQUARE D FACTORY ORDER NUMBER: 37999262-003

<u>Equipment Designation</u>	<u>Equipment Type</u>	<u>Drawing Type</u>	<u>Drawing Number</u>	<u>Page</u>	<u>Revision Level</u>
US-1	QED Switchboard	GENERAL NOTES	F37999262-003-01	1	—
		SIDE, TOP VIEW & FLOOR PLAN	F37999262-003-01	2	—
		CENTER OF GRAVITY	F37999262-003-01	3	—
		ONE LINE	O37999262-003-01	1	—
		SCHEDULE	O37999262-003-01	2	—
		ELEMENTARY DIAGRAM	E37999262-003-01	1	—
			E37999262-003-01	2	A
			E37999262-003-02	1	—
			E37999262-003-03	1	—
			E37999262-003-07	1	—
			E37999262-003-08	1	—
		WIRING DIAGRAM	W37999262-003-02	1	—
			W37999262-003-03	1	A

SWITCHBOARD GENERAL NOTES

PRODUCT DESCRIPTION & RATINGS

Power System Data

480Y/277V 3Ph 4W 60Hz / 3 Phase Wye
Solidly Grounded
System Short Circuit Current Rating: 35kA RMS
Incoming Section 3 Close Coupled to Transformer Through the Side/Right of Lineup

Bus System Data

1600A Silver Plated Copper Main Bus
(2) .25x2.00 IN/6x51 mm Cu Bus Bar Per Phase/Neutral
(1) .25x.875 IN/6x22 mm Cu Ground Bus
Insulated/Taped bus

Enclosure Data

Type 1 Free Standing
Exterior Paint Color: ANSI 61
Front & Rear Accessibility Required
Handling: Rollers & Lifting Assemblies
Nameplate Mounting Type: Adhesive (Field Installed)
Equipment Nameplate: White Surface/Black Letters
Device Nameplate: White Surface / Black Letters

Estimated Shipping Weight

Shipping Split 1 1090.00 lbs / 494.42 kgs
Shipping Split 2 1105.00 lbs / 501.23 kgs
Shipping Split 3 630.00 lbs / 285.77 kgs
Complete Lineup 2825.00 lbs / 1281.42 kgs

Code Standards

U.L. Deadfront and suitable for use as Service Entrance
when not more than six (6) disconnecting means are provided.

Rating Nameplates

ST1– Deadfront– Section Bus 1600A
ST2– Service Entrance – Section Bus 1600A
ST3– Deadfront– Section Bus 300A

PRODUCT INFORMATION

Wiring

All wiring to be SIS Wire type

Instruction Bulletins

Reference 80043–055 For Handling, Installation,
Anchoring, Inspection And Maintenance Information

Product Accessories/Options

Certified Test Report
Seismic Qualified
24V Trip Unit Display Power
Masterpact NW 3–Pole Breaker Lifting Bar Assembly
Test Kit (Handheld)

T-bus 19.5 in T-bus 36.5 in T-bus 36.5 in

The diagram illustrates a technical drawing of a switchboard lineup, divided into three main sections: SECT 1, SECT 2, and SECT 3. The overall height of the unit is 91.50 inches [2324]. Each section has a width of 36.00 inches [914] for SECT 1 and SECT 2, and 24.00 inches [610] for SECT 3. The total width of the lineup is 96.00 inches [2438]. The drawing shows various components including PS (Phase Selector) units, SPD (Surge Protective Device) units, PM (Potential Transformer) units, and SS (Switching Station) units. Dimensions for individual components and their spacing are provided throughout the drawing.

91.50 [2324]

1.50 [38]

SECT 1 SECT 2 SECT 3

36.00 [914] 36.00 [914] 24.00 [610]

SS 1 SS 2 SS 3

36.00 [914] 36.00 [914] 24.00 [610]

Lineup 96.00 [2438]

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	GENERAL NOTES
ENGR:	R.WOLFE	Schneider Electric	
DATE:	OCTOBER 21, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262-003-01	PG 1 OF 3 REV -

PRODUCT DESCRIPTION & RATINGS

480Y/277V 3Ph 4W 60Hz / 3 Phase Wye
Solidly Grounded
System Short Circuit Current Rating: 35kA RMS
Incoming Section 3 Close Coupled to Transformer Through the Side/Right of Lineup

1600A Silver Plated Copper Main Bus
(2) .25x2.00 IN/6x51 mm Cu Bus Bar Per Phase/Neutral
(1) .25x.875 IN/6x22 mm Cu Ground Bus
Insulated/Taped bus

Type 1 Free Standing
Exterior Paint Color: ANSI 61
Front & Rear Accessibility Required
Handling: Rollers & Lifting Assemblies
Nameplate Mounting Type: Adhesive (Field Installed)
Equipment Nameplate: White Surface/Black Letters
Device Nameplate: White Surface / Black Letters

Shipping Split 1	1090.00	lbs /	494.42	kgs
Shipping Split 2	1105.00	lbs /	501.23	kgs
Shipping Split 3	630.00	lbs /	285.77	kgs
Complete Lineup	2825.00	lbs /	1281.42	kgs

U.L. Deadfront and suitable for use as Service Entrance
when not more than six (6) disconnecting means are provided.

ST1- Deadfront- Section Bus 1600A
ST2- Service Entrance - Section Bus 1600A
ST3- Deadfront- Section Bus 300A

All wiring to be SIS Wire type

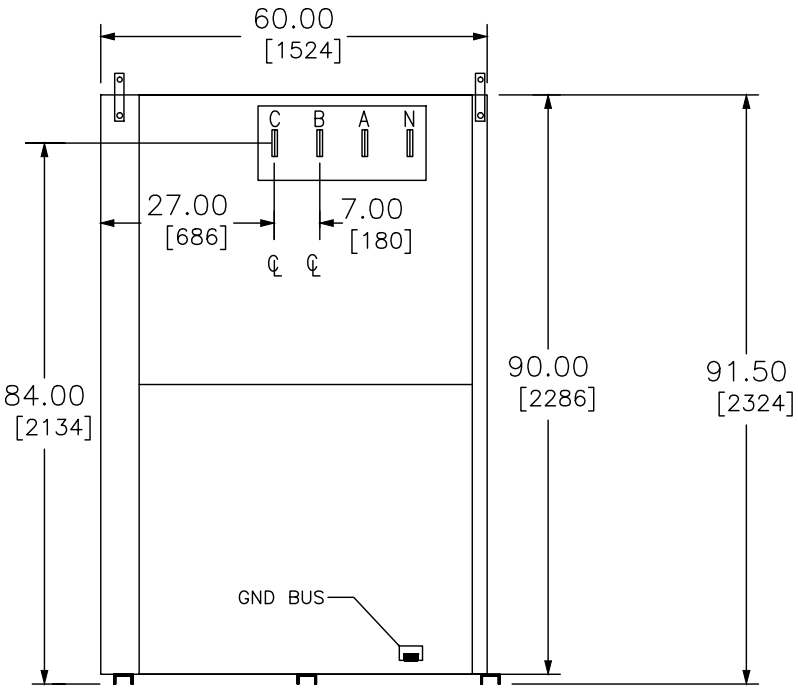
Reference 80043-055 For Handling, Installation,
Anchoring, Inspection And Maintenance Information

Certified Test Report
Seismic Qualified
24V Trip Unit Display Power
Masterpact NW 3-Pole Breaker Lifting Bar Assembly
Test Kit (Handheld)

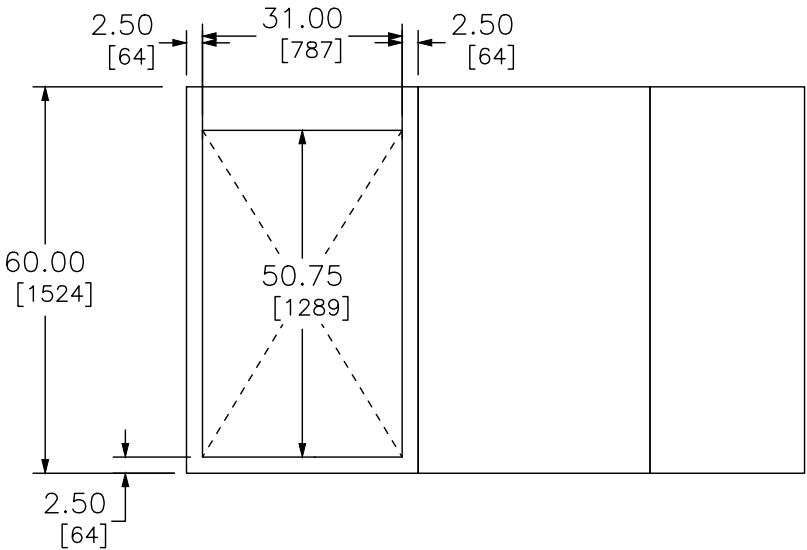
DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1		
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD		
DRAWN BY:	ROW	DRAWING TYPE:	GENERAL NOTES		
ENGR:	R.WOLFE				
DATE:	OCTOBER 21, 2016				
DRAWING STATUS:	RECORD	DWG# F37999262-003-01	PG 1	OF 3	REV -

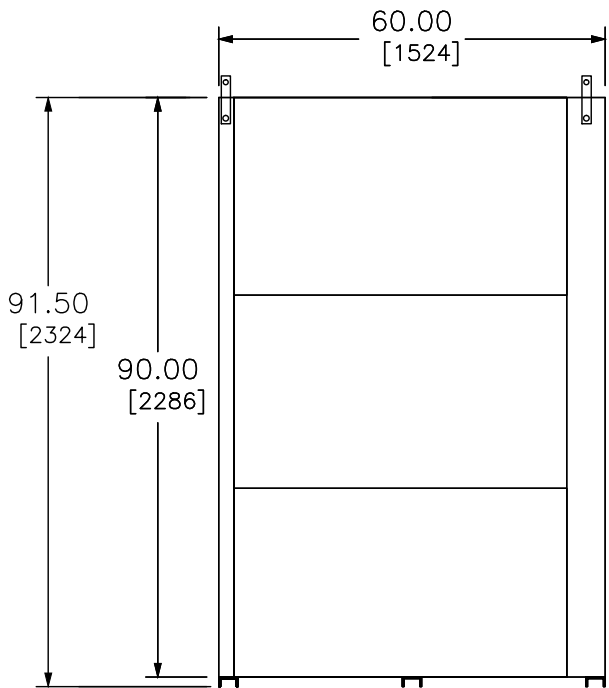
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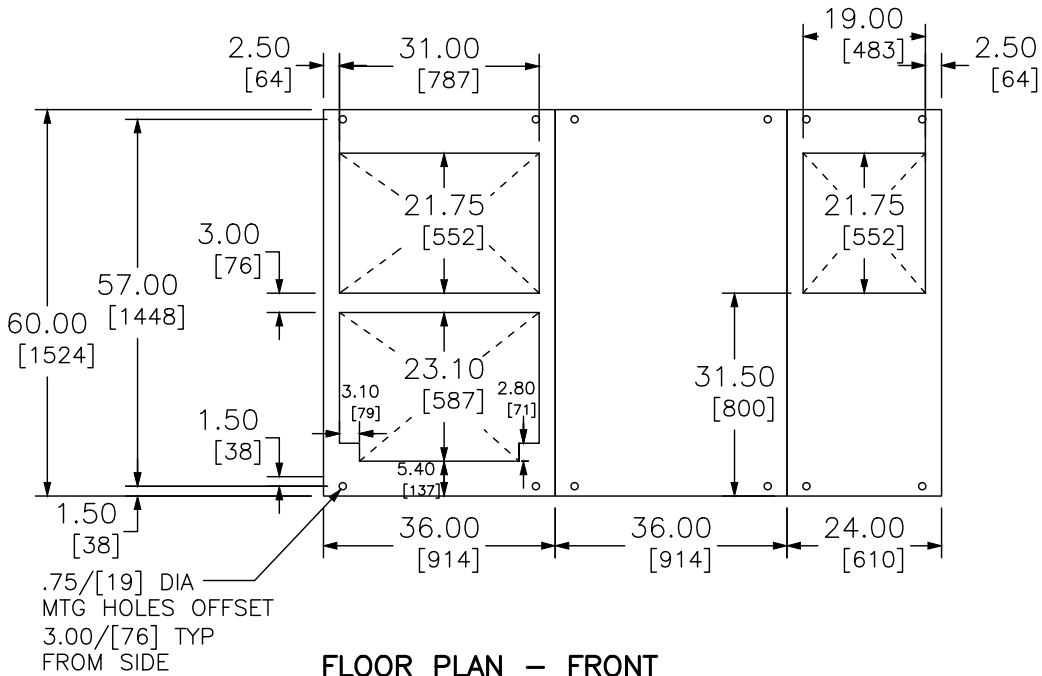
RIGHT SIDE VIEW



TOP VIEW - FRONT



LEFT SIDE VIEW



FLOOR PLAN - FRONT

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	SIDE, TOP VIEW & FLOOR PLAN
ENGR:	R.WOLFE		
DATE:	OCTOBER 24, 2016		
DRAWING STATUS:	RECORD	DWG#	F37999262-003-01
		PG	2 OF 3
		REV	-

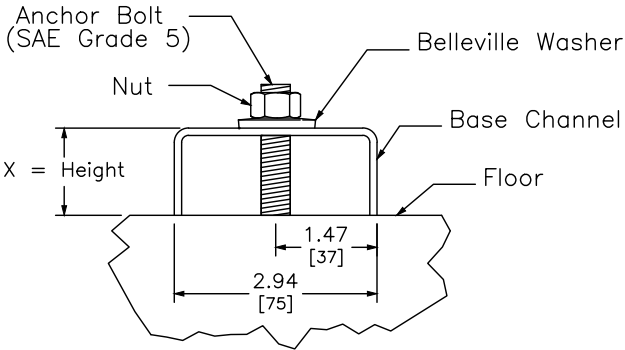
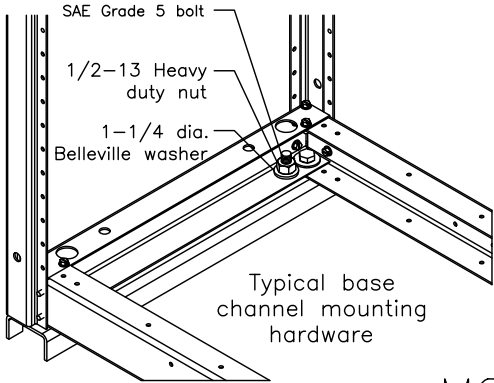
REV	DESCRIPTION	BY	DATE	-	----	--	---/---/---	-	----	--	---/---/---
-	----	--	--/---/---	-	----	--	---/---/---	-	----	--	---/---/---

REQUIREMENTS FOR SEISMIC RATING

ANCHORING CONDITIONS:

To Maintain Seismic Qualifications, Equipment Must Be Installed Per Manual (See General Notes) And Per Any Seismic Anchoring Details Provided By Others. Do Not Install Equipment Before Approved Seismic Anchoring Details Have Been Obtained And Site Prepararations Have Been Made In Accordance With The Approved Seismic Anchoring Details. All Post-Installed Anchors Shall Be Approved For Seismic Loads.

Consideration Must Be Made For Conduit Entry Into Each Section When Developing Mounting Pad Reinforcement Locations. See Conduit Entry Details (Floor Plan) For Dimensional Information.



MOUNTING DETAILS

Each Section Must Be Anchored At All Locations (Refer To Floor Plan And Mounting Detail Above). Anchor Bolt Mounting Points Are .75/[19] Diameter Holes Located 1.50/[38] Or 3.00/[76] Above The Base of the Section. Use Dimensions From The Floor Plan To Determine Mounting Locations.

The Belleville Washer (Shown In Detail Above) Used For Anchoring Connections Is A Tested Component And Is Required To Maintain Position Retention Of The Equipment. The Slip Critical Connection Performance Of The Bolted Connection Was Established To The Shake Table Tested Seismic Capacity Of The Equipment As Shown On The Equipment Seismic Certificate Supplied At The Time Of Order.

CENTER OF GRAVITY CALCULATIONS:

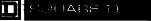
Elevation Center Of Gravity: 55 in. (1387.00mm) Up From Floor
Vertical Center Of Gravity: Use Centerline Of Section From Left To Right
Depth Center Of Gravity: Use CenterLine Of The Section From Front To Rear

SECTION WEIGHT:

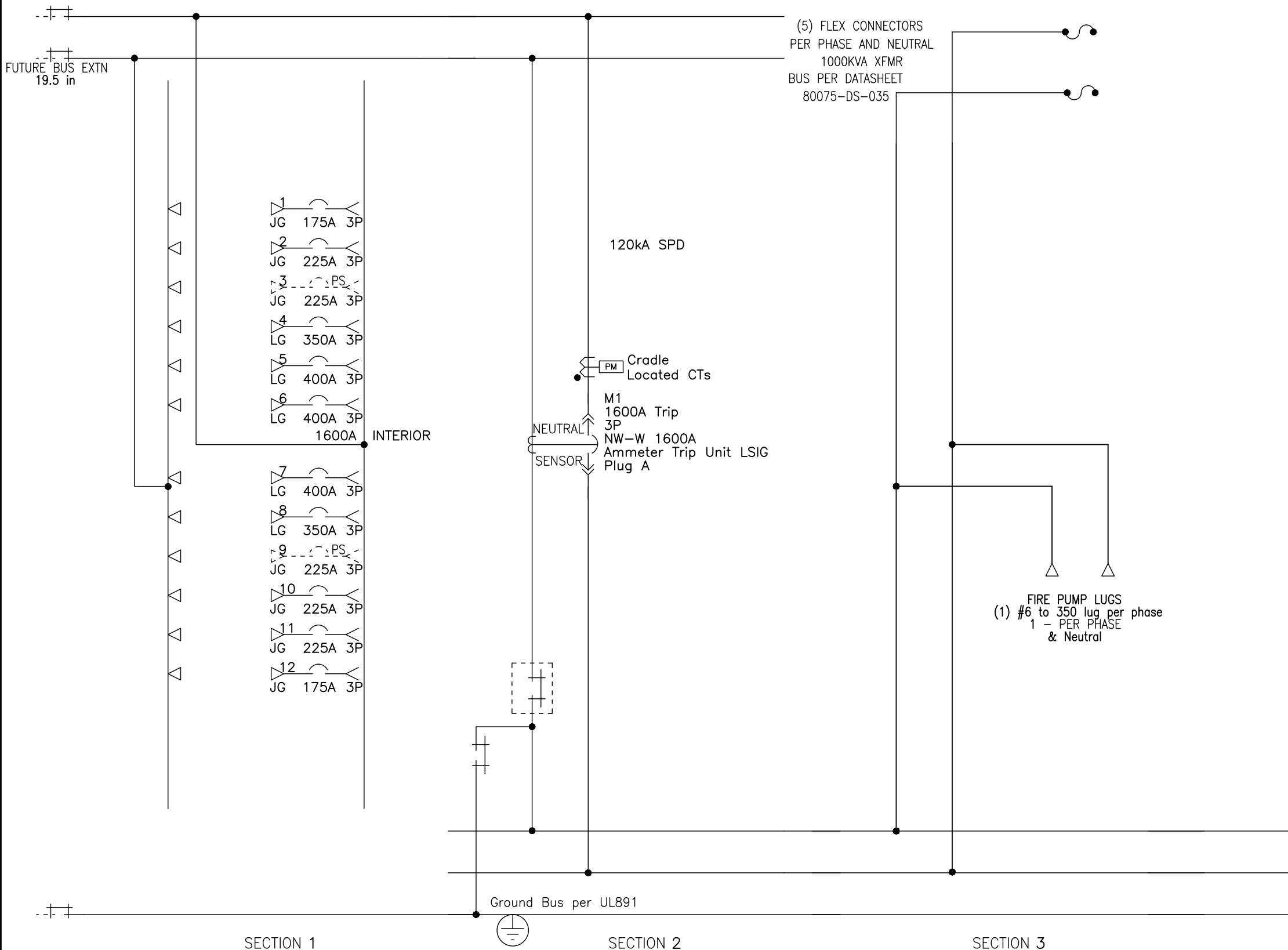
The Weights Given Below Are The Maximum For Each Section And Should Be Used For Calculating Seismic Anchoring Requirements

Section 1 1090.00 lbs / 494.42 kgs
Section 2 1105.00 lbs / 501.23 kgs
Section 3 630.00 lbs / 285.77 kgs

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	CENTER OF GRAVITY
ENGR:	R.WOLFE		
DATE:	SEPTEMBER 30, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262-003-01	PG 3 OF 3 REV -

REV	DESCRIPTION	BY	DATE										
-	----	--	--/--/--	-	----	--	--/--/--	-	----	--	--/--/--	-	----



JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ONE LINE
ENGR:	R.WOLFE		
DATE:	SEPTEMBER 30, 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-003-01
		PG	1 OF 2
		REV	-

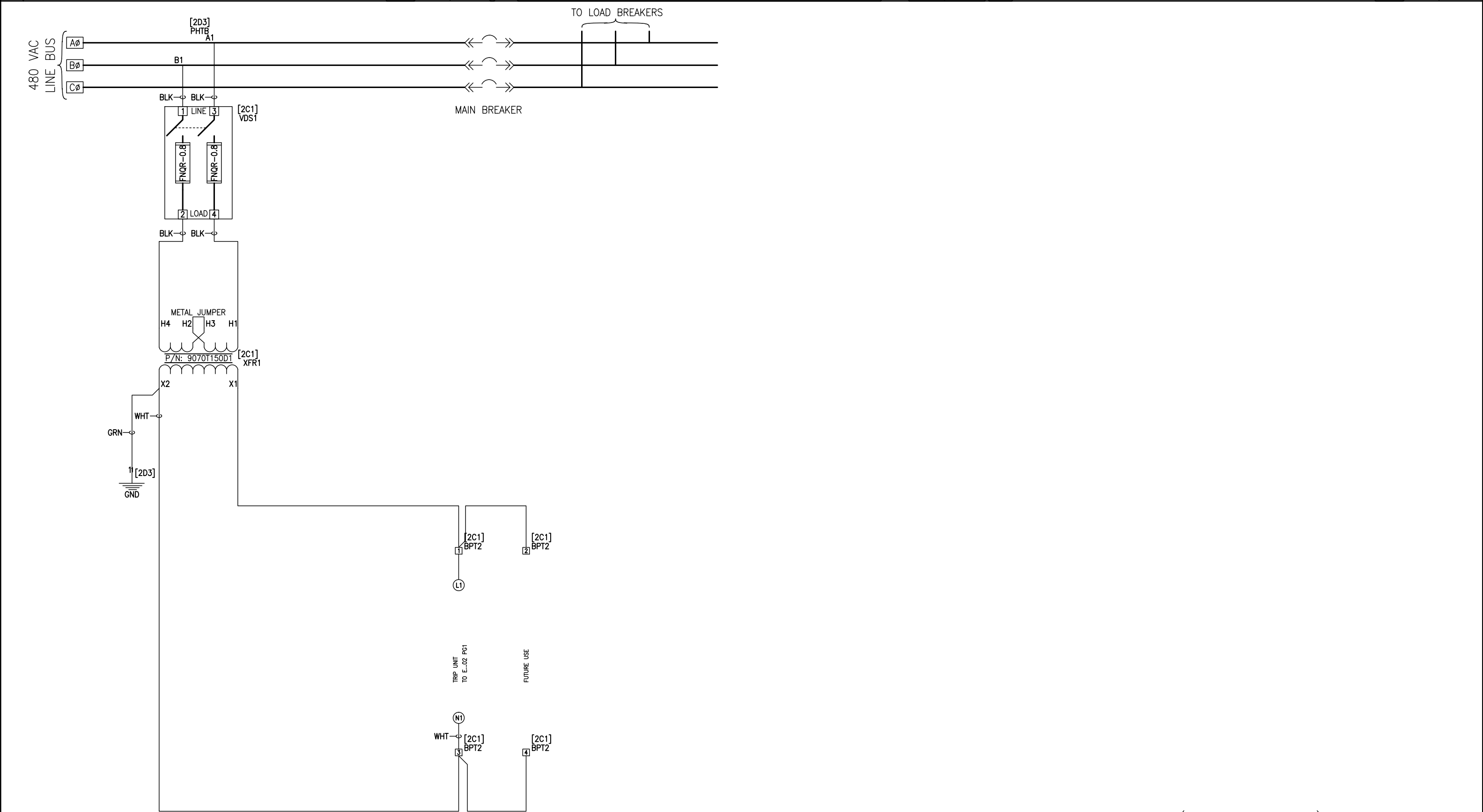
REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--	-	----
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POWER STYLE QED-2 SWITCHBOARD													
SECT NO	CKT NO	GMD HEIGHT	DEVICE/FRAME RATING	TRIP AMP	FUSE/TRIP	#P	DESIGNATION	N/P	LUG/WIRE INFORMATION				ACCESSORIES / NOTES
									QTY	PHASE WIRE RANGE	QTY	NEUT WIRE RANGE	
—	—	—	Equipment Nameplate	—	—	—	US-1	Yes	—	—	—	—	—
1	1	4.5 in	JG 250A	175A	S-LI	3P	1NH1-4NH1	Yes	1	3/0 - 350 kcmil	1	3/0 - 350kcmil	
1	2	4.5 in	JG 250A	225A	S-LI	3P	SPARE	Yes	1	3/0 - 350 kcmil	1	3/0 - 350kcmil	
1	3	4.5 in	JG 250A (PS)	(225A)	(LI)	3P	Blank Nameplate	Yes	1	3/0 - 350 kcmil	1	3/0 - 350kcmil	
1	4	6 in	LG 400A	350A	S-LI	3P	SB1	Yes	1	600 kcmil (Cu Only)	1	600 kcmil (Cu Only)	LK5
1	5	6 in	LG 400A	400A	S-LI	3P	ATSSB	Yes	2	3/0 - 250 kcmil	2	3/0 - 250 kcmil	
1	6	6 in	LG 400A	400A	S-LI	3P	SPARE	Yes	2	3/0 - 250 kcmil	2	3/0 - 250 kcmil	
1	7	6 in	LG 400A	400A	S-LI	3P	BNH1	Yes	2	3/0 - 250 kcmil	2	3/0 - 250 kcmil	
1	8	6 in	LG 400A	350A	S-LI	3P	SB2	Yes	1	600 kcmil (Cu Only)	1	600 kcmil (Cu Only)	LK5
1	9	4.5 in	JG 250A (PS)	(225A)	(LI)	3P	Blank Nameplate	Yes	1	3/0 - 350 kcmil	1	3/0 - 350kcmil	
1	10	4.5 in	JG 250A	225A	S-LI	3P	1NH2	Yes	1	3/0 - 350 kcmil	1	3/0 - 350kcmil	
1	11	4.5 in	JG 250A	225A	S-LI	3P	ATSLS	Yes	1	3/0 - 350 kcmil	1	3/0 - 350kcmil	
1	12	4.5 in	JG 250A	175A	S-LI	3P	SPARE	Yes	1	3/0 - 350 kcmil	1	3/0 - 350kcmil	
2	—	—	120kA SPD	—	—	—	—	—	—	—	—	—	SPD
2	M1	—	NW 1600A Plug A	1600A	A-LSIG	3P	MAIN	Yes	—	—	—	—	CP,GF,SDE1,OF4,MX1,CCKK PM8K,TU
3	—	—	Incoming Connection	—	—	—	—	—	—	XFMR	—	XFMR	CPF
3	—	—	Fire Pump Lugs	—	—	—	—	—	1	#6 - 350 kcmil	1	#6 - 350 kcmil	

LEGEND	
CCKK	Cradle Cell Key Kit
CP	Control Power
CPF	Control Power - Xfmr Fan
GF	Ground Fault
LK5	AL400L61K3 Lug Kit
MX1	Shunt Trip
OF4	4 Form C Breaker Aux Contacts
PM8K	Power Meter PM8XXX
SDE1	Over Current Trip Switch
SPD	Surge Protection Device
TU	24V Trip Unit Display Power

NAMEPLATE INFORMATION:	JOB NAME: WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION: US-1
MOUNTING TYPE: Adhesive (Field Installed)	JOB LOCATION: WEBSTER GROVES MO	EQUIPMENT TYPE: QED SWITCHBOARD
EQUIPMENT: White Surface/Black Letters	DRAWN BY: ROW	DRAWING TYPE: SCHEDULE
DEVICE: White Surface / Black Letters	ENGR: R.WOLFE	 Schneider Electric
	DATE: SEPTEMBER 30, 2016	
	DRAWING STATUS: RECORD	DWG# 037999262-003-01 PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE										
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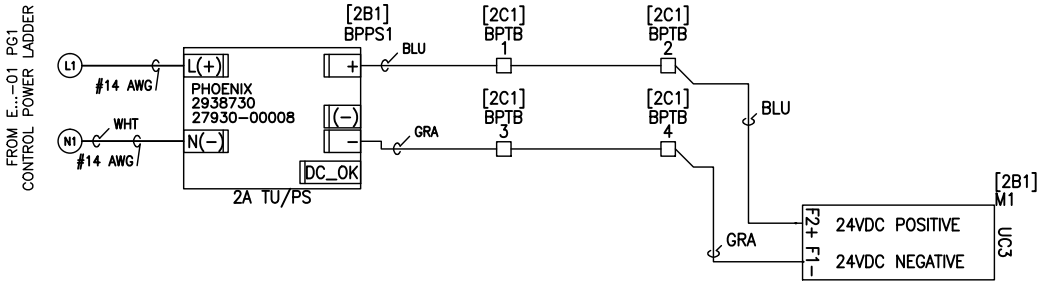


- NOTES:
- 1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
 - 2. ALL CONTROL FUSES MOUNTED IN FUSED PULLOUTS.
 - 3. USE #14 AWG WIRE UNLESS OTHERWISE NOTED.
 - 4. ALL CONDUCTORS TO BE RED WIRE UNLESS OTHERWISE NOTED.

150 VA CONTROL POWER (480:120VAC)

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG#	E37999262-003-01
		PG 1	OF 2
		REV	--

REV	DESCRIPTION	BY	DATE										
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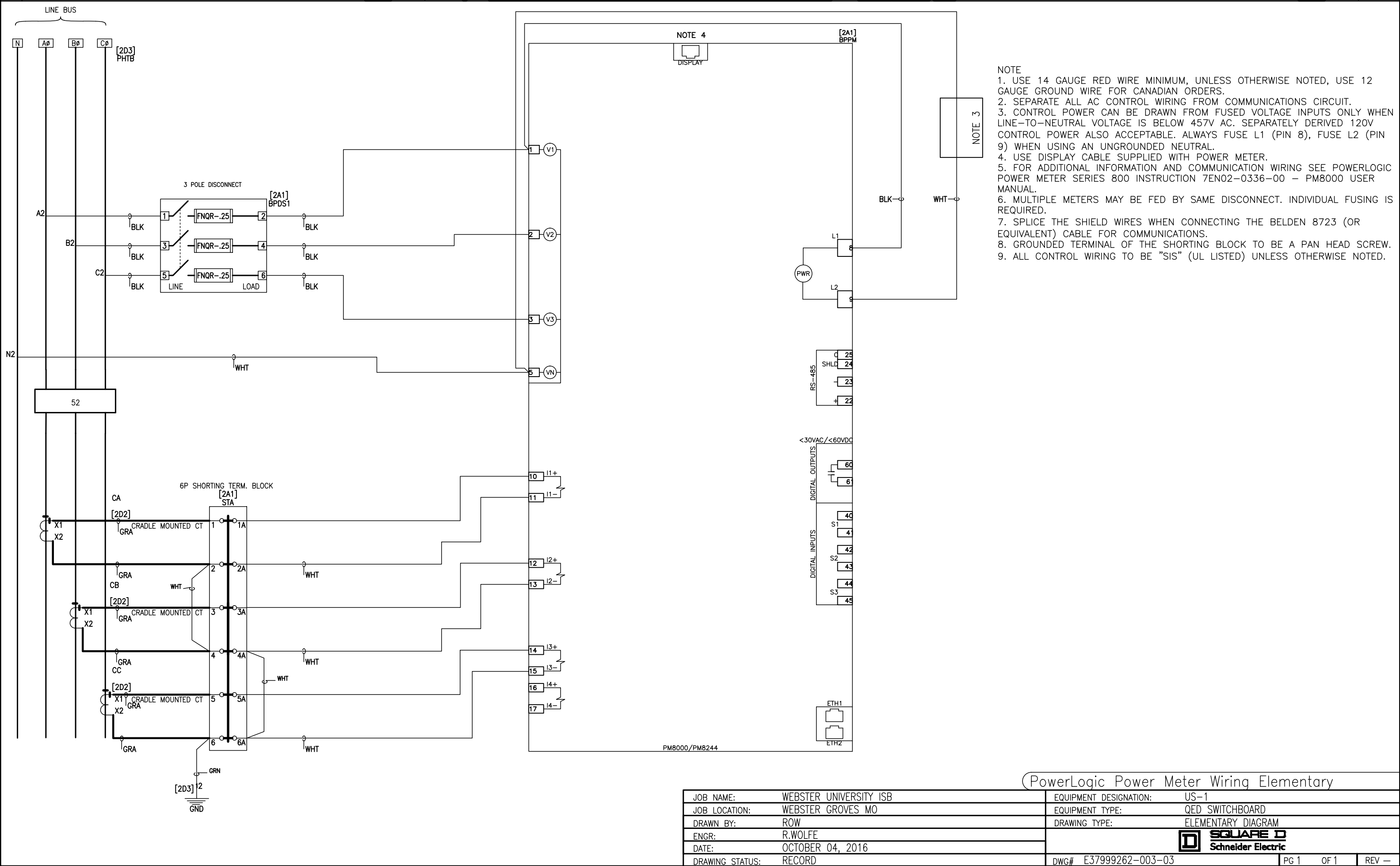
NOTES:

1. POWER SUPPLY CAN ONLY PROVIDE POWER FOR CIRCUIT BREAKER TRIP UNITS.
2. SEPARATE ALL AC CONTROL WIRING FROM COMMUNICATIONS CIRCUIT.
3. ALL CONDUCTORS TO BE #16 SIS UNLESS OTHERWISE NOTED.
4. TWIST SHIELDS TOGETHER, FOLD BACK AGAINST THE OUTER INSULATION, AND HEAT SHRINK SHIELDS AND CABLES.
5. ALL WIRING TO BE RED WIRE UNLESS OTHERWISE NOTED.
6. ALL SHIPPING SPLIT TERMINAL BLOCKS ARE LOCATED ON FRONT LOWER TIE CHANNEL BEHIND BOTTOM FRONT COVER.

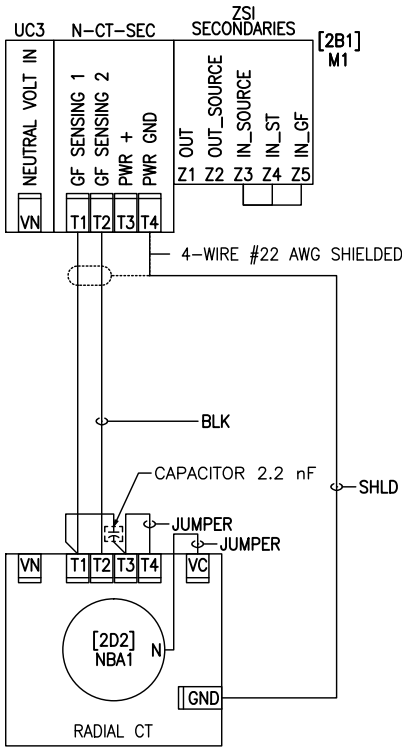
(Trip Unit External Power Wiring Elementary

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG#	E37999262-003-02
		PG 1	OF 1
		REV	—

REV	DESCRIPTION	BY	DATE																	
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REV	DESCRIPTION	BY	DATE	---	-----	---	---/---	---	-----	---	---/---
---	-----	---	---/---	---	-----	---	---/---	---	-----	---	---/---



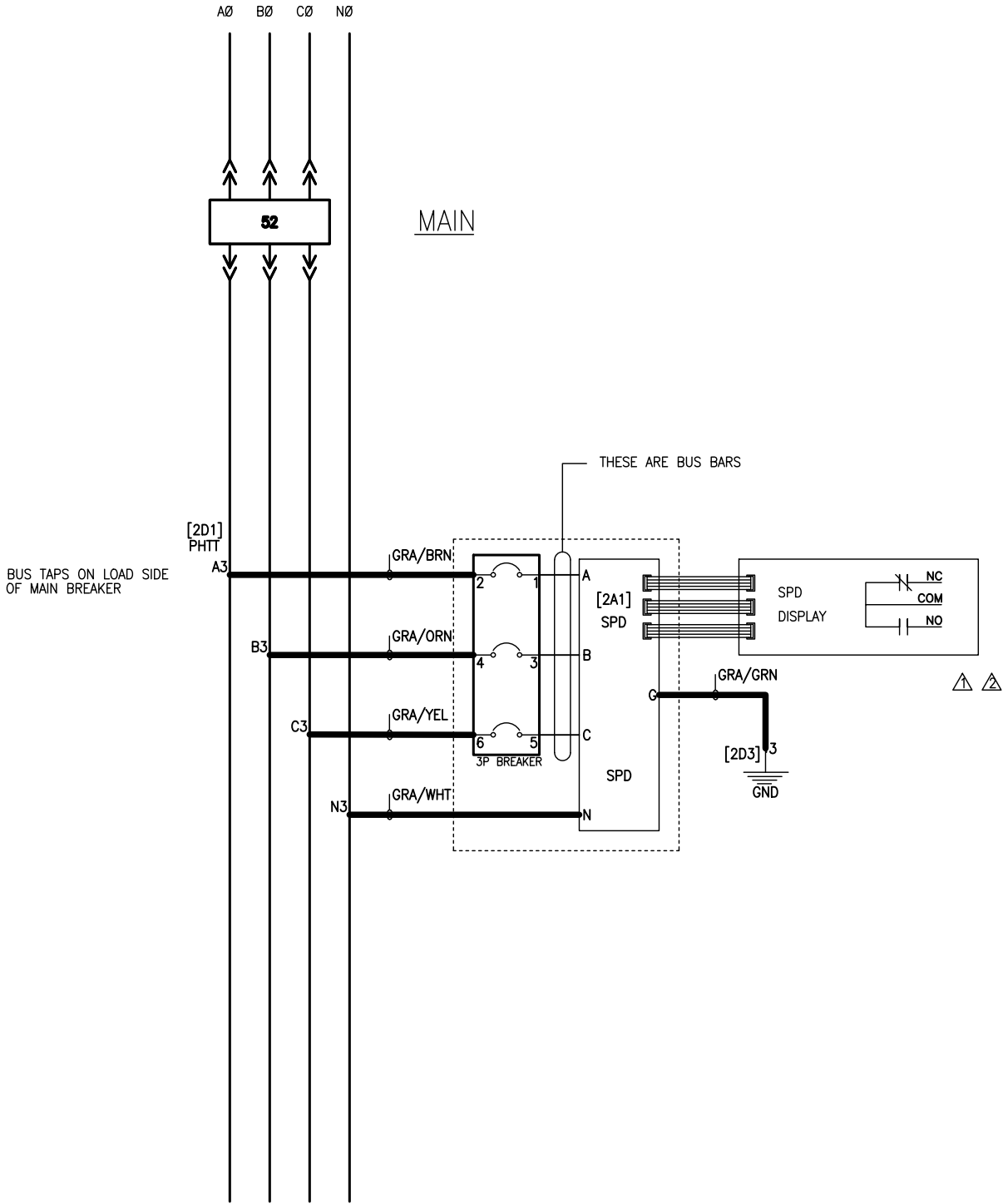
- NOTES:
- 1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
 - 2. USE #22 AWG SHIELDED WIRE UNLESS OTHERWISE NOTED.
 - 3. ALL SYMBOLS ARE SHOWN WITH CIRCUIT BREAKER OPEN, CONNECTED AND CHARGED.
 - 4. JUMPER BETWEEN T1 & T2 IS ONLY PRESENT WHEN NEUTRAL CT IS NOT CONNECTED.
 - 5. ALL CONDUCTORS TO BE RED WIRE UNLESS OTHERWISE NOTED.
 - 6. Vn CONNECTION ONLY REQUIRED FOR 5.0P,6.0P,5.0H,AND 6.0H TRIP UNITS.

 Vn CONNECTION ONLY REQUIRED FOR 5.0P,6.0P,5.0H,AND 6.0H TRIP UNITS.

RADIAL GROUND FAULT

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG#	E37999262-003-07
		PG 1	OF 1
		REV	---

REV	DESCRIPTION	BY	DATE										
—	—	—	—/—	—	—	—	—/—	—	—	—	—	—	—/—



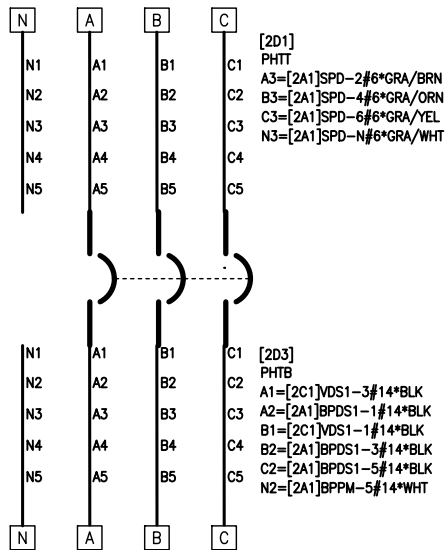
- NOTES:
- ALL WIRING TO BE TYPE #6 AWG RED SIS (UL LISTED) WIRE UNLESS OTHERWISE NOTED.
 - DISPLAY FORM C DRY CONTACTS ARE RATED @ 24VDC/AC – 2 AMPS.
 - CABLES MUST BE AS SHORT AS POSSIBLE WITH A MINIMUM NUMBER OF LARGE RADIUS BENDS. MAXIMUM LENGTH OF CABLE FROM NEUTRAL AND GROUND BUS CONNECTIONS TO TVSS UNIT SHALL NOT EXCEED 8 FEET. MAXIMUM NUMBER OF BENDS SHALL NOT EXCEED 4. MINIMUM RADIUS SHALL BE 3 INCHES. CABLES MUST BE SECURELY FASTENED THROUGHOUT THEIR LENGTH.
 - FOR EQUIPMENT BUILT TO ANSI C37.20.1 OR CSA C22.2 NO. 31–M89, SINGLE CONDUCTOR CABLE MAY BE TYPE SIS AND COLOR CODES MAY BE DISREGARDED FOR SINGLE CONDUCTORS.
 - PATCH CABLES MUST BE PROTECTED WHERE THEY CROSS THE HINGE SIDE DOOR FLANGE FROM DISPLAY TO INSTRUMENT COMPARTMENT, PATCH CABLES MUST BE KEPT SEPARATED FROM POWER WIRING.

SPD Wiring Elementary

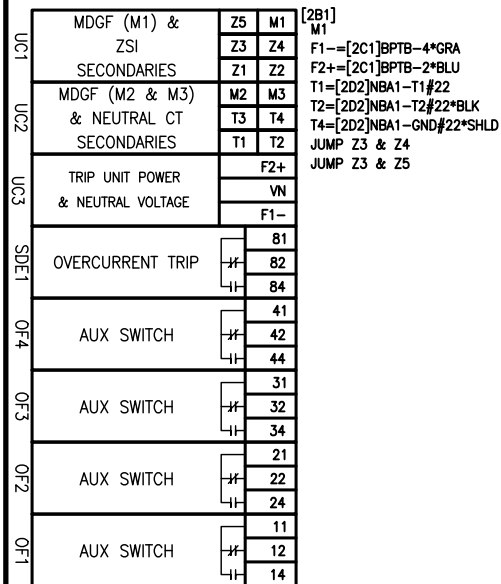
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JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG#	E37999262-003-08
		PG 1	OF 1
		REV	—

REV	DESCRIPTION	BY	DATE	-	----	--	--/--	-	----	--	--/--
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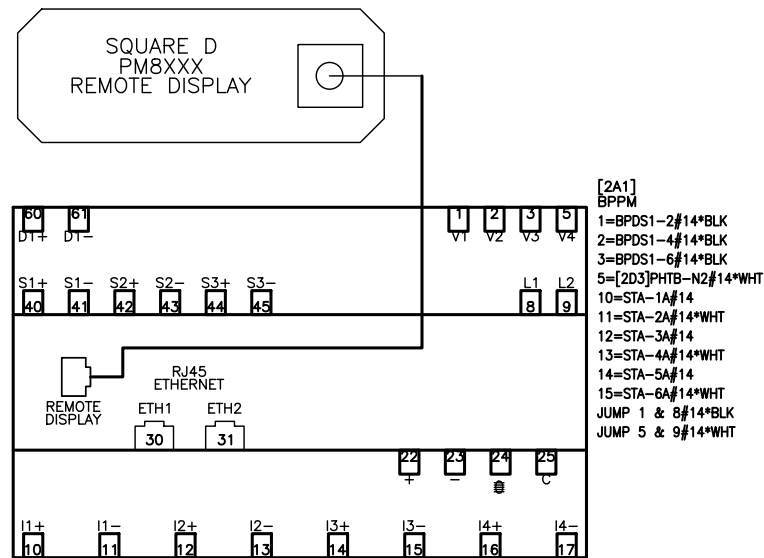
BUS CONNECTION



BREAKER CELL

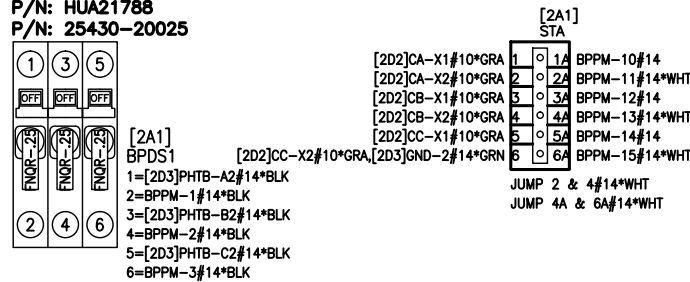


MOUNTING PAN(S)

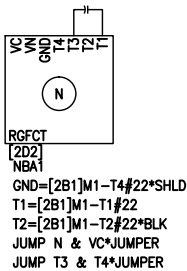
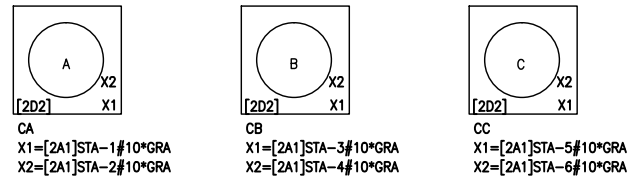


P/N: HUA21788
P/N: 25430-20025

P/N: 27110-00000

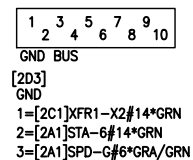


CURRENT TRANSFORMERS



SHIPPING SPLIT

GROUND BUS



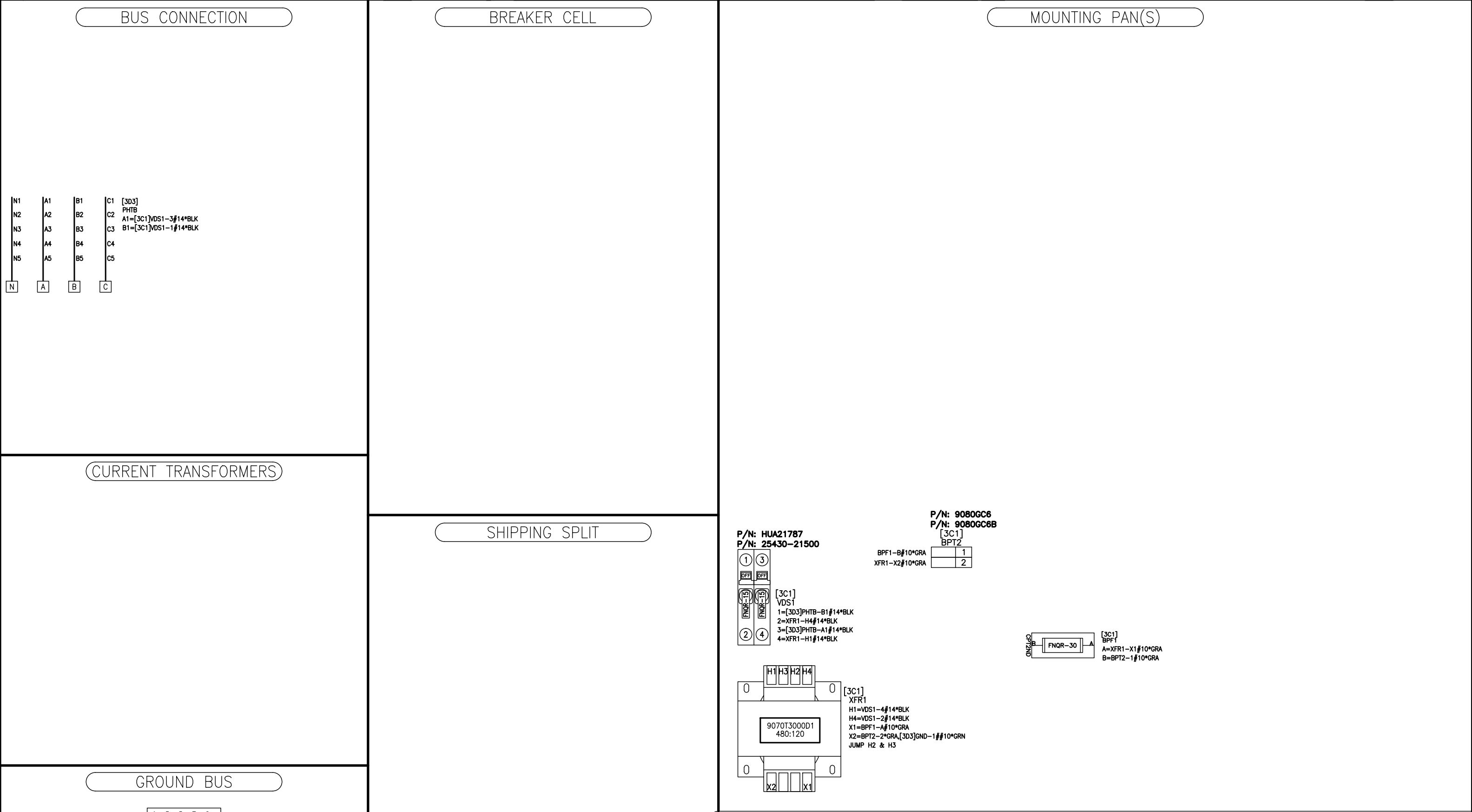
NOTES:

1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
2. ALL CONTROL FUSES MOUNTED IN FUSED PULLOUTS.
3. USE #16 AWG WIRE UNLESS OTHERWISE NOTED.
4. ALL WIRES TO BE RED UNLESS OTHERWISE NOTED.

Section 2 Wiring Diagram

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1			
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD			
DRAWN BY:	ROW	DRAWING TYPE:	WIRING DIAGRAM			
ENGR:	R.WOLFE					
DATE:	SEPTEMBER 30, 2016					
DRAWING STATUS:	RECORD	DWG#	W37999262-003-02	PG 1	OF 1	REV -

REV	DESCRIPTION	BY	DATE										
A	CHANGE TEXT: MTW TO SIS	RW	10/27/2016	-	----	--	--/--	-	----	--	--/--	-	----



Metal-Enclosed Switchgear

2.4 kV to 38 kV

Class 6040

Instruction Bulletin
Retain for future use.



HAZARD CATEGORIES AND SPECIAL SYMBOLS



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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SECTION 1—INTRODUCTION

This bulletin contains instructions for the proper installation, operation, and maintenance of metal-enclosed switchgear manufactured by Schneider Electric. This product line offers switching, metering, and interrupting capabilities for medium voltage systems ranging from 2.4 kV to 38 kV. The equipment is available in a variety of arrangements in both indoor and outdoor enclosures. Metal-enclosed switchgear enclosures house the following types of equipment:

- Load interrupter (HVL) switches, fused and unfused. See the HVL switch instruction bulletin provided with your equipment for operating instructions.
- VISI/VAC, circuit interrupters. See the VISI/VAC interrupter instruction bulletin provided with your equipment for operating instructions.
- Bus transition and special enclosures

Metal-enclosed switchgear is often used with unit substations, applied as service entrance equipment, chosen for protecting substation transformers, or used to sectionalize high voltage feeder systems.

Equipment may be furnished in single or multiple bay units. Sections are shipped completely assembled for ease of handling and installation. The bus material can be copper or aluminum, and carries a continuous rating of 600, 1200, or 2000 amperes with momentary short circuit ratings of 20, 40, or 61 kA. Metal-enclosed switchgear manufactured by Schneider Electric is designed, manufactured, and tested in accordance with ANSI standards C37.20.3, C37.57, and NEMA SG5 where applicable.

Accessories and Optional Equipment

When accessories or optional equipment are included with metal-enclosed switchgear, refer to the instruction bulletins that accompany the shipment. Follow the manufacturer's instructions carefully when operating these devices.

General Description—Assembly

Metal-enclosed switchgear units are designed and manufactured as either single bay or a multiple bay lineups. Each bay is a separate, rigid, self-contained structure fabricated of heavy gauge steel.

Multiple bay switchgear generally consists of a lineup of individual feeder switch bays connected to a common main bus. A ground bus is bolted to the frame of each bay for the complete length of the lineup. The end cubicle can be adapted to accept future feeder switch bays.

Indoor Enclosures

Indoor switchgear enclosures (Figure 1 on page 5) include these standard features:

- Lifting eyes at the top corners of each section
- Provisions for future expansion (when using main cross bus)
- Clear acrylic window for inspection of blade position
- Steel enclosure per ANSI C37.20.3
- Ground pad in single bay enclosures and full-length ground bus in multiple bay enclosures
- Door interlock (electrical and/or mechanical) which prevents opening the front door while the switch or circuit interrupter is closed
- Switch or circuit interrupter interlock (electrical and/or mechanical) which prevents operating the main device while the front door is open
- Provisions for padlocking the switch handle (HVL) or the locking pull handle (VISI/VAC)
- Provisions for padlocking the front door
- Key interlocking, available when requested

Figure 1: Indoor Switchgear



Outdoor Enclosures

Outdoor switchgear enclosures (Figure 2) are designed and manufactured with the following standard features:

- Roof sloped to rear for precipitation runoff
- Operating handles are enclosed to prevent tampering
- Formed steel welded base
- Full-height front doors with gasketing
- Steel enclosure per ANSI C37.20.3
- Removable full-height rear panels
- Strip heaters in each switch bay
- Stay rods to hold hinged doors in open position

Figure 2: Outdoor Switchgear



SECTION 2—SAFETY PRECAUTIONS

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

- Only qualified electrical workers with training and experience on high voltage circuits should perform work described in this set of instructions. Such work should be performed only after reading this complete set of instructions.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power before working on or inside equipment.
- The successful operation of metal-enclosed switchgear depends upon proper handling, installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to electrical equipment or other property.
- Metal-enclosed switchgear has interlocks designed to prevent unsafe operation, but it is not possible to eliminate every hazard with interlocks. Therefore, the person using this device is responsible for recognizing the potential hazards, for wearing protective safety equipment, and for taking adequate safety precautions.
- Do not make any adjustments to the equipment or operate the system with safety features removed. Contact your local Schneider Electric representative for additional instructions if the device does not function as described in this manual.
- Before performing visual inspections, tests, or maintenance on the equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Before replacing covers or closing doors, carefully inspect the bus work area for tools and objects left inside the equipment. Use care while removing or installing panels so that they do not extend into the energized bus; avoid handling the panels, which would cause personal injury.
- Before making any electrical connection, take every precaution to see that all leads to be connected are de-energized with proper safety grounds applied.

Failure to follow these instructions will result in death or serious injury.

SECTION 3—RECEIVING, HANDLING, AND STORAGE

Receiving

Metal-enclosed switchgear is shipped on skids with protective wrapping to prevent damage during normal transit. Check the packing list against the equipment received to ensure the order and shipment are complete. Claims for shortages or other errors must be made in writing to Schneider Electric within 30 days after receipt of shipment. Failure to do so constitutes unqualified acceptance and a waiver of all such claims by the purchaser.

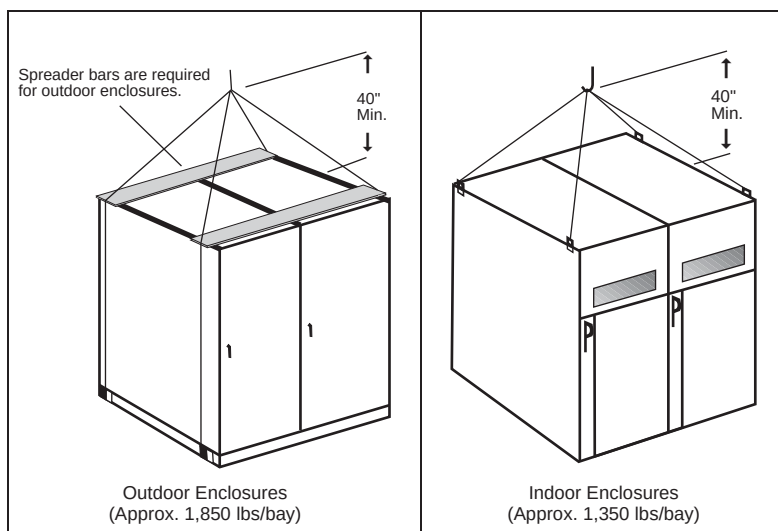
Also upon receipt, immediately inspect the switchgear for damage which may have occurred during transit. If damage is found or suspected, immediately file a claim with the carrier and notify Schneider Electric.

Handling

Use care when uncrating, rolling, hoisting, or handling the switchgear. Removable lifting eyes are provided for inserting hooks to lift each section as shown in Figure 3. Metal-enclosed switchgear is designed to be handled only in an upright position.

Use only lifting equipment suitable for the weight of the switchgear. Review the shipping documentation for the actual weight of the equipment to be handled. When an overhead crane is not available, rollers or pipes may be used for moving the switchgear to its location.

Figure 3: Lifting Methods



After outdoor equipment is placed in its planned location, apply a bead of caulk or similar material between the base of the switchgear and the foundation, as well as between the shipping sections, to prevent water from entering beneath the switchgear. Caulk after the equipment is placed in its final location.

CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Do not remove the skids until the shipping sections are at the final location.
- Always use the skids to prevent equipment distortion.

Failure to follow these instructions can result in serious injury or equipment damage.

Storage

If the switchgear is stored before being placed into service, keep it in a clean, dry place that is free from corrosive elements and mechanical abuse. Energize the heaters inside the switchgear, or add heat from a separate source, such as a light bulb or blower. Use a minimum of 100 watts of heat per vertical section to keep the equipment dry during storage.

Covering the equipment with a tarpaulin may be necessary to protect it from contaminants or moisture. Do not store indoor units outdoors.

In areas of high humidity, such as installations near oceans or rivers, monitor the equipment closely. If necessary, use additional heat to keep the switchgear dry. Contact the factory if the internal heaters do not adequately prevent condensation for your location.

SECTION 4—INSTALLATION

Site Preparation

Good site preparation is necessary to eliminate costly, time-consuming installation problems and ensure proper switchgear operation. Compare the site plans and specifications with the switchgear drawings to be sure there are no discrepancies. Check the site to ensure that the equipment will fit properly.

The floor should be flat and level within 1/16 inch per foot, or a maximum of 1/4 inch within the area of the switchgear, to prevent distortion of the enclosures. Allow aisle space at the front, back, and ends of the switchgear to permit access for equipment maintenance; usually a minimum of five feet is needed on all sides.

Provide area ventilation at all times to maintain the ambient temperature around the equipment between 0°C and 40°C.

Adequate lighting and convenience outlets should be available near the switchgear. Route sewer, water, and steam lines away from the equipment. Provide floor drains to prevent water buildup.

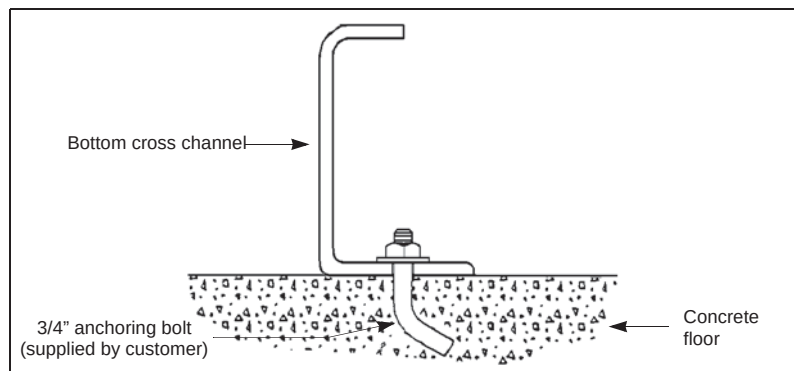
Switchgear Installation

Review the assembly drawings to ensure that the switchgear sections will be assembled in the correct order. If the switchgear will connect to an existing lineup, mount the connecting sections first.

Mount the various shipping sections on the same plane and level them to ensure proper connection. After leveling each section, bolt it to the previously installed switchgear.

Each section includes the necessary means for anchoring it to the floor. Fasten indoor units to the floor using the holes located in the bottom flanges of the enclosure. Fasten outdoor enclosures to the foundation using the holes located in the bottom cross channels (see Figure 4).

Figure 4: Anchoring Method for Outdoor Enclosures



Remove the lifting angles from the side of the base and store. To block entry of water, extraneous objects, or wildlife, replace hardware in the holes where the lifting angles were removed. The bus connectors for the shipping splits are included with the switchgear.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE.

Install the shipping split bus connectors only after the shipping sections are fastened in place and no additional movement will be made to the assembly.

Failure to follow this instruction can result in equipment damage.

Follow these steps when installing the switchgear:

1. Make sure the bus connector contact surfaces are clean and bright. Install the bus connectors one phase at a time. Loosely bolt the bus joints.

After all three bus bars are in place and properly aligned, tighten the bolts using a torque wrench. See Table 1 for torque values.

Table 1: Torque Values (ft lbs)

Bolt Size	Sheet Metal Joints (SAE #2 Steel Bolts)	Electrical Connections (SAE #5 Steel Bolts)
1/4-20	7 ft lbs	10 ft lbs
5/16-18	14 ft lbs	20 ft lbs
3/8-16	21 ft lbs	35 ft lbs
1/2-13	42 ft lbs	70 ft lbs

2. Connect the ground bus splice at each shipping section. Remove the hardware, position the splice plate, and tighten the hardware per Table 1.

⚠ CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

The ground bus must be connected and bonded in accordance with applicable industry standards and/or codes to ensure proper operation of equipment and safety of personnel.

Failure to follow this instruction can result in serious injury or equipment damage.

3. Consult the customer wiring diagrams for re-connection of control wiring at the shipping breaks, when applicable. Each wire has been identified and previously connected during assembly when tested at the factory.

Make all outgoing control connections according to the wiring diagrams. After wiring is complete, carefully check all connections to ensure they are tight and correct.

Cable Connections

Before making the cable connections, determine the phase identity of each cable. Viewing the switchgear from the front, standard bus sequence is normally phased A-B-C left to right, top to bottom, or front to rear, unless labeled otherwise.

When cable terminations are made, follow the cable manufacturer's instructions in stripping the shield and cleaning the unshielded portion of the cable. Install the appropriate stress cone in accordance with the stress cone manufacturer's instructions.

Forming Cables

When forming cables for termination within switchgear, avoid sharp turns, corners, and edges which could damage or weaken the cable insulation. Follow the cable manufacturer's instructions carefully in determining the minimum bending radius of cables.

When installing cables in switchgear, the clearances shown in Table 2 must be maintained to avoid insulation breakdown and flashover.

NOTE: Clearances also apply to any grounded component in the assembly (e.g., stress cone ground).

Table 2: Clearance Requirements for Shielded Cables

kV Rating	X Inches Shields Bare	Y Inches Shields Insulated	Cable Support Assembly
5	4	3	44037-613-50
15	5	4	44037-613-50
25	8	7	44039-523-50
29	8	7	44039-523-50
38	10	9	44039-523-51

NOTE:

(1) X and Y clearances apply to both insulated and bare bus bars.

(2) If required, cable support assemblies are available to hold cables away from bus bars.

Figure 5: Shielded Cable Clearances

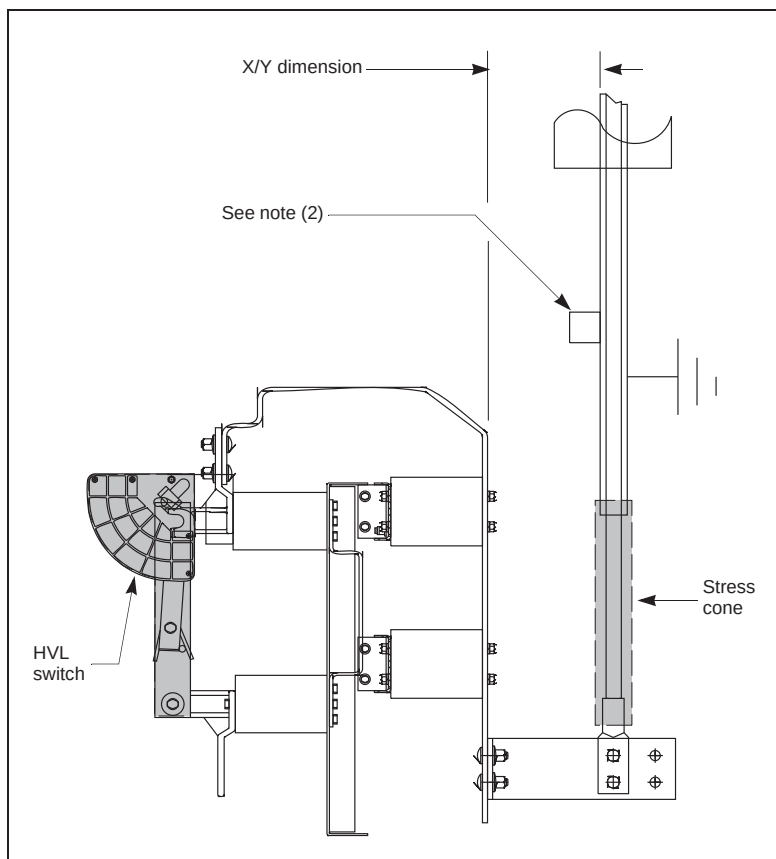
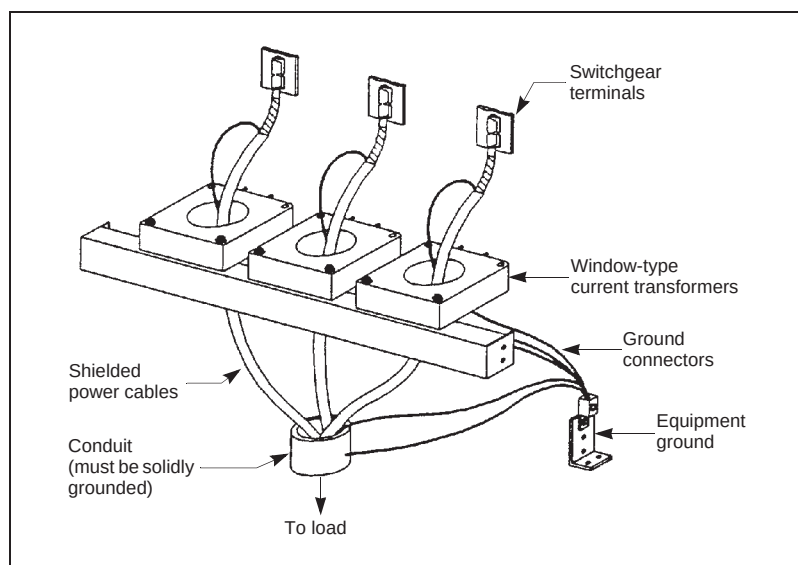
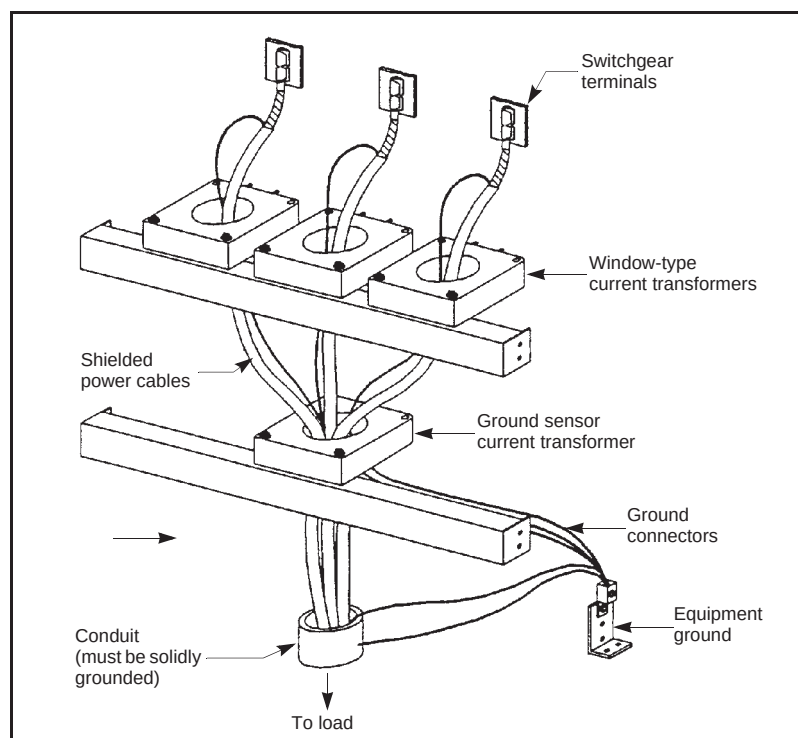


Figure 6: Shielded Cable Connections (through current transformers)

Shielded Cables Through Window-Type Current Transformers

When routing shielded cable through window-type current transformers (Figure 5) or ground sensor current transformers (Figure 6), the shield-ground connection wire is normally routed back through the current transformer and solidly grounded. Occasionally, special four-wire systems require a different routing of the neutral conductor.

Figure 7: Shielded cable connections (through ground sensor current transformers)

Unshielded Cable Connections

To meet switchgear requirements, provide adequate clearances between cables, conduits, and bus (figure 7). These items must be securely fastened or braced to withstand short circuit forces and to prevent strain on the terminals.

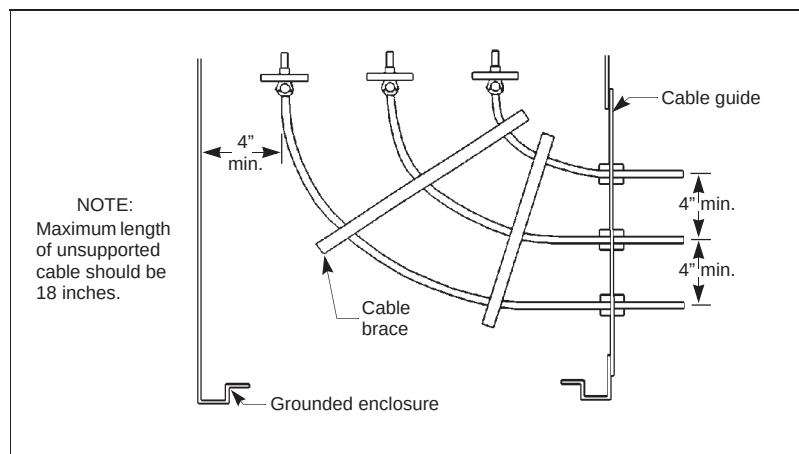
⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.

Maintain a minimum clearance of 4 inches between insulated cable and ground metal parts or other phases.

Failure to follow this instruction can result in death or serious injury.

Figure 8: Example of Unshielded Cable Bracing



SECTION 5—INITIAL PREPARATION

After the switchgear is installed and all interconnections are made, test the equipment and give it a final check before placing it in service.

WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

Exercise extreme care to prevent the equipment from being energized while conducting the preliminary tests. If disconnect switches cannot be opened, disconnect the line leads.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

If the switchgear has been stored for several months or has been exposed to high humidity, a standard 60 cycle hi-pot test will normally indicate if the equipment is satisfactory for service. See Table 3 on page 15 for test values and additional information. Follow other equipment testing procedures as required by customer in-house standards.

When all connections are made and preliminary testing is complete, perform the following inspections:

1. Check all control wiring with the wiring diagrams; ensure that all connections are properly made, all fuses are installed, current transformer circuits are complete, and loose connections are tightened.
2. Before any source of electric power is energized, make a final check of the equipment. Inspect every compartment for loose parts, tools, litter, and miscellaneous construction items.
3. Ensure that all insulating surfaces, including the primary support insulators and isolation barriers, are clean and dry.
4. Check all conductor fasteners and bolted connections for proper tightening torque (see Table 1 on page 9, for torque values).
5. Ensure that all barriers and covers are fastened in place.
6. Review key interlock schemes carefully (if used). Insert only the proper keys in the locks. Remove all extra keys; store them where only authorized personnel can access them.

SECTION 6—INTERLOCKS

Mechanical interlocks are designed as standard features to minimize hazards to the operator while operating the switchgear. For example, the door interlock prevents opening the front door while the load interrupter switch is closed.

Key interlocks are optional equipment, often supplied in conjunction with metal-enclosed switchgear to direct proper operation of the equipment. The key interlock schemes are usually described on the switchgear assembly drawings.

SECTION 7—OPERATING INSTRUCTIONS

Switch Operation

For specific information regarding operation of switches or circuit interrupters, refer to the separate instruction manuals for those devices.

High Voltage Fuses

High voltage fuses provide overcurrent protection for the high-voltage switch; they also give short-circuit interrupting protection up to the short-circuit rating of the equipment. Schneider Electric equipment can use either current limiting fuses or boric acid fuses.

When replacing or performing maintenance on fuses, always follow the safety precautions and steps listed below.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized switch with door open.
- Turn off switch before removing or installing fuses or making load side connections.
- After operating HVL switch to the open position, always look through the viewing window and verify all three main and interrupter blades are fully open.
- Always use a properly rated voltage sensing device at all line and load fuse clips to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all sources of power to the equipment, padlock, and tag all upstream or downstream sources which could energize the fuses.
2. Open the access door to the fuses. Confirm that all electric power to the fuses has been disconnected (use a voltage sensor designed for this purpose).
3. Wearing rubber gloves, grasp the fuse with a “hot stick” and remove it from the fuse clip assembly. Follow the procedures prescribed by the fuse manufacturer.
4. Still using rubber gloves and a hot stick, install new fuses.
5. When replacing “bolted-in” fuses, it may be necessary to handle the fuses by hand. Use extra caution in confirming that the bus is de-energized and grounded before replacing these types of fuses.

SECTION 8—MAINTENANCE

Inspection Schedule

Perform inspection and maintenance on the basis of operating conditions and experience. Abnormal conditions may require immediate attention while regularly scheduled maintenance will depend on availability of “down time” and qualified personnel.

After a circuit experiences a fault current or stressful condition, inspect the equipment at the first opportunity. Otherwise, inspect the switchgear at least once each year.

⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.**

Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E

Failure to follow these instructions will result in death or serious injury.

Individual Devices

The maintenance schedule for individual devices—such as meters and relays—should be based upon recommendations contained in the individual instruction manual for each device. Coordinate the various schedules with the overall maintenance program.

Inspection Procedure

Give the equipment installation a thorough overall maintenance check at least annually in the six areas described below.

Bus And Connections. De-energize the primary circuits before cleaning. Perform a standard 60-cycle hi-pot test to measure bus integrity.

Table 3: Field Test Voltages

Equipment Rating	Field Test Voltage	
	(AC)	(DC)
4.76 kV	14 kV	20 kV
15 kV	27 kV	38 kV
25 kV	45 kV	63 kV
38 kV	60 kV	85 kV

Apply the voltage to each phase individually for one minute with the other two phases and the enclosure grounded. To avoid damage during the test, disconnect the instrument transformers and remove the fuses.

If the test is unsuccessful, inspect the insulators for leakage paths. If necessary, clean the surface of the insulator(s) and re-test.

Connections. Inspect connections for symptoms which might indicate overheating or weakened insulation. Remove dust from busses, connections, supports, and enclosure surfaces. Wipe clean with a solvent such as denatured alcohol.

Instruments, Relays, And Other Devices. Maintain each device according to the specific instructions supplied. Inspect the devices and their contacts for dust or dirt; wipe clean.

Control Wiring. Check wiring connections for tightness and damage.

Mechanical Parts. Manually operate mechanical moving parts such as switch assemblies, interlocks, and doors.

Ventilation. Check all bus areas, grille work, and air passages for obstructions and dirt accumulation.

SECTION 9—REPLACEMENT PARTS

When ordering renewal or spare parts, include as much information as possible. In many cases, the part number of a new part can be obtained from identification of the old part.

Always include the description of the part. Specify the rating, vertical section, and factory order number of the equipment in which the part is to be used.

Table 4: Replacement Parts

Description	Part No.
Insulator—Porcelain 15 kV (6")	80029-002-03
Insulator—Glass Poly. 15 kV (6")	29903-01930
Strip Heater (1000W, 240V)	80031-030-01
Contact Grease (Mobilgrease 28)	1615-100950

ENGLISH

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Instruction Bulletin
Metal-Enclosed Switchgear

Schneider Electric

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www.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Replaces 6040-2, dated 02/2004

01/2005

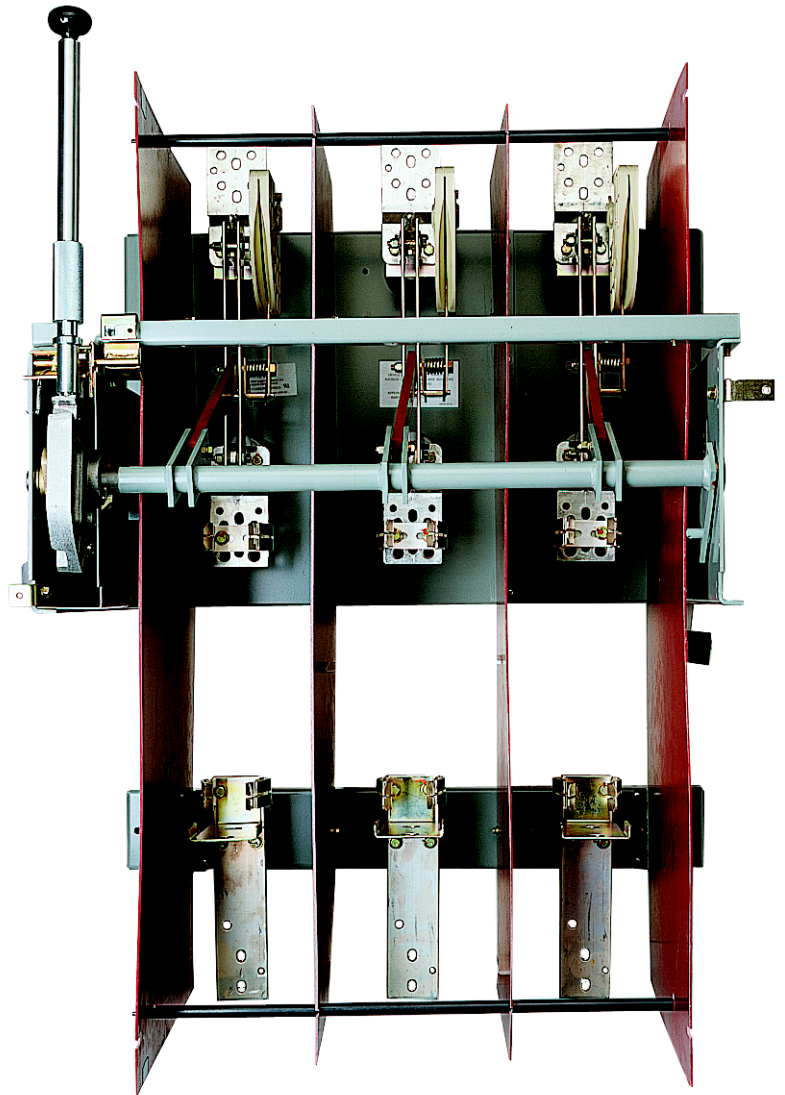
Type HVL Load Interrupter Switch

5/15 kV, upright or inverted
25.8 kV, upright only
38 kV, upright only

Class Number 9840

Instruction Bulletin

Retain for future use.



HAZARD CATEGORIES AND SPECIAL SYMBOLS



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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SECTION 1—INTRODUCTION

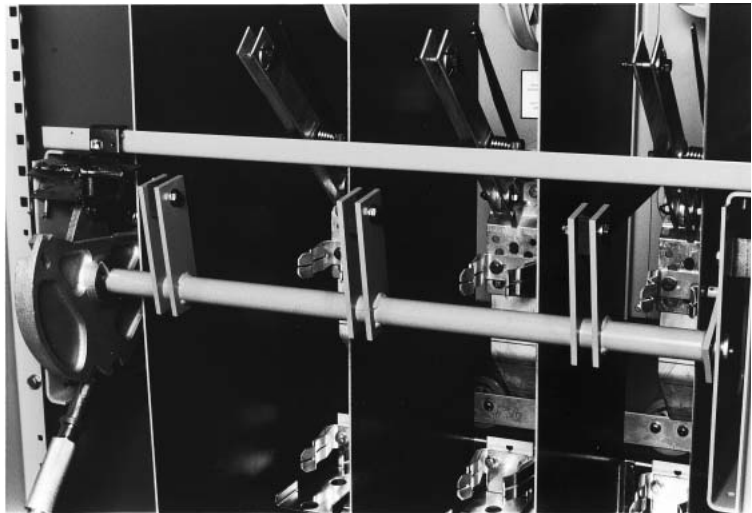
This bulletin contains instructions for the proper installation, operation, and maintenance of the HVL load interrupter switch manufactured by Schneider Electric. The HVL switch is a single-throw type switch. It is a primary component in many 2.4 kV to 38 kV power distribution systems, providing switching and overcurrent protection (when provided with fuses). HVL switches are typically used in unit substations, service entrance equipment, substation transformer protection, and sectioning of high voltage feeder systems.

The HVL switch can be mounted in indoor and outdoor enclosures, and is available in the following arrangements:

- 5/15 kV, upright or inverted, 600 A and 1200 A
- 25.8 and 38 kV, upright only, 600 A and 1200 A

Switches may come from the factory mounted in single or multiple bay units. They may also be furnished separately for OEM customers to use in their enclosures.

Figure 1: 15 kV HVL Switch



SECTION 2—SAFETY PRECAUTIONS

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

- Only qualified electrical workers with training and experience on high voltage circuits should perform work described in this set of instructions. These workers must understand the hazards involved in working with or near high voltage equipment. Such work should be performed only after reading this complete set of instructions.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm the power is off.
- The successful operation of HVL switches depends upon proper handling, installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to electrical equipment or other property.
- HVL switches have features designed to promote proper operation, but it is not possible to eliminate every hazard with these features. Therefore, the person using this device is responsible for recognizing the potential hazards, for wearing protective safety equipment, and for taking adequate safety precautions.
- Do not make any adjustment to the equipment or operate the system with safety features removed. Contact your local Schneider Electric representative for additional instructions if the HVL switch does not function as described in this manual.
- Before performing visual inspections, tests, or maintenance on this device, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Before replacing covers or closing doors, carefully inspect the equipment for tools and objects left inside. Use care while removing or installing panels so that they do not extend into energized bus.
- Before making any electrical connection, take every precaution to see that all connections are de-energized and grounded.
- Introducing foreign objects into this equipment can cause a short circuit which can result in severe damage, personal injury, or death. Short circuits can release large amounts of energy due to a rapid expansion of super-heated, ionized gases. Products of this instantaneous expansion can quickly engulf and burn personnel before preventive action can be taken. The short circuit source can cause additional injuries by propelling personnel or objects several feet from the equipment.

Some foreign objects that can cause short circuits are tools, test leads and instruments not designed for high voltage circuits, wire, and other conducting or semiconducting materials.

Failure to follow these instructions will result in death or serious injury.

SECTION 3—RECEIVING, HANDLING, AND STORAGE

RECEIVING

HVL switches are normally mounted in metal-enclosed switchgear built by Schneider Electric, or in a customer's proprietary enclosure. Check the packing list against the equipment received to ensure the order and shipment are complete. Claims for shortages or other errors must be made in writing to Schneider Electric within 60 days after receipt of shipment. Failure to do so constitutes unqualified acceptance and a waiver of all such claims by the purchaser.

Also upon receipt, immediately inspect the switchgear for damage which may have occurred during transit. If damage is found or suspected, immediately file a claim with the carrier and notify Schneider Electric.

HANDLING

Use care when uncrating, rolling, hoisting, or handling the switch. Use only lifting equipment suitable for the weight of the switch. Review the shipping documentation for the actual weight to be handled.

STORAGE

If the switch is stored before being placed into service, keep it in a clean, dry place that is free from corrosive elements and mechanical abuse. Energize the heaters inside the switchgear, or add heat from a separate source, such as a light bulb or blower. Use a minimum of 100 watts of heat per vertical section to keep the equipment dry during storage.

Covering the equipment with a tarpaulin may be necessary to protect it from contaminants or moisture. Do not store units outdoors.

In areas of high humidity, such as installations near oceans or rivers, monitor the equipment closely. If necessary, use additional heat to keep the switch dry. Contact the factory if the internal heaters do not prevent condensation inside the switchgear.

⚠ CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Do not remove the skids until the shipping sections are at the final location.
- Always use the skids to prevent equipment distortion.

Failure to follow these instructions can result in serious injury or equipment damage.

SECTION 4—INSTALLATION

SITE PREPARATION

Refer to the metal-enclosed switchgear instruction bulletin that was shipped with your equipment; follow site preparation instructions in that manual.

SWITCH INSTALLATION

The HVL switch is shipped factory-mounted in an enclosure or separately for OEM customers. If the switch is factory-mounted in its enclosure, the switchgear is designed to comply with applicable standards. Refer to the metal-enclosed switchgear instruction bulletin for installation instructions.

If the HVL switch is shipped without an enclosure, perform these checks:

- Verify that the mounting provisions align with the holes in the switch frame.
- Ensure that the bus and fuse connections align properly. There should be no stress on the connections or extensions.
- Tighten hardware according to the recommendations shown in Table 1.
- Install insulating barriers where necessary to provide the required clearance between energized bus and grounded parts.
- To view the switch position, a transparent window is recommended in the front panel or door, opposite the contact break area.

The switch and enclosure must interlock in conformance with the planned interlock scheme.

Table 1: Tightening Torques

Bolt Size	Sheet Metal Joints (SAE #2 Steel Bolts)	Electrical Connections (SAE #5 Steel Bolts)
1/4-20	7 lb-ft (9.5 N•m)	—
5/16-18	14 lb-ft (18.9 N•m)	—
3/8-16	21 lb-ft (28.4 N•m)	35 lb-ft (47.2 N•m)
1/2-13	42 lb-ft (56.7 N•m)	70 lb-ft (94.5 N•m)

SECTION 5—INITIAL PREPARATION

After the switch is installed and all interconnections made, test the equipment and give it a final check before placing it in service.

A standard 60 cycle hi-pot test will normally indicate if the equipment is satisfactory for service. See Table 2 on page 12 for test values. Follow other equipment testing procedures as required by in-house standards.

WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

Exercise extreme care to prevent the switch from being energized while conducting the preliminary tests. If disconnect switches cannot be opened, disconnect the line leads.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

After preliminary testing is complete but before energizing the HVL switch, perform the following inspections:

1. Check all control wiring (when present) with the wiring diagrams to ensure that connections are properly made.
2. Inspect all insulating surfaces for dirt and moisture, including the primary support insulators and isolation barriers. If necessary, wipe with a clean cloth.
3. Check all conductor fasteners and bolted connections for proper tightening torque; see the table on Table 1 on page 7 for values. Bolts with a torque seal have already been fastened at the factory.
4. Fasten all barriers and covers in place.
5. Insert the proper keys in the interlocks, when used.

SECTION 6—INTERLOCKS

Mechanical interlocks are standard features designed to minimize hazards to the operator while operating the switchgear. For example, the door interlock is designed to prevent opening the front door while the load interrupter switch is closed.

Key interlocks are optional equipment, often supplied in conjunction with metal-enclosed switchgear to direct proper operation of the equipment. The key interlock schemes are usually described on the switchgear assembly drawings.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.

When equipment is supplied with extra interlock keys, to be used during installation, the user is responsible for removing the extra keys. After reviewing the key interlock specifications, the user should provide only the necessary keys to properly operate the equipment. Extra keys should be destroyed or placed in a secure place, accessible to only selected personnel.

Failure to follow these instructions will result in death or serious injury.

Figure 2: Key Interlock



SECTION 7—OPERATING SEQUENCES

SWITCH OPENING

The switch opens in the following sequence:

1. In the closed position, the main blade mates with the stationary contact. The circuit current flows through the main blades while in this position (Figure 3).

Figure 3: Blades Closed



2. Pull the operating handle back and down. If the switch is motor-operated, the motor relay is activated by a local control switch or remote signal.
3. As the operating handle (or motor) moves toward the open position, the mechanism springs are charged. When the springs are fully charged, they toggle over the top dead center position, quickly discharging force to the operating shaft.
4. The operating shaft motion forces the main blades away from the stationary contacts. The interrupting blades are held closed, momentarily carrying all the circuit current (Figure 4).

Figure 4: Main Blade Open, Interrupter Blade Closed

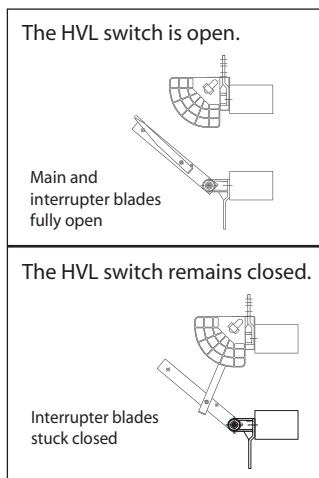


5. Once the main blades have separated well beyond arcing distance, the interrupting blades disengage from the stationary contacts. The resulting arc is elongated and cooled by the arc chute.
6. The main and interrupting blades continue to the fully open position (Figure 5). Spring pressure holds the blades and mechanism in the open position.

Figure 5: Blades Open



Figure 6: Blade Positions



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

After operating the HVL switch to the OPEN position, always look through the viewing window and verify that all three main and interrupter blades are fully open (see Figure 6). If any of the blades remain closed, do not work on or in this switch, or on downstream equipment. Contact Schneider Electric.

Failure to follow these instructions will result in death or serious injury.

SWITCH CLOSING

The switch closes in the following sequence:

1. If the switch is in an enclosure, close the door (to activate the switch interlock). Set the key interlock mechanism to ensure proper operation.
2. Close the switch by lifting the operating handle up and forward. If the switch is motor-operated, the motor relay is activated by a local control switch or remote signal.
3. As the operating handle (or motor) moves toward the closed position, the mechanism springs are charged. When the springs are fully charged, they toggle over the top dead center position, quickly discharging force to the operating shaft.
4. The operating shaft moves the blades toward the closed position.
5. The blades fully close and are maintained in the closed position by the operating shaft arms and the connector links.
6. The interrupter blades are captured behind the stationary arcing contacts, which delay the blades during the successive opening operation.

SECTION 8—MAINTENANCE

INSPECTION SCHEDULE

Perform inspection and maintenance on the basis of operating conditions and experience. Abnormal conditions may require immediate attention while regularly scheduled maintenance will depend on availability of “downtime” and qualified personnel.

After a fault current or stressful condition on a circuit, inspect the switch at the first opportunity. Otherwise, inspect the switch once each year. In a clean indoor or otherwise controlled environment the inspection interval could be extended up to five years.

⚠ DANGER

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Perform inspections, maintenance procedures, and parts replacement only with the primary source(s) of power disconnected and locked open. Be absolutely sure there is no backfeed through any feeder circuit .
- Always use a properly rated voltage sensing device to confirm the power is off.

Failure to follow this instruction will result in death, serious injury, or equipment damage.

INSPECTION PROCEDURE

Give the switch an overall maintenance check in the following areas. As stated in the warning above, make sure the equipment is de-energized before performing any maintenance or parts replacement.

Dielectric

Perform a standard 60-cycle hi-pot test to measure insulation integrity. Use the test voltage levels in Table 2.

Table 2: Field Test Voltages

Equipment Rating	Field Test Voltages	
	(AC)	(DC)
4.76 kV	14 kV	20 kV
8.25 kV	19 kV	27 kV
15 kV	27 kV	38 kV
25.8 kV	45 kV	63 kV
38 kV	60 kV	85 kV

Apply the voltage to each phase individually for one minute, with the other two phases and the enclosure grounded. If the test is unsuccessful, inspect the insulators for leakage paths. If necessary, clean the surface of the insulator(s) and test again. If the results are still unacceptable, please notify your local Schneider Electric sales representative.

Connections

Inspect connections for symptoms which might indicate overheating or weakened insulation. If necessary, re-tighten hardware according to the values in Table 1 on page 7. Remove dust from busses, connections, supports, and enclosure surfaces. Wipe clean with a solvent such as denatured alcohol.

Interrupter Blades

Inspect the switch interrupter blades about every 100 operations. When one-third of the arcing tip is burned away, replace the blade assembly and arc chute assembly as described in the following sections.

Main Blades

Wipe the main blade and jaw occasionally to remove dust accumulation. Lubricate the main blade and jaw with a light film of Mobilgrease 28. Never clean the contacts with an abrasive material. Do not lubricate the interrupter blades or arcing tips.

Control Wiring

Check any wiring connections for tightness.

Mechanical Parts

Manually operate mechanical moving parts such as switch assemblies, interlocks, doors, etc.

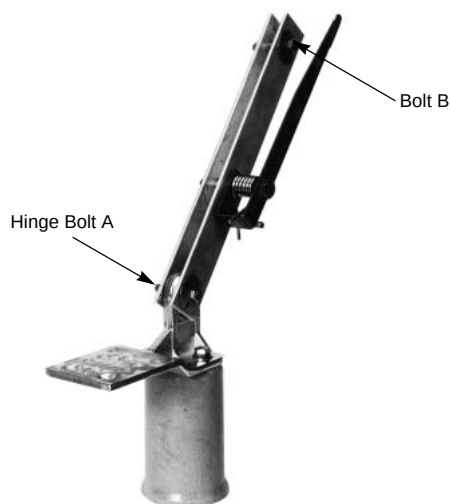
BLADE REPLACEMENT AND ADJUSTMENT

Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off. Lubricate all bearings and moving metal parts with Mobilgrease 28.

The contact pressure of the main and interrupter blades is factory-adjusted; it should require no readjustment with normal switch operation. If field maintenance is required, follow these steps:

1. Begin with the switch in the open position. Disconnect the connector links from the main shaft by removing the bolts, spacers, and nuts.
2. Remove the main and interrupter blade assembly by removing hinge bolt A (Figure 7).

Figure 7: Blade Assembly



3. Clean and lubricate the jaw and hinge contact surfaces using Mobil 28® red grease.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE.

Do not lubricate the interrupter blades or arcing tips.

Failure to follow this instruction can result in product damage.

4. Attach the new blade assembly to the hinge using hinge bolt A (Figure 7 on page 13). Ensure that the silver tungsten arcing tip on the interrupter blade faces the arc chute. Align and adjust the blade assembly as described below.

Blade Alignment:

- Check alignment of each main blade with the jaw. The interrupter blade must also be centered with the arc chute assembly.
- If alignment is necessary, loosen the jaw and hinge casting mounting bolts, align the blades, and re-tighten bolts. The arc chute assembly must be in the extreme upper position to ensure that the interrupter blade does not strike the mounting bracket inside the arc chute.
- Open the switch blades by hand. The interrupter blade must remain in the arc chute until it disengages from the stationary contacts in the arc chute, allowing the interrupter blade to spring outward.

⚠ CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

The blades release at a very high velocity. Use caution when manually opening blades. Keep hands and objects clear of the blade path.

Failure to follow this instruction can result in serious injury or product damage.

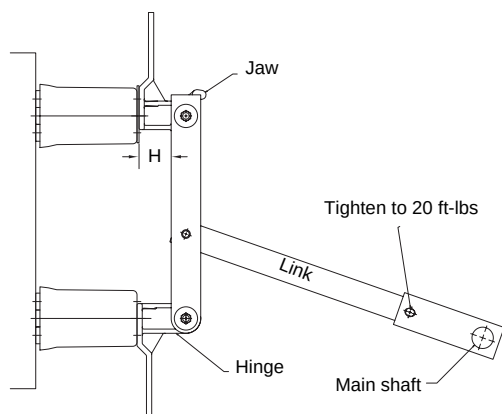
Blade Adjustment:

- Disconnect the connector links from the main shaft.
- Open the blades and tighten bolt A until the lubricated hinge friction is just sufficient to support the weight of the blades when horizontal.
- Close the blades and tighten bolt B until the force required to disconnect the blades (applied at bolt B) matches the force shown in Table 3. Apply the force perpendicular to the closed blades.

Table 3: Blade Disconnect Forces

HVL Switch Short Circuit Rating	Pullout Force
40 kA	60-70 lb
61 kA/80 kA	90-110 lb

Figure 8: Blade Penetration



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Tightening the HVL switch main contact bolts A and B to more than 20 ft-lbs will cause the interrupting or main blades to remain closed even though the switch handle indicates the switch is OPEN.

Failure to follow this instruction will result in death or serious injury.

5. Reassemble the connector links to the main shaft and then close the switch. Adjust the distance H (see Figure 8) between the bottom of the main blades and the top of the arc chute bracket to 1.88 in. for 600 A switches and 1.75 in. for 1200 A switches. Torque the links to the main shaft to 20 ft-lbs.

ARC CHUTE ASSEMBLY REPLACEMENT

Follow these steps to replace the arc chute assembly.

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the insulating links from the main shaft by removing the bolts, spacers, and nuts.
3. Open each blade assembly. Remove the two bolts holding the jaw and arc chute assembly to the insulator.
4. Re-assemble the jaw and new arc chute assembly. Tighten the two mounting bolts until they are finger-tight.
5. Close each blade assembly, aligning the main blade with the jaw. Align the interrupter blade with the center of the arc chute assembly and tighten bolts.
6. Following the steps described in the Blade Adjustment section, adjust the blades.

Figure 9: Arc Chute Assembly



SWITCH JAW OR SWITCH HINGE CASTINGS REPLACEMENT

Follow these steps to replace the switch jaw or switch hinge castings:

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the insulating links from the main shaft by removing the bolts, spacers, and nuts.
3. Open each blade assembly. Remove the two bolts holding the jaw or hinge casting to the insulator.
4. Re-assemble the blade assembly, arc chute assembly, and new casting(s). Tighten the mounting bolts until finger-tight.
5. Close each blade assembly, aligning the main blade with the jaw. Align the interrupter blade with the center of the arc chute assembly and tighten bolts.
6. Following the steps described in the Blade Adjustment section, adjust the blades.

INSULATOR REPLACEMENT

Follow these steps to replace the insulator(s):

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the insulating links from the main shaft by removing the bolts, spacers, and nuts.
3. Open each blade assembly. Remove the two bolts holding the jaw or hinge casting to the insulator. Remove the mounting bolts holding the insulator.
4. Change out the insulator(s) and re-assemble the casting(s), blade assembly, and arc chute assembly. Tighten the front mounting bolts until finger-tight.
5. Close each blade assembly, aligning the main blade with the jaw. Align the interrupter blade with the center of the arc chute assembly and tighten bolts.
6. Following the steps described in the Blade Adjustment section, adjust the blades.

CONNECTOR LINK REPLACEMENT

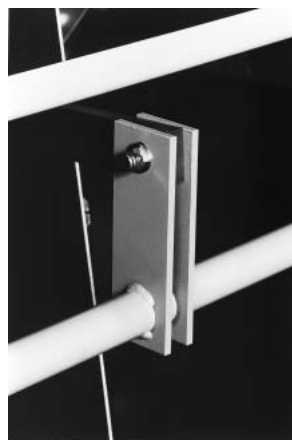
Follow these steps to replace the insulator connector links.

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the connector links from the main shaft by removing the bolts, spacers, and nuts.
3. Re-assemble the new insulator links.
4. Before operating the switch, grasp the main blades, making sure there is a slight amount of play between the main blade spacer and the jaw. The spacer should turn freely at all times.

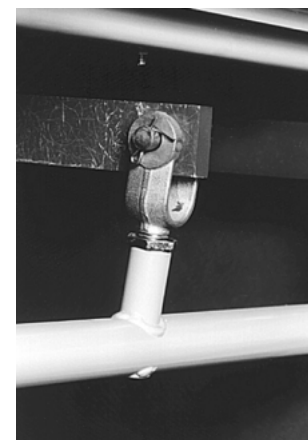
Figure 10 illustrates new- and old-style main shaft connections.

NOTE: Parts are no longer available for old-style connections.

Figure 10: Main Shaft Connections



New Style



Old Style

SECTION 9—REPLACEMENT PARTS

When ordering parts, include as much information as possible. Often, the part number of a new part can be obtained from identification of the old part. Always include the description of the part. Specify the rating, vertical section, and factory order number of the equipment in which the part is to be used.

Table 4: 5/15 kV Replacement Parts ^{1, 2, 3}

Figure 10 Item Number	Description	Part No.
A	Arc Chute Assembly	44035-198-50
B	Interrupter Blade Assembly	44035-199-50
C	Shoulder Bolt Locknut	80025-005-01 23201-10240
D	Spacer	44035-002-01
E	Spring	44035-216-01
F	Main Blade (1200 A) ⁴ Main Blade (600 A) ⁴	44035-204-01 44035-203-01
G	Switch Jaw (1200 A) Switch Jaw (600 A)	44035-001-02 44035-001-01
H	Switch Hinge Casing (1200 A) Switch Hinge Casing (600 A)	44035-202-02 44035-202-01
I	Insulator—Glass Polyester (up to 15 kV) Insulator—Porcelain (up to 15 kV)	29903-01930 80029-002-03
J	Connector Link	44035-208-01
K	Spacer Locknut 3/8 Screw Washer	44035-002-01 23201-10240 21401-24560 23601-00240
L	Interlock Pivot Assembly	44036-161-50
M ⁵	Barrier Assembly—Unfused, 29" (737 mm) L Barrier Assembly, 48" (1219 mm) L Barrier Assembly, 60" (1524 mm) L, SM4, SM5 Barrier Assembly, 60" (1524 mm) L, CLE3, RBA800 Barrier Assembly, 60" (1524 mm) L, RBA200, RBA400 Barrier Assembly—Inverted, 29" (737 mm) L Barrier Assembly—Inverted, 48" (1219 mm) L	44037-571-50 44037-077-50 44037-078-50 44037-079-50 44037-078-50 44037-572-50 44037-081-50
Not Shown	Contact Grease (Mobil 28) Switch Handle Assembly ⁶	1615-100950 44036-320-50

- 1 Consult factory for parts not included in this table.
- 2 Contact the factory for 80 kA switch parts.
- 3 New motor operator after 1996. See Instruction Bulletin 9840-5 for details.
- 4 Continuous current rating.
- 5 Shipped disassembled.
- 6 New handle casting design after 1991.

Figure 11: 5/15 kV Replacement Parts

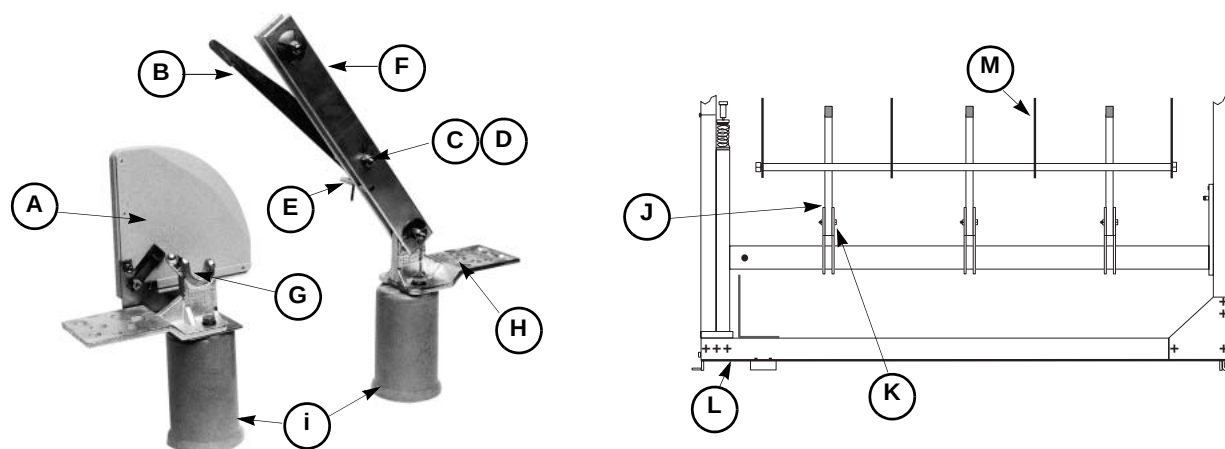


Table 5: 25.8 and 38 kV Replacement Parts ^{1, 2}

Figure 11 Item Number	Description	25.8 kV Square D Part No.	38.0 kV Square D Part No.
A	Arc Chute Assembly	44035-198-50	44035-198-50
B	Interrupter Blade	44035-199-50	44035-199-50
C	Shoulder Bolt Locknut	80025-005-01 23201-10240	80025-005-01 23201-10240
D	Spacer	44035-002-01	44035-002-01
E	Spring	44035-216-01	44035-216-01
F	Main Blade (1200 A) ³ (600 A) ³	44035-808-01 44035-807-01	— 44035-806-01
G	Switch Jaw Casting (1200 A) (600 A)	44035-001-01 44035-001-01	— 44035-001-01
H	Switch Hinge Casting (1200 A) (600 A)	44035-202-01 44035-202-01	— 44035-202-01
I	Insulator 25.8/38 kV (porcelain)	29903-01996	29903-01996
J	Connector Link polyester	44035-208-02	44035-208-05
K	Spacer Locknut 3/8-inch Screw Washer	44035-002-01 23201-10240 21401-24560 23601-00240	44035-002-01 23201-10240 21401-24560 23601-00240
L	Interlock Pivot Assembly	44036-161-50	44036-161-50
M	Barrier Assemblies ⁴	44035-629-(50, 51, 54)	44035-629-(52, 53)
Not Shown	Contact Grease (Mobil 28) Operator Crank Switch Handle ⁵ (Center Knob) (Side Knob)	1615-100950 44035-145-01 80026-001-50 80026-001-51	1615-100950 44035-145-01 80026-001-50 80026-001-51

¹ Consult factory for parts not included in this table.

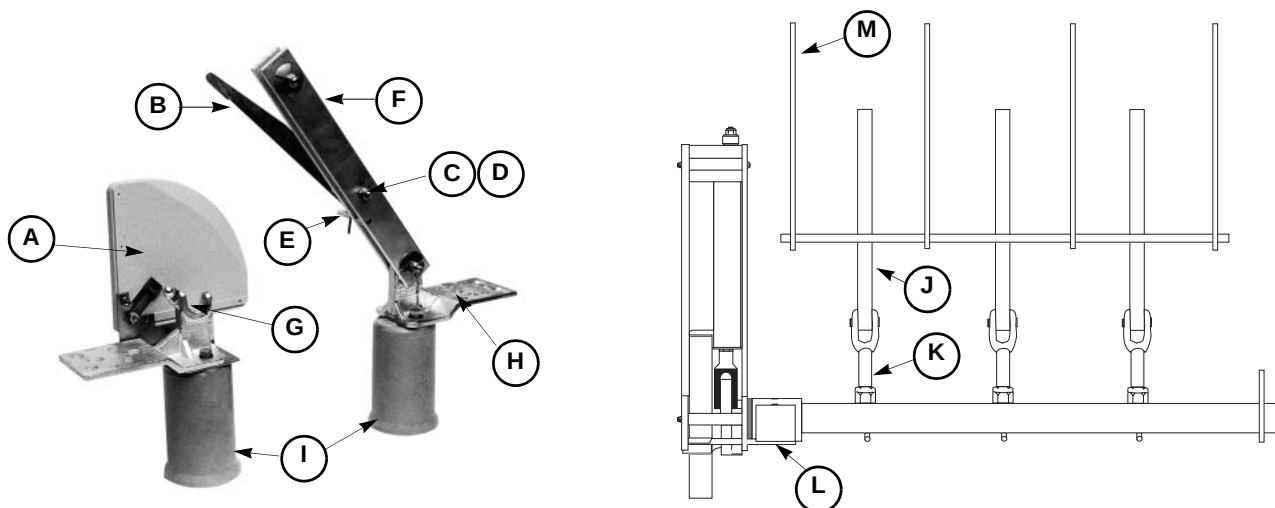
² New motor operator after 1996. See Instruction Bulletin 9840-5 for details.

³ Continuous current rating.

⁴ Shipped disassembled.

⁵ New handle casting design after 1991

Figure 12: 25.8 and 38 kV Replacement Parts



ENGLISH

[illegible]

Instruction Bulletin
Type HVL Load Interrupter Switch

Schneider Electric

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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Power-Dry II™

Dry Type Transformers

Class 7420

Instruction Bulletin
Retain for future use.



NOTICE

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result** in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result** in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be serviced only by qualified electrical maintenance personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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SECTION 1—INTRODUCTION

This instruction bulletin details information about installing, operating, and maintaining ventilated and nonventilated dry type transformers. Each transformer has its own specification and unique construction features. These features are detailed in the transformer outline and nameplate drawings.

This instruction bulletin is not an application guide for the ventilated dry type transformers or a substitute for adequate training in safe working procedures for this and related electrical equipment. Installation of this electrical equipment may require special licenses or training. Consult applicable national, industry, and local codes for specific requirements.

The successful operation of any transformer depends on various factors such as installation, loading, service conditions, and maintenance. Electrical systems in which transformers, along with vacuum or SF⁶ circuit breakers, are used are capable of high frequency overvoltages which will not be suppressed by lightning arresters. These medium voltage systems may require a detailed, high frequency overvoltage system analysis and/or the addition of high frequency overvoltage protection. The transformer should be installed in conditions as specified in ANSI/IEEE Section C57.12.01 *Usual Service Conditions*, unless the transformer is designed specifically for operation in conditions other than the usual service conditions.

NOTE: If additional information is needed that is not covered by this instruction bulletin, contact the nearest Schneider Electric Field Sales Office, or Square D Services at 1-800-634-2003.

SECTION 2— SAFETY PRECAUTIONS

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Read and understand this entire instruction bulletin before installing, operating, or maintaining a dry type transformer. Follow all applicable local and national codes.
- Disconnect all power and verify the transformer is de-energized before servicing the transformer. Operation of a primary protective device may be evidence of a faulted transformer. Do not re-energize the transformer until the cause of operation of the primary protective device is found and corrected.
- Many parts of the transformer operate at high voltages. **DO NOT TOUCH.** Use only electrically insulated tools and clothing, and protective gear when working around electrical equipment.
- Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition. Always assume that a terminal is energized unless it is checked with a properly rated meter to ensure the terminal is de-energized and grounded.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

SECTION 3—RECEIVING, HANDLING, AND STORAGE

Ventilated open wound transformers are shipped either completely assembled in a sheet metal enclosure or as a core and coil assembly. They are covered with a clear plastic sheet to prevent entrance of moisture and dust.

Figure 1: Typical Packaging of Transformers for Shipment



Typical Packaging for an Enclosed-indoor Ventilated Dry Transformer



Typical Crating and Cover for a Core and Coil Assembly

Initial Inspection

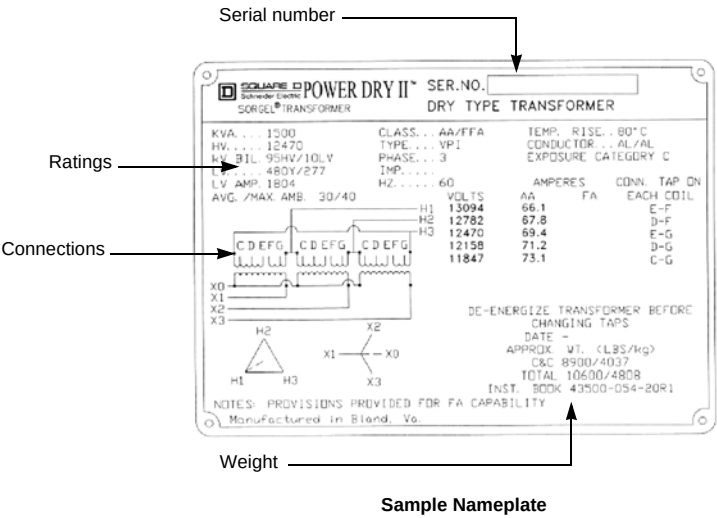
Before unloading the transformer, perform the following inspection:

1. Remove the protective covering.
2. Verify that the serial number on the transformer nameplate (Figure 2 on page 8) matches the serial number listed on the bill of lading. If the numbers do not match, contact your field sales representative immediately.
3. Review the shipping papers to ensure shipment is complete. Accessories, hardware, or both may arrive in a separate container on a separate pallet.
4. Inspect the transformer for any obvious external damage that may have occurred during shipment. An internal inspection of the enclosure is not usually required unless possible external damage has been observed. If an internal inspection is required, carefully inspect the leads, bolted mechanical and electrical joints, the core and coils, and accessory equipment such as fans, controls, heater strips, control power transformers, or current transformers. List any noticeable damage on the receiving papers, file a claim with the carrier at once, and notify Schneider Electric .
5. After completing all of the above steps and if no problems are found, off load the transformer. Refer to "Handling" below.

Figure 2: Typical Transformer Nameplate



Ventilated Transformer (shown with optional features)



Handling

Observe the following safety measures when handling the transformer:

⚠ DANGER

HAZARD OF FALLING EQUIPMENT AND CRUSHING

- Transformer is top heavy and may become unbalanced.
- Verify that the capacity of the handling equipment is adequate for the transformer weight.
- Keep all unnecessary personnel away while handling and moving the transformer.

Failure to follow these instructions will result in death or serious injury.

Unloading and Lifting

Whenever possible, use a crane to unload the transformer. In some cases, smaller transformers may be shipped in a box-type trailer that cannot be unloaded with a crane. In these cases, a forklift may be used to unload the transformer.

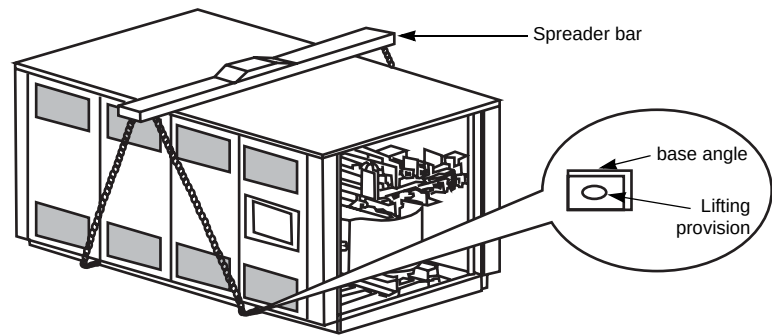
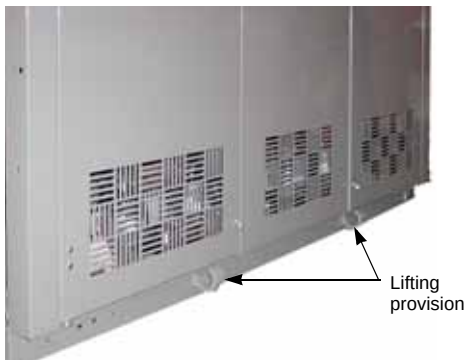
The approximate weight of the transformer is shown on the nameplate. Verify that the capacity of the handling equipment is adequate for the weight of the transformer.

External Lifting Procedures

The transformer assembly may be lifted from provisions on the base frame using lifting slings, chains, or cables with spreaders. Care should be taken to avoid damage to the enclosure by allowing at least 20 feet from the top of the enclosure to the lift hook, or by using a spreader bar (Figure 3).

1. Use spreaders or spanner bars (Figure 3) to provide the vertical lift on lifting pads and slings to prevent crushing or otherwise damaging the frame or its finish.

Figure 3: Using a Spreader Bar

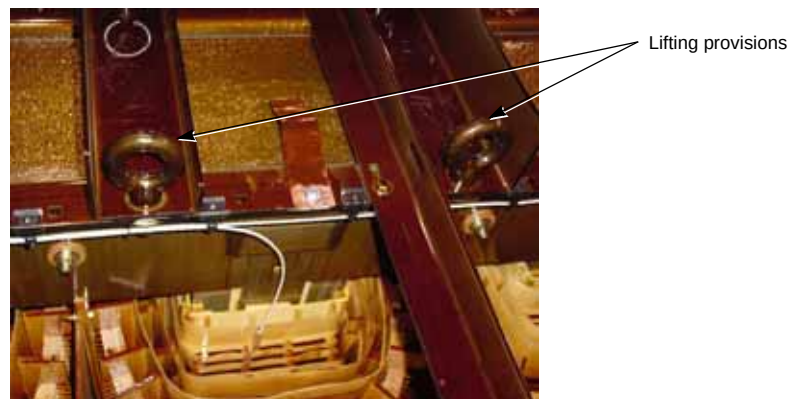


2. Select or adjust the rigging lengths to compensate for any unequal weight distribution of load and to maintain the transformer in an upright position.
3. Do not allow the angle between the lifting cables and vertical to exceed 45° in order to reduce the tension on the rigging and the compressive load on the lifting or spanner bars and spreaders.
4. Do not pass ropes or cables through the lift holes in bars, angles, or channels. Use slings with safety hooks or shackles.
5. Small cushioned pads may be placed on the transformer sides and cover to avoid contact with the enclosure.

Optional Lifting Procedures

If external lifting is not possible, removal of the enclosure top (Figure 4) allows easy attachment of shackles to the lifting provisions located on the top core clamps.

Figure 4: Recommended Method of Lifting from Overhead



NOTE: Cable pull angles should not exceed 45° from vertical. Avoid tilting. Unit is top heavy.

Using a Forklift

If the transformer must be unloaded with a forklift, observe the following safety precautions.

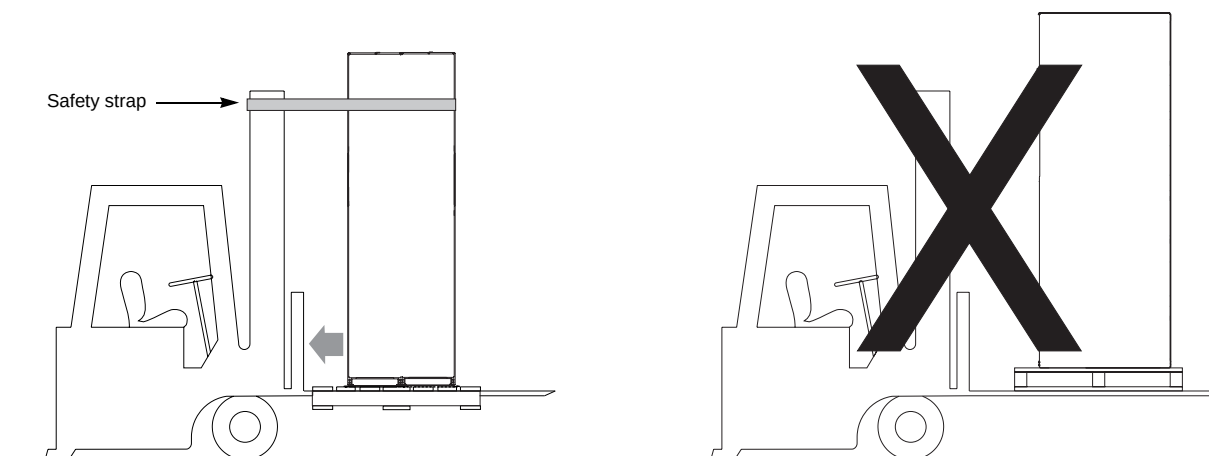
⚠ DANGER

HAZARD OF FALLING EQUIPMENT AND CRUSHING

- Transformer is top heavy and may become unbalanced.
- Verify that the capacity of the handling equipment is adequate for the transformer weight.
- Stabilize the transformer with a safety strap to reduce the possibility of tipping.
- Keep all unnecessary personnel away while handling and moving the transformer.

Failure to follow these instructions will result in death or serious injury.

Figure 5: Handling Using a Forklift



Towing and Moving

After the transformer has been off loaded, moving the transformer into position by a crane is preferred. When a crane cannot be used, the transformer can be skidded or moved on rollers. When doing so, take extra care not to damage the transformer.

The enclosure is a “bolt-together” design. If necessary, the enclosure can be disassembled to facilitate installation.

NOTE: Any disassembly and reassembly of the enclosure will be the sole responsibility of the owner and may void the warranty. Contact Schneider Electric for more information.

Storing

If the transformer must be stored, it is preferable to locate it in its permanent location on a concrete pad. If a level concrete surface is not available, take precautions to keep the unit from contacting an earthen surface. Protect the transformer and the connection points from the environment. Store an indoor unit indoors only. Maintain adequate ventilation so that air can flow through the transformer enclosure.

To reduce condensation and avoid moisture absorption in the transformer while it is being stored, immediately install space heaters, incandescent lamps, other small electric heaters. See “Drying the Core and Coil Assembly” on page 16 for more information.

If the transformer is stored for an extended time, make periodic inspections of the transformer exterior and interior for corrosion or other possible damage. Always make an internal inspection before the transformer is placed in service. If you have any concerns, contact Schneider Electric.

SECTION 4—INSTALLATION

NOTE: Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

Transformer Location Indoor

Follow all local and national codes when locating the transformer. Make sure the ventilated openings, on the top and bottom of the enclosure, are clear. The transformer must be at least 12 inches (305 mm) from walls or other obstructions to allow circulation of air through and around each unit.

For indoor installations, consult local and national codes to ensure all applicable requirements are satisfied. If the transformer is located near combustible materials, make sure the transformer meets or exceeds the minimum clearances as required by the National Electrical Code® (NEC) or other applicable local codes.

Locate the transformer on a level foundation strong enough to support the weight of the transformer, preferably of reinforced concrete. The manufacturer recommends that you do not place the transformer directly on an earthen surface. Ensure the foundation has adequate drainage. Seismic regulations may require that the transformer be anchored to the pad.

Restricting Access to the Transformer

Ventilated dry type transformers are not designed or constructed to be tamperproof. Install the transformer in an area that is secure and that allows only authorized personnel access to the transformer.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

The transformer is not tamperproof, therefore restrict access to it. Allow only authorized personnel access to the transformer.

Failure to follow these instructions will result in death or serious injury.

Transformer Location Outdoor

For outdoor installations, consult local and national codes to ensure all applicable requirements are satisfied. If the transformer is located near combustible materials, make sure the transformer meets or exceeds the minimum clearances as required by the NEC or other applicable local codes. The transformer must be at least 12 inches (305 mm) from walls or other obstructions to allow circulation of air through and around each unit. Ventilated and nonventilated, outdoor substation transformers and pad-mounted unit substations are designed for installation on a well-drained, concrete pad. Unless specified otherwise, the transformer is supplied without a bottom plate in the enclosure. If installing the transformer in a elevated position where the bottom is exposed, add a bottom plate (for rodent resistance) with provisions for drainage to the enclosure.

Atmospheric Conditions

Atmospheric conditions and accessibility are important considerations when locating the transformer outdoors. Install outdoor ventilated transformers in locations that are free from unusual dust or chemical fumes. The enclosure helps protect the transformer from atmospheric conditions such as dust, rain, or snow. Also, the enclosure is designed to divert water from energized parts, insulation, and wiring. However, it may not protect against internal condensation or ice, or completely stop snow from entering. If possible, locate the transformer in a shielded area such as in the corner of a building or landscaped windbreak to provide extra protection from driving wind, rain, or snow. When subjected to severe weather, outdoor dry type transformers should be inspected to determine if added protection is necessary.

Accessibility

Outdoor pad-mounted enclosures have a hinged door on the low voltage compartment with a handle suitable for padlocking. Access to the high voltage is possible only after the low voltage door is opened, allowing authorized personnel access through a second door. Also consider accessibility for maintenance when locating the transformer. Installations where the transformer may be fully exposed to the public spaces, such as shopping centers or school yards may require additional precautions.

The pad-mounted enclosure design meets the ANSI and NEMA standard rod entry test to prevent the entrance of a rod having a diameter of 0.125 inch (3.175 mm) at any point on the enclosure. Ventilated enclosures have the same provisions as the nonventilated, except that the ventilated units have ventilation openings, which are designed according to the ANSI and NEMA standard rod entry test to prevent the entrance of a rod having a diameter of 0.500 inch (12.7 mm).

Cable Connections

When cable connections are required, conductors suitable for at least 194° F (90° C) should be used. Minimum clearance at terminals should be maintained in accordance with the following table.

Table 1: Terminal Clearances

Transformer BIL	Minimum Clearance (in.)
10	1.00
20	1.00
30	1.50
45	2.50
60	3.50
75	4.75
95	6.00
110	7.50
125	8.75
150	11.25
200	15.50

All connections should be made without placing undue stress on the terminals. Connectors should be securely fastened in place and adequately supported with allowances for expansion and contraction.

Lightning Arresters

At times, it becomes necessary to ship the specified lightning arresters loose to the job site due to physical size and/or to prevent damage. See Figure 6 for the typical installation method.

Figure 6: Installing Lightning Arresters



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Low voltage on the transformer windings may exceed 600 V. Do not touch the windings.

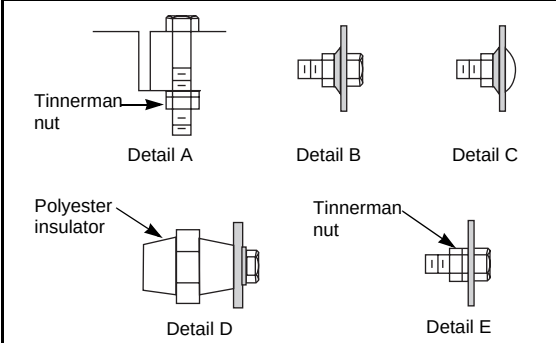
Failure to follow these instructions will result in death or serious injury.

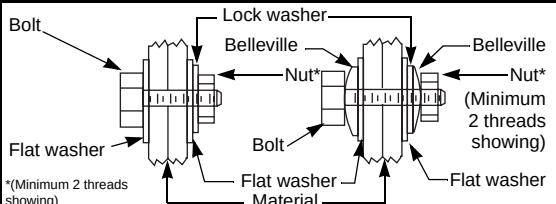
The transformer has both high voltage (HV) and low voltage (LV) winding connections. Multiple tap positions are available on the HV winding to allow for adjustments, which may be necessary because of the specific supply voltage or transformer load characteristics. If tap adjustments are necessary, see “Changing Tap Positions to Adjust Voltage” on page 20. Connection points are clearly labeled on the transformer. Refer to the nameplate and wiring diagram to make the electrical connections.

Follow these guidelines when making connections:

1. Clean the contact areas of the terminals (if applicable).
2. Use leads that are long enough to avoid mechanical strain caused by expansion and contraction. Strain can cause loose connections over time.
3. Using a torque wrench, ensure all bolted connections are torqued to the values given on the transformer label and in this bulletin. Refer to Table 2 on page 14 for torque information.

Table 2: Torque Guidelines

				Bolt Size	Grade	Application (see diagram at left)	Torque Range
Detail A				.38–16	2	Detail A	3–6 lb-ft (4.0–8.1 N•m)
Detail B				.38–16	2	Detail B, C, D	15–20 lb-ft (20.3–27.1 N•m)
Detail C				.75–10	5	Detail B	100–155 lb-ft (135.7–210.3 N•m)
Detail D				.25–20	2	Detail E	3–6 lb-ft (4.0–8.1 N•m)
Detail E				.50–13	2	Detail B, D	40–50 lb-ft (54.3–67.8 N•m)
				.50–13	5	Detail B	40–70 lb-ft (54.3–95.0 N•m)
				.62–11	2	Detail B	80–90 lb-ft (108.5–122.1 N•m)
				1.00–14	1018	Detail B	110–170 lb-ft (149.2–230.6 N•m)
				.62–11	5	Detail B	110–130 lb-ft (149.2–176.4 N•m)

				Electrical Connections		
				Bolt Size	Grade	Torque Range
				.38–16	2	15–20 lb-ft (20.3–27.1 N•m)
				.50–13	2	40–50 lb-ft (54.3–67.8 N•m)
				.62–11	2	80–90 lb-ft (108.5–122.1 N•m)
				.62–11	5	110–130 lb-ft (149.2–176.4 N•m)

Electrical Connections for Pad-Mounted Transformers

Pad-mounted dry type transformers are provided with HV and LV terminals for primary and secondary connections. Multiple tap connections are available on the HV windings to allow for adjustments, which may be necessary because of the specific supply voltage or transformer load characteristics. If tap adjustments are necessary, see “Changing Tap Positions to Adjust Voltage” on page 20. Connection points are clearly labeled on the transformer. Refer to the nameplate and wiring diagram to make the electrical connections.

High Voltage Bushing Connections

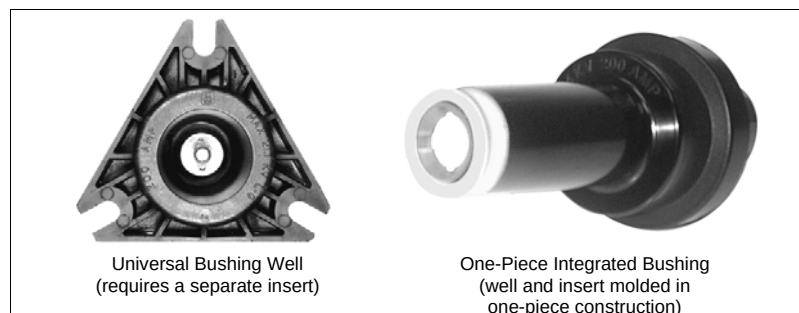
Depending on the transformer specification, HV bushings are either live-front with exposed-metal terminals or molded dead-front (Figure 7).

Live Front: Lugs are required to terminate the cable on a live front bushing. If the live front design and shielded cable are used, install a cable stress relief terminator kit on each high voltage cable.

Dead Front: Install an elbow terminator kit on the cable to connect to the dead front bushing. On the dead-front design, the elbow terminator kit includes the necessary cable stress relief.

Contact the Square D Medium Voltage Transformer facility at 704-283-7411 for application or order information regarding live front or dead front terminator kits. Installation instructions are provided with the terminator kits. Elbow terminators and stress cones are not provided by the manufacturer.

Figure 7: Dead Front Molded HV Bushings



The one-piece integrated bushing is shipped with a red plastic protective cap to protect the internal bushing contact points from dirt or moisture. Leave this cap in place until the transformer is energized. When the transformer is energized, plug the ground cap onto any unused bushing well or insert to avoid partial discharge and subsequent bushing damage.

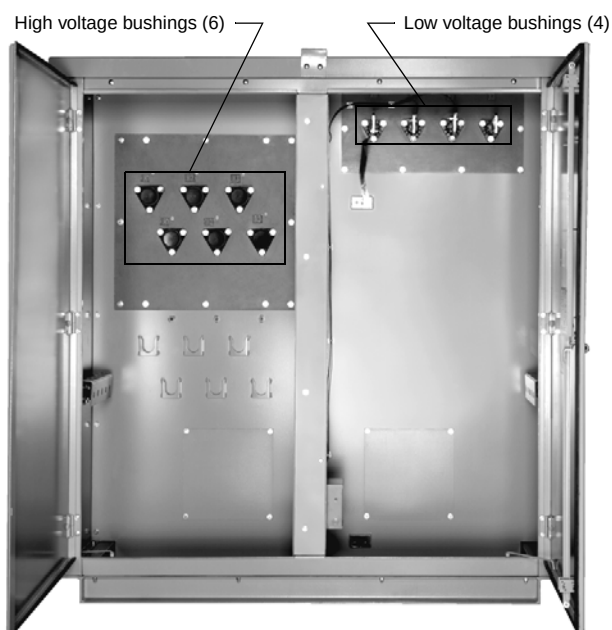
The transformer nameplate (Figure 2 on page 8) illustrates the internal wiring and external marking of each bushing. Refer to the nameplate on the transformer for clarity on where to connect each incoming cable.

On live front designs, ensure that adequate air clearances are between all energized parts in accordance with the latest ANSI Standard C57.12.22.

Low Voltage Bushing Connections

Low voltage terminals through 600 V are supplied with NEMA standard hole drillings and spacings, but are not supplied with lugs. Lugs may be stacked or mounted on either face of the spade. For 600 V bushings only, maintain a minimum of one inch air clearance between phase to phase or phase to ground.

Figure 8: Typical Locations for Bushings on Pad Mounted Dry Type



Grounding

To ground the transformer, use only the ground pads on the base of the transformer. Do not use hold-down bolts or cleats, or any other component to establish the transformer ground.

Figure 9: Core Ground Strap Location



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- When grounding the transformer, conform to all applicable codes. Improper grounding can cause high voltage on the transformer secondary terminals.
- Secondary voltages may reach supply voltage levels. Under certain fault conditions, the secondary voltages from line to ground of transformers with ungrounded secondary windings (such as delta, floating wye and open delta) may approach a level as high as the supply voltage. **DO NOT TOUCH THE WINDINGS.**
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.

Failure to follow these instructions will result in death or serious injury.

SECTION 5—START-UP TESTING

NOTE: Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel should perform these tests.
- Disconnect ALL high voltage, low voltage, and neutral connections.
- Disconnect auxiliary equipment such as lightning arresters, the fan and temperature control system, meters, or any other low voltage control system that is connected to the windings that are involved in these tests.
- **DO NOT** disconnect the ground connection to the transformer frame.

Failure to follow these instructions will result in death or serious injury.

Before energizing the transformer and placing it in service, the manufacturer recommends that the following tests be performed at the installation site:

- **Insulation Resistance:** Measures the resistance of the insulation between the primary and secondary windings and from each winding to ground.
- **Turns Ratio:** Measures the ratio of the primary to secondary turns to check for possible insulation degradation in the windings.
- **Core Megger® Test:** Measures the resistance to the flow of current through and over the surface of the transformer insulation. Results can indicate possible insulation deterioration. Applicable for units ordered with an isolated core only.

Drying the Core and Coil Assembly

If the transformer is to be held in storage or will undergo periods of de-energization, it is recommended that space heaters be used to prevent accumulation of moisture on the core and coil assembly. The space heaters are typically 120 volt/50 watt and are usually thermostatically controlled. Heaters are mounted directly beneath the coils, front and back, on brackets attached to the bottom core clamps and mounting feet. Two heaters are used per coil, with three heaters on the high-voltage side and three on the

Using the Insulation Resistance Test to Determine Drying Time

low-voltage side. Space heaters are provided with a terminal block for connection to an external power source.

The transformer core and coils must be dry before the transformer can be tested and energized. If the transformer has more than surface moisture present, more extensive drying may be required to ensure that the core and coils are dry. To dry the transformer, apply external heat to the transformer using the heater or lamp method described above. For transformers without an enclosure, the core and coil assembly can also be placed in a suitably ventilated oven.

Drying time depends on the condition of the transformer, size, voltage, amount of moisture absorbed, and method of drying. Measuring insulation resistance is valuable in determining the drying status.

Normal humidity has little effect on energized dry type transformers. If a shutdown occurs during a period of low humidity, no special precautions are necessary before re-energizing the transformer.

However, under conditions of high humidity, take precautions to ensure there is no condensation inside the transformer. Space heaters (optional) placed inside the housing should be energized to provide protection against this condition. As a simple rule, always keep the transformer a few degrees above the ambient temperature.

⚠ CAUTION

FIRE HAZARD

Constant attendance during the drying process is recommended. Have a suitable fire extinguisher on hand for use in the event of an emergency.

Failure to follow this instruction can result in injury or equipment damage.

Drying

To remove moisture from a transformer that has been exposed to high humidity, spray, or extended storage, the following methods are recommended:

1. Applications of external heat

External heat is applied by passing heated air through the inlets in the bottom of the transformer housing. Direct the air so that it passes through the winding ducts and not only around the sides of the coils. Adequate ventilation is essential during this process. The most effective way to apply external heat is to place the core and coil assembly into a well ventilated oven.

2. Heating by circulation of current

Heating by circulation of current is accomplished by short circuiting the secondary terminals of the transformer and applying impedance voltage to the primary terminals. This will produce 100% rated current in all windings. To obtain the impedance voltage, multiply the "per unit" value of the nameplate % impedance by the primary voltage noted on the nameplate. For example, for 13,800 volts with 5.75% impedance, multiply $0.0575 \times 13,800 = 794$ volts.

The heating process should be continued until an insulation test gives satisfactory results. In no case should the windings exceed 302° F (150° C) at the hottest measurable spot while applying the circulating current method.

Use of Insulation Resistance for Determining Drying Time

Drying time depends on the condition of the transformer, size, voltage, amount of moisture absorbed and the method of drying used.

The measurement of insulation resistance is a value in determining the status of drying. Take measurements before starting the drying process and at two hour intervals during drying. The initial value, if taken at ambient temperature, may be high even though the insulation may not be dry. Keep the temperature of the transformer constant during the drying period to obtain comparative readings.

As the transformer is heated, the presence of moisture will be evident by the rapid drop in resistance measurements. Following this period, the insulation resistance will generally increase gradually until near the end of the drying period when it will increase more rapidly. Sometimes it will rise and fall through a short range before steadying, because moisture in the interior of the insulation is working out through the initially dried portions. A curve with the time as abscissa and resistance as ordinate can be plotted. Continue the drying until the resistance levels off and remains relatively constant for three to four hours.

Before taking resistance measurements, the transformer should be de-energized and the winding should be short circuited and grounded for at least one minute to drain any static charge. All readings should be taken at the same time of application of the test voltage, preferably one minute.

Insulation resistance measurements should be taken in this order:

1. Primary to ground with secondary grounded.
2. Secondary to ground with primary grounded.
3. Primary and secondary to ground.

If winding resistance is used in determining winding temperature, contact the factory to obtain the needed information.

Insulation Resistance Testing

Before performing the insulation resistance test, use a vacuum cleaner to clean the core and coil assembly. When measured in accordance with ANSI/IEEE Standard C57.94, the minimum insulation resistance should be as listed in Table 3:

Table 3: Insulation Resistance Values

Winding kV Class	Insulation Resistance (MΩ)
1.2	600
2.5	1000
5.0	1500
8.7	2000
15.0	3000

Turns Ratio Test

Perform the turns ratio test at each tap position and for the full winding.

1. Use a Transformer Turns Ratio (TTR) to measure the ratio between the primary and secondary windings.
2. Compare these measurements to the transformer nameplate voltage ratio. The measurements should be within 1/2 of 1% of the nameplate voltage ratio. Refer to ANSI C57.12.91 for additional information.

Core Megger® Test

The core of a ventilated dry type transformer is constructed using one of two methods. For standard construction, the core is not insulated from the clamping structure. The core and clamping structure are at the same potential. In this case, the core Megger test is not applicable.

When specified, the transformer core is totally isolated from the core clamping structure by a layer of insulation. The core does not make contact with the clamping structure. A core ground strap is inserted between the laminations to ground the core to the clamping structure. A core Megger test can be performed to measure the resistance of the flow of current through and over the surface of the transformer insulation.

Before the core Megger test can be performed, inspect the transformer. The copper-foil ground strap extends out from the top of the core and attaches to the top core clamp. Follow these steps to perform the core Megger test:

1. Obtain a 1000 V megohmmeter.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Read and understand the equipment manufacturer's instructions. Use caution while operating the megohmmeter.

Failure to follow these instructions will result in death or serious injury.

2. Disconnect the core ground strap from the core clamp. Make sure the ground strap is clear from any contact with the transformer ground to isolate the clamp structure.
3. Taking care not to pull the core ground strap out of the core, attach the hot lead of the megohmmeter to the core ground strap.
4. Attach the ground lead of the megohmmeter to the core clamping bolt, which is next to the core ground strap. Ensure the lead and core ground strap are not in contact with the ground.
5. Energize the megohmmeter.

NOTE: A reading of 10 megohms or greater is acceptable. If the reading is less than 10 megohms, contact Square D Services at 1-800-634-2003.

6. Reattach the core ground strap to the core clamp.

SECTION 6—OPERATION

Energizing the Transformer

Before energizing the transformer, do the following:

1. Remove all shipping braces and shipping bolts (if present). They are clearly tagged or painted yellow.
NOTE: DO NOT remove the fiberglass tubing (if provided) that surrounds the high voltage cables.
2. Verify the operation of fans, motors, controllers, relays, or other auxiliary devices.
3. Verify the selection of taps and ratio connections against the transformer nameplate information.
4. Torque all connections according to the torque guidelines in Table 2 on page 14 and ensure clearances are adequate between the transformer enclosure and internal bus bars.
5. Remove all hand tools, equipment, or any other foreign material from inside the enclosure. **Do not** leave tools or other equipment on the core and coil assembly.
6. Energize the transformer.

Changing Tap Positions to Adjust Voltage



Figure 10: Disk Wound Tap Connections

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Only qualified personnel with appropriate measurement devices should measure the voltages on the transformer.

Failure to follow these instructions will result in death or serious injury.

7. Check the transformer nameplate before measuring voltages and ensure that properly rated meters are used to verify the primary and secondary transformer voltages.
8. Verify the voltages on the transformer primary and secondary.

If the voltages are not as required, use the taps to adjust the voltage. See the following section, "Changing Tap Positions to Adjust Voltage".

To change the tap position:

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing this procedure, review "Section 2—Safety Precautions" on page 6.
- Do not change the tap connections when the transformer is energized.
- Disconnect all power and verify the transformer is de-energized before servicing the transformer. Use a properly rated meter to measure for the presence of voltage at the terminal and to verify the transformer is de-energized. Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition.
- Ensure no paths are present for backfeeding power to the transformer (such as through a tie-breaker).

Failure to follow these instructions will result in death or serious injury.

NOTE: Do not bend or position the hardware in a manner that would reduce clearance between tap terminals.

1. De-energize the transformer following the safety messages above and your company's lock-out/tag-out procedures.
2. Remove the enclosure panel or door to access the transformer high voltage windings.
3. Use an appropriate grounding device to ground the coils and discharge any static charge.
4. Locate the tap jumpers.
5. Change the tap jumpers on each phase to the appropriate tap connection (Figure 10). The tap jumpers must be on the same tap position for each phase.
6. Torque the tap connections. Refer to the torque values in Table 2 on page 14.

NOTE: For multiple voltages or other special arrangements, see the transformer nameplate.

7. Inspect the enclosure to ensure all hand tools, equipment, or any other foreign materials are removed from the enclosure.

8. Re-install the door or enclosure panel.
9. Energize the transformer.

Sound Level

All transformers have an inherent sound level that varies with the size of the units. The fundamental frequency is twice that of the applied voltage.

Sound waves may be amplified by means of reflected waves and/or radiated waves via walls, floors, ceilings, mechanical vibrations of air ducts, conduits, and mounting bases. For average expected sound levels, refer to NEMA ST-20.

To meet NEMA listed average sound levels, each unit should be installed in a location where there is a 10-foot clearance on all sides except floor or ground. Units located in close proximity to hard surfaces may produce higher than average sound levels. When transformers must be located in noise sensitive areas, precautions should be taken to avoid amplification of the transformer sound.

Install the unit in an area where the noise will be least objectionable. Avoid rooms where hard surfaces are in close proximity to the transformer.

Use acoustic absorbing materials on walls, floors, and ceilings. Avoid installation of units in corners, hallways, and stairways, and near heating and air conditioning ducts.

Reduction of Structure Borne Noise

Loosen anchor bolts between the transformer and enclosure and let the unit rest on the vibration pads only. (Except on certified seismic units.)

Use flexible conduit and bus connections.

Avoid mounting the unit on walls, balconies, and floors with low masses. Avoid uneven mounting surfaces. If specified, low sound level transformers can be provided for most applications.

SECTION 7—MAINTENANCE

Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

Inspect the transformer regularly. The frequency of inspection depends on operating conditions. If the transformer is operating in usual service conditions as defined in ANSI/IEEE C57.12.01, an inspection every two years may be sufficient. However, for unusual locations where the air is contaminated with particles such as dust or chemical fumes, inspect the transformer every three months or sooner. After the first few inspections, determine a more definite schedule based on the existing conditions. Perform the following procedures for maintenance.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing this procedure, review "Section 2—Safety Precautions" on page 6.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.

Failure to follow these instructions will result in death or serious injury.

1. De-energize the transformer following the preceding safety messages and your facility's lock-out /tag-out procedures.
2. Ground unit for one minute to drain static charge.
3. Clear away any debris or other foreign objects from all ventilation openings. If the transformer design includes an optional solid base, make sure air can flow through the bottom grills of the enclosure.
4. Remove the enclosure panel or door to access the transformer high voltage windings.
5. Check the enclosure for deterioration. If deterioration is present, determine the cause and correct (if possible). Repaint deteriorated areas.
6. Replace corroded hardware, as required. See "Replacement Parts" on page 24.
7. Ensure all interior surfaces are clean by following the procedure in "Cleaning" below.
8. Inspect safety labels and replace as necessary.
9. See "Energizing the Transformer" on page 19 to power up the transformer.

After a Major Fault

1. If the transformer is energized, de-energize the transformer following the safety messages above and your facility's lock-out/tag-out procedures.
2. Remove the enclosure panels and inspect the transformer core and coil assembly for any physical damage. If damage has occurred, contact the Square D Medium Voltage Transformer facility at 704-283-7411.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not re-energize the transformer if the transformer has been damaged.

Failure to follow these instructions will result in death or serious injury.

3. Using a torque wrench, ensure all bolted connections are torqued according to the torque guidelines in Table 2 on page 14.
4. Perform the tests described in "Section 5—Start-Up Testing" on page 16. DO NOT re-energize the transformer if the test results are not acceptable. If no damage has occurred and all test results are acceptable, perform maintenance by following the procedures in "Section 7—Maintenance" on page 21.

Cleaning

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing this procedure, review "Section 2—Safety Precautions" on page 6.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.

Failure to follow these instructions will result in death or serious injury.

- To clean the transformer, do the following:
1. De-energize the transformer following the safety messages above and your facility's lock-out/tag-out procedures.
 2. Ground unit for one minute to drain static charge.
 3. Remove the enclosure panel or door to access the transformer high voltage windings.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE
Do not push or pull the cloth through the coils.
Failure to follow this precaution can result in injury or equipment damage.

4. Wipe down all parts of the core, being careful not to cut yourself on any sharp edges or protrusions.
5. Use an industrial vacuum cleaner to clean the ventilation openings and remove dirt and dust from the core, coils, insulators, and remaining structures.
6. Remove all rags or other maintenance equipment from the coil ducts and check for tools when finished. Confirm that the coil ducts are clear.

SECTION 8—OPTIONAL
EQUIPMENT

Temperature Monitoring Systems

This section provides information about optional equipment and replacement parts.

Optional temperature control modules are available on ventilated dry type transformers. The monitor controls the fans and provides alarm indication. See the manufacturer's instruction manual included with the transformer documentation package for detailed information about the installation, operation, and maintenance of the monitor.

The factory pre-set temperature alarm and control settings for ventilated transformers are listed in Table 4.

Table 4: Factory-Set Temperature Alarm and Control Settings

Stage	Temperature Rise
	Transformers with 80 °C / 150 °C Temperature Rise Rating
Fan On	110 °C
Alarm On	125 °C
Trip Signal	220 °C
	Transformers with 115 °C / 150 °C Temperature Rise Rating
Fan On	145 °C
Alarm On	160 °C
Trip Signal	220 °C
	Transformers with 150 °C Temperature Rise Rating
Fan On	180 °C
Alarm On	195 °C
Trip Signal	220 °C

Fans (Forced Air)

When provided, bladed fans located under the transformer coils provide the forced air cooling.

Neutral Grounding Resistors

If specified, optional neutral grounding resistors may be supplied. See the manufacturer's instruction manual included with the transformer documentation package for detailed information about the resistors.

Other Optional Equipment

Other optional equipment, such as monitors, current or potential transformers, or space heaters, may be supplied if specified.

Replacement Parts

Some replacement parts for the transformer are available. Contact your Schneider Electric field sales representative for price and availability. Provide full nameplate information and a description of the part needed. Sketches or photographs may be useful in describing the part.

SECTION 9— TROUBLESHOOTING

If any of the problems listed in Table 5 are identified, the transformer should be removed from service at once. Immediate attention to the problem may prevent dangerous conditions or expensive repairs. In many instances, the trouble can be found quickly and the unit returned to service.

If the trouble cannot be corrected, do not re-energize the transformer. Contact the factory immediately.

Further inspection may require disassembly of the core and coils. This work must be performed by a factory representative or authorized repair facility.

Table 5: Troubleshooting Guide

Circuit	Symptom	Cause
Electric	Overheating	Continuous overload; wrong external connections; poor ventilation; high surrounding air temperature ^a ; damaged or improperly directed fan blades; high harmonic or unbalanced loads
	Reduced or zero voltage	Shorted turns; loose primary tap connections
	Excess secondary voltage	High input voltage; improper primary tap connections
	Unbalanced secondary voltages	Overload; tap connections not on identical tap positions; neutral ungrounded
	Insulation failure	Continuous overloads; dirt accumulation on coils; mechanical damage in handling; lightning or switching surges
	Breakers or fuses opening	Short circuit; overload
	Excessive cable heating	Improperly bolted connection; incorrect cable size for load; incorrect cable routing
	High voltage to ground ^b	Usually a static charge condition
Magnetic	Vibration and noise	Low frequency; high input voltage; core clamps loosened in shipment/handling; improper tap connection
	Overheating	High input voltage; improper loads; harmonics; dirty core
	High exciting current	Low frequency; high input voltage; shorted turns
Dielectric	Smoke	Insulation failure
	Burned insulation	Lightning surge; switching/line disturbance; broken bushings, taps, or arresters; excess dirt or dust on coils
	Overheating	Clogged air ducts or inadequate ventilation
	Breakers or fuses opening	Insulation failure

^a Rating is based on 86° F (30° C) average temperature over a 24-hour period, with peaks not to exceed 104° F (40° C).

^b Using rectifier or VTVM meter.

ENGLISH

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[illegible]

Instruction Bulletin
Power-Dry II™ Dry Type Transformers

Schneider Electric

1010 Airpark Center Drive
Nashville, TN 37217 USA
1-888-SquareD
(1-888-778-2733)
www.us.SquareD.com

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Model 98A Digital Temperature Controller

For Medium Voltage Transformers

Class 7300, 7400

Instruction Bulletin

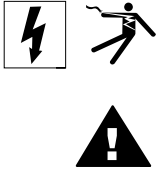
43500-054-34R1

11/2011

Retain for future use.



Hazard Categories and Special Symbols



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates an electrical hazard exists that will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER
DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

⚠ CAUTION
CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION
CAUTION , used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

The Model 98A digital temperature controller can continuously monitor up to three Type K thermocouples in the windings of a dry type transformer. Based on winding temperatures, the controller has the capability to perform the following functions.

- The controller can display the current winding temperature of each phase. It also stores and displays the highest phase temperature, identifying which phase caused that high temperature.
- The controller can operate relays that activate the fans or blowers, sound the high temperature alarm, or actuate a high temperature trip. The controller compares the highest of the three phase temperatures to temperature set points that are stored in the controller's memory. These set points can be reviewed from the controller.
- The default state of the Alarm relay is normally energized so that the alarm sounds upon power failure (fail-safe). The default state of all other relays is normally de-energized (non-fail-safe).
- An internal audible device (buzzer) sounds when the alarm is ON. The audible device can be silenced using the Front Panel Silence button without changing the state of the Alarm relay.
- Two auxiliary relays with non-energized default states are available.
- A Fan Exerciser circuit turns the fans ON for one minute every seven days.
- The controller can interface as part of a complete PowerLogic™ power monitoring and control system manufactured by Schneider Electric. The controller can transfer real-time information to the PowerLogic system about the winding temperatures, status of the relays, and the temperature set points contained within the controller's memory. Once in the PowerLogic system, the information can be used in tables, graphs, and reports.
- The controller can be tested to check its operation at any time. However, the controller continuously performs internal checks and will display error codes if a problem with its operation is detected.

Table 1 shows the outputs from the controller. For details about the functionality of the controller, see "Operation" on page 13.

Table 1: Controller Outputs

Data	Reading	Action
Current Temperature	Left Phase	Displays corresponding phase temperature on the LCD..
	Center Phase	
	Right Phase	
	Maximum Stored	Displays corresponding maximum phase temperature on the LCD..
Relay Set Points and Status	Fan	Activates fans or blowers and lights up the fan LED.
	Alarm	Sounds the alarm buzzer and lights up the alarm LED.
	Trip	Actuates a relay and lights up the trip LED.
	Auxiliary 1	Actuates a relay and lights up the AUX1 LED.
	Auxiliary 2	Actuates a relay and lights up the AUX2 LED.

NOTE: This instruction bulletin is not an application guide for the Model 98A controller or a substitute for adequate training in safe working procedures for this and related electrical equipment. Installation of this electrical equipment may require special licenses or training. Consult applicable national, industry, and local codes for specific requirements that may apply.

The successful operation of this device depends on various factors such as installation, service conditions, and maintenance. Unless designed for other specific applications, this device should be installed on a transformer that is operating under the conditions specified in IEEE C57.12.01.

NOTE: If additional information is needed that is not covered by this instruction bulletin, contact your local Schneider Electric representative.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Read and understand this entire instruction bulletin before operating or maintaining the Model 98A Digital Temperature Controller. Also read and understand the bulletin that ships with the transformer before installing, operating, or maintaining a dry type transformer. Follow all applicable local and national codes.
- The controller is designed to be operated and maintained while the transformer is energized. However, many parts of the transformer operate at high voltages. **DO NOT TOUCH** any transformer parts. Use only electrically insulated tools when working around electrical equipment.
- Disconnect all power and verify the transformer is de-energized before servicing the transformer. Operation of a primary protective device may be evidence of a faulted transformer. Do not re-energize the transformer until the cause of operation of the primary protective device is found and corrected.
- Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition. Always assume that a terminal is energized unless it is checked with a properly rated meter to ensure the terminal is de-energized and grounded.

Failure to follow these instructions will result in death or serious injury.

Installation

The Model 98A controller is installed on the transformer at the factory when the transformer is ordered with a forced air cooling package, with provisions for future air cooling (package without fans), or with provisions for transformer monitoring only.

NOTE: Any disassembly and reassembly of the enclosure or any other part of the transformer will be the sole responsibility of the owner and may void the warranty. Square D Services is available to ensure a factory-authorized installation of the controller.

The Model 98A controller is factory installed in a control box that allows access to the controller without de-energizing the transformer. Do not energize the transformer if the box has been tampered with or removed.

The control box provides additional user safety and shields the controller from free flowing air currents, such as those caused when the fans turn on. Moving air could cause the controller to report incorrect readings.

If the controller has been purchased separately and has not been factory installed, contact Square D Services for recommended installation instructions.

Connections

The type of connection required depends on the use of the controller.

- **Power connections**—If the controller is factory installed without self-contained power, two power connections are required: one for control power and one for fan power. All other wiring is completed at the transformer manufacturing facility.
- **Remote monitoring connections**—If the controller is being used with a remote display and remote alarm, the controller must be wired for this use.
- **PowerLogic system connections**—If the controller is part of a PowerLogic power monitoring and control system, the controller must be connected to the PowerLogic system.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Review “Safety Precautions” on page 6 before making any connections.
- Ensure all personnel, tools, controller wiring, and other work material or equipment are cleared from the transformer and the control box before turning ON power to the controller.

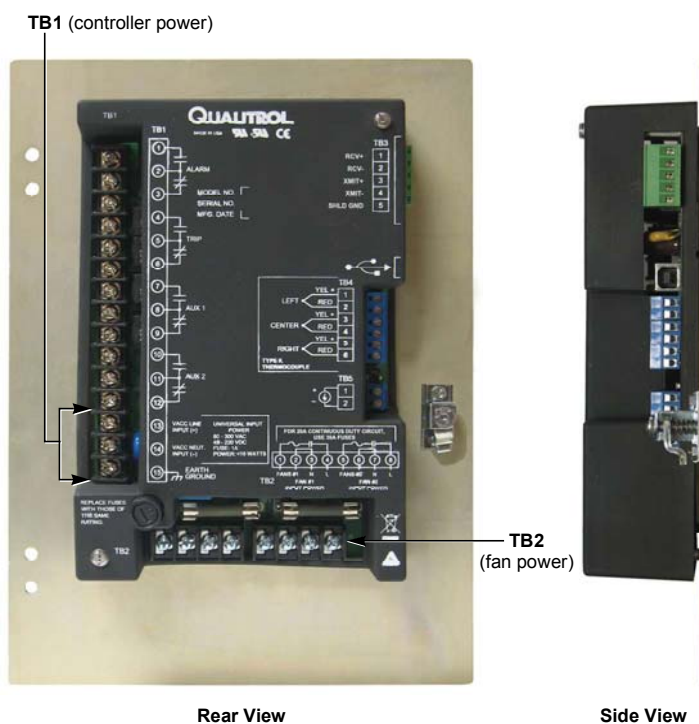
Failure to follow these instructions will result in death or serious injury.

Connecting to the Power Source

The Model 98A controller is equipped with a universal power supply (UPS) that can accept 80–300 Vac, 50/60 Hz or 48–220 Vdc to power the controller only. If the transformer is provided with a self-contained power supply, the power supply is factory-wired. When an external power supply is provided, see the wiring diagram provided with the transformer for power supply connections.

The power supply for the fans or blowers is factory-wired if the transformer is provided with a self-contained power supply. When an external power supply is provided, see the wiring diagram provided with the transformer for power supply connections.

Figure 1: Power Source Connections



⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

Before applying power, make sure all personnel and equipment are clear of the fans or blowers.

Failure to follow these instructions can result in injury or equipment damage.

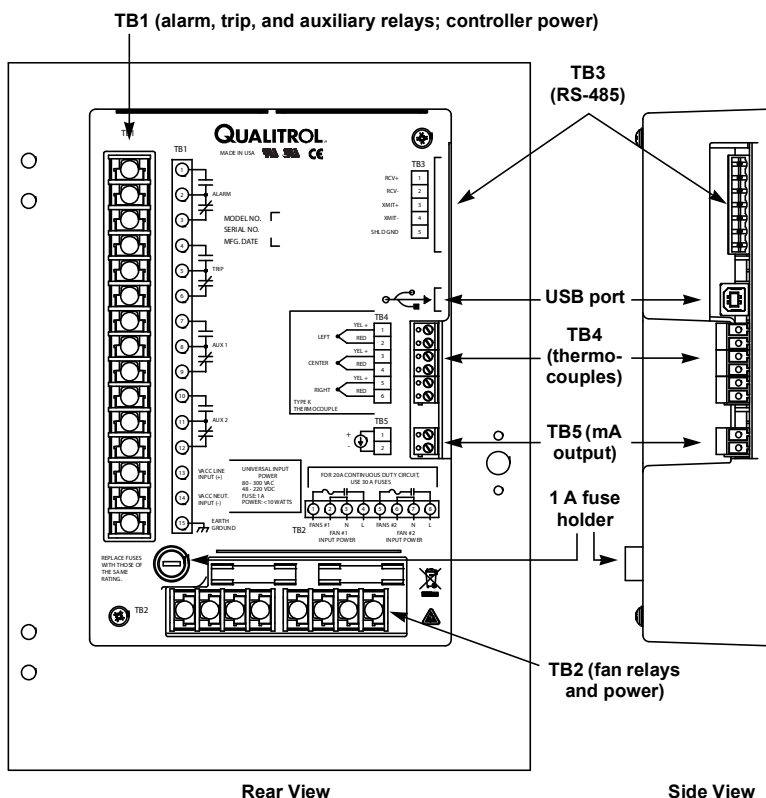
When the controller is powered on, the fans or blowers turn ON and then, after approximately one minute, OFF. This can be used as an initial test to ensure all fans or blowers are operating.

A 5 x 20 mm, 1 A, Type F fuse located in the round fuse holder on the back cover protects the controller. If the fuse blows, make sure the power input voltage connections have been properly made.

Do not replace and re-energize the controller until the situation is corrected. If it is determined that the controller is properly connected, ensure that all power is off, replace the fuse, and re-energize the controller. If the situation cannot be corrected, contact the Schneider Electric Customer Information Center at 1-888-778-2733, or send an e-mail to monroe-after-shipment@us.schneider-electric.com.

All other connections are pre-wired at the transformer facility. Table 2 on page 10 shows the pre-wired connections.

Figure 2: Wiring Terminals/Connectors



⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

The transformer may not operate as designed if the fan, alarm, or trip settings are changed. Only an authorized Schneider Electric representative can make set point changes to the controller. If changes to the factory settings are needed, contact the Schneider Electric Customer Information Center at 1-888-778-2733, or send an e-mail to monroe-after-shipment@us.schneider-electric.com.

Failure to follow this instruction can result in injury or equipment damage.

Table 2: Factory Pre-wired Connections

Connection Type	Controller Terminal	Description	Connection Information
Thermocouples	TB4-1 to TB4-2	Thermocouple sensor #1 (left phase)	Type K thermocouples are standard. The yellow lead is connected to the positive terminal (1, 3, or 5) and the red lead is connected to the negative terminal (2, 4, or 6).
	TB4-3 to TB4-4	Thermocouple sensor #2 (center phase)	
	TB4-5 to TB4-6	Thermocouple sensor #3 (right phase)	
mA output	TB5-1, 2	Milliampere output current loop	Provides a current proportional to the present highest temperature. TB5-1 is the positive terminal.
Controller power	TB1-13, 14, 15	Universal power supply 80–300 Vac, 50/60 Hz or 48–220 Vdc	Required only if the transformer is not provided with a self-contained power supply.
Fan power	TB2-3, 4, 7, 8	Fan voltage	
Relay contacts	TB2-1, 2	Fan #1 controls the fans or blowers through a fuse.	Each fan circuit is protected by its own fuse and controlled by a separate relay with a SPST Form A contact. The contact is open when no power is applied to the unit. The alarm, trip, and auxiliary relay contacts are SPDT Form C. The alarm relay is normally energized and changes state when power is lost. The trip and auxiliary relays are normally de-energized and do not change state when power is lost.
	TB2-5, 6	Fan #2 controls the fans or blowers through a fuse. The Fan #2 circuit is electrically separate from the Fan #1 circuit.	
	TB1-1, 2, 3	Alarm—SPDT (Form C) contacts at TB1-1, 2, and 3 indicate an alarm condition. This relay is usually set to be energized in the normal state so that the loss of control power will cause an alarm.	
	TB1-4, 5, 6	Trip—SPDT (Form C) contacts at TB1-4, 5, and 6 indicate that the temperature being monitored has reached the trip state. This relay is usually set to be de-energized in the off state.	
	TB1-7, 8, 9	Auxiliary 1—SPDT (Form C) contacts at TB1-7, 8, and 9	
	TB1-10, 11, 12	Auxiliary 2—SPDT (Form C) contacts at TB1-10, 11, and 12	

Connecting to Remote Current Loop Output

The temperature controller provides a milliampere analog signal for use with remote meter or SCADA systems. Access this output on TB5 terminals 1 (+) and 2 (-). The output is preset at 4–20 mA.

USB Link

A USB data link is used by the factory to install the standard configuration. A USB plug is provided for this link.

NOTE: Connect a USB cable only when a configuration update is required. No permanent wires should be attached to this connector.

Communications Wiring

The Model 98A controller is equipped with an RS-485 communication port. The RS-485 standard allows daisy chaining up to 32 devices on a single communications link.

A five-terminal connector on the side of the controller (Figure 3) provides a four-wire, RS-485 connection when wired as shown in Table 3. Connect terminals 1 and 3 and terminals 2 and 4 to create a 2-wire network.

The controller can be connected to the serial communication port of any Modbus™ master device, such as a PowerLogic EGX Ethernet gateway.

To daisy chain the Model 98A with other Modbus RTU-compatible devices, use a shielded communications cable containing one twisted pair for 2-wire networking or two twisted pairs for 4-wire networking. For example, use a Belden 9841 or equivalent cable for 2-wire networking or a Belden 9842 or equivalent cable for 4-wire networking. See Table 3 for the RS-485 terminal block connector designations.

The Model 98A controller is designed to interface with the PowerLogic power monitoring and control system from Schneider Electric using the Modbus RTU protocol. All communication setup functions that are normally performed at the controller can be performed remotely via a PC.

To set the parameters for the RS-485 connection, see “Communications Setup” on page 12.

Figure 3: RS-485 Terminal Connections

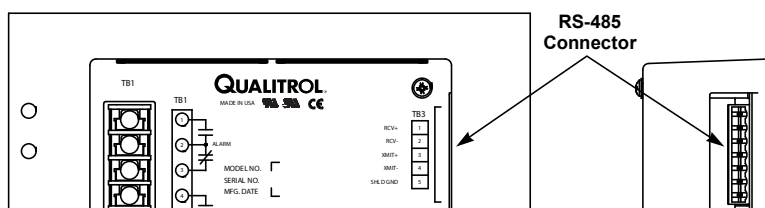


Table 3 shows the block connector designations for the RS-485 terminals.

Table 3: RS-485 Terminal Connector Designations

Terminal Number	Designation
1	Receive +
2	Receive –
3	Transmit +
4	Transmit –
5	Shield ground

Communications Setup

The communications setup of the Model 98A controller can be changed from the front panel by the following procedure:

1. Press and hold all three buttons until the unit stops cycling through the readings (approximately ten seconds).

The controller then displays the current baud rate. See Table 4.

Table 4: Baud Rates

Display	Bits per Second
12	1200
24	2400
48	4800
96	9600
192	19,200

Pressing the SILENCE/TEST (top) button will step the display **up** through the baud rate choices shown in Table 4. Pressing the MANUAL/AUTO (bottom) button will step the display **down** through the choices.

2. When the desired baud rate is displayed, press the RESET (middle) button.

The display then shows the current parity setting:

Table 5: Parity Settings

Display	Description
PE	Even parity (standard)
PO	Odd parity
P--	No parity

3. When the desired parity is displayed, press the RESET (middle) button.
The display then shows the current stop-bit setting.

If parity is even or odd, the display will show S1 and cannot be changed.

If no parity has been selected, the number of stop bits can be set to 1 or 2 (S1 or S2). S1 is used if the unit is communicating through a modem; otherwise, S2 is standard.

4. When the desired stop bit is displayed, press the RESET (middle) button. The display shows the current address setting.
Pressing the SILENCE/TEST (top) button will step the display **up** through the addresses. Pressing the MANUAL/AUTO (bottom) button will step the display **down** through the addresses.

NOTE: Legal Modbus addresses are 1-255.

5. Press the RESET (middle) button to return the controller to normal operation and save the settings. If a button is not pressed for 30 seconds, the unit will automatically return to normal operation and the communications setup will be unchanged.

Operation

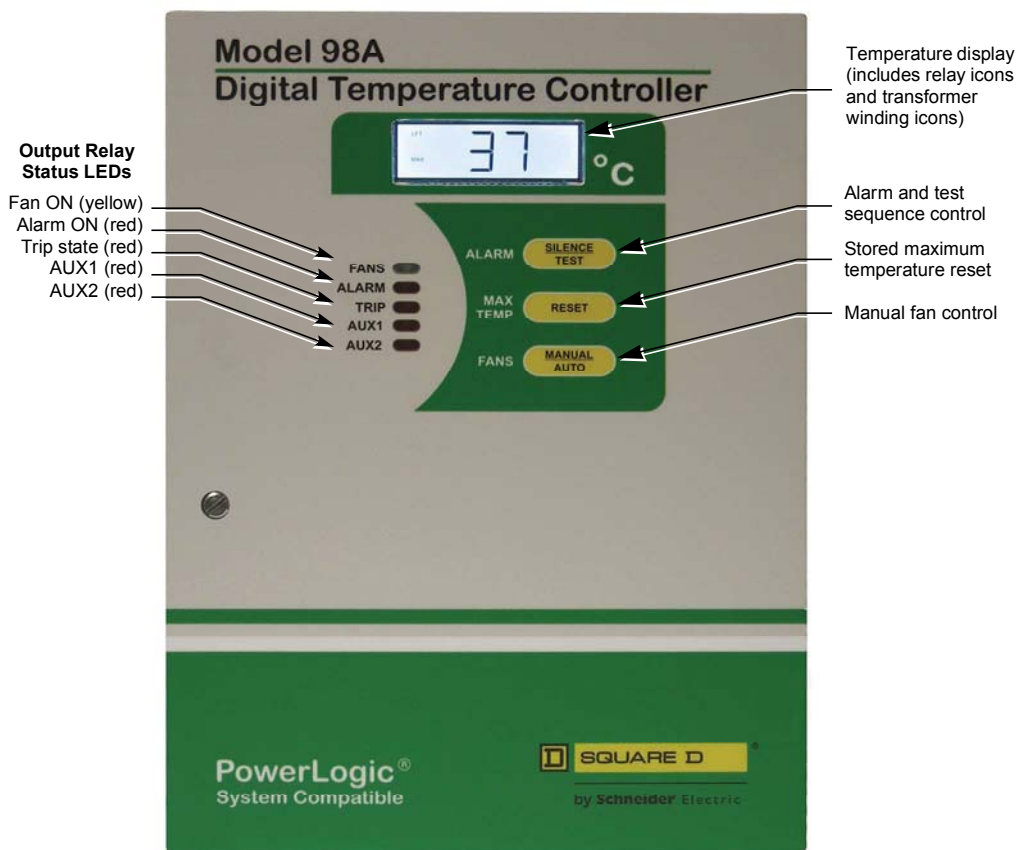
The front panel of the Model 98A controller displays transformer temperature data, communicates the state of the outputs, and allows review of the set points. It is also possible to control the fans and alarm, and reset the maximum temperature setting using the buttons on the front panel.

Output Relay Status LEDs

Figure 4: Front Panel Detail

Five LEDs indicate the status of the output relays:

- The yellow FANS LED illuminates when the fan relay is activated. This is triggered when the transformer temperature is above the temperature set point of the fan relay.
- The red ALARM LED indicates that the alarm relay is in the alarm state when the alarm temperature set point is exceeded.
- The red TRIP LED indicates that the trip relay is in the trip state when the maximum temperature set point is exceeded. The trip relay provides a contact that can be used to take the transformer off line.
- The red AUX1 LED indicates that the first auxiliary relay is in the active state.
- The red AUX2 LED indicates that the second auxiliary relay is in the active state.

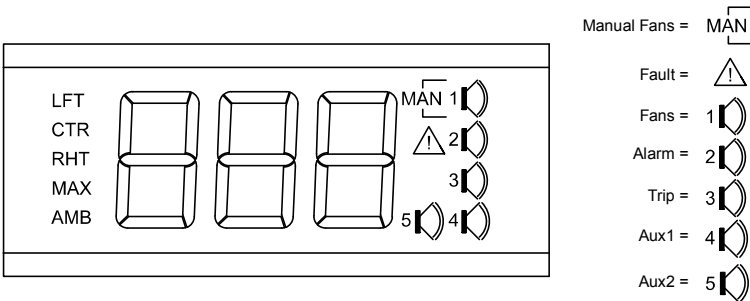


Temperature Display

The temperature display (Figure 5) consists of a three-digit, seven-segment, back-lit LCD display that can show temperatures from 0–250 °C and four individual icons that identify the temperature being displayed. The display shows each reading for approximately one second and then automatically steps to the next reading.

During normal operation, the display cycles through the three winding temperatures and the single highest temperature recorded. While the maximum stored temperature is displayed, both the MAX icon and the icon representing the winding that caused the maximum reading turn ON. The maximum temperature can be reset at any time (see “Resetting the Maximum Stored Temperature” on page 15). See “Thermocouples and the Temperature Display” on page 17 for technical details about the temperature readings.

Figure 5: Temperature Display



Manually Controlling the Fans or Blowers

Pressing the MANUAL/AUTO button manually activates the fan relay and turns the fans or blowers ON. The yellow FANS LED illuminates to show that the fans are ON and the Manual Fan icon () displays to show that the fan function is in manual mode.

When the fan function is in manual mode, pressing the MANUAL/AUTO button returns the function to automatic mode. If the temperature is below the set point that activates the fans, the fans will turn OFF and the yellow FANS LED and the Manual Fan icon () will no longer be displayed. However, if the temperature is above the set point, the Manual Fan icon () will no longer be displayed, but the fans or blowers and the FANS LED will remain ON until the temperature falls below the set point.

You can press the MANUAL/AUTO button any time to verify that the fan relay and the fans or blowers are operating properly.

Silencing the Alarm

Whenever an alarm is activated, an internal buzzer sounds and the ALARM LED illuminates. To silence the buzzer, press the SILENCE/TEST button. The buzzer remains off until a new alarm occurs. The ALARM LED remains illuminated until the temperature drops below the set point or the problem has been corrected. Silencing the buzzer does not eliminate the problem that caused the alarm. Promptly find and correct the situation that caused it.

If the buzzer sounds but the ALARM LED is not illuminated, check the 1 A fuse located in the round fuse holder on the back cover.

Reviewing Set Points

When the alarm is not sounding, pressing the SILENCE/TEST button starts a test sequence to verify that the controller is operating properly and allows a review of the set points. The test sequence performs the following checks at two-second intervals:

1. Displays the FAN ON temperature set point and lights the FANS LED.
2. Displays the ALARM temperature set point and lights the ALARM LED.
3. Displays the TRIP temperature set point, and lights the TRIP LED.
4. Displays the AUX1 temperature set point and lights the AUX1 LED.
5. Displays the AUX2 temperature set point and lights the AUX2 LED.
6. Displays the ambient temperature inside the controller.
7. Displays 888 on the temperature display, turns on all icons on the display, turns on all relay status LEDs, and turns on the alarm.

Resetting the Maximum Stored Temperature

Press the maximum temperature RESET button to clear the memory of the maximum stored temperature. This causes the current highest winding temperature to become the stored maximum temperature.

Controller Error Codes

During normal operation, the controller is constantly checking itself for proper operation. If a problem is detected, the controller displays one of the error codes described in Table 6.

Table 6: Error Codes

Display	Reason	Description	Corrective Action
---	Failed thermocouple or reversed connection	Shows --- on the display when that particular sensor temperature should be displayed. Shows which sensor is malfunctioning. The system activates the alarm, turns ON the fans, and continues to function using the remaining input channels. If the controller detects an open-circuited thermocouple, the alarm sounds and the faulty channel is displayed. A failed thermocouple does not cause a trip. The --- display also indicates a reversed thermocouple connection when the thermocouple is 30 °C below the terminal block temperature.	1. Inspect the thermocouples for possible damage. If damaged, repair or replace. 2. Make sure the thermocouples are wired according to the wiring diagram on page 9.
E11	Failed A/D converter	Shows E11 on all channels, turns ON the fan relay, and activates the alarm.	1. Disconnect power to the controller. 2. Remove the hinges and disconnect the wiring. 3. Contact your Schneider Electric representative to obtain a Returned Material Authorization, then return the controller to the Schneider Electric Medium Voltage Transformer Facility.
E22	Failed ambient temperature sensor	Shows E22 on all channels, sets ambient temperature to 30 °C, activates the alarm, turns ON the fans, and continues to operate using a 30 °C ambient temperature.	
E33	Failed EEROM after initial start up	Shows E33 on all channels, continues to operate, activates the alarm, and turns ON the fan relay.	
	Failed EEROM at power up	Shows E33 on all channels, turns ON the fan relay, and activates the alarm.	
Blank	Failed display driver	Blank temperature, that is, nothing is shown on the digital display. The controller continues to operate, activates the alarm, and turns ON the fan relay.	

Maintenance

Inspect the controller regularly during normal transformer inspection. The frequency of inspection depends on operating conditions. If the controller is installed in a Square D™ brand transformer that is operating in usual service conditions as defined in IEEE C57.12.01, an inspection every five years may be sufficient. However, for unusual locations where the air is contaminated with particles such as dust or chemical fumes, the transformer and controller should be inspected every three months or sooner. After the first few inspections, determine a more definite schedule based on the existing conditions. Perform the following procedures for maintenance.

NOTE: If any problem is found during maintenance, contact your local Schneider Electric representative.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing this procedure, review “Safety Precautions” on page 6.
- Before servicing the controller, turn OFF power to the controller and fans.

Failure to follow these instructions will result in death or serious injury.

Testing the Fans or Blowers

The controller has an automatic fan exerciser that turns the fans ON for a short time at preset intervals. However, during a scheduled inspection of the transformer, turn the blowers or fans ON to confirm that they are working properly. See “Manually Controlling the Fans or Blowers” on page 14.

Testing the Controller

Start the controller’s test sequence by pressing the SILENCE/TEST button while an alarm is not sounding. The temperature display shows the stored set points and the internal temperature of the controller. The controller also tests the digital LCD display, all the LEDs, and the alarm buzzer. For details, see “Reviewing Set Points” on page 15.

Specifications

For reference purposes, typical controller specifications are shown in Tables 7–11.

Table 7: Factory Set Points

Rated Average Transformer Temperature Rise ^a	Relay Set Points					
	Fans or Blowers		Alarm		Emergency Shutdown	
	ON	OFF	ON	OFF	Dry Type Transformers	Cast-Coil Transformers
80 °C	110 °C	100 °C	125 °C	123 °C	220 °C	185 °C
115 °C	145 °C	135 °C	160 °C	158 °C	220 °C	185 °C
150 °C	180 °C	170 °C	195 °C	193 °C	220 °C	—

^a Based on NEMA and IEEE Standards of 30 °C average and 40 °C maximum ambient for any 24-hour period below 3,300 ft. (990 m) altitude.

Thermocouples and the Temperature Display

Three Type K thermocouple sensors are factory-connected to TB4-1(+) and 2(-); TB4-3(+) and 4(-); and TB4-5(+) and 6(-). See Figure 2 on page 9.

NOTE: If replacement of a thermocouple is required, use only Type K thermocouples. Connect the YELLOW lead to a positive terminal (1, 3, or 5) and the RED lead to a negative terminal (2, 4, or 6).

The digital temperature displayed is always the total of ambient plus approximate hot-spot temperatures, not the average temperature rise. For example, a transformer is rated for a 150 °C average temperature rise when carrying the rated full load in a 20 °C ambient temperature. The thermocouple sensors are installed near the theoretical hot spot of the coils. NEMA and IEEE standards permit a 30 °C maximum differential between average and hot-spot temperatures.

Therefore, the digital display would indicate approximately 20 °C + 30 °C + 150 °C = 200 °C total. The alarm would operate at this point to warn that the transformer is approaching the maximum temperature limit of the insulation system.

Table 8: Performance Specifications

Performance Measurement		Specification		
Input Power		80–300 Vac, 50/60 Hz, < 10 W 48–220 Vdc, universal power supply, < 8 W		
Range		0–250 °C		
Display Resolution		1 °C increments		
Accuracy		±3 °C		
Memory Retention		40 years (with power OFF)		
Relay Ratings	Fans	Volts	Resistive	Horsepower
		120 Vac	30 A	1 Hp
		240 Vac	30 A	2 Hp
	Alarm and Trip	120 Vac	10 A	—
		240 Vac	8 A	—
Remote Output Current Loop		0–1 mA = into 10,000 Ω maximum load		
		0–10 mA = into 1,000 Ω maximum load		
		0–20 mA = into 500 Ω maximum load		
		4–20 mA = into 500 Ω maximum load		
		0–5 V		
Accuracy		±3 °C		

Table 9: Mechanical Specifications (Panel Mount Unit)

Mechanical Measurement	Specification
Front Panel	8 in. (203.2 mm) Wide x 11 in. (279.4 mm) High Graphic overlay is UV resistant for outdoor use.
Mounting Panel	Panel mount through 5.37 in. (136.4 mm) Wide x 7.97 in. (202.4 mm) High cutout.
Depth	2.22 in. (56.4 mm)
Weight	3 lbs. (1.4 kg)
Terminals	Screw terminal; maximum 12-gauge wire

Table 10: Approvals

Registered per UL standard 873.
Registered per Canadian standard C22.2 No. 24-93.
Declaration of Conformance CE.

Table 11: Model 98A Register List

Modbus Register No.	Description	Comments
Read Registers		
40001	Temperature left phase	Normal temp range is 0–255d in low byte. A value of 8000h indicates invalid data.
40002	Temperature center phase	
40003	Temperature right phase	
40004	ETM status	bit 0 = 1 = some other bit is 1 bit 1 = 1 = ON, fan state bit 2 = 1 = ON, alarm state bit 3 = 1 = ON, trip state bit 4 = 1 = ON, buzzer state bit 5 = 1 = ON, manual fan state bit 6 = 1 = ON, auxiliary relay 1 bit 7 = 1 = ON, auxiliary relay 2
40005	Maximum stored temperature	Normal temperature range is 0–255d in low byte.
40006	Phase with maximum stored temperature	bit 0 is always a 1 bit 1 = 1 indicates maximum stored temp was left phase bit 2 = 1 indicates maximum stored temp was center phase bit 3 = 1 indicates maximum stored temp was right phase
40007	Temperature at unit's terminal block	The low byte indicates temperature at the instrument terminal block in °C. Temperatures below zero will show as zero.
40008	Diagnostic status	bit 0 = 1 = some other bit is 1 bit 1 = 1 = failed A/D converter bit 3 = 1 = failed terminal block temperature sensor bit 4 = 1 = failed EEROM bit 5 = 1 = failed display driver
40009	Phase status	bit 0 = 1 = some other bit is 1 bit 1 = 1 = left phase disabled bit 2 = 1 = center phase disabled bit 3 = 1 = right phase disabled bit 4 = 1 = left phase has failed sensor bit 5 = 1 = center phase has failed sensor bit 6 = 1 = right phase has failed sensor bit 7 = 1 = fan exerciser is disabled
40010	Fan setpoint	Setpoint and deadband are 8-bit data in the low order byte.
40011	Alarm setpoint	
40012	Trip setpoint	
40013	Fan deadband	
40014	Alarm deadband	
40015	Trip deadband	
40016	Fan exercise interval	1–720 hours (up to 30 days)
40017	Fan exercise run time	1–120 minutes
40018	Time since last ran exercise	1–720 hours (up to 30 days)
40019	Firmware version	
48188	Device I.D.	15060d (15060–15069 reserved for ETM)
Write Registers		
40050	Set manual fan function ON/OFF	0001 turns the fan ON. 0000 sets the fan to AUTO.
40051	Reset maximum stored temperature	0001 sets the maximum temperature stored to the current maximum temperature.
40052	Reset unit	0001 resets the unit.
40053	Buzzer control	0001 turns the buzzer ON. 0000 turns the buzzer OFF.

Model 98A Digital Temperature Controller for Medium Voltage Transformers
Instruction Bulletin

ENGLISH

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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Power-Style™ QED-2 Switchboards

Class 2700

Instruction Bulletin

80043-055-12

05/2015

Retain for future use.

ENGLISH



Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Section 1—Introduction

This manual contains instructions for the proper installation, operation, and maintenance of Power-Style™ QED-2 switchboard equipment manufactured by Schneider Electric. Engineering, installation, and operating staff supervisors should familiarize themselves with this manual and become acquainted with the appearance and characteristics of each piece of equipment mounted or contained in the switchboard.

These instructions and procedures apply to Power-Style QED-2 switchboard installations by Schneider Electric. When special features or non-standard components are incorporated in the switchboard, detailed instructions for these components are included in the instruction material holder.

NOTE: There are references to Series 2 switchboards in several places in this instruction bulletin. To determine if the QED-2 switchboard is a Series 2 model, check the rating nameplate located on the front cover. If the switchboard is a Series 2 model, the nameplate indicates that. If it is not a Series 2 model, there is not a Series designation.

Inspection and Packaging

Every Power-Style QED-2 switchboard is carefully inspected and packaged at the assembly plant. Construction of the switchboard is checked, both structurally and electrically, for compliance with all specifications, codes, and standards. After a complete inspection, the switchboard is prepared for shipment. Each section is shipped separately for easier handling before installation. The factory order number, an identification number, and the shipping weights are plainly marked on each shipping section.

Document Replacement

Contact your local Schneider Electric representative to replace lost or damaged wiring diagrams and instruction sheets. Use the factory order number as a reference.

Section 2—Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm power is off.
- Practice lock-out/tag-out procedures according to OSHA requirements.
- Handle this equipment carefully and install, operate, and maintain it correctly in order for it to function properly. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to equipment or other property.
- Carefully inspect your work area and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual assume that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Section 3—Receiving, Handling, and Storing

Receiving

Upon receipt, check the packing list against the equipment received to ensure the order and shipment are complete. Also upon receipt, immediately inspect switchboard sections for any damage that occurred in transit. If damage is found or suspected, file a claim with the carrier immediately and notify the nearest Schneider Electric representative.

Handling

⚠ WARNING

SPECIAL HANDLING REQUIREMENTS

- Do not lay the equipment on its front or sides.
- Lay equipment only on its back when special handling is required.
- Do not ship the equipment lying down.

Failure to follow these instructions can result in serious injury or equipment damage.

Ensure that proper equipment, such as an overhead crane, is available at the installation site to handle the switchboard. This equipment helps avoid injury to personnel and damage to the switchboard.

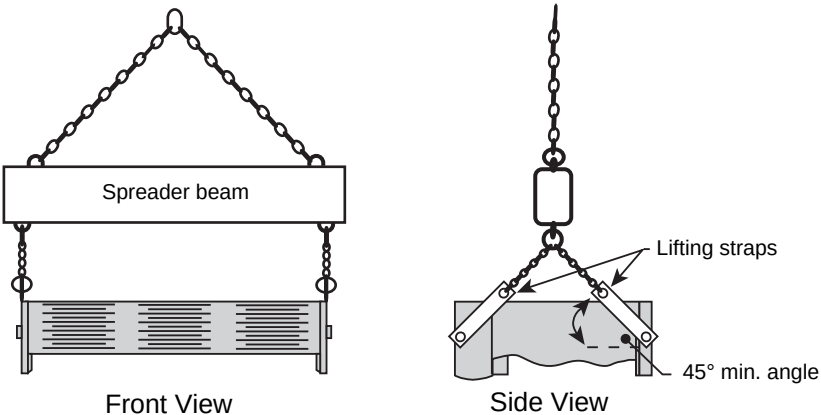
The shipping weight of each shipping section is marked on the packing list. Verify the lifting capacity of the equipment being used to handle the switchboard in accordance with the shipping weight of each shipping section. Keep the switchboard upright during handling.

Schneider Electric recommends using an overhead crane, lifting straps, and cables or chains to handle the switchboard. This method and alternative handling methods are discussed in this section.

Handling with Lifting Straps

Schneider Electric provides lifting straps as standard equipment for NEMA Type 1 switchboard shipping sections rated 3,000 A or less. Instruction labels on each shipping section include drawings and written instructions outlining the proper use of the lifting straps (Figure 1). Use rigid spreaders or a spanner bar to provide vertical lift on the lifting straps. This helps avoid damage to the frame or finish.

Figure 1 – Lifting with an Overhead Crane, Lifting Straps, and Cables or Chains



Follow these instructions to handle the switchboard:

1. Use load-rated cables or chains with safety hooks or shackles. Do not pass cables or chains through holes in lifting straps.
2. Use a load-rated spreader beam to prevent structure damage. Rig so that the minimum angle between the lifting cables or chains and equipment top is 45 degrees.

Follow these instructions for laying equipment on its back:

1. Remove shipping skid and equipment back covers.
2. Use overhead cranes, lifting straps, and cables or chains for laying equipment on its back.
3. Rate of drop or pickup for laying equipment on its back is four feet per minute or less.
4. Reverse the procedure to stand the equipment in its upright position.
5. Reinstall back covers.

The warning label (Figure 2) is attached to both the front and rear of the switchboard.

Figure 2 – Warning Label, Rainproof Switchboards



Handling without Lifting Straps

Lifting straps are not furnished on shipping sections rated more than 3,000 A, or on rainproof switchboards. Use rollers, slings, or other means to handle the shipping sections. The handling label (Figure 3) is affixed to each of these sections.

Figure 3 – Handling Instruction Label, Switchboards without Lifting Straps

⚠ WARNING / ADVERTENCIA / AVERTISSEMENT

Do not pass cables or chains through lift holes. Use only load rated cables or chains with safety hooks or shackles.

No haga pasar cables ni cadenas por los agujeros de levantamiento. Utilice sólo cables o cadenas adecuados para la carga con argollas o ganchos de seguridad.

Ne faites pas passer de câbles ou chaînes par les trous de levage. Utilisez uniquement des câbles ou chaînes classés pour supporter la charge, munis de crochets ou manilles de sécurité.

Load rated spreader bar
Barra separadora adecuada para la carga
Entretoise classée pour supporter la charge

Sling rigging
Montaje de eslinga
Arrimage de élingues

TOP HEAVY LOAD HAZARD OF TIPPING

- This equipment must be moved by a sling, chain or rollers.
- Stabilize the shipping section to prevent tipping.
- Do not work under, around or on this equipment while elevated or moving.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

CARGA PESADA EN LA PARTE SUPERIOR PELIGRO DE QUE SE CAIGA LA CARGA

- Este equipo debe moverse con una eslinga, cadena o rodillos.
- Estabilice la sección de embarque para evitar voltearla.
- No trabaje debajo, alrededor o sobre el equipo mientras se está elevando o moviendo.

El incumplimiento de estas instrucciones puede causar la muerte, lesiones serias o daño al equipo.

CHARGE INSTABLE RISQUE DE RENVERSEMENT DE CHARGE

- Cet appareil doit être déplacé à l'aide d'une élingue, d'une chaîne ou de roulettes.
- Stabilisez la section de transport afin d'éviter qu'il ne bascule.
- Ne travaillez pas en dessous, autour ou sur cet appareil pendant qu'il est soulevé ou déplacé.

Si ces directives ne sont pas respectées, cela peut entraîner la mort, des blessures graves ou des dommages matériels.

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⚠ WARNING**TOP HEAVY LOAD—HAZARD OF TIPPING**

- Stabilize the shipping section to reduce the possibility of tipping.
- Consult with a certified rigging and lifting expert for any situation not covered in these instructions.

Failure to follow these instructions can result in death or serious injury.

When elevating a shipping section not equipped with lifting straps, use an overhead crane equipped with either of the following:

- A chain coupled to a sling rigging
- A wire cable with safety hooks and shackles

Wrap the sling completely around the switchboard and shipping stringers.

NOTE: A forklift is an alternative method of handling the switchboard. Always check the fork lengths to ensure that the forks extend under the entire switchboard. Carefully balance the load, and always use a safety strap when handling or moving a switchboard with a forklift (Figure 4 on page 15).

Storing

When storing the switchboard before installation, cover the top and openings of the equipment during the construction period to protect the switchboard from dust and debris.

If a switchboard is not installed and energized immediately, store it in a clean, dry space with a consistent temperature to prevent condensation. Store the switchboard indoors, if possible. Preferably, store it in a heated building with adequate air circulation and protect it from dirt, fumes, water, and physical damage. Storing the switchboard outdoors can cause harmful condensation inside the switchboard.

NOTE: Install portable electric heaters of approximately 250 watts per vertical section in both indoor-type and rainproof-type switchboard enclosures for adequate protection during storage.

Before energizing the space heaters, remove all loose packing or flammable materials inside the switchboard. Outdoor switchboards are not weather-resistant until completely and properly installed; treat them the same as indoor switchboards until after installation.

Figure 4 – Forklift Safety Label

⚠ WARNING

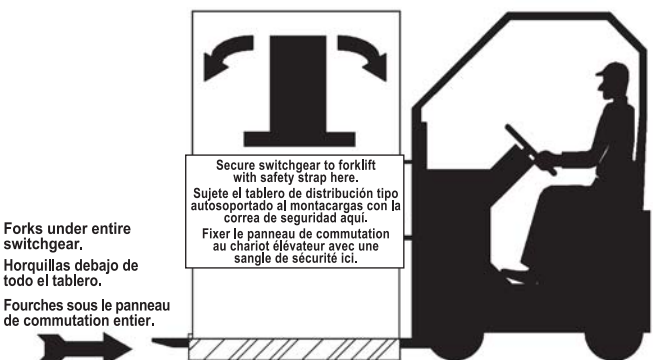
HAZARD OF EQUIPMENT DAMAGE
 • Secure to forklift with safety strap.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ ADVERTENCIA

PELIGRO DE DAÑO AL EQUIPO
 • Sujete al montacargas con la correa de seguridad.
El incumplimiento de estas instrucciones puede causar la muerte, lesiones serias o daño al equipo.

⚠ AVERTISSEMENT

RISQUE DE BLESSURES OU DE DOMMAGES MATÉRIELS
 • Fixer au chariot élévateur avec une sangle de sécurité.
Si ces directives ne sont pas respectées, cela peut entraîner la mort ou des blessures graves ou des dommages matériels.



Secure switchgear to forklift with safety strap here.
 Sujete el tablero de distribución tipo autosoportado al montacargas con la correa de seguridad aquí.
 Fixer le panneau de commutation au chariot élévateur avec une sangle de sécurité ici.

Forks under entire switchgear.
 Horquillas debajo de todo el tablero.
 Fourches sous le panneau de commutation entier.

**Remove label after installation.
 Retire la etiqueta después de la instalación.
 Enlever l'étiquette après l'installation.**

Special Handling Requirements
 Do not lay the equipment on its front or sides. Doing so will damage unit. Lay equipment only on its back when special handling is required. See Instruction Bulletin for special handling instructions for laying equipment on its back.
 Equipment is NOT to be shipped lying down.
Failure to follow these instructions can result in death, serious injury or equipment damage.

Requisitos especiales de manejo
 No coloque el equipo sobre su frente o lados ya que podría dañarse la unidad. Coloque el equipo sobre su parte posterior solamente cuando sea necesario manejarlo de manera especial. Consulte el boletín para obtener las instrucciones especiales de manejo para colocar el equipo sobre su parte posterior. El equipo NO deberá transportarse acostado.
El incumplimiento de estas instrucciones puede causar la muerte, lesiones serias o daño al equipo.

Exigences de manutention spéciales
 Ne couchez pas l'appareil sur sa face avant ou sur les côtés. Faire ainsi l'endommagerait. Couchez l'appareil sur le dos uniquement lorsqu'une manutention spéciale est nécessaire. Consultez les directives d'utilisation pour les instructions de manutention spéciales pour coucher l'appareil sur le dos. N'expédiez PAS l'appareil sur son dos.
Si ces directives ne sont pas respectées, cela peut entraîner la mort ou des blessures graves ou des dommages matériels.

Section 4—Installation

Correct installation of Power-Style QED-2 switchboards is essential for proper operation of all switchboard components. Study the associated instruction books and all drawings carefully. In most cases, all drawings are sent to the purchaser before a switchboard is shipped to enable adequate planning.

NOTE: The top of the switchboard will not support the weight of the installer.

Location

Find the designated area on the building floor plan where the switchboard will be installed. The location chosen for installation should provide working clearances complying with Section 110-26 of the National Electrical Code® (NEC®) or Section 2-308 of the Canadian Electrical Code (CEC) Part 1.

- Front-accessible switchboards require field connections, including mains, branches, ground bus, and neutral bus, to be accessible and maintainable from the front.
- For switchboards having rear ventilation, allow a minimum 1/2-in. (13 mm) clearance between the rear of the switchboard and the wall for proper ventilation. Equipment drawings identify switchboards requiring rear or side access.
- Switchboards that require rear access for installation, field connections, or maintenance (such as filter replacement), require 30 in. (762 mm) of working space per NEC 110-26.
- If the switchboard is in a wet location or outside of the building, enclose it in an outdoor enclosure or equipment to prevent moisture or water from entering and accumulating within the enclosure. Outdoor-rated switchboards drain to the rear, so there must be at least a 1/2-in. (13 mm) clearance between the rear of the switchboard and a wall or other obstruction for proper drainage.

Foundation Preparation

The floor or foundation must be strong enough to support the weight of the switchboard without sagging. The surrounding floor area should gently slope toward a drain.

NOTE: For seismic qualifications, read the section “Anchoring for Seismic Qualifications” on page 20 before pouring the floor or foundation.

Power-Style QED-2 switchboards are assembled on true and level floors at the assembly plant. To ensure correct bus bar alignment, the mounting pad or final installation site must be smooth and level. If parallel steel floor channels are imbedded for mounting the switchboard, take extra care to ensure the floor channels are level over their entire length to avoid distortion of the switchboard structure. Each channel should be level with the finished floor.

When pouring the foundation, make provisions for conduits entering the switchboard from below and carrying the incoming and/or outgoing cables, control wiring, and ground cable. The bottom view in the equipment drawing shows the available conduit area for correct layout.

Conduits should project above the finished floor by about 2 in. (51 mm). However, to simplify moving the shipping sections into place, install the conduits flush with the concrete and, after the sections are in their final position, add the appropriate extension sleeves. Otherwise, raising the shipping section on timbers or lifting it by a crane to

clear the conduit hubs will be necessary. Before pouring the foundation, consider installing additional conduits for future circuits.

Switchboard Preparation

Remove dirt and debris from the foundation and surrounding area before moving the switchboard into final position.

After the switchboard has been moved to its final installation site, take each shipping section off its shipping stringers. For switchboards greater than 24 in. (610 mm) deep, the center base channel can be removed.

Remove all packing materials. If the switchboard is equipped with a bottom closure plate in each vertical section, remove and retain the plates for reuse. When bottom closure plates are furnished, the customer must make any holes necessary for conduit entering the bottom of the switchboard. After making the holes, reinstall the closure plate.

General Installation

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Level and align adjacent shipping sections with one another. Ensure proper alignment of horizontal main through bus and proper splice bus connections.

Failure to follow these instructions can result in equipment damage.

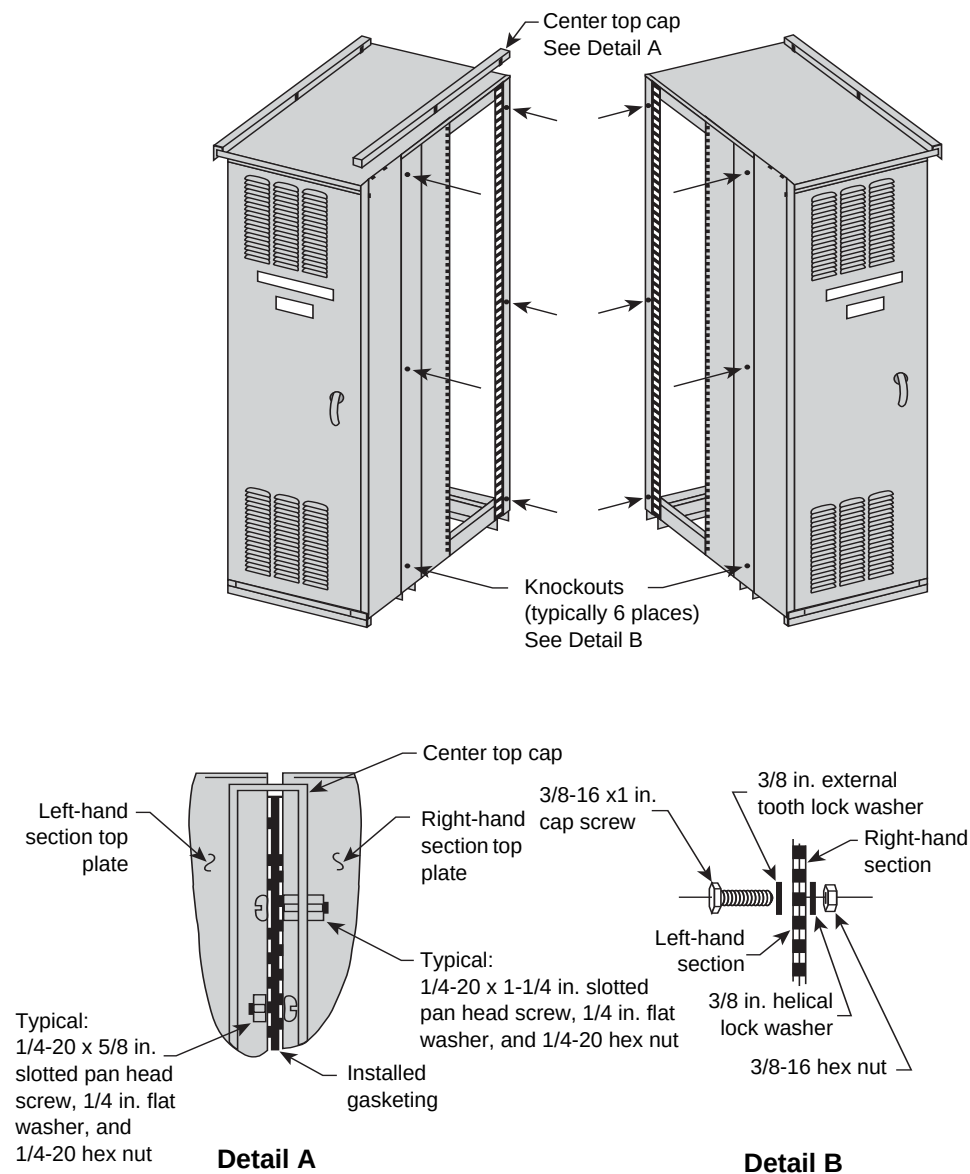
Install the switchboard into its final position by leveling progressively each section and bolting the frames together, if separated. Position shipping sections as follows:

1. Maneuver each shipping section into the desired position using the procedures under “Handling” on page 11.
2. Carefully lower the section over the conduit stubs to comply with the “available conduit area” as shown in the bottom view of the equipment drawings. Otherwise, there might not be sufficient cable bending space.
3. Level the shipping section.
4. After installation of each section is complete, make the through bus splice connection to the preceding section before installing the next section.

Joining Shipping Sections—Outdoor Switchboards

1. Remove the center top cap (Figure 5) from the left-hand section, and retain all hardware for reuse.

Figure 5 – Joining Adjacent Sections—Outdoor Switchboards



2. When possible, open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
3. Remove three 0.5-in. (13 mm) diameter knockouts from the front vertical corner channel and three from the rear vertical corner channel (a total of six per frame side) as indicated by the arrows in Figure 5.
4. Position each adjacent section, carefully leveling it and aligning it with the previous section. If lifting straps are provided, completely remove them from

the sides being bolted together so the sections can be joined flush. The only gasket required between sections is provided on the roof flange.

NOTE: If lifting strap removal is not required to join sections, leave the lifting strap on the switchboard. Verify that the bolt is tight to maintain NEMA Type 3R integrity.

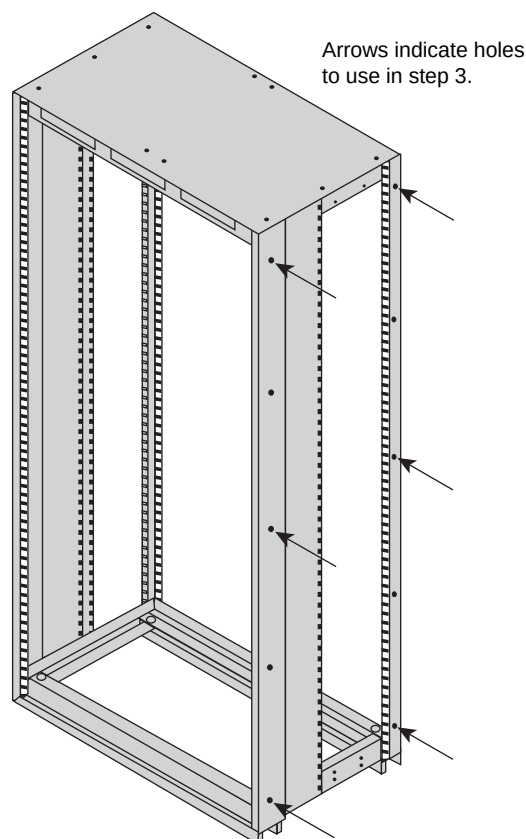
5. Six bolts (3/8-16 x 1 in.) are provided. Place them through the holes created in step 3 to join adjacent sections.
6. Make the through bus splice connections to the preceding section.
7. Replace the center top cap removed in step 1.
8. Replace and secure the front and rear doors and panels removed in step 2.

Joining Shipping Sections—Indoor Switchboards

1. Position each adjacent section, carefully leveling and aligning it with the previous section. If lifting straps are provided, completely remove them from the sides being bolted together so the sections can be joined flush.

NOTE: Leave the other lifting straps on the switchboard if their removal is not required to join adjacent sections flush.

Figure 6 – Indoor Switchboards



2. Open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
3. Six bolts (3/8-16 x 1 in.) are provided. Place the bolts through the existing holes in the front and rear vertical corner channels to join adjacent sections (Figure 6).
4. Make the through bus splice connections to the preceding section.
5. Replace and secure all front and rear doors and panels removed in step 2.

Anchoring for Seismic Qualifications

QED-2 equipment that is seismically certified has been qualified to the site-specific seismic requirements of the listed model building codes and/or standards. Optional construction features may be required, depending on the location of the installation and the particular code and/or standard of interest. Seismic certificates of compliance are provided with all seismically certified QED-2 equipment. To maintain the validity of this certification, the installation instructions provided in this bulletin must be followed.

Responsibility for Mitigation of Seismic Damage

For the purposes of the model building codes, QED-2 equipment are considered nonstructural building components. Equipment capacity was determined from triaxial seismic shake table test results as defined in the International Code Council Evaluation Service (ICCES) Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components (AC156). Unless otherwise indicated, an equipment importance factor of 1.5 ($I_p = 1.5$) was used, indicating that equipment functionality was verified before and after shaker table seismic simulation testing. This importance factor is indicative of critical facilities where maximizing the probability of post event functionality is a priority. The Building Seismic Safety Council (BSSC) recognizes AC 156 as an appropriate methodology in the 2003 National Earthquake Hazard Reduction Program (NEHRP) Commentary (FEMA 450 Part 2). The National Institute of Building Sciences established the BSSC in 1979 to develop and promote regulatory provisions for earthquake risk mitigation at the national level.

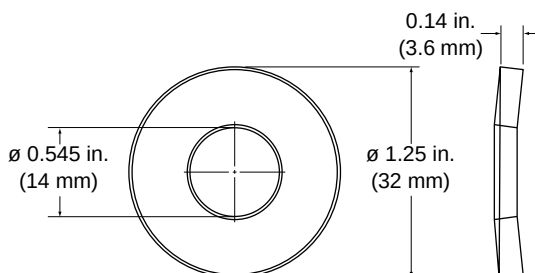
Incoming and outgoing cable and conduit must also be considered as related but independent systems. They must be designed and restrained to withstand the forces generated by the seismic event without increasing the load transferred to the equipment. For applications where seismic hazard exists, bottom entry and/or exit of cable and conduit is preferred. This system must be able to transfer the loads created by a seismic event to the load-bearing path of the building structural system.

Maintaining Seismic Certification

Seismic qualification of nonstructural components by Schneider Electric is just one link in the total chain of responsibility required to maximize the probability that the equipment will be intact and functional after a seismic event. During a seismic event, the equipment must be able to transfer the loads that are created through the mounting pad and anchorage to the load-bearing path of the building structural system. The structural civil engineer or design engineer of record is responsible for detailing the equipment connection and anchorage requirements for the given installation. The installer and manufacturers of the anchorage restraint system are responsible for assuring that the mounting requirements are met. Schneider Electric is not responsible for the specification and performance of these systems.

Anchoring QED-2 Equipment for Seismic Applications

Figure 7 – Belleville Washer



Formed base channels run the width of the section. The channels and connecting braces provide a minimum 0.75-in. (19 mm) diameter hole for fastening the section to the floor. To anchor the QED-2 switchboard to the floor properly, use all four mounting locations for NEMA Type 1 enclosures less than 36 in. deep, all six mounting locations for 36–70 in. deep enclosures, and six of the eight mounting locations for enclosures greater than 70-in. deep (see Figure 8 on page 23).

Use 0.5 in. (13 mm) diameter anchor bolts (Grade 5 minimum, provided by others) for the installation of equipment. Use one 1.25 in. (32 mm) outer diameter Grade 5 Belleville washer (provided by others; see Figure 7) under the head of each bolt or anchor nut. To develop the full strength of the anchor, torque the hardware to the value specified by the anchor manufacturer, or as recommended in the seismic restraint detailing supplied by the Structural Civil Engineer of record for the project (see Figure 9 on page 24).

Additionally, each NEMA Type 1 enclosed section includes four top-located hard points for attaching two upper lateral braces (braces and hardware supplied by others) to the QED-2 structure for top structural restraint (see Figures 10 and 11 on page 25).

Top structural restraint is required for all QED-2 equipment installed:

- where the site-specific 0.2 second spectral ground motion exceeds 2.67 g (as determined from the code-referenced ground motion maps or the site-specific seismic hazard engineering study), or
- when displacement at the top of the equipment cannot be tolerated, or
- for all QED-2 corner sections used for seismic applications.

To develop the full strength of the upper structural anchor, install and torque the hardware as specified by the anchor manufacturer or the seismic restraint detailing supplied by the Structural Civil Engineer of record for the project.

NOTE: Anchoring hardware is not furnished with the QED-2 equipment.

After the QED-2 switchboard and adjacent equipment are properly joined and the entire structure is bolted to the floor, install the incoming service conductors and load side cables. During an earthquake, the top of the QED-2 switchboard can move in any direction. Any top incoming cables must accommodate this motion. Do not use the QED-2 enclosure (particularly the top) to mount exterior equipment.

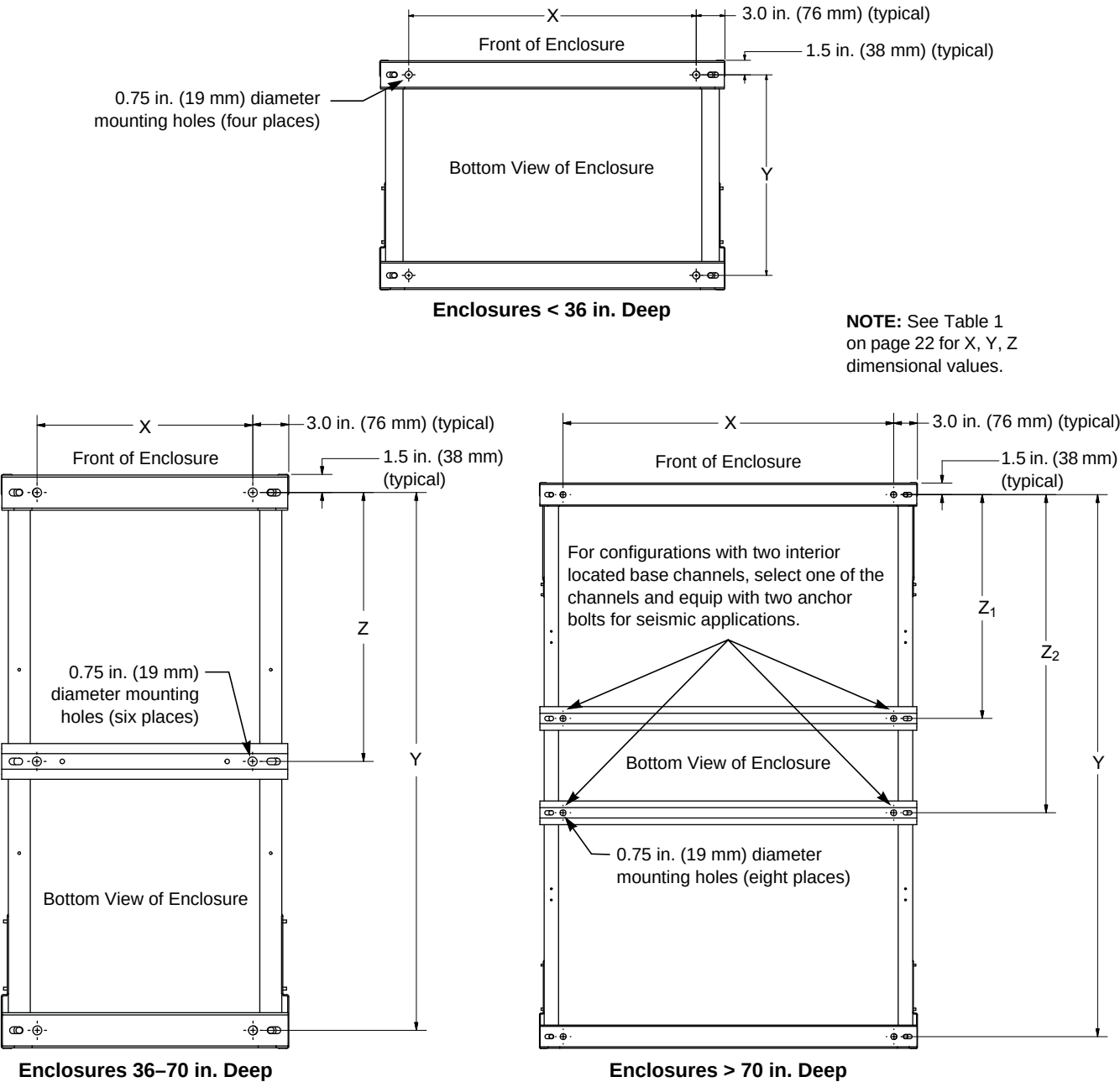
Base Anchoring

- To anchor the switchboard to the floor properly, use all of the designated 0.75 in. (19 mm) diameter mounting hole locations as illustrated in Figure 8 on page 23. The enclosure dimensions corresponding to Figure 8 are listed in Table 1.

Table 1 – Enclosure X,Y, Z Dimensions in Inches (mm)

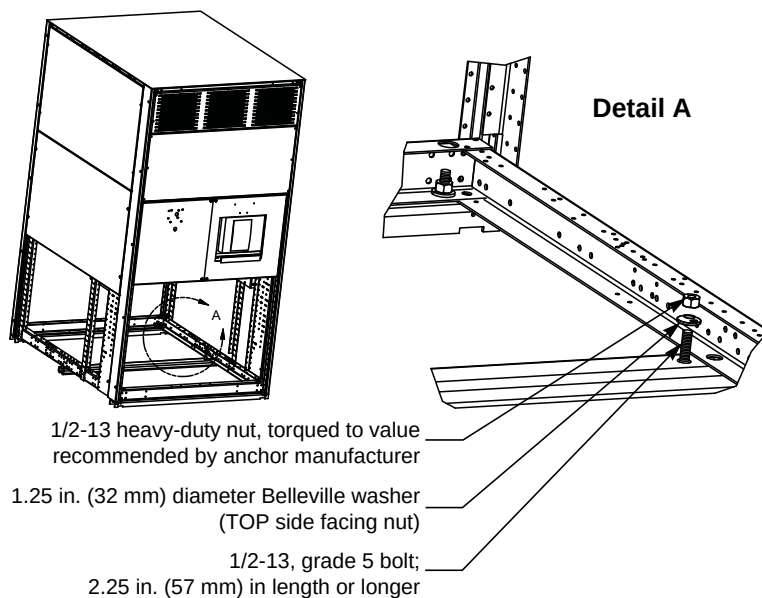
Enclosure Width Enclosure Depth	12 in. (305 mm)	24 in. (610 mm)	30 in. (762 mm)	36 in. (914 mm)	42 in. (1067 mm)	48 in. (1219 mm)	54 in. (1372 mm)
24 in. (610 mm)	X = 6 (152) Y = 21 (533)	X = 18 (457) Y = 21 (533)	X = 24 (610) Y = 21 (533)	X = 30 (762) Y = 21 (533)	X = 36 (914) Y = 21 (533)	X = 42 (1067) Y = 21 (533)	X = 48 (1219) Y = 21 (533)
36 in. (914 mm)	X = 6 (152) Z = 16.5 (419) Y = 33 (838)	X = 18 (457) Z = 16.5 (419) Y = 33 (838)	X = 24 (610) Z = 16.5 (419) Y = 33 (838)	X = 30 (762) Z = 16.5 (419) Y = 33 (838)	X = 36 (914) Z = 16.5 (419) Y = 33 (838)	X = 42 (1067) Z = 16.5 (419) Y = 33 (838)	X = 48 (1219) Z = 16.5 (419) Y = 33 (838)
48 in. (1219 mm)	X = 6 (152) Z = 22.5 (572) Y = 45 (1143)	X = 18 (457) Z = 22.5 (572) Y = 45 (1143)	X = 24 (610) Z = 22.5 (572) Y = 45 (1143)	X = 30 (762) Z = 22.5 (572) Y = 45 (1143)	X = 36 (914) Z = 22.5 (572) Y = 45 (1143)	X = 42 (1067) Z = 22.5 (572) Y = 45 (1143)	X = 48 (1219) Z = 22.5 (572) Y = 45 (1143)
54 in. (1372 mm)	X = 6 (152) Z = 25.5 (648) Y = 51 (1295)	X = 18 (457) Z = 25.5 (648) Y = 51 (1295)	X = 24 (610) Z = 25.5 (648) Y = 51 (1295)	X = 30 (762) Z = 25.5 (648) Y = 51 (1295)	X = 36 (914) Z = 25.5 (648) Y = 51 (1295)	X = 42 (1067) Z = 25.5 (648) Y = 51 (1295)	X = 48 (1219) Z = 25.5 (648) Y = 51 (1295)
60 in. (1524 mm)	X = 6 (152) Z = 28.5 (724) Y = 57 (1448)	X = 18 (457) Z = 28.5 (724) Y = 57 (1448)	X = 24 (610) Z = 28.5 (724) Y = 57 (1448)	X = 30 (762) Z = 28.5 (724) Y = 57 (1448)	X = 36 (914) Z = 28.5 (724) Y = 57 (1448)	X = 42 (1067) Z = 28.5 (724) Y = 57 (1448)	X = 48 (1219) Z = 28.5 (724) Y = 57 (1448)
72 in. (1829 mm)	X = 6 (152) Z ₁ = 28.5 Z ₂ = 40.5 (1029) Y = 69 (1753)	X = 18 (457) Z ₁ = 28.5 (724) Z ₂ = 40.5 (1029) Y = 69 (1753)	X = 24 (610) Z ₁ = 28.5 (724) Z ₂ = 40.5 (1029) Y = 69 (1753)	X = 30 (762) Z ₁ = 28.5 (724) Z ₂ = 40.5 (1029) Y = 69 (1753)	X = 36 (914) Z ₁ = 28.5 (724) Z ₂ = 40.5 (1029) Y = 69 (1753)	X = 42 (1067) Z ₁ = 28.5 (724) Z ₂ = 40.5 (1029) Y = 69 (1753)	X = 48 (1219) Z ₁ = 28.5 (724) Z ₂ = 40.5 (1029) Y = 69 (1753)

Figure 8 – Base Channel Floor Anchor Bolt Locations



- Depending on the frame size (see Figure 8 on page 23), use either four or six 1/2-13 Grade 5 bolts in the locations shown in Figure 9.

Figure 9 – Base Channel Mounting Hardware



NOTE: Base channel mounting hardware detail shown for reference purposes only. Anchoring hardware is not furnished with the switchboard. Covers and internal hardware shown removed for illustration purposes.

- Once the switchboard is in place, secure the base channels to each bolt using a 1.25 in. (32 mm) diameter Belleville washer between a 1/2-13 hardened nut and the switchboard frame as illustrated in Figure 9.

NOTE: The “TOP” side of the Belleville washer must be facing the nut.

- Torque each nut to the value recommended by the anchor manufacturer to develop the full strength of the anchor.

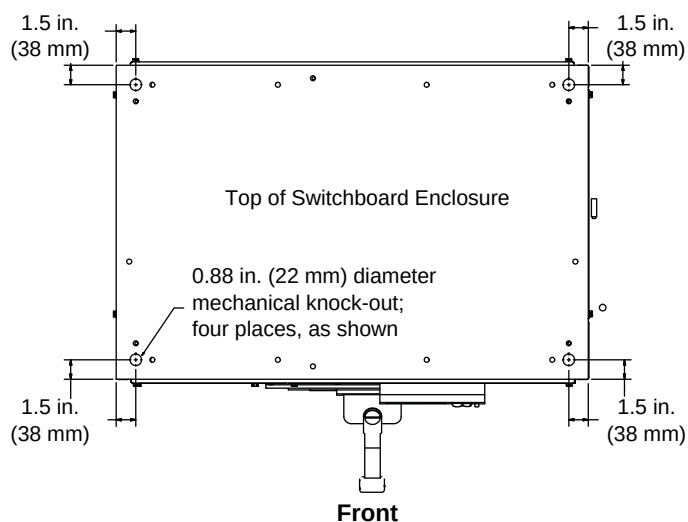
Top Anchoring/Restraint

For installation at locations with an S_s greater than 2.67 g (as determined from the current version of the International Building Code), or where displacement cannot be tolerated at the top of the switchboard during a seismic event, use top restraints attached to the equipment hard points.

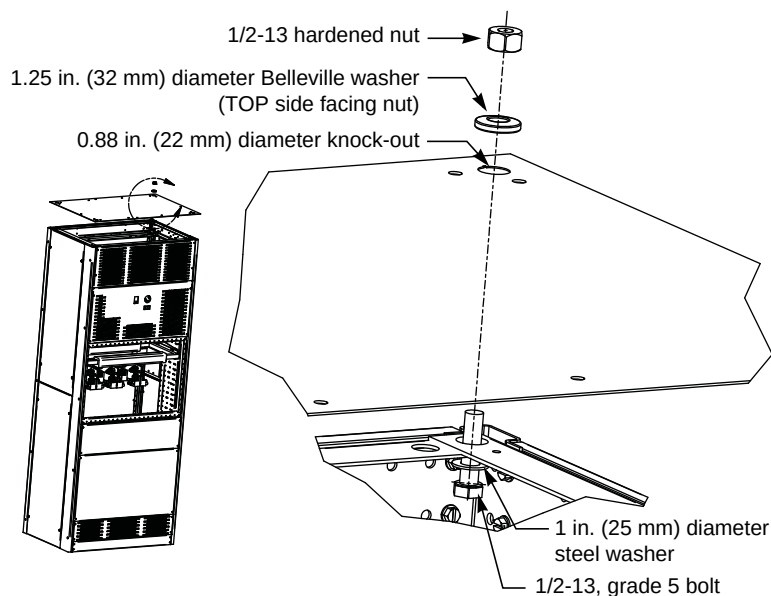
NOTE: Anchoring hardware is not furnished with the switchboard.

- The four 0.88-in. (22 mm) diameter mechanical knock-outs shown in Figure 10 on page 25 serve as hard points for application of a top restraint system.

NOTE: By code, it is the responsibility of the Building Design Professional to determine the top restraint methodology for the intended building application.

Figure 10 – Top Anchor Hard-Point Locations

2. Detach the top plate from the main switchboard enclosure. Retain the screws.
3. Remove the four 0.88 in. (22 mm) diameter mechanical knock-outs as directed by the Building Design Professional.
4. With the knock-outs removed, reattach and re-secure the top plate to the enclosure using the screws removed in Step 2.
5. Attach the top restraint system using a 1/2-13, Grade 5 bolt, a 1 in. (25 mm) diameter steel washer, a 1.25 in. (32 mm) diameter Belleville washer, and a hardened 1/2-13 nut as shown in Figure 11.

Figure 11 – Top Anchor Mounting Hardware

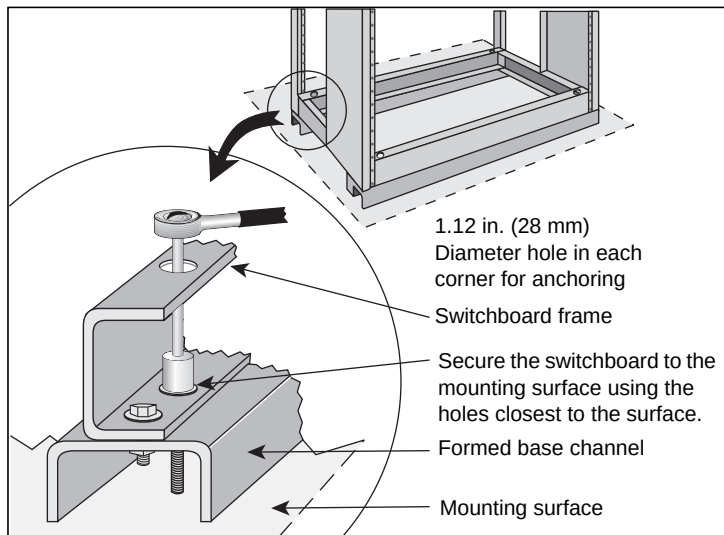
6. After all switchboard sections are properly joined and the entire structure is properly anchored, install the incoming service conductors and load side cables.
7. Do not use the switchboard enclosure (particularly the top) to mount exterior equipment, except for conduit.

Anchoring the Switchboard

Although sections are freestanding, a hard bump or shifting movement can result in damage to the splice joints between sections and conduit hubs connected to the sections. Therefore, each vertical section must be anchored to the floor.

Formed base channels run the width of the shipping section. The channels have 1.12-in. (28 mm) diameter holes for fastening the section to the floor (Figure 12). Anchor each section to the floor with 1/2-in. (Grade 2 minimum) bolts with flat washers and anchors suitable for installation of electrical equipment (not furnished).

Figure 12 – Switchboard Base Channels



After all switchboard sections are properly joined and the entire structure is bolted to the floor, install the incoming service conductors and load side cables.

NOTE: If the switchboard consists of only one shipping section, proceed to “Grounding and Bonding” on page 28.

Through Bus Splice Connections

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not install through bus splice connectors with the switchboard energized.

Failure to follow these instructions will result in death or serious injury.

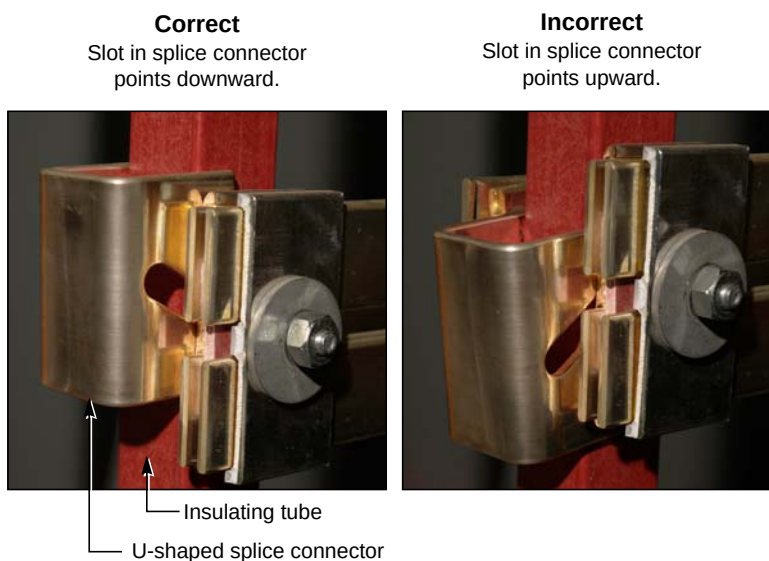
Through bus splice connectors and/or hardware, along with installation instructions, are provided with each shipping split. Follow the installation instructions, and torque splice bolts to the value given in “Section 9—Torque Values for Electrical Connections” on page 53.

If through bus bars are wrapped with an insulative material, cover the splice connections with the material provided.

For splice connections with bus on the front and rear of an insulating tube, ensure the U-shaped, copper connector is centered around the tube. Figure 13 on page 27 shows the proper orientation of the connector.

NOTE: The U-shaped connector will fit snugly against the insulating tube when installed correctly. It is pulled away from the insulating tube in Figure 13 to show the orientation of the connector slot.

Figure 13 – Proper Orientation of U-shaped Splice Connector



Ground Bus Splice Connections

Align and secure the ground bus splice connection between shipping sections. Torque connections to 100 lb-in (11 N•m) (Figure 14 or 15).

NOTE: Proper installation is essential for equipment ground-fault systems.

Figure 14 – Ground Bus Splice Connection

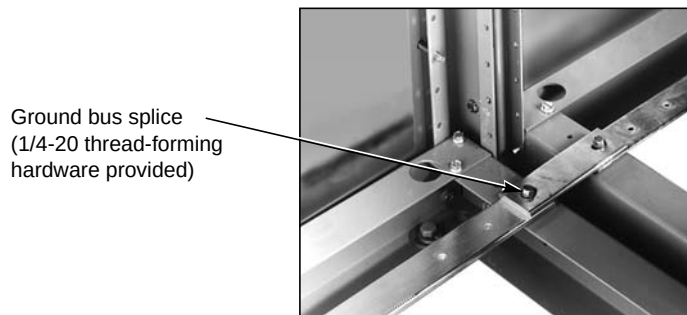
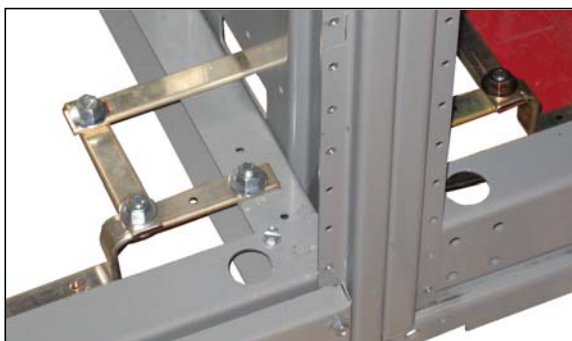


Figure 15 – Series 2 Ground Bus Splice Connection



Grounding and Bonding

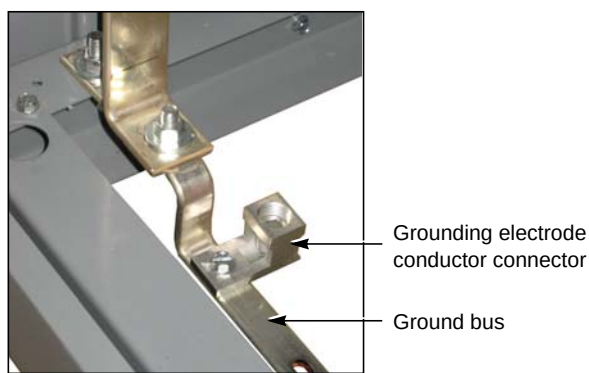
Service Equipment— Grounded System

NOTE: A system is “grounded” if it is grounded at any point ahead of the switchboard, whether the grounded conductor (neutral) is carried through to the loads, or not.

For solidly *grounded* systems used as either service equipment or as a main switchboard on a separately derived system:

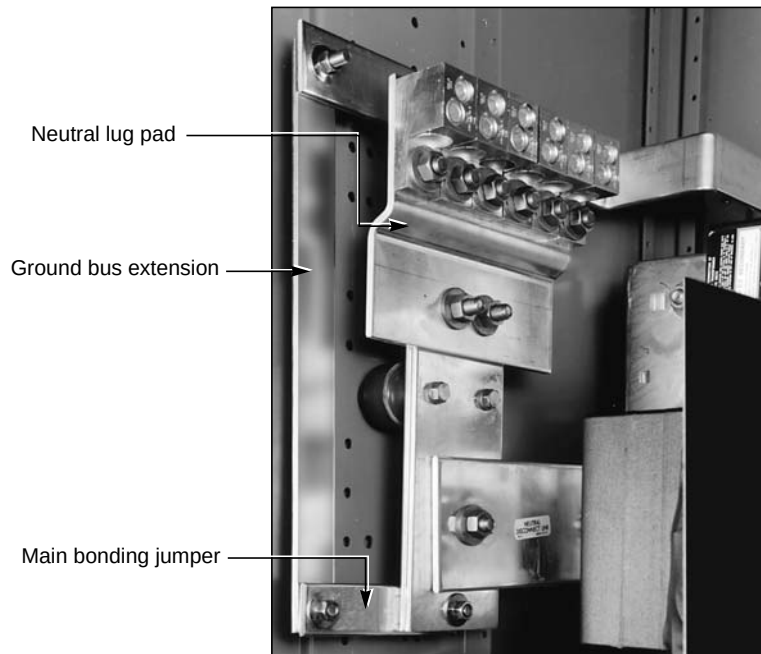
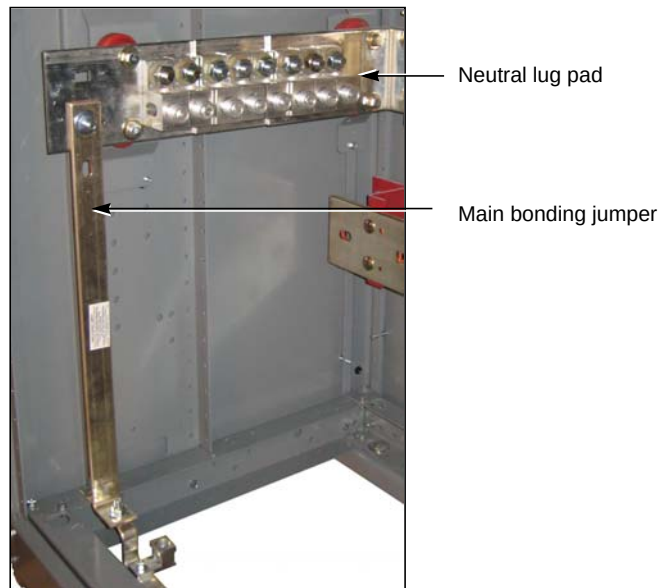
1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the switchboard ground bus (or on the neutral bus, if so indicated on the equipment drawing) (Figure 16). Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC or Sections 10-204 and 10-206 of the 1998 CEC, and install it as specified in Section 250-64 of the NEC or Section 10-908 of the 1998 CEC.

Figure 16 – Grounding Electrode Connector



2. Install the main bonding jumper between the neutral bus and the ground bus (Figure 17 or 18 on 29). For torque values, refer to “Section 9—Torque Values for Electrical Connections” on page 53.

NOTE: If the switchboard is fed from multiple sources (for example, double-ended systems), there may be two or more main bonding jumpers to install.

Figure 17 – Main Bonding Jumper**Figure 18 – Series 2 Main Bonding Jumper**

In Canada, a main bonding jumper bus or cable is provided between the neutral bus and ground bus. When the bonding jumper must be disconnected (for example, for a Megger® test), remove the main bonding jumper bus or cable lug with cable from the neutral bus. This is normally located near the line neutral lugs. Secure the main bonding jumper bus or cable and lug to maintain the required distance from phases and neutral.

NOTE: If the switchboard is fed from multiple sources (for example, a double-ended system like a main-tie-main), there may be two or more main bonding jumpers installed.

**Service Equipment—
Ungrounded System**

For *ungrounded* systems used as either service equipment, or as a main switchboard on a separately derived system:

1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the switchboard ground bus (Figure 16 on page 28).
2. Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC or Sections 10-700 and 10-702 of the 1998 CEC, and install it as specified in Section 250-64 of the NEC or Section 10-204 of the 1998 CEC.

Not Service Equipment

For either *grounded or ungrounded* systems, when a switchboard is not used as service equipment nor as a main switchboard on a separately derived system:

Use equipment grounding conductors sized according to Section 250-122 of the NEC or Section 10-206 of the 1998 CEC to connect the switchboard frame and ground bus to the service ground.

**High-Impedance Grounded
Neutral Systems**

For high-impedance grounded neutral systems:

Ground the system following the instructions provided with the system grounding equipment and in compliance with Section 250-36 of the NEC. Confirm that the switchboard frame and ground bus are bonded in accordance with Section 250-102 of the NEC.

Busway Connections

Schneider Electric switchboards are manufactured with two different styles of busway connections. Qwik Flange™ is used on indoor switchboards only.

The other type of busway connection is the “dummy” flanged end. This type is used on some indoor switchboards, but primarily on outdoor units. The dummy flanged end must be removed to allow actual busway flanged end installation. Either the dummy or actual busway flanged end must be in place before energizing the switchboard.

NOTE: Do not use the switchboard to support the weight of the busway connection. Support busway independently. When busway is installed, make sure no areas of the roof are bowed downward. This will help prevent pooling of water.

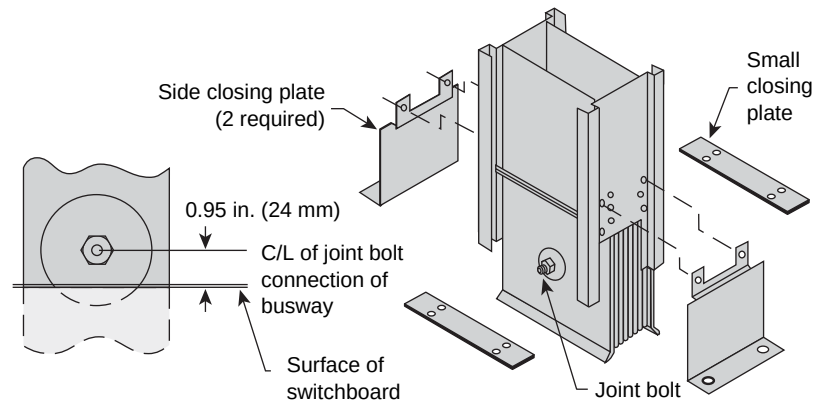
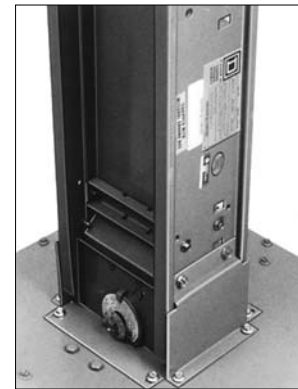
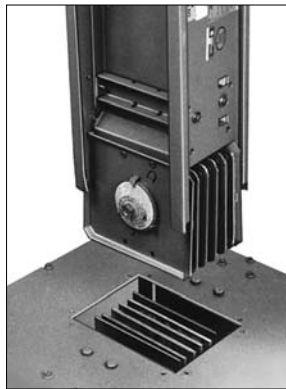
**Busway Connection—NEMA
Type 1 (Indoor) Only
(Qwik Flange™)****⚠ DANGER****HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Turn off all power supplying the switchboard and busway before installing connections.

Failure to follow these instructions will result in death or serious injury

Follow the instructions in this section to make Qwik Flange busway connections (see Figures 19 and 20 on page 31):

1. Remove any protective covering from the opening in the switchboard.
2. Slip the busway joint into the switchboard connectors.
3. Check the joint bolt alignment; the center line (C/L) of the joint bolt to the switchboard surface should be 0.95 in. (24 mm) (Figure 19 on page 31).
4. Attach the side closing plates using two 5/16-in. bolts (provided). When installed properly, the holes in the side closing plates align with the holes in both the switchboard and busway.

Figure 19 – Qwik Flange Installation**Figure 20 – Qwik Flange**

5. Use an 18-in. (457 mm) or longer wrench to torque the joint bolt until the outer break-away head twists off. Do not allow the break-away bolt head or red warning disc to drop into the switchboard.
6. Slip the remaining two small closing plates into position by aligning with the holes in the switchboard. Use the four 1/4-20 screws provided to secure the equipment.
7. Confirm proper phasing of the installed busway before energizing.

**Busway Connections—
NEMA Type 1
(Non-Qwik Flange) and
NEMA Type 3R**

If this style of connection for busway is furnished, the busway “dummy” flanged end must be removed before installing busway (Figure 21 on page 32).

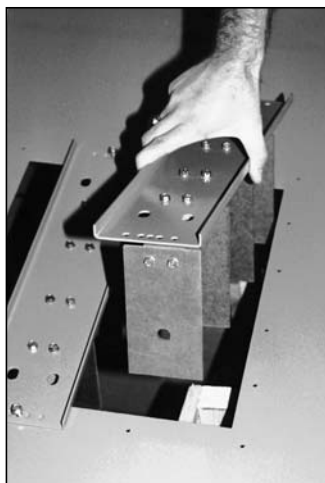
⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Turn off all power supplying the switchboard and busway before installing connections.

Failure to follow these instructions will result in death or serious injury.

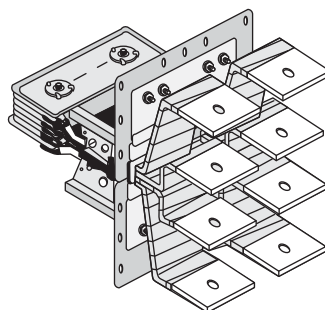
1. From inside the switchboard, remove the 1/2-in. bolts that fasten the switchboard bus to the busway dummy nonmetallic flanges. Retain all hardware for reuse.
2. Remove all screws securing the busway dummy flanged end to the switchboard enclosure.
3. Remove the busway dummy flanged end (Figure 21).

Figure 21 – Removing the Busway Dummy Flanged End



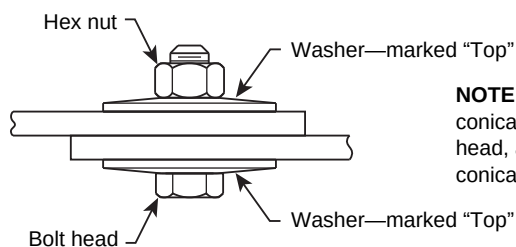
4. Install the actual busway flanged end to the switchboard bus connectors provided in the switchboard (Figure 22). Insert the flanges between the switchboard bus connectors so that the mounting holes in the collar of the flanged end align with the pre-drilled holes in the switchboard enclosure.

Figure 22 – Flanged-End Connections



5. Line up the holes in the bus bar flanges, and reinstall the 1/2-in. (13 mm) hardware that was removed in step 1 on page 32 and as shown in Figure 23.

Figure 23 – Reinstalling the 1/2-In. (13 mm) Hardware



NOTE: The convex side (marked “Top”) of one conical washer should be against the bolt head, and the convex side of the second conical washer should be against the hex nut.

6. Torque the bolts inserted in step 5 as indicated in “Section 9—Torque Values for Electrical Connections” on page 53.
7. Assemble the busway collar to the switchboard enclosure with the screws provided.
8. Ensure that the busway integral ground is connected to the switchboard ground bus.
9. Confirm busway phasing before energizing.

Conduit Area

1. Locate and terminate all conduit in the switchboard enclosure in the “available conduit area” designated on the equipment drawing.

NOTE: On switchboards greater than 24 in. (610 mm) deep, the center base channel can be removed for additional conduit area. **Exception:** Do not remove any base channels when seismic restraint is required.

2. Install the conduit properly. Use hubs, locknuts, and bushings to protect the cables and prevent condensation on the conduit from entering the switchboard.

NOTE: If top entry, do not use the top of the switchboard to support the weight of the conduit. Support the conduit independently. When conduit is installed, make sure no areas of the roof are bowed downward. This will help prevent pooling of water.

If bottom closure plates are furnished, the customer must remove the plates, make holes in them for any conduit entering the bottom of the switchboard, and then reinstall the plates.

Under seismic conditions, consider using top restraints if movement of the top of the switchboard is an issue.

3. Bond all conduit hubs to the switchboard enclosure with approved electrical connections.

Cable Pulling

Power-Style QED-2 switchboards are constructed to customer specifications for the cable entrance arrangement (for example, top or bottom feed). Switchboard components are arranged to give proper cable clearance and bending space for cables entering or exiting the switchboard as specified on the equipment drawing.

1. Use only cable sizes suitable for a proper fit with the corresponding lugs.
2. Pull the proper number of line side and load side cables according to the load served and the NEC or CEC.
3. Position the cables inside the switchboard so that they are not subject to physical damage.
4. Maintain the largest possible bending radii and proper clearance to bus bars and grounded parts. If any cables are lying or bearing on structural members, support them to relieve this condition or place suitable protective material at the bearing point to protect the cable insulation.
5. Be certain to run all phase conductors, including the neutral, through the same opening where cables enter or leave the switchboard, or pass through any metal that has magnetic properties. Otherwise, overheating can result. See Section 300-20(a) of NEC.
6. When instructed, brace or cable-lace the conductors.

Cable Terminations

1. Use a proper insulation stripping tool to strip a length of insulation from the end of the cable sufficient to fit into the full length of the lug barrel. Be careful not to nick or ring the strands.
2. Thoroughly clean aluminum cable contact surfaces with a wire brush, or scrub them with an abrasive cloth to remove oxides and foreign matter.
3. Immediately apply an acceptable joint compound to the bare aluminum surfaces.
4. If compression-type lugs are furnished on any switch or circuit breaker, or as the main incoming power lugs, unbolt and remove them to create sufficient room for crimping the lugs to the cables with the crimping tool.
 - a. Insert the cable into the lug barrel and, using the crimping tool, make the specified number of crimps per the recommendations of the manufacturer.
 - b. Wipe excess joint compound from the connector and insulation.
 - c. With the cables connected, remount the lugs onto the bus bars, switches, or circuit breakers. Torque the bolts to the values given in “Section 9—Torque Values for Electrical Connections” on page 53.
5. Set screw-type lugs may be furnished as main incoming lugs and are standard on molded case circuit breakers and QMB/QMJ/QMQB¹ fusible switches. Torque these lugs to, **but do not exceed**, the specified values. Torque values for circuit breaker and switch lugs are marked on these units. Torque values for other switchboard lugs are marked on the switchboard (Table 7 on page 53).

¹ QMQB switches are available in Canada only.

Cable Restraint for Short-Circuit Current Rating (SCCR)

Cable restraint is recommended for lugs mounted on bus when the following conditions are met:

- Unsupported cable lengths are greater than 3.5 ft. (1 m) ¹

AND

- Cables meet the **Yes** criteria shown in Table 2.

Table 2 – Cable Restraint Criteria

Cable Ampacity	Available Short Circuit Fault Current (RMS)			
	< 65 kA	65 to < 85 kA	85 to < 150 kA	150 to 200 kA
≤ 800 A	No	Yes	Yes	Yes
1200 A	No	No	Yes	Yes
1600 A	No	No	Yes	Yes
2000 A	No	No	Yes	Yes
2500 A	No	No	No	Yes
3000 A	No	No	No	Yes
≥ 4000 A	No	No	No	No

OR

- When otherwise specified.

NOTE: For I-Line™ circuit breakers, or if the lugs are in the circuit breaker, refer to the instruction bulletin for the specific circuit breaker.

Figure 24 – Cable Restraint Example



¹ Cable length is measured from the end of the lug to the conduit fitting through which the cable exits.

NOTICE**HAZARD OF CABLE MOVEMENT UNDER SHORT-CIRCUIT CONDITIONS**

Restrain all cables, including neutral cables, in the switchboard installation when the conditions stated on page 35 are met.

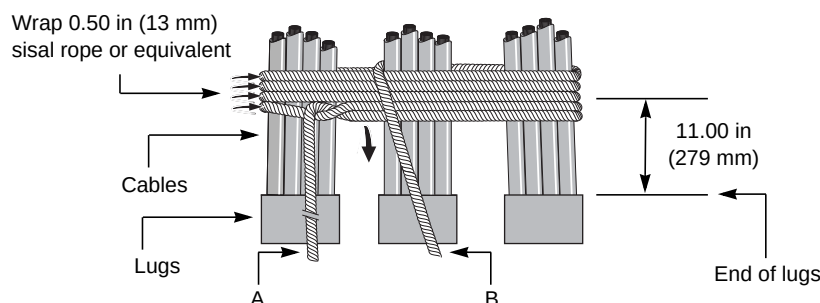
Failure to follow these instructions can result in equipment damage.

When cable restraints are required, perform the following steps.

NOTE: Wrap cables using 1/2-in. (13 mm) diameter sisal rope, 3/8-in. (9.5 mm) diameter nylon rope, or equivalent.

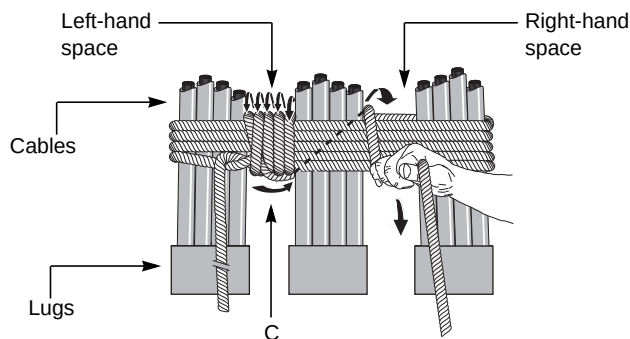
1. Begin wrapping the cables (Figure 25) a maximum distance of 11 in. (279 mm) from the end of the lugs. Continue to wrap the cables on 11-in. (279 mm) center(s) up to the point where the cables leave the enclosure.
 - a. Wrap the cables four (4) times as shown, leaving 3 ft. (1 m) of excess rope at the first end (A).
 - b. Pull the rope (B) taut.

Figure 25 – Wrapping Cables (neutral cables not shown)



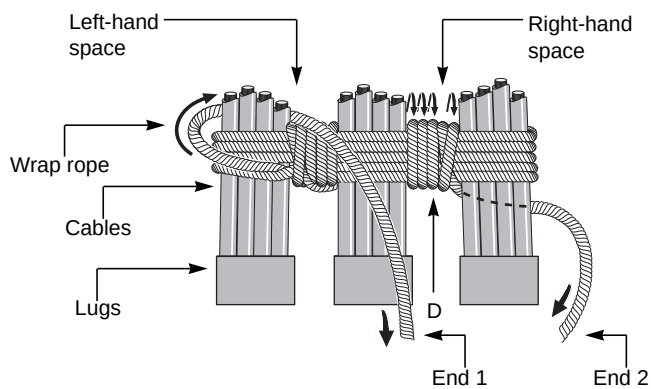
2. Wrap the rope several times (Figure 26) until the space between the cables is completely filled.
 - a. Weave the final rope loop underneath the previous loop (C).
 - b. Bring the rope through the right-hand space.
 - c. Pull the rope taut.

Figure 26 – Wrapping the Space Between Cables



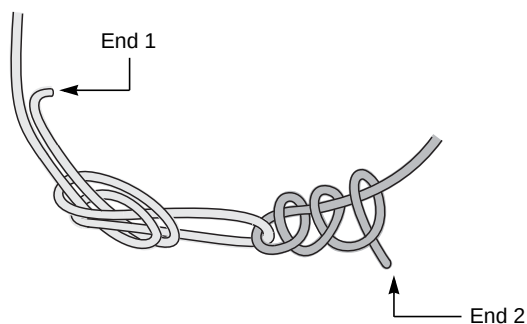
3. Wrap the rope several times until the space between the cables (Figure 27) is completely filled.
 - a. Weave the final rope loop underneath the previous rope loop (D).
 - b. Pull the rope taut.

Figure 27 – Finish Wrapping the Space Between Cables



4. Tie the rope ends (1) and (2) together (Figure 28) until they are taut. Cut off excess rope, and tape ends to prevent fraying.

Figure 28 – Tying Rope Ends Together



5. Recheck torques of wire binding screws after securing the cables.

NOTE: Refer to the torque label supplied with the switchboard for torque values.

Section 5—Pre-energizing Checkout Procedure

Conduct a complete inspection **before** the switchboard is energized to ensure that all components function and operate properly. **Complete every step of the checkout procedure listed before energizing the switchboard.**

1. Check all field-installed bus bar connections. Torque values are listed in “Section 9—Torque Values for Electrical Connections” on page 53.
2. Check all accessible connections for tightness.
3. Check all factory- and field-installed lug terminations for tightness.
4. Check the rigidity of all bus bar supports.
5. Check the switchboard enclosure for dents or other damage that reduces electrical clearances inside the switchboard.
6. Remove all foam blocks, or other temporary cushioning or retaining material, from the electrical devices.
7. Manually open and close all switches, circuit breakers, and other operating mechanisms, checking for correct alignment and free operation.
8. Operate all electrically operated switches, circuit breakers, and other devices equipped with remote operators (not under load). An auxiliary source of control power may be necessary to accomplish this.
9. Check all relays, meters, and instrumentation to verify that all field-installed wiring connections are made properly and that the devices function properly.
10. Current transformers (CTs) supplied for customer use require connection to a metering device load before energizing. Verify that the metering device load is properly connected, including main switchboard connections to remote equipment.
11. All CT circuits supplied by Schneider Electric for customer metering use are shorted for shipment. Remove shorting terminal screws on shorting terminal blocks or jumpers and store in the block.
12. Factory-installed circuit breakers may have an adjustable magnetic or electronic trip which is factory set to the lowest setting. To provide coordinated operation during a fault, adjust the trip as outlined in the instruction manual provided with the circuit breaker. All poles are adjusted simultaneously, using a screwdriver, by the single setting.
13. If ground-fault protection is furnished on type BP switch, adjust the relay to the desired ground current pickup setting. The relay is shipped from the factory at the lowest setting of 120 A for the relay. Relay pickup range is from 120–1,200 A for the relay.

NOTE: For molded case circuit breakers, refer to “Section 11—Reference Publications” on page 56 for circuit breaker information.

14. Check the torque on all bolts of the fuses mounted in Bolt-Loc™ switches, 21–30 lb-ft (28–41 N•m), and in QMB/QMJ/QMQB¹ switches (as marked on the device).

¹ QMQB switches are available in Canada only.

NOTICE**HAZARD OF EQUIPMENT DAMAGE**

Do not pry open or spread the fuse mounting clips. Doing so can cause a loose connection, resulting in overheating.

Failure to follow these instructions can result in equipment damage.

15. Examine fuse clip contact pressure and contact means (QMB/QMJ/QMQB¹ fusible switches). If there is any sign of looseness, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada). Loose fuse clips can result in overheating.
16. Check all QMB/QMJ/QMQB¹ fusible switches, verifying that the proper fuses with the required interrupting rating and continuous current rating are installed. Do not use renewable link fuses in Square D™ brand fusible switches.
17. Verify that all grounding connections are correctly made. If the switchboard is used as a service entrance, double check to see that the main bonding jumper is connected (Figure 17 on page 29).

⚠ CAUTION**HAZARD OF EQUIPMENT DAMAGE OR INJURY**

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating "Warning: Disconnect Plug Before Dielectric Test."
- Some Micrologic™ trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

18. Conduct an electrical insulation resistance (Megger®) test to ensure that the switchboard is free from short circuits and undesirable grounds.
 - a. Open all control power and metering disconnects or remove the fuses from the control circuits.
 - b. Disconnect the neutral connection at any surge protective device or other electronic device before performing the electrical insulation resistance test; reconnect to the device after the test.
 - c. With the neutral isolated from the ground and the power switches and circuit breakers open, conduct electrical insulation tests from phase-to-phase, phase-to-ground, phase-to-neutral, and neutral-to-ground.
 - d. If the resistance reads less than one megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated.
 - e. Consult Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada) to help correct any problems.
19. After completing the electrical insulation resistance test, replace all control power fuses that were removed and close power disconnects that were opened.
20. Check all field-installed wiring. Make certain it is clear of all live parts, and when instructed, secured to withstand fault currents.

21. Verify that all control wiring between sections is connected.
22. Vacuum to remove any dust, scrap wire, or other debris.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not use an air hose to blow out the switchboard. Dust can settle inside relays and overcurrent devices, causing overheating and improper operation.

Failure to follow these instructions can result in equipment damage.

23. Replace all covers and barriers; check for any pinched wires, and close doors. Make certain all enclosure parts are aligned properly and securely fastened.

Ground Fault Protection Systems

Paragraph 230-95(c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed. If the circuit breaker has equipment ground-fault protection installed, test it at this time.

1. Make sure the trip unit is powered. The trip unit is powered if:
 - The circuit breaker is closed or bottom fed and has more than 100 V of load voltage on two phases (P or H trip unit only).
 - The full-function or hand-held test kit is connected and on.
 - The 24 Vdc external power supply is connected.
 - An external voltage tap is installed and voltage of more than 100 V is present on two phases (P or H trip unit only).
2. If the system is a radial (single-ended) system, press the ground-fault Push-to-Test button. The circuit breaker trips, and the trip unit ground-fault indicator light comes on.
3. Record results on the ground fault system test log.

NOTE: If a complete check of the ground-fault system is necessary, use primary injection testing. If the system is multiple source and/or requires field connections at the job site, use primary injection testing.

NOTE: Some ground fault systems require field connections at the job site. Consult the switchboard interconnection wiring drawing for details.

Section 6—Energizing the Switchboard

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Correct short-circuit conditions detected during the checkout procedures described in “Section 5—Pre-energizing Checkout Procedure” beginning on page 38.
- Qualified electrical personnel must be present when energizing this equipment for the first time.
- Follow the instructions in this section to energize the switchboard properly.

Failure to follow these instructions will result in death or serious injury.

1. Make sure there is not a load on the switchboard when it is energized. Turn off all downstream loads.
2. Energize the switchboard in the following sequence:
 - a. Turn on all control power disconnects before energizing the switchboard. Refer to the record drawings supplied with equipment to see if control power disconnects are supplied.
 - b. Close any open doors and/or covers.
 - c. Close all main devices.
 - d. Close each branch circuit breaker or branch fusible switch.
 - e. Proceed to each panelboard and other downstream load.
3. After all overcurrent protective devices are closed, turn on all loads (for example, lighting circuits, contactors, heaters, and motors).

Section 7—Maintaining the Switchboard

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Inspect and perform preventive maintenance only on switchboards and equipment that has been de-energized and electrically isolated (unless otherwise specified). This helps ensure that accidental contact cannot be made with energized parts.
- Follow safety-related work practices as described in NFPA 70E, Part II at all times.

Failure to follow these instructions will result in death or serious injury.

Periodic maintenance of the switchboard includes cleaning, lubrication, and exercising component parts. The interval between maintenance checks can vary depending upon the amount of usage and environmental conditions of each installation. The maximum recommended inspection interval is one year. This definition for periodic maintenance applies throughout this manual, unless otherwise noted.

Always inspect the switchboard after a fault. (Refer to “Section 8—Adverse Circumstances”, beginning on page 50). Service bulletins for the various disconnecting and overcurrent devices mounted in the switchboard are available through your local Schneider Electric representative.

General Inspection and Cleaning

1. Vacuum the switchboard interior to remove any dirt or dust deposits. Wipe all bus bars, insulators, cables, etc., with a clean, dry, lint-free cloth.
2. Check the switchboard interior carefully for moisture, condensation build-up, or signs of any previous wetness. Moisture can cause insulation failures and rapid oxidation of current-carrying parts. Inspect all conduit entrances and cracks between the enclosure panels for dripping leaks. Condensation in conduits can be a source of moisture and must not be allowed to drip onto live parts or insulating material. Take the necessary steps to eliminate the moisture and seal off all leaks.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Do not use an air hose to blow out the switchboard. Dust can settle inside relays and overcurrent devices, causing overheating and improper operation.
- Do not allow paint, chemicals, or petroleum-based solvents to contact plastics or insulating materials.

Failure to follow these instructions can result in equipment damage.

3. Inspect the switchboard for any signs of overheating. Discoloration and flaking of insulation or metal parts are indications of overheating.

NOTE: If overheating occurs, be sure that all conditions that caused the overheating have been corrected. Loose or contaminated connections can cause overheating.

4. Check for signs of rodent nesting in the switchboard. If required, use a good exterminating technique in the general area of the switchboard.
NOTE: Do not place or use exterminating substances and chemicals inside the switchboard. Some products attract rodents.
5. Carefully inspect all devices for any visibly worn-out, cracked, or missing parts.
6. Manually open and close switches and circuit breakers several times to verify they are working properly.
7. Verify that all key interlocks and door interlocking provisions are working properly.

Bus Bar Joints, Lug Terminations, and Insulating Materials

1. Bus bar joints are maintenance-free. Do not retighten them after the pre-energizing checkout procedure is complete.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Do not sand or remove plating on any bus bar, splice bar, or terminal lug.
- Damage to plating can result in overheating. Replace damaged part. Contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

Failure to follow these instructions can result in equipment damage.

2. Check all bus bar joints and terminal lugs for any pitting, corrosion, or discoloration resulting from high temperatures or subjection to high fault conditions. If any damage has occurred, replace the bus bars or lugs. If cleaning is required, use Lectra-Clean®, made by CRC.
3. Inspect all insulating materials. Before re-energizing the switchboard, replace insulators with any visible damage (such as cracks).

General Lubrication Information

For field maintenance re-lubrication of blade/jaw components in switches 600 V and below, use BG20 High Performance Synthetic Grease from Dow Corning (Schneider Electric catalog number SWLUB). This grease is applicable for the following switches:

- Bolt-Loc
- QMB Main and Branch
- QMJ Branch
- QMQB¹ Main and Branch

For bus/plug-on connections, use electric joint compound, Schneider Electric catalog number PJC7201.

For Masterpact™ NW drawout connections, use only Schneider Electric catalog number S48899 Electric Joint Compound.

Automatic Transfer Switches

Consult the documentation provided by the manufacturer for all installation, operation, and maintenance instructions for these devices.

¹ QMQB switches are available in Canada only.

Bolt-Loc Bolted Pressure Contact Switch Maintenance (800–4,000 A)

Refer to the Bolt-Loc switch installation and maintenance manual for complete information (manual is shipped with the switchboard). If the manual is not available, refer to “Section 11—Reference Publications” on page 56, and contact your local Schneider Electric representative to obtain the appropriate manuals.

1. Exercise the operating mechanism at least once a year to ensure proper operation.
2. The Bolt-Loc switch is shipped from the factory properly lubricated. Periodic cleaning and lubrication of the switch is required. The maintenance interval between lubrications depends on factors such as usage and ambient conditions. The maximum recommended maintenance interval is one year for current-carrying parts and five years for operating mechanisms.

⚠ DANGER

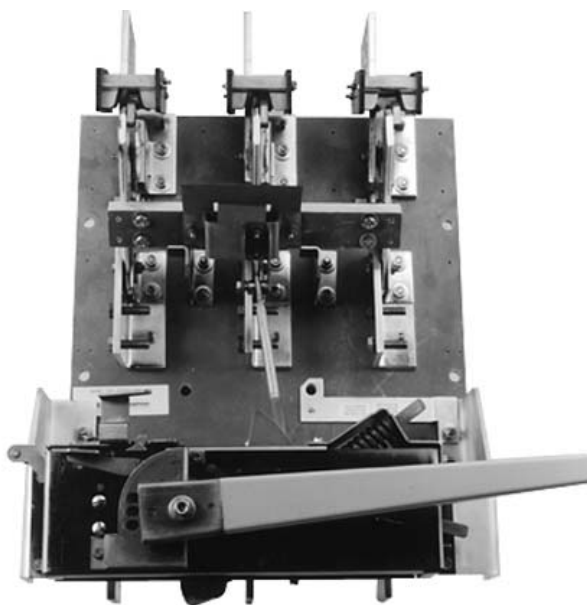
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Always check line and load ends of the fuses for voltage before starting the replacement procedure. The Bolt-Loc switch can be part of a multiple source system in which the fuses can be energized when the Bolt-Loc switch is in the “open” position.

Failure to follow these instructions will result in death or serious injury.

3. To replace the fuse:
 - a. Open the switch before opening the fuse door.

Figure 29 – Type BP Bolt-Loc Fusible Switch



- b. Open the fuse door, releasing the interlock as described in the instructions on the door.
- c. Observe the switch blades to confirm the switch is “open.”
- d. Check the line and load ends of fuses for voltage using a properly rated voltage sensing device. No voltage should be present.

- e. Remove all fuses. Retain the hardware for reuse.
 - f. Using a non-abrasive cleaner such as Lectra-Clean, made by CRC, wipe clean the fuse mounting pads on the switch and the terminals of each new fuse. Check the alignment of fuse terminals before installing new fuses.
 - g. Install new fuses using the same hardware removed in Step e. Tighten to 21–30 lb-ft (28–41 N•m).
4. Close the fuse door, and check the fuse door interlock with the switch in the ON position. The fuse doors should not open using normal hand force.

Circuit Breakers

Schneider Electric circuit breakers are designed and manufactured as sealed units requiring minimal periodic maintenance.

Exercise circuit breakers at least once a year to ensure proper operation. For general maintenance:

1. Trip the circuit breaker by pushing the Push-To-Trip or “Open” button located on the face of the circuit breaker. Refer to the appropriate circuit breaker manual for the specific location of this button.
2. Manually open and close the circuit breaker two to three times.

Figure 30 – PowerPact™ R-Frame Circuit Breaker



NOTE: Schneider Electric instruction bulletin 48049-900-0x, *Field Testing and Maintenance Guide for Thermal-Magnetic and Micrologic™ Electronic Trip Molded Case Circuit Breakers*, provides more in-depth information.

⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- If adjusting circuit breaker settings, do not set the long-time trip rating at a higher ampacity than the rating of the bus bar or load cables it supplies; overheating can occur.
- Before energizing the switchboard, fill all unused I-Line circuit breaker mounting spaces with blank fillers and/or extensions as listed in Table 3.

Failure to follow these instructions will result in death or serious injury.

Refer to individual circuit breaker instruction manuals shipped with the switchboard for additional maintenance information, such as changing rating plugs, sensor plugs, or adjustable settings and removing circuit breakers. If the instruction manual is not available, refer to “Section 11—Reference Publications” on page 56 for the appropriate number, or contact your local Schneider Electric representative.

Table 3 – I-Line™ Blank Fillers and Extensions

Item	Height	Catalog No.	Branch Circuit Side	Circuit Breaker Frame
Blank Fillers	1.50 in. (38 mm)	HNM1BL	Both Sides	Not applicable
	4.50 in. (114 mm)	HNM4BL	Both Sides	
Blank Extensions	1.50 in. (38 mm)	HLW1BL	Wide Side	All applications except PowerPact H/J circuit breakers with Micrologic trip unit 5/6.
	4.50 in. (114 mm)	HLW4BL	Wide Side	
	1.50 in. (38 mm)	HLN1BL	Narrow Side	
	4.50 in. (114 mm)	HLN4BL	Narrow Side	
	4.50 in. (114 mm)	HLN4EBL	Narrow Side	Only PowerPact H/J circuit breakers with Micrologic trip unit 5/6.
	4.50 in. (114 mm)	HLW4EBL	Wide Side	

NOTICE**HAZARD OF EQUIPMENT DAMAGE**

- Do not remove the protective lubricant on the plug-on connectors.
- If additional lubrication is required, apply a coating of electrical joint compound, catalog number PJC7201, to the contact surfaces of the plug-on connector.

Failure to follow these instructions can result in equipment damage.

3. The universal test set, catalog number UTS3, is available to test Schneider Electric Powerpact P and R circuit breakers equipped with Micrologic trip units. It runs trip unit tests automatically, with prompts to the user for initial information. Test modules for each circuit breaker frame are used to store data necessary for automatic tests. Series B Micrologic trip units require test module CBTMB, which is included in UTS3.

A pocket tester, catalog number S434206, or UTA tester, catalog number STRV00910, are available for Schneider Electric Powerpact H, J, and L circuit breakers with Micrologic trip units. These testers supply power to the Micrologic trip units and allow for settings to be adjusted through the keypad located on the circuit breaker or through a PC using the USB interface.

Masterpact NW trip units require the full-function test set, catalog number S33595, or the hand-held test set, catalog number S33594.

NOTE: Tests can be conducted with a circuit breaker installed in the switchboard; circuit breaker removal is not required. **The switchboard must be de-energized.**

QMB/QMJ/QMQB¹ Fusible Switches

Refer to the QMB/QMJ/QMQB¹ instruction manual for complete maintenance information. If the instruction manual is not available, refer to “Section 11—Reference Publications” on page 56 of this manual for the appropriate number. Contact your local Schneider Electric representative to obtain the manual.

Switch Maintenance

1. Periodically exercise the switch to ensure proper operation. This period should not exceed one year.
2. Check the cover interlock with the switch in the ON position. The cover should not open using normal hand force.
3. Inspect the switch interior for any damaged or cracked parts, and replace as necessary.
4. For fusible switch units, check the fuse mounting clips or bolted contact area for corrosion or discoloration (indicating overheating). Replace them if necessary.
5. For additional maintenance instructions, see the label on the inside of the door.

Fuse Replacement (Fusible Switches Only)

1. Turn the switch to the OFF position before opening the door.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Always check line and load ends of the fuses for voltage before starting the fuse replacement procedure with a properly rated voltage sensing device.

Failure to follow these instructions will result in death or serious injury.

2. Observe the switch blades to confirm that the switch is in the OFF position.
3. Using a properly rated voltage sensing device, verify that line and load ends of the fuse are not energized.
4. Observe all warning labels specifying the type of fuse to use. Do not substitute a non-current limiting fuse, or attempt in any way to defeat the rejection feature of the fuse clips furnished with the switch. Do not use renewable link fuses in Schneider Electric fusible switches.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not pry open or spread the fuse mounting clips. Doing so can cause a loose connection, resulting in overheating and nuisance fuse blowing.

Failure to follow these instructions can result in equipment damage.

¹ QMQB switches are available in Canada only.

Installing QMB/QMJ/QMQB¹ Fusible Switches

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Remove power for these sections before installing or removing QMB/QMJ/QMQB¹ switches.
- Do not use a main as a branch unit or a branch as a main.
- All unused spaces must be filled with blank fillers before energizing the switchboard. Refer to Tables 4 and 5 for sizes and catalog numbers.

Failure to follow these instructions will result in death or serious injury.

Table 4 – QMB/QMJ Fusible Switch Blank Fillers

Height	Catalog No.
1.50 in. (38 mm)	QMB1BLW
3.00 in. (76 mm)	QMB3BLW
6.00 in. (152 mm)	QMB6BLW
15.00 in. (381 mm)	QMB15BLW

Table 5 – QMQB¹ Fusible Switch Blank Fillers

Height	Catalog No.
2x: 1.375 in. (35 mm)	QFS1
8x: 5.50 in. (140 mm)	QFS5
10x: 6.875 in. (175 mm)	QFS6
14x: 9.625 in. (244 mm)	QFS9
24x: 16.50 in. (419 mm)	QFS16

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not remove the protective lubricant on the plug-on connectors.

Failure to follow these instructions can result in equipment damage.

1. Turn off the main power.
2. Turn the switch handle(s) to the OFF position. Align switch plug-on connectors with QMB panel vertical bus, and plug switch onto panel.
3. Place and partially tighten all unit mounting screws that mount to the QMB panel mounting rails.
4. Tighten all screws evenly. The unit mounting flange and plug-on connectors must be seated securely.

**Removing
QMB/QMJ/QMQB¹ Fusible
Switches**

1. Turn off the main power.
2. Turn switch handle(s) to the OFF position.
3. Disconnect the load wires.
4. For QMB and QMJ switches, remove mounting screws holding the switch to the mounting rail. For QMQB¹ switches, remove the bolts holding the switch to the line terminal.
5. Unplug the switch.

Ground-Fault Protection Systems

Check the terminal connections on the ground-fault protection system at least once a year for tightness and corrosion. If the system can be tested without tripping the main or branch device, directions for testing the system are in the device manual. Otherwise, testing the ground-fault protection system will trip the main or branch device to which it is connected. If the ground-fault sensor or relay is physically or electrically damaged, replace it.

If the ground-fault protection system does not operate properly and additional equipment has been connected to the installation since the last maintenance test/check, de-energize the entire system, and check for grounds on the neutral downstream from the main bonding jumper. If no downstream grounds are detected and the ground fault system is not operating properly, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

If no additions have been made to the installation and the ground-fault protection system does not operate properly, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

Refer to the ground-fault field test instruction manual for additional testing information. If the manual is not available, refer to “Section 11—Reference Publications” on page 56 of this manual to obtain the appropriate number. Contact your local Schneider Electric representative to obtain this manual.

¹ QMQB switches are available in Canada only.

Section 8—Adverse Circumstances

This section includes, but is not limited to, all electrical components of the switchboard.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying the switchboard before cleaning.
- Always use a properly rated voltage sensing device to confirm all power is off.
- Before energizing the switchboard, all unused circuit breaker mounting spaces must be filled.

Failure to follow these instructions will result in death or serious injury.

NOTE: Before attempting to re-energize the switchboard following adverse circumstances, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada) for special instructions.

Inspection Following a Short Circuit

If a short circuit occurs, make a thorough inspection of the entire system, and verify that no damage to conductors or insulation has occurred. High mechanical and thermal stresses developed by short-circuit currents can damage conductors and insulation. Check the overcurrent-protection device that interrupted the short-circuit current for possible arcing damage.

Do not open sealed devices, such as molded case circuit breakers. Replace these devices if they are damaged. Before energizing the switchboard, all unused circuit breaker mounting spaces must be filled. For more information about these devices, refer to the appropriate instruction manual listed in “Section 11—Reference Publications” on page 56.

Clean-up Following a Short Circuit

The insulating properties of some organic insulating materials can deteriorate during an electrical arc. If so:

1. Remove any soot or debris.
2. Replace carbon-tracked insulation.

Water-Soaked Switchboards

Do not clean or repair a switchboard that has been exposed to large volumes of water or submerged at any time. Current-carrying parts, insulation systems, and electrical components may be damaged beyond repair. **Do not energize the switchboard.** Contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

Water-Sprayed or Splashed Switchboards (Clean Water Only)

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power supplying this equipment before working on it.

Failure to follow these instructions will result in death or serious injury.

Inspection and Clean-up of Clean Water Sprayed or Splashed Switchboards

If the switchboard has been sprayed or splashed with small amounts of clean water, make a thorough inspection of the entire system, and verify that no damage to conductors or insulation has occurred. Do not open sealed devices such as molded case circuit breakers or fuses. Replace these devices if they are damaged. For more information about these devices, refer to the appropriate instruction manual listed in “Section 11—Reference Publications”.

Follow steps 1–10 only if:

- No signs of physical damage to the equipment are present.
- The switchboard has not been submerged or exposed to water for long periods of time.
- The water that has been in contact with the switchboard has not been contaminated with sewage, chemicals, or other substances that can negatively affect the integrity of the electrical equipment.
- The water that has been in contact with the switchboard has not entered any area of the enclosure that may contain wiring installed as intended and located above any live part. Specifically, inspect for water entering through conduits located above live parts.

If any one or more of these conditions have not been met, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

If **ALL** of the conditions listed have been met, proceed as follows:

1. Turn off all power supplying this equipment before working on or inside the equipment.
2. Always use a properly rated voltage sensing device to confirm all power is off.
3. Disconnect and electrically isolate the switchboard so that no contact can be made with energized parts.
4. Wipe off all moisture from the bus bars, insulators, and insulating material with a clean, dry, lint-free cloth. Do **not** use cleaning agents or water displacement sprays.
5. Prepare the switchboard for insulation resistance (Megger®) testing by disconnecting all line side supply connections and all load side cable connections to isolate the switchboard from the wiring system.

⚠ CAUTION**HAZARD OF EQUIPMENT DAMAGE OR INJURY**

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating “Warning: Disconnect Plug Before Dielectric Test.”
- Some Micrologic trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

6. Turn all circuit breakers or switches to their ON position. The switchboard must remain de-energized.
7. Use a megohmmeter with a capacity of 500–1,000 Vdc and apply voltage from:
 - a. Each phase-to-ground with circuit breaker on.
 - b. Phase-to-phase with circuit breaker on.
8. Record resistance values. Refer to “Section 10—Switchboard Insulation Resistance Chart” on page 55.
9. If resistance measurements are less than 0.5 megohm, call Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada) for recommendations.
10. If resistance measurements are greater than 0.5 megohm, the equipment can be energized using the procedures listed in “Section 6—Energizing the Switchboard” on page 41.

Section 9—Torque Values for Electrical Connections

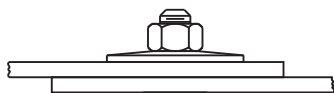
Table 6 – Incoming, Branch, and Neutral Lug

Socket Size Across Flats	Torque Value
1/4 in.	180 lb-in (20 N•m)
5/16 in.	250 lb-in (28 N•m)
3/8 in.	340 lb-in (38 N•m)
1/2 in. ★	450 lb-in (51 N•m)

★ Certain lugs require 620 lb-in (70 N•m) and are marked as such.

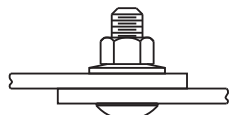
Table 7 – Multiple Conductor Neutral and/or Ground Bar

Screw Type	Lug Wire Range	Conductor Size	Torque Value
Slotted Head	14–4	14-10 Cu, 12-10 Al	20 lb-in (2 N•m)
		8 Cu-Al	25 lb-in (3 N•m)
		6-4 Cu-Al	35 lb-in (4 N•m)
	14–1/0	14-8 Cu-Al	36 lb-in (4 N•m)
		6-1/0 Cu-Al	45 lb-in (5 N•m)
Socket Head	14–1/0	All	100 lb-in (11 N•m)
	6–300 kcmil	All	275 lb-in (31 N•m)

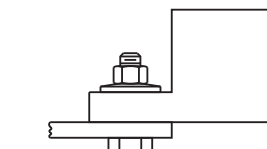


Carriage bolt
Hex nut
Conical washer

Hardware Description	Torque Value
1/2 in.	720–840 lb-in (81–95 N•m)

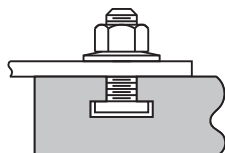


Carriage bolt
Conical washer assembly
Keps nut



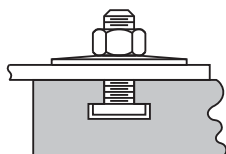
Hex head bolt
Conical washer assembly
Keps nut

Hardware Description	Torque Value
1/4 in.	50–75 lb-in (6–8 N•m)
5/16 in.	80–125 lb-in (9–14 N•m)
3/8 in.	175–225 lb-in (20–25 N•m)
1/2 in.	250–350 lb-in (28–40 N•m)



Square head (Tee) bolt
Conical washer assembly
Keps nut

Hardware Description	Torque Value
1/4 in.	50–75 lb-in (6–8 N•m)
3/8 in.	175–225 lb-in (20–25 N•m)
1/2 in.	250–350 lb-in (28–40 N•m)



Square head (Tee) bolt
Conical washer

Hardware Description	Torque Value	
	Conical Washer OD	Square Head (Tee) Bolt Conical Washer
3/8 in.	0.87 in. (22 mm)	250–280 lb-in (28–32 N•m)
	1.00 in. (25 mm)	130–150 lb-in (15–17 N•m)
1/2 in.	1.25 in. (32 mm)	450–550 lb-in (51–62 N•m)
	2.25 in. (57 mm)	



Hex head bolt
(2) Conical washers

Hardware Description	Torque Value	
	Conical Washer OD	Hex Head Bolt (2) Conical Washers
5/16 in.	0.90 in. (23 mm)	145–160 lb-in (16–18 N•m)
3/8 in.	0.87 in. (22 mm)	250–280 lb-in (28–32 N•m)
	1.00 in. (25 mm)	130–150 lb-in (15–17 N•m)
1/2 in.	1.25 in. (32 mm)	720–840 lb-in (81–95 N•m)
	2.25 in. (57 mm)	
	3.00 in. (76 mm)	

Section 10—Switchboard Insulation Resistance Chart

Always use a 500 or 1,000 Vdc megohmmeter when testing insulation resistance.

NOTE: The Neutral–Ground column is provided to record the results of the pre-energizing checkout procedure only.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power to the switchboard before testing.
- Always use a properly rated voltage sensing device to confirm power is off.

Failure to follow these instructions will result in death or serious injury.

[illegible]

Section 11—Reference Publications

Schneider Electric publications are available through your local Schneider Electric representative. These publications include device replacement procedures and listings of spare parts to make ordering and servicing of replacement parts quick and convenient. Any maintenance procedure or device not listed, such as an I-Line interior, is not customer serviceable.

Contact your local Schneider Electric representative for information at 1-888-778-2733 in the US, or at 1-800-565-6699 in Canada. Or, refer to the Technical Library at <http://www.schneider-electric.us/> to obtain the appropriate publications.

For information about obtaining NEMA documents, write to:

National Electrical Manufacturers Association (NEMA)
Attention: Customer Service
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209

Other Reference Publications	Publication Number
General Instructions for Proper Installation, Operation, and Maintenance of Switchboards Rated 600 V or Less	NEMA Publication PB2.1
Application Guide for Ground Fault Protective Devices for Equipment	NEMA Publication PB2.2
Circuit Breakers	NEMA Publication AB-4
Enclosed and Miscellaneous Distribution Switches	NEMA Publication KS-1
Electrical Equipment Maintenance	NFPA 70B-1999

ENGLISH

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of Deadfront Distribution Switchboards Rated 600 Volts or Less*

Published by

National Electrical Manufacturers Association

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Foreword

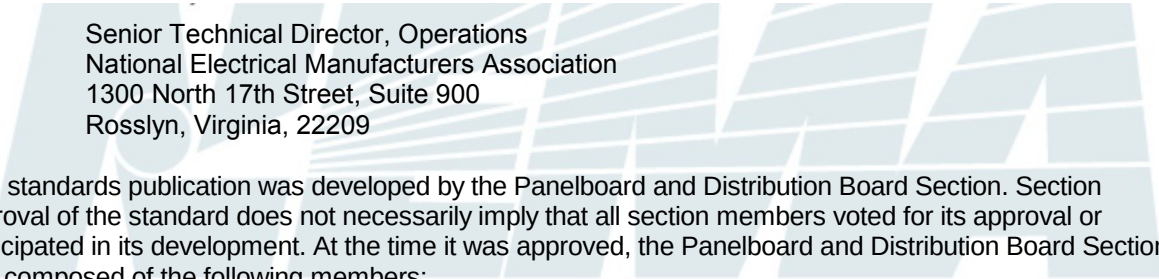
This publication is a guide of practical information containing instructions for the proper handling, installation, operation, and maintenance of deadfront distribution switchboards rated 600 Volts or less.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency regarding handling, installation, operation, or maintenance.

It is recommended that work described in this set of instructions be performed only by qualified personnel familiar with the construction and operation of switchboards and that such work be performed only after reading this complete set of instructions. For specific information not covered by these instructions, you are urged to contact the manufacturer of the switchboard directly.

PB 2.1-2013 revises and supersedes PB 2.1-2007.

In the preparation of this standards publication input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product section by contacting the following:



Senior Technical Director, Operations
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia, 22209

This standards publication was developed by the Panelboard and Distribution Board Section. Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Panelboard and Distribution Board Section was composed of the following members:

Eaton Corporation.—Pittsburgh, PA
GE Industrial Solutions—Plainville, CT
Hubbell, Inc.—Bridgeport, CT
Milbank Manufacturing Company—Kansas City, MO
Penn Panel & Box Company—Collingdale, PA
Reliance Controls Corporation—Racine, WI
Siemens Industry, Inc.—Norcross, GA
Schneider Electric—Palatine, IL

Section 1 GENERAL

1.1 SCOPE

This publication covers floor-mounted deadfront switchboards which consist of an enclosure, molded case and low-voltage power circuit breakers, fusible or non-fusible switches, instruments, and metering, monitoring, or control equipment, with associated interconnections and supporting structures. These units are used in the distribution of electricity at:

- a. 600 volts and less
- b. 6000 amperes or less

1.2 REFERENCES

National Electrical Manufacturers Association

1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

AB 4 *Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications*

PB *Application Guide for Ground Fault Protective Devices for Equipment*

Guidelines for Handling Water Damaged Electrical Equipment

National Fire Protection Association

Batterymarch Park
Quincy, MA 02269

NFPA 70 *National Electrical Code®*

NFPA 70E *Standard for Electrical Safety in the Workplace*

1.3 GENERAL

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON SWITCHBOARDS AND EQUIPMENT TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED, AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times. All requirements of the *National Electrical Code®* NFPA 70 should be followed.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

1.3.1 Successful Operation

The successful operation of switchboards is dependent upon proper handling, installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to severe personal injury, death, or damage to electrical equipment or other property.

1.3.2 Qualified Personnel

Installation, operation, and maintenance of switchboards should be conducted only by qualified personnel.

1.3.3 Definition of Qualified Personnel

For purposes of these guidelines, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, the person is:

1.3.3.1 Knowledgeable of Requirements

Knowledgeable of the requirements of the *National Electrical Code*® and of all other applicable codes, laws, and standards.

1.3.3.2 Trained and Authorized to Test, Energize, Clear, Ground, Tag, and Lockout

Trained and authorized to test, energize, clear, ground, tag, and lockout circuits and equipment in accordance with established safety practices.

1.3.3.3 Trained in Proper Care and Use of Protective Equipment

Trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, and flash resistant clothing in accordance with established safety practices.

1.3.3.4 Trained in Rendering First Aid

Trained in rendering first aid.

Section 2 HANDLING

NOTE—These guidelines are provided to help avoid personal injury and equipment damage during handling and to facilitate moving the switchboard at the job site.

2.1 MANUFACTURER'S HANDLING INSTRUCTIONS

Follow the manufacturer's handling instructions for the specific equipment, if available.

2.2 CARE TO AVOID DAMAGE

Handle the switchboard with care to avoid damage to components, the frame or finish.

2.3 UPRIGHT POSITION

Keep the switchboard in an upright position unless otherwise indicated by the manufacturer.

2.4 EQUIPMENT CAPACITY

Verify that handling equipment capacity is sufficient for the switchboard weight.

2.5 CONCEALED DAMAGE

When the switchboard is received, unpack it sufficiently to inspect it for concealed damage and to determine that the shipment is complete and correct.

2.6 STORAGE PRIOR TO INSTALLATION

If the switchboard is to be stored prior to installation, replace the packing for protection during that period. When conditions permit, leave the packing intact until the switchboard or sections are at their final installation location. If the packing is removed, cover the top and any openings to protect the equipment against dust and debris during the construction period. (See section 3).

2.7 SHIPPING SKID

The switchboard should remain secured to the shipping skid to prevent distortion of the bottom of the frame during moving.

2.8 ROD OR PIPE ROLLERS

Rod or pipe rollers, with the aid of pinch bars, provide a simple method of moving the switchboard on one floor level if there is little or no incline. Steady the load to prevent tipping.

2.9 FORKLIFT TRUCK

A forklift truck may offer a more convenient method of handling the switchboard and has the added advantage of permitting it to be hoisted between levels. Balance the load carefully and use a safety strap when handling or moving switchboards with a forklift.

2.10 OVERHEAD HOISTING

When it is necessary to move the switchboard between elevations without a suitable platform elevator, overhead hoisting may be required. Lifting plates and eye bolts (Figure 2-1), or channels, angles, or bars with lift holes (Figure 2-2) may be provided as a permanent or removable part of the switchboard. If they are not, cable, chain, or band slings (Figure 2-3) may be rigged around the switchboard.

2.10.1 Rigid Spreaders or Spanner Bars

Use rigid spreaders (Figure 2-1) or spanner bars (Figure 2-3) to provide the vertical lift on eye bolts and lifting slings to avoid crushing or otherwise damaging the frame or its finish. Lifting bars on long lineups may require additional spreaders to reduce the horizontal compressive force.

2.10.2 Rigging Lengths

Select or adjust the rigging lengths to compensate for any unequal weight distribution of load and to maintain the switchboard in an upright position.

2.10.3 Angle between Lifting Cables and Vertical

Do not allow the angle between the lifting cables and vertical to exceed 45 degrees in order to reduce the tension on the rigging and the compressive load on the lifting or spanner bars and spreaders.

2.10.4 Slings with Safety Hooks or Shackles

Do not pass ropes or cables through the lift holes in bars, angles, or channels. Use slings with safety hooks or shackles.

2.10.5 Removal of Switchboard Top Covers

The switchboard may contain a heavy transformer with overhead lifting means. Consult the manufacturer regarding the removal of the switchboard top covers and the utilization of such internal lifting means.

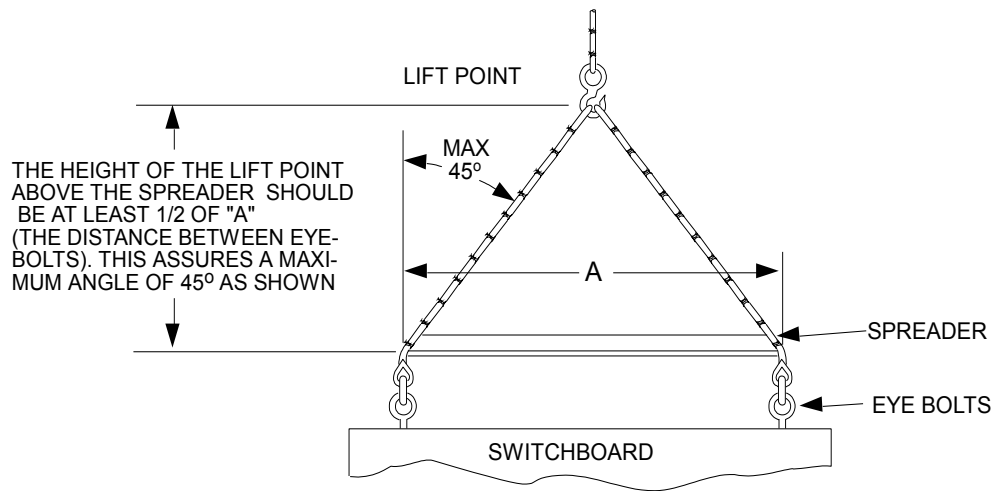


Figure 2-1
LIFTING WITH EYE BOLTS

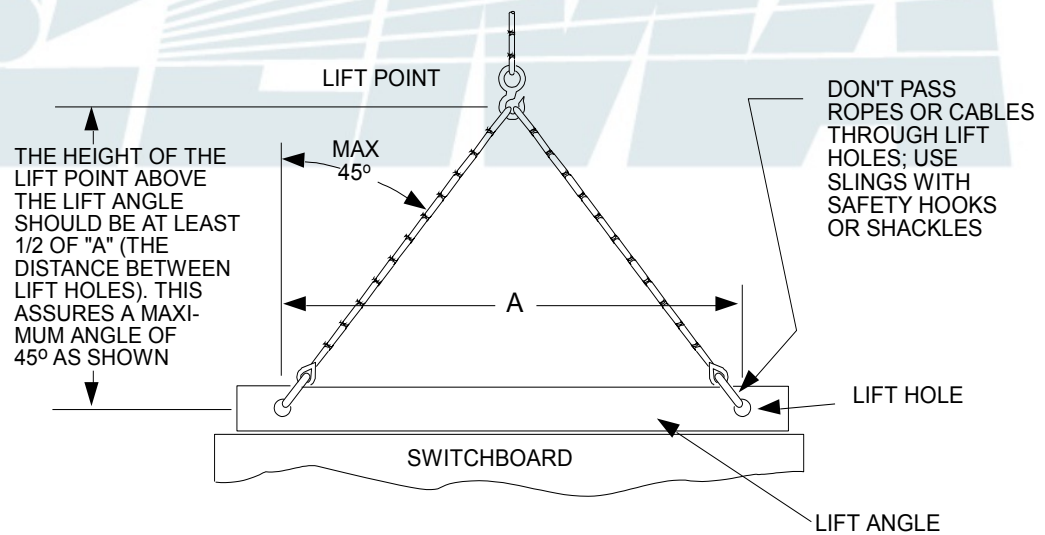


Figure 2-2
LIFTING WITH INTEGRAL LIFT ANGLE

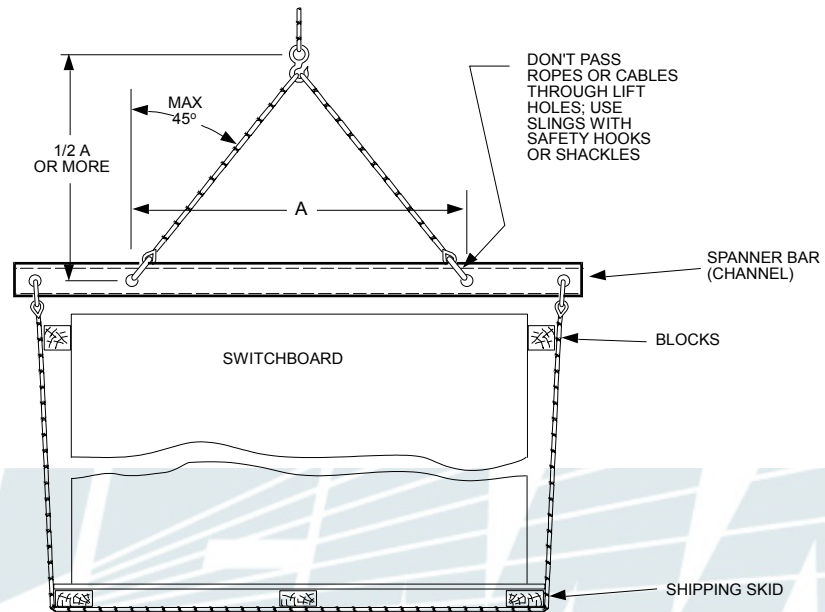


Figure 2-3
LIFTING WITH SLING RIGGING

Section 3 STORAGE

3.1 CLEAN, DRY SPACE HAVING UNIFORM TEMPERATURE

A switchboard that is not installed and energized immediately should be stored in a clean, dry space having a uniform temperature to prevent condensation. Preferably, it should be stored in a heated building having adequate air circulation and protected from dirt, fumes, water, and physical damage.

3.2 PROTECTION FROM WEATHER AND DIRT

It is recommended that switchboards should not be stored outdoors. However, if it must be stored outdoors, cover it securely to provide protection from weather and dirt. Temporary electrical heating should be installed to prevent condensation; approximately 250 watts per section is adequate for the average switchboard size and environment. All loose packing or flammable materials inside the switchboard should be removed before energizing space heaters.

3.3 OUTDOOR SWITCHBOARDS ARE NOT WEATHER RESISTANT UNTIL INSTALLED

Outdoor switchboards are not weather resistant until completely and properly installed and should be treated exactly the same as indoor switchboards until after they are installed.

3.4 UN-ENERGIZED OUTDOOR SWITCHBOARD SHOULD BE KEPT DRY INTERNALLY

An un-energized outdoor switchboard should be kept dry internally by installing temporary heating (see 3.2) or by energizing any self-contained space heaters.

Section 4

INSTALLATION OF SWITCHBOARD OR ENCLOSURE

4.1 MANUFACTURER'S INSTALLATION INSTRUCTIONS

Install the switchboard in a neat and workmanlike manner following the manufacturer's installation instructions, if available.

4.2 LOCATION

Locate the switchboard in the area indicated on the building plans. The switchboard enclosure should be suitable for the environment or protected by other means. Additional precautions may be necessary, during installation, to prevent moisture, water, or other contaminants from entering and accumulating within the enclosures. Clearances or working spaces are as follows:

4.2.1 Clearance from Walls

Clearance from walls (not rear accessible)—minimum of 1/2 inch.

4.2.2 Working Clearances

Working clearances vary substantially depending on voltage and specific applications. See Section 110.26 of the *National Electrical Code*®.

NOTE—Spaces for working clearances and clearances from walls should not be used for storage. Working spaces should have adequate lighting.

4.3 CHANNEL SILLS

When channel sills are used, they should be embedded in the concrete floor or grouted on the surface. In either case, they should be installed in an aligned position and be level over the entire length prior to installing the switchboard.

4.4 CONDUIT AND OTHER RACEWAYS

Position the switchboard so that the raceway stubs or floor openings are located in the area specified on the manufacturer's drawing. In the absence of drawings, locate the switchboard over the raceways or floor openings so as to provide cable bending space and clearances to energized parts or other obstructions. See Section 408.5 of the *National Electrical Code*®.

4.5 LEVELING AND SECURING

Install the switchboard in its final position, progressively leveling each section and bolting the frames together if they are separated. If necessary, secure the switchboard to walls or other supporting surfaces. Security should not depend on wooden plugs driven into holes in masonry, concrete, plaster, or similar materials.

4.6 SPLICE BUS

Connect all through and ground bus at shipping breaks, using the splice bus and hardware supplied with the switchboard. Tighten bolted connections in accordance with the manufacturer's torque specifications. If not furnished, consult the manufacturer.

4.7 GROUNDING AND BONDING

Ground and bond the switchboard as follows:

4.7.1 Grounded Systems

Switchboard used as service equipment for a grounded system or as a main switchboard for a separately derived system.

4.7.1.1 Grounding Electrode System in Switchboard

If the connection for the grounding electrode system is to be in the switchboard, install a grounding electrode conductor sized in accordance with Sections 250.66 or 250.166 of the *National Electrical Code®* from the grounding electrode to the switchboard ground bus or ground terminal designated by the manufacturer. See Sections 250.62 and 250.64 of the *National Electrical Code®*.

4.7.1.2 Switchboards Used as Service Equipment on Grounded Systems

Switchboards used as service equipment on systems that are grounded at any point are required to have a grounded conductor brought to the switchboard in accordance with Section 250.24(C) of the *National Electrical Code®*. This conductor is required even if the switchboard is supplying loads that are only phase-to-phase connected.

4.7.1.3 Installation of Main Bonding Jumper

Unless already done at the factory, install the main bonding jumper from the incoming grounded conductor bus (neutral) to the ground bus or other location designated by the manufacturer.

4.7.1.4 Steps 4.7.1.1 Through 4.7.1.3

Steps 4.7.1.1 through 4.7.1.3 must effectively connect together the grounding electrode, the switchboard frame, all outgoing equipment grounding conductors, and the grounded conductor bus (neutral) of the system on the supply side of any neutral disconnecting link.

4.7.1.5 Neutral Disconnecting Link

Do not connect any grounding conductors to the load side of any neutral disconnecting link or any sensor used for ground fault protection. Do not connect equipment grounding conductors directly to the grounded conductor bus (neutral).

4.7.1.6 Dual Fed Switchboard or System

Where the switchboard or system is dual fed (double-ended) and has ground fault protection, special precautions are necessary to accomplish proper grounding and bonding. Follow the manufacturer's instructions.

4.7.2 Ungrounded Systems—Service Equipment or Separately Derived System Main

4.7.2.1 Conductor Sized in Accordance with *National Electrical Code®*

Install a grounding electrode conductor sized in accordance with Sections 250.66 or 250.166 of the *National Electrical Code®* from the grounding electrode to the switchboard ground bus or ground terminal designated by the manufacturer. See Sections 250.62 and 250.64 of the *National Electrical Code®*. This should effectively connect together the grounding electrode, the switchboard frame, and all outgoing equipment grounding conductors.

4.7.3 Grounded or Ungrounded Systems

Applications other than service equipment or other than main for separately derived systems.

4.7.3.1 Grounding Conductor Size in Accordance with *National Electrical Code*®

Ground the switchboard frame and any ground bus by means of an equipment grounding conductor having a size in accordance with Section 250.122 of the *National Electrical Code*® and run with the main supply conductors or by bonding to the raceway enclosing the main supply conductors in accordance with Sections 250.118 and 250.120 of the *National Electrical Code*®.

4.8 UNUSED OPENINGS

Effectively close all unused openings in the switchboard enclosure.

4.9 DAMP INDOOR LOCATIONS

In damp indoor locations, shield the switchboard so as to prevent moisture and water from entering and accumulating therein.

4.10 UNUSUAL SERVICE CONDITIONS

Unless the switchboard has been designed for unusual service conditions, it should not be located where it will be exposed to ambient temperatures above 40°C (104°F), high humidity, corrosive or explosive fumes, dust, vapors, dripping or standing water, abnormal vibration, mechanical shock, tilting, or other unusual operating conditions.



Section 5

INSTALLATION OF CONDUIT AND CONDUCTORS

5.1 PREVENT MOISTURE OR WATER FROM ENTERING

Conduits and other raceways should be installed to prevent moisture or water from entering and accumulating within the enclosure. All metallic raceways (including stubs) should be bonded to the switchboard. All raceways should be located in the areas recommended by the manufacturer to avoid conductor interference with structural members and live parts. Before pulling any conductors into the switchboard, verify that their size, temperature rating, and conductor insulation comply with the switchboard markings. See Section 110.14(C) of the *National Electrical Code*®.

5.2 TEMPERATURE RATINGS

Care should be exercised to ensure that the types and temperature ratings of conductors being installed in the switchboard are suitable for use with the terminals which have been provided.

5.3 COMPRESSION (CRIMP) TERMINALS

If compression (crimp) terminals are used, crimp with the tool(s) recommended by the manufacturer.

5.4 STRIPPING INSULATION FROM CONDUCTORS

Care should be exercised in stripping insulation from the conductors so as not to nick or ring the conductor. For aluminum, clean all oxide from the stripped portion and apply an oxide inhibiting compound. All mechanical terminals should be tightened per the manufacturer's torque specifications. If not furnished, consult the manufacturer.

5.5 PROPER WIRING METHODS

Refer to Article 300 of the *National Electrical Code*® for proper wiring methods. Conductors should enter the switchboard in the section in which they are to be terminated, except as noted in Section 408.3(A)(3) of the *National Electrical Code*®.

5.6 CONDUCTOR LOCATION IN SWITCHBOARD

Provision should be made to locate conductors in the switchboard so that they will be free from physical damage and to avoid overheating. If required by the manufacturer's instructions, secure the conductors as necessary in order to withstand short-circuit forces. The largest practical bending radii should be maintained to avoid damaging the insulation and causing terminals to loosen. Exercise care so that the conductors will not interfere with any moving parts.

5.7 CONDUCTORS 1/0 AWG IN SIZE AND LARGER

Conductors 1/0 AWG in size and larger may be run in parallel. All parallel conductors should be of the same size, length, and material to assure the equal division of current, as required by Section 310.10(H) of the *National Electrical Code*®. If conductors pass through metal having magnetic properties, all of the circuit conductors, including the neutral, should be run through the same opening, as specified by Section 300.20(A) of the *National Electrical Code*®.

5.8 INCOMING AND OUTGOING CONTROL CONNECTIONS

All incoming and outgoing control connections should be made in accordance with the switchboard manufacturer's schematic and wiring diagrams.

5.9 PREVENT CONDUCTOR INSULATION FROM CRACKING OR SPLITTING

Installation of conductors should be done at temperatures above freezing to prevent conductor insulation from cracking or splitting, unless the conductor insulation is suitable for installation at temperatures below freezing.

5.10 NATIONAL ELECTRICAL CODE®, SECTION 725.136

Refer to the *National Electrical Code®*, Section 725.136 for the separation requirements for conductors of Class 2 and Class 3 remote control, signaling and power-limited circuits.



Section 6

INSTALLATION OF SWITCHBOARD INTERIOR

6.1 INSTRUCTIONS IF SWITCHBOARD INTERIOR WAS NOT FACTORY-MOUNTED

Follow these instructions if the switchboard interior(s) was not mounted at the factory.

6.2 UNPACKING

Exercise care in unpacking the switchboard interior to prevent damage.

6.3 INSPECTION

Check for shipping damage and check to make sure the interior is the correct one for the installation.

6.4 STORAGE

Store the switchboard interior in a clean dry place where it will not be subject to physical damage.

6.5 CLEANING

Clean the switchboard enclosure of all foreign material prior to the installation of the interior. If parts at connection points are splattered with cement, plaster, paint, or other foreign material, remove the foreign material with great care to avoid damage to the plating.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

6.6 MANUFACTURER'S INSTRUCTIONS

Carefully follow the switchboard manufacturer's instructions.

6.7 INTERIOR INSTALLATION

Install the interior and tighten it securely in the enclosure. Install the section bus connection to the through bus, if needed.

Section 7

STEPS TO BE TAKEN BEFORE ENERGIZING

7.1 ACCESSIBLE ELECTRICAL CONNECTIONS

Tighten all accessible electrical connections to the manufacturer's torque specifications. If such information is not provided with the equipment, consult the manufacturer.

7.2 BLOCKS OR OTHER TEMPORARY HOLDING MEANS

Remove all blocks or other temporary holding means used for shipment from all component devices and the switchboard interior.

7.3 INTEGRITY OF ALL BUS MOUNTING MEANS

Check the integrity of all bus mounting means.

7.4 ENCLOSURE

Check the enclosure to see that it has not been damaged in such a manner as to reduce electrical spacings.

7.5 OPERATING MECHANISMS

Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain that they operate freely.

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator

7.6 ELECTRICAL INSULATION RESISTANCE TEST

Conduct an electrical insulation resistance test to ensure that the switchboard is free from short circuit or ground fault conditions. With the neutral isolated from ground and the switches and circuit breakers open, conduct electrical insulation resistance tests from phase to phase, phase to ground, phase to neutral, and neutral to ground. If the resistance reads less than 1 megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated. If after the investigation and possible corrections, low readings are still observed, the manufacturer should be contacted. Some electronic equipment (metering, SPD, etc.) may be damaged by this testing. Refer to the manufacturer's equipment markings for guidelines.

7.7 ELECTRICAL RELAYS, METERS, AND INSTRUMENTATION

Check electrical relays, meters, and instrumentation to determine that connections are made properly and that the devices function properly.

7.8 ELECTRICALLY OPERATED SWITCHES, CIRCUIT BREAKERS, AND OTHER MECHANISMS

With loads disconnected, electrically exercise all electrically operated switches, circuit breakers, and other mechanisms to determine that the devices operate properly. An auxiliary source of control power may be necessary to provide power to the electrical operators.

7.9 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA PB 2.2.

7.10 ADJUSTABLE TIME CURRENT TRIP DEVICE SETTINGS

Set any adjustable time current trip device settings to the proper values.

NOTE—Experience has indicated that damage from overcurrent can be reduced if the devices used for overload and short-circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7.11 FIELD WIRING

Make certain that field wiring is clear of live parts and, when specified by the manufacturer, physically secured to withstand the effects of short circuits.

7.12 GROUNDING CONNECTIONS

Check to determine that all grounding connections are properly made. If the switchboard is used as service equipment, make certain that the neutral, if present, is properly bonded to the cabinet. If there is no ground bus, make certain that the sections of the switchboard which are shipped separately are connected in such a way as to ensure a continuous grounding path.

7.13 FOREIGN MATERIAL

Remove all foreign material from the inside of the switchboard before closing the enclosure.

7.14 COVERS AND DOORS

Install covers, close doors, and make certain that no conductors are pinched and that all enclosure parts are properly aligned and tightened. Hinged covers or doors must open a minimum of 90 degrees when installed.

Section 8 ENERGIZING EQUIPMENT

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ENERGIZING A SWITCHBOARD FOR THE FIRST TIME AFTER INITIAL INSTALLATION OR MAINTENANCE IS POTENTIALLY DANGEROUS.

8.1 QUALIFIED PERSONNEL PRESENT

Only qualified personnel should energize equipment for the first time. If short circuit conditions caused by damage or poor installation practices have not been detected in the checkout procedure specified in Section 7, serious personal injury and damage can occur when the power is turned on.

8.2 NO LOAD ON SWITCHBOARD

There should be no load on the switchboard while it is being energized. Turn off all the downstream loads.

8.3 ENERGIZED IN SEQUENCE

The equipment should be energized in sequence by starting at the source end of the system and working towards the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices. Turn the devices on with a firm positive motion.

8.4 AFTER ALL MAIN, FEEDER, AND BRANCH CIRCUIT DEVICES HAVE BEEN CLOSED

After all main, feeder, and branch circuit devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned on.

Section 9 MAINTENANCE

9.1 MAINTENANCE PROGRAM FOR SWITCHBOARDS

A maintenance program for switchboards should be conducted on a regularly scheduled basis in accordance with the following:

9.2 FIELD TEST

A switchboard which has been carrying its regular load for at least 3 hours just prior to inspection should be field tested by feeling the deadfront surfaces of circuit breakers, switches, interior trims, doors, and enclosure sides with the palm of the hand. If the temperature of these surfaces does not permit you to maintain contact for at least 3 seconds, this may be an indication of trouble and investigation is necessary. Thermographic (infrared) scanning has become a useful method of investigating thermal performance.

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON SWITCHBOARDS TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

9.3 SWITCHBOARD INSPECTION ONCE EACH YEAR

Inspect the switchboard once each year or after any severe short circuit.

9.4 ACCUMULATION OF DUST AND DIRT

If there is an accumulation of dust and dirt, clean out the switchboard by using a brush, vacuum cleaner, or clean lint-free rags. Avoid blowing dust into circuit breakers or other components. Do not use a blower or compressed air.

9.4.1 All Visible Electrical Joints and Terminals

Carefully inspect all visible electrical joints and terminals in the bus and wiring system.

9.4.2 All Conductors and Connections

Visually check all conductors and connections to be certain that they are clean and secure. Loose and/or contaminated connections increase electrical resistance which can cause overheating. Such overheating is indicated by discoloration or flaking of insulation and/or metal parts. Pitting or melting of connecting surfaces is a sign of arcing due to a loose, or otherwise poor connection. Parts which show evidence of overheating or looseness should be cleaned and re-torqued or replaced if damaged. Tighten bolts and nuts at bus joints to manufacturer's torque specifications.

CAUTION—DO NOT REMOVE PLATING FROM ALUMINUM PARTS IN JOINTS OR TERMINATIONS. DAMAGE TO PLATING CAN RESULT IN OVERHEATING. REPLACE DAMAGED ALUMINUM PARTS.

9.4.3 Fuse Clip Contact Pressure and Contact Means

Examine fuse clip contact pressure and contact means. If there is any sign of overheating or looseness follow the manufacturer's maintenance instructions or replace the fuse clips. Loose fuse clips can result in overheating.

9.4.4 All Conditions Which Caused Overheating

Be sure that all conditions which caused the overheating have been corrected.

9.5 PROPER AMPERE, VOLTAGE, AND INTERRUPTING RATINGS

Check circuit breakers, switches, and fuses to ensure they have the proper ampere, voltage, and interrupting ratings. Ensure that non-current-limiting devices are not used as replacements for current-limiting devices. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the incorrect class of fuse.

9.5.1 All Mechanisms Are Free and in Proper Working Order

Operate each switch or circuit breaker several times to ensure that all mechanisms are free and in proper working order. Replace as required. See NEMA AB 4 for maintenance of molded case circuit breakers.

9.6 OPERATION OF ALL MECHANICAL COMPONENTS

Check the operation of all mechanical components. Replace as required.

9.6.1 Full On and Off Positions

Exercise switch operating mechanisms and external operators for circuit breakers to determine that they operate freely to their full on and off positions.

9.6.2 Integrity of Electrical and Mechanical Interlocks

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

9.6.3 Missing or Broken Parts

Whenever practical, check all devices for missing or broken parts, proper spring tension, free movement, corrosion, dirt, and excessive wear.

9.6.4 Manufacturer's Instructions

Adjust, clean, and lubricate or replace parts according to the manufacturer's instructions.

9.6.4.1 Clean, Nonmetallic, Light, Grease or Oil

Use clean, nonmetallic, light grease or oil as instructed.

9.6.4.2 Molded Case Circuit Breakers

Do not oil or grease parts of molded case circuit breakers.

9.6.4.3 Lubrication with Clean, Light Grease

If no instructions are given on the devices, sliding copper contacts, operating mechanisms, and interlocks, they may be lubricated with clean, light grease.

9.6.4.4 Excess Lubrication

Wipe off excess lubrication to avoid contamination.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

9.6.5 Readily Accessible Copper Electrical Contacts, Blades, and Jaws

Clean and dress readily accessible copper electrical contacts, blades, and jaws according to the manufacturer's instructions when inspection indicates the need.

9.7 DETERIORATED INSULATING MATERIAL AND ASSEMBLIES

Look for and replace deteriorated insulating material and assemblies where sealing compounds have melted.

9.8 MOISTURE OR SIGNS OF PREVIOUS WETNESS

Look for any moisture or signs of previous wetness or dripping inside the switchboard.

NOTE—Condensation in conduits or dripping from outside sources is one known cause of switchboard malfunction.

9.8.1 Conduits Which Have Dripped Condensate

Seal off any conduits which have dripped condensate, and provide means for further condensate to drain away from the switchboard.

9.8.2 Cracks or Openings

Seal off any cracks or openings which have allowed moisture to enter the enclosure. Eliminate the source of any dripping on the enclosure and any other source of moisture.

9.8.3 Insulating Material Which is Damp

Replace or thoroughly dry and clean any insulating material which is damp or wet or shows an accumulation of deposited material from previous wettings.

9.8.4 Moisture Damaged Component Device

Inspect all component devices. Replace any component device which shows evidence of moisture damage or has been subjected to water damage or flooding. Additional information may be found in the NEMA document "Guidelines for Handling Water Damaged Electrical Equipment".

9.9 WATER DAMAGE

In the event of water damage, e.g., flooding or sprinkler discharge, the manufacturer should be consulted before clean up and corrective action is attempted.

9.10 SEVERE ELECTRICAL SHORT CIRCUIT

If a severe electrical short circuit has occurred, the excessive currents may have resulted in structural component and/or bus and conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. Examine all devices and bus supports for cracks or breakage. The manufacturer should be consulted before clean up and correction is attempted.

9.11 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA Standards Publication PB 2.2.

9.12 INSULATION RESISTANCE

Check insulation resistance (See 7.6) under any of the following conditions:

- a. If a severe short circuit has occurred. (See 9.10)
- b. If it has been necessary to replace parts or clean insulating surfaces
- c. If the switchboard has been exposed to high humidity, condensation, or dripping moisture.



Section 10

PERMISSIBLE LOADING OF SWITCHBOARDS

10.1 SWITCHBOARDS WITHOUT MAIN OVERCURRENT PROTECTIVE DEVICES

For switchboards without main overcurrent protective devices (main lug switchboard), the total continuous load current through the supply bus should not exceed the current rating of the switchboard.

10.2 SWITCHBOARDS WITH A SINGLE MAIN OVERCURRENT PROTECTIVE DEVICE

For switchboards with a single main overcurrent protective device, the total continuous load current on the protective device should not exceed 80 percent of its ampere rating unless the device is rated to carry 100 percent of its ampere rating.

10.3 SWITCHBOARDS WITH A MULTIPLE MAIN OVERCURRENT PROTECTIVE DEVICE

For switchboards with a multiple main overcurrent protective devices, the total continuous current through the supply bus should not exceed the current rating of the switchboard. The total continuous load current on each main overcurrent protective device should not exceed 80 percent of its ampere rating unless the device is rated to carry 100 percent of its ampere rating.

10.4 FEEDER AND BRANCH CIRCUIT OVERCURRENT PROTECTIVE DEVICES IN SWITCHBOARDS

For feeder and branch circuit overcurrent protective devices in switchboards, the total continuous load current on the overcurrent protective device should not exceed 80 percent of its ampere rating unless the device is rated to carry 100 percent of its ampere rating.

10.5 HARMONICS IN THE ELECTRICAL SYSTEM

Some types of electrical equipment cause harmonics in the electrical system which may result in overheating. This condition should be considered when determining switchboard loading.

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Surgelogic™ Internal Modular Assembly (IMA) Surge Protective Device (SPD)

Dispositif de protection contre les surtensions transitoires (SPD) de type assemblage modulaire interne (IMA)

Instruction Bulletin

8222-0050, Rev. 01 06/2016

Retain for future use.

ENGLISH



by Schneider Electric

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Precautions

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Perform periodic inspection of the Surge Protective Device status indicator lights as part of the preventative maintenance schedule.
- Promptly service the Surge Protective Device when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple Surge Protective Devices to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

At end-of-life conditions, Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that disconnect the surge suppression elements from the electrical supply should the surge suppression elements reach end of life. Tripping of the branch circuit breaker or fuse feeding the SPD can occur when the surge suppression elements reach end of life.

⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the Surge Protective Devices until the electrical system is completely installed, inspected, tested, and all conductors have been connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the Surge Protective Device.
- Perform high-potential insulation testing, or any other tests where Surge Protective Device components will be subjected to voltages higher than their rated turn-on voltage, with the neutral and Surge Protective Device disconnected from the power source.

Failure to follow these instructions can result in injury or equipment damage.

Introduction

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Note: For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

Proper installation is imperative to maximize the IMA SPD's effectiveness and performance. Follow the steps outlined in this instruction bulletin to ensure proper installation. Read the entire instruction bulletin before beginning the installation. These instructions are not intended to replace national or local electrical codes. Check all applicable electrical codes to verify compliance. Installation of IMA surge suppressors should only be performed by qualified electrical personnel.

Unpacking and Preliminary Inspection

Inspect the entire shipping container for damage or signs of mishandling before unpacking the device. Remove the packing material and further inspect the device for any obvious shipping damage. If any damage is found and is a result of shipping or handling, immediately file a claim with the shipping company.

Storage

The device should be stored in a clean, dry environment. Storage temperature is -40 °F to +149 °F (-40°C to +65°C). All of the packaging materials should be left intact until the device is ready for installation.

Safety Labels

English, Spanish, and French versions of all safety labels (Danger, Warning, and Caution) are provided.

Location Considerations

Environment

The device is designed to operate in an ambient temperature range of -4 °F to +149 °F (-20°C to +65°C) with a relative humidity of 0 to 95% non-condensing. The operating temperature of the LCD on the diagnostic display panel is +14 °F to +140 °F (-10°C to +60°C). Refer to the product catalog for further details on enclosures. All IMA devices operate normally without reduction in performance when subjected to shock and vibrations described in IEC 60721-3-3, Class 3M4.

Audible Noise

The device background noise is negligible and does not restrict the location of the installation.

Mounting

Refer to page 13 for typical mounting dimensions.

Service Clearance

The service clearance should meet all applicable code requirements.

Equipment Performance

To obtain the maximum system performance, locate the device as close to the circuit being addressed as possible, to minimize the interconnecting wiring length. For every foot of wire length, approximately 160 Volts (6 kV / 3 kA, 8/20 microsecond) is added to the suppressed voltage. The Voltage Protection Rating (VPR) is located on the device nameplate and is measured six inches from the enclosure sidewall, according to UL® 1449.

Electrical

Voltage Rating

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the module or nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Prior to mounting the SPD, verify that the device has the same voltage rating as the power distribution system in which it is installed. Compare the nameplate voltage on the SPD with the nameplate voltage of the electrical distribution equipment.

The specifier or user of the device must be familiar with the configuration and arrangement of the power distribution system in which any SPD is to be installed. The system configuration of any power distribution system is based strictly on how the secondary windings of the transformer supplying the service entrance main or load are configured. This includes whether or not the transformer windings are referenced to earth via a grounding conductor. The system configuration is not based on how any specific load or equipment is connected to a particular power distribution system. See Table 1 for the service voltage of each SPD.

Table 1: Voltage Rating

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Numbers ¹
120/240 V, 1-phase, 3-wire + ground	120	TVS1IMA12_
	160	TVS1IMA16_
	240	TVS1IMA24_
	320	TVS1IMA32_
	480	TVS1IMA48_
208Y/120 V, 3-phase, 4-wire +ground Wye ²	120	TVS2IMA12_
	160	TVS2IMA16_
	240	TVS2IMA24_
	320	TVS2IMA32_
	480	TVS2IMA48_
240/120 V, 3-phase, 4-wire + ground High-Leg Delta	120	TVS3IMA12_
	160	TVS3IMA16_
	240	TVS3IMA24_
	320	TVS3IMA32_
	480	TVS3IMA48_
480Y/277 V, 3-phase, 4-wire + ground Wye ³	120	TVS4IMA12_
	160	TVS4IMA16_
	240	TVS4IMA24_
	320	TVS4IMA32_
	480	TVS4IMA48_
480 V, 3-phase, 3-wire + ground Delta ⁴	100	TVS5IMA10_
	120	TVS5IMA12_
	160	TVS5IMA16_
	200	TVS5IMA20_
	240	TVS5IMA24_
	320	TVS5IMA32_
	480	TVS5IMA48_
240 V, 3-phase, 3-wire + ground Delta	100	TVS6IMA10_
	120	TVS6IMA12_
	160	TVS6IMA16_
	200	TVS6IMA20_
	240	TVS6IMA24_
	320	TVS6IMA32_
	480	TVS6IMA48_
600/347 V, 3-phase, 4-wire + ground Wye	120	TVS8IMA12_
	160	TVS8IMA16_
	240	TVS8IMA24_
	320	TVS8IMA32_
	480	TVS8IMA48_

Continued—

Table 1: Voltage Rating

600 V, 3-phase, 3-wire + ground Delta ⁵	100	TVS9IMA10_
	120	TVS9IMA12_
	160	TVS9IMA16_
	180	TVS9IMA18_
	200	TVS9IMA20_
	240	TVS9IMA24_
	320	TVS9IMA32_

¹ Catalog numbers are representational. Actual catalog numbers require a suffix to indicate UL Type.

² 208Y/120 series also applies to the following voltage 220Y/127.

³ 480Y/277 series applies to the following voltages 380Y/220, 400Y/230 and 415Y/240.

⁴ 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

⁵ 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

Terminals, Wire Size, and Installation Torque

Terminals are provided for phase (line), neutral, and equipment ground connections. The IMA terminals accept a range of 12 AWG to 2 AWG copper wire for phase, neutral, and ground connectors.

Table 2: Terminal Torque

Power Connection	Torque
AØ, BØ, CØ and N	35 lb-in. (4 N•m)
Ground	

Branch Circuit Overcurrent Protection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use conductors rated for the Overcurrent Protection Device (OCPD) per applicable codes.
- Use conductors rated for the application per applicable codes.

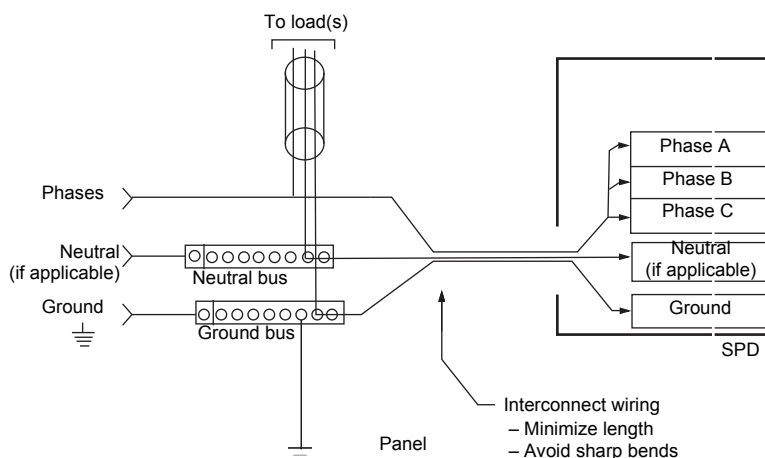
Failure to follow these instructions will result in death or serious injury.

UL 1449 Type 1 SPDs have been designed and approved for line side applications prior to the main service disconnect without supplemental overcurrent protection. Type 2 SPDs must be installed on the load side of the main Overcurrent Protection Device (OCPD). All installations should either provide or include a disconnecting means.

Location of Surge Protective Device (SPD)

Locate the SPD as close as possible to the circuit being addressed to minimize the wire length and optimize SPD performance. Avoid long wire runs so that the device will perform as intended. To reduce the impedance that the wire displays to surge currents, the phase, neutral, and ground conductors must be routed within the same conduit and tightly bundled or twisted together to optimize device performance. Avoid sharp bends in the conductors. See Figure 1.

Figure 1: Surge Protective Device Wiring Practice



Grounding

⚠ WARNING

HAZARDOUS TOUCH VOLTAGE

- Connect the Surge Protective Device ground terminal to the building grounding grid structure.
- Use an appropriately sized equipment grounding conductor.
- When using metallic raceway or conduit:
 - Do not use isolation bushings to interrupt the metallic raceway or conduit.
 - Maintain electrical continuity at all raceway and conduit connections using appropriate bonding devices.
- Do not use a separate isolated ground for the Internal Modular Assembly device.
- Verify proper equipment connection to the grounding system.
- Verify ground grid continuity by performing regularly scheduled inspections and testing as part of a comprehensive electrical maintenance program.

Failure to follow these instructions can result in death or serious injury.

General

The IMA has SPD elements connected from phase to ground. It is critical that there be a robust and effective connection to the building grounding structure. The grounding connection must utilize an equipment grounding conductor run with the phase and neutral connection of the power system. Do not connect the SPD to a separate isolated ground.

For best overvoltage suppression by the IMA SPD, use a single-point ground system where the service entrance grounding electrode system is connected to, and bonded to, all other available electrodes, building steel, metal water pipes, driven rods, etc. (for reference, see NEC Art 250). The ground impedance measurement of the electrical system should be as low as possible and in compliance with all applicable codes.

Power System Grounding

In addition to the power system configuration and voltage, the power system grounding method must be considered when selecting the appropriate IMA device. Refer to the following chart for information concerning the suitability of IMA device to specific power system grounding method.

Table 3: Grounding Methods

IMA Device Catalog Number	Power System Grounding Method
TVS1IMA__	Solidly-Grounded
TVS2IMA__	
TVS3IMA__	
TVS4IMA__	
TVS8IMA__	
TVS5IMA__	Ungrounded / HRG
TVS6IMA__	
TVS9IMA__	

Solidly-Grounded Power Systems

⚠ CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Do not connect devices rated for use on solidly-grounded power systems to resistance-grounded (for example, High Resistance Ground) or ungrounded power systems.
- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral terminal of the power system transformer feeding the device is bonded to system ground in accordance with all applicable codes.

Failure to follow these instructions can result in equipment damage.

SPDs rated for use on solidly-grounded power systems must not be connected to resistance-grounded or ungrounded power systems. Such a connection can result in damage to the SPD.

Always verify the power system grounding configuration prior to application of power to the device. Confirm that all ground bonds are installed at both the service entrance equipment and power system transformer prior to application of power.

Delta and Resistance-Grounded Power Systems

⚠ CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Ungrounded power systems are inherently unstable and can produce excessively high line-to-ground voltages during certain fault conditions. During these fault conditions any electrical equipment, including an SPD, may be subjected to voltages which exceed their designed ratings. This information is being provided to the user so that an informed decision can be made before installing any electrical equipment on an ungrounded power system.
- Resistance-grounded power systems must be maintained in an over-damped state to limit voltage overshoot and duration during operation.
- Verification and adjustment of correct power system damping should be done:
 - Periodically as part of normal system maintenance.
 - Following power system modifications.

Failure to follow these instructions can result in equipment damage.

The IMA product is intended for use on resistance-grounded power systems where the power system has been set for, and is maintained in, an over-damped state. For the power system to be over-damped, the current through the grounding resistor during a bolted phase-to-ground fault must be significantly greater than the total charging current of the system.

Periodic engineering evaluation of the power system is required to determine the worst-case charging current of the system and to adjust the grounding resistance accordingly. As the power system is modified, the value of the grounding resistor must be evaluated and adjusted to maintain the system in the over-damped state.

Installation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

UL Conditions of Acceptability

For use only in equipment where the acceptability of the combination is determined by Underwriters Laboratories®. When installed in the end-use equipment, the following are among the considerations to be made:

1. A suitable electrical enclosure shall be provided in the end-use product.
2. The device is intended for factory wiring only with the suitability of the connections (including spacings between factory connectors) determined in the end-use application.
3. Voltage Protection Rating (VPR) shall be determined in the end-product where applicable.
4. The SPD unit has been subjected to the following tests of UL1449:
 - a. Surge Testing (VPR)
 - b. Nominal Discharge Test (20 kA)
 - c. Operational Voltage Test
 - d. Dielectric Voltage Withstand
 - e. Current Tests (Short Circuit Current, Intermediate Currents, Limited Currents)
5. The component SPD has been evaluated to Short Circuit Rating tests (SCCR), per UL 1449) at 200 kA rms available fault current, without external Overcurrent Protective Devices (OCPD) or external enclosures.

Wiring

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the module or nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Follow the steps listed below when making wiring connections:

1. Turn off all power supplying this equipment before working on or inside any enclosure containing this equipment.
2. Confirm the SPD voltage rating and configuration is the same as the system voltage and power system configuration to which it will be connected.
3. Identify proper location for surge protective device. Locate as close as possible to the panel being addressed so the wires are as short as possible. Mount unit securely.

Note: The surge protective device must be installed in an accessible location as described in the NEC.

4. Install in accordance with national and local electrical codes for overcurrent protection recommendations and wire ampacity considerations.

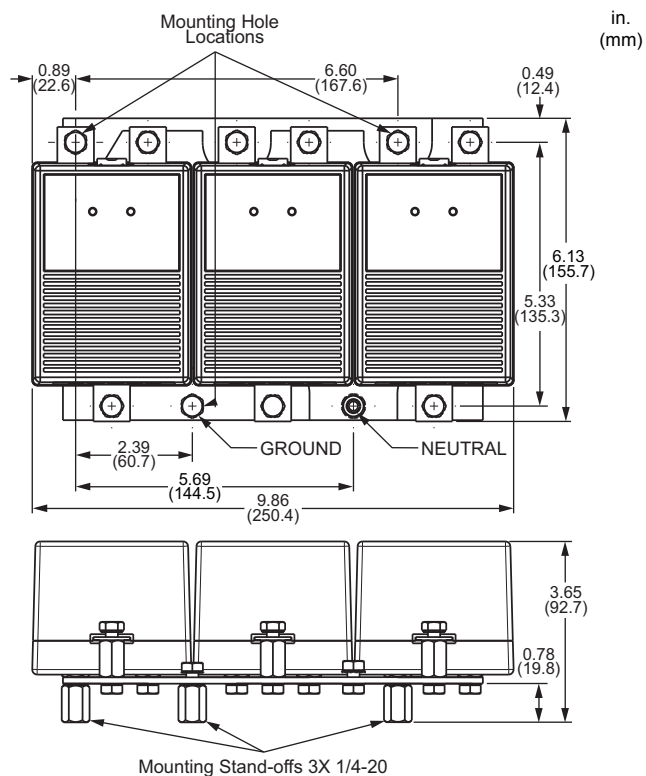
Note: The neutral connection is not present on three-wire, three-phase wye ground or two-wire single-phase mid-point ground power systems. For these systems, bond the neutral and ground lugs together in the SPD. For a High Resistance Ground (HRG) or Delta SPD, no neutral connection exists. For installation wiring see Figures 6 and 7.

Note: See Terminals, Wire Size, and Installation Torque and Table 2 on page 7 for acceptable wire size and installation torque.

5. Twist conductors $\frac{1}{2}$ turn or more for every twelve inches of length. Do not loop or coil wires. Be sure to maintain adequate wire bending space per NEC.
6. If the remote signaling contacts of the diagnostic display panel are to be used, refer to the section, "Dry Contacts", on page 18 for wiring instructions.
7. On a High-Leg Delta installation, note the high leg connection per wiring diagram. See Figure 5.
8. Replace all devices, doors and covers before turning on power to the equipment. If the SPD is properly installed and functioning, the green LED indicators on the display will be lit.

For questions pertaining to the installation of this device, contact the Surgelogic Technical Assistance Group at 1-800-577-7353.

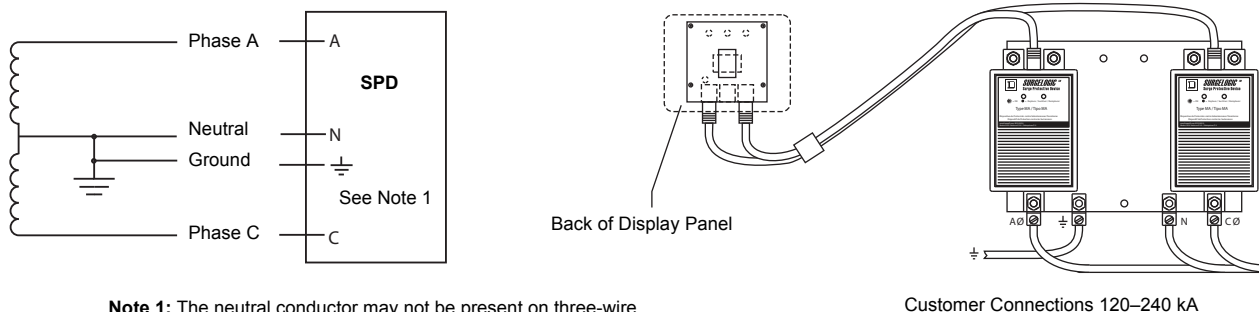
Figure 2: Dimensions and Mounting



Note: The neutral connection will not be present on Delta and HRG configurations.

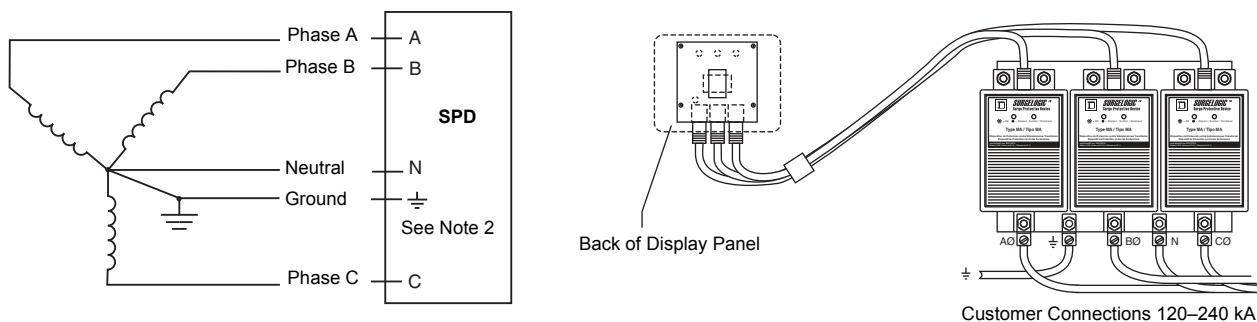
Wiring Diagrams

Figure 3: Single-Phase, Three-Wire, Grounded Installation Integral Switch



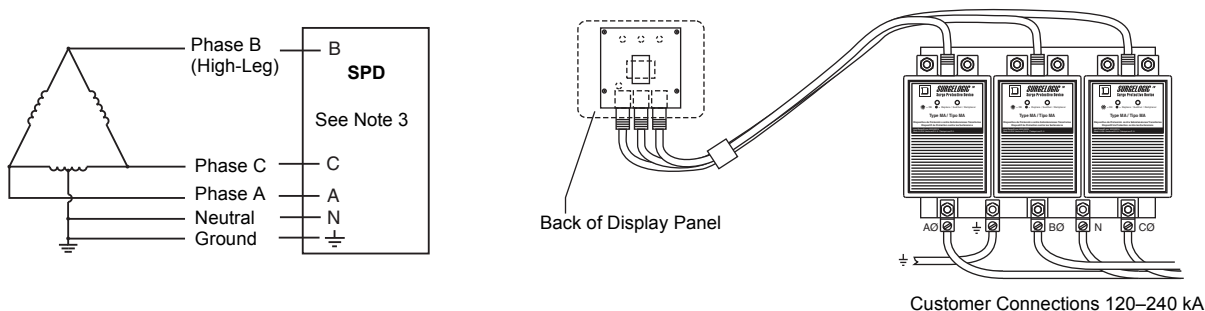
Note 1: The neutral conductor may not be present on three-wire, grounded neutral power systems. For these systems, tie the neutral and ground lugs on the SPD together.

Figure 4: Three-Phase, Three- or Four-Wire, Grounded Wye Installation



Note 2: The neutral conductor is not present on three-wire, grounded neutral power systems. For these systems tie the neutral and ground lugs of the SPD together.

Figure 5: Three-Phase, Three- or Four-Wire, High-Leg Delta Installation



Note 3: The high-leg of the power system must connect to phase B of the SPD. The neutral conductor is not present on three-wire, grounded neutral power systems. For these systems tie the neutral and ground lugs on the SPD together.

Wiring Diagrams for HRG and Delta Systems

Figure 6: High Resistance Ground (HRG) Wye Installation

Note 4: The neutral conductor is not present on HRG wye grounded power systems.

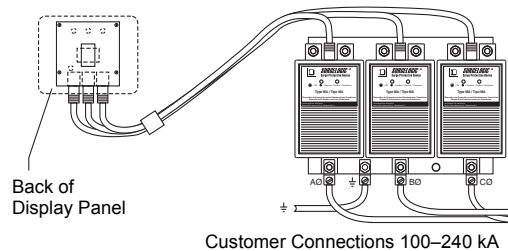
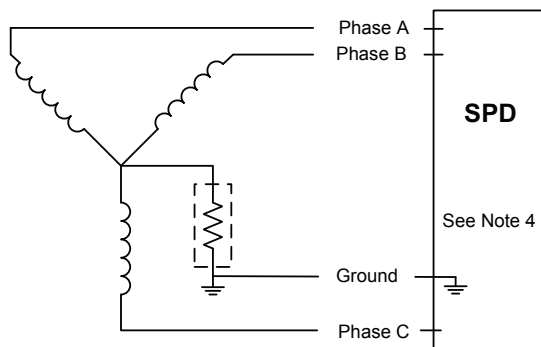
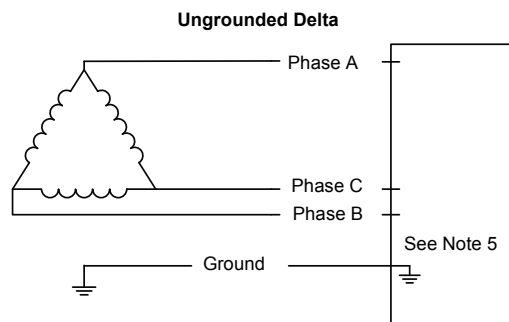
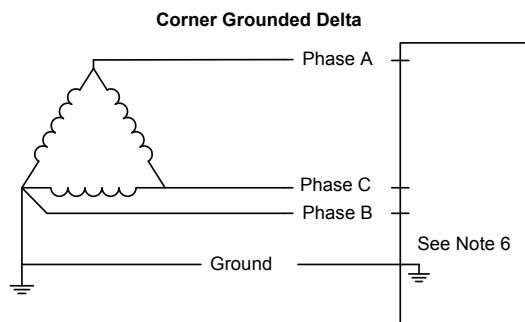
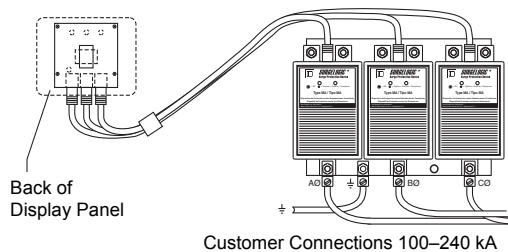


Figure 7: Three-Phase Three-Wire + Ground, Delta Installation

Note 5: The ground connection of the Delta SPD shall be connected to the system ground conductor. The neutral conductor is not present on Delta systems.



Note 6: The ground connection of the Delta SPD shall be connected to the system ground conductor. The neutral conductor is not present on Delta systems. Phase B of the electrical system is typically the grounded phase.



Operation

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

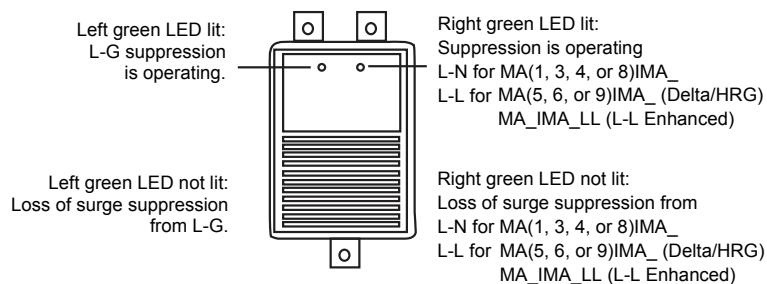
The SPD diagnostic display panel shows the status of each MA module with diagnostically controlled green/red LEDs (see Figure 8). If a unit is operating correctly, all of the phase LEDs will be illuminated green. To test the integrity of the diagnostics for each phase, push the button below the phase LEDs on the diagnostic display panel. The green LED will turn red and the alarm will sound, if the alarm is enabled. Releasing the test button will complete the test; the red LED will turn green and the alarm will shut off.

If an inoperable condition occurs on any phase, the audible alarm sounds and the corresponding phase LED on the diagnostic display panel is illuminated red. This indicates that the device needs service by qualified electrical personnel. The audible alarm can be silenced, until a qualified person is able to evaluate and service the SPD, by pressing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red phase LED will continue to be illuminated until the inoperative condition had been cleared.

On an MA module (see Figure 8), if either LED is not lit, the module should be replaced. If both green LEDs are not lit and the diagnostic display panel has power, then power has been lost to that phase or the module should be replaced (refer to Table 2 on page 7). Refer to the final equipment instruction bulletin for MA module disconnection and access instructions.

When power is applied to the SPD and one or more of the diagnostic display panel LEDs are red, and one or more MA module LEDs are out, the appropriate MA module should be replaced. Refer to “Maintenance and Troubleshooting” on page 21 for proper troubleshooting procedures and Table 5 for replacement modules. If the module LEDs are green and the diagnostic display LEDs are red, please call the SurgeLogic Technical Assistance Group at 1-800-577-7353.

Figure 8: MA Module LEDs



Replacement Modules

Table 4: IMA Replacement Modules

System Voltage	Peak Surge Current Rating (kA)	Catalog Numbers ¹		
		Phase A	Phase B	Phase C
120/240 V, 1-phase, 3-wire + ground	120	MA11MA12_	—	MA11MA12_
	160	MA11MA16_	—	MA11MA16_
	240	MA11MA24_	—	MA11MA24_
208Y/120 V, 3-phase, 4-wire + ground Wye ²	120	MA11MA12_	MA11MA12_	MA11MA12_
	160	MA11MA16_	MA11MA16_	MA11MA16_
	240	MA11MA24_	MA11MA24_	MA11MA24_
120/240 V, 3-phase, 4-wire + ground High-Leg Delta ³	120	MA11MA12_	MA31MA12_	MA11MA12_
	160	MA11MA16_	MA31MA16_	MA11MA16_
	240	MA11MA24_	MA31MA24_	MA11MA24_
240 V, 3-phase, 3-wire + ground Delta	120	MA61MA12_	MA61MA12_	MA61MA12_
	160	MA61MA16_	MA61MA16_	MA61MA16_
	240	MA61MA24_	MA61MA24_	MA61MA24_
480Y/277 V, 3-phase, 4-wire + ground Wye ⁴	120	MA41MA12_	MA41MA12_	MA41MA12_
	160	MA41MA16_	MA41MA16_	MA41MA16_
	240	MA41MA24_	MA41MA24_	MA41MA24_
480 V, 3-phase, 3-wire + ground Delta ⁵	120	MA51MA12_	MA51MA12_	MA51MA12_
	160	MA51MA16_	MA51MA16_	MA51MA16_
	240	MA51MA24_	MA51MA24_	MA51MA24_
600Y/347 V, 3-phase, 4-wire + ground Wye	120	MA81MA12_	MA81MA12_	MA81MA12_
	160	MA81MA16_	MA81MA16_	MA81MA16_
	240	MA81MA24_	MA81MA24_	MA81MA24_
600 V, 3-phase, 3-wire + ground Delta ⁶	120	MA91MA12_	MA91MA12_	MA91MA12_
	160	MA91MA16_	MA91MA16_	MA91MA16_
	180	MA91MA18_	MA91MA18_	MA91MA18_

¹ Catalog numbers are representational. Actual catalog numbers require a suffix to indicate UL Type.

² 208Y/120 series also applies to the following voltage 220Y/127.

³ High-Leg Delta (Phase B modules are different than Phase A and Phase C modules).

⁴ 480Y/277 series applies to the following voltages 380Y/220, 400Y/230 and 415Y/240.

⁵ 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

⁶ 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

Table 5: Replacement Diagnostic Cables

TVS19PCK	Three 19 in. (48.3 cm) cables
TVS36PCK	Three 36 in. (91.4 cm) cables
TVS60PCK	Three 60 in. (152.4 cm) cables
TVS192PCK	Three 192 in. (487.7 cm) cables

Audible Alarm

Push the alarm enable/disable button to enable or disable the alarm (see Figure 9). If the green alarm LED is lit the alarm is enabled. If the green alarm LED is not lit the alarm is disabled.

Surge Counter

The surge counter displays the number of transient voltage surges since the counter was last reset. The counter is battery powered to retain memory in the event of a power loss to the IMA module. To reset the surge counter, remove all power and press the small switch located inside the unit on the underside of the diagnostic circuit board near the diagnostic display connectors (also refer to Figure 10). This will reset the counter to zero.

Dry Contacts

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use 600 V ac rated dry contact wiring.
- Dry contact wiring must have less than 1/16 in. (1.6 mm) exposed wire from the dry contact block.
- Maintain at least 1.0 in. (25 mm) separation between dry contact wiring and the power wiring in the enclosure.

Failure to follow these instructions will result in death or serious injury.

The IMA series SPD is provided with dry contacts. The connection for the dry contacts is located on the back of the diagnostic display panel, (lower right corner, refer to Figure 10), and will accept 22 AWG (0.33 mm²) to 14 AWG (2.1 mm²) stranded or solid wire. The dry contacts are three-position, Form "C" type with Normally Open, Normally Closed, and Common connections.

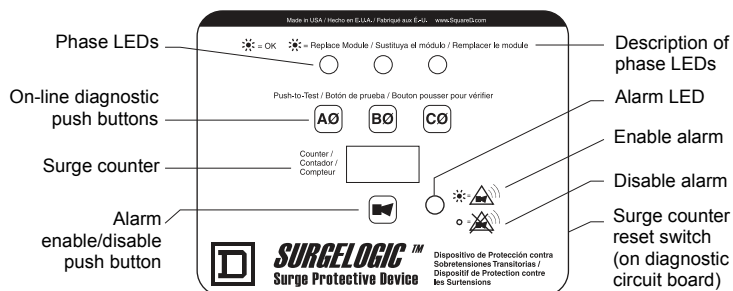
In the unpowered state the contact is closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (See Table 6).

These contacts can be used for remote indication of the SPD's operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described in the next section.

Table 6: Dry Contact Configuration

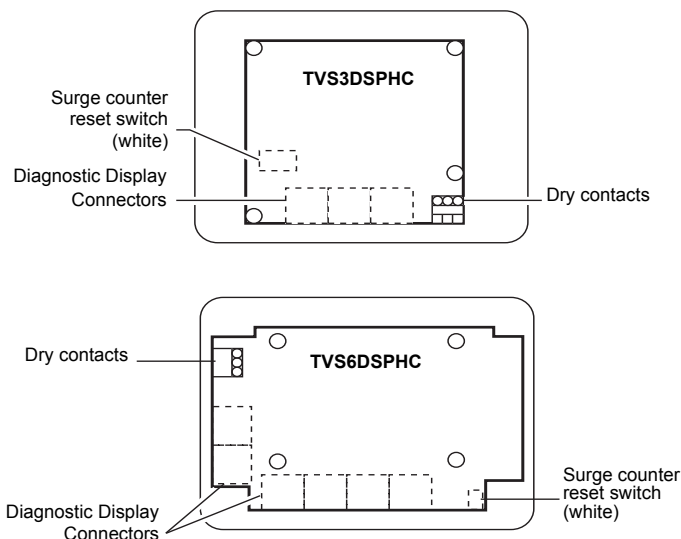
Alarm Contact Terminals	Contact State with Power Applied
NO to COM	Closed
NC to COM	Open

Figure 9: Three-Phase Diagnostic Display Panel with Surge Counter



Note: Phase B is not present on single-phase applications.

Figure 10: Rear of Diagnostic Circuit Board



Care must be taken when installing the dry contact wiring because the terminals are on a moving door. Avoid the door hinge, any switches, and the high voltage areas of the enclosure when routing the wiring. To avoid the door hinge, tie wrap any dry contact wiring to the existing cable harness which crosses the hinge. Once the dry contact wiring is secured on a non-moving point of the enclosure, it is the user's responsibility to maintain at least 1.0 in. (25 mm) separation between 600 V ac rated dry contact wiring and the power wiring in the enclosure.

The dry contacts are designed for a maximum voltage of 24 V dc / 24 V ac and a maximum current of 2 A. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the SurgeLogic Technical Assistance Group at 1-800-577-7353.

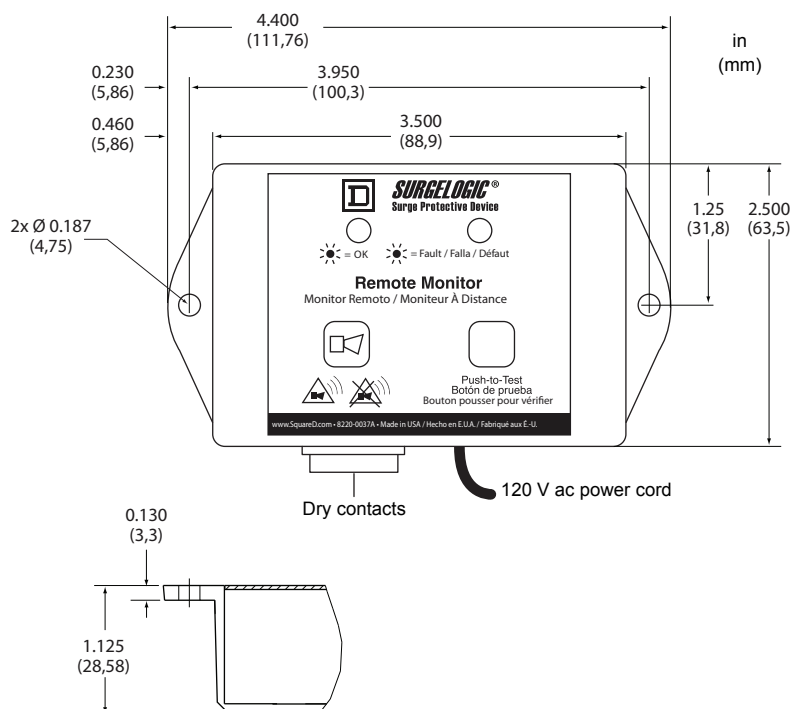
Remote Monitor Option

The remote monitor option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is a lit green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch. If the alarm is enabled, the green LED will turn off, the red LED will turn on, and the alarm will sound. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off.

If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm will sound. The audible alarm can be silenced by pushing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red LED will continue to be illuminated until the inoperative condition has been cleared.

The remote monitor includes a 120 V ac to 12 V dc adapter with a six-foot power cord. Connections are made to the SPD diagnostic panel with Form "C", three-position dry contacts (provided) and the appropriate length of solid or stranded 22 AWG (0.33 mm²) to 14 AWG (2.1 mm²) not provided.

Figure 11: Remote Monitor Option (TVS12RMU)



Maintenance and Troubleshooting

Preventative Maintenance

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

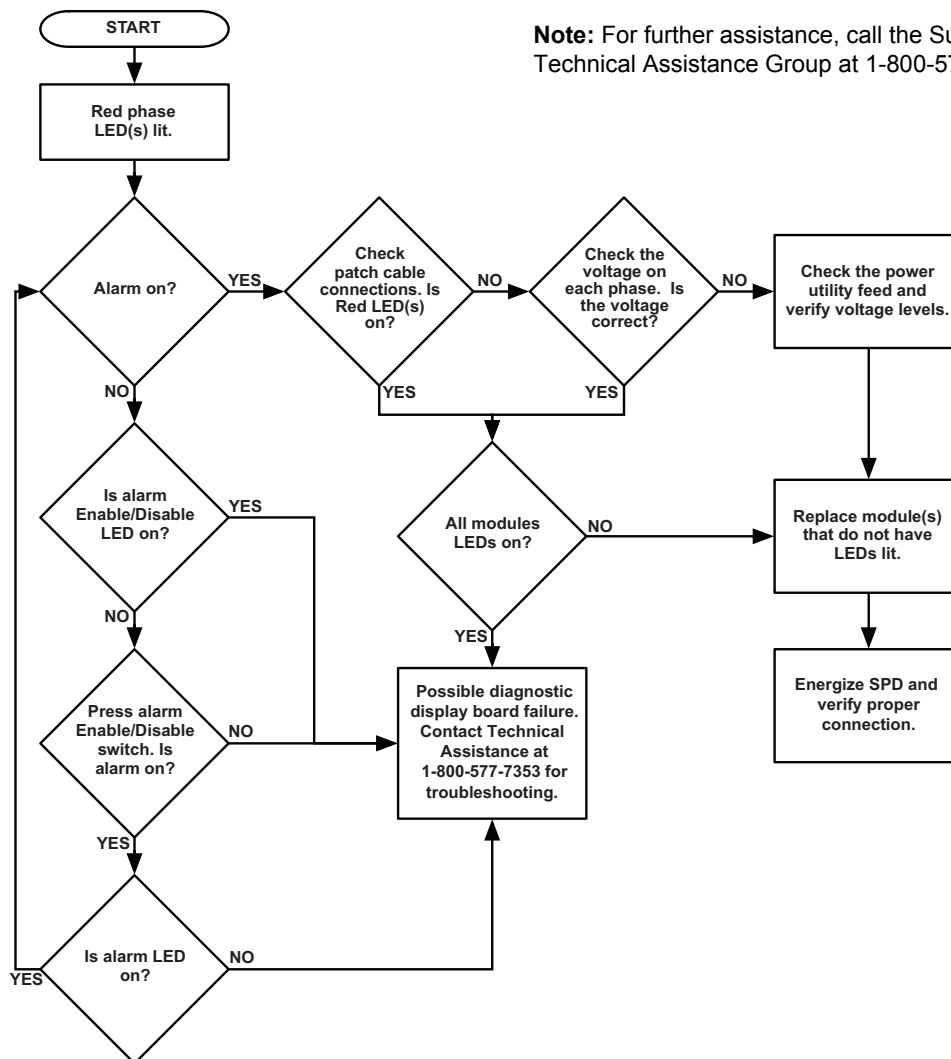
Failure to follow these instructions will result in death or serious injury.

Inspect the SPD periodically to maintain reliable system performance and continued transient voltage surge suppression. Periodically check the state of the diagnostic display panel LED status indicators. Routinely use the built-in diagnostics to inspect for inoperative modules.

Troubleshooting

If a module shows two green indicator lights and the display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 12 below.

Figure 12: Troubleshooting Flow Chart



Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- MA modules. Replacement instructions are included with the replacement parts.
- Diagnostic display panel assemblies. Replacement instructions are included with the replacement parts.

Surgelogic™ Internal Modular Assembly (IMA)
Instruction Bulletin

Schneider Electric USA, Inc.
800 Federal Street
Andover, MA 01810 USA
888-778-2733
www.schneider-electric.us

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Replaces 8222-0050 Rev. G, 06/2013
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PowerLogic™ PM8000 series

User manual

7EN02-0336-00
11/2014



Safety information

Important information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Notices

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Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

FCC Part 15 notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that of the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that any changes or modifications not expressly approved by Schneider Electric could void the user's authority to operate the equipment.

CAN ICES-3 (B) /NMB-3(B)

About this manual

This manual discusses features of the PowerLogic™ PM8000 series power meter and provides installation and configuration instructions. Throughout the manual, the term “meter” refers to all models of the PM8000. All differences between the models, such as a feature specific to one model, are indicated with the appropriate model number or description.

This manual assumes you have an understanding of power metering and are familiar with the equipment and power system in which your meter is installed.

Topics not covered by this manual

This manual does not provide configuration information for advanced features where an expert user would perform advanced configuration. It also does not include instructions on how to incorporate meter data or perform meter configuration using energy management systems or software, other than ION Setup. ION Setup is a free configuration tool available for download from www.schneider-electric.com.

Please contact your local Schneider Electric representative to learn what additional training opportunities are available regarding ION meters.

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Chapter 1 Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Never short the secondary of a voltage transformer (VT).
- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Chapter 2 Introduction

PM8000 overview

The PowerLogic™ PM8000 series power and energy meters help meet the needs of your energy monitoring and cost management applications. All PM8000 meters comply to international metering accuracy standards. You can customize your meter by loading specialized frameworks, and adding option modules and incorporating mounting accessories into the physical installation.

Meter features

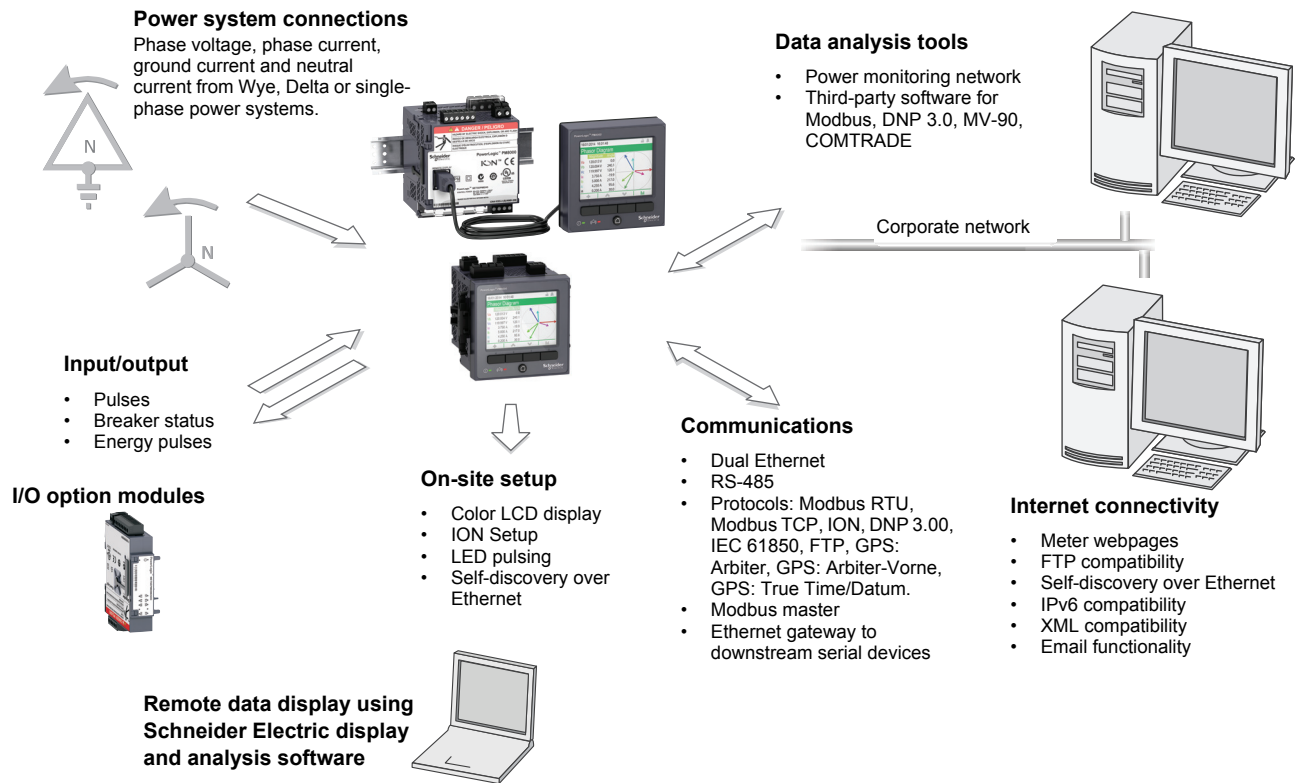
Feature
True RMS metering to the 63rd harmonic
Active (kW), reactive (kVAR) and apparent (kVA) power
600 V direct connection on voltage inputs
Minimum/maximum readings of metered data
Power quality readings (THD)
Downloadable firmware and template
Configuration through integrated or remote display
Modbus master, Ethernet gateway protocols supported
Web interface
Sag/Swell capture for voltage and currents
Time synchronization to 1 ms accuracy
Dual port Ethernet (two physical ports, one Ethernet IP address)
WAGES support
Time of use support
Trending and forecasting
Alarms (active and historic) display viewing and acknowledgment
Multiple languages supported

Your meter in an energy management system

In an energy management system the PM8000 meter collects and aggregates data. This data is used to perform non-critical control or shared with other equipment in the energy management system. Data from the meter can be used by energy management software to help with energy cost management, trending and forecasting, network management, power quality analysis, and more.

The meter is user-configurable to adapt to many situations. Communications allow data to be shared simultaneously across multiple networks, built-in and optional I/O provides monitoring and non-critical control capabilities, and a variety of display and analysis tools can be used to monitor your system.

The following graphic outlines your meter’s capabilities in an energy management system.



Measured parameters

Your meter provides bi-directional 4-quadrant energy metering. The following is a selection of some of the values provided by your meter.

Energy

Your meter provides active, reactive and apparent energy values, including:

- kWh, kVARh, kVAh delivered and received
- kWh, kVARh, kVAh net (delivered - received)
- kWh, kVARh, kVAh total (delivered + received)
- Volt-squared-hours and amp-squared-hours

Energy parameters can be logged automatically on a programmed schedule.

All energy values represent the total for all three phases.

Demand

Your meter supports several demand calculation methods, including block, rolling block, synchronized and predicted demand. It can measure demand on any instantaneous value and record peak (maximum) and minimum demand with time and date information. Demand measurements include:

- kW, kVAR, kVA demand
- kW, kVAR, kVA peak demand
- Amps, Volts demand

Instantaneous

Your meter provides one second and half-cycle measurements, per phase and totals for many values, including:

- Voltage and current
- Apparent power (kVA), active power (kW) and reactive power (kVAR)
- Power factor and frequency
- Voltage and current unbalance

Harmonics

Your meter provides harmonic distortion metering, recording and real-time values for all voltage and current inputs, including:

- Individual harmonics (including magnitude and phase angle) up to the 63rd harmonic
- Total even harmonic distortion (TEHD) and total odd harmonic distortion (TOHD)
- Total harmonic distortion (THD) or total demand distortion (TDD)
- K-factor, Crest factor

Min/max recording

Your meter records new minimum and maximum data every recording interval for the following values:

- Voltage and current
- kW, kVAR and kVA
- Power factor
- Frequency
- Voltage unbalance
- Plus any measured value

Power quality

Your meter measures and records voltage and current sags and swells. Your meter also has many power quality related features, including:

- Disturbance direction detection: this allows the meter to analyze disturbance (sag/swell) information to help determine the direction of the disturbance relative to the meter.
- Setpoint learning: this allows the meter to learn the power quality characteristics of your system, to help identify what constitutes a sag or a swell.
- COMTRADE: this allows the meter to save waveform data in COMmon format for TRANsient Data Exchange (COMTRADE) on its internal FTP server.

Your meter includes the following power quality compliance:

- EN50160: Your meter measures and presents statistics for determining EN50160 compliance.
- IEC 61000-4-30: Your meter complies with the IEC 61000-4-30 power quality standard.
- IEC 62586-1: Your meter complies with the IEC 62586-1 power quality standard.

Localization options

The meter can be customized to use different regional settings, including:

- The language used for the display and webpages
- Time, date and digit formats
- IEC/IEEE symbols and calculations

Data display and analysis tools

Software

Your meter integrates with display and analysis software available from Schneider Electric™, such as StruxureWare™ Power Monitoring Expert that lets you analyze and monitor your system and produce reports for different departments in your organization. This software is designed to make use of your meter's advanced capabilities. You can also use the data acquired by the meter in a variety of third-party systems.

Display

Use the meter's display for local monitoring and standalone applications. The color LCD display lets you view real-time values, events and alarms, and perform basic device configuration. Connect a remote display to a meter without an integrated display to get the same functions as those provided on the integrated display.

Active and historical alarms

The meter's display shows an alarm icon and the alarm LED flashes if your meter detects an active alarm condition. Depending on the priority of the alarm, your meter's display also flashes. You can view and acknowledge active alarms and historic alarms and events through the display and software webpages. An active alarm becomes a historic alarm when the alarm condition no longer exists.

Meter internal web server feature

Your meter's internal web server provides quick and easy access to real-time energy and basic power quality information without special software using an on-board web server combined with an Ethernet port. The built-in web pages display selected energy and power quality information through the web-enabled device; these pages also support basic meter configuration.

Email messaging feature

You can configure your meter to automatically email information, whether notification of a high-priority event or a regularly scheduled send of logged data, to an external email address. Specify the type of event that triggers an email alert, such as a power quality disturbances or interval for logged data. Email messages from your meter are received like any other email message.

Supported protocols

Your meter's fundamental protocol and architecture is ION. You can integrate the meter into various industry-standard networks. Data that the meter measures can be made available to other devices using Modbus, DNP 3.0 and SNMP as well as the MV-90 translation system. You can configure the meter to import data from other devices on

these networks. Your meter supports the IEC 61850 protocol and COMTRADE waveform data format.

Your meter also supports IPv6, DPWS and RSTP Ethernet protocols.

ION Setup device configuration tool

ION Setup is a free configuration tool for your meter that allows you to remotely configure your meter's features over Ethernet or serial communications.

- Use the Setup Assistant to guide you through the process of configuring your meter.
- Use the real-time data screens to verify your meter's configuration.
- Use the data screens to view your meter's recorded data.
- Use the charting function to view your meter's recorded waveforms.

You can download ION Setup from www.schneider-electric.com.

NOTE: Advanced users with a thorough understanding of their meter's architecture, protocols, and the power system in which their meter is installed, can use the advanced mode of ION Setup to create specialized features on their meter.

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for instructions on connecting to your meter and accessing the Setup Assistant.

Additional information and files

The most up-to-date documentation about your meter is available for download from www.schneider-electric.com. You can also contact your local Schneider Electric representative for more information.

Installation sheets

Multilingual installation sheets are shipped with each device or accessory, and provide the information required to install the product.

ION reference

The ION reference describes ION architecture (the common software architecture in all ION devices) and provides an explanation of each of the ION modules.

ION device template reference

The ION device template reference details the type and quantity of ION modules available on your device and how they are configured in the default template.

ION Setup

ION Setup is a free meter configuration tool that can be downloaded for free at www.schneider-electric.com. It has online help that provides instructions on how to connect to and configure your meter using ION Setup.

Technical notes

Technical notes provide instructions for using meter features and for creating custom configurations.

Protocol documents

Each protocol document contains information explaining how your meter interacts with a protocol, such as DNP 3.0, IEC 61850 and MV-90.

Additional files

Additional files for your meter are available for download from www.schneider-electric.com.

File type	Description
Firmware (*.upg)	Firmware upgrade files let you upgrade your meter's firmware to get new features.
Template (*.dcf)	Template files let you replace your meter's existing template with an updated template with new features.
Protocol files	Files required to support a particular protocol on your meter, such as the MIB file for SNMP and your meter's Modbus register map.
Remote display (*.bin) and option module (*.si9) firmware	Firmware upgrade files let you upgrade your remote display or option module's firmware.

Display and analysis software

Documentation for display and analysis software available from Schneider Electric, such as StruxureWare Power Monitoring Expert, is available for download from www.schneider-electric.com.

Chapter 3 Hardware reference

This section provides additional information regarding physical characteristics and capabilities.

Related topics

- See your device's installation sheets, available from www.schneider-electric.com, for installation instructions and specifications.
- See “Specifications” on page 181 for additional specifications.

Meter types

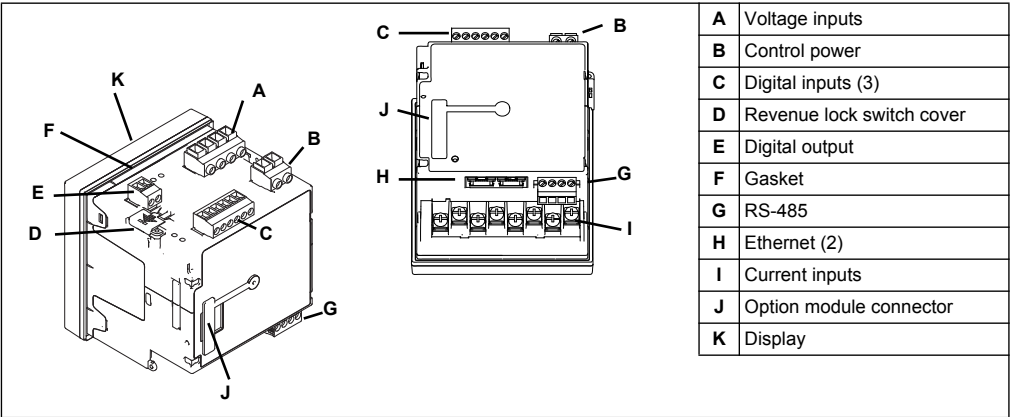
The PM8000 series is available in two physical form factors, and has several accessories:

Model	Commercial reference	Description
PM8240	METSEPM8240	Panel-mounted meter with integrated display
PM8243	METSEPM8243	DIN rail-mounted meter without display, which can be connected to a remote display
PM8244	METSEPM8244	DIN rail-mounted meter packaged with a remote display
PM89RD96	METSEPM89RD96	Remote display (for DIN meter only)
PM89M2600	METSEPM89M2600	Digital I/O option module (2 out, 6 in)
PM89M0024	METSEPM89M0024	Analog I/O option module (2 out, 4 in))
PM8000SK	METSEPM8000SK	PM8000 voltage and current sealing kit
METSEPMAK	METSEPMAK	PM8000 mounting adapter kit for remote display and DIN meter

Related topics

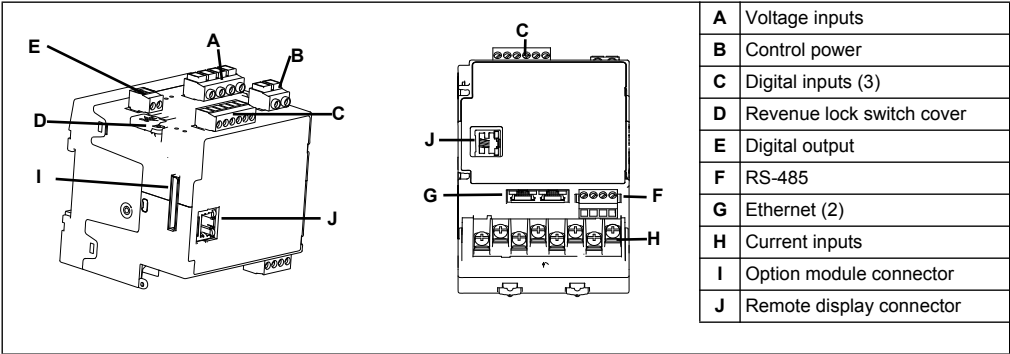
- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for the most up-to-date information about your device, its options and accessories.

Panel meter



Mounting hardware and accessories not shown.

DIN meter



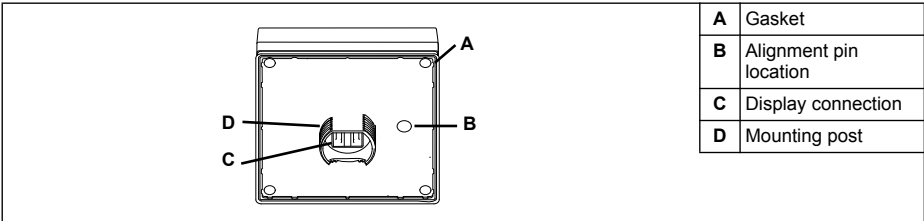
Mounting hardware and accessories not shown.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about your device, its options and accessories.

Remote meter display (RMD)

The remote meter display can be used with DIN meters. It has the same buttons, icons and LEDs as the display on a panel meter, and is powered by the connection to the meter. A remote display cannot be used with meters that have an integrated display.



Mounting hardware and accessories not shown.

Option modules

Option modules are ordered separately from your meter, and can be connected to your meter without specialized equipment.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about option modules available for your meter.

Mounting adaptors

There are different mounting adaptor accessories that can help when installing your meter in existing panels and cutouts where the default mounting hardware is not appropriate. Mounting adaptor kits are ordered separately from the meter.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about mounting adaptors available for your meter.

Other accessories

Voltage and current input covers

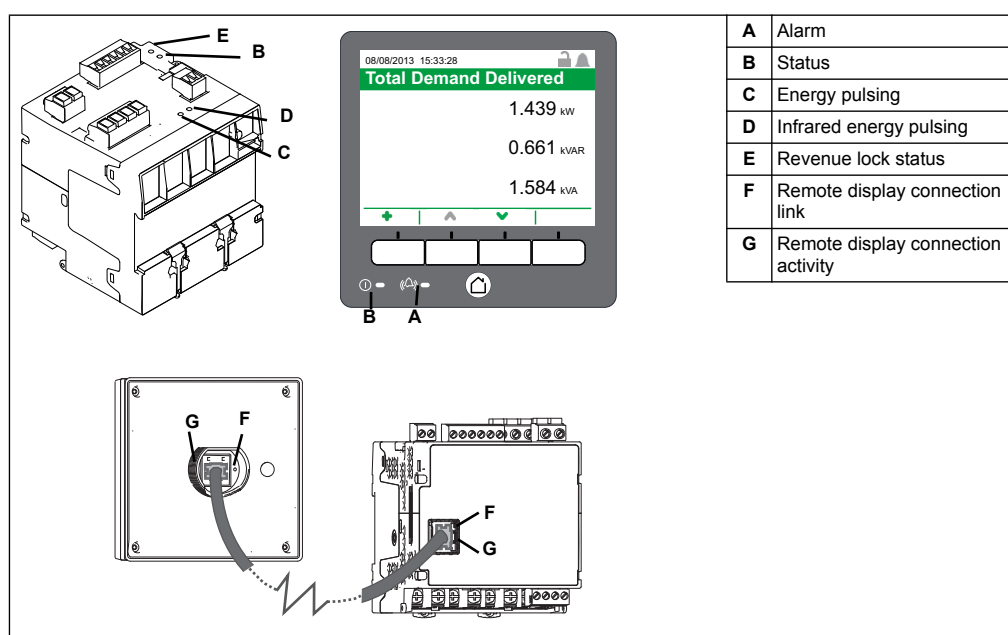
Sealable voltage and current input covers are available and can be ordered separately for your meter. These covers are included for meter models where sealable voltage and current covers are required to comply with revenue or regulatory standards.

Replacement hardware

You can order replacement mounting and installation hardware for your meter and accessories.

Indicator LEDs

LED locations



Related topics

- See “Alarm and status LED indicators” on page 28 for a description of alarm and status LED behavior.

Energy pulsing LED behavior

The visible and infrared LEDs are configured by default to pulse based on the energy (kWh) received by the meter. You can configure the pulse weight (pulses per kWh) and the energy source.

Energy pulsing is used to help verify the energy measurement accuracy of your meter for revenue purposes.

Related topics

- See “Energy pulsing overview” on page 145 for more information about energy pulsing on your meter.
- See “Verifying accuracy” on page 175 for more information about how to perform accuracy verification testing on your meter.

Revenue lock LED behavior

State	Description
Off	The meter is not revenue locked.
On	The meter is revenue locked.
Flashing	New revenue lock state is pending; power cycle your meter to set the revenue lock to on or off.

Remote display connector LED behavior

There are two LEDs in the remote display connector.

LED	Description
Green (link)	On: link established. Off: no link established with the remote display. Check the connections to the remote display and DIN meter.
Yellow (activity)	Flashing: active communications between the meter and the remote display. Off: no communication activity. Check remote display and meter operation.

Chapter 4 Mounting and installation

This section provides supplemental information to help mount and install your meter. It is intended to be used in conjunction with the installation sheet that ships in the box with your meter and accessories. See your device's installation sheet for information related to installation, such as dimensions, mounting and wiring instructions.

The latest technical documentation related to your meter and accessories is available for download from www.schneider-electric.com.

Before you begin

Carefully read and follow the safety precautions and instructions in the installation sheet before working with your meter or accessory.

Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- Never short the secondary of a voltage transformer (VT).
- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
2. Always use a properly rated voltage sensing device to confirm that all power is off.

Mounting

Panel mount meters

The meter retainer clips, located on either side of the meter base and used to secure the meter in the panel, do not usually require any tools to install. If necessary, for panels with limited space, you can use a long-handled slot screwdriver to help install the meter retainer clips.

Mounting adaptors

There are different mounting adaptor accessories that can help when installing your meter in existing panels and cutouts where the default mounting hardware is not appropriate. Mounting adaptors are ordered separately from the meter.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about your device, its options and accessories.

Wiring

This information is supplemental to the installation sheets that shipped with your meter or accessory.

Remote display mounting and wiring

- The remote display can only be used with the DIN meter; it cannot be used by meters with an integrated display.
- The remote display's power and communications is provided through a single, direct, point-to-point connection from the remote display to the DIN meter.

Meter wiring

Power system wiring

You can connect the meter's voltage inputs directly to the phase voltage lines of the power system if the power system's line-to-line or line-to-neutral voltages do not exceed the meter's direct connect maximum voltage limits. The maximum voltage allowed for direct connection may be lower than the manufacturer-specified limits, depending on the local electrical codes and regulations.

If your system voltage is greater than the specified direct connect maximum voltage, you must use PTs (potential transformers) to step down the voltages.

Serial communications (RS-485) wiring

Devices connected to the bus, including the meter, converter(s) and other hardware, must be wired as follows:

- Connect the shield of each segment of the cable to ground at one end only.
- Isolate cables as much as possible from sources of electrical noise.
- Use an intermediate terminal strip to connect each device to the bus. This allows for easy removal of a device for servicing if necessary.
- Install a 1/4 Watt termination resistor between the positive and negative terminals of the device at each end of a straight-line bus. The resistor should match the nominal impedance of the RS-485 cable. Consult the cable manufacturer for the cable impedance value.
- Turn on RS-485 biasing if your meter is the RS-485 master device.
- Avoid device connections that cause a branch or "Tee" in the main RS-485 bus as they can lead to signal reflections that may result in interference.
- Do not connect more than two cables at any connection point on the RS-485 bus.

RS-485 terminals

+	Data plus. This transmits/receives the non-inverting data signals.
-	Data minus. This transmits/receives the inverting data signals.
	Shield. Connect the bare wire to this terminal to help suppress signal noise that may be present. Ground the shield wiring at one end only (either at the master or the last slave device, but not both).
C	Signal common. This provides the voltage reference (zero volts) for the RS-485 signals.

NOTE: If some devices in your RS-485 network do not have the common (C) terminal, use the bare wire in the RS-485 cable to connect the common terminal from the meter to the shield terminal on the devices that do not have the common terminal.

Ethernet communications

Your meter's dual port Ethernet connections enable you to use straight-line or network loop (ring) topologies. If local network loop Ethernet topologies are required, you must enable RSTP for your meter's Ethernet communications to function.

Only use unshielded CAT5/5e UTP Ethernet cables to wire your meter's Ethernet communications. Other cable types may provide an undesired ground path.

NOTICE

EQUIPMENT DAMAGE

Only use unshielded CAT5/5e UTP Ethernet cables.

Failure to follow these instructions may result in equipment damage.

Option modules

Perform an option bus reset to restart the option bus and re-initialize the option modules attached to your meter.

Related topics

- See "Option modules" on page 43 for more information about option modules.
- See "Resets" on page 153 for more information about the resets available on your meter.

Default values for commissioning

Parameter	Default value
Display password (also for logging onto meter webpages)	0
Username (for logging onto meter webpages)	8000
IP address	169.254.0.10
Subnet mask	255.255.0.0
Gateway	0.0.0.0
Unit ID	1
Language	English

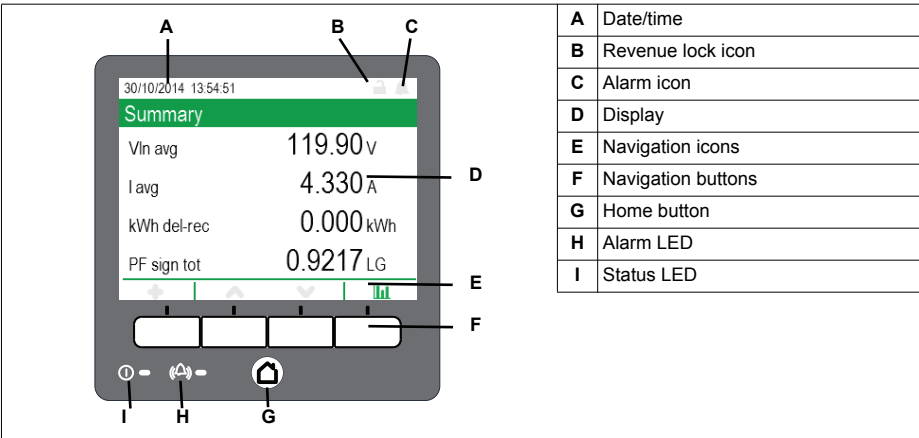
Related topics

- See “Setup menu” on page 33 for instructions on how to perform basic configuration using the display.
- See “Self-discovery over Ethernet” on page 53 for information on how your meter can automatically appear on your network.
- See “Meter webpages” on page 115 for instructions on how to perform basic configuration using your meter’s webpages.
- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to connect to and configure your meter.

Chapter 5 Display and meter setup

Your meter can have either an integrated or an optional remote display. The display allows you to view meter data and perform basic configuration. The integrated and remote display screens have the same meter data and setup screens. Only meters without an integrated display can use the remote display.

Display overview



Home button

Pressing the home button takes you to the associated menu screen. If you are in a data screen, pressing the home button takes you to the display menu, and pressing home twice takes you to the summary display screen. If you are in a setup screen, pressing home takes you to the setup menu, and pressing home again takes you to the display menu.

Revenue lock icon

The revenue lock icon indicates the lock status of the meter. When gray and open, the meter is unlocked. When green and closed, the meter is locked. You can lock and unlock your meter using the revenue lock switch located on the body of your meter.

Alarm icon

The alarm icon indicates the highest level and state of alarms detected by your meter. For example, if the meter detects a low priority and a high priority active alarm, the alarm icon indicates a high priority active alarm.

NOTE: Alarms can only be viewed and acknowledged through your meter's display.

Icon	Description
	Active alarm indicator: - Red: high priority alarm state detected - Yellow: medium priority alarm state detected - Blue: low priority alarm state detected The alarm indicator flashes until you acknowledge the alarm. The alarm indicator changes to the historic alarm indicator of the appropriate level when the alarm state is no longer detected by the meter. NOTE: Your meter's display backlight flashes for unacknowledged high priority active alarms.

Icon	Description
	Unacknowledged historic alarm indicator: - Red: unacknowledged high priority historic alarm - Yellow: unacknowledged medium priority historic alarm NOTE: Low priority historical alarms are not indicated. The active alarm indicator changes to the historic alarm indicator of the appropriate level when the alarm state is no longer detected by the meter.
	No active or unacknowledged high or medium priority historic alarms

Related topics

- See “Revenue locking” on page 173 for more information about your meter’s revenue locking feature.
- See “Alarms and alerts” on page 147 for more information about your meter’s alarms.

Alarm and status LED indicators

Your meter has two LED indicators on the display. These LEDs cannot be configured for other uses.

LED	Description
Status	Off: unpowered Steady green: normal operation Flashing red: no communications (remote display only) Steady red: firmware upgrade required (remote display only) Flashing red/green: startup or firmware upgrade sequence in progress
Alarm	Off: no active or unacknowledged historic alarms On: acknowledged active alarm Flashing: active alarm NOTE: Your meter’s display backlight flashes for unacknowledged high priority active alarms.

Related topics

- See “Indicator LEDs” on page 21 for a description of the meter’s communication and status LEDs.

Navigation symbols

Navigation symbols are displayed on the bottom of the screen above their corresponding navigation button.

NOTE: If the symbol is gray, that navigation function is not available.

Symbol	Description
	More Pressing this button displays additional screens.
	Left Pressing this button moves the displayed cursor one position to the left. If you are in a more or info screen, it returns you to the previous screen.
	Right Pressing this button moves the displayed cursor one position to the right.

Symbol	Description
	Up Pressing this button takes you to the previous screen or menu item.
	Down Pressing this button takes you to the next screen or menu item.
	Select Pressing this button selects or confirms the highlighted value.
	Cancel Pressing this button cancels the current selection and returns you to the previous screen.
	Graphic Pressing this button takes you to a graphical data display.
	Numeric Pressing this button takes you to a numeric data display.
	Info Pressing this button takes you to a detailed information screen.
	Edit Pressing this button allows you to edit the displayed parameter.
	Pressing these buttons allow you to navigate parameter tables in the setup screens.
	Pressing both buttons allows you to perform the described action.

More screens access

Pressing the navigation button associated with the more icon brings up a list of additional screens related to the displayed screen. Press cancel to remove the list. If you do not press any button, the list automatically disappears after a short period of time.

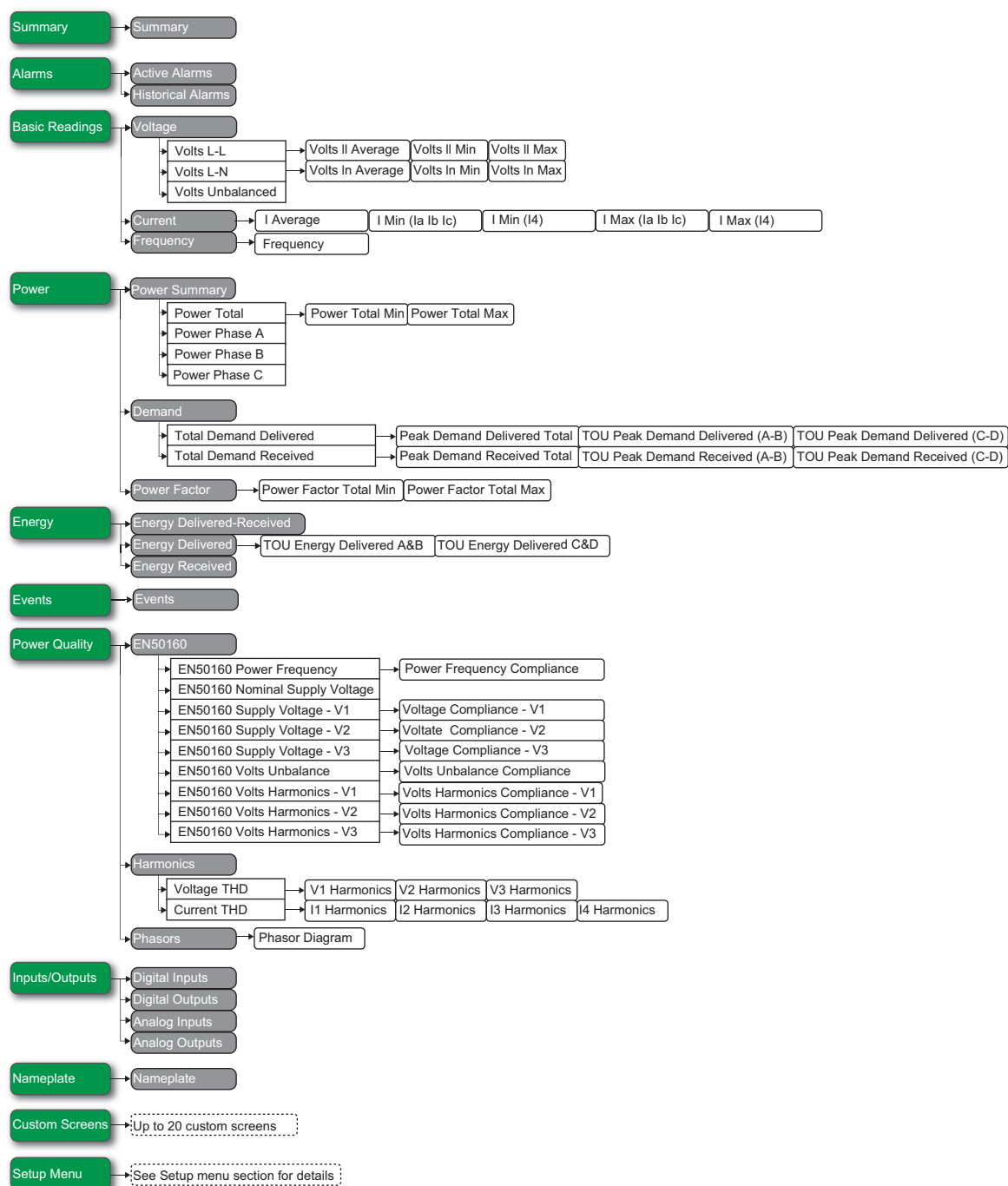
Overrange indication

If any value measured by the meter is too large to fit on the meter's display, the meter initially reduces the size of the text to try and make the value fit. If the value is still too large to be displayed, the meter truncates the value starting with the least significant digit, and encloses the truncated value in a red box.

Display menu

The display menu allows you to select data for viewing and to access the setup menu.

NOTE: Your meter's menus may appear slightly different than shown depending on your display settings.



Viewing data using your meter's display

Use the navigation buttons to view data on your meter's display.

The following examples show how to use the navigation buttons to view data in numeric or graphical format, select and view additional menu screens, and view detailed information about alarms and acknowledge them.

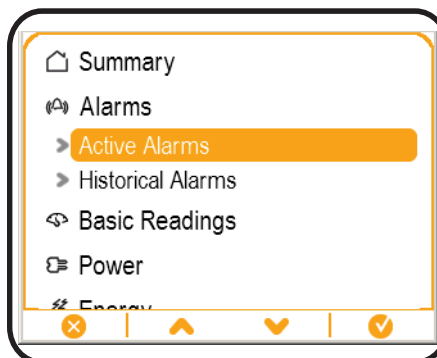
NOTE: Your display may appear differently than shown, depending on your meter's power system and display settings.

NOTE: Your navigation icons change color depending on the type of screen being viewed. If an icon is gray, that navigation option is not available and nothing will happen when you press the button associated with that icon.

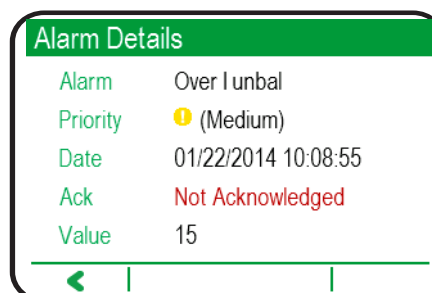
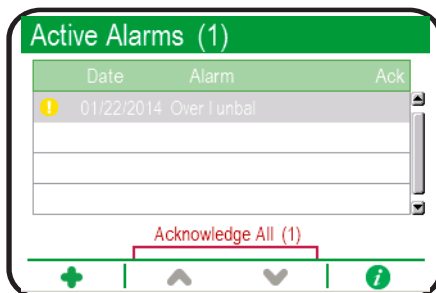
Example: viewing the alarm screens

Use the display navigation buttons to access the alarm screens, display detailed information, and acknowledge active and historic alarms.

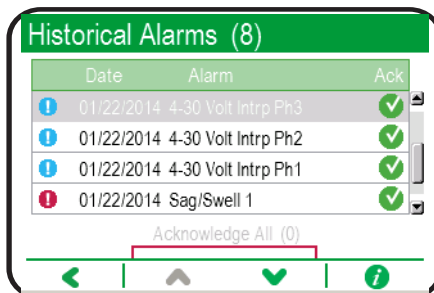
1. Press to display the menu. Press or until **Alarms** is highlighted. Press to display the alarm screens. Press until Active Alarms is highlighted. Press to display Active Alarms. The Active Alarms title lists, in brackets, the total number of active alarms.



2. Press or to highlight a specific alarm, in this case an unbalanced currents alarm. Press to display detailed information about the highlighted alarm, and press to return to the Active Alarms screen. Press both and simultaneously to acknowledge all active alarms.



3. Press to display the menu. Press to highlight Historical Alarms. Press to display Historical alarms. The Historical Alarms title lists, in brackets, the total number of historic alarms.
4. Press or to highlight a specific alarm, in this case a 4-30 voltage interruption alarm. Press to display detailed information about the highlighted alarm. Press both and simultaneously to acknowledge all historical alarms.

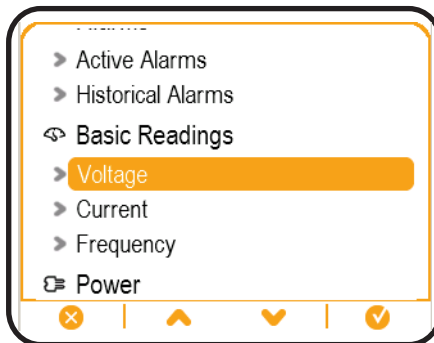


5. Press to return to the menu.

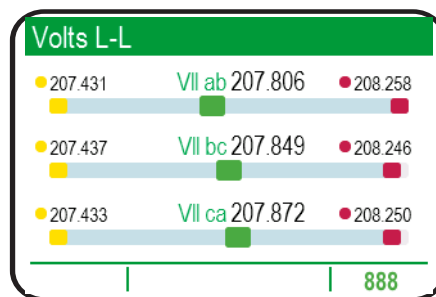
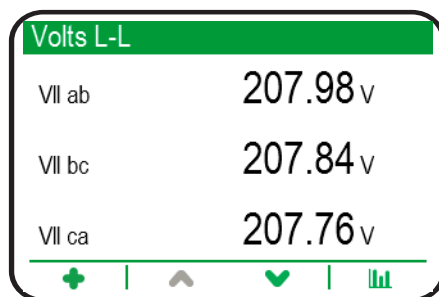
Example: viewing the voltage screens

Use the display navigation buttons to view screens, display detailed information, and display graphical representations of measured voltage data.

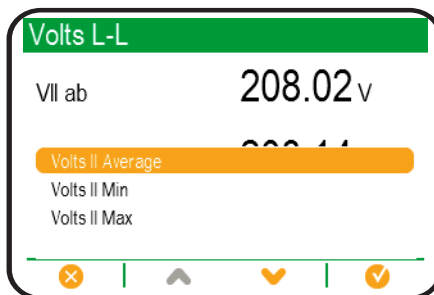
1. Press  to display the menu. Press  or  until Basic Readings is highlighted. Press  to view the basic readings screens. Press  until Voltage is highlighted. Press  to view the voltage screens. Voltage line-to-line values are displayed.



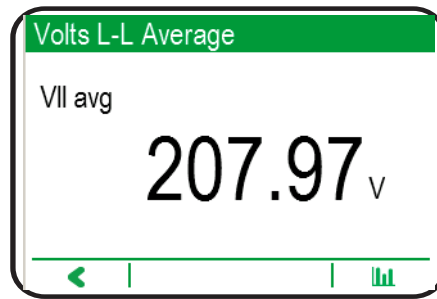
2. Press  to view a graphical display of historic voltage values, then press **888** to return to the numeric display. Press  to show a list of additional screens.



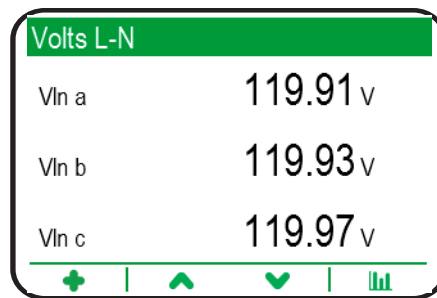
3. Press  or  to highlight an additional screen, in this case, Volts II Average. Press  to go to the highlighted screen. Volts II Average displays the average line-to-line voltage.



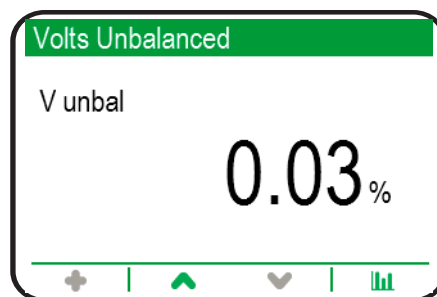
- Press  to view a graphical display of average voltage values, then press  to return to the numeric display. Press  to return to Volts L-L.



- Press  to view Volts L-N, which also has additional screens and the ability to view the information in a graphical format.



- Press  again to view Volts Unbalanced. This is the last voltage screen, so  is grayed out and unavailable. Press  to return to Volts L-N, and press  again to return to Volts L-L.

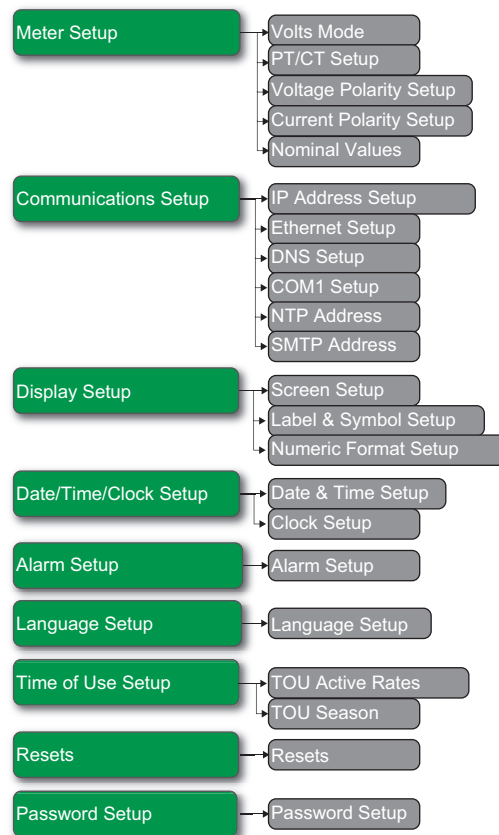


Setup menu

Meter configuration can be performed through the display, using the meter's webpages or through software. This section contains information on how to set up the meter using the display. You must have your meter's security settings configured to allow front panel (display) programming in order to set up the meter using the display.

NOTE: Your display may appear differently than shown, depending on your meter's power system and display settings.

NOTE: Some setup parameters cannot be configured when revenue security is enabled.



Related topics

- See “Revenue locking” on page 173 for more information about your meter’s revenue security and protected parameters.
- See “Security” on page 47 for information about front panel (display) programming security settings.
- See “Accessing the meter’s webpages” on page 116 for instructions on how to access your meter’s webpages.
- See “ION Setup device configuration” on page 84 for instructions on how to configure your meter using ION Setup.

Setting up your meter using the display

Use the navigation buttons and displayed parameters to configure your meter.

The following example shows how to use the navigation buttons to select parameters, enter numeric information or select parameter values from lists.

NOTE: Your display may appear differently than those shown, depending on your meter’s power system and display and localization settings.

NOTE: Your navigation icons change color depending on the type of screen being viewed. If an icon is gray, that navigation option is not available and nothing will happen when you press the button associated with that icon.

NOTE: Your meter goes back to displaying data after a period of inactivity in the setup menu screens.

NOTE: Your meter locks you out of display configuration after you have exceeded the maximum number of attempts to enter a password.

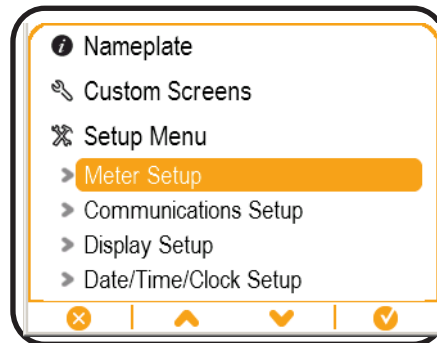
Your meter's default display password is 0 (zero).

Example: setting volts mode and PT/CT ratios

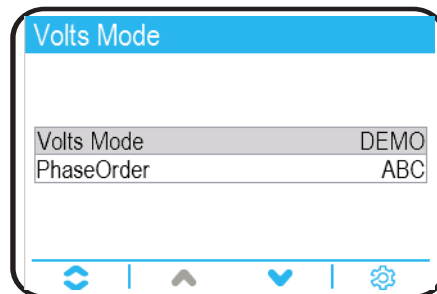
Use the display navigation buttons to set your meter's volts mode and PT ratios.

NOTE: Potential transformers (PT) are also known as voltage transformers (VT).

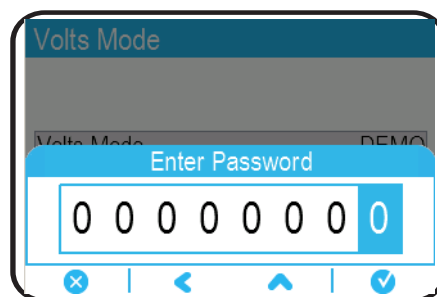
1. Press  to display the menu. Press  until Setup Menu is highlighted. Press  to display the Setup Menu. The **Setup Menu** lists the setup selections on your meter.



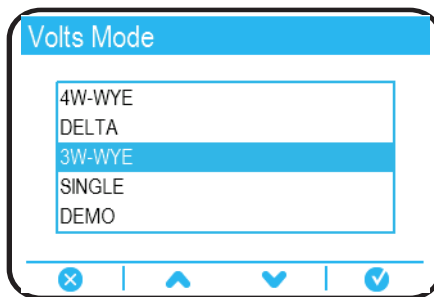
2. Press  or  to highlight the different setup menu selections. Highlight Meter Setup and press  to select the meter setup screens. The Volts Mode setup screen is displayed.
3. Press  to highlight Volts Mode. Press  to edit the Volts Mode. The Enter Password screen is displayed.



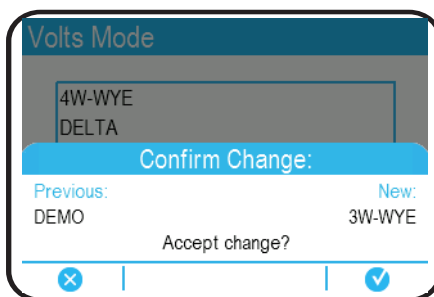
4. Press  to change the value of the highlighted digit (0 - 9). Press  to go to the next digit. Press  to enter your password. The volts mode configuration screen is displayed.



5. Press  or  to highlight the desired volts mode from the list, in this case, 3W-WYE. Press  to select the highlighted volts mode. A confirmation screen is displayed, showing your meter's previous setting and newly selected setting.

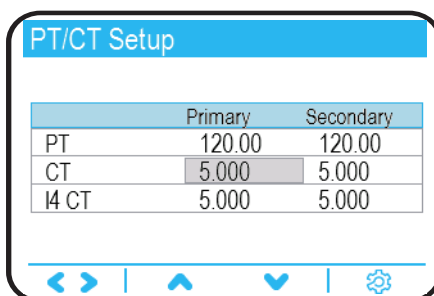


6. Press  to confirm, and the new setting is applied to your meter. Press  to cancel and maintain your meter's original setting.



7. In the Volts Mode screen, press  to go to the PT/CT Setup screen.
8. In the PT/CT Setup screen, press   to highlight the potential transformer (PT) or current transformer (CT) value for editing. Press  to edit the highlighted value.

NOTE: If you have exceeded the password timeout period, you are prompted to enter your meter's display password.



9. Press  to change the value of the highlighted digit (0 - 9). Press  to go to the next digit. Press  to enter the new value. When the confirmation screen is displayed, press  to confirm the new value or  to revert to the original value.

Related topics

- See “Minimum configuration requirements for basic metering” on page 37 for information on the values that must be configured on your meter.
- See “Security” on page 47 for information about the security features of your meter.

Minimum configuration requirements for basic metering

At a minimum, you must configure the following parameters to help your meter perform basic metering functions.

Setup screen	Screen	Minimum configuration
Meter Setup	Volts Mode	Volts Mode
	PT/CT Setup	PT, CT and I4 CT Primary and Secondary
	Nominal values	V nominal, I nominal, Nominal Frequency

NOTE: You must also configure all the parameters related to the meter features you are using, for example, you must configure the DNS server address if you are using the meter's DNS feature.

Setup parameters

The following sections list the parameters that can be configured using your meter's display.

NOTE: Some parameters may appear differently than shown, depending on your meter's power system and display settings.

Meter setup

Screen title	Parameter	Values	Description
Volts Mode	Volts Mode	4W-Wye, Delta, 3W-Wye, Single, Demo	The power system's configuration
	PhaseOrder	ABC, ACB	The power system's phase order
PT/CT Setup	PT Primary	1 to 999,999.99	The potential transformer's primary winding voltage rating NOTE: PTs are also referred to as a VTs or voltage transformers.
	PT Secondary	1 to 999,999.99	The potential transformer's secondary winding voltage rating NOTE: PTs are also referred to as a VTs or voltage transformers.
	CT Primary	1 to 999,999.99	The current transformer's primary winding current rating
	CT Secondary	1 to 999,999.99	The current transformer's secondary winding current rating.
	I4 Primary	1 to 999,999.99	The I4 current transformer's primary winding current rating
	I4 Secondary	1 to 999,999.99	The I4 current transformer's secondary winding current rating
Voltage Polarity Setup	Va Polarity	Normal, Inverted	The polarity of the potential transformer on Va
	Vb Polarity	Normal, Inverted	The polarity of the potential transformer on Vb
	Vc Polarity	Normal, Inverted	The polarity of the potential transformer on Vc
Current Polarity Setup	Ia Polarity	Normal, Inverted	The polarity of the current transformer on Ia
	Ib Polarity	Normal, Inverted	The polarity of the current transformer on Ib
	Ic Polarity	Normal, Inverted	The polarity of the current transformer on Ic
	I4 Polarity	Normal, Inverted	The polarity of the current transformer on I4
Nominal Values	V Nominal	1 to 999,999	The nominal (normal) voltage of the power system
	I Nominal	1 to 999,999	The nominal (normal) current of the power system
	Nominal Frequency	50, 60	The nominal (normal) frequency of the power system

Communications Setup

Screen title	Parameter	Values	Description
IP Address Setup	IP Address	As defined by your network's system administrator	Sets the IP address for the meter NOTE: Your meter's default IP address is 169.254.0.10
	SubnetMask		Used if subnetting applies to your network
	Gateway		Used in networks with multiple segments
	MAC Address	Not configurable	Your meter's media access control (MAC) address.
Ethernet Setup	Enable RSTP	Yes, No	Specifies if rapid spanning tree protocol (RSTP) is enabled NOTE: If local network loop or ring Ethernet topologies are required, you must enable RSTP for your meter's Ethernet communications to function
	Enable ION Over TCP	Yes, No	Specifies if ION protocol communications are enabled over Ethernet
	Enable Web Server	Yes, No	Specifies if the meter's internal web server is enabled
DNS Setup	Primary DNS	As defined by your network's system administrator	Sets the address for the primary DNS server that is configured to resolve domain names
	Secondary DNS		Sets the address for the secondary DNS server that is configured to resolve domain names
COM1 Setup	Protocol	ION, Modbus RTU, Modbus Master, DNP v3.00, EtherGate, GPS: Truetime/Datum, GPS: Arbiter, GPS: Arbiter-Vorne, Factory	Sets the communications protocol for your meter's RS-485 port
	Baud Rate	2400, 4800, 9600, 19200, 38400, 57600, 115200	Sets the data rate, in bits per second
	RTS Delay	0 to 1	Sets the transmit delay in seconds
	Unit ID	1 to 9999	Sets the meter's unique ID on the RS-485 network NOTE: Modbus serial device range 0 to 247
	Serial Port	8N1, 8N2, 8E1, 8E2, 8O1, 8O2	Sets the parity and stop bits for the port
	RS485 Bias	Off, On	Turns on biasing when mastering devices over the RS-485 port
NTP Address	NTP Server	As defined by your network's system administrator	Specifies the IP address of the SNTP or NTP server used by the meter for time synchronization
SMTP Address	SMTP Server	As defined by your network's system administrator	Specifies the IP address of the SMTP server used by the meter for sending email

Display Setup

Screen title	Parameter	Values	Description
Screen Setup	Backlight Timeout	0 to 720	Specifies how many seconds the display's backlight remains lit after the last button press
Label & Symbol Setup	Phase Lbls	ABC, 123	Sets the voltage and current phase labels
	Measurement Symbols	IEEE, IEC	Specifies whether IEEE or IEC measurement symbols are applied to displayed values
	PF Convention	IEEE, IEC	Specifies whether IEEE or IEC power factor conventions are applied to displayed values
Numeric Format Setup	Digit Grouping	1000.0, 1,000.0, 1 000,0	Specifies how digits are grouped for display
	Volts Resolution	1., 1.X, 1.XXX, 1.XXXX	Specifies the number of decimal places displayed for voltages
	Current Resolution	1., 1.X, 1.XXX, 1.XXXX	Specifies the number of decimal places displayed for currents
	Power Resolution	1., 1.X, 1.XXX, 1.XXXX	Specifies the number of decimal places displayed for power and energy measurements

Date/Time/Clock Setup

Screen title	Parameter	Values	Description
Date & Time Setup	Time Format	12 H, 24 H	Specifies how the time is displayed
	Date Format	MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD	Specifies how the date is displayed
	TZ Offset	-12:00:00 to 12:00:00	Sets the time zone of the meter's location, relative to UTC
	DST Offset	-3:00:00 to 3:00:00	Sets the daylight savings time offset of the meter's location

Screen title	Parameter	Values	Description
Clock Setup	Clock Source	Internal, Line Freq, COMM	Specifies the time synchronization source
	Time Sync Source	COM1, Ethernet, Ethernet - ION, Ethernet - DNP, IIRIG-B	Specifies the port to receive time synchronization signals
	Time Sync Type	UTC, Local	Specifies whether time synchronization signals are received in local time or UTC

Alarm Setup

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

You can disable alarms through the display in order to prevent nuisance alarms:

Screen title	Parameter	Description
Alarm Setup ¹	Over I unbal	Over unbalanced current alarm
	Over THD V1	V1 over total harmonic distortion (THD) voltage alarm
	Over THD V2	V2 over total harmonic distortion (THD) voltage alarm
	Over THD V3	V3 over total harmonic distortion (THD) voltage alarm
	Over P sd	Over kW sliding demand alarm
	Over Ia	Ia over current alarm
	Over Ib	Ib over current alarm
	Over Ic	Ic over current alarm
	Over I4	I4 over current alarm
	Over V unbal	Over unbalanced voltage alarm
	V1 Setpoint	V1 setpoint alarm
	V2 Setpoint	V2 setpoint alarm
	V3 Setpoint	V3 setpoint alarm
	Freq Setpoint	Frequency setpoint alarm
	Sag/Swell 1	Voltage sag/swell alarm
	Current Sag Ph1	Current sag alarms for phase 1
	Current Sag Ph2	Current sag alarms for phase 2
	Current Sag Ph3	Current sag alarms for phase 3
	4-30 Volt Intrap Ph1	4-30 voltage interruption power quality alarm for phase 1
	4-30 Volt Intrap Ph2	4-30 voltage interruption power quality alarm for phase 2
	4-30 Volt Intrap Ph3	4-30 voltage interruption power quality alarm for phase 3
	Current Swell Ph1	Current swell alarms for phase 1
	Current Swell Ph2	Current swell alarms for phase 2
	Current Swell Ph3	Current swell alarms for phase 3

¹ Any Setpoint or Relative Setpoint module with an event priority greater than the low alarm event priority is also displayed on this screen.

You can only enable or disable alarms using the display. Alarm configuration is done using ION Setup. Alarms with a priority less than low (info only or none) are not displayed.

You must configure all the parameters related to the alarm for alarm functions to operate. For example, for the Over Ia alarm to operate, you must enter the nominal value and the conditions that define an alarm state, even if the alarm is shown as Enabled on the Alarm Setup screen.

Language Setup

Select the language to be shown on the meter's display. By default, your meter has the following languages:

- English
- Spanish
- French
- German
- Italian
- Portuguese
- Russian
- Chinese (simplified)

Resets

NOTICE

LOST DATA

Save your meter's data before performing a reset.

Failure to follow these instructions can result in data loss.

The following resets can be performed using the display:

Screen title	Parameter	Description
Resets	Master Reset	• Clears all the cumulative and derived quantities from the meter (including demand, peak demand, energy, revenue and test mode parameters) • Clears meter event and waveform logs • Clears COMTRADE waveform records from the meter's internal FTP server • Clears the meter's data logs
	Peak Demand Reset	Clears the peak demand values logged in the meter
	Min/Max Reset	Clears all accumulated maximum and minimum values stored in the meter
	Digital Input Count Reset	Clears the digital input state change counters
	Harmonics Min/Max Reset	Clears all accumulated maximum and minimum harmonics values stored in the meter
	Disturbance Count Reset	Clears the sag/swell event counter
	EN50160 Reset	Clears all EN50160 parameters and statistics accumulated in the meter
	Option Modules Reset	Restarts all option modules attached to the meter

Password Setup

It is strongly recommended that you change your meter's display (front panel) password from the default value of 0 (zero).

If your meter's user access information is lost, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS
Record your device's user and password information in a secure location
Failure to follow these instructions may result in data loss.

Screen title	Parameter	Values	Description
Password Setup	Password	0 to 99999999	Sets the password that must be entered in order to configure parameters using the meter's display NOTE: This is also the password used to access the meter's webpages when standard security is enabled

Display behavior

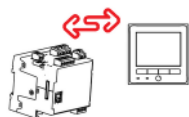
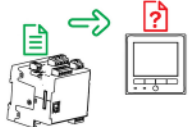
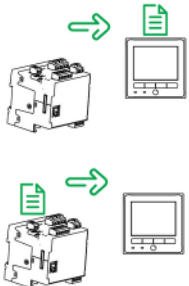
Display backlight

Your meter's display backlight dims after a defined period of inactivity.

When the meter detects an unacknowledged active high priority alarm, the display flashes until the alarm is acknowledged.

Remote display troubleshooting icons

Your meter's remote display shows the following troubleshooting icons in addition to the meter's status LED information:

Icon	Description
	Your remote display cannot communicate to your meter. Check the connection between your meter and the display. Check the meter's status LED to confirm that the meter is operating normally.
	Your remote display needs updated firmware for compatibility with your meter.
	Your remote display is undergoing a firmware upgrade. Do not disconnect your remote display from your meter.

Related topics

- See “Loading remote display firmware using FTP” on page 80 for instructions on how to load remote display firmware.

Localization

The localization settings on the meter affect how information is displayed as well as how some values are calculated. Options include language, number formats as well as the IEEE (Institute of Electrical and Electronics Engineers) or IEC (International Electrotechnical Commission) conventions used for power, power factor and energy.

You can configure your meter's localization settings using ION Setup.

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for instructions on how to connect to and configure your meter.
- See “Power and power factor conventions” on page 157 for details on IEEE and IEC power and power factor conventions.

Custom displays

You can create custom displays using ION Setup.

Related topic

- See “Creating custom displays using ION Setup” on page 111 for instructions on how to create custom displays on your meter.

Lost user access

If you lose your meter's user access information, contact your local Schneider Electric representative for instructions on how to return your meter for factory reconfiguration.

NOTE: Have your meter's serial number available for reference.

Chapter 6 Option modules

This section supplements the option module installation sheets and provides additional information regarding physical characteristics and capabilities.

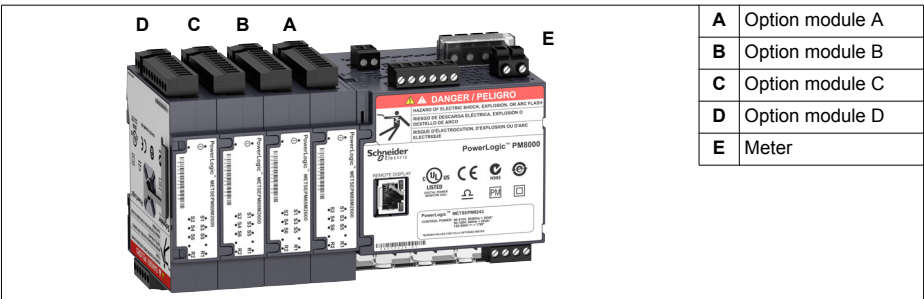
Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for installation instructions and specifications.
- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about option modules available for your meter.

Option modules overview

Option modules are ordered separately from your meter, and can be connected to your meter without specialized equipment. Up to four option modules can be added to your meter.

Option modules are identified based on the physical order of the attached modules. The option module attached directly to the meter is module A, the module attached to module A is module B, and so on. The option module identifier is added to the ION module name and ION label to uniquely describe each possible combination of option modules.



For example, a meter with two option modules, consisting of an analog option module directly attached to the meter (A) and a digital option module attached second (B), describes the Q2 analog output of module A as Port A Q2 and the S3 digital input of module B as Port B S3.

Option modules support

Maximum number of option modules

Depending on the type and quantity of option modules attached to your meter, you may need to reduce your meter's maximum operating temperature.

For a panel mount meter, one limitation on the number of modules that can be attached is the physical strength of the meter mounting hardware. If your meter is mounted in an area subject to vibration or other physical stresses, your meter's ability to physically support multiple option modules and maintain a seal against the mounting surface may be affected.

NOTICE

EQUIPMENT DAMAGE

Do not exceed the maximum number of option modules.

Failure to follow these instructions will result in equipment damage.

Related topics

- See “Specifications” on page 181 for more information about the maximum number and type of attached option modules.

I/O option modules

I/O option modules provide increased digital and analog input/output (I/O) capabilities for your meter.

⚠ WARNING

UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

These I/O modules can be used to monitor the status of breakers, control analog or digital transducers, or receive signals that can be interpreted to provide WAGES data for your energy system. For applications requiring high accuracy, such as energy pulsing to verify accuracy, the digital output on the meter base is recommended.

Your meter's digital and analog outputs may change state during a firmware upgrade. Option modules are offline during an option module firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

Analog I/O option modules

Your meter's analog I/O option modules can measure and output either low voltage or current using standard analog transducers such as 4 - 20 mA current transducers.

Analog option module data viewing

To view analog option module data on your meter's display, go to **Inputs/Outputs** and select either **Analog Inputs** or **Analog Outputs**. If there are no I/O of the specified type, an informative message is displayed.

To view analog option module data on your meter's webpages, connect to your meter's webpages, go to **Monitoring > Inputs/Outputs** and select either **Analog Inputs** or **Analog Outputs**. If there are no I/O of the specified type, an informative message is displayed.

Related topics

- See “Analog inputs/outputs” on page 141 for information about analog I/O.

Digital I/O option modules

You can add digital I/O option modules to increase your meter’s capabilities.

Digital option module data viewing

To view digital option module data on your meter’s display, go to **Inputs/Outputs** and select either **Digital Inputs** or **Digital Outputs**. If there are no I/O of the specified type, an informative message is displayed.

To view digital option module data on your meter’s webpages, connect to your meter’s webpages, go to **Monitoring > Inputs/Outputs** and select either **Digital Inputs** or **Digital Outputs**. If there are no I/O of the specified type, an informative message is displayed.

Related topics

- See “Digital inputs/outputs” on page 145 for information about digital I/O.

Option module troubleshooting

Your meter’s option modules operate sequentially; if one module is non-functional all downstream modules may be affected. If your meter cannot communicate with an option module, by default it cycles power to that module and all downstream modules, making multiple attempts to communicate. After the maximum number of communication attempts has been exceeded the meter will remove power to that module and all downstream modules.

When troubleshooting option modules, attach each option module directly to the meter and verify its operation. If each option module operates when directly connected, use combinations of modules or known good modules to help identify the issue.

Events related to option module initialization and operation are stored in your meter’s onboard event log. Perform an option bus reset to restart the option bus and re-initialize the option modules attached to your meter.

Information about your option module’s type, serial number, firmware version and present status is available in the Factory and Diagnostics modules.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Factory and Diagnostics modules.

Option module reset

During an option module reset, your option module may not operate normally, and digital and analog outputs may change state.

 WARNING**UNINTENDED OPERATION**

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

You can reset your meter's option module bus through the display or using ION Setup. This power cycles all the modules attached to your meter. If you have queued firmware updates for your option modules on your meter's internal FTP site, the firmware updates are performed. Your option modules do not operate normally during an option module reset.

By default, your meter is configured so that your meter automatically performs an option bus reset when needed to help keep the option modules operating normally. Contact Technical Support for instructions on changing this default configuration.

Related topics

- See "Meter resets" on page 153 for more information about the resets you can perform on your meter.
- See "Firmware and templates" on page 77 for information about uploading option module firmware.

Chapter 7 Security

Security overview

You can configure standard or advanced security on your meter, as well as optional revenue security.

Your meter comes with configurable security that you can set to either standard or advanced, which helps protect against unauthorized configuration of your meter and access to your meter's data through the meter's display or communications. Your meter has features that allow you to enable/disable Ethernet protocols and port numbers. Your meter also supports revenue locking, which incorporates revenue security on all revenue-related parameters and revenue sealing.

Your meter ships from the factory with standard security enabled.

Standard and advanced security features

Security allows you to configure the following security features to your meter:

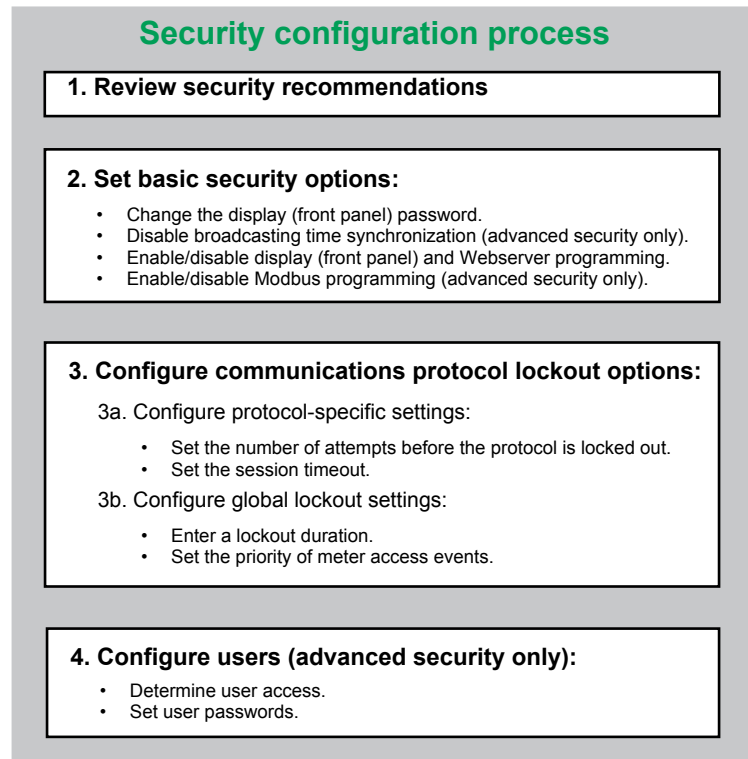
Parameter	Standard/advanced	Details
Meter password	Standard/advanced	The meter's password is used to confirm user access when configuring the meter through the display or over communications. The default meter password is 0 (zero).
Active web server	Standard/advanced	This option allows you to enable or disable the ability to configure your device using webpages.
Allow Modbus programming	Advanced only	This option can only be enabled in advanced security and is disabled for standard security.
Allow front panel programming	Standard/advanced	This option allows you to enable or disable the ability to configure your device using the display.
Allow broadcasting time synchronization	Advanced only	This option can only be disabled in advanced security and is enabled for standard security.
Protocol lockout	Standard/advanced	This option allows you to configure the number of access attempts before lockout, lockout duration and meter access event priorities.

Advanced security user configuration

Advanced security allows you to configure users with specific access levels and passwords.

Security configuration process

The following is an overview of the process to configure security on your meter:



Communications protocol lockout overview

The communications protocol lockout security feature allows you to set the number of invalid login attempts that each user can make using a particular protocol and communications method before being locked out (a user is defined as a user login and password combination). For protocols that are not session-based (ION), you can configure how often the device registers invalid login attempts by configuring the session timeout. You can also configure the lockout duration for all configurable protocols.

NOTE: If protocol lockout is set to 0 (zero) there is no limit to the number of invalid login attempts and the protocol will never be locked out. However, the invalid login attempt events are recorded if the meter access events are configured to record invalid access attempts.

Session timeout specifies the active duration for a protocol; during this time, repeated invalid login attempts using the same USER/password combination are not registered (repeated invalid attempts with different combinations are still registered). Session timeout only applies to protocols which are not session-based and send credentials with each packet, and should be configured to help prevent accidental lockouts and filling the meter's event log with protocol access events.

Once a user is locked out, the device will not accept login attempts from that user on that protocol and communications method until the lockout duration has passed. Invalid login attempts accumulate until the user has completed a valid login or been locked out. For example, once USER01 has been locked out using ION over Ethernet, USER01 cannot access the device using ION over Ethernet until the lockout duration has

passed, even if USER01 enters the correct password. However, if the user enters the correct USER/password combination before being locked out, the invalid attempt counter is reset to zero. Even if the user is locked out using ION over Ethernet, that user can still access the device by entering the correct USER/password combination over a different protocol and communications method (for example, connecting to the device's RS-485 serial port using Modbus protocol).

Related topics

- See “Configuring standard security using ION Setup” on page 87 for instructions on how to set basic security and configure communications protocol lockouts.
- See “Protocols, ports and connections” on page 52 for details of the supported Ethernet protocols, enabling/disabling protocols and changing port numbers.
- See “Specifications” on page 181 for the number of configurable users in advanced security.
- See the ION Reference for more information about the Security Options, Security User and Communications modules.

Security recommendations and best practices

Recommended security configuration

The following meter configuration is recommended to help improve security on your meter.

- Ensure that your meter requires a password for configuration through the display or communications.
- Configure the protocol lockouts to help minimize access to your meter.
- Enable advanced security on your meter.
 - Configure users and passwords to help minimize access to your meter.
- Save a copy of your meter's ION Setup security configuration (*.scf) file in a secure location for future reference or troubleshooting. Your meter's security configuration file can be loaded onto other meters of the same type to configure their security settings.

Password best practices

- Change your meter's display (front panel) password from the default value of 0 (zero).
- Make your meter's display and user-specific passwords as complex as possible.
- Schedule regular changes to your meter's display and user passwords.
- Record your meter's display and user passwords in a secure location.

If your meter's user access information is lost, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Record your device's user and password information in a secure location.

Failure to follow these instructions may result in data loss.

Additional security recommendations

- Disable communications for all unused Ethernet network protocols.
- For the highest level of security, use a revenue-locked meter with advanced security enabled and configured for minimum access.
- Save a copy of your meter's security configuration (*.scf) file in a secure location for future reference or troubleshooting. Your meter's security configuration file can be loaded onto other meters of the same type to configure their security settings.
- Set your meter's time synchronization source to a secure communications port, and disable time synchronization on all other ports.

Related topics

- See "Protocols, ports and connections" on page 52 for more information about your meter's Ethernet network protocols.

Changing your meter's display password using the display

You can change your display password using your meter's display.

NOTE: The display password is also used as the webpage password if standard security is enabled.

1. Go to **Setup Menu > Password Setup**.
2. Configure your meter's display password.

Related links

- See "Setting up your meter using the display" on page 34 for instructions on how to configure your meter using the display.

Chapter 8 Communications

Your meter has one RS-485 connection and two Ethernet connections. The two Ethernet connections have the same IP address; you cannot connect your meter to two different Ethernet networks.

Ethernet communications

Connections

The meter supports a single IP address on both of its two physical Ethernet connections.

Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for communication connection details.

Ethernet LEDs

Your meter has two LEDs that indicate the status of its Ethernet communications:

Link (data rate)	On: valid Ethernet connection • Yellow: data rate is 10 Mbps • Green: data rate is 100 Mbps
Act (activity)	Flashing green: data is being transferred

Related topics

- See your meter's installation sheet for Ethernet wiring information.
- See "Ethernet communications" on page 183 for your meter's Ethernet specifications.

Configuration

In order to use Ethernet communications, you must configure your device's IP address; you must also configure the subnet and gateway information if required by your network. You need to enter network information for any Ethernet servers used by the device (such as for SNTP time synchronization).

NOTE: Contact your network system administrator for your IP address and other Ethernet network configuration values.

Configure your device's Ethernet settings by using the display or directly connecting to your meter and using a web browser to access the device's webpages. Modify your meter's Ethernet settings to those provided by your network system administrator before connecting the device to your local area network (LAN).

After the meter's Ethernet port is configured and connected to the LAN, you can use ION Setup to configure other meter setup parameters

Related topics

- See “Setting up your meter using the display” on page 34 for instructions on how to configure Ethernet communications using your meter’s display.
- See “Self-discovery over Ethernet” on page 53 for instructions on how to connect to and identify your meter over a directly connected network.
- See “Configuring network communications using ION Setup” on page 90 for instructions on how to configure your meter’s Ethernet communications using ION Setup.
- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Communications module and its settings.

Protocols, ports and connections

The Ethernet protocols supported by your device allow simultaneous connections on the following IP service ports:

Protocol	Port (default)	Number of connections
ION	7700	8 ¹
DNP	20000	
Modbus TCP	502	
Modbus RTU over Ethernet	7701	
Modbus TCP (dedicated)	502	32
EtherGate	7801	1
FTP	21 (20)	2
Webserver (HTTP) ²	80	10
SNMP	161	N/A
SMTP server (email) outgoing only	25	1
NTP	123	1
IEC 61850	102	4

¹ These 8 simultaneous connections can be used by ION, Modbus TCP, Modbus RTU over Ethernet, or DNP. You can have a maximum of 3 DNP connections.

² This is used for the meter’s webpages.

By enabling or disabling TCP/IP protocols, you can control whether or not your meter accepts new socket connection requests from the TCP/IP protocols supported by the meter. Changing settings does not impact existing connections. Depending on the protocol, you can also change the port number.

If you configure communications so that you cannot communicate to and configure your meter, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions may result in data loss.

Related topics

- See “Protocols” on page 57 for more information about the protocols supported by your meter.
- See “Network settings” on page 90 for instructions on how to enable/disable your meter’s TCP/IP protocols using ION Setup.

Ethernet topologies

Your device's Ethernet ports have the same IP address. The second Ethernet port acts as an Ethernet switch to help simplify network connections and reduce installation time and costs, by having shorter Ethernet cable runs between devices without needing additional Ethernet routers or repeaters. Your Ethernet connection source should be installed in a location that helps minimize the overall Ethernet cable routing length and complexity of your network.

Each of your device's Ethernet ports has full transmit/receive bandwidth: this means they do not split the signal, so connecting both of your device's Ethernet ports should not impact your communications speed.

When wiring your meter's Ethernet communications, it is recommended to only use straight-line topology. If local network loop or ring Ethernet topologies are required, you must enable RSTP (rapid spanning tree protocol) for your meter's Ethernet communications to function.

Internet protocol (IP) versions and supported features

Your meter supports both IPv4 and IPv6 (local addressing).

Your meter supports DPWS (devices profile for web services). This feature allows for self-discovery of the meter when directly connected on IPv6 local area networks.

Related topics

- See "Configuring network communications using ION Setup" on page 90 for instructions on how to enable and disable IPv6 on your meter.

Self-discovery over Ethernet

When you connect your meter directly to your computer, your meter automatically appears on the network. By default, the meter is named PM8000_<last six digits of MAC address>.

NOTE: You do not need to configure your meter's IP address for self-discovery over Ethernet; an IPv6 address is automatically generated from your meter's MAC address and self-discovery takes place over IPv6.

For example, a meter with a MAC address of 0060784173393 appears on the network as PM8000_713393.

Double-clicking the meter's network icon takes you to the meter's webpages, where you can view data and perform basic meter configuration.

NOTE: For self-discovery, the meter must be connected directly to the computer using only a cable or switches, and not by a router.

Serial communications

The meter supports serial communications through the RS-485 port. Up to 32 devices can be connected on a single RS-485 bus.

In an RS-485 network, there is one master device, typically an Ethernet to RS-485 gateway. It provides the means for RS-485 communications with multiple slave devices (for example, meters). For applications that require only one dedicated computer to

communicate with the slave devices, an RS-232 to RS-485 converter can be used as the master device.

Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for details on how to physically wire your meter's RS-485 connections.
- See "RS-485 communications" on page 183 for specifications related to serial communications.

Serial protocols and ports

Your meter supports the following protocols on its RS-485 serial port:

Protocol
ION
Modbus RTU
Modbus Master
DNP 3.0
EtherGate
GPS: Truetime/Datum ¹
GPS: Arbiter ¹
GPS: Arbiter-Vorne ¹

¹ These protocol settings are for connecting to a GPS receiver communicating in serial ASCII format.

Related topics

- See "Protocols" on page 57 for more information about the protocols supported by your meter.

RS-485 connections

Your meter has one RS-485 connection.

Related topics

- See the "RS-485 communications" on page 183 for maximum devices and wire length.
- See your device's installation instructions, available from www.schneider-electric.com, for communication connection details.

RS-485 configuration

Before connecting your device to the RS-485 bus, use the meter's display, webpages or ION Setup to configure your meter's default RS-485 settings so that it has a unique unit identifier (address) and the following settings match the rest of the devices on the RS-485 bus:

- Protocol
- Baud rate
- Parity and stop bits

You can configure the following settings to help optimize communications performance:

- RTS delay
- RS-485 bias

You can use a communications converter (USB to RS-485 or RS-232 to RS-485) or an Ethernet gateway device to connect to your meter.

RS-485 bias

You can use the RS-485 bias setting to fine tune communications. Turn on the RS-485 bias when the meter is acting as a master over RS-485 communications and turn off the RS-485 bias when the meter is acting as a slave. You can configure RS-485 biasing through the meter's display or ION Setup.

RS-485 and gateway communications

Your meter can act as a gateway from the devices on the RS-485 bus to another communications port on the meter. For example, you can configure your meter as an Ethernet gateway, which lets you communicate through the meter's Ethernet port to the serial devices connected to the meter's RS-485 port using the ION protocol (EtherGate) or Modbus protocol (Modbus gateway).

Related topics

- See the "Configuring an EtherGate gateway using ION Setup" on page 93 for instructions on how to configure EtherGate on your meter.
- See the "Configuring a Modbus gateway using ION Setup" on page 92 for instructions on how to configure Modbus gateway on your meter.

Configuring communications using the display

You can configure your meter's basic communications settings using the display.

Before configuring Ethernet parameters, make sure you obtain your meter's IP address and other network information from your network administrator or IT department.

Before configuring serial parameters, make sure you have a unique unit ID for your meter and know the serial network settings (protocol, baud rate, parity and stop bits).

1. Go to **Setup Menu > Communications Setup > IP Address Setup**. Configure your meter's IP Address and other network information as required.

NOTE: Your meter's default IP address is 169.254.0.10

2. Press the down button to access the next screen of meter communications settings and configure as required.

Related links

- See "Setup menu" on page 33 for a description how to navigate and use your meter's display.

Chapter 9 Protocols

Protocols overview

Your meter supports several different protocols over its Ethernet and serial connections.

Your meter's default protocol implementation meets the needs of most systems with only basic configuration. You can customize these implementations to meet your specific needs; these are advanced procedures that require an understanding of ION architecture, the supported protocols, and the communications network and power system that your meter is connected to.

ION

ION is the native protocol and architecture of your meter. The basic building blocks of ION architecture are the ION modules, each of which is specialized to perform a specific task and contains data and instructions on how to manage that data. ION modules are combined (linked) together to create the meter's functions and features. ION modules that are linked together to perform a specialized task are called a framework, such as the Power Quality framework. These different functional frameworks are then grouped together to define the entire meter, and are collectively referred to as the device template.

Your meter ships with a default device template which provides extensive capabilities. You can also configure your meter's template to modify your meter's existing functions or to create new functions.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for further information about ION architecture and a detailed description of the different ION modules.
- See the *ION Device Template Reference*, available from www.schneider-electric.com, for details on the modules and their configuration in your meter's default template.

Modbus

Modbus is a master/slave communications protocol where the master initiates transactions and the slave(s) responds with the requested information or action. Your device can function as a Modbus slave or Modbus master, depending on how it is configured. Your device comes with Modbus slave functionality configured and ready to use. You can add custom Modbus information to the default Modbus slave data provided by your device.

Key terms

Term	Definition
Modbus gateway	A communications method that lets you communicate through an Ethernet gateway device to a Modbus serial network connected to that device.
Modbus master	A device that issues commands and receives responses from Modbus slave devices. Serial Modbus networks can only have one Modbus master per network.

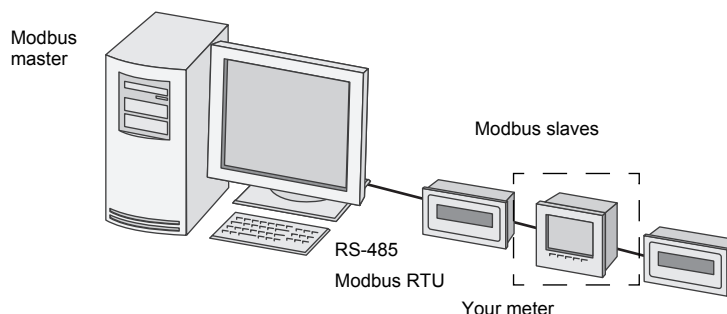
Term	Definition
Modbus RTU	Serial Modbus protocol format; Modbus RTU transmits data using binary. Master and slave devices must use the same format.
Modbus register/address	Identifies the data to read/write. Modbus register maps are available for Modbus slave devices and detail the information available from the slave device. More than one register may be used to store a single value.
Modbus slave	A device that responds to Modbus commands and performs actions or provides information back to the Modbus master. Most Modbus networks contain multiple slave devices.
Modbus TCP	The Ethernet Modbus protocol format.
Modbus unit ID	The identifier for a slave Modbus device.

Related topics

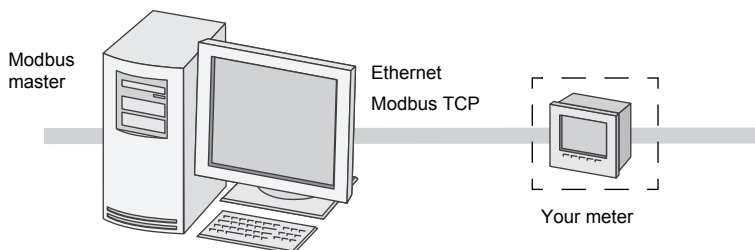
- See “Ethernet gateway (EtherGate and Modbus gateway)” on page 62 for more information about Modbus gateways.
- See “Configuring custom Modbus data using ION Setup” on page 91 for instructions on adding custom Modbus data to your device.
- Download your device’s Modbus map, available from www.schneider-electric.com.
- See the *ION Reference*, available from www.schneider-electric.com, for details about the Modbus Master Device, Modbus Master Map, Modbus Master Options, and Data Mapping modules.
- Go to www.modbus.org for information about the Modbus protocol.

Modbus network examples

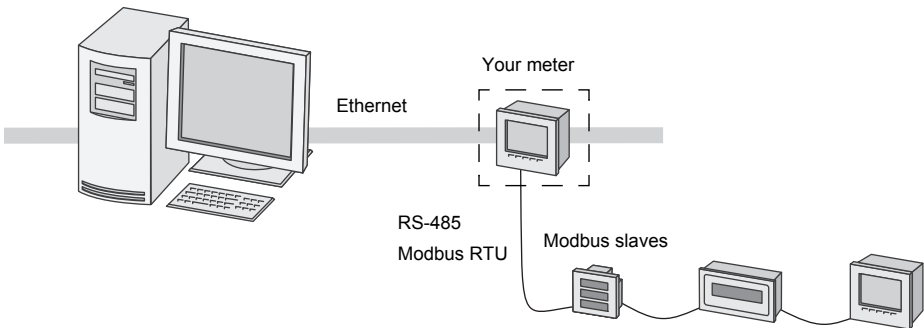
Your meter as a Modbus slave on a serial network



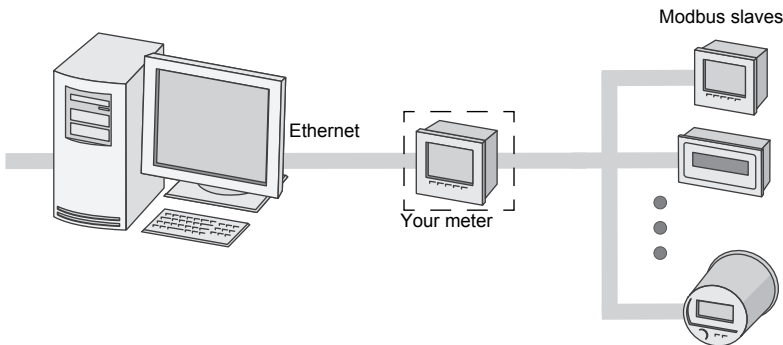
Your meter as a Modbus slave over Ethernet



Your meter as a Modbus master with serial Modbus slave devices



Your meter as a Modbus master with Ethernet Modbus slave devices



Supported features

Modbus data classes

Class	Description
Coils	Digital bits that can be read and written to
Input status	Digital bits that can be read
Input registers	16-bit integers that can be read
Holding registers	16-bit integers that can be read and written to

Modbus data formats

Format	Type	# of Modbus registers used
Unsigned 16-bit	Integer	1
Signed 16-bit	Integer	1
Unsigned 32-bit	Integer	2
Signed 32-bit	Integer	2
Unsigned 32-bit M10k	Integer	2
Signed 32-bit M10k	Integer	2
IEEE float ¹	Floating point	2
Packed Boolean for inputs	Integer	1
Packed Boolean for coils	Integer	1
Unsigned 16-bit read/write	Integer	1
Signed 64 bit	Integer	4

¹ Meters acting as Modbus masters support two versions of IEEE float with different word orders: high/low = Big Endian, low/high = Little Endian.

16-bit data (one word) is transmitted with most-significant byte first and least-significant byte second.

32-bit data (two words) is transmitted with the most-significant word first and the least-significant word second.

Modbus function codes

Function	Description	Master/slave
1	Read coil status	Master and slave
2	Read input status	Master and slave
3	Read holding registers	Master and slave
4	Read input registers	Master
5	Write to a coil	Master
6	Write to a holding register	Master and slave
15	Write to multiple coils	Master
16	Write to multiple holding registers	Master and slave
17	Report slave ID (serial only)	Master and slave
43 (subcode 14)	Read device identification	Master and slave
100	Read scattered holding registers	Master and slave

Modbus commands

A Modbus master command to unit ID 0 is broadcast (sent to) all Modbus slave devices. The only supported broadcast command is preset multiple registers.

For serial Modbus networks with only one slave device, the master can send commands using the single connection, one-to-one address of unit ID 248, regardless of the slave device's actual unit ID.

Modbus implementation

Modbus exception codes

Code	Name	Description
01	Illegal function	The requested command is invalid.
02	Illegal address	This code indicates one of the following: - The requested address is invalid for that function. - The requested address is not within the valid register range for this device. - The requested address is protected by device security.
03	Illegal value	This code indicates one of the following: - The requested value is not allowed for that register in the device. - The requested register is part of a multi-word value.

Modbus invalid read registers responses

Invalid type	Read response
Unmapped (unused) ¹ register	0x8000
Reserved ¹ register responses by type	
Signed integer 16-bit	0x8000
Unsigned integer 16-bit	0xFFFF
Signed integer 32-bits	0x80000000
Unsigned integer 32-bits	0xFFFFFFFF
Signed integer 64-bits	0x8000000000000000
Float32	0xFFC00000 (NaN = Not a number)

¹ Unmapped (unused) registers are registers that will never be used by the meter, and therefore have no defined format. Reserved registers have a defined format and are intended for use by the meter, its options or its variants.

Modbus invalid write registers response

If the meter receives a write command to a Modbus register address that does not have a register mapped, the meter does not respond. No data is written or stored, and the meter does not send back a rejection to the request.

If the meter receives a write command to a read-only Modbus register address, exception code 3 (illegal value) is returned.

Fixed and configurable Modbus map

Your device has a fixed (static) register map for meter data and a flexible, user-configured register map.

Modbus security

Your meter's onboard security options include Modbus-specific settings. These security settings may need to be configured in order to write Modbus data to the meter.

Modbus TCP ports

Port	Descriptions
502	Modbus TCP
7701	Modbus RTU over Ethernet

Modbus best practices

Serial

In order for your meter to operate as a serial Modbus device, you must complete the following prerequisites:

Prerequisite	Description
Wiring	The device's serial connection must be wired correctly. The Modbus slave devices must have communications wiring to the Modbus master.
Protocol	Slave: for your meter to be a serial Modbus slave, the meter's protocol must be set to Modbus RTU. Master and slave devices must use the same format. Master: for your meter to be a serial Modbus master, the meter's protocol must be set to Modbus Master.
Baud rate	The baud rate must be the same for all devices on the serial Modbus network.
Stop bits and parity	The communication stop bits and parity (for example, 8N1) must be the same for all devices on the serial Modbus network.
Unit ID	Each device on the serial Modbus network must have a unique unit ID (also called the device address).

Ethernet

In order for your meter to operate as an Ethernet Modbus device, you must complete the following prerequisites.

NOTE: You do not need to perform any Modbus-specific configuration for your meter to function as a Modbus slave device over Ethernet.

Prerequisite	Description
Ethernet	All devices must have a working Ethernet connection.
IP address	All devices must have a unique IP address.
Port	All devices must be communicating over Ethernet port 502 for Modbus TCP.

NOTE: Devices supporting multiple simultaneous Modbus TCP connections can have communications delays. Adjust your network timeout settings to accommodate this.

Modbus master

In order for your meter to operate as a Modbus master, you must complete the following prerequisites.

NOTE: These settings are required in addition to the serial or Ethernet Modbus prerequisites.

Prerequisite	Description
Modbus slave devices	All Modbus slave devices must be communicating and appropriately configured.
Protocol	- Modbus mastering serial devices: the master's serial port protocol must be set to Modbus master. - Modbus mastering Ethernet devices: the master must be communicating to the slave devices over Ethernet port 502.
Mastered devices	The Modbus master device must have the slave device information entered for mastering.

Modbus map

Your device's Modbus register information (map) is available for download from www.schneider-electric.com. The Modbus register information includes:

- registers and mapped values
- formats and scaling
- additional details where applicable

Configuring your meter for Modbus using the display

You can use the display to configure your meter as a Modbus slave or partially configure your meter for Modbus mastering.

NOTE: Before you begin, your meter's communications must be wired and configured.

Your meter does not require any Modbus-specific configuration to act as a Modbus slave device over Ethernet.

1. Navigate to **Setup Menu > Communications Setup** and select the serial communications setup screen.
2. Configure the serial port's Modbus parameters as required.

Parameter	Setting
Protocol	Modbus RTU or Modbus master
RS485 Bias	• Off if the meter is a Modbus slave • On if the meter is a Modbus master

3. Configure the meter's other serial port parameters as required.

For Modbus master, you must add the Modbus slave devices using ION Setup.

Related topics

- See "Setting up your meter using the display" on page 34 for instructions on display menu navigation.

Ethernet gateway (EtherGate and Modbus gateway)

Ethernet gateway is a communications method that allows you to communicate through a gateway device to a serial network.

When a meter with gateway capabilities is installed on an Ethernet network, a master device (such as an energy management system) can communicate through the

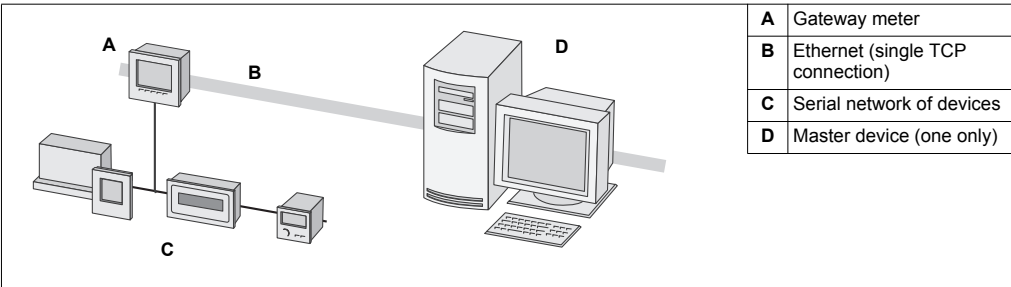
gateway meter to a serial network of devices connected to the gateway meter’s serial port(s). The maximum number of devices on the serial network is determined by the limitations of the gateway meter’s serial port.

There are two types of Ethernet gateways that you can configure on your meter:

- EtherGate: a single TCP connection communicates through the gateway meter to a serial network of ION devices.
- Modbus gateway: up to a maximum of 32 Modbus master TCP connections communicate through the gateway meter to a serial network of Modbus devices.

EtherGate

The meter can function as an Ethernet gateway (EtherGate). EtherGate is a protocol-agnostic communications method that lets you communicate through a gateway meter to a serial network of devices letting ION or other RTU over TCP data pass through the gateway meter to other networks, including third party systems. When a meter installed on the Ethernet network has EtherGate enabled, a master device (such as an energy management system) can communicate through the gateway meter to a serial network of devices wired to the gateway meter’s COM port. You must create an additional communications connection to the gateway meter in order to read its information.



For EtherGate, you must install the serial devices, configure them and connect them to your Ethernet-connected gateway meter. Ensure that each serial device is configured with the same protocol and baud rate and has a unique unit ID. Configure the gateway meter’s serial port to use the EtherGate protocol, create the EtherGate site in ION Setup or an energy management system, and add the serial devices to the EtherGate site.

NOTE: EtherGate supports only one master device.

Related topics

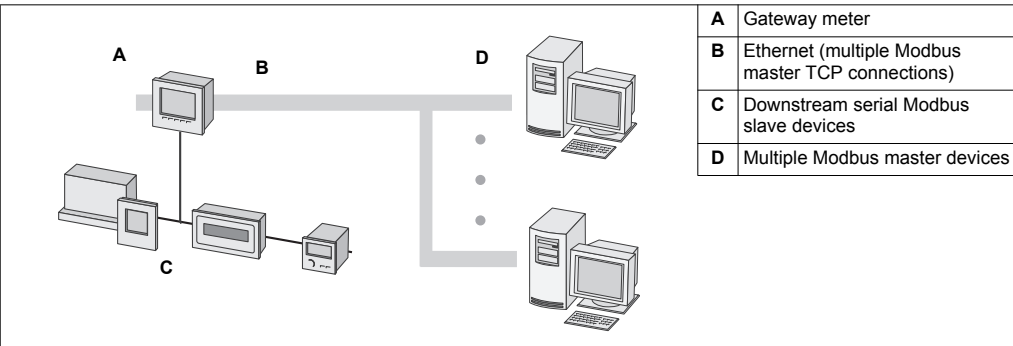
- See “Configuring an EtherGate gateway using ION Setup” on page 93 for instructions on setting up an EtherGate gateway.
- See “Specifications” on page 181 for how many serial devices your meter can support.

Modbus gateway

In a Modbus gateway configuration, a Modbus master device can communicate using Ethernet through the gateway meter to downstream serial devices.

A Modbus request is sent through Ethernet using Modbus/TCP to the gateway meter. If this request is addressed with the slave ID of one of the downstream serial devices, the meter forwards the message to that device using Modbus RTU. When the downstream device responds, the gateway meter forwards the response back to the

Modbus master. In addition to Modbus slave addresses 0 - 247, the Modbus gateway supports slave address 255, which sends a Modbus request to the gateway meter only.



The maximum number of Modbus gateway Ethernet connections available is equal to the number of Modbus TCP connections the gateway meter can handle.

For Modbus gateway, you must install the serial Modbus slave devices, configure them and connect them to your Ethernet-connected Modbus gateway meter. Ensure that each serial device is configured to communicate over Modbus with the same baud rate and has a unique unit ID. Configure the gateway meter's serial port to use the Modbus master protocol and enable the Modbus gateway feature, create a Modbus gateway site in ION Setup or an energy management system, and add the serial devices to the Modbus gateway site.

Related topics

- See “Configuring a Modbus gateway using ION Setup” on page 92 for instructions on setting up a Modbus gateway.
- See “Specifications” on page 181 for how many serial devices your meter can support.

Configuring EtherGate using the display

You can use the meter's display to configure a serial port to use the EtherGate protocol.

1. Navigate to **Setup Menu > Communications Setup** and go to the serial communications setup screen.
2. Set the serial port's protocol to EtherGate. Configure the other serial port parameters as required.

Related topics

- See “Setting up your meter using the display” on page 34 for instructions on how to navigate and use your meter's display.

FTP

Your meter has an internal FTP server where you can load custom webpages and other files onto your meter, and where the meter provides files created by meter features such as COMTRADE waveform records.

File transfer protocol (FTP) is a standard, client-server network protocol used to transfer files over TCP (Ethernet) networks.

NOTE: You can update the firmware on your meter's accessories using your meter's FTP site.

FTP memory allocation

Your meter's FTP memory usage changes when you copy a file to the meter's internal FTP site or modify a feature that uses the meter's FTP site.

If you attempt to load a file onto your meter's FTP site that is too large, your FTP program displays an error, and you must delete files from your meter's internal FTP site to free up memory before loading the file.

If you modify a meter feature which uses FTP memory, such as increasing the number of COMTRADE waveform records, the meter checks to confirm sufficient space is available on its internal FTP site before enabling the modified feature. If there is insufficient space, the feature is disabled, and you must delete files from your meter's FTP site to increase the available space before enabling the feature.

FTP file structure and permissions

Your meter's FTP folder structure is as follows:

- COMTRADE: you can read COMTRADE files from these folders, but you cannot delete or add files to these folders.
- IEC61850: you can add an IEC 61850 configuration (CID) file to this folder to activate the IEC 61850 protocol functions of your meter.
- optionModuleUpg and rmdUpg: you can load firmware update files for your meter's remote display or option modules into these folders.
- documents: this folder is intended for user storage. You can read, write and delete any type of files in this folder.
- web: this folder is where the meter's default webpages are stored and where you can add custom webpages to the meter by copying them into the appropriate sub-folders.

FTP filename requirements

FTP filenames are limited to standard ASCII characters, meaning that they cannot contain a blank space, quotation marks or \, /, *, ?, < or >, and are limited to 68 characters in length, including the file extension. The "/" character is only used as part of the FTP file directory information.

NOTE: FTP files from your meter can only be accessed and modified by Windows-based machines.

Supported FTP features

Ports

Port	Description
21	Command connection
20	Data connection (active and passive)

Your meter's command connection FTP port is configurable, and the data connection port is automatically assigned to the command connection port number minus 1.

FTP software

The recommended FTP software is Filezilla, WinSCP or Windows Explorer running on a Windows-based machine.

Related topics

- See “Specifications” on page 181 for the maximum number of FTP sessions and default timeout value.

Accessing your meter's FTP server

You must have FTP software such as Filezilla, WinSCP or Windows Explorer running on a Windows-based machine to transfer files to and from your meter's internal FTP server.

1. Start your FTP software.
2. Connect to your meter via FTP by entering your meter's IP address. Depending on your FTP software and meter security settings, you may be prompted for login credentials.

NOTE: With standard meter security (no user configured), enter login credentials of 8000 and the meter password to connect to the meter. For advanced meter security, enter a valid user and password.

3. Navigate to the appropriate folder on your meter.
4. Close your FTP software to disconnect from the meter. The FTP connection automatically disconnects once the FTP timeout period has elapsed.

SNMP

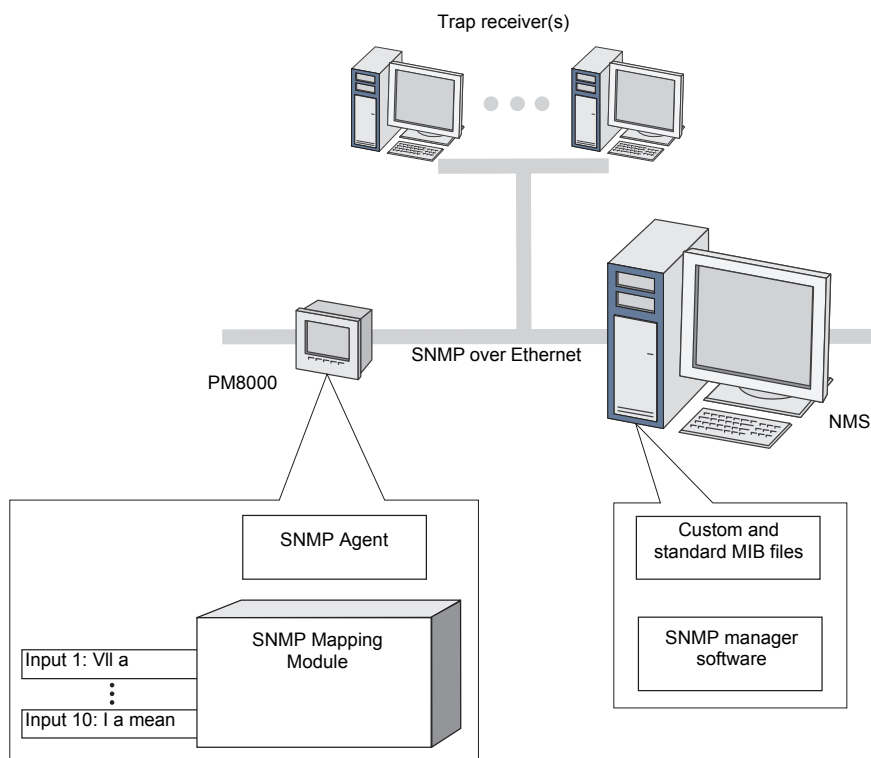
Simple Network Management Protocol (SNMP) is part of the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite. It is an application layer protocol that enables the exchange of network management information between devices, allowing you to manage network performance and to identify and solve problems on networks with devices of various types.

Your meter supports SNMP once you have enabled SNMP on your meter. You need to upload the your meter's MIB file (available from www.schneider-electric.com) into the NMS managing your meter.

Key terms

Term	Definition
Agent	Software resident on the managed device which interfaces between the device and the NMS.
Managed device	Your meter in the SNMP network.
Community string	A text string that helps authenticate requests between the managed device and the NMS.
Managed object	Any parameter referenced in the MIB file, for example the parameters linked to the SNMP Mapping module on your meter.
MIB	A management information base which organizes the OIDs in a hierarchical tree.
NMS	A network management station, manager or client that executes applications to monitor and control devices. An NMS must have the standard and custom MIB files and SNMP manager software.
OID	An object identifier that uniquely identifies and labels a managed object in the MIB.
Trap receiver	An NMS that is configured to receive traps and whose IP address is an SNMP trap destination.

The meter in an SNMP system



SNMP implementation

MIB files

SNMP requires that you load your meter's ION MIB file (available for download from www.schneider-electric.com) into the NMS.

Your meter is compliant with MIB-II as defined by the standard MIB file RFC 1213. You must install RFC 1213, which is required to read basic network information for the meter (for example, TCP/IP traffic or number of packets received), if it is not included with your SNMP manager software.

Community strings

A community string is a text string which acts to help authenticate requests from the NMS to your meter. There are two community strings on your meter:

- **Read Only Community:** this community string is used by SNMP `get` (read-only) requests. The read only community string's initial factory-set value is **public**.
- **Read Write Community:** this community string is used by SNMP `set` (read/write) requests. The read write community string's initial factory-set value is **private**.

NOTE: You can also use the read write community string for SNMP `get` (read-only) requests.

If your meter receives an incorrect community string, it generates an AuthenticationFailure trap.

System strings

A system string is a text string which can be configured to provide information about your meter. There are three system strings on your meter:

- System contact: enter the name of the SNMP system administrator.
- System name: enter a descriptive name for your meter.
- System location: enter a description of your meter's location.

SNMP trapping

SNMP trapping allows your meter's agent to notify the NMS of events with an unsolicited SNMP message (a "trap" of the meter's alarm event). You can enter up to four IP addresses for SNMP trap notification for generic and enterprise-specific traps. For enterprise traps, you must also define the number of events or maximum time delay before SNMP traps are sent to the NMS.

SNMP trapping is only supported on SNMP v2.

Generic SNMP traps supported by your meter are:

- Coldstart: the meter (SNMP agent) is starting.
- Linkup: the SNMP agent is enabled.
- AuthenticationFailure: the meter (SNMP agent) has received an incorrect community value.

Enterprise-specific SNMP traps supported by your meter are:

- Low: trap of events with a low event priority.
- Medium: trap of events with a medium event priority.
- High: trap of events with a high event priority.

Trap	Event priority range
Low	64 - 127
Medium	128 - 191
High	192 - 255

NOTE: The number of events or maximum time delay settings only apply to enterprise SNMP traps.

SNMP Mapping module

The SNMP Mapping module is linked by default to the most commonly used meter values to make them available to SNMP. Modification of the SNMP Mapping module is an advanced procedure that should only be undertaken by those with an advanced understanding of SNMP, ION architecture and their meter's template.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for detailed information on the SNMP Mapping, SNMP Options and Alarm Options modules.
- See "Configuring SNMP using your meter's webpages" on page 117 for instructions on how to configure your meter's SNMP functions using your meter's webpages.
- See "Configuring SNMP using ION Setup" on page 94 for instructions on how to configure your meter's SNMP functions using ION Setup.

Default SNMP mapping

Enabling SNMP provides SNMP access to the meter values linked to the SNMP Mapping module. You can configure the SNMP Mapping module to link to different meter values. By default, the following meter values are linked to the SNMP Mapping module:

I a	kVAR tot	VII ca	VIn avg	Ib mean	kW sd mx del-rec
I b	kVA tot	VII avg	Freq	Ic mx	kW sd del
I c	PF sign tot	VIn a	Ia mx	Ic mean	kW sd rec
I avg	VII ab	VIn b	Ia mean	kW sd mx del	kW sd del-rec
kW tot	VII bc	VIn c	Ib mx	kW sd mx rec	kVAR sd mx del
kVAR sd mx rec	kVAR sd mx del-rec	kVAR sd del	kVAR sd rec	kVAR sd del-rec	kVA sd mx del
kVA sd mx rec	kVA sd mx del-rec	kVA sd del	kVA sd rec	kVA sd del-rec	kWh del
kWh rec	kWh del-rec	kVARh del	kVARh rec	kVARh del-rec	kVAh del
kVAh rec	kVAh del-rec				

The following meter information is always provided by default and cannot be configured:

Voltmode	Model number
Serial number	Device name
Firmware version	MIB version

If you change your meter's default values you must modify the custom MIB file to reflect the new values.

Changing your meter's default SNMP configuration assumes that you have an advanced understanding of ION architecture, SNMP, and the communications network and power system that your meter is connected to.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for detailed information on the SNMP Mapping module.

Configuring your SNMP MIB file

You must configure your MIB file if you have modified the default SNMP information provided by the meter in order for the MIB file labels to reflect the modified values.

Download the ION MIB file from www.schneider-electric.com.

NOTE: You should only configure the variable name and description. Changing other fields in your MIB file may cause the client software to report problems or return errors when trying to retrieve or view parameters.

The variable name must conform to the following rules:

- The first character must be a letter.
 - The first character must be lower case.
 - The name must not contain any special characters such as *, ?, &.
 - The name must not contain spaces.
1. Open your meter's MIB file in a text editing program (such as Notepad).
 2. Update the variable name and description so they match the meter values connected to the SNMP Mapping module.

3. Save your meter’s MIB file. Make sure you keep the original file extension of .MIB.

Example—This example shows an original and an updated OID entry in an MIB file, where the default meter value of voltage line-to-neutral phase A is modified in the meter’s SNMP Mapping module and is now connected to voltage line-to-neutral phase C.

Original OID entry	
VIn_a	OBJECT-TYPE
SYNTAX	DisplayString (SIZE (0..255))
ACCESS	read-only
STATUS	mandatory
DESCRIPTION	"Host Meter Voltage Line A to Neutral Units = V (Volts)" ::= { schneiderElectric 34 }

You must update the variable name and description to match the meter values connected to the SNMP Mapping module:

Value	Original	Updated
Variable name	VIn_a	VIn_c
Description	"Host Meter Voltage Line A to Neutral Units = V (Volts)" ::= { schneiderElectric 34 }	Host Meter Voltage Line C to Neutral Units = V (Volts)" ::= { schneiderElectric 34 }

The SNMP client software reads the original and updated file as follows:

Original	Updated
variable name: VIn_a Description: "SNM1 Input 1 - Voltage (line-to-neutral) phase A"	variable name: VIn_c Description: "SNM1 Input 1 - Voltage (line-to-neutral) phase C"

IEC 61850

IEC 61850 is an Ethernet-based protocol designed for electrical substations. It is a standardized method of communications, developed to support integrated systems composed of multi-vendor, self-describing IEDs (intelligent electronic devices) that are networked together.

Your meter can be integrated into an IEC 61850 system as an IED (or server) supporting concurrent IEC 61850 client connections and an FTP connection (used for transferring data or configuration files).

Related topics

- Go to the IEC (International Electrotechnical Commission) website at www.iec.ch for information about the IEC 61850 protocol.
- See the *IEC 61850 and ION Technology* protocol document, available from www.schneider-electric.com, for more information about how IEC 61850 is implemented on your meter.
- See the *ION Reference*, available from www.schneider-electric.com, for a description of the IEC 61850 ION modules.

Implementation

Your meter comes configured with a default set of meter data available to IEC 61850. This default set of meter data is used in the default data sets and reports in the ICD file(s) available for download from www.schneider-electric.com.

NOTE: Select the ICD file that matches your meter’s option module configuration.

You must load a valid IEC 61850 configuration (CID) file into the meter's internal FTP site in order to activate the IEC 61850 features of your meter.

NOTE: Your meter can have only one IEC 61850 configuration (CID) file loaded onto its internal FTP storage. If additional CID files are loaded, IEC 61850 functions are deactivated until the additional files are removed.

Your meter has up to five dedicated IEC 61850 client connections.

You can load the IEC 61850 configuration file and configure the IEC 61850 custom modules using ION Setup.

Related topics

- See "FTP" on page 64 for information about your meter's FTP connections and folders.
- See "Loading an IEC 61850 configuration file using ION Setup" on page 95 for instructions on how to load your meter's CID file.
- See "Configuring additional data for IEC 61850 using ION Setup" on page 95 for instructions on how to add extra meter data to IEC 61850.
- See "Configuring digital outputs for IEC 61850 control using ION Setup" on page 113 for instructions on how to configure your meter's digital outputs for IEC 61850.

COMTRADE

COMTRADE stands for COMMon format for TRAnsient Data Exchange defined by IEC 60255-24 edition 2001-05, and defines a common format for power quality event (disturbance) data in order to simplify retrieval, analysis and exchange of disturbance data between multiple sources and vendors.

The format of your meter's COMTRADE files is as defined by IEC 60255-24 edition 2001-05.

Your meter can automatically generate COMTRADE files and store them on the meter's internal FTP site. COMTRADE is configured as part of the default waveform recording but not enabled from the factory.

COMTRADE can be used in conjunction with IEC 61850.

NOTE: If you are generating COMTRADE waveform information, the associated waveform recorders cannot be modified unless COMTRADE is disabled. If the waveform recorders are not configured identically, COMTRADE waveform information will not be generated.

Related topics

- See the *COMTRADE and ION technology technical* note for detailed information about COMTRADE file formats and implementation
- See "Configuring COMTRADE waveform recording using ION Setup" on page 110 for instructions on how to enable and configure COMTRADE waveform recording
- See "FTP" on page 64 for information about your meter's FTP connections and folders.

DNP

The Distributed Network Protocol Version 3.0 (DNP 3.0) is an open protocol used in the electric utility industry for communications and interoperability among substation

computers, Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs, e.g. meters), and master stations.

Your meter can be integrated into a DNP network as a DNP slave.

Supported features

Your meter supports a maximum of three concurrent connections (sessions) using the DNP 3.0 protocol; one for each serial port, up to three using Ethernet, or a combination of both. Combinations available depend on the meter's communications options. A session consists of all incoming and outgoing DNP Master/Slave traffic on one of the meter's communications ports.

Default implementation

Your meter is pre-configured for basic DNP Slave functionality. For serial DNP communications, you must assign the DNP protocol to the appropriate serial communication port on your meter; you do not have to configure your meter's Ethernet port(s).

You can modify your meter's default DNP map using configuration software.

Importing data using DNP 3.0

Data can be imported into the meter from a DNP control relay or analog output device. This is an advanced feature intended for users with an in-depth understanding of the DNP 3.0 and ION protocols.

Related topics

- See the *PM8000 DNP 3.0 Device Profile* document, available from www.schneider-electric.com, for detailed information on your meter's default DNP map and implementation.
- See the online ION Setup help for instructions on connecting to your meter and accessing the Setup Assistant, which can be used to modify your meter's DNP port settings and default DNP map.
- See the *Multiport DNP 3.0 and ION Technology* technical note, available from www.schneider-electric.com, for more information on how your meter supports DNP 3.0.

Chapter 10 Time and time synchronization

Your meter supports different time types and time synchronization methods to adjust its internal clock.

Time overview

Your meter's internal clock is used for keeping time, timestamping data and determining intervals for time-based measurements. The meter's clock does not affect externally logged data.

Your meter monitors the passage of time using the frequency of an internal oscillator or the frequency of the line power being measured. You can view your meter's time and date information using the display or through software. To improve your meter clock's accuracy, you can use an external time reference, such as a Global Positioning System (GPS) signal.

Your meter's battery maintains the internal clock when the meter is unpowered.

Your meter displays local time based on the meter's time sync source and settings for timezone and daylight savings time. You can configure your meter's date and time format.

Related topics

- See “Configuring time and time synchronization using ION Setup” on page 96 for instruction on configuring your meter's clock settings.
- See the *Time synchronization and timekeeping* technical note, available from www.schneider-electric.com, for more information about time formats and settings.
- See the *ION Reference*, available from www.schneider-electric.com, for a detailed description of the Clock module and its operation.

Time synchronization overview

The time synchronization source and the duration between time synchronization messages determines the accuracy of the meter's clock.

The clock is adjusted by synchronizing the meter's time with another time source. Time synchronization messages can be automatically generated and sent to your meter from your energy management system software or other time source such as an SNTP/NTP server or GPS receiver. You can also manually trigger a time synchronization message from your energy management system or configuration software.

NOTE: To help maintain data integrity, some energy management systems impose a blackout rule where time synchronization messages near energy interval boundaries are ignored.

Time synchronization sources

Use only one time synchronization source or method on each network to help prevent conflicting time synchronization information. For meters connected to energy management software, the same time synchronization method must be set for all meters connected to the system to help prevent timestamp inconsistencies.

NOTE: If you are configuring your meter clock remotely from another time zone, make sure you modify the meter's configuration to match local time.

For time synchronization sources with a resolution of one second or more, the meter time is only adjusted by a time synchronization message if the difference between the meter time and the message time is greater than one second.

Related topics

- See "Configuring time and time synchronization using ION Setup" on page 96 for instructions on configuring your meter's time synchronization settings.

Supported time synchronization sources

The following time synchronization sources are available to your meter:

- **Meter configuration software (ION Setup):** Configuration software can manually synchronize the time of your meter based on the clock of the computer running the configuration software. Configuration software synchronization is usually performed when the meter is initially commissioned.
- **Energy management system:** Energy management systems can synchronize the time of your meter to be consistent with other meters on the network.
- **Simple Network Time Protocol (SNTP):** SNTP can synchronize the time of your meter up to ± 1 second of other meters on an Ethernet network. For SNTP time synchronization, your meter must be connected to an Ethernet network that has an active SNTP server and be configured with the server's information.
- **GPS receiver (IRIG-B):** A GPS receiver using IRIG-B can synchronize the time of a meter up to ± 1 ms of Coordinated Universal Time (UTC). A dedicated serial network is required to implement a GPS scheme. For IRIG-B, one of your meter's digital inputs must be connected to the IRIG-B network, and the digital input must be configured for IRIG-B time synchronization in addition to configuring your meter's clock.

NOTE: Use the digital inputs located on the meter base for IRIG-B time synchronization and other high-accuracy applications.

- **GPS over serial:** A GPS receiver can synchronize the time of a meter up to ± 1 ms of Coordinated Universal Time (UTC). For GPS over serial, your meter's serial port must be connected to a GPS receiver, and the serial port communications must be configured with the correct protocol setting.
- **Network Time Protocol (NTP):** NTP can typically synchronize the time of a meter to ± 10 to 100 ms, depending on network configuration. To implement NTP time synchronization, your meter must be connected to an Ethernet network that has an active NTP server and be configured with the server's information.

Configuring time information using your meter's display

1. Go to **Setup Menu > Date/Time/Clock Setup > Date & Time Setup**.
2. Configure your time and date formats, time zone offset, and daylight savings time offset. Press the down button to access the Clock Setup screen.
3. Configure the clock and time synchronization source, and the time synchronization time format.

Related topics

- See “Setting up your meter using the display” on page 34 for instructions on how to navigate and use your meter’s display.

Chapter 11 Firmware and templates

You can load different firmware versions and templates onto your meter.

Firmware and template overview

Firmware is your meter's operating system that enables the functions of your meter. Your meter's template defines the meter's features such as its power measurement and analyzing functionality. Your meter ships from the factory with a default template, or you can customize your meter's template to create features specific to your meter's application. You can save your customized template and upload it to other meters of the same type.

You can view your meter's firmware version on your meter's display, webpages and through ION Setup.

You can upgrade your meter's firmware and template using ION Setup. Firmware updates and new factory templates are available for download from www.schneider-electric.com.

Your meter and accessories do not operate normally during firmware and template upgrades. Your meter's digital and analog outputs may change state during a firmware upgrade. Option modules are offline during an option module firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Loading firmware or template onto your meter clears the meter's recorded data.

NOTICE

DATA LOSS

Ensure that all important data has been recorded before uploading firmware or a template to your device.

Failure to follow these instructions can result in data loss.

Typical workflows

To update your meter to the latest available firmware and factory template:

- Download the latest firmware and template for your meter.
- Load the firmware onto your meter; the firmware upgrade process includes upgrading the meter template.

To take an existing meter out of service and replace it with a new meter:

- Save the template from the existing meter.
- Load the existing meter's template onto the new meter; the new meter will now have the customized features from the existing meter.

To update your meter's firmware without updating your meter's template:

- Save your meter's template.
- Download the latest firmware.
- Load the firmware onto your meter. When prompted for a template file, select the template you saved from your meter.

To update the firmware on your meter's remote display:

- Download the display firmware.
- Load the firmware onto the meter's internal FTP site using either an FTP program or ION Setup. The results of the firmware update are stored in the meter's event log.

To update the firmware on your meter's option module(s):

- Download the option module firmware; make sure that the firmware matches the option module type.
- Load the firmware onto the meter's internal FTP site using either an FTP program or ION Setup.
- Power cycle or perform an option bus reset to start the option module firmware upgrade.

NOTE: If the meter is power cycled or an option module reset is performed while there are option module firmware upgrade files loaded on the meter's FTP site, the option module firmware is upgraded.

Related topics

- Visit the company website at www.schneider-electric.com and search for "PM8000" to see the available firmware and templates.
- See "Loading meter firmware using ION Setup" on page 84 for more information about loading meter firmware.
- See the online ION Setup help for instructions on how to load meter templates.

Firmware overview

Your meter has the latest firmware loaded onto it at the factory.

Firmware is your meter's operating system. When new firmware is available for your meter, you can upgrade to the latest version to get the added features and functionality. The firmware version loaded on your meter is shown on your meter's display. You can use ION Setup to upgrade the firmware on your meter.

You must load a meter template as part of the firmware upgrade process. You can save your meter's existing framework before performing a firmware upgrade and then reload it back onto the meter if you do not want to change your meter's template.

Your meter's remote display and option module use firmware information from the meter, but they may also need to have their internal firmware updated if internal components change. To load and update to your meter's remote display firmware, you need to copy the file to your meter's internal FTP server.

You can download firmware files from www.schneider-electric.com.

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for more information on downloading, saving and loading your meter's template.

Laptop computer upgrade considerations

Laptop computers generally have different default power properties than desktop computers. Incorrect power options can adversely affect device upgrading because the connection between the laptop and the device must be maintained in order for the upgrade to proceed. If the laptop's hard disk shuts down or the laptop enters system standby mode, this connection is broken and the upgrade procedure must be restarted.

If you are upgrading your meter's firmware using a laptop computer, follow these guidelines:

- Plug the laptop computer into a wall outlet. Do not run the laptop on its battery.
- Configure the laptop's hard disks so that they do not shut down after a certain period of time (for example, set to "never").
- Turn off the laptop's power suspension (for example, system stand-by) and hibernate options.
- Disable the laptop's option to power down when it is closed. This prevents a shut down if the laptop is accidentally closed.
- Disable the laptop's screen saver; screen savers can burden the CPU.

Firmware upgrade considerations

Ensure that the firmware version you are upgrading to is compatible with your meter, and that the version number is greater than your existing firmware (or else you will downgrade your meter).

Your meter's existing template may not work with different firmware versions if significant meter features have been added or modified.

Remote display (RMD) upgrade behavior

Your meter's remote display will upgrade as soon as the upgrade file is put in the remote display upgrade folder on your meter's internal FTP site. It is deleted as part of the upgrade process.

NOTE: If your meter's remote display loses power during firmware upload, the display will revert to its original firmware and you will have to reload the firmware file.

The results of your remote display firmware upgrade are stored in your meter's event log. Detailed information about your remote display, such as serial number and firmware version is provided in the Factory module.

Related topics

- See “Remote display troubleshooting icons” on page 41 for a description of the icons displayed by the remote display when a display firmware upgrade is required.
- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Factory module.

Option module(s) upgrade behavior

To upgrade option modules, you must load the upgrade file into the appropriate folder on the meter's internal FTP site. The upgrade is triggered by either a power cycle or option module reset. After the upgrade is performed, the upgrade file is deleted from the meter's internal FTP site before the option module is reset to run the new firmware. The option module firmware will not upgrade if more than one upgrade file is in the folder. The upgrade file must be the correct file type and match the type of module being upgraded.

All option modules do not perform their regular functions during firmware upgrade. If more than one option module is being upgraded, the firmware on the option module closest to the meter is done first, then the next closest, proceeding to the furthest module from the meter base requiring upgrading. A single option module firmware upgrade should not take more than five minutes.

The option module upgrade results are stored in your meter's event log. Detailed information about the option module, such as serial number and firmware version is provided in the Factory module. Information about the option module type and details of the option module's state is provided in the Diagnostics module.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Factory and Diagnostic module.

Loading remote display firmware using FTP

You can upload firmware to your meter's remote display by loading the firmware upgrade file onto your meter's internal FTP site.

You must have:

- Your meter's remote display firmware upgrade (.BIN) file. You can download upgrade files from www.schneider-electric.com.
 - The remote display connected to your meter, and have access to your meter's internal FTP site.
1. Connect to your meter's internal FTP site. Open the remote display upgrade (rmdUpg) folder.
 2. Drag the remote display firmware file into the remote display upgrade folder. The file is immediately transferred to the remote display, and is not stored on the meter.
 3. Watch your meter's display to confirm the firmware upgrade is taking place
 4. Review the remote display firmware upgrade details stored in the meter's event log to confirm that the upload was successful.

Related topics

- See “Accessing your meter’s FTP server” on page 66 for instructions on how to connect to your meter using FTP.
- See “Event log overview” on page 134 for instructions on how to view your meter’s event log.
- See “Remote display troubleshooting icons” on page 41 for more information about the firmware-related icons shown on your meter’s remote display.
- See “Loading remote display firmware using ION Setup” on page 85 for instructions on how to load remote display firmware using ION Setup.

Loading option module firmware using FTP

You can upload firmware to your meter’s option modules by loading the firmware upgrade file onto your meter’s internal FTP site.

You must have:

- Your meter’s option module firmware upgrade (.SI9) file(s). You can download upgrade files from www.schneider-electric.com.
- The option module connected to your meter, and have access to your meter’s internal FTP site.

Your meter’s digital and analog outputs may change state during a firmware upgrade. Option modules are offline during an option module firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

NOTE: If your meter’s option module loses power during firmware upload, the option module will revert to its original firmware and you will have to reload the firmware file.

1. Connect to your meter’s internal FTP site. Open the option module upgrade (optionModuleUpg) folder.
2. Drag the option module firmware file into the appropriate option module folder. Repeat for all modules that you want to load firmware onto.
3. Power cycle or perform an option module reset to upload the new firmware to the option module(s).
4. Review the option module firmware update details stored in the meter’s event log to confirm that the upgrade was successful.

Related topics

- See “Accessing your meter’s FTP server” on page 66 for instructions on how to connect to your meter using FTP.
- See “Event log overview” on page 134 for instructions on how to view your meter’s event log.
- See “Loading option module firmware using ION Setup” on page 86 for instructions on how to load option module firmware using ION Setup.

Chapter 12 ION Setup

This section details the device configuration you can perform using ION Setup.

ION Setup overview

ION Setup is a free, downloadable device configuration tool. Devices can be configured over communications links whether they are locally or remotely located.

Devices such as your meter, based on ION architecture, have two different configuration methods using ION Setup.

- The standard method uses the setup assistant; a user-friendly tool that walks you through the process of setting up your meter. It is the recommended method for most users.
- The advanced method allows you to view and configure the ION modules directly. This is an advanced procedure that should only be done by those users who are expert in ION architecture and the systems in which the device is installed.

In addition to configuring your device, you can generate reports and view real-time and logged data using ION Setup.

Basic configuration can be done using your device's display or web pages, but many features are configured using ION Setup.

You can download ION Setup from www.schneider-electric.com. It is recommended that you always upgrade to the latest version of ION Setup to help properly configure features available on your device.

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Refer to the online ION Setup help for precautions and detailed information.

WARNING

INACCURATE DATA RESULTS

Verify that associated devices and ION Setup are configured correctly.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Performing resets and configuring features such as data or waveform recorders will clear recorded data.

NOTICE

DATA LOSS

Ensure that all important data has been recorded before configuring device.

Failure to follow these instructions can result in data loss.

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for instructions on how to use ION Setup and how to connect to your device using ION Setup

ION Setup device communication

Your device communicates to ION Setup using the ION protocol through its RS-485 serial communications port or over Ethernet.

If you are communicating over Ethernet, there are IP service ports set to the ION protocol, so you do not need to perform any additional device configuration to access your device using ION Setup. If you are communicating over RS-485, you will need to set the serial communications protocol to ION as well as configuring the rest of your serial communications settings.

Related topics

- See “Serial communications” on page 53 for instructions on how to configure your meter’s serial communication.

ION Setup device configuration

The best practice for configuring your device is to go through all the screens in the setup assistant and fill in the appropriate information for each feature as you go. The setup assistant has on-screen information and step-by-step wizards to help guide you through the process of configuring your device’s features.

This section contains additional information for ION Setup configuration tasks that are unique or have been modified for your device’s features and settings.

Template screen

Loading meter firmware using ION Setup

You can load firmware onto your meter using ION Setup.

You can download firmware for your meter from www.schneider-electric.com.

You must load a meter template as part of the firmware upgrade process. You can save your meter’s existing template by navigating to **Template > Save to PC** in the ION Setup Assistant and clicking **Save** to save your meter’s template as a .DCF file. You can also use a template that you have saved from another meter of the same type, or download a factory template from www.schneider-electric.com.

Ensure that you record your meter's user and password information in a secure location before upgrading the meter's firmware. If your meter's user and password information is lost, you must return the meter for factory reconfiguration, which resets your meter to its factory defaults and destroys all logged data.

Your meter's digital and analog outputs may change state during a firmware upgrade.

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Obtain the meter firmware (.UPG) and framework (.DCF) that you want to load onto your meter. Save the files where they can be accessed by the computer running ION Setup.
2. Start ION Setup.
3. Open the Setup Assistant for your meter.
4. Select the Template screen.
5. Click the Firmware Upgrade tab, then click **Upgrade**. Enter your meter's password (if prompted) and click **OK**.
6. Navigate to the meter firmware (.UPG) file and click **Open**. Enter your ION Setup password when prompted and click **OK**.
7. Navigate to the meter framework (.DCF) file and click **OK**. The Template Paste Options dialog box appears. Select the check boxes for the settings you want to retain (not overwrite) and click **OK**.

A dialog box describes the template upload and firmware upgrade progress, verifies the firmware, and finishes with an overview stating whether the firmware and framework were successfully uploaded onto your meter.

Loading remote display firmware using ION Setup

This procedure is specific to the DIN meters with a remote display, and cannot be performed on meters with an integrated display.

You can load updates to your meter's remote display firmware using ION Setup over an Ethernet connection.

You must have:

- Your meter's remote display firmware update (.BIN) file. You can download update files from www.schneider-electric.com.
- The remote display connected to your meter.
- FTP access to your meter from the computer running ION Setup.

NOTE: If your meter's remote display loses power during firmware upload, the display will revert to its original firmware and you will have to reload the firmware file.

1. Obtain the remote display firmware (.BIN) that you want to load onto your display. Save the files where they can be accessed by the computer running ION Setup.
2. Start ION Setup.
3. Open the Setup Assistant for your meter.
4. Select the Template screen.
5. Click the Firmware Upgrade tab, then click **Upgrade**. Enter your meter's password (if prompted) and click **OK**.
6. Navigate to where you have stored the remote display firmware. Select the Remote Display firmware file (*.BIN) as the file type. Select the remote display firmware (.BIN) file and click **Open**. Enter your ION Setup password when prompted and click **OK**.

A dialog box describes the firmware upgrade progress, verifies the firmware, and finishes with an overview stating whether the firmware was successfully uploaded

Loading option module firmware using ION Setup

You can upload firmware to your meter's option modules using ION Setup over an Ethernet connection.

You can only upload firmware to the same type of module; if you have different types of option modules connected to your meter, you must perform the upload process for each module type.

You must have:

- Your meter's option module firmware upgrade (.SI9) file. You can download upgrade files from www.schneider-electric.com.
- The option module connected to your meter, and have access to your meter's internal FTP site.
- FTP access to your meter from the computer running ION Setup.

All option modules do not perform their regular functions during firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Obtain the option module firmware (.SI9) files that you want to load onto your option module(s). Save the files where they can be accessed by the computer running ION Setup.
2. Start ION Setup.
3. Open the Setup Assistant for your meter.
4. Select the Template screen.

5. Click the Firmware Upgrade tab, then click **Upgrade**. Enter your meter's password (if prompted) and click **OK**.
6. Navigate to where you have stored the option module firmware. Select the Option Module firmware file (*.SI9) as the file type. Select the option module firmware (.SI9) file and click **Open**. Enter your ION Setup password when prompted and click **OK**.
7. A dialog box describes the firmware upgrade progress, verifies the firmware, and finishes with an overview stating whether the firmware was successfully uploaded

Basic setup screen

There are no additional tasks specific to your device for this screen.

Security

It is strongly recommended that you change your meter's display (front panel) password from the default value of 0 (zero).

If your meter's display (front panel) or user passwords are lost, or if you configure communications so that you cannot communicate to and configure your meter, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

- Record your device's display and user password information in a secure location.
- Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions may result in data loss.

Configuring standard security using ION Setup

You can fully configure standard and advanced security on your meter using ION Setup.

In order to change security settings, you must be logged into ION Setup with an appropriate ION Setup user level. You must also have the appropriate meter-level security access to configure meter security.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Security**. Select Security Mode and click **Edit**. The open dialog box appears.
4. Select the appropriate security configuration file (*.scf) to configure your meter:
 - Standard: allows you to configure basic security and communications protocol lockout.
 - Advanced: includes the standard security features and adds user access/ password security settings.

- The standard options or advanced options configuration screen appears. Configure the security parameters as required, some parameters can only be configured using advanced security:

Parameter	Standard/advanced	Details
Meter password	Standard/advanced	Default meter password is 0 (zero).
Active web server	Standard/advanced	This option allows you to enable or disable the ability to configure your device using webpages.
Allow Modbus programming	Advanced only	This option can only be enabled in advanced security and is disabled for standard security.
Allow front panel programming	Standard/advanced	This option allows you to enable or disable the ability to configure your device using the display.
Allow broadcasting time synchronization	Advanced only	This option can only be disabled in advanced security and is enabled for standard security.

Click **Next** to configure protocol access information. The protocol lockout screen is displayed.

- In the protocol lockout screen select the protocols that you want to be protected by the protocol lockout function. Select each protocol and click **Edit** to configure the protocol-specific parameters:

Parameter	Values	Description
Protocol lockout	0 - 255	The number of invalid login attempts before access is denied. If protocol lockout = 0, there is no limit to the number of invalid login attempts and the protocol will never be locked out.
Session timeout	1 - 43200 minutes (30 days)	The interval between access checks for non-session based protocols.

- Enter the lockout duration (in minutes).
- Click **Events** to configure user access event priorities. The Event Priorities screen appears.
- Configure the user access event priorities.
- If you have selected standard security, click **Finish**. You are prompted to save your security configuration to a file which can be loaded onto other meters.

NOTE: If you chose to save your security file, enter a descriptive name and click **Save**. It is recommended that you do not overwrite the default security files.

If you have selected advanced security, click **Next** to configure user access and passwords.

Related topics

- See “Configuring network communications using ION Setup” on page 90 for instructions on how to enable/disable Ethernet protocols and configure protocol port numbers.
- See “Security recommendations and best practices” on page 49 for recommendations for your meter’s security settings.

Configuring users and passwords using ION Setup (advanced security only)

In order to change security settings, you must be logged into ION Setup with an appropriate ION Setup user level. You must also have the appropriate meter-level security access to configure meter security.

You must have configured the standard security settings on your meter using ION Setup.

This task assumes that you are in the user configuration screen in the security wizard in ION Setup.

1. In the user/passwords screen, select (check) the user that you want to configure to view the user access options.
2. Select the appropriate values to configure the user's access:

Access	Description
Time sync	The user can set the meter's time and time synchronization parameters.
Read	The user can view all parameters except the security configuration.
Peak demand reset	The user can reset peak demand values.
Test mode	The user can put the meter into test mode (not applicable to the PM8000).
Full meter config	The user can configure all aspects of the meter except demand resets, test mode or security.
Security config	The user can configure security.

Some access levels require that multiple access options be selected.

3. Select the user and click **Password**. The password entry screen appears.
4. Enter the desired password and click **OK**.
5. Continue configuring user access and passwords for each unique user of the meter.

NOTE: Select **Show password when user selected** to display the password associated with that user. This feature is intended to help ensure that the correct password is entered for each user.

6. Click **Finish** to save your security configuration to the meter. You are prompted to save your security configuration to a file which can be loaded onto other meters.

NOTE: If you chose to save your security file, enter a descriptive name and click **Save**. It is recommended that you do not overwrite the default security files.

Loading an existing security configuration file (.scf) using ION Setup

You can load an existing security configuration file (*.scf) onto your meter using ION Setup. The *.scf file can be a configuration for either standard or advanced security and must be from the same model of meter.

In order to change security settings, you must be logged into ION Setup with an appropriate ION Setup user level. You must also have the appropriate meter-level security access to configure meter security.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to Security. Select Security Mode and click **Send**. The Open dialog box appears.
4. Navigate to the location of the *.scf file you want to load onto your meter. Select the *.scf file and click **Open**. The *.scf file is loaded onto your meter.

Serial Settings

Configuring your meter as a Modbus slave using ION Setup

You can configure your meter as a Modbus slave using ION Setup.

Your meter's serial connection must be wired and configured correctly. The same mode of serial communication must be used for all devices on the network.

Your meter does not require any Modbus-specific configuration to act as a Modbus slave device over Ethernet.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications > Serial settings**. Select the tab for the serial port you want to configure.
4. Highlight the parameter and click **Edit** to configure the serial port's Modbus parameters as required.

Parameter	Setting
Protocol	Modbus RTU or Modbus master
RS485 bias	• Off if the meter is a Modbus slave • On if the meter is a Modbus master

5. Configure the meter's other serial port parameters as required.

Related topics

- See your device's Modbus map, available from www.schneider-electric.com, for Modbus register information.

Network settings

Configuring network communications using ION Setup

You can configure your device's Ethernet settings using ION Setup.

If you are connected to your device over Ethernet, changing Ethernet configuration parameters without another method of configuration enabled may cause loss of communications with your device and render it inoperable. In this case a factory reconfiguration of your device is required, which resets your device to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions can result in data loss.

1. Start ION Setup.
2. Open the Setup Assistant for your device.
3. Select **Communications > Network Settings** and click the **TCP/IP** tab.
4. Select a setting and then click **Edit**. Configure the settings (for example, IP address, subnet or gateway) to match your communications system.

Parameter	Value	Description
Ethernet device name	configurable	This name is associated with your meter when using DPWS. By default, it is the meter type and the last 6 characters of its MAC address (example: PM8000_354386).
Enable IPv6	Yes/no	Specifies if IPv6 is enabled or disabled.
IP address	Contact your local network administrator for parameter values.	The Internet protocol address of your device.
SubnetMask		The Ethernet IP subnetwork address of your network.
Gateway		The Ethernet IP gateway address of your network.
Rx timeout	configurable	Specifies the number of seconds the meter waits for communication acknowledgments.
Modbus TCP Idle Timeout	configurable	Specify number of seconds the meter waits before disconnecting an idle Modbus TCP connection.
Modbus Gateway	Disabled/COM1	Specify the port on which Modbus Gateway sends/receives Modbus TCP requests. Note: For Modbus gateway to function properly, the serial port protocol must be set to Modbus Master.
MAC address	Read-only	The media access control (MAC) address is factory set and is for reference only.

- Click the **Protocols** tab.
- Select a protocol and then click **Edit**. Select whether the protocol connection requests are accepted by the meter, and configure the port number. Existing connections are not affected, but any new connections must comply with the meter's latest settings.

NOTE: The protocol port number is not configurable on all protocols.

Related topics

- See “Configuring standard security using ION Setup” on page 87 for instructions on how to configure protocol read/write access.

3rd party protocols

Configuring custom Modbus data using ION Setup

You can configure your meter's Modbus map using ION Setup.

- Start ION Setup.
- Open the Setup Assistant for your meter.
- Navigate to **Communications > 3rd party protocols** and click on the **Modbus slave** tab.
- Select the map name and click **Edit**. The Modbus map editor is displayed.
- Select a parameter and click **Edit** to configure:
 - the data associated with that register value
 - the register value
 - the register's format and scaling
- Click **Add** to add a new Modbus register, **Delete** to remove a Modbus register, **Set Name** to create a new name for your Modbus map, or **Save As** to save your Modbus map as a separate file.
- Click **OK**. Your Modbus changes are implemented on your meter.

Related topics

- Refer to your device's Modbus map, available from www.schneider-electric.com, for Modbus register information.

Configuring your meter as a Modbus master using ION Setup

You can configure your device to Modbus master slave devices over serial or Ethernet.

Make sure your master and slave devices have the prerequisite communications wiring and configuration before configuring your meter as a Modbus master.

NOTE: Devices supporting multiple simultaneous Modbus TCP connections can have communications delays. Adjust your network timeout settings to accommodate this.

The meter as a Modbus master over TCP/IP attempts to communicate with a slave device for up to 100 seconds (as per the RFC1122 standard) before moving on to the next slave device.

1. Start ION Setup
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications > 3rd Party Protocols** and click on the Modbus Master tab.
4. Click **Add** to add a Modbus slave device. The Modbus Device dialog appears.
5. Enter the Modbus slave information:
 - Enter the Modbus slave device's name and a label suffix (if applicable).
 - Select the device type of the slave device from **Device Type**.
 - Enter the unit ID of the Modbus slave device into **Slave ID**.
 - Select the serial or TCP connection from **Connected via**. This is the connection from the Modbus master to the slave device.
6. Click **Connections**. The Modbus Master Connections dialog appears.
7. Select the tab that corresponds to the connection you are configuring (for example, if you selected TCP Connection 1 from **Connected via**, select the TCP 1 tab) and configure it based on the connection type.

Connection type	Configuration
Serial connection	Select the serial communications port that is connected to the Modbus slave devices from the Assigned Port list.
TCP connection	Enter the IP address of the Modbus slave device, making sure that the IP port is set to 502.

Click **OK** to return to the Modbus Device dialog.

8. Click **OK** to add the slave device. The device now appears on the list. Repeat these steps to add all of your Modbus slave devices.

Related topics

- See “Modbus” on page 57 for Modbus master and slave prerequisites for communications wiring and configuration.

Configuring a Modbus gateway using ION Setup

You can configure Modbus gateway on your meter using ION Setup.

Before you begin, make sure you have completed the following tasks:

- Confirm the serial network of devices are wired and configured to have the same baud rate, serial port settings (for example, 8N1), and protocol (Modbus).
 - Confirm each serial device has a unique unit identifier.
 - Confirm the serial network of devices are connected to the gateway meter's serial communication port.
 - Confirm your gateway meter is communicating over Ethernet.
1. Start ION Setup.
 2. Open the Setup Assistant for your meter.
 3. Navigate to **Communications > Serial settings** and select the tab for the communications port that the serial network is connected to.
 4. Select **Protocol** and click **Edit**. The protocol selection screen appears.
 5. Set the protocol to Modbus Master.
 6. Navigate to **Communications > Network settings** and select the TCP/IP tab. Select **Modbus Gateway** and click **Edit**. The Modbus gateway selection screen is displayed.
 7. Select the communications port that the serial network is connected to (and you just set to use the Modbus master protocol) and click **OK**. The Modbus gateway connection is created.
 8. Create an Ethernet gateway site to access the serial network of devices through your gateway meter.

Configuring an EtherGate gateway using ION Setup

You can configure EtherGate on your meter using ION Setup.

Before you begin, make sure you have completed the following tasks:

- Confirm the serial network of devices are wired and configured to have the same baud rate, serial port settings (for example, 8N1), and protocol (ION).
 - Confirm each serial device has a unique unit identifier.
 - Confirm the serial network of devices are connected to the gateway meter's serial communication port.
 - Confirm your gateway meter is communicating over Ethernet.
1. Start ION Setup.
 2. Open the Setup Assistant for your meter.
 3. Navigate to **Communications > Serial settings** and select the tab for the communications port that the serial network is connected to.
 4. Select **Protocol** and click **Edit**. The protocol selection screen appears.
 5. Set the protocol to **EtherGate**.
 6. Create an Ethernet gateway site to access the serial network of devices through your gateway meter.

Creating an Ethernet gateway site using ION Setup

You can create an EtherGate or Modbus gateway site in ION Setup to view serial devices connected to your meter when it is functioning as an Ethernet gateway.

You must have Ethernet gateway communications configured and your gateway and serial devices connected and communicating.

1. Start ION Setup.
2. Right-click on your workstation icon and select **Insert Item**. The New Network item dialog appears.
3. Select **Site** and click **OK**. The New Site dialog appears.
4. Select the **General** tab and configure the site.

Parameter	Values/Options	Description
Name	-	Ethernet gateway site name
Comm Link	Ethernet	Ethernet communications
Ethernet options	Gateway	Ethernet gateway communications
Gateway Info: IP Addr	-	IP address of the Ethernet gateway meter
Gateway Info: Port	7801, 502	• 7801 for EtherGate • 502 for Modbus gateway

5. Click **OK** to create the site.
6. Right-click on your newly created site and select **Insert Item**. The New Network Item dialog appears.
7. Make sure your newly created Ethernet gateway site is selected in **Attach to**. Select **Device** and click **OK**. The New Device dialog appears.
8. Enter the details of your serial device. Click **OK** to add the serial device to your Ethernet gateway site. Repeat for all the serial devices on the gateway meter.

NOTE: Use a separate standard Ethernet connection in ION Setup to connect to and read data from your Ethernet gateway meter.

Configuring SNMP using ION Setup

You can enable SNMP and configure SNMP trapping using ION Setup.

You must download the ION MIB file from www.schneider-electric.com.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications > Network Settings** and select the **SNMP** tab.
4. Configure your meter's SNMP parameters by selecting the parameter and clicking **Edit**. Click **OK** in the editing screen to set the parameter value.

Parameter	Description
Enable SNMP	Enables or disables SNMP on your meter.
Enable Traps	Enables or disables SNMP trapping on your meter.
Trap Rcvr Addr1 - Trap Rcvr Addr4	Enter up to four trap receiver IP addresses where trap messages will be sent.
Read only community	Enter the community string used for SNMP get (read-only) requests.
Read write community	Enter the community string used for SNMP set (read/write) requests. NOTE: You can use the read/write community string for SNMP get (read-only) requests.

Parameter	Description
System contact	Enter the name of your SNMP system administrator.
System name	Enter a descriptive name for your meter.
System location	Enter your meter's location.

- Review the rest of the SNMP information and modify if necessary.

Related topics

- See the “SNMP” on page 66 for more information about how SNMP is implemented on your device.

Loading an IEC 61850 configuration file using ION Setup

You can load an IEC 61850 configuration (CID) file using ION Setup over an Ethernet connection.

You must have:

- The IEC 61850 configuration file stored in a location accessible by ION Setup. The configuration file is created by customizing the IEC 61850 device (ICD) file, which can be downloaded from www.schneider-electric.com.
- FTP access to your meter from the computer running ION Setup.

NOTE: Your meter can have only one IEC 61850 configuration (CID) file loaded onto its internal FTP site. If additional CID files are loaded, IEC 61850 functions are deactivated until the additional files are removed.

- Start ION Setup.
- Open the Setup Assistant for your meter.
- Navigate to **Communications > 3rd Party Protocols** and select the **IEC 61850** tab.
- Highlight a parameter and click **Upload**. Navigate to where you stored your meter's CID file, select the file, and click **Open**.

Your meter reviews the CID file to determine if it is valid. This process may take several minutes.

The CID status indicates whether the meter has received and validated an IEC 61850 CID file and is operating as an IEC 61850 server.

Related topics

- See “IEC 61850” on page 70 for more information about IEC 61850 on your device.

Configuring additional data for IEC 61850 using ION Setup

You can map additional data to IEC 61850 using ION Setup.

You must have a valid IEC 61850 configuration file loaded onto your meter for IEC 61850 functionality, but it is not necessary for configuring additional data.

NOTE: You can configure additional data at any time, whether or not IEC 61850 is operating on your meter.

- Start ION Setup.
- Open the Setup Assistant for your meter.

3. Navigate to **Communications > 3rd Party Protocols** and select the **IEC 61850** tab.
4. Select the information type that corresponds to the type of meter information that you want to add to your IEC 61850 data. Select analog for numeric information and digital for boolean or binary information. Click **Edit**. The custom configuration screen is displayed.
5. Select the desired meter value from those available. If the value you want is not shown, select **Show all available registers**.
6. Select an IEC 61850 leaf to associate with the meter data, and click **>>** to map the value. Click **<<** to unmap values. Click **OK** to send and save your changes to the meter.

Related topics

- See “IEC 61850” on page 70 for more information about IEC 61850 on your device.

Clock

Configuring time and time synchronization using ION Setup

You can set the time and date and configure the time synchronization settings using ION Setup.

NOTE: The clock screen is where you set the start date for the time of use feature.

NOTE: You must manually adjust the date and time information if the device is installed in a different time zone location from the computer running ION Setup.

1. Start ION Setup.
2. Open the Setup Assistant for your device.
3. Navigate to **Clock** and select the **Timezone** tab.
4. Select any parameter and click **TimeSync** to synchronize your device's date and time with the computer that is running ION Setup.

Click the **DST Settings** tab to modify your meter's daylight savings time start and end dates, if required.

5. Select the parameter that you want to configure and click **Edit**. Enter the password if prompted.

Parameter	Value	Definition
Timezone	—	Sets the timezone based on the timezones available from the computer's operating system. NOTE: This is also where you can synchronize your meter's DST settings with the computer's.
Time sync type	Local time or UTC	Specifies the time format of the time sync message • UTC: Coordinated Universal time; for the purposes of meter configuration, it is equivalent to Greenwich Mean Time (GMT). • Local time: the local time, with DST and timezone information applied.
Time sync source	COM1, Ethernet, Ethernet - ION, Ethernet - DNP, IRIG-B	Sets which device port accepts time synchronization messages. Time synchronization messages on other ports are ignored

Parameter	Value	Definition
Clock Source	Internal, Line frequency, COMM	Sets the source for the clock: - Internal: the meter's internal clock. - Line frequency: the frequency of the measured power system as the clock source. - COMM: the meter's communication port (used by the GPS time sync source).
DST Offset	Numeric Bounded Format/Elapsed Interval Format	Specifies the amount of time the meter clock is moved forward when entering Daylight Savings. A value of zero disables this feature and clock does not adjust for DST.
Start of the Week	Monday - Sunday	Specifies the start day of the week used for Trending and Forecasting. NOTE: Changing the start day of the week clears all trending and forecasting data.

For SNTP/NTP time synchronization, you must set the **Time sync type** to **UTC** and the **Time sync source** to **Ethernet**.

For GPS/IRIG-B time synchronization, you must set the **Time sync source** to **IRIGB** and the **Clock Source** to **COMM**.

6. For SNTP/NTP time synchronization, you must also enter the following information under **Communications > Network Settings > NTP**:

Parameter	Value	Definition
Enable NTP Time Sync	NTP, SNTP, No	NTP: specifies NTP time synchronization. SNTP: specifies SNTP time synchronization. NOTE: SNTP is recommended for revenue-related applications. No: neither NTP nor SNTP time synchronization are used.
NTP Time Sync Interval	Numeric value or elapsed interval value	Specifies how often the meter synchronizes over SNTP. NOTE: This parameter is not used for NTP.
NTP Event Logging Threshold (NTP only)	1000 to 1000000	Specifies the minimum time difference (in milliseconds) for a time synchronization to be logged as an event. This parameter can be configured to help prevent the meter's event log from being flooded with time synchronization events.
NTP Server	Server IP address or domain name	Specifies the IP address (or fully qualified domain name if DNS is active) of the SNTP or NTP server.

7. For serial GPS time synchronization, you must also enter the following information under **Communications > Serial settings**:

Parameter	Definition
Protocol	Select the GPS setting that matches your GPS receiver.
Baud rate	The recommended baud rate for GPS time synchronization is 9600 bps.
Serial port	The recommended stop bits/parity for GPS time synchronization is 8N1.

Related topics

- See "Time and time synchronization" on page 73 for more information about time and time synchronization on your meter.
- See "Electrical characteristics" on page 181 for information on the IRIG-B standard and specifications.

Demand

There are no additional documented tasks specific to your device for this screen.

Energy pulsing

NOTE: This screen is where you can configure the energy pulsing for accuracy verification testing.

Configuring energy pulsing using ION Setup

You can configure your meter's digital output and energy pulsing LED for energy pulsing.

Ensure that the digital output port or energy pulsing LED is available for energy pulsing and not associated with another function.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

NOTE: For applications where accuracy is important, use the digital output or energy pulsing LED located on the base of the meter.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Select **Energy pulsing**.
4. Select **LED** and configure the following basic parameters for your meter's energy pulsing LED.

Parameter	Description
Source	The energy source used for LED energy pulsing.
W Kt	The amount of source energy required to make the LED pulse.
W Pulse Width	The minimum time in seconds between LED pulse transitions. NOTE: There is a minimum 50% duty cycle on all pulses.
Wh pulse ovrlid	Pulsing normally indicates that the energy pulsing LED should be operating normally. Pulsing suspended indicates that the energy pulsing LED is not able to pulse quickly enough. Modify the W Kt value to decrease the number of energy pulses.

NOTE: Only configure parameters other than those described if you have advanced knowledge of ION and the power system your meter is connected to.

5. Select an energy pulsing source tab (such as Wh Del) to configure energy pulsing using your meter's digital output..

Parameter	Description
Kt	The amount of energy source required to make one pulse. For example, in the Wh Del tab, the Kt value would be amount of real energy delivered (Wh Del) per pulse.
Pulse Width	The minimum time in seconds between pulse transitions. NOTE: There is a minimum 50% duty cycle on all pulses.
Port	Select an output port from the list. Only available output ports are shown.
(source) ovrlid	Pulsing normally indicates that the output port should be operating normally. Pulsing suspended indicates that the output port is not able to pulse quickly enough. Modify the Kt value to decrease the number of energy pulses.

NOTE: Only configure parameters other than those described if you have advanced knowledge of ION and the power system your meter is connected to.

Energy applications

Configuring conditional energy using ION Setup

You can enable and configure conditional energy settings using ION Setup.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

One of your device's digital inputs must be connected and configured to define when conditional energy is accumulated.

1. Start ION Setup.

2. Open the Setup Assistant for your meter.
3. Navigate to **Energy Applications > Digital Input Based**. Review the digital inputs assigned to applications to help ensure there are no conflicting usages.
4. Select **Conditional Energy** and click **Edit**. The **Conditional Energy Setup** screen is displayed.
5. Select **Enabled** to enable the conditional energy feature.
6. Click **Select** to define the digital input. The input's state determines whether conditional energy is accumulated. When this digital input is on, conditional energy is accumulated.

NOTE: It is recommended to set **Assigned Input** to No Connection to disable the conditional energy feature by removing any port associations.

7. Click **OK** to save your configuration.

Configuring standard input metering using ION Setup

You can configure input metering with standard units and rates using ION Setup.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

NOTE: Your device's digital input must be connected to the input metering pulse source. Review the digital inputs assigned to applications to help you understand your existing configuration.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Energy Applications > Digital Input Based**.
4. Select the input metering channel you want to configure and click **Edit**. The **Input Metering Channel Setup** screen is displayed.
5. Select **Enabled** to enable the input metering feature.
6. Click **Select** to define which digital input is the pulse source for the input metering channel.

NOTE: It is recommended to set **Assigned Input** to No connection to disable the input metering channel by removing any port associations.

7. Configure the remaining parameters as required.

Parameter	Description
Pulse Weight	Enter the value per pulse.
Units	Select the measurement units associated with the pulse.
Demand Period	Enter the frequency in minutes that input metering data is calculated in your energy management system.
Rate	Select the rate associated with the defined Units.
Source ID	Enter a data identifier. This value is added to the input metering channel's data to uniquely identify the data within your energy management system.

8. Click **OK** to save your configuration.
9. Configure your meter to log the input metering data if required.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to add input metering data to your meter's onboard data logs.

Configuring custom input metering using ION Setup

You can configure input metering with custom units and rates using ION Setup.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

NOTE: Your device's digital input must be connected to the input metering pulse source. Review the digital inputs assigned to applications to help you understand your existing configuration.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Energy Applications > Digital Input Based**.
4. Select the input metering channel you want to configure and click **Edit**. The **Input Metering Channel Setup** screen is displayed.
5. Select **Enabled** to enable the input metering feature.
6. Click **Select** to define which digital input is the pulse source for the input metering channel.

NOTE: It is recommended to set **Assigned Input** to No connection to disable the input metering channel by removing any port associations.

7. Clear the **Standard quantity** checkbox. The screen changes to display custom input metering parameters.
8. Configure the remaining parameters as required.

Parameter	Description
Pulse Weight	Enter the value per pulse.
Units	Enter the measurement units associated with the pulse. NOTE: Include source identification information by entering "@" followed by the source identifier.
Demand Period	Enter the frequency in minutes that input metering data is calculated in your energy management system.
Rate	Enter the rate associated with the defined Units.
Scaling	Select the scaling value based on the relationship between Units and Rate.
Time Base	Select the value and units to match the Rate.

9. Click **OK** to save your configuration.
10. Configure your meter to log the input metering data if required.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to add input metering data to your meter's onboard data logs.

Configuring incremental energy using ION Setup

You can configure incremental energy using ION Setup.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.

3. Navigate to **Energy Applications > Incremental Energy**.
4. Select **Status** and click **Edit**. The incremental energy configuration screen is displayed.

NOTE: To display parameters for configuration, select **Enable**.

5. Select the parameter to configure and click **Edit**.

Parameter	Range	Description
Status	Enable/disable	Enables the incremental energy feature
Start time	12:00 am to 11:59 pm	The incremental energy first interval's start time. The start time must be prior to the end time for energy accumulation.
End time	12:01 am to 12:00 am	The end time for incremental energy. The end time must be after the start time and be less than or equal to 12 am (midnight)
Interval duration	Configurable	The increment period for the incremental energy duration.

Your changes are made to the meter.

NOTE: Configuring any parameter resets the incremental energy values recorded by your meter.

Onboard I/O

WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Configuring onboard digital inputs using ION Setup

You can use ION Setup to configure your meter's digital inputs.

Digital inputs are available on your meter. You can add more digital inputs using optional I/O modules.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **I/O > Digital Inputs**. The tabs correspond to each digital input. Click on the tab for the digital input you want to edit.
4. Configure the digital input by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Input Mode	Pulse, KYZ, A/C, IRIG-B ¹	Specifies how the meter processes the signal: - Pulse: the meter counts an entire pulse (from off-on to on-off) as one input. - KYZ: the meter counts a transition (from off-on or from on-off) as one input. - A/C: the meter detects analog signals where the ON condition is based on the presence of an AC signal. - IRIG-B¹: the meter detects an IRIG-B time synchronization signal.
Polarity	Inverting/Non-Inverting	Specifies if the signal from the digital port is inverted or not inverted.
Debounce	0.000 - 1.000	Specifies how long (in seconds) the signal must remain in a state to be considered a valid state change.
Port	Defined by your meter's hardware	Your meter's physical digital input port.

¹ IRIG-B can only be connected to one of the digital inputs located on the meter base, not an option module. You must also configure your meter's clock to use IRIG-B time synchronization.

- Once the parameter has been configured, click **OK** to save the setting to the meter.

Related topics

- See "Time synchronization overview" on page 73 for IRIG-B time synchronization information

Configuring onboard digital outputs using ION setup

You can configure your meter's digital outputs using ION Setup.

One form A digital output is available on the base of the meter. You can add more digital outputs using optional I/O modules.

- Start ION Setup.
- Open the Setup Assistant for your meter.
- Navigate to either onboard or expansion I/O, Digital Outputs, and select a digital output tab.
- Configure the digital output by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Source	Digital/Boolean	Link this input to the value that drives the state of the digital output. If Source is not linked, the digital output state is driven by the Force ON, Force OFF values.
Force ON	Pulse	Link this input to a pulse that forces the digital output on for the PulseWidth duration, regardless of the Source input.
Force OFF ¹	Pulse	Link this input to a pulse that forces the digital output off.
Normal ¹	Pulse	Pulsing this input will switch the driver of the digital output from Force ON to Source.
Polarity	Inverting/non-inverting	Specifies if the signal to the digital port is inverted or not inverted.
PulseWidth	0 - 2,000,000	Specifies the duration of the pulse, in seconds. Setting this parameter to 0 sets the digital output continuously on.
Port	-	The physical digital output port connection. Only available ports are shown.

¹ These parameters are only valid when pulse width is set to 0.

The digital output is configured.

Expansion Modules

Option I/O modules

You can configure your meter's I/O option modules using ION Setup.

The I/O option module screen has tabs corresponding to the four possible option module, based on how the option modules are connected to the meter. Each has tab an area where the module's ports are listed for viewing and configuration. The module's type and status is displayed.

Status examples	Description
None	No option module detected
Normal	The option module is operating normally
Option module added	A new option module is detected
Option module removed	The option module has been removed
Invalid SI9	The option module's firmware is not supported
Invalid card	The option module type is not supported

In the option module tabs you can also reset your meter's option modules. This power cycles all the option modules. Option module functions are not available during a bus reset and option module digital and analog outputs will change state.

WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Configuring I/O option module analog inputs using ION Setup

You can configure analog inputs using ION Setup.

Analog inputs are available on the optional I/O modules you can connect to the base of your meter.

Calculate your zero scale and full scale values based on the analog source and the input range of your meter.

Make sure that the analog input port that you want to use is properly configured and connected to a valid external analog signal source.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the option module with the analog input you want to configure.
4. Select the analog input channel and click **Edit**. The setup screen for that analog input is displayed.
5. Configure the analog input by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Zero scale	0 to $\pm 10^9$	The minimum source value that matches the minimum analog input signal.
Full scale	0 to $\pm 10^9$	The maximum source value that matches the maximum analog input signal.
Port	-	The physical analog input port connection.
Mode	Voltage, current	Determines whether the analog input is monitoring voltage or current.

The analog input is configured.

Configuring option module analog outputs using ION Setup

You can configure option module analog outputs using ION Setup.

Analog outputs are available on the optional I/O modules you can connect to the base of your meter.

Calculate your zero scale and full scale values based on the measured value and the analog output range of your meter.

Make sure that the analog output port that you want to use is properly connected to an analog receiver.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the option module with the analog output you want to configure.
4. Select the analog output channel and click **Edit**. The setup screen for that analog output is displayed.
5. Configure the analog output by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Zero scale	0 to $\pm 10^9$	The minimum source value that matches the minimum analog output signal.
Full scale	0 to $\pm 10^9$	The maximum source value that matches the maximum analog output signal.
Port	-	The physical analog output port connection.
Mode	Voltage, current	Determines whether the analog output is putting out voltage or current

The analog output is configured.

Configuring option module digital inputs using ION Setup

You can use ION Setup to configure your meter's digital inputs.

Digital inputs are available on your meter. You can add more digital inputs using optional I/O modules.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the option module with the digital input you want to configure.
4. Select the digital input channel and click **Edit**. The setup screen for that digital input is displayed.
5. Configure the digital input by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Input Mode	Pulse, KYZ, A/C, IRIG-B ¹	Specifies how the meter processes the signal: - Pulse: the meter counts an entire pulse (from off-on to on-off) as one input. - KYZ: the meter counts a transition (from off-on or from on-off) as one input. - A/C: the meter detects analog signals where the ON condition is based on the presence of an AC signal. - IRIG-B¹: the meter detects an IRIG-B time synchronization signal.
Polarity	Inverting/Non-Inverting	Specifies if the signal from the digital port is inverted or not inverted.
Debounce	0.000 - 1.000	Specifies how long (in seconds) the signal must remain in a state to be considered a valid state change.
Port	Defined by your meter's hardware	Your meter's physical digital input port.

¹ IRIG-B can only be connected to one of the digital inputs located on the meter base, not an option module.

6. Once the parameter has been configured, click **OK** to save the setting to the meter.

Configuring option module digital outputs using ION setup

You can configure your meter's digital outputs using ION Setup.

One form A digital output is available on the base of the meter. You can add more digital outputs using optional I/O modules.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the module with the digital output you want to configure.
4. Select the digital output channel and click **Edit**. The setup screen for that digital output is displayed.
5. Configure the digital output by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Source	Digital/Boolean	Link this input to the value that drives the state of the digital output. If Source is not linked, the digital output state is driven by the Force ON, Force OFF values.
Force ON	Pulse	Link this input to a pulse that forces the digital output on for the PulseWidth duration, regardless of the Source input.
Force OFF ¹	Pulse	Link this input to a pulse that forces the digital output off.
Normal ¹	Pulse	Pulsing this input will switch the driver of the digital output from Force ON to Source.
Polarity	Inverting/non-inverting	Specifies if the signal to the digital port is inverted or not inverted.
PulseWidth	0 - 2,000,000	Specifies the duration of the pulse, in seconds. Setting this parameter to 0 sets the digital output continuously on.
Port	-	The physical digital output port connection. Only available ports are shown.

¹ These parameters are only valid when pulse width is set to 0.

The digital output is configured.

Logging

There are no additional tasks specific to your device for this screen.

Revenue

There are no additional tasks specific to your device for this screen.

Alarming

WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Configuring setpoint/standard alarms using ION Setup

You can use ION Setup to configure the standard alarm settings.

1. Start ION Setup
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming** and click the **Standard** tab.
4. Select a setpoint and click **Edit**.
5. Enter unit password and click **OK**, if required. The **Setpoint Setup** screen is displayed.
6. Configure the setpoint values as required.

Parameter	Value/Range	Description
By Percentage	By Percentage/By Value	When available, specifies if the Pickup and Dropoff entries are by percentage or by value. If the option is not available, pickup and dropoff entries are by value.
Force Off	Checked/Unchecked	Forcing the alarm off disables all functions of the associated input. To stop an alarm from being displayed without affecting other meter features, set the alarm priority to Info only.
Label	String value	When available, lets you modify the default label so it more clearly identifies the alarm. Letters, numbers, underscores are permitted. Spaces are not permitted.
Pickup	Numeric value	Use this setting to provide a value for when the alarm turns on.
Pickup Delay	Numeric value	This specifies the number of seconds the digital input must be in the alarm pickup state before the alarm turns on.
Dropout	Numeric value	Use this setting to provide a value for when the alarm turns off.
Dropout Delay	Numeric value	This specifies the number of seconds the digital input must be below the alarm dropoff state before the alarm turns off.
Alarm Priority	None, Info only, Low, Medium or High	Specifies the priority level of the standard alarm. To disable the alarm, set priority to Info only.
Custom Priority	0-255	Select custom priority to view and configure the event priority of the event associated with the alarm. The event log cutoff value is displayed for reference; priorities above the cutoff are stored in the meter's event log.

7. Click **Save** to save the settings to your meter.

Related topics

- See “Alarms overview” on page 147 for more information about your meter's alarms and alarm configuration.

Configuring sag/swell alarms using ION Setup

You can use ION Setup to configure the sag/swell alarm settings.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming > Sag/Swell**.
4. Select a parameter and click **Edit**.
5. Configure the parameters as required.

Parameter	Value/Range	Description
Nominal voltage	1 to 999,999	Specifies the nominal voltage value used for sag/swell detection.
Voltage Swell%	Percentage of nominal	Specifies the swell limit expressed as a percentage of the nominal voltage.
Voltage Sag%	Percentage of nominal	Specifies the sag limit expressed as a percentage of the nominal voltage.
Nominal Current	1 to 999,999	Specifies the nominal current value used for sag/swell detection.
I Sag Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a sag.
I Sag Dropout	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the sag.
I Swell Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a swell.
I Swell Dropout	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the swell.

Related topics

- See “Alarms overview” on page 147 for more information about your meter's alarms and alarm configuration.

Configuring digital input alarms using ION Setup

You can use ION Setup to configure the digital alarm settings.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate **Alarming > Digital Input**.
4. Configure the digital input alarm settings by selecting an input and clicking **Edit**. Some settings are not configurable and are grayed out.

Parameter	Value/Range	Description
Input	Input On/Input Off	Specifies the input state/alarm behavior: • Input On: the alarm is on when the digital input is on. • Input Off: the alarm is on when the digital input is off.
Force Off	Checked/Unchecked	Forcing the alarm off disables all functions of the associated input To stop an alarm from being displayed without affecting digital input features, set the alarm priority to Info only.
Label	String value	When available, lets you modify the default label so it more clearly identifies the alarm. Letters, numbers, and underscores are permitted. Spaces are not permitted.
Alarm Priority	None, Info only, Low, Medium or High	Specifies the priority level of the digital input alarm. To disable the alarm, set priority to Info only.
Custom Priority	0-255	Select custom priority to view and configure the event priority of the event associated with the alarm. The event log cutoff value is displayed for reference; event priorities above the cutoff are stored in the meter's event log.

5. Click **Save** to save the changes to the meter.

Related topics

- See “Alarms overview” on page 147 for more information about your meter’s alarms and alarm configuration.

Implementing alarm setpoint learning using ION Setup

You can use ION Setup to implement setpoint learning, which analyzes your power system and recommends settings.

NOTE: Your meter’s power system must be stable in order to learn valid setpoint values.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming > Standard**.

NOTE: You can manually configure setpoint values by selecting the setpoint and clicking **Edit**.

4. Select a setpoint and click **Learn**. The **Global Setpoint Learning** screen is displayed.
5. Select the setpoint tabs to view existing configured or learned setpoint information.
6. Click **Setup**. The **Alarm Learning Setup** screen is displayed.
7. Configure the learning parameters for each setpoint and click **Save**:

Parameter	Value/Range	Description
Install mode	Automatic, Manual	• Automatic: the learned values are automatically applied if valid. • Manual: the learned values are stored for you to review and enter.
Duration	1-365	Days for maximum learning duration

8. Click **Start All** to begin setpoint learning for all setpoints.
 - When setpoint learning is in progress, an asterisk is displayed next to the setpoint.
 - Click **Abort** to stop learning for a specific setpoint. To stop all setpoint learning, repeat for each setpoint tab.
9. Apply the learned setpoint values:
 - Automatic: the setpoint values are automatically applied unless the learning process has issues or the learned values are invalid.
 - Manual: navigate to **Alarming > Setpoints** and click **Learn**. On each setpoint tab, click **Install** to apply the learned values to that setpoint.

NOTE: If you click **Install** while learning is in progress (in either manual or automatic installation mode), it stops the learning process and prompts you for confirmation that you want to stop learning and install the learned values. Once you confirm, the learned values are automatically installed or prepared for manual installation.

Related topics

- See “Setpoint learning overview” on page 137 for more information about setpoint learning.

Implementing sag/swell limit learning using ION Setup

You can use ION Setup to implement voltage sag/swell learning, which analyzes your power system and recommends settings.

NOTE: Your meter's power system must be stable in order to learn valid sag/swell limits.

You must have configured your meter's nominal voltage in order to learn valid sag/swell limits.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming > Sag/Swell**.
4. Select the **Voltage Swell %** or **Voltage Sag %** and click **Learn**. The **Global Setpoint Learning** screen is displayed.

NOTE: You can manually configure the limit values by selecting the parameter and clicking **Edit**.

5. Click **Setup**. The **Alarm Learning Setup** screen is displayed. Configure the learning parameters:

Parameter	Value/Range	Description
Install mode	Automatic, Manual	- Automatic: the learned values are automatically applied. - Manual: the learned values are stored for you to review and enter.
Duration	1-365	Days for maximum learning duration

Click **Start** to begin sag/swell learning. Click **Abort** to stop learning.

6. Apply the learned sag/swell limits:
 - Automatic: the limits are automatically applied unless there are issues with the learning process.
 - Manual: navigate to **Power quality > Sag/Swell**. Select the **Swell limit %** or **Sag limit %** and click **Learn**. Click **Install** to apply the learned limits.

NOTE: If you click **Install** while learning is in progress (in either manual or automatic installation mode), it stops the learning process and prompts you for confirmation that you want to stop learning and install the learned limits. Once you have confirmed, the learned limits are automatically installed or prepared for manual installation.

Related topics

- See “Setpoint learning overview” on page 137 for more information about setpoint learning, including sag/swell learning.

Power Quality

Configuring waveform recording using ION Setup

You can configure waveform recording using ION Setup.

For waveform recording to trigger automatically, you must enter your system's nominal (normal) voltage and current values, and then the amount of deviation from the nominal required to trigger waveform recording.

Changing your meter's waveform recording configuration clears your meter's existing waveform records.

NOTICE

DATA LOSS

Ensure that all important data has been recorded before configuring waveform recording.

Failure to follow these instructions can result in data loss.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming** and click the **Sag/Swell** tab. Configure your meter's sag/swell detection parameters:

Parameter	Value/Range	Description
Nominal voltage	0 - 999,999	Specifies the nominal voltage value used for sag/swell detection.
Voltage Swell %	Percentage of nominal	Specifies how much a measured value must exceed the nominal in order to be considered a swell.
Voltage Sag %	Percentage of nominal	Specifies how much a measure value must fall below the nominal in order to be considered a sag.
Nominal current	0 - 999,999	Specifies the nominal current used by Swell and Sag limit % for a current sag or a current swell.
Current Sag Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a sag.
Current Sag Dropoff	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the sag.
Current Swell Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a swell.
Current Swell Dropout	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the event.

4. Navigate to **Power Quality** and click the **Sag/Swell** tab to configure your meter's waveform recording parameters.

Parameter	Description
Sag/Swell depth	Specifies the number of records the sag/swell data log can hold
Waveform depth	Specifies the maximum number of waveform records stored on the meter.
Waveform format	Specifies the number of samples per cycle and the number of cycles that are stored in a waveform record.
Post event cycles	Specifies the number of cycles recorded after the waveform is triggered. NOTE: The maximum number of post event cycles cannot exceed the number of cycles in the waveform record.
Hysteresis %	Specifies the difference in magnitude between the start and end thresholds for a power quality event.

NOTE: COMTRADE status must be set to **Disabled** before modifying the waveform format.

Configuring COMTRADE waveform recording using ION Setup

You can enable and configure COMTRADE waveform recording using ION Setup.

COMTRADE is configured as part of the default waveform recording but not enabled from the factory.

Your meter's COMTRADE files' format complies with the standard defined by IEC 60255-24 edition 2001-05.

1. Start ION Setup.

2. Open the Setup Assistant for your meter.
3. Navigate to **Power Quality > COMTRADE**.
4. Configure the COMTRADE parameters:

Parameter	Value	Description
Status	Enabled/Disabled	Enabled: COMTRADE files are generated. Disabled: COMTRADE files are not generated.
Depth	1 or more	The number of COMTRADE records stored on the meter. • By default the oldest COMTRADE record will be overwritten by the newest record. • A message is displayed if the Depth value exceeds the available memory. • A single COMTRADE record uses approximately 45 kB of meter memory.

COMTRADE records are stored as read-only files on your meter's internal FTP server, and are deleted when you perform a Master reset of the meter.

NOTE: To configure waveform recording, you must disable COMTRADE, configure waveform recording, and then enable COMTRADE. COMTRADE records are not generated if the waveform recorders have inconsistent settings.

Downloading COMTRADE files using ION Setup

You can download COMTRADE waveform records from the meter's internal FTP server to another network location using ION Setup.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Power Quality > COMTRADE**.
4. Select the status parameter and click **Save**. The **Upload COMTRADE files** screen is displayed.
5. Select the criteria for the COMTRADE files you want to load from your meter's internal FTP site to another network location. Click **OK**.

NOTE: If no COMTRADE files are downloaded, the ION Setup status bar provides a descriptive message.

Related topics

- See "COMTRADE" on page 71 for additional information about COMTRADE format waveform data.

Custom displays

Creating custom displays using ION Setup

You can use ION Setup to program new custom displays.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Custom Displays**.
4. Select **Custom Displays** from the **Front Panel** tab and click **Edit**. ION Setup loads your meter's display information into the **Display Editor** screen.

5. Rename, delete, or change the order of custom displays through the **Display Editor** screen. Click **New** to add a new display. Click **Edit** to bring up the **Display setup** screen, where you can configure new or existing custom displays.
6. Configure your screen type:
 - **Screen Type**: Specify the number of parameters displayed on the screen.
 - **Screen Title**: Enter the title to be shown at the top of your custom display.
7. Click **Edit** to select the displayed parameters. The number of parameters displayed is determined in the Screen Type selection described above.
8. Select your digit display properties:
 - **Resolution**: Specifies the number of decimal places displayed.
 - **Last Digit**: Specifies whether the last number is rounded or truncated.
9. Click **Send** to save the changes in the meter.

Verification

Performing meter resets using ION Setup

You can perform meter resets on your meter using ION Setup.

Revenue-locked meters must be unlocked to perform resets that impact revenue data.

Meter resets clear the meter's onboard data logs and other related information.

NOTICE

DATA LOSS

Ensure all important data from the device has been retrieved before performing a reset.

Failure to follow these instructions can result in data loss.

1. Open the Setup Assistant for your meter.
2. Select the **Verification** screen.
3. Select **Normal Mode** and click **Display**.
4. Select the desired tab in the **Normal Mode** dialog box. Depending on the tab selected, different resets are available.

Tab	Reset available
Energy	Master Reset
Rolling Demand	Peak Reset Master Reset
Volts, Amps and Power	Master Reset
Conditional Energy	Cnd Reset Master Reset
Input Metering	IM(n) Reset NOTE: n is the input metering number, for example IM1. Peak Reset Master Reset

5. Click the appropriate button to perform the reset.

For some resets, the meter indicates that the reset is in progress. Do not configure or power down your meter until it indicates that the reset is complete or some parameters may not be completely reset.

Related topics

- See “Revenue locking” on page 173 for more information on revenue locked meters.

Reports

There are no additional tasks specific to your device for this screen.

Advanced ION Setup tasks

These configuration tasks are intended for advanced users with a thorough understanding of ION architecture, the features of their device, and the power system in which it is installed.

Configuring digital outputs for IEC 61850 control using ION Setup

You can configure your digital outputs so that they can be used for non-critical control via IEC 61850.

Your meter has a comprehensive default implementation of IEC 61850 which meets the needs of most systems with only basic configuration. You can customize this implementation so that IEC 61850 can be used to control your meter's digital outputs; this is an advanced procedure that requires in-depth knowledge of your meter, its underlying architecture, and the system in which it is installed.

WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Start ION Setup
2. Connect to your meter in advanced mode.
3. Navigate to the GGIO Onboard folder and double-click on the module in the right-hand pane.
4. Select the Setup Registers tab.
5. Select the *SPCS Control Mode* register that corresponds to the digital output you want to control through IEC 61850 and click **Edit**. A dialog appears.
6. Select IEC 61850 CTLVAL from the dropdown list and click **OK**.
7. Select the Inputs tab.

8. Select the digital output *Status* register for the digital output that you want to control through IEC 61850. Click **Delete**.
NOTE: This digital input register must be deleted in order to prevent a circular reference that will cause the affected modules to go offline.
9. Click **Send** to send your changes to the meter.
10. Select the Setup Registers tab and confirm that the Digital Output module's setup registers are appropriately configured.
11. Select the Inputs tab.
12. Select the *Source* register and click **Edit**.
13. Navigate to the IEC 61850 GGIO Onboard folder and select the *SPCS.stVal* output register that corresponds to the digital output.
14. Click **OK** and **Send** to save your changes to the meter.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for information about the IEC 61850 GGIO and Digital output modules.
- See "IEC 61850" on page 70 for more information about how IEC 61850 is implemented on your meter.

Chapter 13 Meter webpages

Overview

This section describes the meter’s webpages. The meter’s Ethernet connection allows you to access the meter so you can view data and perform trending and forecasting and some basic configuration using a web browser. You can also view standard filetypes through the meter’s webpages and create custom webpages for your meter.

 **WARNING**

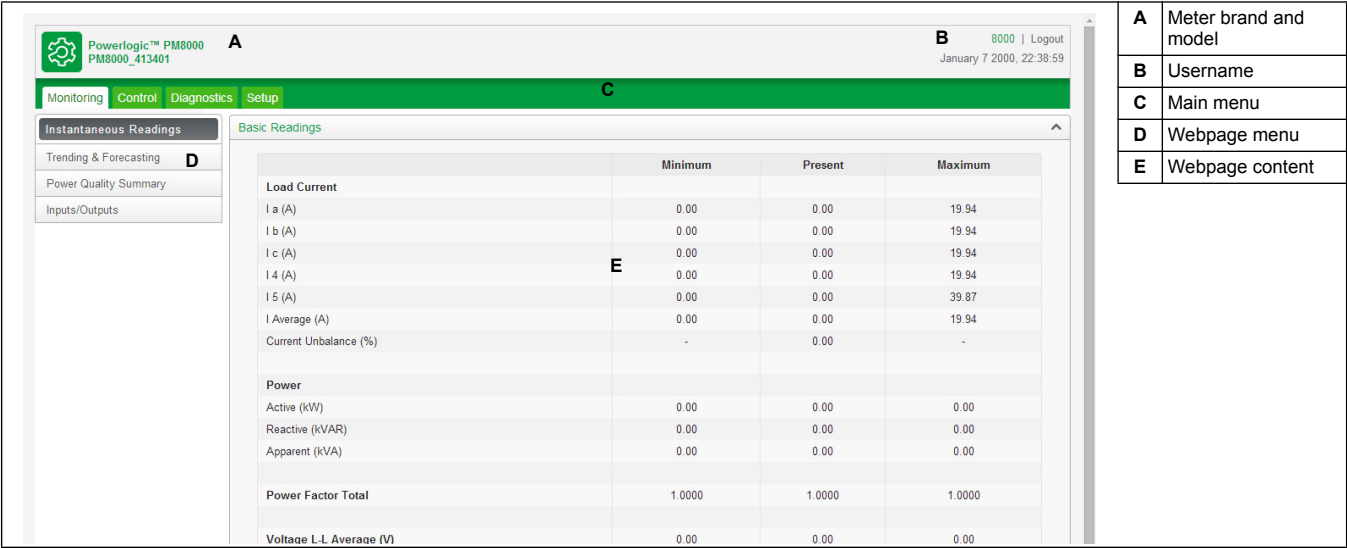
INACCURATE DATA RESULTS

- Do not rely solely on data displayed on the display or in software to determine if this device is functioning correctly or complying with all applicable standards.
- Do not use data displayed on the display or in software as a substitute for proper workplace practices or equipment maintenance.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Webpage interface

Your meter comes with default webpages that contain the typical elements shown below.



NOTE: This graphic is representative only, and your meter’s webpages may appear differently than shown.

Default webpages

The following default webpages are available on your meter.

Main menu	Webpage menu	Webpage content
Monitoring	Instantaneous Readings	• Basic readings • Energy readings • Demand readings • Voltage readings • Power Quality
	Trending & Forecasting	Select the target and interval for trending and forecasting and view the results.
	Power Quality Summary	• Harmonics • ITI (CBEMA)-SEMI • NEMA Motor Derating Curve • EN50160
	Inputs/Outputs	• Digital inputs • Digital outputs • Analog inputs • Analog outputs
Control	Resets	Perform resets, and view when previous resets were performed.
Diagnostics	Statistics	• Communications • Ethernet • Serial port • Meter - Basic • Meter - Advanced
	Phasor diagram	View the phasor diagram and numeric values.
Setup	Ethernet	• Basic Settings • Advanced settings
	Serial Port	• Basic Settings • Advanced Settings
	SNMP Parameters	Configure your meter's SNMP parameters.
	NTP	Configure your meter's NTP parameters.
	SMTP	Configure your meter's SMTP parameters.
	Date & Time	Configure your meter's time and time synchronization.
	Preferences	Enter your meter's nameplate information.
	Metering	Configure the parameters that impact metered data.
Maintenance ¹	-	Custom. No default content.

¹ By default the Maintenance menu is empty, and the menu is not displayed until information is added to it.

Accessing the meter's webpages

You can access the meter's webpages through the meter's Ethernet connection using a web browser.

You must have cookies enabled in order to access your meter's webpages.

If you configure communications so that you cannot communicate to and configure your meter, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions may result in data loss.

1. Open a web browser and enter your meter's IP address in the address box. The webpage login prompt is displayed.

2. Enter a valid username and password, select your desired **Language** from the drop-down list, and click **Log In**. Your meter's webpages are displayed.

NOTE: The username and password are defined by your meter's security configuration; if standard security is enabled, the password is the same as the display password with a default username of 8000. The default display password is 0 (zero). To help increase the security of your meter's configuration and data, configure your meter's username and passwords to be different from the default values.

The meter's Monitoring webpage is displayed, showing real-time data.

3. Select the main menu tab that corresponds to the category of information you want to view, and select the webpage menu from the list on the left. The webpage content is displayed. Click the webpage content headings to expand and view the meter's data.
4. Select **Setup** to view and edit your meter's configuration.

Related topics

- See "Trending and forecasting" on page 127 for instructions on configuring and viewing logging and trending information on the meter's webpages.
- See "Security overview" on page 47 for instructions on how to configure security settings on your meter.

Configuring SNMP using your meter's webpages

You can configure SNMP trapping using your meter's webpages.

You must download the ION MIB file from www.schneider-electric.com.

1. Connect to your meter's webpages.
2. Go to **Setup > SNMP Parameters**.
3. Configure your meter's SNMP parameters by selecting the parameter value.

Parameter	Range	Description
Enable SNMP	Yes/no	Enables or disables SNMP on your meter.
SNMP Port Number	161 (default)	Enter your meter's SNMP port number.
System contact	—	Enter the name of your SNMP system administrator.
System name	—	Enter a descriptive name for your meter.
System location	—	Enter your meter's location.
Read-only Community Name	—	Enter the community string used for SNMP get (read-only) requests.
Read-write Community Name	—	Enter the community string used for SNMP set (read/write) requests. NOTE: You can use the read/write community string for SNMP get (read-only) requests.
Enable SNMP Traps	Enable/disable	Enables or disables SNMP trapping on your meter.
Enable High Priority Alarms	Yes/no	Enables trapping of events that create high priority alarms.
Enable Med Priority Alarms	Yes/no	Enables trapping of events that create medium priority alarms.
Enable Low Priority Alarms	Yes/no	Enables trapping of events that create low priority alarms.
Report Buffer Size	1 - 30	Enter the maximum number of trap messages to be stored before the trap messages are sent. Traps are sent when the number of trap messages is equal to or greater than this value.
Report Hold Time	1 - 300 seconds	Enter the maximum duration for trap messages to be held. Trap messages are sent when the time after a trap event has occurred is equal to or greater than this value.
Trap Rcvr1 Addr - Trap Rcvr4 Addr	—	Enter up to four trap receiver IP addresses, where trap messages will be sent.

4. Click **Apply** to configure the meter's SNMP parameters.

Viewing files using your meter's webpages

You can load files of a variety of standard formats, such as *.pdf, *.jpg and *.png into the webpage folders on your meter's internal FTP site where they can be viewed using your meter's webpages. Videos in *.mp4 format can be played in most browsers. The filenames must be compatible with your meter's FTP filename requirements.

NOTE: Image files are shown at full-size (100%). Scale images to the desired size before loading them onto your meter's internal FTP site.

1. Access your meter's internal FTP site.
2. Open the web folder. Copy your file into the subfolder that corresponds to the webpage main menu tab you want to access your file from.
3. Connect to your meter's webpages. Select the main menu item that corresponds to the folder where you stored your file in step 2. Your file is listed in the webpage menu.
4. Select your file from the webpage menu to view.

Example

To view a schematic diagram (online.pdf) of your power system from the Monitoring menu of your meter's webpages:

1. Access your meter's internal FTP site.
2. Copy online.pdf into **web > monitoring**.
3. Access your meter's internal webpages and select the **Monitoring** menu. In the webpage menu click online.pdf to view your power system schematic.

Related topics

- See "FTP" on page 64 for instructions on how to connect to your meter over FTP.
- See "FTP filename requirements" on page 65 for a listing of characters not permitted in a FTP filename.

Creating custom webpages for your meter

You can create custom webpages to view data or access configuration parameters from your meter.

Download the PM8000 Modbus registers map from www.schneider-electric.com.

1. Connect to your meter's internal FTP site.
2. Go to **web > examples**. Select `samplerreadings.html` to create a data value webpage, or select `sampleconfiguration.html` to create a configuration parameters webpage.
3. Save a copy of the sample file. This filename is the webpage name.
4. Open your webpage in an HTML or webpage editor program.
5. Modify the webpage to reference the desired meter data or parameters from the Modbus registers map, and update the other fields where required. Save your custom webpage.

The meter will display translated content if it exists in the meter’s memory. If translated content is not available, English is displayed.

- 6. Connect to your meter’s internal FTP site.
 - If you have created a data viewing webpage, copy your custom webpage to **web > monitoring**.
 - If you have created a configuration webpage, copy your custom webpage to **web > setup**.
- 7. Login to your meter’s webpages. Your custom webpage is available from the webpage menu under the monitoring (data viewing) or setup (configuration) tab.

Related topics

- See “Sample data viewing webpage” on page 119 for a detailed description of the webpage’s configurable fields.
- See “Sample setup webpage” on page 122 for detailed description of the webpage’s configurable fields.
- See “FTP” on page 64 for instructions on how to connect to your meter over FTP.

Sample data viewing webpage

You can create custom data viewing webpages using the sample webpage stored on your meter.

The sample webpages are stored in the documents folder on your meter’s internal FTP site.

The PM8000 Modbus register map is available from www.schneider-electric.com.

If required, the PM8000 ION handles document is packaged with the meter firmware file which is available for download from www.schneider-electric.com.

The data viewing webpage must be stored on your meter’s internal FTP site in the folder for Monitoring. The custom webpage is viewed by selecting the Monitoring main menu tab on your meter’s webpage.

Configuring the HTML code other than where described is an advanced procedure and should only be performed by those with an advanced understanding of webpages and how your meter processes them.

Sample webpage data viewing result

NOTE: This graphic is representative only, and your meter’s webpages may appear different than shown.

The screenshot shows the Powerlogic PM8000 web interface. At the top, it displays 'Powerlogic™ PM8000 PM8000_354417' and 'User1 | Logout January 28 2000, 08:12:05'. Below this is a navigation bar with tabs: Monitoring (selected), Control, Diagnostics, Setup, and Maintenance. On the left is a sidebar menu with options: Instantaneous Readings, Trending & Forecasting, Power Quality Summary, Inputs/Outputs, and SampleMonitorPane (selected). The main content area is titled 'Basic Readings' and contains a table with columns: Minimum, Present, and Maximum. The table has two rows of data: '1 a (A)' and '1 b (A)'. Below the table is a section for 'Energy Readings'.

	Minimum	Present	Maximum
1 a (A)	0.00	3.76	3.76
1 b (A)	0.00	5.01	5.01

A	HTML filename
B	Content pane title
C	Row heading
D	Units
E	Column heading
F	Named register instantaneous value
G	Second content pane title

Sample data viewing webpage content

Line #	Sample HTML
1	SampleMonitorPane.html
2	<div class="content-fit">
3	<div class="accordion">
4	<h3 target="sample-readings">\${%localizedString(Basic Readings) #\$/h3>
5	<div id="sample-readings">
6	<table class="datatable">
7	<tr>
8	<th> </th>
9	<th>\${%localizedString(Minimum) #\$/th>
10	<th>\${%localizedString(Present) #\$/th>
11	<th>\${%localizedString(Maximum) #\$/th>
12	</tr>
13	<tr class="minor">
14	<td>\${%localizedString(I a) #\$/td> </td>
15	<td regname="I a mn"></td>
16	<td regname="I a"></td>
17	<td regname="I a mx"></td>
18	</tr>
19	<tr class="minor">
20	<td>\${%localizedString(I b) #\$/td> </td>
21	<td regname="I b mn"></td>
22	<td regname="I b"></td>
23	<td regname="I b mx"></td>
24	</tr>
25	</table>
26	</div>
27	<h3 target="sample-energy">\${%localizedString(Energy Readings) #\$/h3>
28	<div id="sample-energy">
29	<table class="datatable">
30	<tr>
31	<th> </th>
32	<th>\${%localizedString(Present) #\$/th>
33	</tr>
34	<tr>
35	<td>\${%localizedString(Active Energy) #\$/td> </td>
36	<td regname="kWh del-rec"></td>
37	</tr>
38	<tr>
39	<td>\${%localizedString(Reactive Energy) #\$/td> </td>
40	<td regname="kVARh del-rec"></td>
41	</tr>
42	</table>
43	</div>
44	</div>
45	
46	
47	<script type="text/javascript">

Line #	Sample HTML
48	
49	<code>instantaneousReadings.initInstantaneousReadings('sample-readings');</code>
50	
51	<code></script></code>
52	<code></div></code>

Sample webpage data viewing content description

Line #	Description
1	SampleMonitorPane.html The HTML filename, including the HTML extension (.html). This filename must comply with FTP filename conventions (no spaces or special characters). The filename (without the HTML extension) is the name shown on the webpage menu.
4	<code><h3 target="sample-readings"></code> This creates the first webpage content pane. "sample-readings" is the name of the webpage content. This name must be unique. <code>`\${localizedString(Basic Readings)}\${`</h3>`}</code> Basic Readings is the title of the webpage content pane. This title is translated if possible.
5	<code><div id="sample-readings"></code> This must match the name of the webpage content in line 4.
9	<code><th>`\${localizedString(Minimum)}\${`</th>`}</code> Minimum is the heading for the first column. This heading is translated if possible.
10	<code><th>`\${localizedString(Present)}\${`</th>`}</code> Present is the heading for the second column. This heading is translated if possible.
11	<code><th>`\${localizedString(Maximum)}\${`</th>`}</code> Maximum is the heading for the last column. This heading is translated if possible.
14	<code><td>`\${localizedString(I a)}\${`</td>`}</code> I a is the row heading. This heading is translated if possible. <code></td></code> This displays the units that the meter has defined for the named register I a.
15	<code><td regname="I a mn"></td></code> This displays the instantaneous value of the named register I a mn. ¹
16	<code><td regname="I a"></td></code> This displays the instantaneous value of the named register I a. ¹
17	<code><td regname="I a mx"></td></code> This displays the instantaneous value of the named register I a mx. ¹
20	<code><td>`\${localizedString(I b)}\${`</td>`}</code> I b is the second row heading. This heading is translated if possible. <code></td></code> This displays the units that the meter has defined for the named register I b.
21	<code><td regname="I b mn"></td></code> This displays the instantaneous value of the named register I b mn. ¹
22	<code><td regname="I b"></td></code> This displays the instantaneous value of the named register I b. ¹
23	<code><td regname="I b mx"></td></code> This displays the instantaneous value of the named register I bmx. ¹
27	<code><h3 target="sample-energy"></code> This creates the second webpage content pane. Sample-energy is the name of the webpage content. This name must be unique. <code>`\${localizedString(Energy Readings)}\${`</h3>`}</code> Energy Readings is the title of the webpage content pane. This title is translated if possible.
28	<code><div id="sample-energy"></code> This must match the name of the webpage content in line 27.

Line #	Description
32	<pre><th>\${%localizedString(Present)}\$</th></pre> Present is the heading for the last column. This heading is translated if possible.
35	<pre><td>\${%localizedString(Active Energy)}\$</pre> Active Energy is the row heading. This heading is translated if possible. <pre></td></pre> This displays the units that the meter has defined for the named register kWh del-rec.
36	<pre><td regname="kWh del-rec"></td></pre> This displays the instantaneous value of the named register kWh del-rec.¹
39	<pre><td>\${%localizedString(Reactive Energy)}\$</pre> Reactive Energy is the row heading. This heading is translated if possible. <pre></td></pre> This displays the units that the meter has defined for the named register kVARh del-rec.
40	<pre><td regname="kVARh del-rec"></td></pre> This displays the instantaneous value of the named register kVARh del-rec.¹
49	<pre>instantaneousReadings.initInstantaneousReadings('sample-readings');</pre> Sample-readings is the unique name of the first webpage content name. This HTML code updates all of the webpage's values.

¹ Named registers are listed in the PM8000 Modbus registers map. If the desired value is not listed, you can reference the value by its ION handle, using the following format: `<td regname="_0x####"></td>`, where `####` is the hexadecimal value of the ION handle.

Sample setup webpage

You can create custom setup webpages using the sample webpage stored on your meter.

Sample webpages are stored in the documents folder on your meter's internal FTP site.

The PM8000 register map is available from www.schneider-electric.com.

The PM8000 ION handles document is packaged with the meter firmware file which is available for download from www.schneider-electric.com.

Custom setup webpages must be stored on your meter's internal FTP site in the folder for Setup. The custom webpage is viewed by selecting the Setup main menu tab on your meter's webpage.

Configuring the HTML code other than where described is an advanced procedure and should only be performed by those with an advanced understanding of webpages and how your meter processes them.

Sample webpage setup result

NOTE: This graphic is representative only, and your meter's webpages may appear different than shown.

User1 | Logout

January 28 2000, 08:44:04

Monitoring

Control

Diagnostics

Setup

Maintenance

Ethernet

Serial Port

SNMP Parameters

NTP

SMTP

Date & Time

Preferences

Metering

SampleSetupPane

Basic Settings

Ethernet

MAC Address

006078354417

Ethernet Device Name

PM8000_354417

IP Address

10.168.64.138

Advanced Settings

Apply

A	HTML filename
B	Content pane title
C	Sub-heading
D	Row heading
E	Named register value
F	Second content pane title

Sample setup webpage content

Line #	Sample HTML
1	SampleSetupPane.html
2	
3	<div class="content-fit">
4	<form id="formSampleSettings">
5	
6	<div class="accordion">
7	<h3 target="sample-basic">\${%localizedString(Basic Settings)}#\$/h3>
8	<div id="sample-basic">
9	<table class="formtable">
10	<tr>
11	<th> </th>
12	<th> </th>
13	</tr>
14	<tr>
15	<td>\${%localizedString(Ethernet)}#\$/td>
16	<td> </td>
17	</tr>
18	<tr class="minor">
19	<td>\${%localizedString(MAC Address)}#\$/td>
20	<td regname="MAC Address"></td>
21	</tr>
22	<tr class="minor">
23	<td>\${%localizedString(Ethernet Device Name)}#\$/td>
24	<td><input name="Ethernet Device Name" type="text" /></td>
25	</tr>
26	<tr class="minor">
27	<td>\${%localizedString(IP Address)}#\$/td>
28	<td><input name="IP Address" type="text" /></td>
29	</tr>
30	</table>
31	
32	</div>
33	
34	<h3 target="sample-advanced">\${%localizedString(Advanced Settings)}#\$/h3>

Line #	Sample HTML
35	<div id="sample-advanced">
36	<table class="formtable" id="frameFormatDropdownContainer">
37	<tr>
38	<th> </th>
39	<th> </th>
40	</tr>
41	<tr>
42	<td>\${%localizedString(TCP Keep Alive Minutes)}#</td>
43	<td><input type="text" name="TCP Keep Alive Minutes" class="small" /> </td>
44	</tr>
45	<tr>
46	<td>\${%localizedString(Enable Web Server)}#</td>
47	<td><select name="Enable Web Server"></select> </td>
48	</tr>
49	</table>
50	
51	</div>
52	</div>
53	
54	<input type="submit" class="apply" value='\${%localizedString(Apply)}#<' />
55	
56	</form>
57	
58	
59	<script type="text/javascript">
60	
61	SetupPane.init('formSampleSettings');
62	formChangeDetection.initFormChangeDetection('#formSampleSettings', '#dialogFormChanges');
63	
64	</script>
65	</div>

Sample setup webpage content description

Line #	Description
1	SampleSetupPane.html The HTML filename, including the HTML extension (.html). This filename must comply with FTP filename conventions (no spaces or special characters). The filename (without the HTML extension) is the name shown on the webpage menu.
4	<form id="formSampleSettings"> "formSampleSettings" is the name of the webpage content. This name must be unique
7	<h3 target="sample-basic"> This creates the first webpage content pane. "sample-basic" is the name of the webpage content. This name must be unique. \${%localizedString(Basic Settings)}#</h3> Basic Settings is the title of the webpage content pane. This title is translated if possible.
8	<div id="sample-basic"> This must match the name of the webpage content in line 7.
15	<td>\${%localizedString(Ethernet)}#</td> Ethernet is the subheading. This heading is translated if possible.

Line #	Description
19	<pre><td>\${%localizedString (MAC Address) #}\$</td></pre> MAC Address is the row heading. This heading is translated if possible.
20	<pre><td regname="MAC Address"></td></pre> This displays the value of the read-only named register MAC Address.¹
23	<pre><td>\${%localizedString (Ethernet Device Name) #}\$</td></pre> Ethernet Device Name is the row heading. This heading is translated if possible.
24	<pre><td><input name="Ethernet Device Name" type="text" /></td></pre> This displays the instantaneous value of the configurable named register Ethernet Device Name in a text-edit field.¹ The type must match the named register type, in this case, an alphanumeric string.
27	<pre><td>\${%localizedString (IP Address) #}\$</td></pre> IP Address is the row heading. This heading is translated if possible.
28	<pre><td><input name="IP Address" type="text" /></td></pre> This displays the instantaneous value of the configurable named register IP Address in a text-edit field.¹ The type must match the named register type, in this case, an alphanumeric string.
34	<pre><h3 target="sample-advanced"></pre> This creates the second webpage content pane. Sample-advanced is the name of the webpage content. This name must be unique. <pre> \${%localizedString (Advanced Settings) #}\$</h3></pre> Advanced Settings is the title of the webpage content pane. This title is translated if possible.
35	<pre><div id="sample-advanced"></pre> This must match the name of the webpage content in line 34.
42	<pre><td>\${%localizedString (TCP Keep Alive Minutes) #}\$</td></pre> TCP Keep Alive Minutes is the row heading. This heading is translated if possible.
43	<pre><td><input type="text" name="TCP Keep Alive Minutes" class="small" /></pre> This displays the instantaneous value of the configurable named register TCP Keep Alive Minutes in a text-edit field.¹ The type must match the named register type, in this case, an alphanumeric string. <pre></td></pre> This displays the units that the meter has defined for the named register TCP Keep Alive Minutes. NOTE: There are no defined units for TCP Keep Alive Minutes, so no units are displayed.
46	<pre><td>\${%localizedString (Enable Web Server) #}\$</td></pre> Enable Web Server is the row heading. This heading is translated if possible.
47	<pre><td><select name="Enable Web Server"></select> </td></pre> Enable Web Server is the named register that is displayed. Named registers are listed in the PM8000 registers map. The type must match the named register type, in this case, an enumerated value that is displayed as a drop-down list.
61	<pre>SetupPane.init('formSampleSettings');</pre> This must match the webpage content name from line 4.
62	<pre>formChangeDetection.initFormChangeDetection('#formSampleSettings', '#dialogFormChanges');</pre> This must match the webpage content name from line 4. This HTML code updates all of the webpage's values.

¹ Named registers are listed in the PM8000 registers map. If the desired value is not listed, you can reference the value by its ION handle, using the following format: `<td regname="_0x####"></td>`, where `####` is the hexadecimal value of the ION handle.

Chapter 14 Trending and forecasting

Trending and forecasting overview

Trending and forecasting is a feature on your device that predicts the next set of measured or calculated data by plotting and analyzing trends in historical data.

Trending and forecasting data is a useful tool to help analyze changes in load and power quality and forecasting values such as demand. For your meter's trending and forecasting feature to work, you only need to give the meter time to accumulate data.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for detailed information about the Trending and Forecasting module.

Trending and forecasting implementation

Data used for trending and forecasting is logged for the following intervals:

- Every hour for the last 24 hours
- Every day for the last month
- Every week for the last 8 weeks
- Every month for the last 12 months

The following parameters are configured for trending and forecasting by default:

kW sd del-rec (demand)	Freq (frequency)
VII ab	I a mean
VII bc	I b mean
VII ca	I c mean
VII avg	I avg mean

You can configure the start day of the week for trending and forecasting using ION Setup.

Related topics

- See “Accessing the meter’s webpages” on page 116 for instructions on how to access your meter’s webpages.
- See “Viewing trending and forecasting data on your meter’s webpages” on page 127 for instructions on how to view trending and forecasting data.
- See “Configuring time and time synchronization using ION Setup” on page 96 for instructions on how to reset your meter’s start day of the week.

Viewing trending and forecasting data on your meter’s webpages

You can select data for forecasting and trending and view the resulting information using your meter’s webpages.

For trending and forecasting to operate, your meter must have accumulated data for at least two of the specified intervals; for example, if you want to view a daily graph, your meter must have accumulated data for at least two previous days before the present day.

1. Log in to your meter’s webpages.

2. Click **Monitoring > Trending & Forecasting**.
3. Select the **Target** and **Interval**. The graph for the selected data is displayed.

Chapter 15 Data, waveform and event logging

Overview

This section describes the meter's logging features. Your meter can support up to 50 logs (data recorders) which can each record up to 16 different parameters.

Your meter has a number of onboard default logs (also called data recorders) that are used to store data related to:

- Power quality and compliance
- Trending and forecasting
- Energy/revenue metering
- Meter events

Your meter also logs voltage and current waveform data when a sag or swell is detected. You must enter your power system's nominal values and configure your meter so that it can identify sags and swells. You can configure your meter's setpoint learning feature to learn your power system's normal operating values and use that information to help identify voltage sags and swells.

Logged data can be retrieved by energy management software.

Related topics

- See "Minimum configuration requirements for basic metering" on page 37 for information on entering your nominal values through the meter's display.

Default logging capacity

The following table summarizes the default logging depths and intervals for your meter's onboard data and waveform recorders:

Data recorder number	Log name	Depth	Interval
1	Revenue Log	3360 (35 days)	900 seconds (15 minutes)
9	Loss Log	3360 (35 days)	900 seconds (15 minutes)
2, 3, 4	Historic Logs	3360 (35 days)	900 seconds (15 minutes)
39	Daily Nominal Log	450	Triggered on demand
7, 8	Harmonics Logs	840 (35 days)	3600 seconds (1 hour)
N/A	Waveform recorders (6 total)	30	Triggered on demand
N/A	COMTRADE records	1	Triggered by waveform recording
10	Energy/Demand (EgyDmd Log)	3360 (35 days)	900 seconds (15 minutes)
5	Sag/Swell Log	100	Triggered on demand
N/A	Event Log	500	Triggered on demand
11, 12, 17, 19 - 26, 28, 29, 32, 35	EN50160 Logs	varies	EN50160 intervals
6, 16, 37, 38, 40	4-30 Logs	varies	IEC61000-4-30 intervals

Changing the log depths

Use ION Setup to change the number of records (depth) stored in the log. Changing how log records information (circular, or stop-when-full) is an advanced procedure to change the *RecordMode* setup register in the Data Recorder and Waveform Recorder modules.

Data logs and circular format waveform recorders have a minimum depth of 2 records.

Changing the log intervals

You can use ION Setup to change the logging intervals for the revenue and energy demand log.

Changing the interval for other data logs is an advanced procedure to modify the Periodic Timer module's *Period* setup register, which triggers the data log's recording.

Do not change the Periodic Timer module's *Sync Mode* setup register.

The default Periodic Timer modules that control the frequency of different data recording are as follows:

- Revenue Log Trg: controls the frequency of the logging of revenue values
- Loss Log Trg: controls the frequency of Loss Compensation Data logging
- EgyDmd Log Trg: controls the frequency of logging for the Energy and Demand Log (this log is used by ION Enterprise software to generate reports.)
- Hist Log Trg: controls the frequency of Historic Data logging
- Harm Log Trg: controls the frequency of Harmonics logging

Programming your meter to write to any data recorder at continuous intervals shorter than 60 seconds (heavy logging configuration) can cause loss of data in the event of a power failure.

NOTICE

DATA LOSS

Use an uninterruptible power supply (UPS) if you program your meter for heavy logging.

Failure to follow these instructions can result in data loss.

Data log memory calculations

The amount of memory required to store data and event logs depends on the number of parameters being logged and the frequency with which these parameters are logged. The memory required is calculated as follows:

Memory consumption for each record (in Bytes) = [(number of parameters x 5) + 8]

For example, a data log recording three parameters consumes 23 Bytes of data. If the data is recorded every 15 minutes for 35 days, the data log requires approximately 80 kiloBytes of logging memory.

Waveform record memory calculations

The meter can simultaneously capture waveforms triggered by events on all channels to a maximum of 96 cycles for each waveform record. The memory required is calculated as follows:

Memory consumption for each waveform (in Bytes) = $[2 \times \text{number of samples per cycle} + 12] \times [\text{number of cycles in waveform} \times 2] + 32$.

A single waveform record requires approximately 8 kB of memory.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for more information about the logging memory allocations and other meter logging memory information displayed by the ION Setup Assistant.

Data logging overview

Your meter has data logging capabilities, including a special type of data log which is an event log, which logs prioritized events.

Data logs are recorded by your meter and stored in the meter's memory inside configurable data logs. Your meter's data logs are retained if the meter loses power.

Logged data can be used by energy management software. Logs can be configured to either overwrite the oldest data when full (circular), or to stop writing data to the log when the number of logged records reaches the maximum log depth (stop-when-full).

Your meter ships with a comprehensive data-logging configuration consisting of data logs set up to record values at specific intervals or on conditions. Your meter's default data logging configuration should be sufficient for most applications, but you can also reconfigure existing logs or create new logs for custom applications if needed.

Your meter can also be configured to email data log information.

Related topics

- See "Default logging capacity" on page 129 for details about your meter's default logging configuration.
- See the *Internal email client feature* technical note, available from www.schneider-electric.com, for instructions on how to configure your meter to email logged data.

Default data logging configuration

The default data logging configuration might be used by other components of your power monitoring system. Do not change the default configuration of any of the logs, unless you understand the impact of the change on these power monitoring system components and the data they use and on your meter's memory.

Revenue log

The Revenue Log is configured for use with UTS MV-90 billing software. The default values logged by the Revenue Log are as follows:

Parameter	Description
kWh del int	Interval kWh delivered
kWh rec int	Interval kWh received

Parameter	Description
kVARh del int	Interval kVARh delivered
kVARh rec int	Interval kVARh received

Historic data logs

Three historic data logs are used to record standard power system quantities, such as phase current, phase voltage and power factor. These logs are labeled Hist Mean Log, Hist High Log, and Hist Low Log. By default, they log the following values:

Hist Mean Log		Hist High Log		Hist Low Log	
Vll ab mean	I avg mean	Vll ab high	I avg high	Vll ab low	I avg low
Vll bc mean	I 4 mean	Vll bc high	I 4 high	Vll bc low	I 4 low
Vll ca mean	kW tot mean	Vll ca high	kW tot high	Vll ca low	kW tot low
Vll avg mean	kVAR tot mean	Vll avg high	kVAR tot high	Vll avg low	kVAR tot low
V unbal mean	kVA tot mean	V unbal high	kVA tot high	V unbal low	kVA tot low
Ia mean	PF lag mean	Ia high	PF lag high	Ia low	PF lag low
Ib mean	PF lead mean	Ib high	PF lead high	Ib low	PF lead low
Ic mean	Freq mean	Ic high	Freq high	Ic low	Freq low

Loss log

The Loss Log is configured to record loss values. By default, it logs the following values:

Parameter	Description
MU Ia^2h int	Phase A interval current squared hours
MU Ib^2h int	Phase B interval current squared hours
MU Ic^2h int	Phase C interval current squared hours
MU Vllab^2h int	Phase A interval voltage Line-to-Line squared hours
MU Vllbc^2h int	Phase B interval voltage Line-to-Line squared hours
MU Vllca^2h int	Phase C interval voltage Line-to-Line squared hours
MU Vln a^2h int	Phase A interval voltage Line-to-Neutral squared hours
MU Vln b^2h int	Phase B interval voltage Line-to-Neutral squared hours
MU Vln c^2h int	Phase C interval voltage Line-to-Neutral squared hours

Harmonics logs

Two harmonics logs record various harmonics data, including K-factor and Total Harmonic Distortion (THD). These recorders are labeled Harm Mean Log and Harm High Log. By default, they log the following values:

Harm Mean Log		Harm High Log	
V1 THD mean	I1 K Fac mean	V1 THD high	I1 K Fac high
V2 THD mean	I2 K Fac mean	V2 THD high	I2 K Fac high
V3 THD mean	I3 K Fac mean	V3 THD high	I3 K Fac high
I1 THD mean		I1 THD high	
I2 THD mean		I2 THD high	
I3 THD mean		I3 THD high	

Energy/Demand log

The Energy/Demand log records energy and demand data used by energy management software to generate reports. Changing the logged data can prevent the generation of reports that use this data.

Sag/swell log

The Sag/swell Log provides details of power quality events. By default, it logs the following values:

SS1 DistDur	SS1 DistV1Min	SS1 DistV1Max	SS1 DistV1Avg
SS1 DistV1Engy	SS1 DistV2Min	SS1 DistV2Max	SS1 DistV2Avg
SS1 DistV2Engy	SS1 DistV3Min	SS1 DistV3Max	SS1 DistV3Avg
SS1 DistV3Engy	SS1 DistNominal	SS1 Swell Lim	SS1 Sag Lim

EN50160 compliance logs

The EN50160 compliance logs are used to record EN50160 compliance parameters:

Data recorder	EN50160 component logged	Data recorder	EN50160 component logged
EN50160 Frq/Mg	Power frequency and supply magnitude	EN50160 PrmHrm1	Parameter data (disabled by default)
EN50160 Hrm Vlt	Harmonics	EN50160 PrmHrm2	
EN50160 Intrp	Short/log interruptions	EN50160 Vlt Dp1	Supply voltage dips
EN50160 OvrVlt1	Temporary overvoltage	EN50160 Vlt Dp2	
EN50160 OvrVlt2		EN50160 Vlt Dp3	
EN50160 Prm-f/V	Parameter data	EN50160 Vlt Dp4	
EN50160 Prm-Vlr	(disabled by default)	EN50160 Vlt Dp5	
EN50160 Vunbal	Voltage unbalance		

The meter logs EN50160 counter data for present and previous observation periods as well as EN50160 events.

4-30 compliance logs

Four 4-30 compliance logs are used to log parameters related to the International Electrotechnical Commission's IEC 61000-4-30 standards' power quality compliance and to create reports:

Data recorder	4-30 parameters logged
4-30 10m Log	- PqFlag - V1 - V2 - V3 - V1 THD (Total Harmonic Distortion) - V2 THD - V3 THD - NegSeqComp (Vneg/Vpos) - ZeroSeqComp (Vzero/Vpos) - Power Freq
4-30 10s Freq	- Power Frequency - PqFlag
4-30 2hr Log	- PqFlag - V1 - V2 - V3 - V1 THD (Total Harmonic Distortion) - V2 THD - V3 THD - NegSeqComp (Vneg/Vpos) - ZeroSeqComp (Vzero/Vpos) - Power Freq

Data recorder	4-30 parameters logged
4-30 3s Log	- PqFlag - V1 - V2 - V3 - V1 THD (Total Harmonic Distortion) - V2 THD - V3 THD - NegSeqComp (Vneg/Vpos) - ZeroSeqComp (Vzero/Vpos)
4-30 V Intrp DrtnAll	Voltage interruption duration (all voltages)

Related topics

- See the *4-30 Compliance and ION Meters* technical note, available from www.schneider-electric.com, for more information about your meter's 4-30 compliance.
- See the *EN50160 2010 compliance and ION meters* technical note, available from www.schneider-electric.com, for more information about your meter's EN50160 compliance.

Advanced logging configuration

Adding or deleting data logs or their parameters outside of the ION Setup Assistant should only be undertaken by those with an advanced understanding of ION architecture and their meter's template.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information about ION Architecture and ION modules.

Event log overview

Your meter records events produced by the meter's ION modules or external meter events.

Meter events, such as meter configuration or changes to I/O state, have priority values associated with them, so you can control what events are logged. Each event has a priority based on its type and severity, and for most events you can configure the priority. The event log records the date and time of the event, along with relevant details about the event.

Your meter's event log can be viewed through the meter's display and ION Setup.

Event log data example:

Date/Time	Cause	Value	Effect	Value
11/10/2014 11:21:13.577 AM	Ethernet	FTP	Front Panel	Auth FAIL
11/10/2014 11:21:43.000 AM	Front Panel	Remote Display	Front Panel	File received on RMD
11/10/2014 11:24:45.000 AM	Front Panel	Remote Display	Front Panel	RMD firmware upgrade successful
11/10/2014 11:24:48.135 AM	Front Panel	Remote Display	Front Panel	RMD disconnected
11/10/2014 11:25:15.820 AM	Front Panel	Remote Display	Front Panel	RMD connected
11/10/2014 11:29:27.316 AM	Ethernet	FTP	Front Panel	Auth FAIL

NOTE: This example is representative only, and your meter's event log may appear different than shown.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Event Log Controller module and other ION modules.
- See “Viewing data using your meter’s display” on page 30 for instructions on how to view your meter’s event log through the display.
- See “Default event log configuration” on page 135 for more information about your meter’s events and priorities.

Default event log configuration

Your meter’s event log might be used by other components of your power monitoring system. Do not change the default event log configuration unless you understand the impact of the change on the power monitoring system components and the data they use and on your meter’s memory.

Changing the default event log configuration should only be undertaken by those with an advanced understanding of ION architecture and their meter’s template.

By default, your meter logs all configuration changes, meter access events, and power system events. You can configure certain features, such as the digital inputs, so an event is logged when the feature changes state (for example, the digital input changes from off to on).

The event log is controlled by the Event Log Controller module, which allows you to set a priority cutoff for event logging. Events with a priority number greater than the cutoff value are logged, and events with lower priorities are discarded. By default, this value is set so that all relevant events are recorded in the meter’s event log. Event priority values range from 0 to 255 with a typical cutoff value of 5.

NOTE: Alarms are generated by events from certain ION modules. The alarm level is determined by the priority of the associated event. To disable the alarm but still record the associated event, set the alarm priority to info only. To disable the alarm and the event, set the alarm priority to none.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Event Log Controller module and event priorities for specific ION modules.
- See “Alarms overview” on page 147 for details of alarm operation and configuration.

Waveform recording overview

Your meter is able to record voltage and current waveform information.

Waveform information is used to help identify power system disturbances, which are an increasing concern for industrial plants, hospitals, data centers and other facilities where the equipment is sensitive to voltage or current sags, swells, and momentary interruptions. Waveform information is also used to help ensure compliance with power quality standards.

In addition to measuring and recording numerical values for voltage and current, your meter can also capture the sinusoidal waveform data. The current and voltage waveform data provides additional information for analysis of the system’s power quality or a power quality event.

You can manually trigger waveform recordings or configure them to trigger automatically when there is a power quality or power system event. For waveform recording to trigger automatically, you must enter your system's nominal (normal) voltage and current values, and then the amount of deviation from the nominal required to trigger waveform recording.

Your meter's waveform data storage format is defined by:

- Cycles: the number of cycles (based on your power system's frequency) included in the waveform (its duration).
- Samples: samples per cycle, which is the number of waveform data points collected in each cycle.

This gives you the option to record a lot of information for a very short duration or less information over a longer duration. You can also configure a delay in starting waveform recording which allows you to record pre- and post-event data.

You can use your meter to detect ITI (CBEMA) - type disturbances, and can determine information regarding the magnitude and duration of each disturbance. This information can be used by your energy management system to plot the disturbance on a CBEMA curve.

COMTRADE waveform data is available from your meter.

NOTE: If you are generating COMTRADE waveform information, the associated waveform recorders cannot be modified unless COMTRADE is disabled. If the waveform recorders are not configured identically, COMTRADE waveform information will not be generated.

Key terms

Term	Definition
COMTRADE	COMMon format for TRAnsient Data Exchange (COMTRADE) is a common format for waveform data.
ITI (CBEMA)	A curve that graphically describes an AC input voltage envelope which can be typically tolerated by information technology equipment. Meter waveform information is plotted on this curve to help evaluate power quality.
Nominal	The normal or usual parameter value. For example, the nominal voltage for many power systems is 120 V.
Sag	A power event where the voltage or current drops below the nominal value.
Swell	A power event where the voltage or current rises above the nominal value.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information on the Waveform Recorder module and its settings.
- See "COMTRADE" on page 71 for more information about COMTRADE waveform data.
- See "Minimum configuration requirements for basic metering" on page 37 for information on the values that must be configured for your meter to perform power quality calculations.
- See "Setpoint learning overview" on page 137 for information about configuring your meter to learn your power system's normal acceptable range of values.

Default waveform recording configuration

Your meter's waveform recording operates once your nominal values are configured.

Your meter has the following default waveform recorders:

Waveform recorder	Description
Wfm Rc V1-Sg/Sw	V1 voltage waveforms recorded during a defined sag or swell event.
Wfm Rc V2-Sg/Sw	V2 voltage waveforms recorded during a defined sag or swell event.
Wfm Rc V3-Sg/Sw	V3 voltage waveforms recorded during a defined sag or swell event.
Wfm Rc I1-Sg/Sw	I1 current waveforms recorded during a defined sag or swell event.
Wfm Rc I2-Sg/Sw	I2 current waveforms recorded during a defined sag or swell event.
Wfm Rc I3-Sg/Sw	I3 current waveforms recorded during a defined sag or swell event.

Setpoint learning overview

Your meter can detect disturbances or values that are outside of a defined acceptable range. If you do not know what that acceptable range is or what threshold constitutes a voltage disturbance, your meter can learn these values by monitoring normal operating values to determine what constitutes a voltage sag or swell in order to help identify high and low setpoints.

NOTE: To help your meter learn the most accurate values possible, it is important that learning occur during a period of normal operation. Do not schedule learning during a period of unusual operations in your system. Do not modify your meter's configuration during the learning period as it may stop the learning process.

You can configure the meter so that learned values are applied automatically once the learning period is complete or require that they are reviewed and manually applied. If a learned value is invalid, the learned values are not automatically applied, but logged for review.

Setpoint learning can be used to identify the following values:

Feature	Values
Setpoints (Alarms)	High limit Low limit Sustain until ON Sustain until OFF
Sag	Voltage sag limit
Swell	Voltage swell limit

Learning installation mode and learning duration

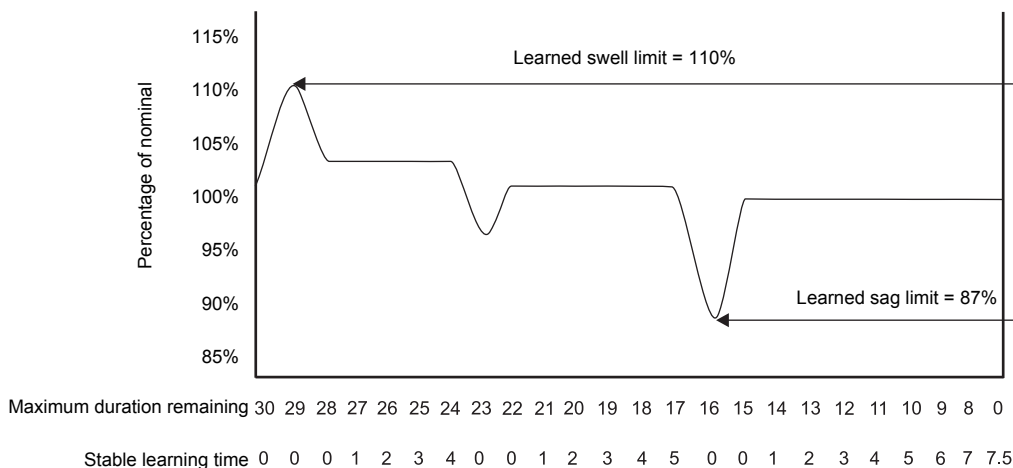
There are two learning installation modes:

- **Manual:** the meter learns the applicable values but does not begin using the learned values. The learned values are recorded for review, and you can decide to use the learned values or adjust them as required before manually implementing the learned values.
- **Automatic:** the meter learns the applicable values and begins using those learned values automatically at the end of the learning period. If a learned value is invalid, the meter does not apply the value, but the value is recorded in the event log.

You can configure the maximum learning duration. The actual learning duration may vary, depending on the stability of the system. If the system is stable for a period equal to one quarter of the maximum learning duration, learning is complete; otherwise, the learning period will be the maximum learning duration.

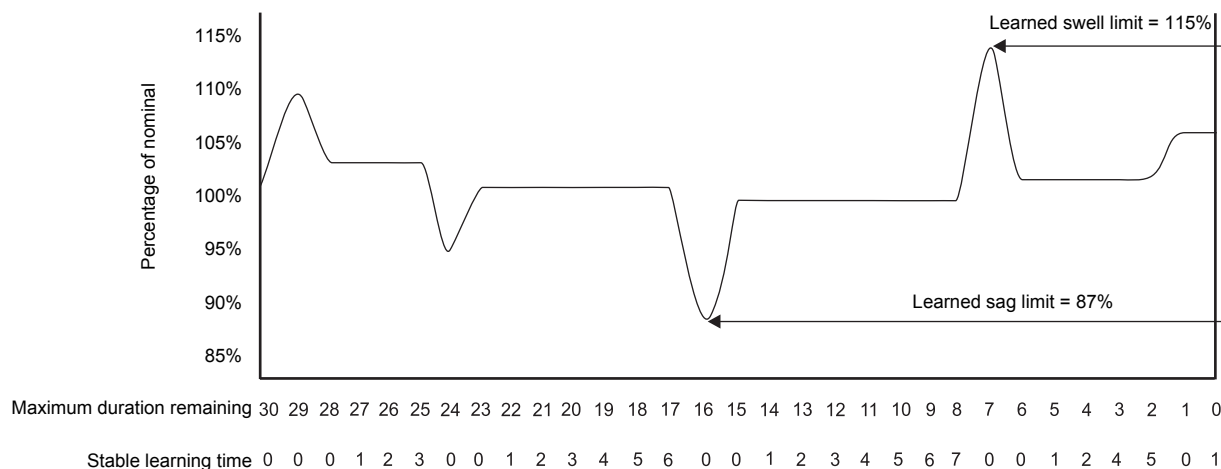
Example: Setpoint learning duration in a stable system

In this example, the learning duration is 30 days. When the system is stable for 7.5 days (one quarter of 30 days) learning is complete.



Example: Setpoint learning duration in an unstable system

In this example, the learning duration is 30 days. Because the system is not stable for 7.5 days (one quarter of 30 days) learning is complete at the end of the maximum learning duration.



Related topics

- See "Implementing sag/swell limit learning using ION Setup" on page 108 for instructions on how to configure learning for determination of sags or swells.
- See "Implementing alarm setpoint learning using ION Setup" on page 108 for instructions on how to configure learning for determination of power system events.
- See the *ION Reference*, available from www.schneider-electric.com, for more information on Sag/Swell, Setpoint and Relative Setpoint modules.

Chapter 16 Inputs/outputs

Inputs/outputs overview

Your meter has onboard digital I/O which can be increased by adding optional digital and analog I/O modules to expand your meter's I/O capabilities.

Your meter's digital and analog outputs may change state when being configured, during an option module reset or power cycle, or during firmware or framework upgrade.

WARNING

UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Your meter's inputs are used to monitor and receive signals from external sources, and its outputs are used to send signals to external sources.

Example:

- You can use a digital input to monitor a breaker to verify how many times the breaker trips. When the breaker reaches its limit for the number of trips, you can use the digital output to light an LED next to the breaker to help remind maintenance personnel know it is due to be replaced.
- You can use a digital output to pulse based on energy measurements.
- You can use an analog input to monitor an analog flowmeter to measure how much water flows through a pipe, and use the meter's analog output to send a signal to an analog-controlled valve to modify the valve position and change the flow rate.

Your PM8000 meter base has:

- 3 digital inputs
- 1 form A digital output
- 2 energy pulsing LEDs (one visible, one infrared)

You can view information about your meter's I/O through the display and webpages, and configure your meter's I/O using ION Setup.

NOTE: The digital outputs can handle voltages less than their specified maximum. For higher voltage applications, use an external relay in the switching circuit.

Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for I/O wiring and installation instructions.

Input/output ION modules

You need to configure the following ION modules in order to use the meter's digital or analog I/O.

- Digital input: uses the Digital Input module, which tells the meter how to interpret incoming signals.
- Digital output: uses one of three ION modules depending on the application.
 - Digital Output module: monitors a change of state to control relay operation via a hardware output device.
 - Pulser module: transfers high-speed pulses to a hardware pulse counting device that is used to track energy usage.
 - Calibration Pulser module: integrates instantaneous power inputs, then outputs high-speed pulses to an LED that can be monitored for energy accuracy verification.

NOTE: All of these modules can act as intermediaries between the physical hardware port and the other modules in the meter. They define the characteristics of the outgoing signals.

- Analog input: uses the Analog Input module, which tells the meter how to interpret an incoming analog voltage or current signal from transducers.
- Analog output: uses the Analog Output module to deliver a continuous direct voltage or current analog signal to transducers.

Input/output ION modules, ports and labels

You can configure the Digital Output, Digital Input, Analog Input, Analog Output, Pulser and Calibration Pulser ION modules to specify which port handles the outgoing or incoming signals. To assign a port to one of these modules, simply modify the *Port* setup register by picking a port from the enumerated list.

The following tables describe the ports that can be configured to handle outgoing or incoming signals:

ION module type	ION module name	Hardware port (device label)	Port name (ION label)	Description
Onboard digital output port				
Digital Output	Port D1	D1	Port D1	Form A output
Calibration Pulser	Wh Pulser -LED	N/A	kWh Pulse LED	Energy pulsing
Onboard digital input ports				
Digital Input	Port S1	S1	Port S1	Externally excited
	Port S2	S2	Port S2	Externally excited
	Port S3	S3	Port S3	Externally excited

ION module type	ION module name	Hardware port (device label)	Port name (ION label)	Description
Option module(s) digital input ports				
Digital Input	Port A/B/C/D-S1-S6	S1 - S6	Port A S1 - S6 Port B S1 - S6 Port C S1 - S6 Port D S1 - S6	Option module digital inputs
Option module(s) digital output ports				
Digital Output	Port A/B/C/D D1 - D2	Relay 1 - Relay 2	Port A D1 - D2 Port B D1 - D2 Port C D1 - D2 Port D D1 - D2	Option module digital output
Option module(s) analog input ports				
Analog Input	Port A/B/C/D A1 - A4	A1 - A4	Port A A1 - A4 Port B A1 - A4 Port C A1 - A4 Port D A1 - A4	Option module analog input
Option module(s) analog output ports				
Analog Output	Port A/B/C/D Q1 - Q2	Q1 - Q2	Port A Q1 - Q2 Port B Q1 - Q2 Port C Q1 - Q2 Port D Q1 - Q2	Option module analog output

NOTE: When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

Related topics

- See “Option modules” on page 43 for a description of how the ports are named based on the option module location with respect to the meter base.

IRIG-B time synchronization

You can connect an IRIG-B time source to one of meter’s digital inputs for IRIG-B time synchronization; for improved accuracy use the digital inputs on the meter base. For IRIG-B time synchronization, you must configure both the meter’s digital input and the meter’s clock.

Related topics

- See “Configuring onboard digital inputs using ION Setup” on page 101 for instructions on how to set your meter’s digital inputs for IRIG-B time synchronization.
- See “Configuring time and time synchronization using ION Setup” on page 96 for instructions on how to configure your meter’s time synchronization settings for IRIG-B time synchronization.

Analog inputs/outputs

Your meter’s analog I/O option modules can measure and output either low voltage or current using standard analog transducers such as 4 - 20 mA current transducers.

For analog input operation, your meter takes an analog input signal and provides the resulting scaled value. For analog output operation, your meter takes an input value and scales it to the appropriate signal value to send out the physical analog output port.

You can view analog I/O values from your meter’s display or webpages.

Analog input voltage and current mode

In current mode, the analog inputs have a low input resistance while the meter is powered on, and a high input resistance when the meter is powered off. In voltage mode, the analog inputs have a high input resistance regardless of whether the meter is powered or not.

NOTE: When unpowered, your meter's analog inputs act like they are in voltage mode (high input resistance).

When connected to a current output transducer, this high resistance can create a high voltage. Standard (i.e., 4 to 20 mA) current transducers have open circuit protection and are able to handle a high input resistance; however, if non-standard transducers are used high voltages may be generated. Your meter's analog input has circuitry to limit this voltage, but it may not be sufficient with a very high-power current source.

NOTICE

EQUIPMENT DAMAGE

- Ensure the analog input is configured for the correct voltage or current mode before connecting or activating the current transducer.
- Do not exceed the device's ratings for maximum limits.

Failure to follow these instructions will result in equipment damage.

Related topics

- See "Option modules" on page 184 for your option module's analog voltage and current range specifications.

Analog input behavior

Analog inputs may show a value below zero scale if an open circuit is detected on the input port.

Analog output behavior

Your meter's analog output, once configured, outputs voltage or current signals. If your meter's analog output source becomes unavailable (N/A) the analog output level should go to zero (0 V / 0 mA) under most conditions.

When your meter is powered off or configured to send voltage, the meter registers as a high impedance.

The electrical signal on the analog output is DC; make sure proper polarity is observed when wiring external devices to the analog output ports.

An unexpected change of state of the analog outputs can result when the supply power to the meter is interrupted, during an upgrade of the meter's firmware or framework or option module firmware or a during an option module reset.

⚠ WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Related topics

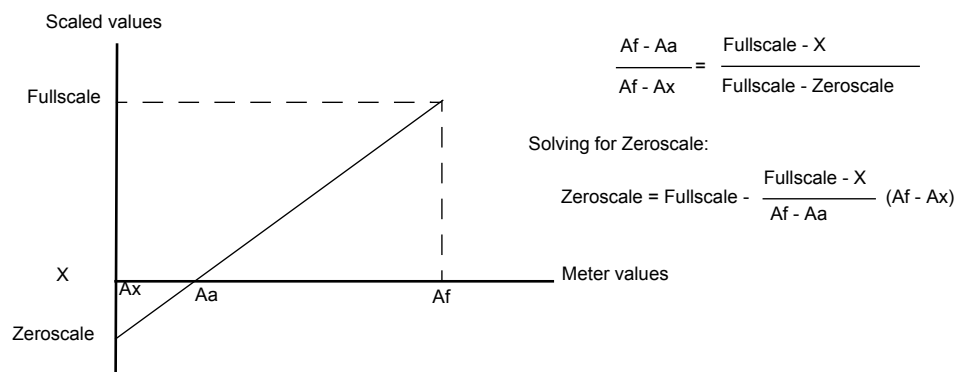
- See “Configuring I/O option module analog inputs using ION Setup” on page 103 and “Configuring option module analog outputs using ION Setup” on page 104 for instructions on how to configure your analog inputs and outputs using ION Setup.
- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Analog Input and Analog Output module settings.

How to calculate analog I/O zero scale and full scale values

Your meter receives an analog signal through its analog input port and scales it before displaying or logging the value. Your meter can also output a scaled analog signal based on measured values such as power. You must calculate the zero scale and full scale values to help ensure the scaled values are correctly interpreted.

Analog inputs will show a value below zero scale if an open circuit is detected on the input port.

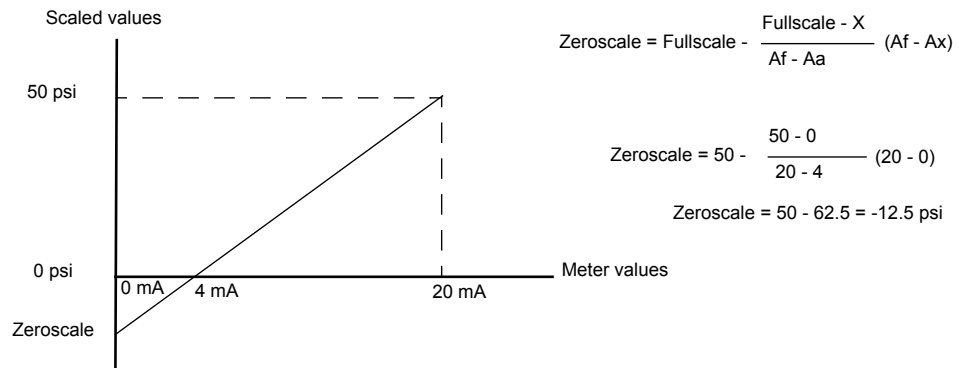
The relationship between the analog source range, the zero and full scale values, and the final value provided by your meter, is as follows:



- Aa = the lowest reading in the nominal operating range that is measured by the meter's analog input port or produced by the meter's analog output port
- Af = the highest reading in the nominal operating range that is measured by the meter's analog input port or produced by the meter's analog output port
- Ax = the analog input source minimum value or the external analog receiver's minimum value
- X = the scaled equivalent of Ax

Example (analog input)

The meter's analog input port can measure from 4 - 20 mA, and you need to monitor a steam pressure sensor which measures between 0 - 50 psi of steam. The steam pressure sensor's output ranges from 4 - 20 mA.



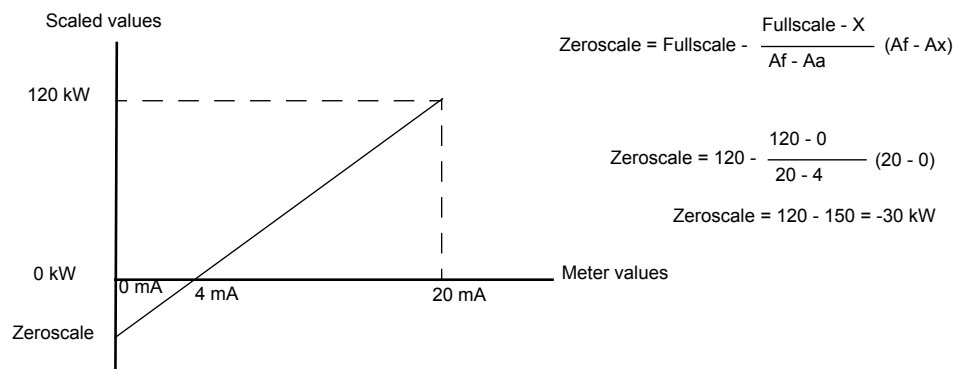
- $A_f = 20 \text{ mA}$
- $A_a = 4 \text{ mA}$
- $A_x = 0 \text{ mA}$
- Fullscale = 50 psi

Calculating the Zeroscale value from the equation above gives -12.5 psi.

Configuring the meter's analog input with Fullscale = 50 psi and Zeroscale = -12.5 psi produces an output value ranging from 0 - 50 psi represented by a 4 - 20 mA signal.

Example (analog output)

The meter is monitoring a 0 to 120 kW system and outputs the real power over a 4 to 20 mA analog output. The receiving device is expecting the 0 to 120 kW signal to be represented by the 4 to 20 mA signal.



- $A_f = 20 \text{ mA}$
- $A_a = 4 \text{ mA}$
- $A_x = 0 \text{ mA}$
- Fullscale = 120 kW
- $X = 0 \text{ kW}$

Calculating the Zeroscale value from the equation above gives -30 kW.

Configuring the meter's analog output with Fullscale = 120 kW and Zeroscale = -30 kW produces an output value ranging from 0 - 120 kW represented by a 4 - 20 mA signal.

Digital inputs/outputs

Your meter has three digital inputs and one digital output, and you can add digital I/O option modules to increase your meter's capabilities.

Digital I/O allows the meter to send and receive digital signals, including sending energy pulse information that can be used for verifying accuracy or receiving IRIG-B information for time synchronization. You can view the digital I/O values from your meter's display or webpages.

For high-accuracy applications like IRIG-B time synchronization or verifying accuracy, use the meter's onboard digital I/O.

Your meter's digital inputs can be used for input metering and incremental energy applications.

An unexpected change of state of the digital outputs can result when the supply power to the meter is interrupted, during an upgrade of the meter's firmware or framework or option module firmware or a during an option module reset.

WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Related topics

- See “Conditional energy” on page 167 for details about your meter's conditional energy feature.
- See “Input metering overview” on page 168 for details about your meter's input metering feature.
- See “IRIG-B time synchronization” on page 141 for information about IRIG-B time synchronization.
- See “Configuring onboard digital inputs using ION Setup” on page 101 for instructions on how to configure your digital inputs.
- See “Configuring onboard digital outputs using ION setup” on page 102 for instructions on how to configure your digital outputs.

Energy pulsing overview

You can use your meter's digital output or energy pulsing LEDs for energy pulsing.

Energy pulsing is when the meter sends a readable pulse or signal based on the measured energy. This pulse can be used for accuracy verification or as an input to another energy monitoring system. You must calculate your pulse values as either pulses per kWh or as kWh per pulse, as defined by your meter, and set the energy value as active, reactive, or apparent delivered, received, or delivered plus received.

For applications where energy pulsing accuracy is required, use the meter's onboard digital output.

Related topics

- See “Verifying accuracy” on page 175 for instructions on how to perform accuracy verification testing on your meter.
- See the *ION Reference*, available from www.schneider-electric.com, for more information about Calibration Pulser and Pulser modules.

Calculate your maximum kWh/pulse (pulse weight) value

To calculate the kWh/pulse (pulse weight) value, divide the highest kW value you can expect by the required pulse rate. Make sure the required pulse rate does not exceed the maximum pulse rate for the digital output.

NOTE: To convert from kWh/pulse to pulse/kWh you must invert (take the reciprocal) of the value. For example, 1.8 kWh/pulse becomes 0.556 pulse/kWh.

Example

For a maximum load of 1600 kW and a pulse rate of 2 pulses per second, calculate the kWh/pulse value as follows:

1. Convert 1600 kW load into kWh/second:
$$(1600 \text{ kW}) \times (1 \text{ hr}) = 1600 \text{ kWh}$$
$$(1600 \text{ kWh}) / (3600 \text{ sec}) = (X \text{ kWh}) / (1 \text{ sec})$$
$$X = 0.444 \text{ kWh/sec}$$
2. Calculate the kWh required per pulse:
$$(0.444 \text{ kWh/sec}) / (2 \text{ pulses per second}) = 0.222 \text{ kWh/pulse}$$
3. Adjust for the KY giving one pulse per 2 transitions if necessary.
$$(0.222 \text{ kWh/pulse}) / (2) = 0.111 \text{ kWh/pulse}$$

Chapter 17 Alarms and alerts

Your meter can display various alarms through the display, and can be configured to send an alert.

 **WARNING**

INACCURATE DATA RESULTS
Confirm your alarm is properly configured.
Failure to follow these instructions can result in death, serious injury or equipment damage.

Alarms overview

An alarm is a notification of a specific event that is annunciated through the display, and can be viewed and acknowledged using your meter’s display.

You can configure your meter to generate and display alarms when predefined events are detected in the meter’s measured values or operating states. Your meter also records and stores meter events in the meter’s onboard event log.

Your meter comes with many alarms. Some are preconfigured, while others need to be configured before your meter can generate alarms. Your meter’s default alarms can be customized, as needed, such as changing the priority. You can create custom alarms using the advanced features of your meter.

NOTE: To stop an alarm from being displayed without impacting other metering features, set its alarm priority to info only.

Related topics

- See “Event log overview” on page 134 for more information about your meter’s on-board event log.
- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Setpoint module.

Alarm types

Your meter has the following types of alarms:

Type	Description
Setpoint (standard)	Setpoint alarms define an alarm by comparing the actual value of a parameter to a specified limit or range of values. These include measured voltage and current values and calculated power quality values. Some setpoint alarms use high-speed measurements for up to 1 millisecond resolution.
Digital	Digital alarms define an alarm condition based on a digital input’s on/off state.
Disturbance (sag/swell)	Disturbance alarms define an alarm based on a measured sag or swell.
Unary	Unary alarms are not configurable, and generate an alarm based on the meter’s state, for example, the meter powering up.

Alarms have two states:

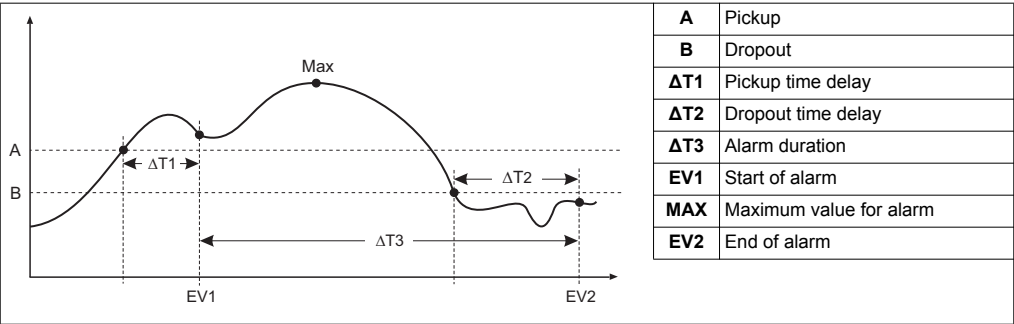
- Active: the meter detects the alarm condition is met.
- Historical: the alarm condition previously existed but the condition has since returned to a non-alarm state.

Setpoint (standard) alarms

You must define the pickup, dropout and set the time delay for these alarms. You can define the pickup and dropout values as actual values, or as a percentage of the nominal value, and set the time delay to minimize nuisance alarms.

The setpoint alarms operate as either over or under alarms, or as bounding alarms (both over and under values are alarmed).

Example of over setpoint alarm operation



When the monitored value rises above the pickup (A) and remains there long enough to satisfy the pickup time delay period ($\Delta T1$), the setpoint alarm is active. When the value falls below the dropout (B) and remains there long enough to satisfy the dropout time delay period ($\Delta T2$), the alarm is no longer active and becomes a historic alarm.

The meter records the date and time when the alarm event starts (EV1) and when it ends (EV2). The meter records the maximum value (Max) during the alarm period.

Disturbance (sag/swell) alarms

You must configure nominal voltage and current for these alarms to function. For voltage disturbances, enter the percentage deviation from the nominal that defines a sag or swell. For current disturbances, enter the percentage deviation from the nominal that defines the pickup and dropout points for a current sag or a current swell.

Digital alarms

These alarms are triggered when the associated digital input changes state. You can configure the alarm to be active when the digital input is on or off, depending on the alarm's purpose.

For example, if you used a digital input to monitor a breaker that is always supposed to be on, you would set the alarm to be active when the breaker has tripped.

NOTE: To stop a digital alarm from being displayed, set the alarm priority to info only. Disabling (force off) the digital alarm off will disable all functions of the associated digital input.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Setpoint and Relative Setpoint module, Digital Input module, Sag/Swell module and Disturbance Analyzer modules.
- See “Configuring setpoint/standard alarms using ION Setup” on page 106 for instructions on how to configure alarms on your meter using ION Setup.

Alarm event priorities

Your meter's alarm priorities correspond to the following event priority ranges:

Alarm priority	Event priority
High (red)	192 - 255
Medium (yellow)	128 - 191
Low (blue)	64 - 127
Info only (no alarm) ¹	1 - 63
None (no alarm or event) ¹	0

¹ Alarms with priority of info only or none are not indicated or displayed.

Info only and none event priority

Alarms with a priority of info only or none are not shown on the meter's display, and do not function as alarms. If the alarm's priority is set to info only, and the event priority is greater than the event log cutoff value, the associated event is recorded in the meter's event log. If the alarm's priority is set to none, the event priority is automatically set to zero, and no associated event is logged in the meter's event log.

For events that you want to log for future reference or troubleshooting, but don't want alarm functions, set the alarm priority to info only.

For nuisance events that frequently occur and you have no desire to log for reference or troubleshooting, set the alarm priority to none.

Related topics

- See "Event log overview" on page 134 for more information about event priority and the meter's event log.

Alarm indicators

Your meter's display has an alarm indicator to show you what alarm levels have been detected (active or historic) and whether they have been acknowledged. For active high priority alarms, the meter's display will also flash until the alarm is acknowledged. There is also an alarm LED to indicate the meter's alarm condition.

Alarm	Alarm icon	Alarm icon flash	Alarm LED	Meter display
Active high	Red solid bell	Flash if not acknowledged	- Flash if not acknowledged - Steady if acknowledged	Flash if not acknowledged
Active medium	Yellow solid bell	Flash if not acknowledged	- Flash if not acknowledged - Steady if acknowledged	No flash
Active low	Blue solid bell	Flash if not acknowledged	- Flash if not acknowledged - Steady if acknowledged	No flash
Historic high	Red outline bell	Flash if not acknowledged	- Flash if not acknowledged - Steady if acknowledged	No flash
Historic medium	Yellow outline bell	Flash if not acknowledged	- Flash if not acknowledged - Steady if acknowledged	No flash
Historic low	Blue outline bell	Flash if not acknowledged	- Flash if not acknowledged - Steady if acknowledged	No flash

Alarm	Alarm icon	Alarm icon flash	Alarm LED	Meter display
No active or unacknowledged alarms	Gray solid bell	No flash	Off	No flash

If there are multiple active alarms, the meter displays the alarm condition associated with the most important active alarm. If there are multiple unacknowledged historic alarms, the meter displays the alarm condition associated with the most important unacknowledged historic alarm.

NOTE: To stop an alarm from being displayed without impacting other metering features, set the alarm priority to info only.

Default alarms

Your meter comes with the following default alarms.

NOTE: Some alarms require configuration in order to operate.

Name	Priority	Description
Current Sag Ph1 - 3	High	Current sag alarms for phase 1, 2, 3
Current Swell Ph1 - 3	High	Current swell alarms for phase 1, 2, 3
Sag/Swell	High	Voltage sag/swell alarm
Over I unbal	Medium	Over unbalanced current alarm
Over V unbal	Medium	Over unbalanced voltage alarm
Over THD V1 - 3	Medium	Over total harmonic distortion (THD) voltage alarms
Over kW (P) sd	Medium	Over kW sliding demand alarm
Over I a - c, (1 -3) 4	Medium	Over current alarms
V1 - V3 Setpoint	Medium	Voltage setpoint alarms
Freq Setpoint	Medium	Frequency setpoint alarm
4-30 Volt Intrap Ph1 - 3	Low	4-30 voltage interruption power quality alarms
Digital In	Info only	Digital input alarms Number of alarms determined by the total number of available digital inputs NOTE: These alarms are not displayed by default.

Alarm information

You can view the following information about an alarm from your meter's display. Only alarms with a priority of low, medium or high are displayed.

Parameter	Description
Alarm	The name of the alarm (for example, Over THD V1).
Priority	Low, medium or high alarm priority.
Date	The date and time the alarm was triggered.
Duration	The duration of the alarm (only applies to inactive alarms).
Ack	The date and time when the alarm was acknowledged (only applies to acknowledged alarms).
Value	Active alarm: The maximum value detected when the alarm was triggered. Historic alarm: The maximum value detected during the duration of the alarm.

Disabling alarms through your meter's display

You can disable alarms through the meter's display when you are performing maintenance tasks on your system and want to prevent nuisance alarms.

NOTE: To stop an alarm from being displayed without impacting other metering features, set the alarm priority to info only.

WARNING

INACCURATE DATA RESULTS

Confirm your alarm is properly configured.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Navigate to **Setup Menu > Alarm Setup**. Press the edit button to access the enable/disable screen. Use the up and down arrows to scroll through the available alarms. Simultaneously press the up and down arrow to enable or disable the highlighted alarm.
2. Press the select button to confirm your settings.
3. Complete the system maintenance tasks.
4. Enable the alarms you disabled in step 1.

Related topics

- See “Setting up your meter using the display” on page 34 for instructions on how to navigate and use your meter’s display.

Alerting

An alert is an external notification produced by the meter to indicate changes, for example, a change of state for a digital input, or a power quality event such as a sag or swell.

Alerts are generated when a pulse or trigger that is configured to indicate the alert condition activates. You can configure alerts to send notification emails or messages to your energy management system through your meter’s existing Ethernet communications connections. You can configure alert messages as a simple text string or you can also include device information. You can configure the alert’s priority so that alerts are also recorded in the meter’s event log.

You can configure multiple alerts on a single meter, each having different activation triggers, messages and/or transmission types. For instance, you can have two alerts, one generating an email, the other sending a message to your energy management system, but using the same trigger conditions; or you can have two alerts with different conditions that send two unique emails to two different email addresses. You can also generate alerts based on triggers from devices connected to your meter.

Creating alerts is an advanced feature that requires familiarity with ION architecture and your power system and communications network. To create an alert, you must configure the Alert module using a configuration tool. You must also configure your device’s communications as needed to send the alerts, such as configuring your meter’s SMTP settings and connecting it via Ethernet to an SMTP mail server in order to send an alert by email.

Related topics

- See the *ION meter alerts* technical note, available from www.schneider-electric.com, for detailed information on creating and configuring alerts.
- See the *ION Reference*, available from www.schneider-electric.com, for detailed information about the Alert module and its operation.

Chapter 18 Resets

Resets overview

Resets allow you to clear various accumulated parameters stored on your meter or re-initialize meter accessories.

Meter resets clear your meter's onboard data logs and other related information. Resets are typically performed after you make changes to the meter's basic setup parameters (such as PT/CT settings) to clear obsolete or invalid data in preparation for putting the meter into active service.

You must enter a valid password in order to perform a reset.

NOTE: Revenue-locked meters must be unlocked to perform meter resets that affect revenue data.

Related topics

- See "Revenue locking" on page 173 for more information locking and unlocking revenue locked meters.

Meter resets

You can perform various meter resets through the meter's display or ION Setup.

Your meter's digital and analog outputs may change state or may not function during resets.

WARNING

HAZARD OF UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Meter resets clear the meter's onboard data logs and other related information.

NOTICE

DATA LOSS

Ensure all important data from the device has been retrieved before performing a reset.

Failure to follow these instructions can result in data loss.

Reset	Description
Master Reset	- Clears all the cumulative and derived quantities from the meter (including demand, peak demand, energy and revenue parameters). - Clears meter event and waveform logs. - Clears COMTRADE waveform records from the meter's internal FTP server. - Clears the meter's data logs.
Peak Demand Reset	Clears the peak demand values logged in the meter. NOTE: The peak demand reset has a lockout period that sets the minimum time allowed between consecutive resets.
Min/Max Reset	Clears all accumulated maximum and minimum values stored in the meter.
Digital Input Count Reset	Clears the digital input status change counters.
Harmonics Min/Max Reset	Clears all accumulated maximum and minimum harmonics values stored in the meter.
Disturbance Count Reset	Clears the sag/swell event counter. The sag/swell event counter counts the number of sag/swells that have occurred since power-up or the last reset, to provide power quality information to energy management systems.
EN50160 Reset	Clears all EN50160 parameters and statistics accumulated in the meter.
Option modules reset	Resets communications to the meter's expansion modules.
Conditional energy reset ¹	Clears the conditional energy values stored in the meter.
Input metering reset ¹	Clears the input metering values stored in the meter.

¹ These resets are only available through ION Setup.

Related topics

- See “Peak demand reset lockout” on page 172 for more information about the peak demand reset lockout.

Performing meter resets using the display

You can perform meter resets from the display after entering a valid password.

Revenue-locked meters must be unlocked to perform resets that impact revenue data.

Your meter's digital and analog outputs may change state or may not function during resets.

WARNING

HAZARD OF UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Meter resets clear the meter's onboard data logs and other related information.

NOTICE

DATA LOSS

Ensure all important data from the device has been retrieved before performing a reset.

Failure to follow these instructions can result in data loss.

- Navigate to **Setup Menu > Resets**.
- Press the edit button to access the configuration menu and use the up and down buttons to navigate through and select the resets you want to perform. Press the select button to perform the resets.

Related topics

- See “Revenue locking” on page 173 for more information on revenue locked meters.

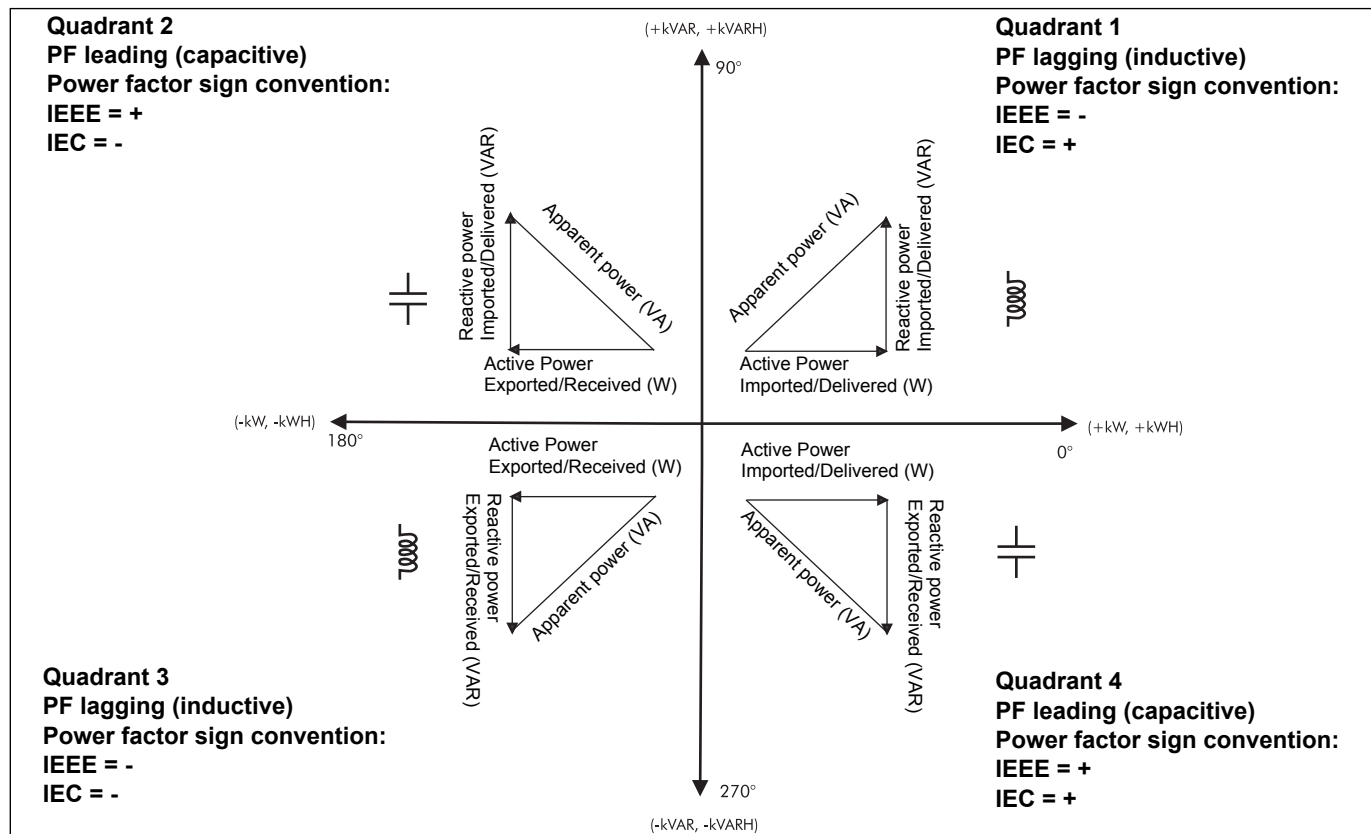
Chapter 19 Power and power factor

This section describes how the meter interprets and calculates power and power factor.

NOTE: The descriptions in this section assume that you are an electrical energy consumer, not a supplier.

Power and power factor conventions

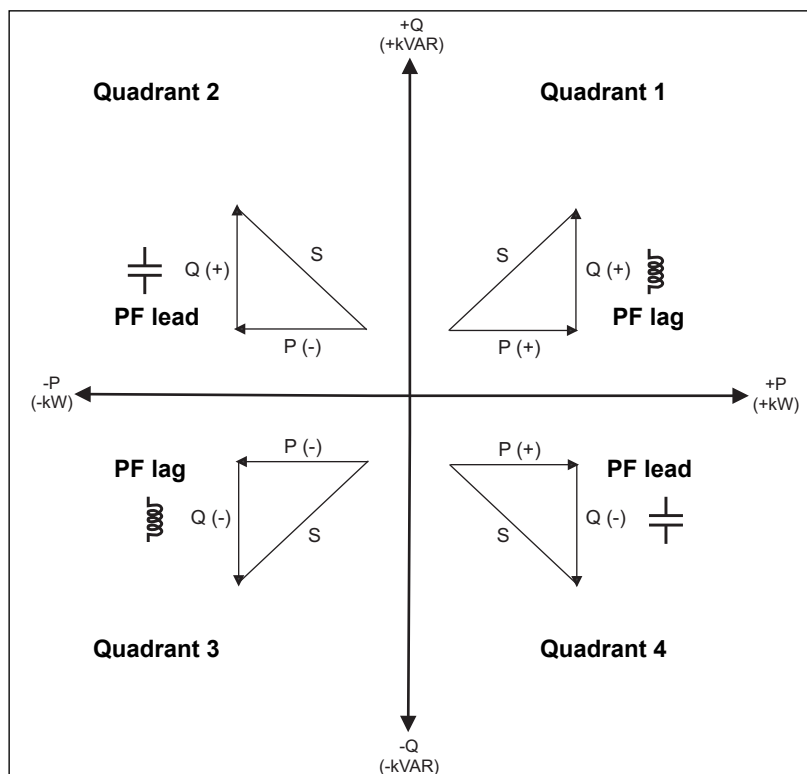
Values for power and power factor are interpreted according to the conventions shown in the diagram below.



Apparent, active and reactive power (PQS)

A typical AC electrical system load has both resistive and reactive (inductive or capacitive) components. Resistive loads consume real power (P). Reactive power (Q) is either consumed (inductive loads) or generated (capacitive loads).

Apparent power (S) is the capacity of your measured power system to provide real and reactive power.



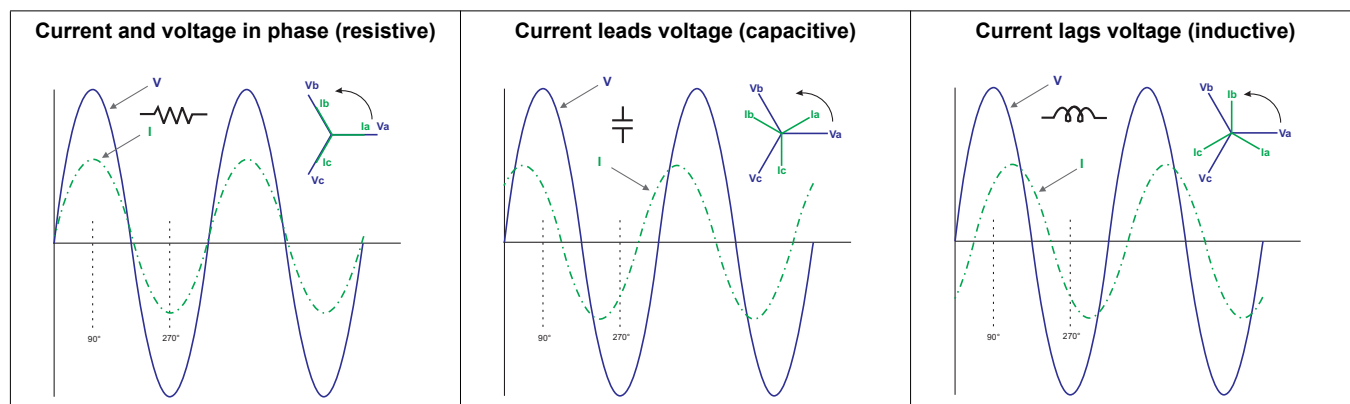
The units for power are watts (W or kW) for real power P, vars (VAR or kVAR) for reactive power Q, and volt-amps (VA or kVA) for apparent power S.

Positive real power P(+) flows from source to load, and negative real power P(-) flows from the load to the power source.

Current phase shift from voltage

For purely resistive loads, the current waveform is in phase with the voltage waveform. For capacitive loads, current leads voltage. For inductive loads, current lags voltage. The following diagram shows how voltage and current waveforms shift based on load type under ideal (laboratory) conditions.

Current lead / lag and load type



Power factor (PF)

Power factor (PF) is the ratio of real power (P) to apparent power (S) and is provided as a number between -1 and 1 or as a percentage from -100% to 100%, where the sign is determined by convention.

$$PF = \frac{P}{S}$$

An ideal, purely resistive load has no reactive components, so its power factor is one (PF = 1, or unity power factor). Inductive or capacitive loads introduce a reactive power (Q) component to the circuit which causes the PF to become closer to zero.

Related topic

- See “Power and power factor conventions” on page 157 for power factor sign convention information.

True PF and displacement PF

The meter supports true power factor and displacement power factor values:

- True power factor includes harmonic content.
- Displacement power factor only considers the fundamental frequency.

NOTE: Unless specified, the power factor displayed by the meter is true power factor.

PF min/max convention

The meter uses the following convention for power factor minimums and maximums.

For negative PF readings:

- The minimum PF value is the measurement closest to -0.
- The maximum PF value is the measurement closest to -1.

For positive PF readings:

- The maximum PF value is the measurement closest to +1.
- The minimum PF value is the measurement closest to +0.

Chapter 20 Power quality

Your meter measures voltage and current harmonics up to the 63rd harmonic, and calculates several harmonic distortion values as well as K-factor and crest factor values.

You must configure your meter with nominal values for voltage, current and frequency for the power system being monitored in order for the meter to perform power quality calculations. Your meter also creates a phasor diagram, including numeric values for magnitude and angle, to represent your power system.

Related topics

- See “Minimum configuration requirements for basic metering” on page 37 for instructions on setting basic metering values through your meter’s display.
- See “Specifications” on page 181 for the power quality standards your meter is compliant to.
- See the *Power quality: ION meters and EN50160:2010* technical note, available from www.schneider-electric.com, for a detailed description of the EN50160 data and statics measured by your meter to monitor compliance to the EN50160 standard.
- See the *4-30 compliance and ION meters* technical note, available from www.schneider-electric.com, for details on how your meter complies with the 4-30 standard.

Sag/swell overview

Your meter monitors your power system’s voltage and current for sags and swells (INCITS (CBEMA) Type 2 and Type 3 disturbances); it then reports the disturbance’s magnitude and duration.

You can manually enter the limits (criteria) used by the meter to identify a sag or swell, or you can have your meter learn sag/swell limits by monitoring your power system.

Related topics

- See “Configuring waveform recording using ION Setup” on page 109 for instructions on how to manually enter sag/swell limits.
- See “Implementing sag/swell limit learning using ION Setup” on page 108 for instructions on to start setpoint learning and have the learned values used by your meter to identify sags/swells.
- See “Waveform recording overview” on page 135 for details on how your meter records voltage and current waveform information.

Harmonics overview

Voltage and current harmonics are measured or calculated by your device, for use in standards compliance and power quality analysis.

Harmonics are integer multiples of the fundamental frequency of your monitored power system. Harmonics information is valuable for power quality analysis, determining properly rated transformers, maintenance and troubleshooting, and is required for compliance to system power quality standards such as EN50160 and meter power quality standards such as IEC 61000-4-30.

Harmonics measurements include per-phase magnitudes and angles (relative to the fundamental frequency of the phase A voltage) for the fundamental and higher harmonics. The device's power system configuration determines which phases are present, and how line-to-line or line-to-neutral voltage harmonics and current harmonics are calculated.

Harmonics are used to identify whether the supplied system power meets required power quality standards, or if non-linear loads are affecting your power system. Power system harmonics can cause current flow on the neutral conductor, and damage to equipment such as increased heating in electric motors. Power conditioners or harmonic filters can be used to minimize unwanted harmonics.

Your meter provides harmonic information up to the 63rd harmonic. Harmonic information can be viewed on the meter's display, and is recorded by your meter.

Related topics

- See “Viewing harmonics information using the display” on page 164 for information on how to view harmonics values on your meter's display.
- See the *ION Reference*, available from www.schneider-electric.com, for details about the Harmonics Measurement and Harmonics evaluation modules.
- See “Default data logging configuration” on page 131 for information on how harmonic information is logged on your meter.

Crest factor and K-factor overview

Crest factor is the ratio of peak to RMS values, and is available for both voltage and current. For a pure sinusoidal waveform, crest factor is equal to the square root of 2. The meter uses the following equation to calculate crest factor:

$$\text{Crest factor} = \frac{V_{\text{peak}}}{V_{\text{RMS}}}$$

$$\text{Crest factor} = \frac{I_{\text{peak}}}{I_{\text{RMS}}}$$

K-factor relates to the heating effect of a distorted current in a transformer to a sinusoidal current with the same RMS magnitude: it describes a transformer's ability to serve non-linear loads without exceeding rated temperature rise limits. The K-factor is equal to the sum of the squares of the harmonic currents multiplied by the squares of the harmonic order. The meter uses the following equation to calculate K-factor:

$$\text{K-factor} = \frac{\sum_{h=1}^{63} (I_h^2 \times h^2)}{\sum_{h=1}^{63} (I_h^2)}$$

Where “h” is the harmonic order and “I_h” is the RMS current of harmonic order “h”.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for details about the Harmonics Measurement module.
- See “Harmonics logs” on page 132 for information on how K-factor information is logged on your meter.

Total harmonic distortion overview

Total Harmonic Distortion (THD) is a measure of the total per-phase voltage or current harmonic distortion present in the power system. It provides a general indication of the quality of a waveform. THD is calculated for each phase of both voltage and current.

The meter uses the following series of equations to calculate THD.

Harmonic content calculations

Harmonic content (H_C) is equal to the RMS value of all the non-fundamental harmonic components in one phase of the power system, and this value is used in THD calculations. The meter uses the following equation to calculate H_C :

$$H_C = \sqrt{(H_2)^2 + (H_3)^2 + (H_4)^2 \dots}$$

THD calculations

THD is a quick measure of the total distortion present in a waveform and is the ratio of harmonic content (H_C) to the fundamental harmonic (H_1). The meter uses the following equation to calculate THD:

$$THD = \frac{H_C}{H_1} \times 100 \text{ percent}$$

thd and TDD

Your meter can be configured to provide thd (total harmonic distortion using the total RMS value for the content rather than the fundamental content) and TDD (total demand distortion, the harmonic current distortion against the maximum demand of the electrical system).

$$thd = \frac{H_C}{RMS} \times 100 \text{ percent}$$

$$TDD = \frac{H_C}{Demand_{Max}} \times 100 \text{ percent}$$

This is an advanced procedure that should only be performed by users with an advanced knowledge of power quality, ION architecture, and the power system being monitored.

Related topics

- See “Viewing data using your meter’s display” on page 30 for information on how to view total harmonic distortion values on your meter’s display.
- See the *ION Reference*, available from www.schneider-electric.com, for details about the Harmonics Measurement module.

Phasor overview

Phasors are used to represent the voltage and current relative magnitude and angles. They can be viewed through your meter’s display or webpages.

The length of the lines in the phasor diagram represent the relative magnitude of the voltages with respect to the other phase voltages, and the currents with respect to the other phase currents. All angles are measured with respect to the Va/V1 phase. The Va/V1 phasor is fixed to the right-hand horizontal axis (positive x-axis). Positive angles are measured counterclockwise.

Numeric values are provided for the magnitude and relative angle for each voltage and current phase.

Phasor information can be used to troubleshoot incorrect connections on the meter's voltage and current inputs, if you know how the phasors should be oriented for your power system.

Related topics

- See “Viewing data using your meter's display” on page 30 for instructions on how to navigate and use your meter's display.

Viewing harmonics information using the display

You can view detailed harmonics data through your meter's display.

1. Navigate to **Power Quality > Harmonics**. The total harmonic distortion (THD) screens are displayed.
2. Press the more button, and select the desired harmonics. The per-phase harmonics are graphically displayed.
3. Press the left and right buttons to move to individual harmonics. The harmonic number, magnitude and angle are displayed.

Related topics

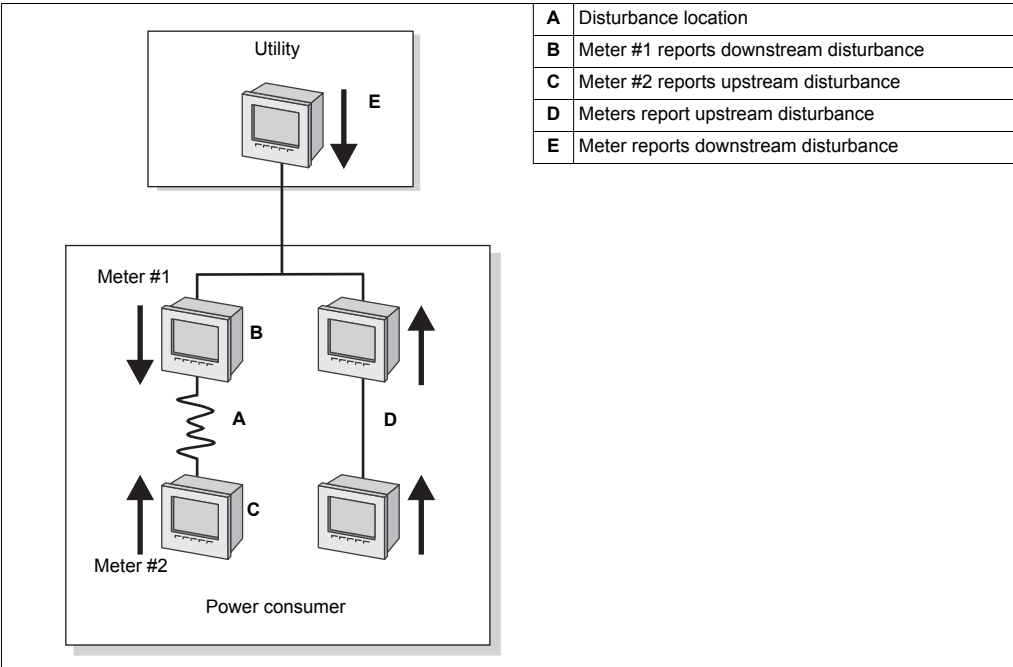
- See “Viewing data using your meter's display” on page 30 for instructions on how to navigate and use your meter's display.

Disturbance direction detection overview

Your meter has disturbance direction detection capabilities to help you determine the location of a power system disturbance. When a disturbance occurs, the meter analyzes the disturbance information to determine the direction of the disturbance relative to the meter. This analysis includes a confidence level indicating the level of certainty that the disturbance is in the determined direction, and is stored in your meter's event log.

Disturbance direction detection is enabled on your meter by default and does not require any additional configuration beyond setting the nominal voltage and nominal frequency.

Disturbance direction detection can help locate the source of a disturbance when used in a system of disturbance direction detection devices, as shown in the diagram below.



The arrows show the direction the meters have determined for the disturbance. With this information, you can determine that the disturbance occurred between meter #1 and meter #2, and can focus on that section of your system to find the cause of the disturbance.

Viewing disturbance direction detection events

The results of the disturbance direction detection algorithm appear in the meter's event log. The image below shows an example of how the Disturbance Direction Detection event appears in your meter's event log when viewed using ION Setup.

NOTE: You can view your meter's event log through the display and ION Setup.

Event Log					
Date/Time	Cause	Value	Effect	Value	
10/22/2007 2:29:11.918 PM	Sag/Swell 1	Disturbance End	SS1 DistState	Normal	
10/22/2007 2:29:10.702 PM	Dist Direction Detection 1	DDD Analysis Done	Dist Direction Detection 1	Disturbance Direction Detected - Upstream - High Confidence	
10/22/2007 2:29:10.702 PM	Sag/Swell 1	Disturbance Start	SS1 DistState	Disturbance	

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more detailed information about the Disturbance Direction Detection module.
- See “Event log overview” on page 134 for more information about your meter's event log.

Chapter 21 Energy and demand

This section includes information on the energy monitoring features of your meter, conditional energy and WAGES (water, air, gas, electricity, steam) input metering. It also provides information on the different power demand calculation methods you can configure on your meter.

Conditional energy

Conditional energy allows you to define an accumulation period for real and reactive energy using one of your meter's digital inputs.

You can use conditional energy to track four-quadrant accumulated energy during a specific period; for example you may want to track accumulated energy values during a particular process controlled using a programmable logic controller (PLC).

Conditional energy is accumulated until it is reset. The conditional energy reset date and time information is stored in the meter's event log.

Related topics

- See "Configuring conditional energy using ION Setup" on page 98 for instructions on how to enable and trigger conditional energy accumulation.
- See "Power and power factor conventions" on page 157 for a detailed description of four-quadrant energy values.

WAGES monitoring overview

Water, air, gas, electric and steam (WAGES) monitoring allows you to monitor and analyze of your energy system's energy sources and utilities usage.

Your meter's digital inputs can be used to count pulses from transducers and convert the pulses to energy measurements for WAGES applications.

This can help you:

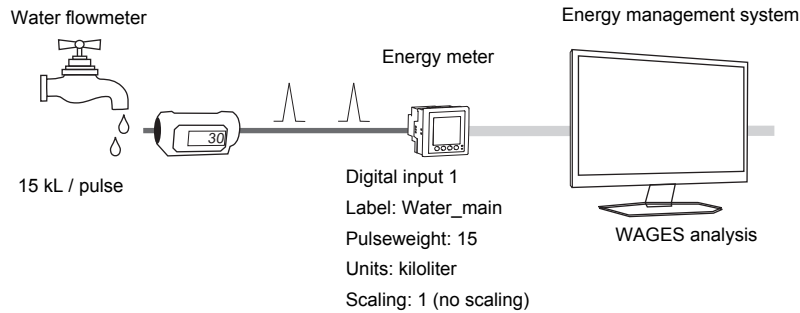
- Identify losses or inefficiencies.
- Modify demand to reduce costs.
- Optimize energy source usage.

Your energy system may use several different types of energy. You may consume steam or compressed air for industrial processes, electricity for lights and computers, water for cooling and natural gas for heating. WAGES collects the usage information from all these different energy sources for a more complete energy analysis.

WAGES example

You can connect your meter's digital input to a transducer that sends a pulse for every 15 kiloliters (4000 US Gal) of water. This information is then labeled, scaled, given a

unit of measure and logged in the meter's onboard memory for subsequent loading into your energy management system.



Related topics

- See “Input metering overview” on page 168 for a description of how your meter supports WAGES information.

Input metering overview

Your meter's digital inputs can be used to count pulses from transducers and convert the pulses to energy measurements for WAGES applications.

Your meter's input metering channels count pulses received from the digital inputs assigned to each channel. The incoming pulses are used in calculating and measuring consumption data (e.g. BTU, kWh, L, kg). Each channel must have the following values configured to match the pulse data:

- Pulse weight: the value per pulse.
- Units: the unit of measure associated with the metered quantity.
- Rate: the time base associated with input metering accumulations. For units with a defined rate, this value is used for scaling.
- Demand period: how frequently the input metering data is calculated in your energy management system.

You can use standard units and rates to configure input metering, or you can create custom input metering parameters for specialized applications.

Standard input metering example

Your meter's onboard digital input S1 is monitoring a flow meter (identified as FL3) that sends one pulse for every 100 liters of water. Your energy management system has a demand period of 15 minutes, and calculates the input metering data using an hourly rate.

Parameter	Value
Assigned Input	S1
Standard quantity	Selected
Pulse Weight	100
Units	L
Rate	l/hr
Demand period	15 minutes
Source ID	FL3

Custom input metering example

Your meter's onboard digital input S1 is monitoring a flowmeter (BF5) installed inside bottle-filling equipment. The desired measurement quantity is bottles/shift (numbers of bottles filled during an eight-hour shift). Each bottle takes 0.4 liters of liquid, and the flowmeter pulses once for every 100 liters. Your energy management system has a demand period of 15 minutes, and calculates the input metering data using an hourly rate.

Pulse weight calculation:

$$\frac{100 \text{ (liters/pulse)}}{0.4 \text{ (liters/bottle)}} = 250 \text{ (bottles/pulse)}$$

Parameter	Value
Assigned Input	S1
Standard quantity	Cleared
Pulse Weight	250
Units	Bottles@BF5
Rate	Bottles/shift
Demand period	15 minutes
Scaling	1
Time Base	8 hours

Incremental energy

Incremental energy allows you to define a start time, end time, and the time interval (increments) for incremental energy accumulation. At the end of each interval, the energy accumulated during that period is stored. By default, the meter only records the previous interval's incremental energy and the instantaneous energy accumulations in the active interval.

The first interval of incremental energy accumulation begins at the specified start time. Incremental energy ends at the specified end time, which may result in a truncated interval if the interval duration does not divide evenly into the overall incremental energy duration (for example, an interval duration of three hours with an overall duration of five hours truncates the last interval duration to two hours). The latest value for the specified end time is midnight (24:00).

Your start time must be before the end time and after midnight, and the period over which incremental energy is accumulated cannot include midnight. This is because your meter's start and end times are defined relative to midnight.

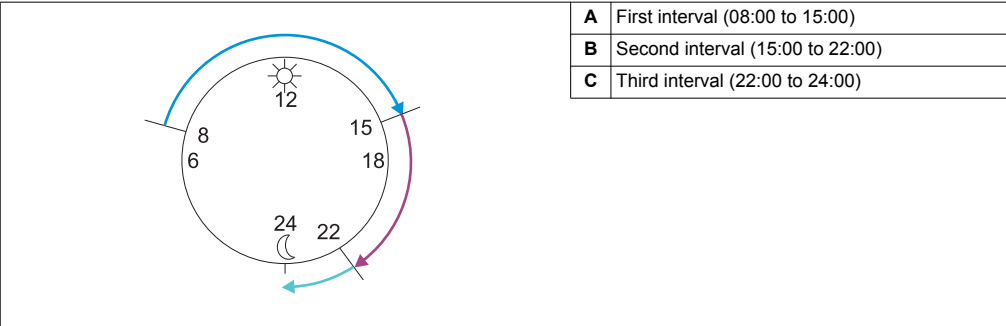
Start: 6am, End: 12am, interval: 3hrs	Incremental energy accumulates from 6am to midnight in intervals of 3 hours.
Start: 6am, End: 2am, interval: 3hrs	Incremental energy will not function. End time must be after start time and before or equal to midnight.

Incremental energy helps provide information for analyzing energy and power usage against present or future utility rates, and is useful for comparing different time-of-use rate structures.

When configuring incremental energy, shorter incremental energy periods provide more granular data which can make the data easier to use for comparison purposes.

Incremental energy example

- Start time: 8 am or 08:00
- End time: 12 am or 24:00
- Interval: 420 minutes (7 hours)



The first incremental energy interval is from 8 am (start time) to 3 pm, and is seven hours long. The second incremental energy interval is from 3 pm to 10 pm, and is also seven hours long. The third interval is from 10 pm to 12 am, and is only 2 hours long because 12 am is the specified end time. These intervals repeat every 24 hours until the configuration is changed or incremental energy feature is disabled.

Related topics

- See “Configuring incremental energy using ION Setup” on page 100 for instructions on how to configure your meter’s start and end times and interval values.

Demand

Demand (also referred to as power demand) is a measure of average power consumption over a fixed time interval. Peak (or maximum) demand is the highest demand level recorded over the billing period. Your meter calculates the average current demand and kW, kVAR and kVA demand using sliding window demand methods.

The meter supports coincident demand values when a peak demand is detected.

Your meter’s default configuration is suitable for most applications, or you can customize it for your specific application.

You can configure the minimum time between consecutive demand resets.

NOTE: If not specified, references to “demand” are assumed to mean “power demand”.

Related topics

- See “Peak demand reset lockout” on page 172 for information about your meter’s peak demand reset lockout feature.
- See the ION Setup online help for instructions on how to configure demand on your meter.
- See the *ION Reference*, available from www.schneider-electric.com, for detailed information on how Sliding Window Demand modules measure and calculate demand values.
- See “Viewing data using your meter’s display” on page 30 for instructions on how to navigate and use your meter’s display.

Sliding window demand

To calculate demand values, your meter uses the sliding window averaging (or rolling interval) method which divides the demand interval into a set number of subintervals of specified duration.

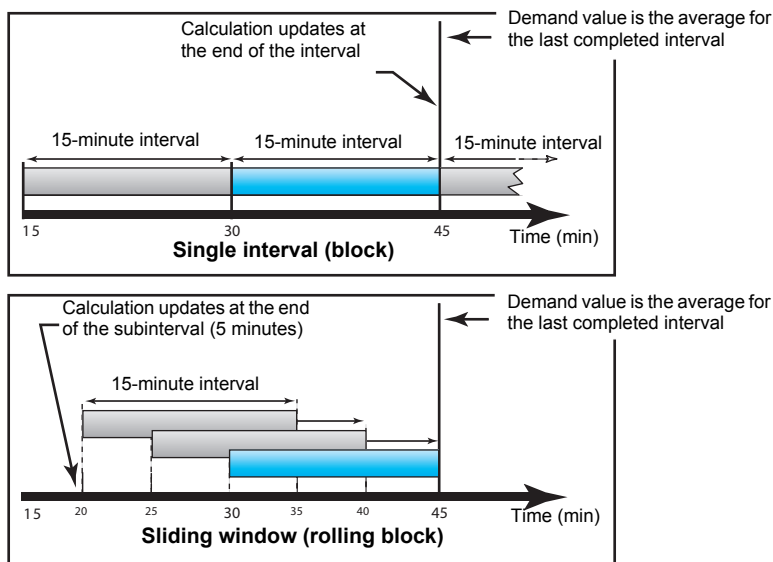
The demand is measured electronically based on the average load level over the most recent set of subintervals.

Sliding window demand also provides predicted demand values.

Examples of sliding window demand

This example shows two different ways of configuring a 15-minute demand interval:

- Single interval (also called block or timed block): the 15-minute demand interval is defined as a single subinterval with a duration of 15 minutes.
- Sliding window (also called rolling block): the 15-minute demand interval is defined as three subintervals with a duration of 5 minutes each. This method offers better response time than a single interval.



Peak demand

Power utilities generally bill commercial customers based on their peak usage levels, called peak demand (in kW) and energy consumption (in kWh). Peak (or maximum) demand is the highest demand level recorded over the billing period. You can view peak demand values on your meter’s display.

Peak demand reset lockout

The demand reset lockout time sets the minimum time allowed between consecutive demand resets; the meter ignores any attempts to reset demand that occur within the lockout period.

The peak demand reset lockout period is user-configurable, with a default value of 25 days.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to configure the peak demand reset lockout period.
- See “Meter resets” on page 153 for more information about the resets available on your meter.

Chapter 22 Revenue

Revenue overview

This section describes your meter's revenue-related features: revenue locking, time of use, PT/CT (potential transformer/current transformer) correction and the recommended process for verifying the accuracy of your meter.

Revenue locking

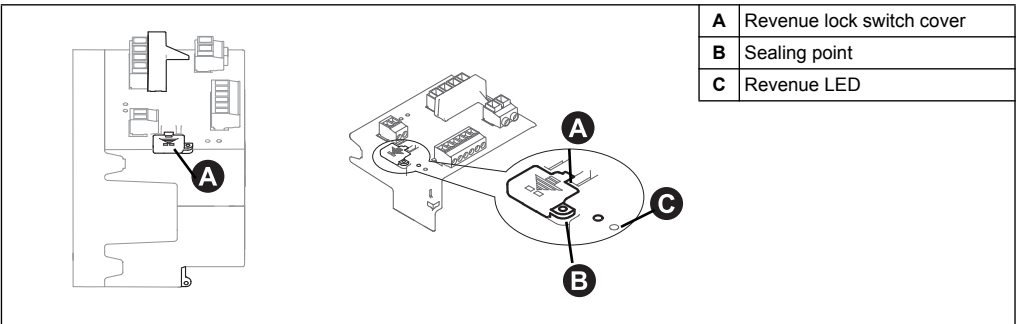
Revenue locking your meter helps prevent modifications to revenue-related settings and data on your meter, or tampering with your meter's voltage and current connections. Revenue locking may be required to help meet government regulations and utility security requirements, or can be used to help ensure the validity of revenue data.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about your device, its options and accessories.
- Download the *ION Device Template Reference*, available from www.schneider-electric.com, to view a complete listing of revenue-locked parameters and data.
- See "Revenue lock LED behavior" on page 22 for revenue lock LED behavior.

Revenue lock switch

You can revenue lock your meter using the revenue lock switch located on the meter base. This switch is accessed through a sealable cover.



Revenue locking your meter

You can revenue lock and unlock your meter using the revenue lock switch located on the meter base.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
2. Always use a properly rated voltage sensing device to confirm that all power is off.
3. Open the revenue lock switch cover.
4. Locate the revenue lock switch. Click the switch to toggle revenue locking on or off.
5. Close the revenue lock switch cover and make sure it is firmly in place.
6. Seal the revenue lock switch cover if required.

Time of use

Time of use (TOU) is often used when a utility has set up schedules with different rates based on time of day, type of day and date when energy is consumed.

You can view the TOU active rates and seasons through your meter's display.

Related topics

- See "Viewing data using your meter's display" on page 30 for instructions on how to view the TOU active rate and seasons through the meter's display.
- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to configure time of use on your meter.
- See the *ION Reference*, available from www.schneider-electric.com, for a description of the Time of Use module and its settings.

PT/CT correction

The primary application for PT/CT (potential transformer / current transformer) correction is to apply correction factors for ratio errors and phase angle errors to instrument transformers. PT/CT correction, also called instrument transformer correction, can help reduce the need to replace transformers in installations where high accuracy is required.

PT/CT correction is done for each current and voltage input to the meter and only affects 1-second power meter data and values derived from it, such as energy or demand. No high-speed, harmonics or waveform values are affected by the correction.

NOTE: For those familiar with ION architecture, the relevant 1-second Power Meter module outputs are compensated using the Instr Xformer (ITC) Correction module, and therefore so are all other modules that use that Power Meter module's data.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to configure PT/CT correction on your device.
- See the *ION Reference*, available from www.schneider-electric.com, for detailed information about the Instr Xformer Correction (ITC) module and how it applies PT/CT correction to your device.

Verifying accuracy

All meters are tested and verified at the factory in accordance with International Electrotechnical Commission (IEC) and American National Standards Institute (ANSI) standards.

Your digital power meter typically does not require re-calibration. However, in some installations, a final accuracy verification of the meter is required, especially if the meter is used for revenue or billing applications.

Testing overview

The most common method for testing meter accuracy is to apply test voltages and currents from a stable power source and compare the meter's readings with readings from a reference device or energy standard.

Accuracy test requirements

Signal and power source

The meter maintains its accuracy during voltage and current signal source variations but its energy pulsing output needs a stable test signal to help produce accurate test pulses. The meter's energy pulsing mechanism needs approximately 10 seconds to stabilize after every source adjustment.

The meter must be connected to control power in order to conduct accuracy verification testing.

Control equipment

Control equipment is required for counting and timing the pulse outputs from the energy pulsing LED or the digital output.

- Most standard test benches have an arm equipped with optical sensors to detect LED pulses (the photodiode circuitry converts detected light into a voltage signal).
- The reference device or energy standard typically has digital inputs that can detect and count pulses coming from an external source (for example, the meter's digital output).

NOTE: The optical sensors on the test bench can be disrupted by strong sources of ambient light (such as camera flashes, florescent tubes, sunlight reflections, floodlights, etc). This can cause test errors. Use a hood, if necessary, to block out ambient light.

Environment

The meter should be tested at the same temperature as the testing equipment. The ideal temperature is about 23 °C (73 °F). Make sure the meter is warmed up sufficiently before testing.

A warm-up time of 30 minutes is recommended before beginning energy accuracy verification testing. At the factory, the meters are warmed up to their typical operating temperature before calibration to help ensure that the meters reach their optimal accuracy at operating temperature.

Most high precision electronic equipment requires a warm up time before it reaches its specified performance levels. Energy meter standards allow the manufacturers to specify meter accuracy derating due to ambient temperature changes and self-heating.

Your meter complies with and meets the requirements of these energy metering standards.

Reference device or energy standard

To help ensure the accuracy of the test, it is recommended that you use a reference device or reference energy standard with a specified accuracy that is 6 to 10 times more accurate than the meter under test. Before you start testing, the reference device or energy standard should be warmed up as recommended by its manufacturer.

Verify the accuracy and precision of all measurement equipment used in accuracy testing (for example, voltmeters, ammeters, power factor meters).

Energy pulsing

Your meter has two energy pulsing LEDs, one visible light and one infrared, located on the meter base. These LEDs emit pulses that are then used to determine the accuracy of the meter's energy measurements. The pulses of light indicate accumulated energy; the meter's accumulations are compared with the reference/standard's accumulated energy in order to help determine the meter's accuracy.

Your meter also has a digital output that can be used for energy pulsing. The relay closes (low impedance) and then opens (high impedance) to represent a pulse. If the accuracy testing equipment has a voltage requirement, a current-limited wetting supply voltage must be provided.

NOTE: Digital outputs on option modules should not be used meter accuracy testing.

Related topics

- See "Electrical characteristics" on page 181 for your device's power supply, measurement accuracy and other specifications.
- See "LED locations" on page 21 for the location of the energy pulsing LEDs
- See "Energy pulsing overview" on page 145 for instructions on how to configure your meter's digital output for energy pulsing.

Verifying accuracy test

The following are guidelines for testing the meter; your meter shop may have specific testing methods.

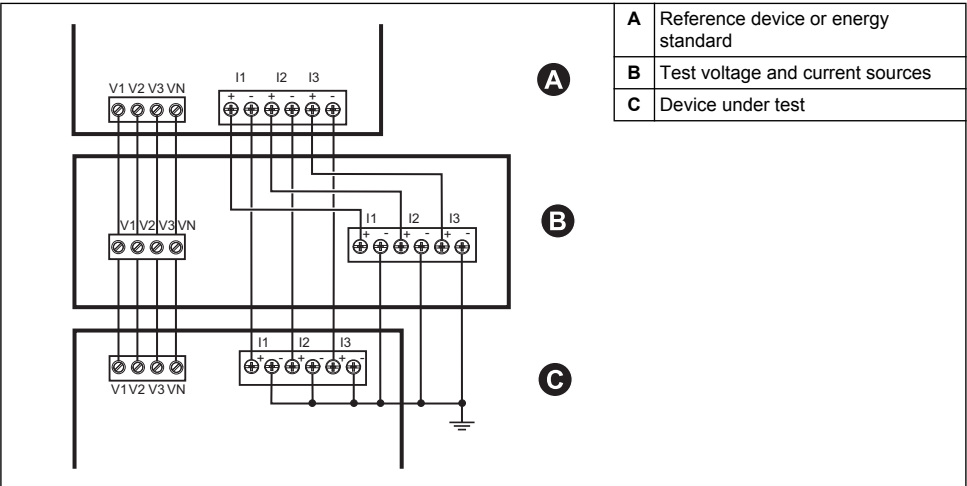
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Verify the device's power source meets the specifications for your device's power supply.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
2. Use a properly rated voltage sensing device to confirm power is off.
3. Connect the test voltage and current source to the reference device or energy standard. Ensure all voltage inputs to the meter under test are connected in parallel and all currents inputs are connected in series.



4. Connect the control equipment used for counting the standard output pulses using one of these methods:

Energy pulsing LED	Align the red or infrared light sensor on the standard test bench armature over the corresponding energy pulsing LED.
Digital output	Connect the meter's onboard digital output to the standard test bench pulse counting connections.

NOTE: When selecting which method to use, be aware that the energy pulsing LEDs and digital output may have different pulse rate limits.

5. Before performing the verification test, let the test equipment power up the meter and apply voltage for at least 30 seconds. This helps stabilize the internal circuitry of the meter.

6. Set the meter's volts mode to 4W-Wye (4 wire Wye).
7. Disable PT/CT correction unless you want the correction included in the verification test.
8. Depending on the method selected for counting the energy pulses, configure the meter's energy pulsing LEDs or the digital output to perform energy pulsing. Set the meter's energy pulse constant so it is synchronized with the reference test equipment.
9. Perform accuracy verification on the test points. Run each test point for at least 30 seconds to allow the test bench equipment to read an adequate number of pulses. Allow 10 seconds of dwell time between test points.

Related topics

- See "PT/CT correction" on page 174 for details of how PT/CT corrections (also called instrument transformer correction) affects your meter's measurements.

Calculate the number of required pulses

The reference test equipment typically requires you to specify the number of pulses required for a test duration of "t" seconds. Normally, the number of pulses required is at least 25 pulses, and the test duration is greater than 30 seconds.

Use the following formula to calculate the required number of pulses:

$$\text{Number of pulses} = \frac{N_e * V * I * PF * t}{3600 * K_t}$$

Where:

- N_e = number of metering elements used
- V = test point voltage in line-to-neutral volts [V] per phase
- I = test point current in amps [A] per phase
- t = test duration in seconds [s] which must be longer than 30 seconds
- PF = power factor
- K_t = pulse constant programmed in the meter under test in Wh/pulse

Round up the result of the calculation to the nearest integer number of pulses.

Example calculation for number of required pulses

This example calculates the number of pulses required for an inductive load 3-phase test point with a test duration of 60s; the source is configured to use $V = 120V$, $I = 5A$, $PF = -0.5$; the pulse constant of the meter under test is $K_t = 1.8$ Wh/pulse.

$$8.3 = \frac{3 * 120V * 5A * 0.5 * 60 s}{3600 * 1.8}$$

Round the number up to the nearest integer: Number of pulses = 9

Calculate the percentage error

For every test point:

$$\text{Energy Error} = \frac{\text{EM} - \text{ES}}{\text{ES}} * 100\%$$

Where:

- EM = energy measured by the meter under test
- ES = energy measured by the reference device or energy standard.

If accuracy verification indicates that there may be inaccuracies with your meter, they may be caused by typical sources of test errors. If there are no sources of test errors present, please contact your local Schneider Electric representative.

Related topics

- See “Typical sources of test errors” on page 179 for possible causes of test errors.
- See “Power factor (PF)” on page 159 for information on how the meter calculates power factor.

Test points

The meter should be tested at full and light loads and at lagging (inductive) power factors to help ensure testing over the entire range of the meter. The test amperage and voltage input rating are labeled on the meter. Refer to the installation sheet or data sheet for your meter’s nominal current, voltage and frequency specifications.

Sample Watt-hour test points

Watt-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

Sample Var-hour test points

Var-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.87 lagging power factor (current lagging voltage by 30° phase angle).

Typical sources of test errors

If excessive errors are observed during accuracy testing, examine your test setup and test procedures to eliminate typical sources of measurement errors:

- Loose connections of voltage or current circuits, often caused by worn-out contacts or terminals. Inspect terminals of test equipment, cables, test harness and the meter under test.

- Device ambient temperature is significantly different than 23 °C (73 °F).
- Floating (ungrounded) neutral voltage terminal in any configuration with unbalanced phase voltages.
- Inadequate device control power, resulting in the device resetting during the test procedure.
- Ambient light interference or sensitivity issues with the optical sensor.
- Unstable power source causing energy pulsing fluctuations.
- Incorrect test setup: not all phases connected to the reference device or the energy standard. All phases connected to the device under test should also be connected to the reference meter/standard.
- Moisture (condensing humidity), debris or pollution present in the device under test.

Chapter 23 Specifications

The information contained in this section is subject to change without notice. You can download updated documentation from www.schneider-electric.com or contact your local Schneider Electric representative for the latest updates.

This section provides additional specifications for your meter and accessories. See your device's installation sheet for specifications related to installation, such as measured voltage and current ranges, inputs/outputs and control power information.

See your product's technical datasheet at www.schneider-electric.com for the most up-to-date and complete specifications.

Mechanical characteristics

Model	Characteristic	Specification			
Panel mount	Mounting position	Vertical			
	IP	IP30 meter body (except connectors), IP54 front display			
	Display type	¼ VGA color graphic TFT LCD 320 x 240 resolution			
	Display backlight	White LED			
	Viewable area	70.6 x 52.9 mm (2.78 x 2.08 in)			
	Keypad	5 button			
	Maximum number of option modules	4 (based on mechanical stress and required IP rating)			
	Operating temperature	-25 °C to Max temp (-13 °F to Max temp) Maximum operation temperature is based on the quantity and type of attached option modules.			
		Max temp	Digital (2 out, 6 in)	Analog (2 out, 4 in)	
70 °C (158 °F)		0 - 4	0, 1		
70 °C (158 °F)		0	2		
60 °C (140 °F)		1, 2	2 - 4		
DIN meter	Mounting position	Horizontal TS35 DIN rail			
	IP	IP30 (except connectors)			
	Maximum number of option modules	4			
	Operating temperature	-25 °C to Max temp (-13 °F to Max temp) Maximum operation temperature is based on the quantity and type of attached option modules.			
		Max temp	Digital (2 out, 6 in)	Analog (2 out, 4 in)	
		70 °C (158 °F)	0 - 4	0, 1	
		70 °C (158 °F)	0	2	
60 °C (140 °F)		1, 2	2 - 4		

Mechanical compliance

Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27

Electrical characteristics

Type of measurement: RMS up to the 63rd harmonic on three-phase systems, 128 samples per cycle, zero blind.

NOTE: Reactive energy and demand values are based on the fundamental, and do not include higher harmonics. Other energy and demand values are measured using the entire signal including harmonics. Contact Technical Support for more information.

Accuracy

Measurement accuracy	IEC 62053-22 - active energy	Class 0.2S
	IEC 62053-24 - reactive energy	Class 0.5S
	IEC 61557-12	PMD/SD/K70/0.2 and PMD/SS/K70/0.2
	Active power	± 0.2% IEC 61557-12 Class 0.2
	Reactive power	± 1% IEC 61557-12 Class 1
	Apparent power	± 0.5% IEC 61557-12 Class 0.5
	Current (per phase)	± 0.2% IEC 61557-12 Class 0.2
	Voltage (L-N)	± 0.2% IEC 61557-12 Class 0.2
	Frequency	± 0.02% IEC 61557-12 Class 0.02
Power quality accuracy	IEC 61000-4-30	Class S
	IEC 62586-1	PQI-S-FI1
	Voltage unbalance	± 0.5% IEC 61557-12 Class 0.5
	Voltage harmonics	± 2% IEC 61557-12 Class 2
	Voltage THD	± 2% IEC 61557-12 Class 2
	Current harmonics	± 2% IEC 61557-12 Class 2
	Current THD	± 2% IEC 61557-12 Class 2

Voltage and current inputs

Voltage inputs	VT (PT) primary	1.0 MV AC max
	Specified accuracy voltage	57 to 400 V L-N / 100 to 690 V L-L (Wye) or 100 to 600 V L-L (Delta)
	Specified accuracy frequency	42 to 69 Hz (50/60 Hz nominal)
Current inputs	Specified accuracy current range	50 mA to 10A

Control power

AC/DC control power	Operating range	50/60 Hz ± 10%: 90 to 415 V AC L-N ± 10% 400 Hz: 90 to 120 V AC ± 10% 120 to 300 V DC ± 10%
	Ride-through time	100 ms (6 cycles at 60 Hz) min., any condition 200 ms (12 cycles at 60 Hz) typ., 120 V AC 500 ms (30 cycles at 60 Hz) typ., 415 V AC

Inputs/outputs

Digital output	Number/type	1 Form A Solid State max 30 V AC / 60 V DC / 75mA
	On resistance	13 to 40 Ω at 25 °C (77 °F)
	Pulse frequency	≤ 25 Hz
	Signal type	Continuous or pulse

Digital inputs	Number/type	3 externally excited max 30 V AC / 60 V DC
	Frequency	≤ 25 Hz
	Minimum pulse width	20 ms
	Response time	20 ms
	Current draw	ON: ≤ 2.5 mA OFF: ≤ 0.5 mA
	Event timestamp accuracy	± 1 ms
	IRIG-B	IRIG-B00x format (unmodulated IRIG-B time code) • Coded expressions 0 to 7 are supported but the year data is not used.

Communications

RS-485 communications

Number of ports	1
Maximum cable length	1200 m (4000 ft)
Maximum number of devices (unit loads)	32
Parity	None, even, odd
Baud rate	2400 - 115200, recommend 19200

Ethernet communications

Number of ports	2 (the second connector functions as an Ethernet switch for networking devices)
Cable type	CAT5/5e UTP (use unshielded cable only)
Connector type	RJ45 modular jack (2)
Maximum cable length	100 m (328 ft) per TIA/EIA 568-5-A
Mode	10Base-T, 100Base-TX, auto-MDIX
Data rate	up to 100 Mbps
FTP	Maximum simultaneous transfer connections (sessions): 2 Default timeout period: 90 seconds
IEC 61850 maximum simultaneous client connections	4

EMC (electromagnetic capability)

Product standards	IEC 62052-11 IEC 61326-1
Immunity to electrostatic discharge	IEC 61000-4-2
Immunity to radiated fields	IEC 61000-4-3
Immunity to fast transients	IEC 61000-4-4
Immunity to surges	IEC 61000-4-5
Immunity to conducted disturbances	IEC 61000-4-6
Immunity to power frequency magnetic fields	IEC 61000-4-8
Immunity to conducted disturbances, 2 - 150 kHz	CLC/TR 50579
Immunity to voltage dips and interruptions	IEC 61000-4-11
Immunity to ring waves	IEC 61000-4-12
Radiated and conducted emissions	FCC part 15 ICES-003 EN55022, EN55011
Surge withstand capability (SWC)	ANSI C37.90.1

Safety

Safety construction	IEC/EN 61010-1 ed.3, CAT III, 400 VLN / 690 V LL UL 61010-1 ed.3 and CSA-C22.2 No. 61010-1 ed.3, CATIII, 347 V LN / 600 V LL IEC/EN 62052-11, Protective Class II
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General characteristics

Clock

Characteristic	Specifications
Clock drift	20 ppm max at 25 °C (77 °F)
Battery backup time	Minimum 7 years under specified storage conditions

LEDs

LED	Characteristic	Specifications
Energy pulsing LEDs (visible and infrared)	Type	Visible orange, infrared
	Wavelength	600 - 609 nm (orange) 825 - 925 nm (infrared)
	Maximum pulse rate	42 - 69 Hz (based on line frequency)

Other

Characteristic	Specification
Meter start time	Typical 18 seconds (power up to measurement)
Meter memory	512 MB
Data update rate	Regular data: 1 second
	High-speed: 50 - 60 Hz half-cycle
Advanced security users	Up to 16 users

Remote display

Characteristic	Specification
IP degree of protection (IEC 60529)	Front: IP54 Rear: IP30
Cable	CAT5/5e UTP (use unshielded cable only)
Mounting position	Vertical
Display type	¼ VGA color graphic TFT LCD 320 x 240 resolution
Display backlight	White LED
Viewable area	70.6 x 52.9 mm (2.78 x 2.08 in)
Keypad	5 button

Option modules

Model	Characteristic	Specification												
METSEPM89M0024	Max analog input current/voltage	20 mA / 30 V DC												
Analog (2 out, 4 in)	Input resistance	< 300 Ω (current mode) > 500 kΩ (voltage mode)												
	Modules per PM8000 series meter	Up to 4												
METSEPM89M0024 Analog (2 out, 4 in) and METSEPM89M2600 Digital (2 out, 6 in)	Operating temperature for PM8000 series meter	-25 °C to Max temp (-13 °F to Max temp) Maximum operating temperature is based on the quantity and type of attached option modules. <table><tr><td>Max temp</td><td>Digital</td><td>Analog</td></tr><tr><td>70 °C (158 °F)</td><td>0 - 4</td><td>0, 1</td></tr><tr><td>70 °C (158 °F)</td><td>0</td><td>2</td></tr><tr><td>60 °C (140 °F)</td><td>1, 2</td><td>2 - 4</td></tr></table>	Max temp	Digital	Analog	70 °C (158 °F)	0 - 4	0, 1	70 °C (158 °F)	0	2	60 °C (140 °F)	1, 2	2 - 4
Max temp	Digital	Analog												
70 °C (158 °F)	0 - 4	0, 1												
70 °C (158 °F)	0	2												
60 °C (140 °F)	1, 2	2 - 4												

Related topics

- Visit the website at www.schneider-electric.com and search for “PM8000 technical datasheet” for the most up-to-date and complete specifications.
- See your remote meter display’s installation sheet for remote meter display specifications.
- See your option module’s installation sheet for option module specifications.
- Visit the company website at www.schneider-electric.com and search for “PM8000” to get additional or updated documentation.

Schneider Electric

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Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker— Installation

Class 0613

Instruction Bulletin

HRB28361

Rev. 02, 02/2015

Retain for future use.



Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



ANSI



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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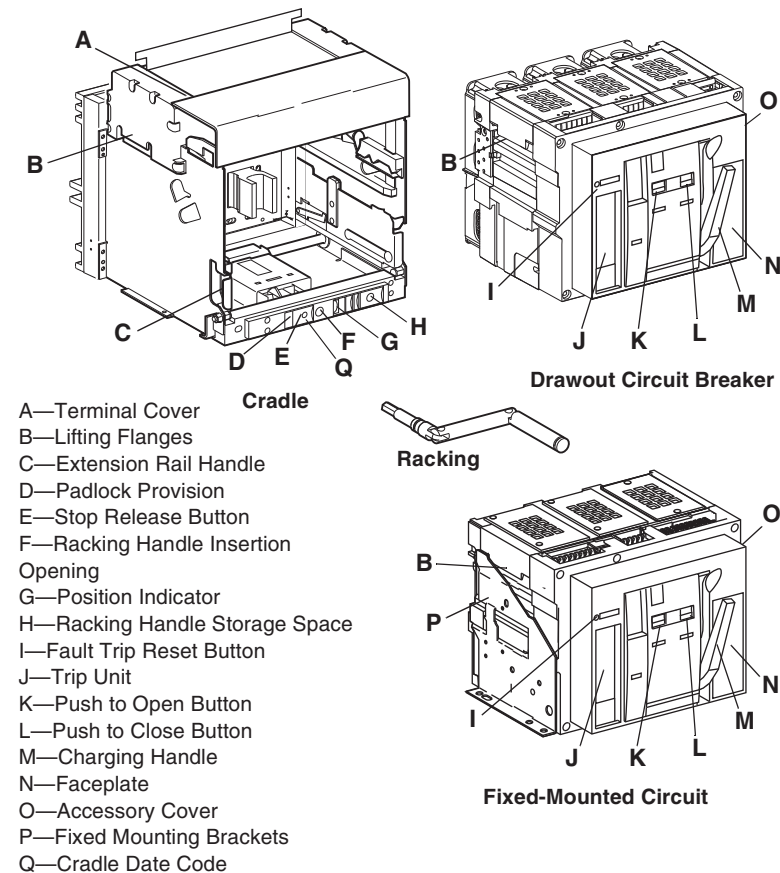
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Section 1— General Information

Introduction

The Masterpact NW low-voltage power circuit breaker¹ and insulated case circuit breaker are designed to mount in a drawout cradle, using rear-mounted, plug-on pressure connections to provide electrical connection to the cradle. A fixed-mounted circuit breaker is also available.

Figure 1 – Circuit Breaker and Cradle



These circuit breakers comply with the following standards:

Low-Voltage Power Circuit Breaker (Drawout and Fixed)	Insulated Case Circuit Breaker (Drawout and Fixed)
ANSI C37.13 ANSI C37.16 ANSI C37.17 ANSI C37.50 UL1066 ¹ CSA C22.2 No 31 ¹ NEMA SG3	UL489 ² NEMA AB1 CSA C22.2 No. 5-02 ³

¹ cULus

² UL® Listed

³ CSA® Certified

¹ In this manual the phrase “circuit breaker” means circuit breaker and switch.

Type L1F 800–2000 A low-voltage power circuit breakers and Type LF 800–2000 A insulated case circuit breakers are tested to show the arc-flash hazard risk category as referenced by NFPA 70E.

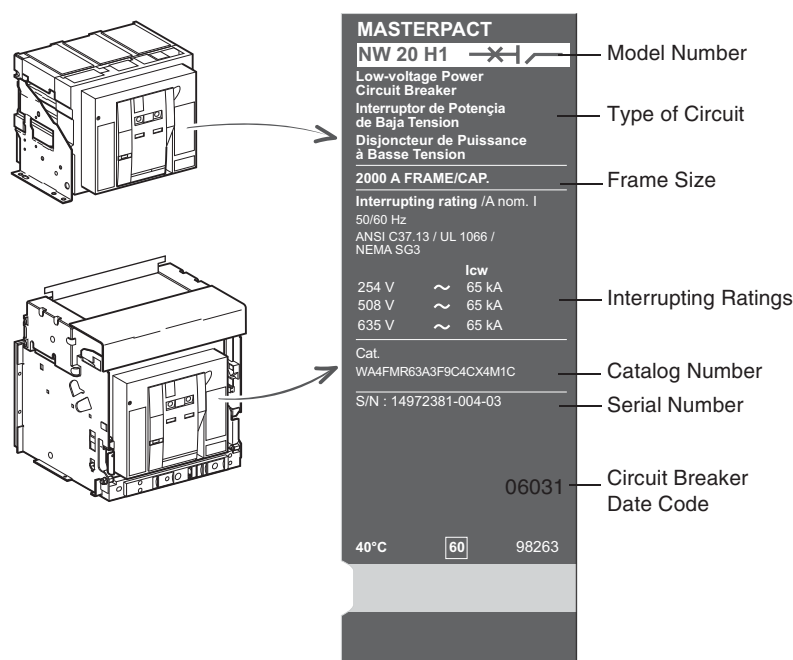
This bulletin provides installation instructions for Masterpact NW circuit breakers. Tripping functions are controlled by the Micrologic™ trip unit.

Information about a specific circuit breaker can be found on the faceplate label on the front of the circuit breaker.

Information about the accessories installed in the circuit breaker can be found on the accessory label on the right side of the circuit breaker.

For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor sizes and trip units, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website.

Figure 2 – Faceplate Information



For additional information see the following user guides available on the Schneider Electric™ website:

- Bulletin 0613IB1204: *Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker User Guide*
- Bulletin 0613IB1205: *Masterpact™ NW Dimensional Drawings*
- Bulletin 0613IB1202: *Masterpact™ NT and NW Field Testing and Maintenance Guide*
- Bulletin 48049-136-05: *Micrologic 2.0A, 3.0A, 5.0A, and 6.0A Electronic Trip Units*
- Bulletin 48049-330-03: *Micrologic 5.0H and 6.0H Electronic Trip Units*
- Bulletin 48049-137-05: *Micrologic 5.0P and 6.0P Electronic Trip Unit*
- Bulletin 48049-207-05: *Micrologic 2.0, 3.0 and 5.0 Electronic Trip Units*

To access the website go to:

<http://www.schneider-electric.com>

For application assistance, please call 1-888-778-2733.

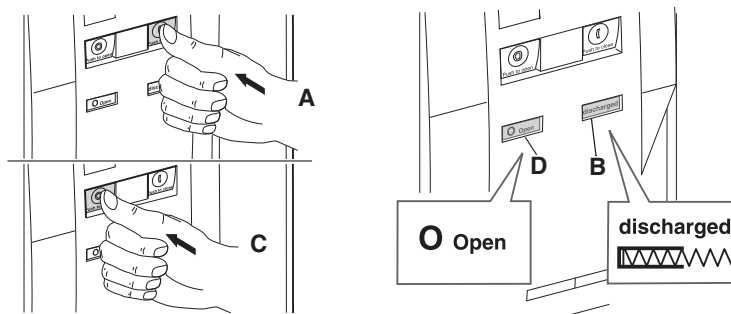
Before Working on Circuit Breaker

1. Turn circuit breaker off:

Press “Push to close” button (**Figure 3, A**) to discharge spring, as indicated by window (**B**).

Press “Push to open” button (**C**) to open contacts, as indicated by window (**D**).

Figure 3 – Turn Off Circuit Breaker



2. Disconnect power from circuit breaker.

- For drawout circuit breaker: rack circuit breaker to disconnected position (**Figure 4, A**). See Drawout Circuit Breaker Disconnection, page 70.

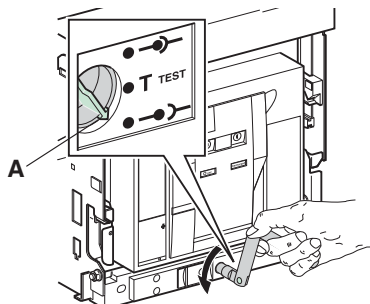
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Beware of potential hazards, wear personal protective equipment and take adequate safety precautions.

Failure to follow these instructions will result in death or serious injury.

Figure 4 – Disconnect Drawout Circuit Breaker



- For fixed-mounted circuit breaker: turn off all power supplying equipment before working on or inside equipment.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

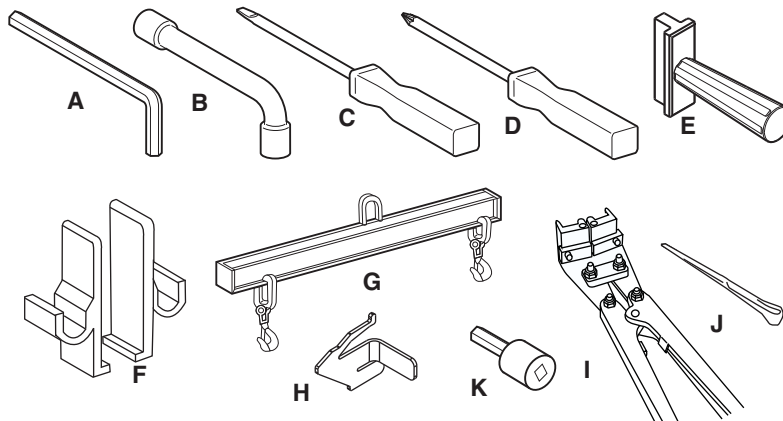
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Tools

Table 1 – Tools Required

- | | |
|--|--|
| <p>A. Hex Key, 5 mm
 B. Angled Socket Wrench, 1/2 in.
 C. Straight Blade Screwdriver (#2 Pozidriv® or Slotted)
 D. Torx® 20 Screwdriver
 E. Cluster Reset Tool, Cat. No. CLUSRETOOL
 F. Lifting Hooks, Cat. No. S48906
 G. Crossbar
 W-Frame, Cat. No. S48900
 Y-Frame, Cat. No. S48901
 H. Cradle Interlock Defeat Tool (Drawout Circuit Breaker Only, Provided)
 I. Cluster Positioning Tool, Cat. No. S47542
 J. Wago® Wire Insert Tool, Wago Part No. 209-129
 K. 10 mm Hex Adapter for Cradle Racking Mechanism</p> | |
|--|--|



Unpacking and Inspection

NOTE: Repacking instructions can be found in bulletin 0613IB1203, *Masterpact NW Low-Voltage Power/Insulated Case Circuit Breaker—User Guide*, found on the Schneider Electric™ web site (see page 5).

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not place circuit breaker on its back. Doing so can damage the clusters.

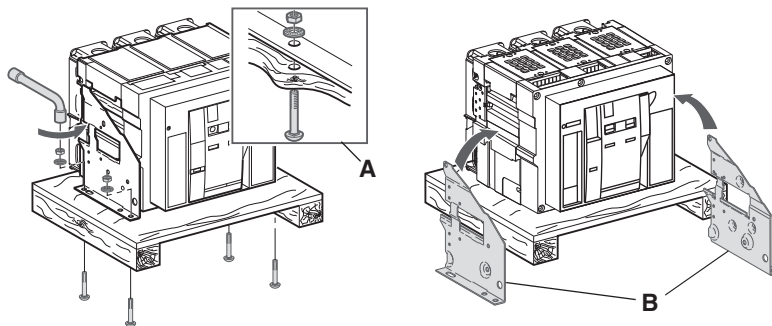
Failure to follow these instructions can result in equipment damage.

Unpack Circuit Breaker

NOTE: Do not place the circuit breaker on its back. Doing so can damage the clusters.

1. Remove the four bolts, nuts and washers (**Figure 5, A**) securing the circuit breaker to the pallet.
2. On drawout circuit breakers only: remove the shipping brackets (**B**).

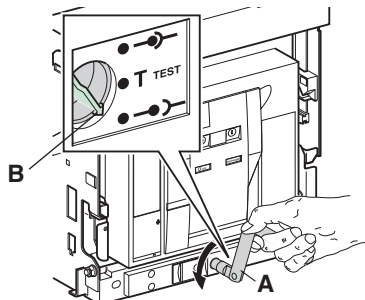
Figure 5 – Unpack Circuit Breaker



Unpack Circuit Breaker Shipped in Cradle

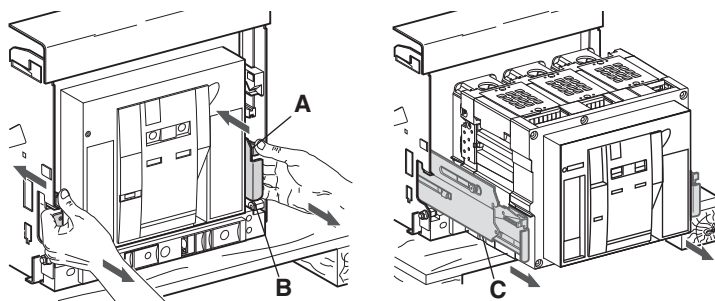
1. Rack the circuit breaker (**Figure 6, A**) to the disconnected position (**B**) (refer to Drawout Circuit Breaker Disconnection, page 70).

Figure 6 – Disconnect Circuit Breaker



2. Pressing in the latching tabs (**Figure 7, A**), pull out on the extension rail handles (**B**) until the extension rails are fully extended (**C**).

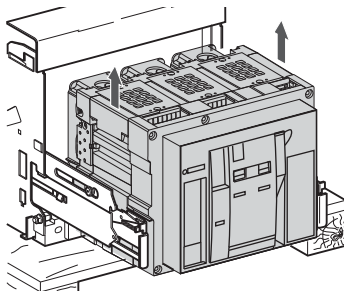
Figure 7 – Pull Out Circuit Breaker



NOTE: Do not place the circuit breaker on its back. Doing so can damage the clusters.

3. Remove circuit breaker. See Cradle Removal, page 37.

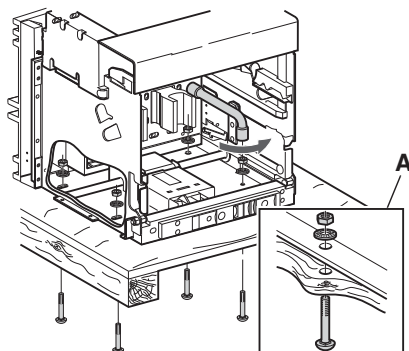
Figure 8 – Remove Circuit Breaker and Cradle



Unpack Cradle

1. Remove the four bolts, nuts and washers (Figure 9, A) securing cradle to pallet.
2. Remove cradle from pallet. See Lifting, page 16.

Figure 9 – Unpack Cradle



Cluster Inspection, Replacement and Lubrication

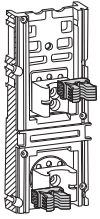
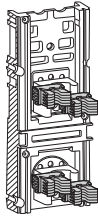
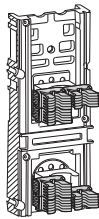
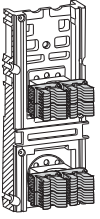
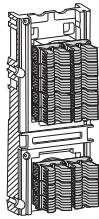
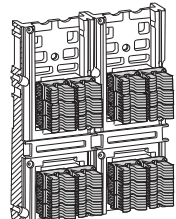
Cluster Inspection

1. Inspect clusters and cluster supports on back of the drawout circuit breaker. Make sure clusters are installed and configured properly as shown in Table 3.
2. Visually inspect clusters for signs of damage such as:
 - Discolored areas
 - Visible copper on fingers
 - Cracked or broken springs
 - Not aligned with other clusters (indicates spring damage)
3. Visually inspect clusters for wear.

Table 2 – Number of Clusters Per Pole

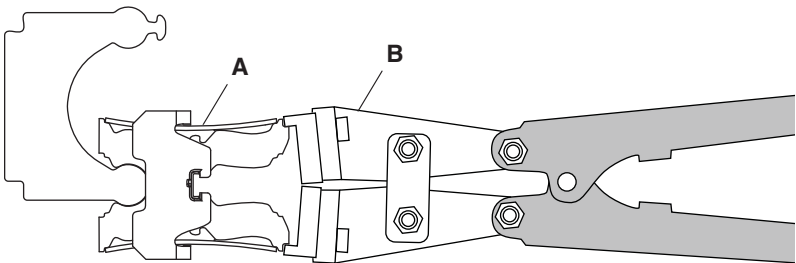
Type	N / N1	H1	HA	H / H2 / H3 / HF	L / L1 / LF / L1F / HB / HC
NW08	2	4	4	4 / 4 / 6 / 4	8
NW12	2	—	—	4	8
NW16	6	6	6	6	8
NW20	8	8	8	8	16
NW25/NW30	—	—	—	16	16
NW32	—	16	16	16	24
NW40/NW50	—	—	24	24	24
NW60	—	—	—	24	24

Table 3 – Cluster Configuration

Number of Clusters Per Pole					
NOTE: Cluster shields are not shown.					
2	4	6	8	16	24
					

4. Replace any cluster which does not pass inspection. Install new clusters (A) using cluster positioning tool (B).

Figure 10 – Install New Clusters



Cluster Lubrication

CAUTION

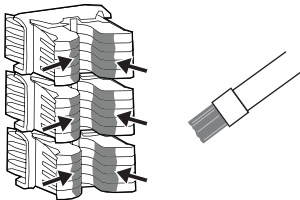
HAZARD OF EQUIPMENT DAMAGE

Inspect the cluster for lubrication when the circuit breaker is removed from the cradle.

Failure to follow these instructions can result in equipment damage.

Use grease kit (catalog number S48899) to lubricate cluster jaws as shown in Figure 11.

Figure 11 – Cluster Grease Application



Cradle Stab Lubrication

The cradle stabs must be inspected and lubricated when the cradle is first installed and again during maintenance periods after all power has been disconnected.

⚠ DANGER

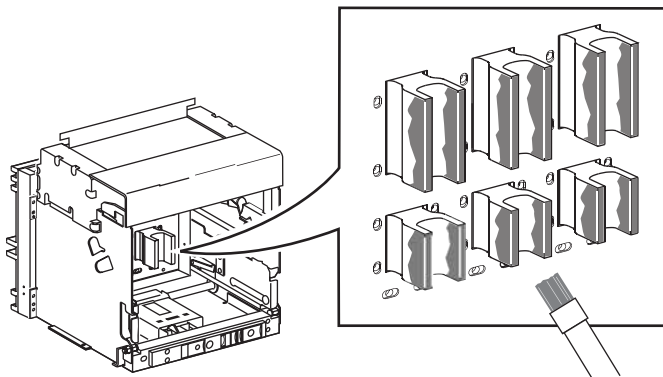
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Confirm that both sides of stab are coated with lubricant. If necessary, use grease kit (catalog number S48899) to lubricate stab.

Figure 12 – Cradle Stab Grease Application



Section 2— Lifting and Transporting

Both the circuit breaker and cradle have lifting flanges for lifting. To lift circuit breaker, use an overhead lifting device attached to the lifting flanges, following the directions given in this section.

⚠ DANGER

HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted.
- Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

Weights

Table 4 – Weights

Frame Rating	Connector Type ¹	Weights (lb./kg.)								
		Circuit Breaker		Cradle		Connector		Pallet	Total	
		3-Pole	4-Pole	3-Pole	4-Pole	3-Pole	4-Pole		3-Pole	4-Pole
800–2000 A, Drawout	FCF	109/50	142/65	97/44	116/53	42/19	55/25	17/8	265/121	330/151
	FCT	109/50	142/65	97/44	116/53	84/38	109/50	17/8	307/140	384/176
	RCTH/RCTV	109/50	142/65	97/44	116/53	17/8	22/10	17/8	240/110	297/136
800–2000 A, Fixed-Mounted	FCF	109/50	142/65	—	—	42/19	55/25	17/8	168/77	214/98
	FCT	109/50	142/65	—	—	84/38	109/50	17/8	210/96	268/123
	RCTH/RCTV	109/50	142/65	—	—	17/8	22/10	17/8	143/66	181/83
2500–3000 A, Drawout	RCTH/RCTV	127/58	165/75	124/57	149/68	26/12	34/15	17/8	294/135	365/166
	FCT	127/58	165/75	124/57	149/68	80/36	104/47	17/8	348/159	435/198
2500–3000 A, Fixed-Mounted	FCT	127/58	165/75	—	—	80/36	104/47	17/8	224/102	286/130
	RCTH/RCTV	127/58	165/75	—	—	26/12	34/15	17/8	170/78	216/98
2000 A L1/L1F & 3200 A, Drawout	RCOV	127/58	165/75	124/57	149/68	100/46	130/59	17/8	368/169	461/210
3200 A, Fixed	RCOV	127/58	165/75	—	—	100/46	130/59	17/8	244/112	312/142
4000 A, (W-Frame) Fixed-Mounted	RCOV (Special)	127/58	165/75	—	—	115/52	145/66	17/8	259/118	327/149
3200 A L1 & 4000 A, Drawout	FCF	227/103	295/134	278/126	334/152	84/38	109/50	39/18	628/285	777/354
	FCT	227/103	295/134	278/126	334/152	168/76	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
4000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
5000 A, Drawout	FCT	227/103	295/134	278/126	334/152	168/77	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
5000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
6000 A, Drawout	RCTV	227/103	295/134	278/126	334/152	396/180	528/240	39/18	940/427	1196/544
6000 A, Fixed-Mounted	RCTV	227/103	295/134	—	—	396/180	528/240	39/18	662/301	862/392

¹FCF = Front-connected flat connector.

FCT = Front-connected “T” connector.

RCTH = Rear-connected “T” horizontal connector.

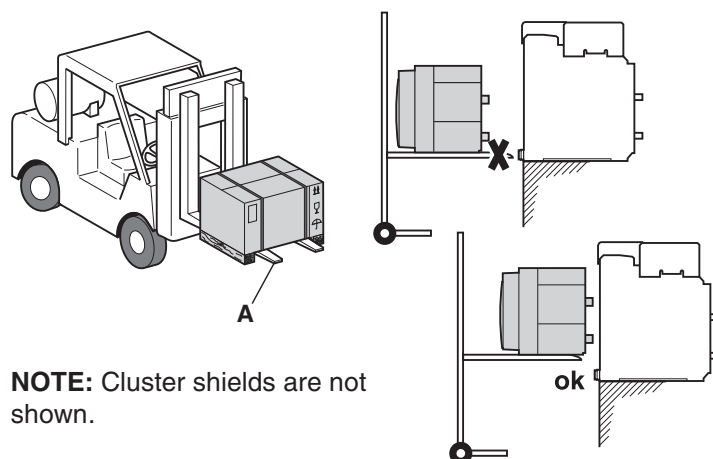
RCTV = Rear-connected “T” vertical connector.

RCOV = Rear-connected offset vertical.

Using a Platform Lift

When using a platform lift, lift flanges (**Figure 13, A**) should not extend beyond the back of the circuit breaker.

Figure 13 – Using a Platform Lift



NOTE: Cluster shields are not shown.

Lifting

Lifting Drawout Circuit Breaker

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured before installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

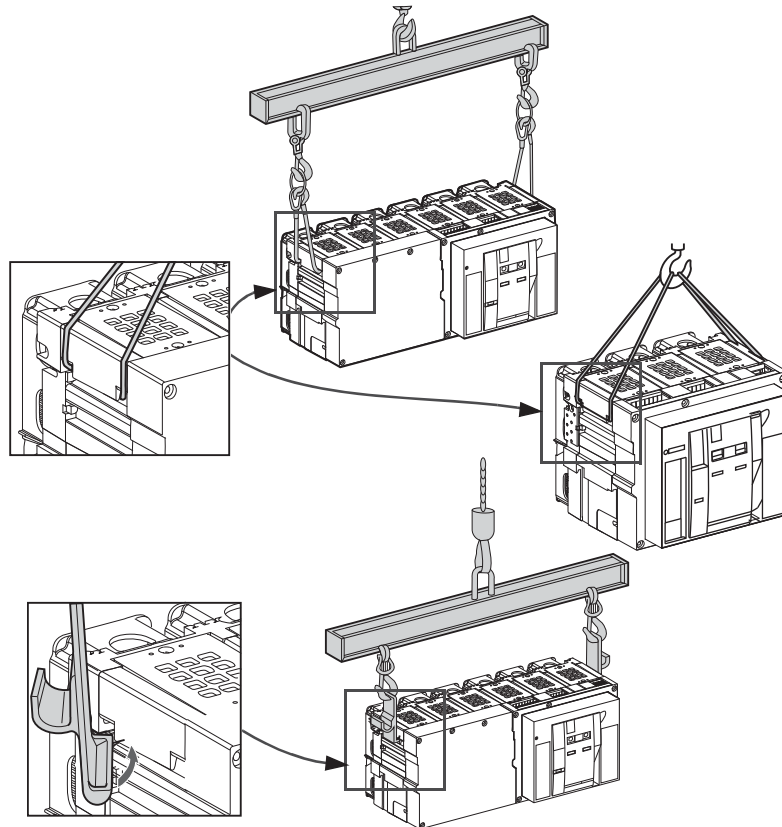
Lift using lifting flanges on sides of the circuit breaker, lifting hooks, and crossbar.

Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

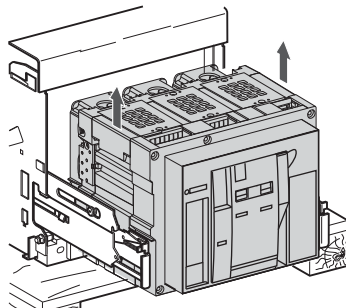
Figure 14 – Lifting Drawout Circuit Breaker



Lifting Cradle or Fixed-Mounted Circuit Breaker

NOTE: If circuit breaker is installed in cradle, remove circuit breaker from cradle before lifting cradle. To remove circuit breaker, see page 46.

Figure 15 – Removing Circuit Breaker From Cradle



Lift using the lifting flanges on the sides of the cradle or circuit breaker, a piece of bar stock through the connectors, lifting hooks, and crossbar.

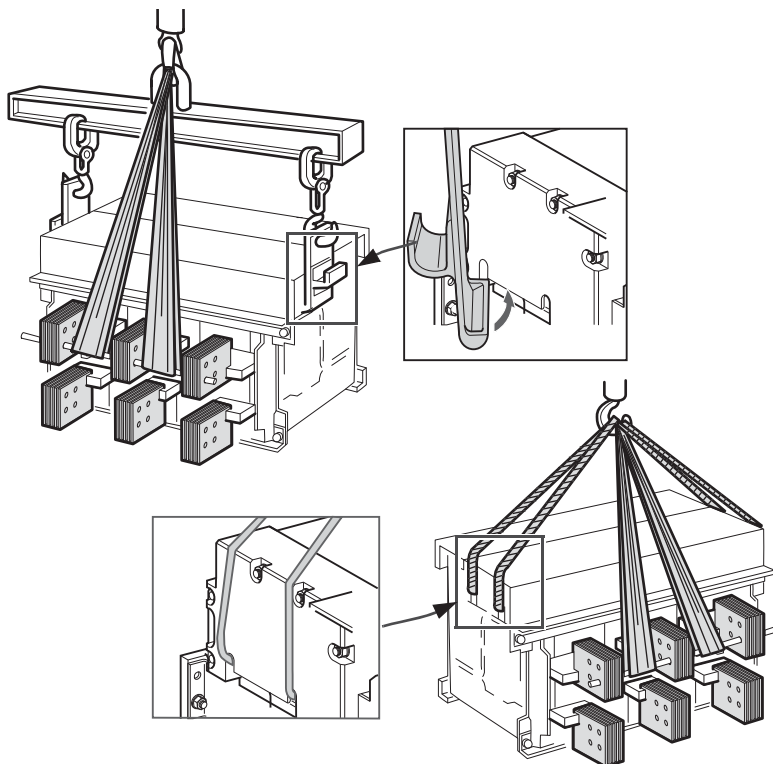
Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

NOTE: Connectors must be supported while lifting cradle or fixed-mounted circuit breaker.

Figure 16 – Lifting Cradle or Fixed-Mounted Circuit Breaker



Section 3— Drawout Circuit Breaker Installation

Equipment is normally shipped with cradles installed and circuit breakers shipped separately.

For equipment shipped without cradles installed, install cradles as described below.

For equipment shipped with cradles installed, see page 38 for circuit breaker installation.

NOTE: When cradles are shipped separately from equipment:

- Standard-width 800–3000 A and 3200 A circuit breakers can be shipped installed in the cradles;
- Wide-construction 3200 A L1 and 4000–6000 A circuit breakers must be shipped separately.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Cradle Installation

Install Accessories

Install any required cradle accessories which were not factory installed.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Do not place tools or other materials on top of cradle.

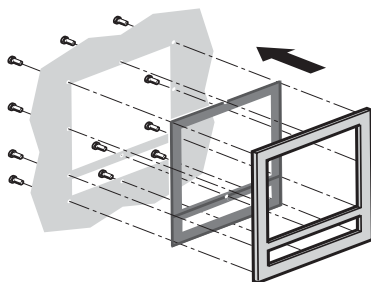
Failure to follow these instructions will result in death or serious injury.

Install Door Escutcheon

If equipment has a door cutout, install the escutcheon shipped with cradle.

1. If not already present, cut opening in the equipment door and drill holes around the opening for the escutcheon. For opening dimensions and hole spacing, refer to bulletin 0613IB1205 on the Schneider Electric™ website (for website information see page 5).
2. Install escutcheon.

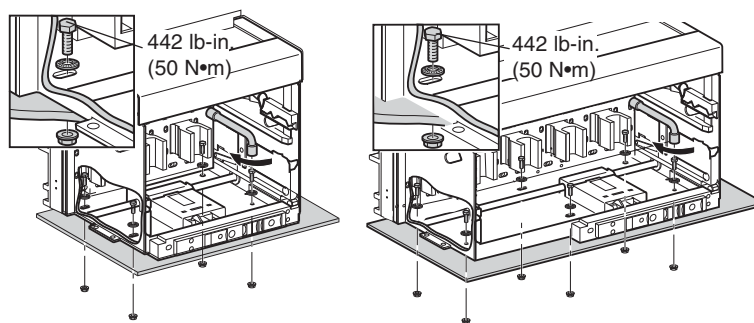
Figure 17 – Install Door Escutcheon



Secure Cradle

1. Turn off all power supplying the equipment before working on or inside equipment.
1. If mounting holes are not already present, drill mounting holes in the pan for mounting the cradle. For cradle mounting hole pattern dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).
2. Check flatness of the mounting surface. Surface must be flat to within 0.08 in. (2 mm).
3. Mount the cradle to the pan, using 3/8 in. bolts, washers, and nuts.

Figure 18 – Secure Cradle

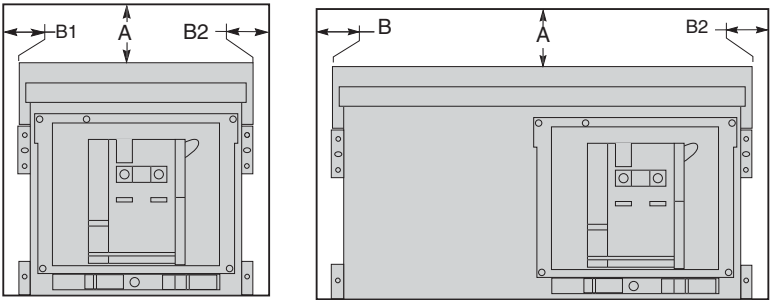


Clearance Requirements

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH
Clearance requirements must be met for proper operation of the equipment.
Failure to follow these instructions will result in death or serious injury.

Table 5 – Clearance Requirements



Minimum Clearance	UL 1066 Listed (ANSI C37.50)				UL 489 Listed			
	A		B1 + B2		A		B1 + B2	
	in.	mm	in.	mm	in.	mm	in.	mm
Insulated Parts	0	0	0	0	0	0	0	0
Metal Parts	0	0	2.36	60	0	0	4.36	111

Install Connectors

Standard connectors are shown in Table 6. Secure connectors and torque bolts to 142–159 lb-in. (16–18 N•m). For information on non-standard connectors, contact the field office.

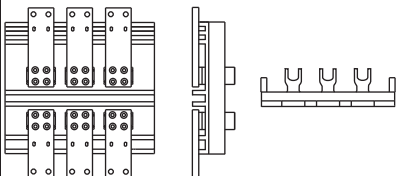
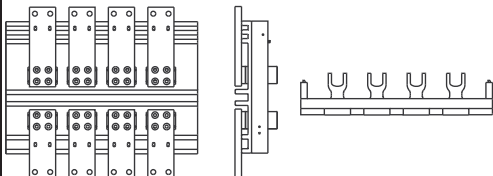
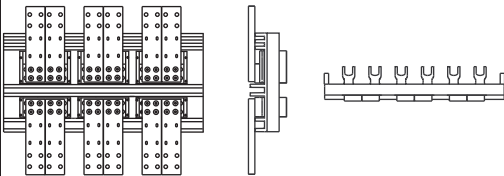
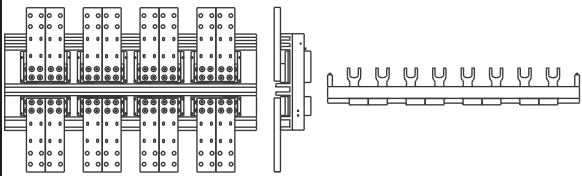
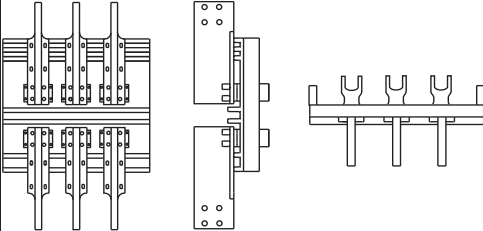
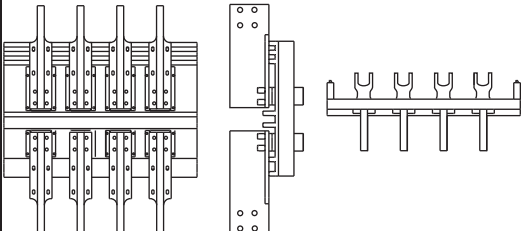
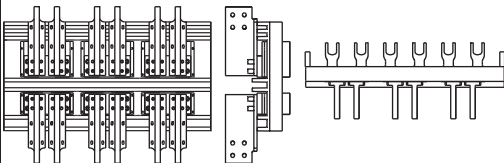
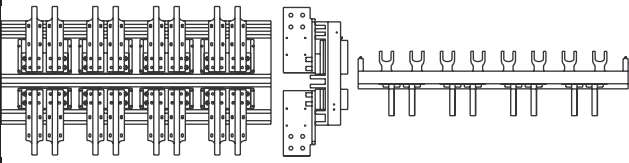
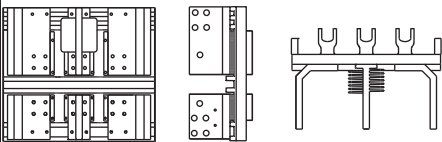
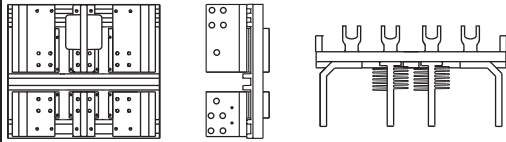
For connector dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).

Table 6 – Standard Connectors

Type	Rating	Three-Pole Layout Front – Side – Top	Four-Pole Layout Front – Side – Top
Rear-Connected “T” Vertical (RCTV)	800– 2000 A		
	2500– 3000 A		
	4000– 5000 A		
	6000 A		
Rear-Connected “T” Horizontal (RCTH)	800– 2000 A		
	2500– 3000 A		
	3200 A L1 4000– 5000 A		

Continued on next page

Table 6 – Standard Connectors *(continued)*

Type	Rating	Three-Pole Layout Front – Side – Top	Four-Pole Layout Front – Side – Top
Front-Connected Flat (FCF)	800–2000 A		
	3200 A L1 4000 A		
Front-Connected "T" (FCT)	800–3000 A		
	3200 A L1 4000–5000 A		
Rear-Connected Offset Vertical (RCOV)	3200 A 2000 A L1/L1F		

Install Bussing

NOTICE

HAZARD OF EQUIPMENT DAMAGE

The busbar supports must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents. See **Figure 19, A**.

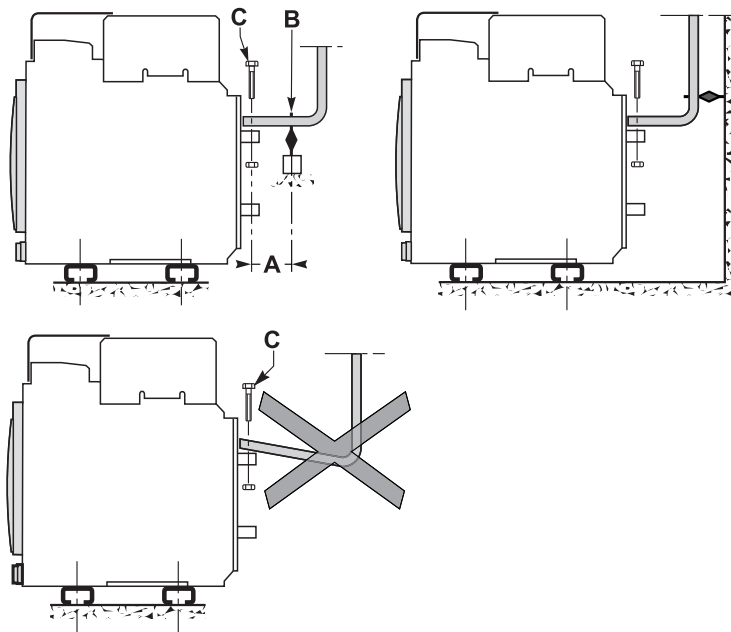
Failure to follow these instructions can result in equipment damage.

NOTE: Installer is responsible for bussing to connectors.

- Bus supports must be braced (**Figure 19, B**) to prevent short circuit forces from deflecting the connectors. The busbar supports (**A**) must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents.
- Busbars should be adjusted to ensure that the connection points are correctly positioned before the bolts (**C**) are inserted. Bussing must be supported by framework of the switchgear, with no weight on connectors.

Bussing requirements by the circuit breaker and connectors are shown in Table 7.

Figure 19 – Busbar Connections



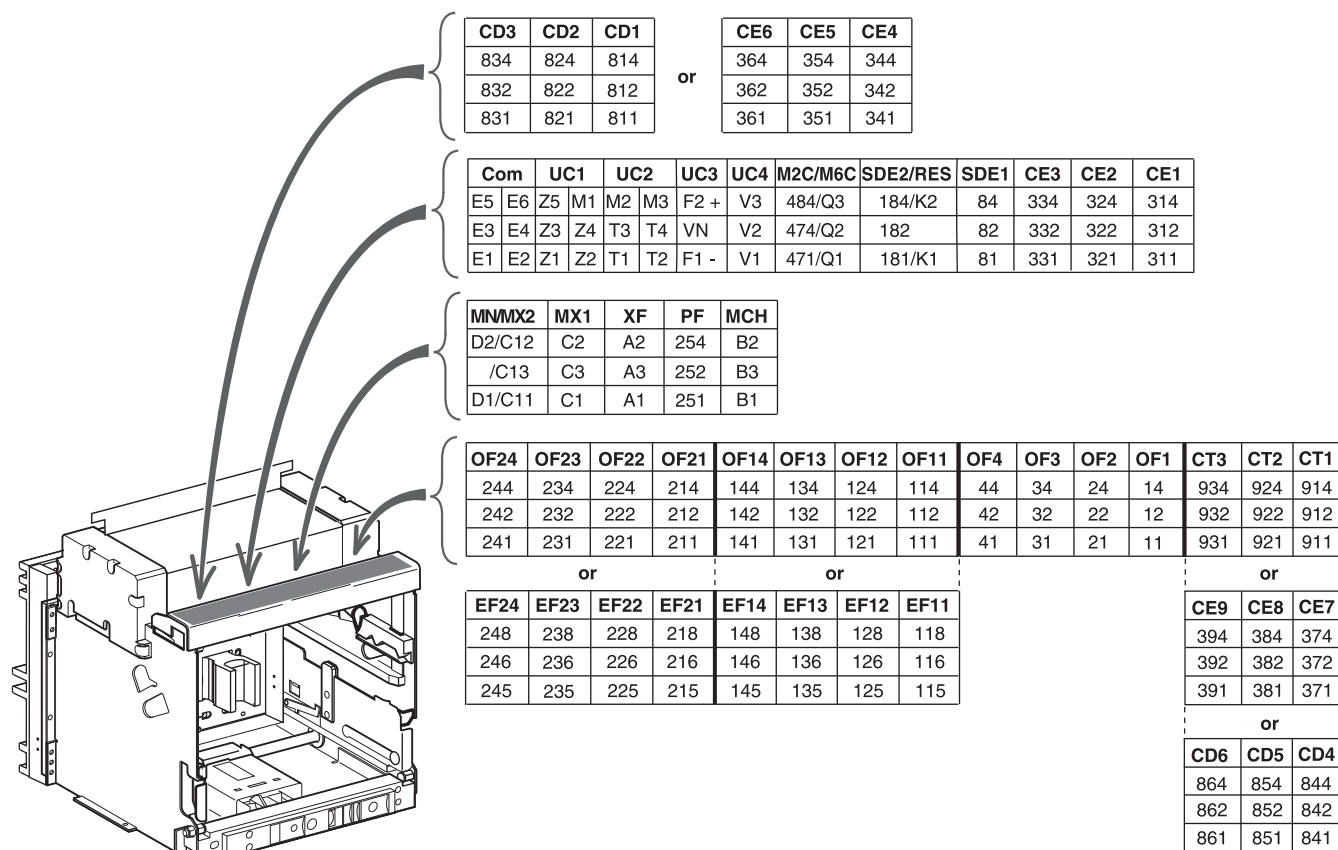
NOTE: The installer is responsible for bussing to the connectors. Bussing must be supported by the framework of the switchgear, with no weight on the connectors. Bus supports must be braced to prevent short circuit forces from deflecting the connectors.

Table 7 – Bus Size Required

Circuit Breaker		Complies with	Connectors	Bus Per Connector	
Rating	Type			Number	Size
800 A, 1200 A	N/N1/H/H1/H2/H3/L /LF/L1/L1F	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	1	0.25 x 3 in. (6 x 76 mm)
1600 A	N/N1/H/H1/H2/H3/L /LF/L1/L1F	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	2	0.25 x 3 in. (6 x 76 mm)
2000 A	N/N1/H/H1/H2/H3/L /LF	ANSI 37.50 UL 489	RCTH	3	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 4 in. (6 x 102 mm)
			FCF	3	0.25 x 3 in. (6 x 76 mm)
	L1/L1F	ANSI 37.50	RCOV	2	0.25 x 4 in. (6 x 102 mm)
2500 A	H/L	UL 489	RCTH	5	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 5 in. (6 x 127 mm)
3000 A	H/L	UL 489	RCTH	8	0.25 x 3 in. (6 x 76 mm)
	H/L		RCTV, FCT	4	0.25 x 4 in. (6 x 102 mm)
3200 A	H1/H2/H3	ANSI 37.50	RCOV	3	0.25 x 5 in. (6 x 127 mm)
	L1		RCTH, FCF	3	0.25 x 6 in. (6 x 152 mm)
	L1		RCTV, FCT	3	0.25 x 5 in. (6 x 127 mm)
4000 A	H/H2/H3/L/L1	ANSI 37.50 UL 489	RCTH	4	0.25 x 6 in. (6 x 152 mm)
		ANSI 37.50	RCTV, FCT	4	0.25 x 5 in. (6 x 127 mm)
			FCF	4	0.25 x 6 in. (6 x 152 mm)
		UL 489	FCF	5	0.25 x 6 in. (6 x 152 mm)
5000 A	H/H2/H3/L/L1	ANSI 37.50 UL 489	RCTH	8	0.25 x 6 in. (6 x 152 mm)
			RCTV, FCT	6	0.25 x 5 in. (6 x 127 mm)
6000 A	H/L	UL 489	RCTV	6	0.25 x 6 in. (6 x 152 mm)

Accessory Connections Using Push-In Connectors

Figure 20 – Terminal Layout for Push-In Connector Installation



Function	Connector	Description
Auxiliary Contacts	OF1	Open/Closed Circuit Breaker or Switch Position Contacts
	EF	Combined Connected and Closed Contact
Cradle Contacts	CD	Disconnected Position Contacts
	CE	Connected Position Contacts
	CT	Test Position Contacts
Remote Operation	SDE	Electrical Fault Alarm Contact
	RES	Remote Reset
	MN	Undervoltage Trip Device
	MX ²	Shunt Trip
	XF ²	Shunt Close
	PF	Ready-to-Close Contact
	MCH	Spring-Charging Motor

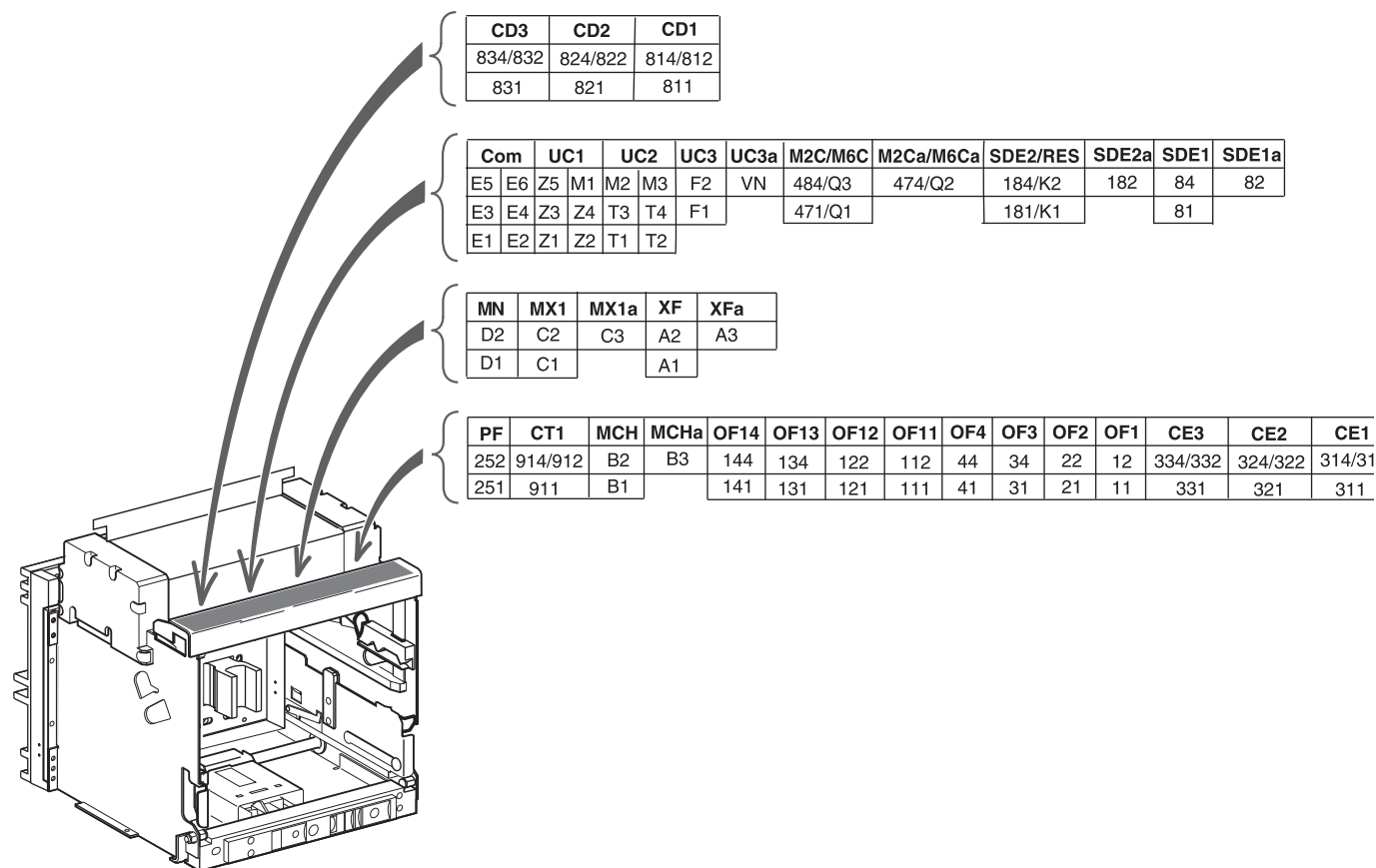
¹ OF1, OF2, OF3 and OF4 contacts are standard.

² When communicating MX1 or XF coils are used, terminal (C3 or A3) must be connected to line even if the communication module is not installed. The bypass circuit through terminal C2/A2 is only momentary duty (0.5 sec). For continuous duty, use the communications command.

Trip Unit Type				Connector	Description
Basic	A	P	H		
–	•	•	•	Com: E1–E6	Communication
–	•	•	•	UC1: Z	Zone-Selective Interlocking Z1 = ZSI OUT signal Z2 = ZSI OUT Z3 = ZSI IN Signal Z4 = ZSI IN Short Time Z5 = ZSI IN Ground Fault
–	•	•	•	UC1: M1	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC2: T	External Neutral
–	•	•	•	UC2: M	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC3: F	24 Vdc External Power Supply
–	–	•	•	UC3: Vn	External Neutral Plug
–	–	•	•	UC4	External Phase Voltage Sensing
–	–	•	•	M2C/M6C	Two Programmable Contacts (internal relay) or Six Programmable Contacts (for connection to external M6C module).

Accessory Connections Using Ring Terminal Connectors

Figure 21 – Terminal Layout for Ring Terminal Connector Installation



Function	Connector	Description
Auxiliary Contacts	OF1	Open/Closed Circuit Breaker or Switch Position Contacts
	EF	Combined Connected and Closed Contact
Cradle Contacts	CD	Disconnected Position Contacts
	CE	Connected Position Contacts
	CT	Test Position Contacts
Remote Operation	SDE	Electrical Fault Alarm Contact
	RES	Remote Reset
	MN	Undervoltage Trip Device
	MX ²	Shunt Trip
	XF ²	Shunt Close
	PF	Ready-to-Close Contact
	MCH	Spring-Charging Motor

¹ OF1, OF2, OF3 and OF4 contacts are standard.

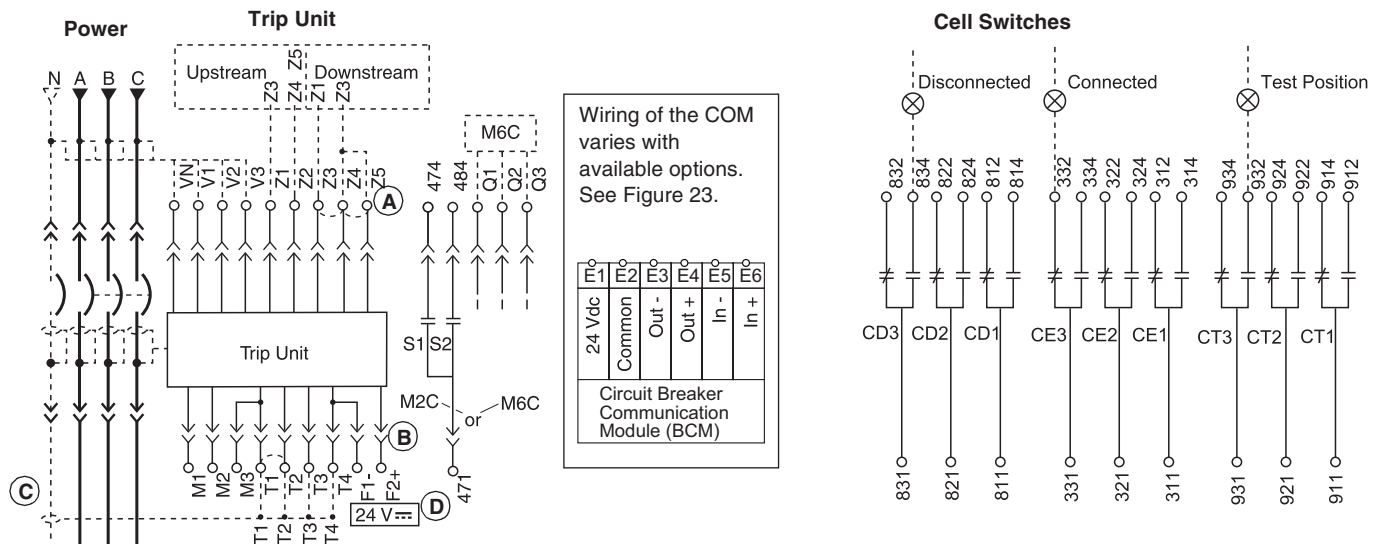
² When communicating MX1 or XF coils are used, terminal (C3 or A3) must be connected to line even if the communication module is not installed. The bypass circuit through terminal C2/A2 is only momentary duty (0.5 sec). For continuous duty, use the communications command.

Trip Unit Type				Connector	Description
Basic	A	P	H		
–	•	•	•	Com: E1–E6	Communication
–	•	•	•	UC1: Z	Zone-Selective Interlocking Z1 = ZSI OUT Signal Z2 = ZSI OUT Z3 = ZSI IN Signal Z4 = ZSI IN Short Time Z5 = ZSI IN Ground Fault
–	•	•	•	UC1: M1	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC2: T	External Neutral
–	•	•	•	UC2: M	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC3: F	24 Vdc External Power Supply
–	–	•	•	UC3: Vn	External Neutral Plug
–	–	•	•	UC4	External Phase Voltage Sensing
–	–	•	•	M2C/M6C	Two Programmable Contacts (internal relay) or Six Programmable Contacts (for connection to external M6C module)

Wiring Diagrams for Auxiliary Connections

NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 22 – Wiring Diagrams for Auxiliary Connections



A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.

B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.

C—For proper wiring of neutral CT, refer to wiring schematics, pages 32 and 33.

D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.

Markings for Push-In Type Terminals

Cell Switches			Trip Unit								Cell Switches		
CD3	CD2	CD1	COM	UC1	UC2	UC3	UC4	M2C/M6C	SDE2/Res.	SDE1	CE3	CE2	CE1
834	824	814	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○
832	822	812	E5 E6	Z5 M1	M2 M3	F2+	V3	484/Q3	184/K2	84	334	324	314
831	821	811	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○
			E3 E4	Z3 Z4	T3 T4	VN	V2	474/Q2	182	82	332	322	312
			○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○
			E1 E2	Z1 Z2	T1 T2	F1-	V1	471/Q1	181/K1	81	331	321	311
			○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○
or													
CE6	CE5	CE4											
364	354	344											
362	352	342											
361	351	341											

Markings for Ring Terminals

Cell Switches			Trip Unit										
CD3	CD2	CD1	COM	UC1	UC2	UC3	UC3a	M2C/M6C	M2Ca/M6Ca	SDE2/Res.	SDE2a	SDE1	SDE1a
○	○	○	○ ○	○ ○	○ ○	○	○	○	○	○	○	○	○
834/832	824/822	814/812	E5 E6	Z5 M1	M2 M3	F2	VN	484/Q3	474/Q2	184/K2	182	84	82
○	○	○	○ ○	○ ○	○ ○	○		○		○		○	
831	821	811	E3 E4	Z3 Z4	T3 T4	F1		471/Q1		181/K1		81	
			○ ○	○ ○	○ ○								
			E1 E2	Z1 Z2	T1 T2								
			○ ○	○ ○	○ ○								

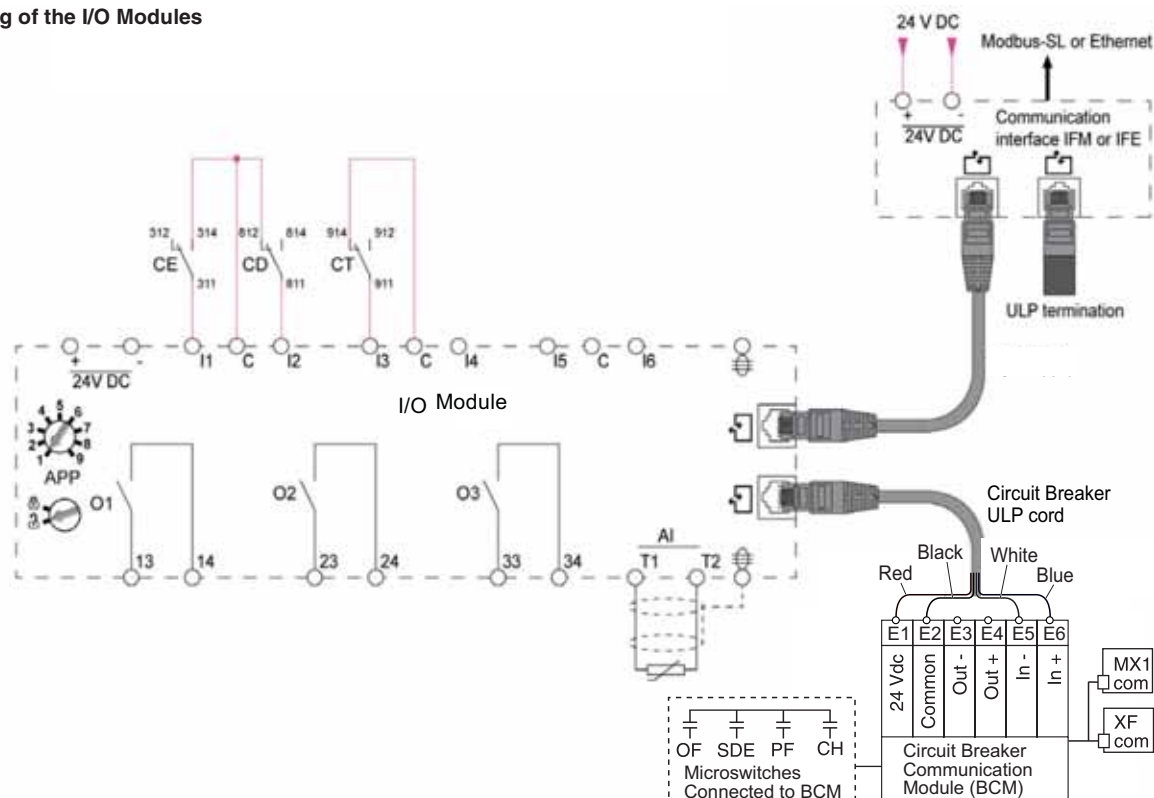
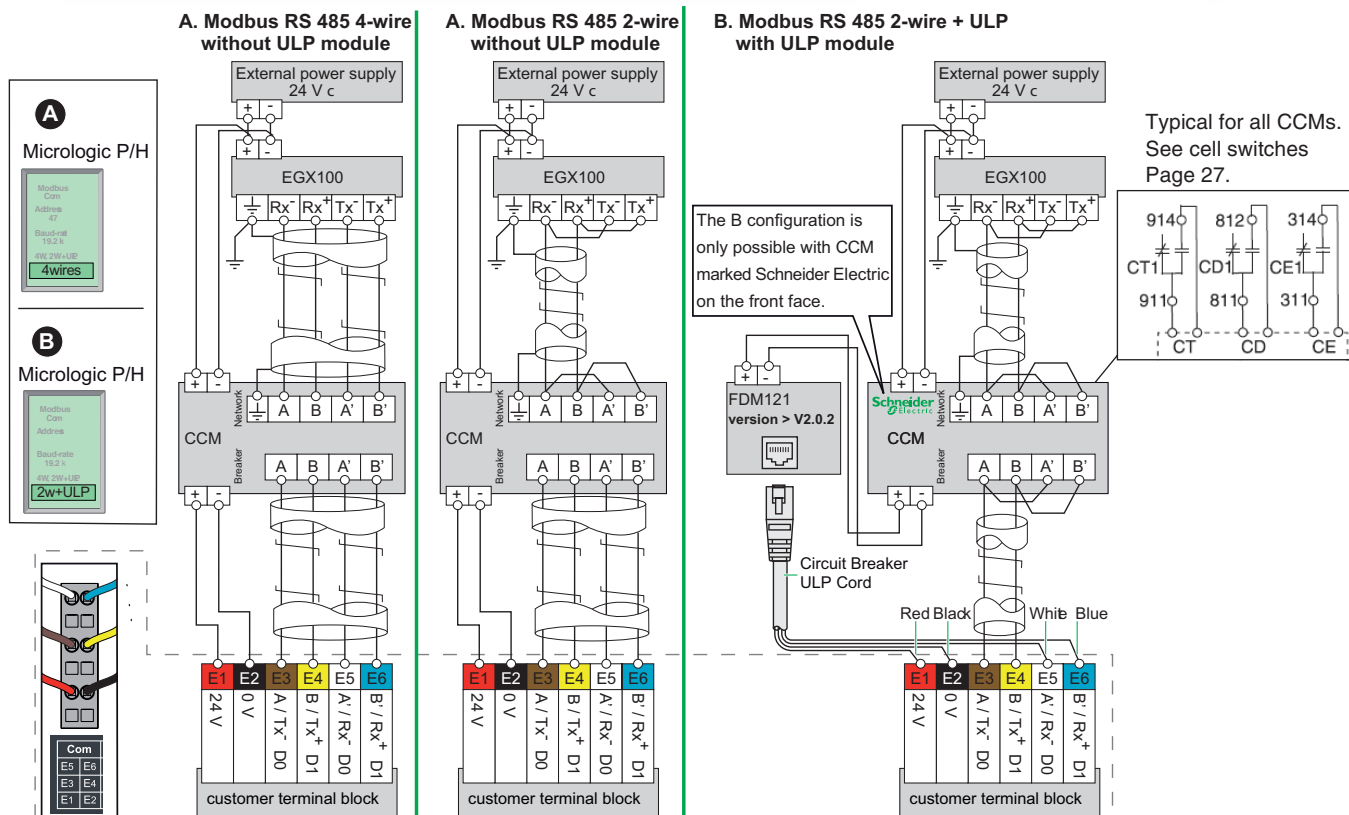
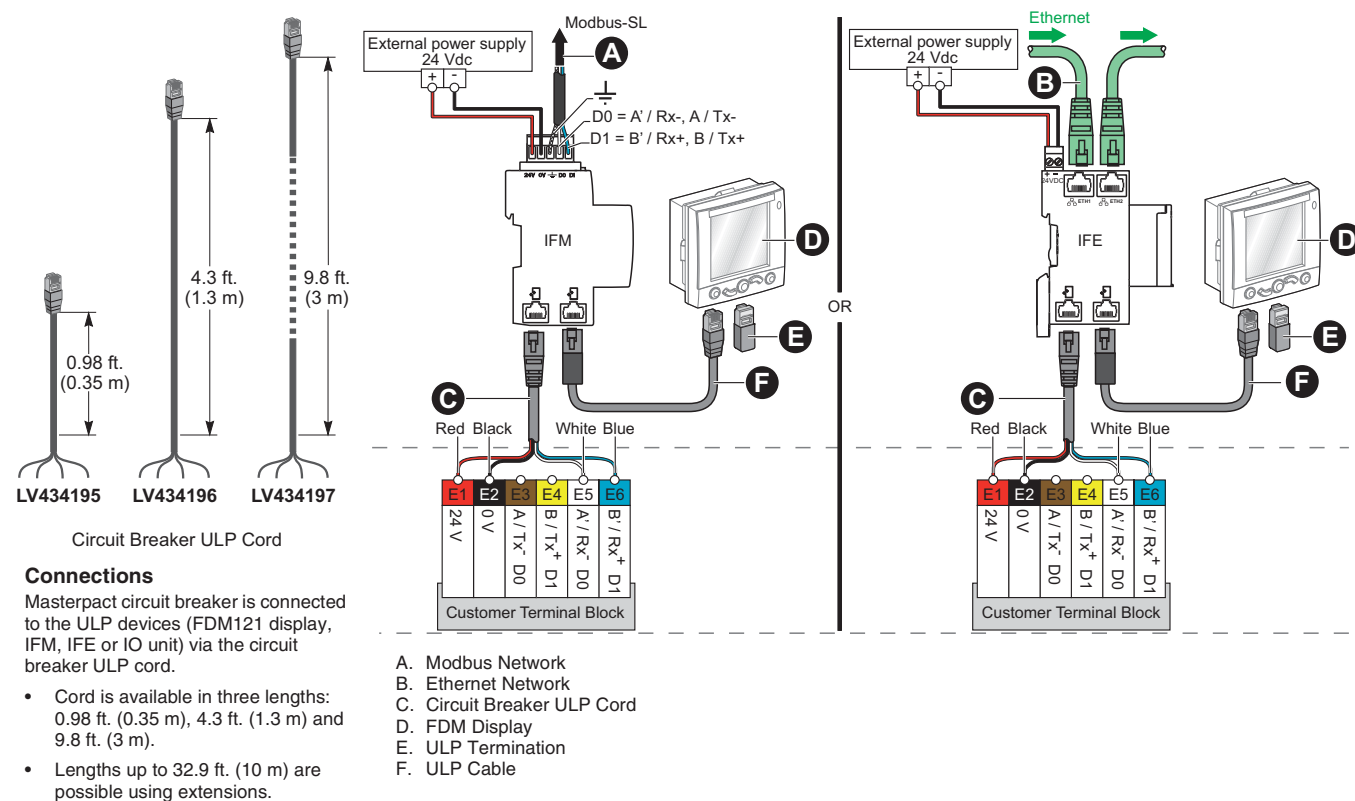
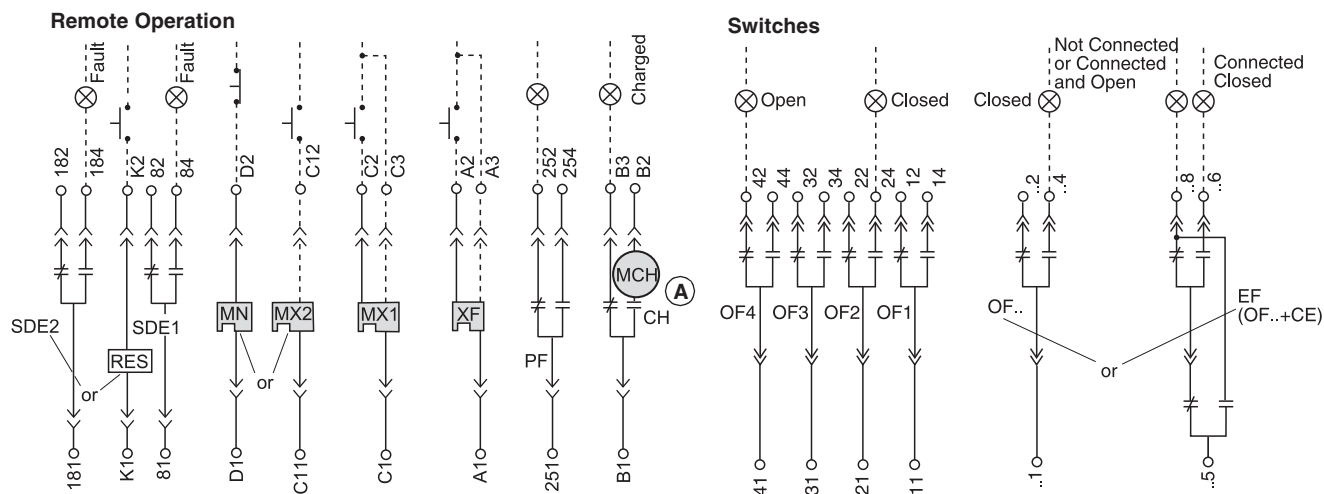
Figure 23 – Wiring Diagrams for the COM Option**Wiring of the I/O Modules****Wiring of the COM Option (Modbus BCM ULP and CCM Modules)**

Figure 24 – Communication Components and FDM121 Connections

NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 25 – Wiring Diagrams for Auxiliary Connections



A—When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

Markings for Push-In Type Terminals

Remote Operation					Auxiliary Switches												Cell Switches									
MN/MX2	MX1	XF	PF	MCH	OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1	CT3	CT2	CT1							
D2/C12	C2	A2	254	B2	244	234	224	214	144	134	124	114	44	34	24	14	934	924	914							
C13	C3	A3	252	B3	242	232	222	212	142	132	122	112	42	32	22	12	932	922	912							
D1/C11	C1	A1	251	B1	241	231	221	211	141	131	121	111	41	31	21	11	931	921	911							
					or								or								or					
					EF24	EF23	EF22	EF21	EF14	EF13	EF12	EF11												CD6	CD5	CD4
					248	238	228	218	148	138	128	118												864	854	844
					246	236	226	216	146	136	126	116												862	852	842
					245	235	225	215	145	135	125	115												861	851	841
																	or									
																	CE9	CE8	C7							
																	394	384	374							
																	392	382	372							
																	391	381	371							

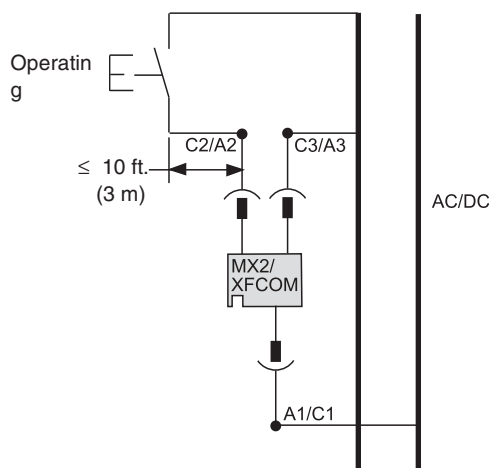
Markings for Ring Terminals

Remote Operation									Auxiliary Switches								Cell Switches		
MN	MX1	MX1a	XF	XFa	PF	CT1	MCH	MCHa	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1	CE3	CE2	CE1
D2	C2	C3	A2	A3	252	914/912	B2	B3	144	134	122	112	44	34	22	12	334/332	324/322	314/312
D1	C1		A1		251	911	B1		141	131	121	111	41	31	21	11	331	321	311

Communicating Shunt Trip (MX) and Shunt Close (XF)

A recommended wiring schematic for the communicating style shunt trip or shunt close coils is shown in Figure 26. Induced voltages in the circuit at terminal C2 and/or A2 can cause the shunt trip or shunt close to not work properly. The best way to prevent the induced voltages is keep the circuit to terminal C2 and A2 as short as possible. If it is impossible to keep the circuit less than ten feet (three meters), use an interposing relay near terminal C2 or A2.

Figure 26 – Communicating Wiring Schematic

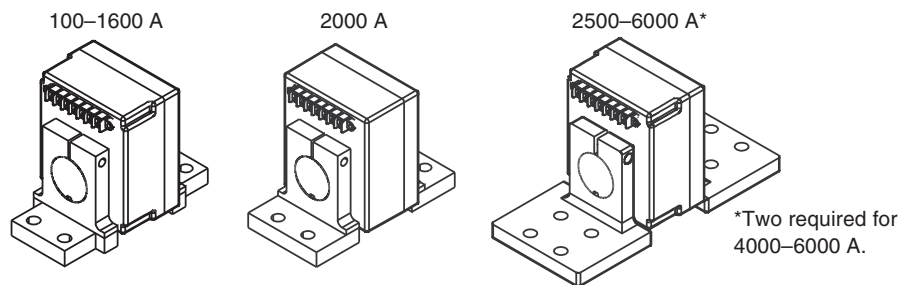


Ground-Fault Protection for Equipment

If the circuit breaker does not have an integral ground-fault tripping or alarm, skip this subsection.

A three-phase, four-wire circuit requires an external neutral current transformer (CT).

Figure 27 – Neutral Current Transformers



Connect the neutral CT to the circuit breaker according to wiring diagrams.

1. Connect the primary:

- If the load is connected to lower end of the circuit breaker, connect the load neutral to the H1 terminal of the neutral CT.
- If the source power is connected to the lower end of the circuit breaker, connect the source neutral to the H1 terminal of the neutral CT.

NOTE: The equipment grounding connection must be upstream (line side) of the neutral CT and a neutral connection must exist from the supply transformer to the equipment.

For circuit breakers using Micrologic™ 5.0P, 5.0H, 6.0P, or 6.0H trip units, connect terminal Vn on the neutral current transformer to the Vn terminal of the control wiring terminal. (This is necessary to allow the trip unit to make voltage measurements.) Terminals Vc and Vn are internally connected.

NOTICE

HAZARD OF IMPROPER TRIP SYSTEM OPERATION

F1 and F2 must be isolated from ground. Verify all wiring per the instructions in this bulletin.

Failure to follow these instructions can result in a nuisance trip during closing.

- 2. Remove the factory-installed jumper connecting T1 and T2.
- 3. Feed the Belden® cable and plastic conduit from the neutral CT to the cradle terminals.
- 4. Connect the cable per the appropriate schematic in Figure 28 or 29.
- 5. Verify all wiring.

NOTE: Modified differential ground-fault circuitry and ground-source return ground-fault circuitry require the use of a modified differential ground-fault module (MDGF) and special current transformers. For wiring of those systems, see the instructions with the MDGF.

Figure 28 – Wiring Schematic for 800–4000 A Standard-Width NW Circuit Breakers

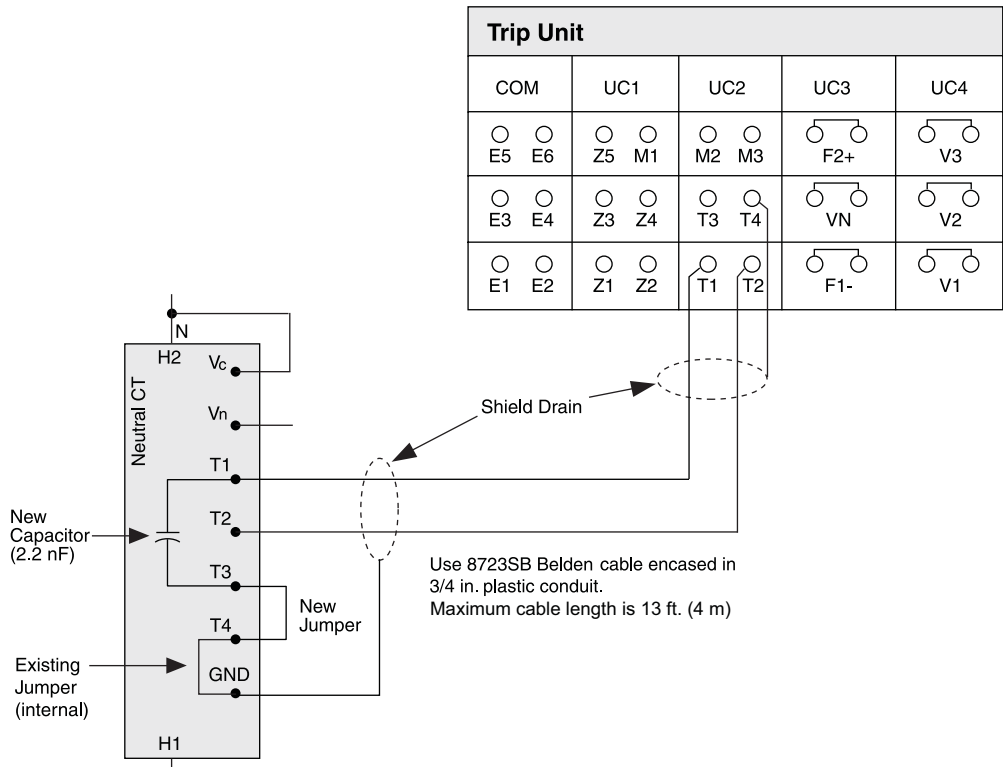
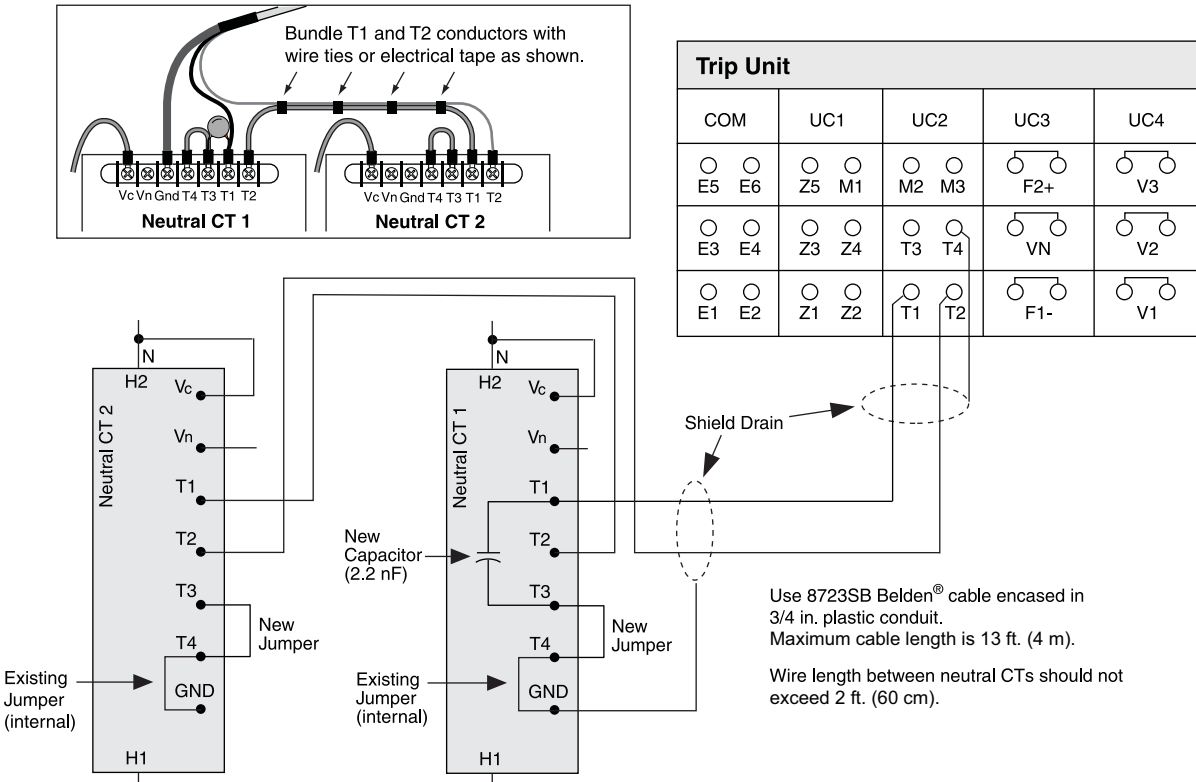


Figure 29 – Wiring Schematic for 3200–6000 A Wide-Construction NW Circuit Breakers

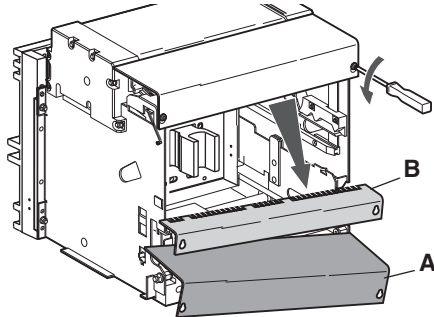


Accessory Wiring—Push-In Connectors

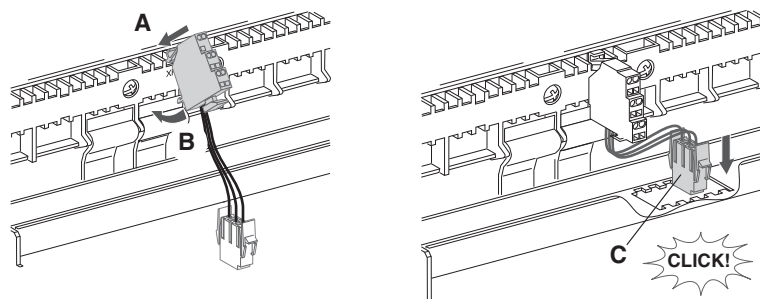
NOTE: Place cradle in test position to install or remove push-in connectors. Place in test position as described on page 70.

1. Remove the optional terminal cover (**Figure 30, A**), if installed, and the wiring cover (**B**).

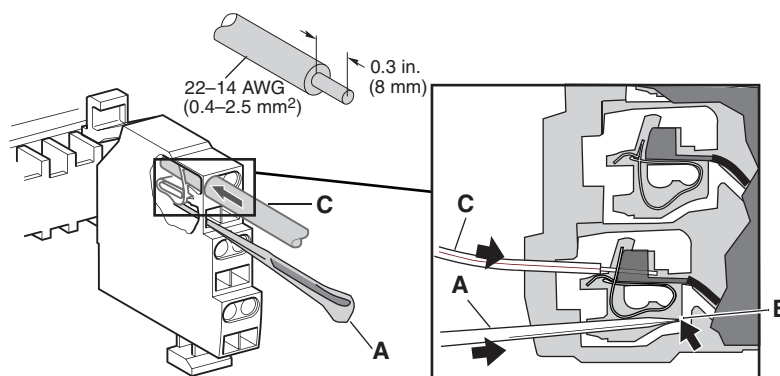
Figure 30 – Remove Covers



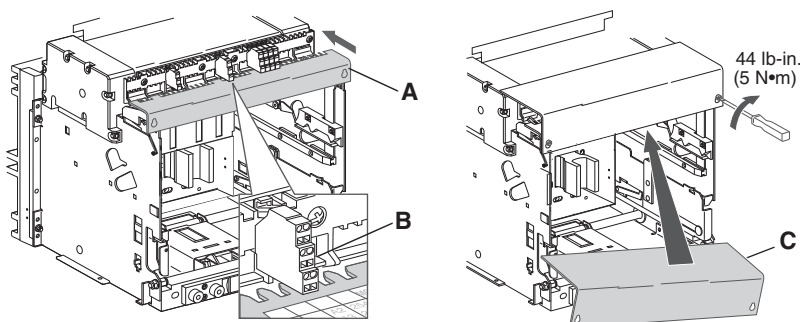
2. Install each push-in connectors in the correct slot (**Figure 31, A**). (Refer to the label on the cradle for standard positioning information.) Rotate the push-in connector down (**B**) to snap in place.
3. Install the wiring connector (**C**). Connector positions are indicated on front of the connector support.

Figure 31 – Install Push-In Connector

4. Push the Wago wire insert tool (**Figure 32, A**, Wago part no. 209-129) fully into the connector (to point **B**) and install control wires (**C**).

Figure 32 – Install Control Wires

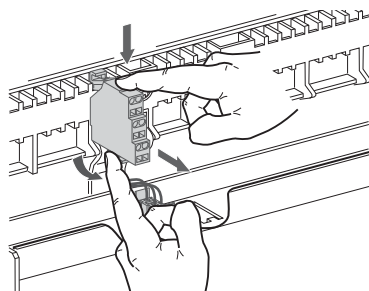
5. Replace the wiring cover (**Figure 33, A**), sliding the top under the installed push-in connectors (**B**).
6. Replace the optional terminal cover (**C**), if installed.

Figure 33 – Replace Covers

NOTE: Remove a push-in connector in reverse order of installation.

Remove the connector by pressing down on top of connector (**Figure 40, A**) while pushing up and out on bottom (**B**) to rotate connector off of latch.

Figure 34 – Remove Push-In Connector

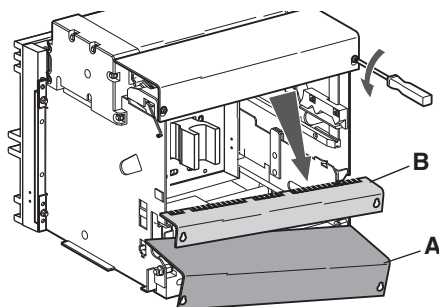


Accessory Wiring—Ring Terminal Connector

NOTE: Place the cradle in its test position to install or remove ring terminal connectors. Place in test position as detailed on page 70, Drawout Circuit Breaker Disconnection.

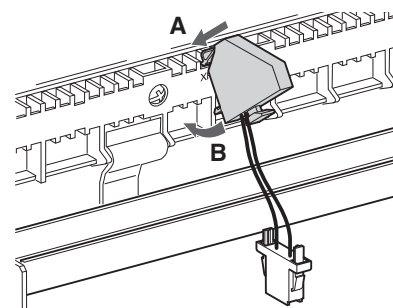
1. Remove the optional terminal cover (**Figure 35, A**), if installed, and the wiring cover (**B**).

Figure 35 – Remove Covers



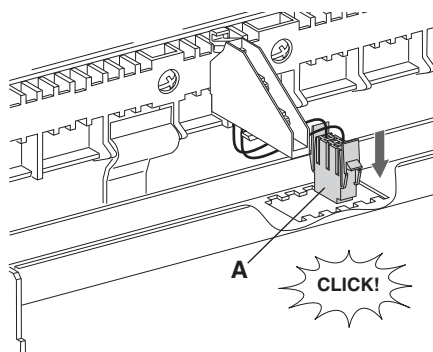
2. Install each ring terminal connector in the correct slot (**Figure 36, A**). (Refer to the label on the cradle for standard positioning information.) Rotate the ring terminal block down (**B**) to snap in place.

Figure 36 – Install Ring Terminal Connector



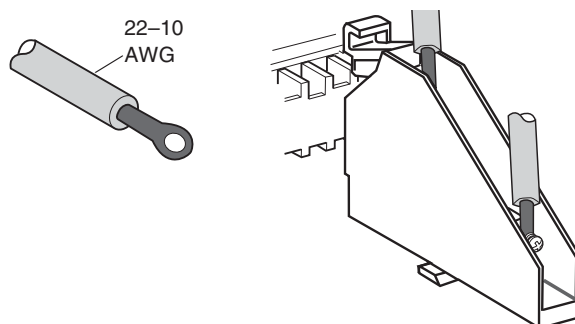
3. Install the wiring connector (**Figure 37, A**). Connector positions are indicated on front of the connector support.

Figure 37 – Install Wiring Connector



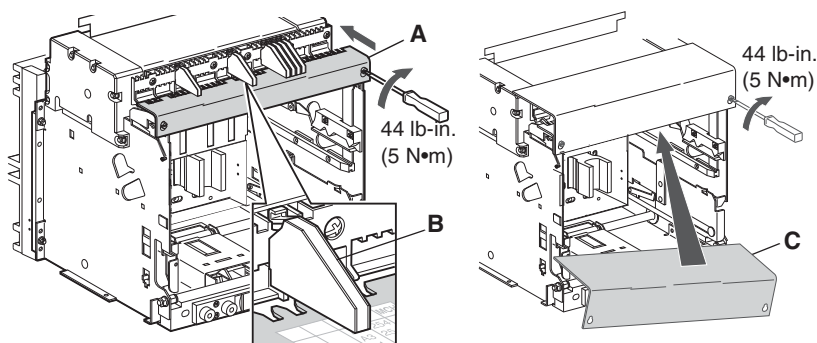
4. Install the ring terminals on the control wire. Secure the ring terminal on the ring terminal block.

Figure 38 – Install Control Wires



5. Replace the wiring cover (**Figure 39, A**), sliding the top under the installed ring terminal connectors (**B**).
6. Replace the optional terminal cover (**C**), if installed.

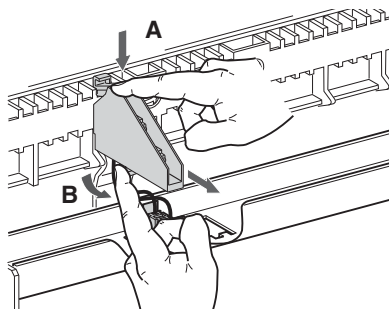
Figure 39 – Replace Wiring Cover



NOTE: To remove a ring terminal connector, the circuit breaker must be in test position. Remove the ring terminal connector in reverse order of installation.

Remove the connector by pressing down on top of connector (**Figure 40, A**) while pushing up and out on bottom (**B**) to rotate connector off of latch.

Figure 40 – Remove Ring Terminal Connector



Cradle Removal

1. Turn off all power supplying the equipment before working on or inside equipment.
2. Remove the cradle in reverse order of installation.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

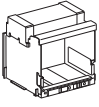
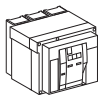
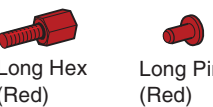
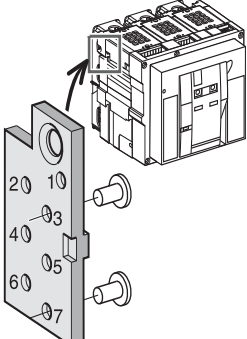
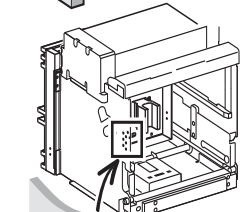
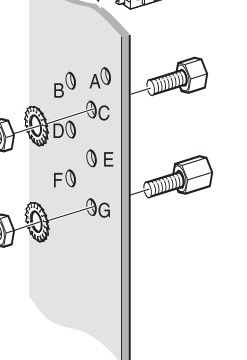
Circuit Breaker Installation

Cradle Rejection Kit

To prevent a Masterpact circuit breaker with an inappropriate ampacity or interrupting rating from being installed in the cradle, install rejection pins on cradle and circuit breaker prior to installing circuit breaker.

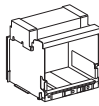
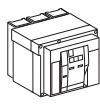
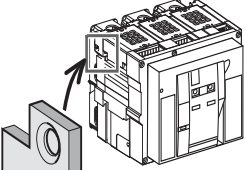
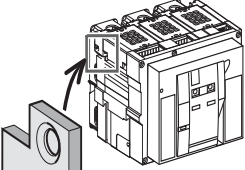
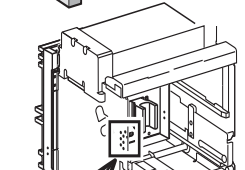
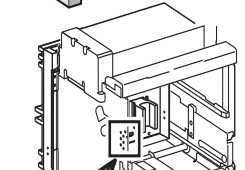
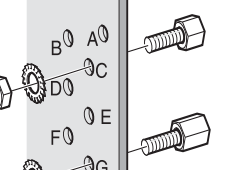
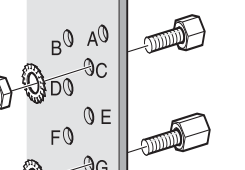
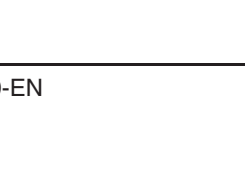
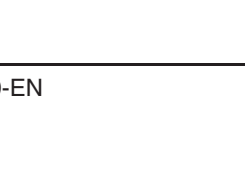
1. Determine rejection pin pattern required. (See Table 8 or 9.)

Table 8 – Recommended Cradle Rejection Pin Keying for Standard UL 1066 (ANSI C37.50) Listed Circuit Breakers

Cradle Rejection Hexes	Circuit Breaker Rejection Pins	Type														
			A	B	C	D	E	F	G	1	2	3	4	5	6	7
 Short Hex (Blue) Medium Hex (Black)	 Short Pin (Blue) Medium Pin (Black)	800 A N1	Black	Black	Black	Red	Blue	Blue	Black	Blue	Blue	Blue	—	Black	Black	Blue
		800 A H1	Black	Black	Black	Blue	Red	Blue	Black	Blue	Blue	Blue	Black	—	Blue	Black
		800 A H2	Black	Black	Black	Red	Red	Blue	Blue	Blue	Blue	Blue	—	—	Black	Black
		800 A H3	Black	Black	Black	Blue	Blue	Red	Blue	Blue	Blue	Blue	Black	Black	—	Black
		800 A L1	Black	Black	Black	Red	—	Red	Blue	Blue	Blue	Blue	—	Red	—	Black
		800 A L1F	Black	Black	Black	—	Red	Red	Blue	Blue	Blue	Blue	Red	—	—	Black
		800 A HF	Black	Black	Black	Blue	—	Red	Red	Blue	Blue	Blue	Black	Red	—	—
		800 A HC	Black	Blue	Black	Red	—	Red	Red	Blue	Black	Blue	—	Red	—	—
		800 A HA	Black	Black	Black	Red	Red	—	Red	Blue	Blue	Blue	—	—	Red	—
 Long Hex (Red) Long Pin (Red)		1600 A N1	—	Red	Blue	Red	Blue	Blue	Black	Red	—	Black	—	Black	Black	Blue
		1600 A H1	—	Red	Blue	Blue	Red	Red	Black	Red	—	Black	Black	—	Blue	Black
		1600 A H2	—	Red	Blue	Red	Red	Blue	Blue	Red	—	Black	—	—	Black	Black
		1600 A H3	—	Red	Blue	Blue	Blue	Red	Blue	Red	—	Black	Black	Black	—	Black
		1600 A L1	—	Red	Black	Red	—	Red	Blue	Red	—	Blue	—	Red	—	Black
		1600 A L1F	—	Red	Black	—	Red	Red	Blue	Red	—	Blue	Red	—	—	Black
		1600 A HF	—	Red	Black	Blue	—	Red	Red	Red	—	Black	Black	Red	—	—
		1600 A HC	—	Red	Blue	Red	—	Red	Red	Red	—	Black	Black	Red	—	—
		1600 A HA	—	Red	Blue	Red	Red	—	Red	Red	—	Black	—	—	Red	—
		2000 A H1	Red	—	Red	Blue	Red	Black	Blue	—	Red	—	Black	—	Blue	Black
 20 10 03 40 05 07		2000 A H2	Red	—	Red	Red	Red	Blue	Blue	—	Red	—	—	—	Black	Black
		2000 A H3	Red	—	Red	Blue	Blue	Red	Blue	—	Red	—	Black	Black	—	Black
		2000 A L1	Red	—	Red	Red	—	Red	Blue	—	Red	—	—	Red	—	Black
		2000 A L1 Wide*	—	Red	Red	Red	Blue	Red	Black	Red	—	—	—	Black	—	Blue
		2000 A L1F	Red	—	Red	—	Red	Red	Blue	—	Red	—	Red	—	—	Black
		2000 A HF	Red	—	Red	Blue	—	Red	Red	—	Red	—	Black	Red	—	—
		2000 A HC	Red	—	Blue	Red	—	Red	Red	—	Red	Black	—	Red	—	—
		2000 A HA	Red	—	Red	Red	Red	—	Red	—	Red	—	—	—	Red	—
		3200 A H1	Blue	Black	Red	Black	Red	Black	Black	Black	Blue	—	Blue	—	Blue	Blue
		3200 A H2	Blue	Black	Red	Red	Red	Black	Blue	Black	Blue	—	—	—	Blue	Black
 B A C D E F G		3200 A H3	Blue	Black	Red	Blue	Black	Red	Blue	Black	Blue	—	Black	Blue	—	Blue
		3200 A HF	Blue	Black	Red	—	—	Red	Red	Black	Blue	—	Red	Red	—	—
		3200 A HC	—	Black	Red	Red	—	Red	Red	Red	Blue	—	—	Red	—	—
		3200 A HC Wide*	Red	Blue	Black	Red	Black	Red	Red	—	Black	Blue	—	Blue	—	—
		3200 A L1 Wide*	Red	Black	Blue	Red	Black	Red	Black	—	Blue	Black	—	Blue	—	Blue
		3200 A HA	—	Black	Red	Red	Red	—	Red	Black	Blue	—	—	—	Red	—
		4000 A H2 Wide*	Black	Red	Blue	Red	Red	Black	Blue	Blue	—	Black	—	—	Blue	Black
		4000 A H3 Wide*	Black	Red	Blue	Blue	Black	Red	Blue	Blue	—	Black	Black	Blue	—	Black
		4000 A HA Wide*	Blue	Red	Blue	Red	Red	—	Red	Black	—	Blue	—	—	Red	—
		4000 A HC Wide*	Blue	Red	Blue	Red	Blue	Red	Red	Black	—	Blue	—	Black	—	—
 B A C D E F G		4000 A HF Wide*	Blue	Red	Blue	Blue	Black	Red	Red	Black	—	Blue	Black	Blue	—	—
		4000 A L1 Wide*	Black	Red	Blue	Red	Blue	Red	Black	Blue	—	Black	—	Black	—	Blue
		5000 A H2	Red	Black	Black	Red	Red	Black	Blue	—	Blue	Blue	—	—	Blue	Black
		5000 A H3	Red	Black	Black	Blue	Black	Red	Blue	—	Blue	Blue	Black	Blue	—	Black
		5000 A HA	Red	Black	Blue	Red	Red	—	Red	—	Blue	Black	—	—	Red	—
		5000 A HF	Red	Black	Blue	Blue	Black	Red	Red	—	Blue	Black	Black	Blue	—	—
		5000 A HC	Red	Black	Blue	Red	Blue	Red	Red	—	Blue	Black	—	Black	—	—
 B A C D E F G		5000 A L1	Red	Black	Black	Red	Blue	Red	Black	—	Blue	Blue	—	Black	—	Blue
		6000 A H2	Black	Black	Red	Red	Red	Black	Blue	Blue	Blue	—	—	—	Blue	Black
		6000 A H3	Black	Black	Red	Blue	Black	Red	Blue	Blue	Blue	—	Black	Blue	—	Black
		6000 A HA	Blue	Blue	Red	Red	Red	—	Red	Black	Black	—	—	—	Red	—
		6000 A HF	Blue	Blue	Red	Blue	Black	Red	Red	Black	Black	—	Black	Blue	—	—
		6000 A HC	Blue	Blue	Red	Red	Blue	Red	Red	Black	Black	—	—	Black	—	—
		6000 A L1	Black	Black	Red	Red	Blue	Red	Black	Blue	Blue	—	—	Black	—	Blue

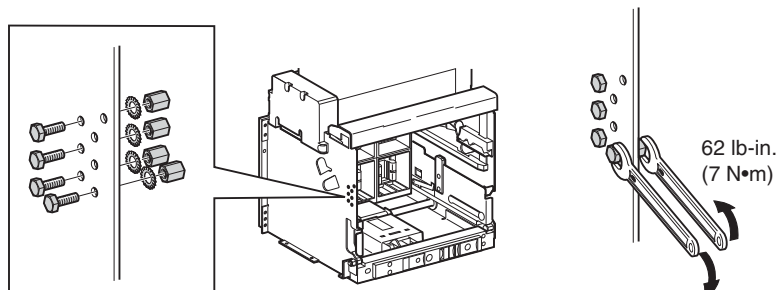
* Wide construction version.

Table 9 – Recommended Cradle Rejection Pin Keying for Standard UL 489 Listed Circuit Breakers

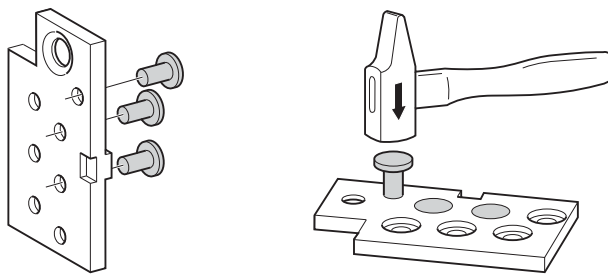
Cradle Rejection Hexes	Circuit Breaker Rejection Pins	Type														
			A	B	C	D	E	F	G	1	2	3	4	5	6	7
		800 A N	Black	Black	Black	Red	Red	Red	—	Blue	Blue	Blue	—	—	—	Red
		800 A H	Black	Black	Blue	Blue	Blue	Blue	Red	Blue	Blue	Black	Black	Black	Black	—
		800 A L	Black	Black	Black	Red	—	Blue	Red	Blue	Blue	Blue	—	Red	Black	—
		800 A LF	Black	Blue	Black	Blue	Red	Blue	Red	Blue	Black	Blue	Black	—	Black	—
		800 A HF	Black	Blue	Black	—	Red	Red	Black	Blue	Black	Blue	Red	—	—	Blue
		800 A HB	Blue	Black	Black	Red	Red	Red	Black	Black	Blue	Blue	—	—	—	Blue
		1200 A N	Red	Blue	Black	Red	Red	Red	—	—	Black	Blue	—	—	—	Red
		1200 A H	Red	Blue	Black	Blue	Blue	Blue	Red	—	Black	Blue	Black	Black	Black	—
		1200 A L	Red	Blue	Black	Red	—	Blue	Red	—	Black	Blue	—	Red	Black	—
		1200 A LF	Red	Blue	Blue	Blue	Red	Blue	Red	—	Black	Black	Black	—	Black	—
		1200 A HF	Red	Black	Blue	—	Red	Red	Red	—	Blue	Black	Red	—	—	—
		1200 A HB	Black	Blue	Blue	Red	Red	Red	Red	Blue	Black	Black	—	—	—	—
		1600 A N	—	Red	Blue	Red	Red	Red	—	Red	—	Black	—	—	—	Red
		1600 A H	—	Red	Black	Blue	Blue	Blue	Red	Red	—	Blue	Black	Black	Black	—
		1600 A L	—	Red	Black	Red	—	Blue	Red	Red	—	Blue	—	Red	Black	—
		1600 A LF	—	Red	Blue	Blue	Red	Blue	Red	Red	—	Black	Black	—	Black	—
		1600 A HF	—	Red	Blue	—	Red	Red	Red	Red	—	Black	Red	—	—	—
		1600 A HB	—	Red	—	Red	Red	Red	Red	Red	—	Red	—	—	—	—
		2000 A N	Red	—	Red	Red	Red	Red	—	—	Red	—	—	—	—	Red
		2000 A H	Red	—	Red	Blue	Blue	Blue	Red	—	Red	—	Black	Black	Black	—
		2000 A L	Red	—	Red	Red	—	Blue	Red	—	Red	—	—	Red	Black	—
		2000 A LF	Red	—	Black	Blue	Red	Blue	Red	—	Red	Blue	Black	—	Black	—
		2000 A HF	Black	—	Red	—	Red	Red	Red	Blue	Red	—	Red	—	—	—
		2000 A HB	Red	—	—	Red	Red	Red	Red	—	Red	Red	—	—	—	—
		2500 A H	—	Blue	Red	Red	Red	Red	—	Red	Blue	—	Black	Black	Black	—
		2500 A L	—	Black	Red	Blue	Blue	Blue	Red	Red	Black	—	—	—	—	Red
		2500 A HF	—	Blue	Red	—	Red	Red	Red	Red	Black	—	Red	—	—	—
		2500 A HB	—	—	Red	Red	Red	Red	Red	Red	Red	—	—	—	—	—
		3000 A H	Blue	Red	—	Red	Red	Red	—	Black	—	Red	—	—	—	Red
		3000 A L	Black	Red	—	Blue	Blue	Blue	Red	Blue	—	Red	Black	Black	Black	—
		3000 A HF	Blue	Red	—	—	Red	Red	Red	Black	—	Red	Red	—	—	—
		3000 A HB	—	Black	Blue	Red	Red	Red	Red	Red	Blue	Black	—	—	—	—
		4000 A H Wide*	Black	Red	Blue	Blue	Blue	Black	Red	Blue	—	Black	Black	Black	Blue	—
		4000 A L Wide*	Black	Red	Blue	Red	Blue	Blue	Red	Blue	—	Black	—	Black	Black	—
		4000 A HF Wide*	Blue	Red	Blue	—	Red	Red	Red	Black	—	Blue	Red	—	—	—
		4000 A HB Wide*	Blue	Red	Blue	Black	Red	Blue	Red	Black	—	Blue	Blue	—	Black	—
		5000 A H	Red	Black	Black	Blue	Blue	Black	Red	—	Blue	Blue	Black	Black	Blue	—
		5000 A L	Red	Black	Black	Red	Blue	Blue	Red	—	Blue	Blue	—	Black	Black	—
		5000 A HF	Red	Black	Blue	—	Red	Red	Red	—	Blue	Black	Red	—	—	—
		5000 A HB	Red	Black	Blue	Black	Red	Blue	Red	—	Blue	Black	Blue	—	Black	—
		6000 A H	Black	Black	Red	Blue	Blue	Black	Red	Blue	Blue	—	Black	Black	Blue	—
		6000 A L	Black	Black	Red	Red	Blue	Blue	Red	Blue	Blue	—	—	Black	Black	—
		6000 A HF	Blue	Blue	Red	—	Red	Red	Red	Black	Black	—	Red	—	—	—
		6000 A HB	Blue	Blue	Red	Black	Red	Blue	Red	Black	Black	—	Blue	—	Black	—

* Wide construction version.

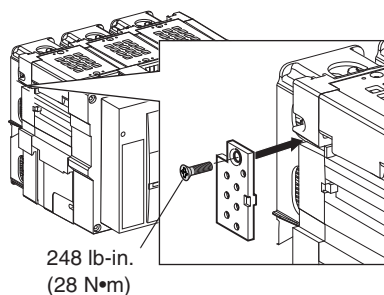
2. Install cradle rejection pins in the pattern determined from Table 8 or 9.

Figure 41 – Install Cradle Rejection Pins

3. Install the circuit breaker rejection pins into the rejection pin plate in the pattern determined from Table 8 or 9.

Figure 42 – Install Circuit Breaker Rejection Pins

4. Install the rejection pin plate on the circuit breaker.

Figure 43 – Install Rejection Pin Plate

Install Accessories

Install any required circuit breaker accessories which were not factory installed.
If installing electrical accessories, remove accessory cover.

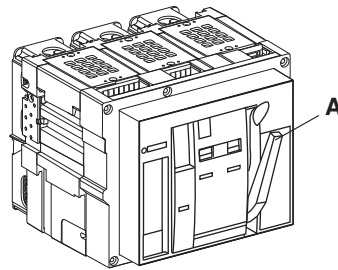
NOTICE

HAZARD OF EQUIPMENT DAMAGE

Use caution when removing or replacing the circuit breaker accessory cover. The spring-charging handle (**Figure 44, A**) extends through the circuit breaker accessory cover and can be damaged when removing the accessory cover.

Failure to follow these instructions can result in equipment damage.

Figure 44 – Spring Charging Handle

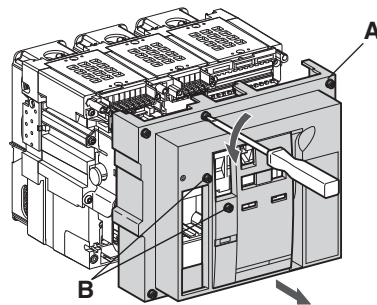


Loosen the accessory cover screws and remove the accessory cover (**Figure 45, A**).

NOTE: Screws (**B**) are for Type L, LF, L1, and L1F circuit breakers only.

Install accessory as instructed in the instructions packed with each accessory.

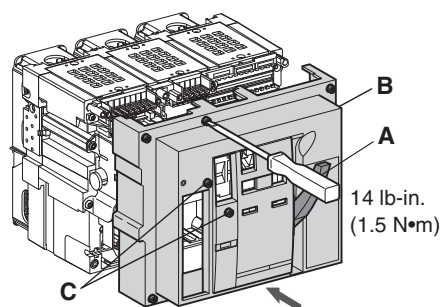
Figure 45 – Remove Accessory Cover



Replace the accessory cover by pulling the handle (**Figure 46, A**) forward and sliding the circuit breaker accessory cover (**B**) down over the handle. Tighten the accessory cover screws.

NOTE: Screws (**C**) are for Type L, LF, L1, and L1F circuit breakers only.

Figure 46 – Replace Accessory Cover



Install Circuit Breaker

NOTICE

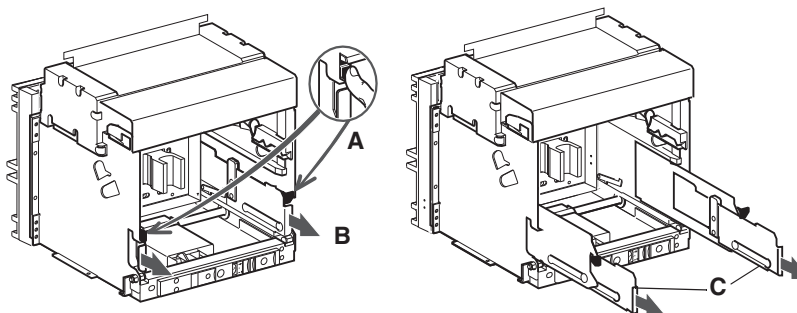
HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

1. Press the latching tabs (**Figure 47, A**), then pull out the extension rail handles (**B**) until the extension rails (**C**) are fully extended.
2. Inspect the circuit breaker clusters for missing or misaligned clusters. See page 11 for information on checking, installing, and lubricating clusters.

Figure 47 – Pull Out Rails



NOTICE**HAZARD OF EQUIPMENT DAMAGE**

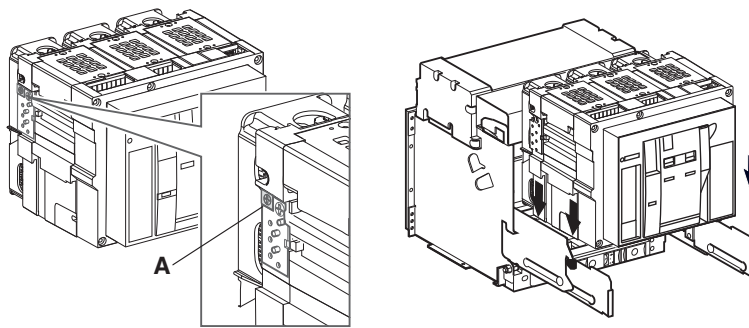
The shutter actuator must be installed on the circuit breaker for proper operation of cell shutters.

Failure to follow these instructions can result in equipment damage.

3. For cells with shutters, check that the shutter actuator (**Figure 48, A**) is installed on the circuit breaker.
4. Install the circuit breaker on the extension rails. See page 16 for proper lifting equipment.

NOTE: The cradle must be secured on a pallet if it is not installed in the equipment prior to installing the circuit breaker.

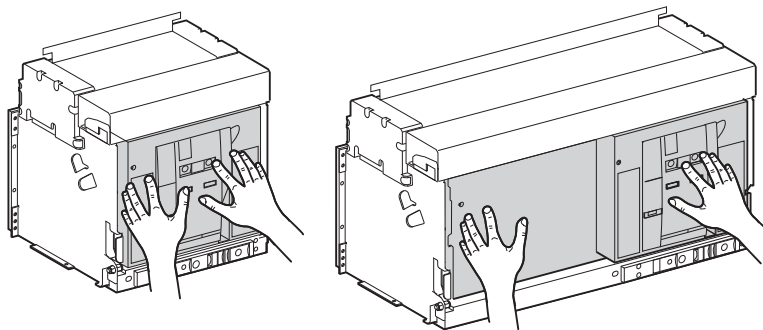
Figure 48 – Check Shutter Actuator



5. Push in the circuit breaker.
6. Connect the circuit breaker. See page 68, Drawout Circuit Breaker Connection for instructions on connecting the circuit breaker.

See Section 6—Operation for instructions on operating the circuit breaker.

Figure 49 – Push In Circuit Breaker



Test Equipment Ground-Fault Protection

Paragraph 230-95(c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed. If the circuit breaker has equipment ground-fault protection installed, test it at this time.

Make sure the trip unit is powered. The trip unit is powered if:

- The circuit breaker is closed or bottom-fed and has more than 100 V of load voltage on two phases (P or H trip unit only).
- The full-function or hand-held test kit is connected and on.
- A 24 Vdc external power supply is connected.
- An external voltage tap is installed and a voltage of more than 100 V is present on two phases (P or H trip unit only).

If this is a radial (single-ended) system, press the ground-fault push-to-test button (Figure 50, A). The circuit breaker will trip and the trip unit ground-fault indicator light will come on.

Record results in Table 10.

If a complete check of the ground-fault system is necessary, use primary injection testing. If the system has multiple sources and/or requires field connections at the job site, use primary injection testing.

Figure 50 – Test Ground-Fault Push-to-Test

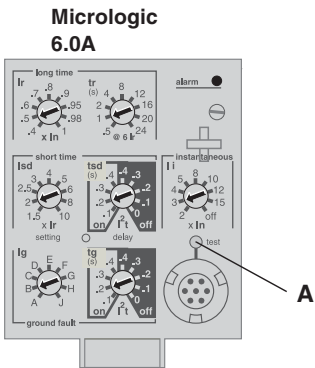


Table 10 – Ground-Fault Test Results

Date	Ground-Fault Settings	Test Results	Signature

Circuit Breaker Removal

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

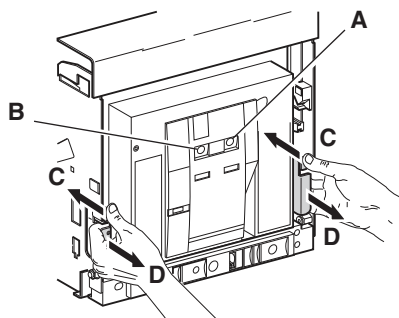
HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted. Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

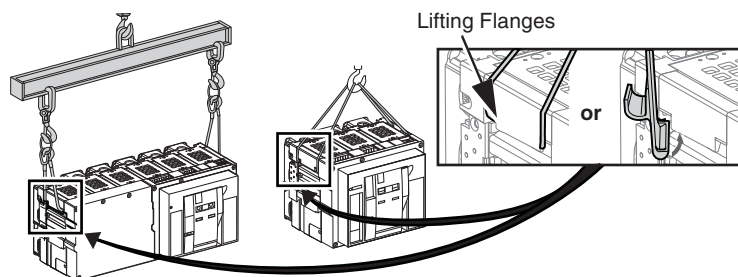
1. Disconnect circuit breaker as detailed on page 70, Drawout Circuit Breaker Disconnection.
2. With the circuit breaker in the disconnected position, press the “push ON” button (**Figure 51, A**) to close the circuit breaker.
3. Press the “push OFF” button (**B**) to open the circuit breaker.
4. Press latching tabs (**C**), then pull out extension rail handles (**D**).

Figure 51 – Circuit Breaker Removal



5. Remove circuit breaker from cradle rails using lifting flanges on sides of circuit breaker, see Section 2—Lifting and Transporting.

Figure 52 – Overhead Lifting



Section 4— Fixed-Mounted Circuit Breaker Installation

Circuit Breaker Installation

Turn off all power supplying this equipment before working on or inside equipment.

Install Accessories

Install circuit breaker accessories not purchased as factory installed at this time.

If installing electrical accessories, remove accessory cover.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

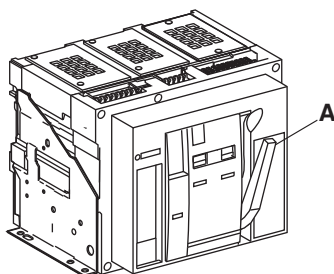
NOTICE

HAZARD OF EQUIPMENT DAMAGE

Use caution when removing or replacing the circuit breaker accessory cover. The spring-charging handle (**Figure 53, A**) extends through the circuit breaker accessory cover and can be damaged when removing the accessory cover.

Failure to follow these instructions can result in equipment damage.

Figure 53 – Spring Charging Handle

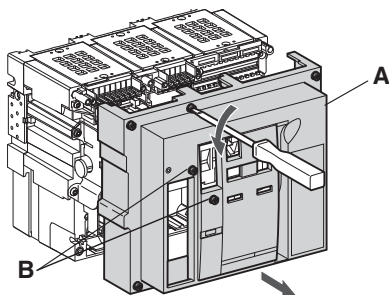


1. Loosen the accessory cover screws and remove the accessory cover (**Figure 54, A**).

NOTE: Screws (**B**) are for Type L and L1 circuit breakers only.

2. Install accessories as instructed in the instructions packed with each accessory.

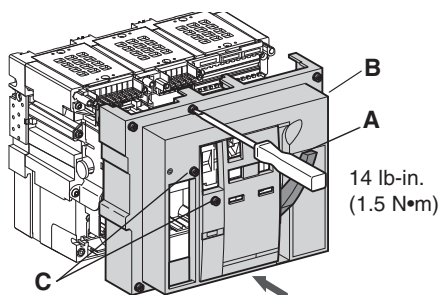
Figure 54 – Remove Accessory Cover



3. Replace the accessory cover by pulling the handle (**Figure 55, A**) forward and sliding the circuit breaker accessory cover (**B**) down over the handle. Tighten the accessory cover screws.

NOTE: Screws (**C**) are for Type L and L1 circuit breakers only.

Figure 55 – Replace Accessory Cover



Clearance Requirements

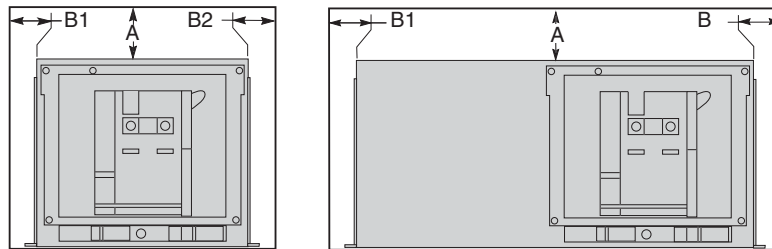
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Clearance requirements must be met for proper operation of the equipment.

Failure to follow these instructions will result in death or serious injury.

Table 11 – Clearance Requirements



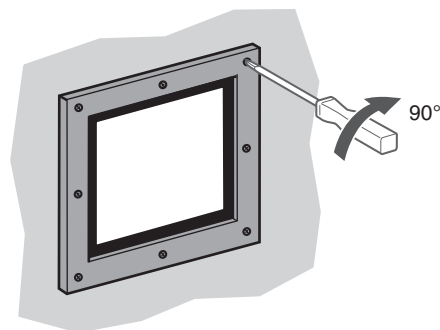
Minimum Clearance	A		B1 + B2	
	in.	mm	in.	mm
Insulated Parts	5.91	150	2.36	60
Metal Parts	5.91	150	5.72	120

Install Door Escutcheon

If the equipment has a door cutout, install the escutcheon shipped with circuit breaker.

1. If not already present, cut an opening in the equipment door for the escutcheon. For the opening dimensions, refer to bulletin 0613IB1205 on the Schneider Electric™ website (for website information see page 5).
2. Install the escutcheon.

Figure 56 – Install Door Escutcheon

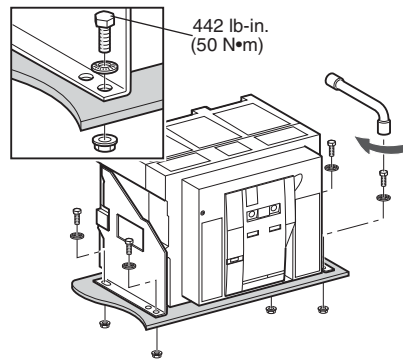


Install Circuit Breaker

1. If mounting holes are not already present, drill the mounting holes in the pan for mounting the circuit breaker. For circuit breaker mounting hole pattern dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).
2. Check flatness of the mounting surface. Mounting surface must be flat to within 0.08 in. (2 mm).
3. Mount the circuit breaker to pan, using 3/8 in. bolts, washers, and nuts.

NOTE: Vertical mounting brackets are available, if needed.

Figure 57 – Secure Circuit Breaker



Install Connectors

Standard connectors are shown in Table 12. Tighten the mounting screws to 142–159 lb-in. (16–18 N•m).

For information on non-standard connectors, contact the field office.

For connector dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).

Table 12 – Standard Connectors

Type	Rating	3-Pole Layout Front – Side – Top	4-Pole Layout Front – Side – Top
Rear- Connected “T” Vertical (RCTV)	800– 2000 A		
	2500– 3000 A		
	4000– 5000 A		
	6000 A		
Rear- Connected “T” Horizontal (RCTH)	800– 2000 A		
	2500– 3000 A		
	4000– 5000 A		
Rear- Connected Offset Vertical (RCOV)	3200 A		

Continued on next page

ENGLISH

Table 12 – Standard Connectors (continued)

Type	Rating	3-Pole Layout Front – Side – Top	4-Pole Layout Front – Side – Top
Rear-Connected Offset Vertical (RCOV Special)	4000 A W-frame		
Front-Connected Flat (FCF)	800–2000 A		
Front-Connected “T” (FCT)	800–3000 A		

Install Bussing

NOTICE

HAZARD OF EQUIPMENT DAMAGE

The busbar supports must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents. See **Figure 58, A**.

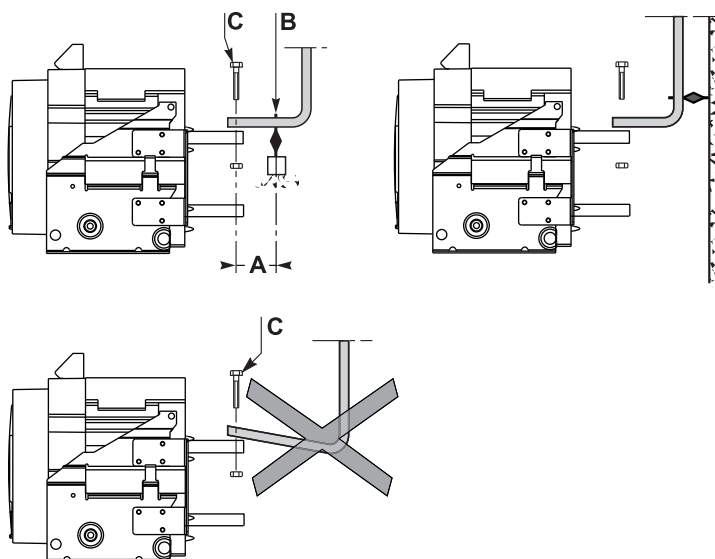
Failure to follow these instructions can result in equipment damage.

NOTE: Installer is responsible for bussing to connectors.

- Bus supports must be braced (**Figure 58, B**) to prevent short circuit forces from deflecting the connectors. The busbar supports (**A**) must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents.
- Busbars should be adjusted to ensure that the connection points are correctly positioned before the bolts (**C**) are inserted. Bussing must be supported by framework of the switchgear, with no weight on connectors.

Bussing requirements by circuit breaker and connector are shown in Table 13.

Figure 58 – Busbar Connections



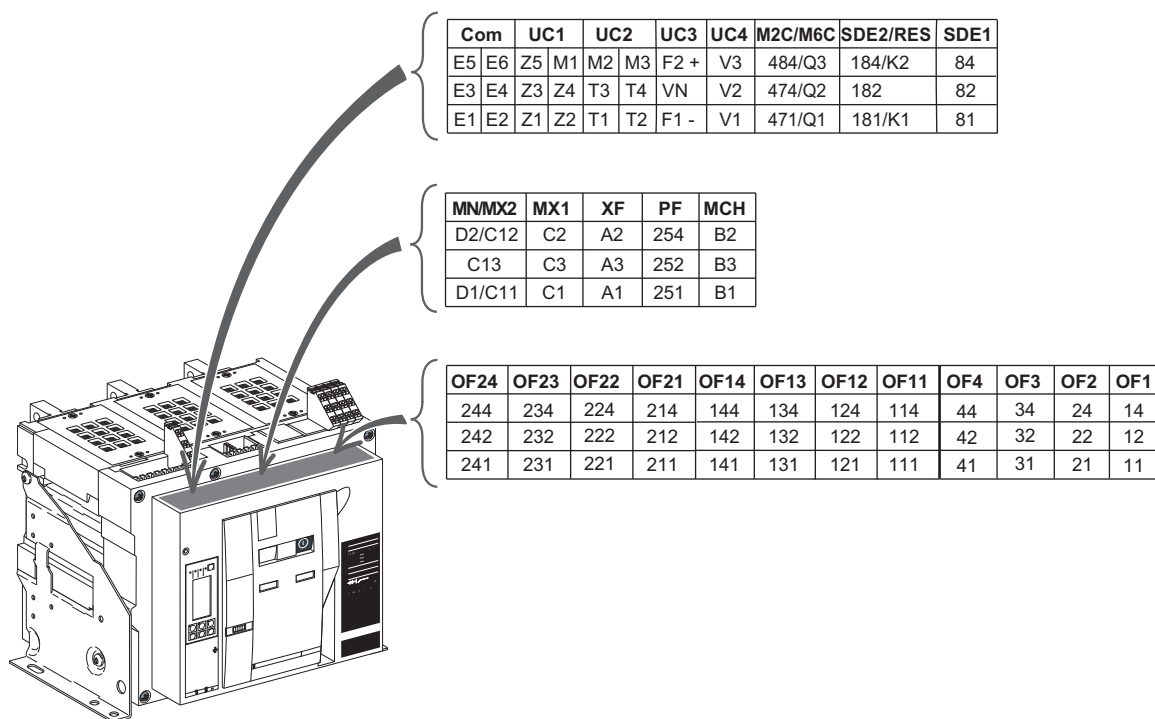
NOTE: The installer is responsible for bussing to connectors. Bussing must be supported by framework of the switchgear, with no weight on the connectors. Bus supports must be braced to prevent short circuit forces from deflecting the connectors.

Table 13 – Bus Size Required

Circuit Breaker		Complies with	Connectors	Bus Per Connector	
Rating	Type			Number	Size
800–1200 A	N/N1/H/H1/H2/H3	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	1	0.25 x 3 in. (6 x 76 mm)
1600 A	N/N1/H/H1/H2/H3	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	2	0.25 x 3 in. (6 x 76 mm)
2000 A	N/N1/H/H1/H2/H3	ANSI 37.50 UL 489	RCTH	3	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 4 in. (6 x 102 mm)
			FCF	3	0.25 x 3 in. (6 x 76 mm)
2500 A	H	UL 489	RCTH	5	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 5 in. (6 x 127 mm)
3000 A	H	UL 489	RCTH	8	0.25 x 3 in. (6 x 76 mm)
	H		RCTV, FCT	4	0.25 x 4 in. (6 x 102 mm)
3200 A	H1/H2/H3	ANSI 37.50	RCOV	3	0.25 x 5 in. (6 x 127 mm)
4000 A (W-Frame)	H1/H2/H3	ANSI 37.50	RCOV (Special)	4	0.25 x 5 in. (6 x 127 mm)
4000 A	H/H2/H3	ANSI 37.50 UL 489	RCTH	4	0.25 x 6 in. (6 x 152 mm)
			RCTV, FCT	4	0.25 x 5 in. (6 x 127 mm)
		ANSI 37.50	FCF	4	0.25 x 6 in. (6 x 152 mm)
		UL 489	FCF	5	0.25 x 6 in. (6 x 152 mm)
5000 A	H/H2/H3	ANSI 37.50 UL 489	RCTH	8	0.25 x 6 in. (6 x 152 mm)
			RCTV, FCT	6	0.25 x 5 in. (6 x 127 mm)
6000 A	H	UL 489	RCTV	6	0.25 x 6 in. (6 x 152 mm)

Accessory Connections Using Push-In Connectors

Table 14 – Terminal Layout for Push-In Connector Installation



Function	Connector	Description
Auxiliary Contacts	OF1	Open/Closed Circuit Breaker or Circuit Breaker Position Contacts
	EF	Combined Connected and Closed Contact
Remote Operation	SDE	Electrical Fault Alarm Contact
	RES	Remote Reset
	MN	Undervoltage Trip Device
	MX ²	Shunt Trip
	XF ²	Shunt Close
	PF	Ready-to-Close Contact
	MCH	Spring-Charging Motor

¹ OF1, OF2, OF3 and OF4 contacts are standard.

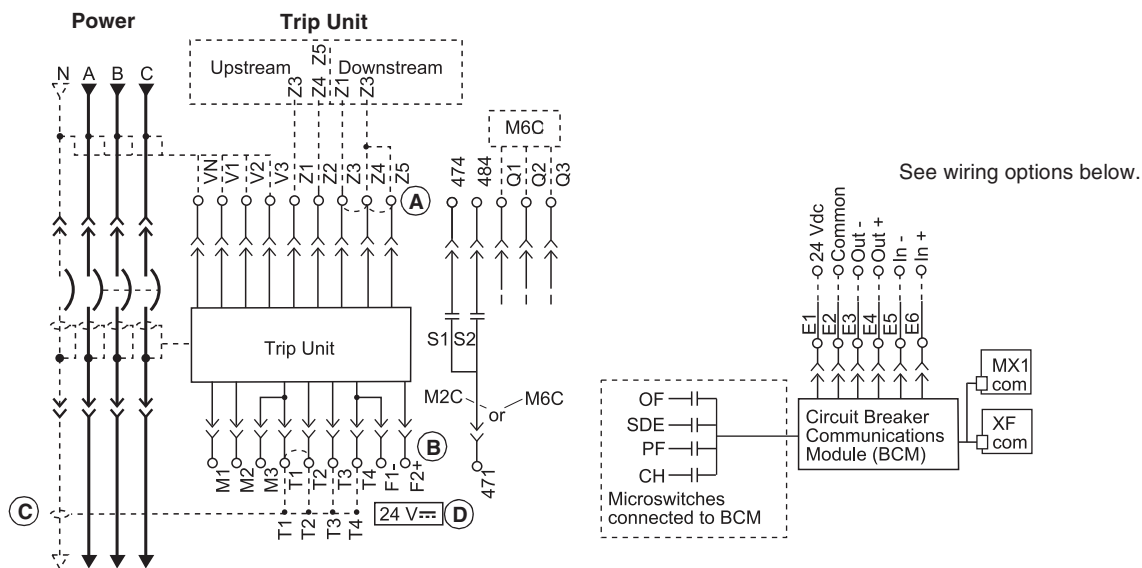
² When communicating MX1 or XF coils are used, terminal (C3 or A3) must be connected to line even if the communication module is not installed. The bypass circuit through terminal C2/A2 is only momentary duty (0.5 sec). For continuous duty, use the communications command.

Trip Unit Type				Connector	Description
Basic	A	P	H		
—	•	•	•	Com: E1–E6	Communication
—	•	•	•	UC1: Z	Zone-Selective Interlocking Z1 = ZSI OUT Signal Z2 = ZSI OUT Z3 = ZSI IN Signal Z4 = ZSI IN Short Time Z5 = ZSI IN Ground Fault
—	•	•	•	UC1: M1	Modified Differential Ground Fault (MDGF)
—	•	•	•	UC2: T	External Neutral
—	•	•	•	UC2: M	Modified Differential Ground Fault (MDGF)
—	•	•	•	UC3: F	24 Vdc External Power Supply
—	—	•	•	UC3: Vn	External Neutral Plug
—	—	•	•	UC4	External Phase Voltage Sensing
—	—	•	•	M2C/M6C	Two Programmable Contacts (internal relay) or Six Programmable Contacts (for connection to external M6C module)

Wiring Diagrams for Auxiliary Connections

NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 59 – Wiring Diagrams for Auxiliary Connections



A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.

B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.

C—For proper wiring of neutral CT, refer to wiring schematics on page 61.

D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.

Wiring of the COM Option (Modbus BCM with or without ULP Module)

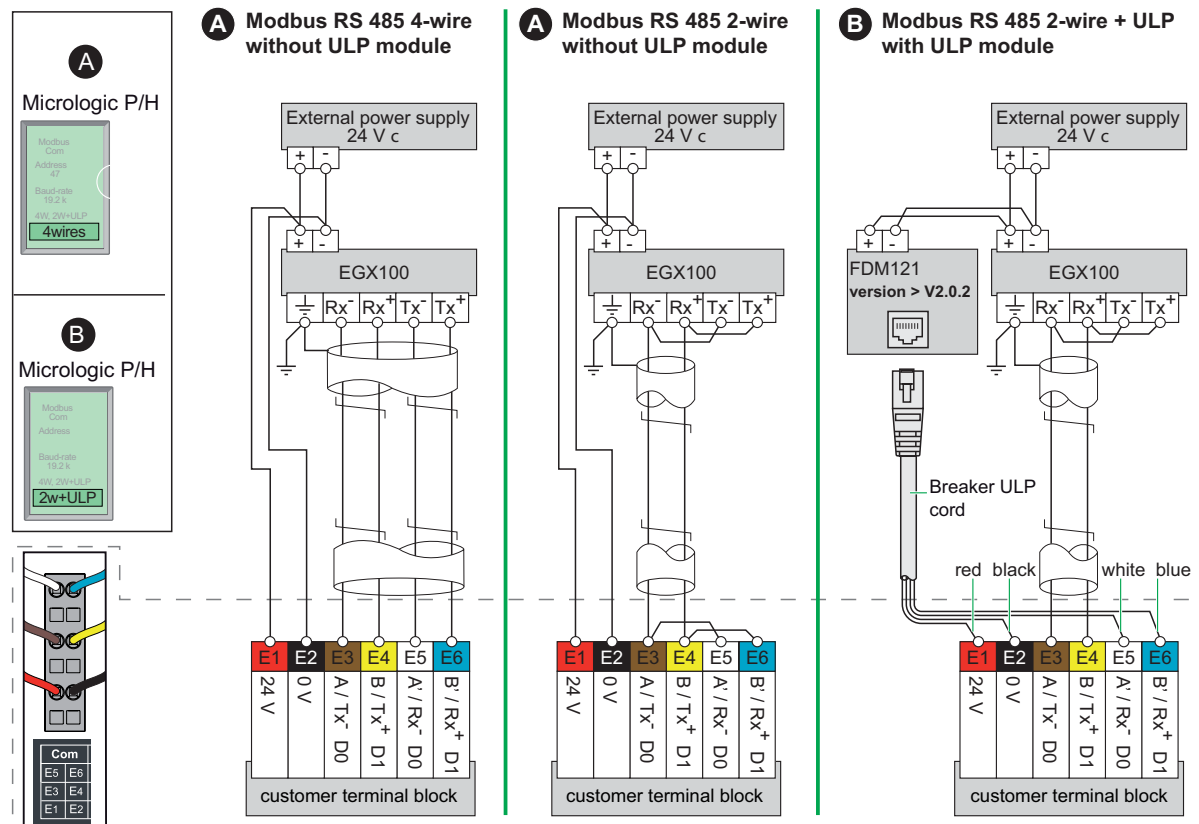
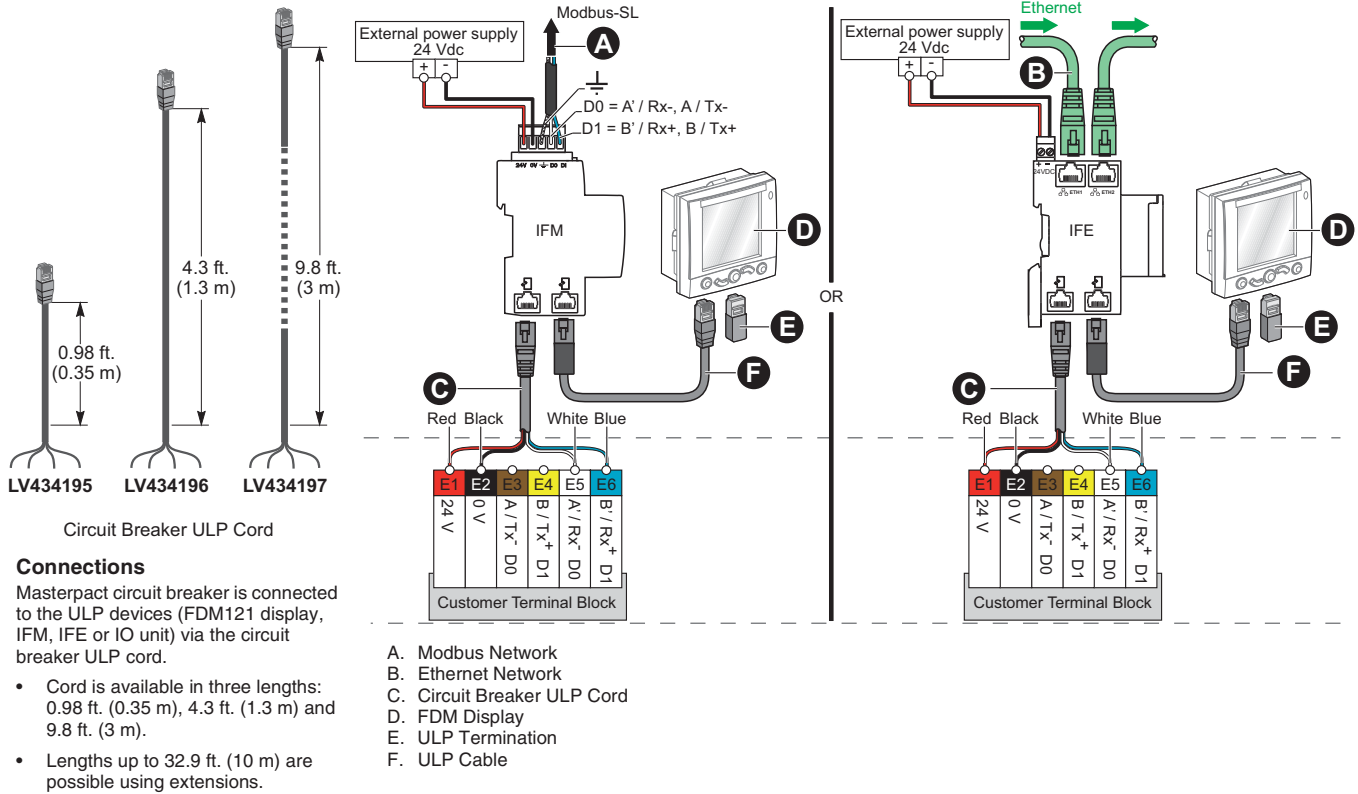


Figure 59 – Wiring Diagrams for Auxiliary Connections (continued)

Communication Components and FDM121 Connections

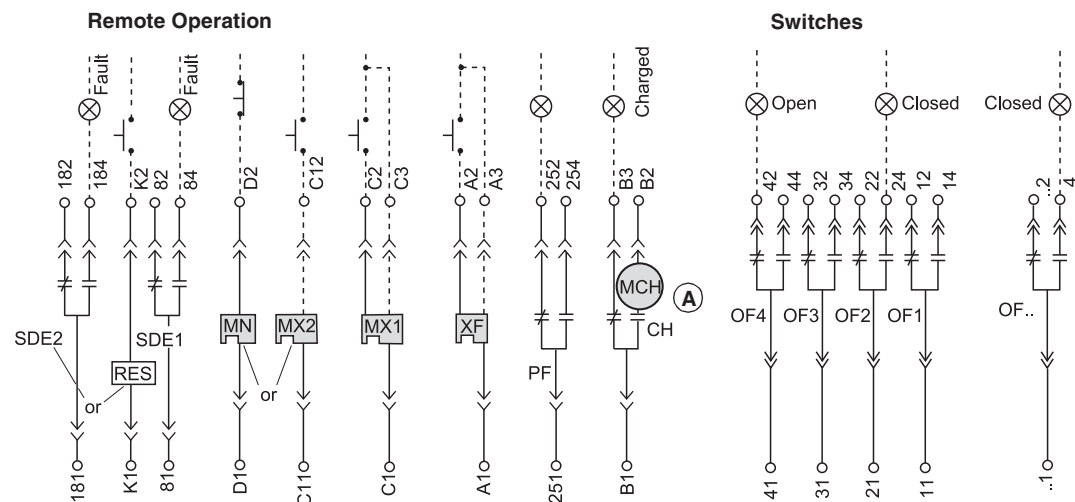


Markings for Push-In Type Terminals

Trip Unit							
COM	UC1	UC2	UC3	UC4	M2C/M6C	SDE2/Res.	SDE1
○ ○ E5 E6	○ ○ Z5 M1	○ ○ M2 M3	○ ○ F2+	○ ○ V3	○ ○ 484/Q3	○ ○ 184/K2	○ ○ 84
○ ○ E3 E4	○ ○ Z3 Z4	○ ○ T3 T4	○ ○ VN	○ ○ V2	○ ○ 474/Q2	○ ○ 182	○ ○ 82
○ ○ E1 E2	○ ○ Z1 Z2	○ ○ T1 T2	○ ○ F1-	○ ○ V1	○ ○ 471/Q1	○ ○ 181/K1	○ ○ 81

NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 60 – Wiring Diagrams for Auxiliary Connections



A—When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

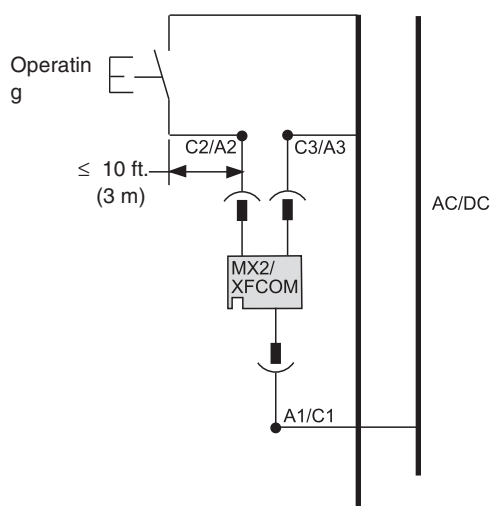
Markings for Push-In Type Terminals

Remote Operation					Auxiliary Switches											
MN/MX2	MX1	XF	PF	MCH	OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1
D2/C12	C2	A2	254	B2	244	234	224	214	144	134	124	114	44	34	24	14
C13	C3	A3	252	B3	242	232	222	212	142	132	122	112	42	32	22	12
D1/C11	C1	A1	251	B1	241	231	221	211	141	131	121	111	41	31	21	11

Communicating Shunt Trip (MX) and Shunt Close (XF)

A recommended wiring schematic for the communicating style shunt trip or shunt close coils is shown in Figure 61. Induced voltages in the circuit at terminal C2 and/or A2 can cause the shunt trip or shunt close to not work properly. The best way to prevent the induced voltages is keep the circuit to terminal C2 and A2 as short as possible. If it is impossible to keep the circuit less than ten feet (three meters), use an interposing relay near terminal C2 or A2.

Figure 61 – Communicating Wiring Schematic

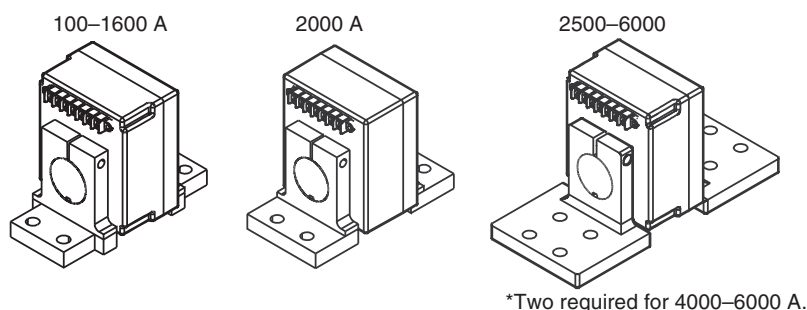


Ground-Fault Protection for Equipment

If the circuit breaker does not have integral ground-fault tripping or alarm, skip this subsection.

A three-phase, four-wire circuit requires an external neutral current transformer (CT). Connect the neutral CT to the circuit breaker according to the wiring diagrams in Figures 63 and 64.

Figure 62 – Neutral Current Transformers



1. Connect the primary:

- If load is connected to the lower end of the circuit breaker, connect the load neutral to the H1 terminal of neutral CT.
- If the source power is connected to the lower end of the circuit breaker, connect the source neutral to the H1 terminal of the neutral CT.

NOTE: The equipment grounding connection must be upstream (line side) of the neutral CT and a neutral connection must exist from the supply transformer to the equipment.

2. For circuit breakers using Micrologic™ 5.0P, 5.0H, 6.0P, or 6.0H trip units, connect terminal Vn on the neutral current transformer to the Vn terminal of the control wiring terminal. (This is necessary to allow the trip unit to make voltage measurements.) Terminals Vc and Vn are internally connected.

CAUTION

HAZARD OF IMPROPER TRIP SYSTEM OPERATION

F1 and F2 must be isolated from ground. Verify all wiring per the instructions in this bulletin.

Failure to follow these instructions can result in a nuisance trip during closing.

3. Remove the factory-installed jumper connecting T1 and T2.
4. Feed Belden cable from the neutral CT to the cradle terminals.
5. Connect the cable per the appropriate schematic in Figure 63 or 64.
6. Verify all wiring.

NOTE: Modified differential ground-fault circuitry and ground-source return ground-fault circuitry require the use of a modified differential ground-fault module (MDGF) and special current transformers. For wiring of those systems, see the instructions with the MDGF.

Figure 63 – Wiring Schematic for 800–4000 A Standard-Width NW Circuit Breakers

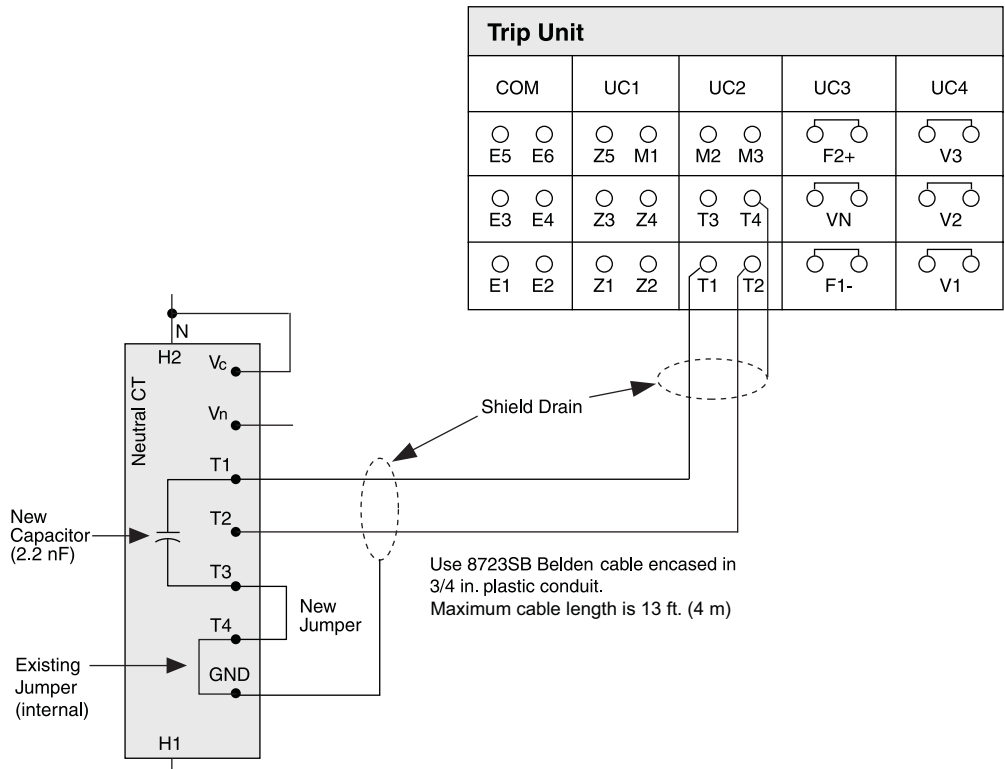
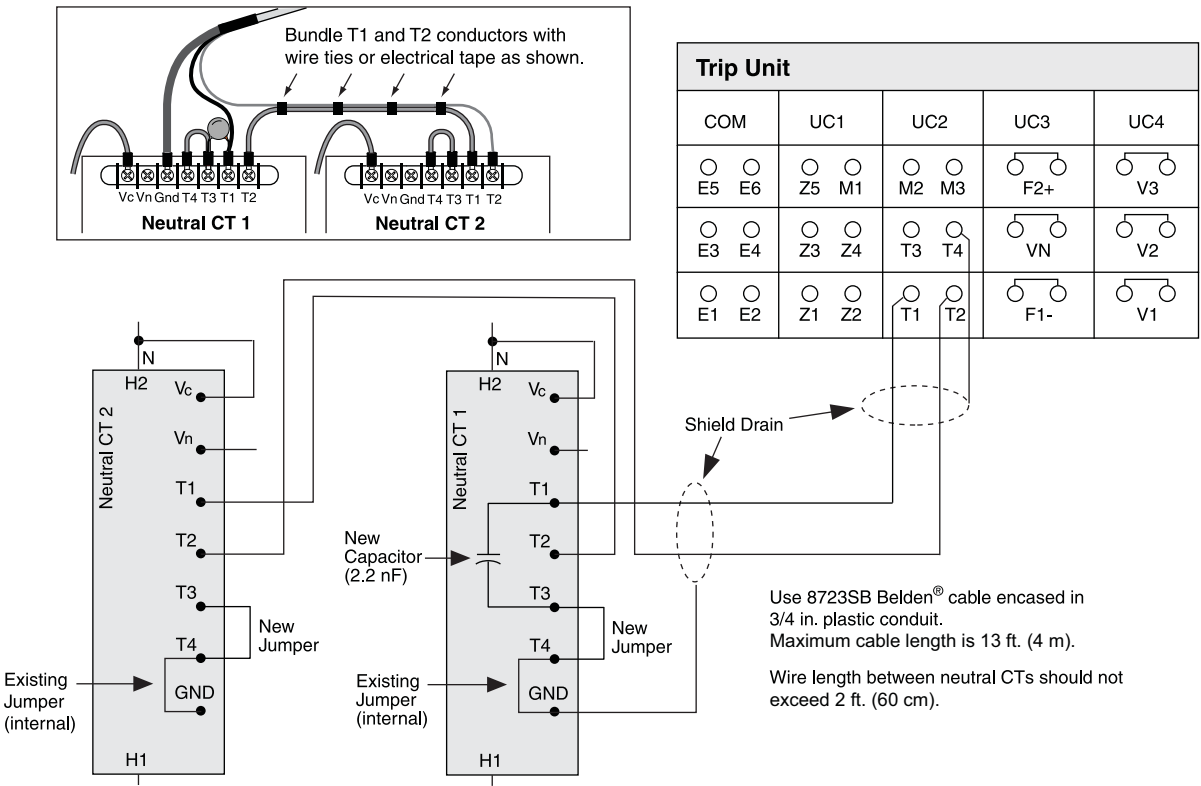


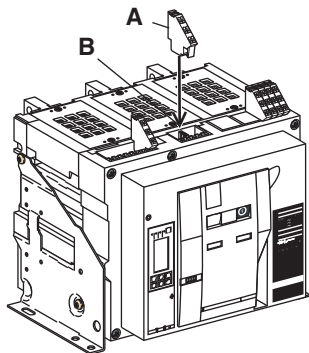
Figure 64 – Wiring Schematic for 3200–6000 A Wide-Construction NW Circuit Breakers



Accessory Wiring

1. Install push-in connector (**Figure 65, A**) in the correct slot (**B**). Connector positions are shown on label next to connector slots.

Figure 65 – Install Push-In Connector

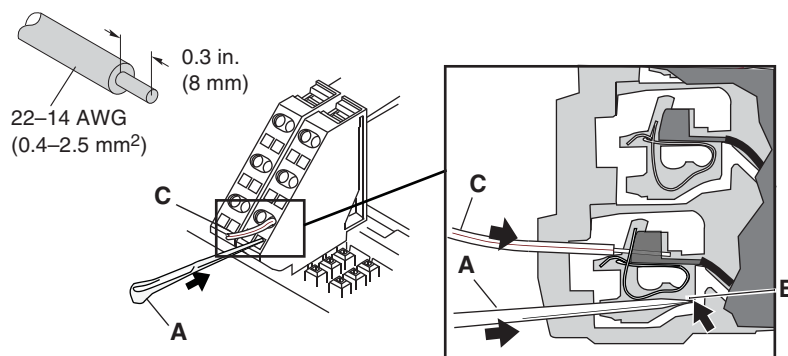


2. Push a Wago wire insert tool (**Figure 66, A**, Wago part no. 209-129) fully into the connector (to point **B**) and install the control wires (**C**).

NOTE: Remove a push-in connector in reverse order of installation.

See Section 6—Operation for instructions on operating circuit breaker.

Figure 66 – Install Control Wires



Test Equipment Ground-Fault Protection

Paragraph 230-95(c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed. If the circuit breaker has equipment ground-fault protection installed, test it at this time.

Make sure the trip unit is powered. The trip unit is powered if:

- The circuit breaker is closed or bottom-fed and has more than 100 V of load voltage on two phases (P or H trip unit only).
- A full-function or hand-held test kit is connected and on.
- A 24 Vdc external power supply is connected.
- An external voltage tap is installed and voltage of more than 100 V is present on two phases (P or H trip unit only).

If this is a radial (single-ended) system, press the ground-fault push-to-test button (**Figure 67, A**). The circuit breaker will trip and the trip unit ground-fault indicator light will come on.

Record results in Table 15.

If a complete check of the ground-fault system is necessary, use primary injection testing. If the system has multiple sources and/or requires field connections at the job site, use primary injection testing.

Figure 67 – Test Ground-Fault Push-to-Test

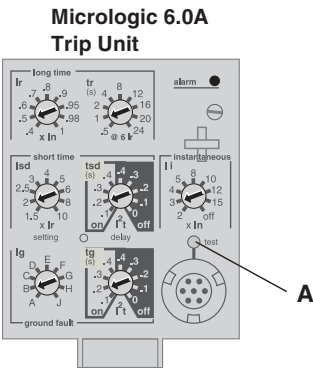


Table 15 – Ground-Fault Test Results

Date	Ground-Fault Settings	Test Results	Signature

Circuit Breaker Removal

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Remove the circuit breaker in reverse order of installation. Use lifting methods as detailed in Section 2—Lifting and Transporting.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

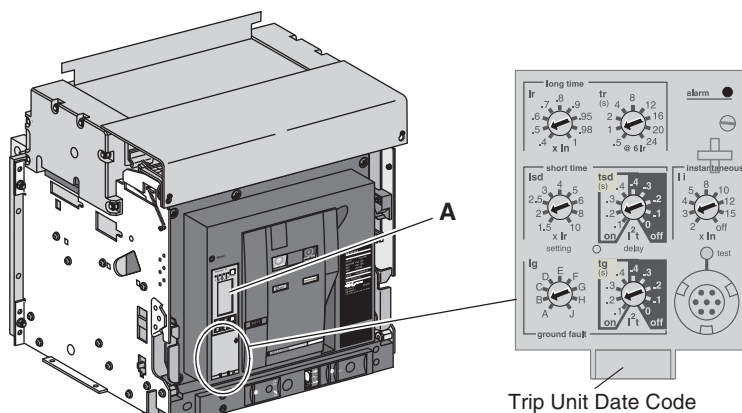
Section 5— Trip Unit

Protective functions, measurement functions, and communications are controlled by the Micrologic™ trip unit (**Figure 68, A**) installed in the circuit breaker. The trip unit is field replaceable for easy upgrading of functionality.

For complete information on the trip unit, its functions, and field replacement, see the trip unit user guide available from the Schneider Electric™ website.

For complete information on which trip units are available and their capabilities, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website (for website information see page 5).

Figure 68 – Micrologic Trip Unit



Section 6— Operation

Drawout Circuit Breaker Status

⚠ DANGER

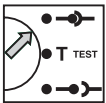
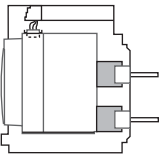
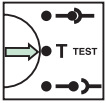
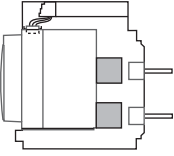
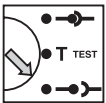
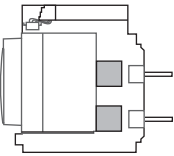
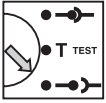
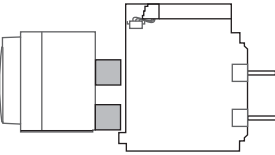
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

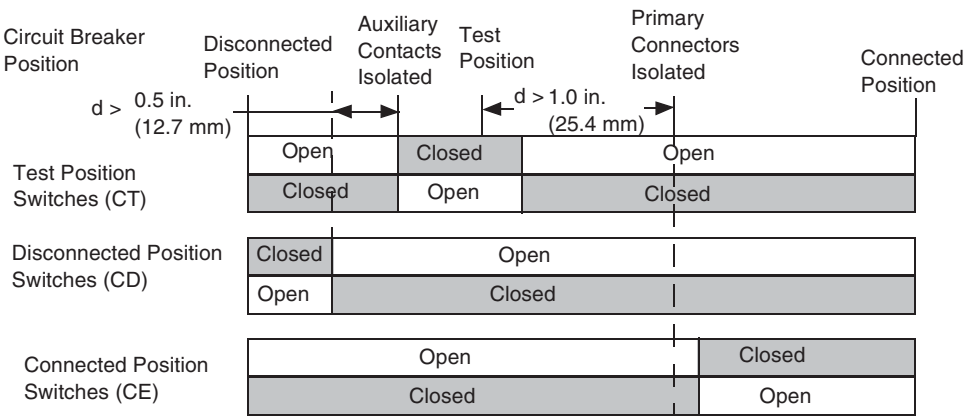
Connection or disconnection of the drawout circuit breaker requires insertion of the racking handle (while pressing the “Push to open” button). If interlocks, padlocks, or an open door lock are in place, the racking handle cannot be inserted.

Table 16 – Drawout Circuit Breaker Positions

Position Indicator	Connector Position (Cluster shield not shown)	Connectors		Circuit Breaker Status
		Clusters	Secondary (Control)	
Connected 		Engaged	Engaged	Can be operated. Ready for service.
Test 		Disengaged	Engaged	Can be operated. Can have operation and control systems tested.
Disconnected 		Disengaged	Disengaged	Can be operated. Can be removed from carriage.
Withdrawn 		Disengaged	Disengaged	Removed from carriage.

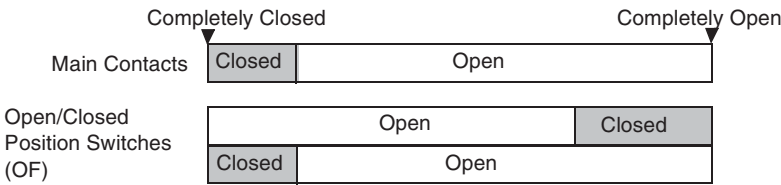
As the circuit breaker position changes, the position contacts change states.

Figure 69 – Device Position Operation



As the circuit breaker main contacts operate, the auxiliary contacts change positions.

Figure 70 – Device Contact Operation



Drawout Circuit Breaker Connection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use the racking handle provided to rack the circuit breaker into or out of the cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

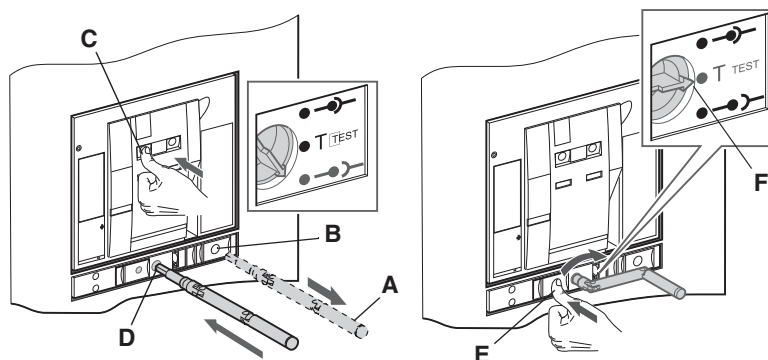
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

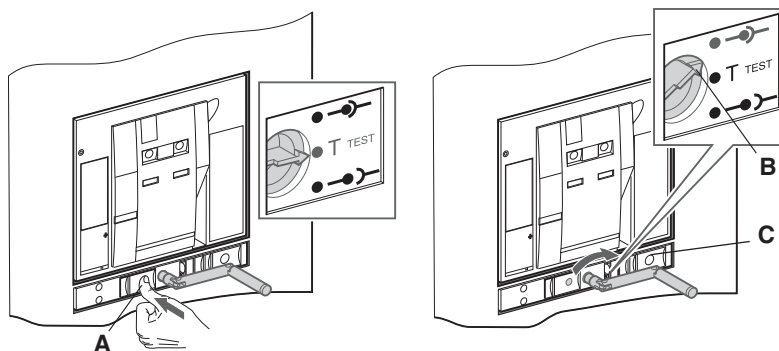
1. Disconnect the load from the secondary disconnects.
2. Remove the racking handle (**Figure 71, A**) from its storage hole (**B**).
3. While pressing the “Push to open” button (**C**), insert the racking handle in the racking slot (**D**).
4. Push the stop release button (**E**).
5. Turn the racking handle clockwise until the test position (**F**) is reached. The stop release button will pop out.

Figure 71 – Rack Circuit Breaker to Test Position



6. Push the stop release button (**Figure 72, A**).
7. Turn the racking handle clockwise until the connected position (**B**) is reached. The stop release button will pop out. Replace the racking handle in its storage hole (**C**).
8. Reconnect the load to the secondary disconnects.

Figure 72 – Rack Circuit Breaker to Connected Position



Drawout Circuit Breaker Disconnection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use the racking handle provided to rack the circuit breaker into or out of the cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

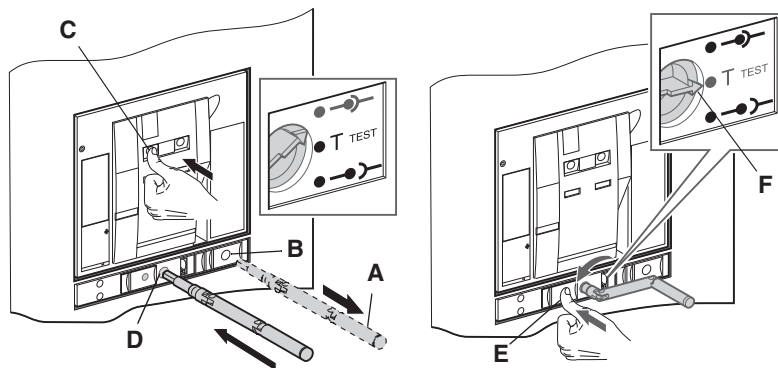
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

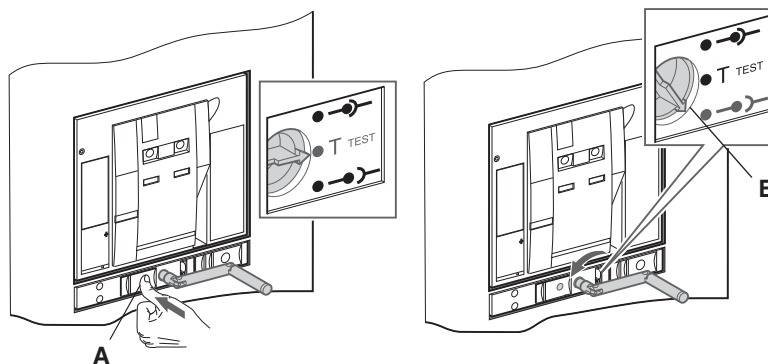
Failure to follow these instructions will result in death or serious injury.

1. Remove the load from the secondary disconnects.
2. Remove the racking handle (**Figure 73, A**) from its storage hole (**B**).
3. While pressing the “Push to open” button (**C**), insert the racking handle in the racking slot (**D**).
4. Push the stop release button (**E**). Turn the racking handle counterclockwise until the test position (**F**) is reached. The stop release button will pop out.

Figure 73 – Rack Circuit Breaker to Test Position

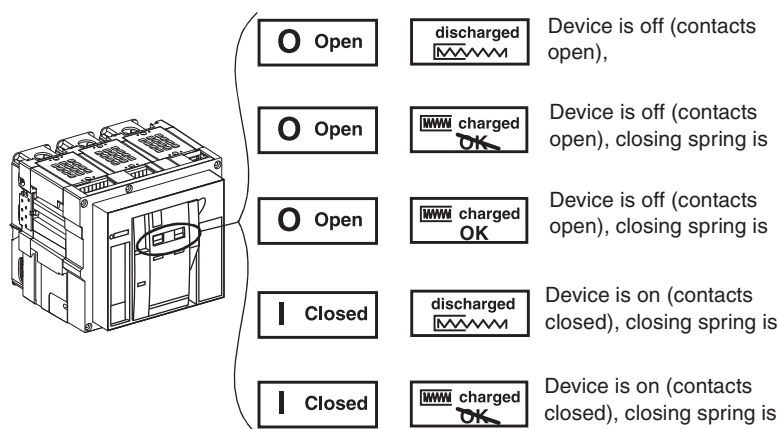


5. Push the stop release button (**Figure 74, A**).
6. Turn the racking handle counterclockwise until the disconnected position (**B**) is reached. The stop release button will pop out. Replace the racking handle in its storage hole.
7. Reconnect the load to the secondary disconnects.

Figure 74 – Rack Circuit Breaker to Disconnected Position

Circuit Breaker Operation

The circuit breaker is closed by means of a two-step stored energy mechanism. Status indicators on the front of the circuit breaker indicate whether the circuit breaker is open or closed, and whether the closing spring is charged or discharged. The opening springs are automatically charged when the circuit breaker closes.

Figure 75 – Status Indicators

¹ Not OK to turn on will be shown if:
 Shunt trip is energized
 Circuit breaker is not connected, test, disconnected or withdrawn position
 Undervoltage trip is not energized

Anti-Pumping Function

The Masterpact circuit breaker is designed to mechanically provide an anti-pumping function. If either the shunt close or shunt trip coil is continuously powered, or both are powered at the same time, the circuit breaker will open and cannot be closed until the power has been removed. This prevents the circuit breaker from cycling between closing and opening (called pumping).

When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) coil. The ready-to-close switch (PF) can be series connected with the shunt close (XF) coil to prevent premature closing.

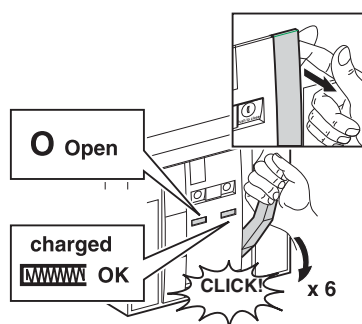
Charging the Closing Spring

To close the circuit breaker, the closing spring must be charged with sufficient energy for closing.

- **Manual Charge:** Use the charging handle to charge the closing spring.
- **Automatic Charge:** If the optional MCH spring-charging motor is installed, the spring is automatically charged after closing.

NOTE: The closing spring on the drawout circuit breaker will automatically discharge when the circuit breaker is moved from the disconnect to the withdrawn position.

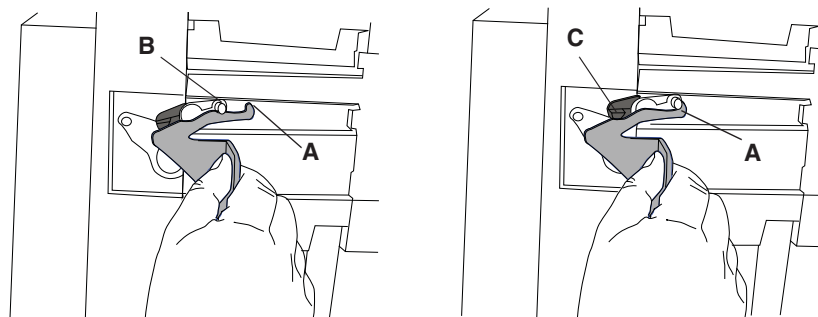
Figure 76 – Manual Spring Charge



NOTE: To close a drawout circuit breaker when it is not installed in the cradle, the cradle interlock must be defeated before the circuit breaker charging spring can be charged. A cradle interlock defeat tool is shipped with every circuit breaker. To install:

1. Slide the interlock defeat tool (**Figure 77, A**) into the groove under the interlock lever (**B**) on the right side of the circuit breaker.
2. Slide the tool toward the front of the circuit breaker and lock it in place under the cradle interlock shaft (**C**).

Figure 77 – Defeating Cradle Interlock



Close Circuit Breaker

To close the circuit breaker, the following conditions must be met:

- The device is open (O).
- The charging spring is charged.
- “OK” is displayed.

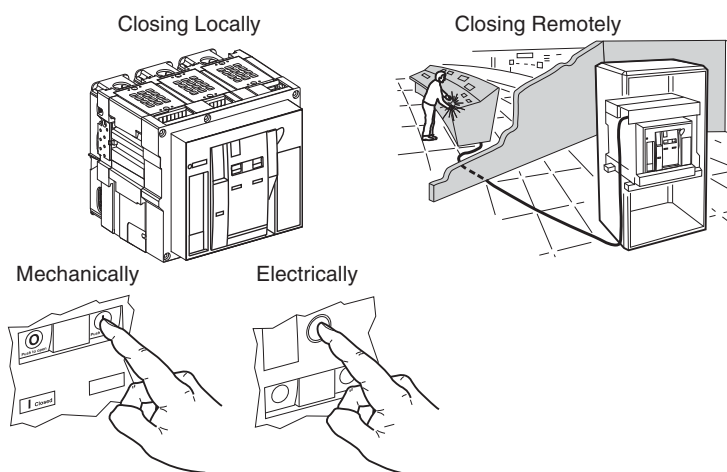
NOTE: The circuit breaker cannot be closed while an opening order is being received. If the “not OK” symbol is displayed, an order to open is being received (electrically or manually) and must be ended before the “OK” will be displayed.

If the above conditions are met, close the device:

- Mechanically: press the “Push to close” button on the circuit breaker.
- Electrically: if the optional shunt close (XF) is installed, press the optional electrical-close push button (BPFE) on the circuit breaker or a push button at a remote location.

For more information, refer to the circuit breaker user guide on the Schneider Electric™ website (for website information see page 5).

Figure 78 – Close Circuit Breaker

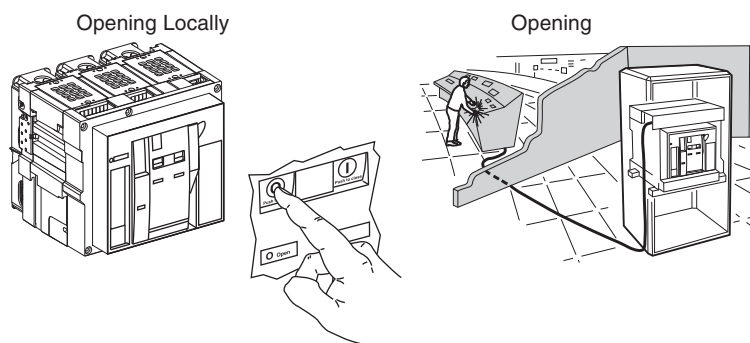


Open Circuit Breaker

- Mechanically: press the “Push to open” button on the circuit breaker.
- Electrically: operate remotely through the optional shunt trips (MX1 and MX2), undervoltage trip device (MN), or time-delay module for undervoltage trip accessory (MNR).

For more information, refer to the circuit breaker user guide on the Schneider Electric website (for website information see page 5).

Figure 79 – Turn Off Circuit Breaker



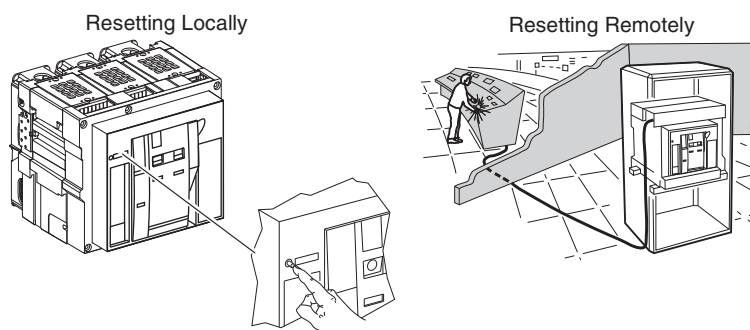
Reset Circuit Breaker

After a fault trip, the circuit breaker must be reset.

- Mechanically: press the “Reset” button located above the trip unit.

Electrically: use the electrical reset option (RES) after an electrical fault. For more information, refer to the circuit breaker user guide on the Schneider Electric website (for website information see page 5).

Figure 80 – Reset Circuit Breaker



Neutral Protection

Neutral protection protects the neutral conductors against overheating.

- For a three-pole circuit breaker with a P or H trip unit, neutral protection is possible if a neutral current transformer is used.
 - Adjust the neutral using the trip unit keypad of the P or H trip unit.
 - Possible settings are OFF, N/2, N, or 1.6N.
 - Factory setting is OFF.

Oversize neutral protection (1.6N) requires the use of the appropriate oversize neutral current transformer. See price list for correct neutral current transformer.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

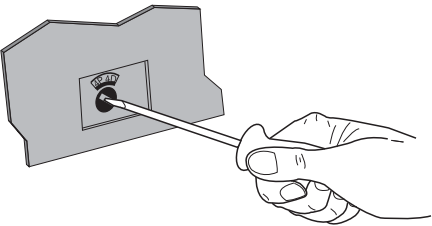
If a four-pole circuit breaker neutral pole switch is set to 4P 3D setting, the current in the neutral must not exceed the rated current of the circuit breaker.

For a three-pole circuit breaker with oversize neutral protection (1.6N), select the appropriate oversize neutral current transformer.

Failure to follow these instructions can result in equipment damage.

- For a four-pole circuit breaker, set the system type using the circuit breaker neutral selector dial (see Figure 81).
 - With a P or H trip unit, make fine adjustments using the trip unit keypad, with the circuit breaker dial setting providing the upper limit for adjustment.
 - Factory setting is 4P 4D.

Figure 81 – Four-Pole Circuit Breaker Neutral Selector Dial



Neutral Protection Settings for Four-Pole Circuit Breaker

Circuit Breaker Selector Dial	P or H Trip Unit Keypad Setting
4P 3D	Off, N/2, N
3P N/2	N/2
4P 4D	N/2, N

- Neutral protection conductor type has four possible settings:
 - Off (4P 3D)—Neutral protection is turned off.
 - N/2 (3P N/2)—Neutral conductor capacity is one-half that of the line conductors.
 - N (4P 4D)—Neutral conductor capacity is the same as that of the line conductors.
 - 1.6N—Neutral conductor capacity is 1.6 times that of the line conductors. (Three pole circuit breaker with P or H trip unit only.)

Table 17 – Micrologic™ Trip Unit Conductor Type

Setting	Long-Time Pickup		Short-Time Pickup		Instantaneous		Ground-Fault Pickup	
	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral
OFF	I _r	None	I _{sd}	None	I _i	None	I _g	None
N/2	I _r	1/2 I _r	I _{sd}	1/2 I _{sd}	I _i	I _i	I _g	I _g
N	I _r	I _r	I _{sd}	I _{sd}	I _i	I _i	I _g	I _g
1.6N	I _r	1.6 x I _r	I _{sd}	1.6 x I _{sd} *	I _i	I _i	I _g	I _g

*In order to limit the range, limited to 10 x I_n.

Section 7— Locks, Interlocks, and Accessories

A number of optional locking and interlocking devices and accessories are available for the Masterpact circuit breaker and cradle. The operation of these devices is described in bulletin 0613IB1203: *Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker with ArcBlok Technology—User Guide* available on the Schneider Electric™ website (for website information see page 5).

For a complete listing of the available locks, interlocks, and accessories, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website. For more information, refer to the circuit breaker user guide on the Schneider Electric website (for website information see page 5).

For detailed installation instructions on field-installable locks, interlocks, and accessories refer to the installation instructions shipped with the devices.

Accessories can be installed in an installed circuit breaker or an installed cradle.

Installing Circuit Breaker Accessories

Place the circuit breaker in the disconnect position. See Circuit Breaker Disconnection, page 70, for instructions on disconnecting the circuit breaker.

Install circuit breaker accessories, see “Install Accessories” on page 42.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

Installing Cradle Accessories

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Remove the circuit breaker from the cradle. See Circuit Breaker Removal, page 46 for instructions on removing the circuit breaker.
3. Install accessory as instructed in the instructions packed with the individual accessory.
4. Replace the circuit breaker in the cradle. See Circuit Breaker Installation, page 38, for instructions on installing the circuit breaker.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Section 8— Testing, Maintenance and Troubleshooting

For information on field testing, maintenance, and troubleshooting see bulletin 06131B1201, Masterpact NT and NW Field Testing and Maintenance Guide, which can be found on the Schneider Electric website:

<http://www.schneider-electric.com>

For application assistance, please call 1-888-778-2733.

Table 18 – Troubleshooting Guide

Problem	Probable Causes	Solutions
Circuit breaker cannot be closed locally or remotely	Circuit breaker padlocked or keylocked in the “OPEN” position.	Disable the locking function.
	Circuit breaker interlocked mechanically in a source changeover system.	- Check the position of the other circuit breaker in the changeover system. - Modify the situation to release the interlock.
	Circuit breaker not completely connected.	Complete racking in (connection) of the circuit breakers.
	The reset button signalling a fault trip has not been reset.	- Clear the fault. - Push the reset button on the front of the circuit breaker.
	Stored energy mechanism is not charged.	- Charge the mechanism manually. - If it is equipped with an MCH spring charging motor, check the supply of power to the motor. If the problem persists, replace the spring charging motor.
	MX opening shunt release (shunt trip) is permanently supplied with power.	There is an opening order. Determine the origin of the order. The order must be cancelled before the circuit breaker can be closed.
	MN undervoltage release (UVR) not supplied with power.	- There is an opening order. Determine the origin of the order. - Check the voltage and the supply circuit ($V \geq 0.84 V_n$). - If the problem persists, replace the release.
	XF closing release (shunt close) continuously supplied with power, but circuit breaker is not “ready to close” (XF not wired in series with PF contact).	Open the supply of power to the XF closing release, then send the closing order again using the XF, but only if the circuit breaker is “ready to close”.
Circuit breaker cannot be closed remotely but can be opened locally using the closing pushbutton.	Circuit breaker uses a Micrologic P or H trip unit, which has a permanent trip order with minimum voltage and minimum frequency protection in the Trip mode and the trip unit powered.	Disable these protection function son the Micrologic P or H control unit.
	Closing order not executed by the XF closing release (shunt close).	Check the voltage on the supply circuit ($0.85-1.1 V_n$). If the problem persists, replace the XF release.
Circuit breaker cannot be opened remotely but can be opened locally	Closing order not executed by the MX opening release (shunt trip).	Check the voltage on the supply circuit ($0.7-1.1 V_n$). If the problem persists, replace the XF release.
	Opening order not executed by the MN undervoltage release (UVR).	Drop in voltage is insufficient or residual voltage ($> 0.35 V_n$) across the terminals of the undervoltage release. If the problem persists, replace the MN release.
Circuit breaker cannot be opened locally.	Operating mechanism malfunction or damaged contacts.	Contact a Schneider Electric service center.
Circuit breaker can be reset locally but not remotely.	Insufficient supply voltage for the MCH spring charging motor.	- Check the voltage and the supply circuit ($0.7-1.1 V_n$). - If the problem persists, replace the MCH release.
Unexpected tripping with activation of the reset button signalling a fault trip.	A fault is present: - Overload - Earth fault (ground fault) - Short-circuit detected by the trip unit.	- Determine and clear the causes of the fault. - Check the condition of the circuit breaker before putting it back into service.

Table 18 – Troubleshooting Guide

Problem	Probable Causes	Solutions
Unexpected tripping without activation of the reset button signalling a fault	MN undervoltage release (UVR) supply voltage too low.	Check the voltage on the supply circuit ($V > 0.58 V_n$).
	Load-shedding order sent to the MX opening release (shunt trip).	- Check the overall load on the distribution system. - If necessary, modify the settings of the devices in the installation.
	Unnecessary opening order from the MX opening release (shunt trip).	Determine the origin of the order.
Instantaneous opening after each attempt to close the circuit breaker with activation of the reset button signalling a fault trip.	Thermal memory.	- See the trip unit user manual. - Press the reset button.
	Transient overcurrent when closing.	- Modify the distribution system or the trip unit settings. - Check the condition of the circuit breaker before putting it back into service. - Press the reset button.
	Closing on a short-circuit.	- Clear the fault. - Check the condition of the circuit breaker before putting it back into service. - Press the reset button.
Nuisance tripping of the circuit breaker with activation of the reset button signalling a fault trip.	Reset button is not pushed in completely.	Push the reset button in completely.
Cannot insert crank in connected, test, or disconnected position.	A padlock or keylock is present on the cradle or a door interlock is present.	Disable the locking function.
Cannot turn the crank.	The reset button has not been pressed.	Press the reset button while turning racking handle (crank).
Circuit breaker cannot be removed from the cradle.	Circuit breaker is not in the disconnected position.	Turn the racking handle (crank) until the circuit breaker is in the disconnected position and the reset button is out.
	The rails are not completely out.	Pull the rails all of the way out.
	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.
Circuit breaker cannot be racked in (placed in connected position).	Cradle/ circuit breaker mismatch protection (cell keying) is preventing racking.	Check that the cradle corresponds with the circuit breaker.
	The disconnecting-contact clusters are incorrectly positioned.	Reposition the clusters.
	Cradle is locked in the disconnected position.	Disable the cradle locking function.
	The reset button has not been pressed, preventing rotation of the crank.	Press the reset button while turning racking handle (crank).
	The circuit breaker has not been sufficiently inserted into the cradle.	Insert the circuit breaker completely so that it is engaged in the racking mechanism.
Circuit breaker cannot be locked in disconnected position.	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure that the reset button is out.
	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.
Circuit breaker cannot be locked in connected or test position.	Check that locking in any position is enabled.	Contact a Schneider Electric service center.
	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.
The crank cannot be inserted to connect or disconnect the circuit breaker.	The rails are not completely in.	Push the rails all the way in.
The right-hand rail of the cradle or the circuit breaker cannot be drawn out.	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.

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Replaces HRB28361 05/2014

Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker—User Guide

Class 0613

Instruction Bulletin

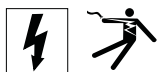
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06/2015

Retain for future use.



Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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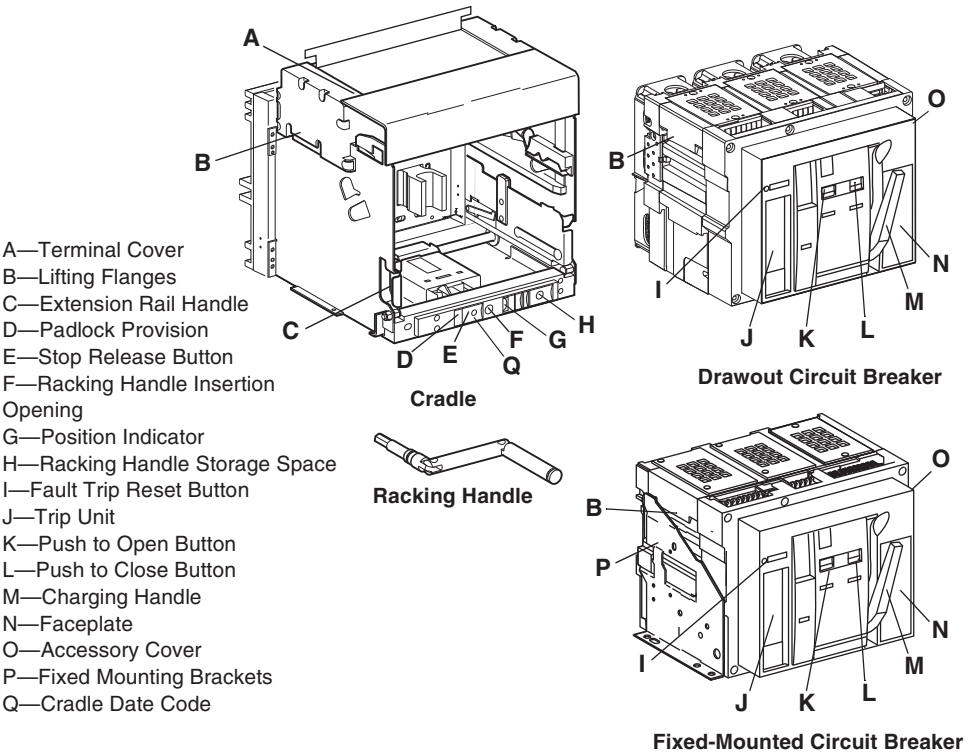
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Section 1— General Information

Introduction

The Masterpact NW low-voltage power circuit breaker¹ and insulated case circuit breaker are designed to mount in a drawout cradle, using rear-mounted, plug-on pressure connections to provide electrical connection to the cradle. A fixed-mounted circuit breaker is also available.

Figure 1 – Circuit Breaker and Cradle



These circuit breakers comply with the following standards.

Low-Voltage Power Circuit Breaker (Drawout/Fixed-Mounted)	Insulated Case Circuit Breaker (Drawout/Fixed-Mounted)
ANSI C37.13 ANSI C37.16 ANSI C37.17 ANSI C37.50 UL1066 ¹ CSA C22.2 No 31 ¹ NEMA SG3	UL 489 ² NEMA AB1 CSA C22.2 No. 5-02 ³

¹ cULus.
² UL® Listed.
³ CSA® Certified.

¹ In this manual the phrase “circuit breaker“ means circuit breaker and switch.

Type L1F 800–2000 A low-voltage power circuit breakers and Type LF 800–2000 A insulated case circuit breakers are tested to show the arc-flash hazard risk category as referenced by NFPA 70E or CSA Z462.

This bulletin provides operating information for Masterpact NW circuit breakers. Tripping functions are controlled by the Micrologic™ trip unit. For information on the trip unit, see the trip unit manual.

For additional information see the following user guides available on the Schneider Electric™ website:

- Bulletin HRB28361: *Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker Installation*
- Bulletin 0613IB1205: *Masterpact™ NW Dimensional Drawings*
- Bulletin 0613IB1202: *Masterpact™ NT and NW Field Testing and Maintenance Guide*
- Bulletin 48049-136-05: *Micrologic 2.0A, 3.0A, 5.0A, and 6.0A Electronic Trip Units*
- Bulletin 48049-330-03: *Micrologic 5.0H and 6.0H Electronic Trip Units*
- Bulletin 48049-137-05: *Micrologic 5.0P and 6.0P Electronic Trip Unit*
- Bulletin 48049-207-05: *Micrologic 2.0, 3.0 and 5.0 Electronic Trip Units*
- Bulletin 1040IB1401: *IFE Ethernet Interface for LV Circuit Breakers User Guide (UL)*
- Bulletin 0613IB1317: *IO Module - Input/Output Interface for LV Circuit Breakers - User Guide*
- Bulletin DOCA0037EN: *FDM128 - Display for 8 LV Devices User Guide*
- Bulletin DOCA0088EN: *FDM121 - Display for LV Circuit Breaker User Guide*
- Bulletin 48940-329-01: *ULP (Universal Logic Plug) System User Guide*
- Bulletin 0613IB1313: *Masterpact NT/NW and PowerPact P- and R-Frame Modbus User Guide*
- Bulletin NHA67346: *Energy Reduction Maintenance Setting (ERMS) Installation*

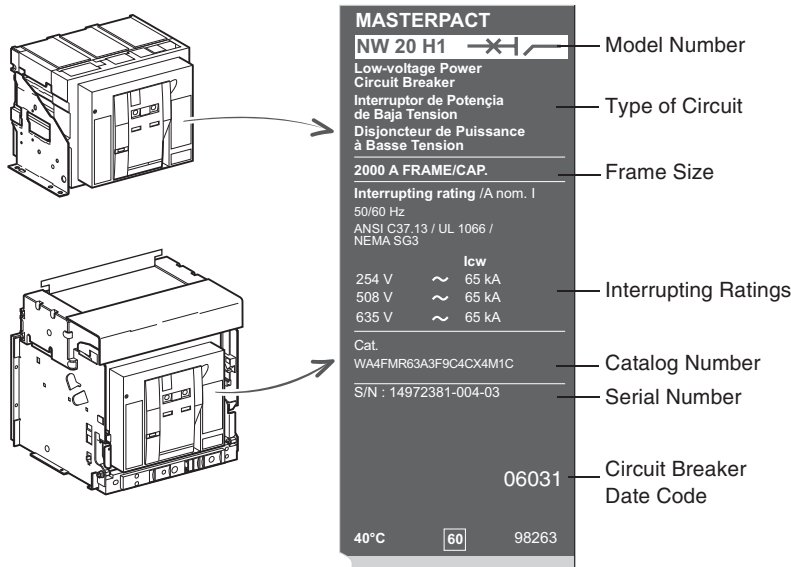
To access the website go to: <http://www.schneider-electric.com>

For application assistance, please call 1-888-778-2733.

Labeling

Information about a specific circuit breaker can be found on the faceplate label on the front of the circuit breaker.

Figure 2 – Faceplate Information



Information about the accessories installed in the circuit breaker can be found on the accessory label on the right side of the circuit breaker.

For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor sizes and trip units, see 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website.

Frame Sizes and Interrupting Ratings

Available frame sizes and ratings are shown in Table 1. For complete information on available circuit breaker and switch models, frame sizes, interrupting ratings, sensor sizes and trip units, see the Masterpact NW catalog.

Table 1 – Frame Sizes and Interrupting Rating

UL1066 Listed (ANSI C37.50)						UL489 Listed					
Frame Size	Type ¹	Model Number	254 Vac	508 Vac	635 Vac	Frame Size	Type ¹	Model Number	240 Vac	480 Vac	600 Vac
800 A	N1	NW08N1	42 kA	42 kA	42 kA	800 A	N	NW08N	65 kA	65 kA	50 kA
	H1, HA	NW08H1/HA	65 kA	65 kA	65 kA		H, HF	NW08H/HF	100 kA	100 kA	85 kA
	H2	NW08H2	85 kA	85 kA	85 kA		L, HB	NW08L/HB	200 kA	150 kA	100 kA
	H3, HF	NW08H3/HF	100 kA	100 kA	85 kA		LF	NW08LF	200 kA	150 kA	100 kA
	L1, HC	NW08L1/HC	200 kA	200 kA	130 kA	1200 A	N	NW12N	65 kA	65 kA	50 kA
	L1F	NW08L1F	200 kA	200 kA	130 kA		H, HF	NW12H/HF	100 kA	100 kA	85 kA
1600 A	N1	NW16N1	42 kA	42 kA	42 kA		L, HB	NW12L/HB	200 kA	150 kA	100 kA
	H1, HA	NW16H1/HA	65 kA	65 kA	65 kA	1600 A	LF	NW12LF	200 kA	150 kA	100 kA
	H2	NW16H2	85 kA	85 kA	85 kA		N	NW16N	65 kA	65 kA	50 kA
	H3, HF	NW16H3/HF	100 kA	100 kA	85 kA		H, HF	NW16H/HF	100 kA	100 kA	85 kA
	L1, HC	NW16L1/HC	200 kA	200 kA	130 kA		L, HB	NW16L/HB	200 kA	150 kA	100 kA
	L1F	NW16L1F	200 kA	200 kA	130 kA		LF	NW16LF	200 kA	150 kA	100 kA
2000 A	H1, HA	NW20H1/HA	65 kA	65 kA	65 kA	2000 A	N	NW20N	65 kA	65 kA	50 kA
	H2	NW20H2	85 kA	85 kA	85 kA		H, HF	NW20H/HF	100 kA	100 kA	85 kA
	H3, HF	NW20H3/HF	100 kA	100 kA	85 kA		L, HB	NW20L/HB	200 kA	150 kA	100 kA
	L1, HC	NW20L1/HC	200 kA	200 kA	130 kA		LF	NW20LF	200 kA	150 kA	100 kA
	L1F	NW20L1F	200 kA	200 kA	130 kA	2500 A	H, HF	NW25H/HF	100 kA	100 kA	85 kA
3200 A	H1, HA	NW32H1/HA	65 kA	65 kA	65 kA		L, HB	NW25L/HB	200 kA	150 kA	100 kA
	H2	NW32H2	85 kA	85 kA	85 kA	3000A	H, HF	NW30H/HF	100 kA	100 kA	85 kA
	H3, HF	NW32H3/HF	100 kA	100 kA	85 kA		L, HB	NW30L/HB	200 kA	150 kA	100 kA
	L1, HC	NW32L1/HC	200 kA	200 kA	130 kA	4000 A	H, HF	NW40H/HF	100 kA	100 kA	85 kA
4000 A ² (W-Frame)	H1, HA	NW40BH1/HA	65 kA	65 kA	65 kA		L, HB	NW40L/HB	200 kA	150 kA	100 kA
	H2	NW40BH2	85 kA	85 kA	85 kA	5000 A	H, HF	NW50H/HF	100 kA	100 kA	85 kA
	H3, HF	NW40BH3/HF	100 kA	100 kA	85 kA		L, HB	NW50L/HB	200 kA	150 kA	100 kA
4000 A	H2, HA	NW40H2/HA	85 kA	85 kA	85 kA	6000 A	H, HF	NW60H/HF	100 kA	100 kA	85 kA
	H3, HF	NW40H3/HF	100 kA	100 kA	85 kA		L, HB	NW60L/HB	200 kA	150 kA	100 kA
	L1, HC	NW40L1/HC	200 kA	200 kA	130 kA	5000 A	H2, HA	NW50H2/HA	85 kA	85 kA	85 kA
5000 A	H3, HF	NW50H3/HF	100 kA	100 kA	85 kA		H3, HF	NW50H3/HF	100 kA	100 kA	85 kA
	L1, HC	NW50L1/HC	200 kA	200 kA	130 kA		L1, HC	NW50L1/HC	200 kA	200 kA	130 kA
6000 A	H2, HA	NW60H2/HA	85 kA	85 kA	85 kA	6000 A	H3, HF	NW60H3/HF	100 kA	100 kA	85 kA
	H3, HF	NW60H3/HF	100 kA	100 kA	85 kA		L1, HC	NW60L1/HC	200 kA	200 kA	130 kA
	L1, HC	NW60L1/HC	200 kA	200 kA	130 kA						

¹ N, H, L, N1, H1, H2, H3, L1, LF, L1F: Circuit Breaker

NA, HA: Non-Automatic Switch

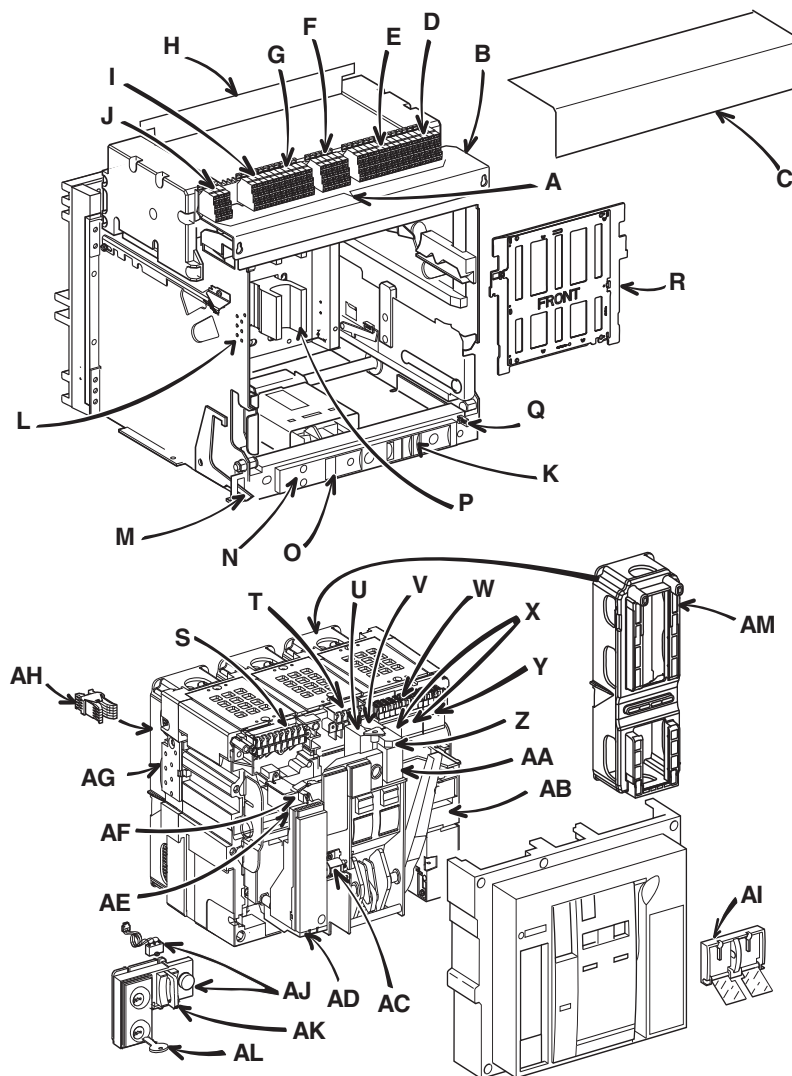
HB, HC, HF: Automatic Switch

² 4000 A W-frame (standard width) circuit breaker is not available in L1 interrupting rating or in drawout construction. See Bulletin 0613IB1205: Masterpact NW Dimensional Drawings for dimensions.

Accessories and Accessory Connections

Figure 3 – Accessories and Accessory Connections

- A. Auxiliary or secondary terminals
- B. Wiring terminal cover
- C. Terminal cover (optional)
- D. Position indicating contact terminal block
- E. Auxiliary contact terminal block
- F. Accessory control terminal block
- G. Position indicating contact terminal block
- H. Tool shield
- I. Trip unit terminal block
- J. Position indicating contact terminal block
- K. Shutter lock
- L. Cradle rejection feature
- M. Door interlock
- N. Key interlock
- O. Padlock provision
- P. Primary connectors
- Q. Racking interlock for open door
- R. Shutters
- S. Trip unit connection to overcurrent trip switch
- T. Auxiliary control connection
- U. MX2 shunt trip or MN undervoltage trip device
- V. MX1 shunt trip
- W. Auxiliary contact connections
- X. Two blocks of four additional OF switches or combined "connected, closed" EF switches
- Y. Block of four form C auxiliary contacts (OF)
- Z. XF shunt close
- AA. PF ready-to-close contact
- AB. MCH spring-charging motor
- AC. Operation counter
- AD. Sensor plug
- AE. SDE1 overcurrent trip switch
- AF. SDE2 overcurrent trip switch or RES electric reset
- AG. Rejection pin plate
- AH. Cluster
- AI. Push button padlockable cover
- AJ. BPFE electrical close push button
- AK. Padlock attachment
- AL. Key interlock
- AM. Cluster Shield



Operating Conditions

Masterpact circuit breakers can be used:

- At ambient temperatures between -13°F (-25°C) and 158°F (70°C)
Mechanical closing of the circuit breaker (by pushbutton) is possible down to -31°F (-35°C)
- Altitude ≤ 13,000 ft. (3900 m)

Operating at other than 104°F (40°C) and at altitudes greater than 6600 ft. (2000 m) may require re-rating, overbussing, heating, or cooling. See Tables 2 and 3 for re-rating values for both UL 489 and UL 1066 (ANSI C37.50) Listed circuit breakers. For 122°F (50°C) overbussing with no derating, contact the field office.

Masterpact circuit breakers have been tested for operation in industrial atmospheres. It is recommended that the equipment be cooled or heated to the proper operating temperature (max. 104°F [40°C]) and kept free of excessive vibration and dust.

Table 2 – Temperature Re-rating Values (per ANSI C37.20.1)

Maximum Ambient Temperature

°F	140	122	104	86	77	68	50	32	14	-4	-22
°C	60	50	40	30	25	20	10	0	-10	-20	-30
Current	0.83	0.92	1.00	1.07	1.11	1.14	1.21	1.27	1.33	1.39	1.44

Table 3 – Altitude Re-rating Values (per ANSI C37.20.1 Table 10)

Altitude	≤ 6600 ft. (≤ 2000 m)	8500 ft. (2600 m)	13000 ft. (3900 m)
Voltage	1.00	0.95	0.80
Current	1.00	0.99	0.96

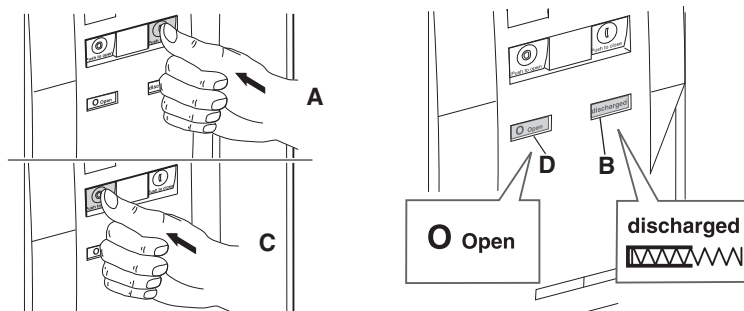
Before Working on Circuit Breaker

- Turn circuit breaker off:

Press “Push to close” button (**Figure 4, A**) to discharge spring, as indicated by window (**B**).

Press “Push to open” button (**C**) to open contacts, as indicated by window (**D**).

Figure 4 – Turn Off Circuit Breaker



- Disconnect power from circuit breaker.

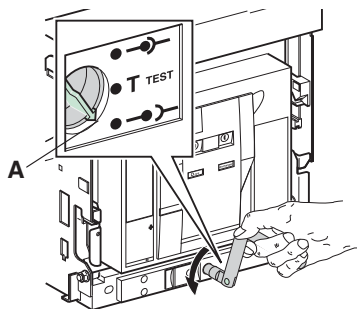
⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

- For drawout circuit breaker: rack circuit breaker to disconnected position (**Figure 5, A**). See Drawout Circuit Breaker Disconnection, page 24.

Figure 5 – Disconnect Drawout Circuit Breaker

**⚠ DANGER****HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

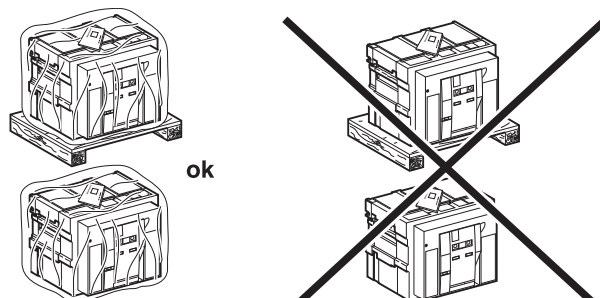
Failure to follow these instructions will result in death or serious injury.

For fixed-mounted circuit breaker: turn off all power supplying equipment before working on or inside equipment.

Storage

Store circuit breaker in original shipping carton or other protective weatherproof covering.

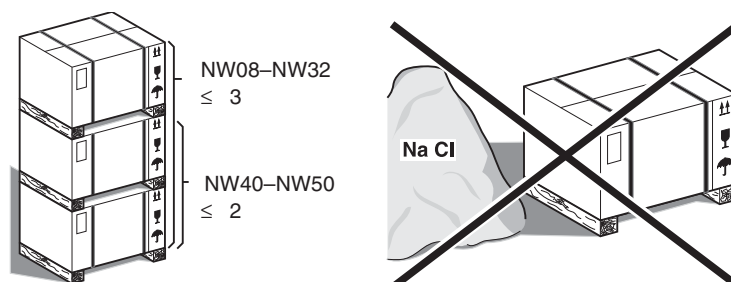
Figure 6 – Storing Circuit Breaker



Do not overstack circuit breakers.

Do not store circuit breaker in corrosive or salt-air environment.

Figure 7 – Storing Circuit Breaker

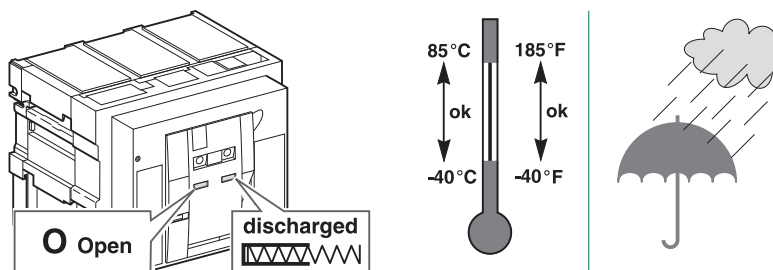


Store circuit breaker with main contacts open and spring discharged.

Store circuit breaker without trip unit at -40° F (-40°C) to +185° F (+85°C).

Store circuit breaker with trip unit and trip units at -13°F (-25°C) to +185°F (+85°C).

Figure 8 – Storing Circuit Breaker



Section 2— Lifting and Transporting

Both the circuit breaker and cradle have lifting flanges for lifting. To lift circuit breaker, use an overhead lifting device attached to the lifting flanges, following the directions given in this section.

⚠ DANGER

HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted.
- Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

Weights

Table 4 – Weights

Frame Rating	Connector Type ¹	Weights (lbs./kg.)								
		Circuit Breaker		Cradle		Connector		Pallet	Total	
		3 Pole	4 Pole	3 Pole	4 Pole	3 Pole	4 Pole		3 Pole	4 Pole
800–2000 A, Drawout	FCF	109/50	142/65	97/44	116/53	42/19	55/25	17/8	265/121	330/151
	FCT	109/50	142/65	97/44	116/53	84/38	109/50	17/8	307/140	384/176
	RCTH/RCTV	109/50	142/65	97/44	116/53	17/8	22/10	17/8	240/110	297/136
800–2000 A, Fixed-Mounted	FCF	109/50	142/65	—	—	42/19	55/25	17/8	168/77	214/98
	FCT	109/50	142/65	—	—	84/38	109/50	17/8	210/96	268/123
	RCTH/RCTV	109/50	142/65	—	—	17/8	22/10	17/8	143/66	181/83
2500–3000 A, Drawout	RCTH/RCTV	127/58	165/75	124/57	149/68	26/12	34/15	17/8	294/135	365/166
	FCT	127/58	165/75	124/57	149/68	80/36	104/47	17/8	348/159	435/198
2500–3000 A, Fixed-Mounted	FCT	127/58	165/75	—	—	80/36	104/47	17/8	224/102	286/130
	RCTH/RCTV	127/58	165/75	—	—	26/12	34/15	17/8	170/78	216/98
2000 A L1/L1F & 3200 A, Drawout	RCOV	127/58	165/75	124/57	149/68	100/46	130/59	17/8	368/169	461/210
3200 A, Fixed-Mounted	RCOV	127/58	165/75	—	—	100/46	130/59	17/8	244/112	312/142
4000 A, (W-Frame) Fixed-Mounted	RCOV (Special)	127/58	165/75	—	—	115/52	145/66	17/8	259/118	327/149
3200 A L1 & 4000 A, Drawout	FCF	227/103	295/134	278/126	334/152	84/38	109/50	39/18	628/285	777/354
	FCT	227/103	295/134	278/126	334/152	168/76	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
4000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
5000 A, Drawout	FCT	227/103	295/134	278/126	334/152	168/77	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
5000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
6000 A, Drawout	RCTV	227/103	295/134	278/126	334/152	396/180	528/240	39/18	940/427	1196/544
6000 A, Fixed-Mounted	RCTV	227/103	295/134	—	—	396/180	528/240	39/18	662/301	862/392

¹FCF = Front-connected flat connector.

FCT = Front-connected “T” connector.

RCTH = Rear-connected “T” horizontal connector.

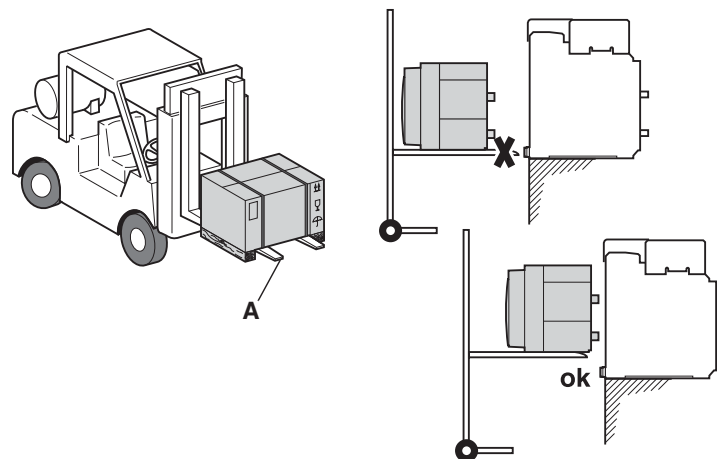
RCTV = Rear-connected “T” vertical connector.

RCOV = Rear-connected offset vertical.

Using a Platform Lift

When using a platform lift, lift flanges (**Figure 9, A**) should not extend beyond back of circuit breaker.

Figure 9 – Using a Platform Lift



Lifting

Lifting Drawout Circuit Breaker

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured before installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

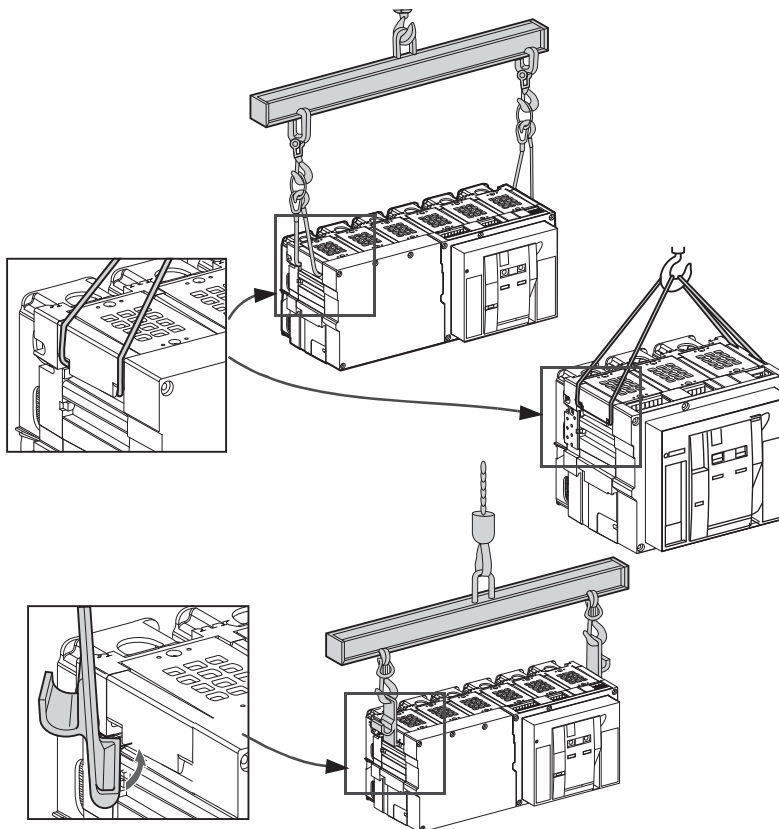
Lift using lifting flanges on sides of circuit breaker, lifting hooks and crossbar.

Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

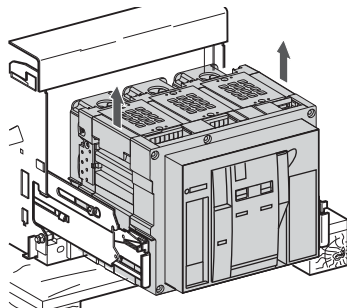
Figure 10 – Lifting Drawout Circuit Breaker



Lifting Cradle or Fixed-Mounted Circuit Breaker

NOTE: If circuit breaker is installed in cradle, remove circuit breaker from cradle before lifting cradle. To remove circuit breaker, see page 17.

Figure 11 – Removing Circuit Breaker From Cradle



Lift using lifting flanges on sides of cradle or circuit breaker, a piece of bar stock through the connectors, lifting hooks and crossbar.

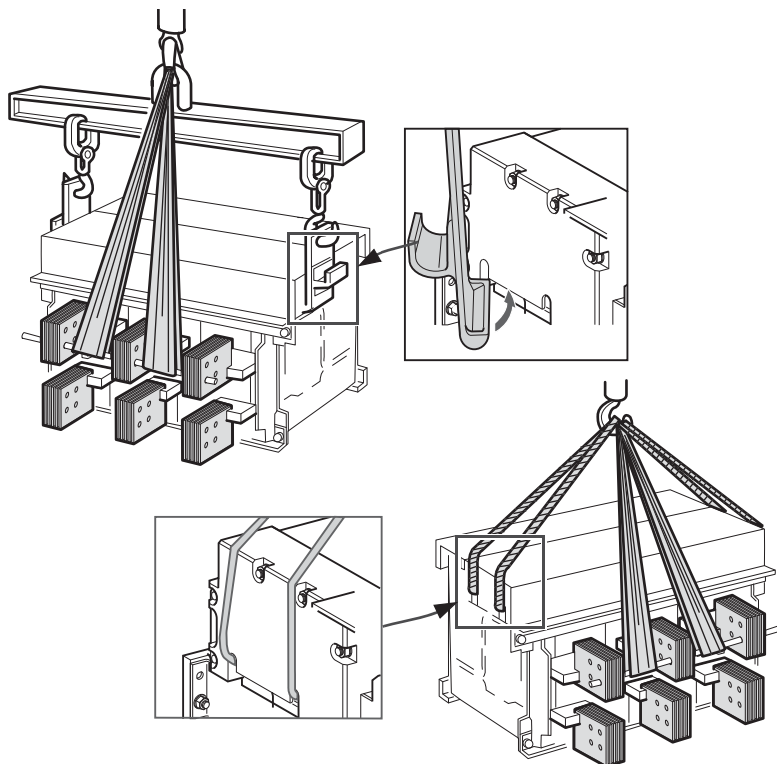
Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

NOTE: Connectors must be supported while lifting cradle or fixed-mounted circuit breaker.

Figure 12 – Lifting Cradle or Fixed-Mounted Circuit Breaker



Section 3— Trip Unit

Protective functions, measurement functions and communications are controlled by the Micrologic™ trip unit (**Figure 13, A**) installed in the circuit breaker. The trip unit is field replaceable for easy upgrading of functionality.

For complete information on the trip unit, its functions and field replacement, see the trip unit user guide. For complete information on trip unit availability and capabilities, refer to catalog 0613CT1001, Masterpact NT and NW Universal Power Circuit Breakers. Both are available from the Schneider Electric™ website:

<http://www.schneider-electric.com>

Figure 13 – Micrologic Trip Unit

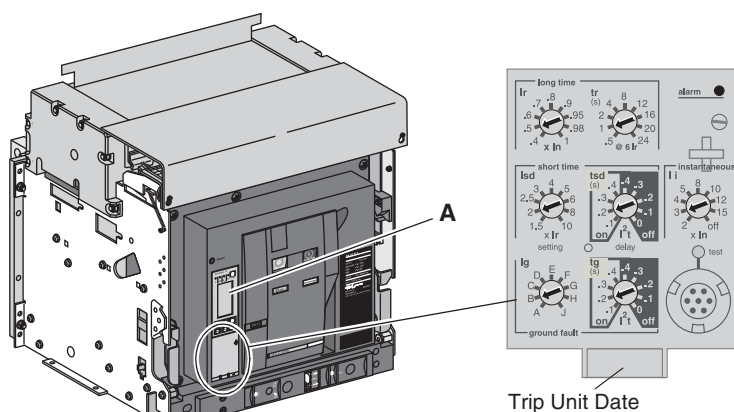


Table 5 describes the features available on the 3.0 and 5.0 standard trip units, the 3.0A, 5.0A, and 6.0A trip units with ammeters, the 5.0P and 6.0P power measurement trip units and the 5.0H and 6.0H harmonic measurement trip units.

Figure 14 – Micrologic Trip Units



Table 5 – Micrologic Trip Unit Features

Feature	Micrologic Trip Unit								
	X = Standard Feature O= Available Option								
	Standard		Ammeter			Power		Harmonics	
	3.0	5.0	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
LI	X		X						
LSI		X		X		X		X	
LSIG/Ground-Fault Trip ²					X		X		X
Ground-Fault Alarm/No Trip ^{1,2}						X		X	
Ground-Fault Alarm and Trip ^{1,2}							X		X
Adjustable Rating Plugs	X	X	X	X	X	X	X	X	X
True RMS Sensing	X	X	X	X	X	X	X	X	X
UL® Listed	X	X	X	X	X	X	X	X	X
Thermal Imaging	X	X	X	X	X	X	X	X	X
Phase-Loading Bar Graph			X	X	X	X	X	X	X
LED for Long-Time Pick-Up	X	X	X	X	X	X	X	X	X
LED for Trip Indication			X	X	X	X	X	X	X
Digital Ammeter			X	X	X	X	X	X	X
Zone-Selective Interlocking				X	X	X	X	X	X
Communications			O	O	O	X	X	X	X
LCD Dot Matrix Display						X	X	X	X
Advanced User Interface						X	X	X	X
Protective Relay Functions						X	X	X	X
Neutral Protection ²						X	X	X	X
Contact Wear Indication						X	X	X	X
Incremental Fine Tuning of Settings						X	X	X	X
Selectable Long-Time Delay Bands						X	X	X	X
Power Measurement						X	X	X	X
Power Quality Measurements								X	X
Waveform Capture								X	X

¹Requires the M2C or M6C programmable contact module.²Requires neutral current transformer for 3-phase, 4-wire system.

Section 4— Operation

Drawout Circuit Breaker Status

⚠ DANGER

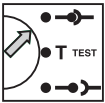
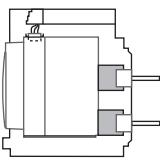
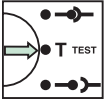
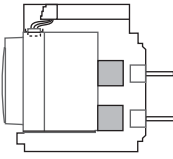
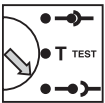
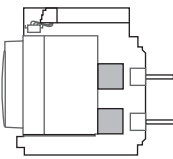
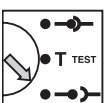
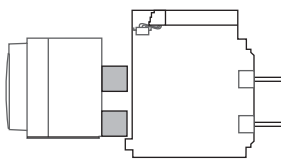
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

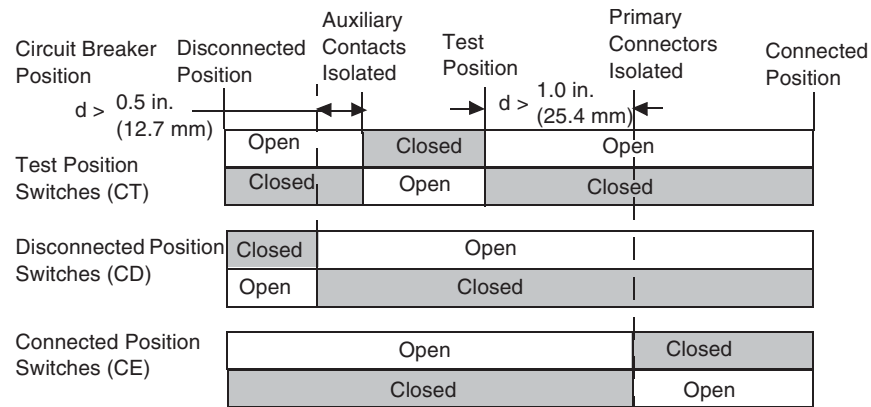
Connection or disconnection of the drawout circuit breaker requires insertion of the racking handle (while pressing “Push to open” button). If interlocks, padlocks or an open door lock are in place, the racking handle cannot be inserted.

Table 6 – Drawout Circuit Breaker Positions

Position Indicator	Connector Position (Cluster shields not shown)	Connectors		Circuit Breaker Status
		Clusters	Secondary (Control)	
Connected 		Engaged	Engaged	Can be operated. Ready for service.
Test 		Disengaged	Engaged	Can be operated. Can have operation and control systems tested.
Disconnected 		Disengaged	Disengaged	Can be operated. Can be removed from carriage.
Withdrawn 		Disengaged	Disengaged	Removed from carriage.

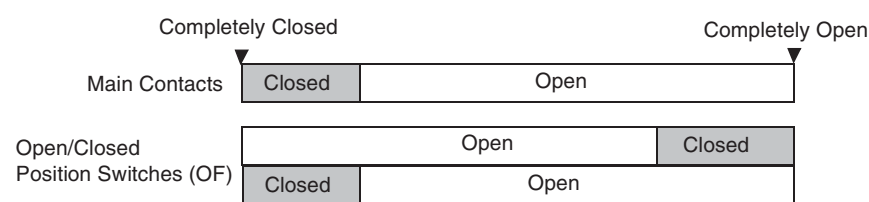
As the circuit breaker position changes, the position contacts change states.

Figure 15 – Device Position Operation



As the circuit breaker main contacts operate, the auxiliary contacts change positions.

Figure 16 – Device Contact Operation



Drawout Circuit Breaker Connection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use racking handle provided to rack circuit breaker into or out of cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

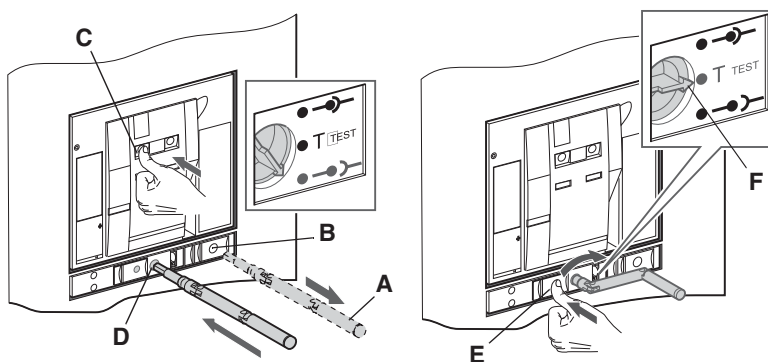
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

1. Disconnect the load from the secondary disconnects.
2. Remove the racking handle (**Figure 17, A**) from its storage hole (**B**).

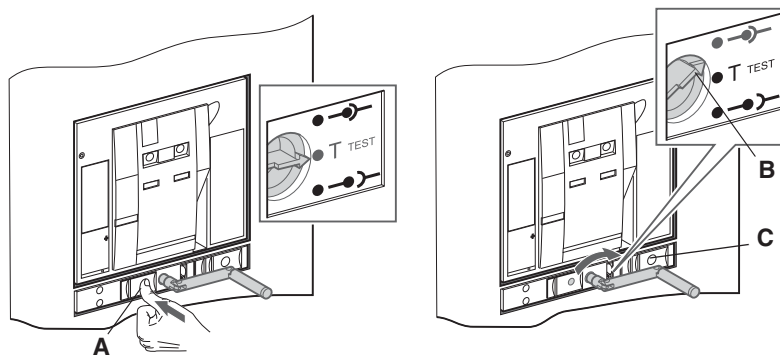
3. While pressing the “Push to open” button (C), insert the racking handle in the racking slot (D).
4. Push the stop release button (E).
5. Turn the racking handle clockwise until the test position (F) is reached. The stop release button will pop out.

Figure 17 – Rack Circuit Breaker to Test Position



6. Push the stop release button (Figure 18, A).
7. Turn the racking handle clockwise until the connected position (B) is reached. The stop release button will pop out. Replace the racking handle in its storage hole (C).
8. Reconnect the load to the secondary disconnects.

Figure 18 – Rack Circuit Breaker to Connected Position



Drawout Circuit Breaker Disconnection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use racking handle provided to rack circuit breaker into or out of cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

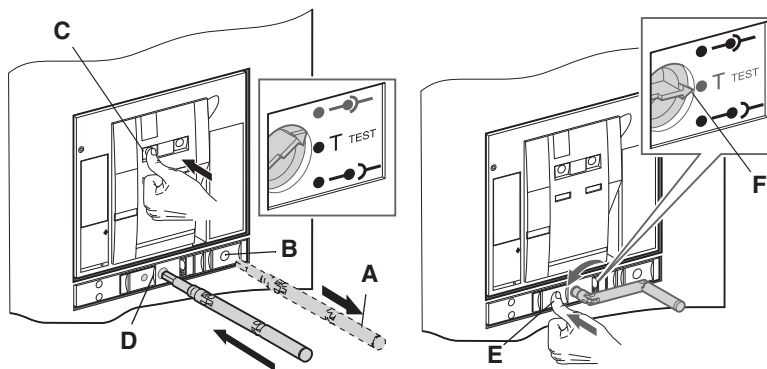
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

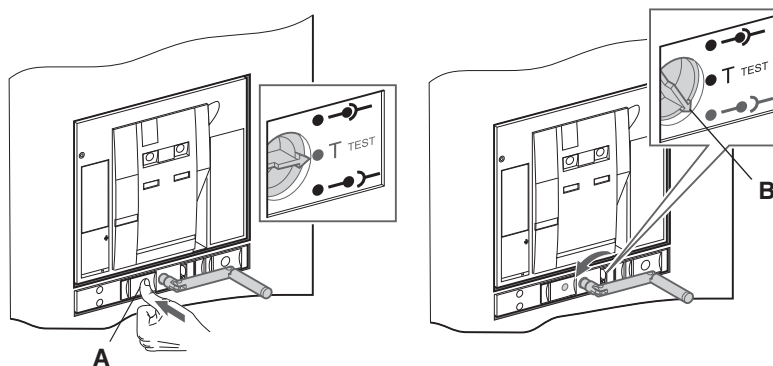
1. Remove the load from the secondary disconnects.
2. Remove the racking handle (**Figure 19, A**) from its storage hole (**B**).
3. While pressing the “Push to open” button (**C**), insert the racking handle in the racking slot (**D**).
4. Push the stop release button (**E**). Turn the racking handle counterclockwise until the test position (**F**) is reached. The stop release button will pop out.

Figure 19 – Rack Circuit Breaker to Test Position



5. Push the stop release button (**Figure 20, A**).
6. Turn the racking handle counterclockwise until the disconnected position (**B**) is reached. The stop release button will pop out. Replace the racking handle in its storage hole.
7. Reconnect the load to the secondary disconnects.

Figure 20 – Rack Circuit Breaker to Disconnected Position



Circuit Breaker Installation and Removal

Circuit Breaker Installation

NOTICE

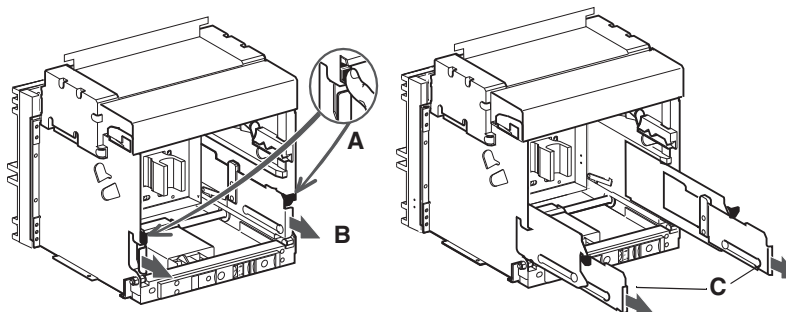
HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

1. Press the latching tabs (**Figure 21, A**), then pull out the extension rail handles (**B**) until the extension rails (**C**) are fully extended.
2. Inspect the circuit breaker clusters for missing or misaligned clusters. See the bulletin shipped with the circuit breaker for information on checking, installing, and lubricating clusters.

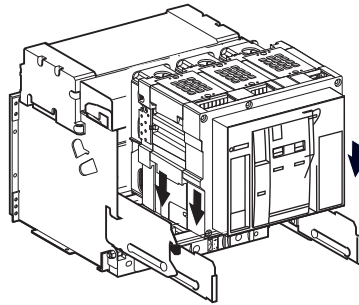
Figure 21 – Pull Out Rails



3. Install the circuit breaker on the extension rails. See page 17 for proper lifting equipment.

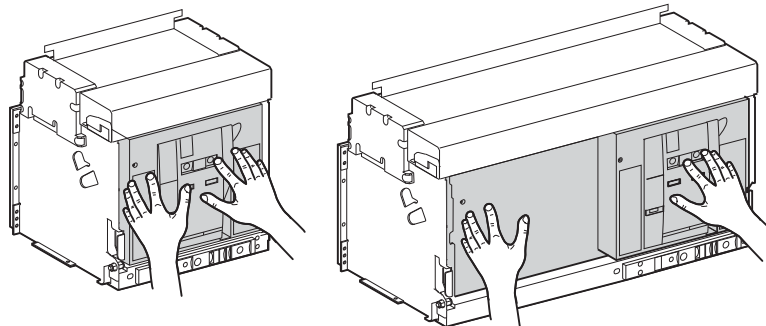
NOTE: The cradle must be secured on a pallet if it is not installed in the equipment prior to installing the circuit breaker.

Figure 22 – Install Circuit Breaker



4. Push in the circuit breaker.
5. Connect the circuit breaker. See page 22, Drawout Circuit Breaker Connection for instructions on connecting the circuit breaker.

Figure 23 – Push In Circuit Breaker



Circuit Breaker Removal

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

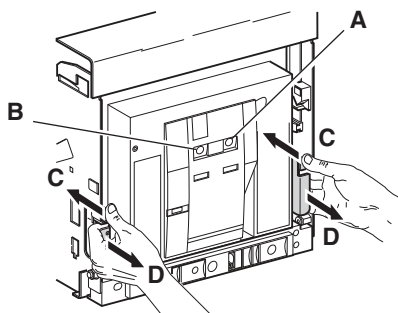
HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted. Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

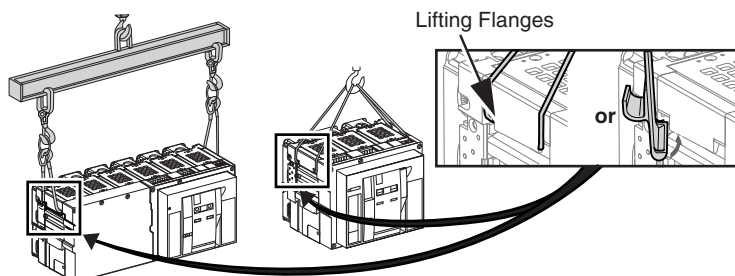
1. Disconnect circuit breaker as detailed on page 24, Drawout Circuit Breaker Disconnection.
2. With the circuit breaker in the disconnected position, press the “push ON” button (**Figure 24, A**) to close the circuit breaker.
3. Press the “push OFF” button (B) to open the circuit breaker.
4. Press latching tabs (C), then pull out extension rail handles (D).

Figure 24 – Circuit Breaker Removal



5. Remove circuit breaker from cradle rails using lifting flanges on sides of circuit breaker, see Section 2—Lifting and Transporting.

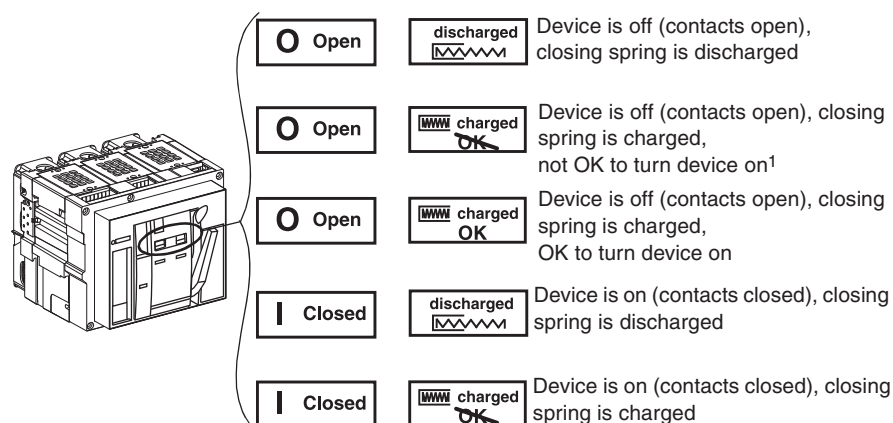
Figure 25 – Overhead Lifting



Circuit Breaker Operation

The circuit breaker is closed by means of a two-step stored energy mechanism. Status indicators on the front of the circuit breaker indicate whether the circuit breaker is open or closed, and whether the closing spring is charged or discharged. Opening springs are automatically charged when the circuit breaker closes.

Figure 26 – Status Indicators



¹It is not OK to turn device on if:

- Shunt trip is energized.
- Circuit breaker is not in connected, test, disconnected or withdrawn position.
- Undervoltage trip is not energized.
- Mechanical interlock is locking mechanism in the open position.

Anti-Pumping Function

The Masterpact circuit breaker is designed to mechanically provide an anti-pumping function. If either the shunt close or shunt trip coil is continuously powered, or both are powered at the same time, the circuit breaker will open and cannot be closed until the power has been removed. This prevents the circuit breaker from cycling between closing and opening (called pumping).

If the circuit breaker is equipped with a communicating-style shunt trip or shunt close (see page 48), the operation of the coil is impulse only. The plungers in the coils do not maintain an interlock on the closing mechanism. An opening signal and a closing signal cannot be sent simultaneously.

When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) coil. The ready-to-close switch (PF) (see page 47) can be series connected with the shunt close (XF) coil to prevent premature closing.

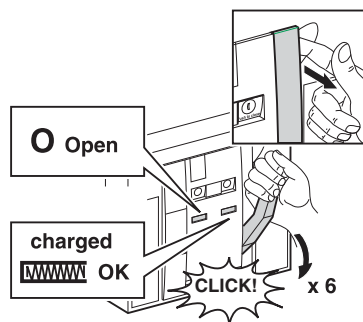
Charging the Closing Spring

To close the circuit breaker, the closing spring must be charged with sufficient energy for closing.

- **Manual Charge:** Use charging handle to charge closing spring.
- **Automatic Charge:** If the optional MCH spring-charging motor is installed, the spring is automatically charged after closing.

NOTE: The closing spring on the drawout circuit breaker will automatically discharge when the circuit breaker is moved from disconnect to withdrawn position.

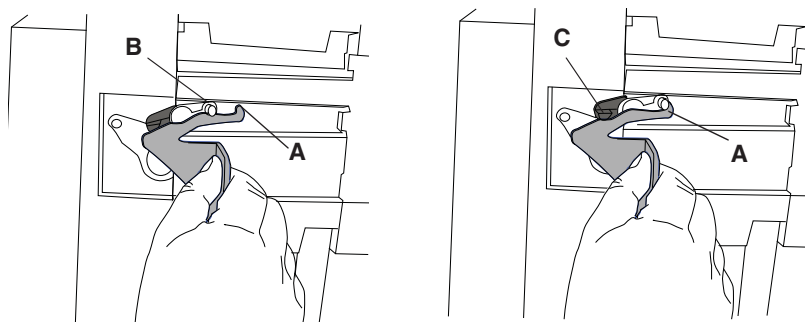
Figure 27 – Manual Spring Charge



NOTE: To close a drawout circuit breaker when it is not installed in the cradle, the cradle interlock must be defeated before the circuit breaker charging spring can be charged. A cradle interlock defeat tool is shipped with every circuit breaker. To install:

1. Slide the interlock defeat tool (**Figure 28, A**) into the groove under the interlock lever (**B**) on the right side of the circuit breaker.
2. Slide the tool toward the front of the circuit breaker and lock it in place under the cradle interlock shaft (**C**).

Figure 28 – Defeating Cradle Interlock



Close Circuit Breaker

To close the circuit breaker, the following conditions must be met:

- The device is open (O).
- The charging spring is charged.
- “OK” is displayed.

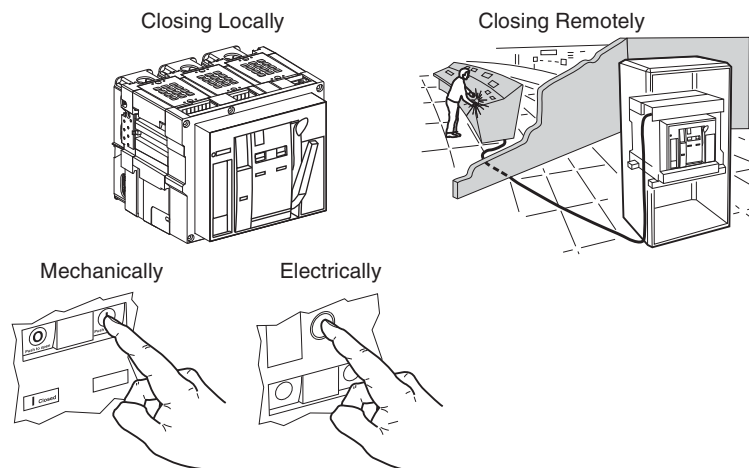
NOTE: The circuit breaker cannot be closed while an opening order is being received. If the “not OK” symbol is displayed, an order to open is being received (electrically or manually) and must be ended before the “OK” will be displayed.

If the above conditions are met, close the device by:

- Mechanically: press the “Push to close” button on the circuit breaker.
- Electrically: if the optional shunt close (XF) is installed, press the optional electrical-close push button (BPFE) on the circuit breaker or a push button at a remote location.

See pages 48 and 49 for more information about these options.

Figure 29 – Close Circuit Breaker

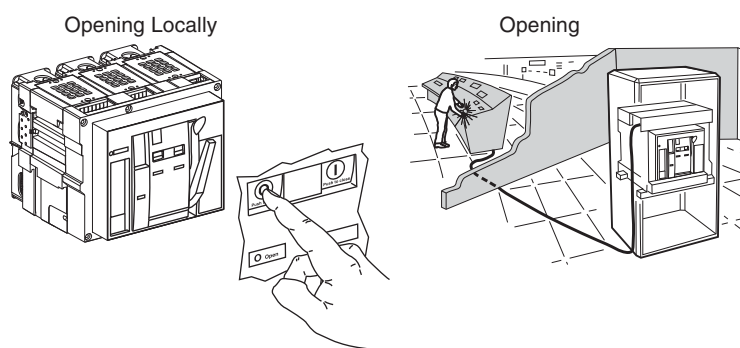


Open Circuit Breaker

- Mechanically: press “Push to open” button on the circuit breaker.
- Electrically: remotely operate using the optional shunt trips (MX1 and MX2), undervoltage trip device (MN), or time-delay module for undervoltage trip accessory (MNR).

See pages 49 and 49 for more information about these options.

Figure 30 – Turn Off Circuit Breaker

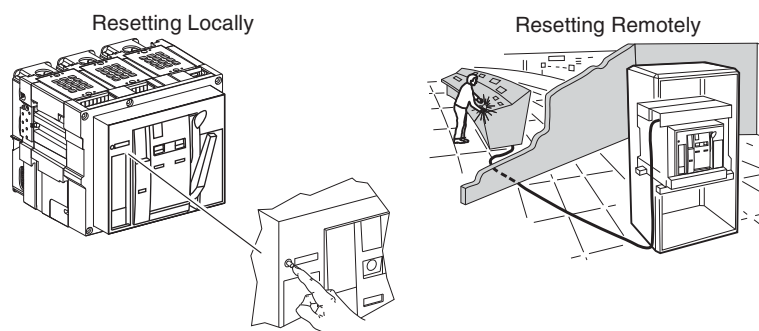


Reset Circuit Breaker

After a fault trip, the circuit breaker must be reset.

- Mechanically: press the “Reset” button located above the trip unit.
- Electrically: use the electrical reset option (RES) after an electrical fault. See page 47 for more information about this option.

Figure 31 – Reset Circuit Breaker



Neutral Protection

Neutral protection protects the neutral conductors against overheating.

- For a three-pole circuit breaker with a P or H trip unit, neutral protection is possible if a neutral current transformer is used.
 - Adjust the neutral using the trip unit keypad of the P or H trip unit.
 - Possible settings are OFF, N/2, N, or 1.6N.
 - Factory setting is OFF.

Oversize neutral protection (1.6N) requires the use of the appropriate oversize neutral current transformer. See price list for correct neutral current transformer.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

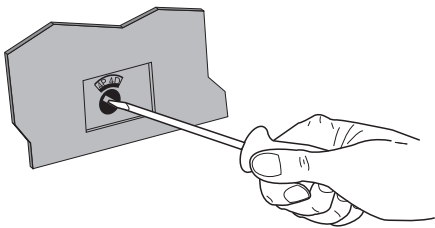
If a four-pole circuit breaker neutral pole switch is set to 4P3D setting, the current in the neutral must not exceed the rated current of the circuit breaker.

For a three-pole circuit breaker with oversize neutral protection (1.6N), select the appropriate oversize neutral current transformer.

Failure to follow these instructions can result in equipment damage.

- For a four-pole circuit breaker, set the system type using the circuit breaker neutral selector dial (see **Figure 32**).
 - With a P or H trip unit, make fine adjustments using the trip unit keypad, with the circuit breaker dial setting providing the upper limit for adjustment.
 - The factory setting is 4P 4D.

Figure 32 – Four-Pole Circuit Breaker Neutral Selector Dial



Neutral Protection Settings for Four-Pole Circuit Breaker

Circuit Breaker Selector Dial	P or H Trip Unit Keypad Setting
4P 3D	Off, N/2, N
3P N/2	N/2
4P 4D	N/2, N

- The neutral protection conductor type has four possible settings:
 - Off (4P 3D)—Neutral protection is turned off.
 - N/2 (3P N/2)—Neutral conductor capacity is one-half that of the line conductors.
 - N (4P 4D)—Neutral conductor capacity is the same as that of the line conductors.
 - 1.6N—Neutral conductor capacity is 1.6 times that of the line conductors. (3P circuit breaker with P or H trip unit only.)

Table 7 – Micrologic™ Trip Unit Conductor Type

Setting	Long-Time Pickup		Short-Time Pickup		Instantaneous		Ground-Fault Pickup	
	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral
OFF	I _r	None	I _{sd}	None	I _i	None	I _g	None
N/2	I _r	1/2 I _r	I _{sd}	1/2 I _{sd}	I _i	I _i	I _g	I _g
N	I _r	I _r	I _{sd}	I _{sd}	I _i	I _i	I _g	I _g
1.6N	I _r	1.6 x I _r	I _{sd}	1.6 x I _{sd} *	I _i	I _i	I _g	I _g

*In order to limit the range, limited to 10 x I_n.

Section 5— Locks and Interlocks

A number of optional locking and interlocking devices are available for the Masterpact circuit breaker and cradle. The operation of most of these devices is described in this section. For a complete listing of available locks and interlocks, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric™ website.

For detailed installation instructions on field-installable locks and interlocks, refer to the installation instructions shipped with the devices.

Push Button Lock

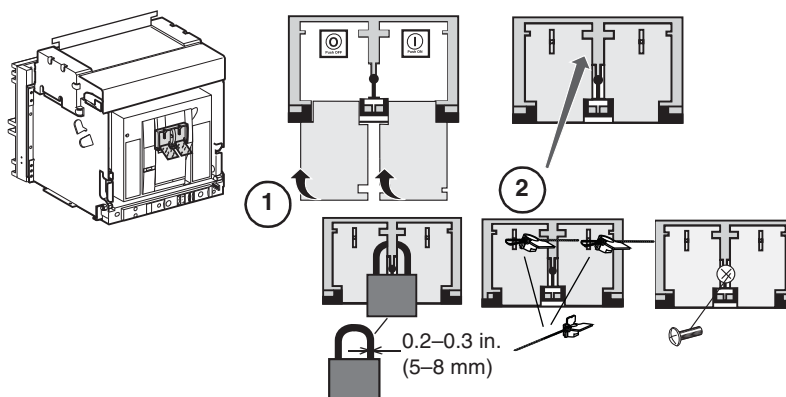
The push button lock prevents the circuit breaker from being opened or closed using the push buttons.

- Optional.
- Can be secured with a padlock, sealing lead or two screws.

To Lock:

1. Install the push button lock over the “Push to open” and “Push to close” buttons.
2. Close the plastic covers of the lock.
3. Lock the plastic cover in place using a padlock, wire seal, or screws.

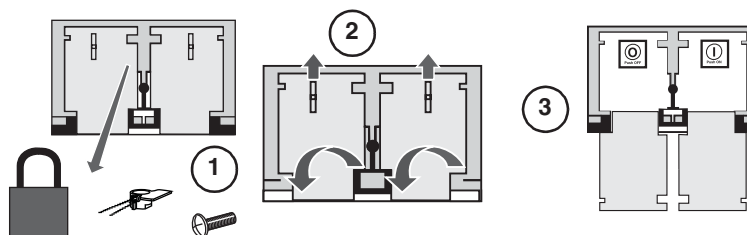
Figure 33 – To Lock Push Buttons



To Unlock:

1. Remove the padlock, wire seal, or screws.
2. Open the plastic covers of lock.
3. The buttons can be pushed.

Figure 34 – To Unlock Push Buttons



Open Position Padlock and Open Position Padlock with Key Lock

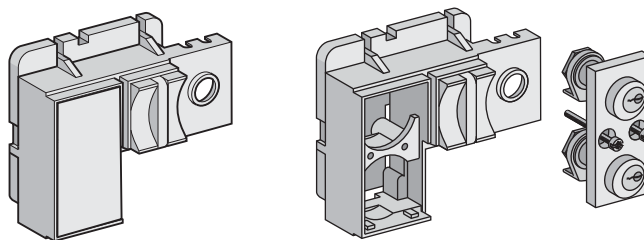
The padlocks prevent the circuit breaker from being closed, either with the push buttons or remotely.

- Optional.
- Secured with one to three padlocks.

The open position padlock and key lock is:

- Optional.
- Available with the Kirk® key lock
- Can be secured with:
 - One padlock;
 - One or two key locks;
 - Or both.

Figure 35 – Open Position Padlock and Open Position Padlock and Key Lock

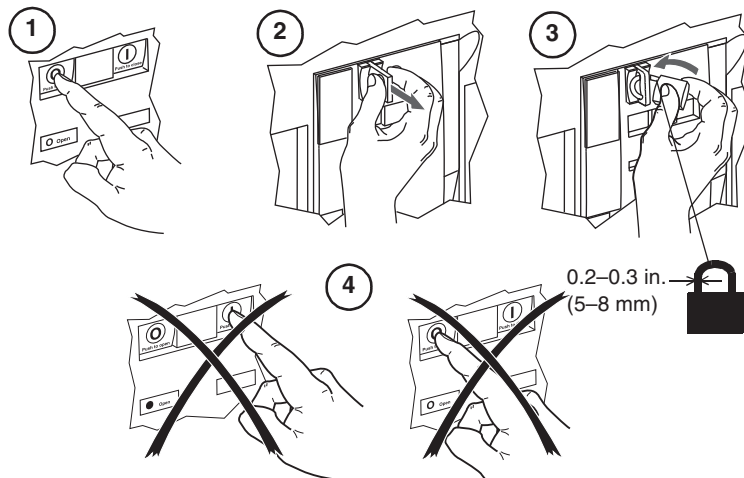


Locking with a Padlock

To Lock (**Figure 36**):

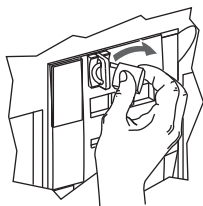
1. Open the circuit breaker.
2. Pull out the tab.
3. Attach the padlock.
4. Verify the controls are disabled.

Figure 36 – Locking with a Padlock



To Unlock (**Figure 37**), remove the padlock.

Figure 37 – Remove the Padlock

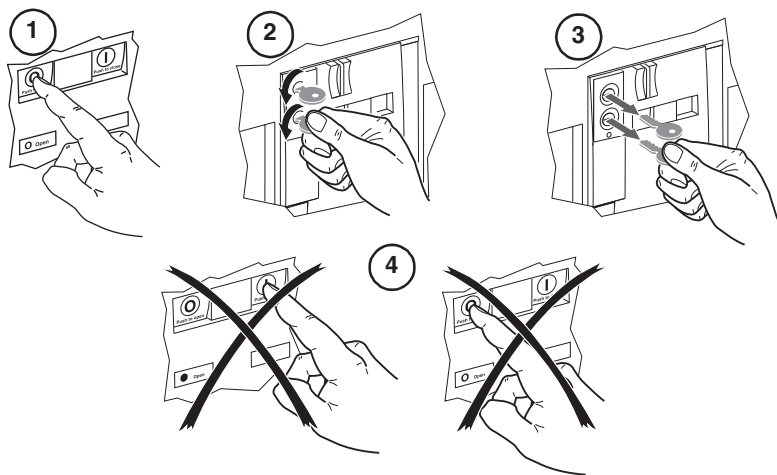


Locking with a Key Lock

To Lock (**Figure 38**):

1. Open the circuit breaker.
2. Turn the key(s).
3. Remove the key(s).
4. Verify the controls are disabled.

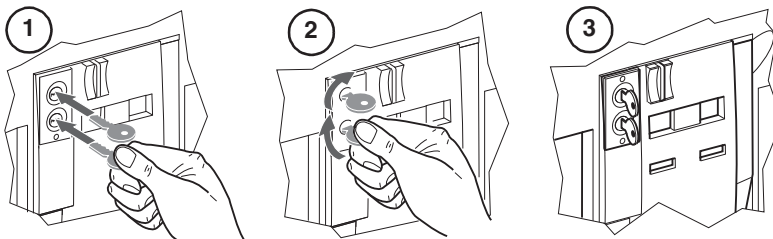
Figure 38 – Locking with Key Lock



To Unlock (**Figure 39**):

1. Insert the key(s).
2. Turn the key(s).
3. Leave the key(s) captive.

Figure 39 – Unlocking the Key Lock



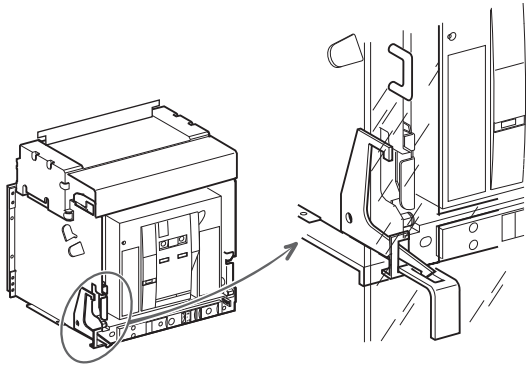
Equipment Door Interlock

If the door lock accessory is installed, the equipment door can only be opened when the circuit breaker is in the disconnected position.

- For drawout circuit breaker only.
- Optional.
- Normally mounts on the right side of the cradle.
- Can be ordered for mounting on the left of the cradle.
- Allows the door to be closed with the circuit breaker in any position.

Table 8 – Door Interlock

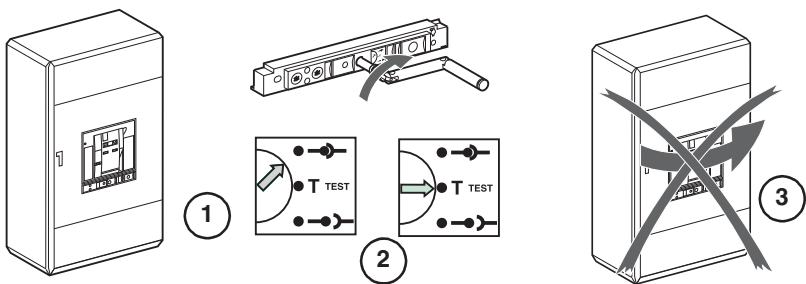
Circuit Breaker Position	Interlock Hook	Door
Connected	Lowered	Locked
Test	Lowered	Locked
Disconnected	Raised	Unlocked



To Lock (**Figure 40**):

1. Close the enclosure door.
2. Move the circuit breaker to the test or connected position.
3. Verify the door is locked.

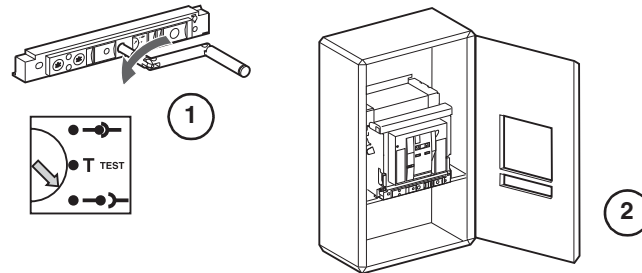
Figure 40 – Locking the Door Interlock



To Unlock (**Figure 41**):

1. Move the circuit breaker to the disconnected position.
2. Verify the door is unlocked.

Figure 41 – Unlocking the Door Interlock

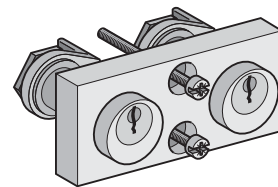


Cradle Locks

The cradle locks prevent the drawout circuit breaker from being racked in or out (by preventing insertion of racking handle) and from being moved from the disconnected position to the fully withdrawn position (by locking the drawout rails).

- Secured with one to three padlocks (standard) and/or with one or two key locks (optional).
- Keylocks are available with the Kirk key lock.
- Allows the cradle to be locked in any position (connected, test, and disconnected).
- Mounted on the cradle.

Figure 42 – Optional Key Interlock



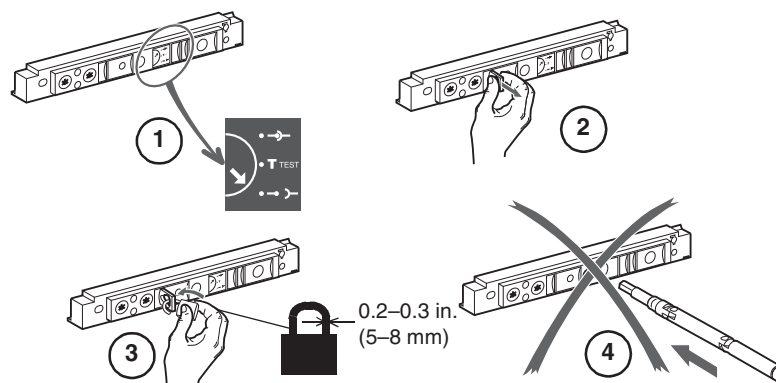
Locking Cradle with a Padlock (Standard)

To Lock (**Figure 43**):

1. Make sure the cradle indicator is in the disconnected, test, or connected position.
2. Pull out the tab.
3. Attach the padlock(s).
4. Verify racking handle cannot be inserted.

NOTE: If circuit breaker is padlocked in disconnected position, the circuit breaker cannot be pulled out from the disconnected position to the fully withdrawn position.

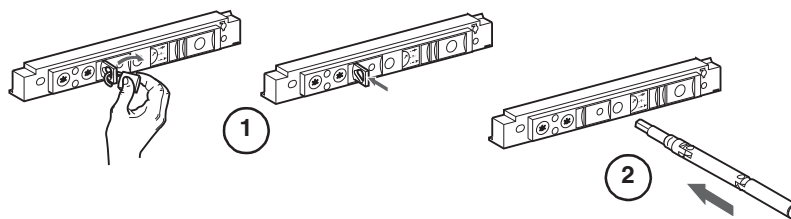
Figure 43 – Locking Cradle With a Padlock



To Unlock (**Figure 44**):

1. Remove the padlock(s).
2. Verify the racking handle can be inserted.

Figure 44 – Unlocking Cradle Padlock

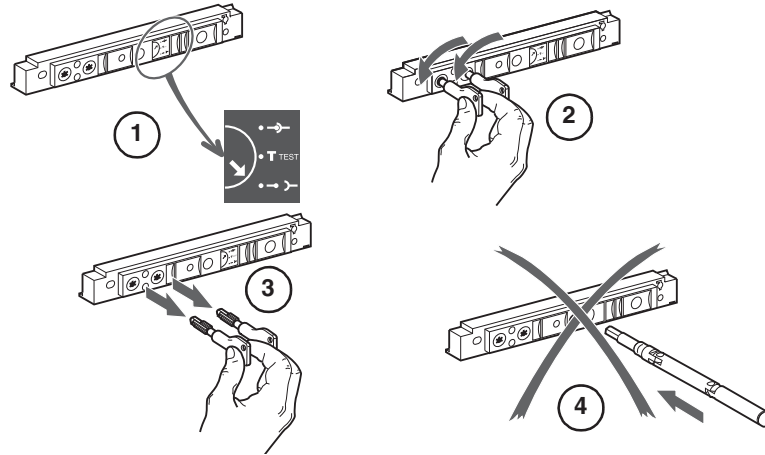


Locking Cradle with a Key Lock

To Lock (**Figure 45**):

1. Make sure the cradle indicator is in the disconnected, test, or connected position.
2. Turn the key(s).
3. Remove the key(s).
4. Verify the racking handle cannot be inserted.

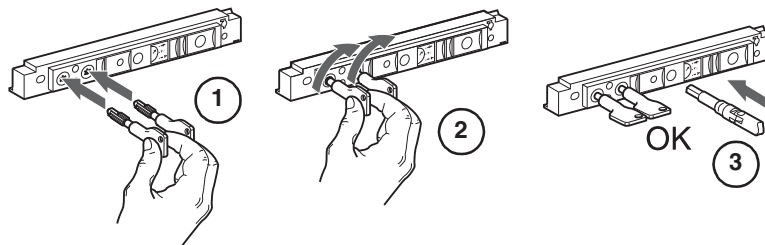
Figure 45 – Locking Cradle with a Key Lock



To Unlock (**Figure 46**):

1. Insert the key(s).
2. Turn the key(s).
3. Leave the key(s) captive.

Figure 46 – Unlocking Cradle Key Lock



Cradle in Any Position Locks

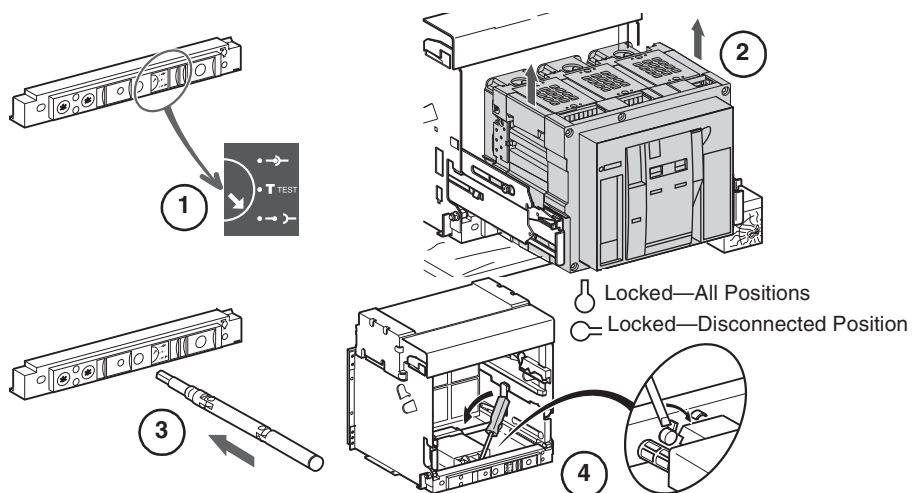
Padlocks and/or key locks used to lock the cradle in the disconnected position can be converted to lock the device in any position (connected, test, or disconnected).

To convert the lock (**Figure 47**):

1. Make sure cradle indicator is in the disconnected position.
2. Remove the circuit breaker from the cradle. (See circuit breaker removal instructions).
3. Insert the racking handle.
4. Rotate the latch to the left. The cradle can now be locked in any position.

NOTE: To return cradle to locking only in the disconnected position, rotate latch to the right.

Figure 47 – Convert Cradle Lock



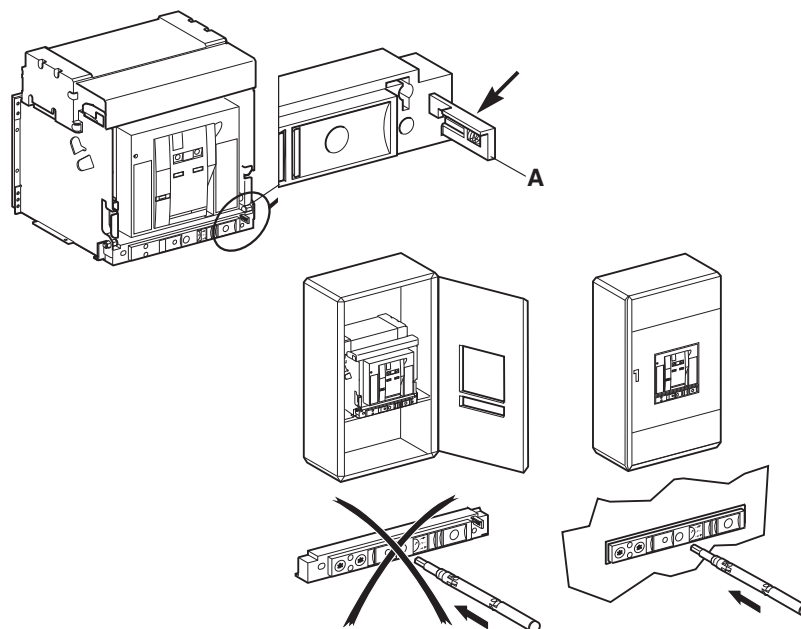
Open Door Racking Interlock

The open door racking interlock prevents the racking handle from being inserted if the equipment door is open.

- Optional.
- Mounts on the right side of the cradle.

To deactivate, pull out the interlock (**Figure 48, A**).

Figure 48 – Interlocking Cradle Position

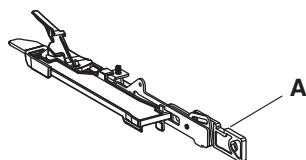


Shutter Lock

The shutter lock (**Figure 49, A**) is used to prevent connection of the circuit breaker by locking the shutter in the closed position.

- Optional.
- Allows the shutter to be padlocked.

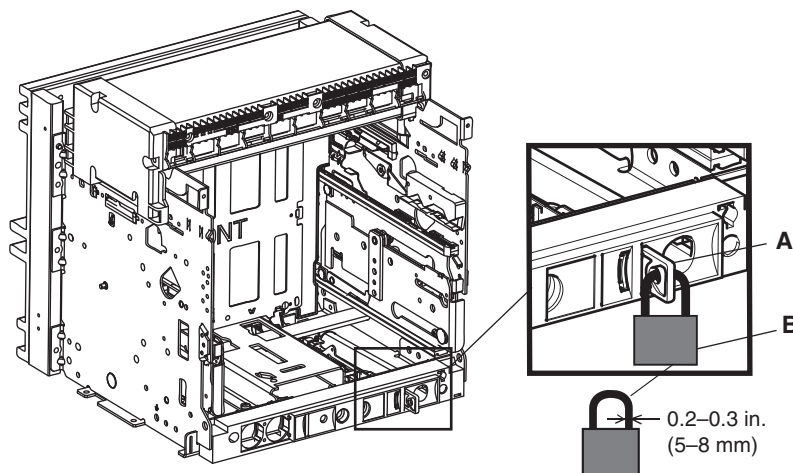
Figure 49 – Shutter Lock



To Lock:

Pull end of shutter indicator arm out of shutter indicator slot (Figure 50, A). Insert padlock (B) through padlock hole.

Figure 50 – Locking the Shutters

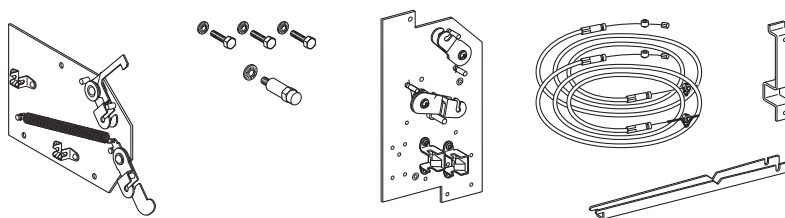


Cable Door Interlock

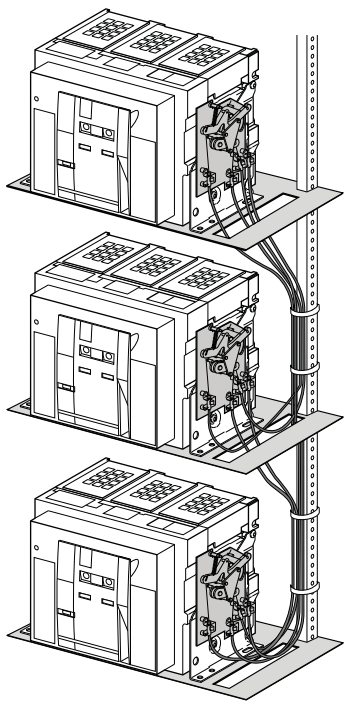
The cable door interlock prevents the panel door from being opened if the circuit breaker is closed.

- Optional.
- Must be installed after the circuit breaker is installed in the enclosure.

Figure 51 – Cable Door Interlock Kit



Source Changeover Interlock



The source changeover interlock kit provides interlocking between three circuit breakers.

- Kit S48608 provides interlocking between two “main” circuit breakers connected to the same power source and a third circuit breaker connected to a generator power source.
 - Four interlocking positions are possible.
 - The generator circuit breaker is “locked open” when either or both of the main circuit breakers are closed.
- Kit S48609 provides interlocking between two “main” circuit breakers connected to the same power source and one “tie” or external source circuit breaker.
 - The tie circuit breaker can be in first, second or third position.
 - Two of the three circuit breakers can be in the closed position at any given time.
- Kit S48610 provides interlocking between three “main” circuit breakers connected to a single power source.
 - Only one of the three circuit breakers can be in the closed position at any give time.
 - The other two circuit breakers will be held in the “locked open” position.

Table 9 – Possible Interlock Configurations

	Vertical Configuration		Horizontal Configuration	
	W-Frame	Y-Frame	W-Frame	Y-Frame
W-Frame	3	3	3	2 x W-Frame 1 x Y-Frame
Y-Frame	3	3	2 x W-Frame 1 x Y-Frame	Contact the Field Sales Office

Section 6— Accessories

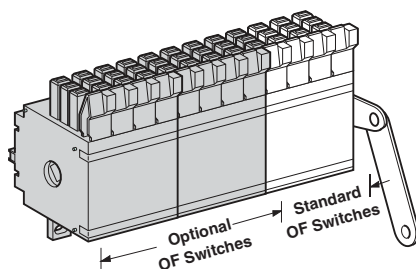
This section describes commonly used accessories. For a complete listing of available accessories, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric™ website.

Auxiliary Switches (OF)

Auxiliary switches (OF) change state when the minimum isolating distance between the main contacts is reached.

- Standard, four switches per circuit breaker, rated 10 A.
- Optional additional OF switches available, rated 6 A:
 - Two blocks of four additional OF switches are available with push-in terminal blocks.
 - One block of four additional OF switches are available with ring terminal blocks.
- Indicates the position of the main contacts on the circuit breaker.
- Form C contacts, NO/NC with common neutral.

Figure 52 – Switches (OF)

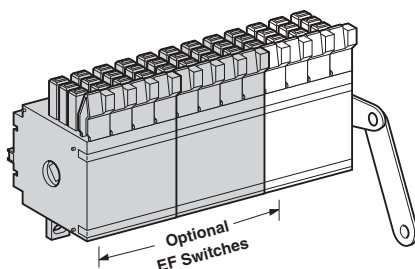


Connected/Closed Switches (EF)

Connected/closed switches (EF) combine “connected device” and “closed device” information, indicating “the circuit is closed.”

- Optional.
- Maximum of eight switches per circuit breaker with push-in terminal blocks.
- Each switch becomes associated with an OF switch when installed in its connector location.
- Form C contacts, NO/NC with common neutral.
- Not available with ring terminal connector.

Figure 53 – Switches (EF)



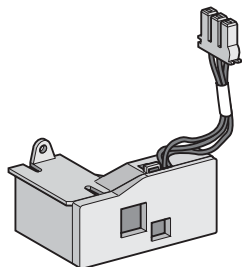
Overcurrent Trip Switch (SDE)



The overcurrent trip switch (SDE) provides remote indication that the circuit breaker has opened because of an electrical fault.

- Standard
- Not available on non-automatic switches
- One form C contacts, NO/NC with common neutral

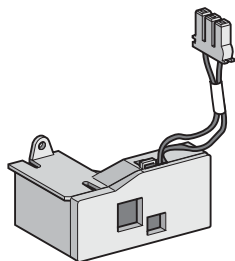
Additional Overcurrent Trip Switch (SDE2)



The additional overcurrent trip switch (SDE2) provides remote indication that the circuit breaker has opened because of an electrical fault.

- Optional.
- Not available on non-automatic switches
- Not compatible with RES option
- One form C contact, NO/NC with common neutral

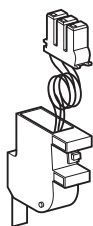
Electric Reset (RES)



The electric reset (RES) resets the circuit breaker remotely after an electrical fault.

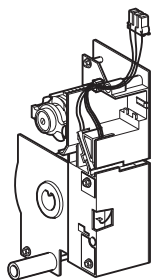
- Optional
- Not compatible with SDE2 option

Ready-to-Close Switch (PF)



- The ready-to-close switch (PF) indicates that the following conditions are met and the circuit breaker can be closed:
 - The circuit breaker is open.
 - The closing springs are charged.
 - The circuit breaker is not locked/interlocked in open position.
 - There is no standing closing order.
 - There is no standing opening order.
- Optional.
- One form C contacts used for push-in connector, NO/NC with common neutral.
- NO contact used for ring terminal connector.

Spring-Charging Motor (MCH)



The spring-charging motor (MCH) charges the closing springs automatically after the circuit breaker closes.

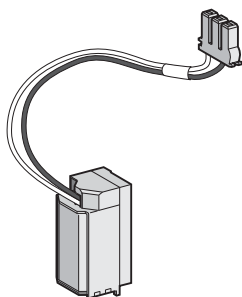
- Optional
- Charging time: 4 seconds maximum
- Operating rate: 3 cycles/minute, maximum
- Minimal voltage: 0.85–1.1 of rated voltage
- Maximum power consumption: 180 VA

Spring-Charged Contact (CH)

The spring-charged contact (CH) indicates that the circuit breaker is charged.

- Standard with the spring-charging motor
- Form C contacts, NO/NC with common neutral

Shunt Trip (MX1 / MX1-COM / MX2) Shunt Close (XF / XF-COM)



Shunt trip: opens the circuit breaker when energized.

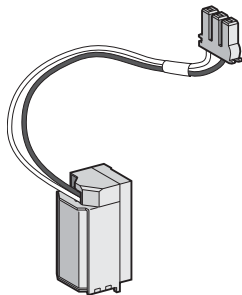
Shunt close: closes the circuit breaker when energized, if the device is ready to close.

NOTE: For a circuit breaker having a circuit breaker communications module (BCM) installed, order MX1-COM and/or XF-COM. These will have three wires instead of the two shown in the illustration.

- Optional.
- One or two shunt trips per circuit breaker.
- One shunt close per circuit breaker.
- Shunt trip and shunt close are the same coil, their action is determined by the location of the coil.
- Circuit breaker response time
 - MX1, MX1-COM and MX2 opening time:
50 ms $\pm$ 10 ms
 - XF and XF-COM closing time:
70 ms $\pm$ 10 ms for NW $\leq$ 4000 A
80 ms $\pm$ 10 ms for NW > 4000 A
- **NOTE:** Shunt trip (MX1) and shunt close (XF) circuits must be energized for a minimum of 200 ms.
- Operating thresholds:
 - MX1, MX1-COM, and MX2:
0.7 to 1.1 x rated voltage
 - XF and XF-COM:
0.85 to 1.1 x rated voltage
- Continuous power supply possible (continuous duty).
For MX1-COM/XF-COM use the comm command for continuous duty. The bypass circuit through terminal C2/A2 is only for momentary duty (0.5 sec. max).
- Maximum power consumption: 4.5 VA maintained, 200 VA inrush.
- MX1-COM can be operated remotely by the circuit breaker communication module (BCM).

XF-COM can be operated remotely by either the electrical close button (BPFE) or the circuit breaker communication module (BCM).

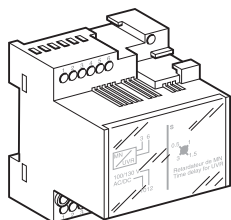
Undervoltage Trip (MN)



The undervoltage trip (MN) opens the circuit breaker when its supply voltage drops below the threshold voltage.

- Optional
- Not compatible with the MX2 shunt trip
- Response time: 90 ms (+5 ms/-5 ms)
- Operating thresholds:
 - Opening: 0.35 to 0.7 x rated voltage
 - Closing: 0.85 x rated voltage
- Continuous power supply required to keep circuit breaker closed
- Maximum power consumption: 20 VA

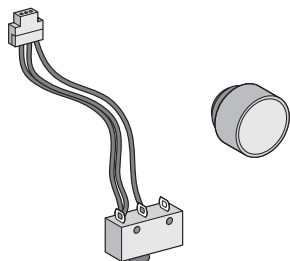
Time-Delay Module for Undervoltage Trip (MNR)



The time-delay module for the undervoltage trip (MNR) can be used to set an adjustable time delay before the undervoltage trip opens the circuit breaker in order to prevent nuisance tripping from a momentary voltage drop. The time-delay mechanism is connected in series with the undervoltage trip (MN) and is installed outside of the circuit breaker.

- Optional
- Available in fixed or adjustable delay versions:
 - Delay time: 0.5 s, 1 s, 1.5 s, 3 s
 - Fixed time: 0.25 s

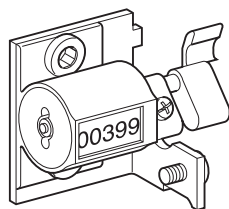
Electrical Closing Push Button (BPFE)



The electrical closing push button (BPFE) closes the circuit breaker electrically using the shunt close (XF).

- Optional
- Located on accessory cover of circuit breaker
- Requires installation of shunt close (XF-COM)
- Cannot be used in combination with a communication module

Operations Counter (CDM)



The operations counter (CDM) registers the total number of operating cycles for the circuit breaker.

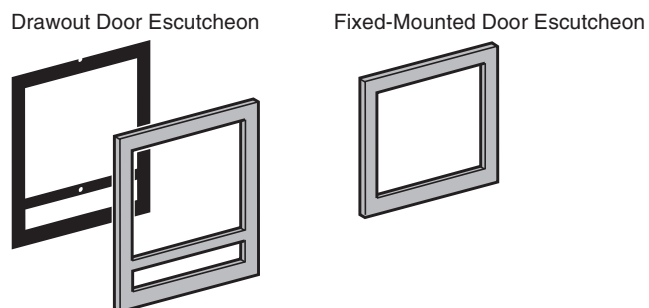
- Optional
- Can be installed on circuit breaker with or without spring charging motor

Door Escutcheon (CDP)

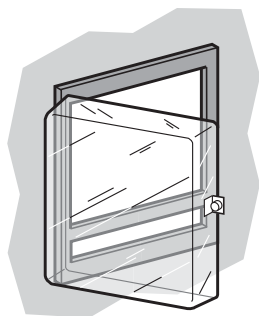
The door escutcheon (CDP) provides an IP40, IK07 (equivalent to NEMA 1) seal for the door.

- Standard

Figure 54 – Door Escutcheon (CDP)



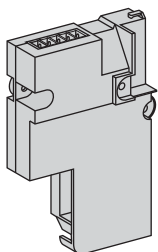
Transparent Cover (CCP)



Mounted on the door escutcheon (CDP), the transparent cover (CCP) provides a IP55, IK10 (equivalent to NEMA 3R/12) seal.

- Optional
- Drawout circuit breaker only

Circuit Breaker Communication Module (BCM)



The circuit breaker communications module (BCM) provides communication between circuit breaker trip unit and the communication network.

- Optional on 3.0A, 5.0A, and 6.0A trip units.
- Standard on 5.0P, 6.0P, 5.0H, and 6.0H trip units.
- Not compatible with the 3.0 or 5.0 trip units.
- Dedicated switches can be used to read status of circuit breaker.
- Actuators (MX/XF) can be used to control the circuit breaker.

I/O (Input/Output) Module



The I/O (input/output) application module for low-voltage circuit breakers links the communication network with the circuit breaker communication module. It connects the Masterpact circuit breaker to a ULP (Universal Logic Plug) system with built-in functions and applications.

- Delivered with the drawout circuit breakers ordered with the COM option for cradle management.
- Must be installed on a DIN rail near the device.
- Must be connected to the ULP system and to the position contacts (CD, CT, CE) that transmit the position of the device in the cradle.
- Compliant with the ULP system specifications.
- Two I/O application modules can be connected in the same ULP network.

The I/O application module resources are:

- Six digital inputs that are self powered for either NO and NC dry contact or pulse counter.
- Three digital outputs that are a bistable relay (5 A maximum).
- One analog input for PT100 temperature sensor.

Ethernet Interface Module (IFE)



The IFE interface and IFE interface + gateway enable Masterpact NW circuit breakers to be connected to an Ethernet network.

- Provides an Ethernet access to one or several LV circuit breakers.
- Functions:
 - Interface: connects one circuit breaker to the IFE interface using its ULP port.
 - Gateway: connects several circuit breakers on a Modbus network using the IFE interface + gateway master Modbus port.
- Dual 10/100 Mbps Ethernet port for simple daisy chain connection.
- Device profile web service for discovery of the IFE interface, IFE interface + gateway on the LAN.
- ULP compliant for placing the IFE interface in the switchboard.
- Ethernet interface for Masterpact circuit breakers.
- Gateway for Modbus-SL connected devices (IFE interface + gateway only).
- Embedded set-up web pages.
- Embedded monitoring web pages.
- Embedded control web pages.
- Built-in e-mail alarm notification.

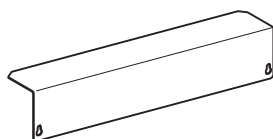
Modbus Interface Module (IFM)



An IFM Modbus communication interface is required for connection of a Masterpact circuit breaker to a Modbus network.

- Requires the circuit breaker be provided with a ULP port. The port is available on the BCM embedded module.
- The IFM is defined as an IMU (Intelligent Modular Unit) in the ULP connection system documentation.
- Connects the circuit breaker as a slave to the Modbus master. Its electrical values, alarm status, open/close signals can be monitored or controlled by a Programmable Logic Controller or any other system.

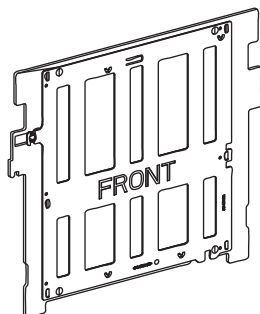
Terminal Cover (CB)



The terminal cover (CB) prevents access to the accessory terminal blocks.

- Drawout circuit breaker only
- Optional
- Mounts on the cradle

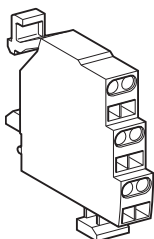
Shutters



The shutters automatically block access to the primary connectors when the circuit breaker is in the test or disconnected position.

- Drawout circuit breaker only
- Optional
- For information on locking the shutters, see page 42

Cradle Position Switch (CE, CD, and CT)



The cradle position switch (CE, CD, or CT) indicates the circuit breaker position in the cradle.

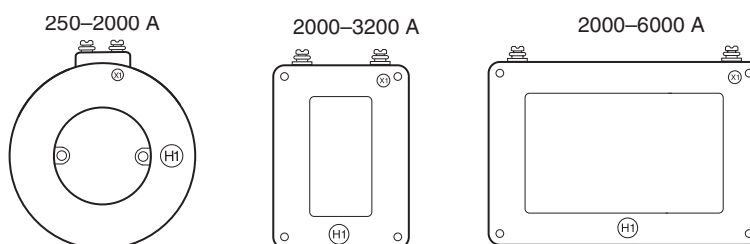
- Drawout circuit breaker only
- Optional
- One to three position switches for each type:
 - CE: Connected
 - CD: Disconnected
 - CT: Test
- Normally-open and normally-closed contacts
- Available as push-in connector switch (shown) or ring tongue terminal connector switch

Metering Current Transformers

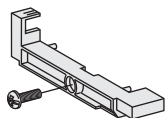
The metering current transformer is used to scale line currents down to usable values for measuring or control purposes.

- Optional (for drawout circuit breaker only)
- Mounts inside the cradle
- Accurate with the 0.3% accuracy class
- Five ampere output at full load
- A standard wiring harness is provided when metering current transformers are factory mounted

Figure 55 – Metering Current Transformers



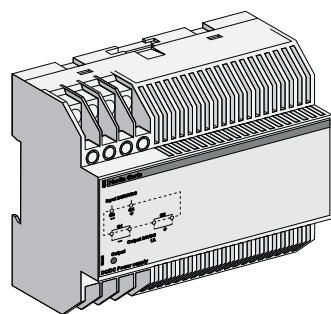
Sensor Plugs



The sensor plug is used to set the current sensor rating (I_n) of the circuit breaker.

- Standard
- Field replaceable

External Power Supply Module

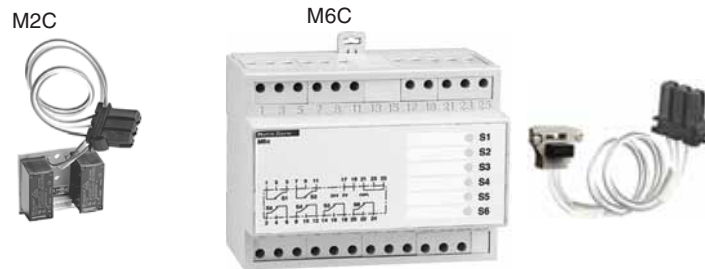


The external power supply module is used with the Micrologic™ A, P, and H trip units to provide external power to the trip unit.

- Optional
- Makes it possible to:
 - Display currents less than 20% of sensor (I_n)
 - Maintain display of last trip unit status even after opening of circuit breaker
 - Store in memory the value of the interrupted current and time-stamp event (P and H trip units only)
- Provides power to the circuit breaker communication module and the cradle communication module
- Field replaceable
- Output:
 - voltage: 24 Vdc
 - current: 1 A
 - ripple < 5%.
- Input Voltage:
 - Vac: 110–130, 200–240, 380–415
 - Vdc: 24–30, 48–60, 100–125
 - 10 VA/10 W consumption

- Optional
- For Micrologic P and H trip units only
- Programmable via the trip unit or through the communications network
- Requires 24 Vdc power supply
- Contact ratings:
 - 5 A/240 Vac
 - 1.8 A/24 Vdc
 - 1.5 A/48 Vdc
 - 0.4 A/125 Vdc

Figure 56 – Programmable Contact Modules (M2C and M6C)



- Optional
- For Micrologic A, P, and H trip units only
- Requires external power supply:
 - 120 Vac or 24 Vdc
 - 220/240 Vac or 24 Vdc

Ground-Fault Interface Module (MDGF/SGR)

The ground-fault interface module provides interface between trip unit types A, P, or H (with MDGF or SGR) and MDGF sensor(s).

- Optional
- Field installable
- For use on circuit breakers with 400 A or higher sensor.

Figure 57 – Ground-Fault Interface Module (MDGF/SGR) and Sensor



Hand-Held Test Kit



The hand-held test kit is used to verify trip unit operation and the tripping and pole-opening sequence.

- Optional
- Can also be used to:
 - Inhibit thermal imaging for primary injection testing
 - Inhibit ground fault for primary injection testing
 - Self-restrain zone-selective interlocking (ZSI)
 - Supply control power to the trip unit for settings via the keypad when the circuit breaker is open (Micrologic A, P, and H trip units only)

Full-Function Test Kit



The full-function test kit is used to verify LSIG functionality.

- Optional
- Can be used to check trip unit operation, for example:
 - Display of settings
 - Operating tests on the electronic component
 - Automatic and manual tests on protection functions (trip curve verification)
 - Tests on the zone-selective interlocking (ZSI) functions
 - Inhibit thermal imaging for primary injection testing
 - Inhibit ground fault for primary injection testing
 - Self-restrain zone-selective interlocking (ZSI)
- Can also be used to:
 - Check mechanical operation of the circuit breaker
 - Check the electrical continuity of the connection between the MITOP (tripping coils) and the trip unit

Print the trip unit and circuit breaker test report when used in conjunction with a PC (FFTK Report Generator software, Catalog No. FFTKRPT-V1-0, is required

Section 7— Installing Accessories

Accessories can be installed in an installed circuit breaker or an installed cradle.

Installing Circuit Breaker Accessories

Drawout Circuit Breaker

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

Place circuit breaker in disconnect position. See Drawout Circuit Breaker Disconnection, page 24, for instructions on disconnecting the circuit breaker.

Fixed-Mounted Circuit Breaker

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Turn off all power supplying this equipment before working on or inside equipment.

Install Circuit Breaker Accessories

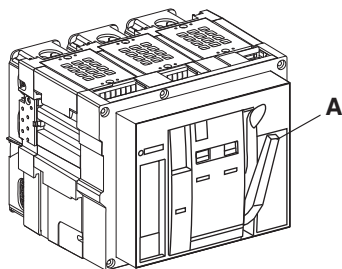
NOTICE

HAZARD OF EQUIPMENT DAMAGE

Use caution when removing or replacing the circuit breaker accessory cover. The spring-charging handle (**Figure 58, A**) extends through the circuit breaker accessory cover and can be damaged when removing the accessory cover.

Failure to follow these instructions can result in equipment damage.

Figure 58 – Spring Charging Handle



If installing electrical accessories, remove the accessory cover.

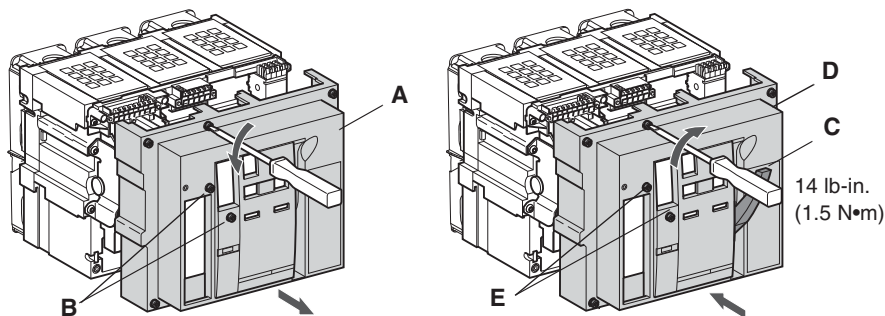
1. Loosen the accessory cover screws and remove the accessory cover (**Figure 59, A**).

NOTE: Screws (**B**) are for Type L, LF, L1 and L1F circuit breakers only.

2. Install accessories as instructed in the instructions packed with the individual accessory.
3. Replace the accessory cover by pulling the spring-charging handle (**C**) forward and sliding the circuit breaker accessory cover (**D**) down over the handle. Tighten the accessory cover screws.

NOTE: Screws (**E**) are for Type L, LF, L1 and L1F circuit breakers only.

Figure 59 – Install Accessories



Drawout Circuit Breaker

The drawout circuit breaker can now be placed back in connected position. See Drawout Circuit Breaker Connection, page 22 for instructions on connecting the circuit breaker.

Fixed-Mounted Circuit Breaker

The fixed-mounted circuit breaker can now be placed back in service.

Installing Cradle Accessories

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment.
2. If circuit breaker is installed in cradle, remove it following the instructions in “Circuit Breaker Removal” on page 27.
3. Install each accessory as instructed in the instructions packed with the individual accessory.
4. Replace the circuit breaker in the cradle, see “Circuit Breaker Installation” on page 25.

The drawout circuit breaker can now be placed back in connected position. See Drawout Circuit Breaker Connection, page 22 for instructions on connecting the circuit breaker.

Section 8— Testing, Maintenance and Troubleshooting

For information on field testing, maintenance, and troubleshooting see bulletin 0613IB1201, *Masterpact NT and NW Field Testing and Maintenance Guide*, which can be found on the Schneider Electric™ website:

<http://www.schneider-electric.com>

For application assistance, please call 1-888-778-2733.

Section 9— Repacking

Materials Required

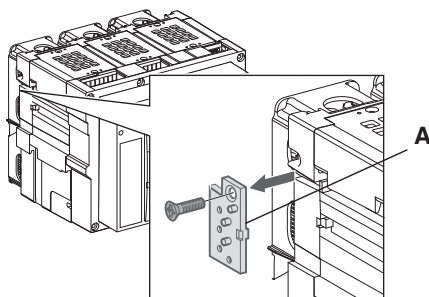
- Pallet
- Packing Carton
- Shipping Brackets, insert nuts and bolts
- Four Carriage Bolts, 3/8 x 12, 2 in. (50 mm) long minimum
- Four Washers, 3/8 in.
- Four Nuts, 3/8 x 12

Repacking

Repacking Circuit Breaker

1. If drawout circuit breaker is installed in the cradle, remove it following the instructions in “Circuit Breaker Removal” on page 27.
If fixed-mounted circuit breaker is installed in equipment, remove it following the instructions in the bulletin shipped with the circuit breaker.
2. Remove the rejection pin plate (**Figure 60, A**) from side of the circuit breaker, if installed.

Figure 60 – Remove Rejection Pin Plate



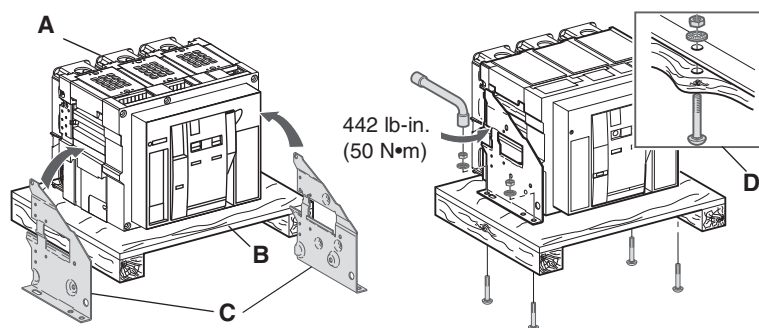
NOTICE**HAZARD OF EQUIPMENT DAMAGE**

Circuit breaker must be secured to the pallet with shipping brackets.

Failure to follow these instructions can result in equipment damage.

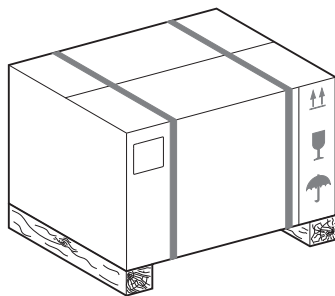
3. Place the circuit breaker (**Figure 61, A**) onto the pallet (**B**).
4. For drawout circuit breakers, place the shipping brackets (**C**) on the circuit breaker. If shipping brackets are needed, consult the local field office. Bolt the shipping brackets to the circuit breaker. (Fixed-mounted circuit breakers use the mounting bracket installed on the circuit breaker as the shipping bracket.)
5. Secure the shipping brackets to pallet with four bolts, nuts and washers (**D**).

Figure 61 – Secure Circuit Breaker



6. Place the packing carton over the circuit breaker and secure with tape.

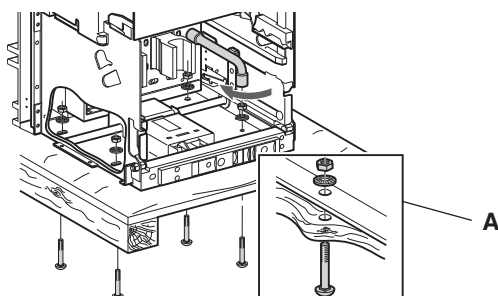
Figure 62 – Secure Packing Carton



Repacking Cradle

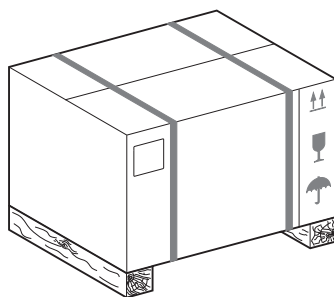
1. If the cradle is installed in equipment, remove it following the instructions in the installation bulletin shipped with the circuit breaker.
2. Secure the cradle to the pallet using four bolts, nuts and washers (**Figure 63, A**).

Figure 63 – Secure Cradle



3. Place the packing carton over the cradle and secure with tape.

Figure 64 – Secure Packing Carton

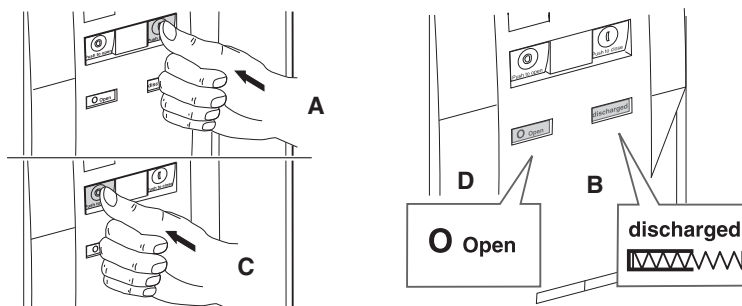


Repacking Circuit Breaker and Cradle

NOTE: 3200 A L1 and all 4000, 5000 and 6000 A circuit breaker and cradle units must be shipped separately.

1. Press the “Push to close” button (**Figure 65, A**) to discharge the spring (**B**).
2. Press the “Push to open” button (**C**) to open contacts (**D**).

Figure 65 – Turn Off Circuit Breaker



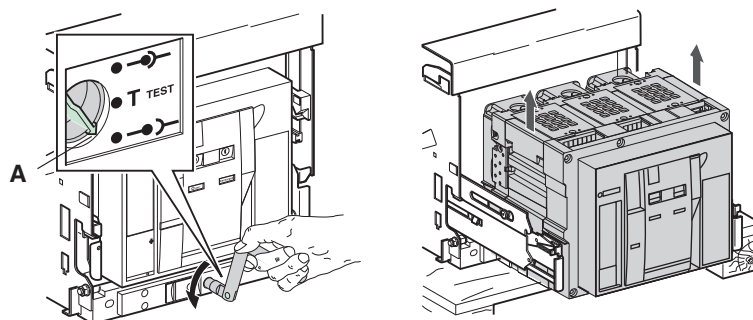
NOTICE**HAZARD OF EQUIPMENT DAMAGE**

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

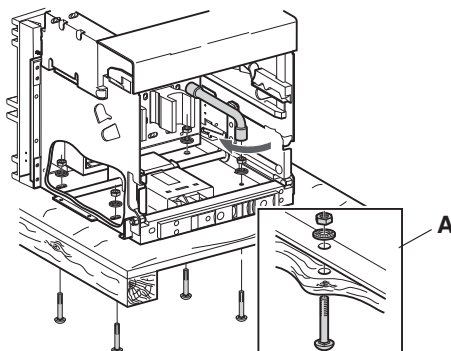
3. Rack the circuit breaker to the disconnected position (Figure 66, A) (refer to Drawout Circuit Breaker Disconnection, page 24).
4. Remove the circuit breaker following the instructions in “Circuit Breaker Removal” on page 27.

Figure 66 – Remove Circuit Breaker



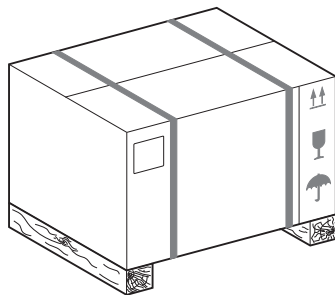
5. If the cradle is installed in equipment, remove it following the instructions in the installation bulletin shipped with the circuit breaker.
6. Secure the cradle to the pallet using four bolts, nuts and washers (Figure 67, A).
7. Replace the circuit breaker in the cradle following the instructions in “Circuit Breaker Installation” on page 25.

Figure 67 – Remove Circuit Breaker and Secure Cradle



8. Place the packing carton over cradle and secure carton with tape.

Figure 68 – Secure Packing Carton



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Replaces 0613IB1204 R05/14

Maintenance and Field Testing Guide

for Masterpact™ NT and NW Circuit Breakers

Class 0613

Instruction Bulletin

0613IB1202 R08/15
08/2015

Retain for future use.



Hazard Categories and Special Symbols



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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Section 1— Introduction

The service life of circuit breakers depends on proper application, correct installation, environmental conditions and preventive maintenance.

To maintain the device's operating and safety characteristics, Schneider Electric™ recommends that systematic checks and periodic maintenance be carried out by qualified personnel.

The standard generally used as a basis for field-testing requirements is the National Electrical Manufacturers Association® standard, NEMA AB 4, "Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications". If additional information, assistance, or on-site service is required contact the local field sales office.

The inspection, preventive maintenance, and field-testing instructions provided in this document are intended for use with Masterpact™ NT and NW circuit breakers with the Micrologic™ electronic trip system. Please read this document carefully and keep it at hand. It provides detailed information on:

- the various types of maintenance required.
- what must receive maintenance.
- the risks involved if the component ceases to operate correctly.
- what is understood by the terms normal, improved and severe environment and operating conditions.
- the periodic preventive maintenance that should be carried out under normal environment and operating conditions as well as the level of competence required for the operations.
- the environment and operating conditions that accelerate device aging and the limits governing use of mechanical and electric accessories and subassemblies.
- the product guides available in order to maintain the device in proper operating condition.

This publication is not intended, nor is it adequate, to verify proper electrical performance of a circuit breaker that has been disassembled, modified, rebuilt, refurbished, or handled in any manner not intended or authorized by Schneider Electric.

Safety Precautions

1. Only qualified electrical workers with training and experience on low-voltage circuits should perform work described in these instructions. Workers must understand the hazards involved in working with or near low-voltage equipment. Such work should be performed only after reading this complete set of instructions.
2. Some inspections or procedures require that certain parts of the electrical system remain energized at hazardous voltage during the procedure. Observe all specific safety messages (Danger, Warning, Caution) throughout this manual.
3. Wear personal protective equipment, recognize potential hazard, and take adequate safety precautions when performing the procedures outlined in this manual.

Types of Maintenance

There are three types of maintenance discussed in this bulletin:

- Corrective
- Preventive
- Predictive

Corrective Maintenance

Corrective maintenance repairs items that are no longer functioning properly.

Incidents During System Startup

Many problems during system startup result from non-observance of the startup instructions or lack of knowledge concerning the equipment and/or switchgear procedures. Schneider Electric user guides contain instructions for operators or maintenance personnel on how to correct these problems.

- The list of the available user guides and data bulletins may be found at the end of this document.
- The PDF files for these documents may be downloaded from the www.schneider-electric.com site.

Incidents During Operation

Contact the local field sales office.

Preventive Maintenance

Preventive maintenance consists in carrying out, at predetermined intervals or according to prescribed criteria, checks intended to reduce the probability of a failure or deterioration in the operation of a system.

There are two types of preventive maintenance:

- Periodic maintenance
For each type of product, maintenance recommendations are intended to maintain systems or their subassemblies in correct operating condition over the targeted service life, and must be carried out according to the time intervals stipulated in this document.
Under no circumstances can Schneider Electric be held responsible for any damage caused by the failure of a device if the periodic checks were not carried out in accordance with the recommendations in this document.
- Conditional maintenance
Conditional maintenance is performed when programmed alarms indicate that a predefined threshold has been reached. To that end, sensors must be installed on the switchgear and in the switchboard.
To a certain extent, conditional maintenance reduces the recommended periodic maintenance that requires an annual shutdown of the installation. Conditional maintenance is the means to optimize installation maintenance. For more information on the possibilities offered by conditional maintenance, contact Schneider Electric Services.

Predictive Maintenance

Predictive maintenance is based on the recording and analysis of system parameters to detect drift from the initial state and significant trends. Using predictive maintenance, the customer can anticipate the corrective action required to ensure equipment safety and continuity of service, and plan the action for the most convenient time.

Section 2— Preventive Maintenance

The tables in this section provide recommended preventive maintenance and time intervals. Recommendations are based on the operating conditions of the device.

Table 1 – Preventive Maintenance

Maintenance Type	Done By	Operating Conditions	Frequency
Type II	Certified customer employee	Normal	Every year
		Favorable	Every two years
		Severe	Twice a year
Type III	Certified customer employee	Normal	Every two years
		Favorable	Every four years
		Severe	Every year
Type IV	Schneider Electric Service	All	• Every five years • After tripping due to a short-time or instantaneous short-circuit • After five trips due to overloads.
Storage Check	Certified customer employee	All	After prolonged storage

Operating Conditions

Normal Conditions

Table 2 – Normal Operating and Environmental Conditions

Temperature	Average annual temperature < 77°F (25 °C) outside the switchboard
Percent load	< 80% of I_n (sensor rating)
Harmonics	Harmonic current per phase < 30% of I_n (sensor rating)
Relative humidity	< 70%
Corrosive atmosphere	Device installed in environment category 3C1 or 3C2 (IEC 60721-3-3) in Tables 14 and 20
Salt environment	No salt mist
Dust	Low level
	Device protected in switchboard equipped with filters or ventilated IP54 (Nema 3) enclosure
Vibration	Permanent vibration < 0.2 g

Under these conditions, the maintenance that must be carried out every one, two or five years on Masterpact NT/NW subassemblies and the level of competence required on the part of service agents are described in the tables on pages 11, 12, and 13.

At the end of each five year period, the maintenance guide must be systematically repeated.

Beyond the above limits, the circuit breakers suffer accelerated aging that may result in malfunctions. For this reason, periodic checks must be carried out at shorter time intervals. On the other hand, when special efforts are made to improve the operating and environment conditions, the preventive-maintenance operations can be carried out less often.

Favorable Conditions

The time interval between Type II and Type III preventive maintenance can be doubled if **all** of the conditions presented below are met. The Type IV preventive maintenance program is still recommended for every 5th year.

Table 3 – Favorable Operating and Environmental Conditions

Protection	Device is protected from environmental conditions
Temperature	Average annual temperature < 77°F (25 °C) outside the switchboard. The device is installed in an air-conditioned room or in a ventilated enclosure
Percent Load	< 50% of I _n (sensor rating)
Relative Humidity	< 50%
Corrosive Atmosphere	Device installed in a protected room (air is conditioned and purified)
Salt Environment	None
Dust	Negligible Device protected in switchboard equipped with filters or ventilated IP54 (Nema 3) enclosure
Vibration	None

Figure 1 – Favorable Conditions



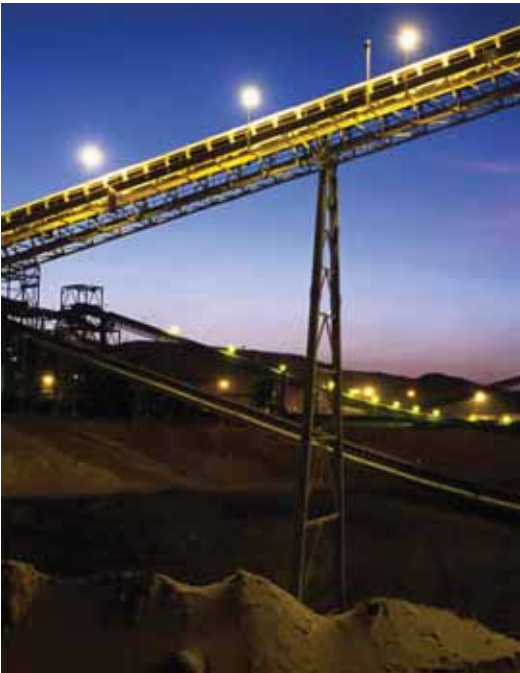
Severe Conditions

The time interval between two preventive maintenance visits must be reduced by half **if any of the conditions** presented below are present unless the device is protected from the condition.

Table 4 – Severe Operating and Environmental Conditions

Temperature (annual average)	Average annual temperature between 95 °F and 113 °F [35 °C and 45 °C] around the switchboard
Percent Load	> 80% of I _n (sensor rating)
Relative Humidity	> 80%
Corrosive Atmosphere	Device installed in environment category 3C3 or 3C4 without any particular protection, see Table 14
Salt Environment	Installation < 6.2 miles (10 kilometers) from seaside and device without any particular protection
Dust	High level of dust and equipment is not protected See Table 13
Vibration	Continuous vibrations between 0.2 and 0.5 g

Figure 2 – Severe Conditions



Preventive Maintenance Operations

Level II Preventive Maintenance

It is recommended that Level II preventive maintenance be done every year.

Level II maintenance consists of minor preventive maintenance such as greasing and operating checks, as well as repairs by standard exchange of certain assemblies, carried out by a certified customer employee according to the manufacturer maintenance instructions. See the instruction bulletin and user guides for procedures. See Section 4 for what must be maintained.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing maintenance inspections. Assume that all circuits are live until they are completely de-energized, tested, grounded and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 5 – Level II Preventive Maintenance

Check	Year					Tool
	1	2	3	4	5 ¹	
Device						
Check the general condition of the device (accessory cover, trip unit, case, cradle, connections)	X	X	X	X	X	None
Mechanism						
Open/close device manually and electrically	X	X	X	X	X	None
Charge device electrically	X	X	X	X	X	None
Check complete closing of device's poles	X	X	X	X	X	None
Check number of device operating cycles	X	X	X	X	X	Operation counter
Breaking Unit (Arc Chutes + Contacts)						
Check the filters cleanliness and the attachment of the arc-chute	X	X	X	X	X	Racking crank
Control Accessories						
Check auxiliary wiring and insulation	X	X	X	X	X	None
Trip Unit						
Trip trip unit using test tool and check operation of contacts SDE and SDE2	X	X	X	X	X	HHTK or FFTK
Check ground fault protection function (Micrologic 6.0)	X	X	X	X	X	None
Device Locking						
Open and close keylocks installed on device	X	X	X	X	X	None
Open and close padlock system installed on device	X	X	X	X	X	None
Cradle (For Drawout Circuit Breakers)						
Remove device from cradle and put it back	X	X	X	X	X	None
Check operation of position contacts (CE, CT, CD, EF)	X	X	X	X	X	None
Check operation of safety shutters	X	X	X	X	X	None
Cradle Locking						
Open and close keylocks installed on cradle	X	X	X	X	X	None
Operate padlocking system	X	X	X	X	X	None

¹ These checks and tests will be carried out by Schneider Electric Services in case of diagnostic the fifth year (see page 13).

Level III Preventive Maintenance

It is recommended that Level III preventive maintenance be done every two years.

Level III maintenance consists of preventive maintenance such as general adjustments, troubleshooting and diagnosis of breakdowns, repairs by exchange of components or functional parts, minor mechanical repairs, carried out by a qualified customer technician using the tools specified in the manufacturer maintenance instructions. See the instruction bulletin and user guides for procedures.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing maintenance inspections. Assume that all circuits are live until they are completely de-energized, tested, grounded and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 6 – Level III Preventive Maintenance

Check	Year					Tool
Mechanism	1	2	3	4	5 ¹	
Check spring charging motor charging time at 0.85 of rated voltage		X		X	X	Stopwatch + external power supply
Check general condition of mechanism		X		X	X	Screwdriver
Breaking Unit (Arc Chutes + Contacts)						
Check condition of breaking unit		X		X	X	Screwdriver
Control Accessories						
Check operation of indication contacts (OF / PF / MCH)		X		X	X	External power supply
Check closing operation of control auxiliary XF		X		X	X	Ohmmeter
Check opening operation of control auxiliary MX at 0.70 of rated voltage		X		X	X	External power supply
Check operation of control auxiliary MN/MNR between 0.35 and 0.7 of rated voltage		X		X	X	External power supply
Check delay of MNR devices at 0.35 and 0.7 of rated voltage		X		X	X	External power supply
Check MX tripping time		X		X	X	Tester
Trip Unit						
Check tripping curves using test tool, signaling LED (tripped, overload). Save results on PC		X		X	X	FFTK FFTK report generator
Cradle (For Drawout Circuit Breakers)						
Remove dirt and any foreign material, then regrease cradle		X		X	X	Mobilith® SHC00
Regrease disconnecting contact clusters (specific case of corrosive atmosphere)		X		X	X	Mobilith SHC00
Power Connections						
Check and tighten loose connections	Only after a visual inspection showing overheating marks					Racking crank

¹ These checks and tests will be carried out by Schneider Electric Services in case of diagnostic the fifth year (see page 13).

Level IV Preventive Maintenance

It is recommended that Level IV preventive maintenance be done every five years.

Level IV maintenance consists of manufacturer diagnostic and replacement of components by the Schneider Electric Services support department. See the instruction bulletin and user guides for procedures.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing maintenance inspections. Assume that all circuits are live until they are completely de-energized, tested, grounded and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 7 – Level IV Preventive Maintenance

Check	Year					Tool
Case	5	10	15	20	25	
Measure insulation resistance	X	X	X	X	X	Ohmmeter
Mechanism						
Check tripping forces (crescent shaped part)	X	X	X	X	X	Tester
Breaking Unit (Arc Chutes + Contacts)						
Measure resistance of input/output contact	X	X	X	X	X	Ohmmeter + injection unit
Control Accessories						
Check the service life of the accessories XF, MX, MN	X	X	X	X	X	“service life” software
Preventative replacement of control accessories	—	—	X	—	—	None
Micrologic Trip Unit						
Check continuity of the tripping chain by primary injection for each phase	X	X	X	X	X	Injection unit
Cradle (For Drawout Circuit Breakers)						
Check connection/disconnection torque	X	X	X	X	X	Racking crank
Clean and regrease racking screw	X	X	X	X	X	Grease

Maintenance After Storage

Storage Conditions

Devices must be stored in a dry, ventilated area, protected from rain, water and chemical agents. They must be well protected against dust, rubble, paint, etc.

If storage is for an extended period, the following storage conditions are necessary:

- relative humidity in the room must be maintained below 70%.
- circuit breakers with trip units without LCD displays may be stored in the original packaging at temperatures between -40 °F to +185 °F (-40 °C to +85 °C).
- circuit breakers with trip units with LCD displays may be stored in the original packaging at temperatures between -13 °F to +185 °F (-25 °C to +85 °C).
- devices must be stored in the open (OFF) position with the charging springs discharged.

Checks and Maintenance

After extended storage, the checks below must be carried out before installation to ensure correct device operation.

Storage ≤ 2 years

Run the Level II and III second year program on the subassemblies below:

- mechanism
- trip unit
- device and cradle locking
- cradle

Storage > 2 years

Run the Level III and IV fifth year diagnostic program on the subassemblies below:

- mechanism
- control accessories
- trip unit
- device and cradle locking
- cradle

If the devices were stored under severe conditions (high temperature, corrosive atmosphere), it is necessary to:

- check the surface condition of the metal parts (zinc) and the copper parts (silver coatings [Ag] or tinning [Sn]).
- check the greasing for the device and cradle.
- regrease the clusters and check primary contacts.

Section 3— Accelerated Aging

Causes of Accelerated Aging



A switchboard and the switchgear age, whether they are in operation or not. Aging is due primarily to the influence of the environment and the operating conditions.

Influence of the environment

A device placed in a given environment is subjected to its effects.

The main environmental factors that accelerate device aging are:

- temperature
- percent load
- relative humidity
- salt environment
- current harmonics
- dust
- corrosive atmospheres.

Table 8 – Ambient Temperature (Outside the Switchboard)¹

Influence	Appearance	Consequences
The mechanical characteristics of plastic parts (insulation, case) are increasingly deteriorated by temperature the higher it rises.	Change in color	Breaking of parts leading to failure of functions
Hardening of grease Elimination of grease on primary contact clusters	Change in color and viscosity Caramel color of grease on clusters	Device cannot be operated Increase of racking forces exerted on clusters
Deterioration of insulating varnishes on coils	Burning smell.	Failure of coils (CT, MN, MX, XF, MCH, electrical reset).
Hardening of glues on labels	Visual	Loss of labels
Deterioration of electronic components	Modified display of LCDs	Loss of display Nuisance tripping or no tripping
Deterioration of opto-electronic devices and SCRs.	Not identifiable	Possible transmission of erroneous orders
Loss of battery backup power	Not identifiable	Fault indications not displayed
Temperature Thresholds in °C		
≤ 77°F (25°C)	78–95°F (26–35°C)	96–113°F (36–45°C)
Optimum operating conditions	An 18°F (10°C) increase in the ambient temperature is equivalent to a 5% increase in the percent load	A 35°F (20°C) increase in the ambient temperature is equivalent to a 10% increase in the percent load
Recommendation		
Preventive maintenance		
Implement the standard program	Carry out more frequent periodic checks (see page 8)	Carry out more frequent periodic checks (see page 8)
Installation		
No particular precautions required	No particular precautions required	Install forced-air ventilation in the switchboard or air-conditioning for the electrical room

¹ The ambient temperature affects the device temperature, which is affected by the percent load. Major variations in temperature (greater than 54°F [30°C]) cause both mechanical stresses (thermal expansion) and condensation that can accelerate aging.

Table 9 – Percent Load (Sensor Rating I_n)¹

Influence		Appearance		Consequences	
Aging of plastic insulation		Change in color of insulation		Breaking of parts leading to failure of functions	
Aging of grease		Change in color and viscosity		Increase in mechanical friction	
Aging of electronic components		Modified display of LCDs		A 10°C increase (i.e. a 90% load) cuts the service life of components by approximately half.	
Deterioration of characteristics: • steel springs (above 100°C) • stainless steel springs (above 200°C)		Rupture		Non-operation of mechanism	
Thresholds					
≤ 80, 24/24 hours	≤ 90%, 8/24 hours	≤ 90%, 24/24 hours	I _n , 8/24 hours	I _n , 24/24 hours	
Maximum percent load generally taken into account in sizing the installation. At this percent load, temperature rise is reduced approximately 40% with respect to a 100 percent load.	At this percent load, temperature rise is reduced only 20%. Heating and cooling cycles impact on the mechanical junctions of the power circuit.	The thermal stress for continuous operation is three times higher than in the previous case, but the absence of thermal cycles slows aging of the electromechanical components.	Between 90 and 100%, temperature rise is close to its maximum value. Heating and cooling cycles impact on the mechanical junctions of the power circuit, with major impact on aging.	Between 90 and 100%, temperature rise is close to its maximum value. This situation has a major impact on aging.	
Recommendations					
Preventive Maintenance					
Implement the standard program	Increase frequency of periodic checks (see page 8)	Preventive maintenance is difficult due to the continuous process	Increase frequency of periodic checks (see page 8)	Preventive maintenance is difficult due to the continuous process. Plan more frequent periodic checks.	
Installation					
			Provide ventilation for switchboard	Spread the load over other circuit breakers Install a device with a higher rating.	

¹ The percent load affects the device temperature, which is itself affected by the ambient temperature.

Table 10 – Relative Humidity

Influence	Appearance	Consequences
Corrosion of metal surfaces that is accelerated when a pollutant is present (corrosive gas, salt, chlorine, etc.)	Appearance of: • red rust on iron • white rust on zinc • blue deposit on copper • black deposit on silver	Increase in friction Risk of mechanical rupture resulting in non-operation of mechanisms Increase in contact resistance (clusters and main contacts)
Deterioration of dielectric qualities of plastics	White traces on case	Risk of a reduction in insulation
Deterioration of electronic components, in particular printed circuit boards and silver-coated components. This phenomenon is worsened by the presence of H ₂ S corrosive gas (hydrogen sulphide).	Not visible Appearance of dendrites on electronic boards	Short-circuiting of circuits resulting in non-operation of control-unit protection, measurement, indication and communication functions.
Deterioration of electronic components, in particular non-varnished copper circuits.	Not visible Erosion of copper tracks Oxidation of metal connectors of components and metal cases Oxidation of connectors of integrated-circuits mounted on supports	Failure due to short-circuit or open circuit Rupture of component connectors along case Poor contact with integrated-circuit supports
Degradation of opto-electronic components.		Failure of data transmission.
Thresholds in%		
< 70%	70 to 85%	> 85%
Level of relative humidity generally found in continental and temperate zones. The level is generally lower in switchboards due to the internal temperature rise. No significant deterioration is noted at this level.	Level of relative humidity generally found in zones close to water. Possible appearance of condensation on cold parts and accelerated rusting.	Level of relative humidity generally found in tropical zones and certain factories (e.g. paper mills). Increased risk of condensation and rust resulting in difficulties to disconnect devices, risk of non-opening or non-closing.
Recommendation		
Preventive Maintenance		
Preventive maintenance	Carry out more frequent periodic checks (see page 8) Measurement of insulation is advised every 5 years	Carry out more frequent periodic checks (see page 8) Inspect for rust on metal parts Measurement of insulation is imperative every two years
Installation		
No particular precautions required		Install heating elements in the switchboard

Figure 3 – High-Humidity Environment Greenhouse

Table 11 – Salt Environment

Influence	Appearance	Consequences
Corrosion of metal parts	Appearance of: • white rust on zinc coatings • red rust on steel	Increase in friction. Freezing of mechanism Broken springs. Blocking of cores of MX / XF / MN control accessories.
Risk of salt deposits on electronic circuit when thick salt mists occur.	Appearance of salt bridges on electronic boards.	Failure of electronic systems due to short-circuiting of circuits, particularly non-varnished circuits.
Risk of conducting salt deposits on the device when thick salt mists occur.	White deposit	Deterioration of device dielectric withstand resulting in risk of phase-to-frame short circuit and a phase-to-phase short circuit if an overload occurs.
Thresholds		
No salt mist	Moderate salt mist < 6 miles (10 km) from seaside	Significant salt mist < 0.6 miles (1 km) from seaside
No influence.	Moderate aging of switchgear.	Rapid aging of exposed switchgear. On average, service life is divided by a factor of three for non-protected devices.
Recommendation		
Preventive Maintenance		
Implement the standard program.	Carry out more frequent periodic checks (see page 8).	Carry out more frequent periodic checks (see page 8). Test the dielectric withstand every two years.
Installation		
No particular precautions required.	No particular precautions required.	Switchgear must be protected from salt mist. Increase the switchboard protection category to IP54 (NEMA 3). Create a protected room.

Figure 4 – Salt Environment (Seaside)

Table 12 – Harmonics

Influence	Appearance	Consequences
Increase in skin effect, proximity effect, iron losses, eddy currents	Change in color of terminals, insulators and grease Modified display of LCDs	Harmonics cause temperature rise greater than that of the fundamental current
Possible overload of neutral if third-order harmonics and their multiples are present	Distorted waveform	Erroneous current value Nuisance tripping if non-rms trip units
Thresholds in % of I_n		
THDi $\leq$ 30%	THDi 30 to 50%	THDi $>$ 50%
No notable influence on aging	At 40% THDI, heat loss is approximately 10% higher, corresponding to 5% more current	
Recommendation		
Preventive Maintenance		
Implement the standard program	Carry out more frequent periodic checks (see page 8)	Carry out more frequent periodic checks (see page 8)
Installation		
No particular precautions required	Standard filtering with an inductor to reduce harmonics	If necessary, oversize the neutral Oversize switchgear

Figure 5 – Harmonics

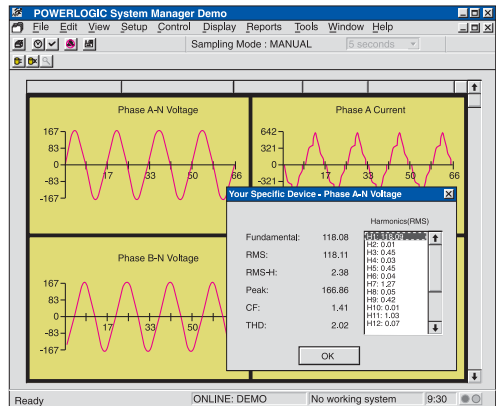
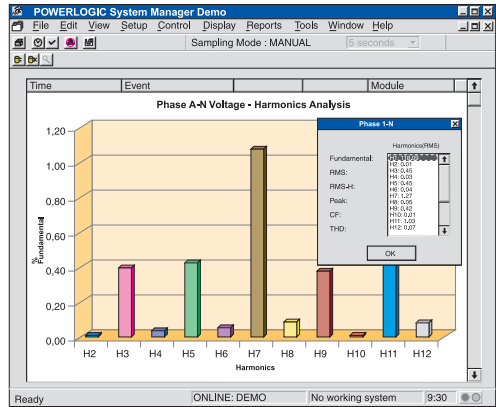


Table 13 – Dust

Influence	Appearance	Consequences
Deposit on grease of mechanisms (device and cradle)	Change in color and texture of greases	Premature wear of mechanisms because dust mixed with grease can be abrasive Increase in mechanical friction and freezing of moving parts Risk of device not moving on cradle Risk of device non-opening or non-closing
Deposit on grease of clusters	Change in color and texture of greases	Increase in racking forces exerted Increased contact resistance and temperature rise
Deposit on displays		Screen data not legible
Deposit on insulation		Reduced insulation resistance (depends on type of dust) This phenomenon is worsened by the presence of humidity
Deposit on device contacts		Increased contact resistance and temperature rise
Deposit on opto-electronic communication system		Failure of communication-data transmission between devices
Dust Deposit		
Low Level	Moderate	High
Quantity of dust generally deposited on and around devices in commercial buildings and on standard industrial premises	Quantity of dust found in protected switchboards installed in dusty environments such as cement works, grain mills, incineration installations, plastic and steel mills, mines, etc.	Quantity of dust deposited on and around devices inside non-protected switchboards installed in dusty environments such as cement works, grain mills, incineration installations, plastic and steel mills, mines, etc.
Recommendations		
Preventive maintenance		
Implement the standard program It is advised to vacuum cleaner dust deposits	Carry out more frequent periodic cleaning (see page 8)	Carry out more frequent periodic cleaning (see page 8)
Installation		
Switchboard with standard IP (NEMA 1)	Make sure the switchboard remains closed	Special equipment required to protect the switchgear is mandatory

Figure 6 – Dust Occurrence

Table 14 – Corrosive Atmosphere

Corrosive atmosphere	Influence	Appearance	Consequences	Thresholds (ppm ¹ in volume) Average value (see next page for Categories 3C1, 3C2, 3C3, 3C4)
SO ₂ Sulphur dioxide	Corrosion of silver, aluminum and bare copper. Phenomenon accelerated by high temperature and relative humidity.	Blackening of exposed silver surfaces. Appearance of dendrites on electronic and power circuits.	Increased resistance of disconnecting contacts exposed to air. Excessive device temperature rise. Short-circuiting of circuits resulting in non-operation of the trip unit.	3C1: 0.037 3C2: 0.11 3C3: 1.85 3C4: 4.8
H ₂ S Hydrogen sulphide	Sulphurization of silver, this phenomenon is accelerated by high temperatures.	Major blackening of exposed silver surfaces. Appearance of dendrites on electronic and power circuits.	Increased resistance of disconnecting contacts exposed to air. Excessive device temperature rise. Short-circuiting of circuits resulting in non-operation of the trip unit.	3C1: 0.0071 3C2: 0.071 3C3: 2.1 3C4: 9.9
Cl ₂ Chlorine	Corrosion of metal parts.	Oxidation Inter-granular corrosion of stainless steel.	Increase in friction. Risk of mechanical rupture. Breaking of stainless-steel springs.	3C1: 0.034 3C2: 0.034 3C3: 0.1 3C4: 0.2
NH ₃ Ammoniac	Attacks polycarbonates, corrodes copper.	Cracking of polycarbonates. Blackening of copper.	Risk of rupture. Increased temperature rise.	3C1: 0.42 3C2: 1.4 3C3: 4 3C4: 49
NO ₂ Nitrogen oxide	Corrosion of metal parts.	Oxidation.	Increased temperature rise.	3C1: 0.052 3C2: 0.26 3C3: 1.56 3C4: 5.2
Oily atmospheres	Attacks polycarbonates.	Cracking of polycarbonates.	Risk of rupture. Increased temperature rise.	

¹ ppm = Parts Per Million.

Table 15 – Environment Categories as per Standard IEC 60721-3-3

Class			
3C1	3C2	3C3	3C4
Rural zones or urban zones with low industrial activity.	Urban zones with scattered industrial activity and heavy traffic.	Immediate vicinity of industrial pollution. Example, paper mills, water treatment, chemicals, synthetic fibers, smelting plants.	Inside polluting industrial premises. Example: paper mills, water treatment, chemicals, synthetic fibers, smelting plants.
Presence of Corrosive Gases			
Negligible	Low level	Significant level	High level
Impact on switchgear			
No impact on service life because concentrations are very low.	Moderate impact on service life.	Major impact, particularly concerning temperature rise. For electronic systems, no impact on varnished boards and gold-plated contacts.	Significantly reduced service life if no particular precautions are taken. For electronic systems, no impact on varnished boards and gold-plated contacts.
Recommendation			
Preventive maintenance			
Implement the standard program.	Implement the standard program. "Pyratex" grease can be used for the disconnecting contacts, but must be changed annually (see the manufacturer procedure).	Carry out more frequent periodic checks (see page 8). Change the grease on the disconnecting contacts.	Carry out more frequent periodic checks (see page 8). Change the grease on the disconnecting contacts.
Installation			
No particular precautions required.	No particular precautions required.	Use fixed rather than drawout devices.	Install the switchgear in a room protected from the pollution. Use fixed rather than drawout devices, or use gold-plated disconnecting contacts.

Operating Conditions

Operating conditions directly affect the service life of switchgear due to the limited electrical and mechanical endurance levels of the various subassemblies. Operating conditions include:

- vibrations,
- the number of operating cycles,
- the interrupted currents.

Table 16 – Vibrations

Influence	Appearance	Consequences	
Premature deterioration of contact surfaces (clusters and main contacts).	Not identifiable.	Increased device temperature rise.	
Loosening of bolted assemblies.	Not identifiable.	Increase in mechanical clearance.	
Wear of mechanical parts.	Not identifiable.	Broken springs. Increase in mechanical clearance between parts.	
Appearance of fretting corrosion on auxiliary connections.	Not identifiable.	Erroneous information or loss of continuity in data or supply, excessive temperature rise.	
Breaking of connectors on large electronic components (e.g. large capacitors).	Not identifiable.	Failure of protection function.	
Wear of adjustment switches on the trip unit.	Not identifiable.	Nuisance tripping or no tripping.	
Thresholds			
< 0.2 g	0.2 g to <0.5 g	0.5 g to 0.7 g	> 0.7 g
Normal condition, no impact on service life.	Reduced service life.	Significant increase in incidents.	Forbidden for standard devices
Recommendation			
Preventive maintenance			
Implement the standard program.	Carry out more frequent periodic checks (see table).	Carry out more frequent periodic checks (see page 8). Check in particular the tightness of connections.	
Installation			
No particular precautions required.	No particular precautions required. Install switchgear on a rubber mounting bushing.	Install switchgear on a rubber mounting bushing.	Use special devices.

Table 17 – Number of Operating Cycles

Influence		Consequences
The number of operating cycles depends directly on the electrical and mechanical endurance of the device.		Device service life depends on the daily number of operating cycles.
Device Service Life (depends on the daily number of operating cycles)		
≤ 30 cycles per month	≤ 60 cycles per month	≤ 120 cycles per month
Corresponds to one cycle per day. For a device endurance of 10,000 cycles and an interrupted current of less than 0.4 I _n , the service life is 30 years.	Corresponds to two cycles per day. For a device endurance of 10,000 cycles and an interrupted current of less than 0.4 I _n , the service life is 15 years.	Corresponds to four cycles per day. For a device endurance of 10,000 cycles and an interrupted current of less than 0.4 I _n , the service life is 10 years.

Table 18 – Interrupted Current

Influence	Appearance	Consequences
Wear of fixed and moving contacts.	Deterioration of contacts.	Beyond the electrical-endurance limit, device temperature rise increases due to the greater contact resistance and a reduction in the pressure of contacts.
Wear of the arc chutes (insulating materials, separators).	Deterioration of insulation.	Beyond the electrical-endurance limit, the insulation separators). (input/output and between phases) is reduced, which results in a reduction of device suitability for isolation and can create an unsafe condition.
Thresholds		
$\leq I_n$ (Sensor Rating)	$> I_n$ to $\leq 4 I_n$ (Sensor Rating)	$> 4 I_n$ to $\leq 8 I_n$ (Sensor Rating)
This level of interrupted current corresponds to the mechanical durability (see Mechanical endurance).	This level of interrupted current corresponds to expected levels of short time events.	This level of interrupted current corresponds to the severe short circuit events. Requires inspection of contacts and arc chutes.

Figure 7 – Wear on Contacts



Section 4— What Must be Maintained

Inspect arc chamber/arc chutes, main contacts, spring charging motor, and trip devices after the operations listed in Table 19.

Table 19 – Electrical Operations

Circuit Breaker Type	Number of Electrical Operations (Open-Close Cycle)			
	Arc Chamber	Main Contacts	Spring-Charging Motor (MCH)	Trip Devices (MX/XF)
NW08–NW16 Types N/N1/H/H1/H2/H3/HA/HF	10,000	10,000	12,500	12,500
NW08–NW16 Types L/LF/L1/L1F/HB/HC	3,000	3,000	12,500	12,500
NW20 Types N/H/H1/H2/H3/HA/HF	8,000	8,000	10,000	12,500
NW20 Types L/LF/L1/L1F/HB/HC	3,000	3000	10,000	12,500
NW32 Types H1/H2/H3/HA/HF NW25–NW30 Types H/L/HB/HF	5,000	5,000	10,000	12,500
NW40B (W-Frame) Types H1/H2/H3/HA/HF	5,000	5,000	10,000	12,500
NW40–NW50–NW60 Types H/H2/H3/L/L1/HA/HB/HC/HF NW32 Type L1	1,500	1,500	5,000	12,500

Molded Case



The case is an essential element in the circuit breaker. First, it provides a number of safety functions by:

- providing functional insulation between the phases themselves and between the phases and the exposed conductive parts in order to resist transient overvoltages caused by the distribution system
- providing a barrier, preventing direct user contact with live parts
- protecting against the effects of electrical arcs and overpressures caused by short-circuits.

Second, it serves to support the operating mechanism as well as the mechanical and electrical accessories of the circuit breaker.

On the case, there should be:

- no traces of grime (grease), excessive dust or condensation which all reduce insulation
- no signs of burns or cracks which could weaken the case and thus its capacity to withstand short-circuits.

Preventive maintenance for cases consists of:

- a visual inspection of its condition and cleaning with a dry cloth or a vacuum cleaner. All cleaning products with solvents are strictly forbidden.
- Measuring the insulation every five years and following trips due to a short-circuit.

Replace the circuit breaker if there are signs of burns or cracks.

Arc Chutes



During a short-circuit, the arc chute serves to extinguish the arc and to absorb the high level of energy along the entire path of the short-circuit. It also contributes to arc extinction under rated current conditions. An arc chute that is not in good condition may not be capable of fully clearing the short-circuit and ultimately result in the destruction of the circuit breaker.

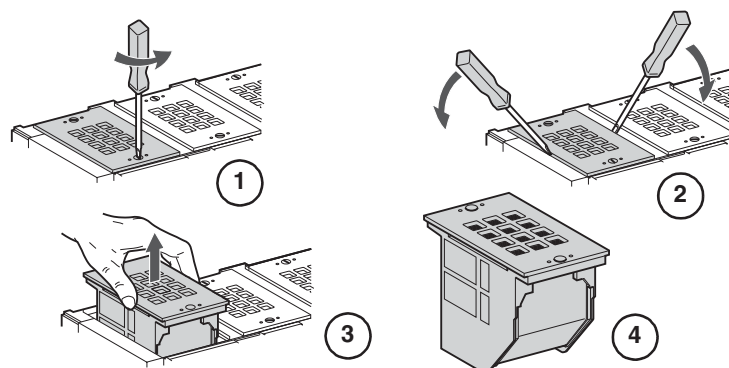
The arc chutes must be regularly checked. The fins of the arc chutes may be blackened (due to the gases produced at I_n) but must not be significantly damaged. What is more, the filters must not be blocked to avoid internal overpressures. Use a vacuum cleaner rather than a cloth to remove dust from the outside of the arc chutes.

Arc Chamber Maintenance

1. Unscrew the mounting screws.
2. Use screwdrivers to lift arc chamber from circuit breaker.
3. Remove arc chamber.
4. Inspect arc chamber. Check that arc chamber body is not broken and that the plates are intact and not significantly burned or melted.

If necessary, replace arc chamber.

Figure 8 – Arc Chamber Maintenance



Main Contacts



The contacts make and break the current under normal conditions (rated current for the installation) and under exceptional conditions (overloads and short-circuits). The contacts are eroded by the many opening and closing cycles and can be particularly deteriorated by short-circuit currents. Worn contacts may result in abnormal temperature rise and accelerate device aging.

It is imperative to remove the arc chutes and visually check contact wear at least once a year and following each short-circuit event.

The contact-wear indicators constitute an absolute minimum value that must not be overrun.

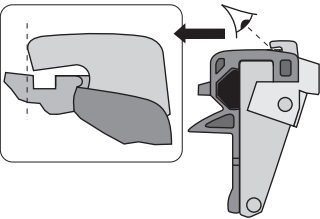
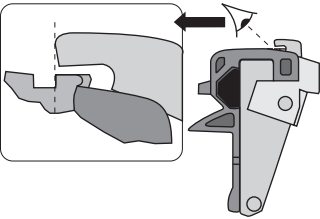
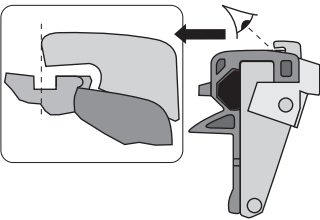
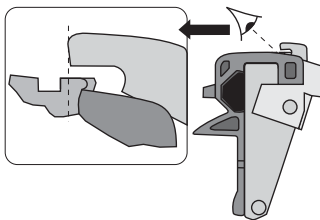
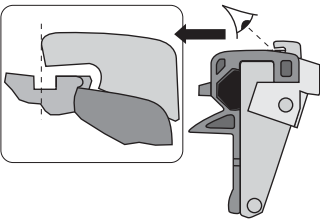
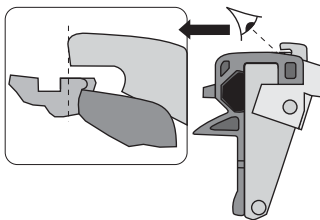
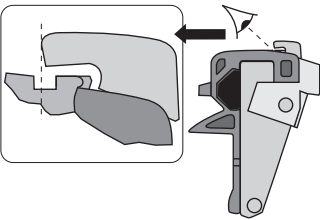
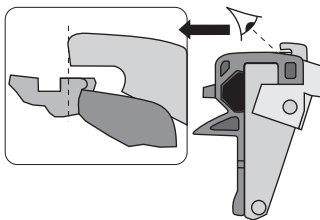
To plan and reduce the number of shutdowns, an electronic wear counter is available with the Micrologic P and H. A visual check is required when the counter reaches 100. When the counter reaches 300, the contacts are worn out and must be replaced.

Main Contact Maintenance

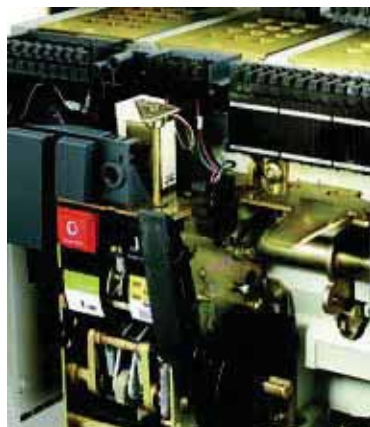
1. Remove the arc chambers.
2. Close the circuit breaker and check the condition of the contacts.

If contacts are worn, the circuit breaker block assembly must be replaced.

Table 20 – Contact Wear

Standard	Frame Size	Interruption Type	Poles	New Contacts	Contacts Need to be Replaced
ANSI	250 A	H1/H2/H3/N1	3P		
	3200–4000 A	H2/H3	3P		
	800–1600 A	N1	4P		
	800–2000 A	H1/HA	4P		
	800–2000 A	H2/H3/HF	3P/4P		
	3200 A	H1/HA/H2/H3/HF	4P		
	3200 A	HF	3P/4P		
UL	250 A	H/N	3P		
	2000–3000 A	L/HB	3P		
	800–3000 A	H/HF	3/4P/4P RHN		
	800–2000 A	N	3P/4P		
ANSI	250 A	L1/L1F	3P		
	800–2000 A	H1/HA/L1/HC/L1F	3P		
	3200–5000 A	L1/HC	3P		
	4000–5000 A	H2/HA/H3/HF	3P/4P		
	800–1600 A	N1	3P		
	3200–4000 A	H1/HA	3P		
UL	250 A	L/LF	3P		
	4000–6000 A	H/HF	3P/4P/4P RHN		
	4000–6000 A	L/HB	3P		
	800–1600 A	L/HB	3P		
	800–2000 A	LF	3P		

Device and Cradle Mechanisms



Mechanical operation of the circuit breaker may be hindered by dust, vibration, aggressive atmospheres, no greasing, or excessive greasing. Operating safety is ensured by dusting and general cleaning, proper greasing, and regular opening and closing of the circuit breaker.

Dusting

Dusting is best carried out using a vacuum cleaner.

Cleaning

Cleaning should be carried out using a cloth or brush that is perfectly clean and dry, without using any solvents, avoiding greased parts except for grease on electrical contacts. Application of products under pressure or containing solvents (trichloroethane, trichloroethylene, WD40®) is strictly forbidden.

The main problems of products under pressure are the following:

- it may be impossible to regrease inaccessible lubrication points (which are greased for the life of the product)
- corrosion of points that are not regreased
- damage caused by the pressure
- risk of temperature rise due to the presence of an insulating solvent in the contact zones
- elimination of special protection
- deterioration of plastic materials.

Greasing

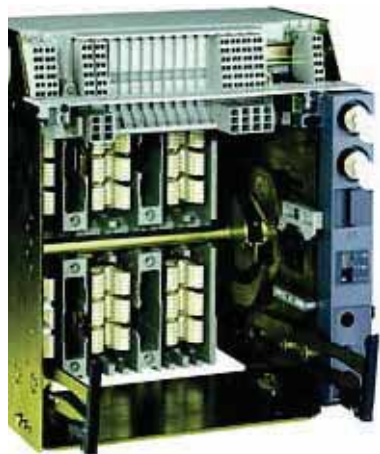
This operation is carried out after cleaning on certain mechanical parts as described in the maintenance procedures, using the various greases recommended by Schneider Electric. Grease must not be over applied because the excess, if mixed with dust, may result in mechanism malfunctions. Generally speaking, under normal operating conditions, the pole-operating mechanism does not require any regreasing as it is greased for the life of the product.

- The clusters and disconnecting-contacts must be greased according to the defined intervals using the greases indicated by Schneider Electric.
- The main contacts must not be greased.

Operating Cycles

The need for continuity of service in an installation generally means that power circuit breakers are rarely operated. While an excessive number of operating cycles accelerates device aging, it is also true that a lack of operation over a long period can result in mechanical malfunctions. Regular operation is required to maintain the normal performance level of each part involved in the opening and closing cycles.

In installations where power circuit breakers are used in source changeover systems, it is advised to periodically operate the circuit breaker for the alternate source.



Auxiliary Circuits



Control Accessories

MX and XF shunt releases are respectively used to remotely open and close the circuit breaker using an electrical order or through a communication network.

The MN undervoltage release is used to break the power circuit if the distribution system voltage drops or fails.

Communicating MX and XF releases and MN releases are continuously supplied and their internal electronic components may suffer accelerated aging if there is temperature rise in the circuit breaker.

Preventive maintenance consists of periodically checking operation at minimum values.



Auxiliary Wiring

Auxiliary wiring is used to transmit orders to the various control devices and to transmit status condition information. Incorrect connections or damaged insulation may result in either non-operation of the circuit breaker or nuisance tripping.

Auxiliary wiring must be regularly checked and replaced as needed, particularly if there are vibrations, high ambient temperatures or corrosive atmospheres.



Indication Contacts

The contacts indicating the status of the circuit-breaker (ON / OFF), of the cradle (CE, CD, CT), a trip due to an electrical fault (SDE), or that the circuit breaker is ready to close (PF) provide the operator with the status information required to react correspondingly. Any incorrect indications may result in erroneous device operation. Contact failure (wear, loose connections) may result from vibrations, corrosion or abnormal temperature rise and preventive maintenance must ensure that contacts correctly conduct or isolate according to their positions.



Spring Charging Motor

The spring charging motor (MCH) automatically recharges the operating-mechanism springs as soon as the circuit breaker is closed. The spring charging motor makes it possible to instantaneously reclose the device following an opening. This function may be indispensable for safety reasons. The charging lever serves simply as a backup means if the auxiliary voltage fails. Periodic checks on the spring charging motor operation and the charging time are required to ensure the device function.

Electronic Trip Unit



If an electric fault occurs in the installation, the electronic trip unit detects the fault and orders the circuit breaker to open.

Electronic components and circuit boards are sensitive to the environment (ambient temperature, humid and corrosive atmospheres) and to severe operating conditions (magnetic fields, vibrations, etc.). To ensure correct operation, it is necessary to periodically check:

- the chain of action resulting in a trip
- the response time as a function of the level of the fault current.

Use HHTK or FFTK test kits for secondary injection testing or test with primary injection.

Communication Module and Accessories

Using the communication bus, the communication option transmits data to a remote site for use by various departments (maintenance, management, production, etc.).

A break in the transmission of data can result in:

- production losses due to unawareness concerning the status of a circuit breaker
- financial losses due to incorrect system management, diagnostic errors, etc.

Periodic checks on the orders (read, write, commands) transmitted by the communication bus are required to maintain a high degree of reliability and confidence in the communication system.



I/O Module

IFM Module



IFE Module

Connections

The connections between the various distribution systems in a switchboard (busbars, cables) and the switchgear are a major source of heat loss. Incorrect tightening may lead to thermal runaway which in turn can provoke damage to the device, the cable insulation, or result in a short-circuit and/or a fire. This type of malfunction is often due to disregard for installation requirements during switchboard assembly.

NOTE: Connections must never use different materials (copper/aluminium).

Fixed Circuit Breakers



Fixed circuit breaker connections use lugs or bars. When made in compliance with Schneider Electric recommendations (tightening torque, hardware, and contact washer), this type of connection does not require any particular maintenance.

Otherwise, regularly check the temperature-rise points. If there is a change in color of copper or tinning:

- dismantle the connections
- clean and scrape the contact surfaces
- then reassemble the connections using new hardware.

Check the terminals.

Drawout Circuit Breakers (Cradle)



Drawout circuit breaker connections are made up of two parts, the clusters and disconnecting contacts. This type of connection is critical and requires periodic cleaning in compliance with the described procedures. The grease facilitates the connection between the clusters and the disconnecting contacts and avoids damaging the silver-coated surface by reducing the racking-in friction.

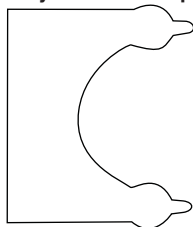
In sulphurous (corrosive) atmospheres (H₂S/SO₂), it is necessary to implement the cleaning procedure using the Thiourea solution, with mandatory regreasing using fluoruous grease (such as Pyratex® EP). This type of grease protects the silver and copper-coated contacts against sulphurizing. Because silver or copper sulphide is insulating it creates an increase in the contact resistance and thus greater temperature rise. The grease breaks down over time and it is therefore necessary to replace it regularly.

Cluster Inspection and Lubrication (Masterpact NW Drawout Circuit Breakers Only)

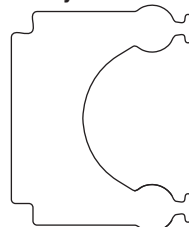
1. If the circuit breaker is equipped with cluster retainers, remove the retainers as necessary to inspect the clusters and cluster supports.
2. If the circuit breaker is equipped with ArcBlok or cluster shields, use the S47542 cluster tool to remove the clusters for inspection.

Figure 9 – Cluster Support Profiles

Old-Style Cluster Support



New-Style Cluster Support



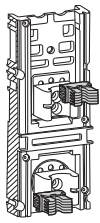
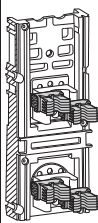
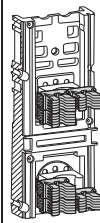
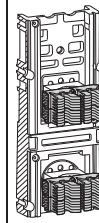
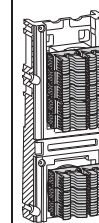
Make sure clusters are installed properly as shown in Table 21.

3. Visually inspect clusters for wear or signs of damage such as:
 - discolored areas
 - visible copper on fingers
 - cracked or broken springs
 - missing clusters
 - not aligned with other cluster (indicates spring damage)
4. Visually inspect clusters for wear.

5. For circuit breakers with cluster retainers: check that all clusters have cluster retainers.

NOTE: Circuit breakers with cluster shields or ArcBlok shields do not need the cluster retention kits. Do not attempt to install the cluster retention kits on those circuit breakers.

Table 21 – Cluster Configuration

Number of Clusters Per Pole					
2	4	6	8	16	24
					

Cluster Replacement

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- If clusters are removed for any reason, clusters must be installed using cluster positioning tool S47542.
- Lubricate clusters as shown in Cluster Lubrication on page 37.
- Do not install anything in the cluster jaw except 3/8 in. (9.5 mm) wide bus bar or Cluster Reset Tool, catalog number CLUSRETOOL.

Failure to follow these instructions can result in equipment damage.

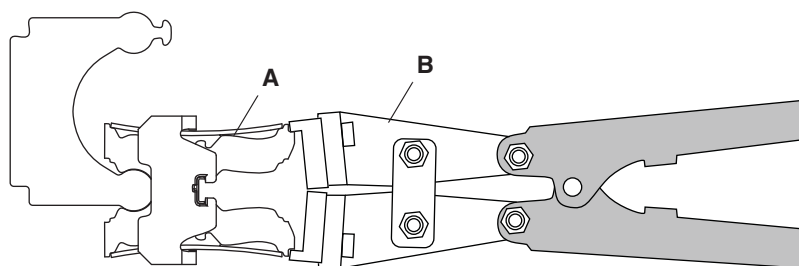
If Masterpact NW clusters are worn or damaged, new clusters must be installed using cluster positioning tool S47542.

Table 22 – Number of Clusters Per Pole

Type		N/N1	H1	HA	H / H2 / H3 / HF	L / L1 / LF / L1F / HB / NC
V $\sim$	NW08	2	4	4	4 / 6 / 6 / 4	8
	NW12	2	—	—	4	8
	NW16	6	6	6	6	8
	NW20	8	8	8	8	16
	NW25 / NW30	—	—	—	16	16
	NW32	—	16	16	16	24
	NW40/NW50	—	—	24	24	24
	NW60	—	—	—	24	24
V $\equiv$	NW80 / NW12 / NW16 / NW20 / NW25	8				
	NW30 / NW40	16				

- Replace worn or damaged clusters on all cluster configurations.
- Install new clusters (Figure 10, A) using cluster positioning tool S47542 (B).

Figure 10 – Cluster Replacement



If clusters and cluster supports are not damaged and the circuit breaker is not equipped with a cluster shield or ArcBlok Shield, you can continue to use the cluster retainer kits. If necessary, retrofit using new cluster supports, finger clusters and cluster shields/ArcBlok shields.

Table 23 – Cluster Retainer Kits

Description	Frame Size	Interruption Type	Clusters Per Pole	Cluster Retainer Kit		Retainer Color	
				3P	4P	Upper	Lower
UL489 Listed Masterpact NW Circuit Breaker	800/1600 A	N	2 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		H	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		L/LF	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	N/H	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		L/LF	16	CRK3000L3P	N/A	Red	Black
	2500/3000 A	H	16	CRK3200A3P	CRK3200A4P	Red	Black
		L	16	CRK3000L3P	N/A	Red	Black
	4000/5000/6000 A	H	24	CRK6000A3P	CRK6000A4P	Black	Black
		L	24	CRK6000A3P	N/A	Black	Black
UL489 Listed Masterpact NW Automatic Switches	800/1600 A	HF	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		HB	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	HF	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		HB	16	CRK3000L3P	N/A	Red	Black
	2500/3000 A	HF	16	CRK3200A3P	CRK3200A4P	Red	Black
		HB	16	CRK3000L3P	N/A	Red	Black
	4000/5000/6000 A	HF	24	CRK6000A3P	CRK6000A4P	Black	Black
		HB	24	CRK6000A3P	N/A	Black	Black
ANSI C37 Certified Masterpact NW Circuit Breaker	800/1600 A	N1	2 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		H1/H2/H3	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		L1/L1F	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	H1/H2/H3	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		L1/L1F	16	CRK3000L3P	N/A	Red	Black
	3200 A	H1/H2/H3	16	CRK3200A3P	CRK3200A4P	Red	Black
		L1	24	CRK6000A3P	N/A	Black	Black
	4000/5000 A	H2/H3	24	CRK6000A3P	CRK6000A4P	Black	Black
		L1	24	CRK6000A3P	N/A	Black	Black
ANSI C37 Certified Masterpact NW Non-Automatic Switches	800/1600 A	HA	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
	2000 A	HA	8	CRK2000A3P	CRK2000A4P	No Color	No Color
	3200 A	HA	16	CRK3200A3P	CRK3200A4P	Red	Black
	4000/5000 A	HA	24	CRK6000A3P	CRK6000A4P	Black	Black
ANSI C37 Certified Masterpact NW Automatic Switches	800/1600 A	HF	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		HC	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	HF	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		HC	16	CRK3000L3P	N/A	Red	Black
	3200 A	HF	16	CRK3200A3P	CRK3200A4P	Red	Black
		HC	24	CRK6000A3P	N/A	Black	Black
	4000/5000 A	HF	24	CRK6000A3P	CRK6000A4P	Black	Black
		HC	24	CRK6000A3P	N/A	Black	Black
Cluster Retainer Clip	All	All	—	CRCLIP	—	—	—

⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

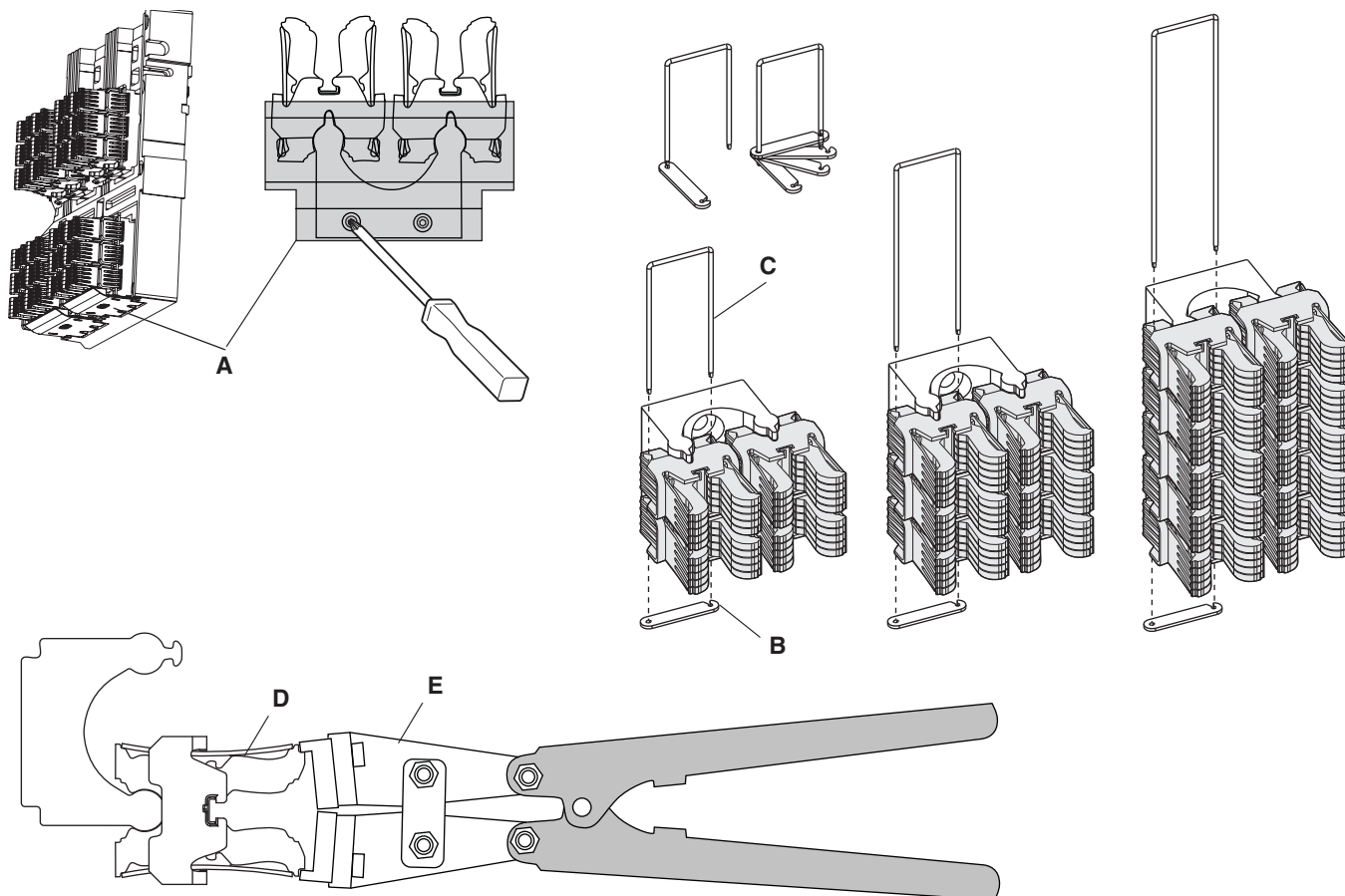
Install the correct cluster retainer identified by color depending on circuit breaker size and type. See Table 23.

Failure to follow these instructions will result in death or serious injury.

NOTE: Cluster retainer clip cannot be reused. Use new cluster retainer clip, part number CRCLIP.

1. Replace worn or damaged clusters on all cluster configurations except lower clusters on 16 and 24 cluster configurations.
 - a. Remove lower connector plate (Figure 11, A), if present. Retain plate, screws and washers.
 - b. Remove cluster retainer clip (B) and cluster retainer (C), if equipped. Discard cluster retainer clip. Remove worn or damaged clusters.
 - c. Install new clusters (D) using cluster positioning tool S47542 (E).
 - d. Secure clusters using cluster retainer (C) and new cluster retainer clip (B). See Table 23 for correct cluster retention kit and cluster retainer color.
 - e. Replace lower connector plate (A), if previously removed. Secure using previously-retained screws and washers. Torque screws to 17.7 lb-in. (2 N•m).

Figure 11 – Cluster Replacement

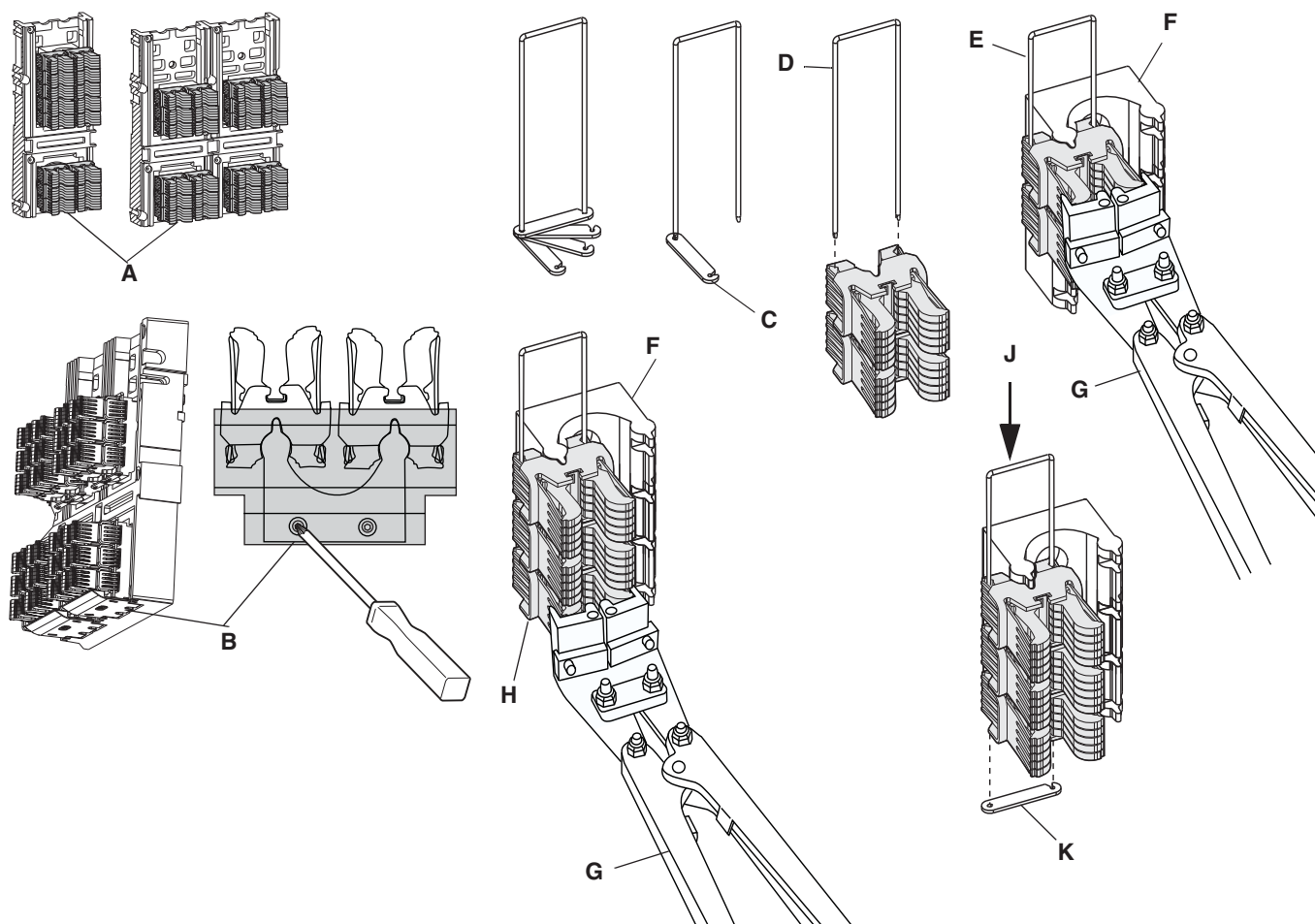


⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

Install the correct cluster retainer identified by color depending on circuit breaker size and type. See Table 23.

Failure to follow these instructions will result in death or serious injury.

2. Replace worn or damaged clusters on lower set of clusters on 16 and 24 cluster configurations (Figure 12, A):
 - a. Remove lower connector plate (B), if present. Retain plate, screws and washers.
 - b. Remove cluster retainer clip (C) and cluster retainer (D), if equipped. Discard cluster retainer clip. Remove all clusters, discard worn or damaged clusters.
 - c. Slide cluster retainer (D) through two clusters until bottom of cluster retainer is even with bottom of lower cluster. See Table 23 for correct cluster retainer kit and color.
 - d. Install the two clusters and cluster retainer (E) on top two notches of cluster support (F) using cluster positioning tool S47542 (G).
 - e. Install the third cluster (H) on bottom notch of cluster support (F) using cluster positioning tool S47542 (G).
 - f. Slide cluster retainer (J) through third cluster and secure using new cluster retainer clip (K).
 - g. Repeat for clusters on other side of cluster support.
 - h. Replace lower connector plate (B), if previously removed. Secure using previously-retained screws and washers. Torque screws to 17.7 lb-in. (2 N•m).

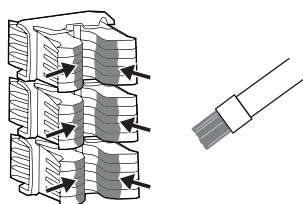
Figure 12 – Cluster Replacement**Cluster Lubrication****NOTICE****HAZARD OF EQUIPMENT DAMAGE**

Inspect the cluster for lubrication when the circuit breaker is removed from the cradle.

Failure to follow these instructions can result in equipment damage.

Use grease kit (catalog number S48899) to lubricate cluster jaws as shown in Figure 13.

NOTE: Remove any existing grease from cluster assembly before applying new grease to clusters.

Figure 13 – Cluster Grease Application

Cradle Stab Lubrication

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

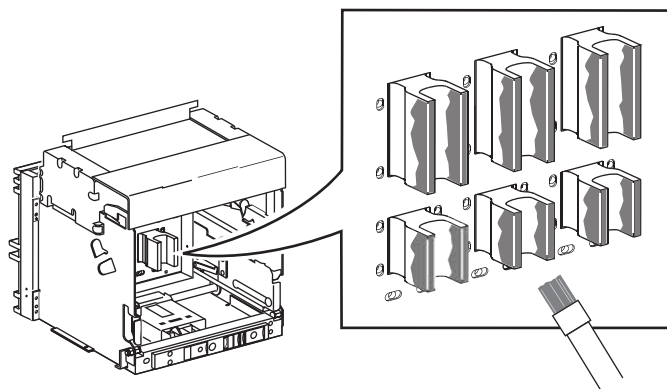
Failure to follow these instructions will result in death or serious injury.

The cradle stabs must be inspected and lubricated when the cradle is first installed and again during maintenance periods after all power has been disconnected.

Confirm that both sides of stab are coated with lubricant. If necessary, use grease kit (catalog number S48899) to lubricate stab.

NOTE: Remove any existing grease from cradle stabs before applying new grease to them.

Figure 14 – Cradle Stab Grease Application



Section 5— Troubleshooting

Table 24 – Troubleshooting and Solutions

Issue	Probable causes	Solutions
Circuit breaker cannot be closed locally or remotely.	1. Circuit breaker padlocked or keylocked in the “open” position. 2. Circuit breaker interlocked mechanically in a source changeover system. 3. Circuit breaker not completely connected. 4. The reset button signaling a fault trip has not been reset. 5. Stored energy mechanism not charged. 6. MX opening shunt release permanently supplied with power. 7. MN undervoltage release not supplied with power. 8. XF closing release continuously supplied with power, but circuit breaker not “ready to close” (XF not wired in series with PF contact). 9. Permanent trip order of a Micrologic P or H trip unit with minimum voltage and minimum frequency protection in Trip mode and the trip unit powered.	1. Disable the locking function. 2. Check the position of the other circuit breaker in the changeover system. Modify the situation to release the interlock. 3. Complete racking in (connection) of the circuit breaker. 4. Clear the fault. Push the reset button on the front of the circuit breaker. 5. Charge the mechanism manually If it is equipped with an MCH spring charging motor, check the supply of power to the motor. If the problem persists, replace the spring charging motor (MCH). 6. There is an opening order. Determine the origin of the order. The order must be cancelled before the circuit breaker can be closed. 7. There is an opening order. Determine the origin of the order. Check the voltage and the supply circuit ($U > 0.85 U_n$). If the problem persists, replace the undervoltage release. 8. Cut the supply of power to the XF closing release. then send the closing order again via the XF, but only if the circuit breaker is “ready to close”. 9. Disable these protection functions on the Micrologic P or H trip unit.
Circuit breaker cannot be closed remotely but can be opened locally using the closing pushbutton.	Closing order not executed by the XF closing release.	Check the voltage and the supply circuit ($0.85 - 1.1 U_n$). If the problem persists, replace the XF release.
Unexpected tripping without activation of the reset button signaling a fault trip.	1. MN undervoltage release supply voltage too low. 2. Load-shedding order sent to the MX opening release by another device. 3. Unnecessary opening order from the MX opening release.	1. Check the voltage and the supply circuit ($U > 0.85 U_n$). 2. Check the overall load on the distribution system If necessary, modify the settings of devices in the installation. 3. Determine the origin of the order.
Unexpected tripping with activation of the reset button signaling a fault trip.	A fault is present: • overload • earth fault • short-circuit detected by the trip unit	Determine and clear the causes of the fault. Check the condition of the circuit breaker before putting it back into service.
Instantaneous opening after each attempt to close the circuit breaker with activation of the reset button signaling a fault trip.	1. Thermal memory. 2. Transient overcurrent when closing. 3. Closing on a short circuit.	1. See the user manual of the trip unit. Press the reset button. 2. Modify the distribution system or the trip unit settings. Check the condition of the circuit breaker before putting it back into service. Press the reset button. 3. Clear the fault. Check the condition of the circuit breaker before putting it back into service. Press the reset button.

Continued on next page

Table 24 – Troubleshooting and Solutions *(continued)*

Issue	Probable causes	Solutions
Circuit breaker cannot be opened remotely, but can be opened locally.	- Opening order not executed by the MX opening release. - Opening order not executed by the MN undervoltage release.	- Check the voltage and the supply circuit ($0.7 - 1.1 U_n$). If the problem persists, replace the MX release. - Drop in voltage insufficient or residual voltage ($> 0.35 U_n$) across the terminals of the undervoltage release. If the problem persists, replace the MN release.
Circuit breaker cannot be opened locally.	Operating mechanism malfunction or welded contacts.	Contact a Schneider Electric service center.
Circuit breaker can be reset locally but not remotely.	Insufficient supply voltage for the MCH spring charging motor.	Check the voltage and the supply circuit ($0.7 - 1.1 U_n$). If the problem persists, replace the MCH release.
Nuisance tripping of the circuit breaker with activation of the reset button signaling a fault trip.	Reset button not pushed in completely.	Push the reset button in completely.
Impossible to insert the crank in connected, test or disconnected position.	A padlock or keylock is present on the cradle or a door interlock is present.	Disable the locking function.
Impossible to turn the crank.	The reset button has not been pressed.	Press the reset button
Circuit breaker cannot be removed from cradle.	- Circuit breaker not in disconnected position. - The rails are not completely out.	- Turn the crank until the circuit breaker is in disconnected position and the reset button out. Remove crank and store it. - Pull the rails all the way out.
Circuit breaker cannot be connected (racked in).	- Cradle/circuit breaker mismatch protection. - The safety shutters are locked. - The disconnecting-contact clusters are incorrectly positioned. - Cradle locked in disconnected position. - The reset button has not been pressed, preventing rotation of the crank. - The circuit breaker has not been sufficiently inserted in the cradle.	- Check that the cradle corresponds with the circuit breaker. - Remove the lock(s). - Reposition the clusters. - Disable the cradle locking function. - Press the reset button. - Insert the circuit breaker completely so that it is engaged in the racking mechanism.
Circuit breaker cannot be locked in disconnected position.	- The circuit breaker is not in the right position. - The crank is still in the cradle.	- Check the circuit breaker position by making sure the reset button is out. - Remove the crank and store it.
Circuit breaker cannot be locked in connected, test or disconnected position.	- Check that locking in any position is enabled. - The circuit breaker is not in the right position. - The crank is still in the cradle.	- Contact a Schneider service center. - Check the circuit breaker position by making sure the reset button is out. - Remove the crank and store it.
The crank cannot be inserted to connect or disconnect the circuit breaker.	The rails are not completely in.	Push the rails all the way in.
The right-hand rail (cradle alone) or the circuit breaker cannot be drawn out.	The crank is still in the cradle.	Remove the crank and store it.

Continued on next page

Table 24 – Troubleshooting and Solutions *(continued)*

Issue	Probable causes	Solutions
Circuit breaker cannot be closed locally or remotely.	Circuit breaker padlocked or keylocked in the “open” position.	Disable the locking function.
	Circuit breaker interlocked mechanically in a source changeover system.	- Check the position of the other circuit breaker in the changeover system. - Modify the situation to release the interlock.
	Circuit breaker not completely connected.	Terminate racking in (connection) of the circuit breaker.
	The reset button signaling a fault trip has not been reset.	- Clear the fault. - Push the reset button on the front of the circuit breaker.
	Stored energy mechanism not charged.	- Charge the mechanism manually. - If it is equipped with a an MCH spring charging motor, check the supply of power to the motor. If the problem persists, replace the spring charging motor (MCH).
	MX opening shunt release permanently supplied with power.	- There is an opening order. Determine the origin of the order. - The order must be cancelled before the circuit breaker can be closed.
	MN undervoltage release not supplied with power.	- There is an opening order. Determine the origin of the order. - Check the voltage and the supply circuit ($U > 0.85 U_n$). If the problem persists, replace the release.
	XF closing release continuously supplied with power, but circuit breaker not “ready to close” (XF not wired in series with PF contact).	Cut the supply of power to the XF closing release, then send the closing order again via the XF, but only if the ‘circuit breaker is “ready to close.”
	Permanent trip order in the presence of a Micrologic P or H trip unit with minimum voltage and minimum frequency protection in Trip mode and the trip unit powered.	Disable these protection functions on the Micrologic P or H trip unit.
Circuit breaker cannot be closed remotely but can be opened locally using the closing pushbutton.	Closing order not executed by the XF closing release	- Check the voltage and the supply circuit ($0.85 - 1.1 U_n$). - If the problem persists, replace the XF release.
Unexpected tripping without activation of the reset button signaling a fault trip.	MN undervoltage release supply voltage too low.	Check the voltage and the supply circuit ($U > 0.85 U_n$).
	Load-shedding order sent to the MX opening release by another device.	- Check the overall load on the distribution system - If necessary, modify the settings of devices in the installation
	Unnecessary opening order from the MX opening release.	Determine the origin of the order
Unexpected tripping with activation of the reset button signaling a fault trip.	A fault is present: - overload - earth fault - short-circuit detected by the trip unit	- Determine and clear the causes of the fault. - Check the condition of the circuit breaker before putting it back into service
Instantaneous opening after each attempt to close the circuit breaker with activation of the reset button signaling a fault trip.	Thermal memory.	- See the user manual of the trip unit. - Press the reset button.
	Transient overcurrent when closing.	- Modify the distribution system or the control-unit settings. - Check the condition of the circuit breaker before putting it back into service. - Press the reset button.
	Closing on a short circuit.	- Clear the fault. - Check the condition of the circuit breaker before putting it back into service. - Press the reset button.

Continued on next page

Table 24 – Troubleshooting and Solutions *(continued)*

Issue	Probable causes	Solutions
Circuit breaker cannot be opened remotely, but can be opened locally.	Opening order not executed by the MX opening release.	Check the voltage and the supply circuit (0.7 - 1.1 Un). If the problem persists, replace the MX release.
	Opening order not executed by the MN undervoltage release.	Drop in voltage insufficient or residual voltage (> 0.35 Un) across the terminals of the undervoltage release. If the problem persists, replace the MN release.
Circuit breaker cannot be opened locally.	Operating mechanism malfunction or welded contacts.	Contact a Schneider Electric service center.
Circuit breaker can be reset locally but not remotely.	Insufficient supply voltage for the MCH spring charging motor.	Check the voltage and the supply circuit (0.7 - 1.1 Un). If the problem persists, replace the MCH release.
Nuisance tripping of the circuit breaker with activation of the reset button signaling a fault trip.	Reset button not pushed-in completely.	Push the reset button in completely.
Impossible to insert the crank in connected, test or disconnected position.	A padlock or keylock is present on the cradle or a door interlock is present.	Disable the locking function.
Impossible to turn the crank.	The reset button has not been pressed.	Press the reset button.
Circuit breaker cannot be removed from cradle.	Circuit breaker not in disconnected position.	Turn the crank until the circuit breaker is in disconnected position and the reset button out.
	The rails are not completely out.	Pull the rails all the way out.
Circuit breaker cannot be connected (racked in)	Cradle/circuit breaker mismatch protection.	Check that the cradle corresponds with the circuit breaker.
	The safety shutters are locked.	Remove the lock(s).
	The disconnecting-contact clusters are incorrectly positioned.	Reposition the clusters.
	Cradle locked in disconnected position.	Disable the cradle locking function.
	The reset button has not been pressed, preventing rotation of the crank.	Press the reset button.
	The circuit breaker has not been sufficiently inserted in the cradle.	Insert the circuit breaker completely so that it is engaged in the racking mechanism.
Circuit breaker cannot be locked in disconnected position	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	The crank is still in the cradle.	Remove the crank and store it.
Circuit breaker cannot be locked in connected, test or disconnected position	Check that locking in any position is enabled.	Contact a Schneider service center.
	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	The crank is still in the cradle.	Remove the crank and store it.
The crank cannot be inserted to connect or disconnect the circuit breaker	The rails are not completely in.	Push the rails all the way in.
The right-hand rail (cradle alone) or the circuit breaker cannot be drawn out	The crank is still in the cradle.	Remove the crank and store it.

Section 6— Testing

Procedures

Visual Inspections During Operation

While circuit breaker is energized:

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Take precautions to ensure that no accidental contact is made with live components during this check.

Failure to follow these instructions will result in death or serious injury.

1. Verify circuit breaker application and rating.

Make sure that the circuit breaker is properly applied within labeled voltage, ampere rating, maximum current interrupting ratings and to Company recommendations. Compare the circuit breaker faceplate data to the installation drawings. Verify trip unit settings on Micrologic electronic-trip circuit breakers with the coordination study. After completing inspection and maintenance procedures, insure that all trip unit settings for all functions are set according to the coordination study.

2. Check for overheating while equipment is energized.

While the circuit breaker is normally operating, under load and at operating temperature, check the exposed, accessible, insulated face of the circuit breaker and adjacent dead front surfaces of the enclosure for overheating. To do this, use an infrared temperature probe to check the temperature. If the temperature exceeds 140°F (60°C), the cause should be investigated.

Allow initially energized circuit breaker at least three hours to reach operating temperature. Compare the surface temperature of individual circuit breakers with the surface temperature of other circuit breakers in the installation. Circuit breaker surface temperatures vary according to loading, position in the panelboard and ambient temperature. If the surface temperature of a circuit breaker is considerably higher than adjacent circuit breakers, the cause should be investigated.

Thermographic inspection methods may also be used to evaluate overheating with equipment energized (see Thermographic Inspection, page 44).

3. Check for cracks in the circuit breaker case.

Any circuit breaker with a cracked case should be replaced because its ability to withstand short-circuit interruption stresses is reduced.

4. Inspect the enclosure.

The enclosure should be clean and dry. All covers and trim pieces should be in place.

Thermographic Inspection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Only qualified electrical workers with training and experience on low-voltage circuits should perform thermographic inspections. These workers must understand the hazards involved in working with or near low-voltage equipment. Perform such work only after reading this complete set of instructions.

Failure to follow these instructions will result in death or serious injury.

Infrared thermographic inspection techniques may be useful in evaluating the operating condition of circuit breakers and terminations. Comparison to stored infrared thermographic images may be useful for the preventive maintenance of circuit breakers and end-use equipment. The actual amount of heat emitted is a function of both load current and ambient conditions. Interpretation of infrared survey requires experience and training in this type of inspection.

Allow initially energized circuit breakers at least three hours to reach operating temperature. Compare the thermographic images of individual circuit breakers to previously stored images of the same circuit breakers.

Performance Tests

Do the performance tests in the order given to maximize the accuracy of the test results.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- Do not touch the circuit breaker terminals or the test leads while the circuit breaker is being tested.

Failure to follow these instructions will result in death or serious injury.

NOTE: Never do the contact resistance test before doing the instantaneous primary injection testing. The primary injection testing will ensure the contacts are clear of resistive films, oxidation and foreign material.

The following tests are intended to verify that a circuit breaker is operating properly. Precisely controlled factory testing conditions are used to establish the characteristic trip curves. If field test results fall outside the characteristic trip curve tolerance band, carefully evaluate the test conditions and methods for accuracy.

When questionable conditions or results are observed during inspection and performance tests, consult the local field sales office. Circuit breakers with accessories or factory modifications may require special investigation. If it is necessary to return a circuit breaker to the manufacturing facility, use proper packaging and packing materials to avoid shipping damage.

Dielectric Testing Masterpact Circuit Breakers with Micrologic P or H Trip Systems

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Dielectric tests (high potential, insulation resistance, or Megger tests) may damage Micrologic P and H trip units.
- Remove rating plug from trip unit prior to testing.
- Replace trip unit if rating plug was not removed during tests or if trip unit was exposed to more than 700 Vac.

Failure to follow these instructions can result in equipment damage.

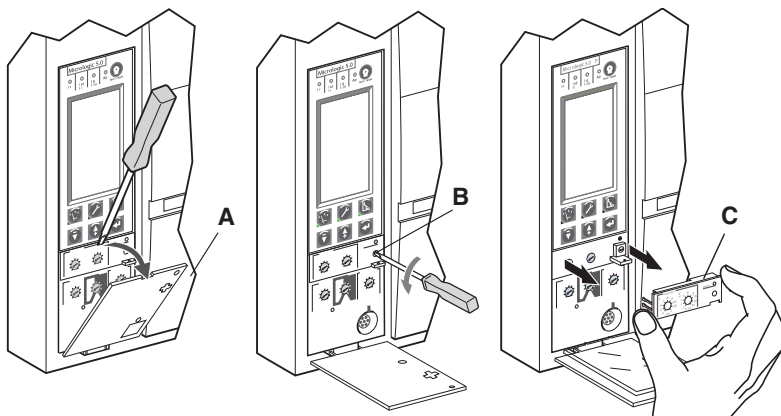
Dielectric tests (high potential, insulation resistance or Megger tests) are used to ensure the proper isolation and insulation between phases and between each phase and ground. The equipment used to conduct these tests creates a high-potential voltage (thousands of volts) to verify dielectric or insulation integrity.

The rating plug on Micrologic P and H trip units connect/disconnect the trip unit with the voltage connections in the circuit breaker. Before conducting any high-voltage tests on circuit breakers with Micrologic P and H trip units, remove the rating plug as shown

NOTE: Only Micrologic P and H trip units have phase voltage connections into the trip unit. For other types of trip units, it is not necessary to remove the rating plug prior to dielectric testing.

1. Open switch cover (Figure 15, A).
2. Unscrew rating plug mounting screw (B).
3. Remove rating plug (C).

Figure 15 – Removing Rating Plug



NOTICE**HAZARD OF EQUIPMENT DAMAGE**

Do not apply test voltage to control circuits or accessory terminals; damage to electronic and/or low-voltage components can result.

Failure to follow these instructions can result in equipment damage.

Insulation Resistance Test

Severe environmental conditions can reduce the dielectric strength of molded case circuit breakers. Check insulation resistance during electrical system testing.

To check the insulation resistance, perform the following steps:

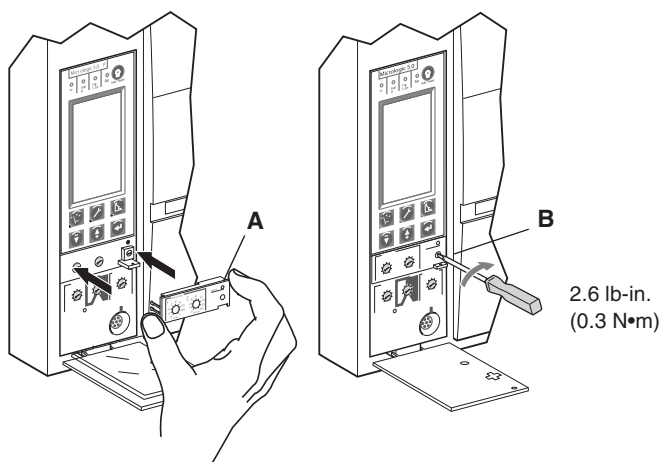
1. De-energize and isolate the circuit breaker:
2. Clean the circuit breaker as described earlier.
3. Using a megohmmeter with a capacity of 500–1000 Vdc, apply voltage from:
 - a. Each phase-to-ground with the circuit breaker on (circuit breaker contacts closed).
 - b. Phase-to-phase with the circuit breaker on (circuit breaker contacts closed).
 - c. Between each line and load terminal with the circuit breaker off (circuit breaker contacts open).
4. Record resistance values. Resistance values of less than one megohm (1,000,000 ohm) should be investigated.

After testing is complete, replace rating plug if previously removed:

1. Replace rating plug (Figure 16, A).
2. Tighten rating plug mounting screw (B).

NOTE: If the rating plug is not installed, the circuit breaker will default to a long-time pickup setting of $0.4 \times I_n$ and some of the advanced functions will not be operable.

Figure 16 – Replacing Rating Plug



Micrologic Trip Unit Checks

Circuit breakers with Micrologic trip units can have their trip unit operation tested with secondary injection testing using the one of the available test kits. (See page 58 for test kits.)

Secondary injection testing does not test the current transformers and connections. Primary injection testing can be used to ensure that all trip system connections have been correctly made.

If the circuit breaker is tested by the primary injection method, the Powerlogic™ system can remain connected to the circuit breaker during testing without affecting the results.

NOTE: Testing a circuit breaker connected to a Powerlogic system causes the Powerlogic system to react as if the circuit breaker were experiencing the actual faults.

Procedure to Defeat Zone-Selective Interlocking

Zone-selective interlocking is a method of communication between electronic-trip overcurrent protective devices. Zone-selective interlocking allows interlocked devices at different levels to work together as a system in which a short circuit or ground fault is isolated and cleared with minimum time delay. The purpose of defeating zone-selective interlocking is to verify the characteristics of the specific circuit breaker short-time and ground-fault trip delay functions. For test purposes, zone-selective interlocking can be inhibited on Masterpact circuit breakers equipped with Micrologic trip units by using the Hand-Held or Full-Function Test Kit.

Secondary Injection Testing

Field installation of a trip unit requires secondary injection testing with a Full-Function Test Kit. This will ensure that the newly-installed trip unit is functioning properly. The test will require opening and closing the circuit breaker. Follow the procedures outlined in the instruction bulletins shipped with the circuit breaker and the Full-Function Test Kit.

1. Make sure the circuit breaker is isolated from all upstream and downstream devices.
2. Perform secondary injection testing as outlined in the instruction bulletin shipped with the full-function test kit. Verify that all applicable trip unit functions are operating properly.
3. Repeat step 2 with the circuit breaker in the open position.

NOTE: The test kit states that the circuit breaker should be closed when performing the test. Do not close the circuit breaker for this step.

4. If any test fails, do not put the circuit breaker into service and contact the local sales office for factory authorization service.

Primary Injection Testing

Primary injection testing can be used to ensure that all trip system connections have been correctly made.

NOTE: Secondary injection testing continues to be the Schneider Electric preferred method for testing circuit breakers. Improper primary injection testing can cause damage to the circuit breakers. Failure to conduct primary injection testing in the proper manner could result in circuit breakers passing testing, while ultimately damaging the integrity of the circuit breaker long term.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Circuit breakers are heavy and can be damaged with improper handling. Use care when handling and transporting circuit breakers to test equipment.
- Make connection to the circuit breaker carefully using rated cable and appropriate connection methods. Do not use clamps or other methods that can score or otherwise damage the finish of the connectors.
- When connecting a drawout-type circuit breaker, use approved primary injection test kit. Adjust circuit breaker position so circuit breaker clusters align with the primary injection test kit.

Failure to follow these instructions can result in equipment damage.

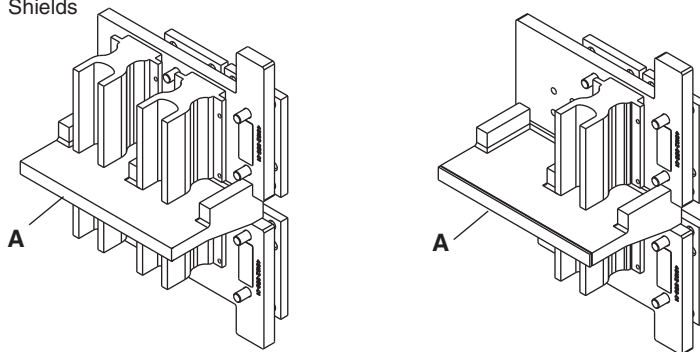
1. If performing primary injection testing on drawout circuit breakers, connect circuit breaker to power supply using primary injection test kits.

Table 25 – Primary Injection Test Kit

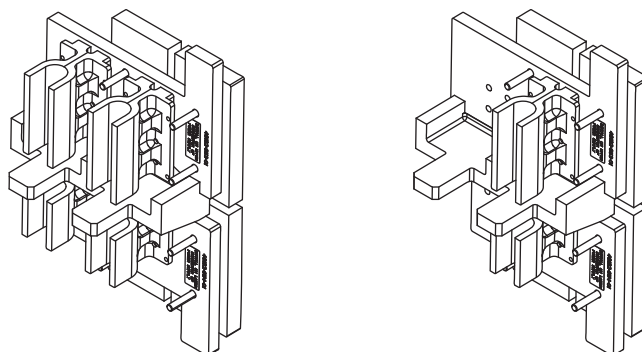
Circuit Breaker Type	Power Supply	Test Kit Required
Masterpact NW without ArcBlok or Cluster Shields	Phoenix®	ULW10025
	MultiAmp®	ULW10026
Masterpact NW with ArcBlok or Cluster Shields	Phoenix®	ULW10025 and Primary Injection Bumper Kit 84958
	MultiAmp®	ULW10026 and Primary Injection Bumper Kit 84958
Masterpact NT	Phoenix or MultiAmp	ULW10027
PowerPact	Phoenix or MultiAmp	ULW10027
All Types	Other Than Phoenix or MultiAmp	Contact Field Office

Figure 17 – Masterpact NW Primary Injection Test Assembly

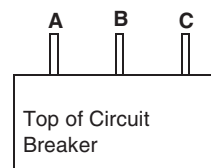
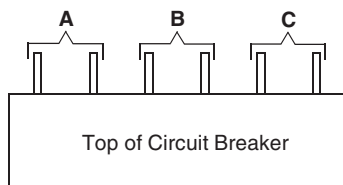
Primary Injection Test Assembly for Circuit Breakers without ArcBlok or Cluster Shields



Primary Injection Test Assembly with Primary Injection Bumper (Kit 84958) for Circuit Breakers with ArcBlok or Cluster Shields



Phases

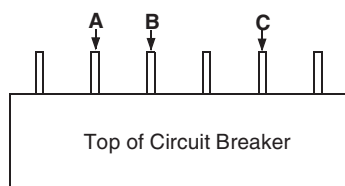


- a. Install primary injection test kit following instructions shipped with the test kit.
- b. Adjust height of the circuit breaker so the stop (A, above) between the top and bottom plates of the test kit is between the top and bottom connectors of the circuit breaker when it is in the connected positions.
- c. Align the circuit breaker so that the clusters on the circuit breaker phase being tested line up with the connectors with the primary injection test kit.
- d. Use grease kit, catalog number S48899, to lubricate connectors. Do not install anything in the cluster jaw except approved test kit.

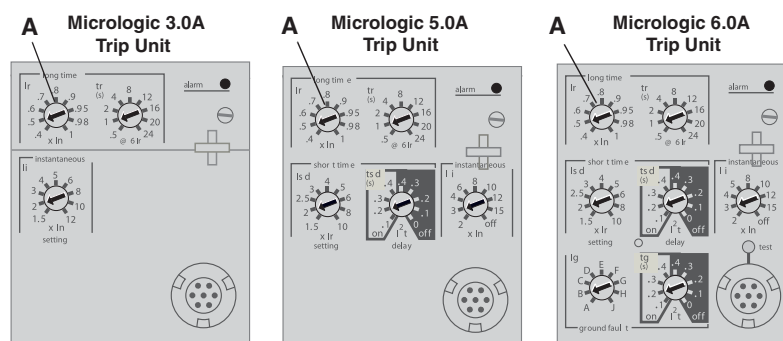
NOTE: Remove any existing grease from cluster assembly before applying new grease to clusters.

2. If performing primary injection testing on fixed circuit breakers, connect circuit breaker to power supply using rated cable and appropriate connection method.

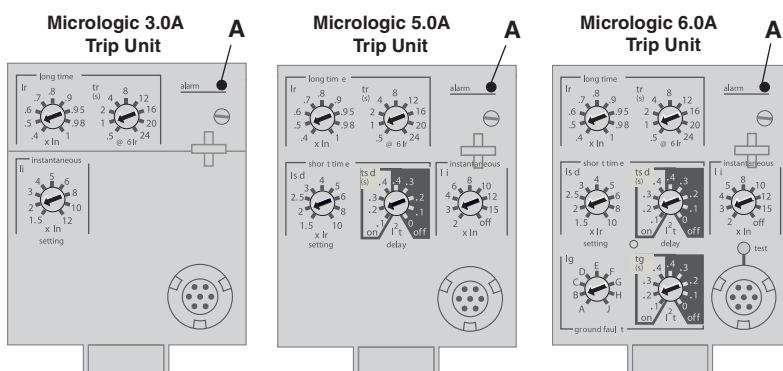
NOTE: Wide-construction circuit breakers only—When primary injection testing a circuit breaker with six bus connectors, current is injected into phases as shown in Figure 18. Do not inject current into outside busses.

Figure 18 – Wide-Construction Circuit Breakers**Primary Injection Test**

3. Record each of the original trip unit switch settings. (Settings must be reset after testing is complete.)
4. Set the long-time pickup (I_r) switch (A) to the minimum setting.

Figure 19 – Record Switch Settings

- a. For ground-fault and/or zone-selective interlocked trip units, use the hand-held or full-function test kit to inhibit ground-fault and zone-selective interlocking functions.
- b. If an auxiliary power supply is being used for the Micrologic trip unit, disconnect the auxiliary power supply.
- c. Find the primary injection current needed by multiplying the long-time pickup current (long-time pickup setting $I_r \times$ sensor plug $I_n \times 125\%$ (i.e. $I_r \times I_n \times 1.25$).
- d. Inject primary current into A-phase and monitor the overload indicator light. Verify that the overload indicator light (A) lights between 105% and 120% of the $I_r \times I_n$ value.
- e. Repeat for all phases and neutral (if applicable).
- f. If overload indicator light does not light correctly, check all trip unit connections and test setup. If unit still fails primary injection testing, contact the local sales office.

Figure 20 – Overload Indicator Light

Circuit Breakers with Integral Ground Fault Protection

Micrologic electronic-trip circuit breakers with the integral ground-fault protection function require special attention when testing overload and short-circuit functions. The single-pole primary injection tests for the inverse-time overcurrent, short-time and instantaneous functions will cause ground-fault trips due to the return current path not going through the circuit breaker. To overcome this difficulty, use the Hand-Held or Full-Function Test Kit to defeat the ground-fault function on Masterpact or PowerPact™ circuit breakers equipped with Micrologic trip units.

NOTE: When the hand-held or full-function test kits are used to inhibit ground-fault, the test kit puts the trip unit in "TEST MODE". While the trip unit is in this mode, the logs, alarms, and advanced protections are turned off so that a test trip is not recorded as an actual event. See the test kit instructions for further information.

Ground-Fault Protection and Indication Only Tests for Radial Systems

Ground-Fault Trip Test

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

The ground-fault function of a Micrologic electronic-trip circuit breaker provides ground-fault protection for equipment with adjustable pickup and delay values. The ground-fault delay feature determines how long the circuit breaker waits before initiating a trip signal during a ground fault. Performance of the ground-fault functions of the circuit breaker can be tested using a high-current, low-voltage ac power supply.

Test Procedure

1. Completely de-energize and remove the circuit breaker from service.
2. Before testing, record pickup and delay setting for all functions. Reset the trip unit to these same settings after the test procedure is completed.
3. If testing a circuit breaker that is equipped with zone-selective interlocking, follow the procedure to defeat zone-selective interlocking on page 47. If you are using a secondary injection test kit for these tests, carefully read and follow the test kit instructions about zone-selective interlocking.

NOTE: Failure to defeat zone-selective interlocking will result in trip time inaccuracy.

4. Use these settings for the test:

Long-time Pickup/Ampere Rating = Max.

Long-time/Overload Delay = Max

Short-time/Short-circuit Delay = Max. (I^2t IN or ON)

Instantaneous = Max.

Ground-fault Pickup = Min.

Ground-fault Delay = 0.2

5. Follow the hookup procedure appropriate to the test application.

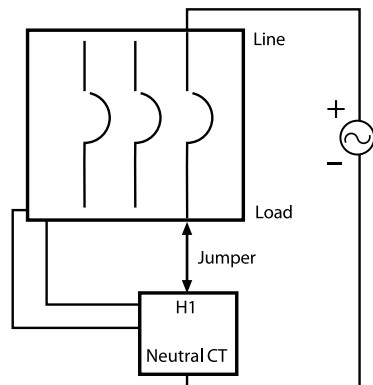
For circuit breakers without a neutral current transformer, go to step 8.

For circuit breakers with the integral ground-fault function in a three-phase, four-wire system, an externally-mounted neutral current transformer (CT) must be used. The neutral CT is connected to the circuit breaker by a shielded cable (14 AWG [2.1 mm²] wire is recommended).

NOTE: When testing, disconnect or turn off 24 Vdc control power to F1 and F2, if equipped and disconnect the Hand-Held or Full-Function Test Kit from the trip unit, if connected.

6. Verify correct phasing of the neutral CT (three-phase, four-wire systems) by performing a No Trip Test as follows:

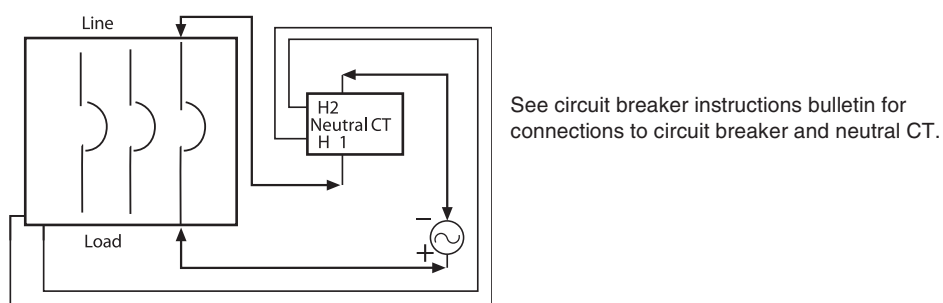
- a. Connect the circuit breaker and neutral CT as shown in Figure 21. The jumper must go from the load connection on the circuit breaker to the H1 connection on the neutral CT (or the side of the neutral CT that has the red dot). Connect the secondary of the neutral CT according to the circuit breaker instruction manual or the neutral CT instructions.
- b. Apply current above the ground-fault pickup level and maintain longer than the ground-fault delay.
- c. The circuit breaker must not trip. No trip indicates that both the phase CT and neutral CT are phased properly.

Figure 21 – Test Hookup Diagram for Neutral CT Phasing Test

See circuit breaker instructions bulletin for connections to circuit breaker and neutral CT.

7. Verify the correct size of the neutral CT (three-phase, four-wire systems) by performing a Trip Test as follows:
 - a. Connect the circuit breaker and neutral CT as shown in Figure 22. Connect the polarity (+) terminal of the high current injection unit to the load side of the circuit breaker. The jumper must go from the line connection on the circuit breaker to the H1 connection on the neutral CT (or the side of the neutral CT that has the red dot). Connect the non-polarity (-) terminal of the high current injection unit to H2 on the neutral CT (on the line side of the circuit breaker). Connect the secondary of the neutral CT according to the circuit breaker instruction manual or the neutral CT instructions.
 - b. Apply current.
 - c. The circuit breaker must trip at half the value of the ground-fault pickup. Tripping indicates that both the phase CT and neutral CT have the same turns ratio (same size).

Figure 22 – Test Hookup Diagram for Neutral CT Size Test



8. Test ground fault pickup and delay by performing a trip test as follows:
 - a. Connect the circuit breaker as shown in Figure 23, (three-phase, three-wire systems) or Figure 24 (three-phase, four-wire systems).

Figure 23 – Test Hookup Diagram for Circuit Breaker Without Neutral CT

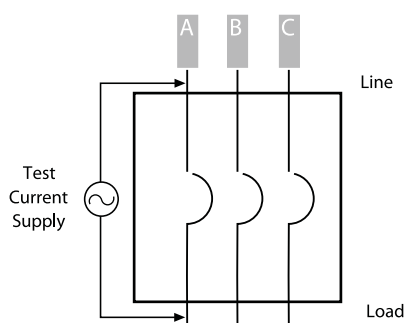
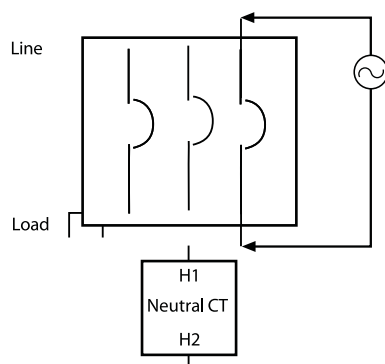


Figure 24 – Test Hookup Diagram for Ground-Fault Pickup and Delay Test

NOTE: The recommended method of testing ground-fault pickup and delay is the “pulse” method. This method will be the most accurate, but requires that the test equipment have a calibrated image-retaining oscilloscope or high-speed sampling rate digital ammeter. An accurate timer is needed to monitor delay time.

- b. After the circuit is properly connected and closed, apply current in short pulses of 10-cycle duration. Starting at 70% of the expected trip value,
- c. Reclose the circuit breaker and reduce the current level; pulse again to determine if the pickup level found was overshoot.
- d. Repeat steps b and c to further isolate the pickup point.
- e. To determine delay time, test each pole of the circuit breaker individually at 150% of the ground-fault pickup setting. Monitor the time from this pickup point until the circuit breaker trips to obtain the delay time.
- f. Record pickup and delay values and compare the results to the trip curve.

The ground-fault test can also be done using secondary injection testing using the Full-Function Test Kit. Secondary injection testing does not test the current transformers and connections.

Table 26 – Maximum Micro-Ohms Per Pole

Masterpact Type	Micro-Ohms (u ohm)	
	Drawout	Fixed
NT06—NT10 H1/H2/L1	38.72	26.39
NT12—NT16 H1/H2	36	26
NW08 N1	42	19
NW08 H/L	30	13
NW10 N1	42	19
NW10 H/L	30	13
NW12 N1	42	19
NW12 H/L	27	13
NW16 N1	37	19
NW16 H/L	27	13
NW20 H/L	27	13
NW25 H1/H2/H3	19	8
NW 32 H1/H2/H3	13	8
NW40 H1/H2/H3	11	8
NW40b, NW50, NW63	7	5

Contact Resistance Test

Circuit breaker pole resistance tests are not reliable indicators of circuit breaker performance because the resistance values are influenced by a number of transient factors including contact surface oxidation, foreign material between the contacts, and testing methods. NEMA AB 4 paragraph 6.4.1 states: “The millivolt drop of a circuit breaker pole can vary significantly due to inherent variability in the extreme low resistance of the electrical contacts and connectors. Such variations do not necessarily predict unacceptable performance and shall not be used as the sole criteria for determination of acceptability.”

High pole resistance may also be caused by eroded contacts, low contact force, and loose termination. The only one of these factors likely to be present on a new circuit breaker is a loose termination, since the contacts are new and there has been no opportunity for contact pressure to have drifted from the factory setting. A loose termination can be corrected in the field.

If a contact resistance test is done, it is important to do it after the contacts have been conditioned by instantaneous primary injection testing to ensure the contacts are clear of resistive films, oxidation and foreign material. If the circuit breaker has been in service with no performance issues, (overheating or nuisance tripping), contact resistance measurements are redundant and of little value.

Square D™ recommends that a Digital Low Resistance Ohmmeter (DLRO) be used, using a 10 A dc test current for circuit breaker ratings below 100 A, and using 100 A dc for circuit breakers rated 100 A and above. the median (middle) value of three readings (toggling the circuit breaker between each reading) should be recorded for each pole tested. If this value is equal to or less than the value listed in Table 26, the pole is acceptable. If the reading is higher, the cause should be investigated and corrected if possible. Contact your local field office for more information.

Circuit Breakers with Direct Current Protection

The Masterpact NW DC circuit breakers are designed, manufactured and calibrated for use on ungrounded, uninterruptable power supplies (UPS). The maximum nominal (loaded) voltage is 500 Vdc and the maximum floating (unloaded) voltage is 600 Vdc.

These circuit breakers are UL Listed when applied with all poles connected in series as shown on the label of the circuit breaker. The series connection is customer provided and external to the circuit breakers.

The Masterpact NW DC circuit breakers are special circuit breakers for dc applications only and must be tested using dc current.

- Select the correct time-current trip curve. The trip curves show both the thermal and magnetic trip ranges of the circuit breakers.
- Use a dc power supply to test the circuit breakers as follows:
 - Time constant ≤ 25 ms
 - DC ripple constant $\leq 1\%$ rms
- Remove the circuit breaker from the enclosure. If removing the circuit breaker is not practical, test the circuit breaker in the end-use equipment. If the test results fall outside of the trip curve tolerance, remove the circuit breaker from the enclosure and retest.
- Use correctly sized cable (per National Electrical Code® [NEC®] tables) with a minimum of four feet (1.22 m) of cable per connection.
- Connect a dc power supply to the circuit breaker with all poles connected in series as shown on the circuit breaker label (see Figure 25–27).
- Make sure connections to circuit breaker are properly torqued.
- Apply a dc test current to the circuit breaker of approximately 70% of the expected value to trip the circuit breaker. The tripping mechanism in the circuit breaker reacts to the magnetic fields created by the current flowing through the circuit breaker. If the circuit breaker does not trip, increase the test current on successive trials until it does trip. When the circuit breaker trips:
 - a. Reset and close the circuit breaker.
 - b. Reapply the dc test current to trip the circuit breaker again.
 - c. Record the current and compare to the trip curve.

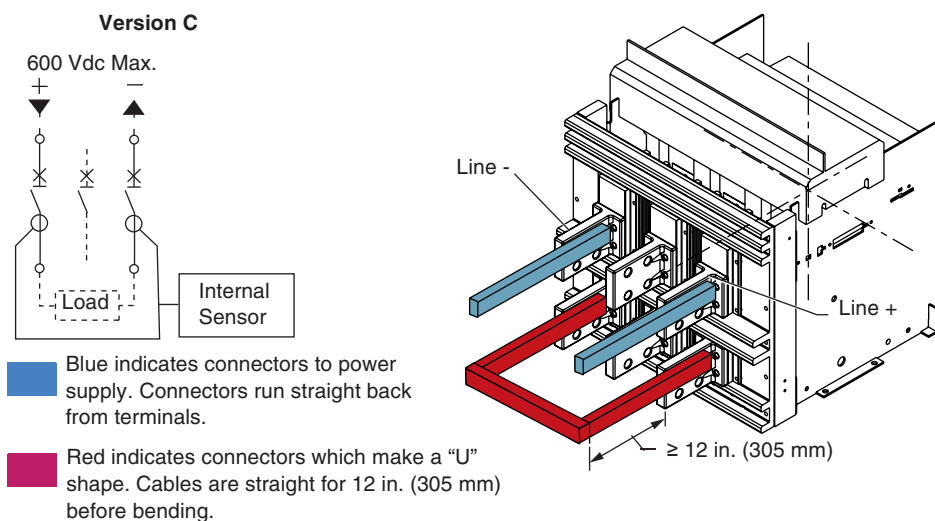
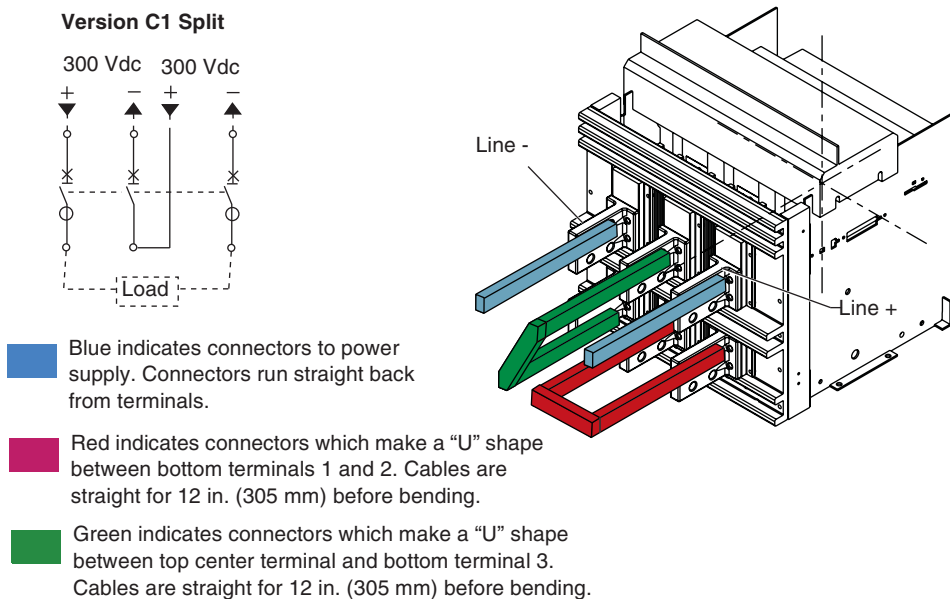
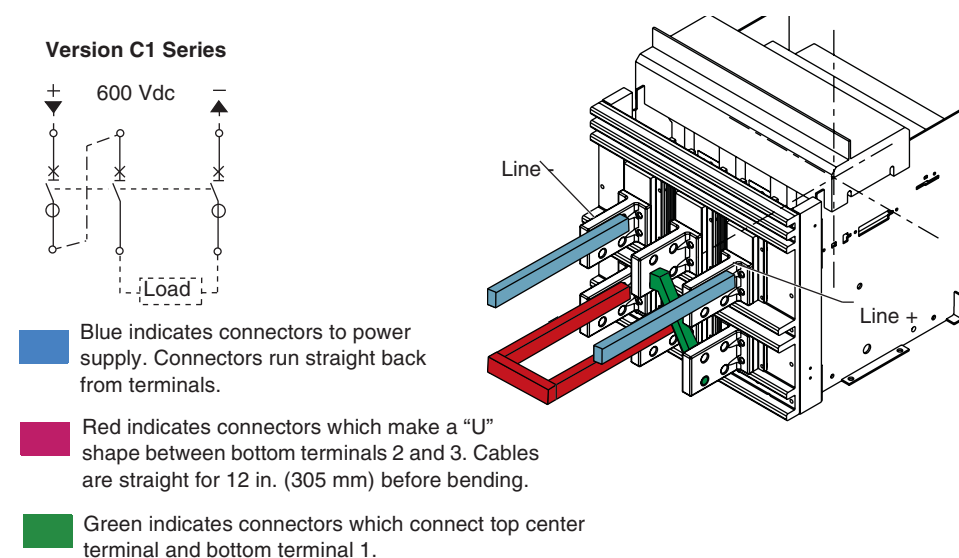
Figure 25 – Version C Wiring Configuration**Figure 26 – Version C1 Split Configurations**

Figure 27 – Version C1 Series Configurations

Remove Test Connections Upon Completing Testing:

- Remove test connections from circuit breaker.
- Inspect connections for damage caused by testing.
- For drawout circuit breakers, inspect, lubricate, and reset clusters before installing circuit breaker, see page 31.
- Reset the long-time pickup switch to original settings, as recorded above.
- If an auxiliary power supply is being used for the Micrologic trip unit, reconnect the auxiliary power supply.

Test Kit Information

Full-Function Test Kit

The Full-Function Test Kit is a microprocessor-based system used to test Compact™ NSJ, Masterpact and PowerPact circuit breakers with Micrologic electronic-trip units. The Full-Function Test Kit is a secondary injection tester and does not test the current transformers and connections.

The Full-Function Test Kit is designed to be used as a stand-alone test unit or in conjunction with a personal computer. The Full-Function Test Kit alone performs the following tests:

- Protection function verification (LSIG)
- Compliance with trip curve
- Electrical and mechanical tests of trip system
- Zone-selective interlocking tests
- Inhibition of ground-fault protection for use during primary injection testing
- Inhibition of thermal imaging for use during primary injection testing
- Supply control power to the trip unit to energize displays

Hand-Held Test Kit

The Hand-Held Test Kit is a small battery-powered unit. It is designed to provide convenient secondary injection tests on Compact NSJ, Masterpact and PowerPact circuit breakers with Micrologic electronic-trip units. The Hand-Held Test Kit is powered by five 9 V batteries and can be used to do the following:

- Verify trip unit operation by tripping the circuit breaker with a secondary injection signal
- Supply control power to the trip unit to energize displays
- Inhibit thermal imaging for primary injection testing
- Inhibit ground-fault for primary injection testing
- Zone-selective interlocking tests¹

Anti-Pumping Feature

All Masterpact NT and NW circuit breakers are designed with an anti-pumping feature which always gives priority to an opening order over a closing order. Specifically, if opening and closing orders occur simultaneously, the charged mechanism discharges without any movement of the main contacts keeping the circuit breaker in the open (OFF) position. In the event that opening and closing orders are simultaneously maintained, the standard mechanism provides an anti-pumping function which continues to keep the main contacts in the open position. In addition, after fault tripping or opening the circuit breaker intentionally (using the manual or electrical controls and with the closing coil continuously energized) the circuit breaker cannot be closed until the power supply to the closing coil is discontinued and then reactivated.

Anti-Pump Check for Electrically Operated Circuit Breakers

If desired, use the following procedure to assure that the anti-pump feature works properly.

1. Open the circuit breaker.
2. Energize the control power for the spring charging motor, shunt trip and shunt close.
3. Spring charging motor will charge the springs whenever they are discharged (during circuit breaker closing).
4. Make sure all interlocks, etc. are disengaged and the circuit breaker is ready to close. Press and hold the Close pushbutton (use the remote close button connected to the shunt close if desired). Verify the circuit breaker closed. Wait for the spring charging motor to complete the spring charge.
5. While continuing to hold the Close button, press the Open button. Make sure the circuit breaker opens and does not reclose.
6. Release the Close button.
7. If circuit breaker does not attempt to reclose, the anti-pump feature is working correctly.
8. Press the Open button and then the Close button.
9. Press and release the Close pushbutton (use the remote close button connected to the shunt close if desired). Verify the circuit breaker closed. Wait for the spring charging motor to complete the spring charge.

¹ Only provides power to trip unit to indicate a ZSI signal was received. Will not initiate the command to send a ZSI restraint signal.

10. Press the Open button. Make sure the circuit breaker opens.
11. Repeat steps 8, 9 and 10 to make sure the circuit breaker opens and closes correctly.

Anti-Pump Check for Manually Operated Circuit Breakers

1. Open the circuit breaker.
2. Operate the spring charging handle to charge the closing springs.
3. Make sure all interlocks, etc. are disengaged and the circuit breaker is ready to close. Press and hold the Close pushbutton. Verify the circuit breaker closed.
4. Operate the spring charging handle to charge the closing springs.
5. While continuing to hold the Close button, press the Open button. Make sure the circuit breaker opens and does not reclose.
6. Release Close button.
7. If circuit breaker does not attempt to reclose, the anti-pump feature is working correctly.
8. Press the Open button and then the Close button.

Additional Information

For more information concerning Schneider Electric and Square D brand circuit breakers, refer to the appropriate instruction manual. These manuals contain installation instructions, mounting information, safety features, wiring diagrams, and troubleshooting charts for specific circuit breakers.

Section 7— Available Bulletins

Table 27 – List of Available Bulletins

	Masterpact NT	Masterpact NW
Catalogs		
Universal Power Circuit Breakers	0613CT0001	0613CT0001
DC Circuit Breakers	—	0613CT0501
Certified to ABS-NVR	0613CT0601	0613CT0601
Instruction Bulletins		
UL rated	HRB39231	HRB28361
IEC Rated	HRB39244	HRB39225
UL Rated DC	—	HRB39255
IEC Rated UL	—	HRB39254
ArcBlok	—	HRB23946
User Guides		
UL Rated	0613IB1209	0613IB1204
IEC Rated	0613IB1210	0613IB1208
UL Rated DC	—	0613IB1211
IEC Rated UL	—	0613IB1212
ArcBlok	—	0613IB1203
Trip Unit User Guide		
Standard (Micrologic 2.0, 3.0 and 5.0) Trip Units	48049-207-05	48049-207-05
Micrologic A Trip Units	48049-136-05	48049-136-05
Micrologic P Trip Units	48049-137-05	48049-137-05
Micrologic H Trip Units	48049-330-03	48049-330-03
Modbus Communication for Micrologic		
Traditional 4-Wire Modbus	0613IB1201	0613IB1201
Ethernet/Modbus + ULP	0613IB1303	0613IB1313
Test Instructions		
Full-Function Test Kit (FFTK)	48049-183-06	48049-183-06
Hand-Held Test Kit (HHTK)	48049-184-03	48049-184-03
Dielectric Testing	48049-550-01	48049-550-01
ERMS Testing	NHA67346	NHA67346
List of Accessory Instructions		
	See the Schneider Electric website.	

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0613IB1202 R08/15, 08/2015
Replaces 0613IB1202 R07/13



ECN 587C Replaces / Reemplaza / Remplace 48049-146-01 04/2001

Undervoltage Trip (MN), Shunt Trips (MX1 and MX2), and Shunt Close (XF) for Masterpact® NW Circuit Breakers

Disparo por baja tensión (MN), disparos en derivación (MX1 y MX2), y cierre en derivación (XF) para los interruptores Masterpact® NW

Déclencheur sur baisse de tension (MN), déclencheurs shunt (MX1 et MX2) et fermeture en shunt (XF) pour disjoncteurs Masterpact® NW

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

NOTE: Each of these accessory devices requires the installation of either a push-in connector or a ring terminal connector.

NOTA: Cada uno de estos dispositivos accesorios requieren la instalación de un conector de terminal a presión o un conector de terminal de anillo.

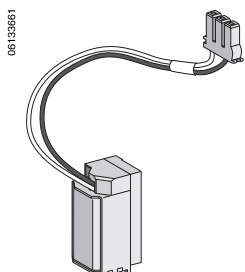
REMARQUE : Chacun de ces dispositifs accessoires exige l'installation d'un connecteur-poussoir ou d'un connecteur de borne à anneau.

Device / Dispositivo / Dispositif	Circuit Breaker / Interruptor automático / Disjoncteur	12 V ~	24–30 V ~ / V ~	48–60 V ~ / V ~	100–130 V ~ / V ~	200–240 V ~ / V ~	277 V ~	380–480 V ~
Undervoltage Trip (MN) / Disparo por baja tensión (MN) / Déclencheur sur baisse de tension (MN)	Fixed / Fijo / Fixe	—	S47380	S47381	S47382	S47383	—	S47385
	Drawout / Removable / Débrochable	—	S48501	S48502	S48503	S48504	—	S48506
Shunt Trip (MX1), Shunt Close (XF) / Disparo en derivación (MX1), cierre en derivación (XF) / Déclencheur shunt (MX1), fermeture en shunt (XF)	Fixed, no communication / Fijo, sin comunicación / Fixe, sans communication	S47359	S47360	S47361	S47362	S47363	S47364	S47365
	Drawout, no communication / Removable, sin comunicación / Débrochable, sans communication	S48490	S48491	S48492	S48493	S48494	S48495	S48496
	Fixed, with communication / Fijo, con comunicación / Fixe, avec communication	S47320	S47321	S47322	S47323	S47324	S47325	S47326
	Fixed, with communication / Fijo, con comunicación / Fixe, avec communication	S48457	S48458	S48459	S48460	S48461	S48462	S48463
	Fixed, no communication / Fijo, sin comunicación / Fixe, sans communication	S47359	S47360	S47361	S47362	S47363	S47364	S47365
Second Shunt Trip (MX2) / Segundo disparo en derivación (MX2) / Deuxième déclencheur shunt (MX2)	Fixed, no communication / Fijo, sin comunicación / Fixe, sans communication	S47359	S47360	S47361	S47362	S47363	S47364	S47365
	Drawout, no communication / Removable, sin comunicación / Débrochable, sans communication	S48490	S48491	S48492	S48493	S48494	S48495	S48496

KIT CONTENTS

CONTENIDO DEL ACCESORIO

CONTENU DU KIT



NOTE: Shunt trips and shunt close used with communication feature have three wires.

NOTA: Los disparos en derivación y el cierre en derivación, utilizados con la función de comunicación, tienen tres hilos.

REMARQUE : Les déclencheurs shunt et le fermeture en shunt utilisés avec la fonction de communication, ont trois fils.

NECESSARY TOOLS

Screwdriver (Pozidriv® No. 2 or 3 pt., or slotted)

HERRAMIENTAS NECESARIAS

Desatornillador (Pozidriv® no. 2 ó 3, o de punta plana)

OUTILS NÉCESSAIRES

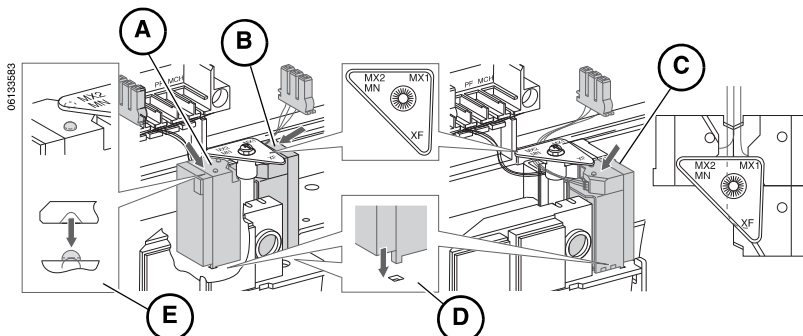
Tournevis (Pozidriv® à embout n° 2, n° 3 ou plat)

INSTALLATION

6. Lift coil retainer and install undervoltage trip MN or shunt trip MX2 (A), shunt trip MX1 (B) and/or shunt close XF (C) as shown below, placing tabs in designated holes (D) and aligning nubs on coil(s) with indentations on coil retainer (E)

6. Levante el sujetador de la bobina e instale el disparo por baja tensión MN o disparo en derivación MX2 (A), disparo en derivación MX1 (B) y/o cierre en derivación XF (C) como se muestra. Coloque las lengüetas en los agujeros designados (D) y alinee las muescas en la(s) bobina(s) con las hendiduras en el sujetador de la bobina (E).

6. Soulever le dispositif de retenue de bobine et installer le déclencheur sur baisse de tension MN ou le déclencheur shunt MX2 (A), le déclencheur shunt MX1 (B) ou le fermeture en shunt XF (C), comme indiqué. Insérer les languettes dans les trous désignés (D) et aligner les languettes sur les bobines avec les bosses du dispositif de retenue de bobine (E).



7. Install coil wiring (A) into corresponding auxiliary control connection slots (B).

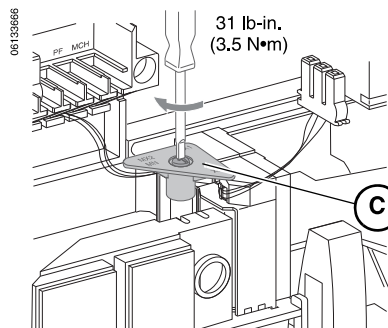
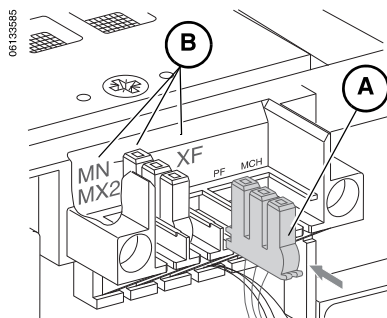
7. Instale el cableado de la bobina (A) en la(s) ranura(s) correspondiente(s) (B) de la conexión al control auxiliar.

7. Installer le câblage de la bobine (A) dans la fente correspondante (B) de la connexion de commande auxiliaire.

8. Lower coil retainer (C) and secure with screw

8. Vuelva a colocar el sujetador de la bobina (C) y sujételo con el tornillo.

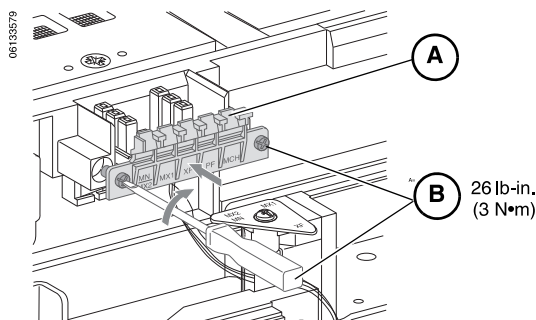
8. Remettre en place le dispositif de retenue de bobine (C) et le fixer à l'aide de la vis.



9. Reinstall wiring cover (A) using two previously removed screws (B)

9. Vuelva a instalar la cubierta del cableado (A) utilizando los dos tornillos retirados anteriormente (B).

9. Réinstaller le couvercle de câblage (A) à l'aide des deux vis (B) précédemment retirées.



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Primary High Current Injection

Field Test Procedure for Modified Differential Ground Fault Protection Systems Class 6036

Instruction Bulletin

Retain for future use.



HAZARD CATEGORIES AND SPECIAL SYMBOLS



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.



Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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SECTION 1—INTRODUCTION

Description

This bulletin contains inspection and testing instructions for modified differential ground fault protection systems manufactured by Schneider Electric. The modified differential ground fault protection system used in Schneider Electric multiple-source switchboard and switchgear line-ups will use one of two types of ground fault current sensing techniques.

The first type is zero sequence sensing, which uses a single sensor to surround all three phase conductors and the neutral conductor. The second type is residual sensing, where each phase and the neutral conductor are surrounded by its own sensor. In normal conditions, the vector sum of the phase currents with the neutral current should equal zero. In a ground fault condition, the vector sum yields a current that is used in a protective relaying scheme to automatically open main or tie circuit breakers (or switches) as required.

NOTE: All diagrams are shown as residual sensing.

Testing

Paragraph 230-95(c) of the National Electrical Code® (NEC)® requires that all ground fault protection systems be performance tested when first installed. Schneider Electric recommends testing be done:

- When the equipment is installed at its permanent location.
- As a part of normal maintenance.
- If the distribution system is altered in any way.

Field testing determines that the ground fault protection system is operational. Consider the following information when using this instruction bulletin:

- The diagrams in this bulletin are provided to illustrate high current injection test connections, but are not intended to depict the ground fault protection system in its entirety as installed in the field. Review all instruction manuals and wiring diagrams provided with the equipment for actual system configuration. Verify that all sensors are installed and wired with correct polarity per the wiring diagrams.
- This field test procedure is not a check of the calibration of any sensing relay.
- Record results within the ground fault test logs (Tables 1–3 on pages 31–33). If test results are not acceptable, recheck the connections and retest. If results are still unacceptable, contact Square D Services at 1-888-Square D (1-888-778-2733).

Tools Required

The following tools are required to inspect and test the modified differential ground fault protection system:

- A high current injection test unit capable of injecting 1000 A. Test jumpers are typically copper welding cables. Use cables and connections that give low impedance.
- Hand-held test kit by Schneider Electric for Micrologic® Type A, H and P trip units.

Systems Covered

This test procedure is restricted to the following types of systems:

- Main-Main, Grounded Wye Configuration
- Main-Tie-Main, Grounded Wye, Non-Relayed Tie Configuration
- Main-Tie-Main, Grounded Wye, Relayed Tie Configuration

NOTE: A relayed system has ground fault protection on the Tie device. A non-relayed system has no ground fault protection on the Tie device.

NOTE: Systems with configurations beyond what are covered in this document can be tested with similar methods as those shown. All possible configurations of open and closed circuit breakers must be tested for both TRIP and NO TRIP functionality. TRIP tests always have the TEST JUMPER connected phase-to-ground. NO TRIP tests always have the TEST JUMPER connected phase-to-neutral (if neutral is not present, connect TEST JUMPER phase-to-phase).

SECTION 2—SAFETY PRECAUTIONS

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This test procedure must be performed only by qualified electrical personnel.
- Turn off all power before working on or inside the equipment. Assume that circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Always practice lock-out/tag-out procedures according to the OSHA requirements.
- Conduct electrical testing to confirm that no short-circuits were created during installation, maintenance, or testing.
- Carefully inspect your work area and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

SECTION 3—MAIN-MAIN, GROUNDED WYE CONFIGURATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying the equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Verify that all ground bus bar splices are solidly connected. For each main, verify that the ground bonding connection is made ahead of the neutral disconnect link and on the line side of any ground fault sensor. See Figure 1.
3. For each main, verify that a neutral connection exists from the supply transformer to the equipment.
4. For residual sensing systems, verify that all phase and neutral sensors are connected with correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
5. For zero sequence sensing systems, verify that all phase conductors and the neutral pass through the sensor in the same direction, and that grounding conductors do not pass through the sensor. Also, verify that the sensor is connected with the correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
6. Remove each main's neutral disconnect link to isolate wiring system neutrals from both supply and ground.
7. Measure the system neutral-to-ground insulation resistance to ensure that no ground connections exist on the load side of the ground fault protection system. The resistance should be at least 1.0 megohm. Remove all connections that exist from neutral-to-ground found during the test. Do not reconnect these grounds after the test is completed.
8. Replace each main's neutral disconnect link.
9. Record all pick-up and time delay settings for each circuit breaker and/or ground fault relay under test in Table 4 on page 34. After testing, return all settings to original values.
10. Adjust the ground fault pick-up setting on each circuit breaker and/or ground fault relay to its lowest current setting.
11. Adjust the ground fault time delay setting on each circuit breaker and/or ground fault relay under test to 0.1 seconds (I2T OUT or OFF).
12. Adjust the long-time, short-time, and instantaneous pick-up and time delay settings on each circuit breaker under test to their highest settings.
13. For each circuit breaker equipped with the Micrologic® Type A, H, or P trip unit, connect a hand-held test unit, and activate the thermal-imaging inhibit function according to the test unit instructions. This step is necessary to inhibit trip history and contact wear counter functions. After testing, de-activate the thermal-imaging inhibit function according to the

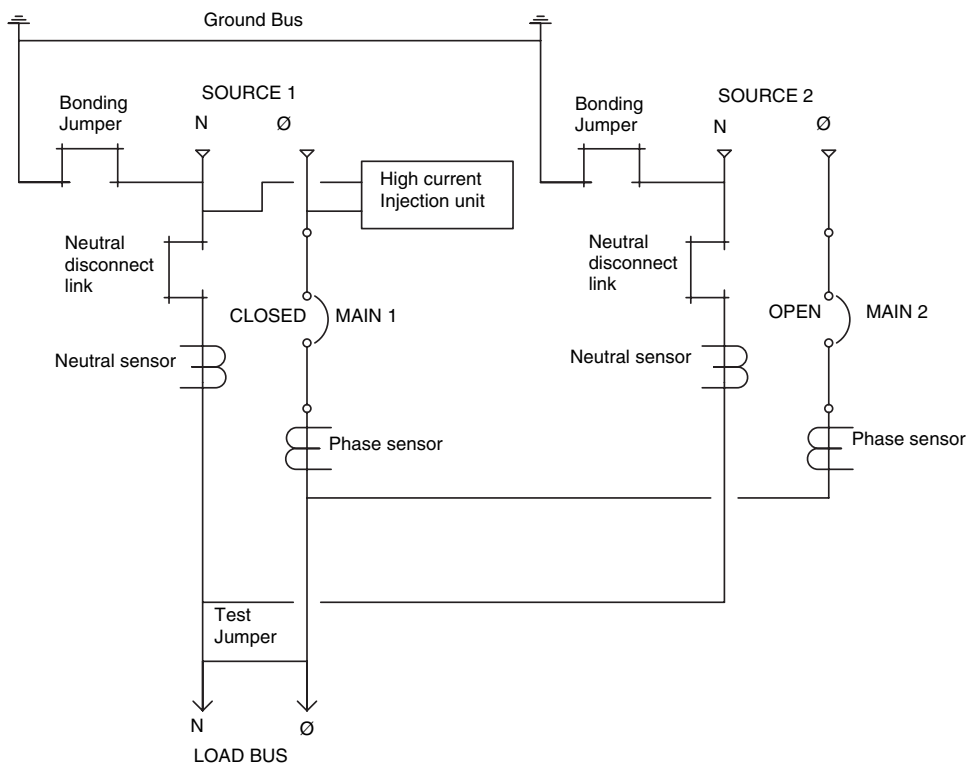
test unit instructions. Refer to bulletin 48049-184-XX for additional information.

14. Disconnect the ground fault protection control power source, if internally derived, and provide control power from an external source. Refer to wiring diagrams supplied for specific connections. After testing, disconnect external control power and re-connect internal control power circuit.

Test No. 1

1. Close MAIN 1 circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 1.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 1.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 1 in Table 1 on page 31.
5. Repeat Test No. 1 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.

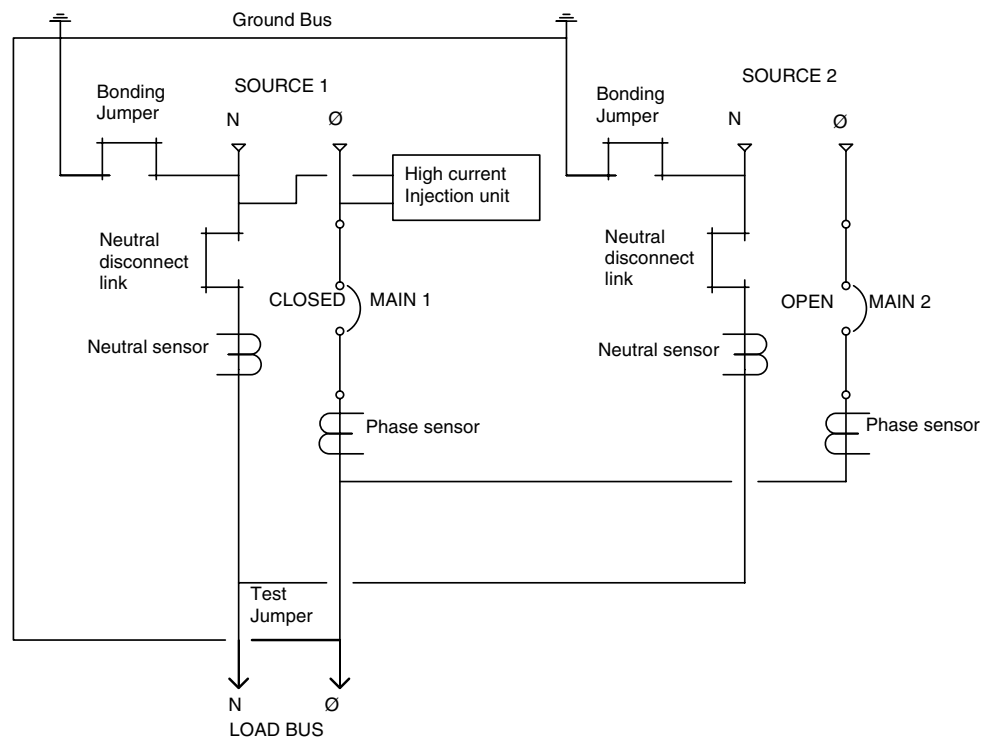
Figure 1: Main-Main Test No. 1 (No Trip) Injection Unit and Test Jumper Connections



Test No. 2

1. Close MAIN 1 circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 2.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 2.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 2 in Table 1 on page 31.
5. Repeat Test No. 2 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.

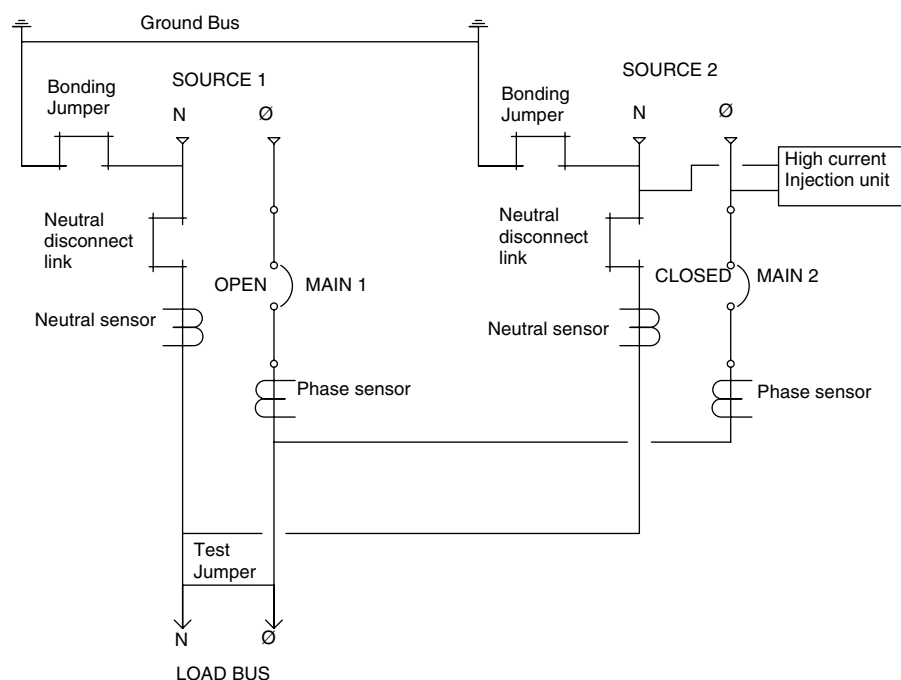
Figure 2: Main-Main Test No. 2 (Trip) Injection Unit and Test Jumper Connections



Test No. 3

1. Close MAIN 2 circuit breaker (or switch), and open MAIN 1 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 3.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 3.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 3 in Table 1 on page 31.
5. Repeat Test No. 3 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.

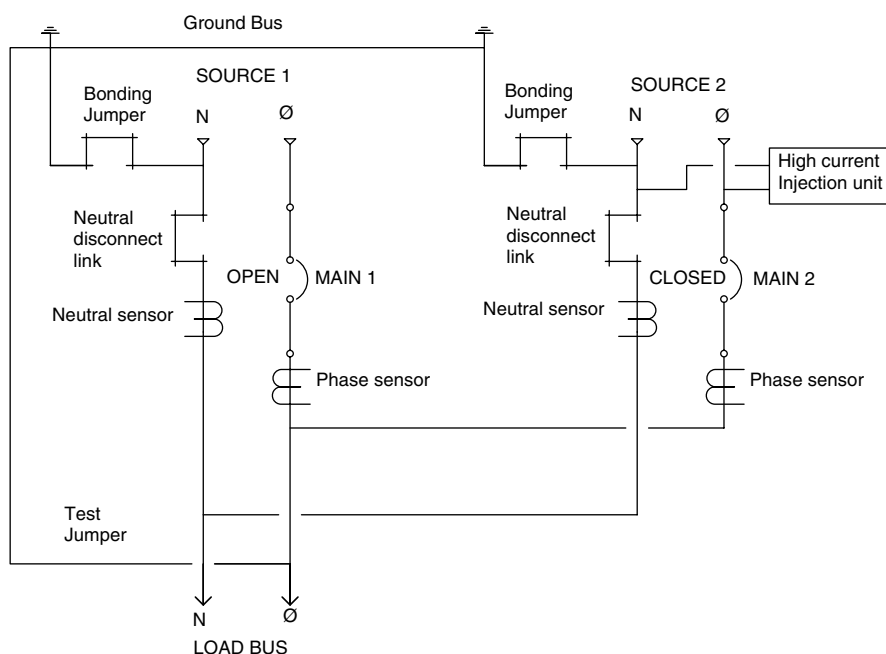
Figure 3: Main-Main Test No. 3 (No Trip) Injection Unit and Test Jumper Connections



Test No. 4

1. Close MAIN 2 circuit breaker (or switch), and open MAIN 1 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 4.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 4.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 4 in Table 1 on page 31.
5. Repeat Test No. 4 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.
6. After testing, return all settings to the original values previously recorded.

Figure 4: Main-Main Test No. 4 (Trip) Injection Unit and Test Jumper Connections



SECTION 4—MAIN-TIE-MAIN, GROUNDED WYE, NON-RELAYED TIE CONFIGURATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying the equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Verify that all ground bus bar splices are solidly connected. For each main, verify that the ground bonding connection is made ahead of the neutral disconnect link and on the line side of any ground fault sensor. See Figure 5.
3. For each main, verify that a neutral connection exists from the supply transformer to the equipment.
4. For residual sensing systems, verify that all phase and neutral sensors are connected with correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
5. For zero sequence sensing systems, verify that all phase conductors and the neutral pass through the sensor in the same direction, and that grounding conductors do not pass through the sensor. Also, verify that the sensor is connected with the correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
6. Remove each main's neutral disconnect link to isolate wiring system neutrals from both supply and ground.
7. Measure the system neutral-to-ground insulation resistance to ensure that no ground connections exist on the load side of the ground fault protection system. The resistance should be at least 1.0 megohm. Remove all connections that exist from neutral-to-ground found during the test. Do not reconnect these grounds after the test is completed.
8. Replace each main's neutral disconnect link.
9. Record all pick-up and time delay settings for each circuit breaker and/or ground fault relay under test in Table 4 on page 34. After testing, return all settings to original values.
10. Adjust the ground fault pickup setting on each circuit breaker and/or ground fault relay to its lowest current setting.
11. Adjust the ground fault time delay setting on each circuit breaker and/or ground fault relay under test to 0.1 seconds (I2T OUT or OFF).
12. Adjust the long-time, short-time, and instantaneous pick-up and time delay settings on each circuit breaker under test to their highest settings.
13. For each main circuit breaker equipped with the Micrologic® Type A, H, or P trip unit, connect a hand-held test unit, and activate the thermal-imaging inhibit function according to the test unit instructions. This step is necessary to inhibit trip history and contact wear counter functions. After testing, de-

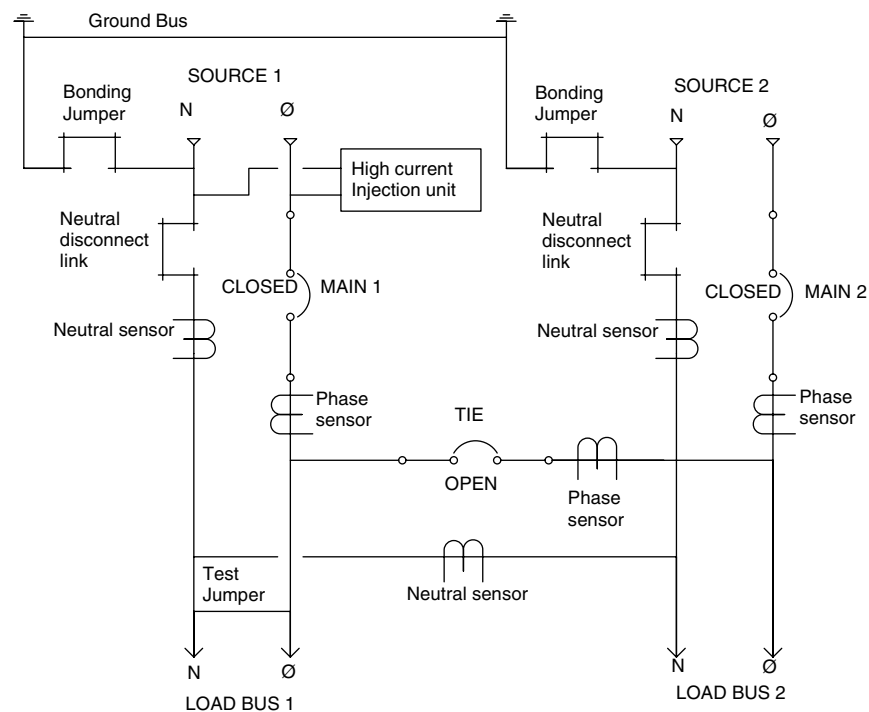
activate the thermal-imaging inhibit function according to the test unit instructions. Refer to bulletin 48049-184-XX for additional information.

14. Disconnect the ground fault protection control power source, if internally derived, and provide control power from an external source. Refer to the wiring diagrams supplied for specific connections. After testing, disconnect external control power and re-connect internal control power circuit.

Test No. 1

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 5.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 5.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 1 in Table 2 on page 32.
5. Repeat Test No. 1 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

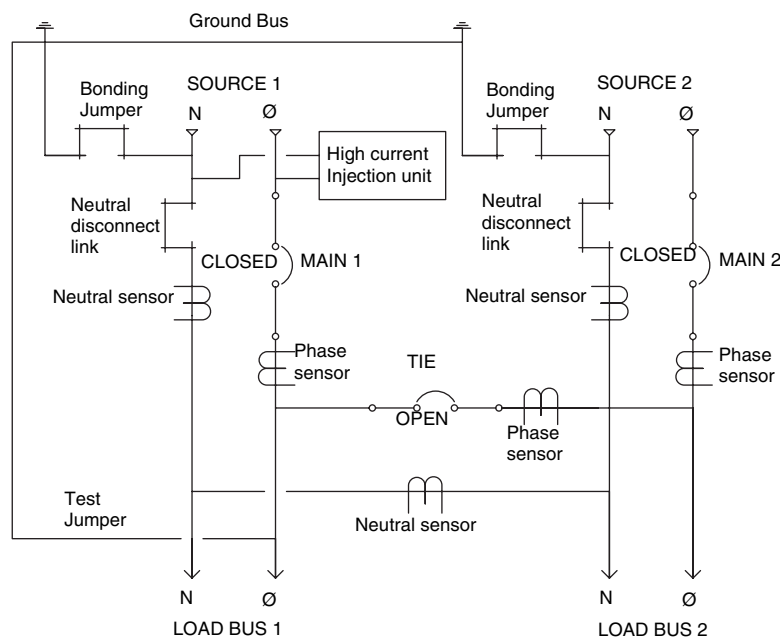
Figure 5: Main-Tie-Main Test No. 1 (No Trip) Injection Unit and Test Jumper Connections



Test No. 2

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 6.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 6.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 2 in Table 2 on page 32.
5. Repeat Test No. 2 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

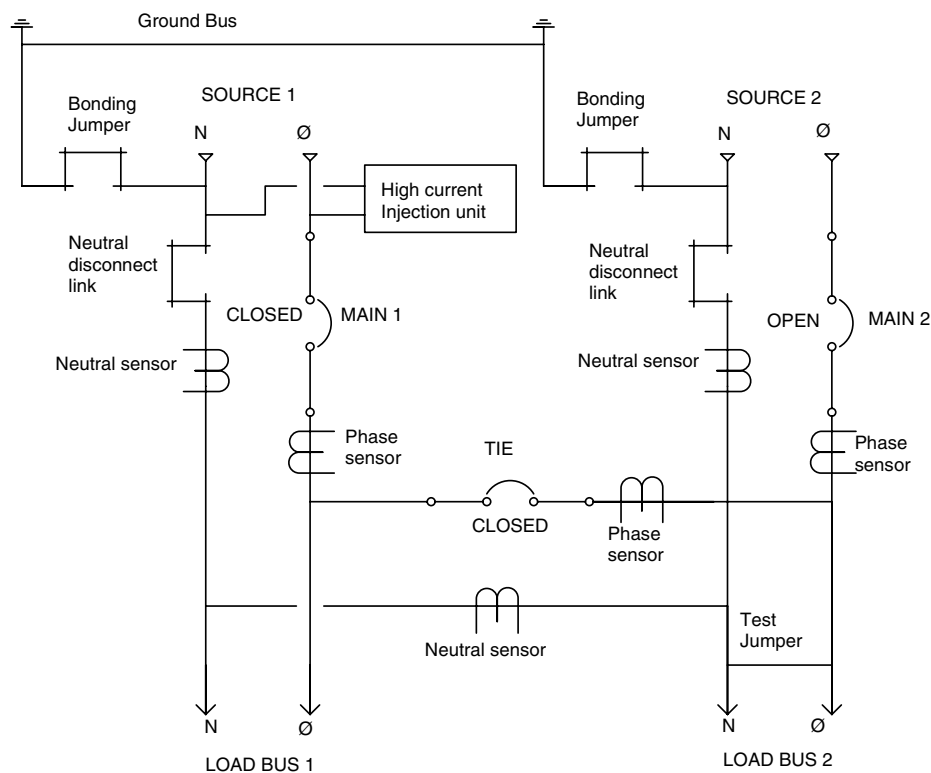
Figure 6: Main-Tie-Main Test No. 2 (Trip) Injection Unit and Test Jumper Connections



Test No. 3

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 7.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 7.
4. Inject 1000 A into Phase A. Neither MAIN 1 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 3 in Table 2 on page 32.
5. Repeat Test No. 3 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

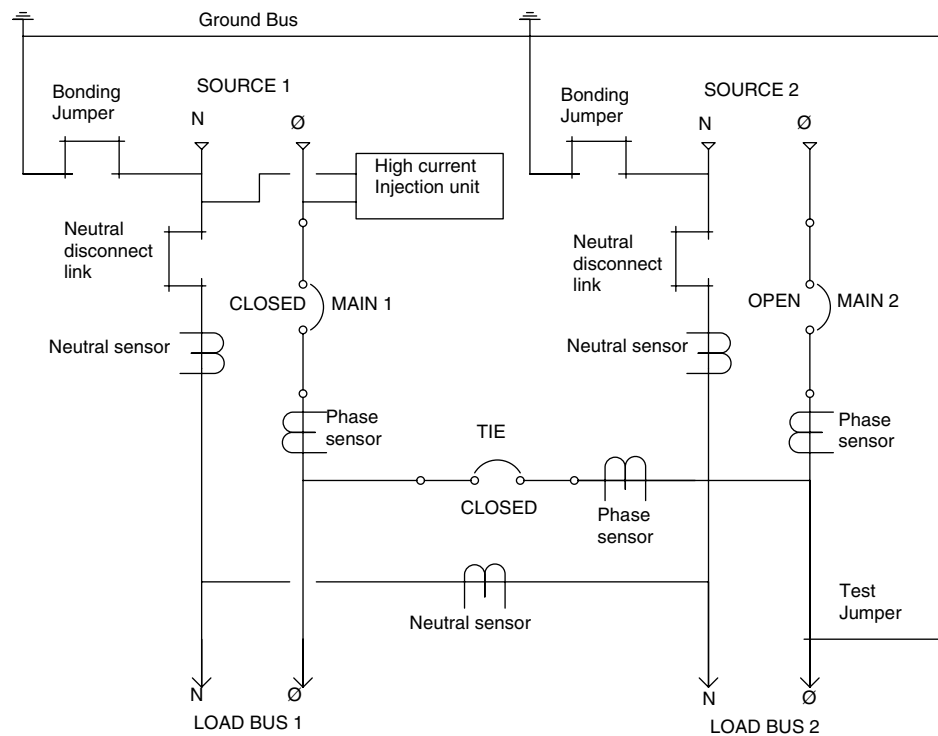
Figure 7: Main-Tie-Main Test No. 3 (No Trip) Injection Unit and Test Jumper Connections



Test No. 4

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 8.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 8.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault, but TIE circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 4 in Table 2 on page 32.
5. Repeat Test No. 4 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

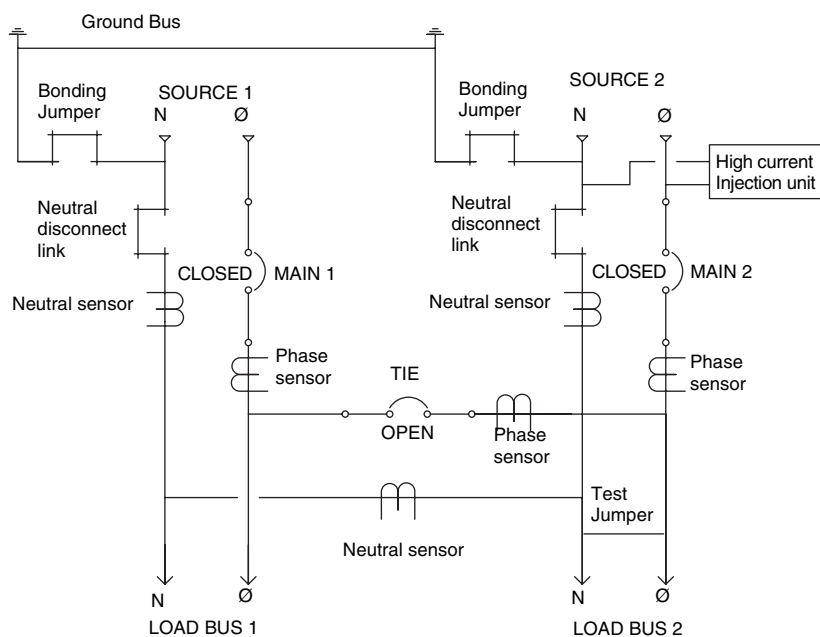
Figure 8: Main-Tie-Main Test No. 4 (Trip) Injection Unit and Test Jumper Connections



Test No. 5

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 9.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 9.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 5 in Table 2 on page 32.
5. Repeat Test No. 5 for Phases B and C (not required for zero sequence systems). Record the actual results for this in Table 2.

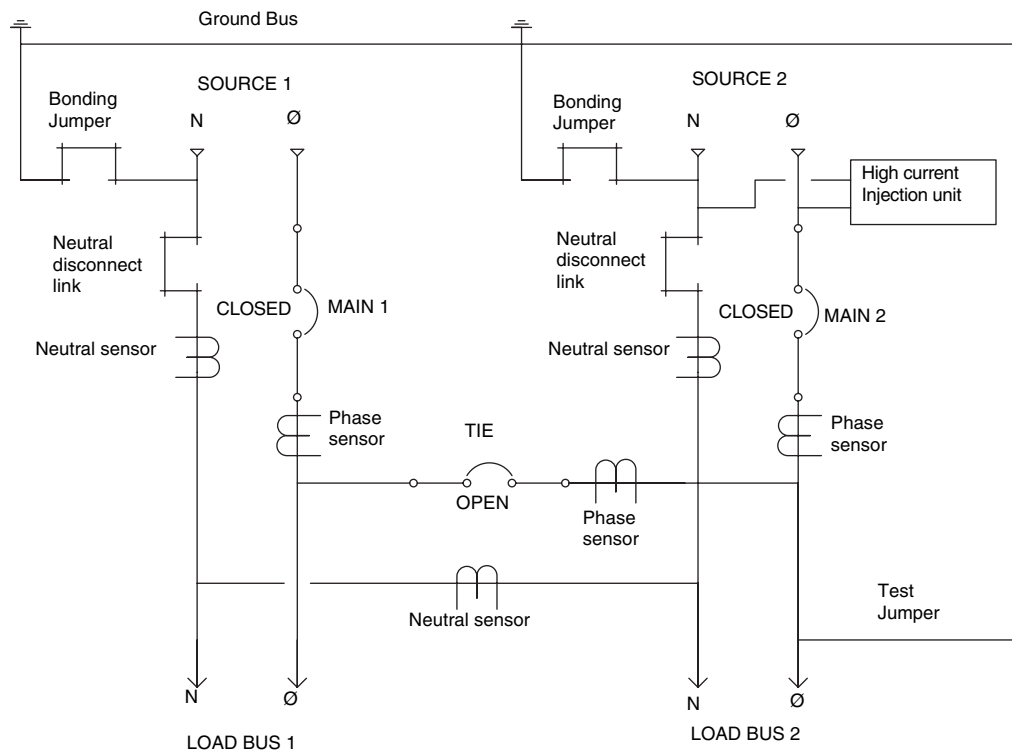
Figure 9: Main-Tie-Main Test No. 5 (No Trip) Injection Unit and Test Jumper Connections



Test No. 6

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 10.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 10.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 6 in Table 2 on page 32.
5. Repeat Test No. 6 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

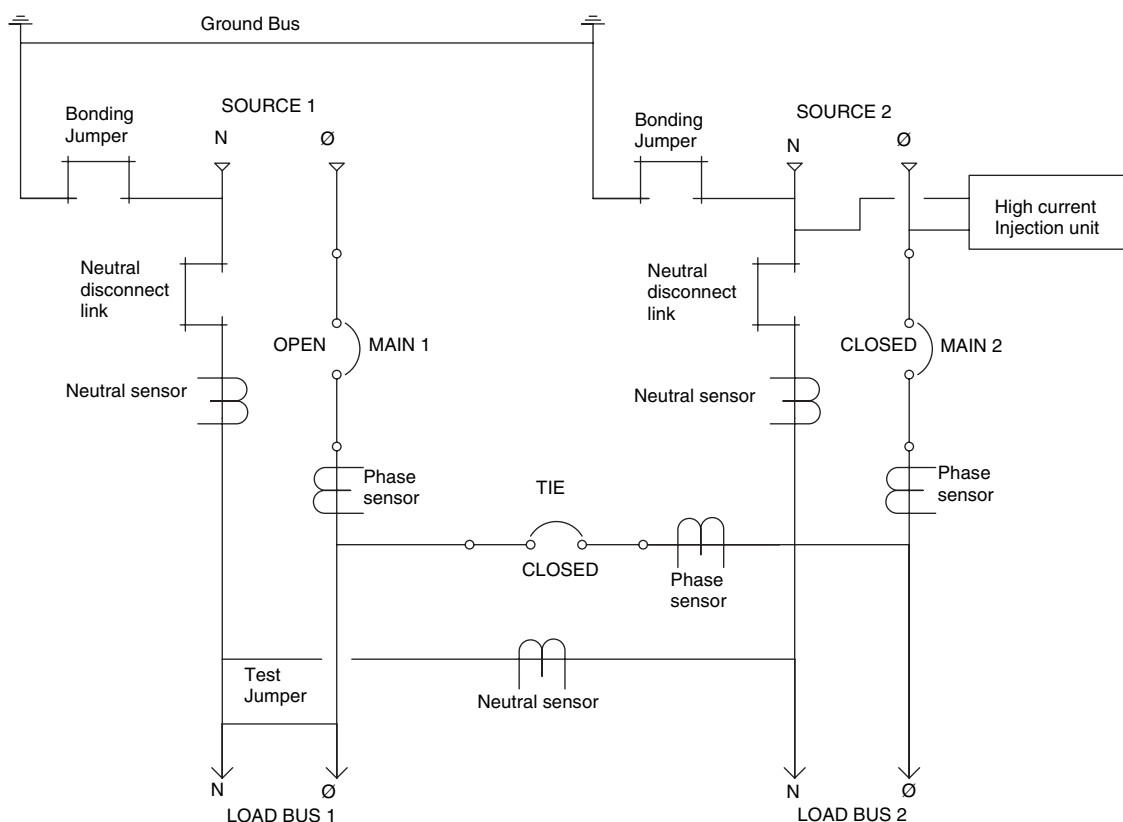
Figure 10: Main-Tie-Main Test No. 6 (Trip) Injection Unit and Test Jumper Connections



Test No. 7

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 11.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 11.
4. Inject 1000 A into Phase A. Neither MAIN 2 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 7 in Table 2 on page 32.
5. Repeat Test No. 7 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

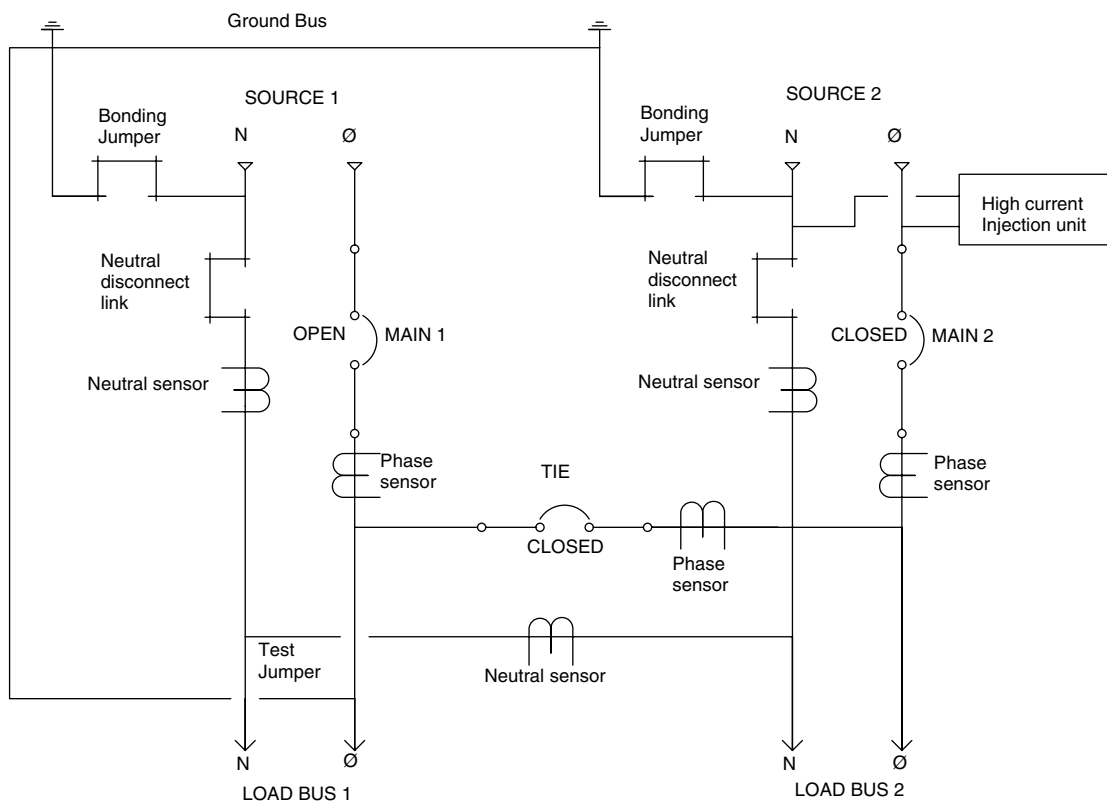
Figure 11: Main-Tie-Main Test No. 7 (No Trip) Injection Unit and Test Jumper Connections



Test No. 8

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 12.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 12.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault, but TIE circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 8 in Table 2 on page 32.
5. Repeat Test No. 8 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.
6. After testing, return all settings to the original values previously recorded.

Figure 12: Main-Tie-Main Test No. 8 (Trip) Injection Unit and Test Jumper Connections



SECTION 5—MAIN-TIE-MAIN, GROUNDED WYE, RELAYED TIE CONFIGURATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying the equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Verify that all ground bus bar splices are solidly connected. For each main, verify that the ground bonding connection is made ahead of the neutral disconnect link and on the line side of any ground fault sensor. See Figure 13.
3. For each main, verify that a neutral connection exists from the supply transformer to the equipment.
4. For residual sensing systems, verify that all phase and neutral sensors are connected with correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
5. For zero sequence sensing systems, verify that all phase conductors and the neutral pass through the sensor in the same direction, and that grounding conductors do not pass through the sensor. Also, verify that the sensor is connected with the correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
6. Remove each main's neutral disconnect link to isolate wiring system neutrals from both supply and ground.
7. Measure the system neutral-to-ground insulation resistance to ensure that no ground connections exist on the load side of the ground fault protection system. The resistance should be at least 1 megohm. Remove all connections that exist from neutral-to-ground found during the test. Do not reconnect these grounds after the test is completed.
8. Replace each main's neutral disconnect link.
9. Record all pick-up and time delay settings for each circuit breaker and/or ground fault relay under test in Table 4 on page 34. After testing, return all settings to original values.
10. Adjust the ground fault pick-up setting on each circuit breaker and/or ground fault relay to its lowest current setting.
11. Adjust the ground fault time delay setting on each circuit breaker and/or ground fault relay under test to 0.1 seconds (I2T OUT or OFF).
12. Adjust the long-time, short-time, and instantaneous pick-up and time delay settings on each circuit breaker under test to their highest settings.
13. For each main and tie circuit breaker equipped with the Micrologic® Type A, H, or P trip unit, connect a hand-held test unit, and activate the thermal-imaging inhibit function according to the test unit instructions. This step is necessary to inhibit trip history and contact wear counter

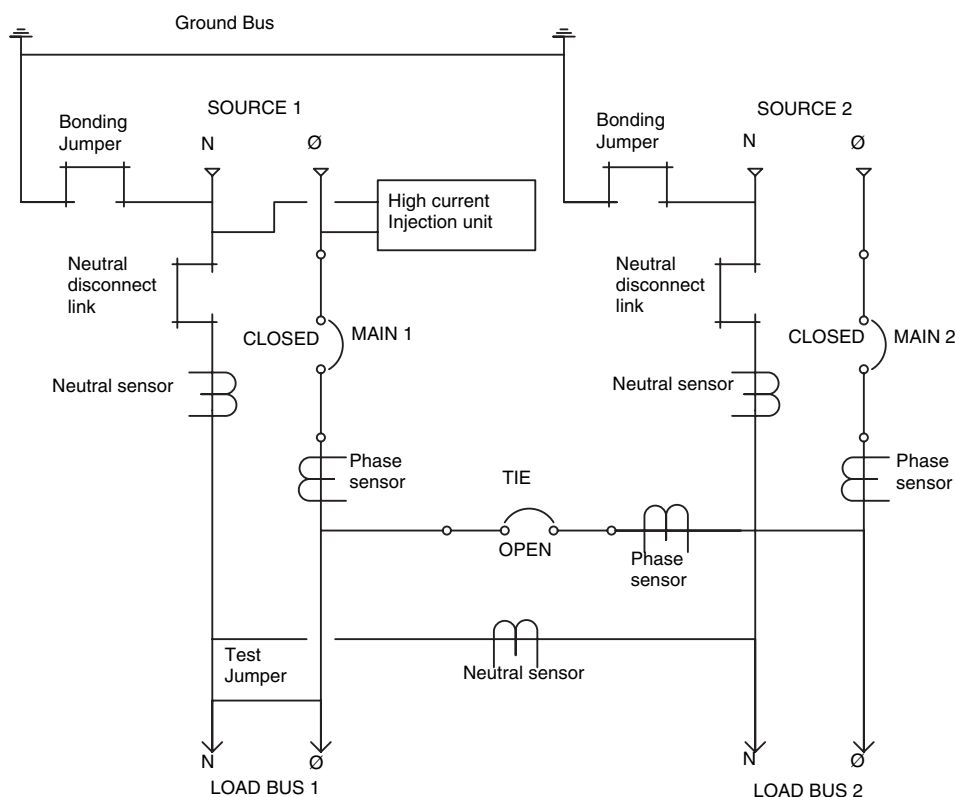
functions. After testing, de-activate the thermal-imaging inhibit function according to the test unit instructions. Refer to bulletin 48049-184-XX for additional information.

14. Disconnect the ground fault protection control power source, if internally derived, and provide control power from an external source. Refer to the wiring diagrams supplied for specific connections. After testing, disconnect external control power and re-connect internal control power circuit.

Test No. 1

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 13.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 13.
4. Inject 1000 A into Phase A. MAIN 1 breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 1 in Table 3 on page 33.
5. Repeat Test No. 1 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

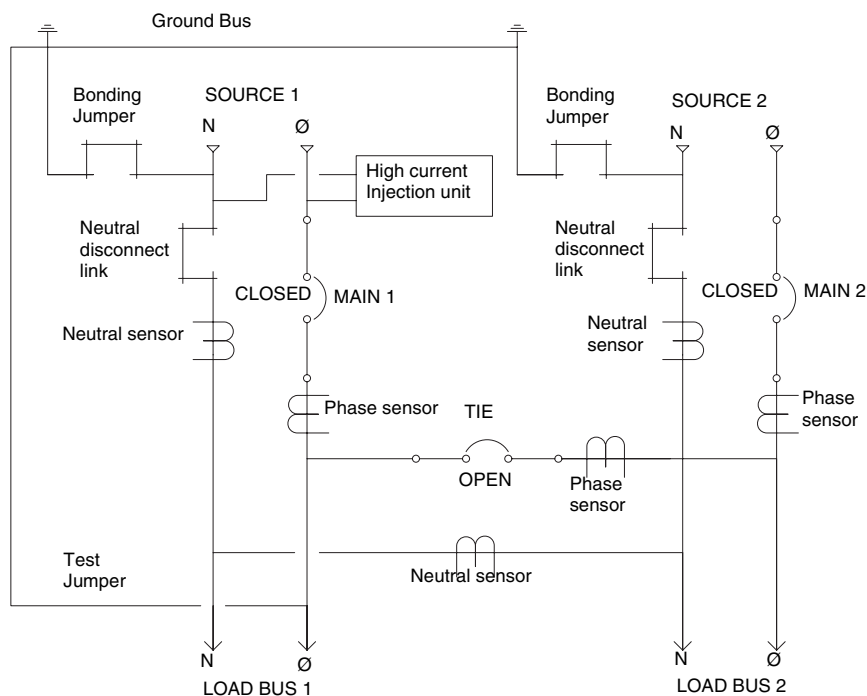
Figure 13: Main-Tie-Main Test No.1 (No Trip) Injection Unit and Test Jumper Connections



Test No. 2

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 14.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 14.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 2 in Table 3 on page 33.
5. Repeat Test No. 2 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

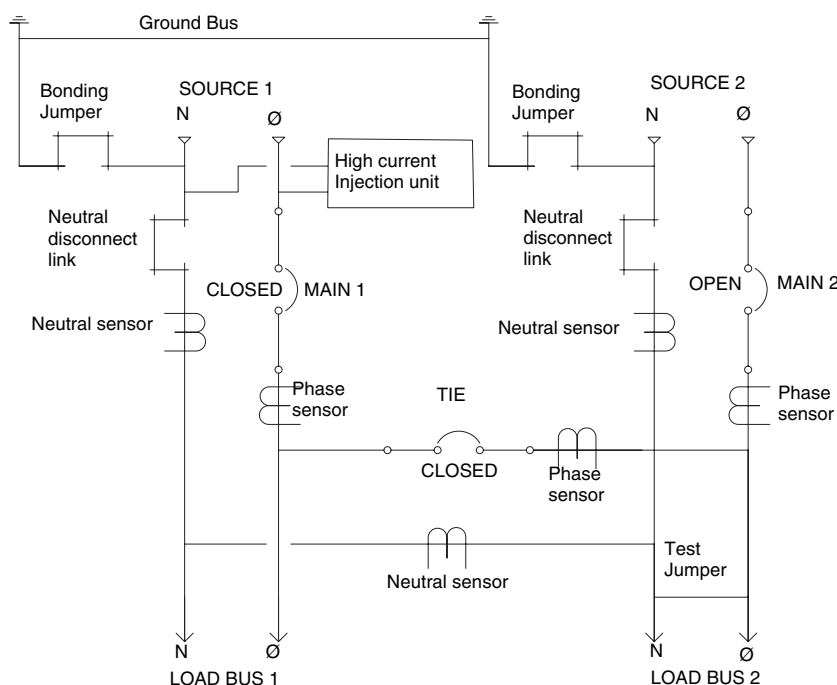
Figure 14: Main-Tie-Main Test No. 2 (Trip) Injection Unit and Test Jumper Connections



Test No. 3

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 15.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 15.
4. Inject 1000 A into Phase A. Neither MAIN 1 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 3 in Table 3 on page 33.
5. Repeat Test No. 3 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

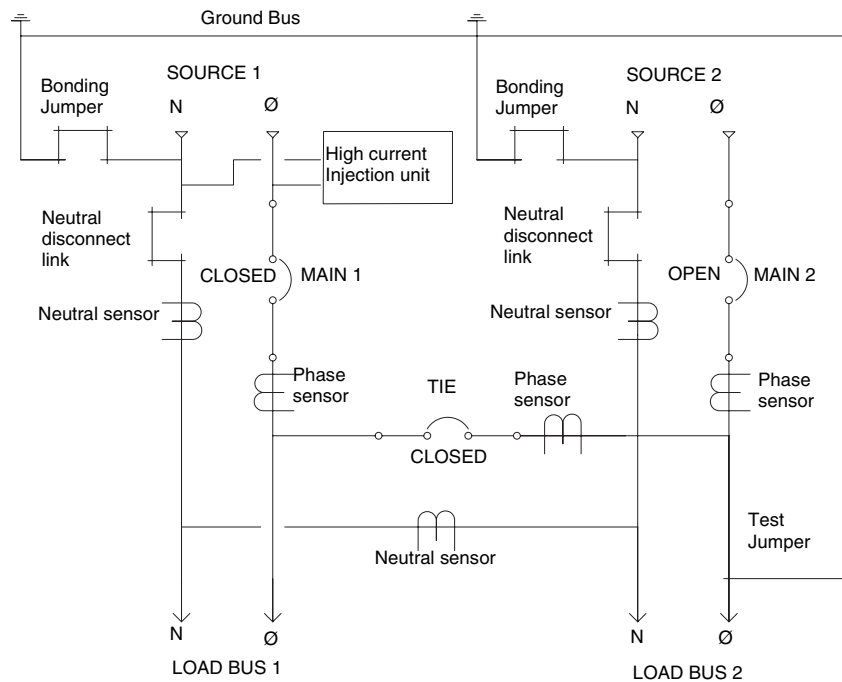
Figure 15: Main-Tie-Main Test No. 3 (No Trip) Injection Unit and Test Jumper Connections



Test No. 4

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 16.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 16.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should not trip on ground fault, but TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 4 in Table 3 on page 33.
5. Repeat Test No. 4 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

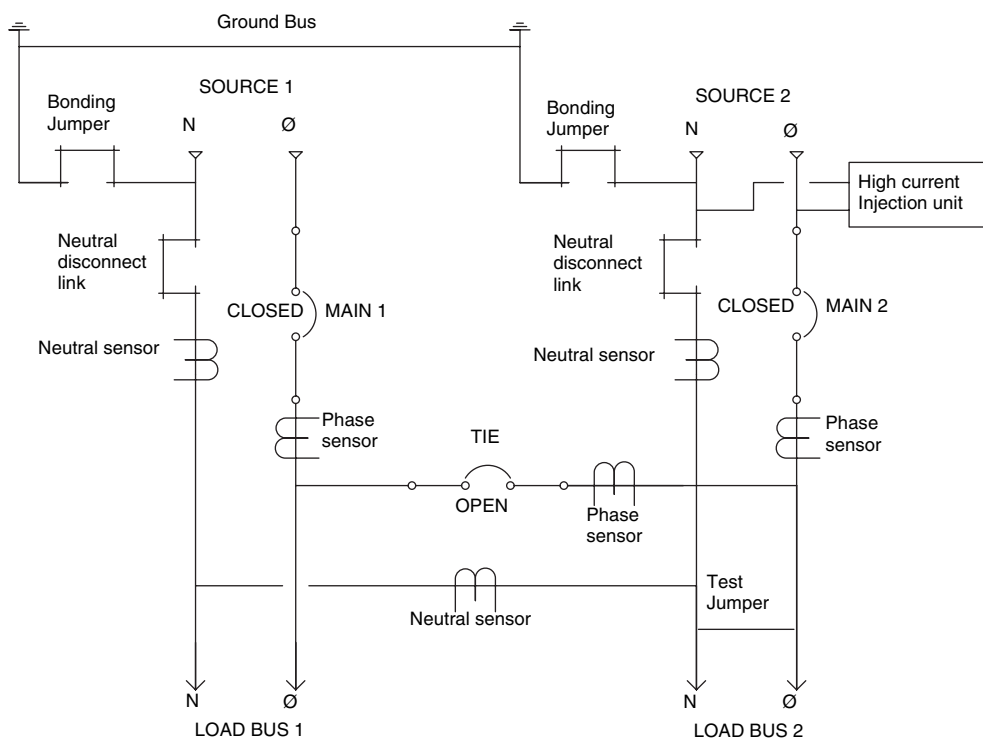
Figure 16: Main-Tie-Main Test No. 4 (Trip) Injection Unit and Test Jumper Connections



Test No. 5

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 17.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 17.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 5 in Table 3 on page 33.
5. Repeat Test No. 5 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

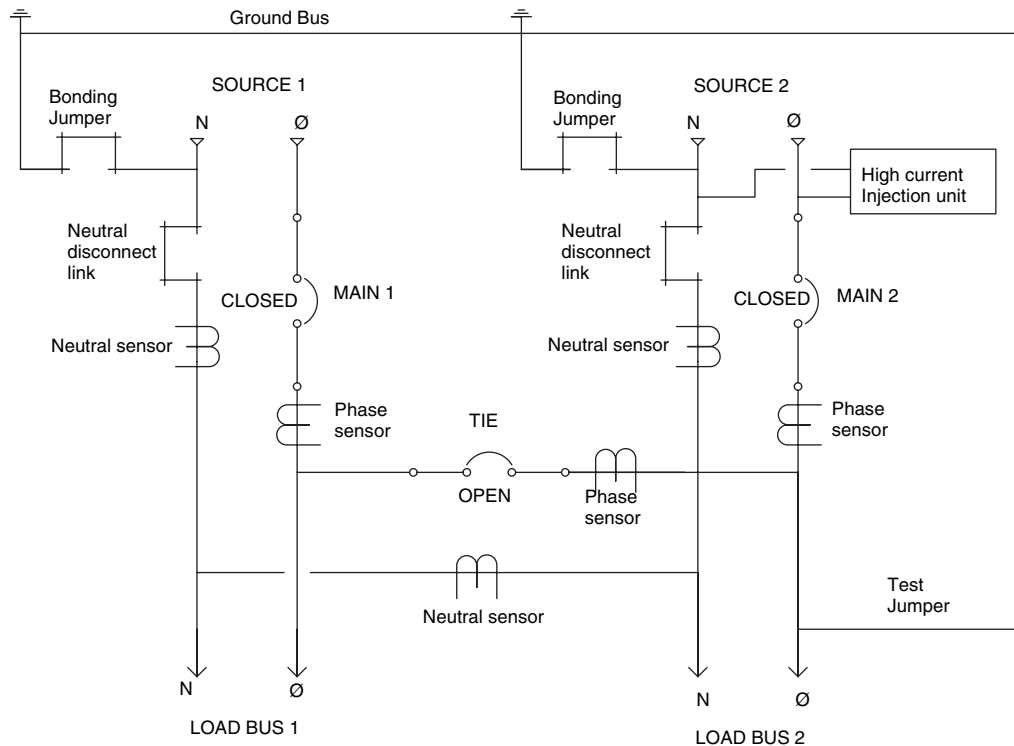
Figure 17: Main-Tie-Main Test No. 5 (No Trip) Injection Unit and Test Jumper Connections



Test No. 6

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 18.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 18.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 6 in Table 3 on page 33.
5. Repeat Test No. 6 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

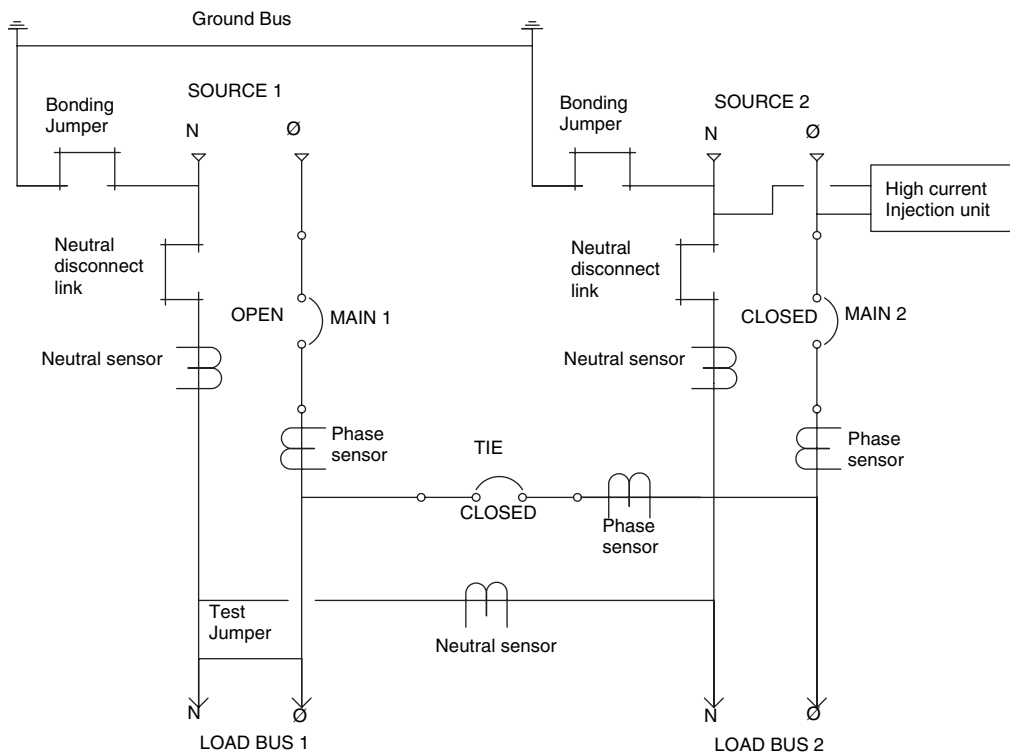
Figure 18: Main-Tie-Main Test No. 6 (Trip) Injection Unit and Test Jumper Connections



Test No. 7

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 19.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 19.
4. Inject 1000 A into Phase A. Neither MAIN 2 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 7 in Table 3 on page 33.
5. Repeat Test No. 7 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

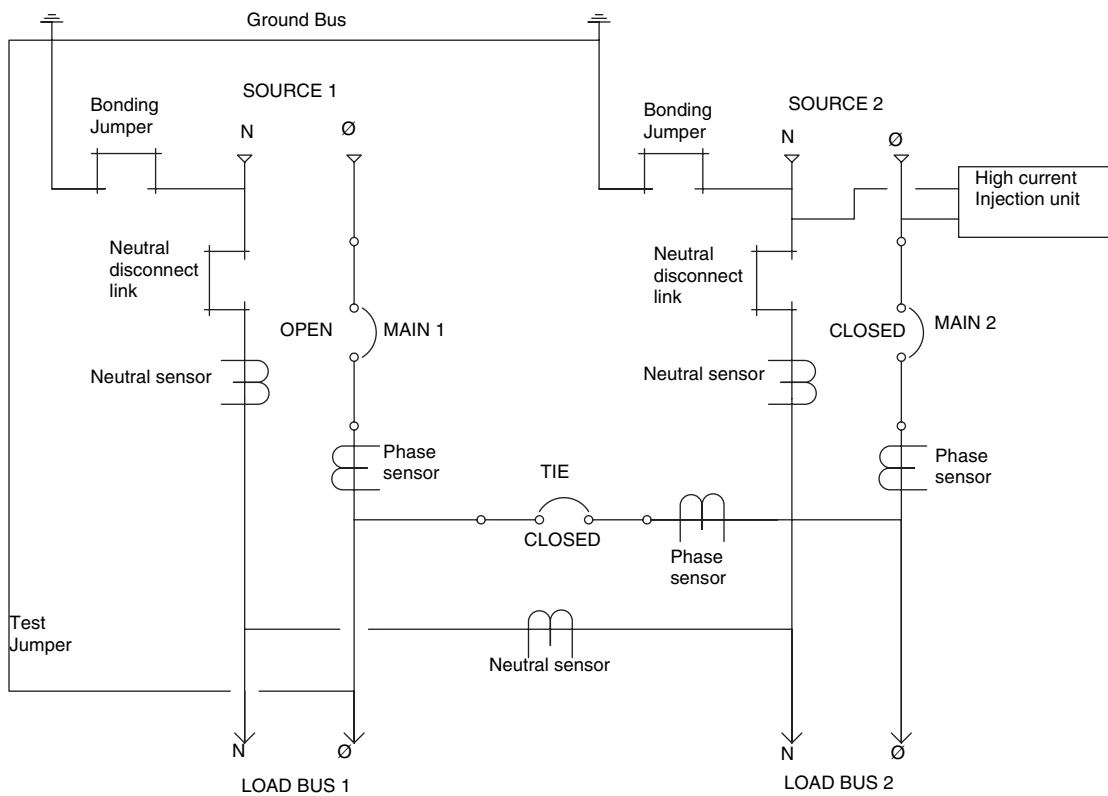
Figure 19: Main-Tie-Main Test No. 7 (No Trip) Injection Unit and Test Jumper Connections



Test No. 8

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 20.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 20.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault, but TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 8 in Table 3 on page 33.
5. Repeat Test No. 8 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.
6. After testing, return all settings to the original values previously recorded.

Figure 20: Main-Tie-Main Test No. 8 (Trip) Injection Unit and Test Jumper Connections



**SECTION 6—MAIN-MAIN TEST
PROCEDURE LOG****Table 1: Main-Main Test Procedure Log**

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

SECTION 7—MAIN-TIE-MAIN NON-RELAYED TEST PROCEDURE LOG

Table 2: Main-Tie-Main Non-Relayed Test Procedure Log

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

SECTION 8—MAIN-TIE-MAIN RELAYED TEST PROCEDURE LOG

Table 3: Main-Tie-Main Relayed Test Procedure Log

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "No Trip" TIE Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "Trip" TIE Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "No Trip" TIE Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "Trip" TIE Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "No Trip" TIE Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "Trip" TIE Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "No Trip" TIE Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "Trip" TIE Circuit Breaker			

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**Primary High Current Injection
Instruction Bulletin**

Schneider Electric USA

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www.us.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Replaces: 80043-058-01 8/2001

Micrologic™ 2.0A, 3.0A, 5.0A, and 6.0A Electronic Trip Units

Instruction Bulletin

48049-136-05

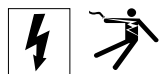
Rev. 02, 06/2015

Retain for future use.



Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



ANSI



IEC



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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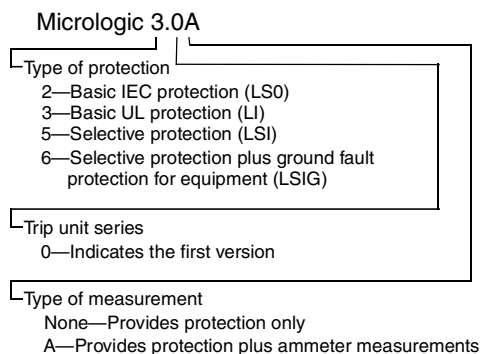
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Section 1— General Information

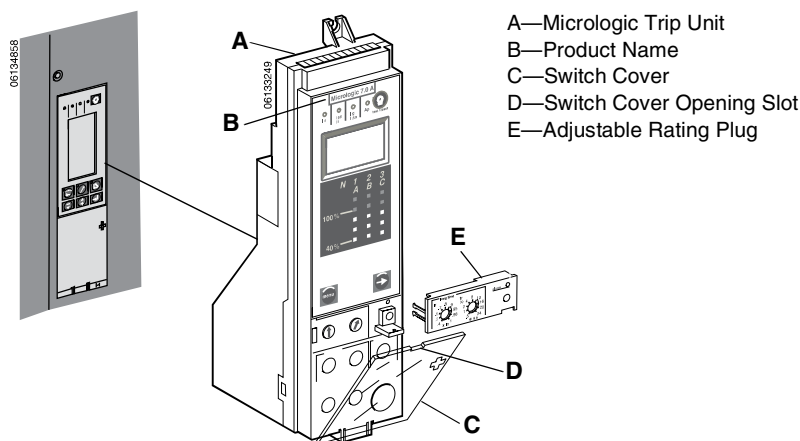
Introduction

Micrologic™ trip units (A) provide adjustable tripping functions on electronic trip circuit breakers. The product name (B) specifies the level of protection provided by the trip unit.



Micrologic trip units are field replaceable to allow for upgrading of the trip unit in the field. For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor plugs, rating plugs and trip units, see the product catalog.

Figure 1 – Micrologic Trip Unit



Communications

Micrologic trip units can communicate with other devices if the optional Circuit Breaker Communication Module (BCM) is installed. For information on the register lists and other communication devices refer to bulletin 06131B1313: *Modbus Communications System*.

Trip Unit Settings

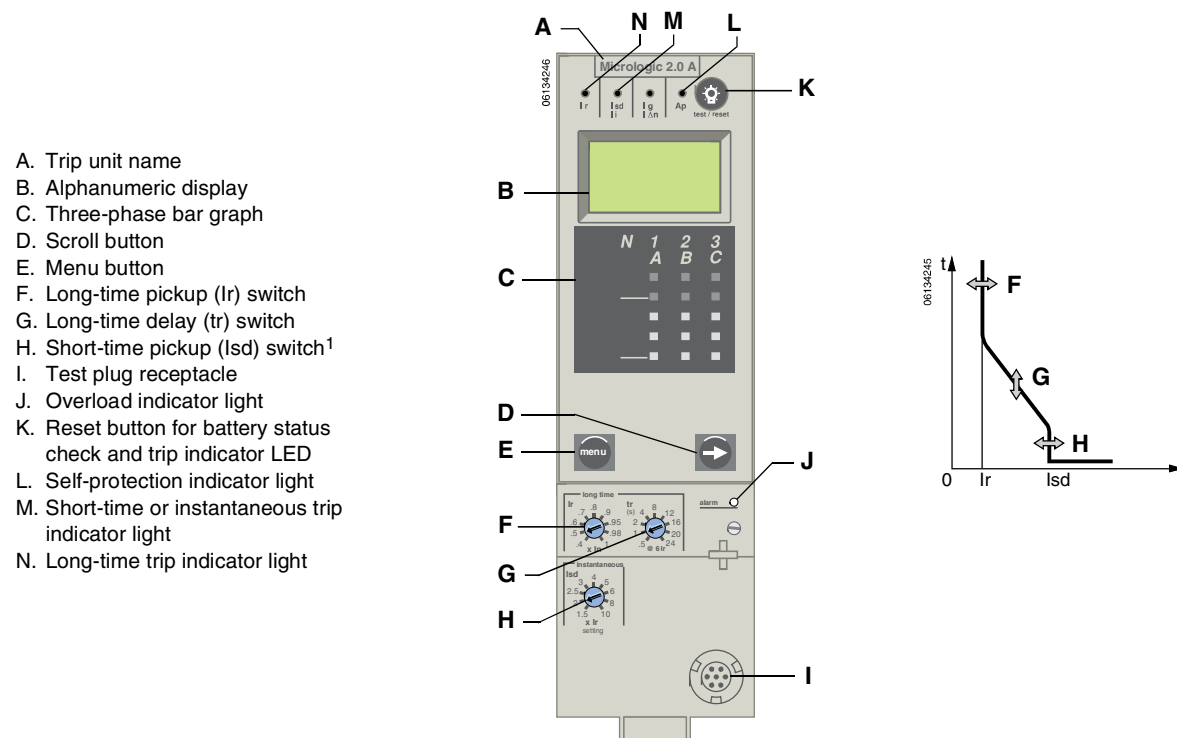
On the face of the trip unit are adjustable switches to allow changing of trip characteristics. Trip units are shipped with the long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings.

Micrologic 2.0A Trip Unit

The Micrologic 2.0A trip unit provides basic IEC (LS0) protection and a built-in ammeter.

NOTE: For use with IEC circuit breakers only.

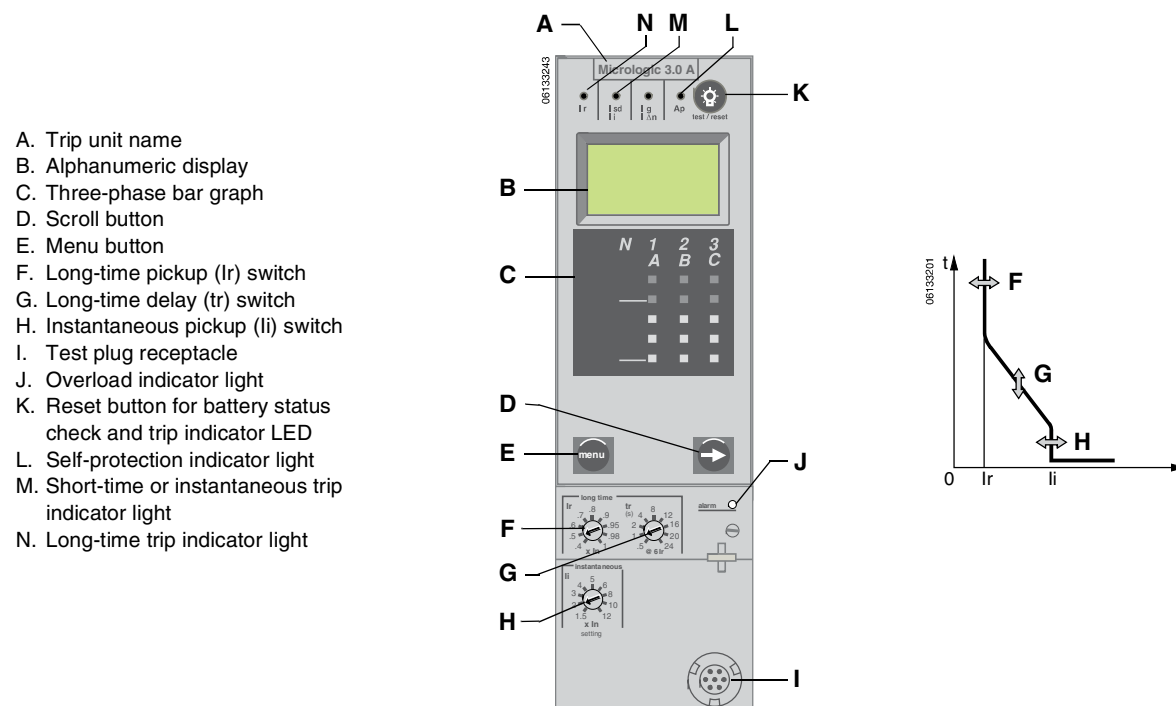
Figure 2 – 2.0A Trip Unit



Micrologic 3.0A Trip Unit

The Micrologic 3.0A trip unit provides basic UL (LI) protection and a built-in ammeter.

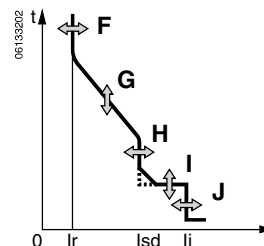
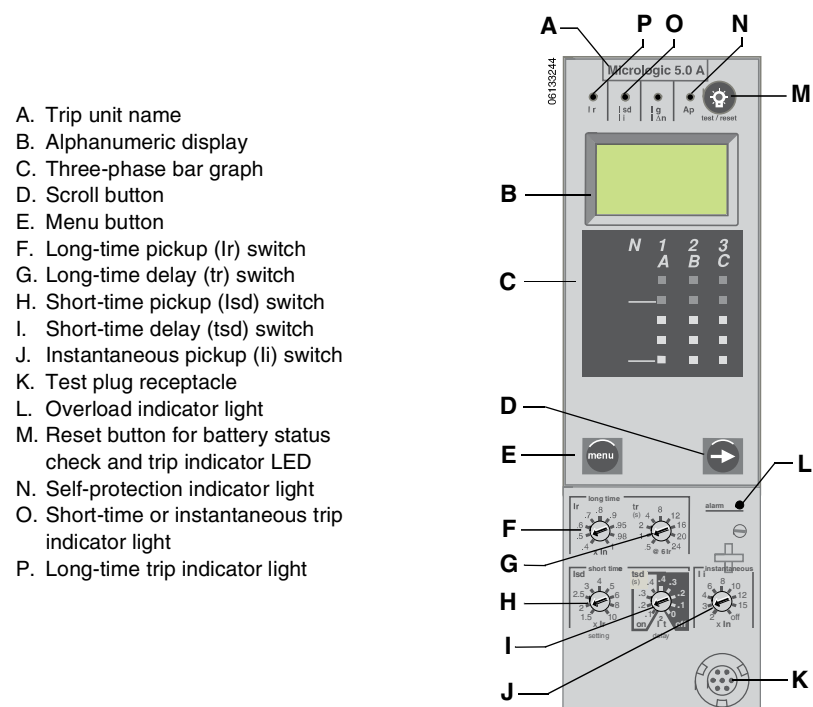
Figure 3 – 3.0A Trip Unit



Micrologic 5.0A Trip Unit

The Micrologic 5.0A trip unit provides selective (LSI) protection and a built-in ammeter.

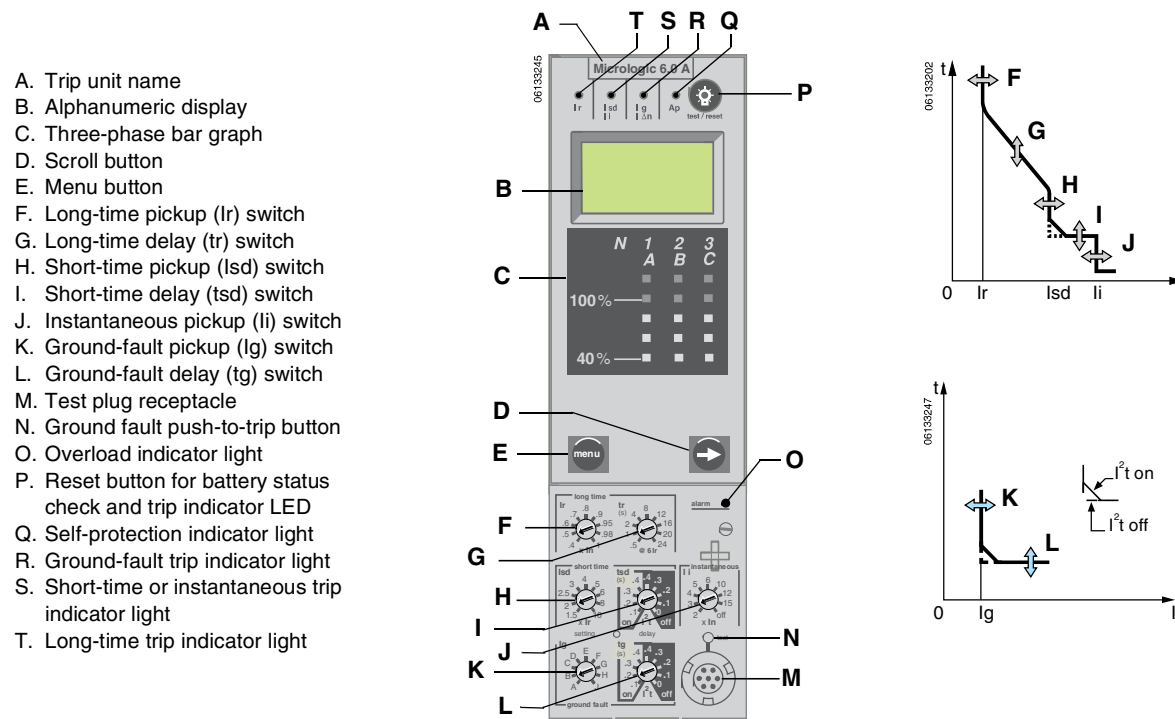
Figure 4 – 5.0A Trip Unit



Micrologic 6.0A Trip Unit

The Micrologic 6.0A trip unit provides selective and ground-fault protection for equipment (≤ 1200 A) (LSIG) and a built-in ammeter.

Figure 5 – 6.0A Trip Unit



Zone-Selective Interlocking

Short-time and ground-fault protection can be interlocked to provide zone-selective interlocking.

NOTE: Use I²t off with ZSI for proper coordination. Using I²t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

NOTE: Setting short-time delay (tsd) or ground-fault delay (tg) to the 0 setting will eliminate selectivity for that circuit breaker.

Control wiring links several trip units in the distribution network and in the event of a fault, a trip unit will obey the set delay time only if receiving a signal from a downstream trip unit.

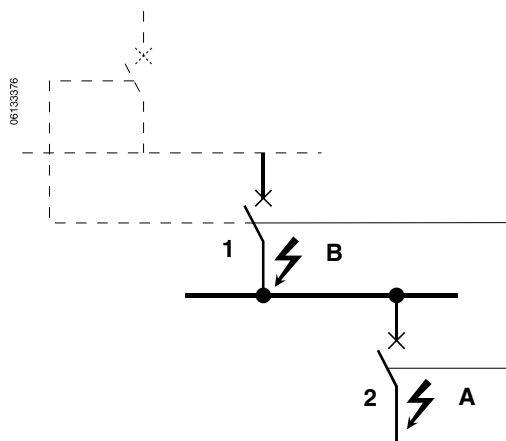
If the trip unit does not receive a signal, tripping will be instantaneous (with no intentional delay).

- The fault is cleared instantaneously by the nearest upstream circuit breaker.
- Thermal stresses (I²t) in the network are minimized without any effect on the correct time delay coordination of the installation.

Figure 6 shows circuit breakers 1 and 2 zone-selective interlocked.

- A fault at A is seen by circuit breaker 1 and 2. Circuit breaker 2 trips instantaneously and also informs circuit breaker 1 to obey set delay times. Thus, circuit breaker 2 trips and clears the fault. Circuit breaker 1 does not trip.
- A fault at B is seen by circuit breaker 1. Circuit breaker 1 trips instantaneously since it did not receive a signal from the downstream circuit breaker 2. Circuit breaker 1 trips and clears the fault. Circuit breaker 2 does not trip.

Figure 6 – Zone-Selective Interlocking



Trip Unit Switches

Long-Time Protection

Long-time protection protects equipment against overloads.

NOTE: Micrologic trip units are powered from the circuit to always provide fault protection. All other functions (display, metering, communications, etc.) require external power. See page 18 for more information.

- Long-time protection is standard on all trip units.
- The long-time pickup (I_r) (A) sets the maximum current level (based on sensor plug rating I_n) which the circuit breaker can continuously carry. If current exceeds this value, circuit breaker will trip after the preset time delay. The long-time pickup (I_r) is adjustable from 0.4–1.0 times the sensor plug rating (I_n).
- The long-time delay (t_r) (B) sets the length of the time that the circuit breaker will carry an overcurrent (below the short-time or instantaneous pickup current level) before tripping. See Table 1 on page 12 for delay settings.
- Both long-time pickup and long-time delay are on the field-replaceable adjustable rating plug. To change settings to more precisely match the application, various rating plugs are available. For instructions on replacing the rating plug, see Section 5 —Adjustable Rating Plug Replacement.
- For Masterpact™ NT and NW circuit breakers, the I_n value can be changed by replacing the sensor plug below the trip unit. For further information, see the instructions packed with the sensor plug replacement kit.
- The overload indicator light (C) indicates that the I_r long-time pickup threshold has been exceeded.
- Long-time protection uses true RMS measurement.

Figure 7 – Long-Time Protection Switches

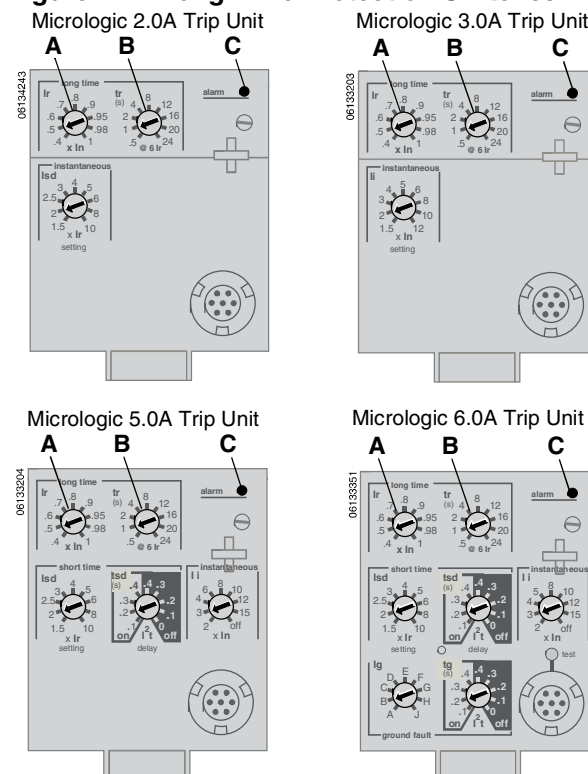


Table 1 – Micrologic Trip Unit Long-Time Delay Values

Setting ¹	Long-Time Delay in Seconds ²								
tr at 1.5 x Ir	12.5	25	50	100	200	300	400	500	600
tr at 6 x Ir	0.5	1	2	4	8	12	16	20	24
tr at 7.2 x Ir	0.34 ³	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6

¹Ir = In x long-time pickup. In = sensor rating. Trip threshold between 1.05 and 1.20 Ir.

²Time-delay accuracy +0/-20%

³For Micrologic 5.0A and 6.0A trip units, when tsd is set to 0.4 on or 4.0 off, then tr = 0.5 instead of 0.34.

Thermal imaging provides continuous temperature rise status of the wiring, both before and after the device trips. This allows the circuit breaker to respond to a series of overload conditions which could cause conductor overheating, but would go undetected if the long-time circuit was cleared every time the load dropped below the pickup setting or after every tripping event.

NOTE: If checking trip times, wait a minimum of 15 minutes after circuit breaker trips before resetting to allow the thermal imaging to reset completely to zero or use a full-function test kit to defeat the thermal imaging.

Short-Time Protection

Short-time protection protects equipment against short circuits.

- Short-time protection is standard on 2.0A, 5.0A and 6.0A trip units. It is not available on 3.0A trip units.
- Short-time protection is based on the long-time pickup (I_r).
- The short-time pickup (I_{sd}) (A) sets current level (below instantaneous trip level) at which circuit breaker will trip after the preset time delay.
- The short-time delay (t_{sd}) (B) sets the length of time that the circuit breaker will carry an overcurrent above the short-time pickup current level before tripping. It is adjustable on the 5.0A and 6.0A trip unit and factory set to zero on the 2.0A trip unit.

Figure 8 – Short-Time Protection Switches

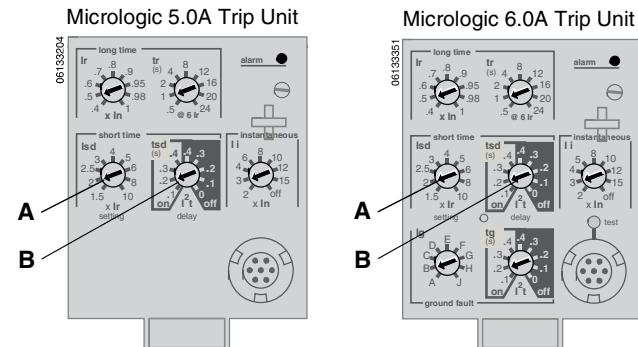


Table 2 – Micrologic Trip Unit Short-Time Delay Values

Setting	Short-Time Delay				
I^2t off (I_{sd} at 10 I_r) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (I_{sd} at 10 I_r) (seconds)		0.1	0.2	0.3	0.4
t_{sd} (min. trip) (milliseconds)	20	80	140	230	350
t_{sd} (max. trip) (milliseconds)	80	140	200	320	500

- The I^2t on/ I^2t off option provides improved selectivity with downstream protective devices:
 - With I^2t off selected, fixed time delay is provided.
 - With I^2t on selected, inverse time I^2t protection is provided up to 10 x I_r . Above 10 x I_r , fixed time delay is provided.
- Intermittent currents in the short-time tripping range which do not last sufficiently long to trigger a trip are accumulated and shorten the trip delay appropriately.
- Short-time protection can be zone-selective interlocked (ZSI) with upstream or downstream circuit breakers.
- Setting t_{sd} to the 0 setting turns off zone-selective interlocking.
- Short-time protection uses true RMS measurement.
- Short-time pickup and delay can be adjusted to provide selectivity with upstream or downstream circuit breakers.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

Instantaneous Protection

Instantaneous protection protects equipment against short circuits with no intentional time delay.

- Instantaneous protection (Ii) (A) is standard on the 3.0A, 5.0A and 6.0A trip units.
- Instantaneous protection on 2.0A trip units is achieved by using short-time protection (I_{sd}) with the short-time delay factory set to 0 (zero).
- Instantaneous protection on the 3.0A, 5.0A and 6.0A trip units is based on the circuit breaker sensor rating (I_n).
- Instantaneous protection on the 2.0A trip unit is based on the long-time pickup setting (I_r).
- Circuit breaker open command is issued as soon as threshold current is exceeded.
- Instantaneous protection uses peak current measurement.
- When instantaneous protection switch is set to off, the instantaneous protection is disabled.

Figure 9 – Instantaneous Protection Switches

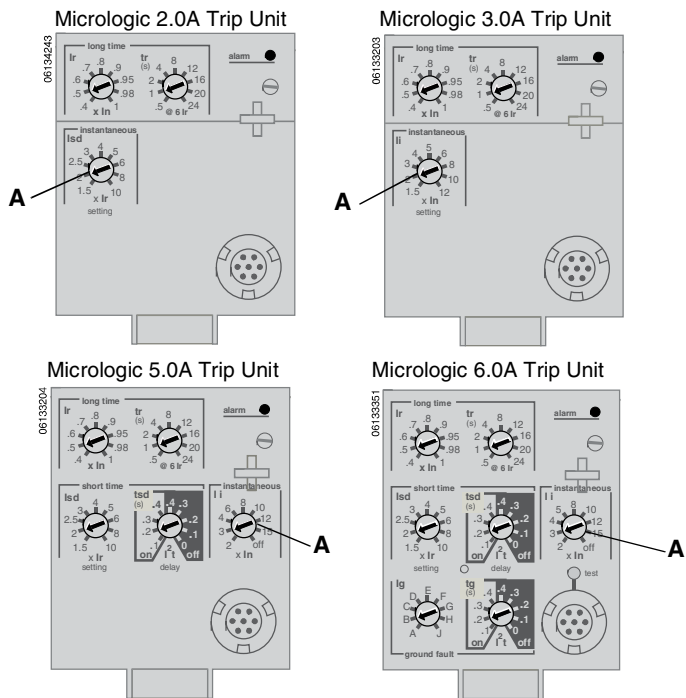


Table 3 – Micrologic Instantaneous Values

Setting	Interruption Current								
2.0A I _{sd} (= I _r x..)	1.5	2	2.5	3	4	5	6	8	10
3.0A I _i (= I _n x..)	1.5	2	3	4	5	6	8	10	12
5.0A I _i (= I _n x..)	2	3	4	6	8	10	12	15	off
6.0A I _i (= I _n x..)	2	3	4	6	8	10	12	15	off

I_i = UL and ANSI instantaneous
I_{sd} = IEC instantaneous (short-time with zero delay)
I_n = sensor rating
I_r = long-time pickup

Ground-Fault Protection

Equipment ground-fault protection protects conductors against overheating and faults from ground-fault currents (≤ 1200 A).

- Equipment ground-fault protection is standard on 6.0A trip units.
- Ground-fault pickup (I_g) (A) sets ground current level where circuit breaker will trip after the preset time delay.
- Ground-fault delay (t_g) (B) sets the length of time that the circuit breaker will carry a ground-fault current above the ground-fault pickup current level before tripping.
- Equipment ground-fault protection can be zone-selective interlocked (ZSI) with upstream or downstream circuit breakers.
- Setting the ground-fault delay (t_g) to the 0 setting turns off zone-selective interlocking.
- Neutral protection and equipment ground-fault protection are independent and can operate concurrently.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

Figure 10 – Ground-Fault Protection Switches

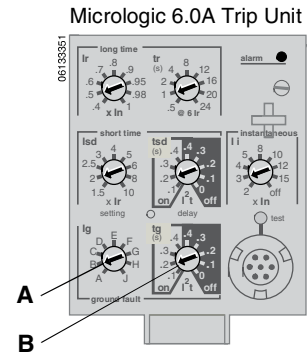


Table 4 – Micrologic Trip Unit Ground-Fault Pickup Values

$I_g (= I_n \times \dots)$	A	B	C	D	E	F	G	H	J
$I_n \leq 400$ A	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
400 A $< I_n \leq 1200$ A	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
$I_n > 1200$ A	500 A	640 A	720 A	800 A	880 A	960 A	1040 A	1120 A	1200 A

I_n = sensor rating.

I_g = ground-fault pickup.

Table 5 – Micrologic Trip Unit Ground-Fault Delay Values

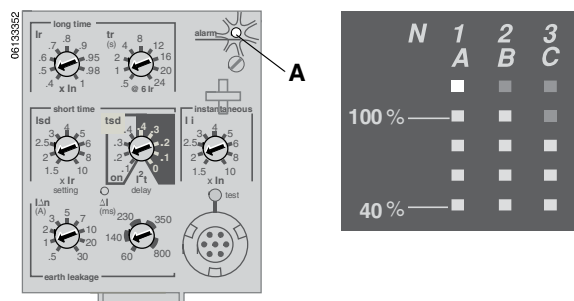
Setting	Ground-Fault Delay				
I^2t off (ms at I_n) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (ms at I_n) (seconds)	—	0.1	0.2	0.3	0.4
tsd (min. trip) (milliseconds)	20	80	140	230	350
tsd (max. trip) (milliseconds)	80	140	200	320	500

Indicator Lights

Overload Indicator Light

The overload indicator light (A) lights when the I_r long-time pickup level has been exceeded (over 100% on the bar graph).

Figure 11 – Overload Indicator Light



Trip Indicator Lights

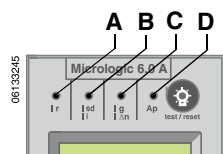
The I_r trip indicator light (A) lights when a trip occurs because the I_r long-time pickup level was exceeded.

The I_{sd}/I_i trip indicator light (B) lights when a trip occurs because the I_{sd} short-time pickup or the I_i instantaneous pickup was exceeded.

The I_g trip indicator light (C) lights when a trip occurs because the I_g ground fault pickup was exceeded.

The A_p self-protection indicator light (D) lights when the trip unit overheats, the instantaneous override level is exceeded, or a trip unit power supply failure occurs.

Figure 12 – Trip Indicator Lights



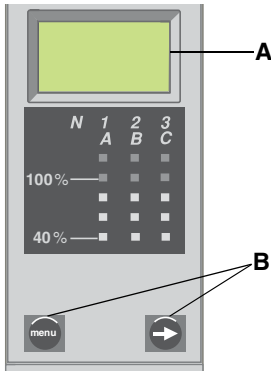
Ammeter

The ammeter monitors and displays the circuit breaker currents. An alphanumeric screen (A) continuously displays the phase at the highest load. Navigation buttons (B) can be pressed to display the various monitored currents.

The process of checking the ammeter values can be stopped at any time. After several seconds, Micrologic trip units automatically return to displaying the phase at the highest load.

See the following section for addition information concerning the ammeter.

Figure 13 – Ammeter



Trip Unit Testing

Trip unit functions can be tested using primary injection testing or secondary injection testing.

Micrologic Trip Unit Configuration

Control Power

Table 6 – Pickup Values

Sensor Plug Value (In)	Minimum Ground-Fault Pickup
100–250 A	30% of Sensor Rating
400–1200 A	20% of Sensor Rating
1600–6300 A	500 A

- The A trip unit was designed to be used with or without an external 24 Vdc power supply.
- The following will be powered and functional even if the trip unit is not externally powered:
- Fault protection for LSIG functions. The A trip unit is fully circuit powered for fault protection.
 - LED trip indication (powered by an onboard battery). The battery’s only function is to provide LED indication if all other power is off
 - All display functions and trip unit features power-up with current flow on one phase greater than or equal to the values in Table 6.
 - Ground-fault push-to-trip button works for testing ground fault with current flow on one phase greater than or equal to the values in Table 6.

The ground-fault push-to-trip is also functional if a Hand-Held Test Kit or Full-Function Test Kit is powering the trip unit.

The following will be powered and functional with external power:

- All of the above functions which are functional without external power.
- Ammeter and bar graph displays are functional with or without current flowing through the circuit breaker. With current flow between 0 and 20% of sensor value, the ammeter may not be accurate.
- Trip settings and max. current readings can be accessed on the display by pressing the navigation buttons with or without current flowing through the circuit breaker.
- Ground-fault push-to-trip button works for testing ground fault with or without current flowing through the circuit breaker.
- Optional Modbus communications are functional, using a separate 24 Vdc power supply for the circuit breaker communications module. This separate 24 Vdc power supply is required to maintain the isolation between the trip unit and communications.

The ground-fault push-to-trip is also functional if a Hand-Held Test Kit or Full-Function Test Kit is powering the trip unit.

External Power Supply

⚠ CAUTION

HAZARD OF SHOCK, ARC FLASH OR EQUIPMENT DAMAGE

Trip unit and communication module must use separate power supplies.

Failure to follow this instruction can result in personal injury or equipment damage.

The trip unit display can be powered by a 24 Vdc external power supply.

Table 7 – Power Supply Specifications

Function	Specification
Power for Trip Unit Alone	24 Vdc, 50 mA
Minimum Input-to-Output Isolation	2400 V
Output (Including Max. 1% Ripple)	±5%
Dielectric Withstand (Input/Output)	3 kV rms
Connections	Connections UC3 F1 (-) ———— F2 (+) ———— 24 Vdc

Power supply is used for graphic screen display when the circuit breaker is open or not carrying current.

Section 2—Ammeter

Display

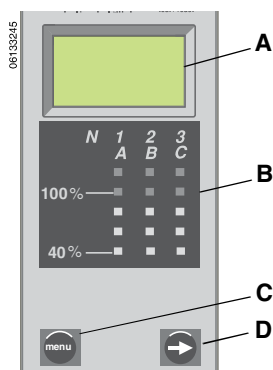
NOTE: The ammeter display will function only if the trip unit is powered. The trip unit is powered by the circuit breaker carrying more than $0.20 \times I_n$ of load current, by being connected to a 24 Vdc external power supply, or by having the Full-Function Test Kit or Hand-Held Test Kit connected and on. Even with external power supplied, current through the circuit breaker must exceed $0.20 \times I_n$ for the ammeter reading to be accurate to within 1.5%.

- A. Alphanumeric screen: Displays ammeter information
- B. Bar graph: Displays currents using an LED bar graph
- C. Menu button: Used to navigate between the various menus
- D. Scroll button: Used to scroll to the next screen in the menus

The default display is the current value of the phase at the highest load.

If no information is displayed, contact the local field office.

Figure 14 – Ammeter



Ammeter Measurements

Micrologic A trip units measure the true RMS value of currents. They provide continuous current measurement from 0.2 to $20 \times I_n$ with an accuracy of 1.5% (including sensors). No auxiliary source is needed where $I > 0.2 \times I_n$. The optional external power supply (24 Vdc) makes it possible to display currents where $I < 0.2 \times I_n$.

A digital LCD screen continuously displays the most heavily loaded phases (I_{max}) or displays the I_a , I_b , I_c , I_g , and (on 4-pole circuit breakers only) I_n stored current and setting values by successively pressing the navigation button.

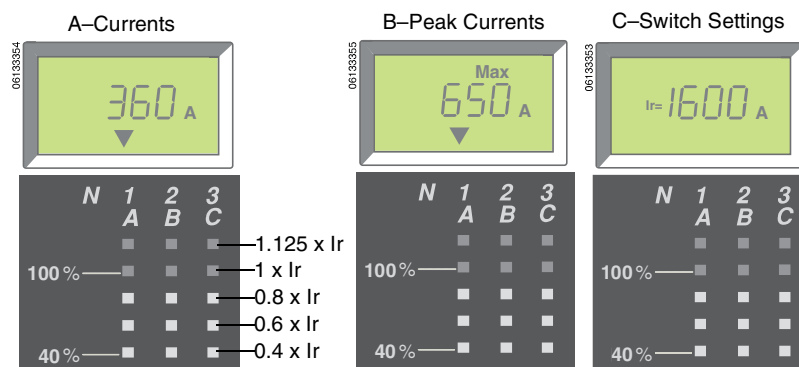
Accessing Information

Three different menus can be accessed:

- A. Current measurements
- B. Stored peak current measurements
- C. Switch settings

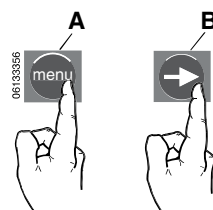
In addition, the ammeter can be used to address the circuit breaker communication module (BCM) in circuit breakers which have the optional circuit breaker communication module installed.

Figure 15 – Menus



To access the next menu, press the menu button (A). To access the next screen in a menu, press the scroll button (B).

Figure 16 – Navigation Buttons



Current Menu

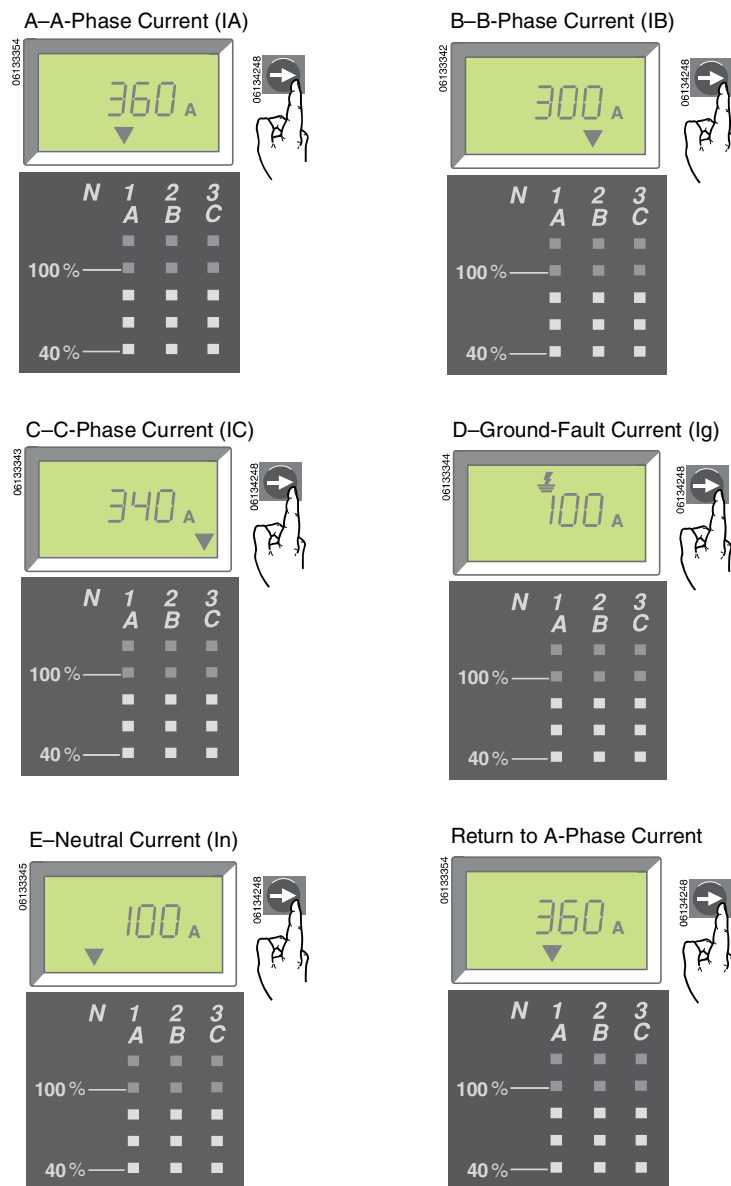
The current (default) menu displays:

- A. Phase current (IA) in A phase
- B. Phase current (IB) in B phase
- C. Phase current (IC) in C phase
- D. Ground-fault current (Ig) (Micrologic 6.0A trip units only)
- E. Neutral current (In)

To display next current, press scroll button.

NOTE: Neutral current is only displayed with a 4-pole circuit breaker with the neutral protection set to half or full. Refer to bulletin 48041-082-03 for NC CT wiring guidelines.

Figure 17 – Current Menus



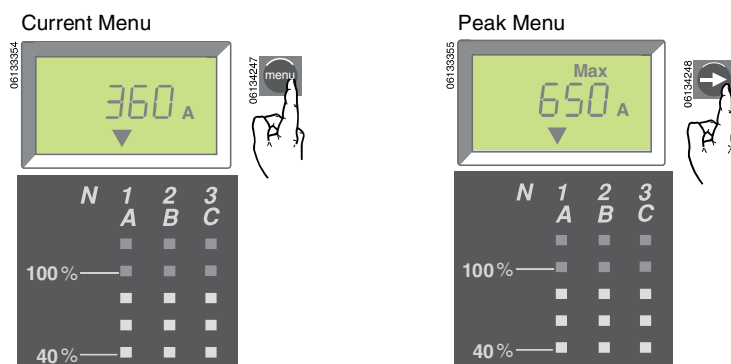
Peak Menu

To access the peak menu:

1. Current menu is displayed.
2. Press menu button.
3. Peak menu appears.

To access menu screens, press scroll button.

Figure 18 – Access the Peak Menu



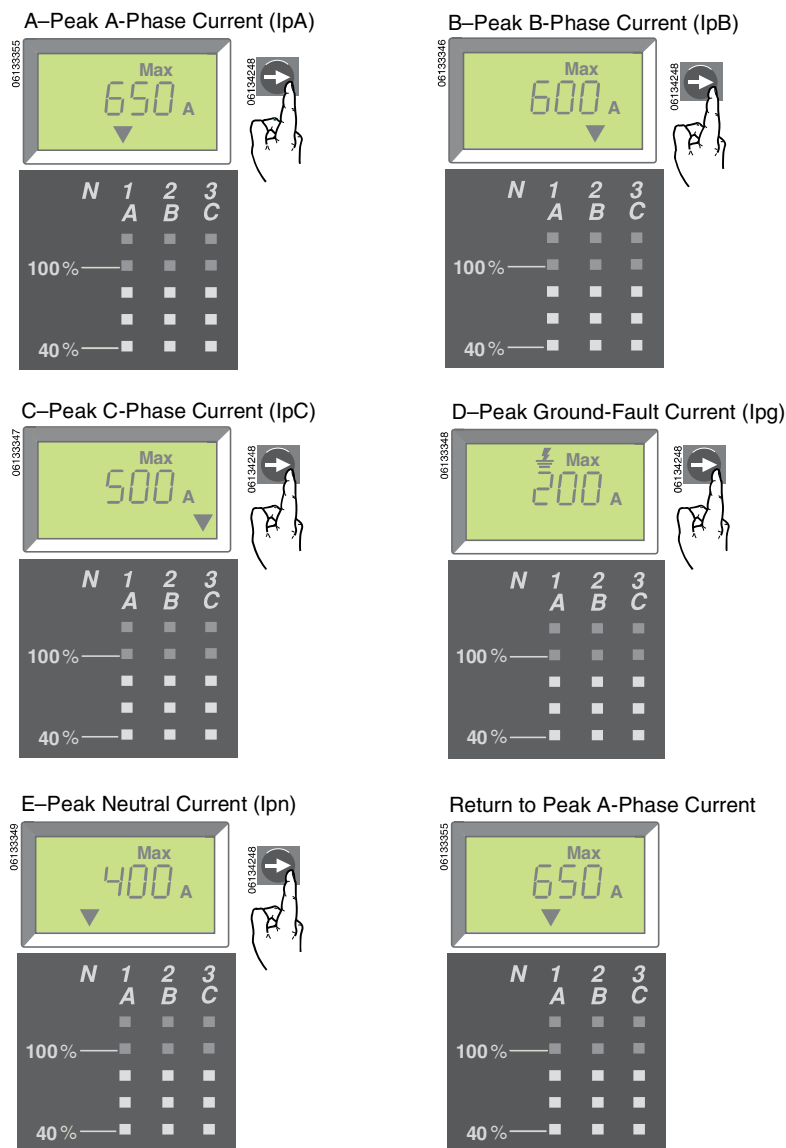
The peak menu displays:

- A. Peak current (IpA) in A phase
- B. Peak current (IpB) in B phase
- C. Peak current (IpC) in C phase
- D. Peak ground-fault current (Ipg) (Micrologic 6.0A trip unit only)
- E. Peak neutral current (Ipn)

To display next peak current, press scroll button.

To reset a max value, scroll to the particular max value screen to be reset and hold the scroll button for three seconds.

Figure 19 – Peak Menus



Switch Settings Menu

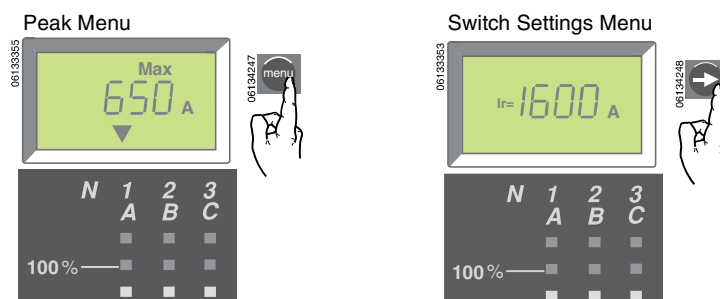
The switch settings menu displays the values at which the switches are set.

To access the switch settings menu:

1. Peak menu is displayed.
2. Press menu button.
3. Switch settings menu will appear.

To access menu screens, press scroll button.

Figure 20 – Access the Switch Settings Menu

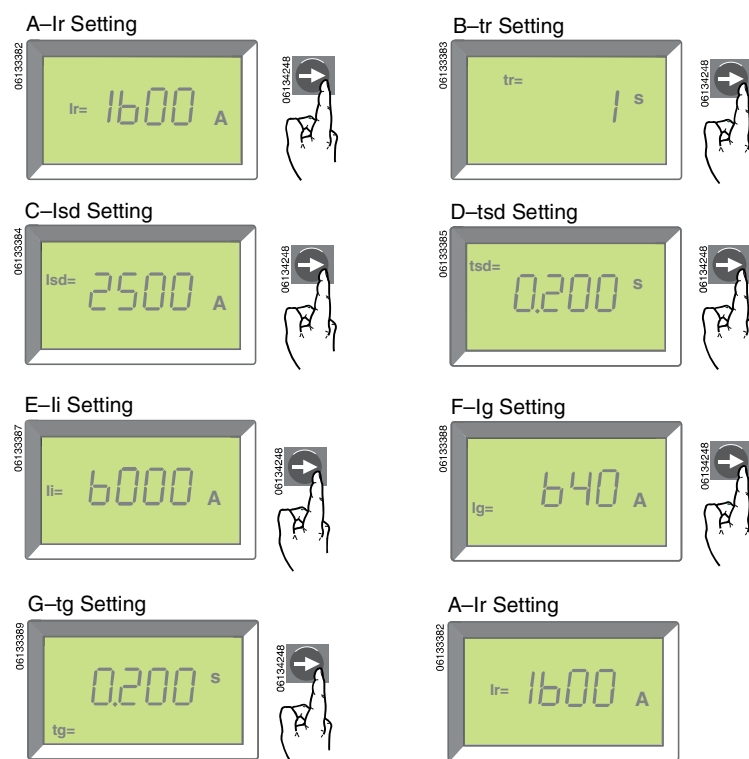


The switch settings menu displays:

- A. Long-time pickup (I_r) setting
- B. Long-time delay (t_r) setting
- C. Short-time pickup (I_{sd}) setting
- D. Short-time delay (t_{sd}) setting
- E. Instantaneous pickup (I_i) setting
- F. Ground-fault pickup (I_g) setting (6.0A trip units only)
- G. Ground-fault delay (t_g) setting (6.0A trip units only)

To display next switch setting, press scroll button.

Figure 21 – Trip Unit Switch Settings

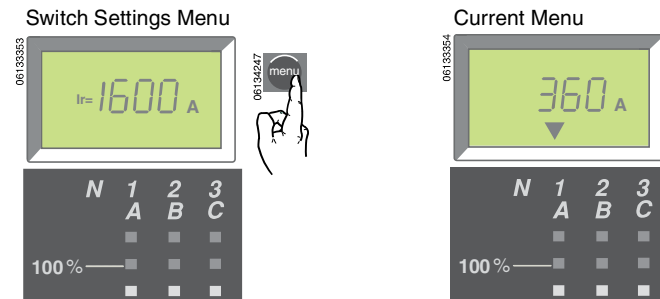


To return to the current menu:

1. Switch settings menu is displayed.
2. Press menu button.
3. Current menu will appear.

Or wait several seconds and ammeter will automatically return to the current (i.e., default) menu.

Figure 22 – Return to Current Menu

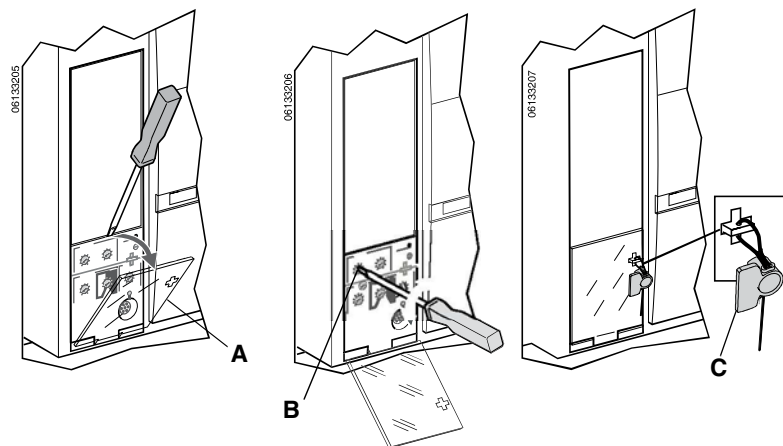


Section 3— Operation

Switch Setting Adjustment

1. Open switch cover (A).
2. Adjust the appropriate switches (B) to desired values.
3. Replace switch cover. Use wire seal MICROTUSEAL (C, not provided), if necessary, to provide tamper evidence.

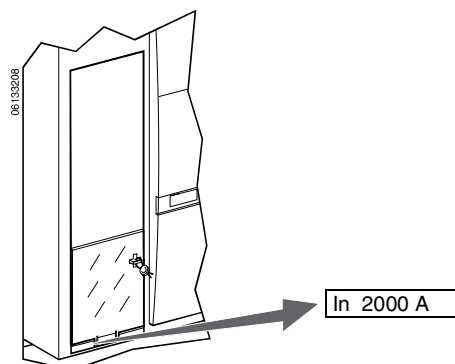
Figure 23 – Adjust Switch Settings



Examples

Circuit breaker is rated 2000 A.

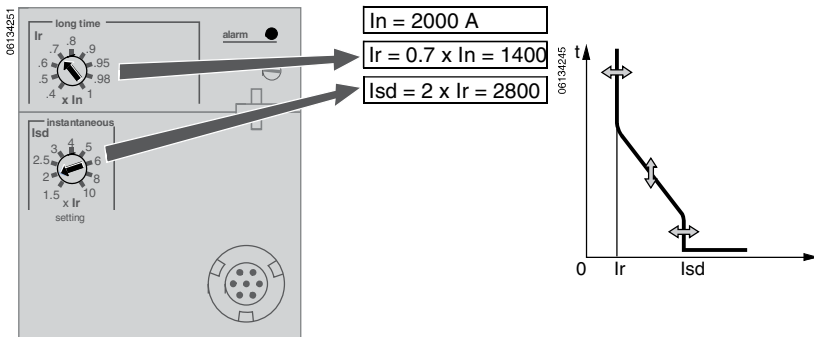
Figure 24 – Circuit Breaker Rating



Micrologic 2.0A Trip Unit

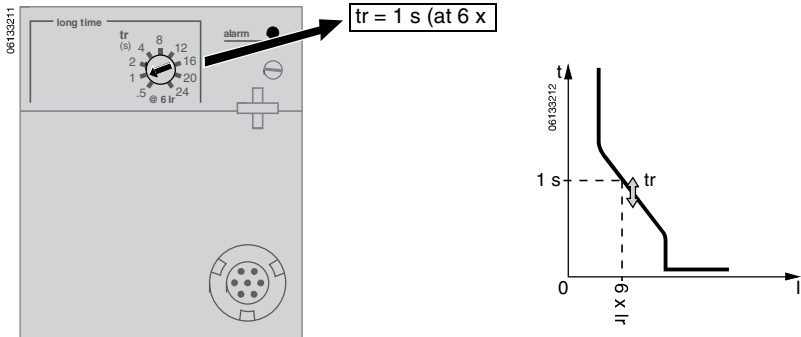
- 1. Set pickup levels.

Figure 25 – Set Pickup Levels



- 2. Set time delay.

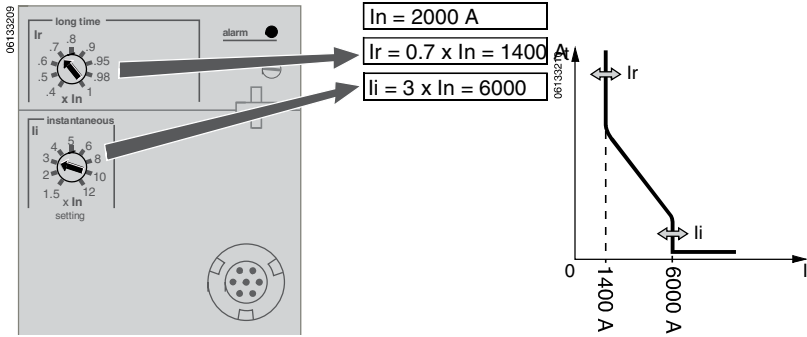
Figure 26 – Set Time Delay



Micrologic 3.0A Trip Unit

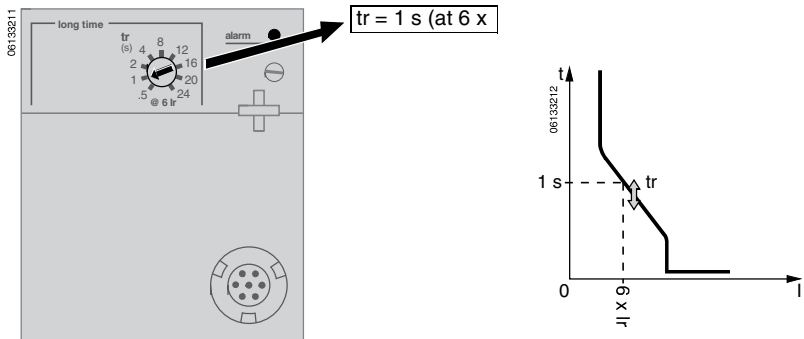
- 1. Set pickup levels.

Figure 27 – Set Pickup Levels



2. Set time delay.

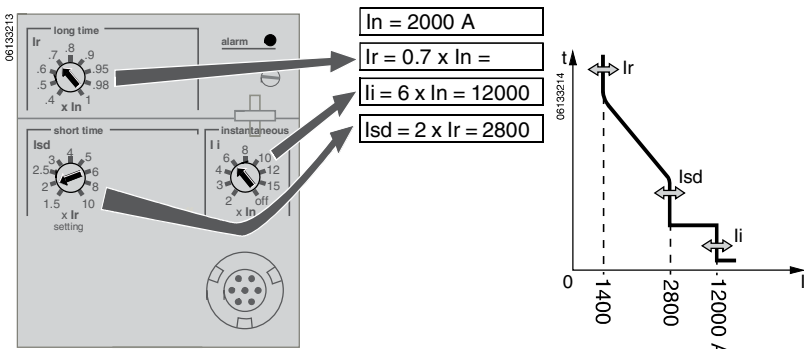
Figure 28 – Set Time Delay



Micrologic 5.0A Trip Unit

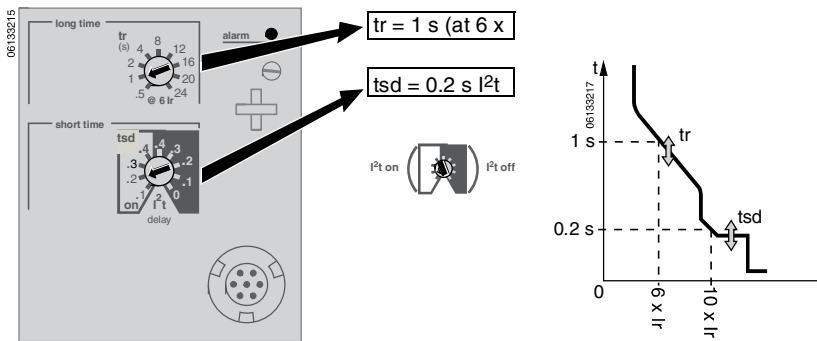
1. Set pickup levels.

Figure 29 – Set Pickup Levels



2. Set time delay.

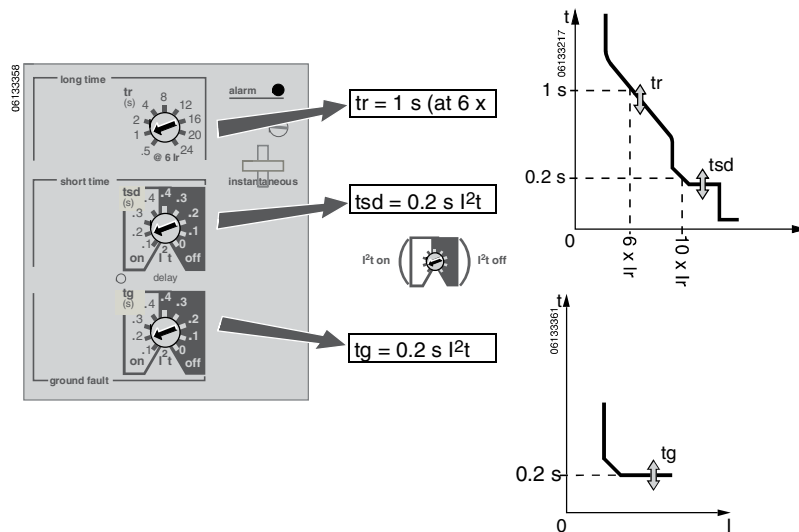
Figure 30 – Set Time Delays



- ### Figure 31 – Set Pickup Levels



Figure 32 – Set Pickup Levels



Zone-Selective Interlocking (ZSI)

The number of devices which can be interlocked are shown in Table 8.

Table 8 – ZSI Combinations

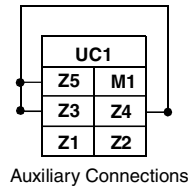
Upstream Device (receives input from RIM) Downstream Device (sends output to RIM)	Micrologic #.0x Trip Units	Square D Micrologic Series B Trip Units	Square D GC-100 Ground-Fault Relay for Equipment Protection	Square D GC-200 Ground-Fault Relay for Equipment Protection	Merlin Gerin STR58 Trip Units	Federal Pioneer USRC and USRCM Trip Units
Micrologic #.0x Trip Units	15	R	R	15	15	R
Square D Micrologic Series B Trip Units	R	26	R	R	R	15
Square D GC-100 Ground-Fault Relay for Equipment Protection	R	R	7	R	R	R
Square D GC-200 Ground-Fault Relay for Equipment Protection	15	R	R	15	15	R
Merlin Gerin STR58 Trip Units	15	R	R	15	15	R
Merlin Gerin STR53 Trip Units	15	R	R	15	15	R
Federal Pioneer USRC and USRCM Trip Units	R	15	R	R	R	15
Square D Add-On Ground Fault Module for Equipment Protection	R	5	R	R	R	R

R—RIM module is required to restrain any devices.

Numerical References—Maximum number of upstream circuit breakers which can be restrained without requiring a RIM Module.

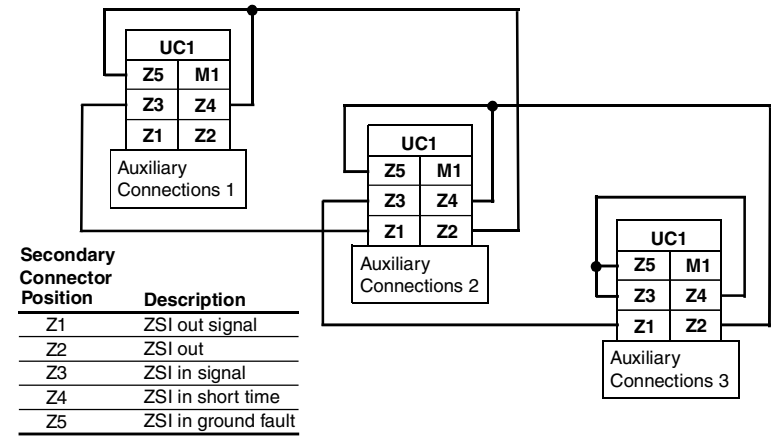
Circuit breaker terminals are shipped with terminals Z3, Z4 and Z5 jumpered to self-restrain the short-time and ground-fault functions. Remove the jumpers when activating zone-selective interlocking.

Figure 33 – Jumpered Terminals



Wire circuit breakers for zone-selective interlocking.

Figure 34 – ZSI Wiring Example



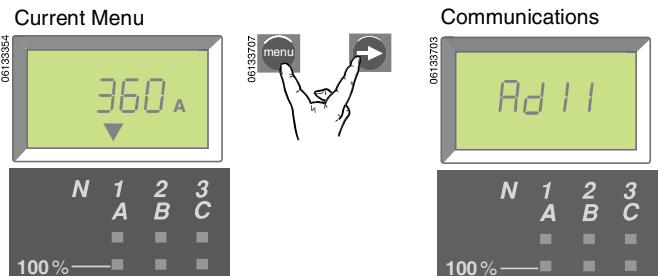
Communication Module Values

If the optional circuit breaker communication module (BCM) is installed, use the ammeter to set communication module values.

To access the communication module menu:

- 1. Current menu is displayed.
- 2. Simultaneously press both menu button and scroll button down for three seconds.
- 3. Communication module addressing menu will appear.

Figure 35 – Access Communication Module Menu

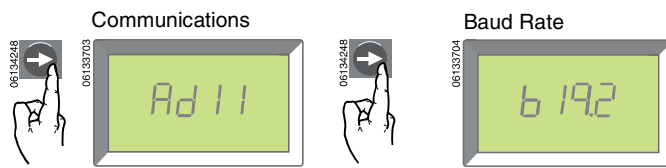


Set communication module values:

1. Press and release scroll button to sequence addresses (1 through 47). When the correct address number is reached, enter the value by pressing and holding scroll button until the display stops flashing.

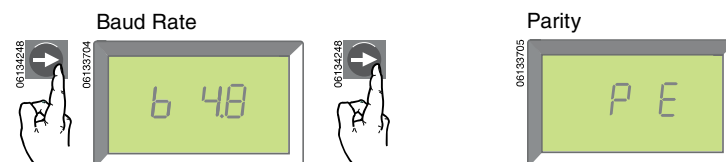
Baud rate screen will appear after address has been entered.

Figure 36 – Set Communication Module Values



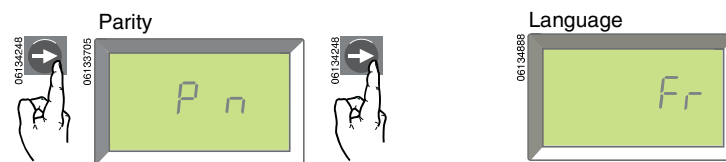
2. Press and release scroll button to sequence baud rates (4.8k, 9.6k or 19.2k). When the desired baud rate appears, enter the value by pressing and holding scroll button until the display stops flashing.

Parity screen will appear after baud rate has been entered.



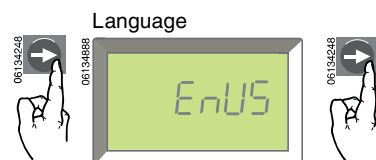
3. Press and release scroll button to sequence parities (E [even] or n [none]). When the desired parity appears, enter the value by pressing and holding scroll button until the display stops flashing.

Languages screen will appear after parity has been entered.



4. Press and release scroll button to scroll through languages (French [Fr], US English [En US], UK English [En], German [d], Spanish [SP] or Italian [It]). When the desired language appears, enter the value by pressing and holding scroll button until the display stops flashing.

Ammeter display will return to the default screen after language is entered.



After the communication module values have been set, ammeter will automatically return to the current (i.e., default) menu.

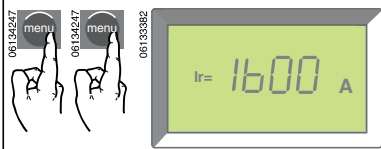
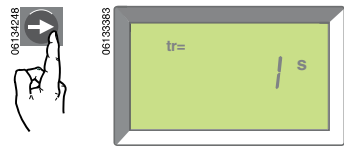
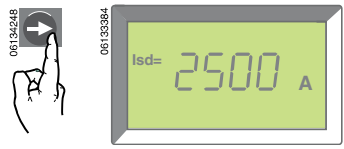
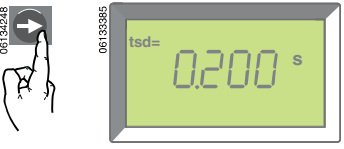
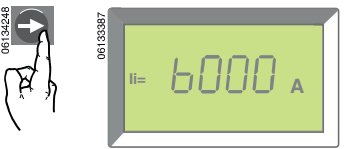
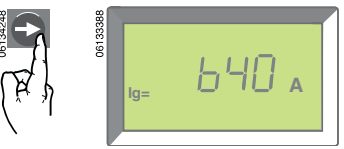
Refer to the *Modbus Communications Guide* 0613IB1313 for other components and setup instructions.

Trip Unit Settings Check

Use the ammeter switch setting menu to check the trip unit settings.

1. Press menu button twice.
2. Switch settings menu will appear.
3. Press scroll button to advance to next screen.
4. After checking trip unit settings, press menu button once to return to main menu.

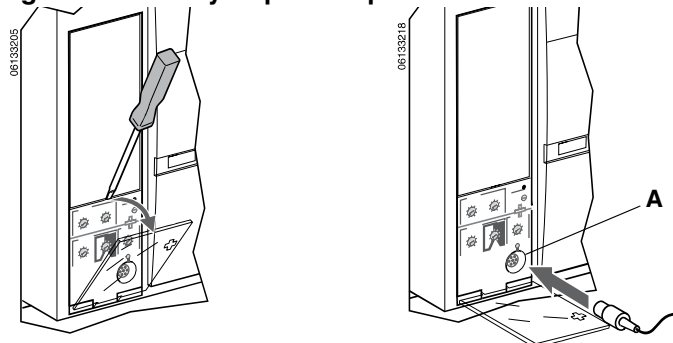
Table 9 – Trip Unit Settings

Setting		Window	2.0A	3.0A	5.0A	6.0A
Ir	Long-Time Pickup		X	X	X	X
tr	Long-Time Delay		X	X	X	X
I _{sd}	Short-Time Pickup		X		X	X
t _{sd}	Short-Time Delay				X	X
I _i	Instantaneous Pickup			X	X	X
I _g	Ground-Fault Pickup					X
t _g	Ground-Fault Delay					X

Trip Unit Operation Verification

Use a test kit connected to the trip unit test plug receptacle (A) to verify trip unit is functioning as desired. See instructions shipped with test kit to perform verification tests.

Figure 37 – Verify Trip Unit Operation



Equipment Ground-Fault Trip Functions Testing

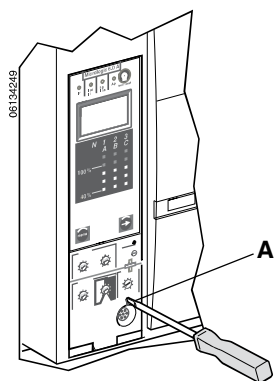
Paragraph 230-95 (c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed.

With the circuit breaker closed, test the ground-fault (Micrologic 6.0A trip unit only) trip functions. For instructions on how to close circuit breaker, refer to the circuit breaker installation instructions shipped with the circuit breaker.

1. Press the ground-fault test button (A). Circuit breaker should trip.
2. If circuit breaker does not trip, contact the local field office.

NOTE: Trip unit must be powered to test ground-fault trip function. The trip unit is powered if the circuit breaker is carrying more than $0.20 \times I_n$ of load current, if the 24 Vdc external power supply is connected or if the Full-Function Test Kit or Hand-Held Test Kit is connected and on.

Figure 38 – Test Equipment Ground-Fault Trip Function



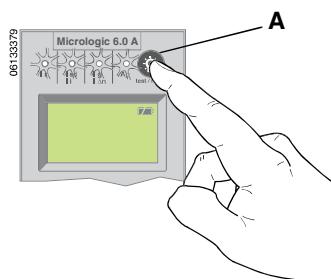
Trip Unit Resetting

When the circuit breaker trips, the fault indicator will remain lit until the trip unit is reset.

Press the reset/test button (A) to reset the trip unit after trip.

Do not return circuit breaker to service until cause of trip is determined. For more information, refer to the circuit breaker installation instructions shipped with the circuit breaker.

Figure 39 – Reset Trip Unit



Trip Unit Status Check

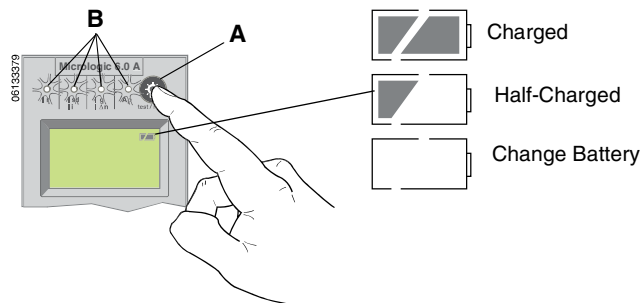
NOTE: Trip unit must be powered to test battery. The trip unit is powered if the circuit breaker is carrying more than $0.20 \times I_n$ of load current, if the 24 Vdc external power supply is connected or if the Full-Function Test Kit or Hand-Held Test Kit is connected and on.

To check trip unit battery and trip indicators, press the test/reset button (A).

- All trip indicators (B) will light up
- Battery status will be displayed
- If no battery status is displayed, there is no battery installed.
- The battery bar graph reading is valid after the reset button has been released.
- If the battery bar graph shows the battery needs to be changed, use Square D battery catalog number S33593:
 - lithium battery
 - 1.2AA, 3.6 V, 800 ma/h

For instructions on replacing battery, see Section 6—Battery Replacement.

Figure 40 – Check Trip Unit Status



Section 4— Trip Unit Replacement

Trip unit replacement must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.

Before replacing trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.

Read this entire section before starting the replacement procedure.

NOTE: If trip unit being replaced is a Micrologic 2.0, 3.0 or 5.0 trip unit, order connector block S33101 and circuit breaker or cradle wiring harness if necessary.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Failure to follow these instructions for installation, trip test and primary injection testing may result in the failure of some or all protective function.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Replacement/upgrading of a trip unit in the field must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.
- Before replacing/upgrading trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.
- If the circuit breaker fails to function properly in any manner upon completion of the trip unit installation, immediately remove the circuit breaker from service and call Field Services.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Required Tools

- Torque-controlled screwdriver, set at 7 in-lbs (0.8 N•m) $\pm$ 10% (Lindstrom torque driver MAL500-2 or equivalent)
- Micrologic Full-Function Test Kit (part number S33595)

Preparation

Record Switch Settings

Record all trip unit switch settings for later use.

Circuit Breaker Disconnection

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker. The circuit breaker must be completely isolated. (For a drawout circuit breaker, place circuit breaker in the disconnected position.)

For a fixed-mounted circuit breaker, all voltage sources, including auxiliary power, must be disconnected.)

Circuit Breaker Accessory Cover Removal

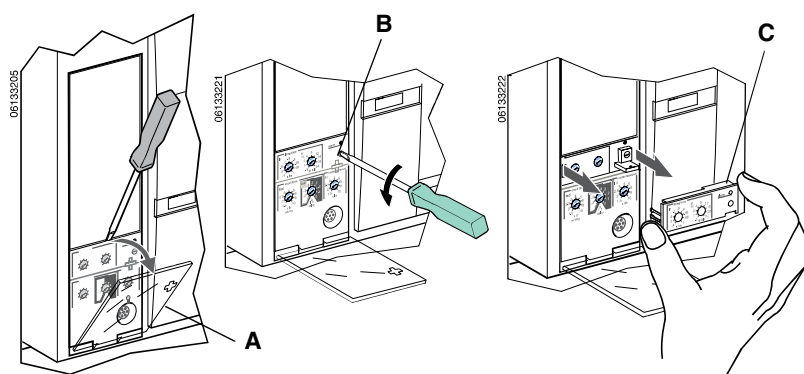
Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Rating Plug Removal

A small Phillips screwdriver is needed to remove the adjustable rating plug.

1. Open switch cover (A).
2. Unscrew adjustable rating plug mounting screw (B).
3. Remove adjustable rating plug (C). Save for installation in replacement trip unit.

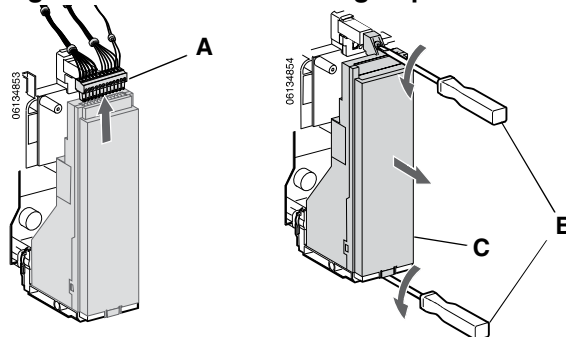
Figure 41 – Remove Adjustable Rating Plug



Trip Unit Removal

1. Remove connector block (A) from top of trip unit, if present.
2. Loosen two trip unit screws (B).
3. Slide out trip unit (C).

Figure 42 – Remove Existing Trip Unit



Trip Unit Replacement

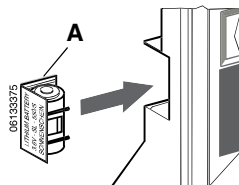
Battery Installation

If a new trip unit is being installed, install the trip unit battery.

Install battery holder with battery (A) in trip unit, observing the correct polarity as indicated on the battery compartment.

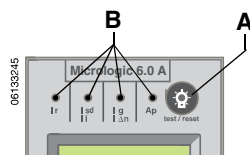
NOTE: Battery holder with battery is located under the side flap in the cardboard box the trip unit is shipped in.

Figure 43 – Install Battery



Press test/reset button (A). All four indicator lights (B) should light. If they do not light, check polarity of battery and retest. If indicator lights still do not light up when test/reset button is pressed, stop installation and contact the local sales office for factory authorized service

Figure 44 – Trip Indicator Lights

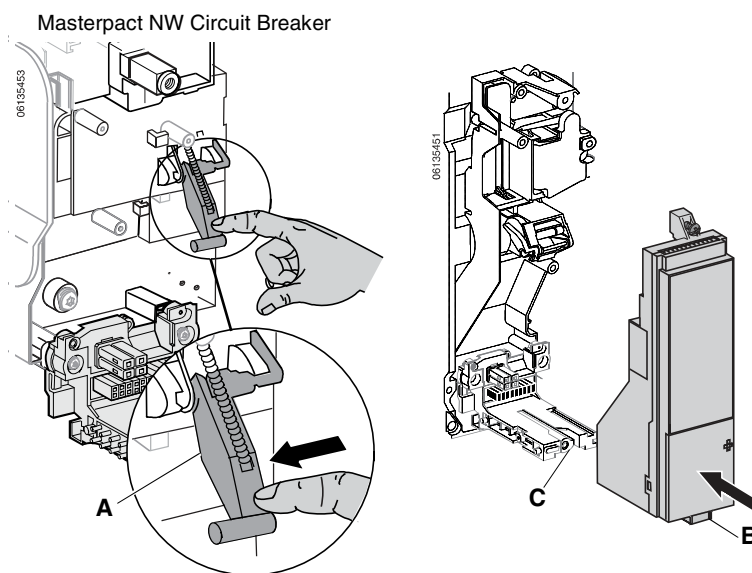


Trip Unit Installation

1. Inspect trip unit connector pins and surfaces. If there is any damage, misaligned pins, or contamination, stop installation and contact the local sales office for factory authorized service.
2. Inspect trip unit mounting base on the circuit breaker. Clear any debris from area and check that all accessory wiring is properly routed for the trip unit being installed. If there is any damage or contamination, stop installation and contact the local sales office for factory authorized service.
3. For Masterpact NW circuit breaker only: Manually depress trip unit interlock (A) and hold it in place during steps 4–6.
4. Align guide rail (B) on bottom of trip unit with guide rail slot (C) on trip unit mounting base in circuit breaker and gently slide the trip unit in until it stops.

NOTE: The Masterpact NT and NW trip unit mounting bases are shock mounted and therefore can flex slightly.

Figure 45 – Install Trip Unit



NOTICE

HAZARD OF EQUIPMENT DAMAGE

Check installation of trip unit to assure proper connections and seating.

Failure to follow this instruction can result in equipment damage or improper circuit breaker tripping.

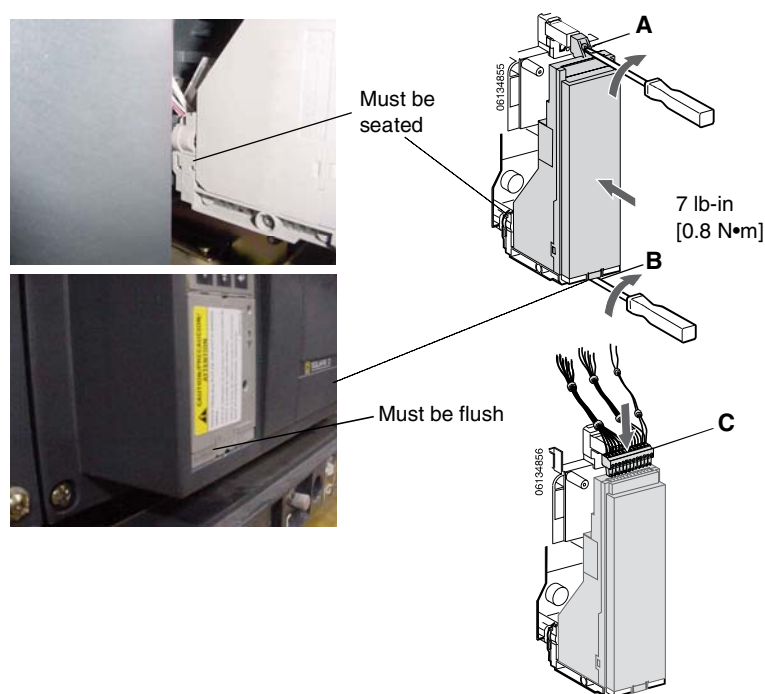
5. Align the trip unit so top mounting screw (A) aligns with the top threaded insert and start the screw by turning the screw two full rotations.
6. Use a torque-controlled screwdriver to drive the bottom screw (B) to 7 in-lbs (0.8 N•m) $\pm$ 10%. The back of the trip unit must be flush with the trip unit mounting base.
7. Use a torque-controlled screwdriver to drive the top screw to 7 in-lbs (0.8 N•m) $\pm$ 10%. Mounting tab must be flush with the mounting standoff and sensor plug.

NOTE: The face of the closed switch cover must be flush with adjoining mounting base surfaces. If these surfaces are not flush, stop installation and contact the local sales office for factory authorized service.

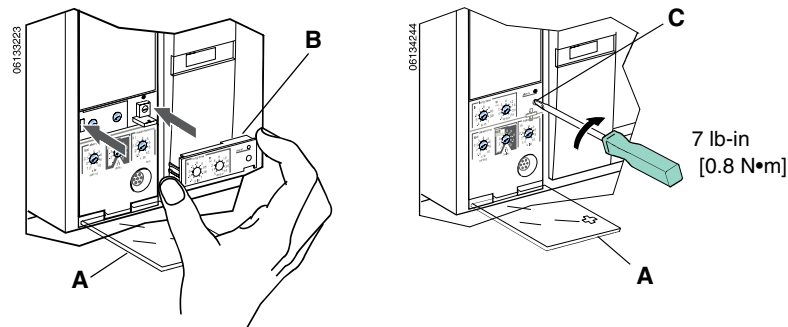
NOTE: If you are upgrading from a Micrologic 2.0, 3.0 or 5.0 trip unit, the connector block must be ordered separately (Part Number S33101). See instructions shipped with the connector block for installation into circuit breaker.

8. Install connector block (C) into top of trip unit.

Figure 46 – Install Trip Unit



9. Install adjustable rating plug into the trip unit.
 - a. Open switch cover (A) on new trip unit.
 - b. Inspect mounting area for debris and contamination.
 - c. Gently push adjustable rating plug (B) into new trip unit.
 - d. Tighten adjustable rating plug mounting screw (C). The plug will be drawn into position flush with front face as screw is tightened.
10. Set trip unit switches to values recorded above or per coordination study results.
11. Close switch cover (A).

Figure 47 – Install Adjustable Rating Plug

Circuit Breaker Accessory Cover Replacement

Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Trip Unit Installation Check

Secondary Injection Testing

Field installation of a trip unit requires secondary injection testing with the Full-Function Test Kit, to ensure that the newly-installed trip unit is functioning properly. The test will require opening and closing the circuit breaker. Follow the procedures outlined in the instruction bulletins shipped with the circuit breaker and the test kit.

1. Make sure the circuit breaker is isolated from all upstream and downstream devices.
2. Perform secondary injection testing as outlined in the instruction bulletin shipped with the test kit. Verify that all applicable trip unit functions are operating properly.
3. Repeat step 2 with the circuit breaker in the open position.

NOTE: The test kit states that the circuit breaker should be closed when performing the test. Do not close the circuit breaker for this step.

4. If any test fails, do not put the circuit breaker into service and contact the local sales office for factory authorization service.

Primary Injection Testing

Primary injection testing is recommended to ensure that all trip system connections have been correctly made. Perform primary injection testing per the instructions in the Field Testing and Maintenance Guide, bulletin number 0600IB1201.

Check Accessory Operation

1. Installed accessories – Validate the proper operation of all installed accessories. See the corresponding accessory instruction bulletins for operational testing procedures.
2. Zone selective interlocking – If the circuit breaker is part of a ZSI system, follow the zone selective interlocking test procedures as outlined in the Full Function Test Kit instruction bulletin.
3. Communications – If communication modules exist, validate circuit breaker has re-established communications with the supervisor.

Trip Unit Setup

1. If an auxiliary power supply is being used for the Micrologic trip unit, reconnect the auxiliary power supply.
2. Reset the trip unit switches to original values, as recorded at the beginning of this section.

Circuit Breaker Reconnection

Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

Section 5— Adjustable Rating Plug Replacement

NOTE: To select correct replacement rating plug, see the product catalog.

NOTE: If adjustable rating plug is removed, the circuit breaker will default to a long-time pickup rating of $0.4 \times I_n$ and a long-time delay at whatever setting was selected before the rating plug was removed.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

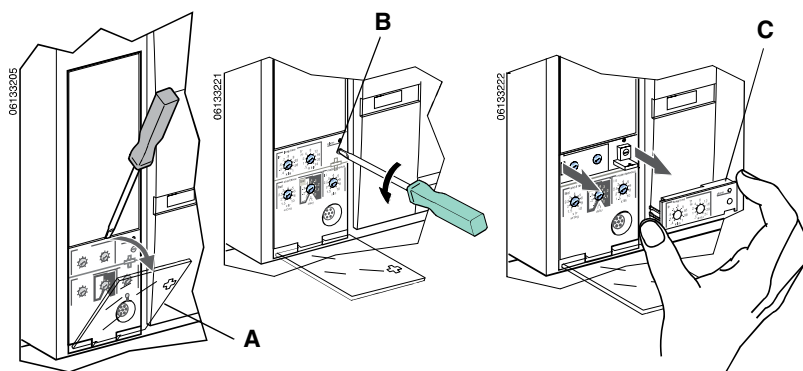
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Rating Plug Removal

1. Open circuit breaker contacts:
 - For Masterpact NT and NW circuit breakers, press the “Push to open” button on the circuit breaker.
 - For other circuit breakers, move handle to the off (O) position.
2. Open switch cover (A).
3. Unscrew adjustable rating plug mounting screw (B).
4. Remove adjustable rating plug (C).

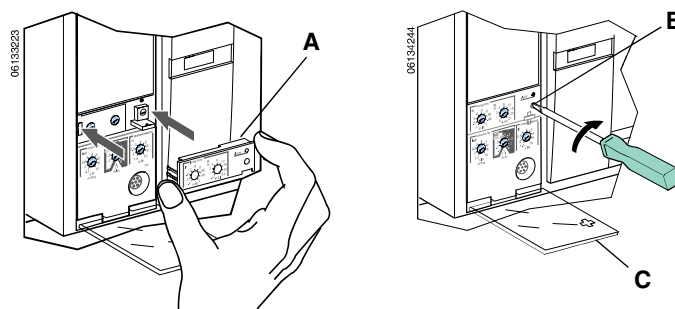
Figure 48 – Remove Adjustable Rating Plug



New Rating Plug Installation

1. Inspect mounting area for debris and contamination.
2. Gently push in new adjustable rating plug (A).
3. Tighten adjustable rating plug mounting screw (B).
4. Set the switches on the trip unit (see Section 3 —Operation).
5. Close switch cover (C).

Figure 49 – Install New Adjustable Rating Plug



Section 6— Battery Replacement

Circuit Breaker Disconnection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

Accessory Cover Removal

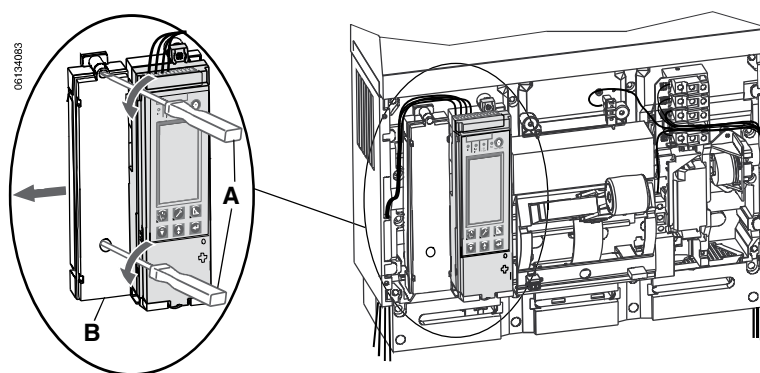
Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Withstand Module Shifting

NOTE: Some R-frame and NS1600b–NS3200 circuit breakers have a withstand module that needs to be moved to access the battery.

Loosen screws (A) securing withstand module (B). Swing module to side to access trip unit battery cover. Do not remove withstand module connector.

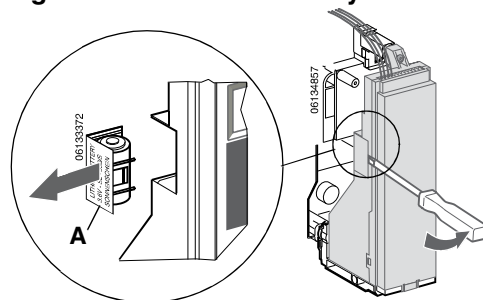
Figure 50 – Shift Withstand Module



Battery Replacement

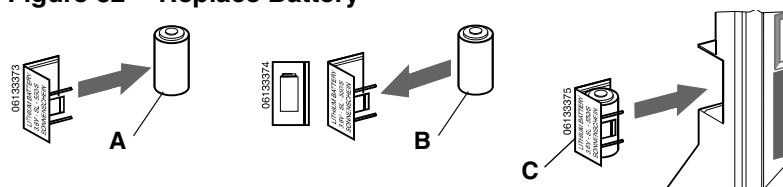
1. Insert small screwdriver blade into battery housing cover notch and rotate to slide battery housing cover (A) out of trip unit.

Figure 51 – Remove Battery Cover



2. Remove battery (A).
3. Insert new battery (B). Make sure that the polarity is correct.
4. Replace battery housing cover (C).

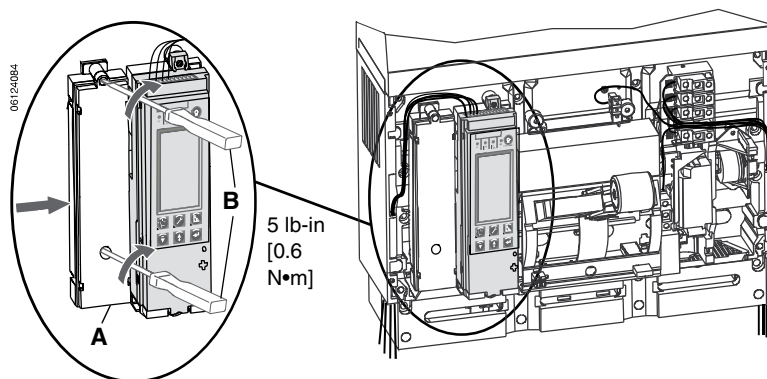
Figure 52 – Replace Battery



Withstand Module Replacement

If the withstand module was moved to access the battery, replace the withstand module (A) and tighten the screws (B).

Figure 53 – Replace Withstand Module



Accessory Cover Replacement

Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Circuit Breaker Reconnection

Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

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Replaces 48049-136-05 Rev. 01, 07/2012

Micrologic™ 2.0, 3.0 and 5.0 Electronic Trip Units

ENGLISH

Instruction Bulletin

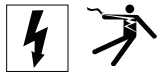
48049-207-05

Rev. 01, 07/2012

Retain for future use.



Hazard Categories and Special Symbols



ANSI



IEC



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in death or serious injury**.

WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in death or serious injury**.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in minor or moderate injury**.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

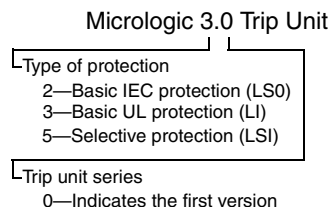
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Section 1—General Information

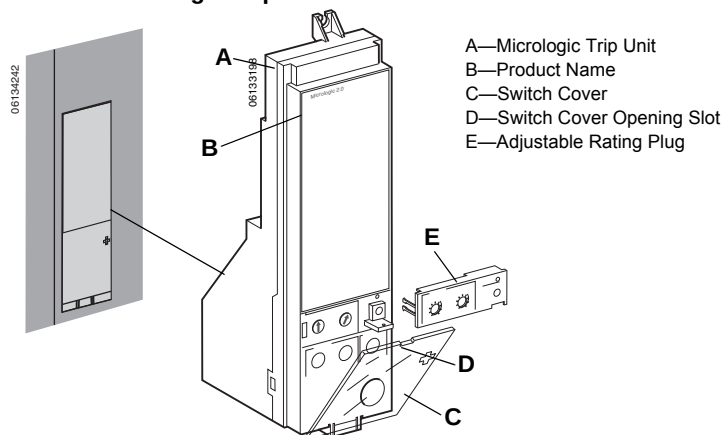
Introduction

Micrologic™ trip units (A) provide adjustable tripping functions on electronic trip circuit breakers. The product name (B) specifies the level of protection provided by the trip unit.



Micrologic trip units are field replaceable to allow for upgrading of the trip unit in the field. For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor plugs, rating plugs and trip units, see the product catalog.

Figure 1: Micrologic Trip Unit



Trip Unit Settings

On the face of the trip unit are adjustable switches to allow changing of trip characteristics. Trip units are shipped with the long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings.

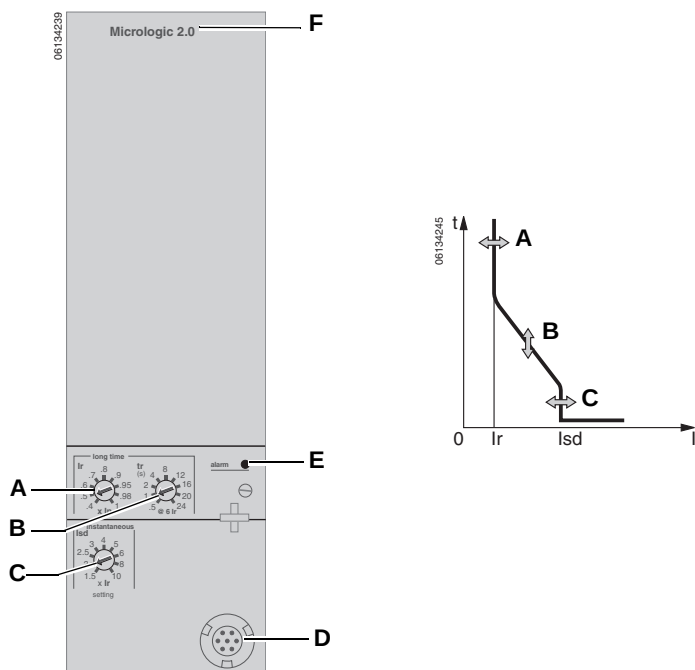
Micrologic 2.0 Trip Unit

NOTE: For use with IEC circuit breakers only.

The Micrologic 2.0 trip unit provides basic IEC (LS0) protection.

- A. Long-time pickup (I_r) switch
- B. Long-time delay (t_r) switch
- C. Short-time pickup (I_{sd}) switch*
- D. Test plug receptacle
- E. Overload indicator light
- F. Trip unit name

Figure 2: Micrologic 2.0 Trip Unit



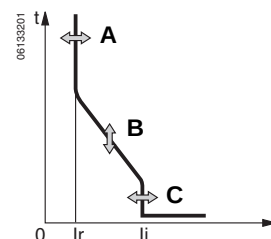
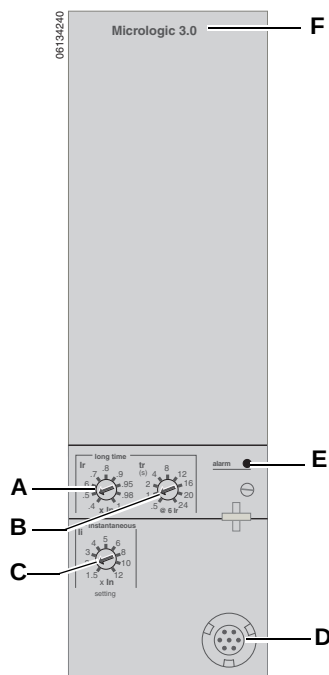
*Short-time delay is factory set at 0 (no delay), thus short-time pickup provides instantaneous protection.

Micrologic 3.0 Trip Unit

The Micrologic 3.0 trip unit provides basic (LI) protection.

- A. Long-time pickup (I_r) switch
- B. Long-time delay (t_r) switch
- C. Instantaneous pickup (I_i) switch
- D. Test plug receptacle
- E. Overload indicator light
- F. Trip unit name

Figure 3: Micrologic 3.0 Trip Unit

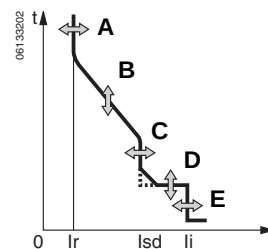
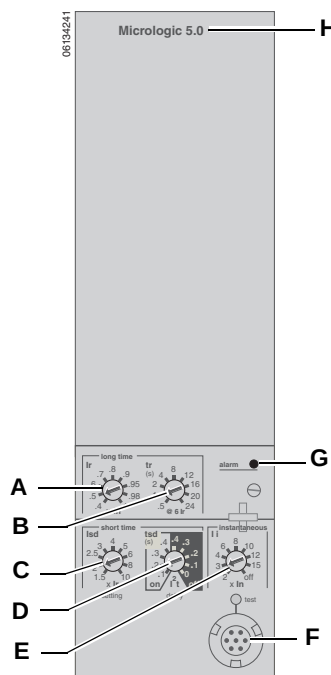


Micrologic 5.0 Trip Unit

The Micrologic 5.0 trip unit provides selective (LSI) protection.

- A. Long-time pickup (I_r) switch
- B. Long-time delay (t_r) switch
- C. Short-time pickup (I_{sd}) switch
- D. Short-time delay (t_{sd}) switch
- E. Instantaneous pickup (I_i) switch
- F. Test plug receptacle
- G. Overload indicator light
- H. Trip unit name

Figure 4: Micrologic 5.0 Trip Unit



Trip Unit Switches

Long-Time Protection

Long-time protection protects equipment against overloads.

- Long-time protection is standard on all trip units.
- The long-time pickup (I_r) (A) sets maximum current level (based on sensor plug rating I_n) which circuit breaker will carry continuously. If current exceeds this value, circuit breaker will trip after the preset time delay. The long-time pickup (I_r) is adjustable from 0.4–1.0 times the sensor plug rating (I_n).
- The long-time delay (t_r) (B) sets the length of time that the circuit breaker will carry an overcurrent below the short-time or instantaneous pickup current level before tripping. See Table 1 for long-time delay settings.
- The overload indicator light (C) indicates that the I_r long-time pickup threshold has been exceeded.
- Both long-time pickup and long-time delay are on the field-replaceable adjustable rating plug. To change settings to more precisely match the application, various rating plugs are available. For instructions on replacing the rating plug, see Section 4—Adjustable Rating Plug Replacement.
- The I_n value can be changed by replacing the sensor plug below the trip unit. For further information, see the instructions packed with the sensor plug replacement kit.
- Long-time protection uses true RMS measurement.

Thermal imaging provides continuous temperature rise status of the wiring, both before and after the device trips. This allows the circuit breaker to respond to a series of overload conditions which could cause conductor overheating, but would go undetected if the long-time circuit was cleared every time the load dropped below the pickup setting or after every tripping event.

NOTE: If checking trip times, wait a minimum of 15 minutes after circuit breaker trips before resetting to allow the thermal imaging to reset completely to zero.

Figure 5: Long-Time Protection Switches

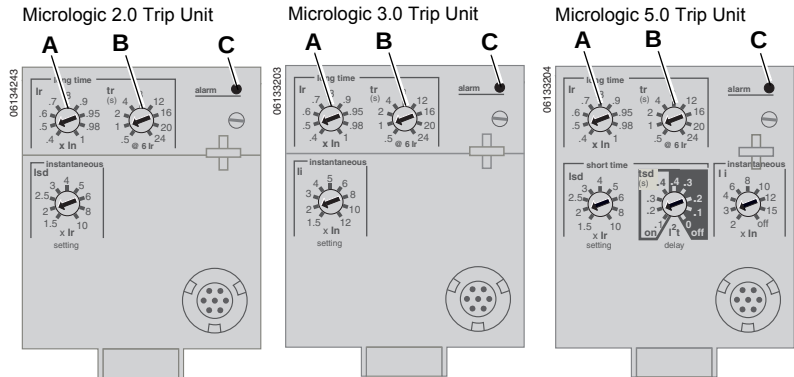


Table 1: Micrologic Trip Unit Long-Time Delay Values

Setting ¹	Long-Time Delay in Seconds ²								
tr at 1.5 x Ir	12.5	25	50	100	200	300	400	500	600
tr at 6 x Ir	0.5	1	2	4	8	12	16	20	24
tr at 7.2 x Ir	0.34 ³	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6

¹ I_n = sensor rating. I_r = I_n x long-time pickup. Trip threshold between 1.05 and 1.20 I_r .

²Time-delay accuracy +0/-20%

³For Micrologic 5.0 trip units, when tsd is set to 0.4 off or 0.4 on, then t_r = 0.5 instead of 0.34.

Short-Time Protection

Short-time protection protects equipment against short circuits.

- Short-time protection is standard on 2.0 and 5.0 trip units. It is not available on 3.0 trip units.
- Short-time protection is based on the long-time pickup (I_r)
- The short-time pickup (I_{sd}) (A) sets the current level (below instantaneous trip level) where the circuit breaker will trip after the preset time delay.
- The short-time delay (t_{sd}) (B) sets the length of time that the circuit breaker will carry an overcurrent above the short-time pickup current level before tripping. It is adjustable on the 5.0 trip unit and factory set to zero on the 2.0 trip unit.
- The I^2t on/ I^2t off option provides improved selectivity with downstream protective devices:
 - With I^2t off selected, fixed time delay is provided.
 - With I^2t on selected, inverse time I^2t protection is provided up to $10 \times I_r$. Above $10 \times I_r$, a fixed time delay is provided.
 - Intermittent currents in the short-time tripping range which do not last sufficiently long to trigger a trip are accumulated and shorten the trip delay appropriately.
- Setting t_{sd} to the 0 setting turns off time-delay features.
- Short-time protection uses true RMS measurement.
- Short-time delay can be adjusted to provide selectivity with a downstream circuit breaker.

Figure 6: Short-Time Protection Switches

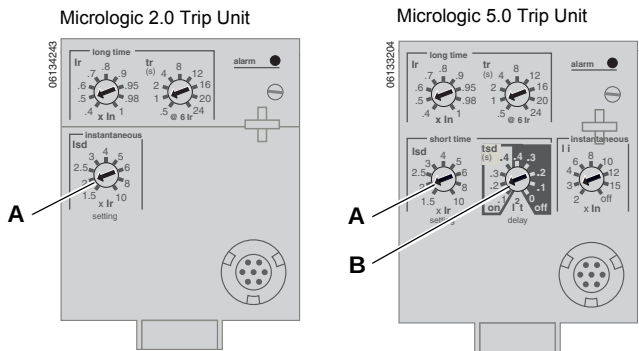


Table 2: Micrologic Trip Unit Short-Time Delay Values

Setting	Short-Time Delay				
	I^2t off (I_{sd} at 10 I_r) (seconds)	I^2t on (I_{sd} at 10 I_r) (seconds)	t_{sd} (min. trip) (milliseconds)	t_{sd} (max. trip) (milliseconds)	
I^2t off (I_{sd} at 10 I_r) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (I_{sd} at 10 I_r) (seconds)	—	0.1	0.2	0.3	0.4
t_{sd} (min. trip) (milliseconds)	20	80	140	230	350
t_{sd} (max. trip) (milliseconds)	80	140	200	320	500

Instantaneous Protection

Instantaneous protection protects equipment against short circuits with no intentional time delay.

- Instantaneous protection (Ii) (A) is standard on 3.0 and 5.0 trip units.*
- Instantaneous protection for 2.0 trip units is based on the circuit breaker sensor rating (Ir).
- Instantaneous protection for 3.0 and 5.0 trip units is based on the long-time delay pickup (In).
- Circuit breaker open command is issued as soon as threshold current is exceeded.
- Instantaneous protection for 3.0 and 5.0 trip units use peak current measurement. Instantaneous protection for 2.0 trip units use RMS current measurement.
- When instantaneous protection switch is set to off, the instantaneous protection is disabled.

*Instantaneous protection on 2.0 trip units is achieved by using short-time protection (Isd) with short-time delay factory set to 0 (zero).

Figure 7: Instantaneous Protection Switches

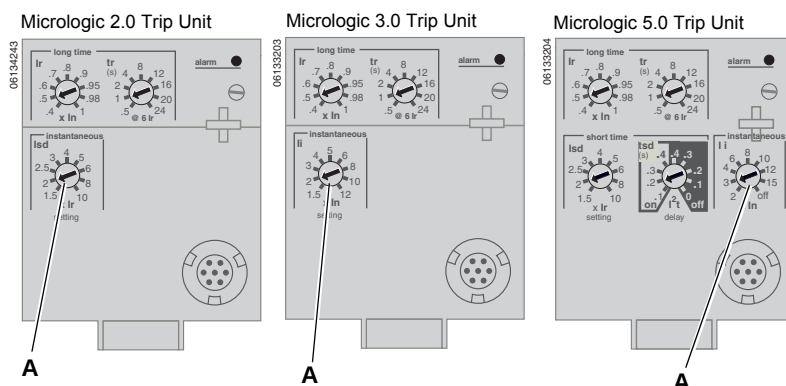


Table 3: Micrologic Instantaneous Values

Setting	Interruption Current								
2.0 Isd (= Ir x..)	1.5	2	2.5	3	4	5	6	8	10
3.0 Ii (= In x..)	1.5	2	3	4	5	6	8	10	12
5.0 Ii (= In x..)	2	3	4	6	8	10	12	15	off

Ii = UL and ANSI instantaneous

Isd = IEC instantaneous (short-time with zero delay)

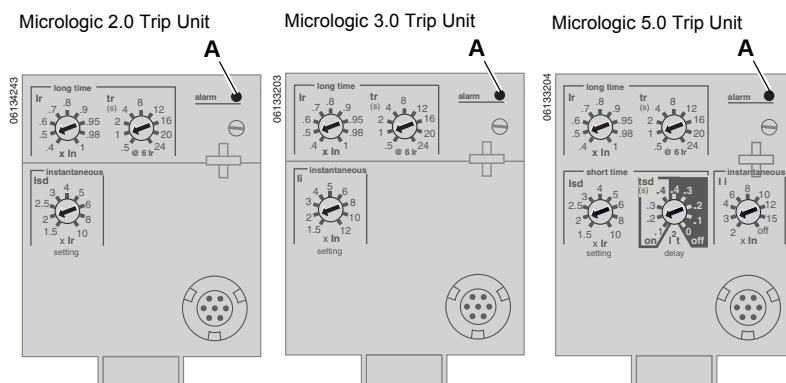
In = sensor rating

Ir = long-time pickup

Overload Indicator Light

The overload indicator light (A) lights when the Ir long-time pickup level has been exceeded.

Figure 8: Overload Indicator Lights



Trip Unit Testing

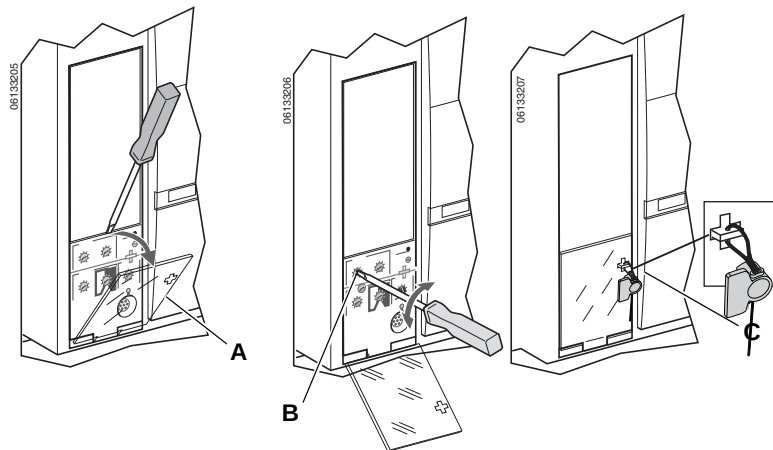
Trip unit functions can be tested using primary injection testing or secondary injection testing.

Section 2—Operation

Switch Adjustment

1. Open switch cover (A).
2. Adjust the appropriate switches (B) to desired values.
3. Replace switch cover. Use wire seal MICROTUSEAL (C), if necessary, to provide tamper evidence.

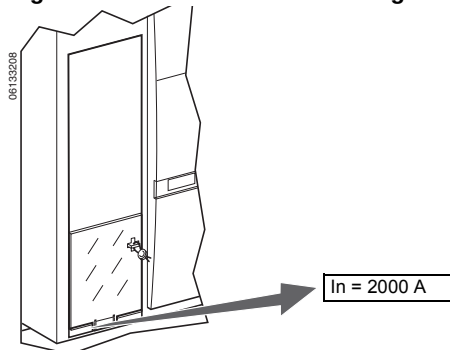
Figure 9: Adjust Switch Settings



Examples

Circuit breaker is rated 2000 A.

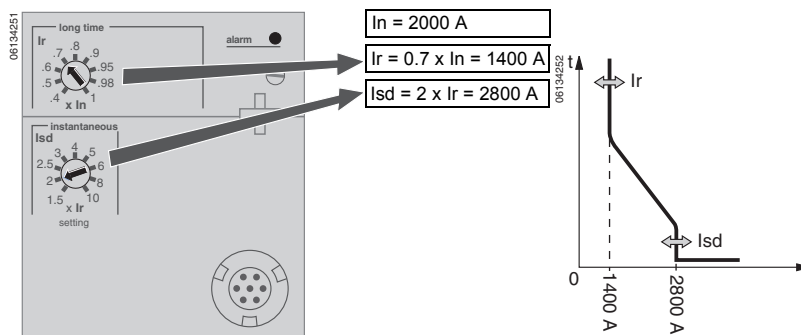
Figure 10: Circuit Breaker Rating



Micrologic 2.0 Trip Unit

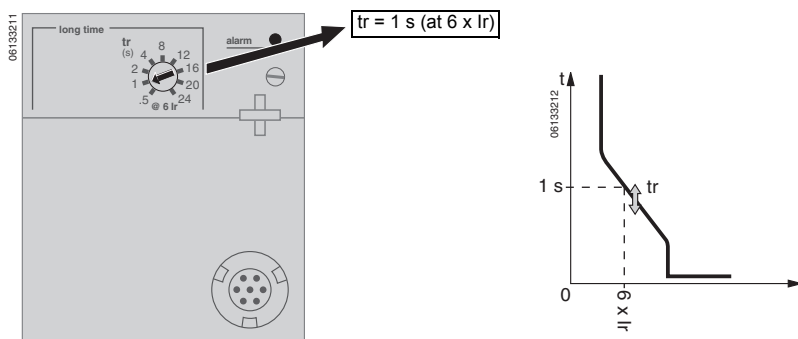
1. Set pickup levels.

Figure 11: Set Pickup Levels



- Set time delay.

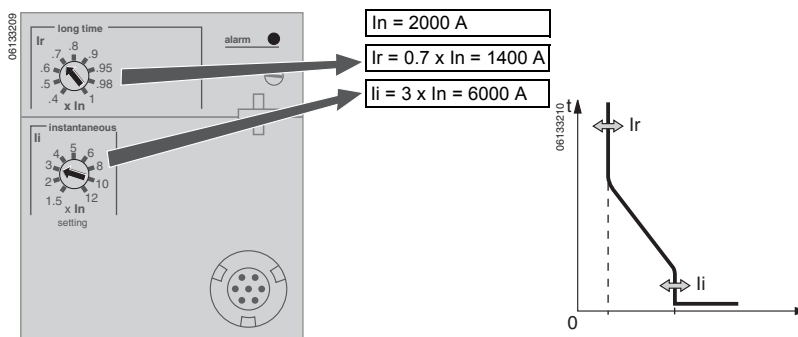
Figure 12: Set Time Delay



Micrologic 3.0 Trip Unit

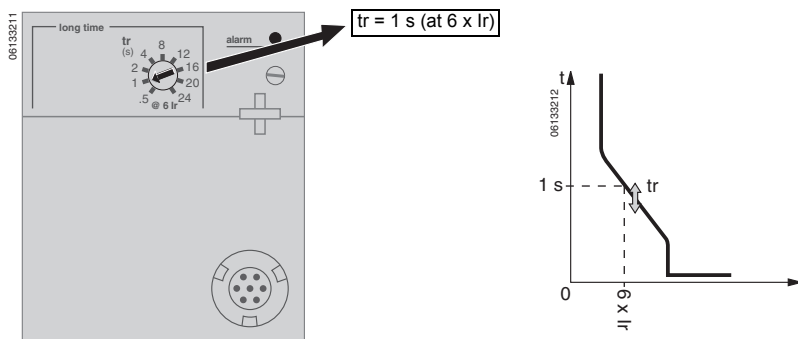
- Set pickup levels.

Figure 13: Set Pickup Levels



- Set time delay.

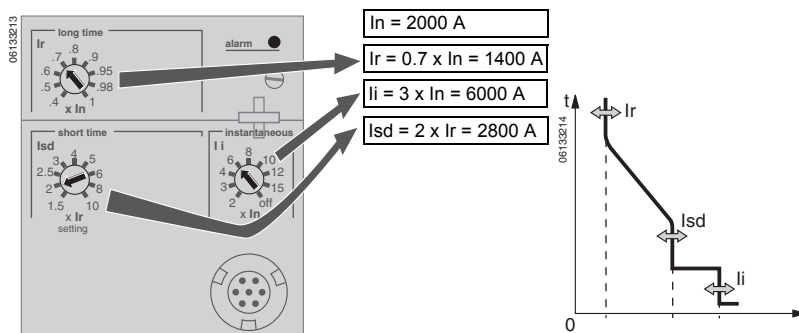
Figure 14: Set Time Delay



Micrologic 5.0 Trip Unit

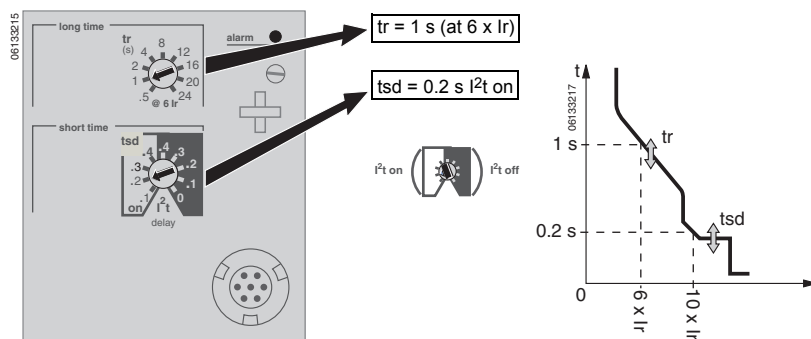
1. Set pickup levels.

Figure 15: Set Pickup Levels



2. Set time delay.

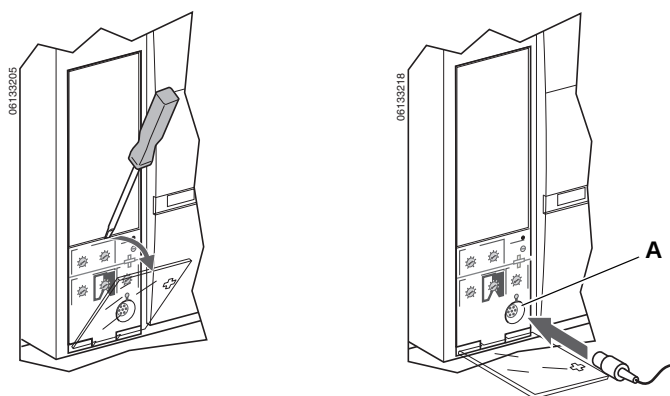
Figure 16: Set Time Delay



Trip Unit Operation Verification

Use a test kit connected to the trip unit test plug receptacle (A) to verify trip unit is functioning as desired. See instructions shipped with test kit to perform verification tests.

Figure 17: Verify Trip Unit Operation



Section 3—Trip Unit Replacement

Trip unit replacement must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.

Before replacing trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.

Read this entire section before starting the replacement procedure.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Failure to follow these instructions for installation, trip test and primary injection testing may result in the failure of some or all protective function.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Replacement/upgrading of a trip unit in the field must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.
- Before replacing/upgrading trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.
- If the circuit breaker fails to function properly in any manner upon completion of the trip unit installation, immediately remove the circuit breaker from service and call Field Services.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Required Tools

- Torque-controlled screwdriver, set at 7 in-lbs (0.8 N•m) $\pm$ 10% (Lindstrom torque driver MAL500-2 or equivalent)
- Micrologic Full-Function Test Kit (part number S33595)

Preparation

Record Switch Settings

Record all trip unit switch setting for later use.

Circuit Breaker Disconnection

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker. The circuit breaker must be completely isolated. (For a drawout circuit breaker, place circuit breaker in the disconnected position. For a fixed-mounted circuit breaker, all voltage sources, including auxiliary power, must be disconnected.)

Circuit Breaker Accessory Cover Removal

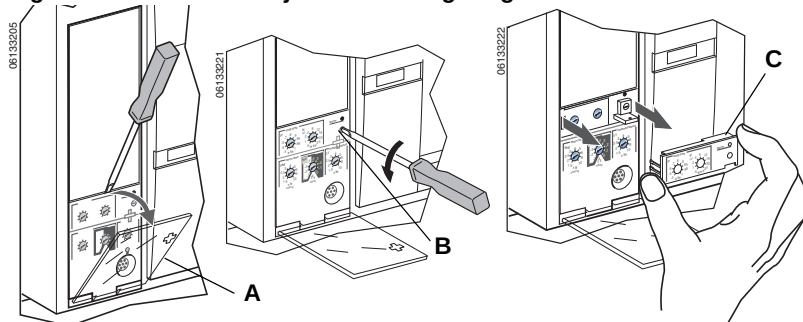
Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Rating Plug Removal

A small Phillips screwdriver is needed to remove the adjustable rating plug.

1. Open switch cover (A).
2. Unscrew adjustable rating plug mounting screw (B).
3. Remove adjustable rating plug (C). Save for installation in replacement trip unit.

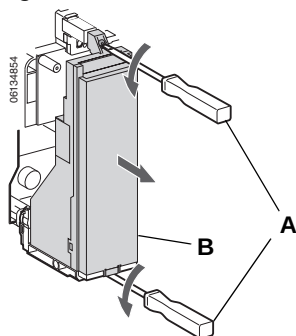
Figure 18: Remove Adjustable Rating Plug



Trip Unit Removal

1. Loosen two trip unit screws (A).
2. Slide out trip unit (B).

Figure 19: Remove Existing Trip Unit



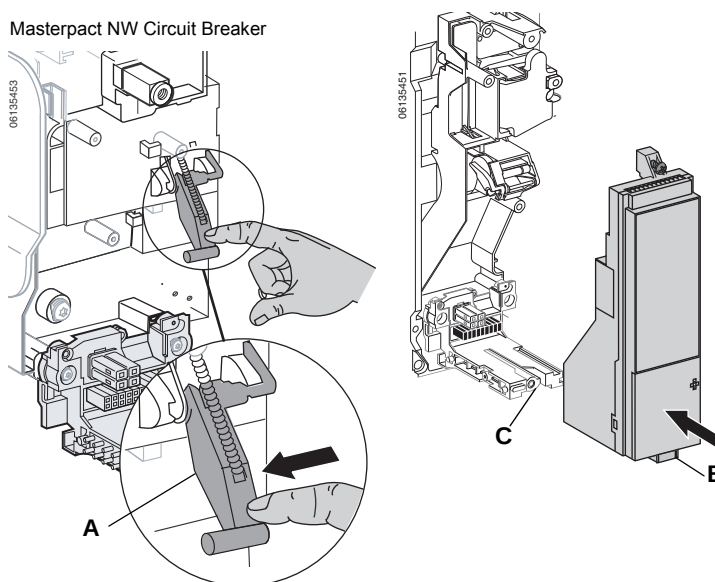
Trip Unit Replacement

Trip Unit Installation

1. Inspect trip unit connector pins and surfaces. If there is any damage, misaligned pins, or contamination, stop installation and contact the local sales office for factory authorized service.
2. Inspect trip unit mounting base on the circuit breaker. Clear any debris from area and check that all accessory wiring is properly routed for the trip unit being installed. If there is any damage or contamination, stop installation and contact the local sales office for factory authorized service.
3. For Masterpact NW circuit breaker only: Manually depress trip unit interlock (A) and hold it in place during steps 4–6 below.
4. Align guide rail (B) on bottom of trip unit with guide rail slot (C) on trip unit mounting base in circuit breaker and gently slide the trip unit in until it stops.

NOTE: The Masterpact NT and NW trip unit mounting bases are shock mounted and therefore can flex slightly.

Figure 20: Install Trip Unit



⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

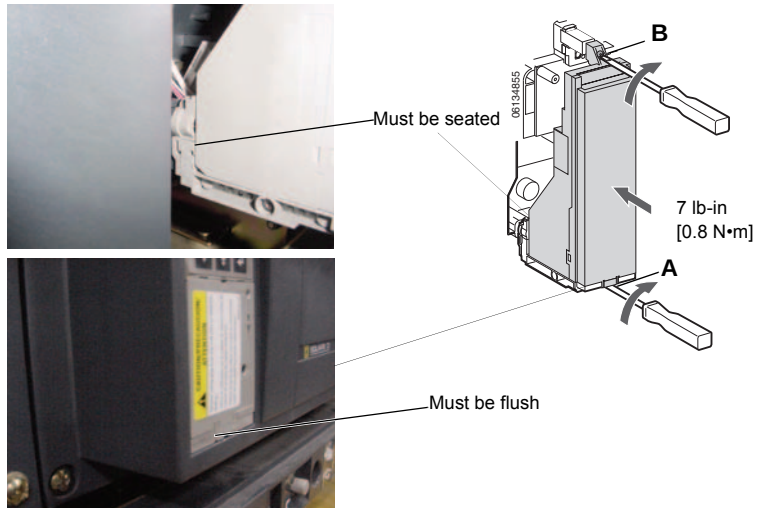
Check installation of trip unit to assure proper connections and seating.

Failure to follow this instruction can result in equipment damage or improper circuit breaker tripping.

5. Align the trip unit so top mounting screw (B) aligns with the top threaded insert and start the screw by turning the screw two full rotations.
6. Use a torque-controlled screwdriver to drive the bottom screw to 7 in-lbs (0.8 N•m) ± 10%. The back of the trip unit must be flush with the trip unit mounting base.
7. Use a torque-controlled screwdriver to drive the top screw to 7 in-lbs (0.8 N•m) ± 10%. Mounting tab must be flush with the mounting standoff and sensor plug.

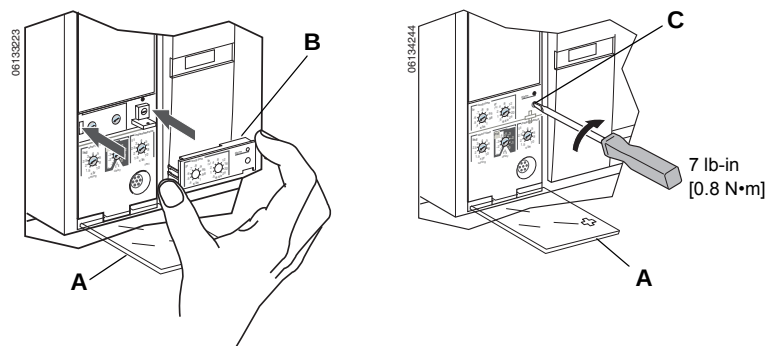
NOTE: The face of the closed switch cover must be flush with adjoining mounting base surfaces. If these surfaces are not flush, stop installation and contact the local sales office for factory authorized service.

Figure 21: Install Trip Unit



8. Install adjustable rating plug into the trip unit.
 - a. Open switch cover (A) on new trip unit.
 - b. Inspect mounting area for debris and contamination.
 - c. Gently push adjustable rating plug (B) into new trip unit.
 - d. Tighten adjustable rating plug mounting screw (C). The plug will be drawn into position flush with front face as screw is tightened.
9. Set trip unit switches to values recorded above or per coordination study results.
10. Close switch cover (A).

Figure 22: Install Adjustable Rating Plug



Circuit Breaker Accessory Cover Replacement

Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Trip Unit Installation Check

Secondary Injection Testing

Field installation of a trip unit requires secondary injection testing with a Full-Function Test Kit.

This will ensure that the newly-installed trip unit is functioning properly. The test will require opening and closing the circuit breaker. Follow the procedures outlined in the instruction bulletins shipped with the circuit breaker and the Full-Function Test Kit.

1. Make sure the circuit breaker is isolated from all upstream and downstream devices.
2. Perform secondary injection testing as outlined in the instruction bulletin shipped with the Full-Function Test Kit. Verify that all applicable trip unit functions are operating properly.
3. Repeat step 2 with the circuit breaker in the open position.

NOTE: The test kit will state that the circuit breaker should be closed when performing the test. Do not close the circuit breaker for this step.

4. If any test fails, do not put the circuit breaker into service and contact the local sales office for factory authorization service.

Primary Injection Testing

Primary injection testing is recommended to ensure that all trip system connections have been correctly made. Perform primary injection testing per the instructions in the Field Testing and Maintenance Guide, bulletin 0600IB1201.

Trip Unit Setup

Reset the trip unit switches to original values, as recorded at the beginning of this section.

Circuit Breaker Reconnection

Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

Section 4—Adjustable Rating Plug Replacement

NOTE: To select correct replacement rating plug, see the product catalog.

NOTE: If adjustable rating plug is removed, the circuit breaker will default to a long-time pickup rating of $0.4 \times I_n$ and a long-time delay at whatever setting was selected before the rating plug was removed.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

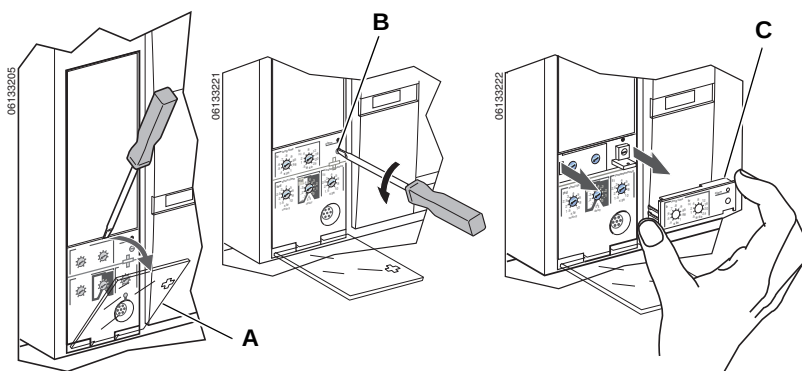
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Rating Plug Removal

1. Open circuit breaker contacts:
 - For NT and NW circuit breakers, press the “Push to open” button on the circuit breaker.
 - For other circuit breakers, move handle to the off (O) position.
2. Open switch cover (A).
3. Unscrew adjustable rating plug mounting screw (B).
4. Remove adjustable rating plug (C).

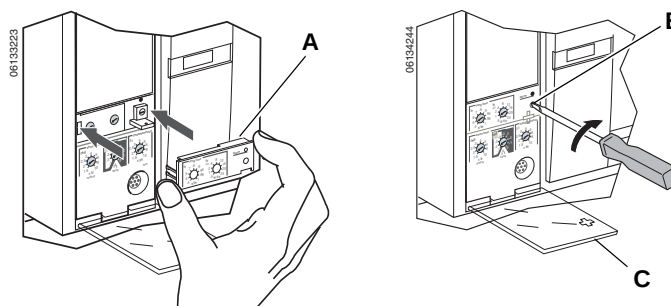
Figure 23: Remove Adjustable Rating Plug



New Rating Plug Installation

1. Inspect mounting area for debris and contamination.
2. Gently push in new rating plug (A).
3. Tighten adjustable rating plug mounting screw (B).
4. Set the switches on the trip unit (see Section 2—Operation).
5. Close switch cover (C).

Figure 24: Install New Adjustable Rating Plug

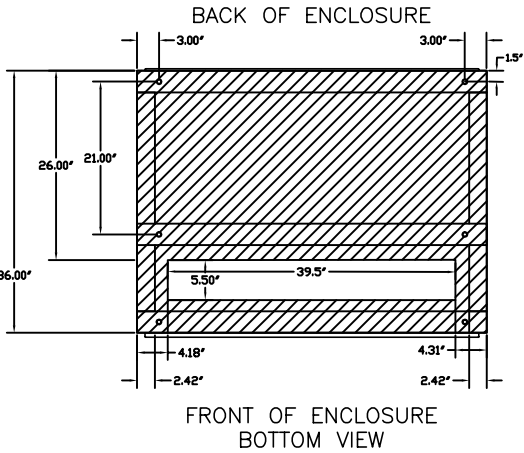
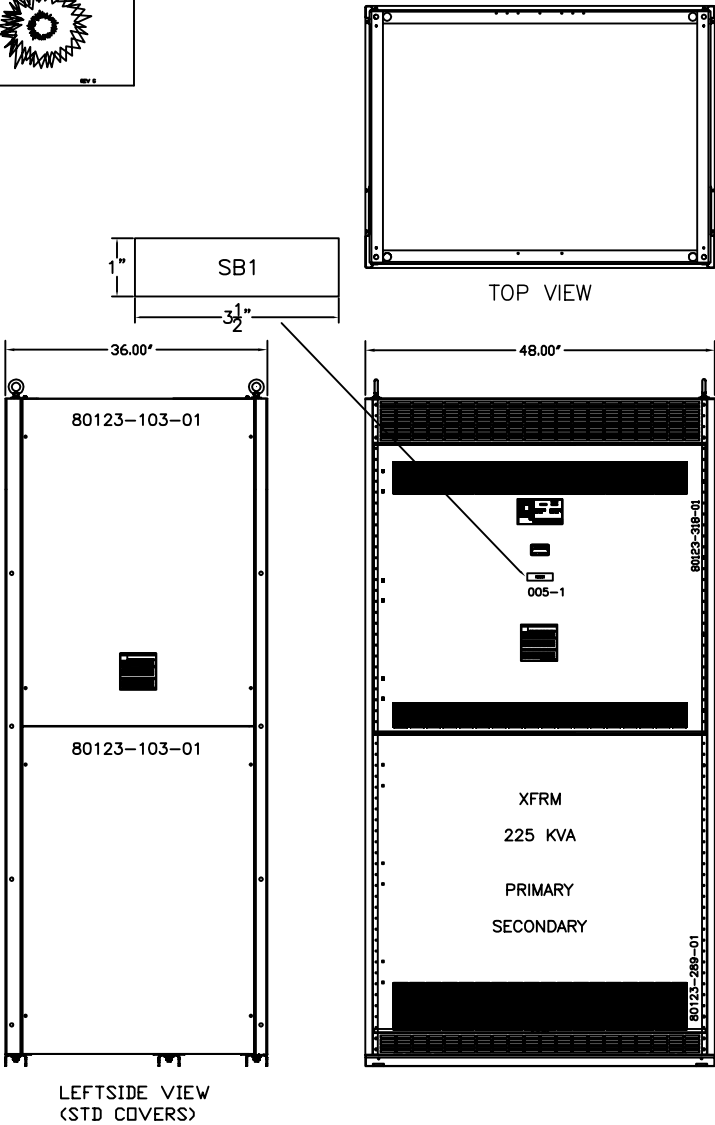
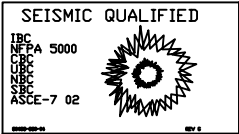


Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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REV	DESCRIPTION	BY	DATE	—	----	--	---/--	-	----	--	---/--
—	----	---	---/--	—	----	---	---/--	—	----	---	---/--

SEISMIC QUALIFIED LABEL REQUIRED



FACTORY INSTALLED POWER CABLES

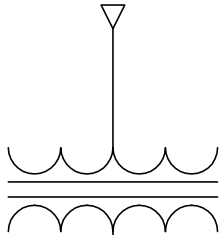
CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
----	----	----	----	—	—
----	----	----	----	—	—

PANEL INFORMATION

CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	MIDDLE BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	-----	----	-/-	-/-	-/-	—	-----
2	-----	----	-/-	-/-	-/-	—	-----

ENCLOSURE DATA:
NEMA TYPE 1
COLOR: ANSI 49

PRIMARY CONNECTION
CABLED TO REMOTE



SECONDARY CONNECTION
CABLED TO PANEL SB1

TRANSFORMER DATA:
DESIGNATION: XFRM
2255 KVA (EX225T3HB)
ENERGY EFFICIENT
TRANSFORMER VOLTAGE:
3-PH 480V – 208Y/120V
TRANSFORMER WINDINGS:
ALUMINUM WINDINGS
OPTIONS:
H-220°C INS, 80°C RISE
52dB 1975lbs 25J

GROUND BUS PER UL891



GENERAL NOTES

- REFERENCE INSTRUCTIONS BULLETIN 80043-708-XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
- SOLID LINE (—) REPRESENTS FACTORY INSTALLED CABLES.
- INSTALL (1) 220-9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
- REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

NOTE

BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!

480V/277V

A PHASE - BROWN

B PHASE - ORANGE

C PHASE - YELLOW

NEUTRAL - GRAY

208V/120V

A PHASE - BLACK

B PHASE - RED

C PHASE - BLUE

NEUTRAL - WHITE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG#	37999262-005-1-01-1
		PG 1	OF 4
		REV	—

REV	DESCRIPTION	BY	DATE	---	---	---	---
---	---	---	---	---	---	---	---

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	PHASE BUS CONN	PHASE BUS CONN	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
	40517-407-01 (4 1/2" FILLER)							40517-408-01 (1 1/2" FILLER)	
	40517-407-01 (4 1/2" FILLER)							40517-408-01 (1 1/2" FILLER)	
	40517-407-01 (4 1/2" FILLER)							40517-408-01 (1 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
	40517-408-01 (1 1/2" FILLER)							40517-407-01 (4 1/2" FILLER)	
1		QD	225/3	ABC		ABC	225 /3	QD	2
3		QD	225/3	ABC		ABC	225 /3	QD	4
5		QD	225/3	ABC		ABC	225 /3	QD	6
	BRANCH MOUNTED MAIN	MG	800/3	ABC		ABC	60 /3	HL	SPD

HCP50868/40517-428-51

PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY
- FRONT CAT#: N/A
- BOX CAT#: N/A
- DIMENSIONS: "H X "W X "D
- WIRE BENDING SPACE: TOP BOTTOM SIDE
- BUSSING: COPPER BUS STANDARD PLATING
- SPECIAL: COPPER SOLID NEUTRAL COPPER GROUND BAR

ELECTRICAL DATA

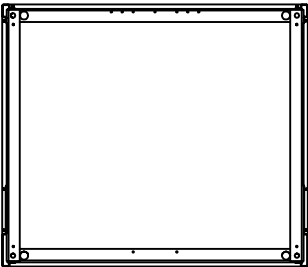
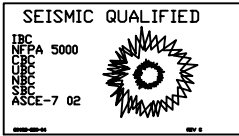
- SYSTEM: 208Y/120 VAC 3PH 4W 60 HZ 25,000 AMPS SYMS. SCCR
- MAIN: MAIN BREAKER: 800A BOTTOM FEED
- BRANCH MOUNTING TYPE: PLUG-ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL SB1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	I-LINE
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		
DATE:	9/30/2016		
DRAWING STATUS:	RECORD	DWG#	37999262-005-2-01-1

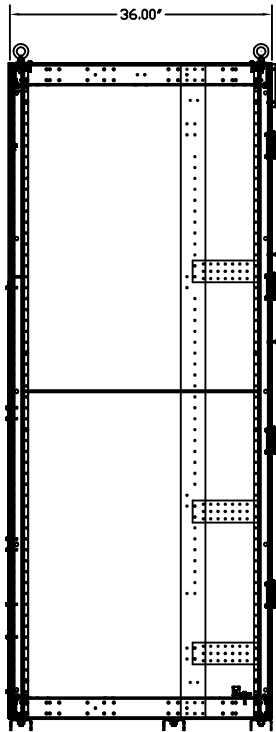


REV	DESCRIPTION	BY	DATE	—	----	--	--/--	—	----	--	--/--
—	----	--	--/--	—	----	--	--/--	—	----	--	--/--

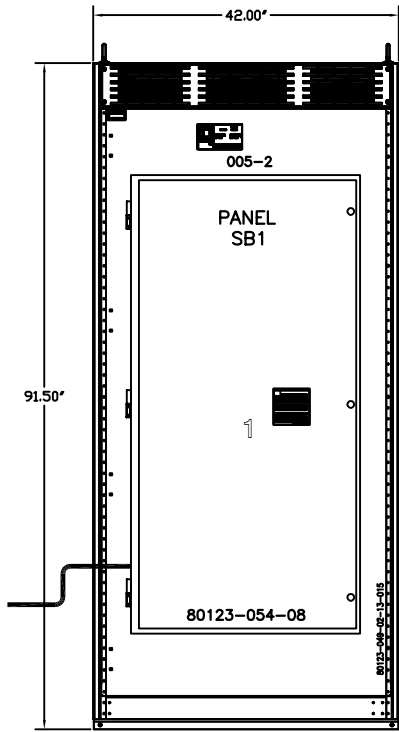
SEISMIC QUALIFIED LABEL REQUIRED



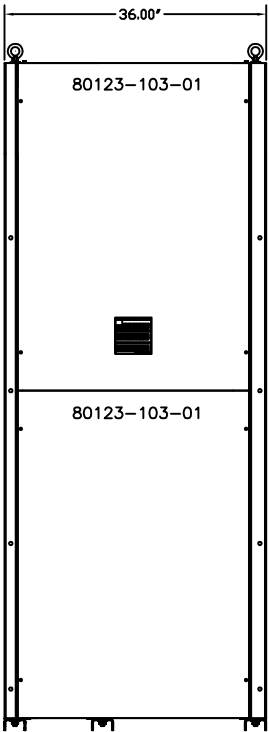
TOP VIEW



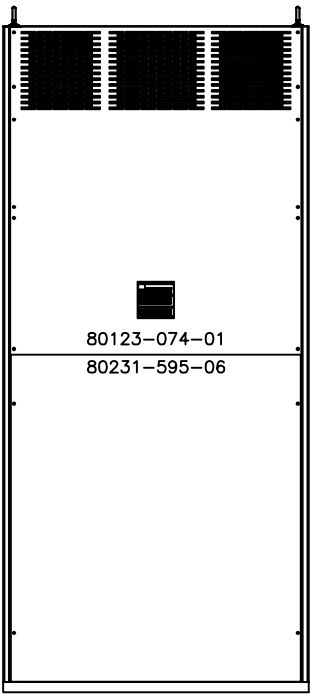
LEFTSIDE VIEW
(NO COVERS)



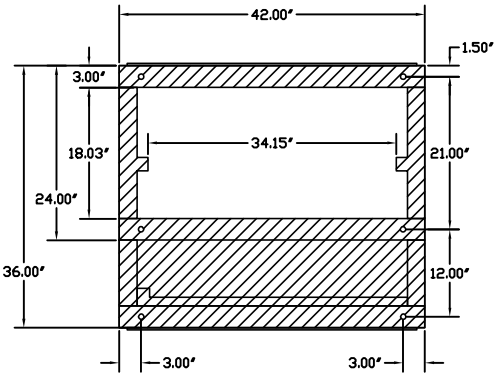
BACK OF ENCLOSURE



RIGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



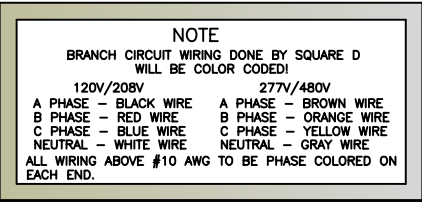
FRONT OF ENCLOSURE
BOTTOM VIEW

FACTORY INSTALLED POWER CABLES:

CABLE FROM	CONNECT TO	CABLE TO	CONNECT TO	WIRE SIZE	QTY PER PHASE
PANEL SB1	MAIN BREAKER (800A)	225 KVA TRANSFOMER	SECONDARY LUGS	300 kcmil	3
CONNECT FEEDER TO MAIN AND ROLL UP INSIDE ENCLOSURE, NEED APPROX 12' PER PHASE.					

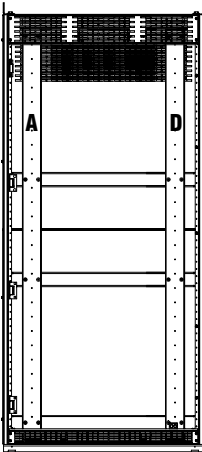
PANELS INFORMATION:

CELL REFERENCE	PANEL	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	PANEL SB1	BOTTOM	A-3/D-3	A-26/D-26	----	PK32DGTACU



GENERAL NOTES

- REFERENCE INSTRUCTION BULLETIN 80043-708-03 FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTANENCE.
- SOLID LINE (————)REPRESENTS FACTORY INSTALLED CABLES.
- INSTALL 1-220-9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR.
- REFER TO DATA SHEETS 80123-DS-000P1 TO 80123-DS-022P1 FOR ASSEMBLY INSTRUCTIONS.

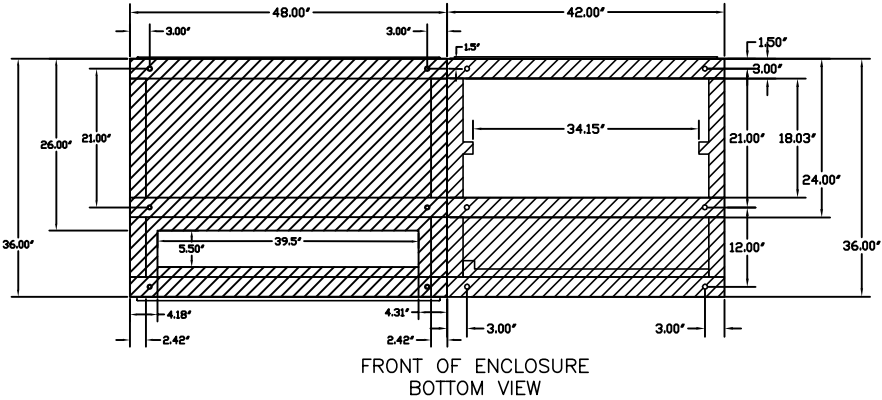
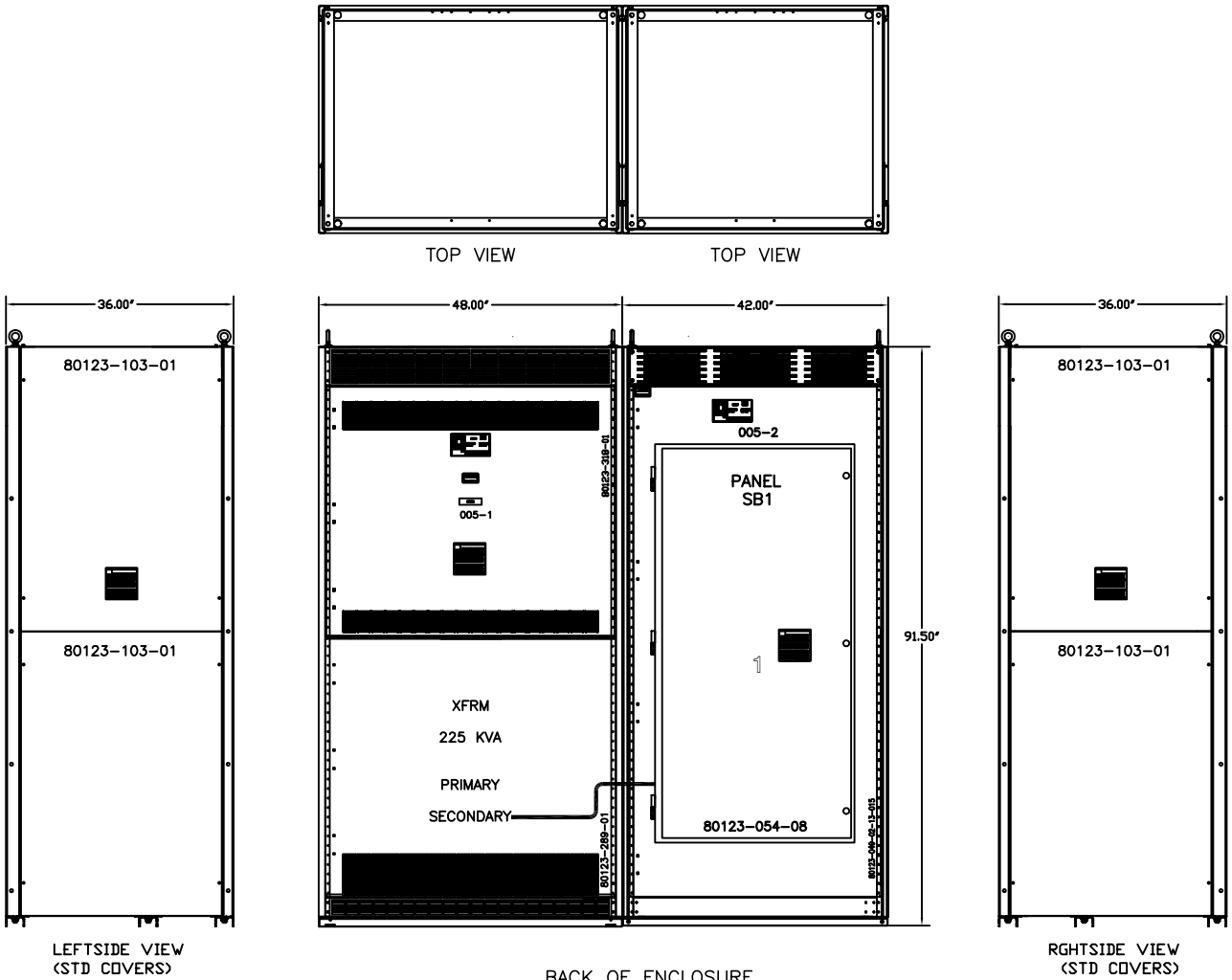


STRUCTURE BOM ASSEMBLY #

8012316158I

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-005-2-01-2	PG 3 OF 4 REV —

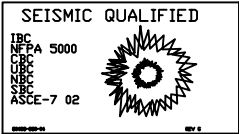
REV	DESCRIPTION	BY	DATE	—	----	--	--/--	—	----	--	--/--
—	----	--	--/--	—	----	--	--/--	—	----	--	--/--



JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS	 SQUARE D Schneider Electric	
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-005 LINE UP	PG 4 OF 4 REV —

REV	DESCRIPTION	BY	DATE	—	----	--	--/--	-	----	--	--/--
—	----	---	---/--	—	----	--	--/--	-	----	--	--/--

SEISMIC QUALIFIED LABEL REQUIRED



FACTORY INSTALLED POWER CABLES

CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
----	----	----	----	—	—
----	----	----	----	—	—

PANEL INFORMATION

CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	MIDDLE BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	-----	----	-/-	-/-	-/-	—	-----
2	-----	----	-/-	-/-	-/-	—	-----

ENCLOSURE DATA:
NEMA TYPE 1
COLOR: ANSI 49

TRANSFORMER DATA:

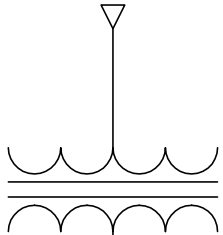
DESIGNATION: XFRM
2255 KVA (EX225T3HB)
ENERGY EFFICIENT

TRANSFORMER VOLTAGE:
3-PH 480V – 208Y/120V

TRANSFORMER WINDINGS:
ALUMINUM WINDINGS

OPTIONS:
H-220°C INS, 80°C RISE
52dB 1975lbs 25J

PRIMARY CONNECTION
CABLED TO REMOTE



SECONDARY CONNECTION
CABLED TO PANEL ----



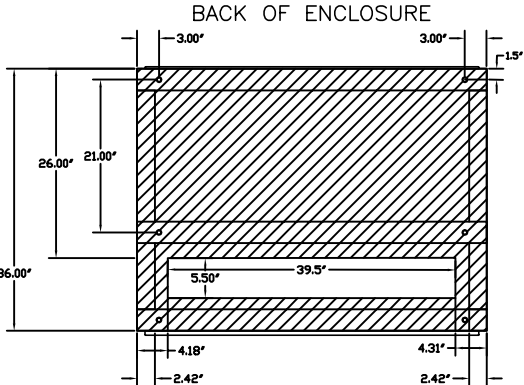
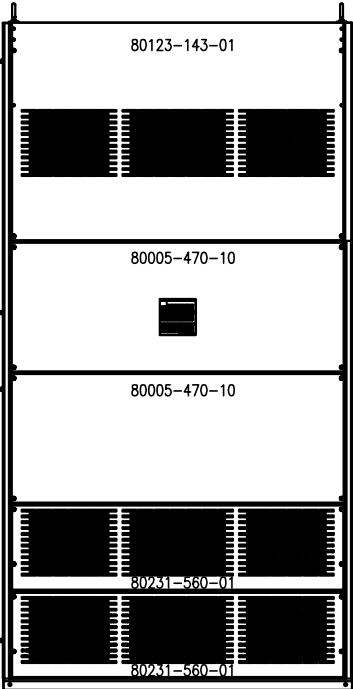
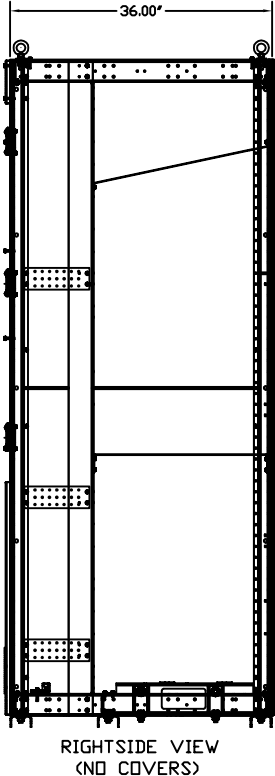
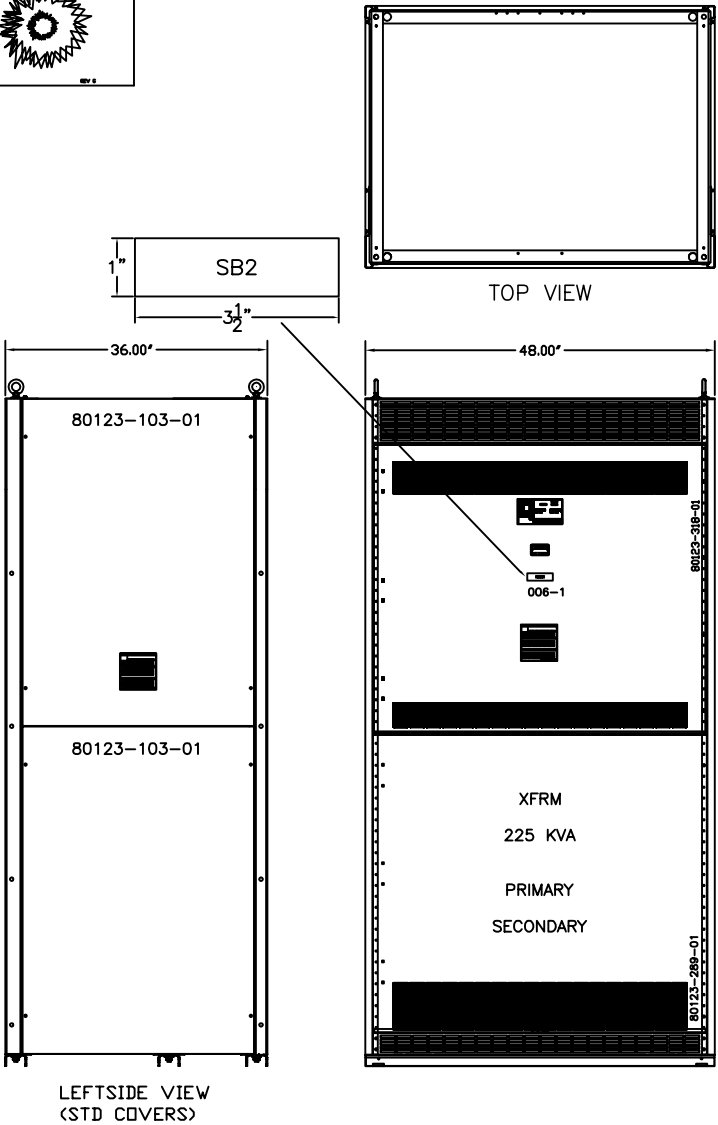
GROUND BUS PER UL891

GENERAL NOTES

- REFERENCE INSTRUCTIONS BULLETIN 80043-708-XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
- SOLID LINE (—) REPRESENTS FACTORY INSTALLED CABLES.
- INSTALL (1) 220-9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
- REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

STRUCTURE BOM ASSEMBLY #
8012330959

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB2
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG#	37999262-006-1-01-1
		PG 1	OF 4
		REV	—



NOTE

BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!

480V/277V

A PHASE - BROWN
B PHASE - ORANGE
C PHASE - YELLOW
NEUTRAL - GRAY

208V/120V

A PHASE - BLACK
B PHASE - RED
C PHASE - BLUE
NEUTRAL - WHITE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

REV	DESCRIPTION	BY	DATE	---	---	---	---
---	---	---	---	---	---	---	---

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	PHASE BUS CONN	PHASE BUS CONN	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
	40517-407-01 (4½" FILLER)							40517-408-01 (1½" FILLER)	
	40517-407-01 (4½" FILLER)							40517-408-01 (1½" FILLER)	
								40517-408-01 (1½" FILLER)	
1		QD	225/3	ABC	ABC	225/3	QD		2
3		QD	225/3	ABC	ABC	225/3	QD		4
5		QD	225/3	ABC	ABC	225/3	QD		6
7		QD	225/3	ABC	ABC	225/3	QD		8
9		QD	225/3	ABC	ABC	225/3	QD		10
11		QD	225/3	ABC	ABC	225/3	QD		12
13		QD	225/3	ABC	ABC	225/3	QD		14
	BRANCH MOUNTED MAIN	MG	800/3	ABC	ABC	60/3	HL	SPD	

HCP50868/40517-428-51

PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

FRONT CAT#: N/A

BOX CAT#: N/A

DIMENSIONS:

"H X "W X "D

WIRE BENDING SPACE:

TOP

BOTTOM

SIDE

- BUSSING: COPPER BUS
STANDARD PLATING

- SPECIAL:

COPPER SOLID NEUTRAL

COPPER GROUND BAR

ELECTRICAL DATA

- SYSTEM: 208Y/120 VAC 3PH 4W 60 HZ
25,000 AMPS SYMS. SCCR

- MAIN: MAIN BREAKER: 800A
BOTTOM FEED

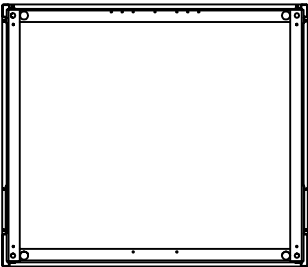
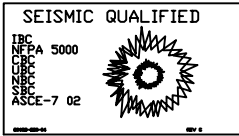
- BRANCH MOUNTING TYPE: PLUG-ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL SB2
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	I-LINE
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		
DATE:	9/30/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-006-2-01-1	PG 1 OF 2 REV -

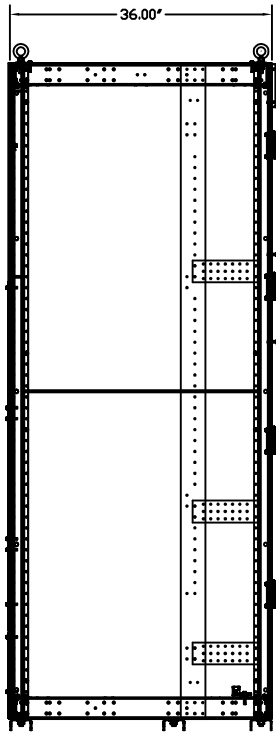


REV	DESCRIPTION	BY	DATE	—	----	--	--/--	—	----	--	--/--
—	----	--	--/--	—	----	--	--/--	—	----	--	--/--

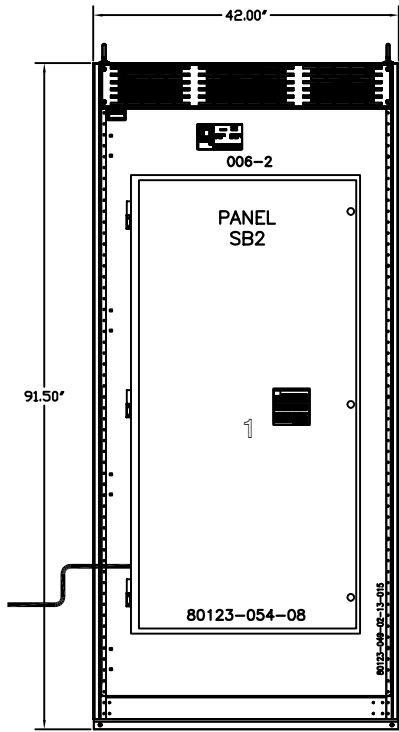
SEISMIC QUALIFIED LABEL REQUIRED



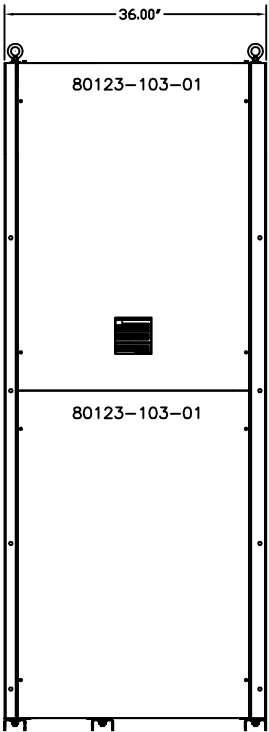
TOP VIEW



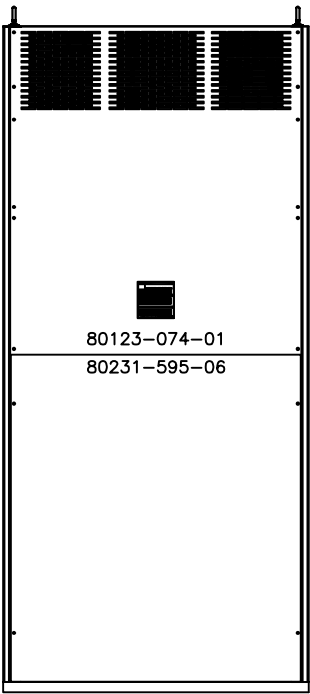
LEFTSIDE VIEW
(NO COVERS)



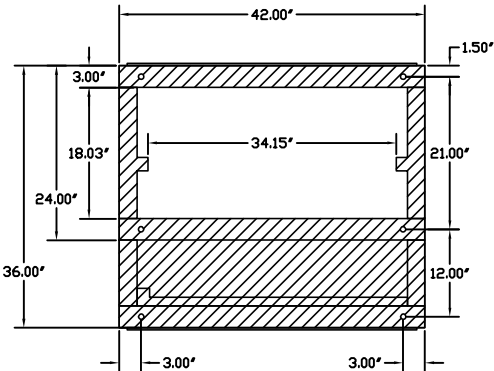
BACK OF ENCLOSURE



RIGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



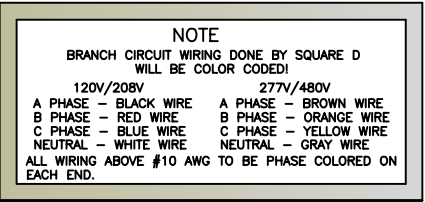
FRONT OF ENCLOSURE
BOTTOM VIEW

FACTORY INSTALLED POWER CABLES:

CABLE FROM	CONNECT TO	CABLE TO	CONNECT TO	WIRE SIZE	QTY PER PHASE
PANEL SB2	MAIN BREAKER (800A)	225 KVA TRANSFOMER	SECONDARY LUGS	300 kcmil	3
CONNECT FEEDER TO MAIN AND ROLL UP INSIDE ENCLOSURE, NEED APPROX 12' PER PHASE.					

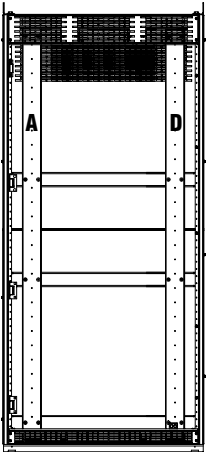
PANELS INFORMATION:

CELL REFERENCE	PANEL	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	PANEL SB2	BOTTOM	A-3/D-3	A-26/D-26	----	PK32DGTACU



GENERAL NOTES

- REFERENCE INSTRUCTION BULLETIN 80043-708-03 FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTANENCE.
- SOLID LINE (————)REPRESENTS FACTORY INSTALLED CABLES.
- INSTALL 1-220-9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR.
- REFER TO DATA SHEETS 80123-DS-000P1 TO 80123-DS-022P1 FOR ASSEMBLY INSTRUCTIONS.

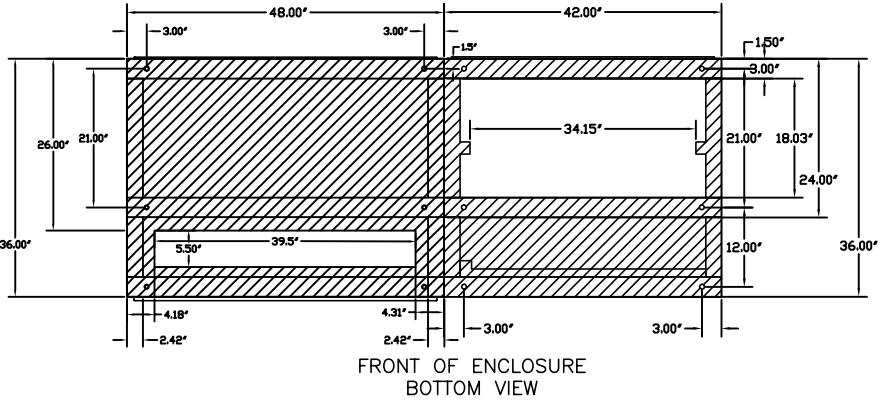
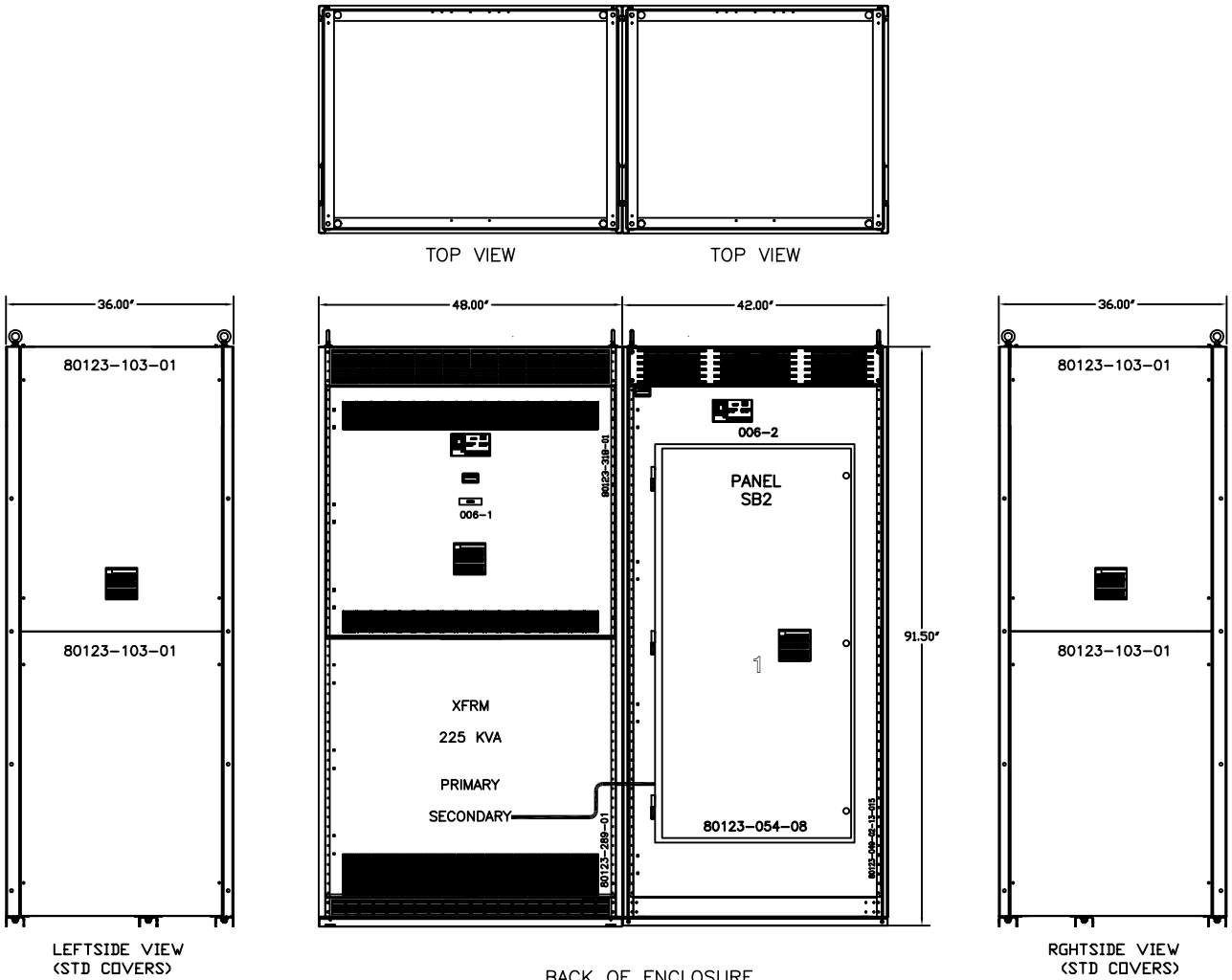


STRUCTURE BOM ASSEMBLY #

8012316158I

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB2
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-006-2-01-2	PG 3 OF 4 REV —

REV	DESCRIPTION	BY	DATE	—	----	--	--/--	—	----	--	--/--
—	----	--	--/--	—	----	--	--/--	—	----	--	--/--



JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB2
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS	 SQUARE D Schneider Electric	
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-006 LINE UP	PG 4 OF 4 REV —

REV	DESCRIPTION	BY	DATE	—	----	---	---/---/---
1	UPDATED PRINT	AMS	12/7/16	—	----	---	---/---/---

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	225A M/L	A	B	C	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		EGB	20/1							20/1	EGB		2
3		EGB	20/1							20/1	EGB		4
5		EGB	20/1							20/1	EGB		6
7		EGB	20/1							20/1	EGB		8
9		EGB	20/1							20/1	EGB		10
11		EGB	20/1							20/1	EGB		12
13		EGB	20/1							20/1	EGB		14
15		EGB	20/1							20/1	EGB		16
17		EGB	20/1							20/1	EGB		18
19		EGB	20/1							20/1	EGB		20
21		EGB	20/1							20/1	EGB		22
23		EGB	20/1							20/1	EGB		24
25		EGB	20/1							20/1	EGB		26
27		EGB	20/1							20/1	EGB	PREPARED SPACE	28
29	PREPARED SPACE	EGB	20/1							20/1	EGB	PREPARED SPACE	30
31	PREPARED SPACE	EGB	20/1							20/1	EGB	PREPARED SPACE	32
33	PREPARED SPACE	EGB	20/1							20/1	EGB	PREPARED SPACE	34
35	PREPARED SPACE	EGB	20/1							20/1	EGB	PREPARED SPACE	36
37		EGB	20/1							20/1	EGB	PREPARED SPACE	38
39	XFRM PRIMARY	EGB	45/3							20/1	EGB	PREPARED SPACE	40
41										20/1	EGB	PREPARED SPACE	42

37999262-FM1

SEISMIC QUALIFIED LABEL REQUIRED



PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

FRONT CAT#: N/A

BOX CAT#: N/A

DIMENSIONS:

"H X "W X "D

WIRE BENDING SPACE:

TOP

BOTTOM

SIDE

PBA 507A

- BUSSING: COPPER BUS
STANDARD PLATING

- SPECIAL:
SPD SURGE SUPPRESSION
PEAK SURGE RATING: 100kA
WITH DRY CONTACTS
WITH SURGE COUNTER
STANDARD SOLID NEUTRAL
STANDARD GROUND BAR

ELECTRICAL DATA

- SYSTEM: 480Y/277 VAC 3PH 4W 60 HZ
35,000 AMPS SYMS.

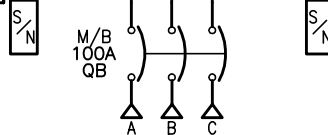
- MAIN LUGS: 225A
ACC:
TOP FEED

- BRANCH MOUNTING TYPE: BOLT-ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL 1EH1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	NF
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG#	37999262-007-1-01-1
		PG 1	OF 4
		REV	-

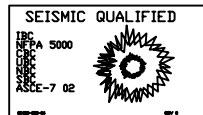
REV	DESCRIPTION	BY	DATE	—	----	---	---/---/---
—	----	---	---/---/---	—	----	---	---/---/---

CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20 / 1		20 / 1	QOB		2
3		QOB	20 / 1		20 / 1	QOB		4
5		QOB	20 / 1		20 / 1	QOB		6
7		QOB	20 / 1		20 / 1	QOB		8
9		QOB	20 / 1		20 / 1	QOB		10
11		QOB	20 / 1		20 / 1	QOB		12
13		QOB	20 / 1		20 / 1	QOB		14
15		QOB	20 / 1		20 / 1	QOB		16
17		QOB	20 / 1		20 / 1	QOB		18
19		QOB	20 / 1		20 / 1	QOB		20
21		QOB	15 / 1		15 / 1	QOB		22
23		QOB	15 / 1		15 / 1	QOB		24
25	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	26
27	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	28
29	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	30
31	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	32
33	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	34
35	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	36
37	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	38
39	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	40
41	PREPARED SPACE	QOB	20 / 1		20 / 1	QOB	PREPARED SPACE	42



NQ442L2CSR/NQMB2QSK/QBL32100

SEISMIC QUALIFIED LABEL REQUIRED



PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

FRONT CAT#: N/A

BOX CAT#: N/A

DIMENSIONS:

"H X "W X "D

WIRE BENDING SPACE:

TOP

BOTTOM

SIDE

- BUSSING: COPPER BUS
STANDARD PLATING

- SPECIAL:
STANDARD SOLID NEUTRAL
STANDARD GROUND BAR

ELECTRICAL DATA

- SYSTEM: 208Y/120V 3PH 4W 60Hz
10,000 AMPS SYMS. SCCR

- MAIN BREAKER: 100A
ACC:
BOTTOM FEED

- BRANCH MOUNTING TYPE: BOLT-ON

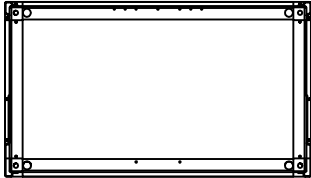
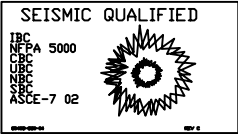
JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL 1EL1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	NQ
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG#	37999262-007-1-01-2



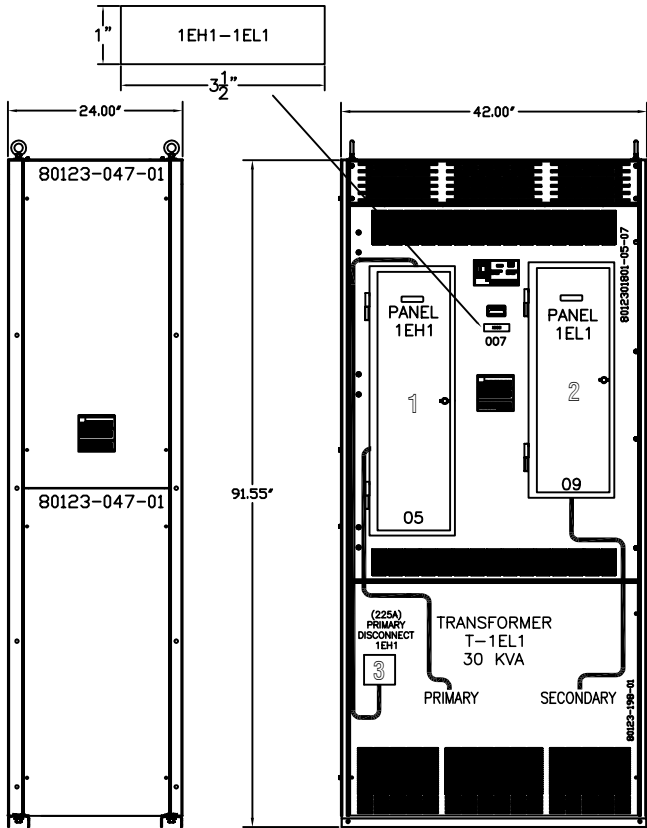
SQUARE D
Schneider Electric

REV	DESCRIPTION	BY	DATE	—	----	--	--/--	—	----	--	--/--
1	UPDATED PRINT	AMS	12/7/16	—	----	--	--/--	—	----	--	--/--

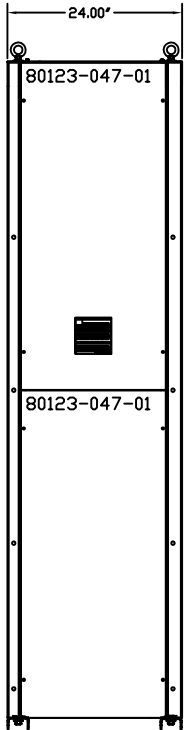
SEISMIC QUALIFIED LABEL REQUIRED



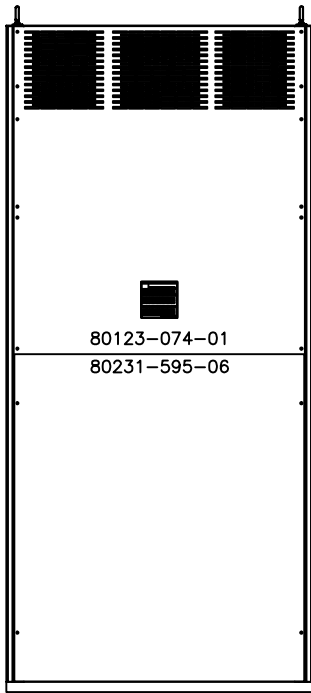
TOP VIEW



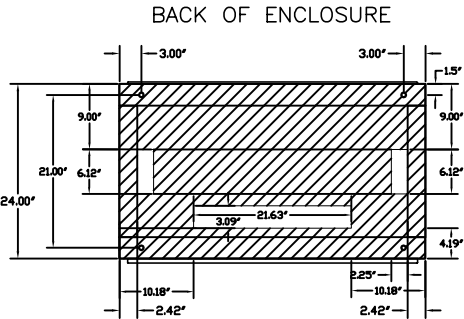
LEFTSIDE VIEW
(STD COVERS)



RIGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



FRONT OF ENCLOSURE
BOTTOM VIEW

FACTORY INSTALLED POWER CABLES

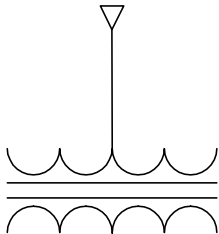
CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
PANEL 1EH1	MAIN LUGS	LOAD LUGS	1EH1 PRIMARY DISCONNECT (225A)	#4/0	1
T-1EL1 30 KVA	PRIMARY LUGS	PANEL 1EH1	BREAKER (45A) CKT 37	#8	1
T-1EL1 30 KVA	SECONDARY LUGS	PANEL 1EL1	MAIN BREAKER (100A)	#3	1

PANEL INFORMATION

CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	MIDDLE BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	PANEL 1EH1	TOP	A/B	-/-	K/L	-	PK27GTACU
2	PANEL 1EL1	BOTTOM	C/D	-/-	G/H	-	PK27GTACU
3	(8012320552) JGL36225	----	-/-	-/-	-/-	-	-----

ENCLOSURE DATA:
NEMA TYPE 1
COLOR: ANSI 49

PRIMARY CONNECTION
CABLED TO PANEL 1EH1



SECONDARY CONNECTION
CABLED TO PANEL 1EL1

TRANSFORMER DATA:

DESIGNATION: T-1EL1

30 KVA (EX30T3HF)

ENERGY EFFICIENT

TRANSFORMER VOLTAGE:
3-PH 480V - 208Y/120V

TRANSFORMER WINDINGS:
ALUMINUM WINDINGS

OPTIONS:
H-220°C INS, 115°C RISE
42dB 400lbs 18K

GROUND BUS PER UL891



GENERAL NOTES

- REFERENCE INSTRUCTIONS BULLETIN 80043-708-XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
- SOLID LINE (————) REPRESENTS FACTORY INSTALLED CABLES.
- INSTALL (1) 220-9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
- REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

STRUCTURE BOM ASSEMBLY #

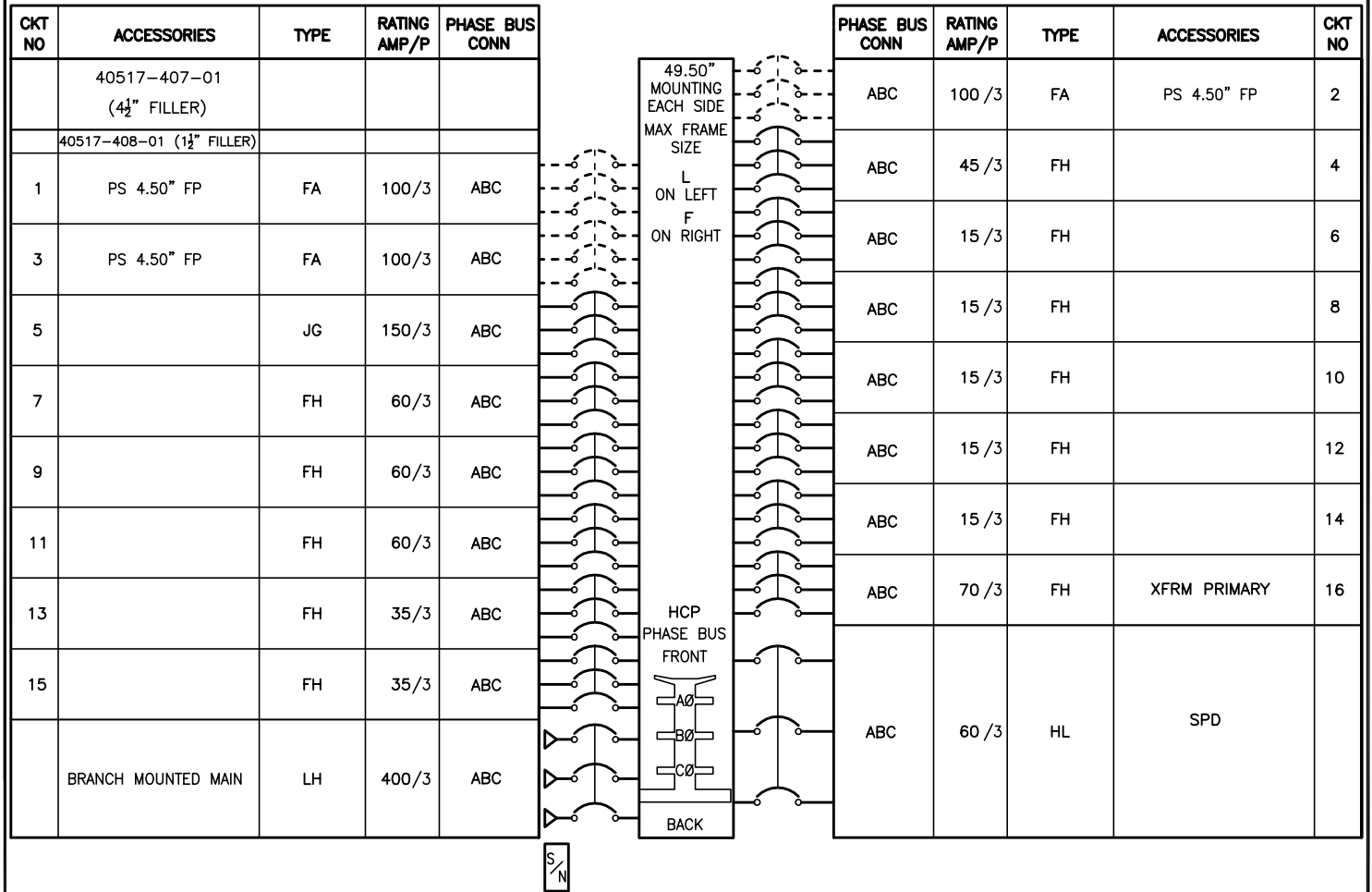
8012302870

NOTE	
BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!	
480V/277V	208V/120V
A PHASE - BROWN	A PHASE - BLACK
B PHASE - ORANGE	B PHASE - RED
C PHASE - YELLOW	C PHASE - BLUE
NEUTRAL - GRAY	NEUTRAL - WHITE
ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.	

INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1EH1-1EL1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-007-1-01-3	PG 3 OF 4 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
---	---	---	---	---	---	---	---



HCP50864/40517-426-51

PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

FRONT CAT#: N/A

BOX CAT#: N/A

DIMENSIONS:

"H X "W X "D

WIRE BENDING SPACE:

TOP

BOTTOM

SIDE

- BUSSING: COPPER BUS
STANDARD PLATING

- SPECIAL:

COPPER SOLID NEUTRAL

COPPER GROUND BAR

ELECTRICAL DATA

- SYSTEM: 480Y/277 VAC 3PH 4W 60 HZ
25,000 AMPS SYMS. SCCR

- MAIN: MAIN BREAKER: 400A
BOTTOM FEED

- BRANCH MOUNTING TYPE: PLUG-ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL 1SH1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	I-LINE
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		
DATE:	11/1/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-008-1-01-1	PG 1 OF 2 REV -



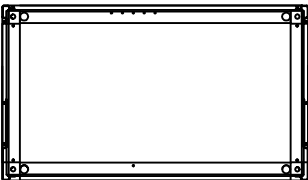
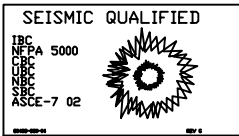
SQUARE D
Schneider Electric

REV	DESCRIPTION	BY	DATE	—	----	--	--/--	-	----	--	--/--
-	----	--	--/--	-	----	--	--/--	-	----	--	--/--

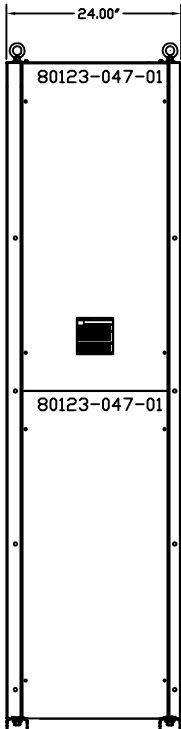
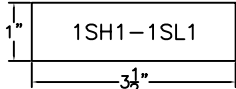
FACTORY INSTALLED POWER CABLES:

CABLE FROM	CONNECT TO	CABLE TO	CONNECT TO	WIRE SIZE	QTY PER PHASE
PANEL 1SH1	BREAKER (70A/3P)	TRANSFORMER T-1SL1	PRIMARY LUGS	#4	1
CONNECT FEEDER TO PANEL 1SH1 AND ROLL UP INSIDE ENCLOSURE, NEED APPROX 12' PER PHASE.◀					

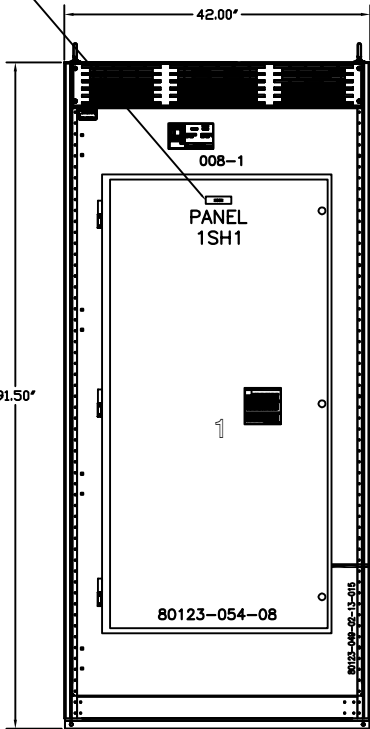
SEISMIC QUALIFIED LABEL REQUIRED



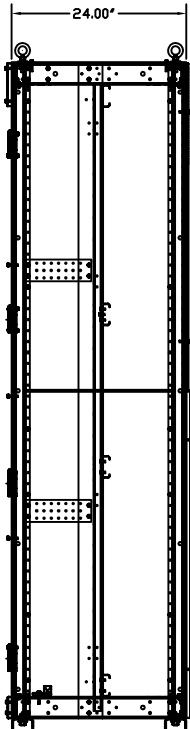
TOP VIEW



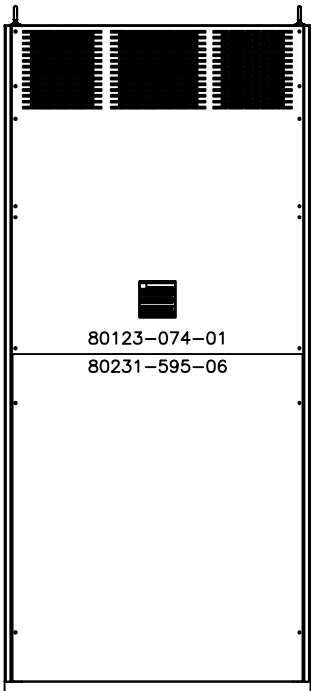
LEFTHAND VIEW
(STD COVERS)



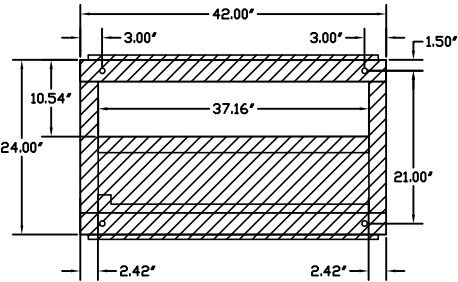
BACK OF ENCLOSURE



RIGHTSIDE VIEW
(NO COVERS)



BACK VIEW (COVERS REQ'D)

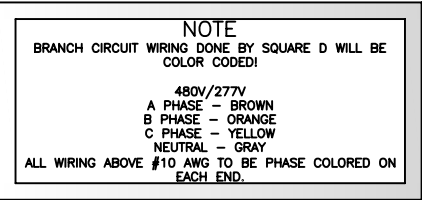


FRONT OF ENCLOSURE
BOTTOM VIEW

INDICATES EQUIPMENT THAT
INTERFERES WITH CONDUIT ENTRY

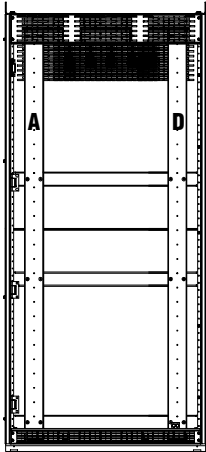
PANELS INFORMATION:

CELL REFERENCE	PANEL	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	PANEL 1SH1	BOTTOM	A-3/D-3	A-26/D-26	----	PK32DGTACU



GENERAL NOTES

- REFERENCE INSTRUCTION BULLETIN 80043-708-03 FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
- SOLID LINE (—) REPRESENTS FACTORY INSTALLED CABLES.
- INSTALL 1-220-9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR.
- REFER TO DATA SHEETS 80123-DS-000P1 TO 80123-DS-022P1 FOR ASSEMBLY INSTRUCTIONS.



STRUCTURE BOM ASSEMBLY #
80123063611

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SH1-1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-008-1-01-2	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	—	----	---	---/---/---
1	UPDATED PRINT	AMS	12/6/16	—	----	---	---/---/---

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	M/B 150A QB	A	B	C	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20/1							20/1	QOB		2
3		QOB	20/1							20/1	QOB		4
5		QOB	20/1							20/1	QOB		6
7		QOB	20/1							20/1	QOB		8
9		QOB	20/1							20/1	QOB		10
11		QOB	20/1							20/1	QOB		12
13		QOB	20/1							20/1	QOB		14
15		QOB	20/1							20/1	QOB		16
17		QOB	20/1							20/1	QOB		18
19		QOB	20/1							20/1	QOB		20
21		QOB	20/1							20/1	QOB		22
23		QOB	20/1							20/1	QOB		24
25		QOB	20/1							20/1	QOB		26
27		QOB	20/1							20/1	QOB		28
29		QOB	20/1							20/1	QOB		30
31		QOB	20/1							20/1	QOB		32
33		QOB	30/2										34
35		QOB	30/2										36
37		QOB	30/2										38
39		QOB	30/2							150/3	QOB-VH		40
41		QOB	30/2										42
43		QOB	30/2										44
45		QOB	30/2							20/1	QOB	PREPARED SPACE	46
47		QOB	30/2							20/1	QOB	PREPARED SPACE	48
49	PREPARED SPACE	QOB	20/1							20/1	QOB	PREPARED SPACE	50
51	PREPARED SPACE	QOB	20/1							20/1	QOB	PREPARED SPACE	52
53	PREPARED SPACE	QOB	20/1							20/1	QOB	PREPARED SPACE	54

NQ454L2C/NQMB2Q/QBL32150

SEISMIC QUALIFIED LABEL REQUIRED

PHYSICAL DATA

o ENCLOSURE: INTERIOR ONLY

FRONT CAT#: N/A
BOX CAT#: N/A
DIMENSIONS:
"H X "W X "D
WIRE BENDING SPACE:
TOP
BOTTOM
SIDE
PBA 709A
o BUSSING: COPPER BUS
STANDARD PLATING

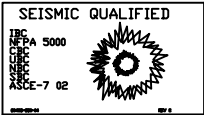
o SPECIAL:
COPPER SOLID NEUTRAL
COPPER GROUND BAR

ELECTRICAL DATA

o SYSTEM: 208Y/120 VAC 3PH 4W 60 HZ
10,000 AMPS SYMS. SCCR

o MAIN BREAKER: 150A
TOP FEED

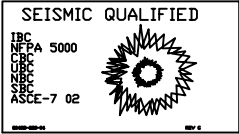
o BRANCH MOUNTING TYPE: BOLT-ON



JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NQ PANEL
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG#	37999262-008-2-01-1
		PG 3	OF 5
		REV	—

REV	DESCRIPTION	BY	DATE	—	----	--	--/--	—	----	--	--/--
—	----	--	--/--	—	----	--	--/--	—	----	--	--/--

SEISMIC QUALIFIED LABEL REQUIRED



FACTORY INSTALLED POWER CABLES

CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
TRANSFORMER T-1SL1	150A/3P MAIN BRK	PANEL 1SL1	SECONDARY LUGS	#1/0	1

PANEL INFORMATION

SECTION #	CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	GROUND BAR
2	1	PANEL 1SL1	TOP	B/C	J/K	PK27GTACU

ENCLOSURE DATA:

NEMA TYPE 1 FREE STANDING
COLOR: ANSI 49

TRANSFORMER DATA:

DESIGNATION: T-1SL1

45 KVA (EX45T3HF)

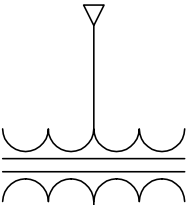
ENERGY EFFICIENT

TRANSFORMER VOLTAGE:
3-PH 480V - 208Y/120V

TRANSFORMER WINDINGS:
ALUMINUM WINDINGS

OPTIONS:
H-220°C INS, 115°C RISE

PRIMARY CONNECTION
CABLED TO PANEL 1SH1



SECONDARY CONNECTION
CABLED TO PANEL 1SL1

GROUND BUS PER UL891



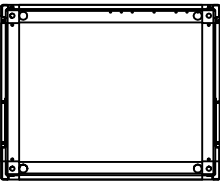
GENERAL NOTES

- REFERENCE INSTRUCTIONS BULLETIN 80043-708-XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
- SOLID LINE (—) REPRESENTS FACTORY INSTALLED CABLES.
- INSTALL (1) 220-9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
- REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

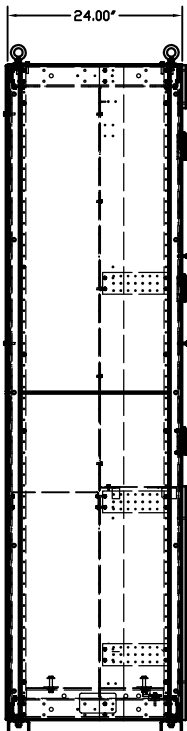
STRUCTURE BOM ASSEMBLY #

8012330955R

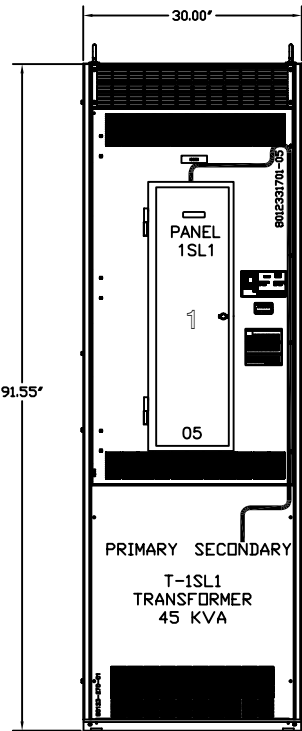
JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SH1-1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS	 SQUARE D Schneider Electric	
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG#	37999262-008-2-01-2
		PG 3	OF 5
		REV	—



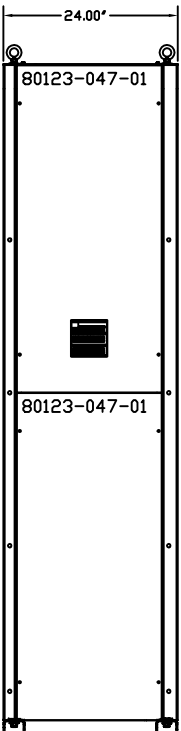
TOP VIEW



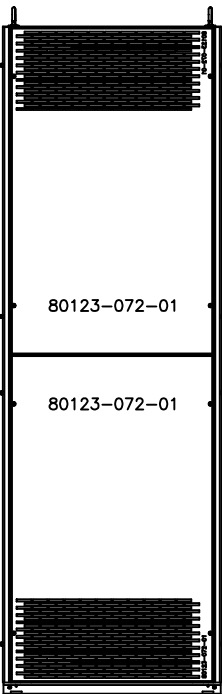
LEFTHAND VIEW
(NO COVERS)



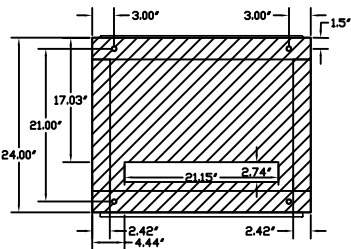
BACK OF ENCLOSURE



RIGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



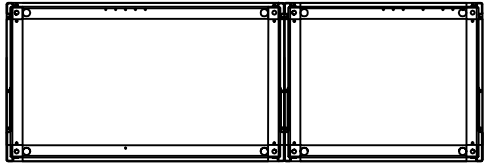
FRONT OF ENCLOSURE
BOTTOM VIEW

NOTE	
BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!	
480V/277V	208V/120V
A PHASE - BROWN	A PHASE - BLACK
B PHASE - ORANGE	B PHASE - RED
C PHASE - YELLOW	C PHASE - BLUE
NEUTRAL - GRAY	NEUTRAL - WHITE
ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.	



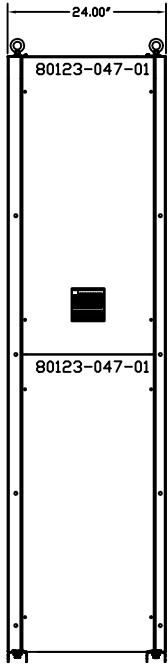
INDICATES EQUIPMENT THAT
INTERFERES WITH CONDUIT ENTRY

REV	DESCRIPTION	BY	DATE	—	----	--	--/--	—	----	--	--/--
—	----	--	--/--	—	----	--	--/--	—	----	--	--/--

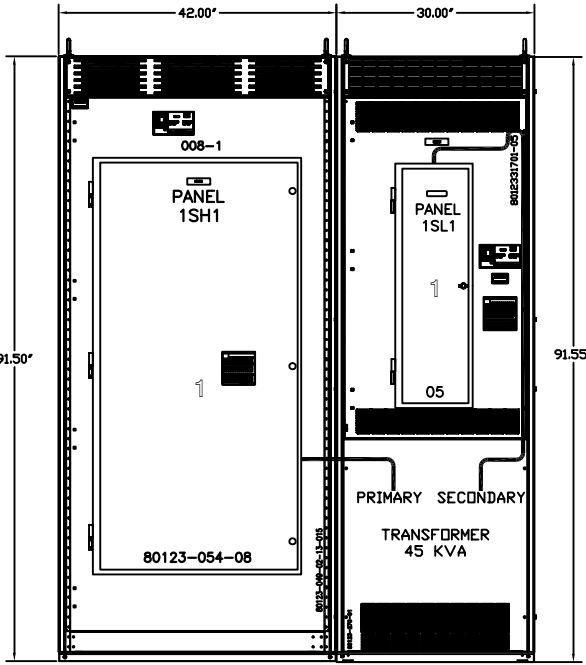


TOP VIEW

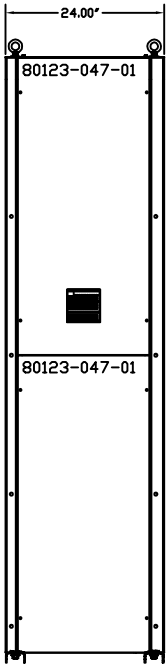
TOP VIEW



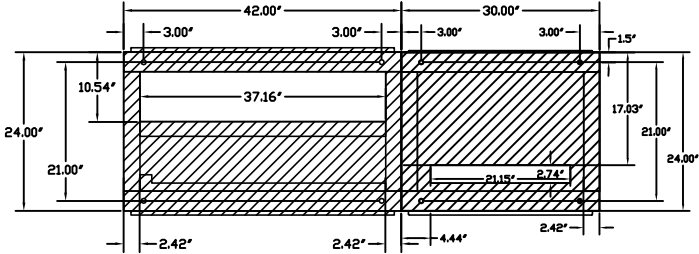
LEFTSIDE VIEW
(STD COVERS)



BACK OF ENCLOSURE



RIGHTSIDE VIEW
(STD COVERS)



FRONT OF ENCLOSURE
BOTTOM VIEW

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SH1-1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS	 SQUARE D Schneider Electric	
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-008 LINE UP	PG 5 OF 5 REV —

Integrated Power Center 2 (IPC2™)

Integrated Power and Control Solutions (IPaCS)

Class 2735

Instruction Bulletin

80043-708-04

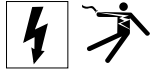
07/2010

Retain for future use.



by **Schneider** Electric

HAZARD CATEGORIES AND SPECIAL SYMBOLS



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Section 1—Introduction

This bulletin contains instructions for the proper installation, operation, and maintenance of Square D® Integrated Power and Control Solutions (IPaCS™) Integrated Power Center 2 (IPC2™) equipment manufactured by Schneider Electric. The purchaser's engineering, installation, and operating staff supervisors should familiarize themselves with this bulletin and become acquainted with the appearance and characteristics of each piece of equipment mounted or contained in the IPC2.

These instructions and procedures apply to IPC2 installations by Schneider Electric. When special features or non-standard components are incorporated in the IPC2, detailed instructions for these components are included in the instruction material holder.

Inspection and Packaging

Every IPC2 is carefully inspected and packaged at the assembly plant. Construction of the IPC2 is checked, both structurally and electrically, for compliance with all specifications, codes, and standards. After a complete inspection, the IPC2 is prepared for shipment. The factory order number, the identification number, and the shipping weights are plainly marked on each shipping block.

Document Replacement

Contact your nearest Schneider Electric field office to replace lost or damaged wiring diagrams and instruction sheets. Use the factory order number as a reference.

Section 2—Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm power is off.
- Handle this equipment carefully and install, operate, and maintain it correctly in order for it to function properly. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to equipment or other property.
- Disconnect the neutral connection at any TVSS or other electronic device prior to performing electrical insulation resistance tests; reconnect to the device after testing.
- Carefully inspect your work area and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this bulletin assume that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Section 3—Receiving, Handling, and Storing

Receiving

Upon receipt, check the packing list against the equipment received to ensure the order and shipment are complete. Also upon receipt, immediately inspect the IPC2™ shipping blocks for any damage that may have occurred in transit. If damage is found or suspected, file a claim with the carrier immediately and notify the nearest Schneider Electric representative. Claims for shortages or errors must be made in writing to Schneider Electric within 60 days after delivery. Failure to give such notice will constitute unqualified acceptance and a waiver of all such claims by the purchaser.

Delivery of equipment to a carrier at any of the Schneider Electric plants or other shipping points constitutes delivery to the purchaser regardless of freight payment and title. All risk of loss or damage pass to the purchaser at that time.

For details concerning claims for equipment shortages and other errors, refer to Schneider Electric “Terms and Conditions of Sale.”

Handling

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not lay the NEMA 1 enclosed IPC2 equipment on its back or front. Do not lay the NEMA 1 enclosed IPC2 equipment on its side during transit to the job site. When necessary at the job site, the NEMA 1 enclosed IPC2 equipment may be carefully and gently laid onto its side. The NEMA 1 enclosed IPC2 equipment should be returned to its upright position as soon as possible. Then inspect the structure and its contents to ensure all components and insulators remained undamaged and secured before continuing the installation of the IPC2 equipment.

All IPC2 equipment with drip hoods or with NEMA 3R enclosures must always be kept upright during handling.

Failure to follow these instructions can result in equipment damage.

Ensure that proper equipment, such as an overhead crane, is available at the installation site to handle the IPC2.

The shipping weight of each shipping block is marked on the packing list. Verify the lifting capacity of the equipment being used to handle the IPC2 in accordance with the shipping weight of each shipping block. Whenever possible, keep the NEMA 1 enclosed IPC2 equipment upright during handling. If it is necessary to lay this equipment down, see the caution statement on this page for instructions. All IPC2 equipment with drip hoods or with NEMA 3R enclosures must always be kept upright during handling.

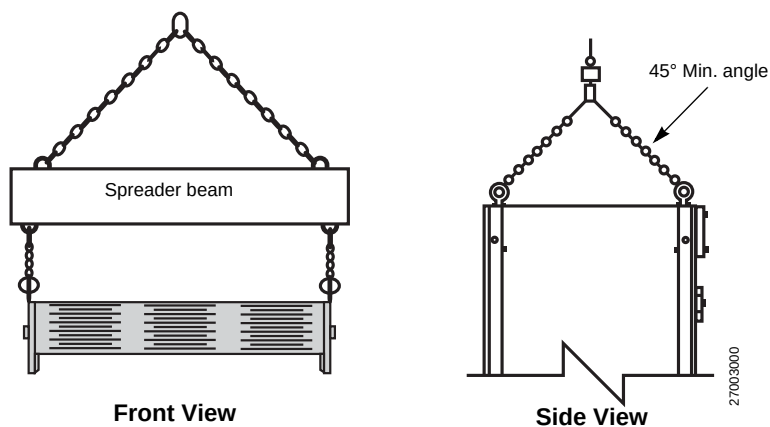
Schneider Electric recommends using an overhead crane, lifting eyebolts, and cables or chains to handle the NEMA 1 enclosed IPC2. This method and alternative handling methods are discussed in this section.

Handling NEMA 1 IPC2 Enclosures with Lifting Eyebolts

Schneider Electric provides lifting eyebolts as standard equipment for NEMA 1 enclosed IPC2 shipping blocks. Instruction labels on each shipping block include drawings and written instructions outlining the proper use of the lifting eyebolts (Figure 1). Use rigid spreaders or a spanner bar to provide vertical lift on the lifting eyebolts. This will help prevent damage to the frame or finish.

NOTE: For NEMA 1 enclosures with drip hoods, see “Handling NEMA 3R Enclosures or NEMA 1 IPC2 Enclosures with Drip Hoods” on page 9.

Figure 1: Lifting with an Overhead Crane, Lifting Eyebolts, and Cables or Chains



Follow these instructions to handle the NEMA 1 enclosed IPC2:

1. Use load-rated cables or chains with safety hooks or shackles. Do not pass cables or chains through holes in lifting means.
2. Use a load-rated spreader beam to prevent structure damage. Rig so that the minimum angle between the lifting cables or chains and equipment top is 45 degrees.

The following lifting warning labels (Figure 2) are attached to the IPC2.

Figure 2: Lifting Warning Labels for IPC2



Front Label on IPC2



Rear Label on IPC2



Label Applied Adjacent to Lifting Eyebolts

Handling NEMA 3R Enclosures or NEMA 1 IPC2 Enclosures with Drip Hoods

Rollers or slings may be used to handle the shipping blocks. When elevating a shipping block without the use of the lifting eyebolts, an overhead crane equipped with either of the following may be used:

- Load rated chain coupled to a sling rigging
- Load rated wire cable with safety hooks and shackles

Wrap the sling completely around the IPC2 and shipping stringers (see Figure 3).

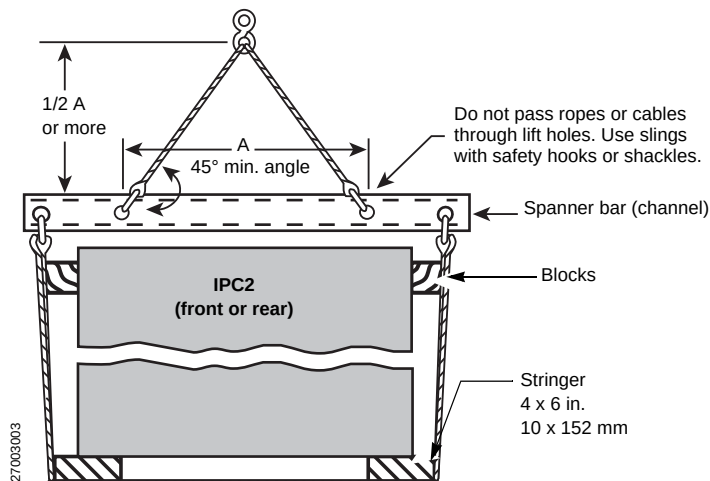
⚠ WARNING

HAZARD OF EQUIPMENT DAMAGE— TOP HEAVY LOAD

Stabilize the shipping block to reduce the possibility of tipping.

Failure to follow these instructions can result in death or serious injury.

Figure 3: IPC2 in Sling Rigging



A forklift is an alternative method of handling the IPC2.

NOTE: Always check the fork lengths to ensure that the forks extend under the entire IPC2. Carefully balance the load, and always use a safety strap when handling or moving an IPC2 with a forklift (Figure 4).

Figure 4: Forklift Safety Strap



Storing

When storing the IPC2 before installation, cover the top and any openings of the equipment during the construction period to protect the IPC2 from dust and debris.

If the IPC2 is not installed and energized immediately, store it in a clean, dry space with a consistent temperature to prevent condensation. Store the IPC2 indoors, if possible. Preferably, store it in a heated building with adequate air circulation and protect it from dirt, fumes, water, and physical damage. Storing the IPC2 outdoors may cause harmful condensation inside the IPC2.

NOTE: Install portable electric heaters of approximately 250 watts per vertical section in both indoor-type and rainproof-type IPC2 enclosures for adequate protection during storage.

Before energizing the space heaters, remove all loose packing or flammable materials inside the IPC2. Outdoor IPC2 equipment is not weather-resistant until completely and properly installed; treat them the same as indoor IPC2 equipment until after installation.

Section 4—Installation

Correct installation of IPC2™ equipment is essential for proper operation of all IPC2 components. Study the associated instruction books and all drawings carefully. In most cases, all drawings are sent to the purchaser before an IPC2 is shipped to enable adequate advance planning.

NOTE: While installing IPC2 equipment, do not use the top of the IPC2 as a support for the weight of the installer.

Location

Find the designated area on the building floor plan where the IPC2 will be installed. The location chosen for installation should provide working clearances complying with Section 110-26 of the National Electrical Code® (NEC®) or Section 2-308 of the Canadian Electrical Code (CEC) Part 1. IPC2 equipment requires field connections, including mains, branches, and ground bus, to be accessible and maintainable from the front.

Foundation Preparation

The floor or foundation must be strong enough to support the weight of the IPC2 without sagging. The surrounding floor area should gently slope toward a drain.

NOTE: For seismic qualifications, read the section "Anchoring the IPC2 for Seismic Qualifications" on page 17 before pouring the floor or foundation.

IPC2 equipment is assembled on true and level floors at the assembly plant. To ensure correct alignment with adjoining equipment, the mounting pad or final installation site must be smooth and level. If parallel steel floor channels are imbedded for mounting the IPC2, take extra care to ensure the floor channels are level over their entire length to avoid distortion of the IPC2 structure. Each channel should be level with the finished floor.

When pouring the foundation, make provisions for conduits entering the IPC2 from below and carrying the incoming and/or outgoing cables, control wiring, and ground cable. The bottom view in the equipment drawing shows the available conduit area for correct layout.

Conduits should project above the finished floor by about 2.00 in. (51 mm). However, to simplify moving the shipping blocks into place, install the conduits flush with the concrete and, after the blocks are in their final position, add the appropriate extension sleeves. Otherwise, raising the shipping block on timbers or lifting it by a crane to clear the conduit hubs will be necessary.

NOTE: Before pouring the foundation, consider installing additional conduits for future circuits.

IPC2 Preparation

- Remove dirt and debris from the foundation and surrounding area before moving the IPC2 into final position.
- After the IPC2 has been moved to its final installation site, take each shipping block off its shipping stringers.
- Remove all packing materials.

General Installation

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Level and align adjacent shipping sections with one another. Ensure proper alignment of horizontal main through bus and proper splice bus connections.

Failure to follow these instructions can result in equipment damage.

Joining Shipping Sections— Indoor IPC2 and Switchboards

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

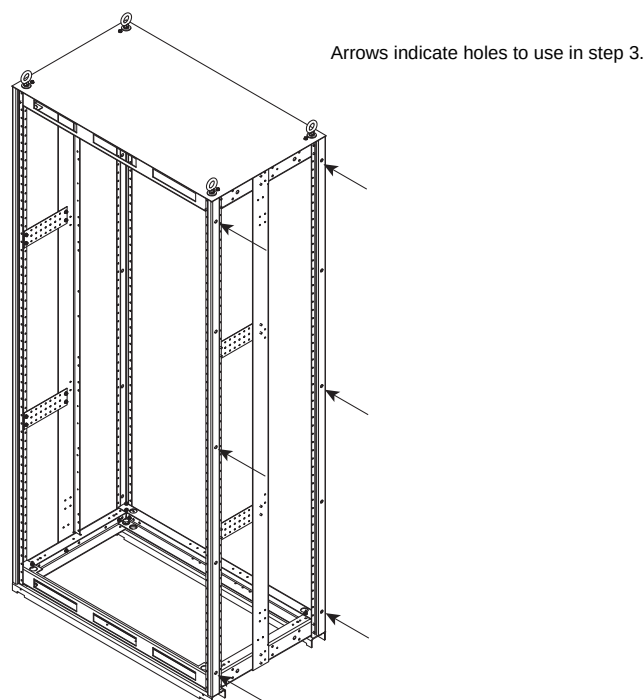
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death and serious injury.

Install the IPC2 into its final position by leveling progressively each section and bolting the frames together, if separated. Position shipping sections as follows:

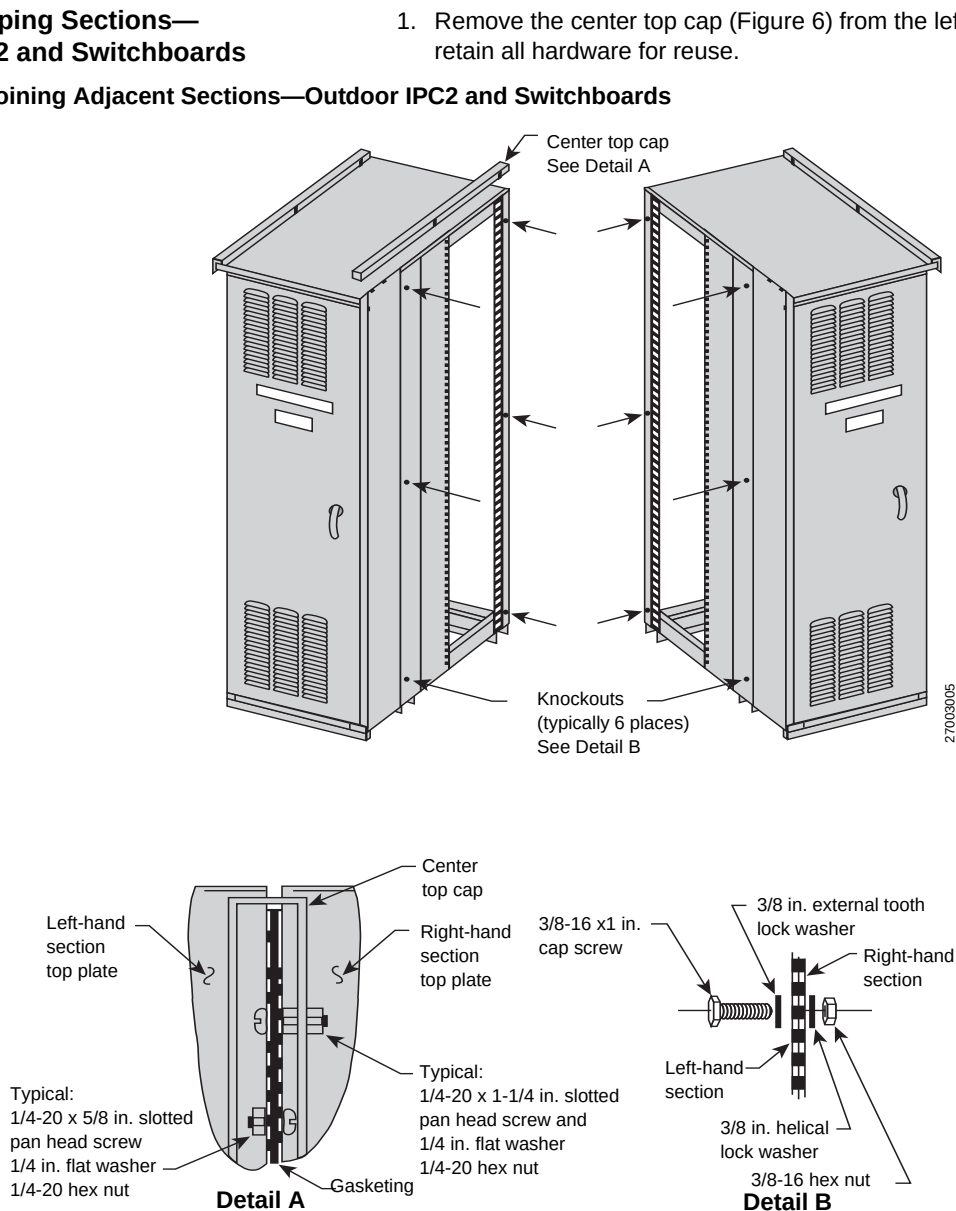
1. Maneuver each shipping section into the desired position using the procedures under “Handling” on page 6.
 2. Carefully lower the equipment over the conduit stubs to comply with the “available conduit area” as shown in the bottom view of the equipment drawings. Otherwise, there may not be sufficient cable bending space.
 3. Level the shipping section.
 4. After the installation of each section is complete, make the ground bus splice connection to the preceding section before installing the next section.
1. Position each adjacent section, carefully leveling and aligning it with the previous section.
 2. Open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
 3. Six bolts (3/8-16 x 1 inch) are provided. Place the bolts through the existing holes in the front and rear vertical corner channels to join adjacent sections (Figure 5).
 4. Make the ground bus splice connections to the preceding section. See “Ground Bus Splice Connections Between IPC2 and Power-Style® QED Switchboards” on page 13.
 5. Replace and secure all front and rear doors and panels removed in step 2.

Figure 5: Indoor IPC2



Joining Shipping Sections— Outdoor IPC2 and Switchboards

Figure 6: Joining Adjacent Sections—Outdoor IPC2 and Switchboards



1. Remove the center top cap (Figure 6) from the left-hand section, and retain all hardware for reuse.
2. When possible, open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
3. Remove three 0.50-in. (13 mm) diameter knockouts from the front vertical corner channel and three from the rear vertical corner channel (a total of six per frame side) as indicated by the arrows in Figure 6. Ensure the knockouts do not fall into the structure.
4. Position each adjacent section, carefully leveling it and aligning it with the previous section.
5. Six bolts (3/8-16 x 1 inch) are provided. Place them through the holes created in step 3 to join adjacent sections. See Detail B.
6. Make the ground bus splice connections to the preceding section. See "Ground Bus Splice Connections Between IPC2 and Power-Style® QED Switchboards" on page 13.
7. Replace the center top cap removed in step 1. See Figure 6, Detail A.
8. If applicable, replace and secure all the front and rear doors and panels removed in step 2.

Ground Bus Splice Connections Between IPC2 and Power-Style® QED Switchboards

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death and serious injury.

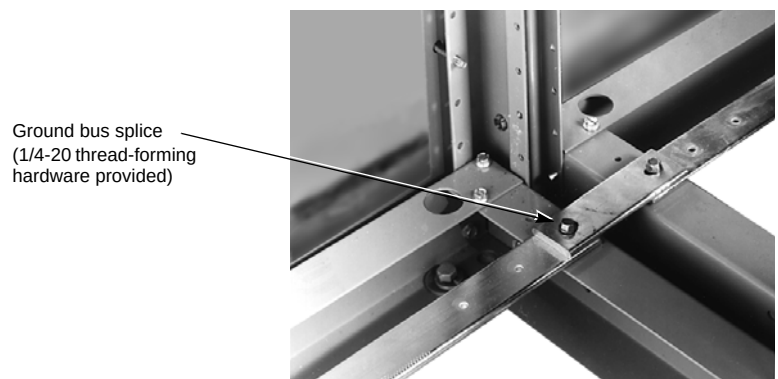
IPC2 Connection to Indoor Integrated Power Center (IPC) and Modular Panelboard System (MPS)

Integrated Power Center (IPC) and IPC2
Enclosure Splice

Align and secure the ground bus splice connection between shipping sections. Torque connections to 100 lb-in (11 N•m). See Figure 7.

NOTE: Proper installation is essential for equipment ground-fault systems.

Figure 7: Ground Bus Splice Connection



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Preparing the IPC2

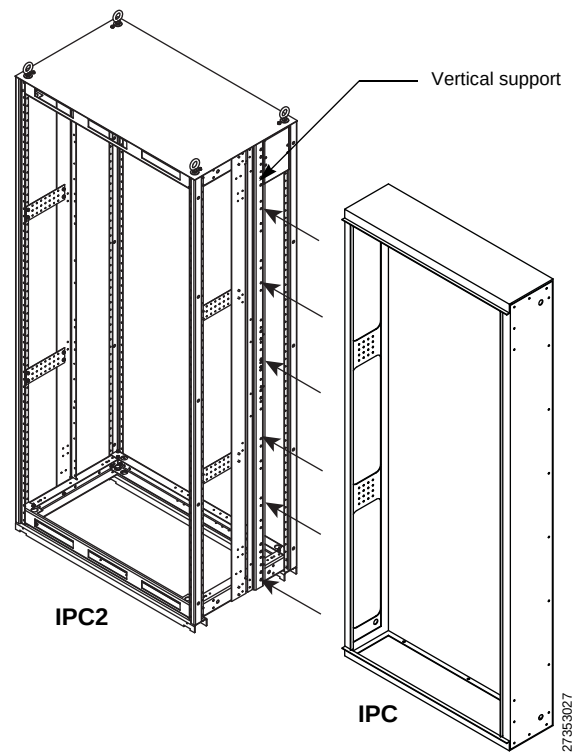
NOTE: Before joining shipping blocks, ensure the IPC equipment is installed per the Integrated Power Center instruction bulletin no. 80043-056-__.

1. Remove dirt and debris from the foundation and surrounding area before moving the IPC2 enclosure into its final position.
2. After the IPC2 enclosure has been moved to its final installation site, take the equipment off its shipping stringers.

Joining Shipping Sections

1. Remove the side covers from the IPC2 enclosure to access the vertical support. Open or remove the front doors of the IPC to access the side panels.
2. Position the IPC2 enclosure and IPC sections adjacent to one another, carefully leveling and aligning the rear of each section.

Figure 8: IPC2 and IPC Shipping Sections



3. Locate and move any factory-installed cables through the side openings into the appropriate sections.
4. Bolts (1/4-20 x 1 inch), washers, and nuts are provided in the IPC structure. Seven sets of hardware will be used to join the sections. Align the section splicing holes in the front of the IPC side panel with the corresponding holes in the IPC2 vertical support.
5. Place the bolts through the holes in the IPC2 vertical support and IPC side panels to join the adjacent sections (Figure 8). Secure each bolt with a washer and nut until the connection is finger-tight.
6. Torque the hardware to 72 lb-in (8 N•m) to complete bolting the sections together.
7. Connect any factory-installed cables per Table 3 on page 32.
8. Replace the side covers on the IPC2 enclosure.

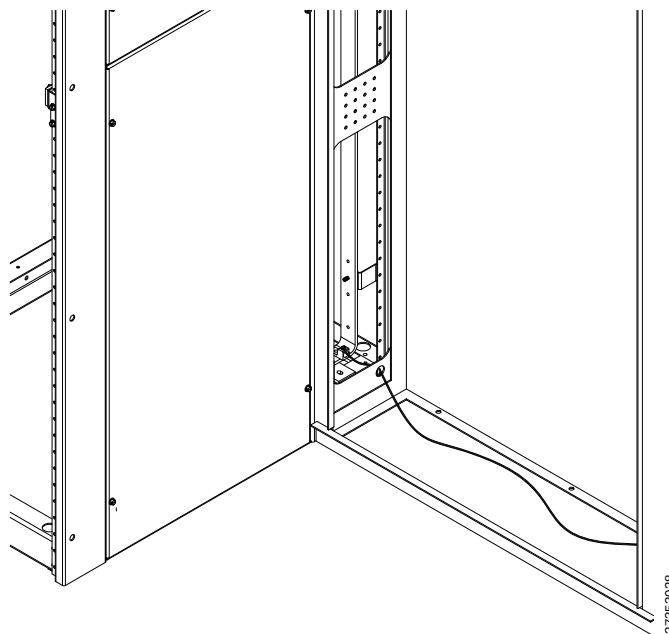
Making Ground Cable Splice Connections

1. Align and secure the ground cable connection between the IPC shipping sections per the *Integrated Power Center* instruction bulletin (see Figure 9).

NOTE: Proper installation is essential for equipment ground-fault systems.

2. Locate the ground lug on the horizontal ground bus bar in the bottom of the IPC2 enclosure.
3. Place the stripped end of the ground cable from the IPC sections into the lug on the IPC2 ground bar (Figure 9).
4. Torque the ground cable connection per Table 3 on page 32.
5. Replace the IPC door, and reinstall the side covers on the IPC2 enclosure if not already completed.

Figure 9: Ground Splice Connection



Modular Panelboard System (MPS) and IPC2
Enclosure Splice

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Preparing the IPC2

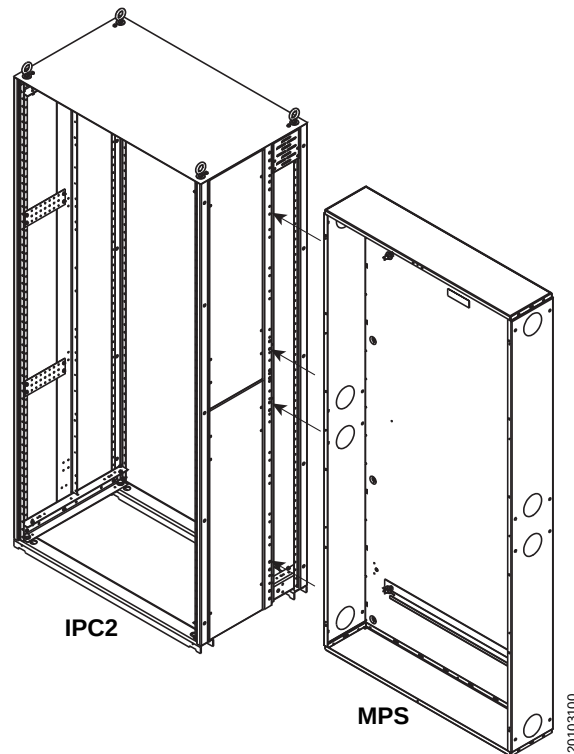
NOTE: Before joining shipping blocks, ensure the MPS equipment is positioned in its final location.

1. Remove dirt and debris from the foundation and surrounding area before moving the IPC2 enclosure into its final position.
2. After the IPC2 enclosure has been moved to its final installation site, take the equipment off its shipping stringers.

Joining Shipping Sections

1. Remove the side covers from the IPC2 enclosure to access the vertical support. Remove the front covers of the MPS to access the side panels of adjacent sections.
2. Position the IPC2 enclosure and MPS sections adjacent to one another, carefully leveling and aligning the rear of each sections.

Figure 10: IPC2 and MPS Shipping Sections

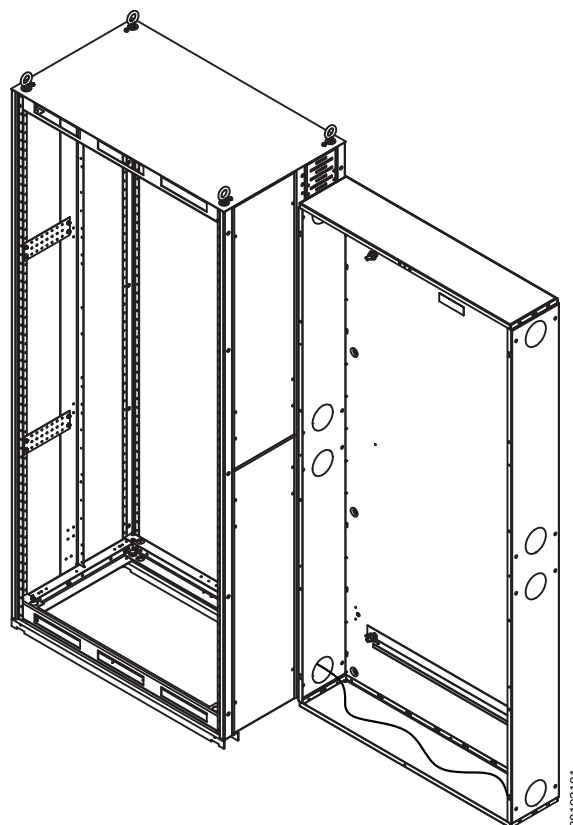


3. Locate and move any factory-installed cables through the side openings into the appropriate sections.
4. Bolts (3/8-16-x 1 inch), washers, and nuts are provided in the MPS structure. Four sets of hardware will be used to join the sections. Align the section splicing holes in the front of the MPS side panel with the corresponding holes in the IPC2 vertical support.
5. Place the bolts through the holes in the IPC2 vertical support and MPS side panels to join the adjacent sections (Figure 10). Secure each bolt with a washer and nut until the connection is finger-tight.
6. Torque the hardware to 72 lb-in (8 N•m) to complete bolting the sections together.
7. Connect any factory-installed cables per Table 3 on page 32.
8. Replace the side covers on the IPC2 enclosure.

Making Ground Cable Splice Connections

1. Run ground cable from the MPS ground bar to the IPC2 enclosure ground bar (see Figure 11).
- NOTE:** Proper installation is essential for equipment ground-fault systems.
2. Locate the ground lug on the horizontal ground bus bar in the bottom of the IPC2 enclosure.
3. Place the stripped end of the ground cable into the lug on the IPC2 ground bar (Figure 11).
4. Torque the ground cable connection per Table 3 on page 32.
5. Replace the MPS covers, and reinstall the side covers on the IPC2 enclosure if not already completed.

Figure 11: Ground Splice Connection



Anchoring the IPC2 for Seismic Qualifications

IPC2 equipment that is seismically certified has been qualified to the site-specific seismic requirements of the listed model building codes and/or standards. Optional construction features may be required, depending on the location of the installation and the particular code and/or standard of interest. Seismic certificates of compliance are provided with all seismically-certified IPC2 equipment. To maintain the validity of this certification, the installation instructions provided in this bulletin must be followed.

Responsibility for Mitigation of Seismic Damage

For the purposes of the model building codes, IPC2 equipment is considered as nonstructural building components. Equipment capacity was determined from tri-axial seismic shake table test results as defined in the International Code Counsel Evaluation Service (ICCES) Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components (AC156). Unless otherwise indicated, an equipment importance factor of 1.5 ($I_p = 1.5$) was used, indicating that equipment functionality was verified before and after shaker table seismic simulation testing. This importance factor is indicative of critical facilities where maximizing the probability of post event functionality is a priority. AC156 is published by the ICC ES and has been recognized by the Building Seismic Safety Council (BSSC) as an appropriate methodology in the 2003 National Earthquake Hazard Reduction Program (NEHRP) Commentary (FEMA 450 Part 2). The National Institute of Building Sciences established the BSSC in 1979 to develop and promote regulatory provisions for earthquake risk mitigation at the national level.

Incoming and outgoing cable and conduit must also be considered as related but independent systems. They must be designed and restrained to withstand the forces generated by the seismic event without increasing the load transferred to the equipment. For applications where seismic hazard exists, bottom entry and/or exit of cable and conduit is preferred. This system must be capable of transferring the loads created to the load-bearing path of the building structural system.

Maintaining Seismic Certification

Seismic qualification of nonstructural components by Schneider Electric is just one link in the total chain of responsibility required to maximize the probability that the equipment will be intact and functional after a seismic event. During a seismic event, the equipment must be able to transfer the loads that are created through the mounting pad and anchorage to the load-bearing path of the building structural system.

The structural civil engineer or design engineer of record is responsible for detailing the equipment connection and anchorage requirements for the given installation. The installer and manufacturers of the anchorage restraint system are responsible for assuring that the mounting requirements are met. Schneider Electric is not responsible for the specification and performance of these systems.

Anchoring IPC2 for Seismic Applications

Formed base channels run the width of the section. The channels and connecting braces provide a 0.62-in. (16 mm) minimum diameter hole for fastening the section to the floor. To properly anchor the IPC2 to the floor, use all four mounting locations for 24-in. deep NEMA 1 enclosures, all six mounting locations for 36-in. deep NEMA 1 enclosures and 35-in. deep NEMA 3R enclosures, and all eight mounting locations for 47-in. deep NEMA 3R enclosures and all corner sections. Use ½-in. (12.7 mm) diameter anchor bolts (Grade 5 minimum, provided by others) for the installation of equipment. Use one 1.25-in (31.75 mm) outer diameter Grade 5 belleville washer (Square D part no. 23903-33201, stored inside each seismically qualified structure next to the front bottom base channel) under the head of each bolt or anchor nut. To develop full strength of the anchor, torque the hardware to the value specified by the anchor manufacturer or seismic restraint detailing supplied by the Structural Civil Engineer of record for the project.

Additionally, each NEMA 1 enclosed section includes two rear top-located eyebolts that may be removed to allow the user to attach two upper lateral braces (braces and hardware supplied by others) to the IPC2 structure for top structural restraint.

Top structural restraint is required for all IPC2 equipment installed:

- where the site-specific 0.2 second spectral ground motion exceeds 2.67 g's (as determined from the code-referenced ground motion maps or the site-specific seismic hazard engineering study),
- or when displacement at the top of the equipment cannot be tolerated,
- or for all IPC2 corner sections used for seismic applications.

To develop full strength of the upper structural anchor, install and torque the hardware as specified by the anchor manufacturer or seismic restraint detailing supplied by the Structural Civil Engineer of record for the project.

NOTE: Most of the anchoring hardware is not furnished with the IPC2 equipment, with the exception of the Grade 5 belleville washer (Square D part no. 23903-33201) mentioned above.

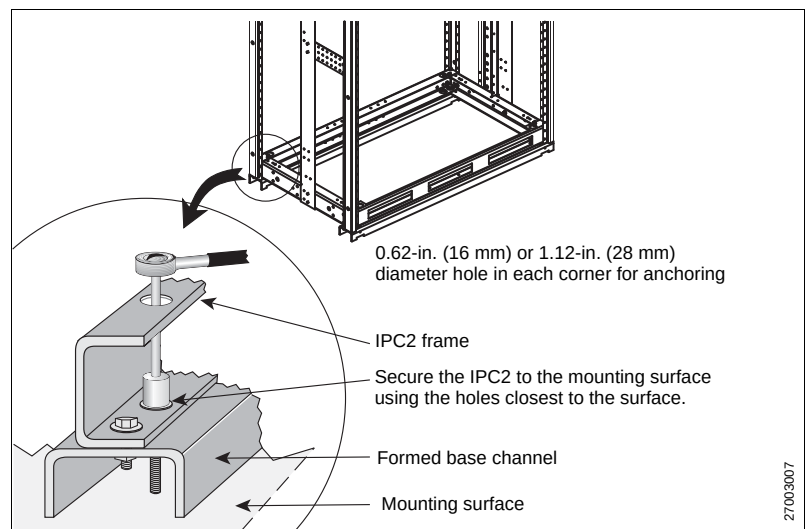
After the IPC2 and adjacent equipment are properly joined together and the entire structure is bolted to the floor, install the incoming service conductors and load side cables. During an earthquake, the top of the IPC2 can move in any direction. Any top incoming cables must accommodate this motion. The IPC2 enclosure (particularly the top) should not be used to mount exterior equipment.

Anchoring the IPC2

Although sections are freestanding, a hard bump or shifting movement can result in damage to the splice joints between sections and conduit hubs connected to the sections. Therefore, each vertical section must be anchored to the floor.

Formed base channels run the width of the shipping section. For fastening the section to the floors, the channels have 0.62-in. (16 mm) diameter holes for seismic applications or 1.12-in. (28 mm) diameter holes for non-seismic applications (see Figure 12 below). Anchor each section to the floor with 1/2-in. diameter (Grade 2 minimum) bolts with flat washers and anchors suitable for installation of electrical equipment (not furnished).

Figure 12: IPC2 Base Channels

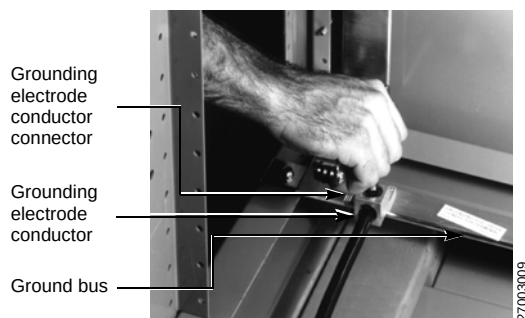


After all equipment sections are properly joined together and the entire structure is bolted to the floor, install the incoming service conductors and load side cables.

Grounding and Bonding

Service Equipment—Grounded System

Figure 13: Grounding Electrode Connector



NOTE: A system is “grounded” if it is grounded at any point ahead of the IPC2, whether the grounded conductor (neutral) is carried through to the loads, or not.

For solidly *grounded* systems used as either service equipment or as a main IPC2 on a separately derived system:

1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the IPC2 ground bus (Figure 13). Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC® or Sections 10-204 and 10-206 of the CEC, and install it as specified in Section 250-64 of the NEC or Section 10-908 of the CEC.
2. Install the main bonding jumper (provided with the IPC2) between the neutral assembly of the service entrance panelboard located in the IPC2 equipment and a ground lug located on the IPC2 unit ground bus. For torque values, refer to Table 3 on page 32.

NOTE: If the IPC2 is fed from multiple sources (for example, double-ended systems), there may be two or more main bonding jumpers to install.

In Canada, a main bonding jumper cable is provided between the neutral assembly and ground bus. When disconnection of the bonding jumper is required (for example, for a Megger® test), remove the cable lug with cable from the neutral assembly. This is normally located near the line neutral lugs. Secure the cable and lug to maintain the required distance from phases and neutral.

NOTE: If the IPC2 is fed from multiple sources (for example, a double-ended system like a main-tie-main), there may be two or more main bonding jumpers installed.

Service Equipment—Ungrounded System

For *ungrounded* systems used as either service equipment, or as a main IPC2 on a separately derived system:

1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the IPC2 ground bus (Figure 13).
2. Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC or Sections 10-700 and 10-702 of the CEC, and install it as specified in Section 250-64 of the NEC or Section 10-204 of the CEC.

Not Service Equipment

For either *grounded* or *ungrounded* systems, when an IPC2 is used neither as service equipment, nor as a main IPC2 on a separately derived system:

Use equipment grounding conductors sized according to Section 250-122 of the NEC or Section 10-206 of the CEC to connect the IPC2 frame and ground bus to the service ground.

High-Impedance Grounded Neutral Systems

For high-impedance grounded neutral systems:

Ground the system following the instructions provided with the system grounding equipment and in compliance with Section 250-36 of the NEC. Confirm that the IPC2 frame and ground bus are bonded in accordance with Section 250-102 of the NEC.

Conduit Area

1. Locate and terminate all conduit in the IPC2 enclosure in the “available conduit area” designated on the equipment drawing.
 - a. When cables are entering the top of the IPC2, remove the IPC2 top plate and retain the hardware for reuse. For future reference, note that the top plates used on the 36-in. deep Transformer Combo structures include a rear-located notch.
 - b. Add cutouts in the top plate as needed. Ensure no metal shavings are allowed to fall into the IPC2.
 - c. Reinstall the top plate and secure it with the hardware retained in step a. For 36-in. deep Transformer Combo structures, ensure the top plate is installed with the notch located at the rear.

2. Install the conduit properly. Use hubs and ring connectors to protect the cables and prevent condensation on the conduit from entering the IPC2.

NOTE: If top entry, do not use the top of the IPC2 to support the weight of the conduit. Support the conduit independently.

Under seismic conditions, the top of the IPC2 can move as much as 3.00 in. (76 mm) in any direction. Any top incoming cables must accommodate this motion.

3. Bond all conduit, stubs, and ring connectors to the IPC2 enclosure with approved electrical connections.

IPC2 Top Plate Closing Plugs

A closing plug bag kit used to fill the four holes that result from the removal of the four top-located lifting eyebolts is provided with each structure. This kit is located inside the structure next to the front base channel. Install the closing plugs whenever the lifting eyebolts are removed. If additional plugs are needed, order kit number 80123-154-50 that includes four individual plugs.

Cable Pulling

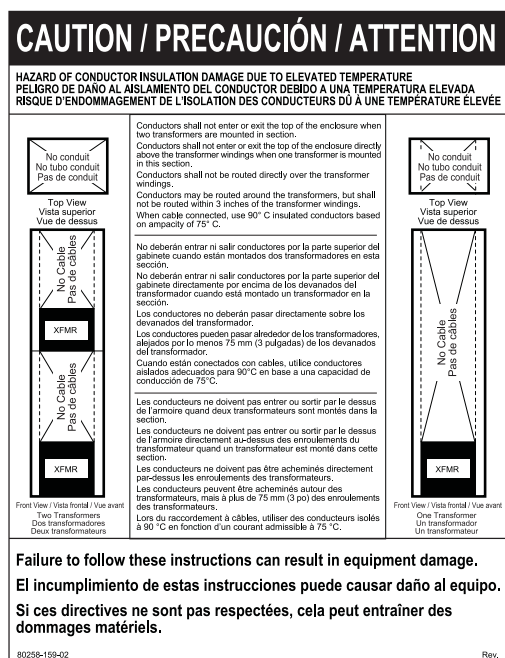
IPC2 units are constructed to customer specifications for the cable entrance arrangement (for example, top or bottom feed). IPC2 components are arranged to give proper cable clearance and bending space for cables entering or exiting the IPC2 as specified on the equipment drawing.

Figure 14: General IPC2 Danger Label

	⚠ DANGER	⚠ PELIGRO	⚠ DANGER
	HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH • Do not remove the horizontal barrier that separates the upper and lower compartments. • Do not route conductors directly over the transformer windings or core. • Do not route conductors that do not terminate at the transformer within 3" of the four sides of the transformer windings. • Always reliably route conductors to ensure there is no direct contact between the cables and the transformer core and coils. • Always use 90 Degree C Insulated Conductors based on ampacity of 75 degree C within Transformer Compartment. Failure to follow these instructions will result in death or serious injury.	PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO • No desmonte la barrera horizontal que separa los compartimientos superior e inferior. • No dirija los conductores directamente por encima de los devanados o núcleo del transformador. • No dirija los conductores que no se conectan a las terminales del transformador dentro de una distancia de 76 mm (3 pulg.) en los cuatro lados de los devanados del transformador. • Siempre dirija los conductores de manera fiable y asegúrese de que no haya contacto directo entre los cables y el núcleo, y las bobinas del transformador. • Use siempre conductores aislados adecuados para 90°C en base a una capacidad de conducción de 75°C dentro del compartimiento del transformador. El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.	RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC • Ne retirez pas la cloison horizontale qui sépare les compartiments supérieur et inférieur. • N'acheminez pas les conducteurs directement au-dessus des enroulements ou le noyau du transformateur. • N'acheminez pas les conducteurs qui ne se terminent pas au transformateur à moins de 75 mm (3 po) des quatre côtés des enroulements du transformateur. • Acheminez toujours les conducteurs de façon fiable afin d'assurer qu'il ne se produise aucun contact direct entre les câbles et le noyau ou les bobines du transformateur. • Utilisez toujours des conducteurs isolés à 90 °C en fonction d'une courant admissible de 75 °C dans le compartiment du transformateur. Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

1. Use only cable sizes suitable for a proper fit with the corresponding lugs.
2. Pull the proper number of line side and load side cables according to the load served and the NEC or CEC.
3. Position the cables inside the IPC2 so that they are not subject to physical damage.
4. Maintain the maximum possible bending radii and proper clearance to bus bars and grounded parts. If any cables are lying or bearing on structural members, support them to relieve this condition or place suitable protective material at the bearing point to protect the cable insulation. Additionally, when it is necessary to route feeder cables through the Transformer Combo transformer compartment, the installer must reliably route the cables as to ensure there is no direct contact between the cables and the transformer core or coils. **Do not** route cables directly over the transformer core or coils. Use of the cable support brackets on each side of the structure is recommended.
5. **Be certain to run all phase conductors, including the neutral, through the same opening where cables enter or leave the IPC2, or pass through any metal that has magnetic properties. Otherwise, overheating can result. See Section 300-20(a) of NEC.**
6. When instructed, brace or cable-lace the conductors.

Cable Terminations

Figure 15: Conductor Insulation
Caution Label

1. Use a proper insulation stripping tool to strip a length of insulation from the end of the cable sufficient to fit into the full length of the lug barrel. Be careful not to nick or ring the strands.
2. Thoroughly clean aluminum cable contact surfaces with a wire brush, or scrub them with an abrasive cloth to remove oxides and foreign matter.
3. Immediately apply an acceptable joint compound to the bare aluminum surfaces.
4. If compression-type lugs are furnished, unbolt and remove them to create sufficient room for crimping the lugs to the cables with the crimping tool.
 - a. Insert the cable into the lug barrel and, using the crimping tool, make the specified number of crimps per the manufacturer's recommendations.
 - b. Wipe excess joint compound from the connector and insulation.
 - c. With the cables connected, remount the lugs onto the bus bars or circuit breakers. Torque the bolts to the values given in "Section 9—Torque Values for Electrical Connections" on page 31.
5. Set screw-type lugs may be furnished as main incoming lugs and are standard on molded case circuit breakers. Torque these lugs **to, but do not exceed**, the specified values. Torque values for circuit breaker lugs are marked on these units. Torque values for other IPC2 lugs are marked on the IPC2.

Ground-Fault Protection for Equipment

⚠ WARNING

**LOSS OF EQUIPMENT
GROUND-FAULT PROTECTION**

Do not connect grounding conductors to any load neutral terminal(s).

Failure to follow these instructions can result in death or serious injury.

According to Section 230-95(c) of the NEC, "The ground-fault protection system shall be performance tested when first installed . . . A written record of this test shall be made and shall be available to the authority having jurisdiction."

Schneider Electric tests the factory-installed ground-fault system prior to shipment. However, improper grounding of the IPC2 and devices downstream at the job site will defeat the ground-fault system. Performance testing of the ground-fault system, as stated in the NEC, requires injecting sufficient current into the system to test the ground fault. High current injection by a certified testing organization will test the polarity of the ground-fault sensors, interconnection wiring, and proper bonding of the neutral.

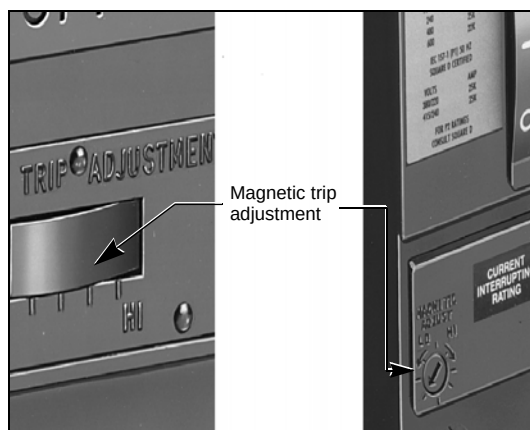
NOTE: Some equipment ground-fault systems require field connections at the job site. Consult the IPC2 interconnection wiring drawing for details.

Section 5—Pre-Energizing Checkout Procedure

Conduct a complete inspection **before** the IPC2™ is energized to ensure that all components function and operate properly. **Complete every step of the checkout procedure listed before energizing the IPC2.**

1. Check the ground bus bar connections. Torque values are listed in Table 3 on page 32.
2. Check all accessible connections for tightness.
3. Check all factory- and field-installed lug terminations for tightness.
4. Check the IPC2 enclosure for dents or other damage that reduces electrical clearances inside the IPC2.
5. Remove all foam blocks, or other temporary cushioning or retaining material, from the electrical devices.
6. Manually open and close all switches, circuit breakers, and other operating mechanisms, checking for correct alignment and free operation.
7. Operate all electrically operated switches, circuit breakers, and other devices equipped with remote operators (not under load). An auxiliary source of control power may be necessary to accomplish this.
8. Check all relays, meters, and instrumentation to verify that all field-installed wiring connections are made properly and that the devices function properly.
9. Current transformers (CTs) supplied for customer use require connection to a metering device load before energizing. Verify that the metering device load is properly connected, including main IPC2 connections to remote equipment.
10. All CT circuits supplied by Schneider Electric for customer metering use are shorted for shipment. Remove shorting terminal screws on shorting terminal blocks or jumpers and store in the block.
11. Factory-installed molded case circuit breakers, 250 A frames or larger, may have an adjustable magnetic trip, which is shipped on the "LO" setting. The markings between "LO" and "HI" settings represent a range of instantaneous magnetic trip values of 5–10 times the circuit breaker's continuous current rating. To provide coordinated operation during a fault, adjust the magnetic trip as outlined in the respective instruction bulletin. All poles are adjusted simultaneously, using a screwdriver, by the single setting (Figure 16).
12. On IPC2 units containing an electronic trip circuit breaker, set the tripping characteristic curve of the adjustable electronic trip unit per the job requirements, or as outlined in the respective instruction bulletin.
13. If ground-fault protection is furnished on molded case circuit breakers, refer to "Section 11—Reference Publications" on page 34 for information to obtain circuit breaker publications.
14. Inspect all cables to ensure the insulation has not been damaged in any fashion.
15. Verify that all grounding connections are correctly made. If the IPC2 is used as a service entrance, double check to see that the main bonding jumper is connected.

Figure 16: Instantaneous Trip Setting



CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not pry open or spread the fuse mounting clips. This can cause a loose connection, resulting in overheating.

Failure to follow these instructions can result in equipment damage.

16. Conduct an electrical insulation resistance (Megger®) test to ensure that the IPC2 is free from short circuits and undesirable grounds.
 - a. Open all control power and metering disconnects or remove the fuses from the control circuits.
 - b. Disconnect the neutral connection at any TVSS or other electronic device prior to performing the electrical insulation resistance test; reconnect to the device after the test.
 - c. With the neutral isolated from the ground and the power switches and circuit breakers open, conduct electrical insulation tests from phase-to-phase, phase-to-ground, phase-to-neutral, and neutral-to-ground. If the resistance reads less than one megohm while testing with the branch circuit breaker devices in the open position, the system may be unsafe and should be investigated. Consult Square D Services at 1-888-778-2733 (US) or 1-800-265-3374 (Canada) to help correct any problems.
17. Record resistance values. See “Section 10—IPC2™ Power Center Insulation Resistance Chart” on page 33.
18. After completing the electrical insulation resistance test, replace all control power fuses that may have been removed, and close power disconnects that have been opened.
19. Check all field-installed wiring. Make certain it is clear of all live parts, and when instructed, secured to withstand fault currents.

NOTE: MG-, MJ-, P-, and R-frame circuit breakers require cable lacing within the IPC2 unit. Follow lacing instructions provided with these circuit breakers.
20. Verify that all control wiring between sections is connected.
21. Vacuum to remove any dust, scrap wire, or other debris.
22. Replace all covers; check for any pinched wires, and close doors. Make certain all enclosure parts are aligned properly and securely fastened.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE OR INJURY

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating “Warning: Disconnect Plug Before Dielectric Test.”
- Some Micrologic® trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not use an air hose to blow out the IPC2. The dust may settle inside relays and overcurrent devices, causing overheating and improper operation.

Failure to follow these instructions can result in equipment damage.

Section 6—Energizing the IPC2™

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Correct short-circuit conditions detected during the checkout procedures described in “Section 5—Pre-Energizing Checkout Procedure”, beginning on page 24.
- Qualified electrical personnel must be present when energizing this equipment for the first time.
- Follow the instructions in this section to properly energize the IPC2.

Failure to follow these instructions will result in death or serious injury.

1. No load should be on the IPC2 when it is energized. Turn off all downstream loads.
2. Energize the IPC2 in the following sequence:
 - a. Turn on all control power disconnects before energizing the IPC2. Refer to the record drawings supplied with equipment to see if control power disconnects are supplied.
 - b. Close any open doors and/or covers.
 - c. Close the main device(s).
 - d. Close each branch circuit breaker or branch fusible switch.
 - e. Proceed to each panelboard and other downstream load.
3. After all overcurrent protective devices are closed, turn on all loads (e.g., lighting circuits, contactors, heaters, and motors).

Section 7—Maintaining the IPC2™

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Inspect and perform preventive maintenance only on IPC2 equipment to which power has been turned to the OFF position, disconnected, and electrically isolated (unless otherwise specified) so that no accidental contact can be made with energized parts.

Failure to follow these instructions will result in death or serious injury.

Periodic maintenance of the IPC2 includes cleaning, lubrication, and exercising component parts. The interval between maintenance checks can vary depending upon the amount of usage and environmental conditions of each installation. The maximum recommended inspection interval is one year. This definition for periodic maintenance applies throughout this bulletin, unless otherwise noted.

Always inspect the IPC2 after a fault. (Refer to “Section 8—Adverse Circumstances”, beginning on page 30.) Service bulletins for the various disconnecting and overcurrent devices mounted in the IPC2 are available through your local Schneider Electric field office.

General Inspection and Cleaning

The following danger label is applied to the IPC2 only when a breaker is installed in the bottom compartment of a transformer combo section.

Figure 17: Breaker in Bottom Compartment of Transformer Combo Section Danger Label

⚠ DANGER	⚠ PELIGRO	⚠ DANGER
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH - Identify the use of this breaker before working on or inside this equipment. - Turn off all power sources supplying this breaker and transformer. - Always use a properly rated voltage sensing device to confirm all power is off. Failure to follow these instructions will result in death or serious injury.	PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN, O DESTELLO POR ARQUEO - Identifique el uso de este interruptor automático antes de efectuar cualquier trabajo dentro o fuera de él. - Desconecte todas las fuentes de alimentación que suministran a este interruptor automático y transformador. - Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo. El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.	RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC - Identifiez l'utilisation de ce disjoncteur avant d'y travailler. - Coupez l'alimentation de toutes les sources alimentant ce disjoncteur et ce transformateur. - Utilisez toujours un dispositif de détection de tension à valeur nominale appropriée pour vous assurer que l'alimentation est coupée. Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

The following danger label is applied to the IPC2 at a control panel location.

Figure 18: Control Panel Danger Label

⚠ DANGER / PELIGRO / DANGER
 HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH The main or feeder disconnect(s) does not turn off control power and instrument circuits. Turn off Control / Instrument Circuit Disconnect(s) before working on or inside this equipment. Failure to follow these instructions will result in death or serious injury.
PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO Estos desconectadores principales o de alimentación no desconectan los circuitos de instrumentos ni de la alimentación de control. Desenergice el/los desconectador(es) de circuitos de instrumentos / control antes de realizar cualquier trabajo dentro o fuera del equipo. El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.
RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC Ces sectionneurs principaux ou de dérivation ne coupent pas l'alimentation de contrôle ni celle des circuits alimentant les appareils de mesure. Mettre en position d'arrêt les sectionneurs de contrôle / des circuits alimentant les appareils de mesure avant de travailler sur cet appareil. Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.
80258-663-03 REV

CAUTION
HAZARD OF EQUIPMENT DAMAGE - Do not use an air hose to blow out the IPC2. The dust may settle inside relays and overcurrent devices, causing overheating and improper operation. - Do not allow paint, chemicals, or petroleum-based solvents to contact plastics or insulating materials. Failure to follow these instructions can result in equipment damage.

1. Turn off all power supplying this equipment before working on or inside equipment.
2. If equipped with a breaker in the transformer section, identify the use of this breaker before working on or inside this equipment.
3. Always practice lock-out/tag-out procedures according to OSHA requirements.
4. Always use a properly rated voltage sensing device to confirm all power is off.
5. Vacuum the IPC2 interior to remove any dirt or dust deposits. Wipe all bus bars, insulators, cables, etc., with a clean, dry, lint-free cloth.
6. Check the IPC2 interior carefully for moisture, condensation build-up, or signs of any previous wetness. Moisture can cause insulation failures and rapid oxidation of current-carrying parts. Inspect all conduit entrances and cracks between the enclosure panels for dripping leaks. Condensation in conduits may be a source of moisture and must not be allowed to drip onto live parts or insulating material. Take the necessary steps to eliminate the moisture and seal off all leaks.
7. Inspect the IPC2 for any signs of overheating. Discoloration, flaking, and cracking of insulation or metal parts are indications of overheating.
Inspection of the cable insulation within the Transformer Combo transformer compartment is imperative.

NOTE: If overheating occurs, be sure that all conditions that caused the overheating have been corrected. Loose or contaminated connections can cause overheating.

8. Check for signs of rodent nesting in the IPC2. If required, use a good exterminating technique in the general area of the IPC2.
NOTE: Do not place or use exterminating substances and chemicals inside the IPC2. Some of these products attract rodents.
9. Carefully inspect all devices for any visibly worn-out, cracked, or missing parts.
10. Manually open and close switches and circuit breakers several times to verify they are working properly.
11. Verify that all locking mechanisms are working properly.

Panel Bus Bar Joints, Lug Terminations, and Insulating Materials

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Do not sand or remove plating on any bus bar, splice bar, or terminal lug.
- Damage to plating can result in overheating. Replace damaged part. Contact Square D Services at 1-888-778-2733 (US) or 1-800-265-3374 (Canada).

Failure to follow these instructions can result in equipment damage.

1. Do not retighten panel bus bar joints after the pre-energizing checkout procedure is complete.
2. Check all panel bus bar joints and terminal lugs for any pitting, corrosion, or discoloration resulting from high temperatures or subjection to high fault conditions. If any damage has occurred, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374 to help correct any problems. If cleaning is required, use Lectra-Clean®, made by CRC Industries, Inc.
3. Inspect all insulating materials. Before re-energizing the IPC2, replace insulators with any visible damage (such as cracks).

General Lubrication Information

For field maintenance re-lubrication of bus/plug-on connections, use Schneider Electric catalog number PJC7201 (Electric Joint Compound).

Automatic Transfer Switches

Consult the manufacturer's bulletin about these devices for all installation, operation, and maintenance instructions.

Circuit Breakers

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- If circuit breaker settings are adjusted, do not set the long time trip rating at a higher ampacity than the rating of the bus bar or load cables it supplies; overheating can occur.
- Before energizing the IPC2, all unused circuit breaker mounting spaces must be filled with blank fillers and/or extensions as listed in Table 1.

Failure to follow these instructions will result in death or serious injury.

Schneider Electric circuit breakers are designed and manufactured as totally sealed units requiring minimal periodic maintenance.

Exercise circuit breakers at least once a year to ensure proper operation. For general maintenance:

1. Trip the circuit breaker by pushing the Push-To-Trip or "Open" button located on the face of the circuit breaker. Refer to the appropriate circuit breaker bulletin for the specific location of this button.
2. Manually open and close the circuit breaker two to three times.

NOTE: Schneider Electric bulletin 0600DB9901 "Field Testing and Maintenance Guide for Micrologic® Electronic Trip and Thermal-magnetic Molded Case Circuit Breakers" provides more in-depth information. Refer to "Section 11—Reference Publications" on page 34 and contact your local Schneider Electric field office to obtain this bulletin.

Refer to individual circuit breaker instruction bulletins shipped with the IPC2 for additional maintenance information, such as changing rating columns or adjustable settings and removing circuit breakers. If the instruction bulletins are not available, see "Section 11—Reference Publications" on page 34, and contact your local Schneider Electric field office for information to obtain the appropriate bulletins.

CAUTION**HAZARD OF EQUIPMENT DAMAGE**

- Do not remove the protective lubricant on the plug-on connectors.
- If additional lubrication is required, apply a coating of electrical joint compound, catalog number PJC7201, to the plug-on connector's contact surfaces.

Failure to follow these instructions can result in equipment damage.

Table 1: Blank Fillers and Extensions

	Height	Catalog No.
NF Filler Plate	1.00 in. (25 mm)	EFP
NQOD Filler Plate	0.75 in. (19 mm)	QOFP
I-Line® Blank Fillers	1.50 in. (38 mm)	HNM1BL
	4.50 in. (114 mm)	HNM4BL
I-Line Blank Extensions	1.50 in. (38 mm)	HLW1BL
	4.50 in. (114 mm)	HLW4BL

3. The universal test set, Schneider Electric catalog number UTS3, is available to test all Schneider Electric circuit breakers equipped with Micrologic® trip units. It runs trip unit tests automatically, with prompts to the user for initial information. Test modules for each circuit breaker frame are used to store data necessary for automatic tests. Series B Micrologic trip units require test module CBTMB, which is included in UTS3.

Masterpact® and Powerpact® circuit breakers with Micrologic trip units require the full-function test set (catalog no. 533595) or hand-held test set (catalog no. 533594).

NOTE: Tests may be conducted with a circuit breaker installed in the IPC2; removing the circuit breaker is not required. The IPC2 must be de-energized.

Ground-Fault Protection for Equipment

Check the terminal connections on the equipment ground-fault protection system at least once a year for tightness and corrosion. If the system can be tested with or without tripping the main or branch device, directions for testing the system are in the device bulletin. Otherwise, testing the equipment ground-fault protection system will trip the main or branch device to which it is connected. If the equipment ground-fault sensor or relay is physically or electrically damaged, replace it.

If the ground-fault protection system does not operate properly and additional equipment has been connected to the installation since the last maintenance test/check, de-energize the entire system and check for grounds on the neutral downstream from the main bonding jumper. If no downstream grounds are detected and the equipment ground-fault system is not operating properly, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374.

Refer to Schneider Electric bulletin 0600DB9901 *“Field Testing and Maintenance Guide for Micrologic® Electronic Trip and Thermal-magnetic Molded Case Circuit Breakers”* for additional testing information. If the bulletin is not available, refer to “Section 11—Reference Publications” on page 34 and contact your local Schneider Electric field office to obtain the bulletin.

Other Manufacturers’ Devices

Consult the manufacturers’ bulletins about these devices for all installation, operation, and maintenance instructions.

Section 8—Adverse Circumstances

This section includes, but is not limited to, all electrical components of the IPC2™.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm all power is off.
- Before energizing the IPC2, all unused circuit breaker mounting spaces must be filled.

Failure to follow these instructions will result in death or serious injury.

NOTE: Before attempting to re-energize the IPC2 following an adverse circumstance, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374, for special instructions.

Inspection Following a Short Circuit

High mechanical and thermal stresses developed by short circuit currents may damage conductors and insulation. If a short circuit occurs, make a thorough inspection of the entire system and verify that no damage to conductors or insulation has occurred. Check the overcurrent protection device that interrupted the short circuit current for possible arcing damage.

Do not open sealed devices, such as molded case circuit breakers. These devices should be replaced if damaged. Before energizing the IPC2, all unused circuit breaker mounting spaces must be filled. For more information about these devices and to obtain the appropriate bulletin, refer to "Section 11—Reference Publications" on page 34.

Clean-up Following a Short Circuit

The insulating properties of some organic insulating materials may deteriorate during an electrical arc. If so:

1. Remove any soot or debris.
2. Replace carbon-tracked insulation.

Water-Soaked Equipment

Do not clean or repair an IPC2 that has been exposed to large volumes of water or submerged at any time. Current-carrying parts, insulation systems, and electrical components may be damaged beyond repair. Do not energize the IPC2. Contact Square D Services, and also refer to Square D Data Bulletin 0110DB0401R9/05.

Water-Sprayed or Splashed Equipment (Clean Water Only)

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm all power is off.

Failure to follow these instructions will result in death or serious injury.

Inspection and Clean-up of Clean Water Sprayed
or Splashed Equipment**⚠ CAUTION****HAZARD OF EQUIPMENT DAMAGE OR INJURY**

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating "Warning: Disconnect Plug Before Dielectric Test."
- Some Micrologic trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

If the IPC2 has been sprayed or splashed with small amounts of clean water, make a thorough inspection of the entire system and verify that no damage to conductors or insulation has occurred. Do not open sealed devices such as molded case circuit breakers or fuses. These devices should be replaced if damaged. For more information about these devices and to obtain the appropriate instruction bulletin, refer to "Section 11—Reference Publications" on page 34.

Follow the steps below only if:

- No signs of physical damage to the equipment are present.
- The IPC2 has not been submerged or exposed to water for long periods of time.
- The water that has been in contact with the IPC2 has not been contaminated with sewage, chemicals, or other substances that can negatively affect the integrity of the electrical equipment.
- The water that has been in contact with the IPC2 has not entered any area of the enclosure that may contain wiring located above any live part. Specifically, inspect for water entering through conduits located above live parts.

If any of these conditions have not been met, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374.

1. Turn off all power supplying this equipment before working on or inside the equipment.
2. Always use a properly rated voltage sensing device to confirm all power is off.
3. Disconnect and electrically isolate the IPC2 so no contact can be made with energized parts.
4. Wipe off all moisture from the panel bus, insulators, and insulating material with a clean, dry, lint-free cloth. Do not use cleaning agents or water displacement sprays.
5. Prepare the IPC2 for insulation resistance (Megger®) testing by disconnecting all line-side supply connections and all load-side cable connections to isolate the IPC2 from the wiring system.
6. Turn all circuit breakers or switches to the ON position. The IPC2 must remain completely de-energized.
7. Use a megohmmeter with a capacity of 500–1000 Vdc, and apply voltage from:
 - a. each phase-to-ground with circuit breaker on
 - b. phase-to-phase with circuit breaker on
8. Record resistance values. See "Section 10—IPC2™ Power Center Insulation Resistance Chart" on page 33.
9. If resistance measurements are less than 1.0 megohm, call Square D Services for recommendations.
10. If resistance measurements are greater than 1.0 megohm, the equipment can be energized using the procedures listed in "Section 6—Energizing the IPC2™" on page 26.

Section 9—Torque Values for Electrical Connections

Table 2: Multiple Conductor Neutral and/or Ground Terminal

Screw Type	Lug Wire Range	Conductor Size	Torque Value
Slotted Head	14–4	14-10 Cu, 12-10 Al	20 lb-in (2.25 N•m)
		8 Cu-Al	25 lb-in (2.8 N•m)
		6-4 Cu-Al	35 lb-in (3.9 N•m)
	14–1/0	14-8 Cu-Al	36 lb-in (4 N•m)
		6-1/0 Cu-Al	45 lb-in (5.08 N•m)
Socket Head	14–1/0	All	100 lb-in (11.3 N•m)
	6–300 kcmil	All	275 lb-in (31 N•m)

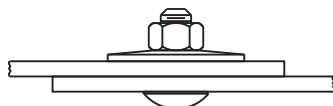
Table 3: Incoming, Branch, Neutral, and Ground Lugs

Socket Size Across Flats	Torque Value
1/8 in.	45 lb-in (5 N•m)
5/32 in.	100 lb-in (11 N•m)
3/16 in.	120 lb-in (13 N•m)
7/32 in.	150 lb-in (17 N•m)
1/4 in.	180 lb-in (20.3 N•m)
5/16 in.	250 lb-in (28.2 N•m)
3/8 in.	340 lb-in (38.4 N•m)
1/2 in.*	450 lb-in (50.8 N•m)
9/16 in.	600 lb-in (68 N•m)

* 1/2 in. lug marked with 620 lb-in (70 N•m) should be torqued as such.

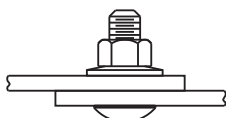
Table 4: Contactors, Terminal Block Conductor, and Torque Data

Device	Conductor Type	Lug Torque
Square D Class 8903 Contactor Types		
LO/LX 20—1200	Cu only, 75° C rated minimum	20 lb-in (2.25 N•m)
SMO1, 2, 3, 4, 10, 11, 12, 13		20 lb-in (2.25 N•m)
SVO1, 2, 3, 4, 10, 11, 12	Cu–Al, 75° C rated minimum	275 lb-in (31 N•m)
SPO1, 2, 3, 4, 10, 11, 12, 13		50 lb-in (6 N•m)
SQO1, 2, 3, 4, 10, 11, 12, 13		80 lb-in (9 N•m)
Square D Class 8910 Contactor Types		
DPA 32, 33, 34	Cu only, 75° C rated minimum	18 lb-in (2 N•m)
Square D Class 9080 Terminal Blocks		
GR6	Cu only, 75° C rated minimum	18–20 lb-in (2 N•m)
GC6		32–35 lb-in (4 N•m)

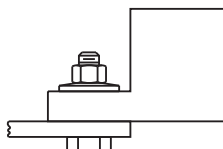


Carriage bolt
Hex nut
Conical washer

Hardware Description	Torque Value
1/2 in.	720–840 lb-in (81–95 N•m)



Carriage bolt
Conical washer assembly
(Keps nut)



Hex head bolt
Conical washer assembly
(Keps nut)

Hardware Description	Torque Value
1/4 in.	50–75 lb-in (6–8 N•m)
5/16 in.	80–125 lb-in (9–14 N•m)
3/8 in.	175–225 lb-in (20–25 N•m)
1/2 in.	250–350 lb-in (28–40 N•m)



Hex head bolt
(2) Conical washers

Hardware Description	Torque Value	
	Conical Washer OD	Hex Head Bolt (2) Conical Washers
5/16 in.	0.90 in. (23 mm)	145–160 lb-in (16–18 N•m)
3/8 in.	0.87 in. (22 mm)	250–280 lb-in (28–32 N•m)
	1.00 in. (25 mm)	130–150 lb-in (15–17 N•m)
1/2 in.	1.25 in. (32 mm)	720–840 lb-in (81–95 N•m)
	2.25 in. (57 mm)	
	3.00 in. (76 mm)	

⚠ DANGER

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm all power is off.

NOTE: The Neutral–Ground column is provided to record the results of the pre-energizing checkout procedure only.

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Section 11—Reference Publications

Schneider Electric publications are available through your local Schneider Electric field office. These publications include device replacement procedures and spare parts listings to make ordering and servicing of replacement parts quick and convenient.

Contact the nearest Schneider Electric field office for information in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374. Or, refer to the Technical Library at <http://ecatalog.squared.com/techlib/> to obtain the appropriate publications.

For information about obtaining NEMA documents, write to:

National Electrical Manufacturers Association (NEMA)
Attention: Customer Service
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209

Other Reference Publications	Publication Number
General Instructions for Proper Installation, Operation, and Maintenance of Switchboards Rated 600 V or Less	NEMA Publication PB2.1
Application Guide for Ground-Fault Protective Devices for Equipment	NEMA Publication PB2.2
Circuit Breakers	NEMA Publication AB-4
Enclosed and Miscellaneous Distribution Switches	NEMA Publication KS-1
Electrical Equipment Maintenance	NFPA 70B-1999

**Integrated Power Center 2 (IPC2™)
Instruction Bulletin**

Schneider Electric
105 Summit Park Drive
Salisbury, NC 28146 USA
1-888-SquareD
(1-888-778-2733)
www.schneider-electric.us

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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Integrated Power Center 2 (IPC2™) Application Guide

Class 2230

Retain for future use.

Introduction

Square D® Integrated Power and Control Solutions (IPaCS) integrates electrical distribution and controls in a factory assembled and pre-wired solution. Designed with the flexibility to meet individual customer requirements, Integrated Power Center 2 (IPC2™) enclosures are available with NQ®, NF, and I-Line® panelboard interiors and distribution dry transformers.

Optional distribution and control equipment include Powerlink® lighting control, contactors, PowerLogic monitoring and metering, automatic transfer switches, and transient voltage surge suppressors (TVSS). IPC2 solutions can be further customized to include third party components such as building management systems.

All IPC2 sections are available in Type 1, Type 1 with driphood, or Type 3R enclosures. IPC2 equipment is listed to UL891.



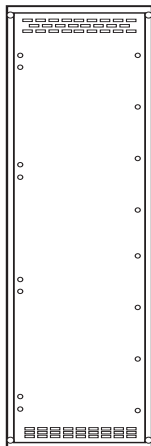
The 42-circuit limitation for Lighting and Appliance Panelboards has been removed from Article 408 of the 2008 National Electrical Code® (NEC®) edition. If the 2008 NEC edition has not been adopted for use in your area, you are still required to adhere to the 42-circuit rule for Lighting and Appliance panelboards.

Figure 1: Integrated Power Center 2 (IPC2™)



Full Height or Stacked Equipment Space

Figure 2: Equipment Space
24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



Equipment Space—1/2 Height or Full Height

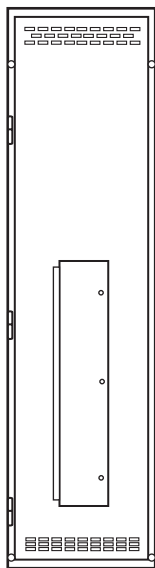
- Backplate size 17.75 in. w x 40.75 in. h
- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

Full Height NQ or NF Panelboard

Figure 3: NQ—Full Height
24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

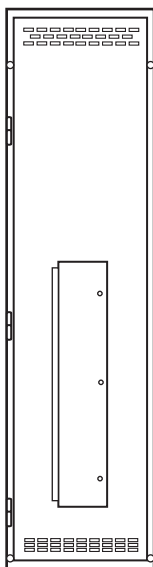
NQ—Full Height

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breakers (225 A max.)
 - Sub-feed lugs
 - TVSS
- 400 A max. MLO, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed lugs
- 600 A max. MLO, 42, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breakers (225 A max.)
 - TVSS
- 600 A max. MLO, 84 circuits
 - Option: Feed-through lugs
- 400 A max. vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breakers (225 A max.), not available with 200% neutral
 - TVSS
- 400 A max. vertical Main circuit breaker, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - TVSS
- 400 A max. vertical Main circuit breaker, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs

Figure 2 (cont.)



- 600 A max. vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - TVSS
- 600 A max. vertical Main circuit breaker, 54, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs

NF Full Height or NF Powerlink G3 Full Height

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

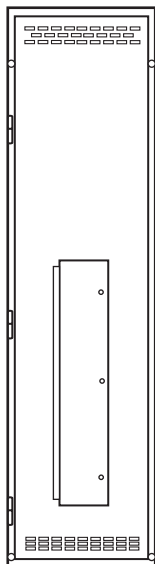
- 250 A MLO, 42, 54, 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breakers (250 A max.)
 - Sub-feed lugs
 - TVSS (54 circuits max.)
- 400 A MLO, 42, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breakers (250 A max.)
 - Sub-feed lugs
 - TVSS
- 400 A MLO, 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lug
- 400 A MLO, 84 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 600 A MLO, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breakers (250 A max.)
 - TVSS



250 A NF MLO or Main circuit breaker:
An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

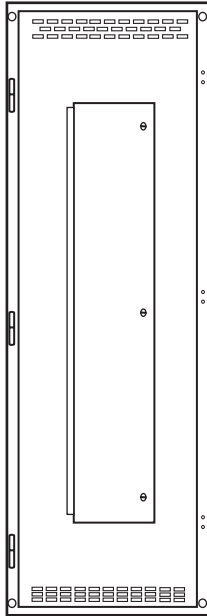
Figure 2 (cont.)



- 600 A MLO, 54, 66, 84 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Options: None
- 250 A max. Main circuit breaker, 42, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breakers (250 A max.)
 - TVSS
- 250 A max. Main circuit breaker, 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Feed-through lugs
- 400 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breakers (250 A max.)
 - Feed-through lugs
 - TVSS
- 400 A max. Main circuit breaker, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Feed-through lugs
- 600 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breakers (250 A max.)
 - Feed-through lugs
 - TVSS
- 600 A max. Main circuit breaker, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- NF Powerlink G3 Master 600 A MLO, or a Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 600 A MLO, or a Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Full Height Single Row I-Line Panel

Figure 3: 30 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



HCP-SU Single Row I-Line

SCCR 10–200 kA

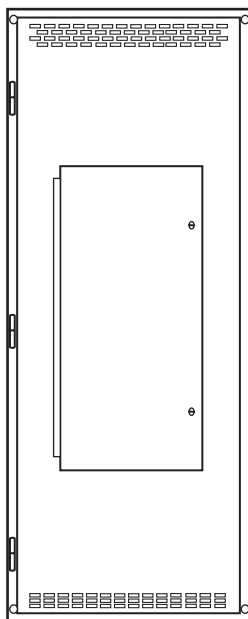
600 Vac max.

Single Row Mounting

- 800 A max. MLO with 54-in. circuit breaker mounting space without a Main Lug kit
 - Feeder circuit breaker: 600 A
 - Options:
 - Non Linear (200% neutral), 400 A max.
 - Sub-feed lugs
 - TVSS
- 800 A max. Back-Fed MCB with 54-in. circuit breaker mounting space without a Main circuit breaker
 - Feeder circuit breaker: 600 A
 - Options:
 - Non Linear (200% neutral), 400 A max.
 - Sub-feed lugs
 - TVSS

Full Height HCM, I-Line Panel

Figure 4: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



HCM I-Line

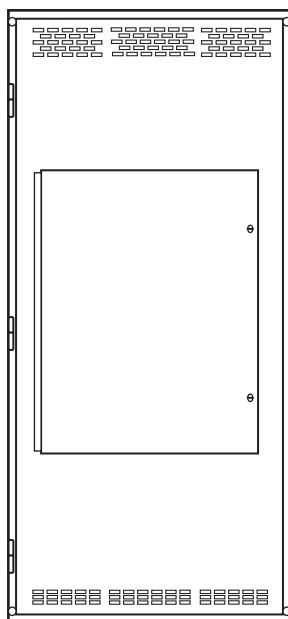
SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A max. MLO with 99-in. circuit breaker mounting space
 - Feeder circuit breaker: 250 A max.
 - Options:
 - Sub-feed lugs
 - TVSS
- 800 A max. Vertical Main circuit breaker with 36-in. circuit breaker mounting space
 - Feeder circuit breaker: 250 A max.
 - Options:
 - Sub-feed lugs
 - TVSS

Full Height HCP, I-Line Panel

Figure 5: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



HCP I-Line

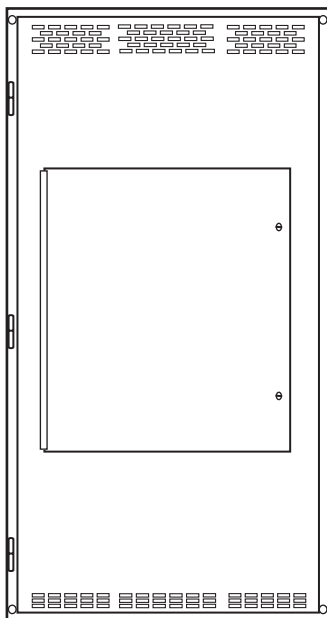
SCCR 10–200 kA

600 Vac max., double-row mounting

- 1200 A max. MLO with 99-in. max. circuit breaker mounting space
 - Feeder circuit breaker: 800 A max.
 - Options:
 - Sub-feed lugs
 - TVSS
- 800 A Main circuit breaker (Backfed) with 99-in. max. circuit breaker mounting space without a Main circuit breaker
 - Feeder circuit breaker: 800 A max.
 - Options:
 - Sub-feed lugs
 - TVSS

Full Height HCR-U, I-Line Panel

Figure 6: 48 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



HCR-U I-Line

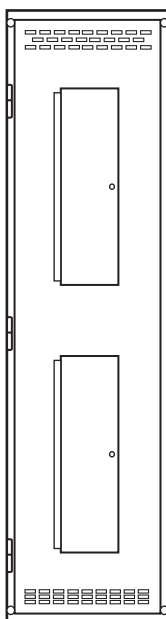
SCCR 10–200 kA

600 Vac max., double-row mounting

- 1200 A MLO, max. with 108-in. max. circuit breaker mounting space without the Main Lug Kit
 - Feeder circuit breaker: 1200 A max.
 - Options:
 - Non Linear (200% neutral)
 - Sub-feed lugs
 - TVSS
- 1200 A max., Main circuit breaker (Backfed), with 108-in. max. circuit breaker mounting space without a Main circuit breaker
 - Feeder circuit breaker: 1200 A max.
 - Options:
 - Non Linear (200% neutral)
 - Sub-feed lugs
 - TVSS

Stacked NQ/NF Panels

Figure 7: 24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO—max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs, not available with 200% neutral
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs), and 1–225 A max. MLO, 42 circuit interiors (Options: None)



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Stacked or NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

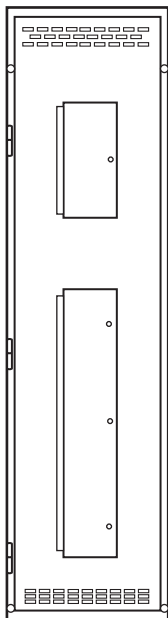


100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

Stacked NQ or NF Panelboard

Figure 8: 24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ Stacked Top (1/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 100 A MLO, max. 18 circuits
 - Branch circuit breakers: 100 A max.
 - Options: None
- 100 A, Main circuit breaker (Backfed), max. 15 circuits
 - Branch circuit breakers: 100 A max.
 - Options: None

NQ Stacked Bottom (3/4 Height)

SCCR 10–200 kA

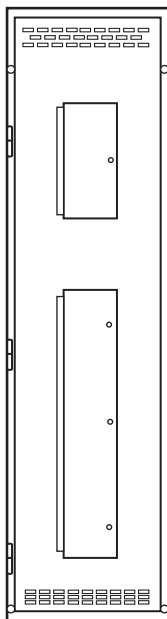
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 225 A MLO, max. 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 600 A MLO, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 225/250 A max. Vertical Main circuit breaker, 42 circuits max.
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 250 A max. Vertical Main circuit breaker, 54, 72 circuits max.
 - Branch circuit breakers: 150 A max.
 - Options: None



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Figure 8 (cont.)



250 A NF MLO or Main circuit breaker:
An optional 200% rated neutral is
available in combination with any of the
options listed.

300–400 A NF MLO or Main
circuit breaker: An optional 200% neutral
can not be combined with any other
option in this configuration.

NF Stacked Bottom or NF Powerlink G3 Stacked Bottom

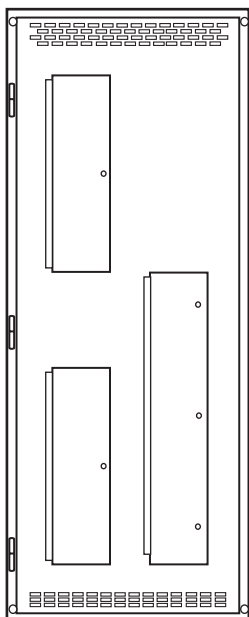
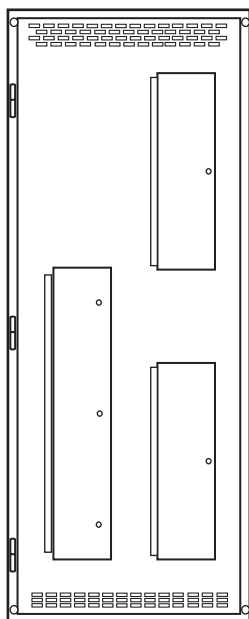
SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF
Powerlink G3 480Y/277 Vac 3Ø4W max.

- 250 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Side-by-Side NQ Panelboard

Figure 9: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



For max. quantity of contactors see the "Appendix" on page 78.

NQ Side-by-Side—NF not permitted

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO 42, 54, 72, 84 circuits max.
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed circuit breaker (225 A max.)
 - Sub-feed lugs
 - TVSS
- 225/250 A Vertical Main circuit breaker, 42, 54, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits, top or bottom
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

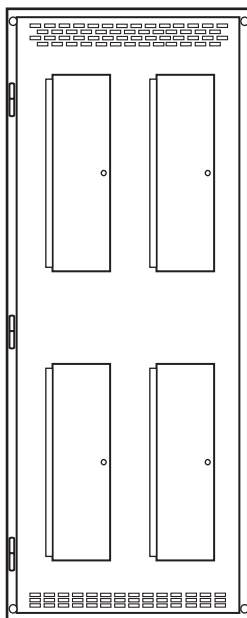
Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Side-by-Side Stacked NQ Panelboard

Figure 10: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ Stacked—NF not permitted

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits, top or bottom
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

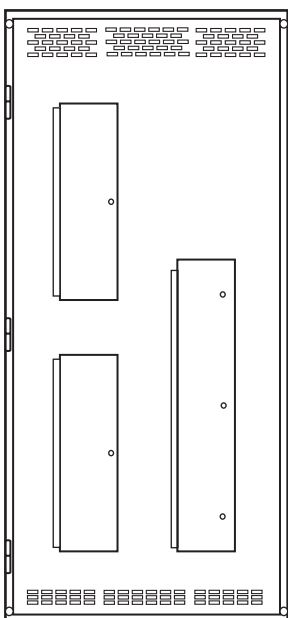
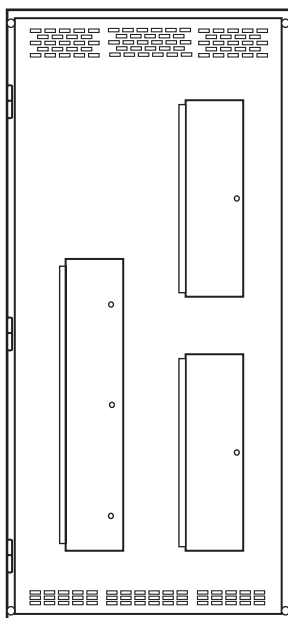
- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

Side-by-Side NF Panelboard

Figure 11: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NF Stacked or NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

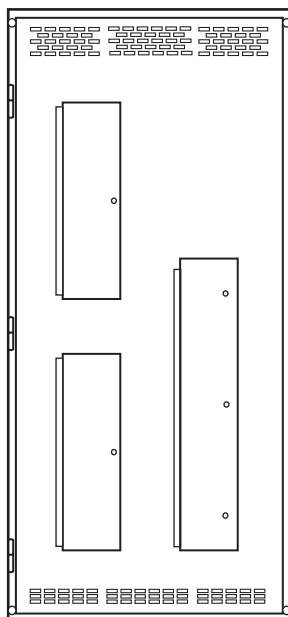
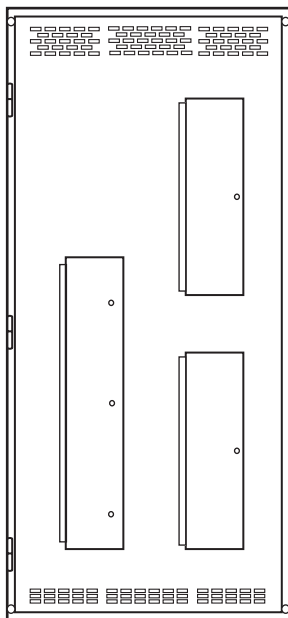
NF Side-by-Side or NF Powerlink G3 Side-by-Side

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- 250 A MLO 42, 54, 66, 84 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breaker (250 A max.)
 - Sub-feed lugs
 - TVSS

Figure 11 (cont.)

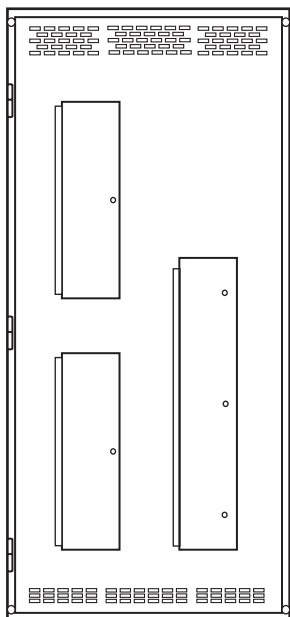
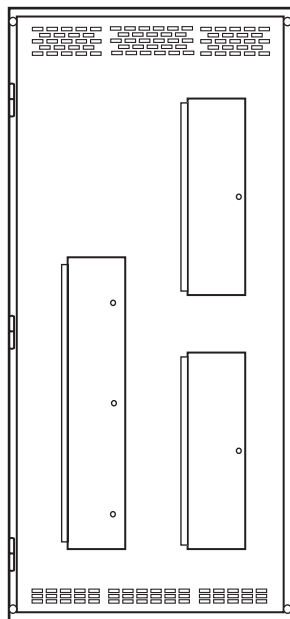


250 A NF MLO or Main circuit breaker:
An optional 200% rated neutral is
available in combination with any of the
options listed.

300–400 A NF MLO or Main
circuit breaker: An optional 200%
neutral can not be combined with any
other option in this configuration.

- 400 A MLO 42, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
 - Sub-feed lugs
 - TVSS
- 400 A MLO 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers are not available in this circuit count
 - Option: Sub-feed lugs
- 400 A MLO 84 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 600 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
 - Sub-feed lugs
 - TVSS
- 600 A MLO 54, 66, 84 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers are not available in 66 or 84 circuit interiors
 - Options: None
- 250 A Main circuit breaker, 42, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (250 A max.)
 - TVSS
- 250 A Main circuit breaker, 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers are not available in this circuit count
 - Option: Feed-through lugs

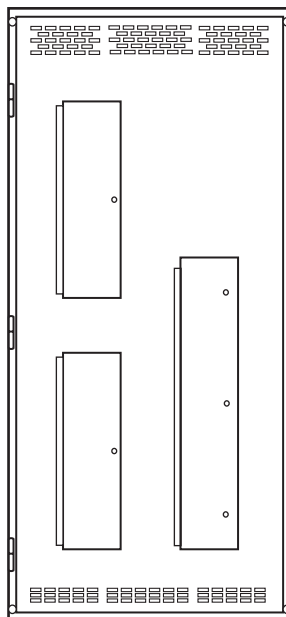
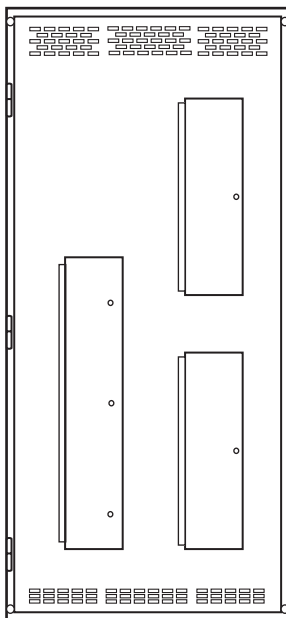
Figure 11 (cont.)



- 400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
 - TVSS
- 400 A Main circuit breaker, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Feed-through lugs
- 600 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
 - TVSS
- 600 A Main circuit breaker, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- NF Powerlink G3 Master 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Master 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Side-by-Side NQ Panelboard

Figure 12: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO 42 circuits, top or bottom
 - Branch circuit breakers: 150 A max.
 - Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

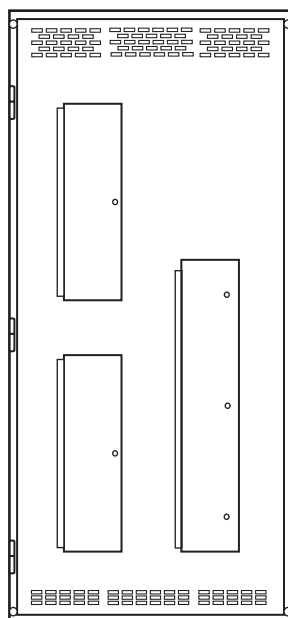
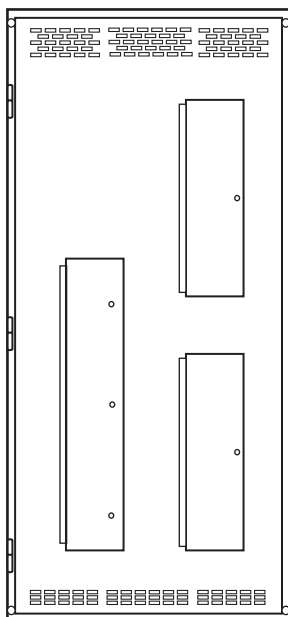
NQ Side-by-Side

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A MLO, 42, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed circuit breaker (225 A max.)
 - Sub-feed lugs
 - TVSS

Figure 12 (cont.)



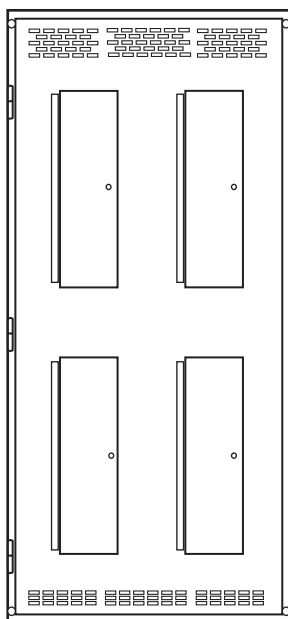
- 400 A MLO, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 600 A MLO, 42, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed circuit breaker (225 A max.)
 - Feed-through lugs
 - TVSS
- 600 A MLO, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 400 A Main circuit breaker, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - TVSS
- 400 A Main circuit breaker, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 600 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - TVSS
- 600 A Main circuit breaker, 54, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Stacked NQ, NF, or NF Powerlink G3 Panelboard

Figure 13: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits, top or bottom
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Stacked or NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W

- NF 400 A MLO, max. 42 circuits, top or bottom
 - Branch breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.)
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Same options as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Same options as NF panel



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

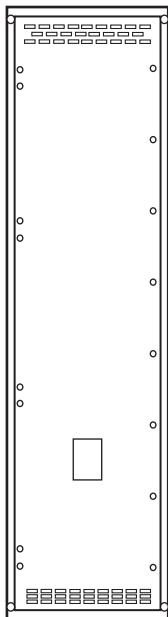
- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

Automatic Transfer Switch Section

Figure 14: 24 in. w x 91.5 in. x 24 in. d
ATS/Individually-Mounted Circuit
Breaker
Type 1 Enclosure



Stacked Automatic Transfer Switch (1/2 Height)

SCCR 10–65 kA (240 Vac)

SCCR 10–65 kA (480Y/277 Vac)

SCCR 10–50 kA (600Y/347 Vac)

600Y/347 Vac 3Ø4W, or 480Y/277 Vac 3Ø4W, or 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

ATS Ampere ratings 30–400 A with or without switched neutral

Options:

- Programmable Engine Exerciser (11BG)
- Two Utility and two Generator auxiliary contacts (14 AA/14 BA)
- Strip heater with Thermostat (External 120 Volt power source) (44 A)
- Strip heater with Thermostat (Internal Power Source) (44 G)
- Transfer to emergency alarm horn and silence switch (City of Chicago) includes 11BG (62W)
- Serial module (RS-485 interface) (72 A)
- Connectivity Module (Ethernet TCP/IP network) (72E)
- Surge Suppressor
 - (73VN1) for Utility, 1 required—240 volts, 1 phase
 - (73VB1) for Utility and Generator, 2 required—240 volts, 1 phase
 - (73VN3) for Utility, 1 required—208 volts, 3 phase
 - (73VB3) for Utility and Generator—2 required 208 volts, 3 phase

Individually Mounted Circuit Breakers (1/2 Height)

SCCR 10–100 kA

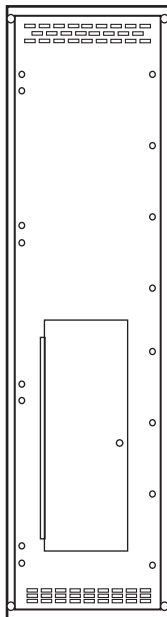
15–800 A circuit breaker trip rating; 600 Vac max.

Circuit breaker options:

- 120 Vac shunt trip
- Handle padlock attachment

Stacked Automatic Transfer Switch—Stacked NF or NQ

Figure 15: 24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



Automatic Transfer Switch (1/2 Height)

SCCR 10–65 kA (240 Vac)

SCCR 10–65 kA (480Y/277 Vac)

SCCR 10–50 kA (600Y/347 Vac)

600Y/347 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or
120/240 Vac 1Ø3W

ATS Ampere ratings 30–400 A with or without switched neutral

Options:

- Programmable Engine Exerciser (11BG)
- Two utility and two generator auxiliary contacts—14 AA/14 BA
- Strip heater with Thermostat (External 120 Volt power source) (44 A)
- Strip heater with Thermostat (Internal Power Source) (44 G)
- Transfer to emergency alarm horn and silence switch (City of Chicago) includes 11BG (62W)
- Serial module (RS-485 interface) (72 A)
- Connectivity Module (Ethernet TCP/IP network) (72E)
- Surge Suppressor
 - (73VN1) for Utility, 1 required—240 volts, 1 phase
 - (73VB1) for Utility and Generator, 2 required—240 volts, 1 phase
 - (73VN3) for Utility, 1 required—208 volts, 3 phase
 - (73VB3) for Utility and Generator—2 required 208 volts, 3 phase

Equipment Space (1/2 Height)

Backplate size 17.75-in. w x 40.75-in. h

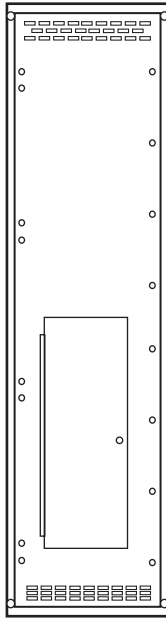
Short circuit current rating (SCCR), see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

Figure 15 (cont.)



NQ Stacked Combination

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits, top or bottom
 - Branch circuit breakers: 150 A max.
 - Options: Sub-feed lugs
- 250 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Stacked Combination or NF Powerlink G3 Stacked Combo

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: Sub-feed lugs
- NF Powerlink G3 Master, 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave, 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

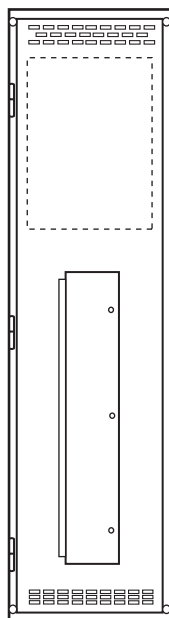


100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

Stacked Equipment Space

Figure 16: 24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space (1/4 Height)

Backplate size 17.5 in. w x 20.38 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

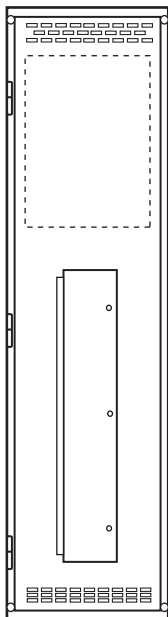
NQ Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225 A MLO, max. 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 600 A MLO, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 225/250 A max. Vertical Main circuit breaker, 42 circuits max.
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 250 A max. Vertical Main circuit breaker, 54, 72 circuits max.
 - Branch circuit breakers: 150 A max.
 - Options: None

Figure 16 (cont.)



250 A NF MLO or Main circuit breaker:
An optional 200% rated neutral is
available in combination with any of the
options listed.

300–400 A NF MLO or Main
circuit breaker: An optional 200%
neutral can not be combined with any
other option in this configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination

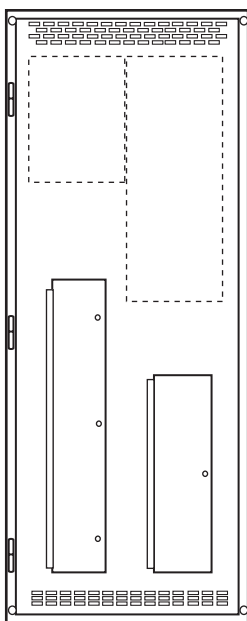
SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W

- 250 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 250 A MLO, max. 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

NQ Stacked Combination

Figure 17: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



For max. quantity of contactors see “Appendix” on page 78.

Equipment Space— Left (1/4 Height)

Backplate size 13.75 in. w x 20.38 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination— Left (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits max.
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 225 A max. MLO, 72, 84 circuits max.
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 225/250 A max. Main circuit breaker, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Equipment Space— Right (1/2 Height)

Backplate size 13.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks.

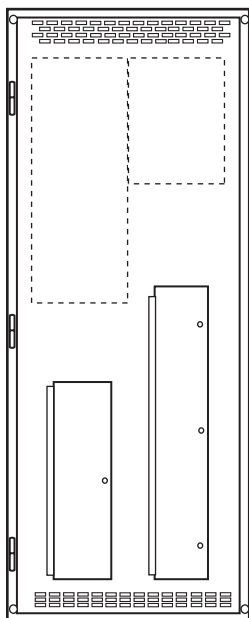
NQ Stacked Combination— Right (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Figure 18: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60 A–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



For max. quantity of contactors see “Appendix” on page 78.

Equipment Space— Left (1/2 Height)

Backplate size 13.75 in. w x 40.75 in. h
SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination 1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits max.
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Equipment Space— Right (1/4 Height)

Backplate size 13.75 in. w x 20.38 in. h
SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

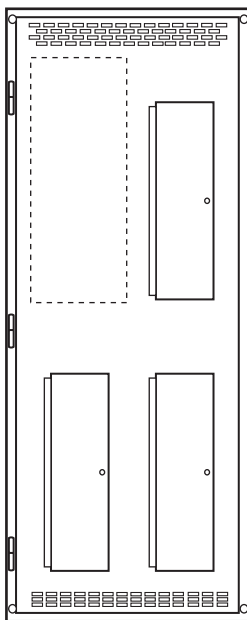
NQ Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 225 A max. MLO, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 225/250 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 225/250 A max. Main circuit breaker, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Figure 19: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60 A–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



For max. quantity of contactors see “Appendix” on page 78.

Equipment Space— 1/2 Height—Left

Backplate size 13.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

NQ Stacked—Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits, top or bottom
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 250 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

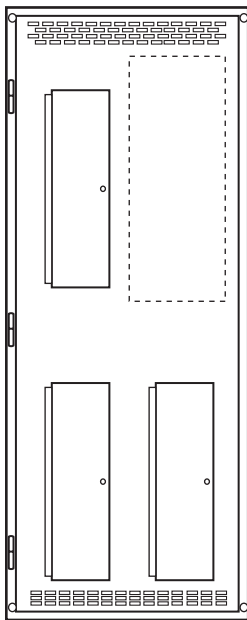
NQ Stacked Combination—Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42/54 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

Figure 20: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60 A–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked Combination—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

NQ Stacked Combination—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

Equipment Space— 1/2 Height—Right

Backplate size 13.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked—Right

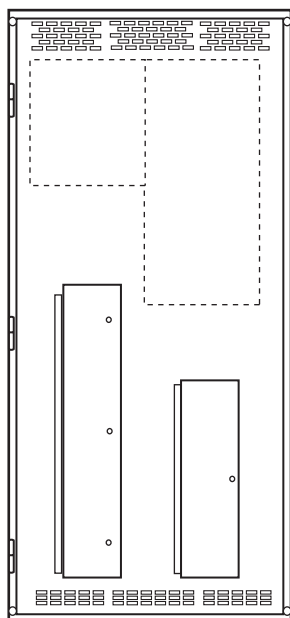
SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits, top or bottom
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

NQ, NF, or NF Powerlink G3 Stacked Combination

Figure 21: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



For max. quantity of contactors see “Appendix” on page 78.

Equipment Space—Left (1/4 Height)

Backplate size 17.75 in. w x 20.38 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 225 A max. MLO, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 400 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 225/250 A Vertical Main circuit breaker, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Option: None

Equipment Space—Right (1/2 Height)

Backplate size 17.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

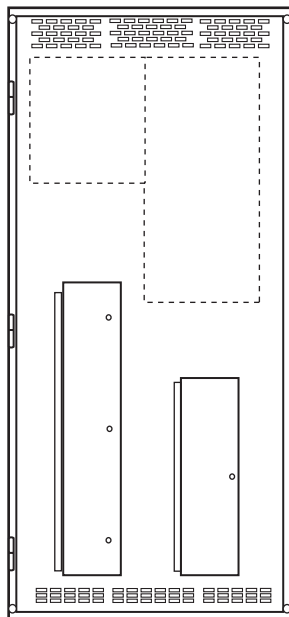
NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Figure 21 (cont.)



100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% rated neutral can not be combined with any other option in this configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 250 A max. MLO, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- NF 250 A max. MLO, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF 400 A max. MLO, 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Same options as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Same options as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Same options as NF panel
- NF Powerlink G3 Slave 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Same options as NF panel

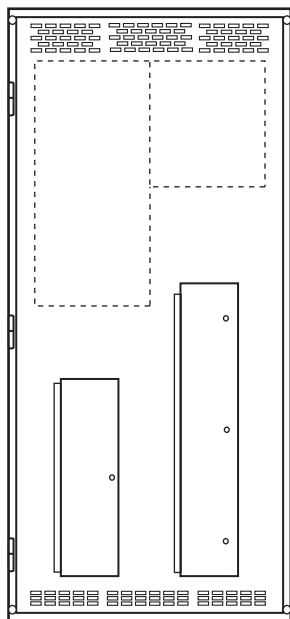
NF Stacked Combination or NF Powerlink G3 Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Figure 22: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



For max. quantity of contactors see “Appendix” on page 78.

Equipment Space—Left (1/2 Height)

Backplate size 17.75 in w x 40.75 in h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and, mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Equipment Space—Right (1/4 Height)

Backplate size 17.75 in w x 20.38 in h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and, mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

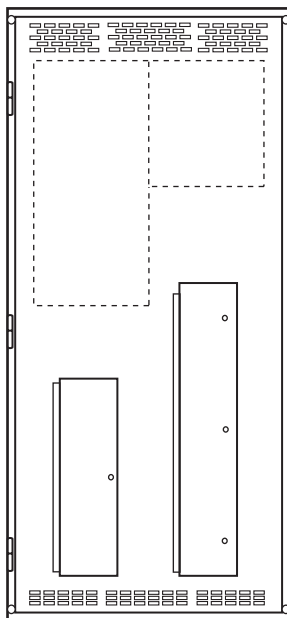
NQ Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Through-feed lugs
 - Sub-feed Circuit Breaker (225 A max.)
 - TVSS
- 225 A max. MLO, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 400 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: Feed-through lugs
- 225/250 A Vertical Main circuit breaker, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Figure 22 (cont.)



100 A–250 A NF MLO
 or Main circuit breaker:
 An optional 200% rated
 neutral is available in
 combination with any of
 the options listed.

300 A–400 A NF MLO
 or Main circuit breaker:
 An optional 200%
 neutral can not be
 combined with any other
 option in this
 configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A max. MLO, 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

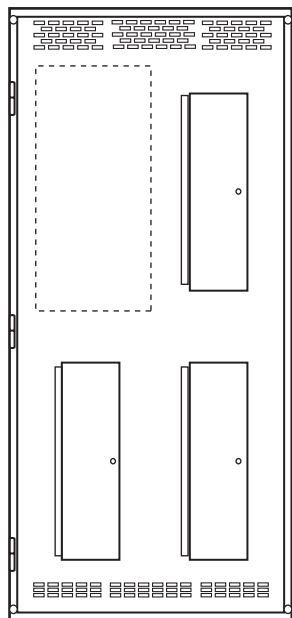
NF Stacked Combination or NF Powerlink G3 Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 250 A max. MLO, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- NF 250 A max. MLO, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF 400 A MLO, max. 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 250 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Figure 23: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral in combination with any of the options listed.



100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.



For max. quantity of contactors see “Appendix” on page 78.

Equipment Space—Left (1/2 Height)

Backplate size 17.75-in w x 40.75-in h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and, LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max., Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

NF/NF Powerlink G3 Stacked Combination (1/2 Height)

SCCR 10 kA–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

NQ Stacked—Right (top or bottom)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: Two (2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: One (1)–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and one (1)–225 A max. MLO, 42 circuit interiors (Options: None)

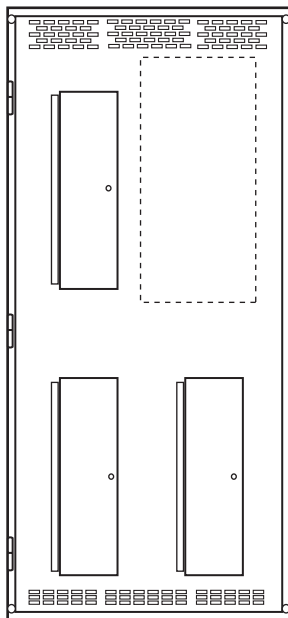
NF/NF Powerlink G3 Stacked (top or bottom)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Figure 24: 42 in. w x 91.5 in. x 24 in. d
 Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.



For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
- Branch circuit breakers: 150 A max.
 - Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

NF/NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A, MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Equipment Space—Right (1/2 Height)

Backplate size 17.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
- Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 250 A max., Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

NF/NF Powerlink G3 Stacked Combination

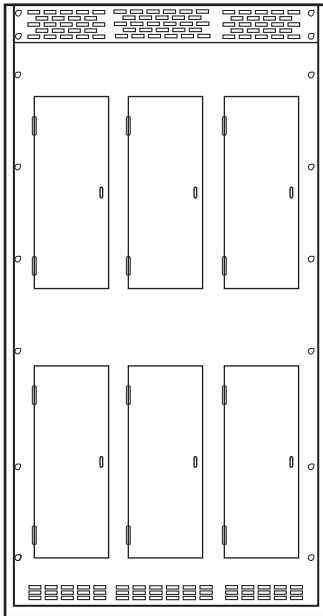
SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Stacked Combination

Figure 25: 48 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ Stacked—NF panel is not permitted

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max., MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Stacking rules:
 - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
 - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Option: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space (1/2 Height) (any of the six locations)

Backplate size 13.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

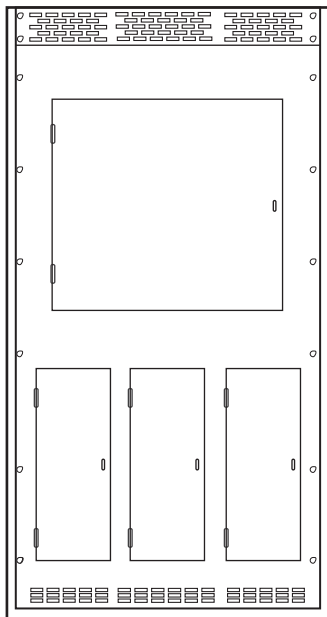
- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s) with load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

Stacked, Combo, Side-by-Side Panelboard

Figure 26: 48 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



HCP I-Line

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A max. MLO with 27-in. max. circuit breaker mounting space
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 800 A max. Main circuit breaker (Backfed) with 27-in. max. circuit breaker mounting space without a Main circuit breaker
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

NQ—Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

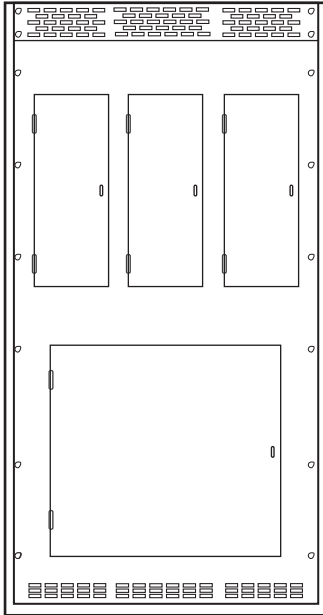
- 225 A MLO, max. 42/54 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Stacked, Side-by-Side, Combo Panelboard

Figure 27: 48 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



HCP I-Line

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max., circuit breaker mounting space
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 800 A Main circuit breaker (Backfed), with 27-in. max., circuit breaker mounting space without a Main circuit breaker
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

NQ—Stacked

SCCR 10–200 kA

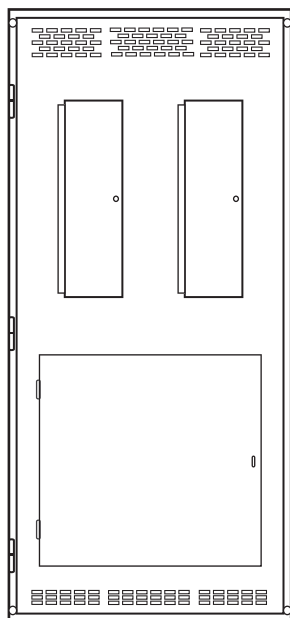
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

**Figure 28: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure**



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NQ—Stacked—Left and Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

NF/NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: Sub-feed lugs
- NF Powerlink G3 Master 400 A, MLO, max. 42 circuits 480Y/277 Vac 3Ø4W
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

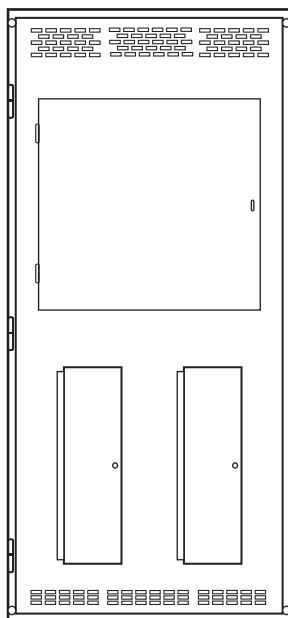
HCP I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 800 A Main circuit breaker (Backfed), with 27-in. max. circuit breaker mounting space without a Main circuit breaker
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

**Figure 29: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure**



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

HCP I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 800 A Main circuit breaker (Backfed) with 27-in. max. circuit breaker mounting space without a Main circuit breaker
 - Feeder circuit breaker: 800 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

NQ—Stacked—Left and Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42/54 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

NF/NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 480Y/277 Vac 3Ø4W or 600Y/347 Vac 3Ø4W NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A, 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

Figure 30: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure

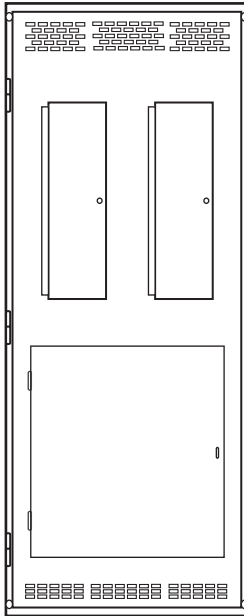
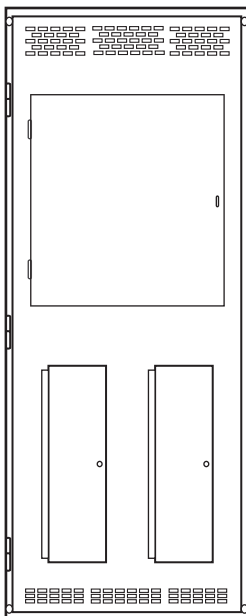


Figure 31: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ—Stacked—Left and Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42/54 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

HCM I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
 - Feeder circuit breaker: 250 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

HCM I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
 - Feeder circuit breaker: 250 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

NQ—Stacked—Left and Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

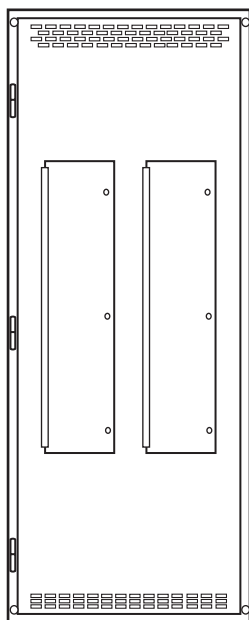
- 225 A MLO, max. 42/54 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Side-by-Side Panelboard

Figure 32: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



NQ Side-by-Side—NF not permitted

SCCR 10–200 kA

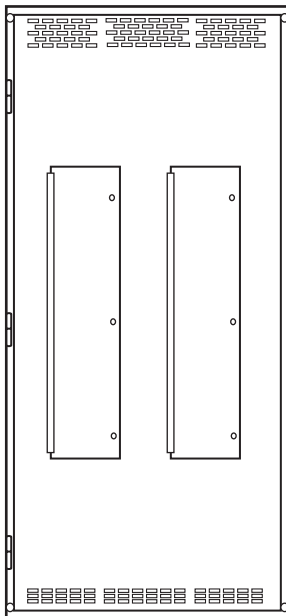
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO 42, 54, 72, 84 circuits max.
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed circuit breaker (225 A max.)
 - Sub-feed lugs
 - TVSS
- 250 A Vertical Main circuit breaker, 42, 54, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed circuit breaker (225 A max.)
 - Sub-feed lugs
 - TVSS



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

**Figure 33: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure**



NQ Side-by-Side

SCCR 10–200 kA

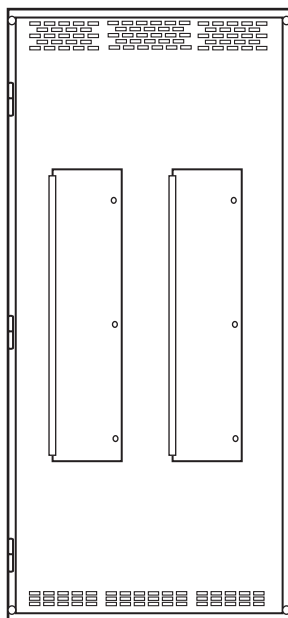
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO 42, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed circuit breaker (225 A max.)
 - Sub-feed lugs
 - TVSS
- 400 A max. MLO 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 600 A max. MLO 42, 54, 72 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 600 A max. MLO 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Figure 33 (cont.)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

- 400 A max. vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (225 A max.)
 - TVSS
- 400 A max. vertical Main circuit breaker, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - TVSS
- 400 A max. vertical Main circuit breaker, 72, 84 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 600 A max. vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Feed-through lugs
 - TVSS
- 600 A max. vertical Main circuit breaker, 54, 72, 82 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs

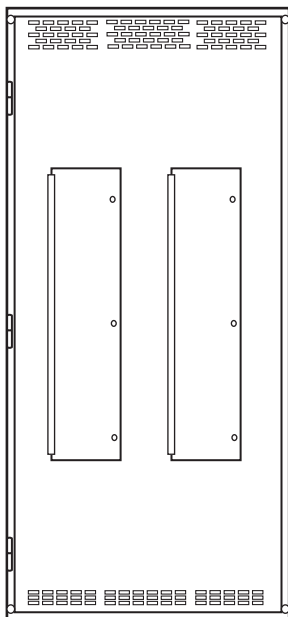
NF Side-by-Side or NF Powerlink G3 Side-by-Side

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- 250 A MLO 42, 54, 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breaker (250 A max.)
 - Sub-feed lugs
 - TVSS
- 400 A MLO 42, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Sub-feed circuit breaker (250 A max.)
 - Sub-feed lugs
 - TVSS

Figure 33 (cont.)

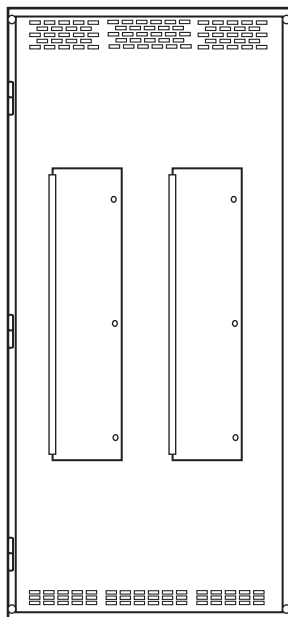


100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

- 400 A MLO 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers are not available in this circuit count
 - Option: Sub-feed lugs
- 400 A MLO 84 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers are not available in this circuit count
 - Options: None
- 600 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (250 A max.)
 - TVSS
- 600 A MLO 54, 66, 84 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers are not available in this circuit count
 - Options: None
- 250 A max. Main circuit breaker, 42, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (250 A max.)
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - TVSS
- 250 A max. Main circuit breaker, 66 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers are not available in this circuit count
 - Option: Feed-through lugs
- 400 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker (250 A max.)
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - TVSS
- 400 A max. Main circuit breaker, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Feed-through lugs

Figure 33 (cont.)



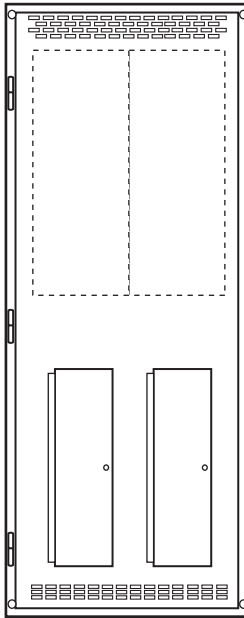
100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

- 600 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options (choose one):
 - Feed-through lugs
 - Sub-feed circuit breaker
 - TVSS
- 600 A max. Main circuit breaker, 54 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- NF Powerlink G3 Master 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Master 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

NQ Stacked Combination

Figure 34: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



Equipment Space—Right/Left (1/2 Height)

Backplate size 13.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and, mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked Combination—Right/Left

SCCR 10–200 kA

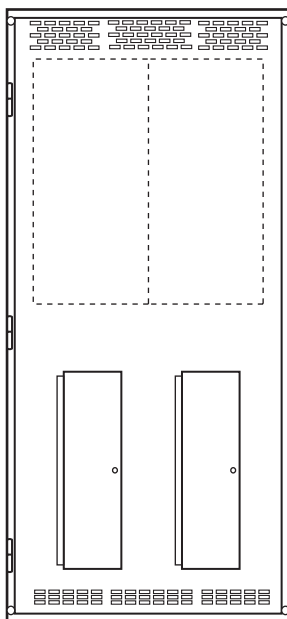
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

**Figure 35: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure**



Equipment Space—Right/Left (1/2 Height)

Backplate size 17.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
 - Unwired: Mounted in cell only
 - Line side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks



For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked Combination Right/Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
 - Options: Same as NF panel

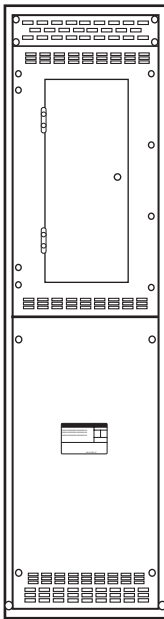
IPC2: Transformer Combo

The Transformer Combo integrates panelboards, individually mounted circuit breakers or lighting contactors with a dry type transformer into one factory-assembled and pre-wired solution.

All configurations have factory-installed Type THHN copper cable.

Transformer Combo Section

Figure 36: 24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top cell: NF Panelboard, NQ
Panelboard
Bottom cell: Transformer



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Panelboard Interiors or NF Powerlink Panelboard

SCCR 10–200 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.,
480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 200–400 A MLO 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–400 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 60–250 A Main circuit breaker 42 circuits
 - Branch circuit breakers: 125 A max. or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A Main circuit breaker 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None (not available with Powerlink)

Or

NQ Panelboard Interior

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–400 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None
- 60–225 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Transformer

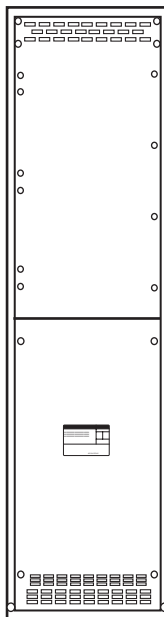
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, or 45 kVA, 3Ø, EE, 150 degree C Rise
- 15 or 30 kVA, 3Ø, EE, 80 and 115 degree C Rise
- 15 or 30 kVA, 3Ø, EE, 150 degree C rise rated K4/K13
- 15 kVA, 3Ø, EE, 80 and 115 degree C rise rated K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.7, or 50 kVA, 1Ø, EE, 150 degree C Rise
- 15, 25, or 37.7 kVA, 1Ø, EE, 80 and 115 degree C Rise

**Figure 37: 24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top cell: Equipment Space
Bottom cell: Transformer**



Equipment Space Options

- 3rd party equipment
- Contactors options:
 - 20 A to 200 A
 - Electrically held or mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Load side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

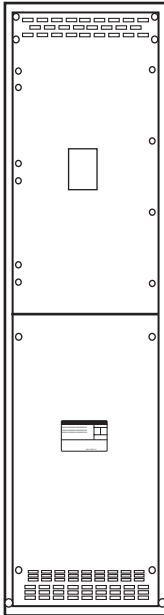
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30 or 45 kVA 3Ø kVA, EE, 150 degree C Rise
- 15 or 30 kVA 3Ø EE, 80 and 115 degree C Rise
- 15 or 30 kVA 3Ø EE, 150 degree C rise rated K4/K13
- 15 kVA 3Ø EE 80 and 115 degree C rise rated K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5 or 50 kVA 1Ø EE, 150 degree C Rise
- 15, 25 or 37.7 kVA 1Ø EE, 80 and 115 degree C Rise

Figure 38: 36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top cell: One Individually-
Mounting Circuit Breaker
Bottom cell: Transformer



Individually-Mounted Circuit Breakers

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

Circuit breaker options:

- 120 Vac shunt trip
- Handle padlock attachment

Transformer

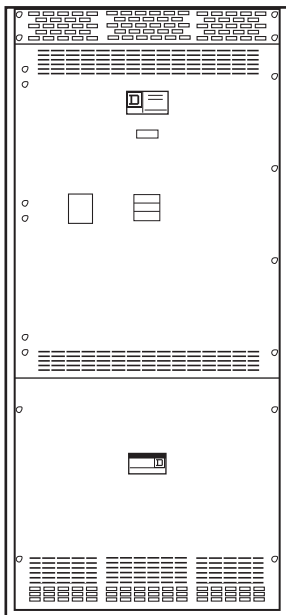
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30 or 45 kVA 3Ø kVA, EE, 150 degree C Rise
- 15 or 30 kVA 3Ø EE, 80 and 115 degree C Rise
- 15 or 30 kVA 3Ø EE, 150 degree C rise rated K4/K13
- 15 kVA 3Ø EE 80 and 115 degree C rise rated K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5 or 50 kVA 1Ø EE, 150 degree C Rise
- 15, 25 or 37.7 kVA 1Ø EE, 80 and 115 degree C Rise

**Figure 39: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure**
Top Left: Individually-Mounted
Circuit Breaker
Top Right: Equipment Space
Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

- Circuit breaker options:
 - 120 Vac shunt trip
 - Handle padlock attachment

Equipment Space

- With removable back pan for third party equipment, or with contactors
- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Load side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

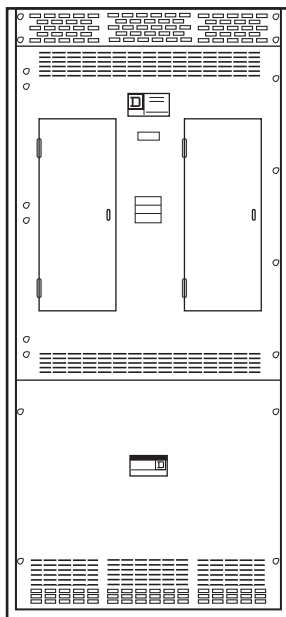
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

**Figure 40: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top Left: NF, NF Powerlink, NQ
Top Right: NF, NF Powerlink, NQ
Bottom: Transformer**



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

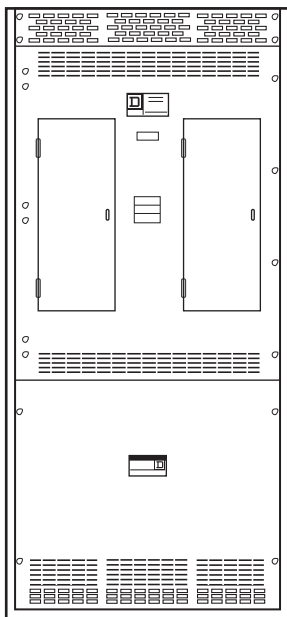
NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A Main circuit breaker 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None (not available with Powerlink)

Figure 40 (cont.)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Panelboard Interior

SCCR 10–100 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
 - Branch circuit breakers: 225 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 60–400 A MLO 42 circuits
 - Branch circuit breakers: 225 A max.
 - Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
 - Branch circuit breakers: 225 A max.
 - Options: None



If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 225 A max.
 - Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 225 A max.
 - Options: None

Transformer

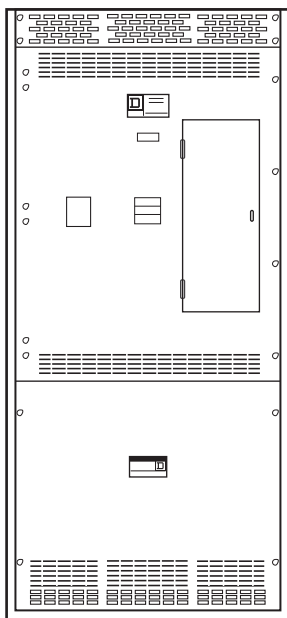
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

Figure 41: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top Left: Individually-Mounted
Circuit Breaker
Top Right: NF, NF Powerlink, NQ
Bottom: Transformer



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% rated neutral can not be combined with any other option in this configuration.



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Individually-Mounted Circuit Breaker

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

- Circuit breaker options:
 - 120 Vac shunt trip
 - Handle padlock attachment

NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.,
480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed circuit breakers (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A Main circuit breaker 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None (not available with Powerlink)

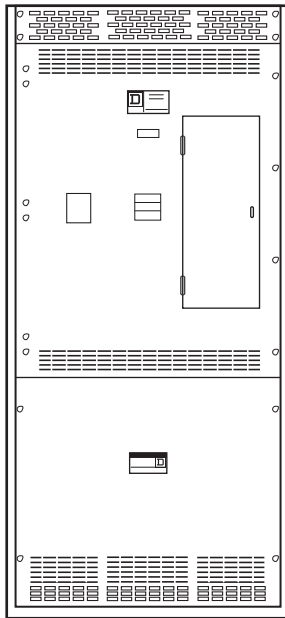
NQ Panelboard Interior

SCCR 10–100 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

Figure 41 (cont.)



- 60–400 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Transformer

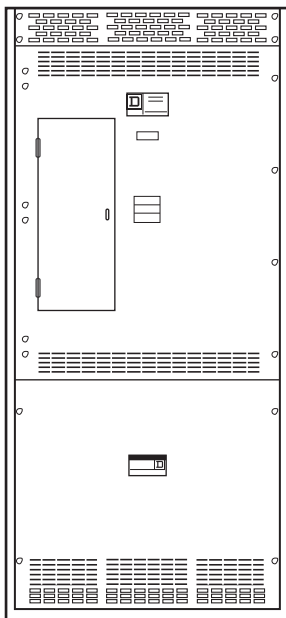
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

**Figure 42: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top Left: NF, NF Powerlink, NQ
Top Right: Equipment Space
Bottom: Transformer**



NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or
120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed circuit breakers (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A Main circuit breaker 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None (not available with Powerlink)



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

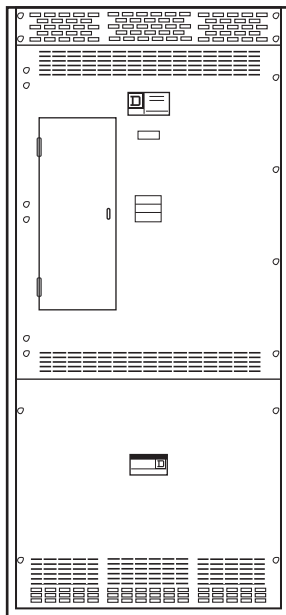
NQ Panelboard Interior

SCCR 10–100 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 60–400 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 400 A max. MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs

Figure 42 (cont.)



- 225/250 A Vertical Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

- 450–600 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Equipment Space

With removable back pan for third party equipment or with contactors

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Load side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

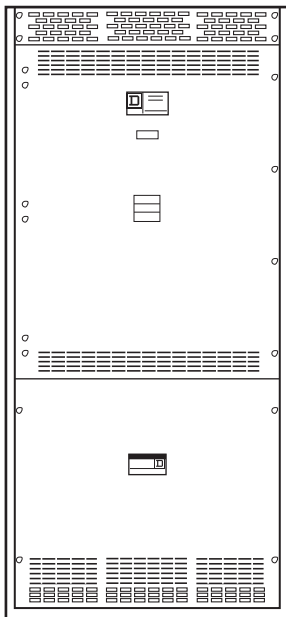
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

**Figure 43: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top Left: Equipment Space
Top Right: Equipment Space
Bottom: Transformer**



Equipment Space

With removable back pan for third party equipment or with contactors

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Load side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

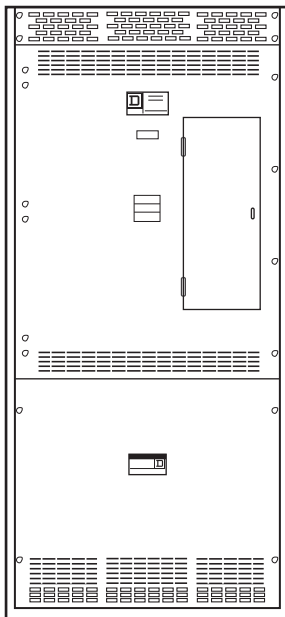
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

**Figure 44: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top Left: Equipment Space
Top Right: NF, NF Powerlink, NQ
Bottom: Transformer**



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

Equipment Space

With removable back pan for customer-installed devices or with contactors

- Contactor options:
 - 8903 Type LO, 20 A electrically held and LX mechanically held
 - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
 - Unwired: Mounted in cell only
 - Load side wired: Line side wired to a branch circuit breaker(s)
 - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

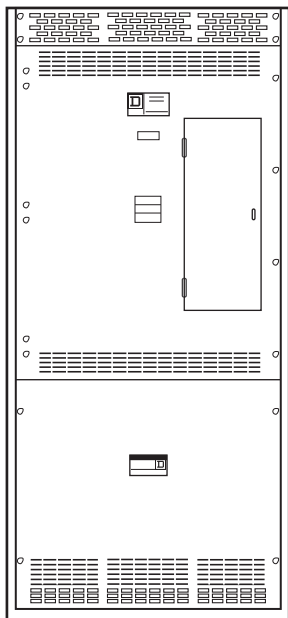
NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A Main circuit breaker 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None (not available with Powerlink)

Figure 44 (cont.)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Panelboard Interior

SCCR 10–100 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS
- 60–400 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Transformer

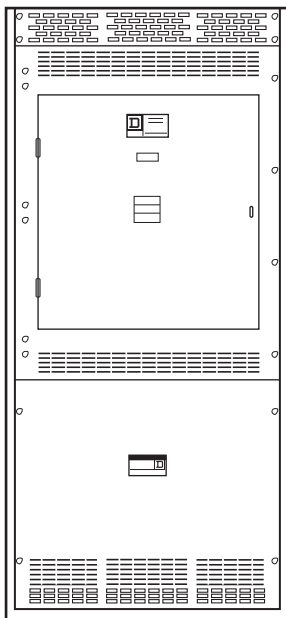
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

Figure 45: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top: I-Line Panel
Bottom: Transformer
Type 1 Enclosure



I-Line Panelboard Interior

SCCR 10–100 kA

600 Vac max.

- 225–800 A MLO with 45-in. mounting space
 - Max. branch circuit breaker 800 A
- 225–800 A Main circuit breaker with 45-in. mounting space without Main circuit breaker kit
 - Max. branch circuit breaker 800 A

Transformer

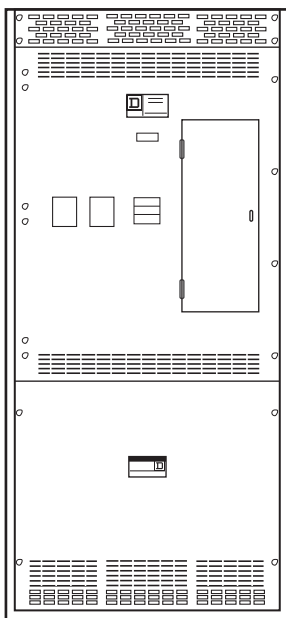
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

**Figure 46: 42 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure
Top Left: Two Individually-
Mounted Circuit Breakers
Top Right: Main Lug Only Panel
Bottom: Transformer**



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Individually-Mounted Circuit Breaker

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

- Circuit breaker options:
 - 120 Vac shunt trip
 - Handle padlock attachment

NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.,
480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A MLO 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None
- 300–400 A Main circuit breaker 30 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None (not available with Powerlink)

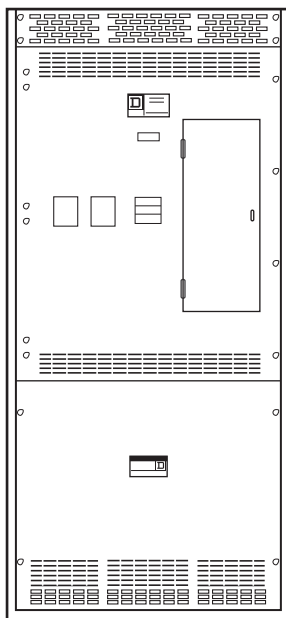
NQ Panelboard Interior

SCCR 10–100 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options (choose one):
 - Sub-feed lugs
 - TVSS

Figure 46 (cont.)



- 60–400 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None



If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None

Transformer

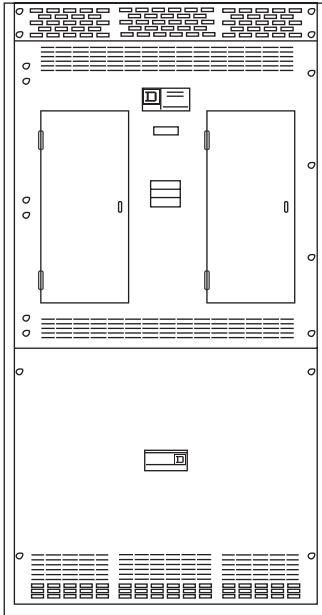
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

**Figure 47: 48 in. w x 91.5 in. x 36 in. d
Type 1 Enclosure
Top Left or Top Right, NF, NQ
Panelboard
Bottom: Transformer**



NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–200 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.,
480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: Sub-feed lugs
- 60–250 A MLO, 54 circuits (top feed only)
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NQ Panelboard Interior

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 60–225 A MLO, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None
- 250–400 A MLO, 42 circuit
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 450–600 A MLO, 42 circuit
 - Branch circuit breakers: 150 A max.
 - Options: None



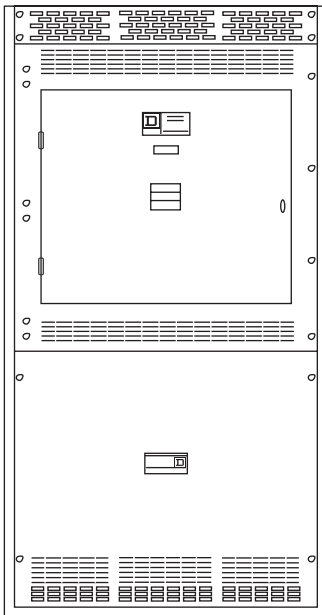
60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.



If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225/250 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: TF lugs (bottom feed only)

**Figure 48: 48 in. w x 91.5 in. x 36 in. d
Type 1 Enclosure
Top Cell, I-Line Panelboard
Bottom: Transformer**



Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

I-Line Panelboard Interior

SCCR 10–200 kA

600 Vac max.

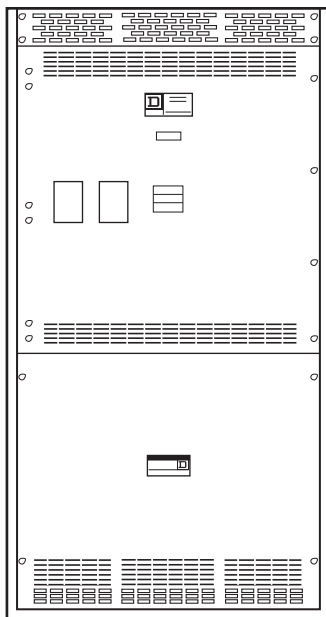
- 800 A max. MLO with 27-in. of circuit breaker mounting space without a main lug kit
 - Max. branch circuit breaker 800 A
 - Options (choose one):
 - Sub-feed lugs
 - TVSS unit
- 800 A max. Back-fed Main circuit breakers interiors with 27 in. of circuit breaker mounting space without a Main circuit breaker.
 - Max. branch circuit breaker 800 A
 - Options (choose one):
 - Sub-feed lugs
 - TVSS unit

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

Figure 49: 48 in. w x 91.5 in. x 36 in. d
Type 1 Enclosure
Top Left: Two Individually-
Mounted Circuit Breakers
Top Right: Equipment Space
Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10 kA–100 kA

15 A–800 A circuit breaker trip rating; 600 V max.

Two circuit individually mounted circuit breakers mounted side by side

Circuit breaker options:

- 120 V shunt trip
- Handle padlock attachment

Equipment Space

Third party equipment

Contactors options:

- 20 A to 200 A
- Electrically held or mechanically held

Contactor wiring options:

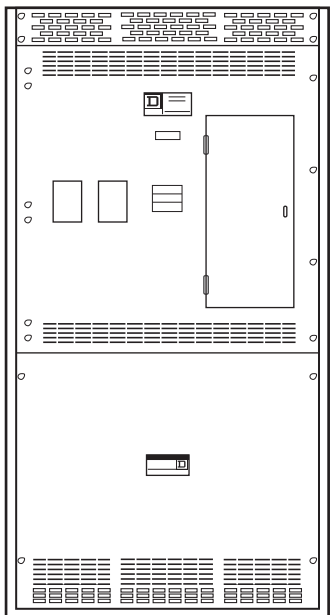
- Unwired: Mounted in cell only
- Load side wired: Line side wired to a branch circuit breaker(s)
- Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

Figure 50: 48 in. w x 91.5 in. x 36 in. d
Type 1 Enclosure
Top Left: Two Individually-
Mounted Circuit Breakers
Top Right: NF, NF Powerlink, NQ
Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10 kA–100 kA

15 A–800 A circuit breaker trip rating; 600 V max.

Two circuit individually mounted circuit breakers mounted side by side

Circuit breaker options:

- 120 V shunt trip
- Handle padlock attachment

NF Panelboard Interiors or NF Powerlink Panelboard

SCCR 10 kA–200 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., or 480Y/277 Vac 3Ø4W, or 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60 A–250 A MLO, 42 circuits
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Option: SF lugs
- 60 A–250 A MLO, 54 circuits (top feed only)
 - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
 - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
 - Options: None



100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Panelboard Interior

SCCR 10 kA–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 60–225 A MLO, 54 circuits
 - Branch circuit breakers: 150 A max.
 - Options: None
- 250–400 A MLO, 42 circuit
 - Branch circuit breakers: 150 A max.
 - Option: Sub-feed lugs
- 450–600 A MLO, 42 circuit
 - Branch circuit breakers: 150 A max.
 - Options: None



If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225/250 A Main circuit breaker, 42 circuits
 - Branch circuit breakers: 150 A max.
 - Option: TF lugs (bottom feed only)

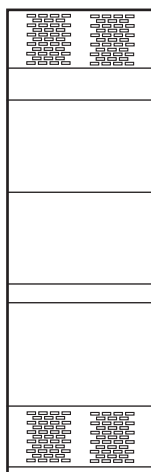
Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

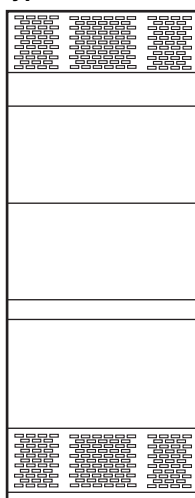
- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

Stacked Transformer Section

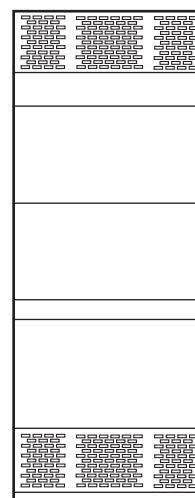
24 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



36 in. w x 91.5 in. x 24 in. d
Type 1 Enclosure



36 in. w x 91.5 in. x 36 in. d
Type 1 Enclosure



Only valid configurations are shown.

Stacked Transformer 24 in. W x 24 in. D Enclosure — 480 V

Table 1: 480 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations ¹			
EE 150° C Rise	Top	Blank	EE15T3H	EE15T3H	EE30T3H
	Bottom	EE15T3H	EE15T3H	EE30T3H	EE45T3H
	Top	Blank	EE15T3HCU	EE15T3HCU	EE30T3HCU
	Bottom	EE15T3HCU	EE15T3HCU	EE30T3HCU	EE45T3HCU
	Top	Blank	EE30T3H	EE30T3H	EE45T3H
	Bottom	EE30T3H	EE30T3H	EE45T3H	EE45T3H
	Top	Blank	EE30T3HCU	EE30T3HCU	EE45T3HCU
	Bottom	EE30T3HCU	EE30T3HCU	EE45T3HCU	EE45T3HCU
EE 115° C Rise	Top	Blank	EE15T3HF	EE15T3HF	EE30T3HF
	Bottom	EE15T3HF	EE15T3HF	EE30T3HF	EE30T3HF
	Top	Blank	EE15T3HFCU	EE15T3HFCU	EE30T3HFCU
	Bottom	EE15T3HFCU	EE15T3HFCU	EE30T3HFCU	EE30T3HFCU
EE 80° C Rise	Top	Blank	EE15T3HB	EE15T3HB	EE30T3HB
	Bottom	EE15T3HB	EE15T3HB	EE30T3HB	EE30T3HB
	Top	Blank	EE15T3HBCU	EE15T3HBCU	EE30T3HBCU
	Bottom	EE15T3HBCU	EE15T3HBCU	EE30T3HBCU	EE30T3HBCU

Table 1: 480 V Primary — 208Y/120 Secondary 3Ø Transformers (continued)

Type	Location	Configurations ¹			
K-13 150° C Rise	Top	Blank	EE15T3HISNPL	EE15T3HISNPL	EE30T3HISNPL
	Bottom	EE15T3HISNPL	EE15T3HISNPL	EE30T3HISNPL	EE30T3HISNPL
	Top	Blank	EE15T3HISCUNPL	EE15T3HISCUNPL	EE30T3HISCUNPL
	Bottom	EE15T3HISCUNPL	EE15T3HISCUNPL	EE30T3HISCUNPL	EE30T3HISCUNPL
K-13 115° C Rise	Top	Blank	EE15T3HFISNPL	EE15T3HFISNPL	EE30T3HFISNPL
	Bottom	EE15T3HFISNPL	EE15T3HFISNPL	EE30T3HFISNPL	EE30T3HFISNPL
	Top	Blank	EE15T3HFISCUNPL	EE15T3HFISCUNPL	EE30T3HFISCUNPL
	Bottom	EE15T3HFISCUNPL	EE15T3HFISCUNPL	EE30T3HFISCUNPL	EE30T3HFISCUNPL
K-4 150° C Rise	Top	Blank	EE15T3HISNL	EE15T3HISNL	EE30T3HISNL
	Bottom	EE15T3HISNL	EE15T3HISNL	EE30T3HISNL	EE30T3HISNL
	Top	Blank	EE15T3HISCUNL	EE15T3HISCUNL	EE30T3HISCUNL
	Bottom	EE15T3HISCUNL	EE15T3HISCUNL	EE30T3HISCUNL	EE30T3HISCUNL
K-4 115° C Rise	Top	Blank	EE15T3HFISNL	EE15T3HFISNL	EE30T3HFISNL
	Bottom	EE15T3HFISNL	EE15T3HFISNL	EE30T3HFISNL	EE30T3HFISNL
	Top	Blank	EE15T3HFISCUNL	EE15T3HFISCUNL	EE30T3HFISCUNL
	Bottom	EE15T3HFISCUNL	EE15T3HFISCUNL	EE30T3HFISCUNL	EE30T3HFISCUNL

- ¹ A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The KVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 2: 480 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations ¹				
EE 150° C Rise	Top	Blank	EE15S3H	EE15S3H	EE15S3H	EE15S3H
	Bottom	EE15S3H	EE15S3H	EE25S3H	EE37S3H	EE50S3H
	Top	Blank	EE15S3HCU	EE15S3HCU	EE15S3HCU	EE15S3HCU
	Bottom	EE15S3HCU	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU
	Top	Blank	EE25S3H	EE25S3H	EE25S3H	—
	Bottom	EE25S3H	EE25S3H	EE37S3H	EE50S3H	—
	Top	Blank	EE25S3HCU	EE25S3HCU	EE25S3HCU	—
	Bottom	EE25S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	—
	Top	Blank	EE37S3H	EE37S3H	—	—
	Bottom	EE37S3H	EE37S3H	EE50S3H	—	—
	Top	Blank	EE37S3HCU	EE37S3HCU	—	—
	Bottom	EE37S3HCU	EE37S3HCU	EE50S3HCU	—	—

- ¹ A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The KVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Stacked Transformer 24 in. W x 24 in. D Enclosure — 600 V**Table 3: 600 V Primary — 208Y/120 Secondary 3Ø Transformers**

Type	Location	Configurations ¹			
EE 150° C Rise	Top	Blank	EE15T65H	EE15T65H	EE30T65H
	Bottom	EE15T65H	EE15T65H	EE30T65H	EE45T65H
	Top	Blank	EE15T65HCU	EE15T65HCU	EE30T65HCU
	Bottom	EE15T65HCU	EE15T65HCU	EE30T65HCU	EE45T65HCU
	Top	Blank	EE30T65H	EE30T65H	EE45T65H
	Bottom	EE30T65H	EE30T65H	EE45T65H	EE45T65H
	Top	Blank	EE30T65HCU	EE30T65HCU	EE45T65HCU
	Bottom	EE30T65HCU	EE30T65HCU	EE45T65HCU	EE45T65HCU

¹ A single phase transformer may be combined with three phase transformer provided:

a) The three phase transformer must be bottom located

b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 4: 600 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations ¹				
EE 150° C Rise	Top	Blank	EE15S3534H	EE15S3534H	EE15S3534H	EE15S3534H
	Bottom	EE15S3534H	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H
	Top	Blank	EE15S3534HCU	EE15S3534HCU	EE15S3534HCU	EE15S3534HCU
	Bottom	EE15S3534HCU	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU
	Top	Blank	EE25S3534H	EE25S3534H	EE25S3534H	—
	Bottom	EE25S3534H	EE25S3534H	EE37S3534H	EE50S3534H	—
	Top	Blank	EE25S3534HCU	EE25S3534HCU	EE25S3534HCU	—
	Bottom	EE25S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	—
	Top	Blank	EE37S3534H	EE37S3534H	—	—
	Bottom	EE37S3534H	EE37S3534H	EE50S3534H	—	—
	Top	Blank	EE37S3534HCU	EE37S3534HCU	—	—
	Bottom	EE37S3534HCU	EE37S3534HCU	EE50S3534HCU	—	—

¹ A single phase transformer may be combined with three phase transformer provided:

a) The three phase transformer must be bottom located

b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Stacked Transformer 36 in. W x 24 in. D Enclosure — 480 V

Table 5: 480 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations ¹			
EE 150° C Rise	Top	Blank	EE15T3H	EE15T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
	Top	Blank	EE30T3H	EE30T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
	Top	Blank	EE45T3H	EE45T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
	Top	Blank	EE75T3H	EE75T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
EE 115° C Rise	Top	Blank	EE15T3HCU	EE15T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
	Top	Blank	EE30T3HCU	EE30T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
	Top	Blank	EE45T3HCU	EE45T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
	Top	Blank	EE75T3HCU	EE75T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
EE 80° C Rise	Top	Blank	EE15T3HF	EE30T3HF	EE30T3HF
	Bottom	EE45T3HF	EE45T3HF	EE45T3HF	EE75T3HF
	Top	Blank	EE45T3HF	EE45T3HF	—
	Bottom	EE45T3HF	EE45T3HF	EE75T3HF	—
	Top	Blank	EE15T3HFCU	EE30T3HFCU	—
	Bottom	EE45T3HFCU	EE45T3HFCU	EE45T3HFCU	—
	Top	Blank	EE45T3HFCU	EE45T3HFCU	—
	Bottom	EE45T3HFCU	EE45T3HFCU	EE75T3HFCU	—
EE 150° C Rise	Top	Blank	EE15T3HB	EE30T3HB	EE45T3HB
	Bottom	EE45T3HB	EE45T3HB	EE45T3HB	EE45T3HB
	Top	Blank	EE75T3HB	—	—
	Bottom	EE75T3HB	EE75T3HB	—	—
	Top	Blank	EE15T3HBCU	EE30T3HBCU	EE45T3HBCU
	Bottom	EE45T3HBCU	EE45T3HBCU	EE45T3HBCU	EE45T3HBCU
	Top	Blank	EE30T3HBCU	EE45T3HBCU	—
	Bottom	EE75T3HBCU	EE75T3HBCU	EE75T3HBCU	—
K-13 150° C Rise	Top	Blank	EE75T3HBCU	—	—
	Bottom	EE75T3HBCU	EE75T3HBCU	—	—
	Top	Blank	EE15T3HISNLP	EE30T3HISNLP	EE45T3HISNLP
	Bottom	EE45T3HISNLP	EE45T3HISNLP	EE45T3HISNLP	EE45T3HISNLP
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP
	Bottom	EE45T3HISCUNLP	EE45T3HISCUNLP	EE45T3HISCUNLP	EE45T3HISCUNLP
	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	—
	Bottom	EE75T3HISNLP	EE75T3HISNLP	EE75T3HISNLP	—
K-13 150° C Rise	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP
	Bottom	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP

Table 5: 480 V Primary — 208Y/120 Secondary 3Ø Transformers (continued)

Type	Location	Configurations ¹			
K-13 115° C Rise	Top	Blank	EE15T3HFISNLP	EE30T3HFISNLP	EE45T3HFISNLP
	Bottom	EE45T3HFISNLP	EE45T3HFISNLP	EE45T3HFISNLP	EE45T3HFISNLP
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP
	Bottom	EE45T3HFISCUNLP	EE45T3HFISCUNLP	EE45T3HFISCUNLP	EE45T3HFISCUNLP
	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	—
	Bottom	EE75T3HFISNLP	EE75T3HFISNLP	EE75T3HFISNLP	—
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP
	Bottom	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP
K-4 150° C Rise	Top	Blank	EE15T3HISNL	EE30T3HISNL	EE45T3HISNL
	Bottom	EE45T3HISNL	EE45T3HISNL	EE45T3HISNL	EE45T3HISNL
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL
	Bottom	EE45T3HISCUNL	EE45T3HISCUNL	EE45T3HISCUNL	EE45T3HISCUNL
	Top	Blank	EE30T3HISNL	EE45T3HISNL	—
	Bottom	EE75T3HISNL	EE75T3HISNL	EE75T3HISNL	—
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL
	Bottom	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL
K-4 115° C Rise	Top	Blank	EE15T3HFISNL	EE30T3HFISNL	EE45T3HFISNL
	Bottom	EE45T3HFISNL	EE45T3HFISNL	EE45T3HFISNL	EE45T3HFISNL
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL
	Bottom	EE45T3HFISCUNL	EE45T3HFISCUNL	EE45T3HFISCUNL	EE45T3HFISCUNL
	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	—
	Bottom	EE75T3HFISNL	EE75T3HFISNL	EE75T3HFISNL	—
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL
	Bottom	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL

¹ A single phase transformer may be combined with three phase transformer provided:

- a) The three phase transformer must be bottom located
- b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 6: 480 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations ¹					
EE 150° C Rise	Top	Blank	EE15S3H	EE25S3H	EE37S3H	EE50S3H	EE75S3H
	Bottom	EE75S3H	EE75S3H	EE75S3H	EE75S3H	EE75S3H	EE75S3H
	Top	Blank	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	EE75S3HCU
	Bottom	EE75S3HCU	EE75S3HCU	EE75S3HCU	EE75S3HCU	EE75S3HCU	EE75S3HCU

¹ A single phase transformer may be combined with three phase transformer provided:

- a) The three phase transformer must be bottom located
- b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Stacked Transformer 36 in. W x 24 in. D Enclosure — 600 V

Table 7: 600 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations ¹		
EE 150° C Rise	Top	Blank	EE15T65H	EE15T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE30T65H	EE30T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE45T65H	EE45T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE75T65H	EE75T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE30T65HCU	EE30T65HCU
	Bottom	EE75T65HCU	EE75T65HCU	EE112T65HCU
	Top	Blank	EE45T65HCU	EE45T65HCU
	Bottom	EE75T65HCU	EE75T65HCU	EE112T65HCU
	Top	Blank	EE75T65HCU	EE75T65HCU
	Bottom	EE75T65HCU	EE75T65HCU	EE112T65HCU

¹ A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 8: 600 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations ¹					
EE 150° C Rise	Top	Blank	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H	EE75S3534H
	Bottom	EE75S3534H	EE75S3534H	EE75S3534H	EE75S3534H	EE75S3534H	EE75S3534H
	Top	Blank	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	EE75S3534HCU
	Bottom	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU

¹ A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Stacked Transformer 36 in. W x 36 in. D Enclosure — 480 V

Table 9: 480 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations ¹					
EE 150° C Rise	Top	Blank	EE15T3H	EE30T3H	EE45T3H	EE75T3H	EE112T3H
	Bottom	EE112T3H	EE112T3H	EE112T3H	EE112T3H	EE112T3H	EE112T3H
	Top	Blank	EE15T3HCU	EE30T3HCU	EE45T3HCU	EE75T3HCU	EE112T3HCU
	Bottom	EE112T3HCU	EE112T3HCU	EE112T3HCU	EE112T3HCU	EE112T3HCU	EE112T3HCU
	Top	Blank	EE15T3H	EE30T3H	EE45T3H	EE75T3H	EE112T3H
	Bottom	EE150T3H	EE150T3H	EE150T3H	EE150T3H	EE150T3H	EE150T3H
	Top	Blank	EE15T3HCU	EE30T3HCU	EE45T3HCU	EE75T3HCU	EE112T3HCU
	Bottom	EE150T3HCU	EE150T3HCU	EE150T3HCU	EE150T3HCU	EE150T3HCU	EE150T3HCU
	Top	Blank	EE15T3H	EE30T3H	EE45T3H	EE75T3H	EE112T3H
	Bottom	EE225T3H	EE225T3H	EE225T3H	EE225T3H	EE225T3H	EE225T3H
	Top	Blank	EE15T3HCU	EE30T3HCU	EE45T3HCU	EE75T3HCU	EE112T3HCU
	Bottom	EE225T3HCU	EE225T3HCU	EE225T3HCU	EE225T3HCU	EE225T3HCU	EE225T3HCU
EE 115° C Rise	Top	Blank	EE30T3HF	EE45T3HF	EE75T3HF	—	—
	Bottom	EE112T3HF	EE112T3HF	EE112T3HF	EE112T3HF	—	—
	Top	Blank	EE45T3HFCU	EE75T3HFCU	—	—	—
	Bottom	EE112T3HFCU	EE112T3HFCU	EE112T3HFCU	—	—	—
	Top	Blank	EE30T3HF	EE45T3HF	EE75T3HF	—	—
	Bottom	EE150T3HF	EE150T3HF	EE150T3HF	EE150T3HF	—	—
	Top	Blank	EE45T3HFCU	EE75T3HFCU	—	—	—
	Bottom	EE150T3HFCU	EE150T3HFCU	EE150T3HFCU	—	—	—
EE 80° C Rise	Top	Blank	EE75T3HB	—	—	—	—
	Bottom	EE112T3HB	EE112T3HB	—	—	—	—
	Top	Blank	EE30T3HBCU	EE45T3HBCU	EE75T3HBCU	—	—
	Bottom	EE112T3HBCU	EE112T3HBCU	EE112T3HBCU	EE112T3HBCU	—	—
	Top	Blank	EE75T3HB	—	—	—	—
	Bottom	EE150T3HB	EE150T3HB	—	—	—	—
	Top	Blank	EE30T3HBCU	EE45T3HBCU	EE75T3HBCU	—	—
	Bottom	EE150T3HBCU	EE150T3HBCU	EE150T3HBCU	EE150T3HBCU	—	—
K-13 150° C Rise	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	EE75T3HISNLP	—	—
	Bottom	EE75T3HISNLP	EE75T3HISNLP	EE75T3HISNLP	EE75T3HISNLP	—	—
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP	EE75T3HISCUNLP	—
	Bottom	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	—
	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	EE75T3HISNLP	—	—
	Bottom	EE112T3HISNLP	EE112T3HISNLP	EE112T3HISNLP	EE112T3HISNLP	—	—
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP	EE75T3HISCUNLP	—
	Bottom	EE112T3HISCUNLP	EE112T3HISCUNLP	EE112T3HISCUNLP	EE112T3HISCUNLP	EE112T3HISCUNLP	—
	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	EE75T3HISNLP	—	—
	Bottom	EE150T3HISNLP	EE150T3HISNLP	EE150T3HISNLP	EE150T3HISNLP	—	—
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP	EE75T3HISCUNLP	—
	Bottom	EE150T3HISCUNLP	EE150T3HISCUNLP	EE150T3HISCUNLP	EE150T3HISCUNLP	EE150T3HISCUNLP	—
K-13 115° C Rise	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	EE75T3HFISNLP	—	—
	Bottom	EE75T3HFISNLP	EE75T3HFISNLP	EE75T3HFISNLP	EE75T3HFISNLP	—	—
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	EE75T3HFISCUNLP	—
	Bottom	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	—
	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	EE75T3HFISNLP	—	—
	Bottom	EE112T3HFISNLP	EE112T3HFISNLP	EE112T3HFISNLP	EE112T3HFISNLP	—	—

Table 9: 480 V Primary — 208Y/120 Secondary 3Ø Transformers (continued)

Type	Location	Configurations ¹					
K-13 115° C Rise	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	EE75T3HFISCUNLP	—
	Bottom	EE112T3HFISCUNLP	EE112T3HFISCUNLP	EE112T3HFISCUNLP	EE112T3HFISCUNLP	EE112T3HFISCUNLP	—
	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	EE75T3HFISNLP	—	—
	Bottom	EE150T3HFISNLP	EE150T3HFISNLP	EE150T3HFISNLP	EE150T3HFISNLP	—	—
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	EE75T3HFISCUNLP	—
	Bottom	EE150T3HFISCUNLP	EE150T3HFISCUNLP	EE150T3HFISCUNLP	EE150T3HFISCUNLP	EE150T3HFISCUNLP	—
K-4 150° C Rise	Top	Blank	EE30T3HISNL	EE45T3HISNL	EE75T3HISNL	—	—
	Bottom	EE75T3HISNL	EE75T3HISNL	EE75T3HISNL	EE75T3HISNL	—	—
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	EE75T3HISCUNL	—
	Bottom	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	—
	Top	Blank	EE30T3HISNL	EE45T3HISNL	EE75T3HISNL	—	—
	Bottom	EE112T3HISNL	EE112T3HISNL	EE112T3HISNL	EE112T3HISNL	—	—
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	EE75T3HISCUNL	—
	Bottom	EE112T3HISCUNL	EE112T3HISCUNL	EE112T3HISCUNL	EE112T3HISCUNL	EE112T3HISCUNL	—
	Top	Blank	EE30T3HISNL	EE45T3HISNL	EE75T3HISNL	—	—
	Bottom	EE150T3HISNL	EE150T3HISNL	EE150T3HISNL	EE150T3HISNL	—	—
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	EE75T3HISCUNL	—
	Bottom	EE150T3HISCUNL	EE150T3HISCUNL	EE150T3HISCUNL	EE150T3HISCUNL	EE150T3HISCUNL	—
K-4 115° C Rise	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	EE75T3HFISNL	—	—
	Bottom	EE75T3HFISNL	EE75T3HFISNL	EE75T3HFISNL	EE75T3HFISNL	—	—
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	EE75T3HFISCUNL	—
	Bottom	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	—
	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	EE75T3HFISNL	—	—
	Bottom	EE112T3HFISNL	EE112T3HFISNL	EE112T3HFISNL	EE112T3HFISNL	—	—
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	EE75T3HFISCUNL	—
	Bottom	EE112T3HFISCUNL	EE112T3HFISCUNL	EE112T3HFISCUNL	EE112T3HFISCUNL	EE112T3HFISCUNL	—
	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	EE75T3HFISNL	—	—
	Bottom	EE150T3HFISNL	EE150T3HFISNL	EE150T3HFISNL	EE150T3HFISNL	—	—
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	EE75T3HFISCUNL	—
	Bottom	EE150T3HFISCUNL	EE150T3HFISCUNL	EE150T3HFISCUNL	EE150T3HFISCUNL	EE150T3HFISCUNL	—

¹ A single phase transformer may be combined with three phase transformer provided:

- The three phase transformer must be bottom located
- The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 10: 480 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations ¹						
EE 150° C Rise	Top	Blank	EE15S3H	EE25S3H	EE37S3H	EE50S3H	EE75S3H	EE100S3H
	Bottom	EE100S3H	EE100S3H	EE100S3H	EE100S3H	EE100S3H	EE100S3H	EE100S3H
	Top	Blank	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	EE75S3HCU	EE100S3HCU
	Bottom	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU
	Top	Blank	EE15S3H	EE25S3H	EE37S3H	EE50S3H	EE75S3H	EE100S3H
	Bottom	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H
	Top	Blank	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	EE75S3HCU	EE100S3HCU
	Bottom	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU
	Top	Blank	EE15S3H	EE25S3H	EE37S3H	EE50S3H	EE75S3H	EE100S3H
	Bottom	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H

¹ A single phase transformer may be combined with three phase transformer provided:

- The three phase transformer must be bottom located
- The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Stacked Transformer 36 in. W x 36 in. D Enclosure — 600 V

Table 11: 600 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations ¹					
EE 150° C Rise	Top	Blank	EE15T65H	EE30T65H	EE45T65H	EE75T65H	EE112T65H
	Bottom	EE112T65H	EE112T65H	EE112T65H	EE112T65H	EE112T65H	EE112T65H
	Top	Blank	EE30T65HCU	EE45T65HCU	EE75T65HCU	EE112T65HCU	—
	Bottom	EE112T65HCU	EE112T65HCU	EE112T65HCU	EE112T65HCU	EE112T65HCU	—
	Top	Blank	EE15T65H	EE30T65H	EE45T65H	EE75T65H	EE112T65H
	Bottom	EE150T65H	EE150T65H	EE150T65H	EE150T65H	EE150T65H	EE150T65H
	Top	Blank	EE30T65HCU	EE45T65HCU	EE75T65HCU	EE112T65HCU	—
	Bottom	EE150T65HCU	EE150T65HCU	EE150T65HCU	EE150T65HCU	EE150T65HCU	—
	Top	Blank	EE15T65H	EE30T65H	EE45T65H	EE75T65H	EE112T65H
	Bottom	EE225T65H	EE225T65H	EE225T65H	EE225T65H	EE225T65H	EE225T65H
	Top	Blank	EE30T65HCU	EE45T65HCU	EE75T65HCU	EE112T65HCU	—
	Bottom	EE225T65HCU	EE225T65HCU	EE225T65HCU	EE225T65HCU	EE225T65HCU	—

¹ A single phase transformer may be combined with three phase transformer provided:

- a) The three phase transformer must be bottom located
- b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 12: 600 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations ¹						
EE 150° C Rise	Top	Blank	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H	EE75S3534H	EE100S3534H
	Bottom	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H
	Top	Blank	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	EE75S3534HCU	EE100S3534HCU
	Bottom	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU
	Top	Blank	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H	EE75S3534H	EE100S3534H
	Bottom	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H
	Top	Blank	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	EE75S3534HCU	EE100S3534HCU
	Bottom	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU
	Top	Blank	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H	EE75S3534H	EE100S3534H
	Bottom	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H

¹ A single phase transformer may be combined with three phase transformer provided:

- a) The three phase transformer must be bottom located
- b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

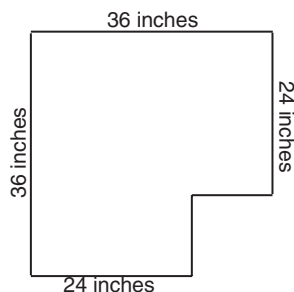
IPC2 Corner Section

Full Height Corner Sections

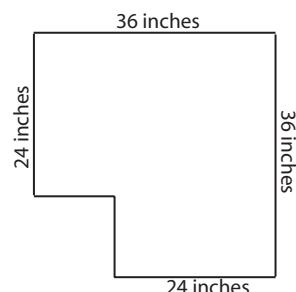
Figure 51: 36 in. w x 91.5 in. x 36 in.
Type 1 Enclosure

NOTE: This is the corner section looking down from above.

Left corner section



Right corner section



Appendix

Quantity of Electrically Held Contactors per Equipment Space Cell

Contactors	24 in. w		36 in. w		42 in. w		48 in. w	
	1/4 in. h	1/2 in. h	1/4 in. h	1/2 in. h	1/4 in. h	1/2 in. h	1/4 in. h	1/2 in. h
8903 Type S 2,3 pole 30 A	6	12	6	12	6	12	6	12
8903 Type S 4,5 pole 30 A	6	12	4	8	6	12	4	8
8903 Type S 2,3 pole 60 A	6	12	4	8	6	12	4	8
8903 Type S 4,5 pole 60 A	2	4	2	4	2	4	2	4
8903 Type S 2,3 pole 100 A	2	6	2	6	2	6	2	6
8903 Type S 4,5 pole 100 A	1	2	1	2	1	2	1	2
8903 Type S 2,3 pole 200 A	2	4	2	4	2	4	2	4
8903 Type S 4,5 pole 200 A	1	2	1	2	1	2	1	2
8903 Type LO 2-4 pole	10	20	8	16	10	20	8	16
8903 Type LO 6 pole	6	12	4	8	6	12	4	8
8903 Type LO 8-12 pole	4	8	3	6	4	8	3	6

Quantity of Mechanically Held Contactors per Equipment Space Cell

Contactors	24 in. w		36 in. w		42 in. w		48 in. w	
	1/4 in. h	1/2 in. h	1/4 in. h	1/2 in. h	1/4 in. h	1/2 in. h	1/4 in. h	1/2 in. h
8903 Type S 2,3 pole 30 A	3	6	3	6	3	6	3	6
8903 Type S 4,5 pole 30 A	3	6	2	4	3	6	2	4
8903 Type S 2,3 pole 60 A	3	6	2	4	3	6	2	4
8903 Type S 4,5 pole 60 A	2	4	2	4	2	4	2	4
8903 Type S 2,3 pole 100 A	2	4	2	4	2	4	2	4
8903 Type S 4,5 pole 100 A	1	2	1	2	1	2	1	2
8903 Type S 2,3 pole 200 A	2	4	2	4	2	4	2	4
8903 Type S 4,5 pole 200 A	1	2	1	2	1	2	1	2
8903 Type LX 2-4 pole	5	10	4	8	5	10	4	8
8903 Type LX 6 pole	3	6	2	4	3	6	2	4
8903 Type LX 8-12 pole	2	4	2	4	2	4	2	4

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I-Line™ Circuit Breaker Power Distribution Panelboards

Information Manual

Class 2110

ENGLISH

Instruction Bulletin
80043-309-20

Retain for future use.



by **Schneider** Electric

Hazard Categories and Special Symbols



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand I-Line™ circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept I-Line branch circuit breakers.



For technical support on the installation of this panelboard, contact the Schneider Electric at customer support 1-888-778-2733.



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Read and understand this entire instruction bulletin and the latest edition of the NEMA PB 1.1 standards publication included before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Installation

This section provides instructions for the following I-Line panelboard procedures:

- Interior Mounting into Square D Brand Enclosures, on page 9
- Neutral Bonding Strap Installation, on page 12
- I-Line Circuit Breaker Installation and Removal, on page 14
- Interior Trim Barrier Preparation, on page 18

Interior Mounting into Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1-2007), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EXCESSIVE HEAT DUE TO LOOSE CONNECTION

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the I-Line panelboard enclosure, please refer to the NEMA PB 1.1-2007 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

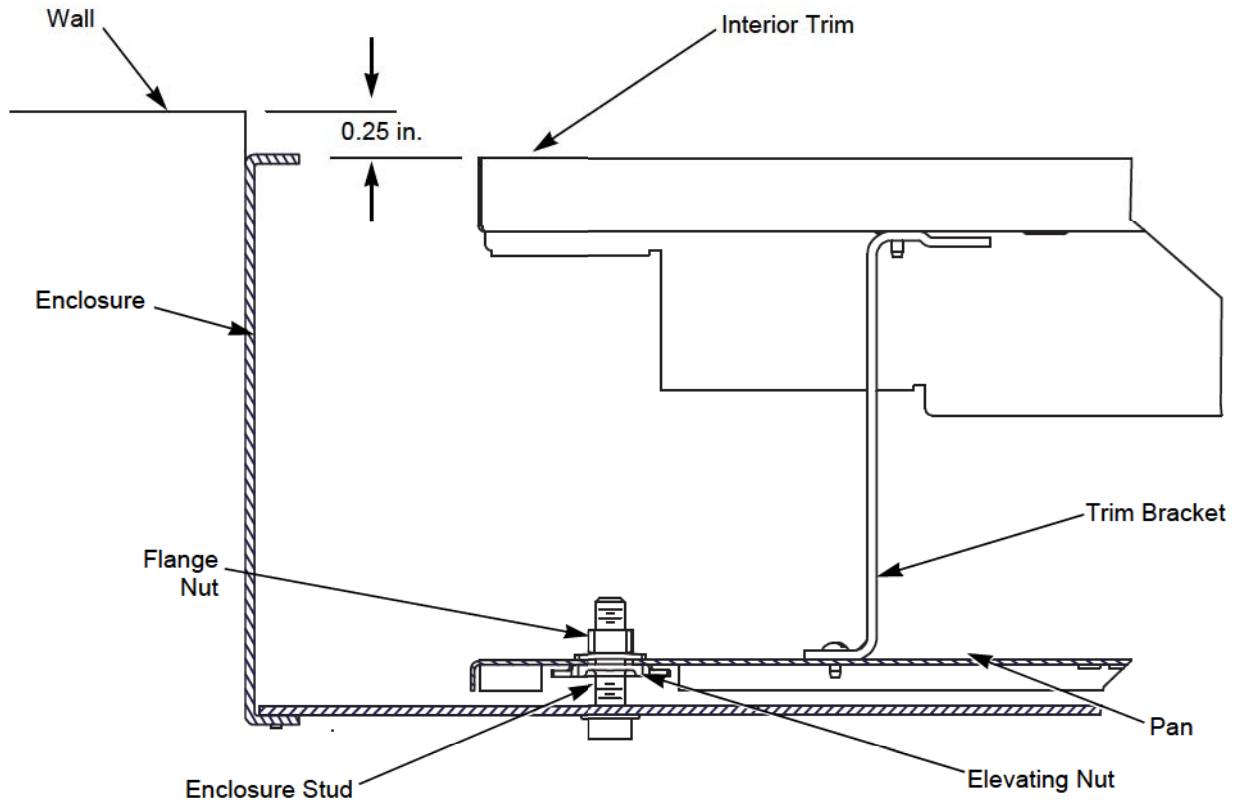
Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
 - a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
 - b. Adjust each elevating nut to maintain a maximum distance of 0.125 in. between the interior trim and the front/door assembly.
 - c. Tighten the flange nuts against the pan.
 - d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required (see “Neutral Bonding Strap Installation” on page 12).
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1-2007 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
 - a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1 on page 10). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
 - b. Adjust each elevating nut to position the lip of the interior trim approximately 0.25 in. from the outside wall line.
 - c. Tighten the flange nuts against the pan.
 - d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 12.
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Figure 1: Interior Mounting into Square D Brand Enclosures



Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “Standard Neutral Bonding Strap Installation” or “Neutral with Current Transformer Bonding Strap Installation” on pages 13 and 14, respectively.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Turn off all power supplying this equipment before working on or inside the equipment.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

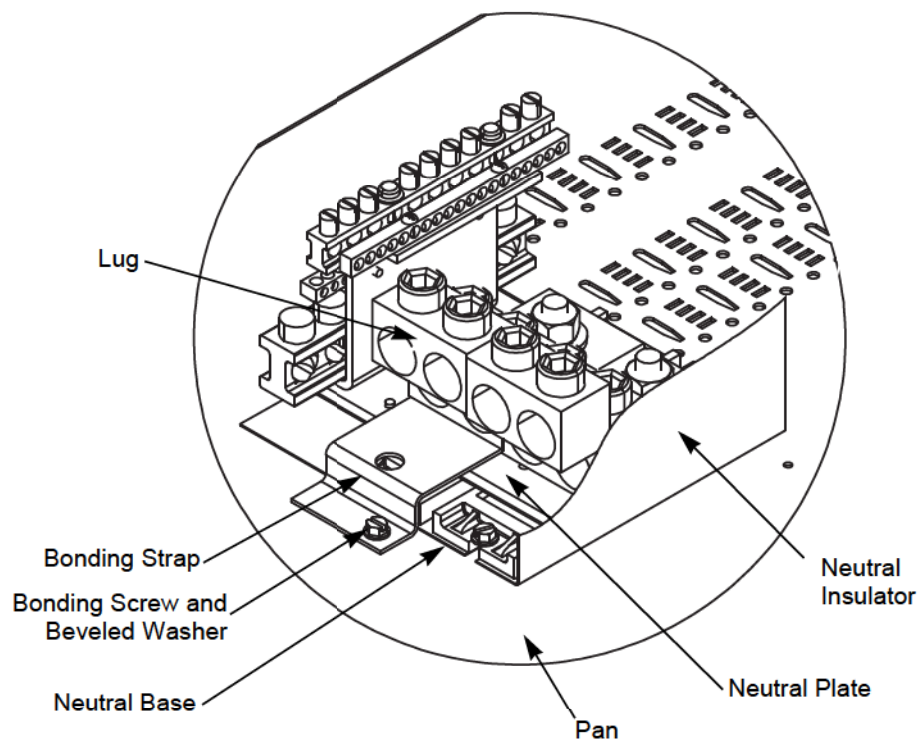
NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

Standard Neutral Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard, refer to Figure 2 and follow the instructions below.

1. Remove lug. Retain lug and fastening hardware.
2. Place bonding strap between neutral plate and lug, as shown.
3. Secure bonding strap to pan with bonding screw and beveled washer. Tighten the bonding screw to 65–75 lb-in (7.3–8.5 N•m).
4. Reinstall lug with the hardware retained in step 1. Tighten to 60–70 lb-in (6.8–7.9 N•m).

Figure 2: Standard Neutral Bonding Strap Installation



Neutral with Current Transformer Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard with a current transformer, refer to Current Transformer Neutral Bonding Installation Instructions, Schneider Electric document 80043-706-xx or 80043-789-xx, that is supplied with the current transformer neutral.

I-Line Circuit Breaker Installation and Removal

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

I-Line Circuit Breaker Installation

Refer to Figure 3 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim barrier.
3. Turn the circuit breaker off. Position the circuit breaker jaws against the bus bar stack so the guiding boss on the bottom of the circuit breaker is oriented towards the alignment groove in the bus insulator base, and the “fingers” of the circuit breaker mounting bracket fit into the keyslots in the pan.

NOTE: Install the main circuit breaker adjacent to the main lugs.

4. Place a screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker firmly into the bus bar stack and align the retaining screw with the 0.219 in. (5.6 mm) mounting hole in the pan.
5. Tighten the retaining screw securely to prevent the circuit breaker from moving.

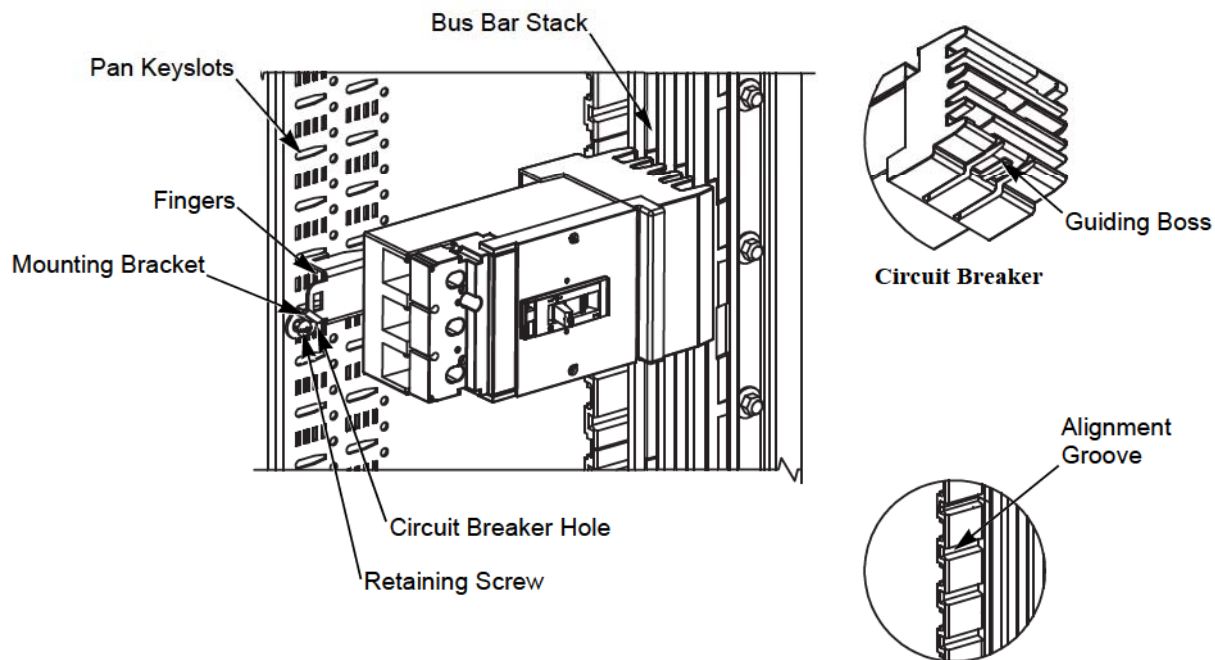
NOTE: Ensure the retaining screw is tight, but do not tighten it enough to bend the mounting bracket.

6. **For main circuit breakers only:**
Attach the “Main Breaker” label to the circuit breaker cover.
7. Reinstall the interior trim barrier.
8. Re-energize the panelboard.
9. Turn the circuit breaker on.

NOTE: I-Line circuit breakers are supplied with factory-applied joint compound on the plug-on connectors. The compound must not be removed because it contributes to the overall performance of the connection.

Whenever an I-Line circuit breaker is removed and reinstalled, the joint compound must be reapplied. A two-ounce container of compound especially formulated for I-Line plug-on connectors is available for purchase (catalog number PJC-7201).

Figure 3: I-Line Circuit Breaker Installation and Removal

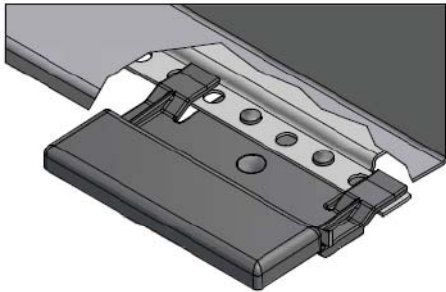


I-Line Circuit Breaker Removal

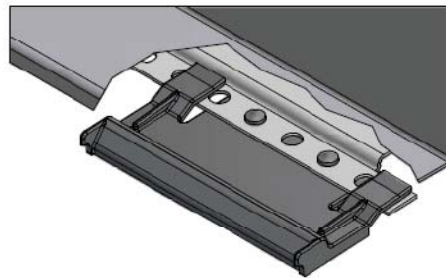
Refer to Figure 3 for the following instructions:

1. Turn off all power to the panelboard.
2. Turn the circuit breaker off.
3. Remove the interior trim barrier.
4. Loosen the retaining screw(s) in the circuit breaker mounting bracket until the screw(s) is completely removed from the 7/32 in. (5.6 mm) mounting hole in the mounting pan.
5. Place the screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker away from the bus bar stack.
6. Lift the circuit breaker away from the bus bars.
7. Install the blank fillers where the circuit breaker was removed, using Table 1 on page 18 as reference.
8. Secure the blank filler extensions to the interior trim barrier (HCPSU, HCP, and HCRU panelboards only), using Table 1 on page 18 for reference. Mount the extension over the mounting bracket in the deadfront as shown in Figure 4 on page 17.

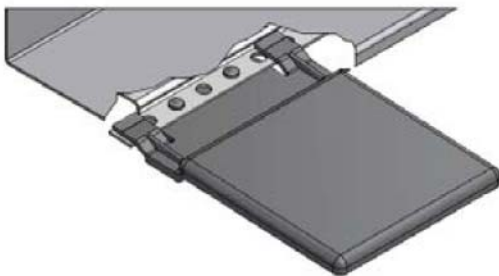
Figure 4: Blank Extension Installation



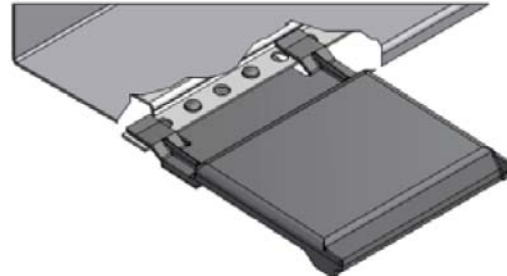
Blank Extension HLN4BL on narrow side



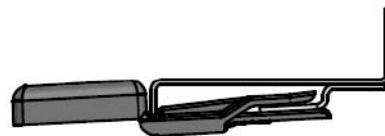
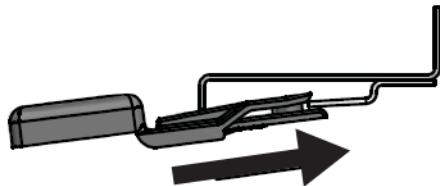
Blank Extension HLN4EBL on narrow side



Blank Extension HLW4BL on wide side



Blank Extension HLW4EBL on wide side

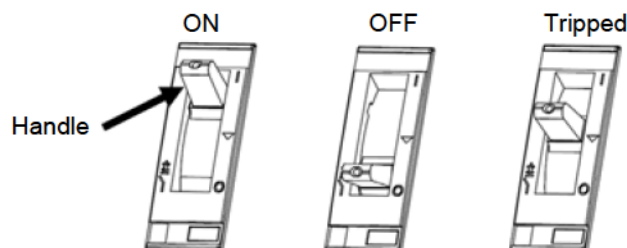


9. Reinstall the interior trim barrier.
10. Re-energize the panelboard.

Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



Interior Trim Barrier Preparation

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 1: Blank Fillers and Blank Extensions Catalog Numbers

Blank Extensions			
Circuit Breaker Frame	Circuit Breaker Mounting Height	Branch Circuit Side	Catalog Number
All applications except Powerpact H/J with Micrologic Trip Unit 5/6	1.5 in. (38.1 mm)	Wide Side	HLW1BL
	4.5 in. (114.3 mm)	Wide Side	HLW4BL
	1.5 in. (38.1 mm)	Narrow Side	HLN1BL
	4.5 in. (114.3 mm)	Narrow Side	HLN4BL
Only Powerpact H/J Frames with Micrologic Trip Unit 5/6	4.5 in. (114.3 mm)	Narrow Side	HLN4EBL
	4.5 in. (114.3 mm)	Wide Side	HLW4EBL
Blank Fillers			
All Applications	Mounting Height	Catalog Number	—
	1.5 in. (38.1 mm)	HNM1BL	
	4.5 in. (114.3 mm)	HNM4BL	

I-Line Stack Assemblies

NOTICE

RISK OF IMPROPER ASSEMBLY

- Do not disassemble the I-Line Bus Stack Assembly.
- If maintenance is required, contact Schneider Electric.

Failure to follow these instructions can result in severe equipment damage and will void the warranty.

I-Line Solid Neutral Assemblies

Table 2: I-Line Solid Neutral Assembly Catalog Numbers

Amps	Catalog Number
225	HC2SN
400	HC4SN ¹ , HCW4SN ²
600	HC6SN ¹ , HCW6SN ²
800	HC8SN ¹ , HCW8SN ² HCPSU8SN ³
800 ⁷	HCPSU8SNCW ⁵
1200 ²	HCW12SN
1200 ^{2, 8}	HCWM12SN ⁴
1200 ^{2, 7}	HCR12SNCTW ⁶

¹ Used on type HCN and HCM panelboards only.

² Used on 400 A, 600 A, 800 A, 1200 A HCP (main lugs), and 600 A, 800 A (main circuit breaker).

³ Used on type HCP-SU panelboards only.

⁴ Used on type HCR-U panelboards only.

⁵ Used on type HCP-SU panelboards only.
For use with circuit breaker types PG, PJ, PK, PL.

⁶ Used on type HCR-U panelboards only.
For use with circuit breaker types PG, PJ, PK, RG, RJ, RK.

⁷ Including neutral CT for 3Ø4W systems.

⁸ Used on type HCR-U universal panelboards only.

Appendix 1: Specifications

Typical Wiring

Table 3: Panelboard Typical Wiring ¹

Voltage AC ²	1-Phase Panelboards		3-Phase Panelboards	
	Phase	Wires	Phase	Wires
208Y/120 ³	—	—	3	4
120/240 ³	1	3	—	—
240 ⁴	3	3	—	—
600	1	2	—	—
480Y/277 ³	—	—	3	4
240/120 ^{3, 6}	—	—	3	4 Delta
600	—	—	3	3 Delta
600Y/347 ^{3, 5}	—	—	3	4
125/250 Direct Current	—	3	—	—
250 Direct Current	—	2	—	—

¹ Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

² Unless otherwise specified.

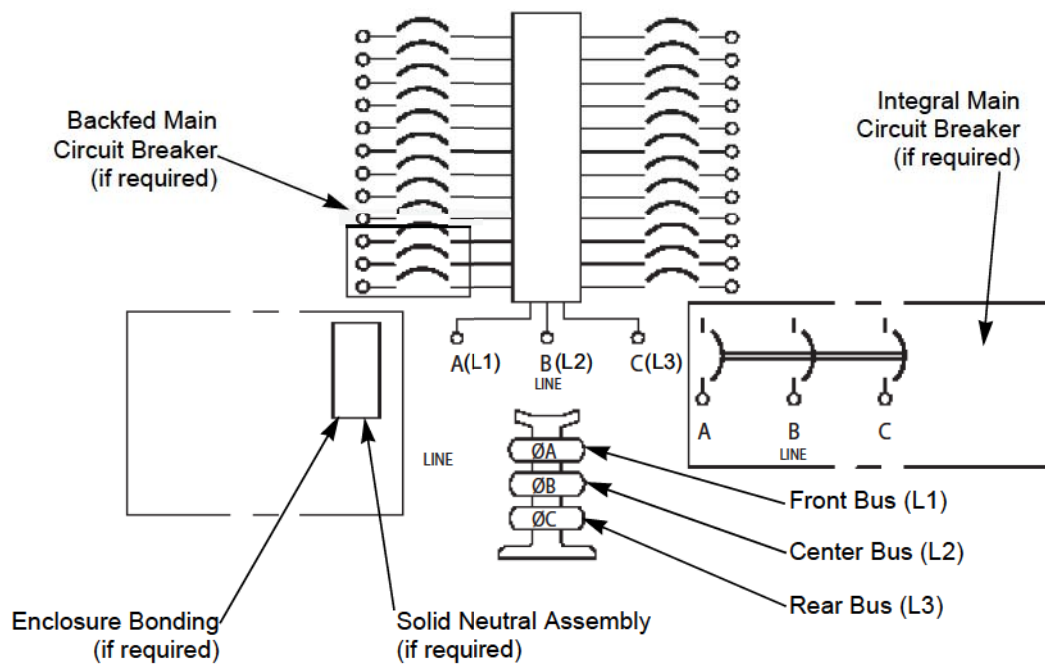
³ Requires use of solid neutral assembly. See panelboard.

⁴ For grounded "B" phase system.

⁵ For use in Canada only.

⁶ When wiring for delta systems, phases "A" and "C" must be 120 V to neutral, with phase "B" 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum, not 120 V or 120/240 V to "B" phase.

Figure 6: Main Lugs / Main Circuit Breaker Wiring Diagram



NOTE: For 1Ø systems, the center bus is not used.

NOTE: Branch connections phasing is determined by the circuit breaker selected. See the latest catalog or the Digest for circuit breaker selection.

NOTE: Assure that the circuit breaker voltage rating is appropriate for the system. With the selection of proper units, any of the listed voltage systems can be used.

Panelboard Ratings

Refer to NEC section 110-22, 2011 Edition and CEC rule 12-014, 2002 Edition for more information. The series rated system label is located in the bag assembly. Short circuit tests are conducted at 100–105% of the maximum panelboard voltage. Interiors with CE mark meet IEC 61439-1 and IEC 61439-2.

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
120	42,000	MG	FY	1
	65,000	QG, LH	FA, FD	
	100,000	FJ, QJ	FD	
		QJ, LC	FA	
		LJ	FH	
	200,000	LR	FH, FY	
208Y/120	100,000	QJ	FA, FD	2, 3
		QJ, PH, PJ, RJ	QD, QG	
240	35,000	MG	FA	1
	42,000	KA	FD	1, 2, 3
		LA, MA	HD, JD, QD	2, 3
	50,000	MG	FA	1
		MG	FA (25 A MAX.)	
	65,000	HG, JG	FA, HD	2, 3
		JG	JD, QD	
		QG	FA, FD, QD	
		LH, MH, PA, PG, RG	HD, JD, QD	
		FG, FH, MH, MX, PJ	FD	1, 2, 3
		FC, KC, KH, LC, LH	FD, FG	
		LH	FA	
		LH	LA	2, 3
		MG	HD, JD, KA	
		DG	FH, HD, JD, KA, LA, MA	2, 3
		LG	HD, JD, KA, LA, MA	
		LG	LD	3
	85,000	RL	FH, KH	2, 3

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
240	100,000	FC, KC, LC, LX	FD, FG, FJ	1
		PH, PJ, RJ	QD, QG	2, 3
		QJ	FD	2
		FJ	FD	
		LJ	HD, HG, JD, JG, FH, KA, LA, MA, MG	2, 3
		LJ	LD, LG	3
		FC, KC	FA, FH, FD, FG, FJ	2, 3
		LC, LX	FH, FD, FG, FJ	
		KC, LC, LX	KA	
		KC, LC	KH	
		LC	LA, LH, MG	1, 2, 3
		LC	FA	
		HJ, JJ	FA, FH, HD, HG	
		JJ	JD, JG	
		LC, LX, MJ, PJ, RJ	HD, HG, JD, JG	2, 3
		MJ	LA, LH	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA, MG	
	125,000	RL	RG	2, 3
		HL, JL	HD, HG, HJ, FA, FH	
		JL	JD, JG, JJ	
		PC, PH, PL, RL	HD, HG, JD, JG	
		PC, PL, RL	HJ, JJ	
	200,000	FI, KI, LI, LXI	HD, HG, HJ	1
		KI, LI, LXI	JD, JG, JJ	
		FI, KI, LI, LXI	FD, FG, FJ	
		FI, KI	FA, FH, FC, FD, FG, FJ	
		LI, LXI	FH, FD, FG, FJ	2, 3
		LI	FC	
		KI, LI, LXI	KA, QD, QG, QJ	
		LI	KC	
		JR	QD	
		LR	FH, HJ, HL, JJ, JL, QD, QG, QJ, LA, LH	

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3- Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
277	18,000	LD	FY	1
	25,000	FH, KA	FD	
	35,000	FG, KH, LH	FD	
		DG, LG	FH, FY	
	65,000	FJ	FD	
		FC, KC	FA, FH, FY, FD, FG	
		LC, LX (400 A MAX.)	FH	
		LC, LX (600 A MAX.)	FY, FD, FG	
		DJ	FH, FY	
		LL	FY	
		LJ	FH, FY	
	100,000	DL, LL	FH, FJ	
	200,000	FI, KI	FA, FH, FY, FD, FG, FJ	
		HR, JR	FA, FY, FJ	
		LI, LXI, (400 A MAX.)	FH	
		LI, LXI, (600 A MAX.)	FY, FD, FG, FJ	
		LR	FH, FY	
480	22,000	MG	FA	2, 3
	30,000	KH, LA, MA, MX, PA, PC, PX, PJ	FH	
		LA, MA, PA, PC, PX	KA	
		LA, MA, PA	HD, JD	
		MG	FA (25 A MAX.), FH, KA	
	35,000	MH, MX, PA	HD, JD	2, 3
		HG, JG	FA, HD	
		JG	JD	
		LH, MG, PG, RG	HD, JD	2, 3
		LH	HG, JG	
		DG	FH, HD, JD, KA, LA, MA	
		LG	LD	
		LG	HD, JD, FH, KA, LA, MA	2, 3

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480	42,000	MJ	FH (25 A MAX.)	2, 3
		RL	RG	
	50,000	MJ	KA, KH	
		FC, KC	FA, FH	
		HJ, JJ	FA, FH, HD, HG	
		JJ	JD, JG	
		LC, LI, LX, LXI	HD, HG, JD, JG	
		LC, LX, (400 A MAX.)	FH	
		KC, LC, LX	KA	
		LC, LX	LA	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA	
		LJ	LD, LG	3
		LJ	HD, HG, JD, JG, FH, KA, LA, MA	2, 3
	100,000	HL, JL	FA, FH, HD, HG, HJ	2, 3
		JL	JD, JG, JJ	
		JR	FA	
		LI, LXI (600 A MAX.)	KA	
		PC, PH, PL, RL	HJ, JJ	
		RL	RG	
		DL	FH, HD, HG, HJ, JD, JG, JJ, KA, LA, MA	
		LL	LD, LG, LJ	3
	200,000	LL	HD, HG, HJ, JD, JG, JJ, FH, KA, LA, MA	2, 3
		FI, KI	FA, FH, FC, HD, HG, HJ	
		HR	FA, HD, HG, HJ, HL	
		JR	HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI	JD, JG, JJ, KA	
		LI	FC, KA, KC, LA, HJ, HL, JJ, JL	
		LXI	KA, HJ, HL, JJ, JL	
		LR	FH, HJ, HL, JJ, JL, LA, LH	

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480Y/277	25,000	FH, KA	FD	2, 3
	35,000	FG, KH, LH	FD	
	65,000	FJ	FD	
		FC, KC	FD, FG	
		LC, LX (600 A MAX.)	FD, FG	
	200,000	FI, KI	FD, FG, FJ	
		LI, LXI (600 A MAX.)	FD, FG, FJ	
600	18,000	HG, JG	FA, HD	3
		JG	JD	
		MG, PG, RG	HD, JD	
		MG	FA	
		LG	LD	
		LG	HD, JD	
	25,000	HJ, JJ	FA, HD, HG	2, 3
		JJ	JD	
		PJ, RJ	MG	3
		LJ	LD, LG	
		LJ	JD, JG, HD, HG, MA	
	35,000	LC	FH, HD, HG, HJ, JD, JG, JJ, LA	2, 3
	50,000	HL, JL	FA, HD, HG, HJ	
		JL	JD, JG, JJ	
		PK	HJ, JJ, MJ	
		LL	LD, LG, LJ	
	100,000	LL	HD, HG, HJ, JD, JG, JJ, MA	2, 3
		FI, KI	HD, HG, HJ	
		KI	JD, JG, JJ	
		HR	FA, HD, HG, HJ, HL	
		JR	FA, HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI, LI	FH	
		LI	LA	

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
600Y/347	18,000	MG	FA (25 A MAX.)	1
	25,000	MJ	FA (25 A MAX.)	
	50,000	HL, JL	FJ	

¹ LD, LG, LJ, and LL are only available in 3-pole configurations.² For indicated circuit breakers rated less than this maximum voltage the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.**Table 5: Series Connected Fuse Ratings (RMS Symmetrical)**

Maximum System Voltage AC ¹	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
120/240 1Ø 208Y/120	100,000	1200 A	L, T (300 V)	QD, QG
		800 A	T (600 V)	
		600 A	J, RK5	
240	65,000	1200 A	L, T (300 V)	QD
		800 A	T (600 V)	
		600 A	J, RK5	
	100,000	1200 A	L, T (300 V)	QD, QG (2-Pole)
		800 A	T (600 V)	
		600 A	J, RK5	FA, FH, KA, KH, KC, LA, LH, MA, MH, MX, PG
			J, T (600 V)	
			RK5	
			J	
		800 A	T (600 V)	FH, KA, KH, LA, LH, MA, MH, MX, PG
			T (300 V)	
			L	
		1200 A	L	FH, KH, LA, LH, MA, MH, MX, PG
			T (600 V)	
		1600/2000 A	L	KH, MA, MH, MX, PG
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL

Continued on next page

Table 5: Series Connected Fuse Ratings (RMS Symmetrical) (Continued)

Maximum System Voltage AC ¹	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
240	200,000	600 A	J, T (600 V)	FA(3 POLE ONLY) FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			RK5	FH, FC, HD, HG, HJ, HL, JD, JG, JJ, JL, KH, KC, LA, LH, LC, MA, MH, MX, NC, NX, PG,PJ, PL
			J	HD, HG, HJ, HL, JD, JG, JJ, JL
		800 A	T (600 V)	FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (300 V)	PG, PJ, PL
			L	FH, FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	FC, KH, KC, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		1600/2000 A	L	NA, NC, NX, PJ, PL
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL
480	100,000	400 A	J, T(600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		600 A	J, RK5	HJ, HL, JJ, JL
		600 A	J, T (600 V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			RK5	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		800 A	L, T(600V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		1200 A	L	FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			T (600 V)	HJ, HL, JJ, JL
		1600 A	L	KC, LC, MA, MH, MX, NA, PG, PJ
		2000 A	L	KC, LC, MH, MG, MJ, MX, NA, PG, PJ
		4000 A	L	HJ, HL, JJ, JL
	200,000	200 A	RK5	HJ, HL
		400 A	J	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
		600 A	J	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
			RK5	KC, LA, LH, LC, MA, MH, MX, MG, MJ, NC, NX, PG, PJ

Continued on next page

Table 5: Series Connected Fuse Ratings (RMS Symmetrical) (Continued)

Maximum System Voltage AC ¹	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
480	200,000	800 A	T(300 V)	PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			L	KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	KC, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
		1600/2000 A	L	NA, NC, NX
600	100,000	30 A	CC	HG, JG (Molded Case Switches)
		200 A	J	HD, HG, HJ, HL, JD, JG, JJ, JL
		400 A	J, T (600 V)	HJ, HL, JJ, JL
		600 A	R	MG, MJ
		1200 A	L	MG, MJ
	200,000	600 A	J	MG, MJ
		800 A	T (600 V)	MG, MJ

¹ For indicated circuit breakers rated less than this maximum voltage. The indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

Additional Short Circuit Current Ratings

Square D I-Line plug-on lugs installed in this panelboard and protected by indicated Square D circuit breakers are suitable for use where the available short circuit current is not greater than that shown in the following table. The short circuit current rating cannot exceed the rating marked on the protecting circuit breaker. The protecting circuit breakers may be the main, or if plugged onto the same I-Line bus stack, may be downstream from the plug-on lugs.

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL100, 100 A SL225, 225 A SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	FA	2, 3	100	25	240
				18	480
				14	600
	FH	2, 3	100	65	240
				25	480
				18	600
	FD	2, 3	100	25	240
				18	480Y
	FG	2, 3	100	65	240
				35	480Y
	FJ	2, 3	100	100	240
				65	480Y
SL225, 225 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	KA	2, 3	225	42	240
				25	480
				22	600
	KH	2, 3	225	65	240
				35	480
				25	600
	KC	2, 3	225	100	240
				65	480
	KI	2, 3	225	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A SL33930, 1200 A SL33931, 1200 A	DG	3	400	65	240
				35	480
	DJ	3	400	100	240
				65	480
	DL	3	400	125	240
				100	480
SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	DG	3	600	65	240
				35	480
	DJ	3	600	100	240
				65	480
	DL	3	600	125	240
				100	480

Continued on next page

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹ (Continued)

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	HD/JD	2, 3	150/250	25	240
				18	480
				14	600
	HG/JG	2, 3	150/250	65	240
				35	480
				18	600
	HJ/JJ	2, 3	150/250	100	240
				65	480
				25	600
	HL/JL	2, 3	150/250	125	240
				100	480
				50	600
	HR/JR	2, 3	150/250	200	240
				200	480
				100	600
	KI	2, 3	250	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LA	2, 3	400	42	240
				30	480
				22	600
	LH	2, 3	400	65	240
				35	480
				25	600
	LD	3	400	25	240
				18	480
				14	600
	LG	3	400	65	240
				35	480
				18	600
	LJ	3	400	100	240
				65	480
				25	600
	LL	3	400	125	240
				100	480
				50	600
	LR	3	400	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	400	100	240
				65	480
				35	600
	LI/LXI	2, 3	400	200	240
				200	480
				100	600

Continued on next page

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹ (Continued)

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LD	3	600	25	240
				18	480
				14	600
	LG	3	600	65	240
				35	480
				18	600
	LJ	3	600	100	240
				65	480
				25	600
	LL	3	600	125	240
				100	480
				50	600
LR	3	600	200	240	
			200	480	
			100	600	
SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	600	100	240
				65	480
				35	600
	LI/LXI	2, 3	600	200	240
				200	480
				100	600
	MA	2, 3	800	42	240
				30	480
				22	600
	MH/MX	2, 3	800	65	240
				65	480
				25	600
SL800M5, 800 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A	MG, PG	2, 3	800	65	240
				35	480
				18	600
	MJ, PJ	2, 3	800	100	240
				65	480
				25	600
	PK	2, 3	800	65	240
				50	480
				50	600
	PL	2, 3	800	125	240
				100	480
				25	600
MA/MH/MX	2, 3	800	65	240	
			65	480	
			25	600	

Continued on next page

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹ (Continued)

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL1200, 1200 A S33930, 1200 A	NA	2, 3	1200	100	240
				50	480
				25	600
	NC/NX	2, 3	1200	125	240
				100	480
				65	600
SL1200P5, 1200A SL1200P6, 1200A SL1200P7, 1200A	PG/RG	2, 3	1200	65	240
				35	480
				18	600
	PJ/RJ	2, 3	1200	100	240
				65	480
				25	600
	PK	2, 3	1200	65	240
				50	480
				50	600
	RK	2, 3	1200	65	240
				65	480
				65	600
	PL	2, 3	1200	125	240
				100	480
				25	600
	RL	2, 3	1200	125	240
				100	480
				50	600
S33930, 1200 A S33931, 1200 A	MG PG	2, 3	800	65	240
				35	480
		2, 3	1200	18	600
	MJ PJ	2, 3	800	100	240
				65	480
	2, 3	1200	25	600	
				65	240
	PK	2, 3	1200	50	480
				50	600
				125	240
S33930, 1200 A	PL	2, 3	1200	100	480
				65	240
				35	480
	RG	2, 3	1200	18	600
				100	240
				65	480
	RJ	2, 3	1200	25	600
				125	240
				100	480
	RL	2, 3	1200	50	600
				65	240/480/600

¹ S33930, S33931, SL1200P5, SL1200P6, SL1200P7, SL kits are rated 1200 A and may be applied to 1200 ampere loads when installed into HCRU panelboards restrictively on the wide side.

CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards. Main Lug interiors with the "CE" mark have been tested to withstand 42,000 RMS symmetrical amperes for 30 cycles. Only IEC rated circuit breakers may be used with "CE" marked interiors and the short circuit rating of the interior is limited to the lowest IEC rated branch breaker unless series rated with an IEC rated main breaker in Table 4. (See Digest for details)

Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for I-Line panelboards:

- Equipment Ground Bar Kits, on page 36
- Mechanical Interlock Kits, on page 36
- Main Lug Kits, on page 37
 - Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum, on page 37
 - Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper, on page 37
- Circuit Breaker Lug Kits, on page 38
 - Versa-Crimp Lugs and Versatile Compression Lug Kits, on page 38
- Extension Kits, on page 40

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of I-Line panelboards. Select the required kit according to the interior catalog number. Kits can be field installed.

Table 7: Equipment Ground Bar Kits Specifications

Panelboard	Use Ground Bar Kit Catalog Number	
	Aluminum ¹	Copper ²
HCN	PK27GTA	PK27GTACU
HCM, HCP, HCRU	PK32DGTA	PK32DGTACU

¹ Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

² Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol  stamped into the back wall of the enclosure.

Mechanical Interlock Kits

Kits can be field installed.

Table 8: Mechanical Interlocks Specifications

Catalog Number	Circuit Breaker Combinations		Panelboard Type
	Mains	Auxiliary	
HFK3DTI	FA	FA	HCN, HCM, HCP, HCRU
HFM3DTI	LA	FA	HCRU
HLM3DTI	LA	LA	HCP, HCRU
HPFK3DTI	MG/MJ	FA/KA	HCP, HCPSU, HCRU
HPHJ3DTI	MG/MJ	H/J	HCP, HCPSU, HCRU
HPL3DTI	MG/MJ	LA	HCP, HCPSU, HCRU
HPP3DTI	MG/MJ	MG/MJ	HCP, HCPSU, HCRU

Main Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 9: Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A				—
400 A	4–300 kcmil AL/CU 21.1–151 mm ²	VCCEL-030-516H1	VC-6 Series	HCN400VCA HCM400VCA HCW400VCA
	500–750 kcmil AL 253–380 mm ²	VCCEL-075-12H1	VC-6FT, VC-8	—
600 A	2/0–500 kcmil AL/CU 67.4–253 mm ²	VCCEL-050-38H1	VC-6 FT	HCN600VCA HCM600VCA HCW600VCA
800 A		VCCEL-050-12H1		HCM800VCA HCW800VCA
1200 A	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VCCEL-075-12H1 ¹	VC-6FT, VC-8	HCW1200VCA

¹ When this lug is installed, the box extension HC-4212-DEX (F or S) must be added to the incoming cable end of the enclosure.

Table 10: Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A				—
400 A	2/0–300 kcmil CU 67.4–151 mm ²	VCCELC-030-38H1	VC-6-3 VC7 VC6-FT VC7-FT	HCN400VCA HCM400VCA HCW400VCA
	400–750 kcmil CU 203–380 mm ²	VCCELC-075-12H1	VC-6FT VC7-FT VC8	—
600 A	250–500 kcmil CU 127–253 mm ²	VCCELC-050-12H1	VC6-3 VC7 VC6-FT VC7-FT	HCN600VCA HCM600VCA HCW600VCA
800 A				HCM800VCA HCW800VCA
1200 A	400–750 kcmil CU 203–380 mm ²	VCCELC-075-12H1	VC-6FT VC7-FT VC8	HCW1200VCA

Circuit Breaker Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 11: Versa-Crimp Lugs and Versatile Compression Lug Kits ¹

Aluminum	Wire Range ²	Versa-Crimp Tool	Copper	Wire Range ²	Versa-Crimp Tool	
VC100FA VC100FD	8–1/0 8.36–53,5 mm ²	VC-6	CVC100FA CVC100FD	6–1/0 CU 13.3–53.5 mm ²	VC-6 Series	
VC250KA3	4–300 kcmil 21.1–151 mm ²		CVC250KA3	2/0–300 kcmil CU 67.4–151 mm ²		
VC250KA35	250–350 kcmil 127–177 mm ²		CVC400LA3	4–300 kcmil CU 21.1–151 mm ²		
VC400LA35	250–350 kcmil 127–177 mm ²		CVC400LA5 CVC600MA5	250–500 kcmil CU 127–253 mm ²		
VC400LA3	4–300 kcmil 21.1–151 mm ²		CVC1200NE5	2/0–500 kcmil 67.4–253 mm ²		
VC400LA5	2/0–500 kcmil 67.4–253 mm ²		CVC1200NE7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²		
VC400LA7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VC-6 FT VC-8				
VC400LA7	2/0-500 kcmil 67.4–253 mm ²	VC-6 Series	—			
VC800MA7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VC-6 FT VC-8				
VC1200NE5	2/0–500 kcmil 67.4–253 mm ²	VC-6 Series				
VC1200NE7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VC-6 FT VC-8				
YA060HD	# 6–#2 AWG	3	CYA060HD	# 6–1/0 AWG CU	3	
YA150HD	# 1–4/0 AWG		CYA150JD	# 4–2/0 AWG CU		
YA150JD	# 1–3/0 AWG		CYA150HD	# 6–1/0 AWG CU		
YA250J35	3/0–350 kcmil		CYA250J3	1/0–350 kcmil CU		

¹ Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

² Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

³ Use crimp tools in accordance with instructions that are provided within each lug kit.

Table 12: Compression Lug Kits for L-, MG-, MJ-, P-, and R-Frame Circuit Breaker ¹

Aluminum	Wire Range ²	Versa-Crimp Tool	Copper	Wire Range ²	Versa-Crimp Tool
YA250P3	2/0–300 kcmil 67.4–151 mm ²	4, 5	CYA400P5	4/0–500 kcmil CU 107–253 mm ²	4, 5
YA300P5	4/0–500 kcmil 107–253 mm ²		CYA600P5	4/0–500 kcmil CU 107–253 mm ²	
YA400P3	2/0–300 kcmil 67.4–151 mm ²		CYA800P7	500–750 kcmil CU 253–380 mm ²	
YA400P7	500–750 kcmil 253–380 mm ²		CYA1200R5	4/0–500 kcmil CU 107–253 mm ²	
YA600P5	4/0–500 kcmil 107–253 mm ²		CYA1200R7	500–750 kcmil CU 253–380 mm ²	
YA800P7 ³	500–750 kcmil 253–380 mm ²		—		
YA1200R3	2/0–300 kcmil 67.4–151 mm ²				
YA1200R5	4/0–500 kcmil 107–253 mm ²				
YA1200R7	500–750 kcmil 253–380 mm ²				
YA400L31K3 ⁷	#4–300 kcmil 21–151 mm ²	4	CYA400L31K3 ⁷	2/0–300 kcmil	4
YA600L32K3 ⁷			CYA600L32K3 ⁷	67.4–151 mm ²	
YA400L51K3 ⁷	CYA400L51K3 ⁷		250–500 kcmil		
YA600L52K3 ⁷	CYA600L52K3 ⁷		127–253 mm ²		
YA400L71K3 ^{6, 7}	500–750 kcmil 253–380 mm ²		—		

¹ Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

² Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

³ When this lug is installed on a vertically mounted main circuit breaker, in an HCP interior, add box extension HC-4212-DEX (F or S) to the end of that enclosure.

⁴ Use crimp tools in accordance with instructions that are provided within each lug kit.

⁵ Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition. I-LINE panelboards with a Type 1 enclosure require a 5.0 in. extended width box when the branch breakers use these lugs (these compression lugs may not be used in weatherproof enclosures). Contact your local Schneider Electric representative for assistance.

⁶ This lug is only allowed in HCP/HCPSPU panelboards with Type 1 enclosures with a 5.0 in. wide side extension.

⁷ For L-frame circuit breakers only.

Extension Kits

Table 13: Extension Kits for HCN, HCM, HCRU and HCP Panelboards

Catalog Number	For Use With
HC2609EX ¹	HC26--B ²
HC2609DEX ¹	HC26--DB ²
HC3209EX ¹	HC32--B ²
HC4212DEX ¹	HC42--DB ²
HC4406DEX ¹	HC44--DB ²
HC4412DEX ¹	HC44--DB ²

¹ Add "F" for flush, "S" for surface as required.

² Series E1 Enclosures.

NOTE: Kits can be field installed. Extension kit must be attached to enclosure before mounting enclosure to wall.

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I-Line™ Circuit Breaker Power Distribution Panelboards
Instruction Bulletin

Schneider Electric USA, Inc.
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80043-309-20
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NF/NFOM Panelboards

Information Manual

Class 1670

Instruction Bulletin

80043-741-02

Retain in the directory card
pocket for future use.



SQUARE D

by **Schneider** Electric

HAZARD CATEGORIES AND SPECIAL SYMBOLS

ENGLISH



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

 **DANGER**

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

 **CAUTION**

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.



Provides additional information to clarify or simplify a procedure.

PLEASE NOTE Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D® brand NF and NFOM circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept ECB, EDB, EGB, and EJB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at 1-888-SquareD (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Installation

This section provides instructions for the following NF/NFOM panelboard procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 8
- “Neutral Bonding Strap Installation” on page 11
- “ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal” on page 15
- “Circuit Breaker Reset Instructions” on page 17
- “Interior Trim Preparation” on page 18

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NF/NFOM panelboard interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

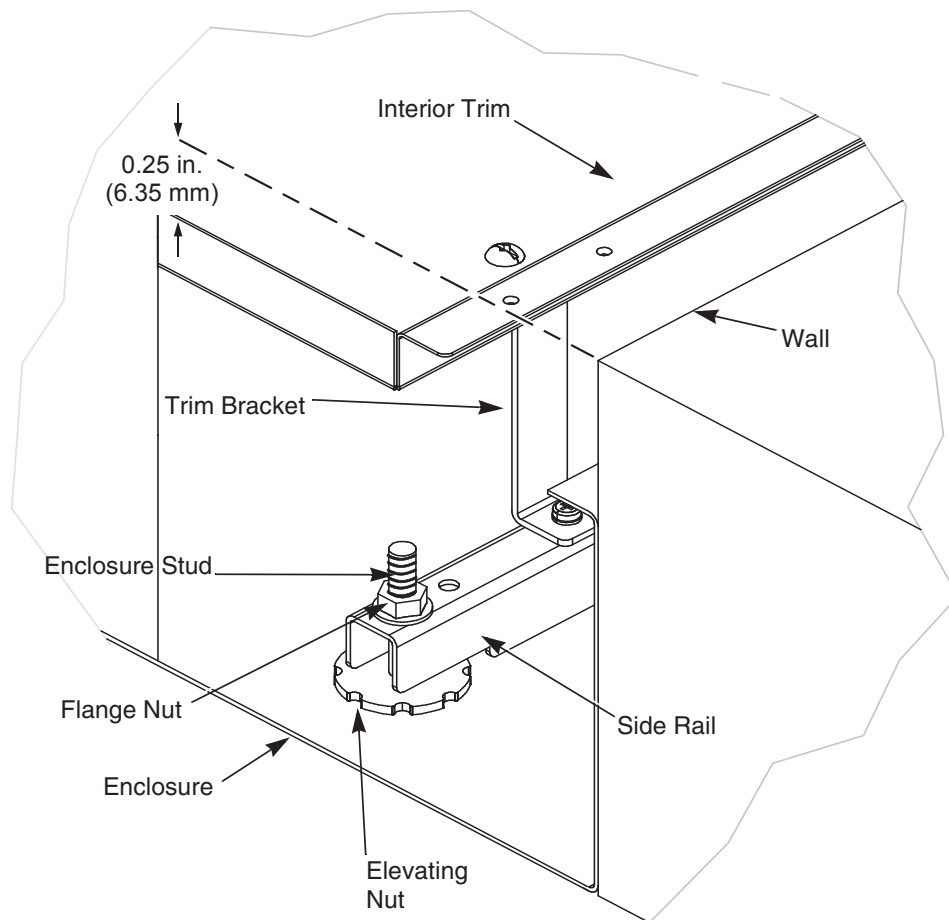
Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Thread the provided elevating nuts on the enclosure studs.
 - b. Set the interior on the enclosure studs. (See Figure 1 on page 10).
 - c. Tighten the flange nuts against the interior side rails until the rails are against the back of the enclosure.
 - d. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Thread the provided elevating nuts on the enclosure studs.
 - b. Set the interior on the enclosure studs (see Figure 1 on page 10). Place the flange nuts onto the enclosure studs, but do not tighten.
 - c. Adjust the elevating nuts so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
 - d. Tighten the flange nuts against the side rails.
 - e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Figure 1: Interior Mounting of Square D Brand Enclosures



Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “125 A or 250 A Maximum NF Panelboards”, “400 A or 600 A Maximum NF Panelboards”, or “800 A Maximum NF Panelboards” below, and on pages 12–14.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside the equipment.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

125 A or 250 A Maximum NF Panelboards

To install a neutral bonding strap on a 125 A or 250 A maximum NF panelboard, refer to Figure 2 and follow the instructions below.

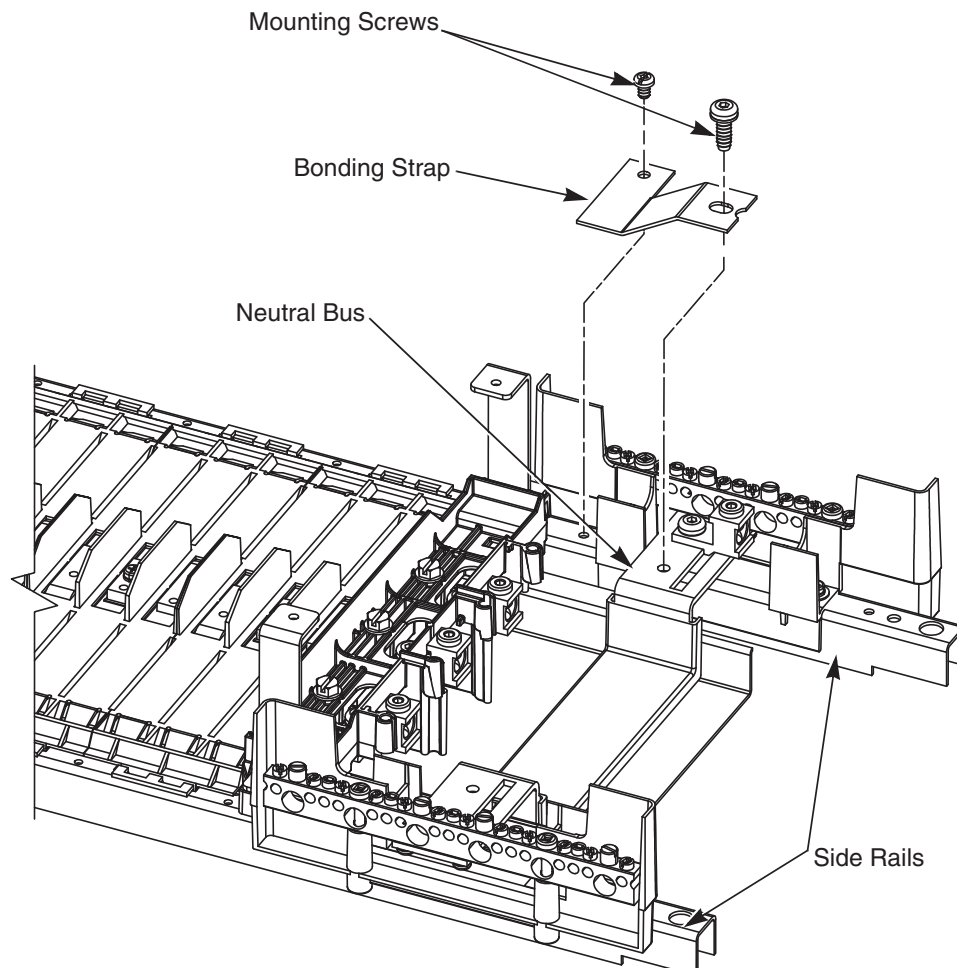
1. Align the bonding strap on the side rail, as pictured.

NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 25–30 lb-in (2.8–3.4 N•m).

NOTE: If the lug was removed in Step 1, reinstall it on top of the bonding strap. Use the 1/4-20 x 3/4 in. mounting screw. Lug mounting screws are provided in the bonding strap bag assembly.

**Figure 2: Bonding Strap Installation —
125 A or 250 A Maximum NF Panelboards**



400 A or 600 A Maximum NF Panelboards

To install a neutral bonding strap on a 400 A or 600 A maximum NF panelboard, refer to Figure 3 and follow the instructions below.

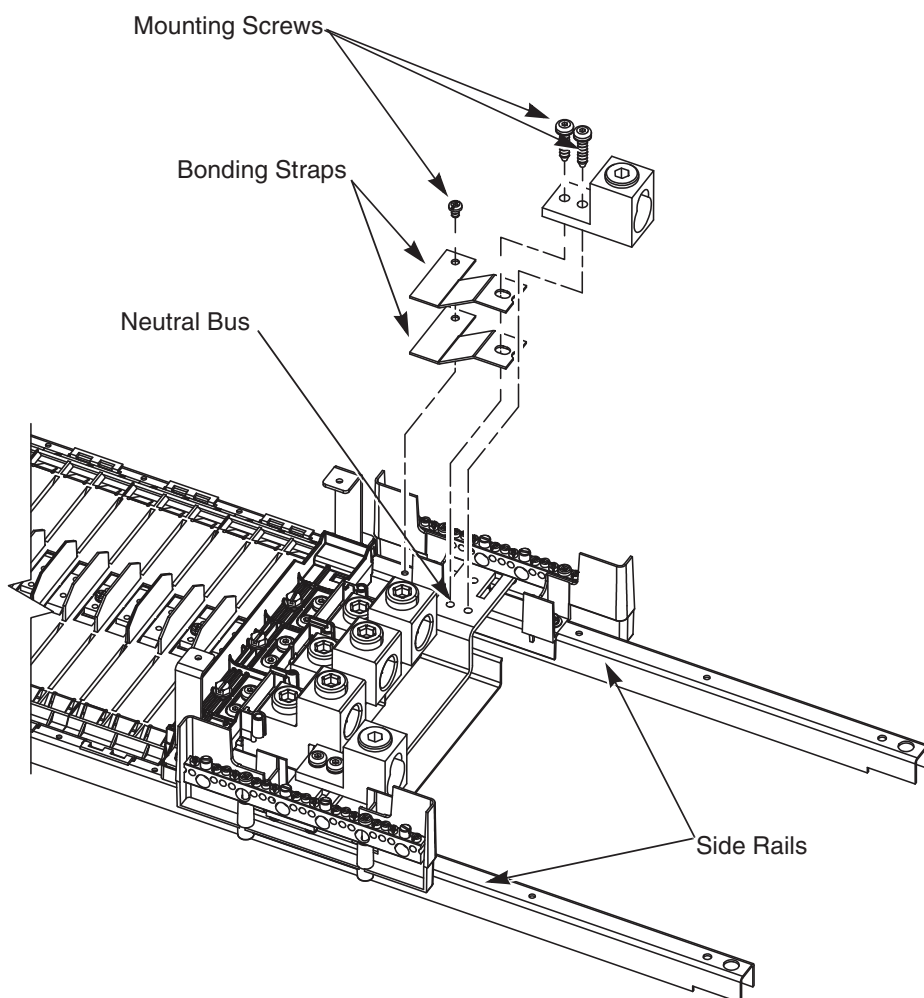
1. Align the two bonding straps on the side rail, as pictured.

NOTE: For some applications, it may be necessary to remove the lug before installing the bonding strap.

2. Insert the three mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the two 1/4-20 screws to 60–65 lb-in (6.8–7.3 N•m).

NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 1 1/8 in. mounting screws. Lug mounting screws are provided in the bonding strap bag assembly.

**Figure 3: Bonding Strap Installation —
400 A or 600 A Maximum NF Panelboards**

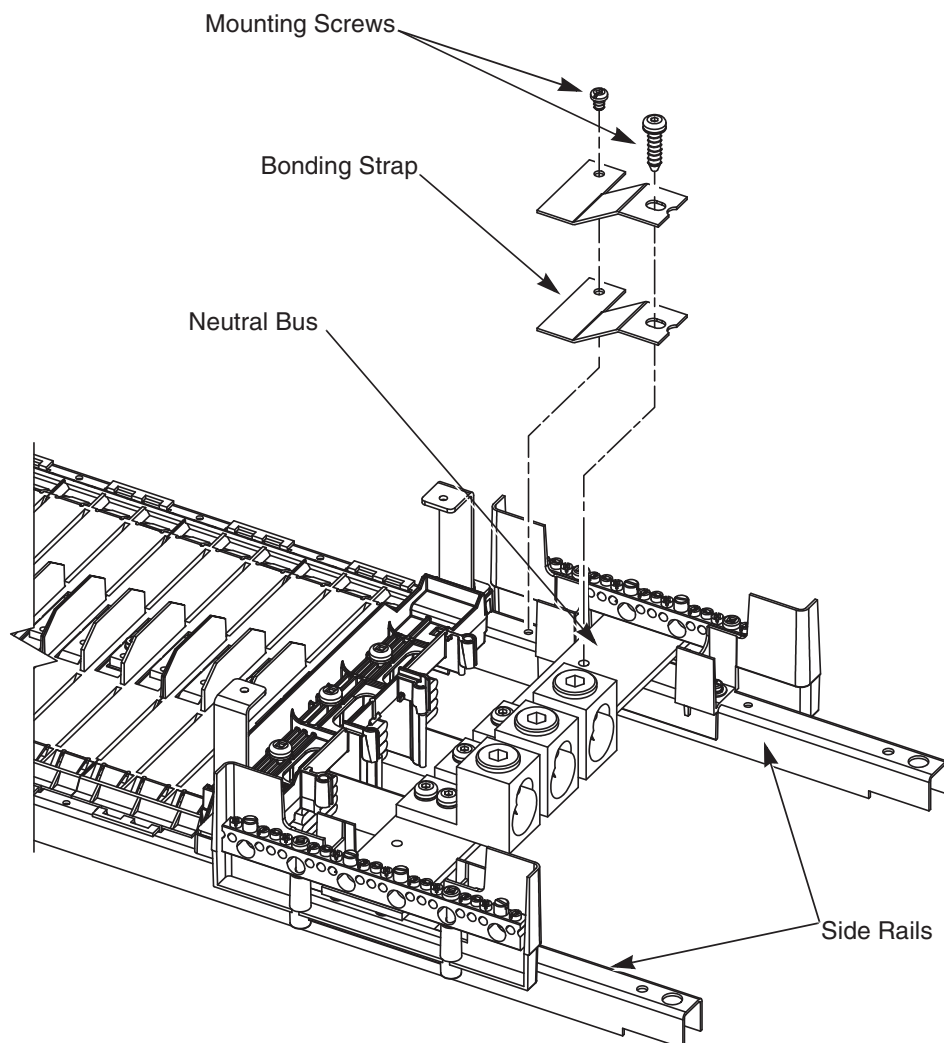


800 A Maximum NF Panelboards

To install a neutral bonding strap on an 800 A maximum NF panelboard, refer to Figure 4 and follow the instructions below.

1. Align the two bonding straps on the side rail, as pictured.
2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 60–65 lb-in (6.8–7.3 N•m).

**Figure 4: Bonding Strap Installation —
800 A Maximum NF Panelboards**



ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

ECB, EDB, EGB, and EJB Circuit Breaker Installation

Refer to Figure 5 on page 16 for the following instructions:

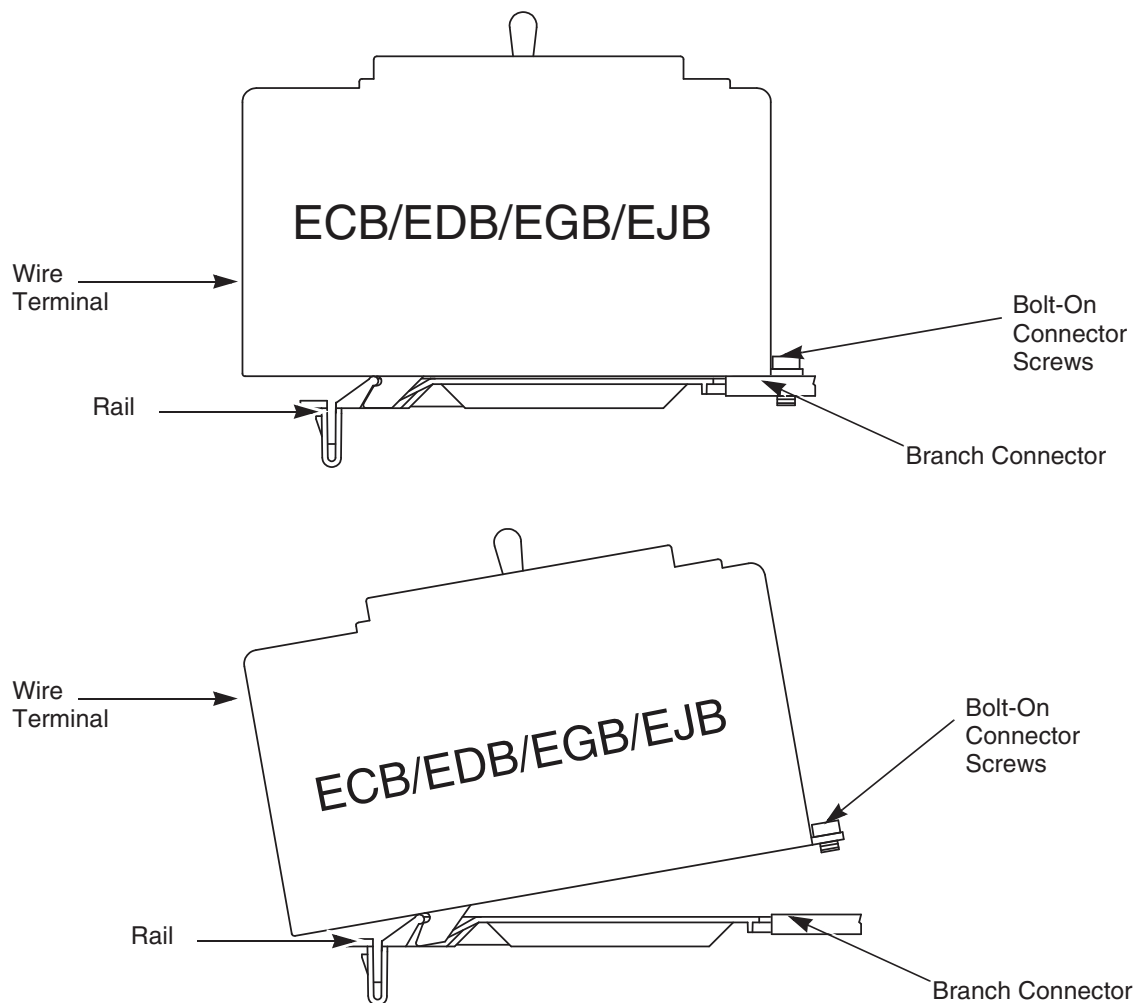
1. Turn off all power to the panelboard.
2. Turn the breaker off.
3. Remove the interior trim.
4. With the bolt-on connector end of the circuit breaker slightly elevated, insert the mounting foot into the slot in the phase cover.
5. Rotate the breaker down and back until the captive screw(s) align with the tapped holes in the breaker connectors.
6. Engage the screws into the branch connector hole and tighten it to 20–30 lb-in (2.3–3.4 N•m).
7. Install the load wire.
8. Reinstall the interior trim.

ECB, EDB, EGB, and EJB Circuit Breaker Removal

Refer to Figure 5 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim.
3. Turn the breaker off.
4. Remove the load wire.
5. Loosen the screw(s) in the breaker connector and lift the breaker off of the panelboard.
6. Reinstall the interior trim.

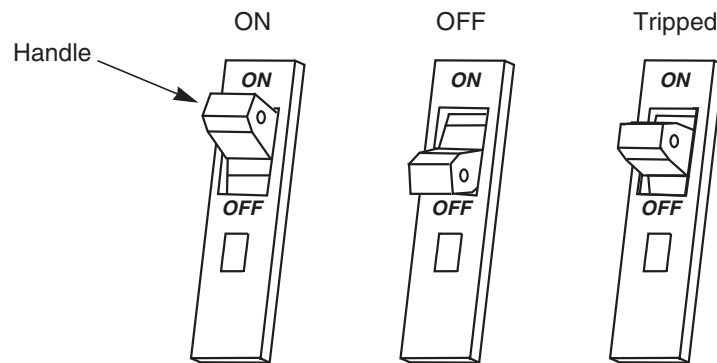
Figure 5: ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal



Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 6: Circuit Breaker Handle Positions



Interior Trim Preparation

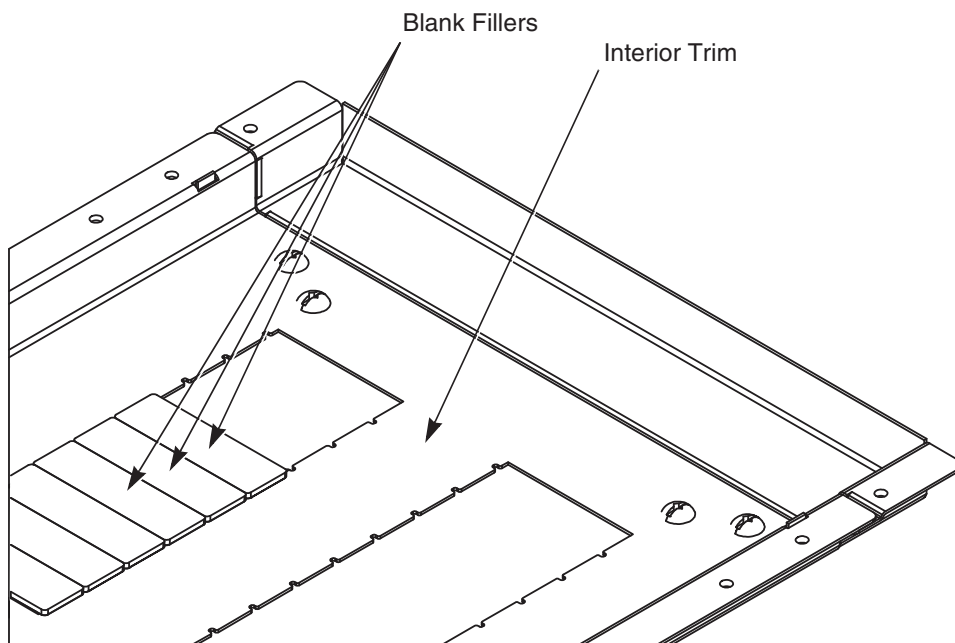
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 7: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

Appendix 1: Specifications

Typical Wiring

NOTE: Do not use on 600 V or 480 V, 3-phase 3-wire delta systems.

Table 1: Panelboard Typical Wiring¹

Voltage AC	1-Phase Panelboards		3-Phase Panelboards	
	Phase	Wires	Phase	Wires
600Y/347	1	3	3	4
480Y/277	1	3	3	4
208Y/120	1	3	3	4
120/240	1	3	—	—
240 ²	1	2	3	3
240	3	3	—	—
240/120 ³	—	—	3	4 Delta

¹ Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

² For this system, the neutral is not used.

³ When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral.

Integral Main or Sub-Feed
(FI, KI, H, J, LA, LC, LH, EDB, EGB, EJB)

Figure 8: NF/NFOM 125–250 A Main Lugs or Main Breaker Diagram

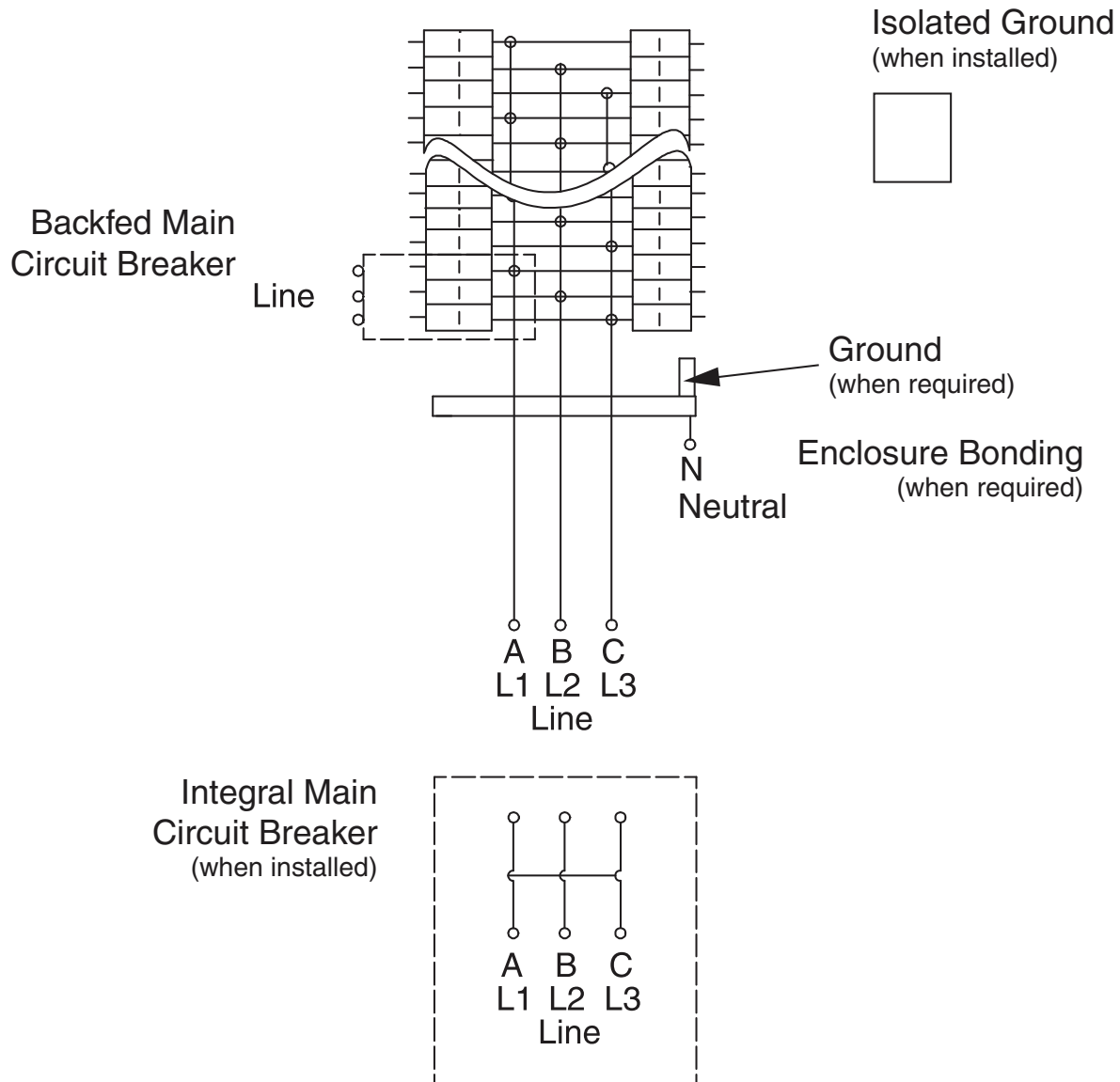


Figure 9: NF 400–800 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram

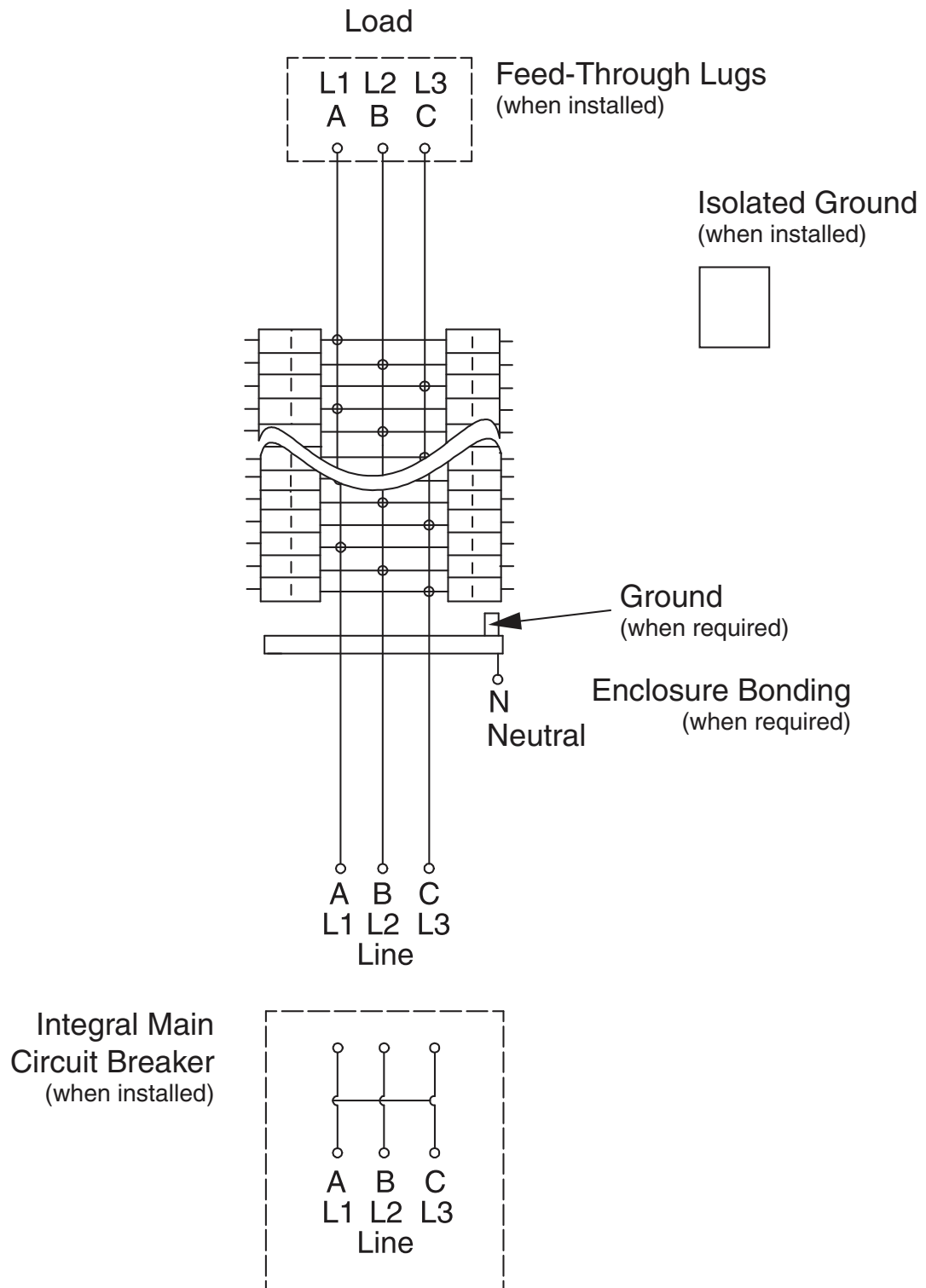


Figure 10: NF 400–800 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram

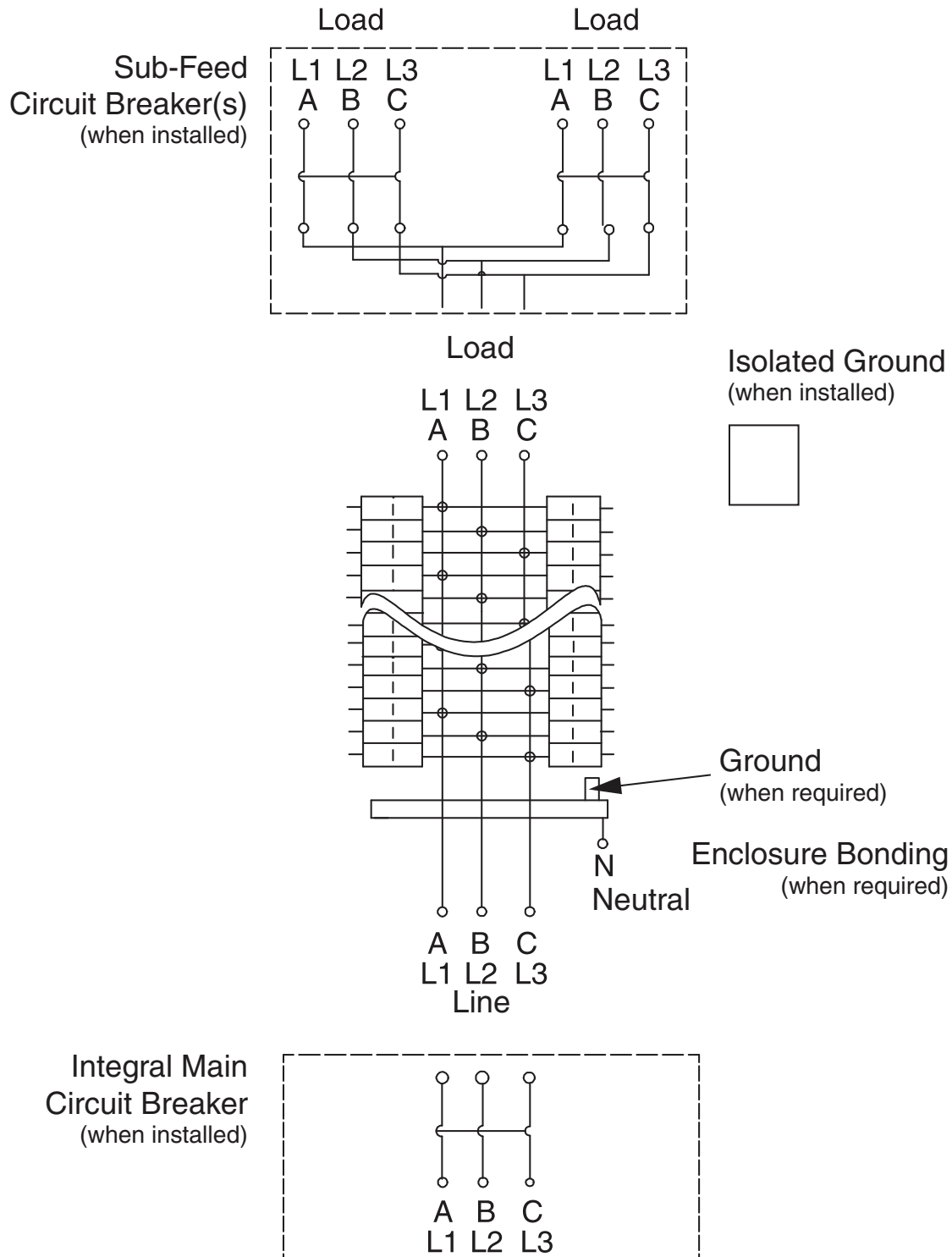
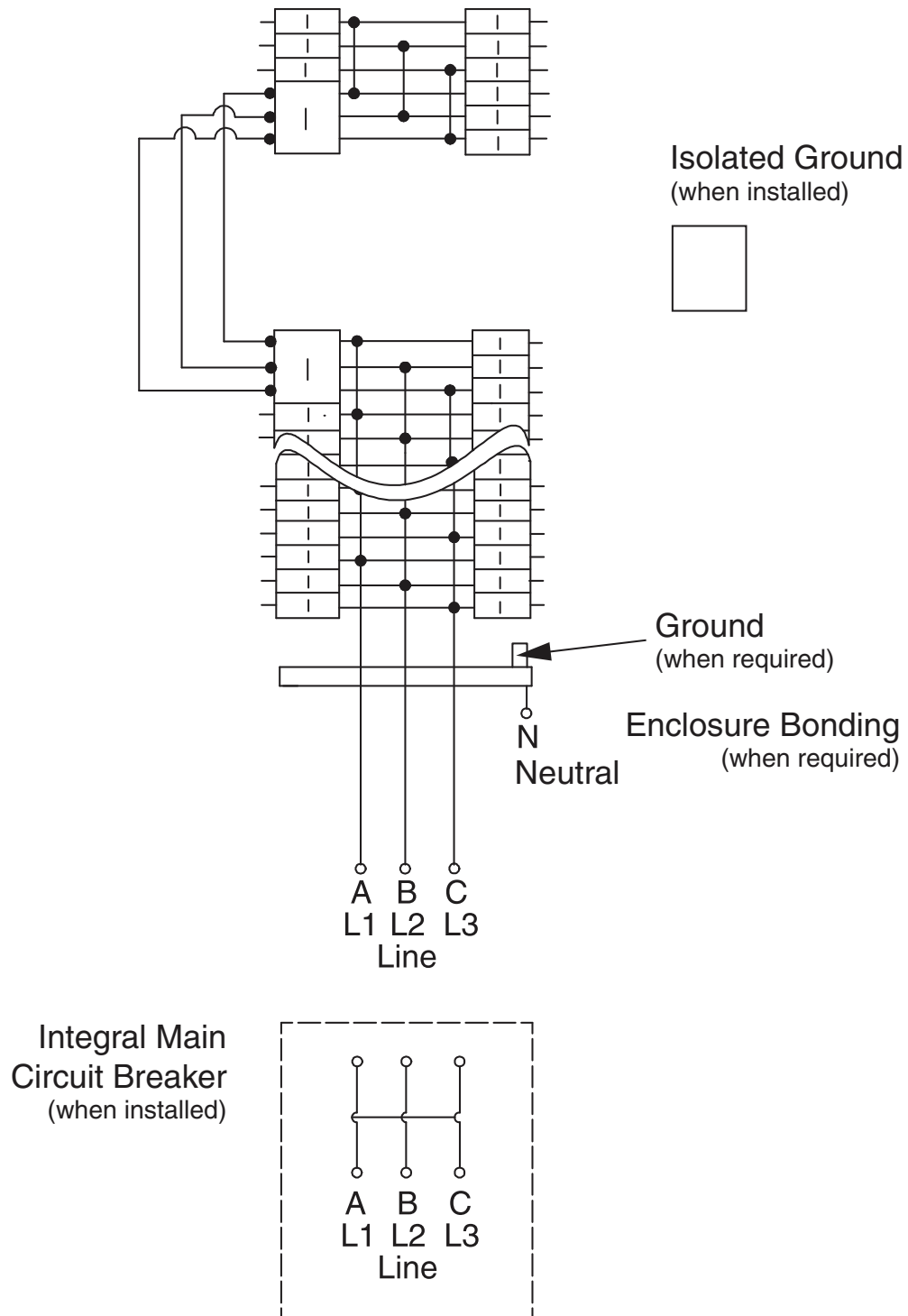


Figure 11: Typical NF Panelboard with Split Bus Diagram



Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information.
The series rated system label is located in the bag assembly.

NOTE: 125 A ED/EG/EJ breakers are 480Y/277 Vac maximum only.

Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC ¹	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges
120 120/240 240	65,000	EG, FH, FG, KH, LH, MH, MX, HG, JG, DG	EDB, EDB-EPD
		EG	ECB-G3
	100,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ	EDB, EDB-EPD, EGB
		DJ	EDB, EGB
		EJ, FC, KC, HJ, JJ	ECB-G3
	125,000	HL, JL	EDB, EDB-EPD, EGB, ECB-G3
	200,000	FI, KI, LI, LXI	EDB, EDB-EPD, EGB, EJB
		FI, KI	ECB-G3
		Class J or T (600 V) 200 A Max Fuses	ECB-G3
277 480Y/277	35,000	EG, FG, KH, LH, HG, JG, DG	EDB, EDB-EPD
		EG, HG, JG	ECB-G3
	65,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ, DJ	EDB, EDB-EPD, EGB
		EJ, FC, KC, HJ, JJ	ECB-G3
	100,000	HL, JL	EDB, EDB-EPD, EGB, EJB
		DL	EDB, EGB, EJB
		400 A Max Fuses	EDB, EDB-EPD, EGB, EJB
	200,000	FI, KI, LI, LXI	EDB, EDB-EPD, EGB, EJB
		FI, KI	ECB-G3
		200 A Max Fuses	EDB, EDB-EPD, EGB, EJB, ECB-G3
600Y/347	18,000	HG, JG, MG	EDB
	25,000	EJ, FI, KH, KI, LC, LE, LX, LI, LXI, HJ, JJ	EDB, EGB
		LH	(15–70 A) EDB, EGB
	35,000	LC, LE, LX	EDB, EGB, EJB
	50,000	HL, JL	EDB, EGB, EJB
	65,000	FI, KI	EDB, EGB, EJB
		LI, LXI	EJB
	200,000	Class J or T (600 V) 200 A Max Fuses	EDB, EGB, EJB

¹ Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

Short Circuit Current Rating for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Main lug interiors equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D device, are rated to 25,000 RMS symmetrical amperes at 600Y/347 Vac maximum for three cycles. Use of one of the Square D circuit breakers of the correct ampere rating, listed as main circuit breakers on page 19, ahead of these lugs will result in a rating equal to that of the circuit breaker.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Use only one wire per phase for incoming circuit breaker connections when the integral LH main circuit breaker is upstream of the feed-through lugs.

Failure to follow these instructions can result in equipment damage.

CE Marking

Interiors with the “CE” mark meet the IEC 60439-1 standard.

Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NF panelboards:

- Equipment Ground Bar Kits, on page 27
- Sub-Feed Lug Kits 125–400 A Panelboards, on page 27
- Main Lug Kits
 - Mechanical Lug Kits — Aluminum, on page 28
 - Mechanical Lug Kits — Copper, on page 28
 - Versa-Crimp[®] Compression Lug Kits — Aluminum, on page 29
 - Versa-Crimp[®] Compression Lug Kits — Copper, on page 29

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NF panelboards.

Table 3: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	Mains Rating	Aluminum ¹	Copper ²
1–42	800 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

¹ Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

² Copper bars suitable for 60° C or 75° C Copper conductors.

Ground bar mounting locations are identified by the ground symbol  stamped into the backwall of the enclosure.

Sub-Feed Lug Kits 125–400 A Panelboards

Sub-Feed main lugs are available for 125, 250, or 400 A applications.

Table 4: Sub-Feed Lugs kits for 125–400 A Panelboard Applications

Main Amps	Kit Catalog Number	Maximum Circuits
125	NF125SFL	18, 30
250	NF250SFL	30, 42, 54, 66, 84
400	NF400SFL	30, 42, 54, 66, 84

Main Lug Kits

Table 5: Mechanical Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range
125	Standard	#6–350 kcmil 13.3–177.3 mm ²
250	Standard	
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm ² (2) 53.48–177.3 mm ²
600	Standard	(2) 1/0–750 kcmil (2) 53.48–380 mm ²
800	Standard	(3) 1/0–750 kcmil (3) 53.48–380 mm ²

Table 6: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
125	NFCUM1	#6–350 kcmil 13.3–177.3 mm ²
250	NFCUM2	
400	NFCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm ² (2) 53.48–177.3 mm ²
600	NFCUM6	(2) 1/0–750 kcmil (2) 53.48–380 mm ²

Table 7: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFALV1	#4–300 kcmil 21.15–152 mm ²	VC6
250	NFALV2	250–350 kcmil 126.7–177.3 mm ²	
400	NFALV4	(2) 2/0–500 kcmil	
600	NFALV6	(2) 67.43–253.4 mm ²	

Table 8: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFCUV1	#6–1/0 kcmil 13.30–53.48 mm ²	VC6-3
250	NFCUV2	(1) 2/0–300 kcmil (1) 67.43–152 mm ²	VC6-FT, VC7, VC7-FT, VC8
400	NFCUV4	(1) 400–750 kcmil (1) 202.7–380 mm ²	
600	NFCUV6	(2) 250–500 kcmil (2) 126.7–253.4 mm ²	VC6 Series

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Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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NQ/NQM Panelboards and QONQ Load Centers

Information Manual

Class 1640

ENGLISH

Instruction Bulletin

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Retain for future use.



by **Schneider** Electric

Hazard Categories and Special Symbols



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand NQ circuit breaker panelboards and QONQ load centers. These panelboards and load centers are Underwriters Laboratories (cULus) listed and accept QO™ and QOB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is OFF.
- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Installation

This section provides instructions for the following NQ panelboard and QONQ load center procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 6
- “Neutral Bonding Strap/Cable Installation” on page 9
- “QO and QOB Circuit Breaker Installation and Removal” on page 12
- “Circuit Breaker Reset Instructions” on page 15
- “Interior Trim Preparation” on page 16

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EQUIPMENT DAMAGE DUE TO LOOSE CONNECTIONS

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NQ panelboard or QONQ load center interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” on page 7” or “Flush Mounting (Enclosure Recessed in Wall)” on page 7.”

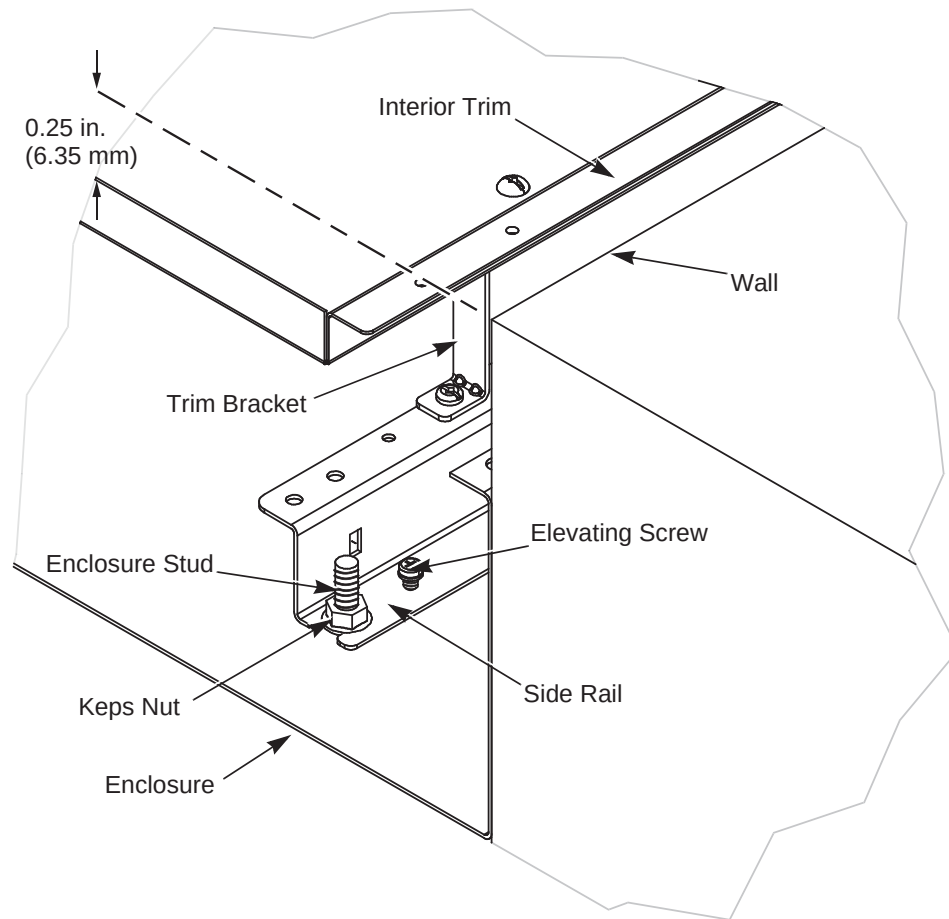
Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Set the interior on the enclosure studs. An elevating screw is not required (See Figure 1 on 8).
 - b. Tighten the keps nuts against the interior side rails until the rails are against the back of the enclosure.
 - c. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the "Neutral Bonding Strap/Cable Installation" instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Thread the (4) 10-32 x .875 in. self-tapping, elevating screws provided with the flush trim into the side rails.
 - b. Set the interior on the enclosure studs (see Figure 1 on 8). Place the keps nuts onto the enclosure studs, but do not tighten.
 - c. Adjust the screws so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
 - d. Tighten the keps nuts against the side rails.
 - e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the "Neutral Bonding Strap/Cable Installation" instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Figure 1: Interior Mounting of Square D Brand Enclosures



Neutral Bonding Strap/Cable Installation

The neutral bonding strap/cable should be used only when the panelboard is **installed** as service entrance equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “100 or 250 A Maximum NQ Panelboards” or “400 or 600 A Maximum NQ Panelboards and QONQ Load Centers” below and on page 11, respectively.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- The main bonding strap/cable should be used only when the panelboard is installed as service entrance equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap/cable parts are found in the bag assembly provided with the interior.

100 or 250 A Maximum NQ Panelboards

To install a neutral bonding strap on a 100 or 250 A maximum NQ panelboard, refer to Figure 2 and follow the instructions below.

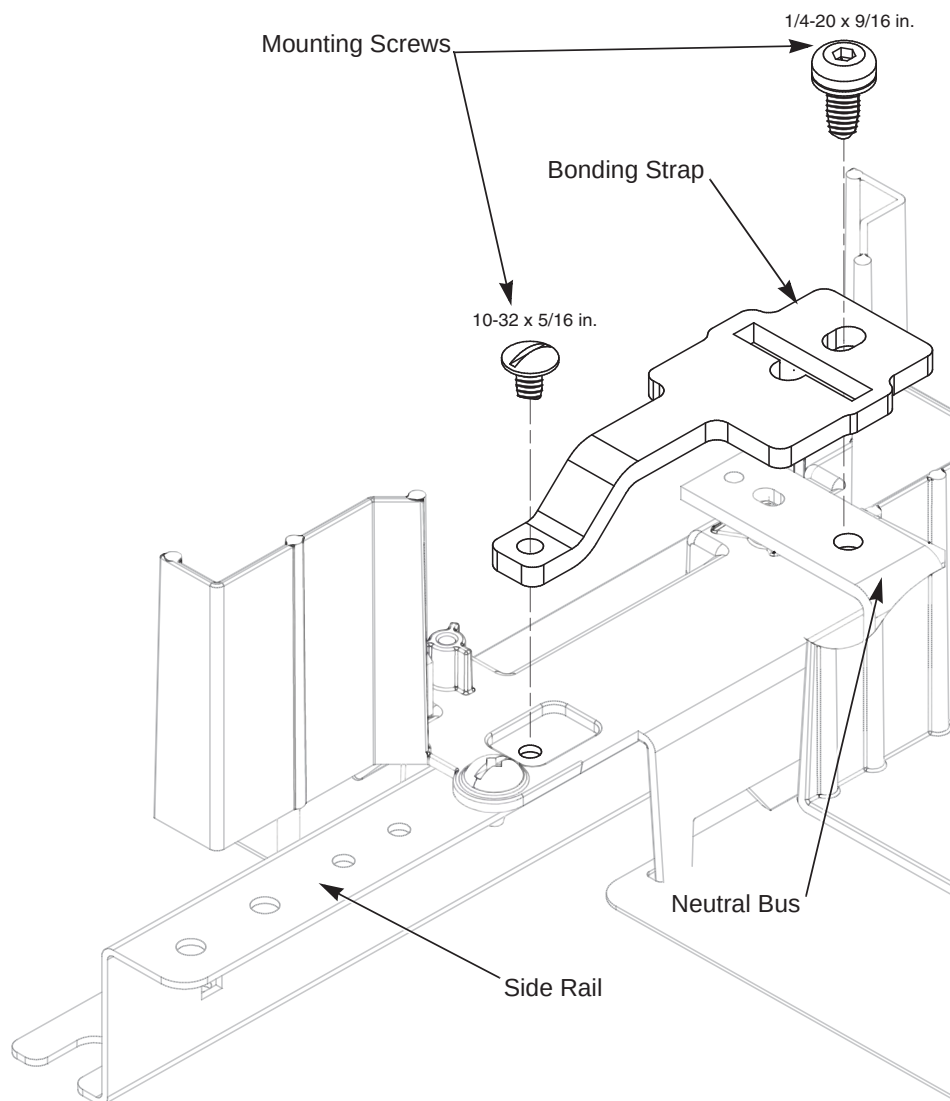
1. Align the bonding strap on the side rail, as pictured.

NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 to 25–30 lb-in (2.8–3.4 N•m).

NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 11/16 in. mounting screw with feed-through lug, sub-feed lug, sub-feed breaker, or 200% neutral applications. Use the 1/4-20 x 7/8 in. lug mounting screw with 200% neutral on 225 A applications with feed-through lug, sub-feed lug, or sub-feed circuit breaker applications. Lug mounting screws are provided in the bonding strap bag assembly.

**Figure 2: Bonding Strap Installation —
100 or 250 A Maximum NQ Panelboards**

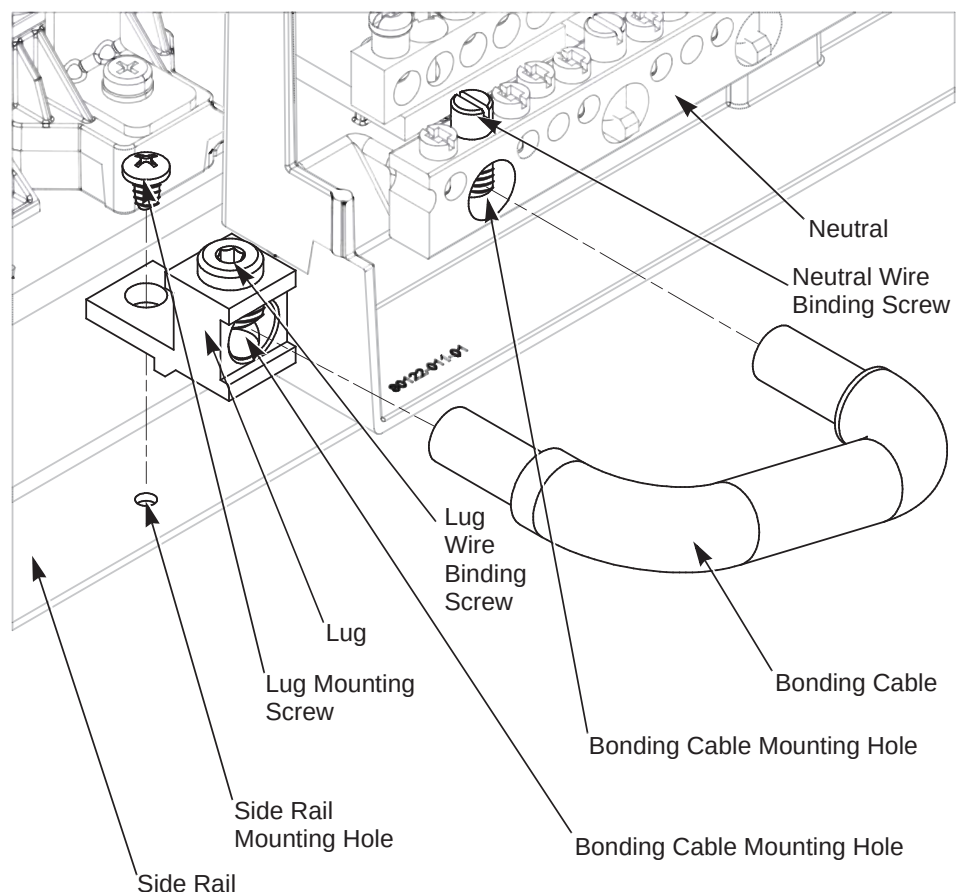


400 or 600 A Maximum NQ Panelboards and QONQ Load Centers

To install a neutral bonding cable on a 400 or 600 A maximum NQ panelboard and QONQ load center, refer to Figure 3 and follow the instructions below.

1. Align the lug on the side rail mounting hole, as pictured.
2. Tighten the lug mounting screw against the side rail to 10–12 lb-in (1.1–1.4 N•m).
3. Align the bonding cable, as pictured, and insert it into the lug and neutral mounting holes.
4. Tighten both the lug wire binding screw and the neutral wire binding screw to 45–50 lb-in (5.1–5.6 N•m).

Figure 3: Bonding Cable Installation — 400 or 600 A Maximum NQ Panelboards and QONQ Load Centers



QO and QOB Circuit Breaker Installation and Removal

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is OFF.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

QO and QOB Breaker Installation

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Turn the breaker OFF.
3. Remove the interior trim.
4. Snap the wire terminal end of the circuit breaker onto the mounting rail.
5. Engage the branch connector.

For QO Circuit Breakers:

- a. Push inward until the plug-on jaws fully engage the branch connector.

For QOB Circuit Breakers:

- a. Push inward until the breaker connector is centered on the branch connector mounting hole. Engage the screw into the branch connector hole and tighten it to the torque values shown on the interior wiring and torque diagram.

6. Install the load wire.
7. Reinstall the interior trim.

QO and QOB Breaker Removal

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Remove the interior trim.
3. Remove the load wire.
4. Disengage the branch connector.

For QO Circuit Breakers:

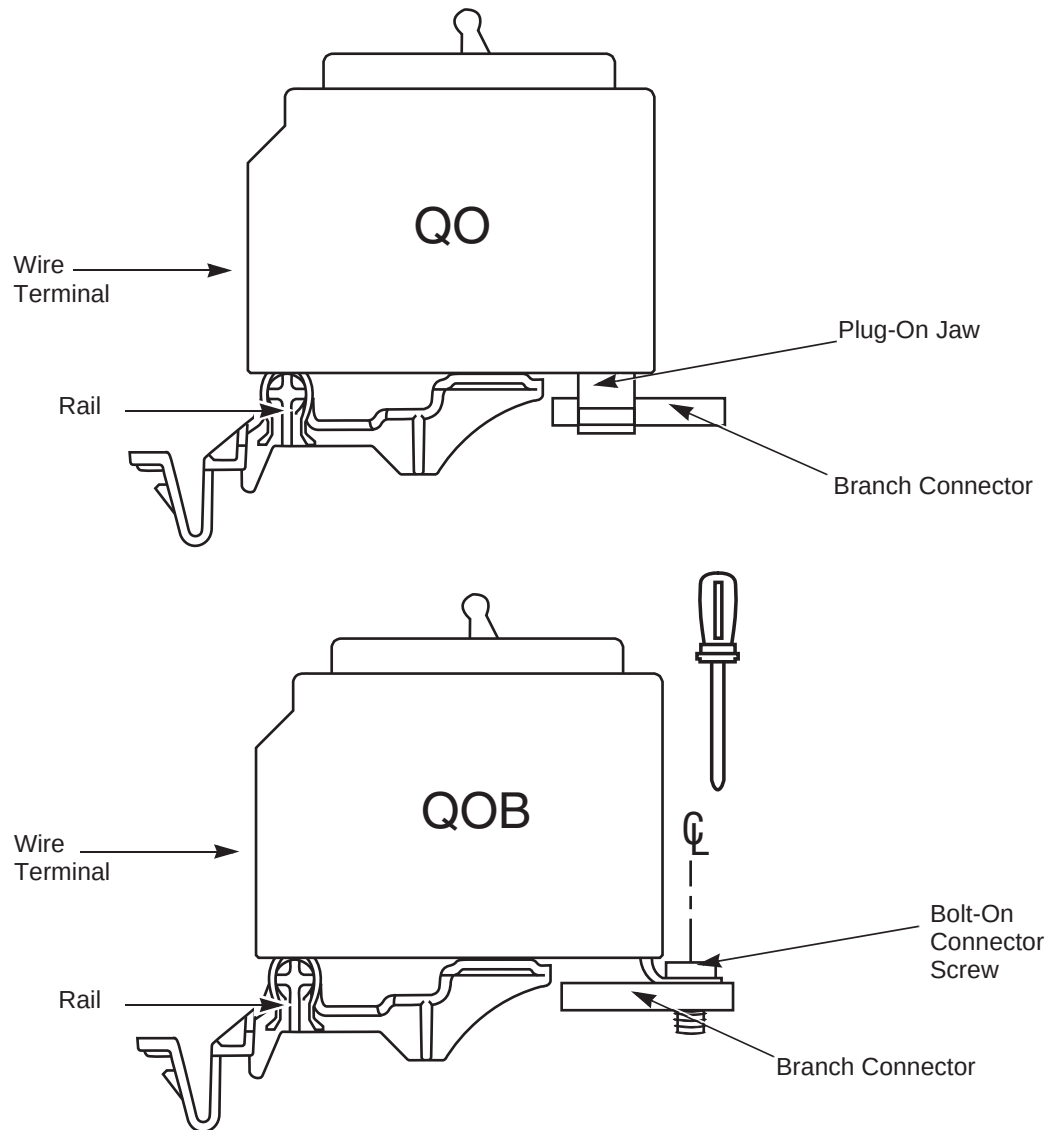
- a. Pull outward until the plug-on jaws fully disengage the branch connector.

For QOB Circuit Breakers:

- a. Loosen the screw in the breaker connector and pull the breaker off of the branch connector.

5. Snap the wire terminal end of the circuit breaker off of the mounting rail.
6. Reinstall the interior trim.

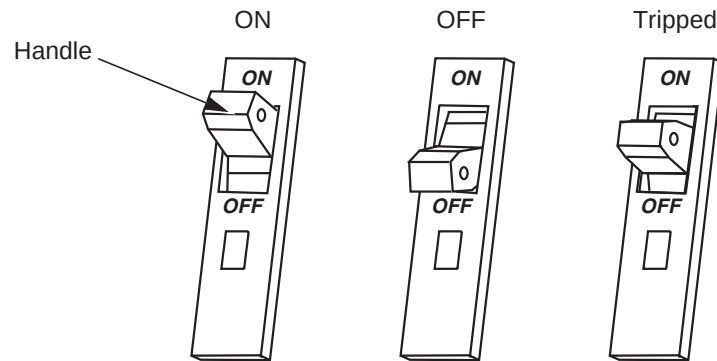
Figure 4: QO and QOB Circuit Breaker Installation and Removal



Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



Interior Trim Preparation

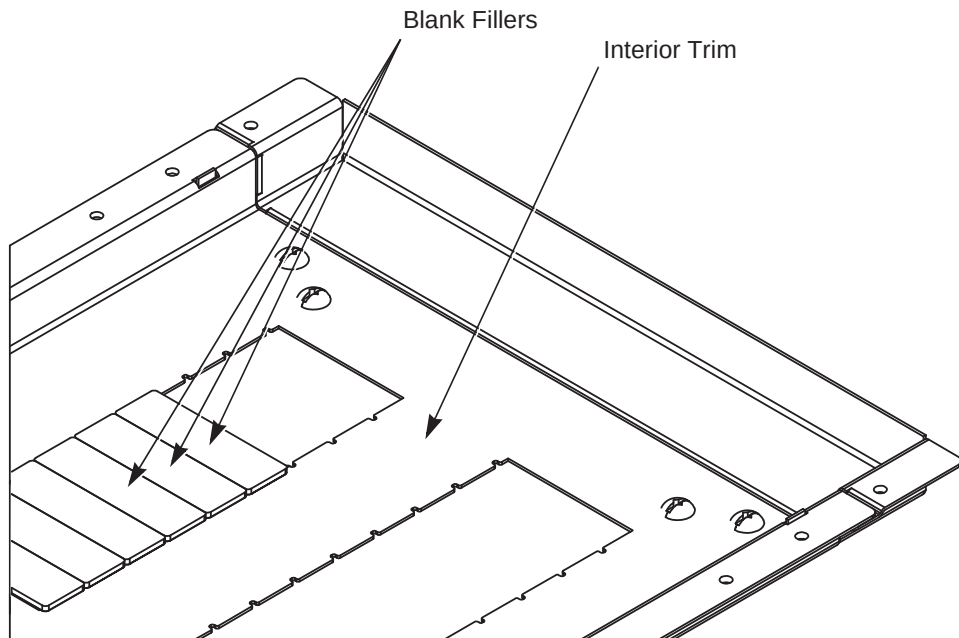
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 6: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

Appendix 1: Specifications

Typical Wiring

Table 1: Panelboard Typical Wiring¹

Voltage AC	1-Phase Panelboards		3-Phase Panelboards	
	Phase	Wires	Phase	Wires
208Y/120	—	—	3	4
120/240	1	3	—	—
240 ²	1	2	3	3
240 ³	1	3	—	—
240/120 ⁴	—	—	3	4 Delta

¹ Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

² For this system, the neutral is not used and only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

³ For a grounded “B” phase system, only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

⁴ When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum. Do not use circuit breakers rated 120 V or 120/240 V to “B” phase.

Integral Main or Sub-Feed:

DJ, FI, KI, H, J, LA, LC, LH, QB, QD, QG, QJ, QO(B)VH

Figure 7: NQ/NQM 100–225 A Main Lugs or 100–250 A Main Breaker Diagram

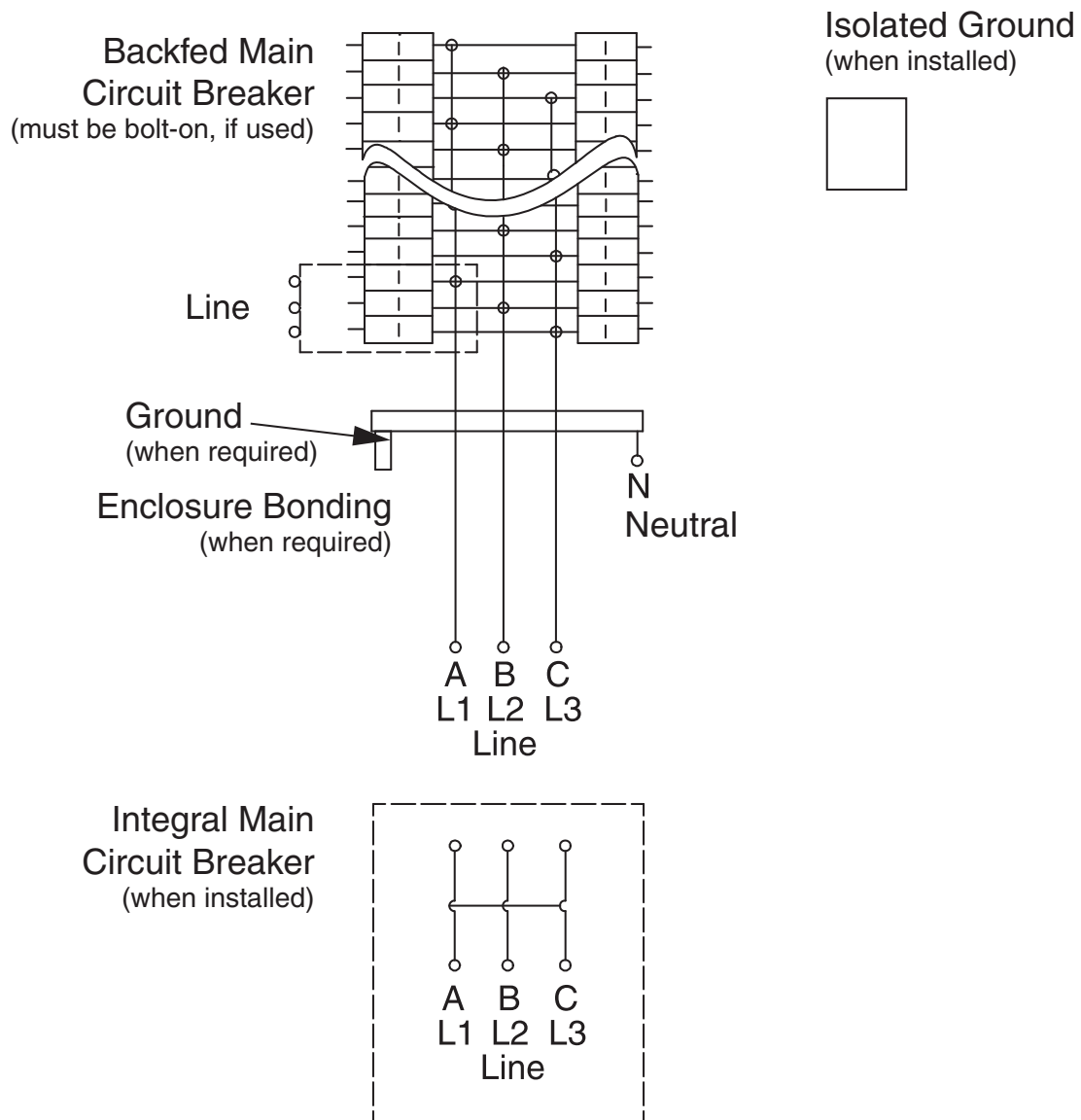


Figure 8: NQ Panelboard or QONQ Load Center 400–600 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram

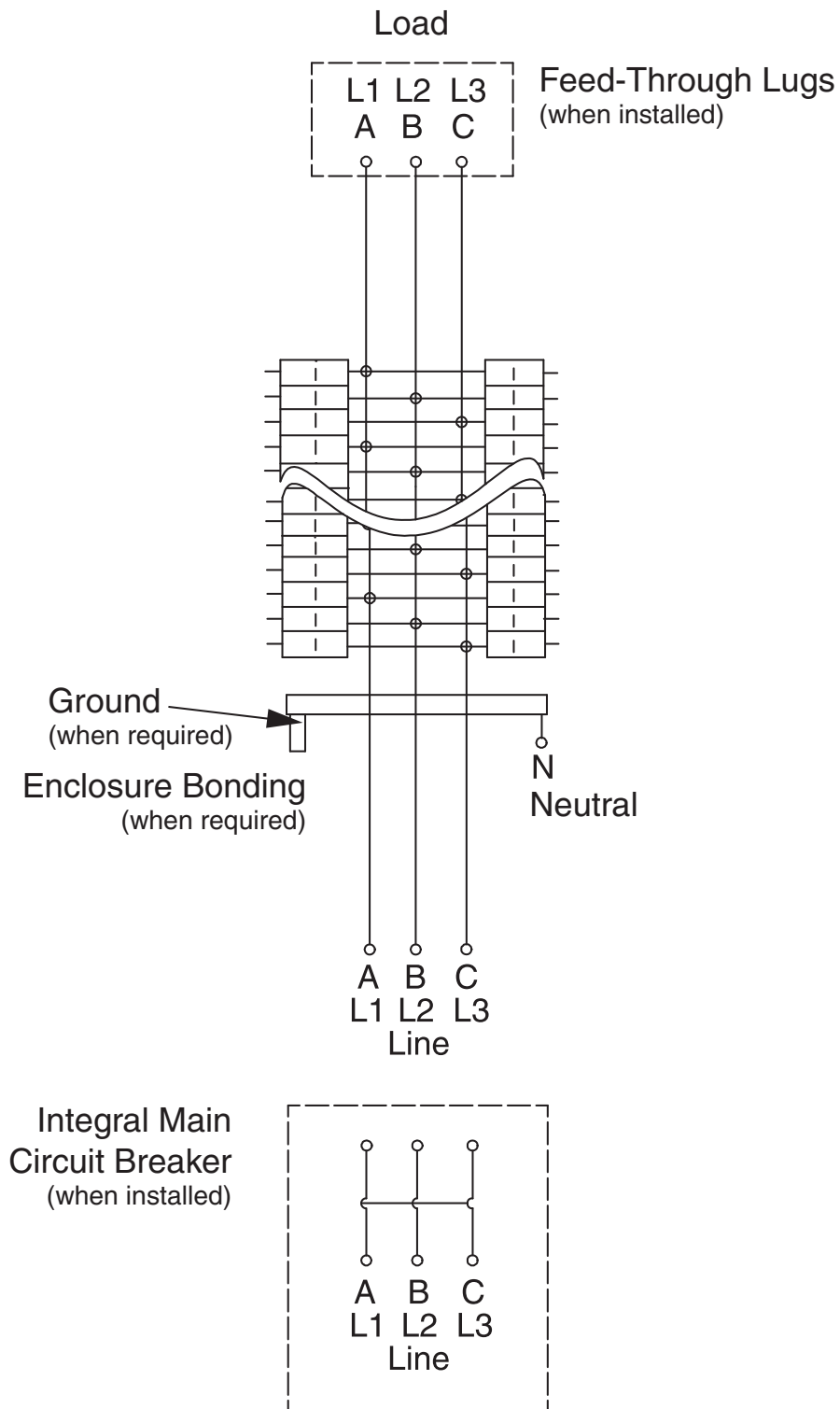


Figure 9: NQ Panelboard or QONQ Load Center 400–600 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram

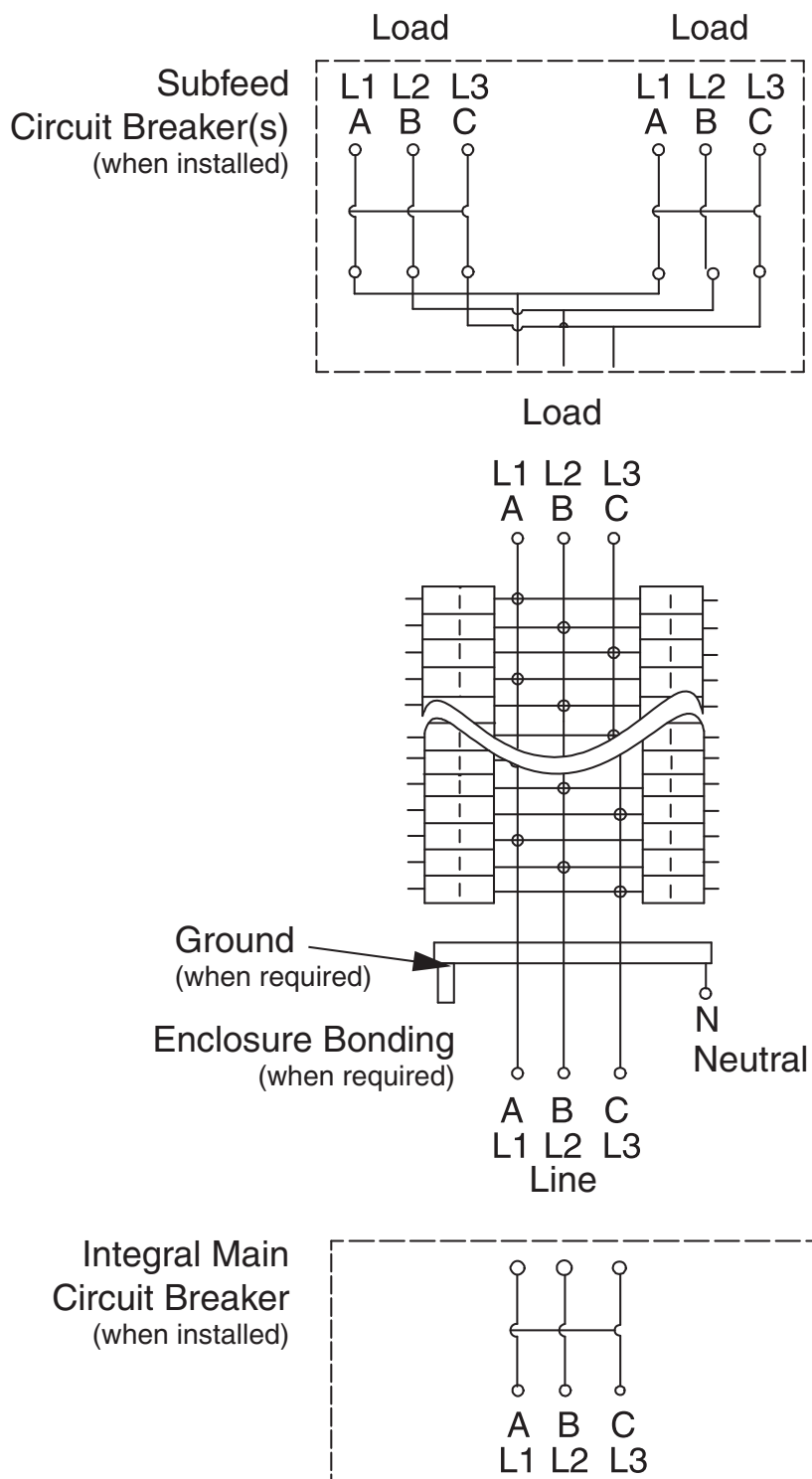
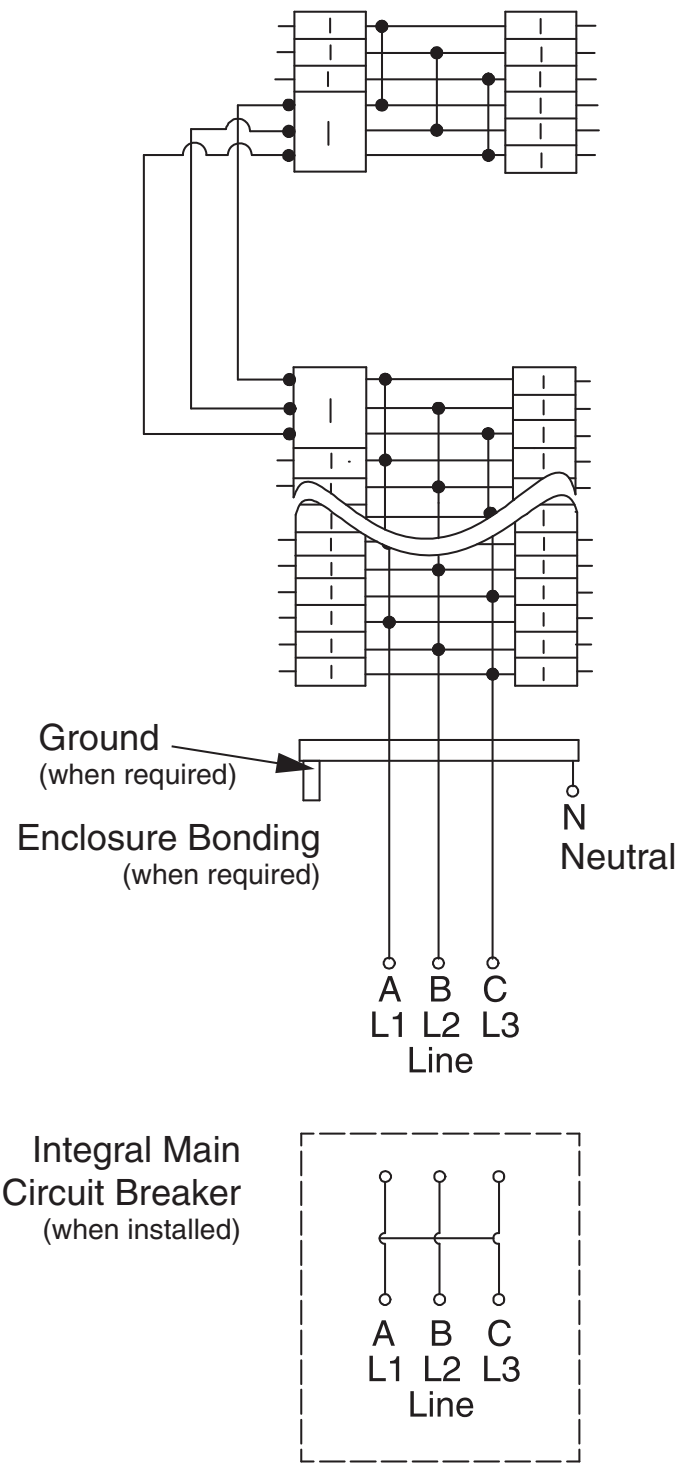


Figure 10: Typical NQ Panelboard with Split Bus Diagram



Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information. The series rated system label is located in the bag assembly.

Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	22,000	MG	QO (B)	15–30 A	—	—
	25,000	LD, HD, JD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	65,000	HG, JG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	—
	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges 3, 4, 5, 6			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	100,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	150 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	—
			QO (B) AS	15–30 A	15–30 A	—
			QO (B) VH	—	150 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
208Y/120 3P/4W	18,000	LA/LH (L) 34200MC	QO (B)	15–30 A	15–30 A	15–30 A
		LA/LH (L) 34225MC				
		LA/LH (L) 34250MC				
		LA/LH (L) 34400MC				

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	30,000	DJ-W 150 A MC ⁷	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 250 A MC ⁷	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 600 A MC ⁷	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges 3, 4, 5, 6			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	65,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LL	QO (B) GFI	—	—	15–30 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	15–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	22,000	QO (B) VH	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	25,000	QD	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		ED, FD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		KD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) AS	15–30 A	15–30 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		HD, JD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges 3, 4, 5, 6			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	42,000	LA, MA	Q2L-H	—	100–225 A	100–225 A
			QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B)	15–70 A	15–70 A	—
			QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		MG	QO (B) VH	15–30 A	15–30 A	15–30 A
			QO (B)	15–30 A	15–30 A	—
		LC 400 A	QO (B) VH	15–30 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	DJ_W	QO (B)	15–70 A	15–150 A	—
			QO (B)-VH	—	110–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
		EG, FG, KG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QG	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		HG, JG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		FC_ or KC_22_	QO (B)	15–70 A	15–100 A	15–100 A
			QO (B) AS	15–30 A	15–30 A	15–30 A

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges 3, 4, 5, 6			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_ or KC_22____ FC_ or KC_34____	QO (B) GFI	15–30 A	15–30 A	—
			QO (B) AFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		EJ	QO (B)	15–70 A	15–125 A	15–100 A
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	FI, KI, HR, JR	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
240 3P/3W or 240 1P/2W (two pole only)	22,000	QO (B) VH	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
			QO (B) PL	—	15–30 A	—
		Q2-H	QO (B)	—	—	15–30 A

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	25,000	QD	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) PL	—	15–60 A	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) GFI	—	—	15–50 A
		ED, FD	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
		KD	QO (B)	—	—	15–100 A
		HD, JD	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	—	15–50 A
	25,000	LD	QO (B) VH	—	—	15–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	42,000	LA, MA	QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–100 A
		MG	QO (B) VH	—	—	150 A
	65,000	LC 400 A	QO (B) VH	—	—	15–100 A
			QO (B) VH	—	—	15–30 A
		DJ 400 A	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		EG, FG, KG	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	65,000	QG	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		QG, HG, JG	QO (B) PL	—	—	15–30 A
		HG, JG	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		FC_or KC_22____ FC_or KC_34____	QO (B)	—	—	15–100 A
			QO (B) AS	—	15–30 A	15–30 A
		LG	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LJ	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_or KC_24____ FC_or KC_34____	QO (B) GFI	—	15–30 A	—
		DJ 400 A				
		DJ 400 A	QO (B) H	—	15–100 A	—
	100,000	EJ, FJ	QO (B)	—	—	15–100 A
		LJ	QO (B) VH	—	—	15–100 A
			QO (B) H	—	15–100 A	—
		HJ, JJ	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	125,000	HL, JL	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	200,000	FI, KI, HR, JR	QO (B)	—	—	15–100 A
120/240 1P/3W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–70 A	15–125 A	—
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
208Y/120 3P/4W	200,000	200 A Max. Class T6, J Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	—	—	15–50 A
			QO (B) EPD	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–30 A	15–125 A	—
	50,000	400 A Max. Class T3 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–125 A	—
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) AFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
			QOT	15–30 A	15–30 A	—
	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	50,000	400 A Max. Class J or T6 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	—	—	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T6 Fuses	QO (B) VH	—	—	15–150 A
			QOB VH 1φ, 2W only	—	150 A	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	15–30 A
240 3P/3W or 240 1P/2W (two pole only)	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A

¹ For shown circuit breakers rated less than this maximum voltage, the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

² Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

³ Suffixes HID, SWD, and SWN may also be applied to the applicable branch circuit breakers shown above. Suffix SWN may **not** be applied in combination with LC main breakers.

⁴ Where QO (B) circuit breakers are shown above, QO (B) H, QO (B) VH, and QH (B) circuit breakers may also be used.

⁵ Where QO (B) GFI circuit breakers are shown above, QO (B) EPD and/or QO (B) EPE circuit breakers may also be used. QO-EPE only comes in 3 pole construction.

⁶ Where QO (B) AFI circuit breakers are shown above, QO (B) CAFI circuit breakers may also be used.

⁷ To achieve selective coordination, the rating of the DJ main circuit breaker must be at least two times greater than the ampere rating of any branch circuit breaker.

Table 3: NQ Panel Mission Critical Breaker Selectivity

Maximum SCCR (RMS Symmetrical)	Integral or Remote Main Circuit Breakers	Branch Circuit Breakers			
		Type	1-pole	2-pole	3-pole
Fully Rated and Selective to 10kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A L-W, 250 A	QO(B)	10–70	10–125	10–125
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 12kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–70	10–125	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 15kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–60	10–60	10–30
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 18kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–30	10–30	—
		QO(B)-H			
		QO(B)-VH			
		QH			
	L-W, 250 A	QO(B)	10–60	10–60	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 30kA at 208Y/120 Vac or at 240/120 Vac	L-W, 400 A L-W, 600 A	QO(B)	15–70	15–150	15–150
		QO(B)-H			
		QO(B)-VH			
		QH			

Including AFI, CAFI, EPD and GFI Circuit Breakers

Table 4: Short Circuit Current Rating¹ for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Maximum System Voltage AC	Maximum Current Rating	Branch Circuits	Application	Adder ²	Maximum Short Circuit Current Rating ³
240	100	18, 30	SFL and FTL	—	10,000
	225	30, 42, 54, 72, 84	SFL	6 inches (152.4 mm)	
		42	FTL	—	
		30, 54, 72, 84		6 inches (152.4 mm)	
	400	30, 42, 54, 72, 84	SFL	—	25,000
		30, 84	FTL	—	
		42, 54, 72		6 inches (152.4 mm)	
		30, 42, 54, 72, 84	FTL	12 inches (304.8 mm)	

¹ This rating applies to main lug interiors, equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D brand device. Use of a Square D brand main circuit breaker ahead of these lugs will result in a rating equal to the rating of the breaker. Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

² The adder is the additional length of the enclosure.

³ RMS symmetrical amperes, for three cycles.

CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards.

Main lug interiors with the "CE" mark have been tested to withstand 10,000 RMS symmetrical amperes for 30 cycles.

Interiors with the "CE" mark are only approved for use with QOXD or QOBXD branch circuit breakers which carry the "CE" mark.

Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NQ panelboards:

- Equipment Ground Bar Kits
- Oversized Lug Kits for 100–250 A Panelboards
- Sub-Feed Lug Kits for 100–400 A Panelboards
- Main Lug Kits
 - Mechanical Lug Kits—Aluminum
 - Mechanical Lug Kits—Copper
 - Versa-Crimp® Compression Lug Kits—Aluminum
 - Versa-Crimp Compression Lug Kits—Copper

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NQ panelboards and QONQ load centers.

Table 5: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	Mains Rating	Aluminum ¹	Copper ²
1–42	600 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

¹ Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

² Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol  stamped into the backwall of the enclosure.

Oversized Lug Kits for 100–250 A Panelboards

Oversized lug kits are available for applications where termination conductors of 3 AWG or larger are required for the neutral.

Table 6: Oversized Lug Kits for 100–250 A Panelboards Specifications

Circuit Breaker Rating	Kit Catalog Number	Wire Range
70 A	QO70AN	(1) 10–2 Al ([1] 5.76–33.6 mm ²) (1) 14–4 Cu ([1] 2.08–21.1 mm ²)
80–125 A	Q1100AN	(1) 4–1/0 Al/Cu ([1] 42.4–53.5 mm ²)
125–150 A	Q1150AN	(1) 1–4/0 Al/Cu ([1] 42.4–107 mm ²)

Sub-Feed Lug Kits for 100–400 A Panelboards

Sub-feed main lugs are available for 100, 225, or 400 A applications.

Table 7: Sub-Feed Lug Kits for 100–400 A Panelboards Specifications

Main Amps	Kit Catalog Number	Maximum Circuits
100	NQSFL1	18, 30
225	NQSFL2	30 ¹ , 42 ¹ , 54 ¹ , 72 ¹ , 84 ¹
400	NQSFL4	30, 42, 54, 72, 84

¹ These panels require an additional 6 inches (152.4 mm) for the box and trim, for proper wire bending space.

Main Lug Kits**Table 8: Mechanical Lug Kits — Aluminum**

Panelboard Amps	Kit Catalog Number	Wire Range
100	Standard	#6–2/0 AWG (13.3–67.43 mm ²)
225	Standard	#6–350 kcmil (13.3–177.3 mm ²)
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm ²) ([2] 53.48–177.3 mm ²)
600	Standard	(2) 1/0–750 kcmil ([2] 53.48–380 mm ²)
	NQALM6A	(3) #6–250 kcmil ([3] 13.3–127 mm ²)

Table 9: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
100	NQCUM1	#6–2/0 AWG (13.3–67.43 mm ²)
225	NQCUM2	#6–250 kcmil (13.3–127 mm ²)
400	NQCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm ²) ([2] 53.48–177.3 mm ²)
600	NQCUM6	

Table 10: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQALV1	#8–1/0 AWG (8.36–53.48 mm ²)	VC6 (All)
225	NQALV2	#4–300 kcmil (21.15–152 mm ²)	
400	NQALV4	(2) 2/0–500 kcmil ([2] 67.43–253.4 mm ²)	VC6-3, VC6-FT
600	NQALV6		

Table 11: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQCUV1	#6–1/0 AWG (13.30–53.48 mm ²)	VC6 (All), VC7 (All)
225	NQCUV2	2/0–300 kcmil (67.43–152 mm ²)	VC6-3, VC7, VC6-FT, VC7-FT
400	NQCUV4	400–750 kcmil (202.7–380 mm ²)	VC6-FT, VC7-FT, VC8
600	NQCUV6	(2) 250–500 kcmil [(2) 126.7–253.4 mm ²)	VC6-3, VC7, VC6-FT, VC7-FT

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www.us.SquareD.com

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Panelboards Rated 600 Volts or Less*

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Foreword

This publication is a guide of practical information containing instructions for the proper installation, operation, and maintenance of panelboards rated 600 volts or less.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency regarding installation, operation, or maintenance.

It is recommended that work described in this set of instructions be performed only by qualified personnel familiar with the construction and operation of panelboards and that such work be performed only after reading this complete set of instructions. For specific information not covered by these instructions, you are urged to contact the manufacturer of the panelboard directly.

In the preparation of this standards publication input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product section by contacting the following: These recommendations will be reviewed periodically and updated as necessary.

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This standards publication was developed by the Panelboard and Distribution Board Product Group of the LVDE Section. Product Group approval of the standard does not necessarily imply that all Product Group members voted for its approval or participated in its development. At the time it was approved, the Product Group was composed of the following members:

Eaton Corporation.—Pittsburgh, PA
GE Industrial Solutions—Plainville, CT
Hubbell, Inc.—Orange, CT
Milbank Manufacturing Company—Kansas City, MO
Penn Panel & Box Company—Collingdale, PA
Reliance Controls Corporation—Racine, WI
Siemens Industry, Inc.—Norcross, GA
Schneider Electric —Palatine, IL

Section 1

SCOPE

This publication covers single panelboards or groups of panel units suitable for assembly in the form of single panelboards, including buses, and with or without switches or automatic overload protective devices (fuses or circuit breakers), or both. These units are used in the distribution of electricity at 600 volts and less with:

- 1600—ampere mains or less
- 1200—ampere branch circuits or less

Specifically excluded are live-front panelboards, panelboards employing cast enclosures for special service conditions, and panelboards designed primarily for residential and light commercial service equipment.



Section 2 **REFERENCES**

National Fire Protection Association (NFPA)

Batterymarch Park
Quincy, MA 02269

NFPA 70
NFPA 70E

National Electrical Code®
Standard for Electrical Safety in the Workplace

National Electrical Manufacturers Association (NEMA)

1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

AB 4

*Guidelines for Inspection and Preventative Maintenance of Molded Case Circuit
Breakers Used in Commercial and Industrial Applications*

PB 2.2

Application Guide for Ground Fault Protective Devices for Equipment

Guidelines for Handling Water Damaged Electrical Products



Section 3 GENERAL

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS AND EQUIPMENT TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety-related work practices, as described in NFPA 70E, should be followed at all times. All requirements of the *National Electrical Code*® NFPA 70 should be followed.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE COMPONENTS DURING INSTALLATION OR MAINTENANCE.

3.1 SUCCESSFUL OPERATION OF PANELBOARDS

The successful operation of panelboards is dependent upon proper installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, death, or damage to electrical equipment or other property.

3.2 QUALIFIED PERSONNEL

Installation, operation, and maintenance of panelboards should be conducted only by qualified personnel.

3.3 DEFINITION OF QUALIFIED PERSONNEL

For purposes of these guidelines, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, the person is:

3.3.1 Requirements

Knowledgeable of the requirements of the *National Electrical Code*® and of all other applicable codes, laws, and standards.

3.3.2 Established Safety Practices

Trained and authorized to test, energize, clear, ground, tag, and lockout circuits and equipment in accordance with established safety practices.

3.3.3 Protective Equipment

Trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, and flash resistant clothing in accordance with established safety practices.

3.3.4 First Aid

Trained in rendering first aid.

3.4 SUITABLE RATINGS

Verify that all equipment being installed has ratings suitable for the installation.



Section 4

INSTALLATION OF PANELBOARD CABINETS (BOXES)

4.1 INSTALLATION INSTRUCTIONS

Installation of the cabinet in a neat and workmanlike manner. Follow the manufacturer's installation instructions.

4.2 LOCATION IN BUILDING

Locate the cabinet so that it is readily accessible and not exposed to physical damage.

4.3 FLAMMABLE MATERIAL

Locate the cabinet well away from flammable material.

4.4 UNUSUAL SERVICE CONDITIONS

Do not locate the cabinet where it will be exposed to ambient temperatures above 40°C (104°F), corrosive or explosive fumes, dust, vapors, dripping or standing water, abnormal vibration, mechanical shock, high humidity, tilting, or unusual operating conditions, unless the cabinet/panelboard combination has been designed and so identified by the manufacturer for these conditions.

4.5 INDOOR DAMP LOCATIONS

Locate or shield the cabinet so as to prevent moisture and water from entering and accumulating therein. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.6 WET LOCATIONS

Cabinets should be specifically approved for wet locations. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.7 CLEARANCE FROM CEILING

Do not locate the cabinet against a non-fireproof ceiling; allow a space of 3 feet between the ceiling and cabinet unless an adequate fireproof shield is provided.

4.8 SPACE AROUND THE CABINET

When selecting a location, provide sufficient access and working space around the cabinet (see Section 110.26 of the *National Electrical Code*®). The width of the working space in front of the panelboard should be at least 30 inches, or the width of the cabinet, whichever is greater, and this space should not be used as storage. The working space should have adequate lighting and a minimum head room of 6 feet 6 inches.

4.9 MOUNTING OF CABINET

The cabinet should be reliably secured to the mounting surface. Do not depend on wooden plugs driven into holes in masonry, concrete, plaster, or similar materials. (See Section 110.13 of the *National Electrical Code*®.)

4.10 FLUSH MOUNTING IN WALL

In walls of concrete, tile, or other noncombustible material, install the cabinet so that its front edge will not set back more than 1/4 inch from the finished surface. In walls of wood or other combustible material, cabinets should be flush with or project beyond the finished surface. (See Section 312.3 of the *National Electrical Code®*.)

4.11 UNUSED OPENINGS IN CABINET

Effectively close unused openings in the cabinet to provide protection which is substantially equivalent to that afforded by the wall of the cabinet.

4.12 GROUNDING OF PANELBOARD CABINETS

Ground the cabinet as specified in Article 250 of the *National Electrical Code®*. When the cabinet contains service equipment, it is necessary to bond the cabinet to the grounded (neutral) service conductor.



Section 5

INSTALLATION OF CONDUIT AND CONDUCTORS

5.1 CONDUITS INSTALLATION

Conduits should be installed so as to prevent moisture or water from entering and accumulating within the enclosure. Provision should be made to protect conductors from abrasion in accordance with Article 312 of the *National Electrical Code*®.

5.2 KNOCKOUTS REMOVAL

Knockouts should be removed as follows:

IMPORTANT—Remove knockouts, ONE AT A TIME, alternating INWARD and OUTWARD.

5.2.1 First Step—Remove Center Knockout

Remove center knockout INWARD.

5.2.1.1 Screwdriver Blade

Place screwdriver blade against point farthest from tie and strike INWARD (Figure 1). Bend back and forth to break tie.

5.2.2 Next Step—Remove Rings

Remove rings ONE AT A TIME without straining remaining rings.

5.2.2.1 Pry First Ring

Pry first ring OUTWARD with screwdriver midway between ties, using pliers flat against box under screwdriver (Figure 2). Bend ring sections OUTWARD with pliers, then back and forth to break ties (Figure 5-3).

5.2.2.2 Second Ring

Remove second ring INWARD by striking screwdriver (with blade against point midway between ties) then breaking ring sections inward and back and forth to break ties.

5.3 NATIONAL ELECTRICAL CODE®, ARTICLE 300

Refer to the *National Electrical Code*®, Article 300 for proper wiring methods. See 6.7 for making proper connections.

5.4 CONDUCTOR LENGTH

Keep conductor length to a minimum within the wiring gutter. Excessive conductor length will result in additional heating and may result in overheating. However, conductors should be long enough to reach the terminal location in a manner that avoids strain on the terminal.

5.5 EXERCISE CARE

Exercise care to maintain the largest practical bending radius of conductors; otherwise the insulation may be damaged and terminal connections may become loosened. Deflection of conductors shall comply with *NEC*® Section 312.6.

5.6 *NATIONAL ELECTRICAL CODE®*, SECTION 725.136

Refer to the *National Electrical Code®*, Section 725.136 for the separation requirements for conductors of Class 2 and Class 3 remote-control, signaling and power-limited circuits.



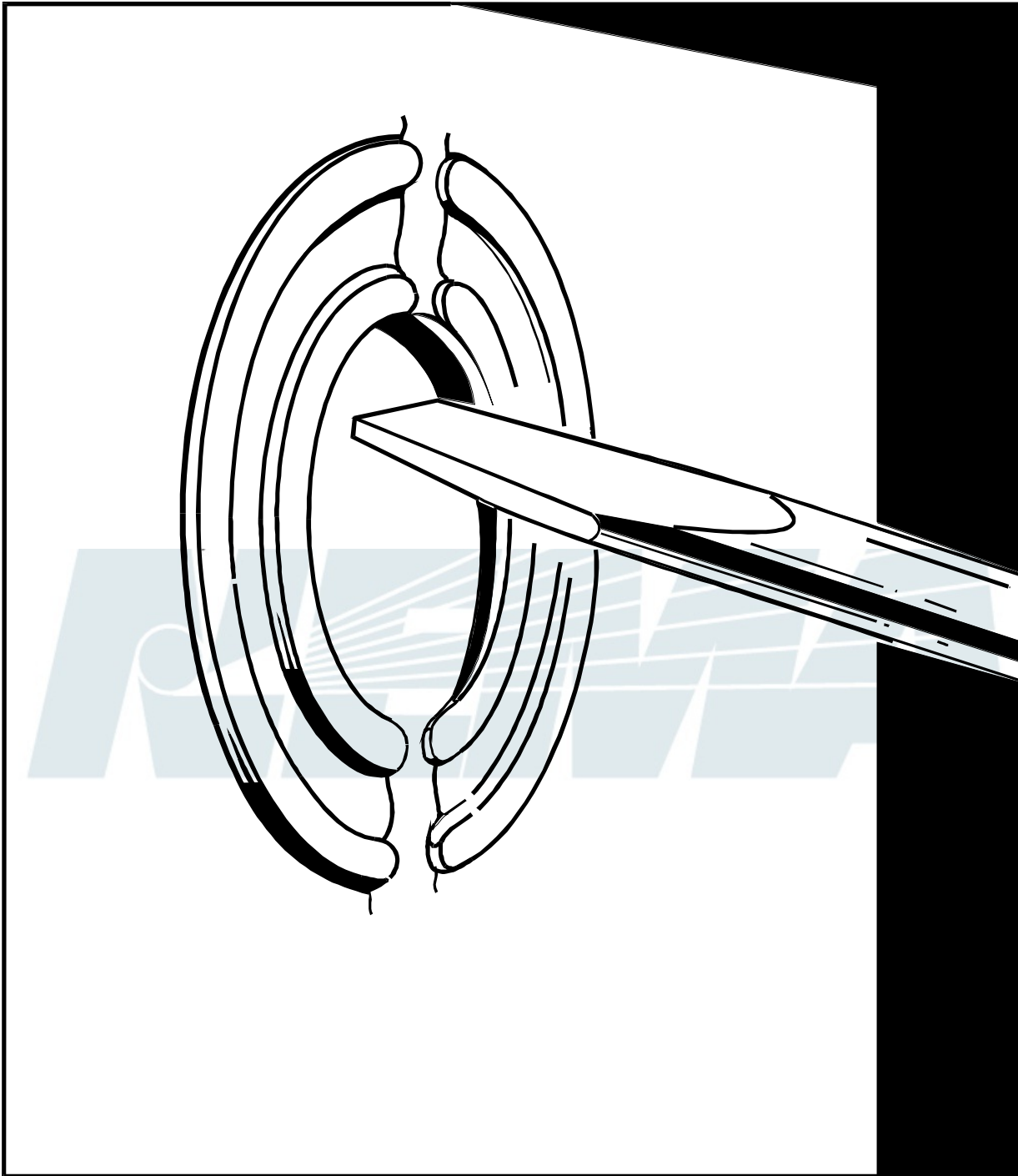


Figure 5-1
KNOCKOUT REMOVAL—STEP 1

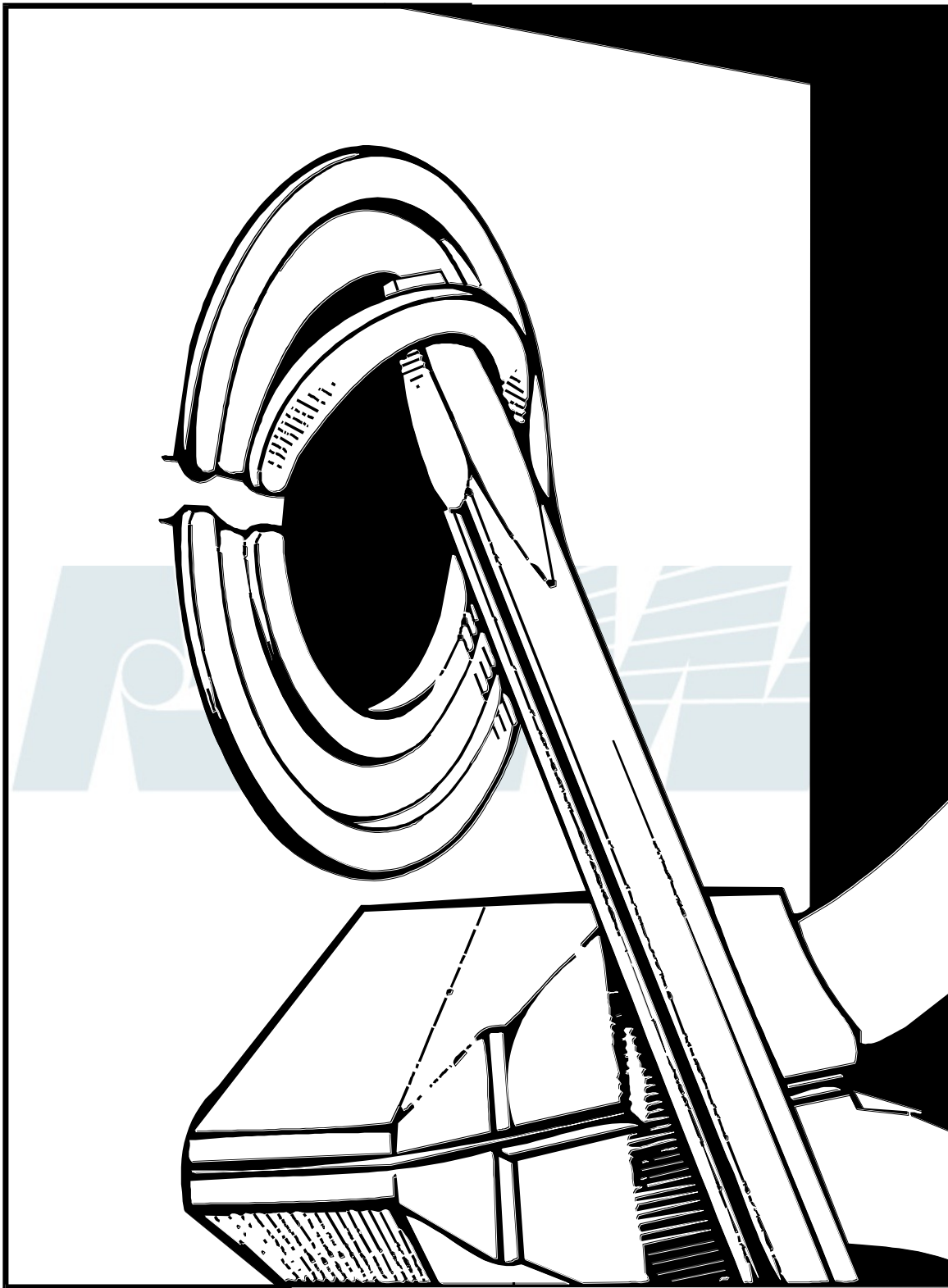


Figure 5-2
KNOCKOUT REMOVAL—STEP 2

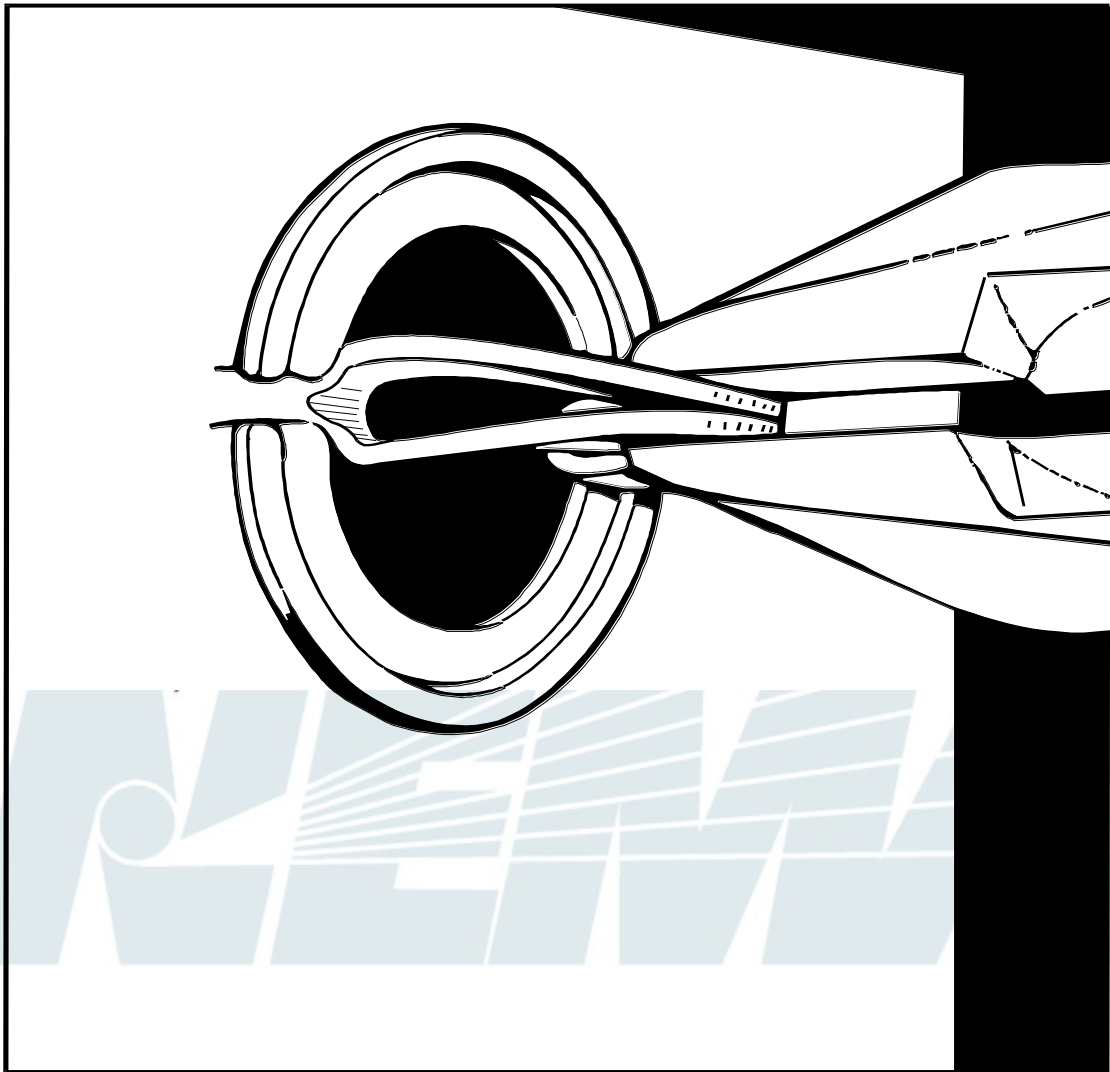


Figure 5-3
KNOCKOUT REMOVAL—STEP 3

Section 6

INSTALLATION OF PANELBOARD

6.1 PROPER STORAGE

Store the panelboard in a clean, dry place located so that mechanical damage from work personnel in the area is not likely to happen.

6.2 UNPACKING

Care should be exercised in unpacking the panelboard to prevent damage and loss of instruction materials and loose parts.

6.3 INSPECTION

Check for shipping damage and check to make sure that the panelboard is the correct one for installation in the cabinet.

6.4 CARE

Care should be taken to protect the panelboard internal parts from contamination during the installation process.

6.4.1 Cleaning

Clean the cabinet of all foreign materials. If parts at connection points are spattered with cement, plaster, paint, or other foreign material, remove the foreign materials with great care to avoid damage to the plating.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

6.5 MANUFACTURER'S INSTRUCTIONS

Carefully follow the manufacturer's instructions and labels.

6.6 INSTALLATION

6.6.1 Alignment Devices

Adjust the alignment devices where provided.

6.6.2 Panelboard

Install the panelboard, finalize its alignment, and tighten it securely in the cabinet.

6.6.3 Flange of Deadfront Shield

Unless otherwise instructed by the manufacturer, adjust the panelboard so that the flange of the deadfront shield is no more than 3/16 inch from (1) the front of the cabinet for surface mounting or (2) the surrounding wall surfaces for flush mounting.

6.7 LINE AND BRANCH CONDUCTORS

Connect Line and Branch Conductors

6.7.1 Conductors

Use care in stripping insulation from conductors so as not to nick or ring the conductor. For aluminum, clean all oxide from the stripped portion and apply an antioxidant compound.

6.7.1.1 Wiring Gutters

Distribute and arrange conductors neatly in the wiring gutters. (See Section 5.)

6.7.1.2 Types and Temperature Ratings

Care should be exercised to ensure that the types and temperature ratings of conductors being installed in the panelboard are suitable for use with the terminals, which have been provided.

6.7.1.3 Tighten All Terminals

Use the manufacturer's torque values. (See 7.1).

6.8 PANELBOARD GROUNDING AND BONDING

Ground the panelboard cabinet in accordance with 4.12. (See Section 408.40 of the *National Electrical Code*®.)

6.8.1 Equipment Grounding Conductors

Where separate equipment grounding conductors are used, prepare equipment grounding conductors in accordance with 6.7.1 and connect them to the equipment grounding terminal bar. Check to be sure that the terminal bar is securely bonded to the cabinet or panelboard frame and that it is not connected to the neutral bar except at service equipment (as permitted in Section 250.28 of the *National Electrical Code*®) or at separately derived systems (as permitted in Section 250.30 of the *National Electrical Code*®).

NOTE—An equipment grounding terminal bar is not always required. For example, when a properly installed metallic raceway is used as the equipment grounding path or when the grounded conductor terminals (neutral bar) complies with the conditions of the last sentence of Section 408.40 of the *National Electrical Code*®.

6.9 PROPER TYPE OR CLASS AND RATING

When installing circuit breakers or fuses, ensure that they are of the proper type or class and rating.

6.10 DEBRIS

Clean the cabinet of all debris, which has accumulated during the panelboard installation. Ensure that all foreign materials, including cement, plaster and paint (overspray) are cleaned and removed. Remove all such materials with great care to avoid damage to conductors, plating, etc. (see 6.4.1).

6.11 STEPS IN SECTION 7

If the job is complete, perform the steps in Section 7 and then install the cabinet front (see Section 8).

Section 7

STEPS TO BE TAKEN BEFORE ENERGIZING

7.1 ACCESSIBLE ELECTRICAL CONNECTIONS

Tighten all accessible electrical connections to the manufacturer's torque specifications. If such information is not provided with the equipment, consult the manufacturer.

7.2 BLOCKS AND PACKING MATERIALS

Make certain that all blocks and packing materials used for shipment have been removed from all component devices and the panelboard.

7.3 SWITCHES, CIRCUIT BREAKERS, AND OTHER OPERATING MECHANISMS

Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they operate freely. If devices with self-test function are installed, perform test and verify proper operation per the manufacturer's instructions.

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

7.4 SHORT CIRCUITS AND GROUND FAULTS

To make sure that the system is free from short circuits and ground faults, conduct an insulation resistance test phase to ground and phase to phase with the switches or circuit breakers in both the open and closed positions. If the resistance reads less than 1 megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated. If after investigation and possible correction, low readings are still observed, the manufacturer should be contacted. Some electronic equipment (metering, SPD, etc.) may be damaged by this testing. Refer to the manufacturers equipment markings for guidelines.

7.5 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code®* and NEMA PB 2.2, *Application Guide for Ground Fault Protective Devices for Equipment*.

7.6 ADJUSTABLE TIME CURRENT TRIP DEVICE SETTINGS

Set any adjustable time current trip device settings to the proper values.

NOTE—Experience has indicated that damage from overcurrent can be reduced if the devices used for overload and short-circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7.7 GROUNDING CONNECTIONS

Check to determine that all grounding connections are properly made. If the panelboard is used as service equipment, make certain that the neutral, if present, is properly bonded to the cabinet.

7.8 FOREIGN MATERIAL

Remove all foreign material from the panelboard and cabinet before installing the cabinet front. Make certain that all deadfront shields are properly aligned and tightened. Install the cabinet front in accordance with Section 8.



Section 8 INSTALLATION OF CABINET FRONT

8.1 CABINET FRONT OR TRIM PACKAGE

The cabinet front or trim package is designed to prevent damage to the front during shipment and handling.

8.2 UNPACKING

Care should be used when unpacking and handling the cabinet front.

8.3 COVERS AND DOORS

Install covers, close doors, and make certain that no conductors are pinched and that all enclosure parts are properly aligned and tightened. Hinged covers or doors must open a minimum of 90 degrees when installed.

8.4 TOUCH-UP

A suitable paint or other corrosion-resistant finish should be applied to those places where the finish is damaged.

8.5 FRONT ALIGNMENT

The cabinet front may be provided with an adjusting means to align it squarely with the building even though the cabinet may be slightly out of plumb with the building.

Section 9 ENERGIZING EQUIPMENT

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ENERGIZING A PANELBOARD FOR THE FIRST TIME AFTER INITIAL INSTALLATION OR MAINTENANCE IS POTENTIALLY DANGEROUS.

9.1 QUALIFIED PERSONNEL

Only qualified personnel should energize equipment for the first time. If short circuit conditions caused by damage or poor installation practices have not been detected in the procedures specified in Section 7, serious personal injury and damage can occur when the power is turned on.

9.2 LOAD ON THE PANELBOARD

There should be no load on the panelboard when it is energized. Turn off all of the downstream loads.

9.3 ENERGIZED IN SEQUENCE

The equipment should be energized in sequence by starting at the source end of the system and working towards the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices. Turn the devices on with a firm positive motion.

9.4 LOADS SUCH AS LIGHTING CIRCUITS, CONTACTORS, HEATERS, AND MOTORS

After all main, feeder, and branch circuit devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned on.

Section 10 MAINTENANCE

10.1 MAINTENANCE PROGRAM

A maintenance program for panelboards should be conducted on a regularly scheduled basis in accordance with the following:

10.2 PANELBOARD WHICH HAS BEEN CARRYING ITS REGULAR LOAD FOR AT LEAST 3 HOURS

A panelboard which has been carrying its regular load for at least 3 hours just prior to inspection should be field tested by feeling the deadfront surfaces of circuit breakers, switches, interior trims, doors, and enclosure sides with the palm of the hand. If the temperature of these surfaces does not permit you to maintain contact for at least 3 seconds, this may be an indication of trouble and investigation is necessary. Thermographic (infrared) scanning has become a useful method of investigating thermal performance.

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.3 INSPECT PANELBOARD ONCE EACH YEAR

Inspect the panelboard once each year or after any severe short circuit.

10.4 ACCUMULATION OF DUST AND DIRT

If there is an accumulation of dust and dirt, clean out the panelboard by using a brush, vacuum cleaner, or clean lint-free rags. Avoid blowing dust into circuit breakers or other components. Do not use a blower or compressed air.

10.4.1 Visible Electrical Joints and Terminals

Carefully inspect all visible electrical joints and terminals in the bus and wiring system.

10.4.2 Conductors and Connections

Visually check all conductors and connections to be certain that they are clean and secure. Loose and/or contaminated connections increase electrical resistance which can cause overheating. Such overheating is indicated by discoloration or flaking of insulation and/or metal parts. Pitting or melting of connecting surfaces is a sign of arcing due to a loose or otherwise poor connection. Parts which show evidence of overheating or looseness should be cleaned and re-torqued or replaced if damaged. Tighten bolts and nuts at bus joints to manufacturer's torque specifications.

CAUTION—DO NOT REMOVE PLATING FROM ALUMINUM PARTS IN JOINTS OR TERMINATIONS. DAMAGE TO PLATING CAN RESULT IN OVERHEATING. REPLACE DAMAGED ALUMINUM PARTS.

10.4.3 Fuse Clip Contact Pressure and Contact Means

Examine fuse clip contact pressure and contact means. If there is any sign of overheating or looseness, follow the manufacturer's maintenance instructions or replace the fuse clips. Loose fuse clips can result in overheating.

10.4.4 Plug Fuses

Re-tighten plug fuses.

10.4.5 Conditions Which Caused Overheating

Be sure that all conditions which caused the overheating have been corrected.

10.5 PROPER AMPERE, VOLTAGE, AND INTERRUPTING RATINGS

Check circuit breakers, switches, and fuses to ensure they have the proper ampere, voltage, and interrupting ratings. Ensure that non-current-limiting devices are not used as replacements for current-limiting devices. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the incorrect class of fuse.

10.5.1 Mechanisms Free and in Proper Working Order

Operate each switch or circuit breaker several times to ensure that all mechanisms are free and in proper working order. Replace as required. See NEMA AB-4 for maintenance of molded case circuit breakers.

10.6 OPERATION OF ALL MECHANICAL COMPONENTS

Check the operation of all mechanical components. Replace as required.

10.6.1 Switch Operating Mechanisms

Exercise switch operating mechanisms and external operators for circuit breakers to determine that they operate freely to their full on and off positions.

10.6.2 Integrity of Electrical and Mechanical Interlocks

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

10.6.3 Missing or Broken Parts

Whenever practical, check all devices for missing or broken parts, proper spring tension, free movement, corrosion, dirt, and excessive wear.

10.6.4 Manufacturer's Instructions

Adjust, clean, and lubricate or replace parts according to the manufacturer's instructions.

10.6.4.1 Clean Nonmetallic Light Grease or Oil

Use *clean* nonmetallic light grease or oil as instructed.

10.6.4.2 Molded Case Circuit Breakers

Do *not* oil or grease parts of molded case circuit breakers.

10.6.4.3 Clean, Light Grease

If no instructions are given on the devices, sliding copper contacts, operating mechanisms, and interlocks may be lubricated with clean, light grease.

10.6.4.4 Excess Lubrication

Wipe off excess lubrication to avoid contamination.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.6.5 Accessible Copper Electrical Contacts, Blades, and Jaws

Clean and dress readily accessible copper electrical contacts, blades, and jaws according to the manufacturer's instructions when inspection indicates the need.

10.7 DAMAGED INSULATING MATERIAL AND ASSEMBLIES

Look for and replace damaged insulating material and assemblies where sealing compounds have deteriorated.

10.8 MOISTURE OR SIGNS OF PREVIOUS WETNESS OR DRIPPING

Look for any moisture or signs of previous wetness or dripping inside the cabinet.

NOTE—Condensation in conduits or dripping from outside sources is one known cause of panelboard malfunction.

10.8.1 Conduits Which Have Dripped Condensate

Seal off any conduits which have dripped condensate, and provide means for further condensate to drain away from the panelboard.

10.8.2 Cracks or Openings

Seal off any cracks or openings which have allowed moisture to enter the enclosure. Eliminate the source of any dripping on the enclosure and any other source of moisture.

10.8.3 Insulating Material Which is Damp or Wet

Replace or thoroughly dry and clean any insulating material, which is damp or wet or shows an accumulation of deposited material from previous wettings.

10.8.4 Component Devices Which Show Evidence of Moisture Damage

Inspect all component devices. Replace any component device which shows evidence of moisture damage or has been subjected to water damage or flooding. Additional information may be found in the NEMA document "Guidelines for Handling Water Damaged Electrical Products."

10.9 BEFORE CLEANUP AND CORRECTIVE ACTION IS ATTEMPTED

In the event of water damage, e.g., flooding or sprinkler discharge, the manufacturer should be consulted before clean up and corrective action is attempted.

10.10 SEVERE ELECTRICAL SHORT CIRCUIT

If a severe electrical short circuit has occurred, the excessive currents may have resulted in structural component and/or bus and conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. Examine all devices and bus supports for cracks or breakage. The manufacturer should be consulted before cleanup and correction is attempted.

10.11 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code®* and NEMA PB 2.2 *Application Guide for Ground Fault Protective Devices for Equipment*.

10.12 INSULATION RESISTANCE

Check insulation resistance (see 7.4) under any of the following conditions:

10.12.1 Severe Short Circuit

If a severe short circuit has occurred (see 10.10);

10.12.2 Parts Replaced

If it has been necessary to replace parts or clean insulating surfaces;

10.12.3 Panelboard Exposed to High Humidity

If the panelboard has been exposed to high humidity, condensation, or dripping moisture.



Section 11

PERMISSIBLE LOADING OF PANELBOARDS

11.1 *NATIONAL ELECTRICAL CODE®*

In compliance with the *National Electrical Code®*, the normal continuous loads (3 hours or more) of panelboard circuits should be not more than 80 percent of the rating of the overcurrent protective device, unless the marking of the device indicates that it is suitable for continuous duty at 100 percent of its rating.

11.2 HARMONICS IN ELECTRICAL SYSTEM

Some types of electrical equipment cause harmonics in the electrical system, which may result in overheating. This condition should be considered when determining panelboard loading.

§



Replaces
Reemplaza
Remplace
40272-214-03
09/2001

40559-377-50/51

Series / Serie / Série 0



40272-214-04
06/2006
Lexington, KY, USA

15681

PK27GTA Equipment Grounding Bar Accesorio de la barra de tierra del equipo PK27GTA Kit de barre de m.à.l.t. de l'appareil PK27GTA

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

Contents / Contenido / Contenu

- 1 Equipment grounding bar / Barra de puesta a tierra del equipo / Barre de m.à.l.t. de l'appareil
- 2 Mounting screws / Tornillos de montaje / Vis de montage
- 1 2/0 Lug / Zapata 2/0 / Cosse 2/0
- 1 Wire binding screw / Tornillo de sujeción de cables / Vis de fixation de fils
- 1 Lug mounting screw / Tornillo de montaje de la zapata / Vis de montage de cosse
- 1 Equipment grounding label / Etiqueta de puesta a tierra del equipo / Etiquette de m.à.l.t. de l'appareil

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía, consulte la norma 70E de NFPA.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension ayant une valeur nominale appropriée pour vous assurer que l'alimentation est coupée.
- Remplacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.



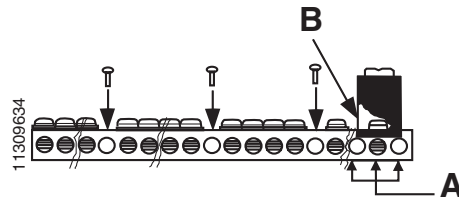
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- | | | |
|--|--|---|
| <ul style="list-style-type: none"> When mounting with one screw, use the center mounting hole and position the two outer mounting holes on the two matching nubs. Use the two outer mounting holes when mounting with two screws. Tighten mounting screw(s) to 30 lb-in. (3.4 N•m) after overcoming starting torque. <ol style="list-style-type: none"> Remove any three adjacent wire binding screws (A), install lug as shown. Tighten lug mounting screw (B) to 40 lb-in. (4.5 N•m). | <ul style="list-style-type: none"> Cuando realice la instalación con un tornillo, utilice el agujero de montaje central y coloque los otros dos agujeros de montaje exteriores sobre las muescas correspondientes. Utilice los dos agujeros de montaje externos para la instalación con dos tornillos. Apriete los tornillos de montaje a 3,4 N•m (30 lbs-pulg) una vez realizado el apriete inicial. <ol style="list-style-type: none"> Retire cualquiera de los tres tornillos de sujeción de cables adyacentes (A) e instale la zapata como se muestra. Apriete el tornillo de montaje de la zapata (B) a 4,5 N•m (40 lbs-pulg). | <ul style="list-style-type: none"> Pour l'installation avec une seule vis, utiliser le trou de montage central et placer les deux trous de montage extérieurs sur les deux ergots correspondants. Utiliser les deux trous de montage extérieurs pour l'installation à deux vis. Serrer la ou les vis de montage à 3,4 N•m (30 lb-po) après le serrage de départ. <ol style="list-style-type: none"> Retirer n'importe quelles trois vis de fixation de fils adjacents (A) et installer la cosse comme indiqué. Serrer la vis de montage de cosse (B) à 4,5 N•m (40 lb-po). |
|--|--|---|



Lug Wire Size / Calibre del cable de la zapata / Calibre du fil de cosse	Torque (lb-in.) / Par de apriete (lbs-pulg) / Couple de serrage (lb-po)
#6-2/0 Cu / Al	50

Apply equipment grounding bar label to enclosure beside equipment grounding bar. See equipment grounding bar label for torque requirements.

Adhiera la etiqueta de la barra de puesta a tierra del equipo al gabinete junto a la barra de tierra. Consulte la etiqueta para conocer los valores de par de apriete.

Placer l'étiquette de barre de m.à.l.t. de l'appareil sur le coffret, à côté de la barre de m.à.l.t. Consulter l'étiquette de m.à.l.t. de l'appareil pour obtenir le couple de serrage.

Made in USA

Hecho en EUA

Fabriqué aux É.-U.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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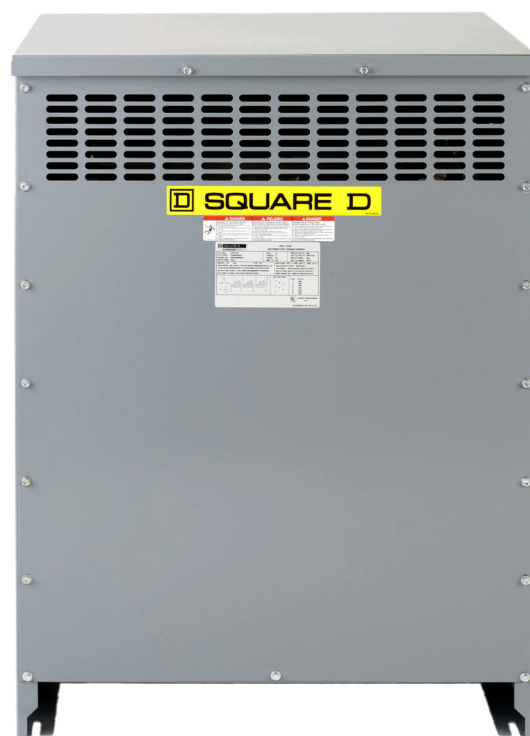
Class 7400

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Retain for future use.



by Schneider Electric

Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Section 1—Introduction

This instruction bulletin provides installation, operation and maintenance instructions for dry-type transformers 1000 volts and below for use in commercial and industrial applications.

NOTE: This bulletin should be used only by qualified personnel.

The following dry-type transformer product families are included in this instruction bulletin. Typical transformers are shown in Figures 1–6.

- Low Voltage Distribution Transformers, Three-phase and Single-phase
 - General Purpose—50 and 60 Hz
 - Energy Efficient (EE)—60 Hz
 - Energy Efficient 2016 (EX)—60 Hz
 - Non-linear Offering (NL, NP or NLP)—50 and 60 Hz
 - Harmonic Mitigating Transformers (HM)—50 and 60 Hz
 - Open Core and Coil (OC)
- Drive Isolation Transformers (DIT)
- Non-ventilated Transformers (NV)

Figure 1: Energy Efficient 2016 Transformers (EX)



Figure 2: Energy Efficient 2016 Transformers (EX)



Figure 3: Open Core and Coil

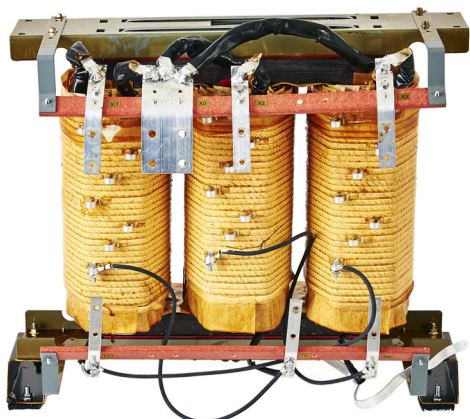


Figure 4: Energy Efficient (EE) Ventilated Transformer



Figure 5: Non-Linear (NL, NP, NLP) and Harmonic Mitigating (HM)



Figure 6: Non-ventilated Transformer



Section 2—Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Carefully inspect your work area, and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Codes and Standards

It is the responsibility of the users of this document to use qualified electrical personnel and to comply with applicable federal, state and local electrical codes when installing electrical products and systems.

This document adheres to the codes and standards as outlined by the National Fire Protection Association® (NFPA). Refer to NFPA 70: 2014 Edition National Electrical Code (NEC®).

Disclaimer Statement

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Section 3—Receiving, Handling and Storing

Receiving

1. Upon receipt, remove the packaging.
 - Immediately inspect the new transformer for shipping damage.
 - Refer to Replacement Parts and Accessories on page 41 for replacement parts, accessories (e.g., touch-up paint) and spare parts for minor damage.
2. Check the packing list against the product nameplate.
 - Verify that the order and shipment align with each other and that the shipment is complete.

NOTE: Follow Schneider Electric Conditions of Sale for shortages and errors.
3. Repackage the transformers for storage if they are not to be installed immediately.
 - Cover all ventilation openings to protect against exposure to moisture, dust and contaminants.
 - Leave packing materials intact until the transformers are ready to install.
4. Refer to “Conditions of Sale” for details regarding claims for equipment shortages and other errors. Contact your local Schneider Electric distributor for additional assistance.

Handling

Handle transformers carefully to avoid damage. Avoid subjecting the transformers to impact, jolting, jarring and rough handling. Ensure that transformers are transported in the upright position. When possible, transport transformers to the installation site while still mounted on their shipping pallets.

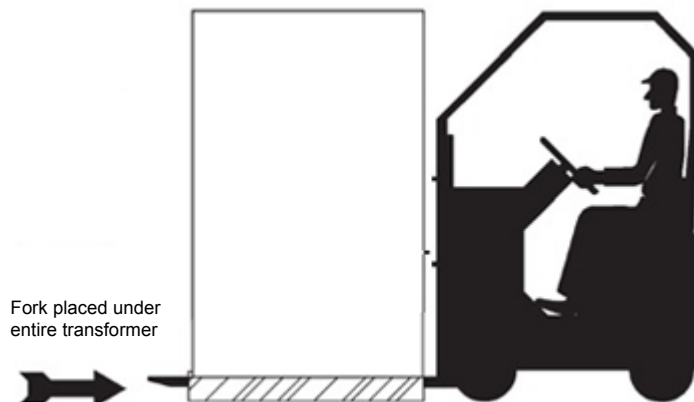
Verify that the weight of the transformer does not exceed the rated capacity of the handling equipment to be used.

Handling with Platform Dollies or Lifts, Pallet Jacks or Fork Trucks

Extreme care should be exercised when moving transformers from the bottom. See Figure 7.

- Use care to distribute the weight when transporting transformers using platform dollies, platform lifts, pallet jacks or fork trucks.
- Use hand trucks or forklifts only when the blades or forks are long enough to pass completely under the transformer enclosure or shipping pallet. Wider fork separation is preferred to distribute the weight of the unit evenly for increased stability.

Figure 7: Handling with a Fork Truck: Blades/Forks Placed under the Entire Transformer (Shipping Pallet Attached)



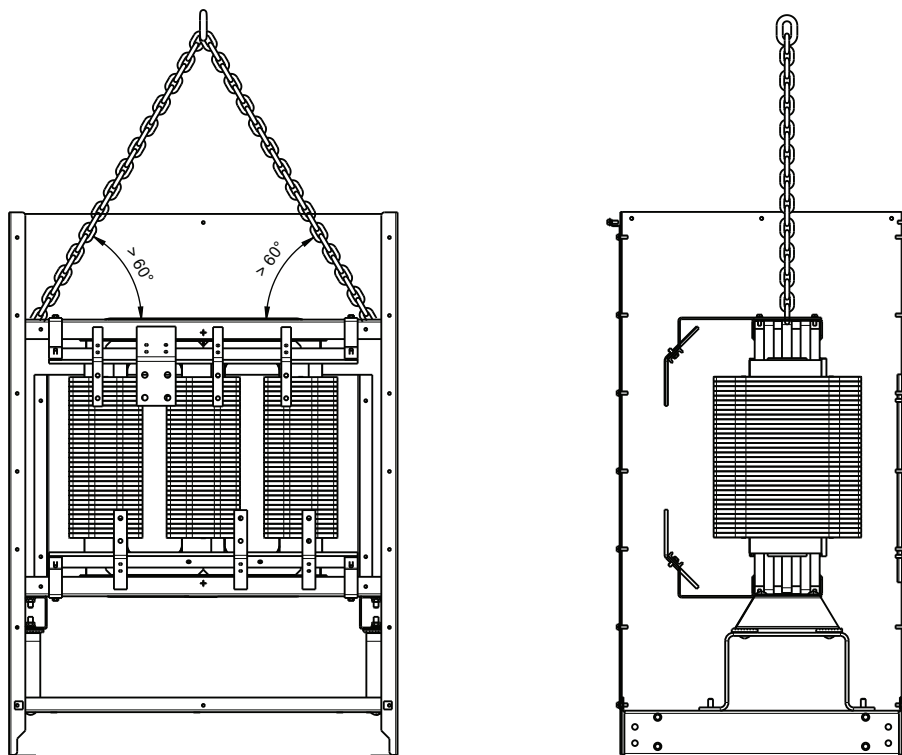
Handling with Cranes: Using Cables, Chains or Straps

When lifting the transformer from above, the use of spreader bars with cables or chains is permissible. This will help avoid damage to the enclosure or equipment.

The enclosure can be removed to allow the units to be transported through small openings, lifting as the same means as shown in Figure 8 on page 11, Figure 9 on page 12, and Figures 10 and 11 on page 13. Refer to Figures 34 and 35 in Replacement Parts and Accessories on page 41 for exploded views of parts and accessories.

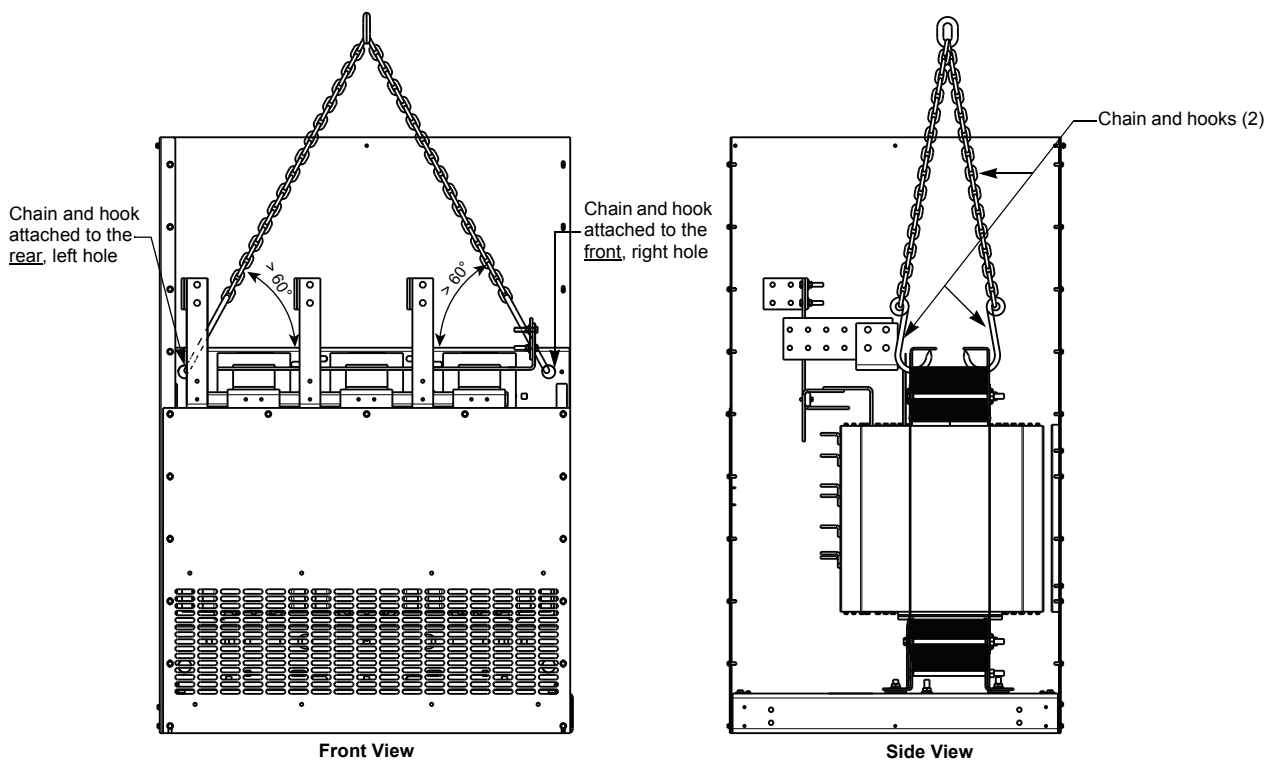
Ensure that the lifting cable pull angles are not less than 60 degrees from horizontal. See Figure 8 on page 11.

Figure 8: Two-Point Lift: Cable Pull Angles (Not Less than 60 Degrees from Horizontal)



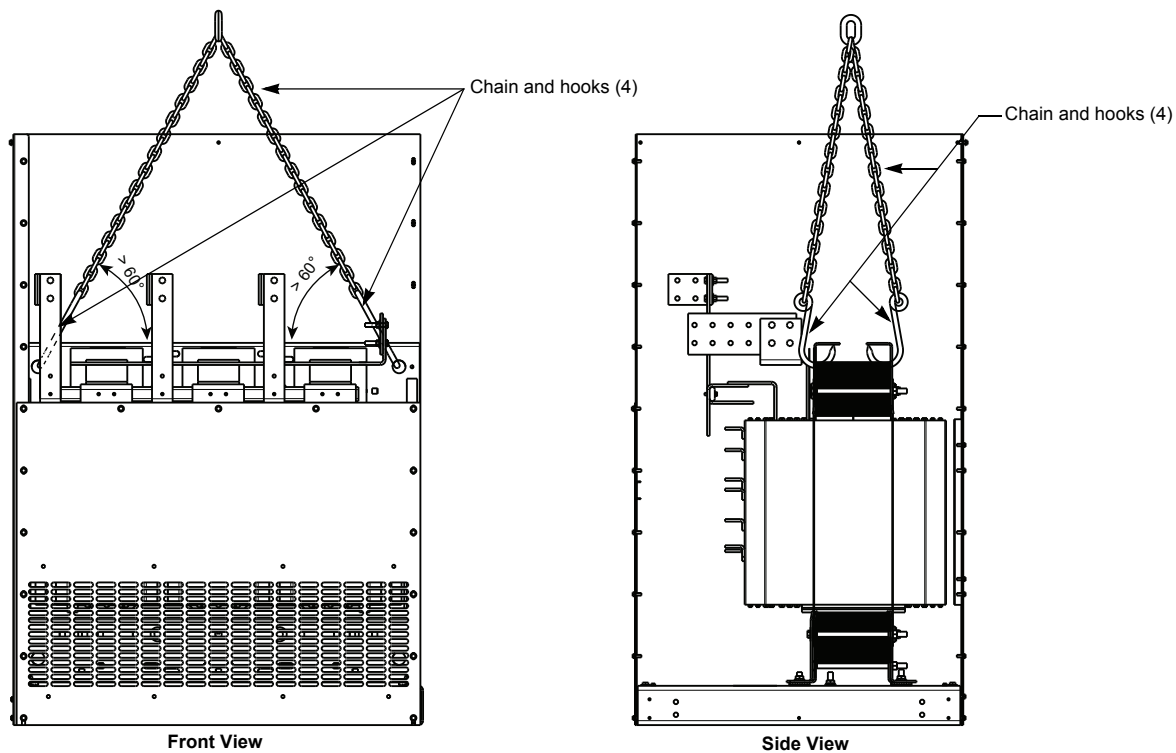
Refer to Figures 9 –11 on pages 12 – 13 for other permissible lifting and handling options.

Figure 9: Two-Point Lift: Handling with Chains, Hooks and Cross Corners (Not Less than 60 Degrees from Horizontal)



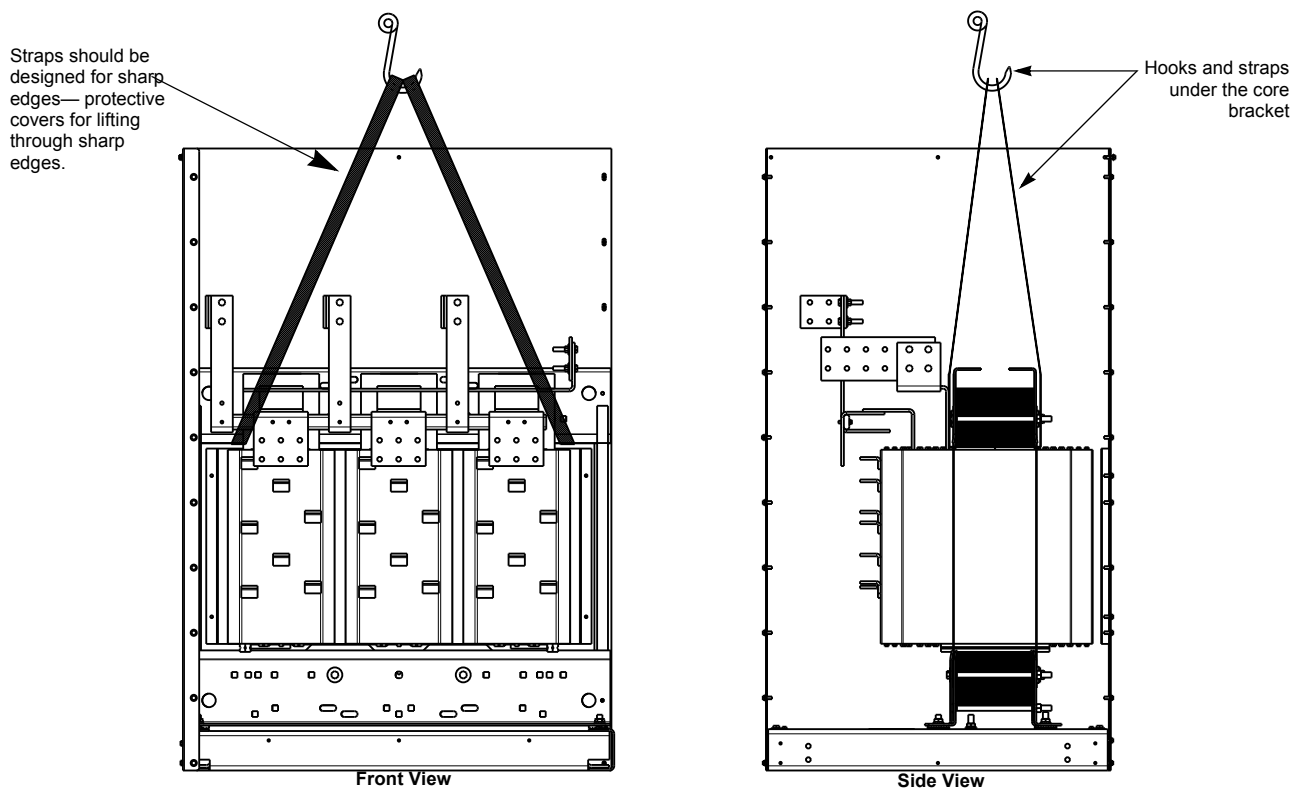
Two-point lift with chains and hooks: Top core bracket, right side and front hole. Rear bracket, left side and rear hole

Figure 10: Four-Point Lift: Handling with Chains, Hooks and Four Corners (Not Less than 60 Degrees from Horizontal)



Four-point lift: The hooks are in the front and back holes of the core bracket (4), with chains lifting on the hooks.

Figure 11: Four-Point Lift: Handling with a Strap and Hooks (Not Less than 60 Degrees from Horizontal)



Four-point lift: The straps are under the core brackets, with the front-to-back straps coming together at the top with a hook. Use straps with protective cover, core clamps edges are sharp.

Handling Enclosure Styles D, H and K after Removal of the Shipping Pallet

Hand trucks and forklifts can access and move the transformer via the front and rear openings below the bottom of the base. See Figure 12. Follow the same handling instructions (beginning on page 10) as if the pallet is still attached.

Figure 12: Handling with a Pallet Jack: Enclosure Styles D, E, H and K after Removing the Shipping Pallet



Storing

Leave the packing material that encloses the transformer in place until the unit is ready for its final placement and wiring. This will help to protect the transformer enclosure and internal parts from dirt, water, moisture contamination and physical damage during storage. Provide extra measures to protect the transformer when the original packing material cannot be retained.

Store transformers indoors in a clean, dry, and heated building with uniform temperatures and adequate air circulation. If necessary, install electric heating to maintain a uniform temperature above the ambient temperature to prevent condensation.

Protect transformers from weather and contamination when it is not possible to store the transformers indoors.

Before energizing the transformer, complete the steps in Pre-commissioning/Pre-energizing Checks and Testing along with the following steps:

1. Test the insulation resistance if storage in a controlled environment was not feasible. Refer to Insulation Resistance on page 39.
2. Dry the unit if test levels are unacceptable:
 - a. Use two heaters or lamps per coil at 120 V, 50 W to apply external heat to the coils.
 - b. Mount the heater or lamp directly below the coils located at the front and rear of the core.

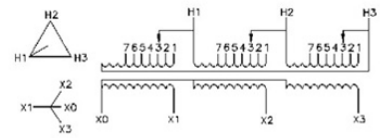
NOTE: Outdoor transformers are not weather resistant until they are properly and completely installed and energized. Treat outdoor transformers in exactly the same manner as indoor transformers until after they are installed.

Section 4—Installation

Locating/Placing Ventilated and Non-ventilated Transformers

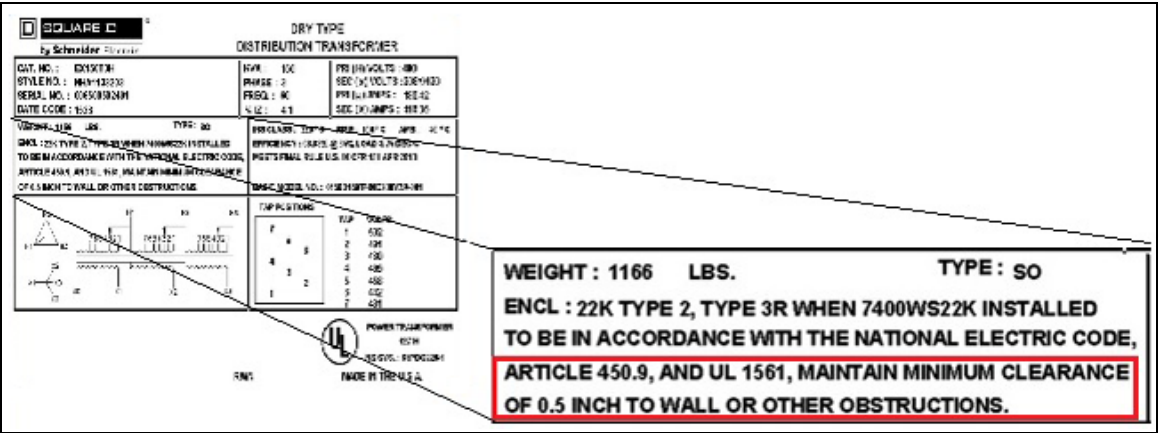
1. Remove all packaging material. Keep the shipping pallet attached to the transformer to assist with moving the unit to its final installation location.
2. Verify that the nameplate matches the description from the building layout drawings (kVA, primary and secondary voltages, etc.). See Figure 13.

Figure 13: Sample Nameplate

 SQUARE D by Schneider Electric		DRY TYPE DISTRIBUTION TRANSFORMER																	
CAT. NO. : EX150T3H STYLE NO. : NHA1133203 SERIAL NO. : 006500502491 DATE CODE : 1523		KVA : 150 PHASE : 3 FREQ. : 60 % IZ : 4.1	PRI (H) VOLTS : 480 SEC (X) VOLTS : 208Y/120 PRI (H) AMPS : 180.42 SEC (X) AMPS : 416.36																
WEIGHT : 1166 LBS. ENCL : 22K TYPE 2, TYPE 3R WHEN 7400WS22K INSTALLED TO BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE, ARTICLE 450.9, AND UL 1561, MAINTAIN MINIMUM CLEARANCE OF 0.5 INCH TO WALL OR OTHER OBSTRUCTIONS.		TYPE : SO INS CLASS : 220 °C EFFICIENCY : 98.83% @ 35% LOAD & 75 DEG C MEETS FINAL RULE U.S. 10 CFR 431 APR 2013 BASIC MODEL NO. : 065EX150T480D208Y2A-001																	
		TAP POSITIONS <table border="1"> <thead> <tr> <th>TAP</th> <th>VOLTS</th> </tr> </thead> <tbody> <tr><td>1</td><td>502</td></tr> <tr><td>2</td><td>491</td></tr> <tr><td>3</td><td>480</td></tr> <tr><td>4</td><td>469</td></tr> <tr><td>5</td><td>458</td></tr> <tr><td>6</td><td>442</td></tr> <tr><td>7</td><td>431</td></tr> </tbody> </table>		TAP	VOLTS	1	502	2	491	3	480	4	469	5	458	6	442	7	431
TAP	VOLTS																		
1	502																		
2	491																		
3	480																		
4	469																		
5	458																		
6	442																		
7	431																		
		POWER TRANSFORMER 127 H INS SYS. : 65PDG220-1 MADE IN THE U.S.A.																	
RWN																			

3. Locate the unit per the building's layout drawing.
4. Verify the environment is suitable for the enclosure type.
5. Ensure the location is readily accessible to qualified personnel (per NEC 450.13). Units located in the open can be mounted on walls, columns, or otherwise supported from structures.
6. Ensure adequate ventilation since it is essential to properly cool ventilated transformers. Refer to National Electrical Code (NEC®) Article 450.
 - The minimum distance is marked on Nameplate NEC 450.9. See Figure 14 on page 17.
 - Minimum distance varies by enclosure style. See the approval drawing from Schneider Electric for minimum distance.
 - Clean, dry air is desirable.
 - Filtered air may reduce maintenance if the location of the transformer presents a problem.

Figure 14: Minimum Distance Marked on Nameplate NEC 450.9



7. Mount any accessories prior to installing the transformer when using wall or ceiling (trapeze) mounting.
 - a. Observe the four mounting hole locations in each enclosure base.
 - b. Obtain the actual dimensions via approval drawings from Schneider Electric.
 - c. Secure the units using one of two mounting methods: without floor mounting brackets (Figures 15–16 and Figure 17 on page 18) or with floor mounting brackets (Figures 18 and 19 on page 18).
8. Place the transformer in final position.

Figure 15: Mounting: Enclosure Styles D, H, K, and E

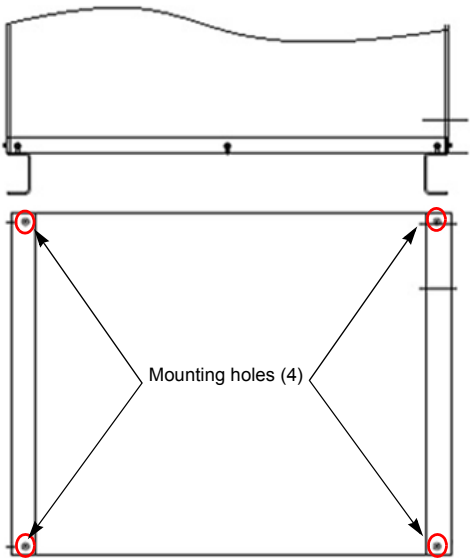
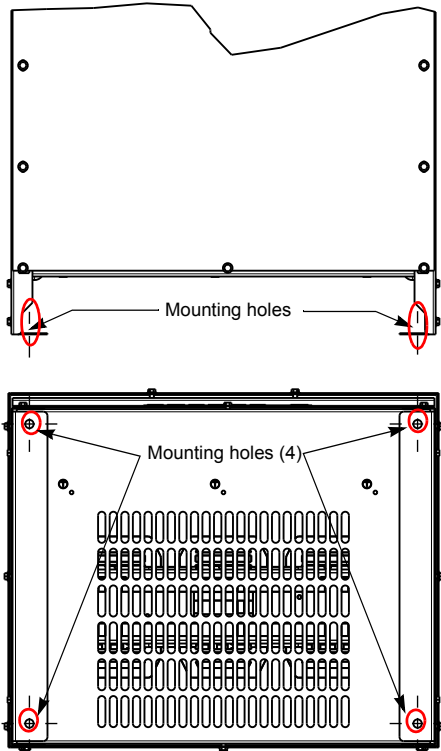
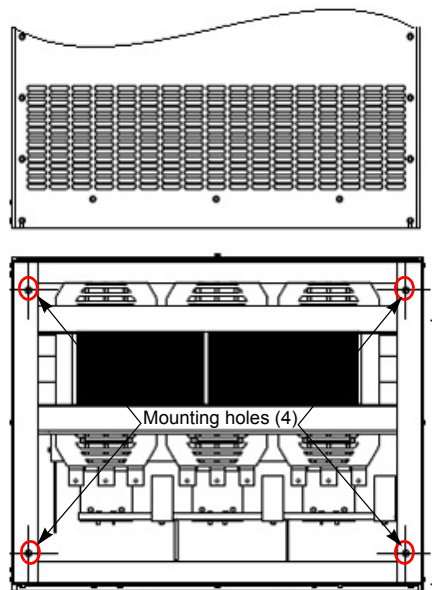


Figure 16: Enclosure D, H, K, and E



**Figure 17: Mounting Enclosure Style J:
Ventilated**



Units not for use on combustible floor (open bottom)

Figure 18: Floor Mounting Bracket: Enclosure Style K

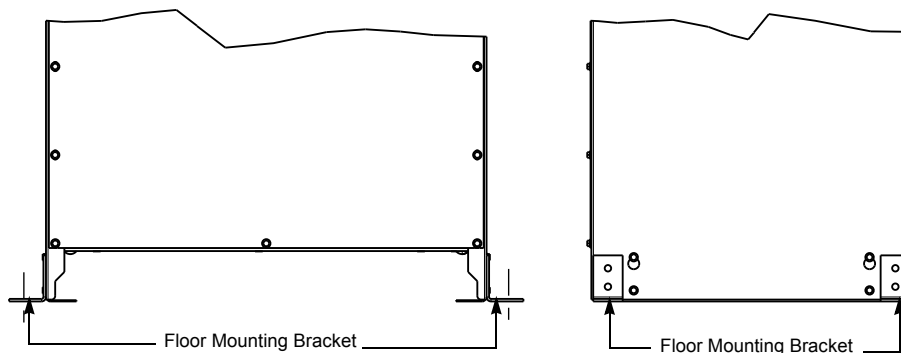
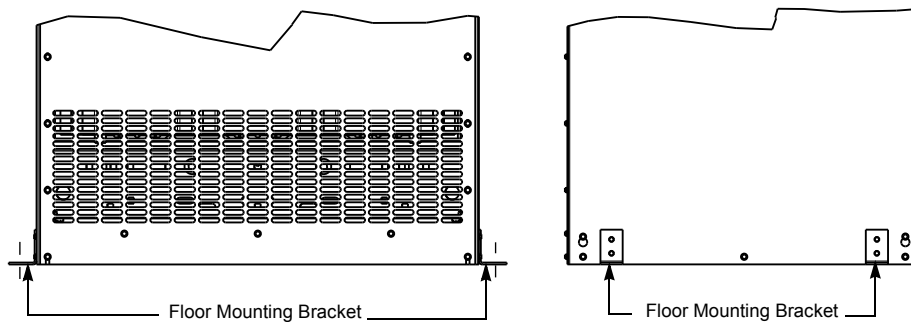


Figure 19: Floor Mounting Bracket: Enclosure Style K



All Enclosure Styles (D, E, F, H, K and J)

- Transformers Installed Indoors (Styles D, E, F, H, K and J):
 - Completely enclosed or completely enclosed with ventilated openings; complies with NEC 450.21 (A) Exception
 - Units greater than 112.5 kVA
 - Have 428°F (220°C) or 392°F (200°C) insulation systems; complies with 450.21 (B) Exception No. 2

See Figure 20.

Figure 20: Transformers Installed Indoors: NEC 450.21 Exceptions A or B from Sample Nameplate

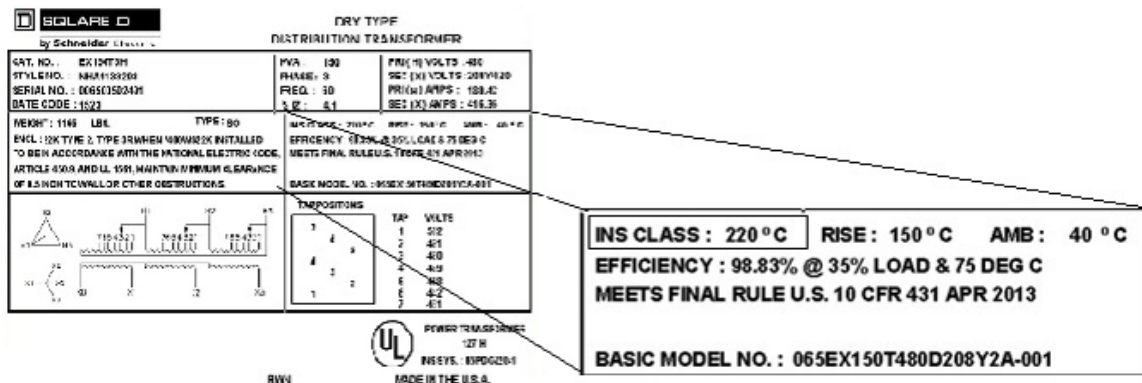


Table 1: Enclosure Clearances

Enclosure Style	Front Clearance	Side Clearance (in. / mm)	Rear Clearance (in. / mm)
D	Working Clearance for all styles vary substantially depending on voltage and specific application. Refer to NEC 110.26	0.50 / 12.7	Type EE – 3 / 76.2 All other styles – 6 / 152
H			3 / 76.2
E			3 / 76.2
K			0.50 / 12.7
J			0.50 / 12.7
F			12 / 305

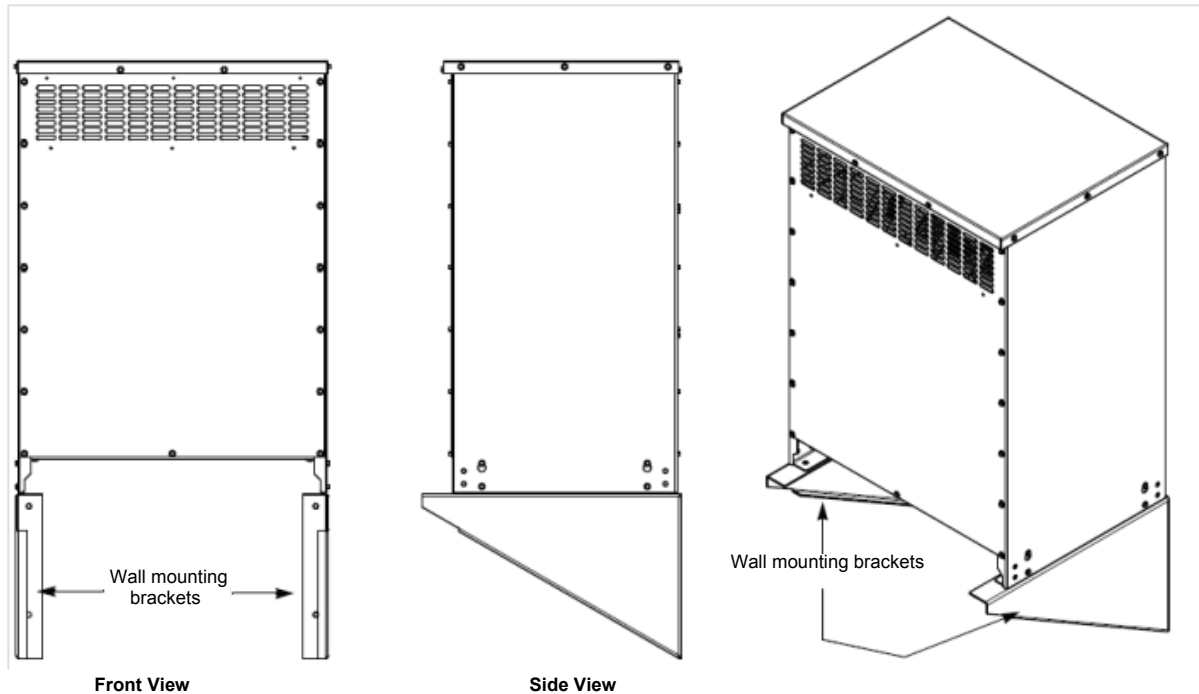
Transformers can be converted from Floor to Wall mounted (See Table 2 below and Figure 21 on page 20) or Floor to Trapeze mounted (See Table 3 and Figure 22 on page 21) using factory available kits. The kits are pre-punched to align with enclosure mounting holes; and, when the transformer is installed, holds the minimum clearance for the units. New Style K wall mounting bracket allows for 6 in. (152 mm) and 3 in. (76 mm) clearances, all other styles require a 6 in. (152 mm) clearance.

The factory kits do not include hardware, hardware must be supplied by the customer. Hardware includes the thread rod for trapeze mounting the transformers. The designer of record must size and choose the anchors and hardware because of the large variety of construction materials and techniques. Schneider Electric can not advise on the anchoring, the wall mounting, or sizing of rods for trapeze mounting.

**Table 2: Converting from Floor to Wall Mounting
(using factory kits)**

Enclosure Style	Enclosure Number	Maximum Weight (lb. / kg)
D	17 – 20	700 / 317
H	17 – 18	700 / 317
E	17 – 20	700 / 317
K	17 – 20	850 / 386

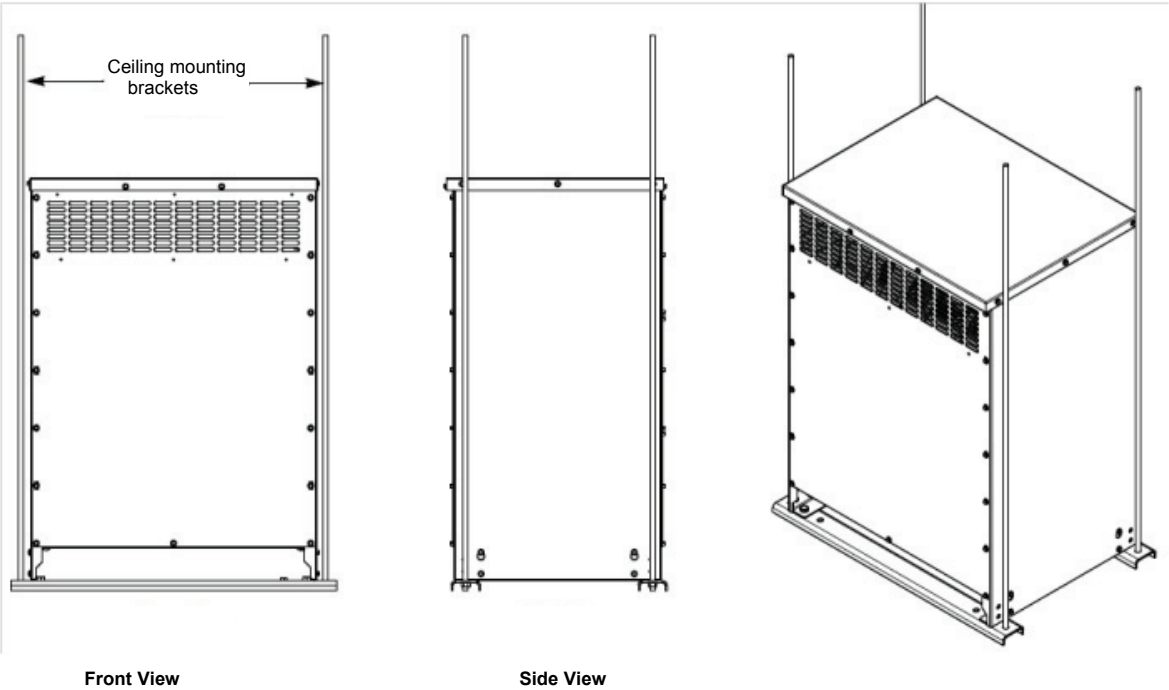
Figure 21: Wall mounted transformer



**Table 3: Converting from Floor to Trapeze (Ceiling) Mounting
(using factory kits)**

Enclosure Style	Enclosure Number	Maximum Weight (lb. / kg)
D	17 – 24	1200 / 544
H	17 – 18	1200 / 544
E	17 – 22	1200 / 544
K	17 – 22	1200 / 544

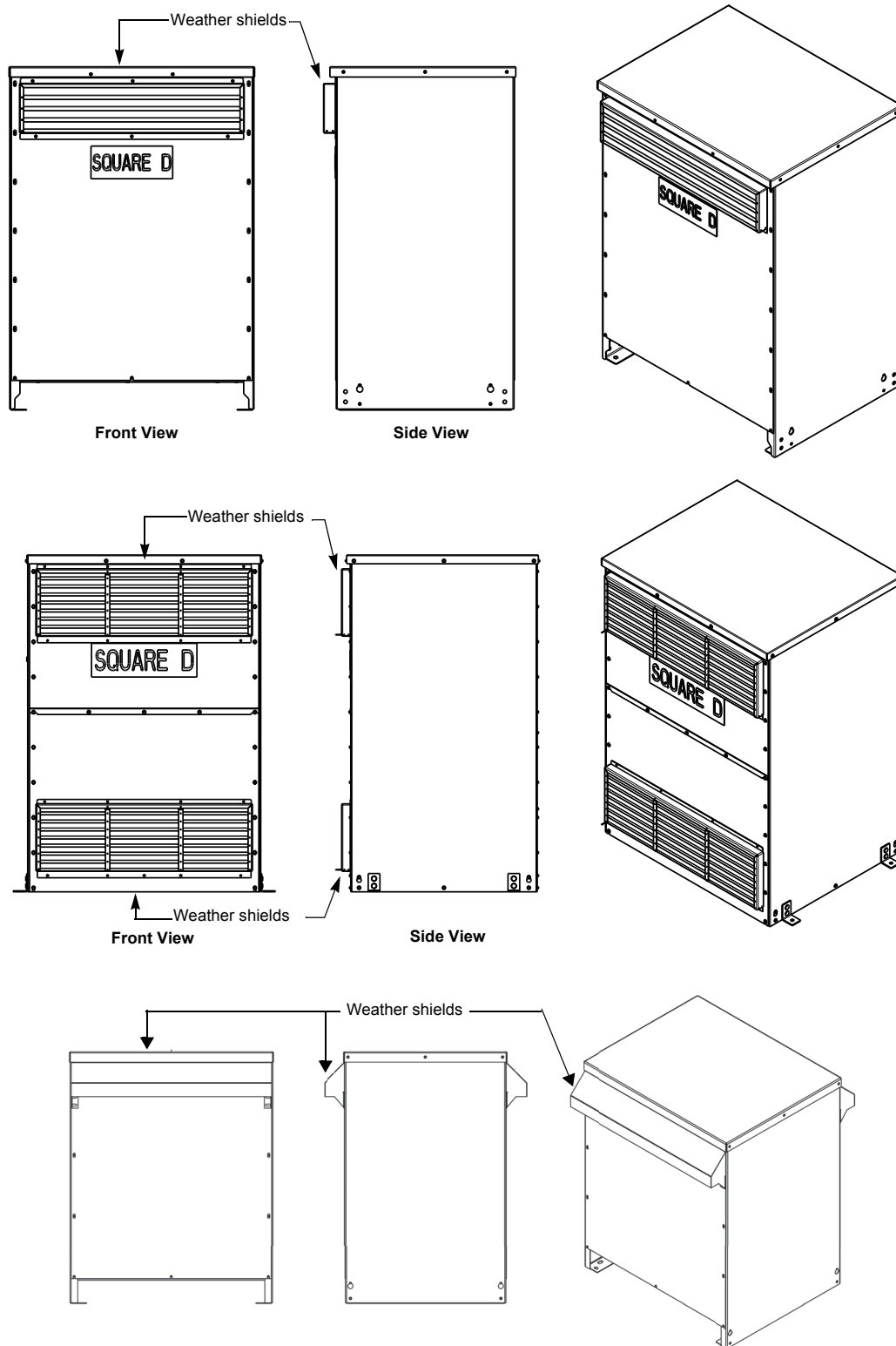
Figure 22: Trapeze (Ceiling) mounted transformer



Enclosure D, E, H, K, J can be converted to Type 3R using field installed kits. See Figure 23 on page 22.

Type F enclosure – must be factory order if installed outdoors.

Figure 23: Type 3R Enclosure Kits



Grounding

1. Permanently and adequately ground the enclosure and core assembly of dry-type transformers in accordance with NEC requirements.
 - Windings may be grounded with consideration given to local conditions and in accordance with the NEC.
 - The ground terminal bar must be UL listed for this purpose.
 - In accordance with NEC 450.10, the terminal bar shall be bonded to the enclosure in accordance with NEC 250.12 and shall not be installed on or over any ventilated openings.
2. Connect the transformer, related accessories and components to ground in accordance with NFPA 70 (NEC).
3. Terminate all grounding and bonding conductors at a common equipment ground point on the enclosure.
4. Remove paint from around the area where the ground terminal bar is mounted to increase contact with enclosure parts.
 - Enclosure Styles D, E and H: An area is available in the transformer's base to drill and mount the ground terminal bar.
 - Enclosure Style K: Three pre-drilled holes are stamped ground to mount the ground terminal bar.
 - Enclosure Style J: Two pre-drilled holes are stamped ground to mount the ground terminal bar.

Square D brand secondary lug kits include a four-conductor ground terminal bar. The bar can also be obtained as a separate device from Schneider Electric. Refer to Table 6 on page 45 and see Figure 24.

Figure 24: Four-conductor Ground Terminal Bar



Seismic Qualifications

Seismic limits for dry-type low voltage transformers are obtained from tri-axle shake table test results that are conducted in accordance with the AC156 test protocol. Certifications are based on the location where units are installed and building codes governing the installation.

Building codes results are available for CBC 2001, CBC 2007, CBC 2010, IBC 2000, IBC 2003, IBC 2006, IBC 2009, NBC 2005, NBCC 2005, NBCC 2010, NFPA 5000, UBC 94, CBC 95, UBC97 and UFC 3-310-04.

Contact your local Schneider Electric distributor, or call 1-888-Square D (1-888-778-2733) to obtain the specific level of Sds, z/h and Ip for each enclosure style.

The levels supplied are based on the units being mounted and the notes on the approval drawings of each part number. Drawings are available that include mounting dimensions, mounting hole dimensions, overall dimensions, unit weight and approximate center of gravity location to assist in a seismic qualification. Contact your local Schneider Electric distributor, or call 1-888-Square D (1-888-778-2733) to obtain these drawings.

Other parties are responsible for detailing the equipment connection and anchorage requirements (including the lateral restraint system, if appropriate) for the given transformer installation. The installer and manufacturers of the anchorage and lateral restraint system are responsible for ensuring that the mounting requirements are met.

Sound/Vibration Control

The transformer has been designed to minimize the amount of audible sound produced. Sound isolation pads are secured between the transformer mounting bracket and the enclosure using bolts and nuts. The mounting hardware is tightened prior to shipment to prevent damage.

Loosen the nut one full turn to float the transformer on the isolation pads, thereby isolating the transformer from the enclosure. This will reduce audible sound levels even further. See Figures 25 and 26.

Figure 25: Loosening the Nut One Full Turn (Four Places) Label

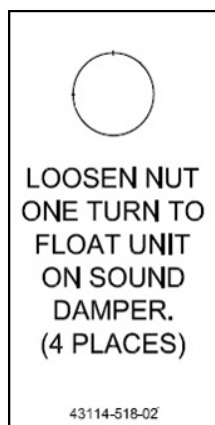
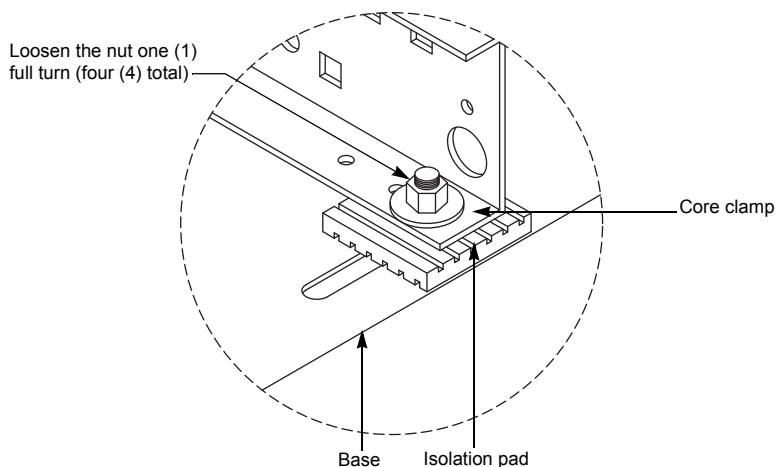


Figure 26: Floating the Transformer on the Isolation Pads/Sound Damper



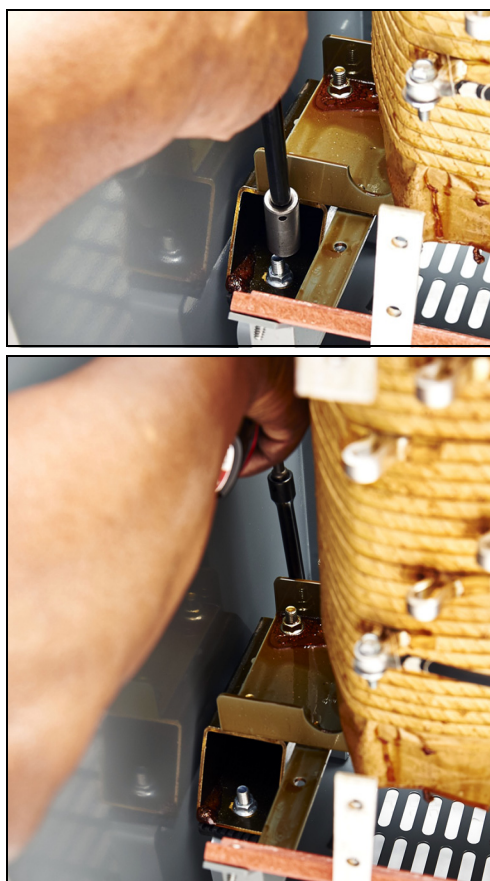
In addition, the area where the transformer is located can affect the sound level:

- ❑ Try to avoid installing the transformer in a corner, narrow hall or in an area with smooth surfaces. Doing so can result in the sound being reflected and amplified.
- ❑ Securely fasten all the enclosure panels. Loose panels can result in rattling, thereby increasing the sound produced.
- ❑ Use flexible conduit, if possible.
- ❑ Ensure that the type of structure on which the transformer is mounted is strong enough to support the weight of the transformer.

Enclosure Style K

Enclosure Style K bolts are accessible from the front with an extension. See Figure 27.

Figure 27: Enclosure Style K: Bolts Accessible from the Front of the Transformer



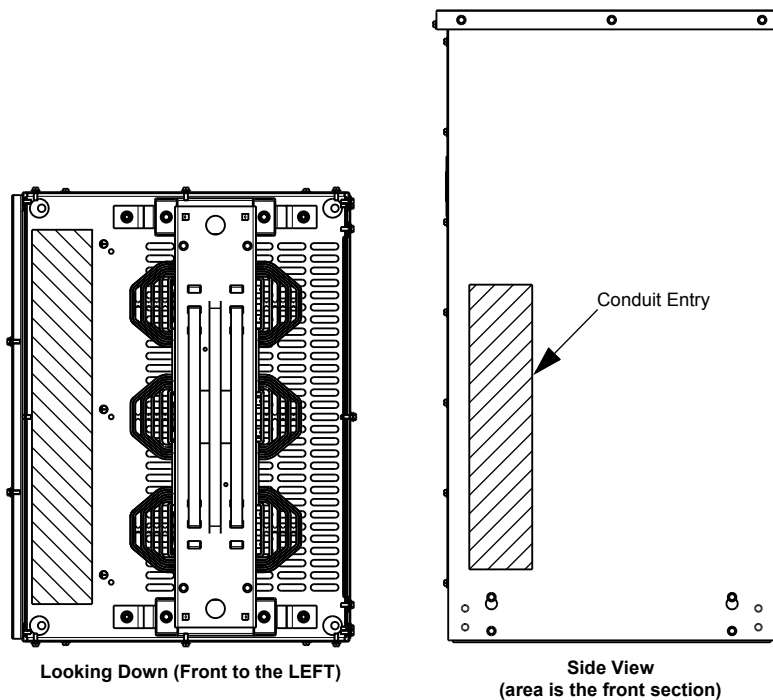
Enclosure Styles D, E, H and J

Enclosure Styles D, E, H and J bolts are accessible from the front. See Figure 26 on page 24 for the access for these enclosures.

Making Electrical Connections

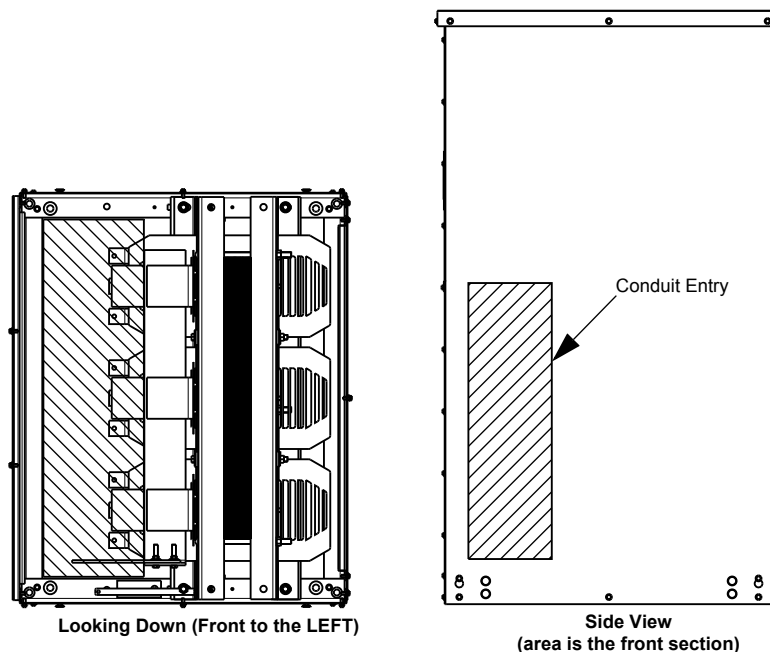
- ❑ Use flexible raceways, conduits and connectors, when possible, as attachments to transformer enclosures. This will help to reduce audible noise generation.
- ❑ Adhere to NFPA 70 (NEC) and minimum wire bending space requirements for the transformer enclosure. As an industry standard, bundle associated phase, neutral and equipment grounding conductors together within the transformer enclosure.
- ❑ Always use a calibrated torque wrench to tighten electrical connectors and terminals. For additional guidance, refer to Standard UL468A.
- ❑ Ensure that raceways, conduits and connectors enter the enclosure only in an area shown on the drawings. Access points for each enclosure style are listed below:
 - Enclosure Style D: (See Figure 28)
 - Front section of the transformer
 - Side and bottom access
 - Enclosure Style E: (See Figure 28)
 - Front section of the transformer
 - Side and bottom access
 - Enclosure Style H: (See Figure 28)
 - Front section of the transformer
 - Side and bottom access
 - Enclosure Style K: (See Figure 28)
 - Front section of the transformer
 - Side and bottom access

Figure 28: Access Point: Enclosure Styles D, E, H and K



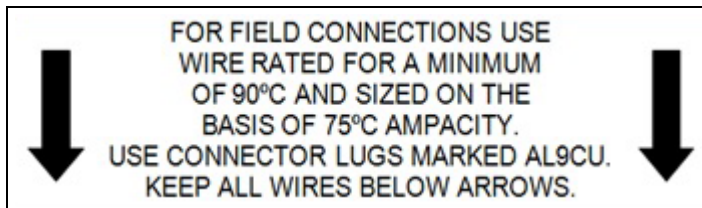
- Enclosure Style F:
 - Bottom section of the transformer
 - Air connection chambers offered if side access is needed
- Enclosure Style J: (See Figure 29)
 - Front section of the transformer
 - Side access
 - Open bottom access front to the core clamps

Figure 29: Access Point: Enclosure Style J



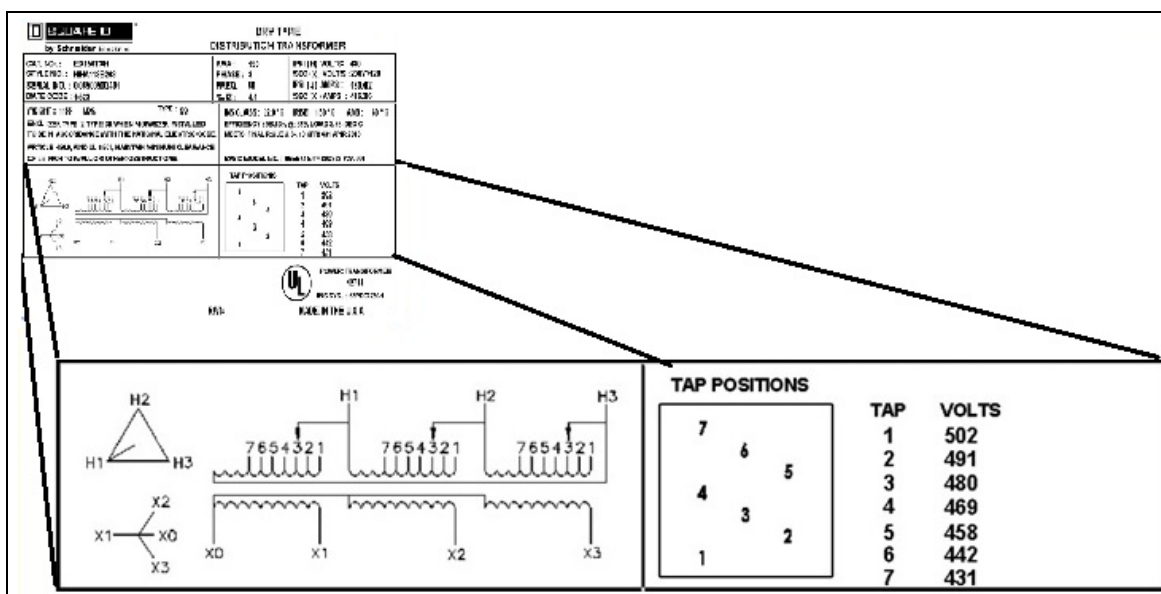
- ❑ Keep all access points below the top terminal board to prevent heat from exiting through the raceways, conduits and connectors. The sticker will show this top location on all enclosure styles (also shown on drawings). See Figure 30.

Figure 30: Label to Show Top Location on Enclosures (Access Points Below the Top Terminal Board)



- ❑ Ensure that the side access complies with NEC 312.6 (A): Minimum Wire-Bending at Terminals. Bottom access must comply with NEC 312.6 (B): Minimum Wire-Bending Space at Terminals.
- ❑ Follow UL 1561 which requires that all lugs be suitable for 194°F (90°C). In addition, the conductors' temperature rating table must be 167°F (75°C) for the size to meet the current requirements of the overcurrent protection device and nameplate currents. Refer to Table 5 on page 44, Table 6 on page 45 and Table 7 on page 46 for a list of Square D lug kits, wire ranges by kVA and US voltage systems.
- ❑ Make sure that the contact surface is clean. This will minimize the possibility of a high resistance contact which could cause localized heating and possible premature failure. Refer to Connections and Contact Surfaces on page 38 for instructions to apply an approved electrical compound.
- ❑ Connect phases to proper terminals for proper motor-rotation. The phase diagram is shown on nameplate. The nameplate also shows the taps locations and voltage rating for each tap. See Figure 31.

Figure 31: Phase Diagram, Tap Locations and Voltage Rating Marked on Nameplate

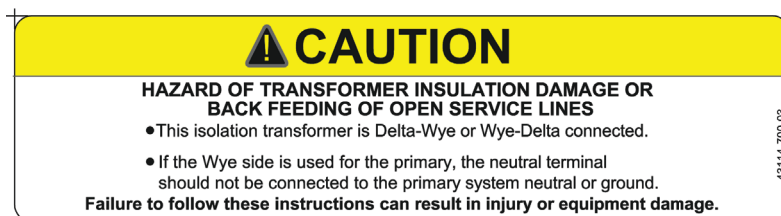


- ❑ Connecting the source of supply to the transformer secondary is permitted by NE C450.11 where the installation conforms to the manufacturer's instructions.

When the source of supply is connected to the transformer secondary, the inrush current will increase. The overcurrent device should be selected based on NEC 450.3(B) using the 250% allowance in order to reduce the potential for nuisance tripping during energization. Secondary overcurrent protection will be required.

For source of supply side connections to a WYE configured transformer winding, do not make any connections to the supply side HO or XO terminals. See Figure 32.

Figure 32: Caution Label for Delta Wye or Wye Delta Connected Transformers



Pre-commissioning/Pre-energizing Checks and Testing

Cleaning

1. Ensure that all of the packing material, including any packing material used inside the enclosure of the transformer used to support and protect the unit during shipping, have been removed.
2. Vacuum away as much dust as possible. Dust will act as a thermal insulating material which will increase the temperature of the unit and could possibly decrease operational life. Refer to Cleaning on page 38.

Visual and Mechanical Checks

Perform the following visual and mechanical checks below. In addition, refer to Performing Visual and Mechanical Checks on page 37 for a detailed listing of instructions.

- ☐ Visually inspect the transformer for physical damage. Repair any physical damage, if possible, and provide suitable protective barriers to prevent future damage.
- ☐ Compare the transformer nameplate information with the drawings and/or specifications for the installation.
- ☐ Verify proper connection of the taps in accordance with the nameplate information.
- ☐ Check the clearance of all electrical connections. Verify all connections for tightness with a calibrated torque wrench.
- ☐ Visually check the core, frame, enclosure, conduits, raceways and conductors for proper ground bonding. In addition, refer to Grounding and Bonding on page 39.

Electrical Testing

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Carefully inspect your work area, and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Refer to Maintenance on page 37 to perform the following pre-commissioning electrical testing:

- ☐ Measure contact resistance using a low resistance ohmmeter. Refer to Contact Resistance on page 39.
- ☐ Perform insulation resistance tests with an appropriate device. Refer to Insulation Resistance on page 39.
- ☐ Perform a turns ratio test on all taps and on the full winding voltages for each phase. Refer to Turns Ratio on page 39.
- ☐ Measure and record the winding resistances on larger transformers (>500 kVA). Refer to Winding Resistance on page 39.

Section 5—Operation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Carefully inspect your work area, and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Effects of Humidity

The standard dip and baked varnish process does not support the growth of fungus. The only concern when units are stored in high humidity areas is retaining the integrity of the insulation material. If units are properly maintained and cleaned at shut down prior to long periods of de-energization there should be no issue with fungus.

Humidity conditions are unimportant as long as the transformer is energized. However, follow the precautionary steps listed below if the transformer is de-energized, is allowed to cool to ambient temperature, and will exceed a shutdown of 12 hours (especially in high humidity conditions).

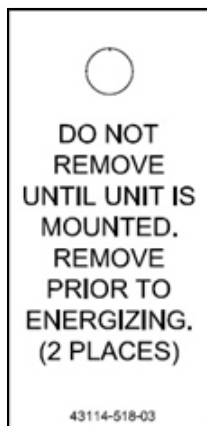
1. Place small strip heaters in the bottom of the unit shortly after shutdown to maintain the temperature of the unit a few degrees above that of the outside air.
2. Inspect the unit for evidence of moisture before returning it to service.
3. Check the insulation resistance. If evidence of moisture exists, or if the insulation resistance is less than 1 megohm, dry out the transformer by placing it in an oven or by blowing heated air over it.

Enclosure Temperature

The temperature rise on the enclosure exterior for ventilated transformers should not exceed 122°F (50°C), except as indicated in UL 1561.

Prior to Energizing the Transformers

Figure 33: Removing Temporary Braces



1. Remove any temporary braces. See Figure 33.
2. Check bolted electrical connections. Refer to Making Electrical Connections on page 26 for a detailed check list.
3. Remove excess dirt accumulations from the transformer windings and insulators to permit free circulation of air and to guard against the possibility of insulation breakdowns. Refer to Cleaning on page 38 for a detailed check list.
4. Perform insulation resistance tests with an appropriate device. Refer to Insulation Resistance on page 39 for a detailed instructions.
5. Perform a visual and mechanical check of the transformer and its surrounding environment. Refer to Performing Visual and Mechanical Checks on page 37 for a detailed check list.

Energizing the Transformer

1. Follow all safety precautions and requirements for PPE as outlined in NFPA 70E and any other applicable standards and/or codes.
 - a. Immediately de-energize the transformer if there is any indication of arcing (visual or audible) at any time during the initial start-up.
 - b. Investigate and correct the cause of the arcing before re-energizing the unit.
2. Investigate and correct sources of excessive noise. When energized, the transformer will make some audible noise. Excessive mechanical noise, hums or rattles may be an indication of improperly installed or tightened hardware or enclosure parts.
3. Measure and verify the primary and secondary phase-to-phase and phase-to-ground voltages for all windings.
 - a. Where applicable, measure and verify phase-to-neutral voltages, as well.
 - b. Record and save the values for future reference.

NOTE: Phase-to-phase, phase-to-ground and phase-to-neutral measurements will verify that the transformer is functioning per the nameplate voltages.

- c. Measure phase-to-ground voltages.
- d. Record and save the values for future reference.

NOTE: Phase-to-ground voltages will verify that the unit has been installed correctly.

4. Move one tap at a time, or verify that the jumper lands per the wiring diagram as shown on the nameplate. See Figure 31 on page 28.

NOTE: Do not change taps while the transformer is energized.

- a. Adjust the transformer taps as necessary to match the actual voltage requirements.
 - b. Ensure taps are cleaned of varnish or other insulating material.
5. Perform a phase rotation check with an appropriate device for loads that are phase sensitive (e.g., certain motor or drive applications).
 - a. Follow the manufacturer's instructions for the device.
 - b. Correct phase rotation errors before energizing the transformer.

Section 6—Maintenance

Performing Visual and Mechanical Checks

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel should clean, inspect maintain and test transformers.
- Turn off power supplying this equipment before working on it.
- Disconnect and electrically isolate power to the transformer so that no accidental contact can be made with energized parts.
- Discharge all static charges held by coils.

Failure to follow these instructions will result in death or serious injury.

1. Perform a visual inspection of the transformer and its surrounding environment.
 - a. Inspect the enclosure for any physical damage.
 - b. Repair any damage, if possible.
 - c. Provide guards to prevent future damage.
2. Record operational data while the transformer is still energized and in service.
3. De-energize the transformer prior to performing work on the unit.
 - a. Follow all safety procedures to place the unit into an electrically safe condition.
 - b. Remove the access covers. Inspect for:
 - dirt on insulating surfaces and at areas which tend to restrict air flow.
 - loose connections.
 - the condition of tap changers or terminal boards.
 - the general condition of the transformer.
4. Inspect the enclosure, transformer, terminals, terminal boards, and insulators for signs of overheating from internal or external sources. Check for voltage creepage over insulating surfaces, evident by tracing or carbonization.
5. Check for evidence of rusting, corrosion and paint deterioration. Repair any rust and corrosion where necessary.

Frequency

The frequency at which transformers should be inspected depends on operating conditions.

For clean, dry locations, annual inspections may be sufficient. However, for other locations, such as where the air is contaminated with dust or chemical fumes, an inspection at three- or six-month intervals may be required. Usually after the first few inspection periods, a definite schedule can be set up based on the transformer's existing conditions.

Severe, Environmental or Special Events

- ❑ Perform routine inspections, maintenance, and testing after any severe electrical short circuit, ground fault, or environmental event (e.g., flooding) to determine the operational status of the transformer.
- ❑ Perform the inspections, maintenance and testing if the transformer has been out of service for an extended period of time. Place strip heaters to maintain the transformer temperature above ambient to prevent condensation from forming in the transformer during extended down time.

Cleaning

Connections and Contact Surfaces

A clean contact surface area is necessary, and terminals must be clean. Where the transformers are installed indoors or outdoors or in a harsh environment, the connections must be sealed with an approved electrical joint compound.

Apply the compound to exposed connections and the surface area before making a bolted connection.

Enclosures, Windings and Insulators

1. De-energize the transformer.
 2. Follow the check list below to permit free circulation of air and to guard against insulation breakdowns and thermal performance issues:
- ❑ Clean the transformer enclosure, windings and insulators by vacuuming or by blowing clean, dry, compressed air or nitrogen. Be sure to wear appropriate personal protective equipment (PPE) when cleaning.
NOTE: Vacuuming is the preferred first step for cleaning. Compressed air should have a dew point of -50°F (-45.5°C) or less, and a pressure at or below 25 psi.
 - ❑ Clean lead supports, tap changers, terminals boards, bushings and other major insulating surfaces with lint-free rags or soft bristle brushes.
NOTE: Do not use liquids, solvents or detergents, as they may deteriorate insulating materials.
 - ❑ Carefully inspect and thoroughly clean the ventilation openings (ducts) and winding assemblies. Remove any blockages.
 - ❑ Remove any trash and/or combustible materials from the area around the unit.

Performing Electrical Testing

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel should clean, inspect maintain and test transformers.
- Turn off power supplying this equipment before working on it.
- Disconnect and electrically isolate power to the transformer so that no accidental contact can be made with energized parts.
- Discharge all static charges held by coils.

Failure to follow these instructions will result in death or serious injury.

Perform the following electrical tests during maintenance:

Contact Resistance

- ❑ Check all electrical contacts with a calibrated torque wrench.
- ❑ Verify proper spacing.
- ❑ Refer to the manufacturer's specifications for torque values.
- ❑ Check all external hardware for tightness.
- ❑ Use a low resistance ohmmeter to measure contact resistance.
 - a. Compare values with similar connections looking for unusually high contact resistance points.
 - b. Investigate any connections that may deviate from common values by more than 50% of the lowest values.
- ❑ An infrared scanning device may be used to look for abnormal temperatures at transformer contacts for energized units.

NOTE: Take care to follow the manufacturer's procedures, as small errors in scanner operation can cause significant errors in detected temperatures.

Insulation Resistance

- Insulation resistance checks may create a capacitive charge on a winding.
1. Ground each winding for at least one minute between tests to drain any static charge created during the test.
 2. Perform insulation resistance tests with an appropriate device.
 3. Test from winding-to-winding and winding-to-ground.
 4. Record all test results for comparison for future readings.
 - Values are installation site dependent and not pre-set at the factory. All testing is compliant to NEMA ST-20.
 - Insulation resistance readings should be at least 1 megohm.
 - Lower readings may indicate the presence of moisture and require a drying procedure to correct.

Winding Resistance

- On larger transformers (>500 kVA):
1. Measure the winding resistances and record for future reference.
 2. Compare the results with the values obtained during the pre-commissioning checks. Readings should not vary by more than 5% with adjacent coils and the pre-commissioning checks.
 3. Record the temperature at which these initial readings were taken.
 - Values are installation site dependent and not pre-set at the factory. All testing is compliant to NEMA ST-20.
 4. Adjust the resistance values based on any differences in temperature between current readings and pre-commissioning values.

Grounding and Bonding

1. Check for proper values of resistance between the system ground lug (or point) and the transformer enclosure, core, frame and clamps.
2. Compare with pre-commissioning values, looking for trends that may indicate a compromise in the quality of the ground bond.

Turns Ratio

1. Perform a turns ratio test on all taps and on the full winding voltages for each phase. Significant changes may indicate a loss of winding continuity.
 - a. Compare these values with those obtained during the pre-commissioning checks. Voltages between phases should not deviate by more than 0.5% from adjacent coils.
 - b. Investigate abnormal readings found outside of this limit.
2. Verify input and output voltages are correct for the tap and output voltages expected. Investigate abnormal readings.

Sound Isolation Pads

Inspect the sound isolation pads for signs of physical deterioration.

Coil Cooling Ducts

1. Inspect all coil cooling ducts for any accumulation of dust, dirt or other obstructions.
2. Follow standard cleaning procedures to ensure proper air flow.

Terminals

Ensure terminals are in good working condition for the proper operation of transformers.

- ❑ Inspect terminals for alignment, tightness (see torque requirements), pressure, burns or corrosion. Investigate and correct any signs of damage.
- ❑ Repair minor pitting, as long as the plating on the terminal has not been compromised.

Section 7—Replacement Parts and Accessories

See Figures 34 and 35 for transformer covers (top, rear and front) and side panels (left and right), and Figure 21 on page 20 and Figure 22 on page 21 for mounting brackets (wall and ceiling). Refer to Table 4 on page 43 for a listing of replacement and accessory parts.

Figure 34: Exploded Assembly for EX75T3H Energy Efficient Transformer with Enclosure Style 20K Front

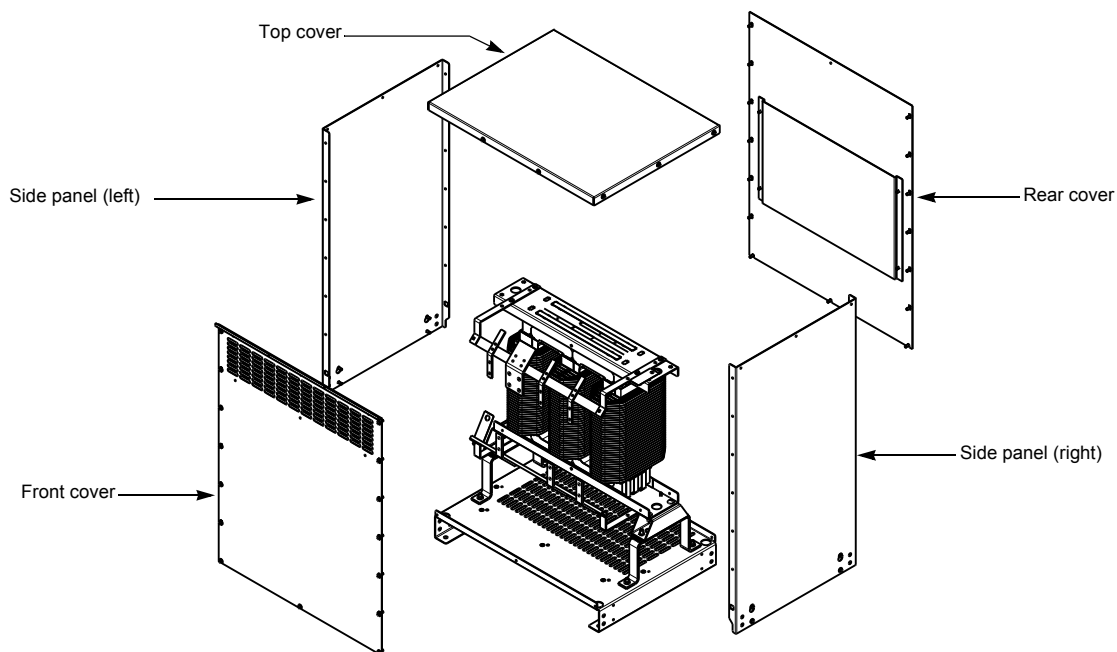
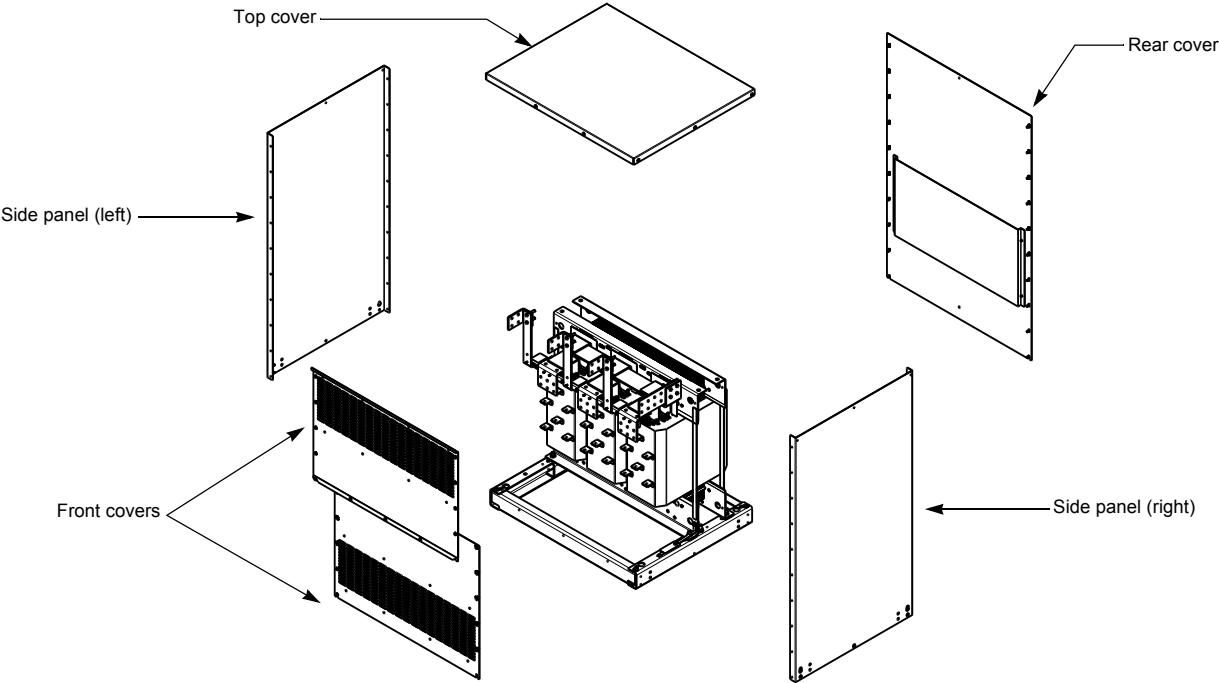


Figure 35: Exploded Assembly for EX300T3H Energy Efficient Transformer with Enclosure Style 25J Front



Refer to the Schneider Electric *Digest*, Section 14, Transformers or call 1-888-Square D (1-888-778-2733) to order replacement parts and accessories.

Refer to Table 4 for enclosure types (top, rear and front covers) side panels, weather-shields and mounting brackets (wall and ceiling).

Table 4: Covers, Side Panels, Weather Shields and Mounting Brackets

Enclosure	Top Cover	Rear Cover	Front Cover	Side Panel (Left and Right)	Weather-shield	Wall Mounting Bracket	Ceiling Mounting Bracket
Catalog Number							
17D	4310191501	4310191601	4310191601	4310191701	WS363	WMB361362	CMB363
17E	4310191501	—	—	4310191701	—	WMB361362	CMB363
17H	4310191501	4305502003	4305502003	4310191702	WS363	WMB361362	CMB363
17K	7400TC17K	7400R17K	7400FNP17K	7400LR17K	7400WS17K	7400WMB17K	7400CMB17K
18D	4305502101	4305502001	4305502001	4305501001	WS363	WMB363364	CMB363
18E	4305502101	—	—	4305501001	—	WMB363364	CMB363
18H	4305502101	4305502003	4305502003	4310179701	WS363	WMB363364	CMB363
18K	7400TC18K	7400R18K	7400FNP18K	7400LR18K	7400WS18K	7400WMB18K	7400CMB18K
19D	4305501201	4305501101	4305501101	4305501001	WS364	WMB363364	CMB364
19E	—	—	—	—	—	—	—
19K	7400TC19K	7400R19K	7400FNP19K	7400LR19K	7400WS19K	7400WMB19K	7400CMB19K
20D	4305501201	4310192201	4310192201	4310179701	WS364	WMB363364	CMB364
20E	4305501201	—	—	4310179701	—	—	—
20K	7400TC20K	7400R20K	7400FNP20K	7400LR20K	7400WS20K	7400WMB20K	7400CMB20K
21D	4305512501	4300507404	4300507404	4305512601	WS364	—	CMB364
21E	4305512501	—	—	4305512601	—	—	CMB364
21K	7400TC21K	7400R21K	7400FNP21K	7400LR21K	7400WS21K	—	7400CMB21K
22D	4310189001	4310189102	4310189102	4310189201	WS380	—	CMB380
22E	4310189001	—	—	4310189201	—	—	CMB380
22K	7400TC22K	7400R22K	7400FNP22K	7400LR22K	7400WS22K	—	7400CMB22K
23E	—	—	—	—	—	—	—
24D	4310190701	4310190802	4310190802	4310190901	WS381	—	CMB381
24E	4310190701	—	—	4310190901	—	—	CMB381
24K	7400TC24K	7400R24K	7400FNP24K	7400LR24K	7400WS24K	—	7400CMB24K
25D	4310189901	4310190001	4310190001	4310190101	WS382	—	—
25E	4310189901	—	—	4310190101	—	—	—
25J	7400TC25J	7400R25J	7400FNP25J	7400LR25J	7400WS25J	—	—
26D	—	—	—	—	—	—	—
28D	—	—	—	—	—	—	—
28E	—	—	—	—	—	—	—
29D	—	—	—	—	—	—	—
30D	4310192601	(U)4310192901 (L)4310193001	(U)4310192901 (L)4310193001	4310192801	WS383	—	—
30E	4310192601	—	—	—	—	—	—
30J	7400TC30J	7400RU30J 7400RL30J	7400FU30J 7400FLNP30J	7400LR30J	7400WS30J	—	—
31D	—	—	—	—	—	—	—
31E	—	—	—	—	—	—	—
31J	7400TC31J	7400RU31J 7400RL31J	7400FU31J 7400FLNP31J	7400LR31J	7400WS31J	—	—

Touch-up Paint: Catalog Number PK49SP

Refer to Table 5 for available transformer lug kits. For additional information regarding terminal connectors, refer to the label on the reverse side of the transformer front panel. See Figure 36.

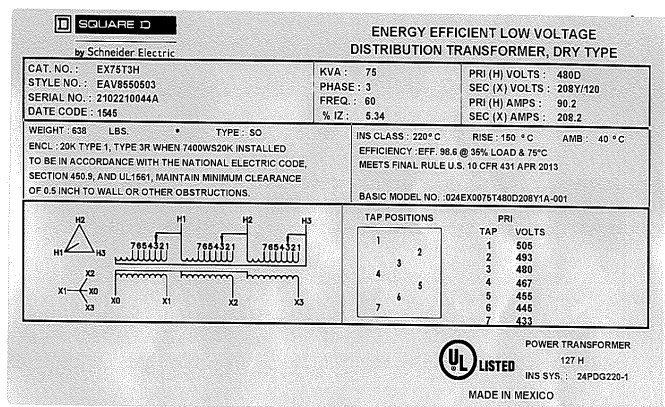
Table 5: VERSAtile™ Compression Lugs and Mechanical Set-Screw Types—UL Listed Lugs AL9CU

Transformer kVA Sizes	Kit Catalog Number	Terminal Lugs		Aluminum or Copper Conductor Range (AWG or kcmil)	Hardware Included	
		Qty.	Catalog Number		Qty.	Cap Screws
VERSAtile Compression Equipment Lugs						
15–37 ¹ / ₂ 1Ø	VCELSK1	8	VCEL02114S1	#8–1/0	8	1/4 in. x 1 in.
15–45 3Ø		5	VCEL030516H1	#4–300 kcmil	1	1/4 in. x 2 in.
50–75 1Ø	VCELSK2	13	VCEL030516H1	#4–300 kcmil	8	1/4 in. x 1 in.
75–112 ¹ / ₂ 3Ø					8	1/4 in. x 2 in.
100–167 1Ø 150–300 3Ø	VCELSK3	3 26	VCEL030516H1	#4–300 kcmil	3	1/4 in. x 3/4 in.
			VCEL07512H1	#500–750 kcmil Al #500 kcmil Cu	16	3/8 in. x 2 in.
500 3Ø	VCELSK4	34	VCEL07512H1	#500–750 kcmil Al #500 kcmil Cu	21	3/8 in. x 2 in.

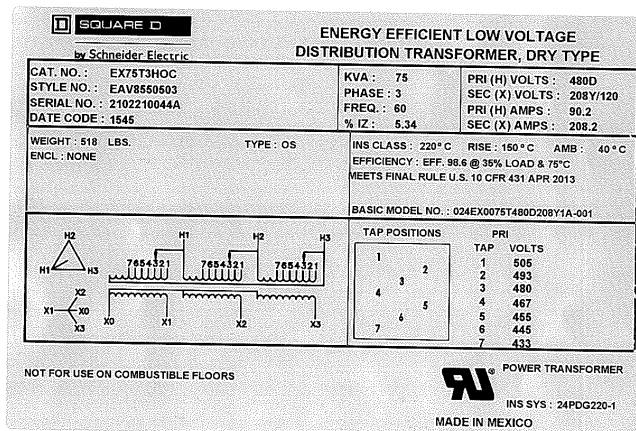
NOTE: Refer to UL 486A for torque values to be used with lug connection hardware.

Two nameplates are attached to each unit. See Figure 36. One on the front cover which is required by standards, the second nameplate is attached to the core and coil, providing installation information inside the unit. The second nameplate also carries a UR listing for the core and coil, allowing the enclosure to be removed and the device installed in the equipment.

Figure 36: Sample Nameplates



Attached to the Front Cover



Attached to the Core and Coil

Refer to Table 6 for Square D lug kits for the following dry-type transformers:

- Single-phase primary, single-phase secondary, three-phase Delta primary, three-phase secondary
- Single-phase primary and secondary, three-phase Wye secondary, three-phase Delta with center tap

Table 6: Square D Lug Kits for Dry-type Transformers

Catalog Number	Lugs per Kit	Wire Range	Cap Screws	Current Range	Grounding Lugs per Kit	Wire Range	Bonding Lugs per Kit	Wire Range
Single-phase Primary, Single-phase Secondary, Three-phase Delta Primary, Three-phase Secondary								
DASKP100	3	1/0–14 STR.	1/4 in. x 1 in.	Up to 100 A	Not Applicable	Not Applicable	Not Applicable	Not Applicable
DASKP250	3	350 kcmil–6 STR.	3/8 in. x 2 in.	101–250 A				
DASKP400	3	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	201–400 A				
DASKP600	6	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	601–800 A				
DASKP1000	9	600 kcmil–2 STR.	3/8 in. x 2 in.	601–800 A				
DASKP1200	12	600 kcmil–2 STR.	3/8 in. x 2 in.	801–1200 A				
Single-phase Primary and Secondary, Three-phase Wye Secondary, Three-phase Delta with Center Tap								
DASKGS100	5	1/0–14 STR.	1/4 in. x 1 in.	Up to 100 A	1	(4) 2/0–14 STR.	1	2–14 STR.
DASKGS250	5	350 kcmil–6 STR.	3/8 in. x 2 in.	101–250 A	1	(4) 2/0–14 STR.	1	2–14 STR.
DASKGS400	5	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	201–400 A	1	(4) 2/0–14 STR.	1	1/0–14 STR.
DASKGS600	10	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	601–800 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.
DASKGS1000	15	600 kcmil–2 STR.	3/8 in. x 2 in.	601–800 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.
DASKGS1200	20	600 kcmil–2 STR.	3/8 in. x 2 in.	801–1200 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.
DASKGS2000	25	600 kcmil–2 STR.	3/8 in. x 2 in.	1201–2000 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.

NOTE: Lugs are not supplied with transformer units. They must be purchased separately.

Refer to UL 486A for torque values to be used with lug connection hardware.

Refer to Table 7 for terminal mechanical and compression lugs and their appropriate wire ranges for dry-type transformers.

NOTE: All terminals allow for NEMA two-hole lugs.

Table 7: Terminal Sizes, Mechanical and Compression Lugs and Wire Ranges

kVA	300 Volts and Above		Below 300 Volts	
	Terminal Mechanical Lugs	Terminal Compression Lugs	Terminal Mechanical Lugs	Terminal Compression Lugs
15	2/0–14 AWG	(1) #12–10 AWG (1) #8–#1/0 AWG	2/0–14 AWG	(1) #8–#1/0 AWG
30	2/0–14 AWG	(1) #8–#1/0 AWG	350 kcmil–6 AWG	(1) #8–#1/0 AWG (1) #4–300 kcmil (1) 250–350 kcmil
45	2/0–14 AWG 350 kcmil–6 AWG	(1) #8–#1/0 AWG (1) #4–300 kcmil	350 kcmil–6 AWG (1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(1) 250–350 kcmil (1) #2/0–500 kcmil (2) #4–300 kcmil
75	2/0–14 AWG 350 kcmil–6 AWG	(1) #8–#1/0 AWG (1) #4–300 kcmil (1) 250–350 kcmil	(1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(2) #2/0–500 kcmil (1) 400–600 kcmil Al (2) #4–300 kcmil (2) 250–350 kcmil
112.5	350 kcmil–6 AWG (1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(1) 250 kcmil–350 kcmil (1) #2/0–500 kcmil (2) #4–300 kcmil	(2) 350 kcmil–6 AWG (2) 600 kcmil–2 AWG	(3) 250–350 kcmil (3) #4–300 kcmil (2) 400–600 kcmil Al
150	(1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(1) 250–350 kcmil (2) #4–300 kcmil	(3) 350 kcmil–6 AWG (2) 600 kcmil–2 AWG	(3) #2/0–500 kcmil (3) #4–300 kcmil (3) 400–600 kcmil Al (4) 250–350 kcmil
225	(1) 600 kcmil–2 AWG (2) 600 kcmil–2 AWG	(2) #2/0–500 kcmil (2) 400–600 kcmil Al (2) #4–300 kcmil	(3) 600 kcmil–2 AWG	(4) #4–300 kcmil (4) #2/0–500 kcmil
300	(2) 600 kcmil–2 AWG	(3) 250–350 kcmil (3) #2/0–500 kcmil (3) 400–600 kcmil Al	(4) 600 kcmil–2 AWG	(6) #2/0–500 kcmil (6) 400–600 kcmil Al
500	(3) 600 kcmil–2 AWG	(4) #4–300 kcmil (4) #2/0–500 kcmil	(6) 600 kcmil–2 AWG	(9) #2/0–500 kcmil (9) 400–600 kcmil Al
750	(4) 600 kcmil–2 AWG	(6) #2/0–500 kcmil (6) 400–600 kcmil Al	(9) 600 kcmil–2 AWG	(15) #2/0–500 kcmil (15) 400–600 kcmil Al

NOTE: All terminals allow for NEMA two-hole lugs.

Refer to Table 8 for Square D ground bar kits.

Table 8: Square D Ground Bar Kits

Catalog Number	Grounding Lugs per Kit	Wire Range
DASKGTB100400	1	(4) 2/0–14 STR.
DASKGTB6002000	1	(4) 350 KCMIL–6 STR.

Schneider Electric
800 Federal Street
Andover, MA 01810 USA
1-888-778-2733
www.schneider-electric.us

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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43006-850-01 Rev. 02, 11/2015
Replaces 43006-850-01 Rev 01, 12/1992

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	TYPE	VOLTAGE	AIC	MOUNTING	PBA	NOTES AND REMARKS
1GH1	I-LINE	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	418	Standard Panel (Box Ahead),Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar,Standard Mains and Feeders Mechanically Restrained Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1GH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
BNH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	554	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: BNH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	553	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 1NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NH2	NF	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	550	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NH2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 2NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 3NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553T	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 4NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4SH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553T	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 4SH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	TYPE	VOLTAGE	AIC	MOUNTING	PBA	NOTES AND REMARKS
BNL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: BNL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	701A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 2NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 3NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 4NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	701A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 1LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	TYPE	VOLTAGE	AIC	MOUNTING	PBA	NOTES AND REMARKS
1LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Flush with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 1LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 2LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL4	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL4 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 3LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	TYPE	VOLTAGE	AIC	MOUNTING	PBA	NOTES AND REMARKS
3LL4	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL4 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL5	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Flush with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL5 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL4	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL4 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL5	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL5 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL5	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL5 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	TYPE	VOLTAGE	AIC	MOUNTING	PBA	NOTES AND REMARKS
1SL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1SL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

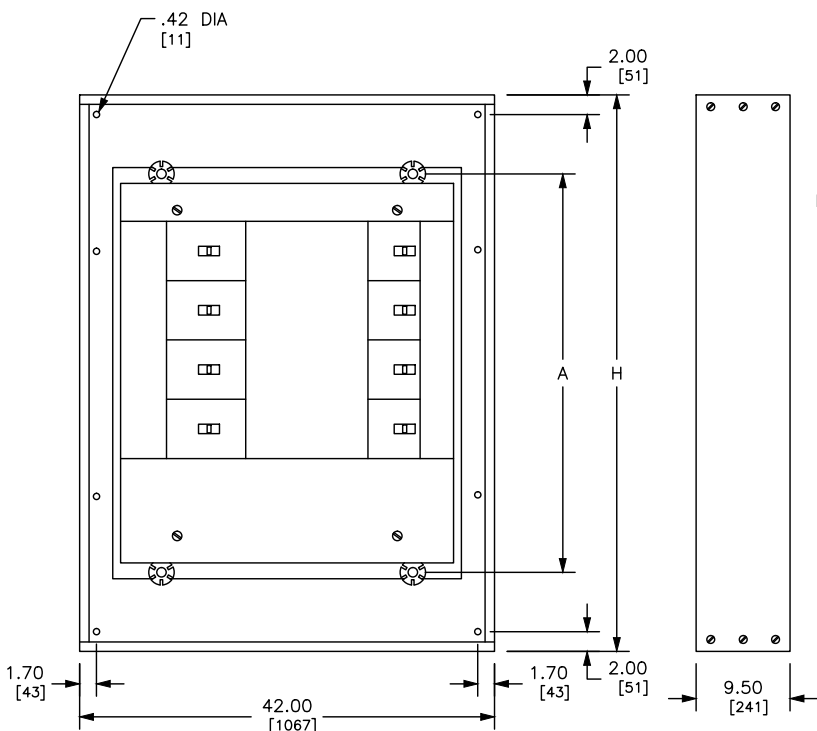
PLEASE CONFIRM THAT THE PANEL DETAILS MATCHES THE PLANS AND SPECIFICATIONS.

ALL LUGS ON PANELBOARDS AND CIRCUIT BREAKERS ARE RATED AT 75 DEGR C.

ALL LUGS ARE SIZED PER UL STANDARDS. PLEASE CONFIRM THAT THEY ARE APPROPRIATE FOR THE QUANTITY AND SIZE OF THE CABLE BEING CONNECTED.

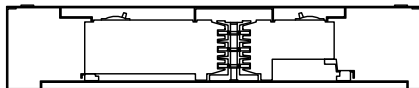
PLEASE CONFIRM TOP OR BOTTOM FEED, AND SURFACE OR FLUSH COVERS.

REV	DESCRIPTION	BY	DATE	—	----	—	—	—	—
—	----	—	—/—/—	—	----	—	—	—	—

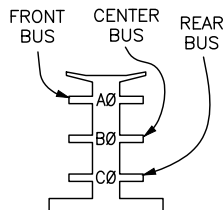


TYPICAL BOX WITH INTERIOR

TYPICAL BOX SIDE VIEW



TYPICAL MOUNTING OF FA, FC, FD, FG, FH, FI, FJ, FK, FY, HD, HG, HJ, HL, JD, JG, JJ, JL, KA, KC, KH, KI, LA, LC, LE, LH, LI, LX, LXI, MG, MJ, PG, PJ, PK, PL, Q2, Q2H, Q2-H, QB, QD, QG, QJ, OR QO, BREAKERS



BRANCH CONNECTION PHASING IS DETERMINED BY CIRCUIT BREAKER SELECTION

REFER TO DP CATALOG CLASS 2110 FOR ADDITIONAL INFORMATION

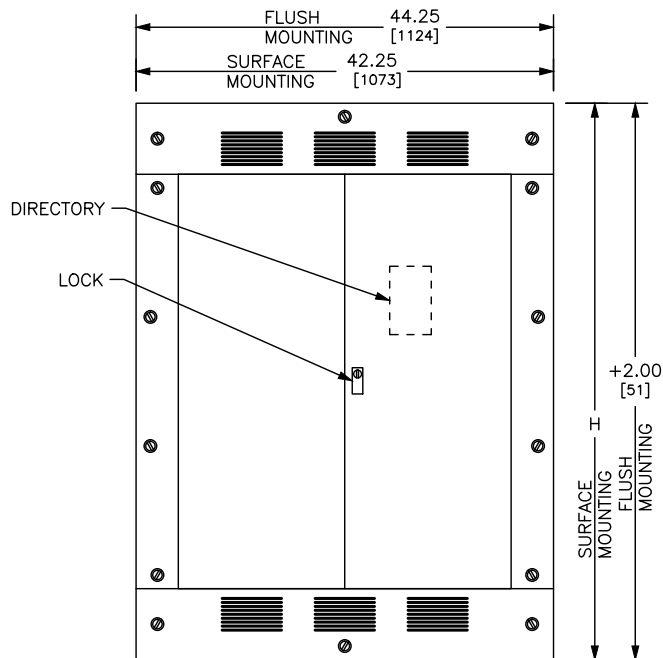
I-LINE HCP PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

BOX: CODE GAUGE GALVANIZED STEEL WITH REMOVABLE BLANK ENDWALLS.

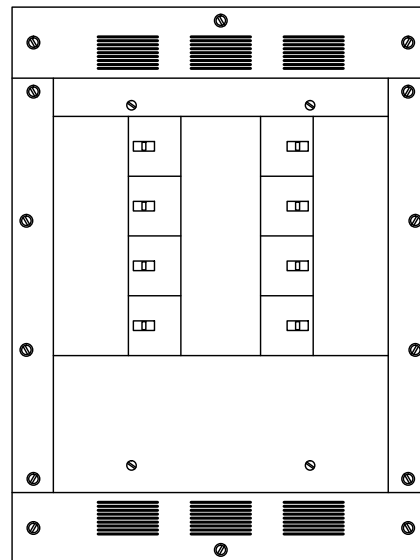
FRONT: CODE GAUGE STEEL. GRAY BAKED ENAMEL FISHISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: (COVERS WITH DOORS) HAVE 3 POINT ESCUTCHEON FLUSH LOCK WITH NSR-251 KEY.

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA412.



TYPICAL FRONT
(4 PIECE TRIM – WITH DOOR)



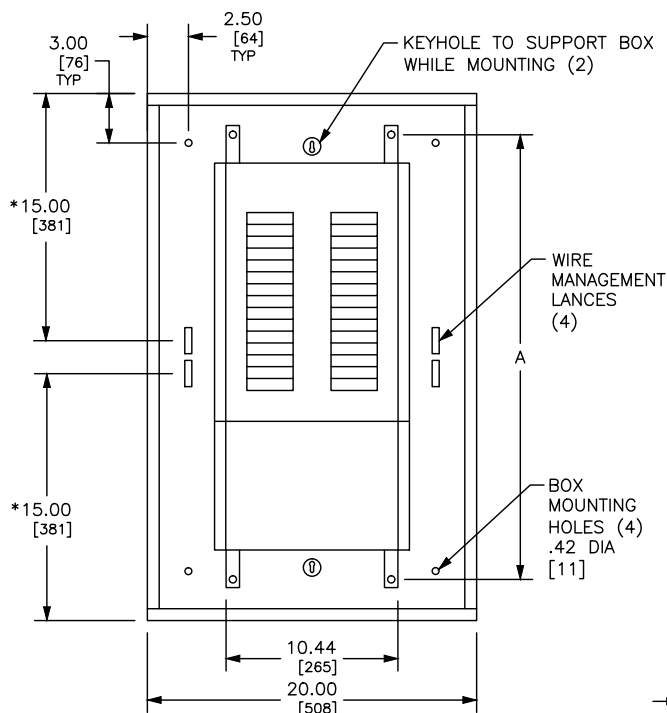
TYPICAL SURFACE FRONT
(4 PIECE TRIM – NO DOOR)

DUAL DIMENSIONS: INCHES
MILLIMETERS

MAXIMUM MLO OR BF-MCB AMPERE RATING	BRANCH BREAKER MOUNTING SPACE (INCHES)	H		A	
		IN	MM	IN	MM
400 THRU 800	27	50.00	1270	20.40	518
	45	59.00	1499	38.40	975
	63	68.00	1727	47.40	1204
	99	86.00	2184	65.10	1654

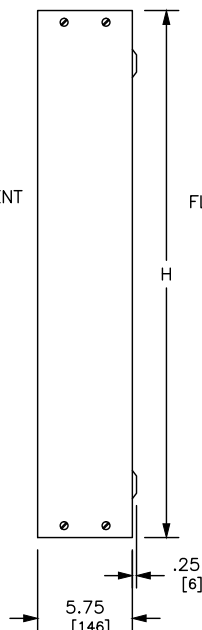
JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1GH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	I-Line (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	September 27 2016		
DRAWING STATUS:	RECORD	DWG#	A37999262-418-01
		PG 1	OF 1
		REV	—

REV	DESCRIPTION	BY	DATE						
-	----	--	---/---/---	-	-----	--	---/---/---	--	---

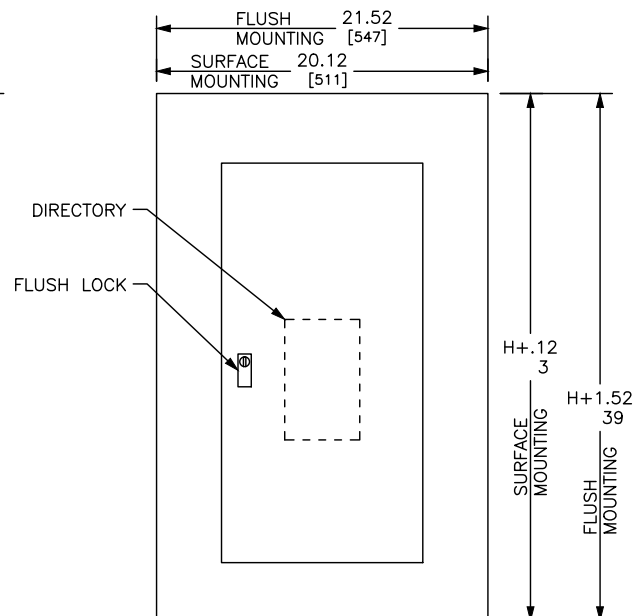


TYPICAL BOX WITH INTERIOR

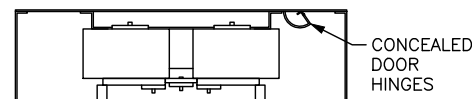
*FOR ENCLOSURES WHERE DIMENSION "H" IS 26.00/[660], THIS DIMENSION IS 11.00/[279]



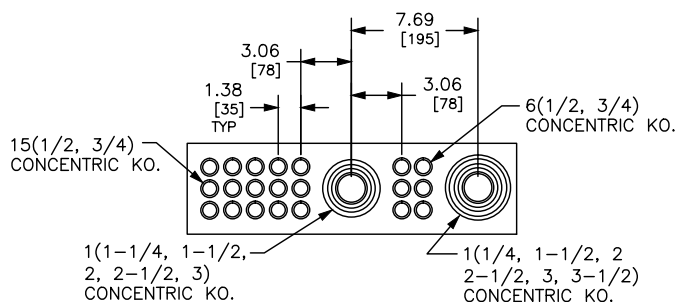
TYPICAL BOX SIDE VIEW



TYPICAL FRONT



TYPICAL MOUNTING OF EDB OR ECB-G3 BREAKERS



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)

DUAL DIMENSIONS: INCHES
MILLIMETERS

MAXIMUM MAIN LUG AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
125	18	26.00	660	21.00	533
	30	32.00	813	27.00	686
	30	38.00	965	33.00	838
	42	44.00	1118	39.00	991
250	54	50.00	1270	45.00	1143
	66	62.00	1575	57.00	1448
125 WITH SUB-FEED LUGS	18	26.00	660	21.00	533
	30	32.00	813	27.00	686
	30	38.00	965	33.00	838
	42	44.00	1118	39.00	991
250 WITH SUB-FEED LUGS	54	50.00	1270	45.00	1143
	66	62.00	1575	57.00	1448
125 WITH FEED-THRU LUGS	18	32.00	813	27.00	686
	30	38.00	965	33.00	838
	30	50.00	1270	45.00	1143
	42	56.00	1422	51.00	1295
250 WITH FEED-THRU LUGS	54	62.00	1575	57.00	1448
	66	74.00	1880	69.00	1753
250 WITH SUB-FEED BREAKERS	30	56.00	1422	51.00	1295
	42	62.00	1575	57.00	1448
	54	68.00	1727	63.00	1600
	66	74.00	1880	69.00	1753

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION
FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555
NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

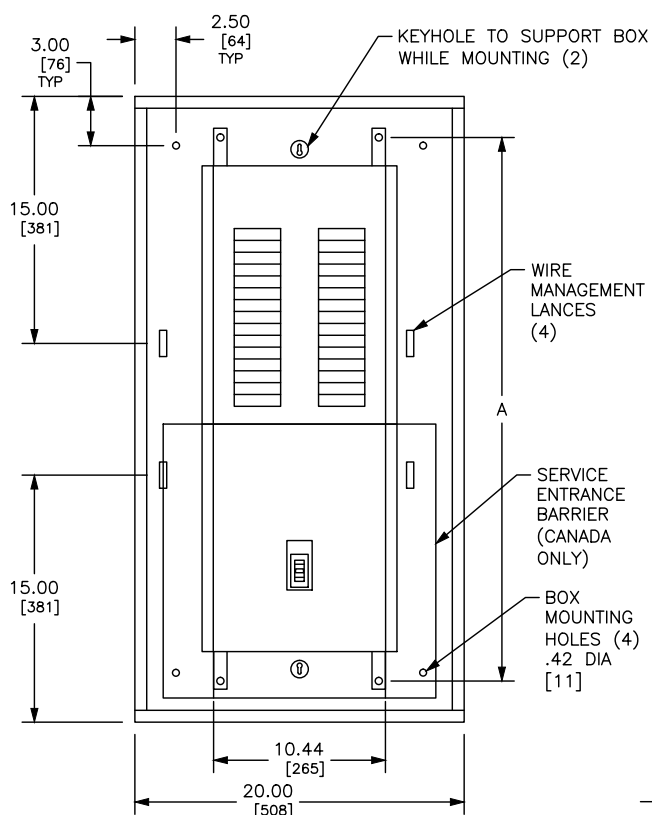
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

FRONT: MONO-FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

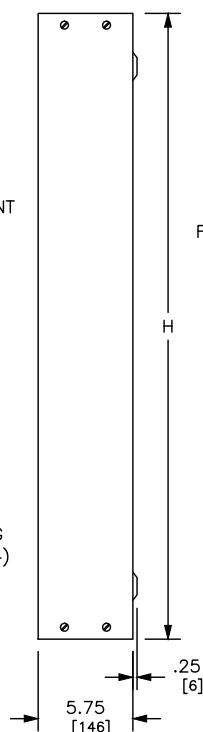
LOCK: FLUSH LOCK WITH BRUSHED STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NH2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016	by Schneider Electric	
DRAWING STATUS:	RECORD	DWG# A37999262-550-01	PG 1 OF 1 REV -

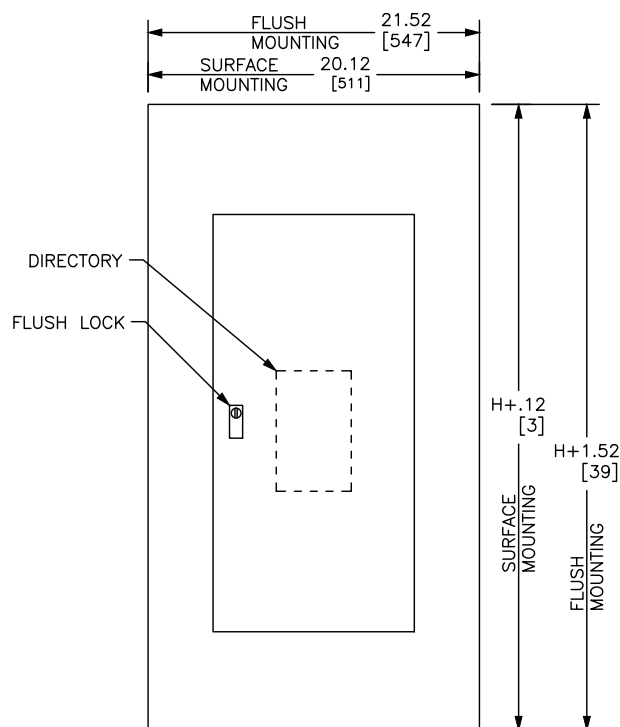
REV	DESCRIPTION	BY	DATE						
-	-	-	-	-	-	-	-	-	-



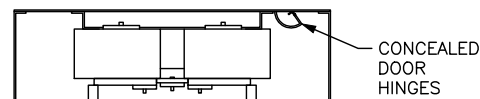
TYPICAL BOX WITH INTERIOR



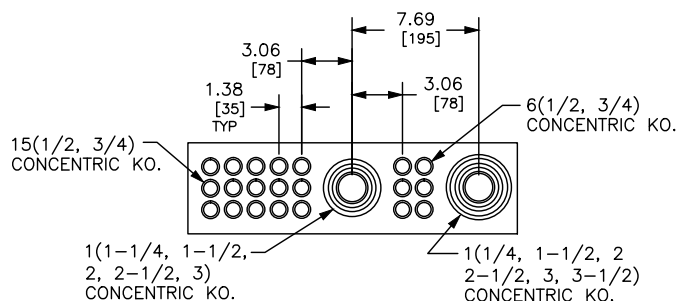
TYPICAL BOX SIDE VIEW



TYPICAL FRONT



TYPICAL MOUNTING OF EDB OR ECB-G3 BREAKERS



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)

DUAL DIMENSIONS: INCHES
MILLIMETERS

MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
100	18	38.00	965	33.00	838
	30	44.00	1118	39.00	991
	42	50.00	1270	45.00	1143
250	54	56.00	1422	51.00	1295
	66	62.00	1575	57.00	1448
		74.00	1880	69.00	1753
100 WITH FEED-THRU LUGS	18	44.00	1118	39.00	991
	30	50.00	1270	45.00	1143
	42	56.00	1422	51.00	1295
250 WITH FEED-THRU LUGS	54	62.00	1575	57.00	1448
	66	68.00	1727	63.00	1600
		74.00	1880	69.00	1753
		86.00	2184	81.00	2057
250 WITH SUB-FEED BREAKERS	30	68.00	1727	63.00	1600
	42	74.00	1880	69.00	1753
	54	80.00	2032	75.00	1905

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555

NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

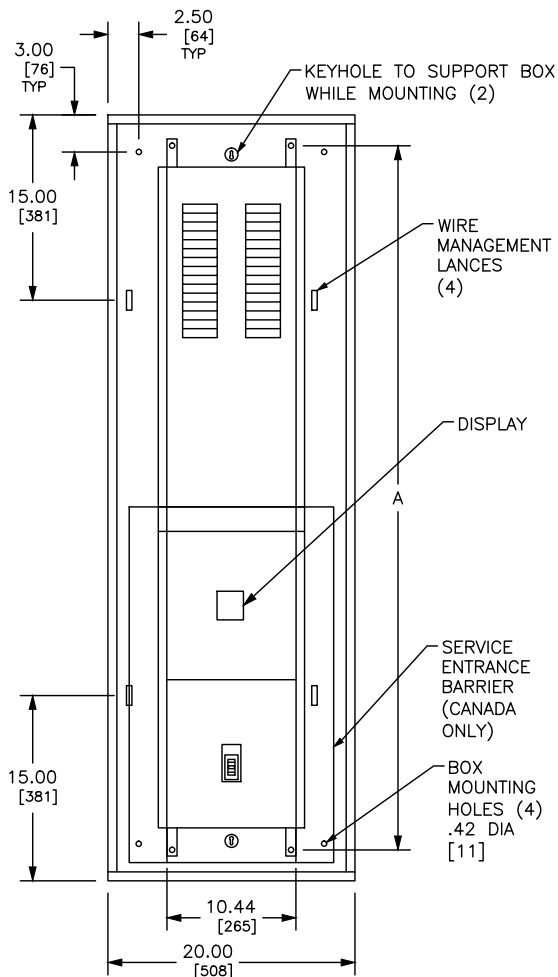
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

FRONT: MONO-FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

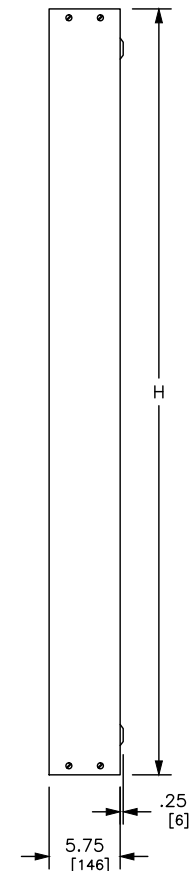
LOCK: FLUSH LOCK WITH BRUSHED, STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# A37999262-553-01	PG 1 OF 1 REV -

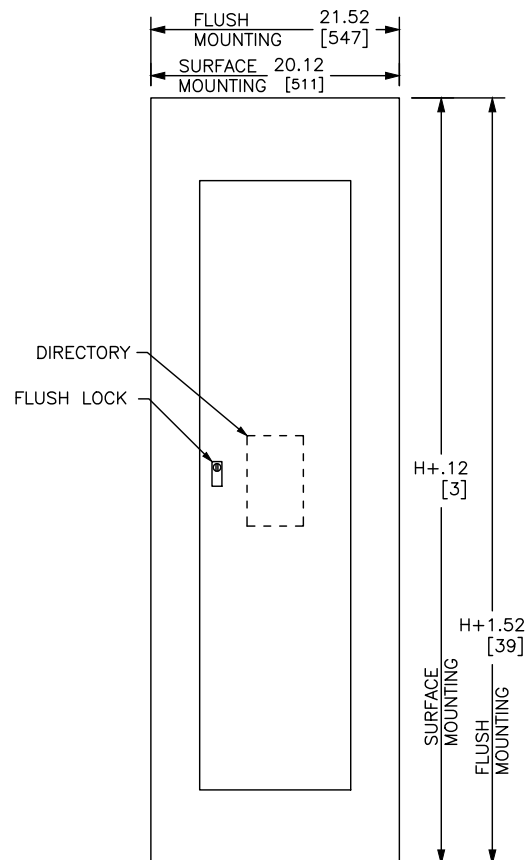
REV	DESCRIPTION	BY	DATE						
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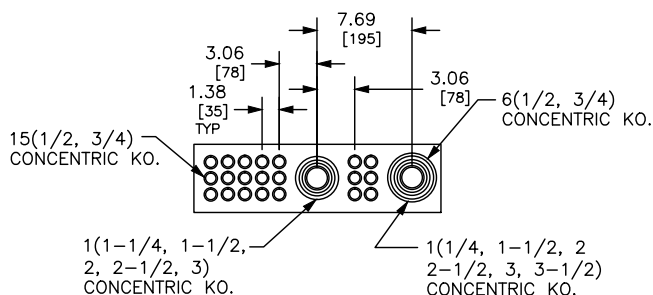
TYPICAL BOX WITH INTERIOR



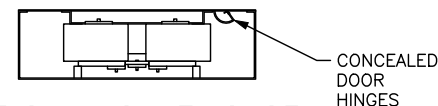
TYPICAL BOX SIDE VIEW



TYPICAL FRONT



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)



TYPICAL MOUNTING OF
EDB OR ECB-G3 BREAKERS

DUAL DIMENSIONS: INCHES
MILLIMETERS

MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
100 WITH SPD	30	62.00	1575	57.00	1448
250 WITH SPD	30	62.00	1575	57.00	1448
	42	68.00	1727	63.00	1600
	54	74.00	1880	69.00	1753
100 WITH SPD AND FEED-THRU LUGS	30	68.00	1727	63.00	1600
250 WITH SPD AND FEED-THRU LUGS	30	74.00	1880	69.00	1753
	42	80.00	2032	75.00	1905
	54	86.00	2184	81.00	2057
250 WITH SPD AND SUB-FEED BREAKERS	30	80.00	2032	75.00	1905
	42	86.00	2184	81.00	2057

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555

NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

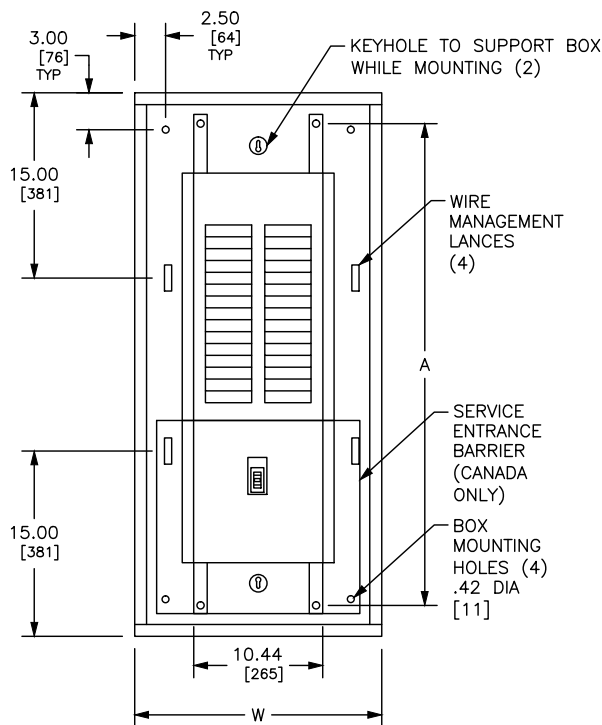
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

FRONT: MONO-FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

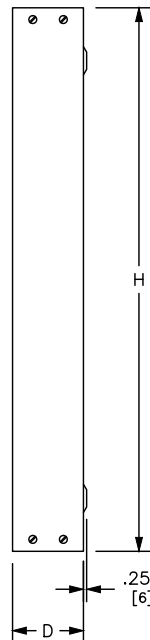
LOCK: FLUSH LOCK WITH BRUSHED, STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4SH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	A37999262-553T-01
		PG 1	OF 1
		REV	-

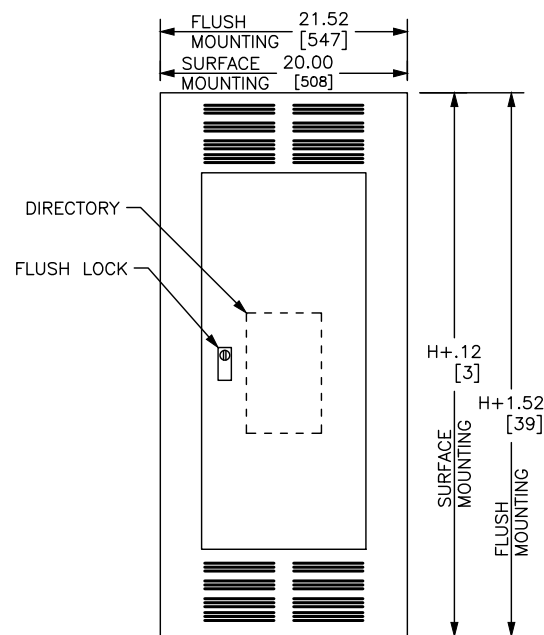
REV	DESCRIPTION	BY	DATE	—	----	---	---	---
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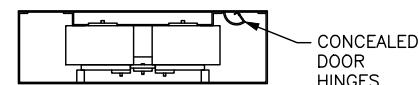
TYPICAL BOX WITH INTERIOR



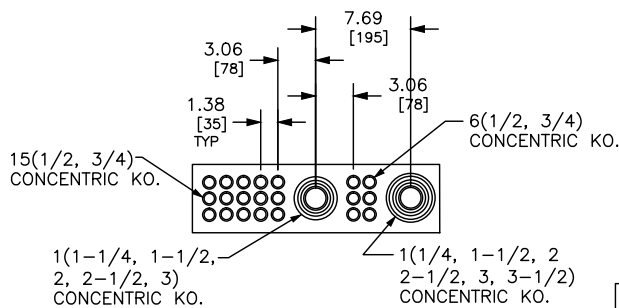
TYPICAL BOX SIDE VIEW



TYPICAL FRONT



TYPICAL MOUNTING OF EDB OR ECB-G3 BREAKERS



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)

DUAL DIMENSIONS: INCHES
MILLIMETERS

MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NO OF CIRCUITS	H		W		D		A	
		IN	MM	IN	MM	IN	MM	IN	MM
400 (LAL,LHL)	30	62.00	1575	20.00	508	5.75	146	57.00	1448
	42	68.00	1727					63.00	1600
	54	74.00	1880					69.00	1753
	66	86.00	2184					81.00	2057
400/600 (LCL,LIL)	30	68.00	1727	20.00	508	8.75	203	63.00	1600
	42	74.00	1880					69.00	1753
	54	80.00	2032					75.00	1905
400 WITH FEED-THRU LUGS (LAL,LHL)	30	68.00	1727	20.00	508	5.75	146	63.00	1600
	42	74.00	1880					69.00	1753
	54	80.00	2032					75.00	1905
400 WITH FEED-THRU LUGS (LCL,LIL)	30	74.00	1880	20.00	508	8.75	203	69.00	1753
	42	80.00	2032					75.00	1905
	54	86.00	2184					81.00	2057
600 WITH FEED-THRU LUGS (LCL,LIL)	30	74.00	1880	26.00	660	8.75	203	69.00	1753
	42	80.00	2032					75.00	1905
	54	86.00	2184					81.00	2057
400 WITH SUB-FEED BREAKERS (LAL,LHL)	30	80.00	2032	20.00	508	5.75	146	75.00	1905
	42	86.00	2184					81.00	2057
400/600 WITH SUB-FEED BREAKERS (LCL,LIL)	30	86.00	2184	26.00	660	8.75	203	81.00	2057

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555

NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS. BOTH ENDWALLS ARE BLANK ON 26.00/[660] WIDE BOXES AND 8.00/[203] DEEP BOXES.

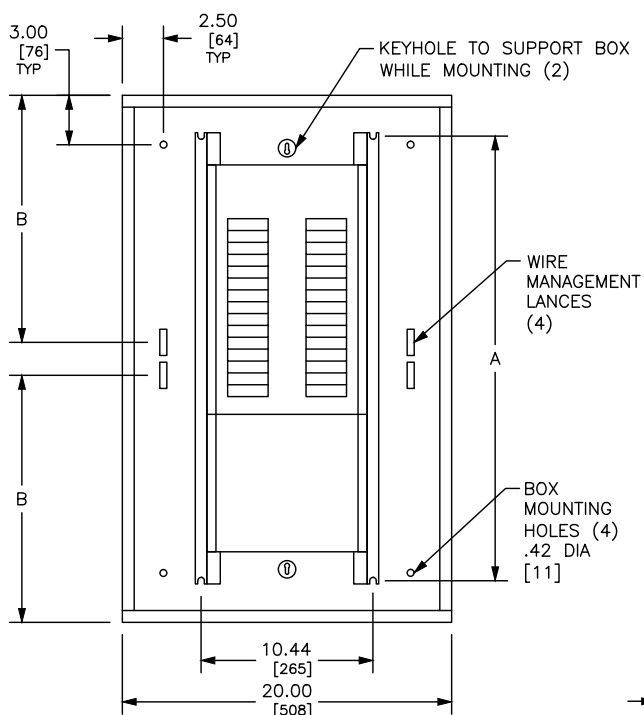
FRONT: GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL. FRONT IS VENTED AND MOUNTS TO ENCLOSURE WITH SCREWS. DOOR HINGES ARE CONCEALED.

LOCK: FLUSH LOCK WITH BRUSHED, STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.

WIRE MANAGEMENT LANCES AND KEYHOLE SLOTS IN BACK OF BOX ARE AVAILABLE IN 20.00/[508] BOX WIDTHS ONLY.

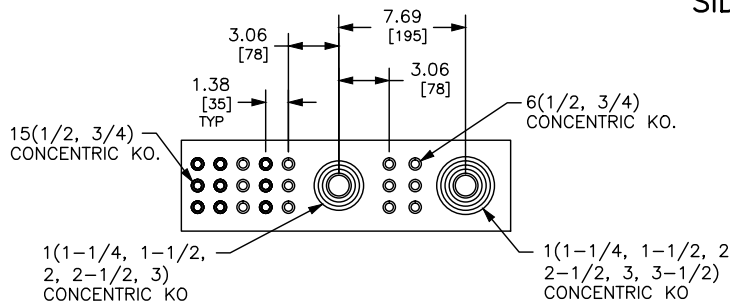
JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	BNH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016	by Schneider Electric	
DRAWING STATUS:	RECORD	DWG# A37999262-554-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE						
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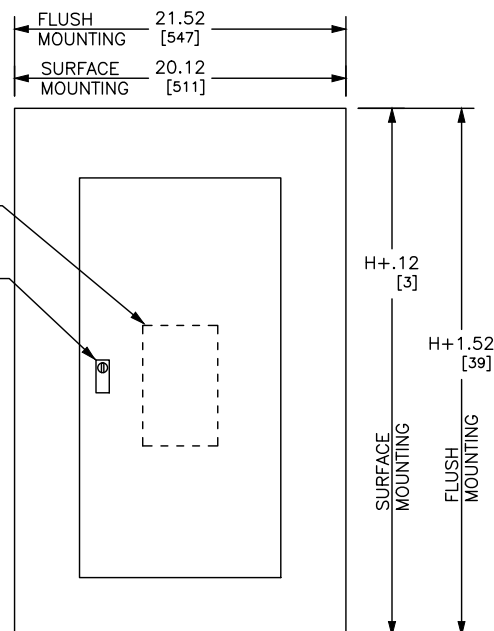


TYPICAL BOX WITH INTERIOR

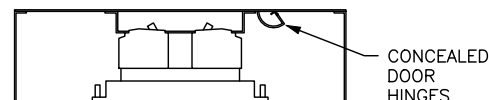
TYPICAL BOX SIDE VIEW



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)



TYPICAL FRONT



TYPICAL MOUNTING OF
QO, QOB BREAKERS

DUAL DIMENSIONS: INCHES
MILLIMETERS

MAXIMUM MAIN LUGS AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A		B	
		IN	MM	IN	MM	IN	MM
100A	18 30	26.00 32.00	660 813	21.00 27.00	533 686	11.00 15.00	279 381
225A	30 42 & 54 72 84	32.00 38.00 44.00 50.00	813 965 1118 1270	27.00 33.00 39.00 45.00	686 838 991 1143	15.00 15.00 15.00 15.00	381 381 381 381
100A WITH SUB FEED LUGS OR FEED THRU LUGS	18 30	26.00 32.00	660 813	21.00 27.00	533 686	15.00 15.00	381 381
225A WITH SUB FEED LUGS	30 42 & 54 72 84	38.00 44.00 50.00 56.00	965 1118 1270 1422	33.00 39.00 45.00 51.00	838 991 1143 1295	15.00 15.00 15.00 15.00	381 381 381 381
225A WITH FEED THRU LUGS	30 & 42 54 72 84	38.00 44.00 50.00 56.00	965 1118 1270 1422	33.00 39.00 45.00 51.00	838 991 1143 1295	15.00 15.00 15.00 15.00	381 381 381 381
225A WITH SUB FEED BREAKER	30 42 & 54 72 84	50.00 56.00 62.00 68.00	1270 1422 1575 1727	45.00 51.00 57.00 63.00	1143 1295 1448 1600	15.00 15.00 15.00 15.00	381 381 381 381

REFER TO DP CATALOG CLASS 1640 FOR ADDITIONAL INFORMATION

FOR TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA711

NQ PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

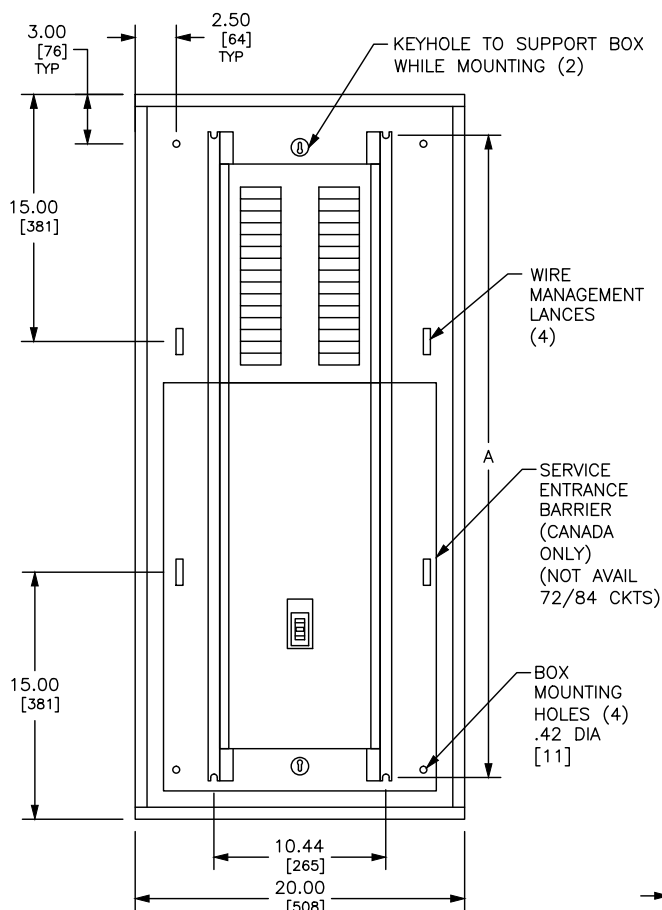
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

FRONT: MONO-FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: FLUSH LOCK WITH BRUSHED STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.

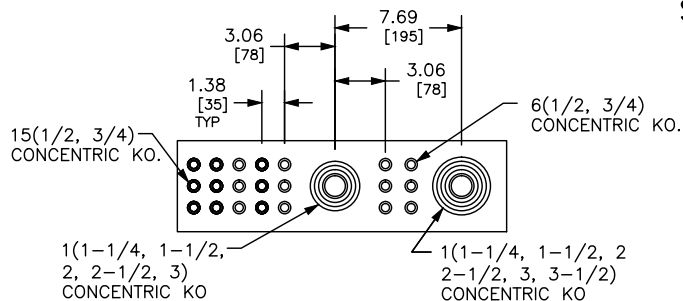
JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	A37999262-701A-701
		PG 1	OF 1
		REV	-

REV	DESCRIPTION	BY	DATE						
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TYPICAL BOX WITH INTERIOR

TYPICAL BOX SIDE VIEW



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)

REFER TO DP CATALOG CLASS 1640 FOR ADDITIONAL INFORMATION

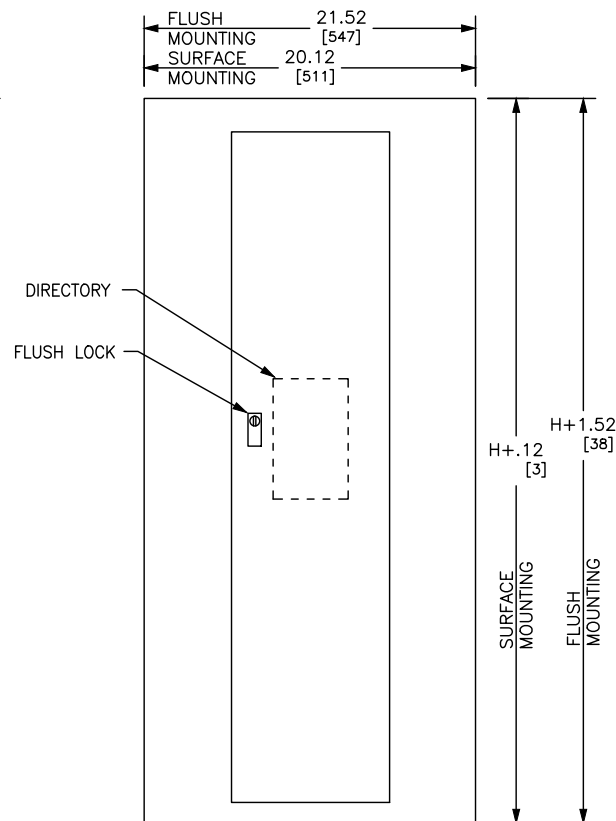
FOR TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA711

NQ PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

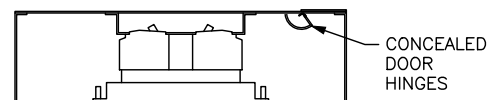
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, HE OTHER HAS KNOCKOUTS.

FRONT: MONO-FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: FLUSH LOCK WITH BRUSHED STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.



TYPICAL FRONT



TYPICAL MOUNTING OF
QO, QOB BREAKERS

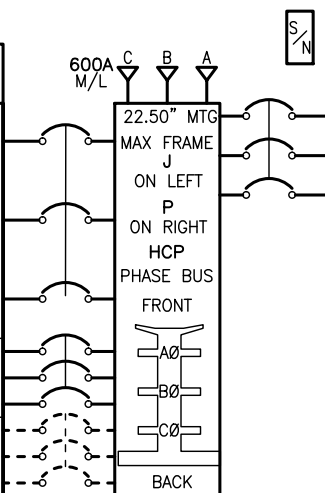
DUAL DIMENSIONS: INCHES
MILLIMETERS

MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
250A	30	44.00	1118	39.00	991
	42 & 54	50.00	1270	45.00	1143
	72	56.00	1422	51.00	1295
	84	62.00	1575	57.00	1448
250A WITH FEED THRU LUGS	30 & 42	50.00	1270	45.00	1143
	54	56.00	1422	51.00	1295
	72	62.00	1575	57.00	1448
	84	68.00	1727	63.00	1600
250A WITH SUB FEED BREAKER	30	62.00	1575	57.00	1448
	42 & 54	68.00	1727	63.00	1600
	72	74.00	1880	69.00	1753
	84	80.00	2032	75.00	1905

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1SL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016	by Schneider Electric	
DRAWING STATUS:	RECORD	DWG# A37999262-707A-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	PHASE BUS CONN
	SPD	HL	60/3	ABC
1		JG	225/3	ABC
3	PS 4.50" FP	JG	225/3	ABC



PHASE BUS CONN	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
ABC	400 /3	LA		2
			4.50" BLANK	
			4.50" BLANK	
			4.50" BLANK	
			1.50" BLANK	
			1.50" BLANK	

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
 FRONT CAT#: HCW59TSD
 BOX CAT#: HC4259DB
 DIMENSIONS:
 59"H x 42"W x 9.5"D
 WIRE BENDING SPACE:
 TOP - 15.22
 BOTTOM - 16.78
 LEFT SIDE - 8.77
 RIGHT SIDE - 8.66
 PBA: 418

BUSSING: Copper

Tin Plated

OPTIONAL FEATURES:

SEISMICALLY QUALIFIED : IBC/ASCE7

BRANCH USER PLACEMENT

Copper GROUND BAR

COPPER SOLID NEUTRAL

SPD DRY CONTACTS

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 600A

22kA SYMS. SCCR

MAIN: MAIN LUGS : 600A

Top FEED

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

(2) #2 - 500kcmil

BRANCH MOUNTING TYPE: PLUG-ON

-----BRANCH SUMMATION-----

1 - 225A/3P JG

1 - 225A/3P-PS JG

1 - 400A/3P LA

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1GH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	I-Line (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	September 27 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-009-01	PG 1 OF 2 REV -

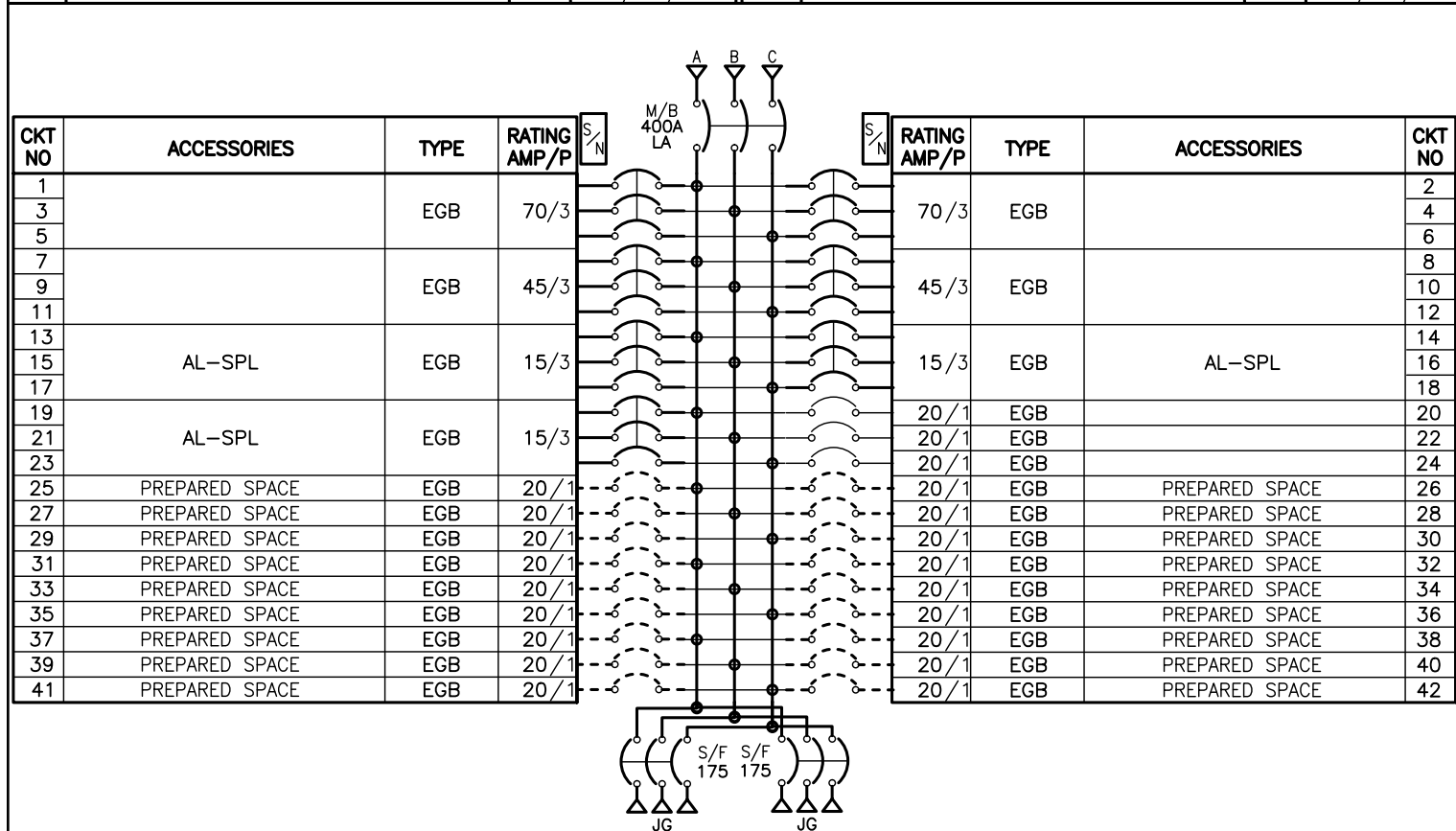
REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
-	----	--	--/--/--	-	----	--	--/--/--

PHYSICAL DATA CONTINUED

SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 120kA
SPD LINE TO GRD PROTECT
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 1GH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1GH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	I-Line (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	September 27 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-009-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC86VS
BOX CAT#: MH86BE
DIMENSIONS:
86"H x 20"W x 5.75"D
WIRE BENDING SPACE:
TOP - 15
BOTTOM - 12.25
SIDE - 4.1
PBA: 554

BUSSING: Copper

Silver/Tin Plated

OPTIONAL FEATURES:

SEISMICALLY QUALIFIED : IBC/ASCE7

BRANCH USER PLACEMENT

Copper GROUND BAR

BLANK ENDWALLS

COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: BNH1

COLOR: White Surface / Black Letters

SIZE: 3.50" Wide x 1.00" High (Std)

TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 400A

22kA SYMS. SCCR

Panel Ampacity: 400A

MAIN: MAIN BREAKER LA 400A

Top FEED

30kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#1 - 600,(2)#1 - 250 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

2 - 70A/3P EGB

2 - 45A/3P EGB

3 - 15A/3P EGB

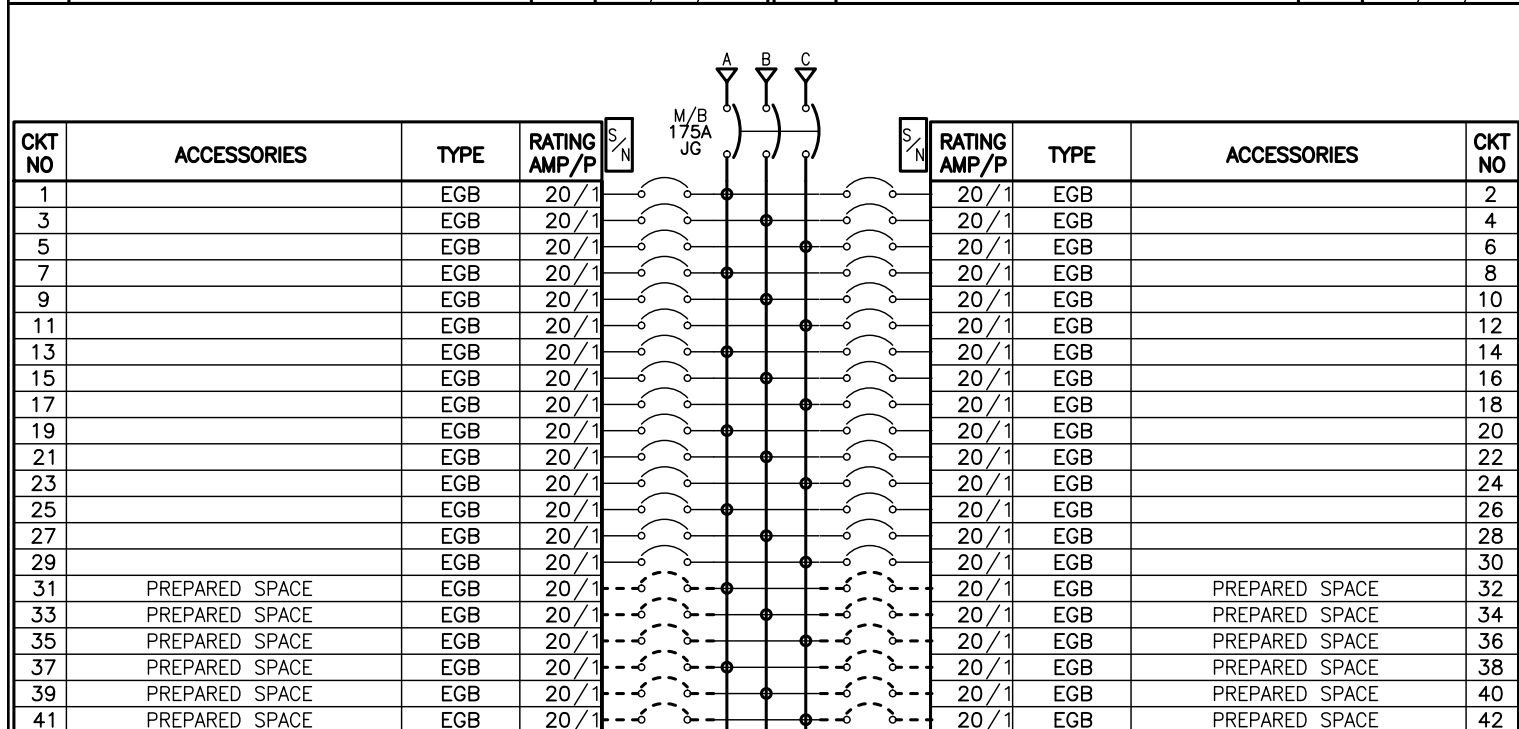
18 - 20A/1P-PS EGB

3 - 20A/1P EGB

2 - 175A/3P JG

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	BNH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-010-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 12.75
BOTTOM - 5
SIDE - 4.1
PBA: 553

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 1NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 175A

22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A

Top FEED

35kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

30 - 20A/1P EGB

12 - 20A/1P-PS EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-011-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	225A M/L	A	B	C	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1													2
3	AL-SPL	EGB	15/3							70/3	EGB		4
5													6
7													8
9	AL-SPL	EGB	15/3							40/3	EGB		10
11													12
13	PREPARED SPACE	EGB	20/1										14
15	PREPARED SPACE	EGB	20/1							15/3	EGB	AL-SPL	16
17	PREPARED SPACE	EGB	20/1										18
19	PREPARED SPACE	EGB	20/1										20
21	PREPARED SPACE	EGB	20/1							15/3	EGB	AL-SPL	22
23	PREPARED SPACE	EGB	20/1										24
25	PREPARED SPACE	EGB	20/1							20/1	EGB	PREPARED SPACE	26
27	PREPARED SPACE	EGB	20/1							20/1	EGB	PREPARED SPACE	28
29	PREPARED SPACE	EGB	20/1							20/1	EGB	PREPARED SPACE	30

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC38S
BOX CAT#: MH38BE
DIMENSIONS:
38"H x 20"W x 5.75"D
WIRE BENDING SPACE:
TOP - 13.25
BOTTOM - 5
SIDE - 4.1

PBA: 550

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:

SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 1NH2

COLOR: White Surface / Black Letters

SIZE: 3.50" Wide x 1.00" High (Std)

TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 225A

22kA SYMS. SCCR

MAIN: MAIN LUGS : 225A

Top FEED

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#6 - 350 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

4 - 15A/3P EGB

12 - 20A/1P-PS EGB

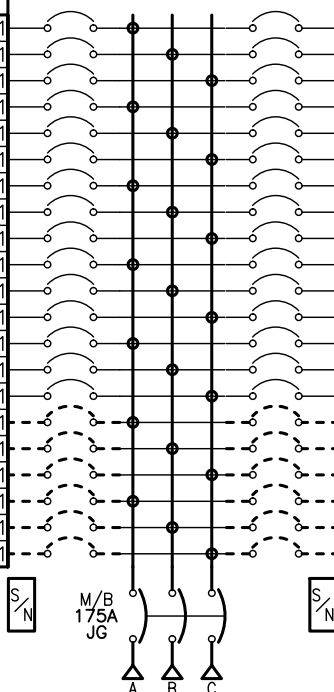
1 - 70A/3P EGB

1 - 40A/3P EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NH2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-012-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	--	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		EGB	20 / 1		20 / 1	EGB		2
3		EGB	20 / 1		20 / 1	EGB		4
5		EGB	20 / 1		20 / 1	EGB		6
7		EGB	20 / 1		20 / 1	EGB		8
9		EGB	20 / 1		20 / 1	EGB		10
11		EGB	20 / 1		20 / 1	EGB		12
13		EGB	20 / 1		20 / 1	EGB		14
15		EGB	20 / 1		20 / 1	EGB		16
17		EGB	20 / 1		20 / 1	EGB		18
19		EGB	20 / 1		20 / 1	EGB		20
21		EGB	20 / 1		20 / 1	EGB		22
23		EGB	20 / 1		20 / 1	EGB		24
25		EGB	20 / 1		20 / 1	EGB		26
27		EGB	20 / 1		20 / 1	EGB		28
29		EGB	20 / 1		20 / 1	EGB		30
31	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	32
33	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	34
35	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	36
37	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	38
39	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	40
41	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	42



PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 12.75
SIDE - 4.1
PBA: 553

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:

SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 2NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 175A
22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A

Bottom FEED

35kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

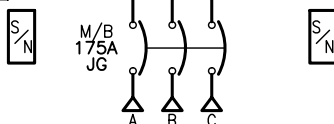
30 - 20A/1P EGB

12 - 20A/1P-PS EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-013-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		EGB	20 / 1		35 / 3	EGB		2
3		EGB	20 / 1					4
5		EGB	20 / 1					6
7		EGB	20 / 1					8
9		EGB	20 / 1		35 / 3	EGB		10
11		EGB	20 / 1					12
13		EGB	20 / 1		20 / 1	EGB		14
15		EGB	20 / 1		20 / 1	EGB		16
17		EGB	20 / 1		20 / 1	EGB		18
19		EGB	20 / 1		20 / 1	EGB		20
21		EGB	20 / 1		20 / 1	EGB		22
23		EGB	20 / 1		20 / 1	EGB		24
25		EGB	20 / 1		20 / 1	EGB		26
27		EGB	20 / 1		20 / 1	EGB		28
29		EGB	20 / 1		20 / 1	EGB		30
31	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	32
33	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	34
35	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	36
37	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	38
39	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	40
41	PREPARED SPACE	EGB	20 / 1		20 / 1	EGB	PREPARED SPACE	42



PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 12.75
SIDE - 4.1
PBA: 553

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 3NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 175A
22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A

Bottom FEED

35kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

24 - 20A/1P EGB

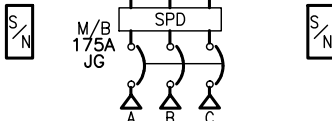
12 - 20A/1P-PS EGB

2 - 35A/3P EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-014-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1								2
3		EGB	20/3		15/3	EGB		4
5								6
7					20/1	EGB		8
9		EGB	15/3		20/1	EGB		10
11					20/1	EGB		12
13		EGB	20/1		20/1	EGB		14
15		EGB	20/1		20/1	EGB		16
17		EGB	20/1		20/1	EGB		18
19		EGB	20/1		20/1	EGB		20
21		EGB	20/1		20/1	EGB		22
23		EGB	20/1		20/1	EGB		24
25		EGB	20/1		20/1	EGB		26
27		EGB	20/1		20/1	EGB		28
29		EGB	20/1		20/1	EGB		30
31	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	32
33	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	34
35	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	36
37	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	38
39	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	40
41	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	42



PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC68S
BOX CAT#: MH68BE
DIMENSIONS:
68"H x 20"W x 5.75"D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 12.75
SIDE - 4.1
PBA: PBA553T

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:

SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 120kA
SPD LINE TO GRD PROTECT

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 175A

22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A

Bottom FEED

35kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

1 - 20A/3P EGB

2 - 15A/3P EGB

21 - 20A/1P EGB

12 - 20A/1P-PS EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-015-01	PG 1 OF 2 REV -

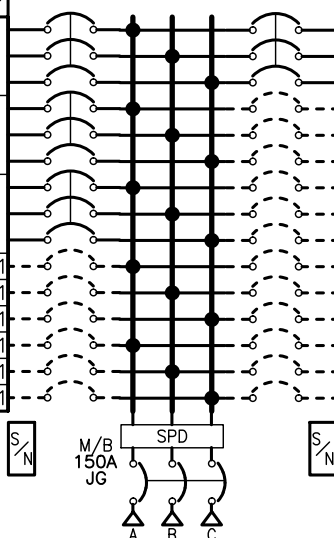
REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
-	----	--	--/--/--	-	----	--	--/--/--

PHYSICAL DATA CONTINUED
LINE 1: 4NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-015-01 PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	—	----	---	---/---/---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1								2
3		EGB	70/3		15/3	EGB		4
5								6
7					20/1	EGB	PREPARED SPACE	8
9		EGB	70/3		20/1	EGB	PREPARED SPACE	10
11					20/1	EGB	PREPARED SPACE	12
13					20/1	EGB	PREPARED SPACE	14
15		EGB	70/3		20/1	EGB	PREPARED SPACE	16
17					20/1	EGB	PREPARED SPACE	18
19	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	20
21	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	22
23	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	24
25	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	26
27	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	28
29	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	30



PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC62S
BOX CAT#: MH62BE
DIMENSIONS:
62''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 12.75
SIDE - 4.1
PBA: PBA553T

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:

SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 120kA
SPD LINE TO GRD PROTECT

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz

System Ampacity: 150A

22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 150A

Bottom FEED

35kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

3 - 70A/3P EGB

18 - 20A/1P-PS EGB

1 - 15A/3P EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4SH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-016-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED
LINE 1: 4SH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4SH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-016-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	M/B 225A QB	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	25/2				25/2	QOB		2
3										4
5		QOB	25/2				25/2	QOB		6
7										8
9		QOB	30/1				20/1	QOB		10
11		QOB	20/1				20/1	QOB		12
13		QOB	20/1				20/1	QOB		14
15		QOB	20/1				20/1	QOB		16
17		QOB	20/1				20/1	QOB		18
19		QOB	20/1				20/1	QOB		20
21		QOB	20/1				20/1	QOB		22
23		QOB	20/1				20/1	QOB		24
25		QOB	20/1				20/1	QOB		26
27		QOB	20/1				20/1	QOB		28
29		QOB	20/1				20/1	QOB		30
31		QOB	20/1				20/1	QOB		32
33		QOB	20/1				15/1	QOB		34
35	PREPARED SPACE	QOB	20/1				20/1	QOB	PREPARED SPACE	36
37	PREPARED SPACE	QOB	20/1				20/1	QOB	PREPARED SPACE	38
39	PREPARED SPACE	QOB	20/1				20/1	QOB	PREPARED SPACE	40
41	PREPARED SPACE	QOB	20/1				20/1	QOB	PREPARED SPACE	42

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 10.47
BOTTOM - 5
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: BNL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Top FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

4 - 25A/2P QOB
24 - 20A/1P QOB
1 - 15A/1P QOB
1 - 30A/1P QOB
8 - 20A/1P-PS QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	BNL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-017-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	225A M/L	A	B	C	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20/1							20/1	QOB		2
3		QOB	20/1										4
5		QOB	20/1							60/2	QOB		6
7		QOB	20/1							20/1	QOB		8
9		QOB	20/1							20/1	QOB		10
11		QOB	20/1							20/1	QOB		12
13		QOB	20/1							20/1	QOB		14
15		QOB	20/1							20/1	QOB		16
17		QOB	15/1							20/1	QOB		18
19		QOB	15/1										20
21		QOB	20/1							30/2	QOB		22
23		QOB	20/1							20/1	QOB		24
25		QOB	15/1							20/1	QOB		26
27		QOB	20/1							20/1	QOB		28
29		QOB	20/1							20/1	QOB		30
31		QOB	20/1							20/1	QOB		32
33		QOB	20/1							20/1	QOB		34
35		QOB	20/1							20/1	QOB	ST 120Vac	36
37		QOB	20/1										38
39		QOB	20/1							20/1	QOB	ST 120Vac	40
41		QOB	20/1										42
43		QOB	20/1							20/1	QOB		44
45		QOB	20/1							20/1	QOB		46
47		QOB	20/1							20/1	QOB		48
49		QOB	20/1							20/1	QOB		50
51										20/1	QOB		52
53		QOB	100/2							20/1	QOB		54

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
 FRONT CAT#: NC38S
 BOX CAT#: MH38BE
 DIMENSIONS:
 38''H x 20''W x 5.75''D
 WIRE BENDING SPACE:
 TOP - 9.26
 BOTTOM - 5
 SIDE - 6.13

PBA: 701A

BUSSING: Copper
 Silver/Tin Plated

OPTIONAL FEATURES:
 SEISMICALLY QUALIFIED : IBC/ASCE7
 BRANCH USER PLACEMENT
 Copper GROUND BAR
 (Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
 10kA SYMS. SCCR

MAIN: MAIN LUGS : 225A
 Top FEED

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#6 - 350 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

41 - 20A/1P QOB	3 - 15A/1P QOB
1 - 100A/2P QOB	1 - 60A/2P QOB
1 - 30A/2P QOB	2 - 20A/1P QOB ST

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-018-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 1NL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-018-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	M/B 225A QB	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	30/2				20/1	QOB		2
3							20/1	QOB		4
5		QOB	20/1				20/1	QOB		6
7		QOB	20/1				20/1	QOB		8
9		QOB	20/1				20/1	QOB		10
11		QOB	20/1				20/1	QOB		12
13		QOB	20/1				20/1	QOB		14
15		QOB	20/1				20/1	QOB		16
17		QOB	20/1				30/1	QOB		18
19		QOB	20/1				20/1	QOB		20
21		QOB	20/1				20/1	QOB		22
23		QOB	20/1				20/1	QOB		24
25		QOB	20/1				20/1	QOB		26
27		QOB	20/1				20/1	QOB		28
29		QOB	20/1				20/1	QOB		30
31		QOB	20/1				20/1	QOB		32
33		QOB	20/1				20/1	QOB		34
35		QOB	20/1				20/1	QOB		36
37		QOB	20/1				20/1	QOB		38
39		QOB	20/1				20/1	QOB		40
41		QOB	20/1				20/1	QOB		42
43		QOB	20/1				20/1	QOB		44
45		QOB	20/1				20/1	QOB		46
47		QOB	20/1				20/1	QOB		48
49		QOB	20/1				20/1	QOB		50
51		QOB	15/1				20/1	QOB		52
53		QOB	15/1				20/1	QOB		54
55		QOB	20/1				20/1	QOB		56
57		QOB	20/1				20/1	QOB		58
59		QOB	20/1				20/1	QOB		60
61										62
63										64
65										66
67										68
69										70
71	BLANK								BLANK	72

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
 FRONT CAT#: NC56S
 BOX CAT#: MH56BE
 DIMENSIONS:
 56''H x 20''W x 5.75''D
 WIRE BENDING SPACE:
 TOP - 10.47
 BOTTOM - 5
 SIDE - 6.13
 PBA: 707A

BUSSING: Copper
 Silver/Tin Plated

OPTIONAL FEATURES:
 SEISMICALLY QUALIFIED : IBC/ASCE7
 BRANCH USER PLACEMENT
 Copper GROUND BAR
 (Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
 System Ampacity: 225A
 10kA SYMS. SCCR
 MAIN: MAIN BREAKER QB 225A
 Top FEED
 10kA AIR
 INCOMING CONDUCTORS(S) PER NEC
 Wire Bending Space:
 #4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

1 - 30A/2P QOB 55 - 20A/1P QOB
 2 - 15A/1P QOB 1 - 30A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-019-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 1NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-019-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	M/B 225A QB	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20 / 1				20 / 1	QOB		2
3		QOB	20 / 1				20 / 1	QOB		4
5		QOB	20 / 1				20 / 1	QOB		6
7		QOB	20 / 1				20 / 1	QOB		8
9		QOB	20 / 1				20 / 1	QOB		10
11		QOB	20 / 1				20 / 1	QOB		12
13		QOB	20 / 1				20 / 1	QOB		14
15		QOB	20 / 1				20 / 1	QOB		16
17		QOB	20 / 1				20 / 1	QOB		18
19		QOB	20 / 1				20 / 1	QOB		20
21		QOB	20 / 1				20 / 1	QOB		22
23		QOB	20 / 1				20 / 1	QOB		24
25		QOB	20 / 1				20 / 1	QOB		26
27		QOB	20 / 1				20 / 1	QOB		28
29		QOB	20 / 1				20 / 1	QOB		30
31		QOB	20 / 1				20 / 1	QOB		32
33		QOB	20 / 1				20 / 1	QOB		34
35		QOB	20 / 1				20 / 1	QOB		36
37		QOB	20 / 1				20 / 1	QOB		38
39		QOB	20 / 1				20 / 1	QOB		40
41		QOB	20 / 1				15 / 1	QOB		42

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 10.47
BOTTOM - 5
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 1NL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Top FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

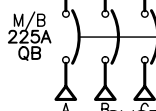
41 - 20A/1P QOB 1 - 15A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-020-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	--	----	--	---/---/---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20 / 1		20 / 1	QOB		2
3		QOB	20 / 1		20 / 1	QOB		4
5		QOB	20 / 1		20 / 1	QOB		6
7		QOB	20 / 1		20 / 1	QOB		8
9		QOB	20 / 1		20 / 1	QOB		10
11		QOB	20 / 1		20 / 1	QOB		12
13		QOB	20 / 1		20 / 1	QOB		14
15		QOB	20 / 1		20 / 1	QOB		16
17		QOB	20 / 1		20 / 1	QOB		18
19		QOB	20 / 1		20 / 1	QOB		20
21		QOB	20 / 1		20 / 1	QOB		22
23		QOB	20 / 1		20 / 1	QOB		24
25		QOB	20 / 1		20 / 1	QOB		26
27		QOB	20 / 1		20 / 1	QOB		28
29		QOB	20 / 1		20 / 1	QOB		30
31		QOB	20 / 1		30 / 1	QOB		32
33		QOB	20 / 1		20 / 1	QOB		34
35		QOB	20 / 1		20 / 2	QOB		36
37		QOB	20 / 1		20 / 1	QOB		38
39		QOB	20 / 1		20 / 1	QOB		40
41		QOB	20 / 1		20 / 1	QOB		42
43		QOB	20 / 1		15 / 1	QOB		44
45		QOB	20 / 1		20 / 1	QOB		46
47		QOB	20 / 1		20 / 1	QOB		48
49		QOB	20 / 1		20 / 1	QOB		50
51		QOB	15 / 1		20 / 1	QOB		52
53		QOB	20 / 1		20 / 1	QOB		54
55		QOB	20 / 1		20 / 1	QOB		56
57		QOB	20 / 1		20 / 1	QOB		58
59		QOB	20 / 1		20 / 1	QOB		60
61								62
63								64
65								66
67								68
69								70
71	BLANK						BLANK	72

S/N



S/N

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56"H x 20"W x 5.75"D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

55 - 20A/1P QOB

2 - 15A/1P QOB

1 - 30A/1P QOB

1 - 20A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-021-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 2NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-021-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20 / 1		20 / 1	QOB		2
3		QOB	20 / 1		20 / 1	QOB		4
5		QOB	20 / 1		20 / 1	QOB		6
7		QOB	20 / 1		20 / 1	QOB		8
9		QOB	20 / 1		20 / 1	QOB		10
11		QOB	20 / 1		20 / 1	QOB		12
13		QOB	20 / 1		20 / 1	QOB		14
15		QOB	20 / 1		20 / 1	QOB		16
17		QOB	20 / 1		20 / 1	QOB		18
19		QOB	20 / 1		20 / 1	QOB		20
21		QOB	20 / 1		20 / 1	QOB		22
23		QOB	20 / 1		30 / 1	QOB		24
25		QOB	20 / 1		20 / 1	QOB		26
27		QOB	20 / 1		20 / 1	QOB		28
29		QOB	20 / 1					30
31		QOB	20 / 1		20 / 2	QOB		32
33		QOB	20 / 1		20 / 1	QOB		34
35		QOB	20 / 1		20 / 1	QOB		36
37		QOB	20 / 1		20 / 1	QOB		38
39		QOB	20 / 1		20 / 1	QOB		40
41		QOB	20 / 1		20 / 1	QOB		42
43		QOB	20 / 1		20 / 1	QOB		44
45		QOB	20 / 1		20 / 1	QOB		46
47		QOB	20 / 1		20 / 1	QOB		48
49		QOB	20 / 1		20 / 1	QOB		50
51		QOB	20 / 1		20 / 1	QOB		52
53		QOB	20 / 1		20 / 1	QOB		54
55		QOB	20 / 1		20 / 1	QOB		56
57		QOB	20 / 1		20 / 1	QOB		58
59		QOB	20 / 1		20 / 1	QOB		60
61								62
63								64
65								66
67								68
69								70
71	BLANK						BLANK	72

PHYSICAL DATA
ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT-ON
-----BRANCH SUMMATION-----
57 – 20A/1P QOB 1 – 30A/1P QOB
1 – 20A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-022-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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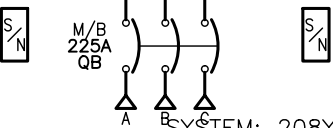
PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 3NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-022-01
		PG	2 OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P		RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20 / 1		20 / 1	QOB		2
3		QOB	20 / 1		20 / 1	QOB		4
5		QOB	20 / 1		20 / 1	QOB		6
7		QOB	20 / 1		20 / 1	QOB		8
9		QOB	20 / 1		20 / 1	QOB		10
11		QOB	20 / 1		20 / 1	QOB		12
13		QOB	20 / 1		20 / 1	QOB		14
15		QOB	20 / 1		20 / 1	QOB		16
17		QOB	20 / 1		30 / 2	QOB		18
19		QOB	20 / 1		20 / 1	QOB		20
21		QOB	20 / 1		20 / 1	QOB		22
23		QOB	20 / 1		20 / 1	QOB		24
25		QOB	20 / 1		20 / 1	QOB		26
27		QOB	20 / 1		20 / 1	QOB		28
29		QOB	20 / 1		20 / 1	QOB		30
31		QOB	20 / 1		25 / 2	QOB		32
33		QOB	20 / 1					34
35		QOB	20 / 1		25 / 2	QOB		36
37		QOB	20 / 1		20 / 1	QOB		38
39		QOB	20 / 1		20 / 1	QOB		40
41		QOB	20 / 1		15 / 3	QOB		42
43		QOB	20 / 1					44
45		QOB	20 / 1		20 / 2	QOB		46
47		QOB	20 / 1		20 / 1	QOB		48
49		QOB	20 / 1		20 / 1	QOB		50
51		QOB	20 / 1		20 / 1	QOB		52
53		QOB	20 / 1		20 / 1	QOB		54
55								56
57								58
59	BLANK						BLANK	60
	Surge Counter Dry Contacts	SPD 100kA/3				SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA
ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
(Continued on next page.)

ELECTRICAL DATA
SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 - 300 kcmil
BRANCH MOUNTING TYPE: BOLT-ON
-----BRANCH SUMMATION-----
43 - 20A/1P QOB 1 - 30A/2P QOB
2 - 25A/2P QOB 1 - 15A/3P QOB
1 - 20A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-023-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
-	----	--	--/--/--	-	----	--	--/--/--

PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 4NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-023-01
		PG 2	OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	225A M/L	A	B	C	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
	Surge Counter Dry Contacts	SPD 100kA/3									SPD 100kA/3	Surge Counter Dry Contacts	
13		QOB	20 / 1							20 / 1	QOB		14
15		QOB	20 / 1							20 / 1	QOB		16
17		QOB	20 / 1							20 / 1	QOB		18
19		QOB	20 / 1							20 / 1	QOB		20
21		QOB	20 / 1							20 / 1	QOB		22
23		QOB	20 / 1							20 / 1	QOB		24
25		QOB	20 / 1							20 / 1	QOB		26
27		QOB	20 / 1							20 / 1	QOB		28
29		QOB	20 / 1							20 / 1	QOB		30
31		QOB	20 / 1							20 / 1	QOB		32
33		QOB	20 / 1							20 / 1	QOB		34
35		QOB	20 / 1							20 / 1	QOB		36
37		QOB	20 / 1							20 / 1	QOB		38
39		QOB	20 / 1							20 / 1	QOB		40
41		QOB	20 / 1							20 / 1	QOB		42
43		QOB	20 / 1							20 / 1	QOB		44
45		QOB	20 / 1							20 / 1	QOB		46
47		QOB	20 / 1							20 / 1	QOB		48
49		QOB	20 / 1							20 / 1	QOB		50
51		QOB	20 / 1							20 / 1	QOB		52
53		QOB	20 / 1							20 / 1	QOB		54

PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC38S
BOX CAT#: MH38BE
DIMENSIONS:
38''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 9.26
BOTTOM - 5
SIDE - 6.13

PBA: 701A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN LUGS : 225A
Top FEED

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#6 - 350 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-024-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

-----STANDARD EQUIPMENT NAMEPLATE-----

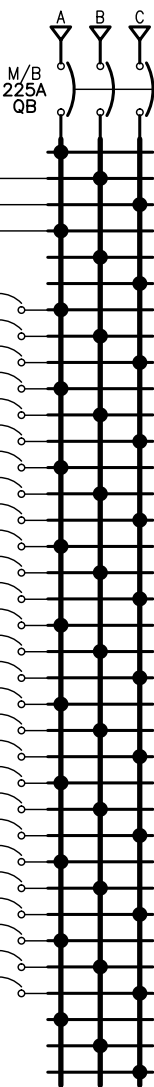
Engraved as Follows

LINE 1: 1LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-024-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
	Surge Counter Dry Contacts	SPD 100kA/3					SPD 100kA/3	Surge Counter Dry Contacts	
13		QOB	20 / 1			20 / 1	QOB		14
15		QOB	20 / 1			20 / 1	QOB		16
17		QOB	20 / 1			20 / 1	QOB		18
19		QOB	20 / 1			20 / 1	QOB		20
21		QOB	20 / 1			20 / 1	QOB		22
23		QOB	20 / 1			20 / 1	QOB		24
25		QOB	20 / 1			20 / 1	QOB		26
27		QOB	20 / 1			20 / 1	QOB		28
29		QOB	20 / 1			20 / 1	QOB		30
31		QOB	20 / 1			20 / 1	QOB		32
33		QOB	20 / 1			20 / 1	QOB		34
35		QOB	20 / 1			20 / 1	QOB		36
37		QOB	20 / 1			20 / 1	QOB		38
39		QOB	20 / 1			20 / 1	QOB		40
41		QOB	20 / 1			20 / 1	QOB		42
43		QOB	20 / 1			20 / 1	QOB		44
45		QOB	20 / 1			20 / 1	QOB		46
47		QOB	20 / 1			20 / 1	QOB		48
49		QOB	20 / 1			20 / 1	QOB		50
51		QOB	20 / 1			20 / 1	QOB		52
53		QOB	20 / 1			20 / 1	QOB		54
55		QOB	20 / 1			20 / 1	QOB		56
57		QOB	20 / 1			20 / 1	QOB		58
59		QOB	20 / 1			20 / 1	QOB		60
61		QOB	20 / 1			20 / 1	QOB		62
63		QOB	20 / 1			20 / 1	QOB		64
65		QOB	20 / 1			20 / 1	QOB	PREPARED SPACE	66
67									68
69									70
71	BLANK							BLANK	72



PHYSICAL DATA

ENCLOSURE Type 1

Flush with Door

FRONT CAT#: NC56F

BOX CAT#: MH56BE

DIMENSIONS:

56''H x 20''W x 5.75''D

WIRE BENDING SPACE:

TOP - 10.47

BOTTOM - 5

SIDE - 6.13

PBA: 707A

BUSSING: Copper

Silver/Tin Plated

OPTIONAL FEATURES:

SEISMICALLY QUALIFIED : IBC/ASCE7

Copper GROUND BAR

BLANK ENDWALLS

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A

10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Top FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

53 - 20A/1P QOB

1 - 20A/1P-PS QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-025-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE					
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

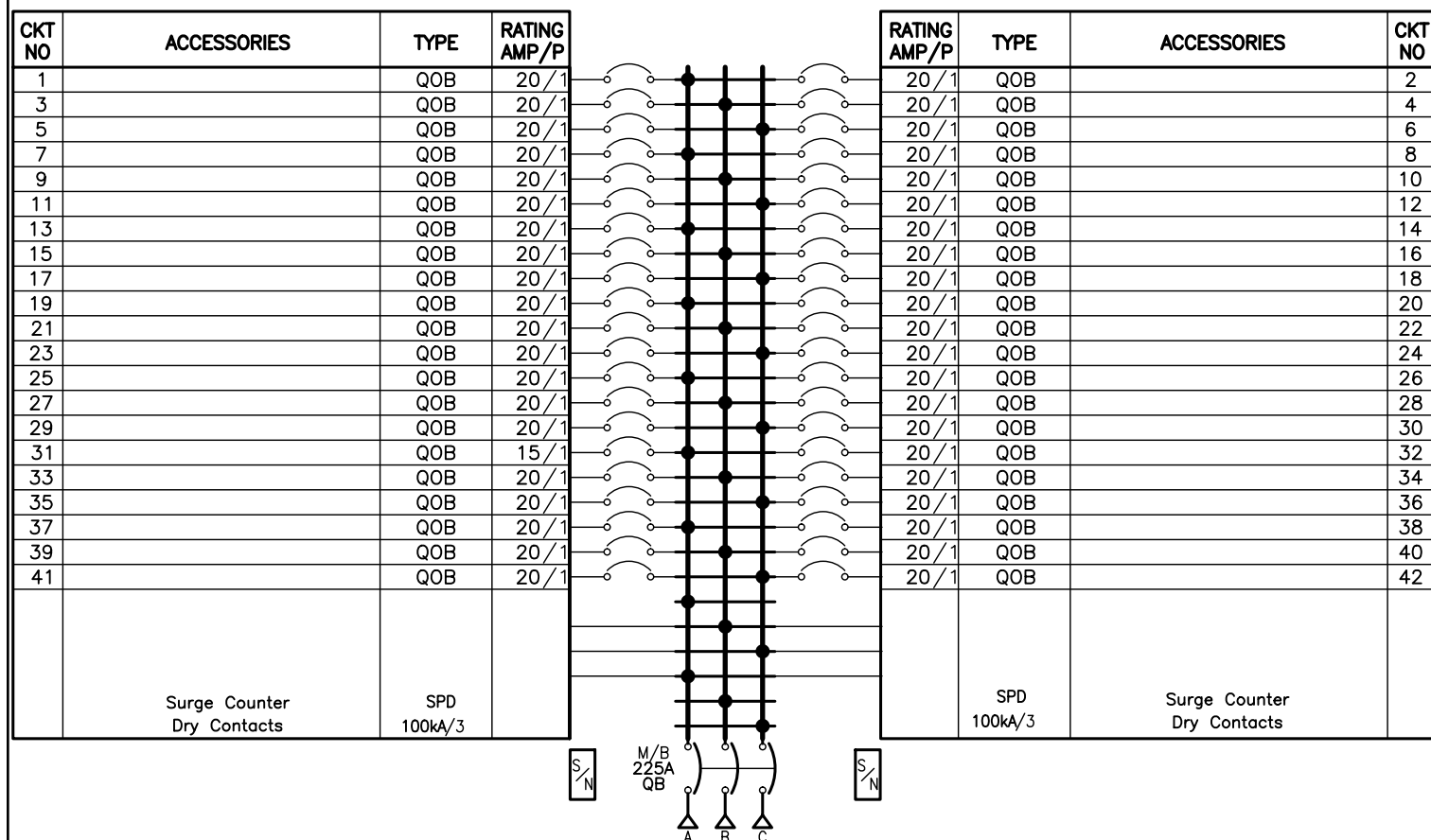
-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 1LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-025-01
		PG 2	OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

41 - 20A/1P QOB

1 - 15A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-026-01	PG 1 OF 2 REV -

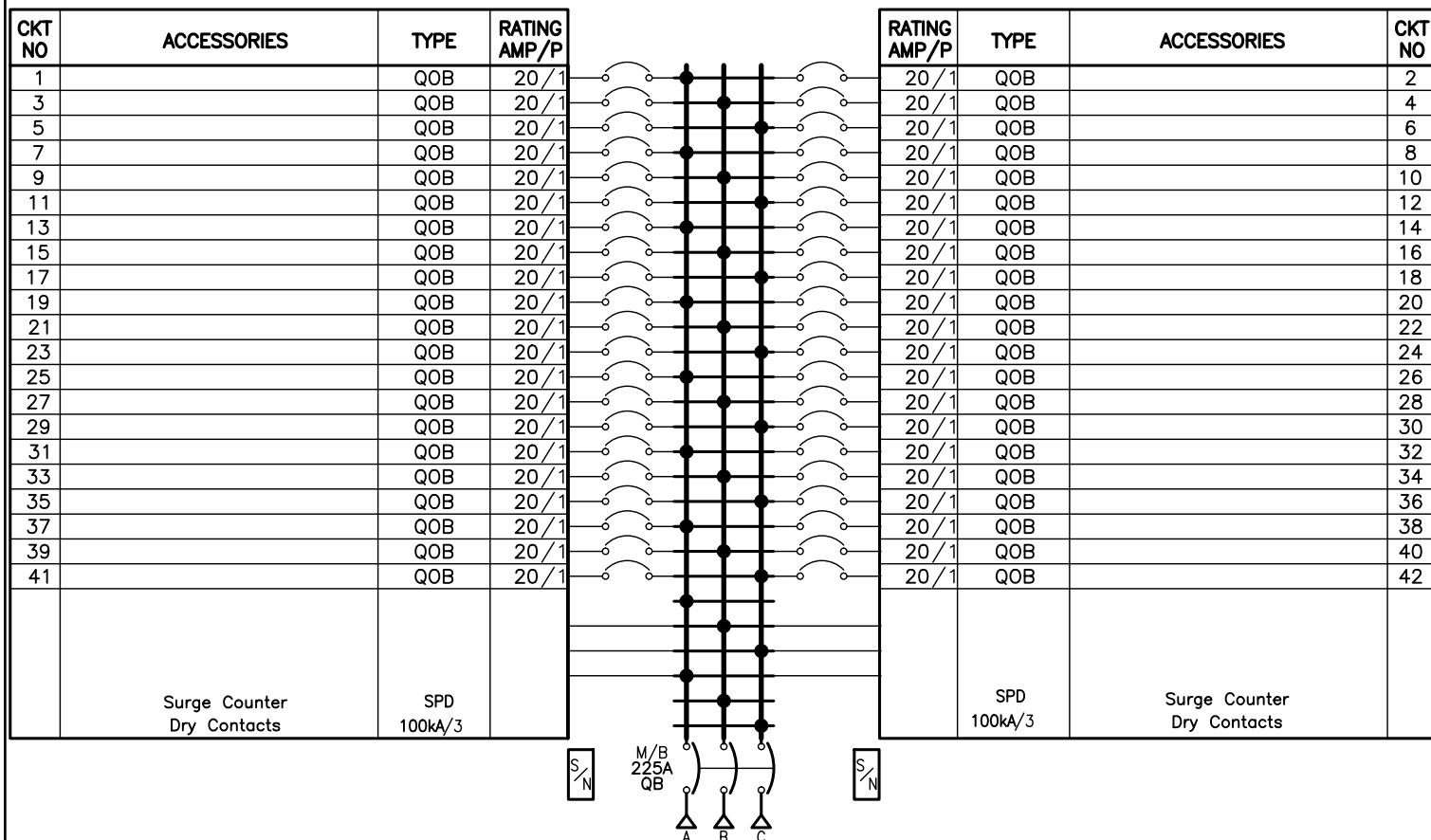
REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
-	----	--	--/--/--	-	----	--	--/--/--

PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 2LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-026-01 PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
COPPER SOLID NEUTRAL
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-027-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

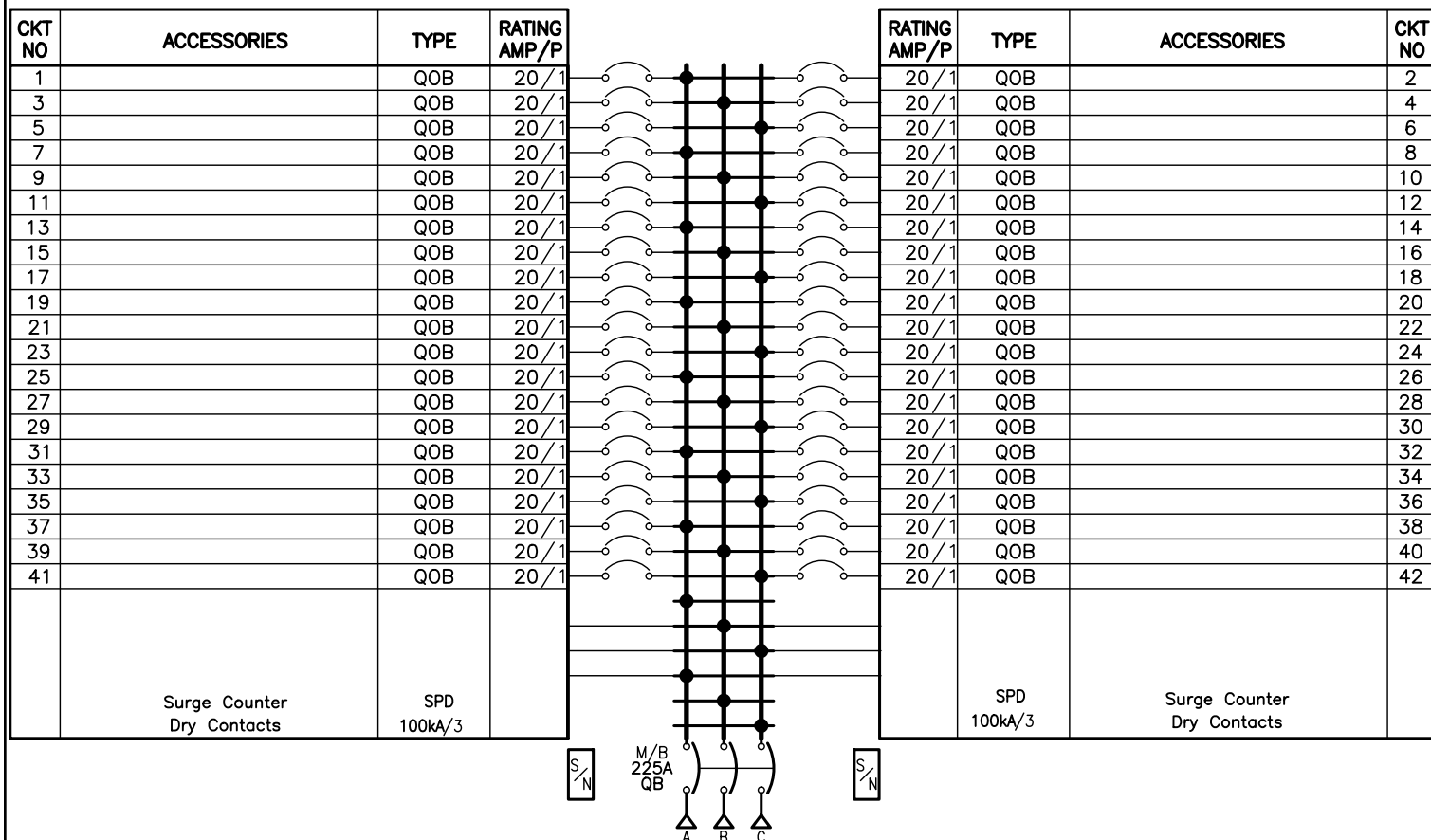
-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 2LL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:		[Redacted]	
DATE:	October 10 2016	by Schneider Electric	
DRAWING STATUS:	RECORD	DWG# 037999262-027-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
 FRONT CAT#: NC50S
 BOX CAT#: MH50BE
 DIMENSIONS:
 50''H x 20''W x 5.75''D
 WIRE BENDING SPACE:
 TOP - 5
 BOTTOM - 10.47
 SIDE - 6.13
 PBA: 707A

BUSSING: Copper
 Silver/Tin Plated

OPTIONAL FEATURES:
 SEISMICALLY QUALIFIED : IBC/ASCE7
 Copper GROUND BAR
 BLANK ENDWALLS
 (Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
 10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-028-01	PG 1 OF 2 REV -

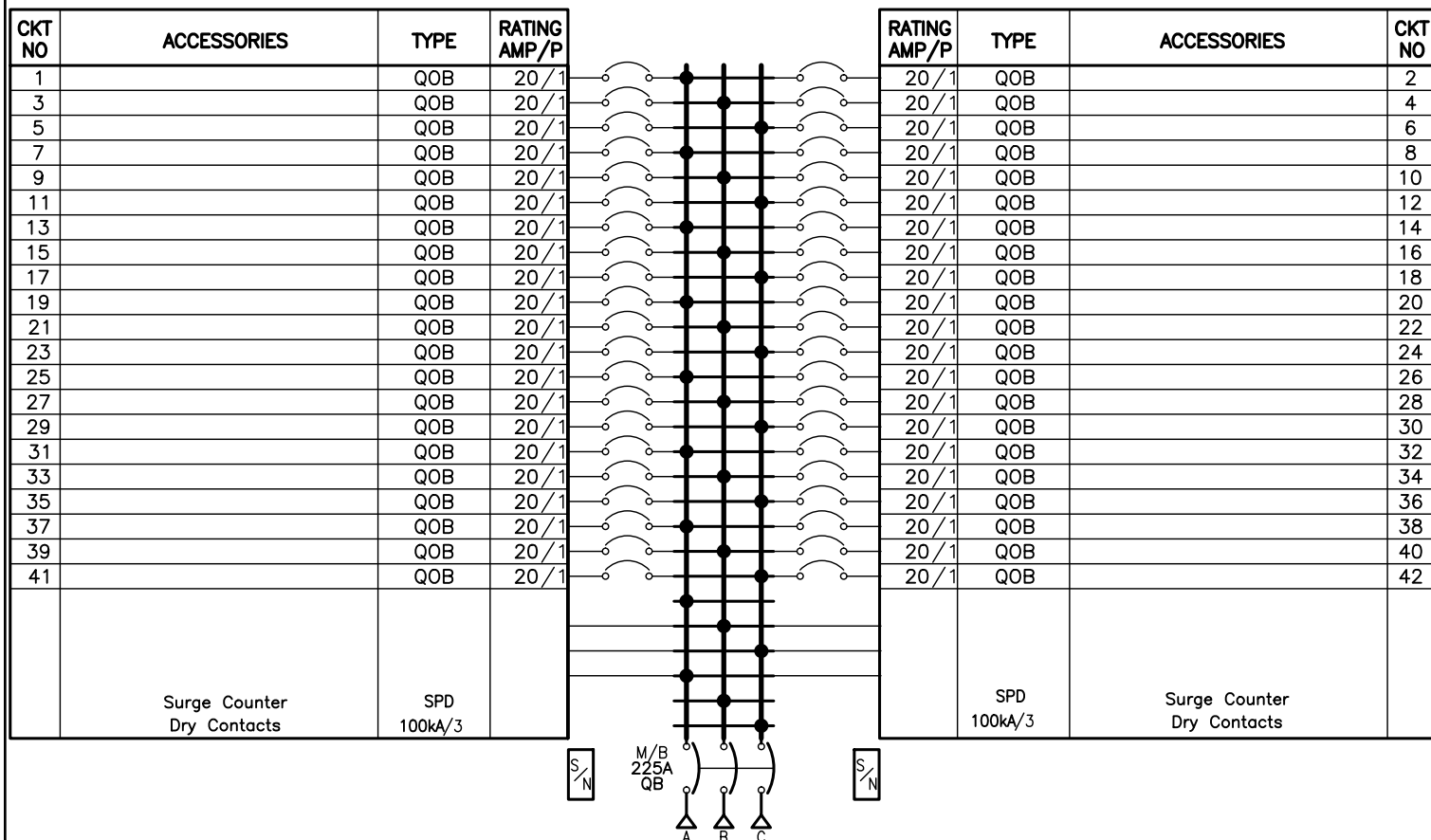
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 2LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-028-01	PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-029-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

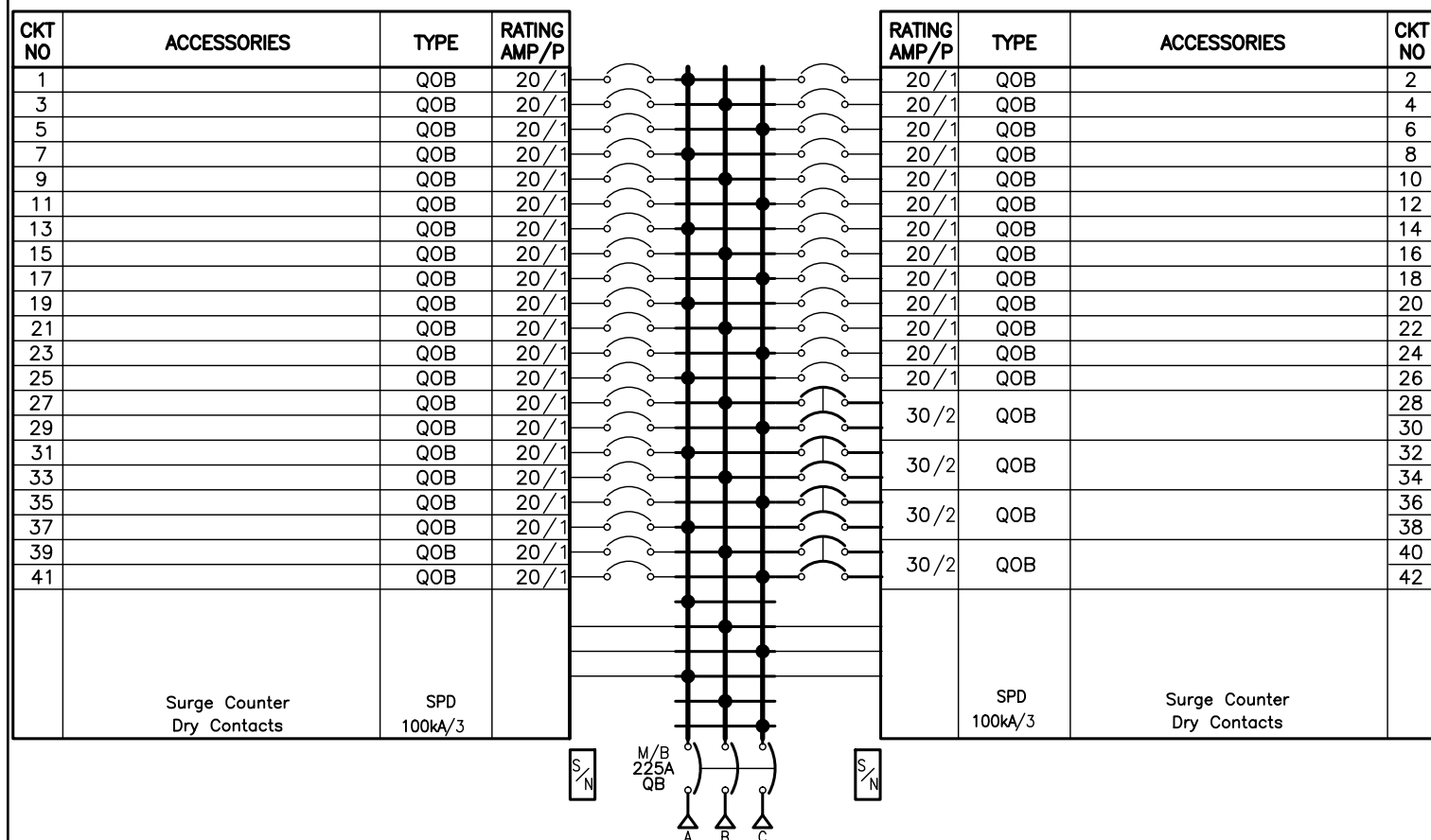
-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 2LL4
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-029-01
		PG 2	OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	--	----	--	---/---/---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----
34 - 20A/1P QOB 4 - 30A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-030-01	PG 1 OF 2 REV -

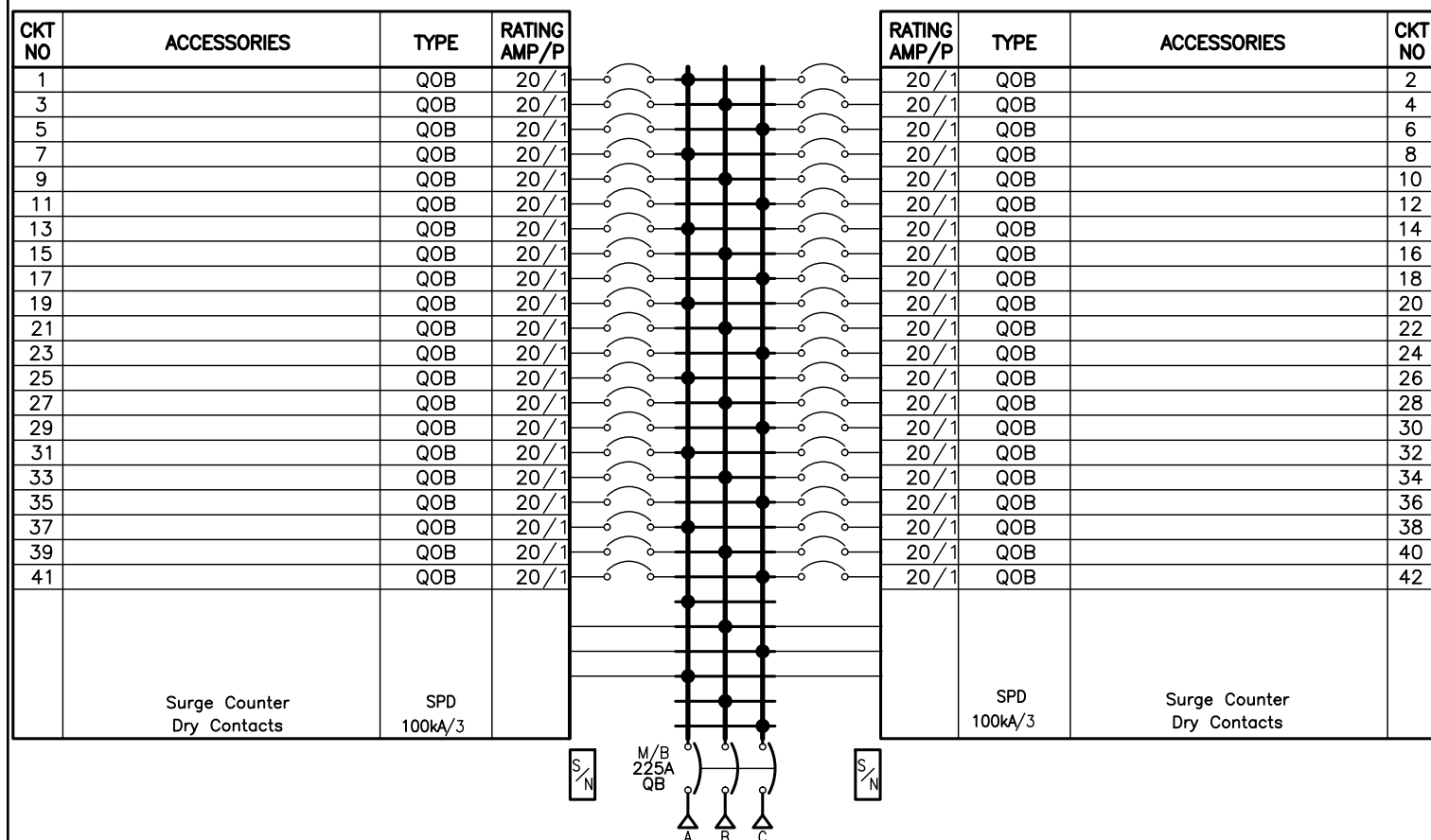
REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT
-----STANDARD EQUIPMENT NAMEPLATE-----
Engraved as Follows
LINE 1: 3LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-030-01 PG 2 OF 2 REV -

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-031-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE						
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

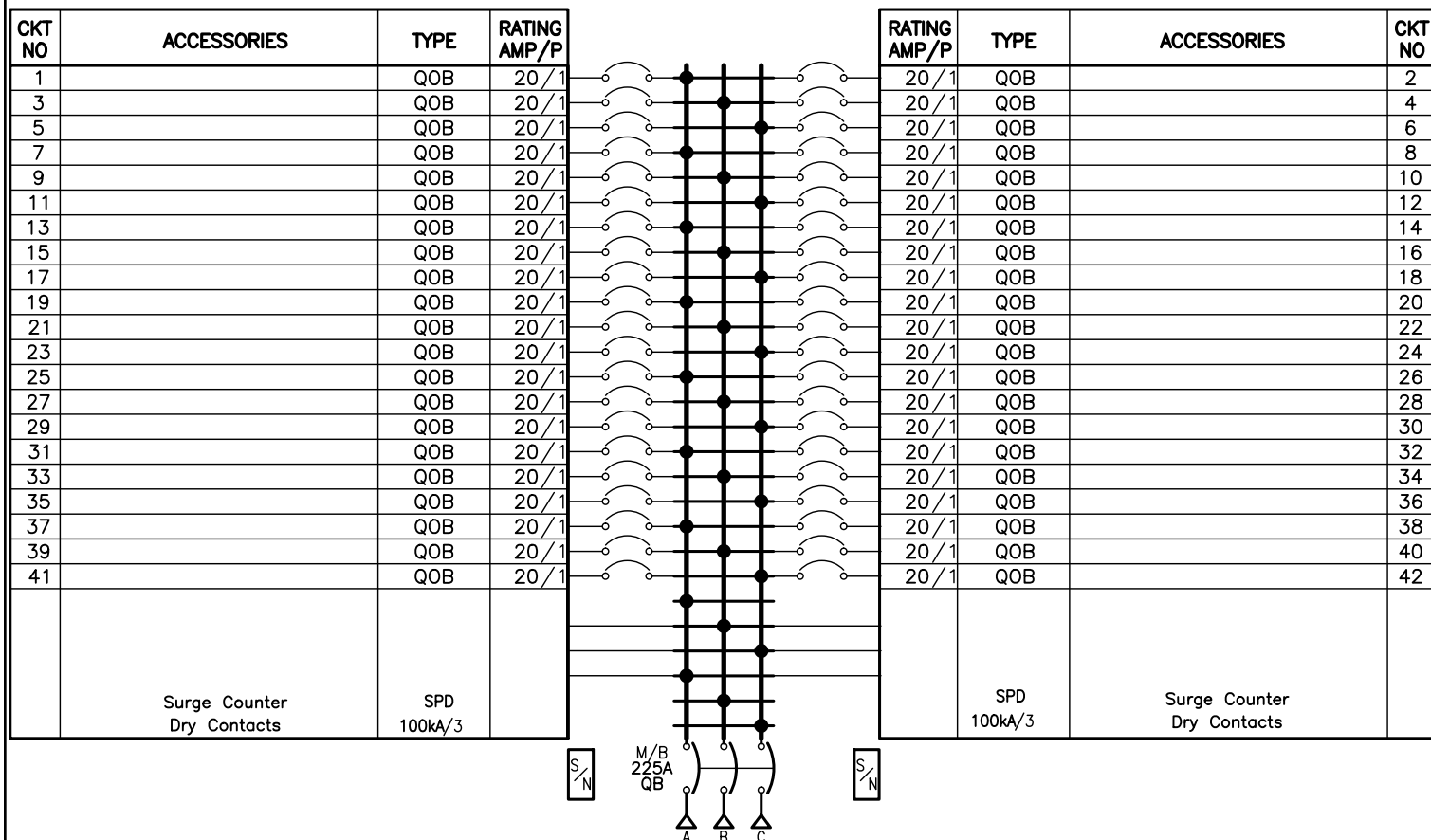
-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 3LL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-031-01
		PG	2 OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	--	----	--	---/---/---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-032-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE					
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PHYSICAL DATA CONTINUED

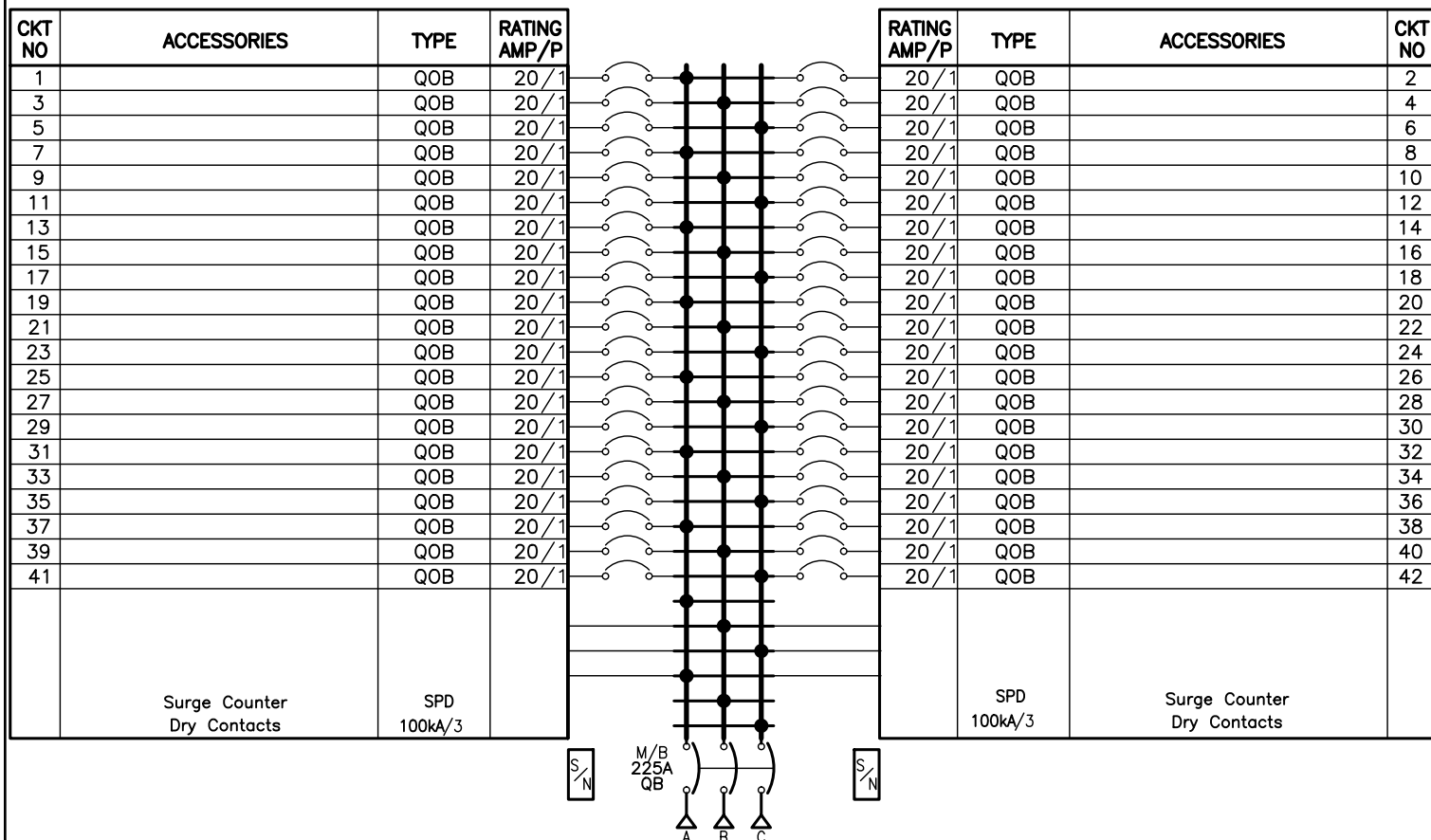
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows
LINE 1: 3LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG#	037999262-032-01
		PG	2 OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-033-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

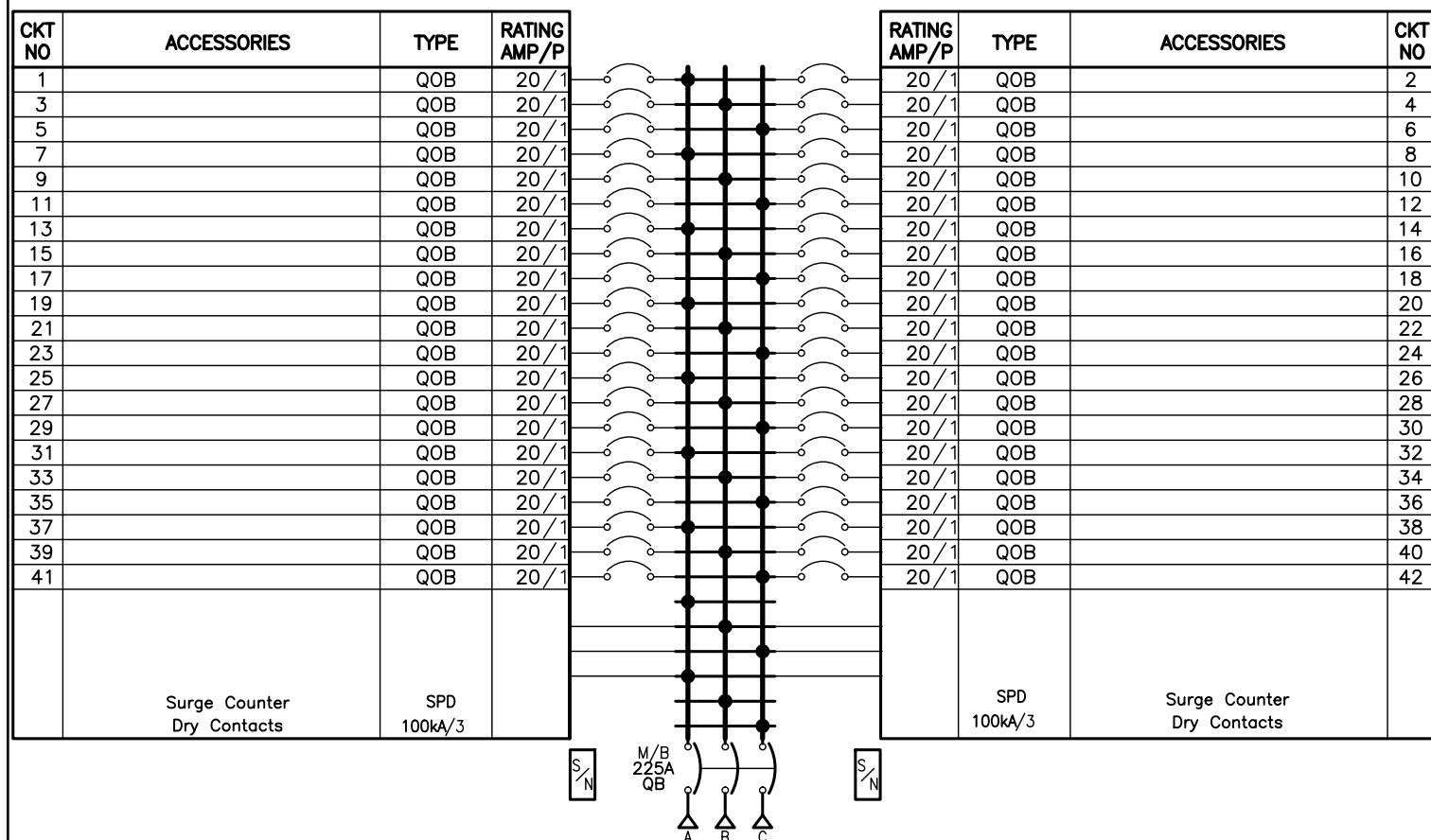
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Engraved as Follows

LINE 1: 3LL4
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
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REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Flush with Door
 FRONT CAT#: NC50F
 BOX CAT#: MH50BE
 DIMENSIONS:
 50''H x 20''W x 5.75''D
 WIRE BENDING SPACE:
 TOP - 5
 BOTTOM - 10.47
 SIDE - 6.13
 PBA: 707A

BUSSING: Copper
 Silver/Tin Plated

OPTIONAL FEATURES:
 SEISMICALLY QUALIFIED : IBC/ASCE7
 Copper GROUND BAR
 BLANK ENDWALLS
 (Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
 10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-034-01	PG 1 OF 2 REV -

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PHYSICAL DATA CONTINUED

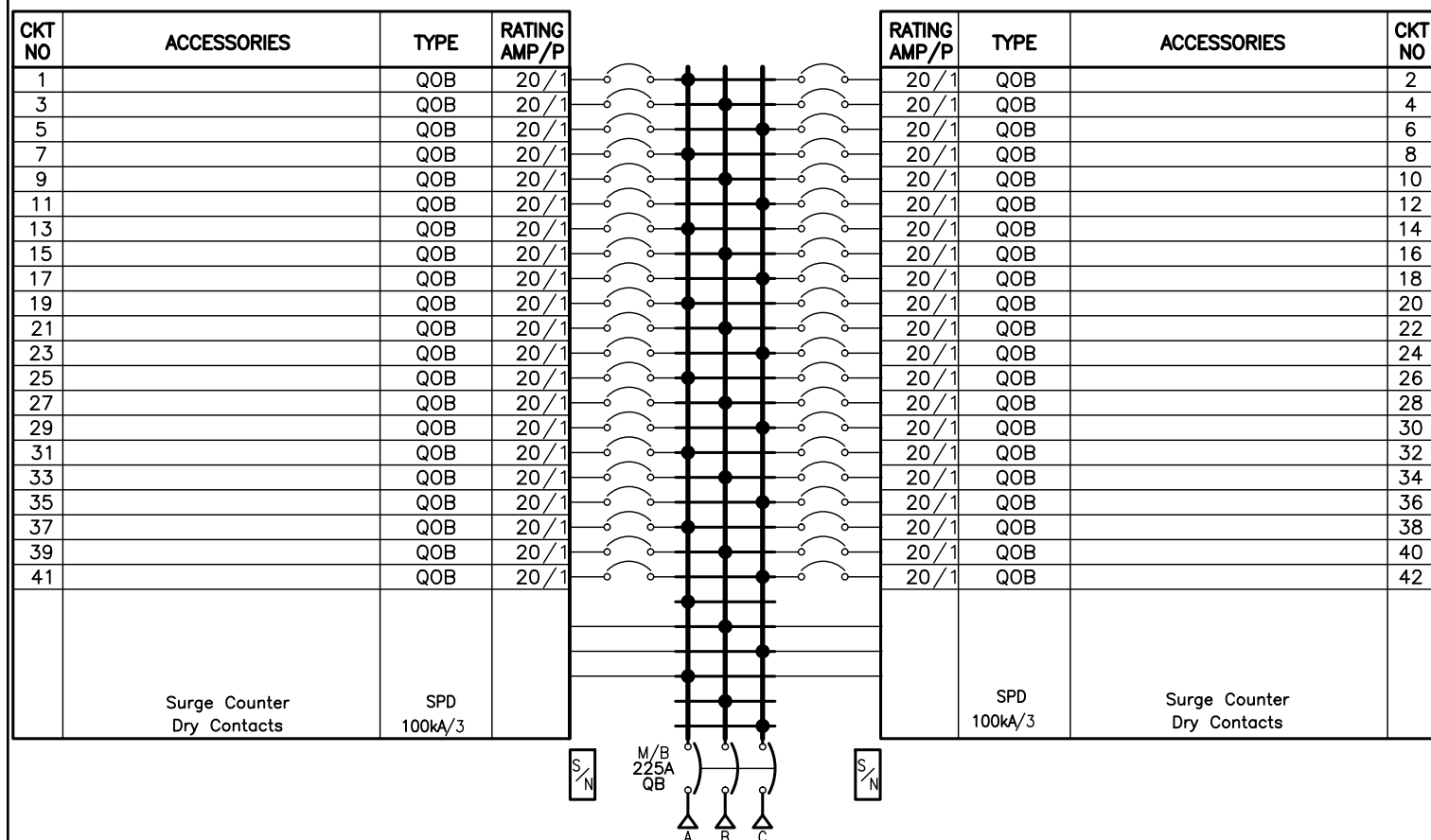
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows
LINE 1: 3LL5
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
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REV	DESCRIPTION	BY	DATE	--	----	--	---/---/---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
 FRONT CAT#: NC50S
 BOX CAT#: MH50BE
 DIMENSIONS:
 50''H x 20''W x 5.75''D
 WIRE BENDING SPACE:
 TOP - 5
 BOTTOM - 10.47
 SIDE - 6.13
 PBA: 707A

BUSSING: Copper
 Silver/Tin Plated

OPTIONAL FEATURES:
 SEISMICALLY QUALIFIED : IBC/ASCE7
 Copper GROUND BAR
 BLANK ENDWALLS
 (Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
 10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-035-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

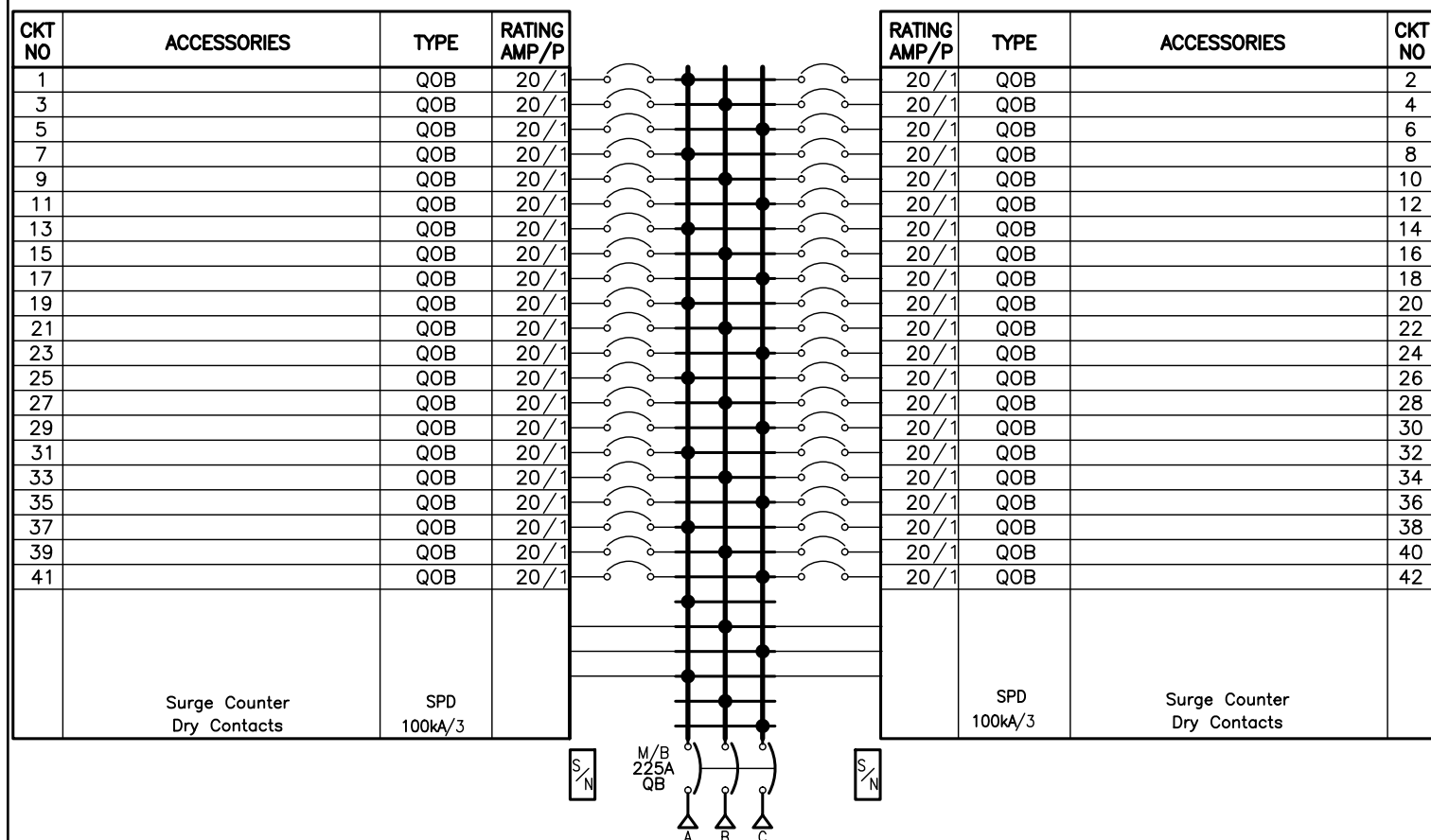
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Engraved as Follows

LINE 1: 4LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
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		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-036-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE						
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

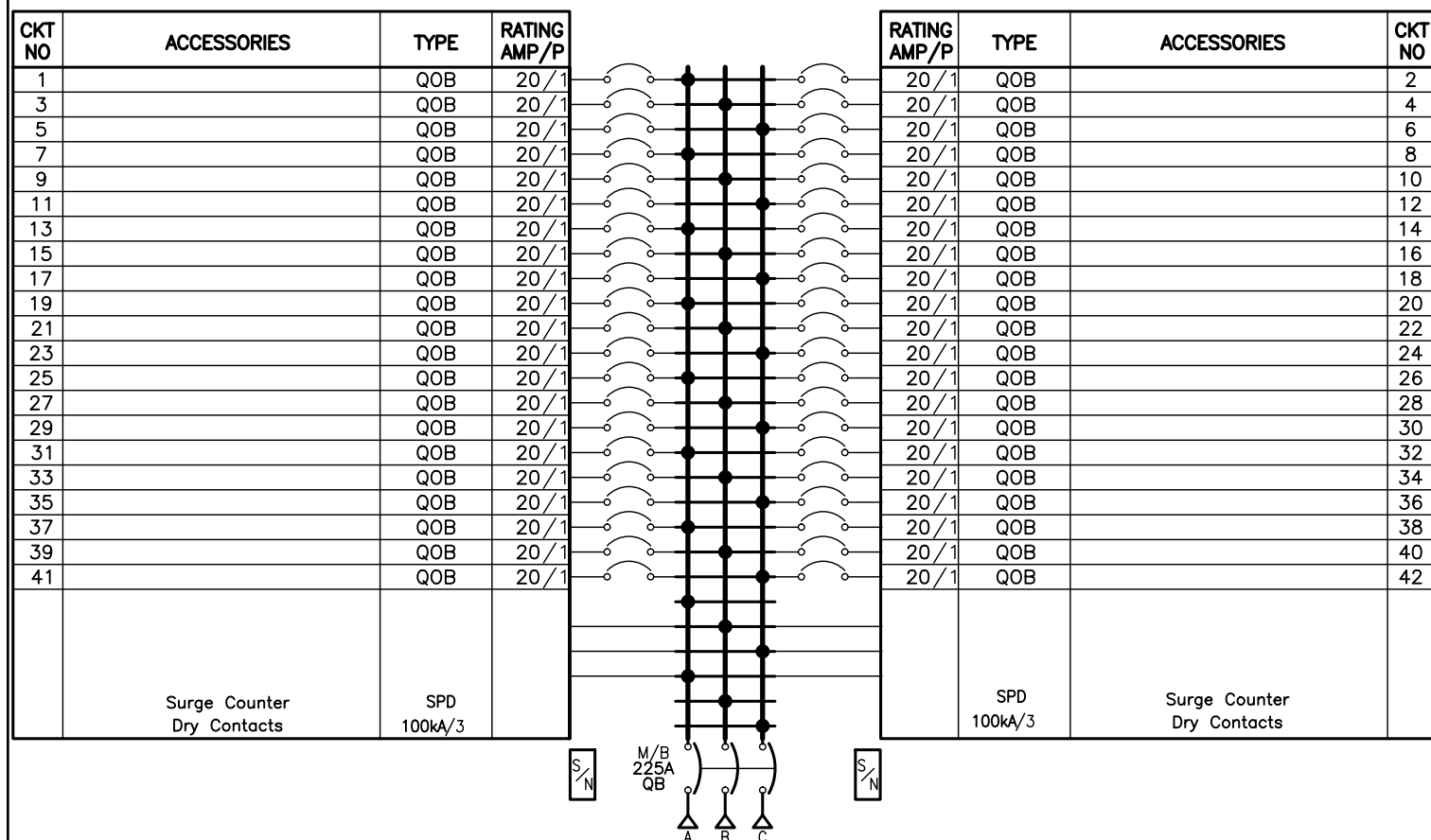
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Engraved as Follows

LINE 1: 4LL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
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		REV	-

REV	DESCRIPTION	BY	DATE	--	----	--	---/---/---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-037-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE					
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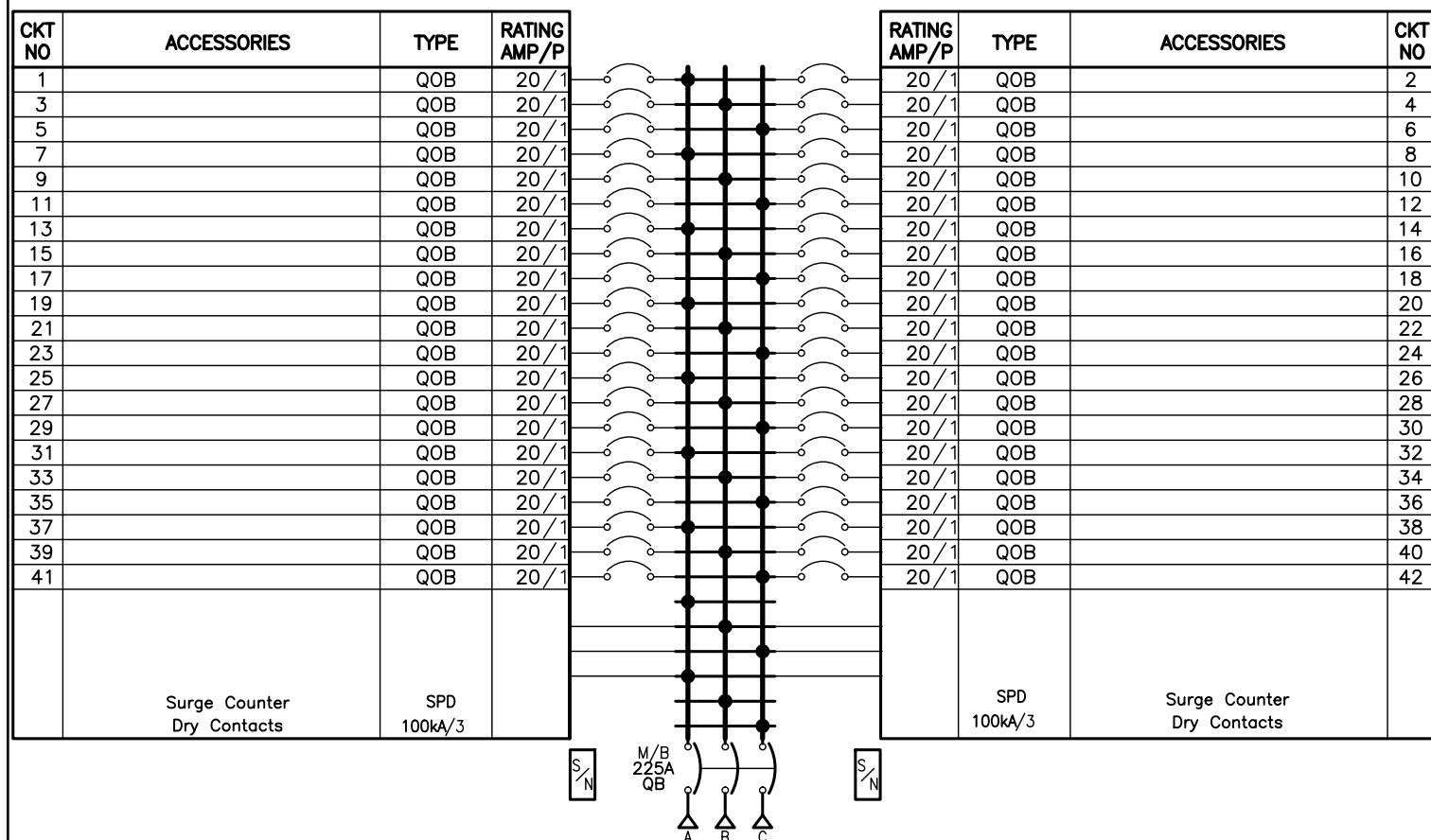
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows
LINE 1: 4LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
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		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
 FRONT CAT#: NC50S
 BOX CAT#: MH50BE
 DIMENSIONS:
 50''H x 20''W x 5.75''D
 WIRE BENDING SPACE:
 TOP - 5
 BOTTOM - 10.47
 SIDE - 6.13
 PBA: 707A

BUSSING: Copper
 Silver/Tin Plated

OPTIONAL FEATURES:
 SEISMICALLY QUALIFIED : IBC/ASCE7
 Copper GROUND BAR
 BLANK ENDWALLS
 (Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
 10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-038-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

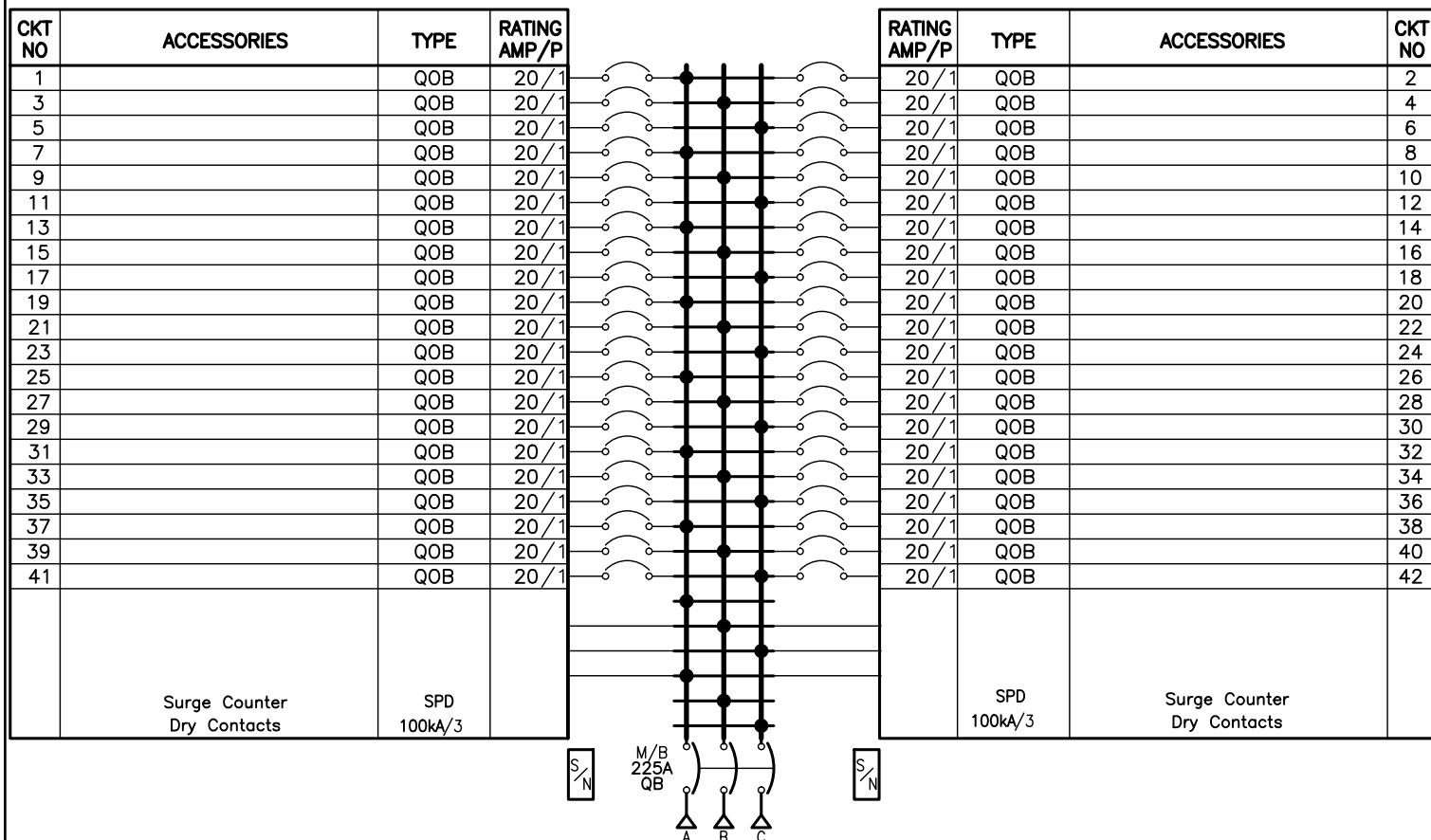
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Engraved as Follows

LINE 1: 4LL4
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
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		PG	2 OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	--	----	--	---/---/---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
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REV	DESCRIPTION	BY	DATE						
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

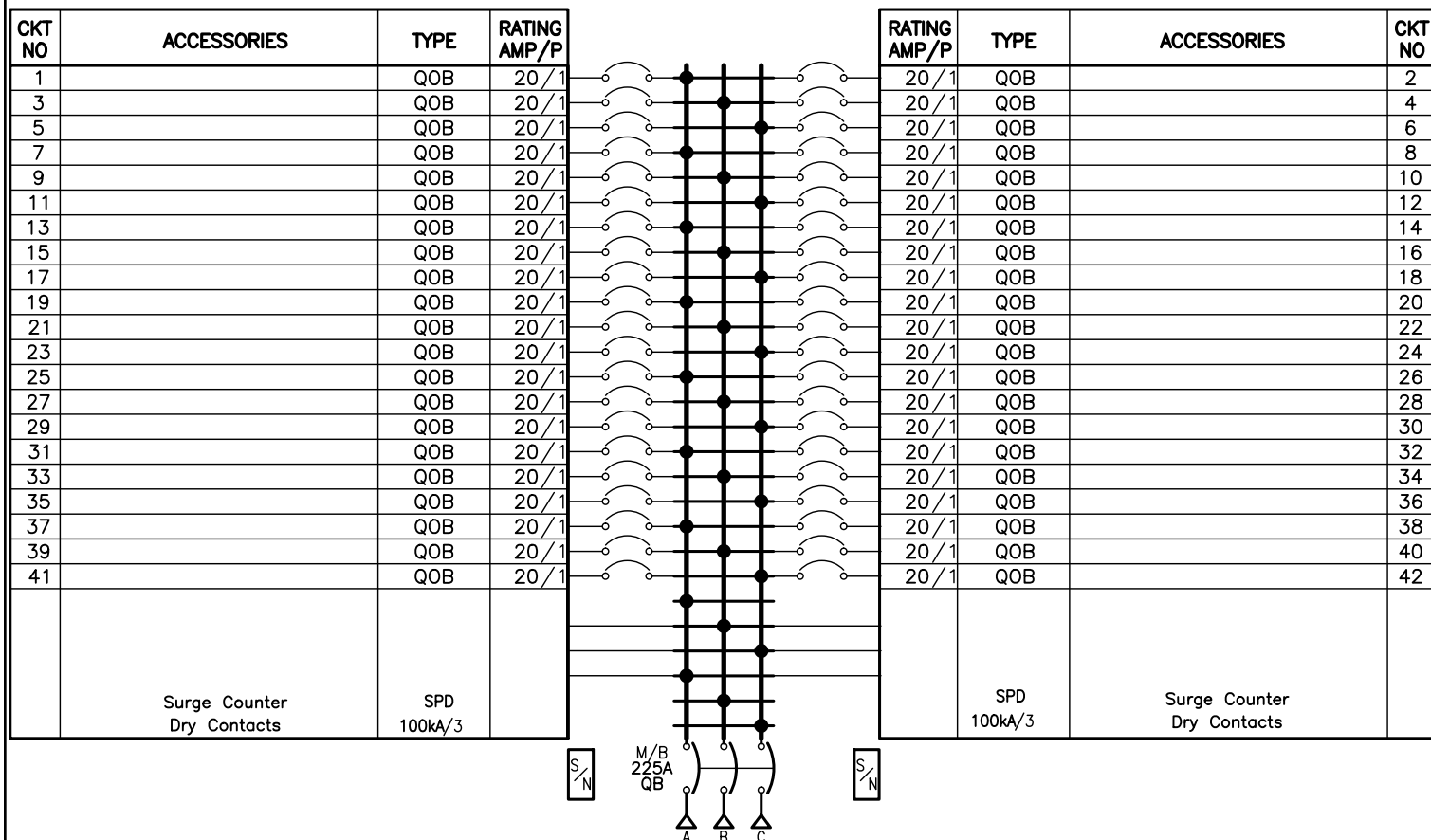
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LINE 1: 4LL5
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
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		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP - 5
BOTTOM - 10.47
SIDE - 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz

System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A

Bottom FEED

10kA AIR

INCOMING CONDUCTORS(S) PER NEC

Wire Bending Space:

#4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----

42 - 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-040-01	PG 1 OF 2 REV -

REV	DESCRIPTION	BY	DATE					
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

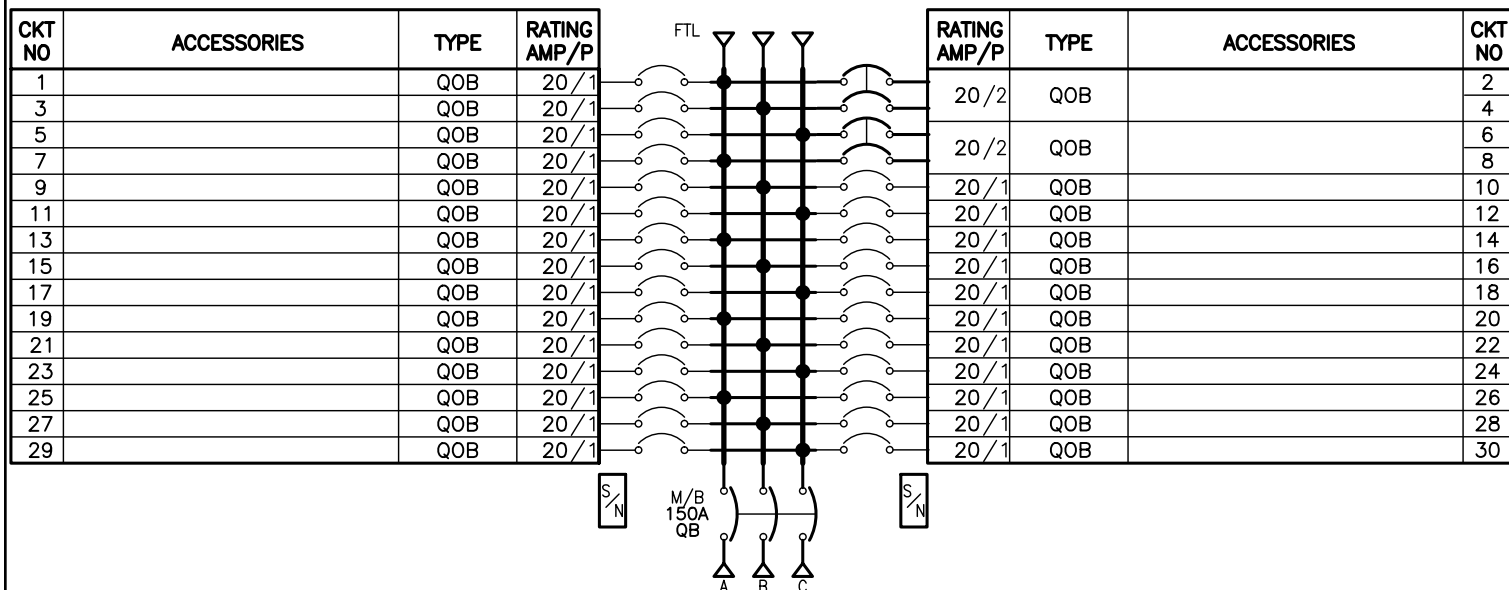
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Engraved as Follows

LINE 1: 2LL5
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive - Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
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DRAWING STATUS:	RECORD	DWG#	037999262-040-01
		PG	2 OF 2
		REV	-

REV	DESCRIPTION	BY	DATE	---	---	---	---
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PHYSICAL DATA

ENCLOSURE Type 1

Surface with Door
 FRONT CAT#: NC50S
 BOX CAT#: MH50BE
 DIMENSIONS:
 50"H x 20"W x 5.75"D
 WIRE BENDING SPACE:
 TOP - 12.4
 BOTTOM - 10.47
 SIDE - 6.13
 PBA: 707A

BUSSING: Copper
 Silver/Tin Plated

OPTIONAL FEATURES:
 SEISMICALLY QUALIFIED : IBC/ASCE7
 BRANCH USER PLACEMENT
 Copper GROUND BAR
 BLANK ENDWALLS
 COPPER SOLID NEUTRAL

-----STANDARD EQUIPMENT NAMEPLATE-----

Engraved as Follows

LINE 1: 1SL2
 COLOR: White Surface / Black Letters
 SIZE: 3.50" Wide x 1.00" High (Std)
 TYPE: Plastic/Adhesive - Screw-on

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
 System Ampacity: 150A
 10kA SYMS. SCCR
 MAIN: MAIN BREAKER QB 150A
 ACC: FEED THRU LUGS
 Bottom FEED
 10kA AIR
 INCOMING CONDUCTORS(S) PER NEC
 Wire Bending Space:
 #4 - 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

-----BRANCH SUMMATION-----
 26 - 20A/1P QOB 2 - 20A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1SL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-041-01	PG 1 OF 1 REV -

I-Line™ Circuit Breaker Power Distribution Panelboards

Information Manual

Class 2110

ENGLISH

Instruction Bulletin
80043-309-20

Retain for future use.



by **Schneider** Electric

Hazard Categories and Special Symbols



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand I-Line™ circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept I-Line branch circuit breakers.



For technical support on the installation of this panelboard, contact the Schneider Electric at customer support 1-888-778-2733.



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Read and understand this entire instruction bulletin and the latest edition of the NEMA PB 1.1 standards publication included before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Installation

This section provides instructions for the following I-Line panelboard procedures:

- Interior Mounting into Square D Brand Enclosures, on page 9
- Neutral Bonding Strap Installation, on page 12
- I-Line Circuit Breaker Installation and Removal, on page 14
- Interior Trim Barrier Preparation, on page 18

Interior Mounting into Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1-2007), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EXCESSIVE HEAT DUE TO LOOSE CONNECTION

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the I-Line panelboard enclosure, please refer to the NEMA PB 1.1-2007 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

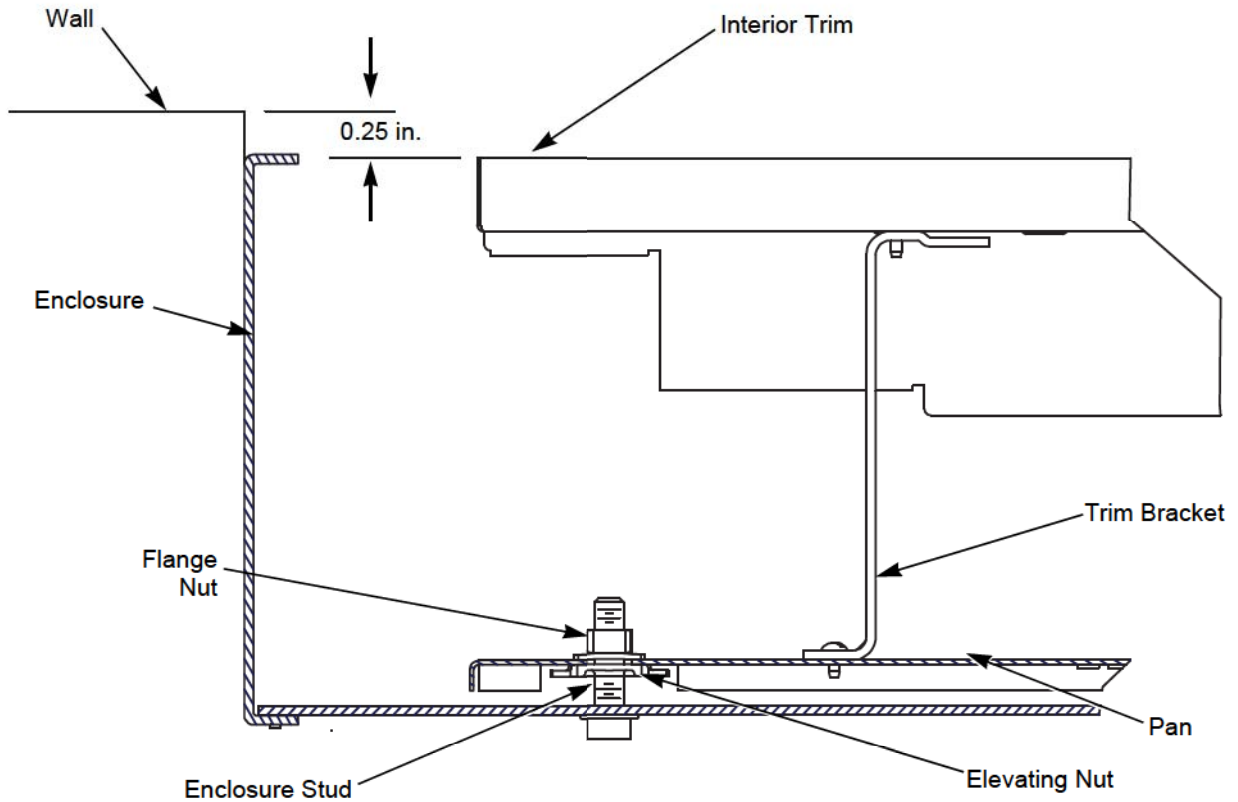
Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
 - a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
 - b. Adjust each elevating nut to maintain a maximum distance of 0.125 in. between the interior trim and the front/door assembly.
 - c. Tighten the flange nuts against the pan.
 - d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required (see “Neutral Bonding Strap Installation” on page 12).
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1-2007 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
 - a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1 on page 10). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
 - b. Adjust each elevating nut to position the lip of the interior trim approximately 0.25 in. from the outside wall line.
 - c. Tighten the flange nuts against the pan.
 - d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 12.
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Figure 1: Interior Mounting into Square D Brand Enclosures



Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “Standard Neutral Bonding Strap Installation” or “Neutral with Current Transformer Bonding Strap Installation” on pages 13 and 14, respectively.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Turn off all power supplying this equipment before working on or inside the equipment.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

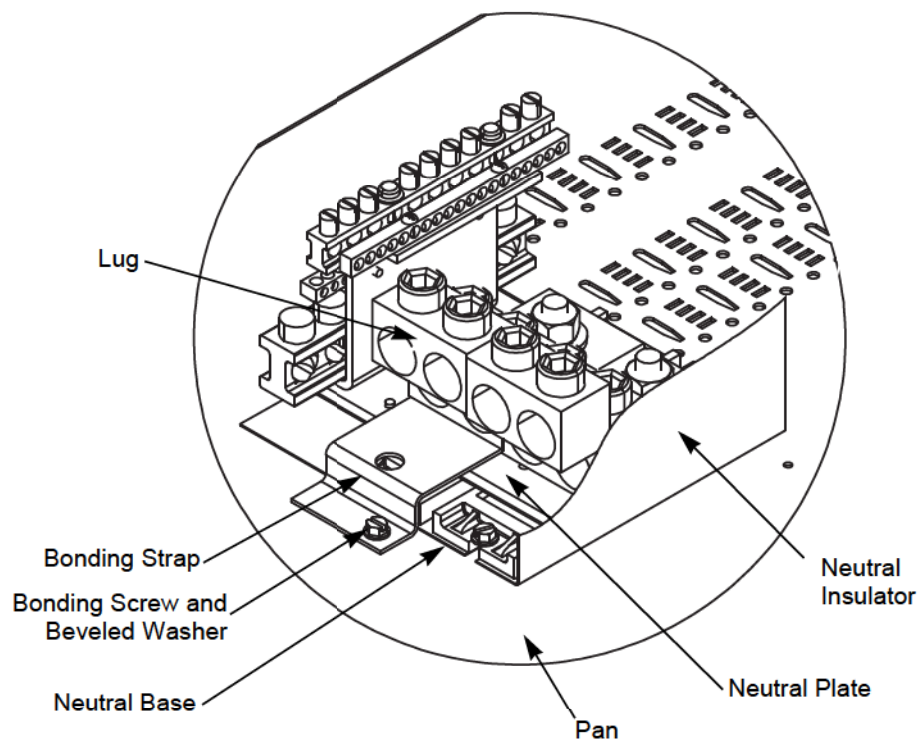
NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

Standard Neutral Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard, refer to Figure 2 and follow the instructions below.

1. Remove lug. Retain lug and fastening hardware.
2. Place bonding strap between neutral plate and lug, as shown.
3. Secure bonding strap to pan with bonding screw and beveled washer. Tighten the bonding screw to 65–75 lb-in (7.3–8.5 N•m).
4. Reinstall lug with the hardware retained in step 1. Tighten to 60–70 lb-in (6.8–7.9 N•m).

Figure 2: Standard Neutral Bonding Strap Installation



Neutral with Current Transformer Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard with a current transformer, refer to Current Transformer Neutral Bonding Installation Instructions, Schneider Electric document 80043-706-xx or 80043-789-xx, that is supplied with the current transformer neutral.

I-Line Circuit Breaker Installation and Removal

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

I-Line Circuit Breaker Installation

Refer to Figure 3 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim barrier.
3. Turn the circuit breaker off. Position the circuit breaker jaws against the bus bar stack so the guiding boss on the bottom of the circuit breaker is oriented towards the alignment groove in the bus insulator base, and the “fingers” of the circuit breaker mounting bracket fit into the keyslots in the pan.

NOTE: Install the main circuit breaker adjacent to the main lugs.

4. Place a screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker firmly into the bus bar stack and align the retaining screw with the 0.219 in. (5.6 mm) mounting hole in the pan.
5. Tighten the retaining screw securely to prevent the circuit breaker from moving.

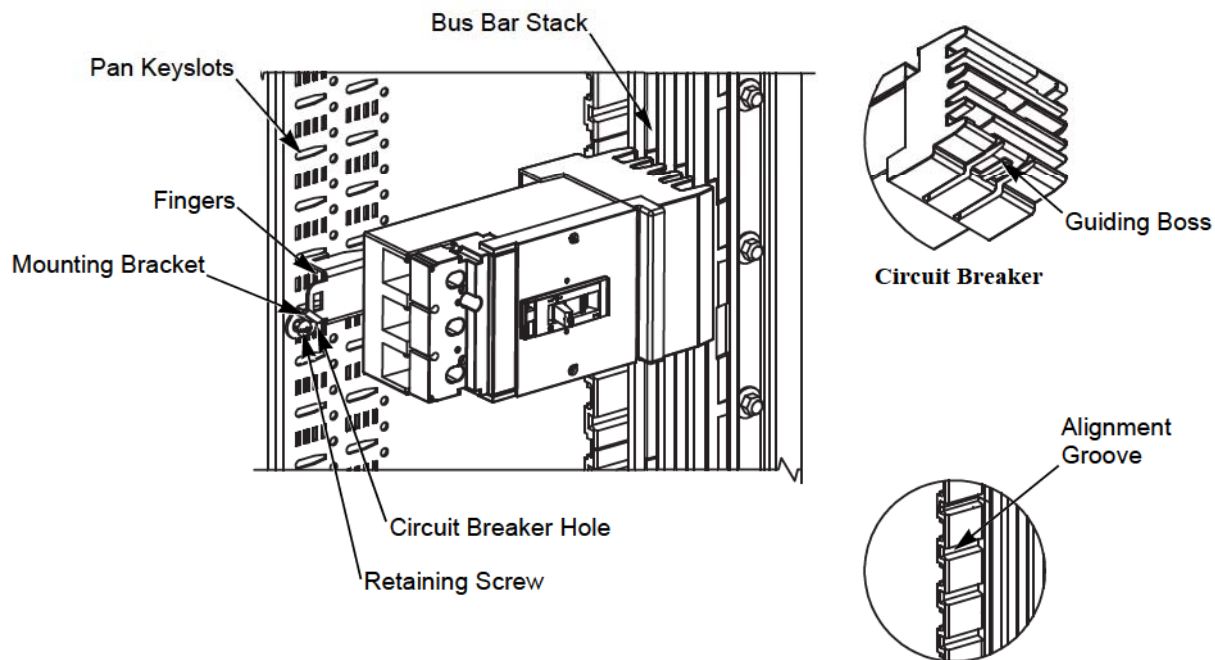
NOTE: Ensure the retaining screw is tight, but do not tighten it enough to bend the mounting bracket.

6. **For main circuit breakers only:**
Attach the “Main Breaker” label to the circuit breaker cover.
7. Reinstall the interior trim barrier.
8. Re-energize the panelboard.
9. Turn the circuit breaker on.

NOTE: I-Line circuit breakers are supplied with factory-applied joint compound on the plug-on connectors. The compound must not be removed because it contributes to the overall performance of the connection.

Whenever an I-Line circuit breaker is removed and reinstalled, the joint compound must be reapplied. A two-ounce container of compound especially formulated for I-Line plug-on connectors is available for purchase (catalog number PJC-7201).

Figure 3: I-Line Circuit Breaker Installation and Removal

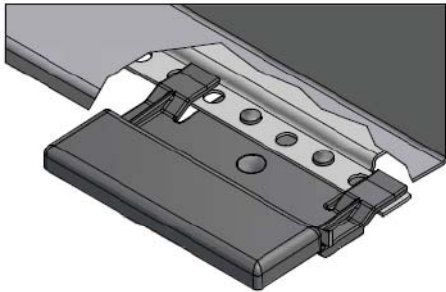


I-Line Circuit Breaker Removal

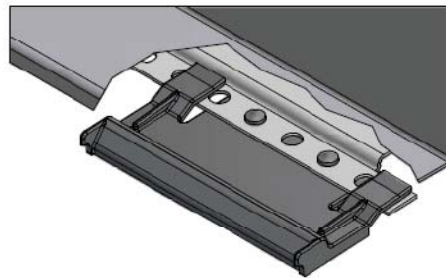
Refer to Figure 3 for the following instructions:

1. Turn off all power to the panelboard.
2. Turn the circuit breaker off.
3. Remove the interior trim barrier.
4. Loosen the retaining screw(s) in the circuit breaker mounting bracket until the screw(s) is completely removed from the 7/32 in. (5.6 mm) mounting hole in the mounting pan.
5. Place the screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker away from the bus bar stack.
6. Lift the circuit breaker away from the bus bars.
7. Install the blank fillers where the circuit breaker was removed, using Table 1 on page 18 as reference.
8. Secure the blank filler extensions to the interior trim barrier (HCPSU, HCP, and HCRU panelboards only), using Table 1 on page 18 for reference. Mount the extension over the mounting bracket in the deadfront as shown in Figure 4 on page 17.

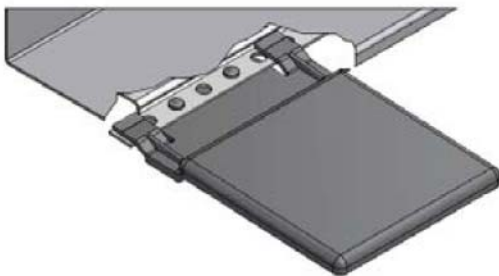
Figure 4: Blank Extension Installation



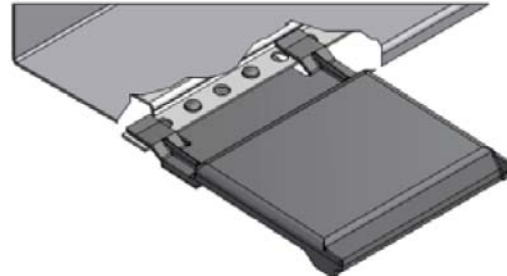
Blank Extension HLN4BL on narrow side



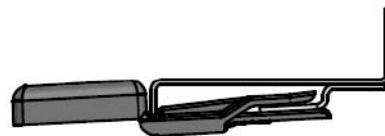
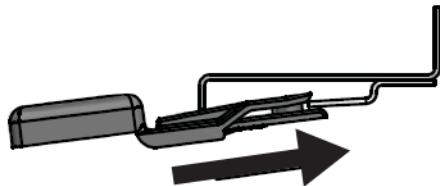
Blank Extension HLN4EBL on narrow side



Blank Extension HLW4BL on wide side



Blank Extension HLW4EBL on wide side

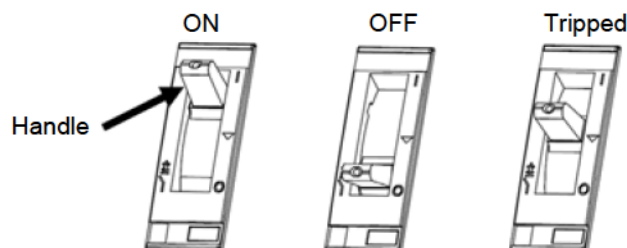


9. Reinstall the interior trim barrier.
10. Re-energize the panelboard.

Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



Interior Trim Barrier Preparation

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 1: Blank Fillers and Blank Extensions Catalog Numbers

Blank Extensions			
Circuit Breaker Frame	Circuit Breaker Mounting Height	Branch Circuit Side	Catalog Number
All applications except Powerpact H/J with Micrologic Trip Unit 5/6	1.5 in. (38.1 mm)	Wide Side	HLW1BL
	4.5 in. (114.3 mm)	Wide Side	HLW4BL
	1.5 in. (38.1 mm)	Narrow Side	HLN1BL
	4.5 in. (114.3 mm)	Narrow Side	HLN4BL
Only Powerpact H/J Frames with Micrologic Trip Unit 5/6	4.5 in. (114.3 mm)	Narrow Side	HLN4EBL
	4.5 in. (114.3 mm)	Wide Side	HLW4EBL
Blank Fillers			
All Applications	Mounting Height	Catalog Number	—
	1.5 in. (38.1 mm)	HNM1BL	
	4.5 in. (114.3 mm)	HNM4BL	

I-Line Stack Assemblies

NOTICE

RISK OF IMPROPER ASSEMBLY

- Do not disassemble the I-Line Bus Stack Assembly.
- If maintenance is required, contact Schneider Electric.

Failure to follow these instructions can result in severe equipment damage and will void the warranty.

I-Line Solid Neutral Assemblies

Table 2: I-Line Solid Neutral Assembly Catalog Numbers

Amps	Catalog Number
225	HC2SN
400	HC4SN ¹ , HCW4SN ²
600	HC6SN ¹ , HCW6SN ²
800	HC8SN ¹ , HCW8SN ² HCPSU8SN ³
800 ⁷	HCPSU8SNCW ⁵
1200 ²	HCW12SN
1200 ^{2, 8}	HCWM12SN ⁴
1200 ^{2, 7}	HCR12SNCTW ⁶

¹ Used on type HCN and HCM panelboards only.

² Used on 400 A, 600 A, 800 A, 1200 A HCP (main lugs), and 600 A, 800 A (main circuit breaker).

³ Used on type HCP-SU panelboards only.

⁴ Used on type HCR-U panelboards only.

⁵ Used on type HCP-SU panelboards only.
For use with circuit breaker types PG, PJ, PK, PL.

⁶ Used on type HCR-U panelboards only.
For use with circuit breaker types PG, PJ, PK, RG, RJ, RK.

⁷ Including neutral CT for 3Ø4W systems.

⁸ Used on type HCR-U universal panelboards only.

Appendix 1: Specifications

Typical Wiring

Table 3: Panelboard Typical Wiring ¹

Voltage AC ²	1-Phase Panelboards		3-Phase Panelboards	
	Phase	Wires	Phase	Wires
208Y/120 ³	—	—	3	4
120/240 ³	1	3	—	—
240 ⁴	3	3	—	—
600	1	2	—	—
480Y/277 ³	—	—	3	4
240/120 ^{3, 6}	—	—	3	4 Delta
600	—	—	3	3 Delta
600Y/347 ^{3, 5}	—	—	3	4
125/250 Direct Current	—	3	—	—
250 Direct Current	—	2	—	—

¹ Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

² Unless otherwise specified.

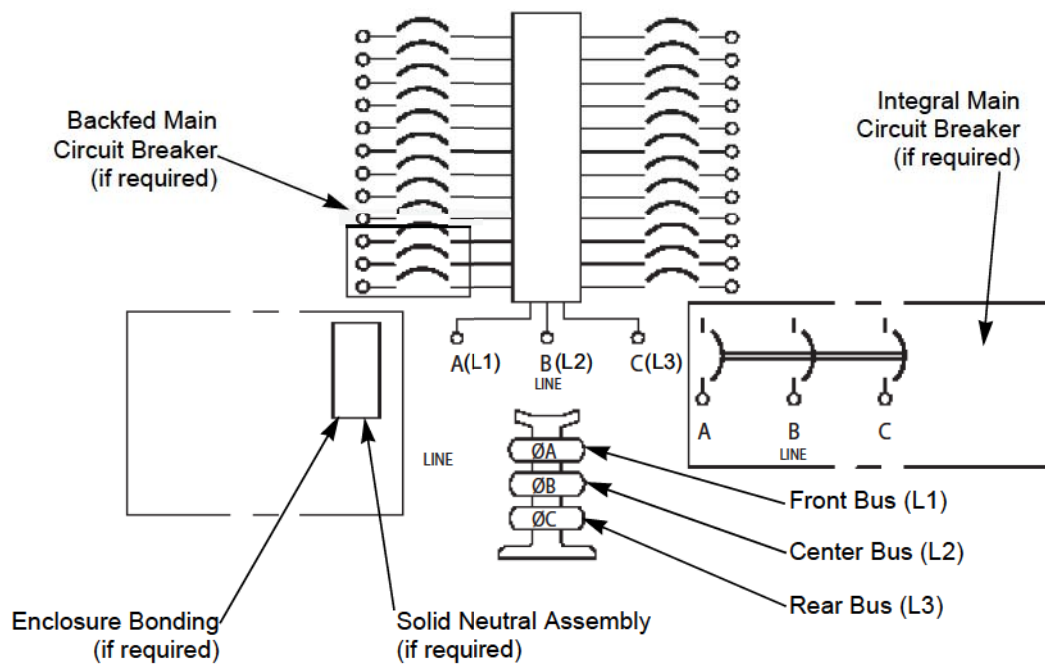
³ Requires use of solid neutral assembly. See panelboard.

⁴ For grounded "B" phase system.

⁵ For use in Canada only.

⁶ When wiring for delta systems, phases "A" and "C" must be 120 V to neutral, with phase "B" 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum, not 120 V or 120/240 V to "B" phase.

Figure 6: Main Lugs / Main Circuit Breaker Wiring Diagram



NOTE: For 1Ø systems, the center bus is not used.

NOTE: Branch connections phasing is determined by the circuit breaker selected. See the latest catalog or the Digest for circuit breaker selection.

NOTE: Assure that the circuit breaker voltage rating is appropriate for the system. With the selection of proper units, any of the listed voltage systems can be used.

Panelboard Ratings

Refer to NEC section 110-22, 2011 Edition and CEC rule 12-014, 2002 Edition for more information. The series rated system label is located in the bag assembly. Short circuit tests are conducted at 100–105% of the maximum panelboard voltage. Interiors with CE mark meet IEC 61439-1 and IEC 61439-2.

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
120	42,000	MG	FY	1
	65,000	QG, LH	FA, FD	
	100,000	FJ, QJ	FD	
		QJ, LC	FA	
		LJ	FH	
	200,000	LR	FH, FY	
208Y/120	100,000	QJ	FA, FD	2, 3
		QJ, PH, PJ, RJ	QD, QG	
240	35,000	MG	FA	1
	42,000	KA	FD	1, 2, 3
		LA, MA	HD, JD, QD	2, 3
	50,000	MG	FA	1
		MG	FA (25 A MAX.)	
	65,000	HG, JG	FA, HD	2, 3
		JG	JD, QD	
		QG	FA, FD, QD	
		LH, MH, PA, PG, RG	HD, JD, QD	
		FG, FH, MH, MX, PJ	FD	1, 2, 3
		FC, KC, KH, LC, LH	FD, FG	
		LH	FA	
		LH	LA	2, 3
		MG	HD, JD, KA	
		DG	FH, HD, JD, KA, LA, MA	2, 3
		LG	HD, JD, KA, LA, MA	
		LG	LD	3
	85,000	RL	FH, KH	2, 3

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
240	100,000	FC, KC, LC, LX	FD, FG, FJ	1
		PH, PJ, RJ	QD, QG	2, 3
		QJ	FD	2
		FJ	FD	
		LJ	HD, HG, JD, JG, FH, KA, LA, MA, MG	2, 3
		LJ	LD, LG	3
		FC, KC	FA, FH, FD, FG, FJ	2, 3
		LC, LX	FH, FD, FG, FJ	
		KC, LC, LX	KA	
		KC, LC	KH	
		LC	LA, LH, MG	1, 2, 3
		LC	FA	
		HJ, JJ	FA, FH, HD, HG	
		JJ	JD, JG	
		LC, LX, MJ, PJ, RJ	HD, HG, JD, JG	2, 3
		MJ	LA, LH	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA, MG	
	125,000	RL	RG	2, 3
		HL, JL	HD, HG, HJ, FA, FH	
		JL	JD, JG, JJ	
		PC, PH, PL, RL	HD, HG, JD, JG	
		PC, PL, RL	HJ, JJ	
	200,000	FI, KI, LI, LXI	HD, HG, HJ	1
		KI, LI, LXI	JD, JG, JJ	
		FI, KI, LI, LXI	FD, FG, FJ	
		FI, KI	FA, FH, FC, FD, FG, FJ	
		LI, LXI	FH, FD, FG, FJ	2, 3
		LI	FC	
		KI, LI, LXI	KA, QD, QG, QJ	
		LI	KC	
		JR	QD	
		LR	FH, HJ, HL, JJ, JL, QD, QG, QJ, LA, LH	

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
277	18,000	LD	FY	1
	25,000	FH, KA	FD	
	35,000	FG, KH, LH	FD	
		DG, LG	FH, FY	
	65,000	FJ	FD	
		FC, KC	FA, FH, FY, FD, FG	
		LC, LX (400 A MAX.)	FH	
		LC, LX (600 A MAX.)	FY, FD, FG	
		DJ	FH, FY	
		LL	FY	
		LJ	FH, FY	
	100,000	DL, LL	FH, FJ	
	200,000	FI, KI	FA, FH, FY, FD, FG, FJ	
		HR, JR	FA, FY, FJ	
		LI, LXI, (400 A MAX.)	FH	
		LI, LXI, (600 A MAX.)	FY, FD, FG, FJ	
		LR	FH, FY	
480	22,000	MG	FA	2, 3
	30,000	KH, LA, MA, MX, PA, PC, PX, PJ	FH	
		LA, MA, PA, PC, PX	KA	
		LA, MA, PA	HD, JD	
		MG	FA (25 A MAX.), FH, KA	
	35,000	MH, MX, PA	HD, JD	
		HG, JG	FA, HD	
		JG	JD	
		LH, MG, PG, RG	HD, JD	
		LH	HG, JG	
		DG	FH, HD, JD, KA, LA, MA	
		LG	LD	
		LG	HD, JD, FH, KA, LA, MA	

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3- Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480	42,000	MJ	FH (25 A MAX.)	2, 3
		RL	RG	
	50,000	MJ	KA, KH	
		FC, KC	FA, FH	
		HJ, JJ	FA, FH, HD, HG	
		JJ	JD, JG	
		LC, LI, LX, LXI	HD, HG, JD, JG	
		LC, LX, (400 A MAX.)	FH	
		KC, LC, LX	KA	
		LC, LX	LA	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA	
		LJ	LD, LG	3
		LJ	HD, HG, JD, JG, FH, KA, LA, MA	2, 3
	100,000	HL, JL	FA, FH, HD, HG, HJ	2, 3
		JL	JD, JG, JJ	
		JR	FA	
		LI, LXI (600 A MAX.)	KA	
		PC, PH, PL, RL	HJ, JJ	
		RL	RG	
		DL	FH, HD, HG, HJ, JD, JG, JJ, KA, LA, MA	
		LL	LD, LG, LJ	3
	200,000	LL	HD, HG, HJ, JD, JG, JJ, FH, KA, LA, MA	2, 3
		FI, KI	FA, FH, FC, HD, HG, HJ	
		HR	FA, HD, HG, HJ, HL	
		JR	HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI	JD, JG, JJ, KA	
		LI	FC, KA, KC, LA, HJ, HL, JJ, JL	
		LXI	KA, HJ, HL, JJ, JL	
		LR	FH, HJ, HL, JJ, JL, LA, LH	

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480Y/277	25,000	FH, KA	FD	2, 3
	35,000	FG, KH, LH	FD	
	65,000	FJ	FD	
		FC, KC	FD, FG	
		LC, LX (600 A MAX.)	FD, FG	
	200,000	FI, KI	FD, FG, FJ	
		LI, LXI (600 A MAX.)	FD, FG, FJ	
600	18,000	HG, JG	FA, HD	3
		JG	JD	
		MG, PG, RG	HD, JD	
		MG	FA	
		LG	LD	
		LG	HD, JD	
	25,000	HJ, JJ	FA, HD, HG	2, 3
		JJ	JD	
		PJ, RJ	MG	3
		LJ	LD, LG	
		LJ	JD, JG, HD, HG, MA	
	35,000	LC	FH, HD, HG, HJ, JD, JG, JJ, LA	2, 3
	50,000	HL, JL	FA, HD, HG, HJ	
		JL	JD, JG, JJ	
		PK	HJ, JJ, MJ	
		LL	LD, LG, LJ	
	100,000	LL	HD, HG, HJ, JD, JG, JJ, MA	2, 3
		FI, KI	HD, HG, HJ	
		KI	JD, JG, JJ	
		HR	FA, HD, HG, HJ, HL	
		JR	FA, HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI, LI	FH	
		LI	LA	

Continued on next page

**Table 4: Series Connected Circuit Breaker Ratings
(RMS Symmetrical) (Continued)**

Maximum System Voltage AC ²	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker ¹	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
600Y/347	18,000	MG	FA (25 A MAX.)	1
	25,000	MJ	FA (25 A MAX.)	
	50,000	HL, JL	FJ	

¹ LD, LG, LJ, and LL are only available in 3-pole configurations.² For indicated circuit breakers rated less than this maximum voltage the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.**Table 5: Series Connected Fuse Ratings (RMS Symmetrical)**

Maximum System Voltage AC ¹	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
120/240 1Ø 208Y/120	100,000	1200 A	L, T (300 V)	QD, QG
		800 A	T (600 V)	
		600 A	J, RK5	
240	65,000	1200 A	L, T (300 V)	QD
		800 A	T (600 V)	
		600 A	J, RK5	
	100,000	1200 A	L, T (300 V)	QD, QG (2-Pole)
		800 A	T (600 V)	
		600 A	J, RK5	FA, FH, KA, KH, KC, LA, LH, MA, MH, MX, PG
			J, T (600 V)	
			RK5	
			J	
		800 A	T (600 V)	FH, KA, KH, LA, LH, MA, MH, MX, PG
			T (300 V)	
			L	
		1200 A	L	FH, KH, LA, LH, MA, MH, MX, PG
			T (600 V)	
		1600/2000 A	L	KH, MA, MH, MX, PG
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL

Continued on next page

Table 5: Series Connected Fuse Ratings (RMS Symmetrical) (Continued)

Maximum System Voltage AC ¹	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
240	200,000	600 A	J, T (600 V)	FA(3 POLE ONLY) FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			RK5	FH, FC, HD, HG, HJ, HL, JD, JG, JJ, JL, KH, KC, LA, LH, LC, MA, MH, MX, NC, NX, PG,PJ, PL
			J	HD, HG, HJ, HL, JD, JG, JJ, JL
		800 A	T (600 V)	FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (300 V)	PG, PJ, PL
			L	FH, FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	FC, KH, KC, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		1600/2000 A	L	NA, NC, NX, PJ, PL
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL
480	100,000	400 A	J, T(600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		600 A	J, RK5	HJ, HL, JJ, JL
		600 A	J, T (600 V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			RK5	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		800 A	L, T(600V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		1200 A	L	FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			T (600 V)	HJ, HL, JJ, JL
		1600 A	L	KC, LC, MA, MH, MX, NA, PG, PJ
		2000 A	L	KC, LC, MH, MG, MJ, MX, NA, PG, PJ
		4000 A	L	HJ, HL, JJ, JL
	200,000	200 A	RK5	HJ, HL
		400 A	J	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
		600 A	J	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
			RK5	KC, LA, LH, LC, MA, MH, MX, MG, MJ, NC, NX, PG, PJ

Continued on next page

Table 5: Series Connected Fuse Ratings (RMS Symmetrical) (Continued)

Maximum System Voltage AC ¹	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
480	200,000	800 A	T(300 V)	PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			L	KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	KC, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
		1600/2000 A	L	NA, NC, NX
600	100,000	30 A	CC	HG, JG (Molded Case Switches)
		200 A	J	HD, HG, HJ, HL, JD, JG, JJ, JL
		400 A	J, T (600 V)	HJ, HL, JJ, JL
		600 A	R	MG, MJ
		1200 A	L	MG, MJ
	200,000	600 A	J	MG, MJ
		800 A	T (600 V)	MG, MJ

¹ For indicated circuit breakers rated less than this maximum voltage. The indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

Additional Short Circuit Current Ratings

Square D I-Line plug-on lugs installed in this panelboard and protected by indicated Square D circuit breakers are suitable for use where the available short circuit current is not greater than that shown in the following table. The short circuit current rating cannot exceed the rating marked on the protecting circuit breaker. The protecting circuit breakers may be the main, or if plugged onto the same I-Line bus stack, may be downstream from the plug-on lugs.

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL100, 100 A SL225, 225 A SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	FA	2, 3	100	25	240
				18	480
				14	600
	FH	2, 3	100	65	240
				25	480
				18	600
	FD	2, 3	100	25	240
				18	480Y
	FG	2, 3	100	65	240
				35	480Y
	FJ	2, 3	100	100	240
				65	480Y
SL225, 225 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	KA	2, 3	225	42	240
				25	480
				22	600
	KH	2, 3	225	65	240
				35	480
				25	600
	KC	2, 3	225	100	240
				65	480
	KI	2, 3	225	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A SL33930, 1200 A SL33931, 1200 A	DG	3	400	65	240
				35	480
	DJ	3	400	100	240
				65	480
	DL	3	400	125	240
				100	480
SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	DG	3	600	65	240
				35	480
	DJ	3	600	100	240
				65	480
	DL	3	600	125	240
				100	480

Continued on next page

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹ (Continued)

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	HD/JD	2, 3	150/250	25	240
				18	480
				14	600
	HG/JG	2, 3	150/250	65	240
				35	480
				18	600
	HJ/JJ	2, 3	150/250	100	240
				65	480
				25	600
	HL/JL	2, 3	150/250	125	240
				100	480
				50	600
	HR/JR	2, 3	150/250	200	240
				200	480
				100	600
	KI	2, 3	250	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LA	2, 3	400	42	240
				30	480
				22	600
	LH	2, 3	400	65	240
				35	480
				25	600
	LD	3	400	25	240
				18	480
				14	600
	LG	3	400	65	240
				35	480
				18	600
	LJ	3	400	100	240
				65	480
				25	600
	LL	3	400	125	240
				100	480
				50	600
	LR	3	400	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	400	100	240
				65	480
				35	600
	LI/LXI	2, 3	400	200	240
				200	480
				100	600

Continued on next page

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹ (Continued)

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LD	3	600	25	240
				18	480
				14	600
	LG	3	600	65	240
				35	480
				18	600
	LJ	3	600	100	240
				65	480
				25	600
	LL	3	600	125	240
				100	480
				50	600
LR	3	600	200	240	
			200	480	
			100	600	
SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	600	100	240
				65	480
				35	600
	LI/LXI	2, 3	600	200	240
				200	480
				100	600
	MA	2, 3	800	42	240
				30	480
				22	600
	MH/MX	2, 3	800	65	240
				65	480
				25	600
SL800M5, 800 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A	MG, PG	2, 3	800	65	240
				35	480
				18	600
	MJ, PJ	2, 3	800	100	240
				65	480
				25	600
	PK	2, 3	800	65	240
				50	480
				50	600
	PL	2, 3	800	125	240
				100	480
				25	600
MA/MH/MX	2, 3	800	65	240	
			65	480	
			25	600	

Continued on next page

Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers¹ (Continued)

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL1200, 1200 A S33930, 1200 A	NA	2, 3	1200	100	240
				50	480
				25	600
	NC/NX	2, 3	1200	125	240
				100	480
				65	600
SL1200P5, 1200A SL1200P6, 1200A SL1200P7, 1200A	PG/RG	2, 3	1200	65	240
				35	480
				18	600
	PJ/RJ	2, 3	1200	100	240
				65	480
				25	600
	PK	2, 3	1200	65	240
				50	480
				50	600
	RK	2, 3	1200	65	240
				65	480
				65	600
	PL	2, 3	1200	125	240
				100	480
				25	600
	RL	2, 3	1200	125	240
				100	480
				50	600
S33930, 1200 A S33931, 1200 A	MG	2, 3	800	65	240
				35	480
	PG	2, 3	1200	18	600
				100	240
	MJ	2, 3	800	65	480
				25	600
	PJ	2, 3	1200	65	240
				50	480
	PK	2, 3	1200	50	600
				125	240
S33930, 1200 A	PL	2, 3	1200	100	480
				65	240
	RG	2, 3	1200	35	480
				18	600
	RJ	2, 3	1200	100	240
				65	480
	RL	2, 3	1200	25	600
				125	240
	RK	2, 3	1200	100	480
				50	600
	RK	2, 3	1200	65	240/480/600

¹ S33930, S33931, SL1200P5, SL1200P6, SL1200P7, SL kits are rated 1200 A and may be applied to 1200 ampere loads when installed into HCRU panelboards restrictively on the wide side.

CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards. Main Lug interiors with the "CE" mark have been tested to withstand 42,000 RMS symmetrical amperes for 30 cycles. Only IEC rated circuit breakers may be used with "CE" marked interiors and the short circuit rating of the interior is limited to the lowest IEC rated branch breaker unless series rated with an IEC rated main breaker in Table 4. (See Digest for details)

Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for I-Line panelboards:

- Equipment Ground Bar Kits, on page 36
- Mechanical Interlock Kits, on page 36
- Main Lug Kits, on page 37
 - Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum, on page 37
 - Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper, on page 37
- Circuit Breaker Lug Kits, on page 38
 - Versa-Crimp Lugs and Versatile Compression Lug Kits, on page 38
- Extension Kits, on page 40

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of I-Line panelboards. Select the required kit according to the interior catalog number. Kits can be field installed.

Table 7: Equipment Ground Bar Kits Specifications

Panelboard	Use Ground Bar Kit Catalog Number	
	Aluminum ¹	Copper ²
HCN	PK27GTA	PK27GTACU
HCM, HCP, HCRU	PK32DGTA	PK32DGTACU

¹ Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

² Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol  stamped into the back wall of the enclosure.

Mechanical Interlock Kits

Kits can be field installed.

Table 8: Mechanical Interlocks Specifications

Catalog Number	Circuit Breaker Combinations		Panelboard Type
	Mains	Auxiliary	
HFK3DTI	FA	FA	HCN, HCM, HCP, HCRU
HFM3DTI	LA	FA	HCRU
HLM3DTI	LA	LA	HCP, HCRU
HPFK3DTI	MG/MJ	FA/KA	HCP, HCPSU, HCRU
HPHJ3DTI	MG/MJ	H/J	HCP, HCPSU, HCRU
HPL3DTI	MG/MJ	LA	HCP, HCPSU, HCRU
HPP3DTI	MG/MJ	MG/MJ	HCP, HCPSU, HCRU

Main Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 9: Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A				—
400 A	4–300 kcmil AL/CU 21.1–151 mm ²	VCCEL-030-516H1	VC-6 Series	HCN400VCA HCM400VCA HCW400VCA
	500–750 kcmil AL 253–380 mm ²	VCCEL-075-12H1	VC-6FT, VC-8	—
600 A	2/0–500 kcmil AL/CU 67.4–253 mm ²	VCCEL-050-38H1	VC-6 FT	HCN600VCA HCM600VCA HCW600VCA
800 A		VCCEL-050-12H1		HCM800VCA HCW800VCA
1200 A	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VCCEL-075-12H1 ¹	VC-6FT, VC-8	HCW1200VCA

¹ When this lug is installed, the box extension HC-4212-DEX (F or S) must be added to the incoming cable end of the enclosure.

Table 10: Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A				—
400 A	2/0–300 kcmil CU 67.4–151 mm ²	VCCELC-030-38H1	VC-6-3 VC7 VC6-FT VC7-FT	HCN400VCA HCM400VCA HCW400VCA
	400–750 kcmil CU 203–380 mm ²	VCCELC-075-12H1	VC-6FT VC7-FT VC8	—
600 A	250–500 kcmil CU 127–253 mm ²	VCCELC-050-12H1	VC6-3 VC7 VC6-FT VC7-FT	HCN600VCA HCM600VCA HCW600VCA
800 A				HCM800VCA HCW800VCA
1200 A	400–750 kcmil CU 203–380 mm ²	VCCELC-075-12H1	VC-6FT VC7-FT VC8	HCW1200VCA

Circuit Breaker Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 11: Versa-Crimp Lugs and Versatile Compression Lug Kits ¹

Aluminum	Wire Range ²	Versa-Crimp Tool	Copper	Wire Range ²	Versa-Crimp Tool	
VC100FA VC100FD	8–1/0 8.36–53,5 mm ²	VC-6	CVC100FA CVC100FD	6–1/0 CU 13.3–53.5 mm ²	VC-6 Series	
VC250KA3	4–300 kcmil 21.1–151 mm ²		CVC250KA3	2/0–300 kcmil CU 67.4–151 mm ²		
VC250KA35	250–350 kcmil 127–177 mm ²		CVC400LA3	4–300 kcmil CU 21.1–151 mm ²		
VC400LA35	250–350 kcmil 127–177 mm ²		CVC400LA5 CVC600MA5	250–500 kcmil CU 127–253 mm ²		
VC400LA3	4–300 kcmil 21.1–151 mm ²		CVC1200NE5	2/0–500 kcmil 67.4–253 mm ²		
VC400LA5	2/0–500 kcmil 67.4–253 mm ²		CVC1200NE7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²		
VC400LA7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VC-6 FT VC-8				
VC400LA7	2/0-500 kcmil 67.4–253 mm ²	VC-6 Series	—			
VC800MA7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VC-6 FT VC-8				
VC1200NE5	2/0–500 kcmil 67.4–253 mm ²	VC-6 Series				
VC1200NE7	500–750 kcmil AL 253–380 mm ² 500 kcmil CU 253 mm ²	VC-6 FT VC-8				
YA060HD	# 6–#2 AWG	3	CYA060HD	# 6–1/0 AWG CU	3	
YA150HD	# 1–4/0 AWG		CYA150JD	# 4–2/0 AWG CU		
YA150JD	# 1–3/0 AWG		CYA150HD	# 6–1/0 AWG CU		
YA250J35	3/0–350 kcmil		CYA250J3	1/0–350 kcmil CU		

¹ Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

² Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

³ Use crimp tools in accordance with instructions that are provided within each lug kit.

Table 12: Compression Lug Kits for L-, MG-, MJ-, P-, and R-Frame Circuit Breaker ¹

Aluminum	Wire Range ²	Versa-Crimp Tool	Copper	Wire Range ²	Versa-Crimp Tool
YA250P3	2/0–300 kcmil 67.4–151 mm ²	4, 5	CYA400P5	4/0–500 kcmil CU 107–253 mm ²	4, 5
YA300P5	4/0–500 kcmil 107–253 mm ²		CYA600P5	4/0–500 kcmil CU 107–253 mm ²	
YA400P3	2/0–300 kcmil 67.4–151 mm ²		CYA800P7	500–750 kcmil CU 253–380 mm ²	
YA400P7	500–750 kcmil 253–380 mm ²		CYA1200R5	4/0–500 kcmil CU 107–253 mm ²	
YA600P5	4/0–500 kcmil 107–253 mm ²		CYA1200R7	500–750 kcmil CU 253–380 mm ²	
YA800P7 ³	500–750 kcmil 253–380 mm ²		—		
YA1200R3	2/0–300 kcmil 67.4–151 mm ²				
YA1200R5	4/0–500 kcmil 107–253 mm ²				
YA1200R7	500–750 kcmil 253–380 mm ²				
YA400L31K3 ⁷	#4–300 kcmil 21–151 mm ²	4	CYA400L31K3 ⁷	2/0–300 kcmil	4
YA600L32K3 ⁷			CYA600L32K3 ⁷	67.4–151 mm ²	
YA400L51K3 ⁷	CYA400L51K3 ⁷		250–500 kcmil		
YA600L52K3 ⁷	CYA600L52K3 ⁷		127–253 mm ²		
YA400L71K3 ^{6, 7}	500–750 kcmil 253–380 mm ²		—		

¹ Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

² Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

³ When this lug is installed on a vertically mounted main circuit breaker, in an HCP interior, add box extension HC-4212-DEX (F or S) to the end of that enclosure.

⁴ Use crimp tools in accordance with instructions that are provided within each lug kit.

⁵ Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition. I-LINE panelboards with a Type 1 enclosure require a 5.0 in. extended width box when the branch breakers use these lugs (these compression lugs may not be used in weatherproof enclosures). Contact your local Schneider Electric representative for assistance.

⁶ This lug is only allowed in HCP/HCPSPU panelboards with Type 1 enclosures with a 5.0 in. wide side extension.

⁷ For L-frame circuit breakers only.

Extension Kits

Table 13: Extension Kits for HCN, HCM, HCRU and HCP Panelboards

Catalog Number	For Use With
HC2609EX ¹	HC26--B ²
HC2609DEX ¹	HC26--DB ²
HC3209EX ¹	HC32--B ²
HC4212DEX ¹	HC42--DB ²
HC4406DEX ¹	HC44--DB ²
HC4412DEX ¹	HC44--DB ²

¹ Add "F" for flush, "S" for surface as required.

² Series E1 Enclosures.

NOTE: Kits can be field installed. Extension kit must be attached to enclosure before mounting enclosure to wall.

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HAZARD CATEGORIES AND SPECIAL SYMBOLS

ENGLISH



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

 **DANGER**

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

 **CAUTION**

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.



Provides additional information to clarify or simplify a procedure.

PLEASE NOTE Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D® brand NF and NFOM circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept ECB, EDB, EGB, and EJB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at 1-888-SquareD (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Installation

This section provides instructions for the following NF/NFOM panelboard procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 8
- “Neutral Bonding Strap Installation” on page 11
- “ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal” on page 15
- “Circuit Breaker Reset Instructions” on page 17
- “Interior Trim Preparation” on page 18

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NF/NFOM panelboard interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

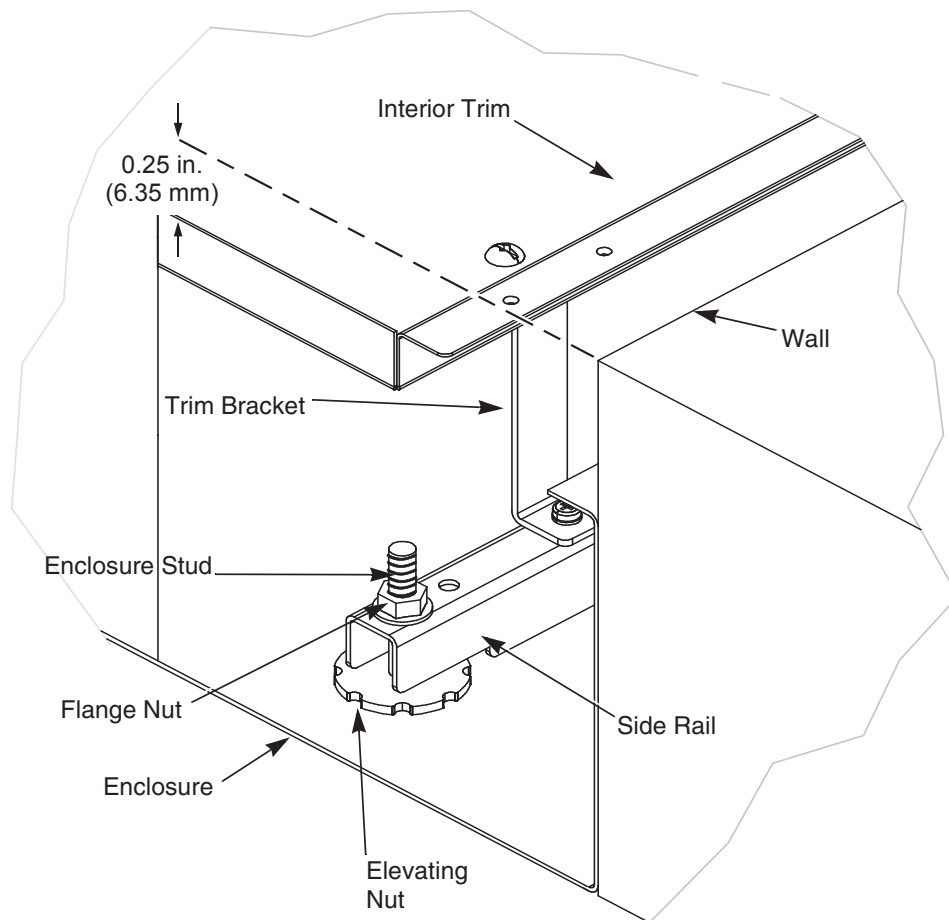
Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Thread the provided elevating nuts on the enclosure studs.
 - b. Set the interior on the enclosure studs. (See Figure 1 on page 10).
 - c. Tighten the flange nuts against the interior side rails until the rails are against the back of the enclosure.
 - d. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Thread the provided elevating nuts on the enclosure studs.
 - b. Set the interior on the enclosure studs (see Figure 1 on page 10). Place the flange nuts onto the enclosure studs, but do not tighten.
 - c. Adjust the elevating nuts so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
 - d. Tighten the flange nuts against the side rails.
 - e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Figure 1: Interior Mounting of Square D Brand Enclosures



Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “125 A or 250 A Maximum NF Panelboards”, “400 A or 600 A Maximum NF Panelboards”, or “800 A Maximum NF Panelboards” below, and on pages 12–14.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside the equipment.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

125 A or 250 A Maximum NF Panelboards

To install a neutral bonding strap on a 125 A or 250 A maximum NF panelboard, refer to Figure 2 and follow the instructions below.

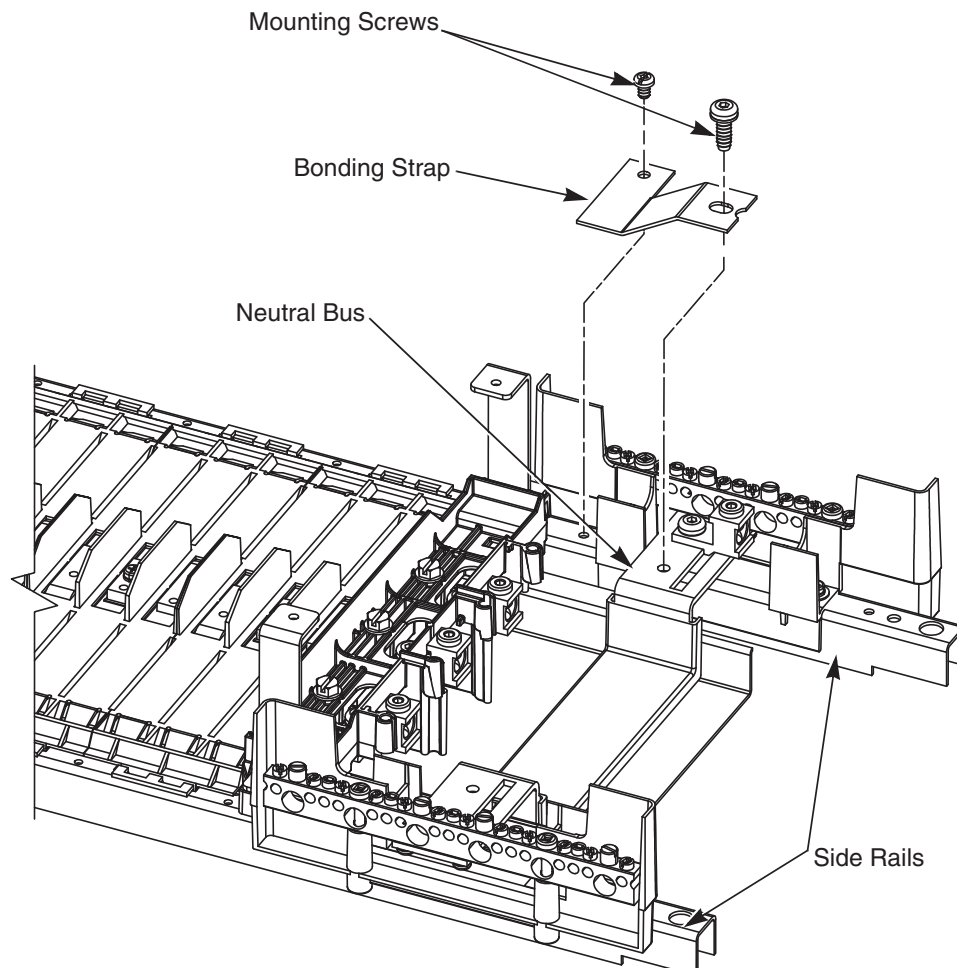
1. Align the bonding strap on the side rail, as pictured.

NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 25–30 lb-in (2.8–3.4 N•m).

NOTE: If the lug was removed in Step 1, reinstall it on top of the bonding strap. Use the 1/4-20 x 3/4 in. mounting screw. Lug mounting screws are provided in the bonding strap bag assembly.

**Figure 2: Bonding Strap Installation —
125 A or 250 A Maximum NF Panelboards**



400 A or 600 A Maximum NF Panelboards

To install a neutral bonding strap on a 400 A or 600 A maximum NF panelboard, refer to Figure 3 and follow the instructions below.

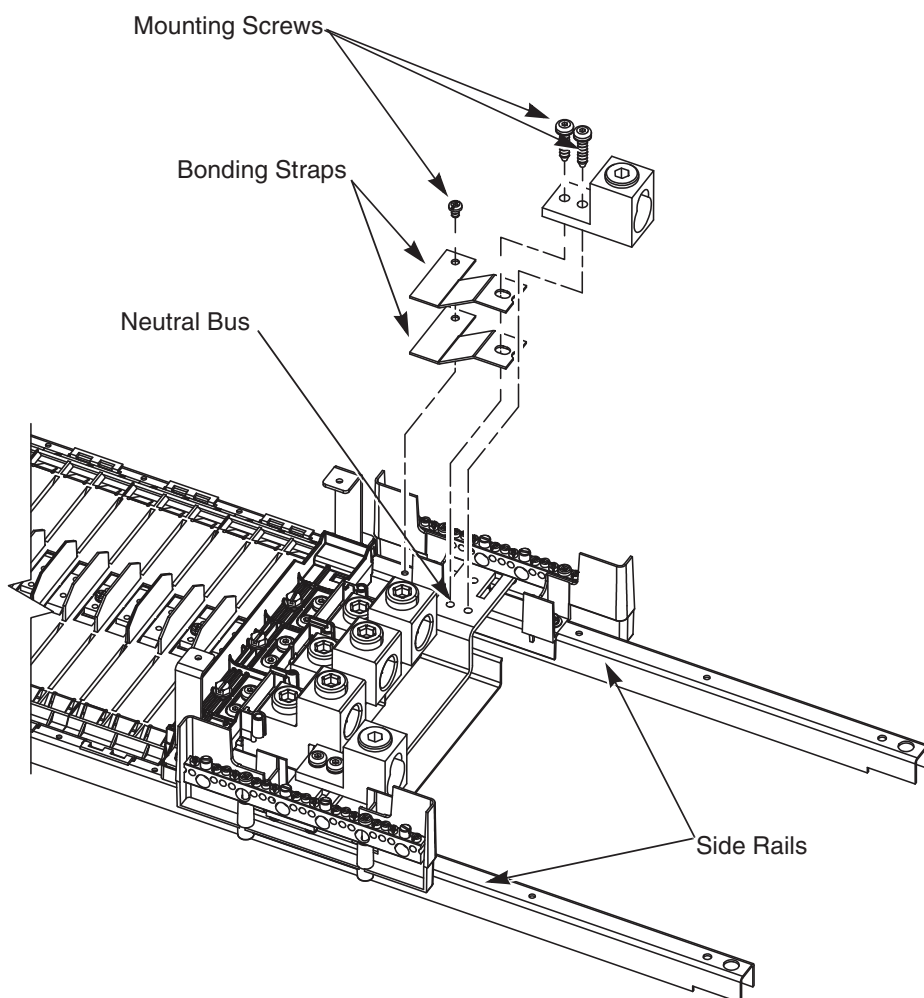
1. Align the two bonding straps on the side rail, as pictured.

NOTE: For some applications, it may be necessary to remove the lug before installing the bonding strap.

2. Insert the three mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the two 1/4-20 screws to 60–65 lb-in (6.8–7.3 N•m).

NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 1 1/8 in. mounting screws. Lug mounting screws are provided in the bonding strap bag assembly.

**Figure 3: Bonding Strap Installation —
400 A or 600 A Maximum NF Panelboards**

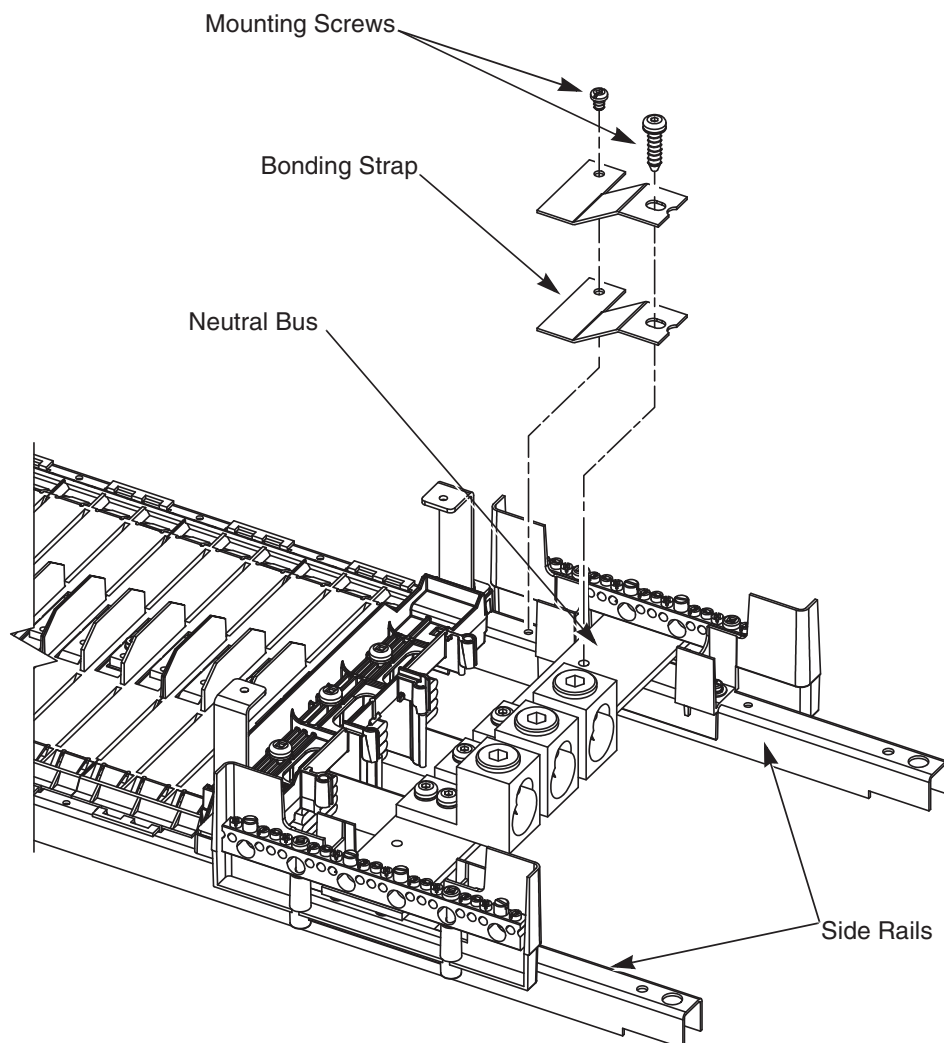


800 A Maximum NF Panelboards

To install a neutral bonding strap on an 800 A maximum NF panelboard, refer to Figure 4 and follow the instructions below.

1. Align the two bonding straps on the side rail, as pictured.
2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 60–65 lb-in (6.8–7.3 N•m).

**Figure 4: Bonding Strap Installation —
800 A Maximum NF Panelboards**



ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

ECB, EDB, EGB, and EJB Circuit Breaker Installation

Refer to Figure 5 on page 16 for the following instructions:

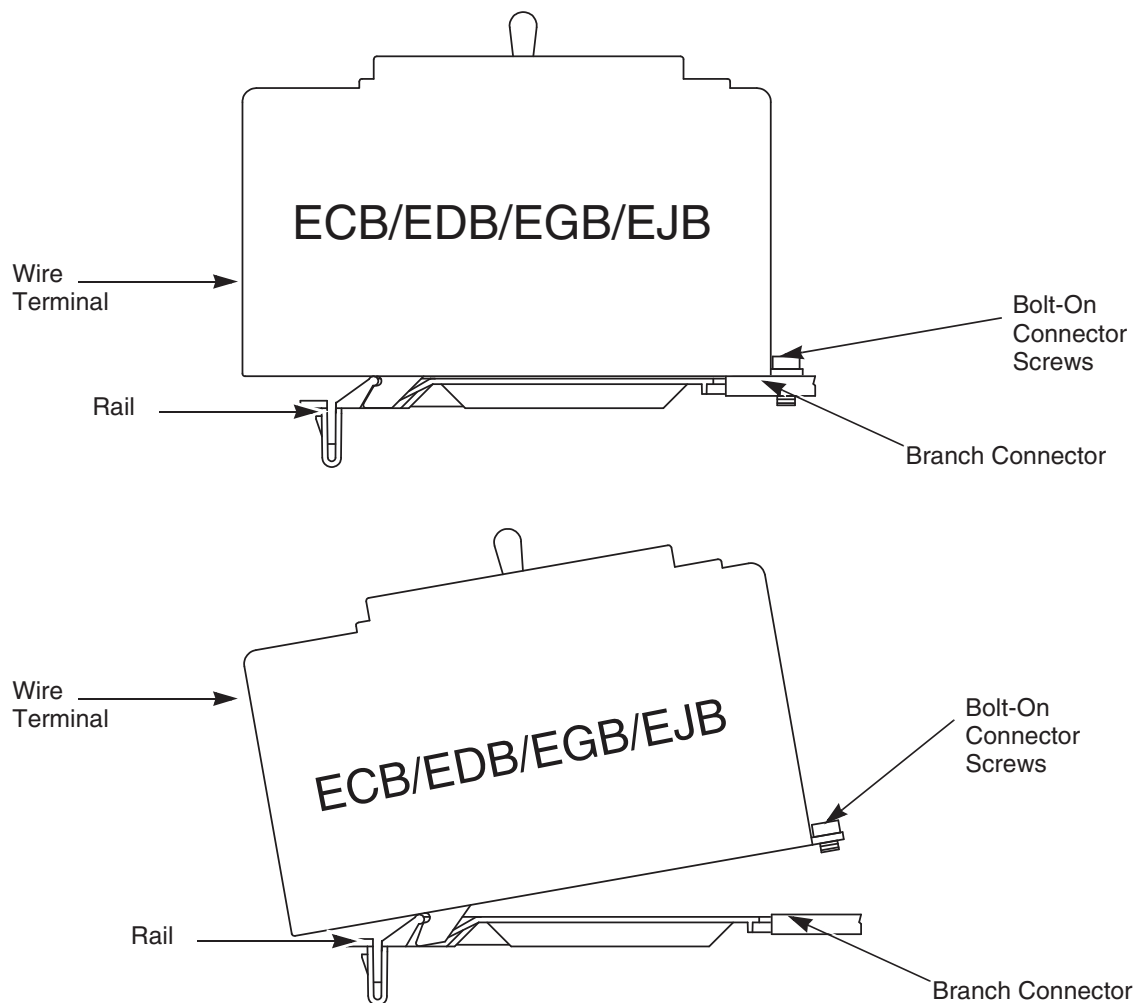
1. Turn off all power to the panelboard.
2. Turn the breaker off.
3. Remove the interior trim.
4. With the bolt-on connector end of the circuit breaker slightly elevated, insert the mounting foot into the slot in the phase cover.
5. Rotate the breaker down and back until the captive screw(s) align with the tapped holes in the breaker connectors.
6. Engage the screws into the branch connector hole and tighten it to 20–30 lb-in (2.3–3.4 N•m).
7. Install the load wire.
8. Reinstall the interior trim.

ECB, EDB, EGB, and EJB Circuit Breaker Removal

Refer to Figure 5 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim.
3. Turn the breaker off.
4. Remove the load wire.
5. Loosen the screw(s) in the breaker connector and lift the breaker off of the panelboard.
6. Reinstall the interior trim.

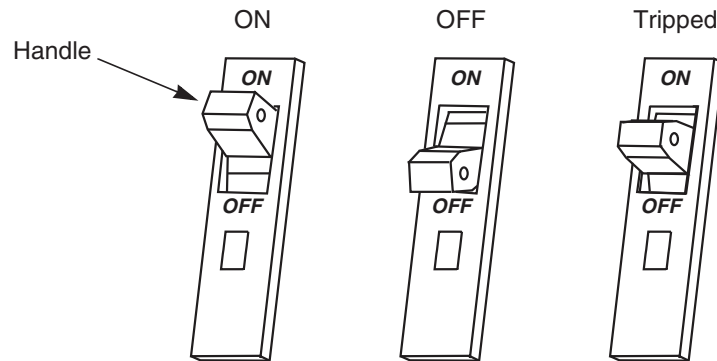
Figure 5: ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal



Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 6: Circuit Breaker Handle Positions



Interior Trim Preparation

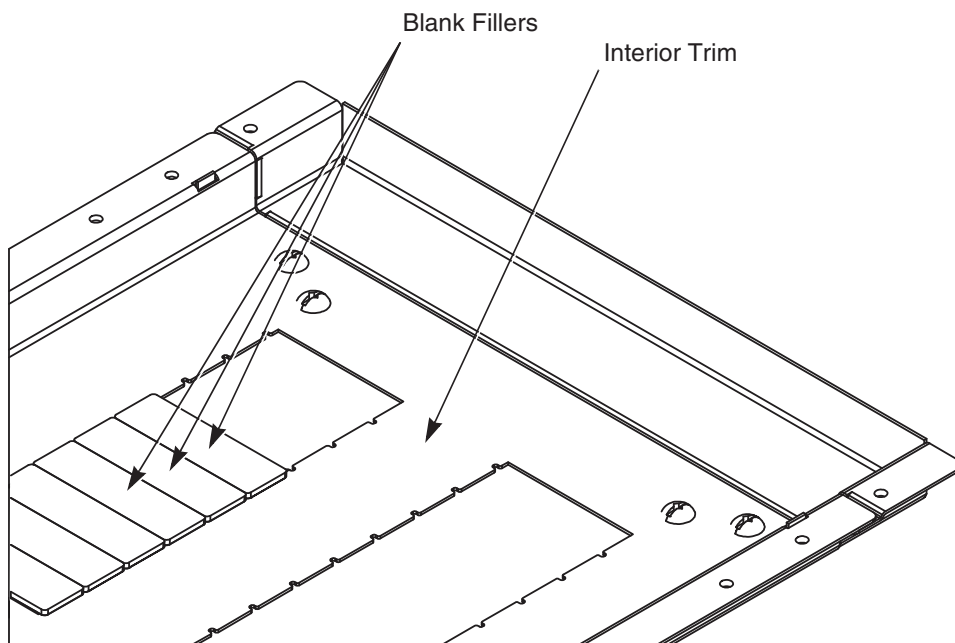
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 7: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

Appendix 1: Specifications

Typical Wiring

NOTE: Do not use on 600 V or 480 V, 3-phase 3-wire delta systems.

Table 1: Panelboard Typical Wiring¹

Voltage AC	1-Phase Panelboards		3-Phase Panelboards	
	Phase	Wires	Phase	Wires
600Y/347	1	3	3	4
480Y/277	1	3	3	4
208Y/120	1	3	3	4
120/240	1	3	—	—
240 ²	1	2	3	3
240	3	3	—	—
240/120 ³	—	—	3	4 Delta

¹ Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

² For this system, the neutral is not used.

³ When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral.

Integral Main or Sub-Feed
(FI, KI, H, J, LA, LC, LH, EDB, EGB, EJB)

Figure 8: NF/NFOM 125–250 A Main Lugs or Main Breaker Diagram

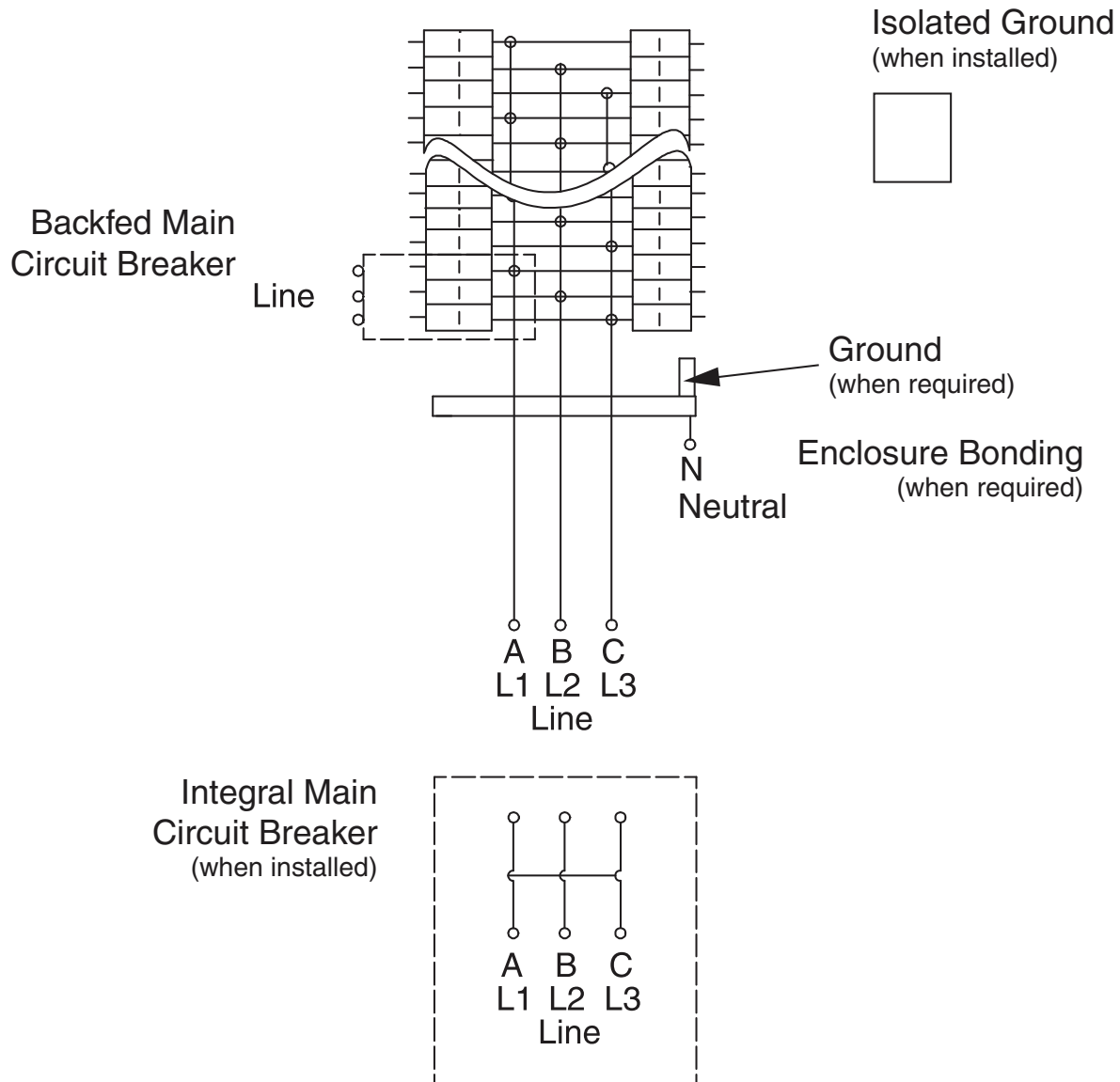


Figure 9: NF 400–800 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram

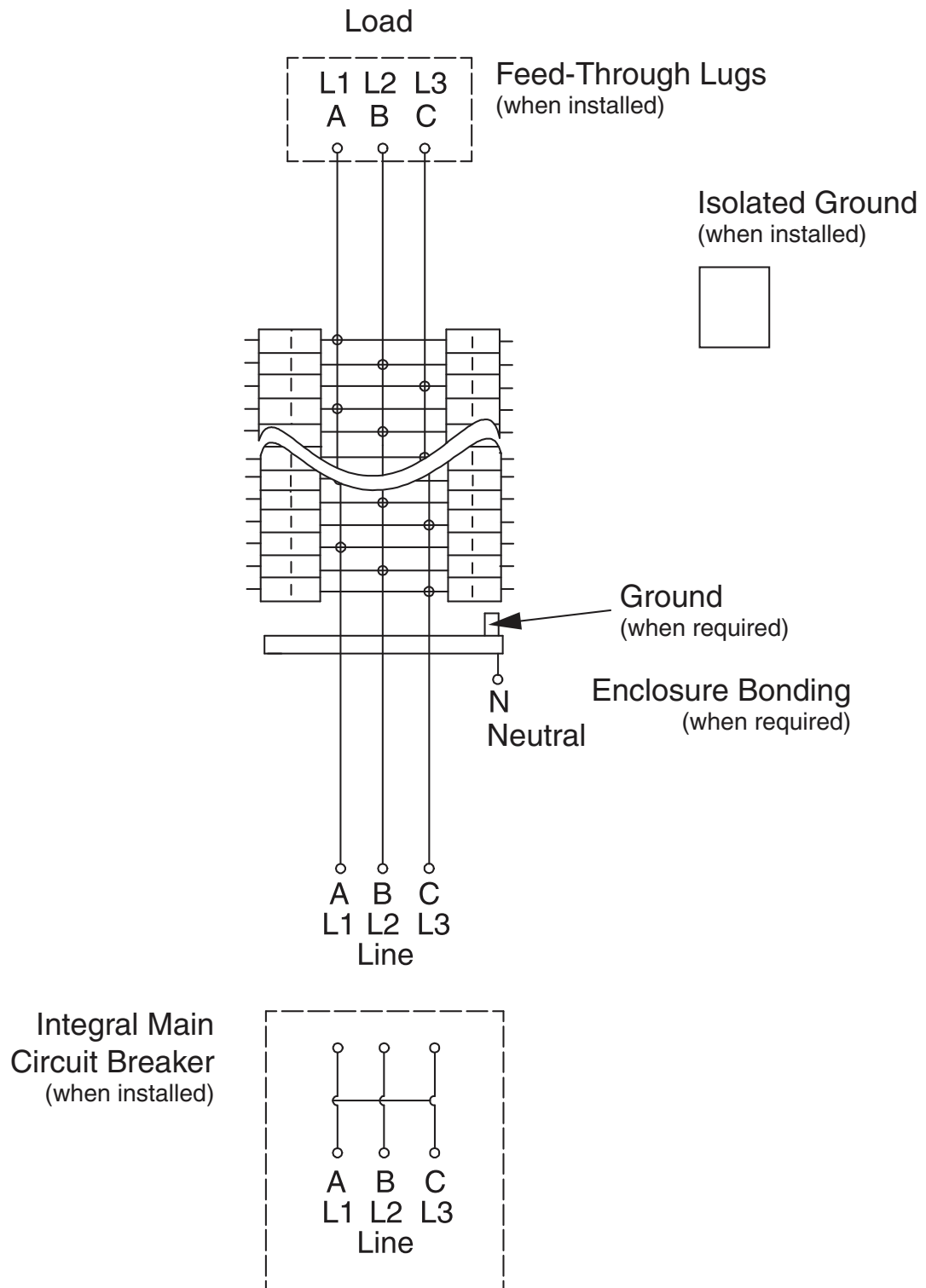


Figure 10: NF 400–800 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram

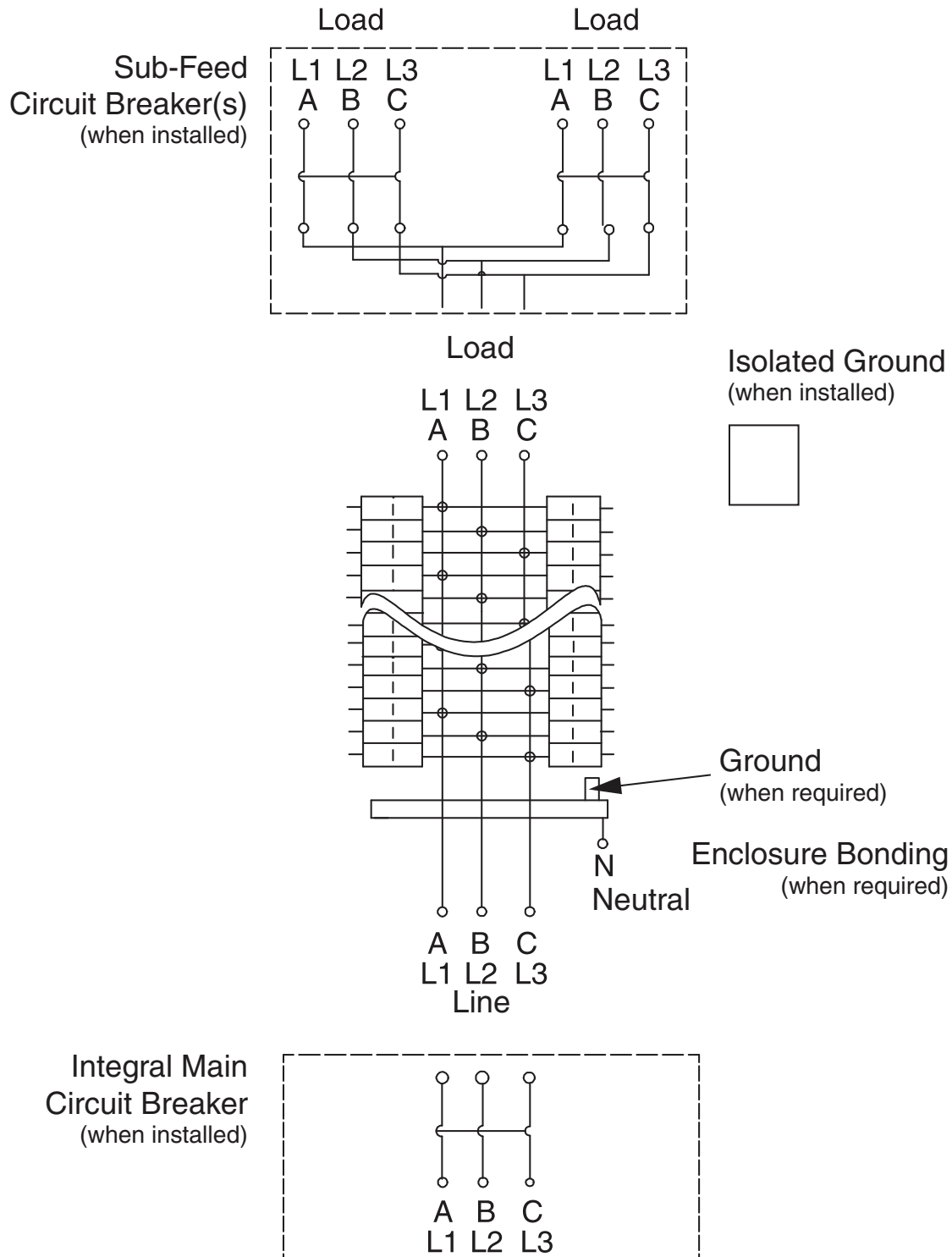
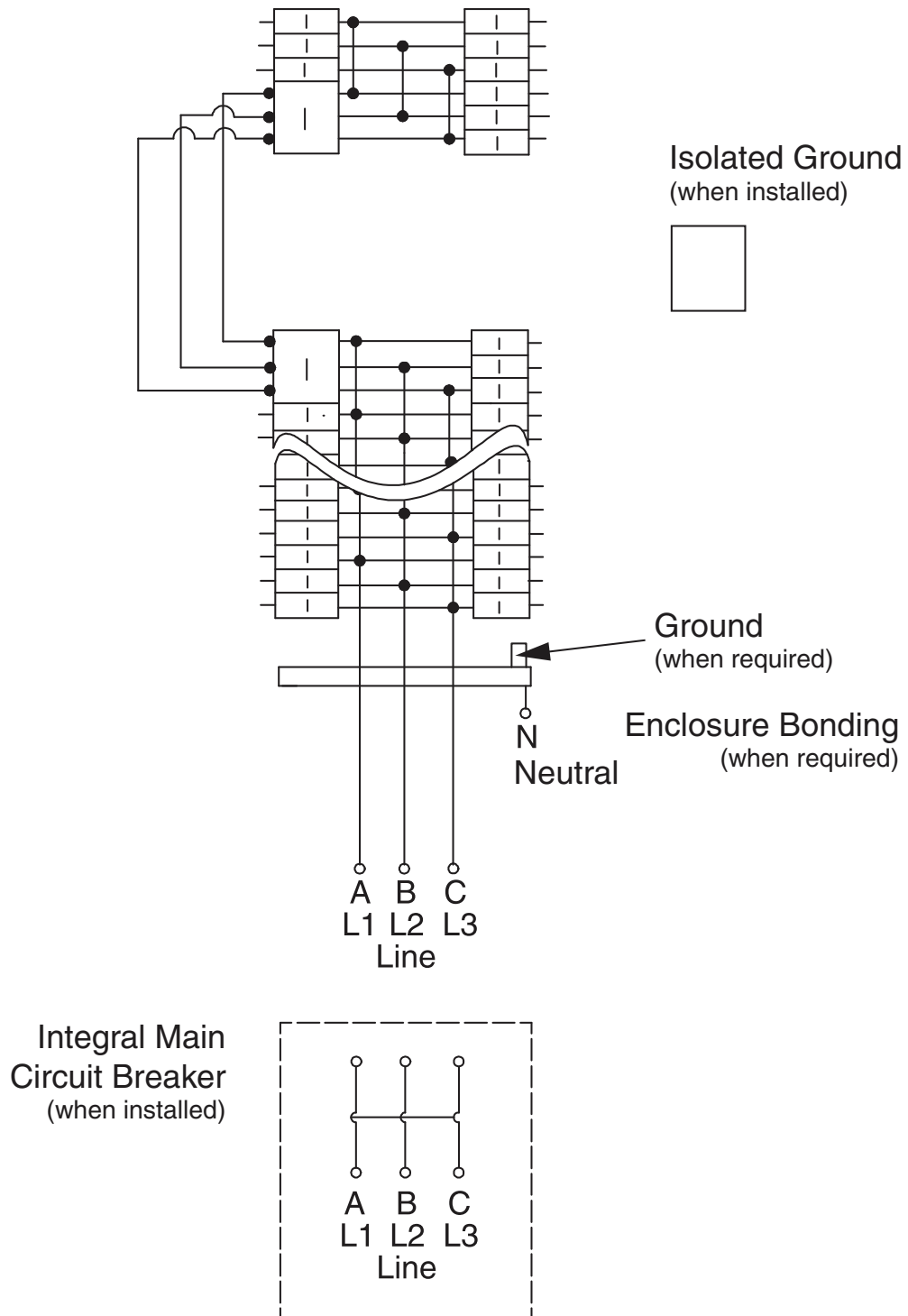


Figure 11: Typical NF Panelboard with Split Bus Diagram



Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information.
The series rated system label is located in the bag assembly.

NOTE: 125 A ED/EG/EJ breakers are 480Y/277 Vac maximum only.

Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC ¹	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges
120 120/240 240	65,000	EG, FH, FG, KH, LH, MH, MX, HG, JG, DG	EDB, EDB-EPD
		EG	ECB-G3
	100,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ	EDB, EDB-EPD, EGB
		DJ	EDB, EGB
		EJ, FC, KC, HJ, JJ	ECB-G3
	125,000	HL, JL	EDB, EDB-EPD, EGB, ECB-G3
	200,000	FI, KI, LI, LXI	EDB, EDB-EPD, EGB, EJB
		FI, KI	ECB-G3
		Class J or T (600 V) 200 A Max Fuses	ECB-G3
277 480Y/277	35,000	EG, FG, KH, LH, HG, JG, DG	EDB, EDB-EPD
		EG, HG, JG	ECB-G3
	65,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ, DJ	EDB, EDB-EPD, EGB
		EJ, FC, KC, HJ, JJ	ECB-G3
	100,000	HL, JL	EDB, EDB-EPD, EGB, EJB
		DL	EDB, EGB, EJB
		400 A Max Fuses	EDB, EDB-EPD, EGB, EJB
	200,000	FI, KI, LI, LXI	EDB, EDB-EPD, EGB, EJB
		FI, KI	ECB-G3
		200 A Max Fuses	EDB, EDB-EPD, EGB, EJB, ECB-G3
600Y/347	18,000	HG, JG, MG	EDB
	25,000	EJ, FI, KH, KI, LC, LE, LX, LI, LXI, HJ, JJ	EDB, EGB
		LH	(15–70 A) EDB, EGB
	35,000	LC, LE, LX	EDB, EGB, EJB
	50,000	HL, JL	EDB, EGB, EJB
	65,000	FI, KI	EDB, EGB, EJB
		LI, LXI	EJB
	200,000	Class J or T (600 V) 200 A Max Fuses	EDB, EGB, EJB

¹ Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

Short Circuit Current Rating for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Main lug interiors equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D device, are rated to 25,000 RMS symmetrical amperes at 600Y/347 Vac maximum for three cycles. Use of one of the Square D circuit breakers of the correct ampere rating, listed as main circuit breakers on page 19, ahead of these lugs will result in a rating equal to that of the circuit breaker.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Use only one wire per phase for incoming circuit breaker connections when the integral LH main circuit breaker is upstream of the feed-through lugs.

Failure to follow these instructions can result in equipment damage.

CE Marking

Interiors with the “CE” mark meet the IEC 60439-1 standard.

Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NF panelboards:

- Equipment Ground Bar Kits, on page 27
- Sub-Feed Lug Kits 125–400 A Panelboards, on page 27
- Main Lug Kits
 - Mechanical Lug Kits — Aluminum, on page 28
 - Mechanical Lug Kits — Copper, on page 28
 - Versa-Crimp[®] Compression Lug Kits — Aluminum, on page 29
 - Versa-Crimp[®] Compression Lug Kits — Copper, on page 29

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NF panelboards.

Table 3: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	Mains Rating	Aluminum ¹	Copper ²
1–42	800 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

¹ Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

² Copper bars suitable for 60° C or 75° C Copper conductors.

Ground bar mounting locations are identified by the ground symbol  stamped into the backwall of the enclosure.

Sub-Feed Lug Kits 125–400 A Panelboards

Sub-Feed main lugs are available for 125, 250, or 400 A applications.

Table 4: Sub-Feed Lugs kits for 125–400 A Panelboard Applications

Main Amps	Kit Catalog Number	Maximum Circuits
125	NF125SFL	18, 30
250	NF250SFL	30, 42, 54, 66, 84
400	NF400SFL	30, 42, 54, 66, 84

Main Lug Kits

Table 5: Mechanical Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range
125	Standard	#6–350 kcmil 13.3–177.3 mm ²
250	Standard	
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm ² (2) 53.48–177.3 mm ²
600	Standard	(2) 1/0–750 kcmil (2) 53.48–380 mm ²
800	Standard	(3) 1/0–750 kcmil (3) 53.48–380 mm ²

Table 6: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
125	NFCUM1	#6–350 kcmil 13.3–177.3 mm ²
250	NFCUM2	
400	NFCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm ² (2) 53.48–177.3 mm ²
600	NFCUM6	(2) 1/0–750 kcmil (2) 53.48–380 mm ²

Table 7: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFALV1	#4–300 kcmil 21.15–152 mm ²	VC6
250	NFALV2	250–350 kcmil 126.7–177.3 mm ²	
400	NFALV4	(2) 2/0–500 kcmil	
600	NFALV6	(2) 67.43–253.4 mm ²	

Table 8: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFCUV1	#6–1/0 kcmil 13.30–53.48 mm ²	VC6-3
250	NFCUV2	(1) 2/0–300 kcmil (1) 67.43–152 mm ²	VC6-FT, VC7, VC7-FT, VC8
400	NFCUV4	(1) 400–750 kcmil (1) 202.7–380 mm ²	
600	NFCUV6	(2) 250–500 kcmil (2) 126.7–253.4 mm ²	VC6 Series

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www.us.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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07/2010

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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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NQ/NQM Panelboards and QONQ Load Centers

Information Manual

Class 1640

ENGLISH

Instruction Bulletin

80043-712-06 Rev. 01

02/2015

Retain for future use.



by **Schneider** Electric

Hazard Categories and Special Symbols



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand NQ circuit breaker panelboards and QONQ load centers. These panelboards and load centers are Underwriters Laboratories (cULus) listed and accept QO™ and QOB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is OFF.
- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Installation

This section provides instructions for the following NQ panelboard and QONQ load center procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 6
- “Neutral Bonding Strap/Cable Installation” on page 9
- “QO and QOB Circuit Breaker Installation and Removal” on page 12
- “Circuit Breaker Reset Instructions” on page 15
- “Interior Trim Preparation” on page 16

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EQUIPMENT DAMAGE DUE TO LOOSE CONNECTIONS

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NQ panelboard or QONQ load center interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either ““Surface Mounting (Enclosure Mounted on Wall)” on page 7” or ““Flush Mounting (Enclosure Recessed in Wall)” on page 7.”

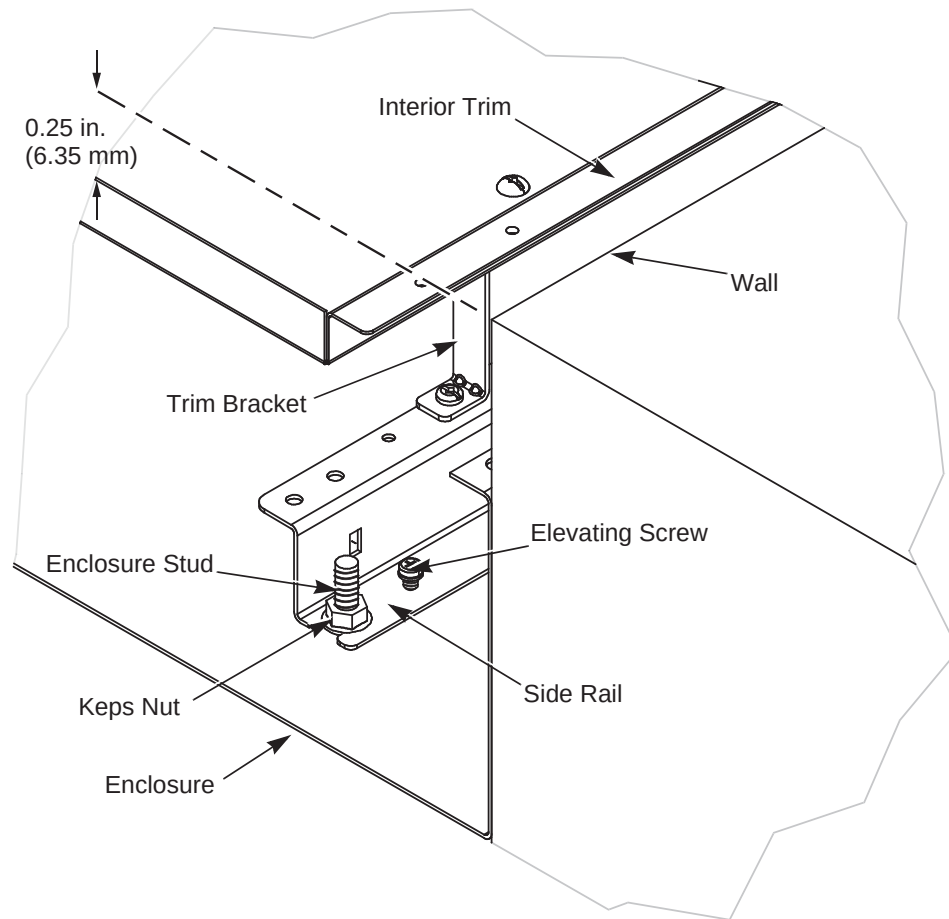
Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Set the interior on the enclosure studs. An elevating screw is not required (See Figure 1 on 8).
 - b. Tighten the keps nuts against the interior side rails until the rails are against the back of the enclosure.
 - c. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
 - a. Thread the (4) 10-32 x .875 in. self-tapping, elevating screws provided with the flush trim into the side rails.
 - b. Set the interior on the enclosure studs (see Figure 1 on 8). Place the keps nuts onto the enclosure studs, but do not tighten.
 - c. Adjust the screws so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
 - d. Tighten the keps nuts against the side rails.
 - e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Figure 1: Interior Mounting of Square D Brand Enclosures



Neutral Bonding Strap/Cable Installation

The neutral bonding strap/cable should be used only when the panelboard is **installed** as service entrance equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “100 or 250 A Maximum NQ Panelboards” or “400 or 600 A Maximum NQ Panelboards and QONQ Load Centers” below and on page 11, respectively.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- The main bonding strap/cable should be used only when the panelboard is installed as service entrance equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap/cable parts are found in the bag assembly provided with the interior.

100 or 250 A Maximum NQ Panelboards

To install a neutral bonding strap on a 100 or 250 A maximum NQ panelboard, refer to Figure 2 and follow the instructions below.

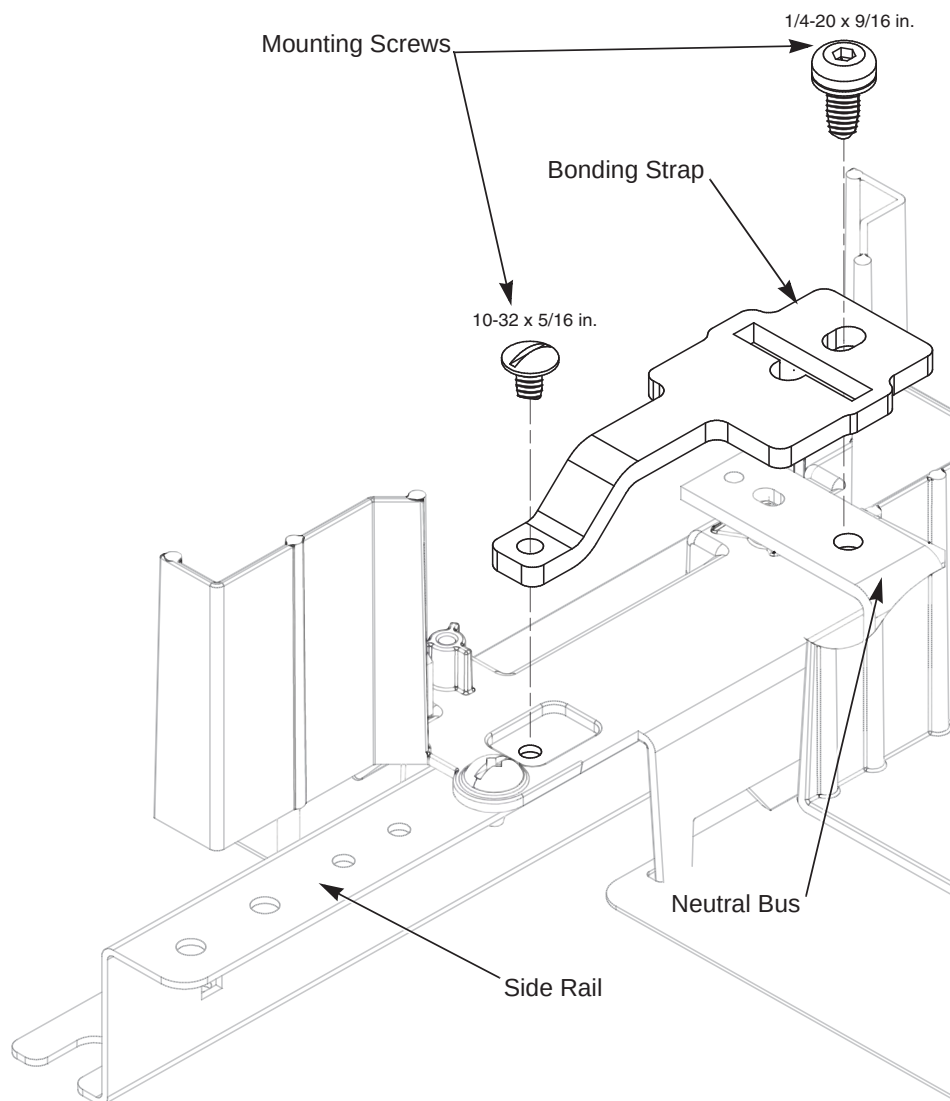
1. Align the bonding strap on the side rail, as pictured.

NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 to 25–30 lb-in (2.8–3.4 N•m).

NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 11/16 in. mounting screw with feed-through lug, sub-feed lug, sub-feed breaker, or 200% neutral applications. Use the 1/4-20 x 7/8 in. lug mounting screw with 200% neutral on 225 A applications with feed-through lug, sub-feed lug, or sub-feed circuit breaker applications. Lug mounting screws are provided in the bonding strap bag assembly.

**Figure 2: Bonding Strap Installation —
100 or 250 A Maximum NQ Panelboards**

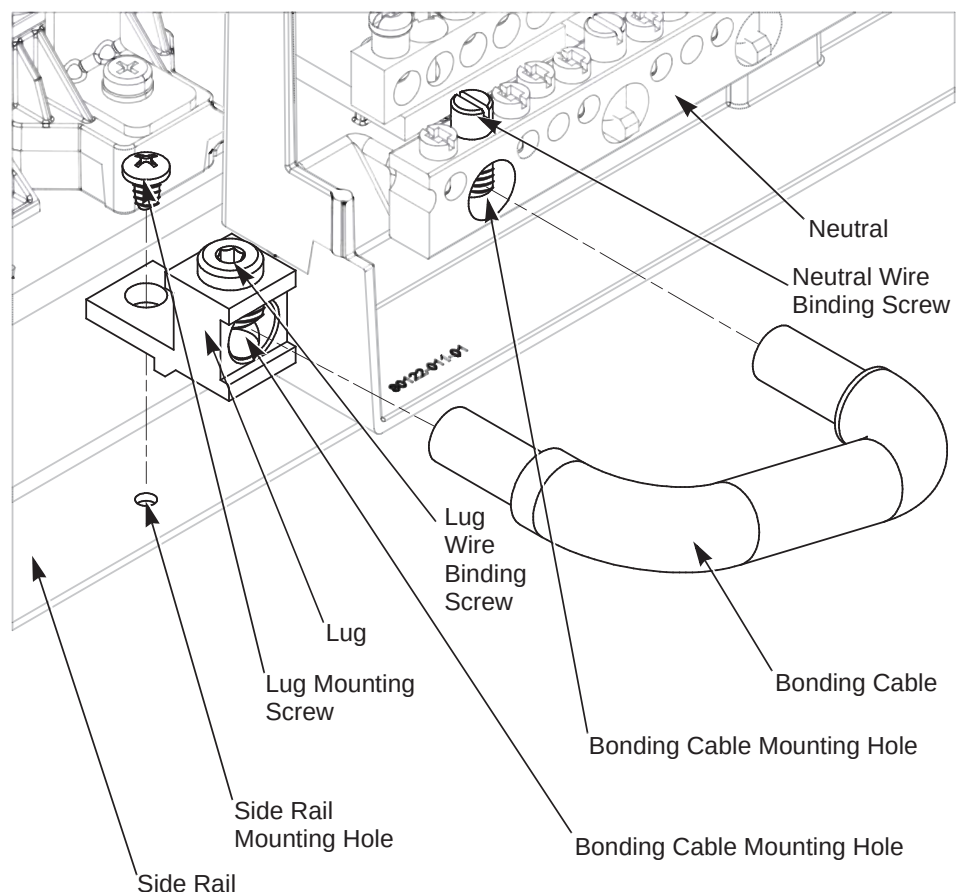


400 or 600 A Maximum NQ Panelboards and QONQ Load Centers

To install a neutral bonding cable on a 400 or 600 A maximum NQ panelboard and QONQ load center, refer to Figure 3 and follow the instructions below.

1. Align the lug on the side rail mounting hole, as pictured.
2. Tighten the lug mounting screw against the side rail to 10–12 lb-in (1.1–1.4 N•m).
3. Align the bonding cable, as pictured, and insert it into the lug and neutral mounting holes.
4. Tighten both the lug wire binding screw and the neutral wire binding screw to 45–50 lb-in (5.1–5.6 N•m).

Figure 3: Bonding Cable Installation — 400 or 600 A Maximum NQ Panelboards and QONQ Load Centers



QO and QOB Circuit Breaker Installation and Removal

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is OFF.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

QO and QOB Breaker Installation

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Turn the breaker OFF.
3. Remove the interior trim.
4. Snap the wire terminal end of the circuit breaker onto the mounting rail.
5. Engage the branch connector.

For QO Circuit Breakers:

- a. Push inward until the plug-on jaws fully engage the branch connector.

For QOB Circuit Breakers:

- a. Push inward until the breaker connector is centered on the branch connector mounting hole. Engage the screw into the branch connector hole and tighten it to the torque values shown on the interior wiring and torque diagram.

6. Install the load wire.
7. Reinstall the interior trim.

QO and QOB Breaker Removal

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Remove the interior trim.
3. Remove the load wire.
4. Disengage the branch connector.

For QO Circuit Breakers:

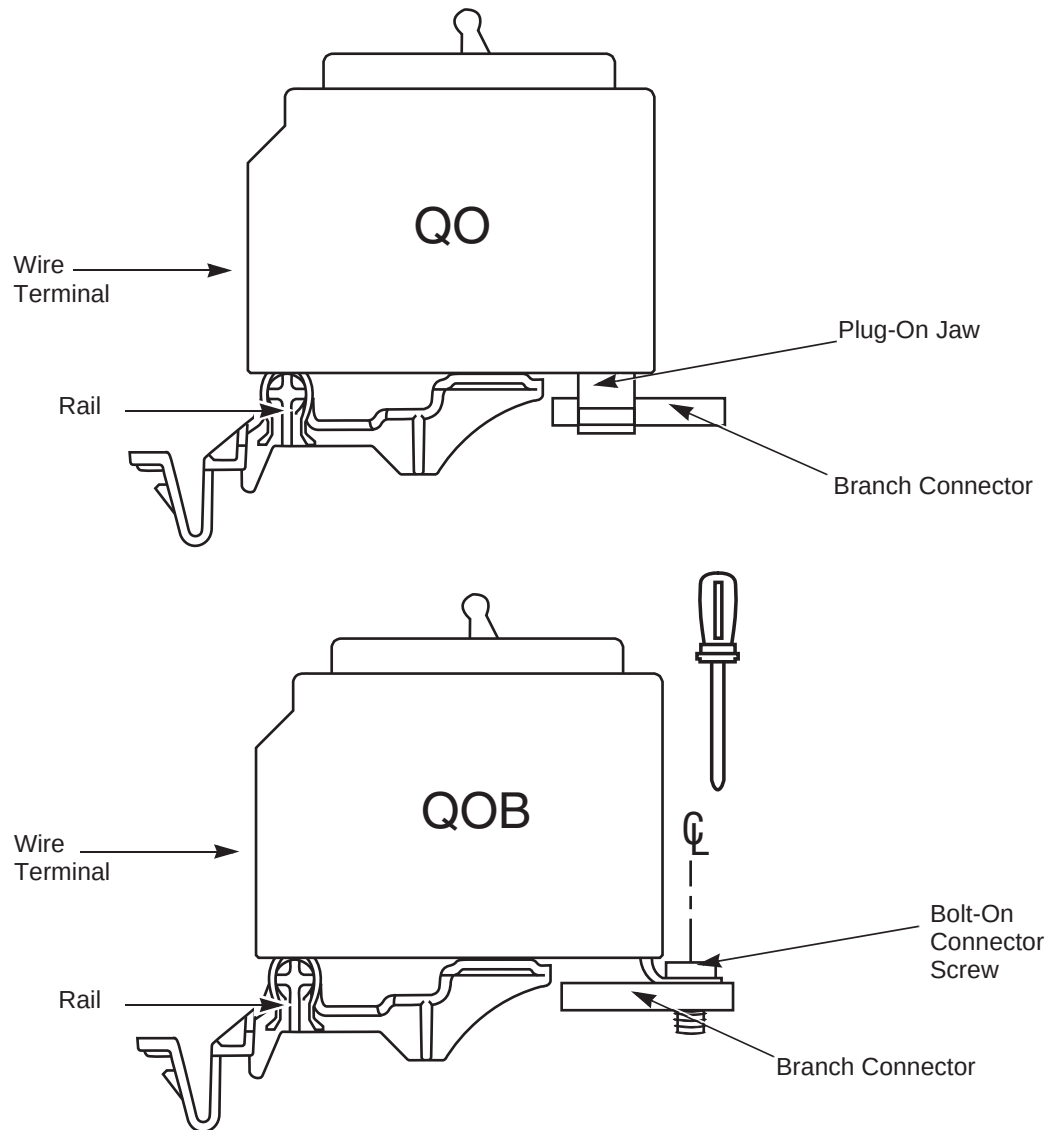
- a. Pull outward until the plug-on jaws fully disengage the branch connector.

For QOB Circuit Breakers:

- a. Loosen the screw in the breaker connector and pull the breaker off of the branch connector.

5. Snap the wire terminal end of the circuit breaker off of the mounting rail.
6. Reinstall the interior trim.

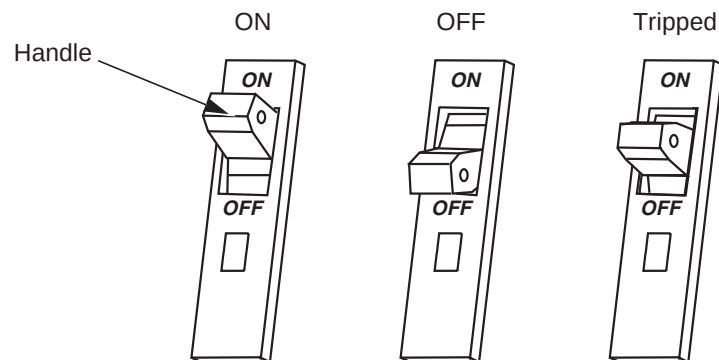
Figure 4: QO and QOB Circuit Breaker Installation and Removal



Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



Interior Trim Preparation

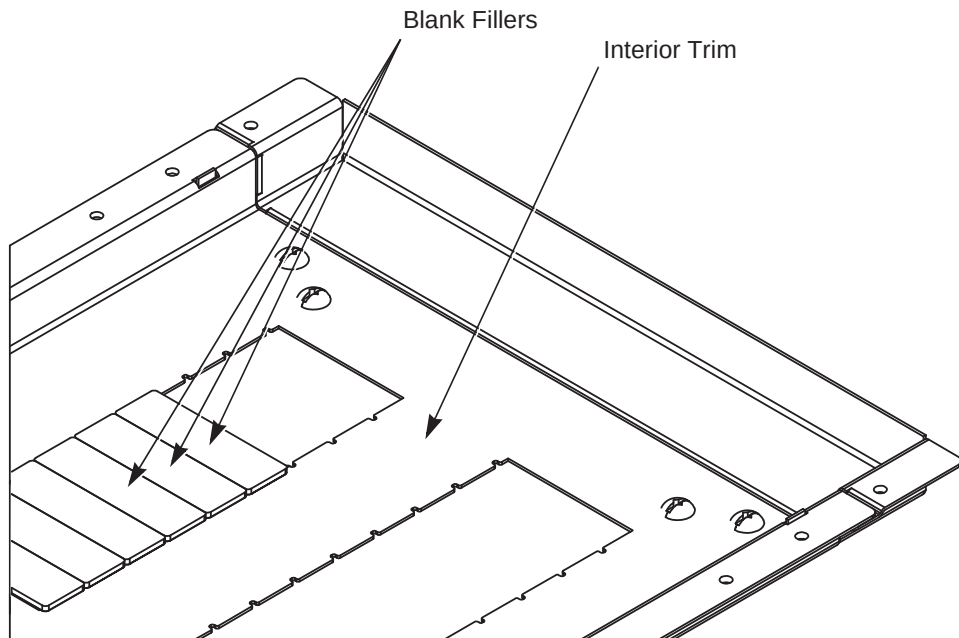
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 6: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

Appendix 1: Specifications

Typical Wiring

Table 1: Panelboard Typical Wiring¹

Voltage AC	1-Phase Panelboards		3-Phase Panelboards	
	Phase	Wires	Phase	Wires
208Y/120	—	—	3	4
120/240	1	3	—	—
240 ²	1	2	3	3
240 ³	1	3	—	—
240/120 ⁴	—	—	3	4 Delta

¹ Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

² For this system, the neutral is not used and only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

³ For a grounded “B” phase system, only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

⁴ When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum. Do not use circuit breakers rated 120 V or 120/240 V to “B” phase.

Integral Main or Sub-Feed:

DJ, FI, KI, H, J, LA, LC, LH, QB, QD, QG, QJ, QO(B)VH

Figure 7: NQ/NQM 100–225 A Main Lugs or 100–250 A Main Breaker Diagram

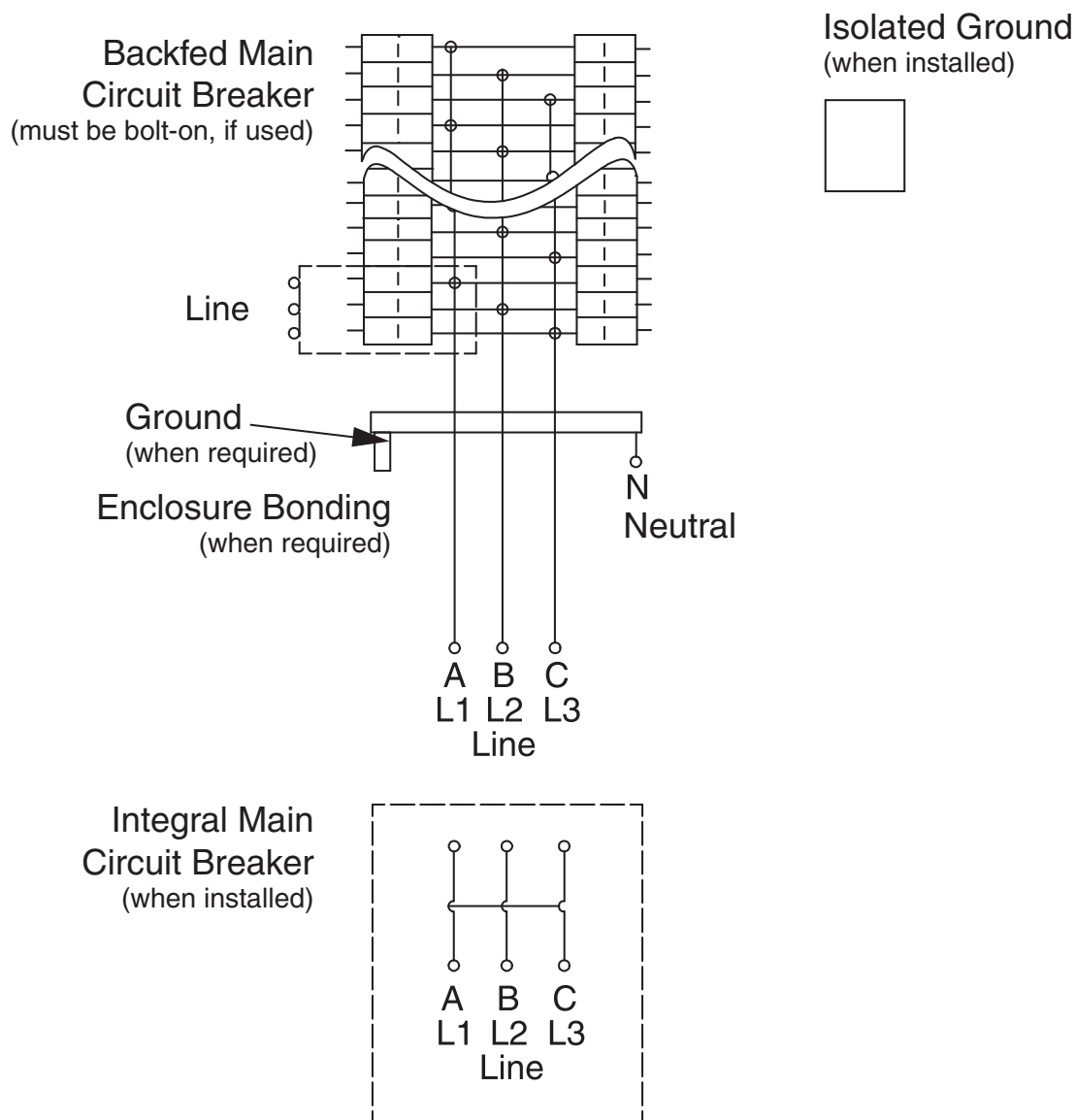


Figure 8: NQ Panelboard or QONQ Load Center 400–600 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram

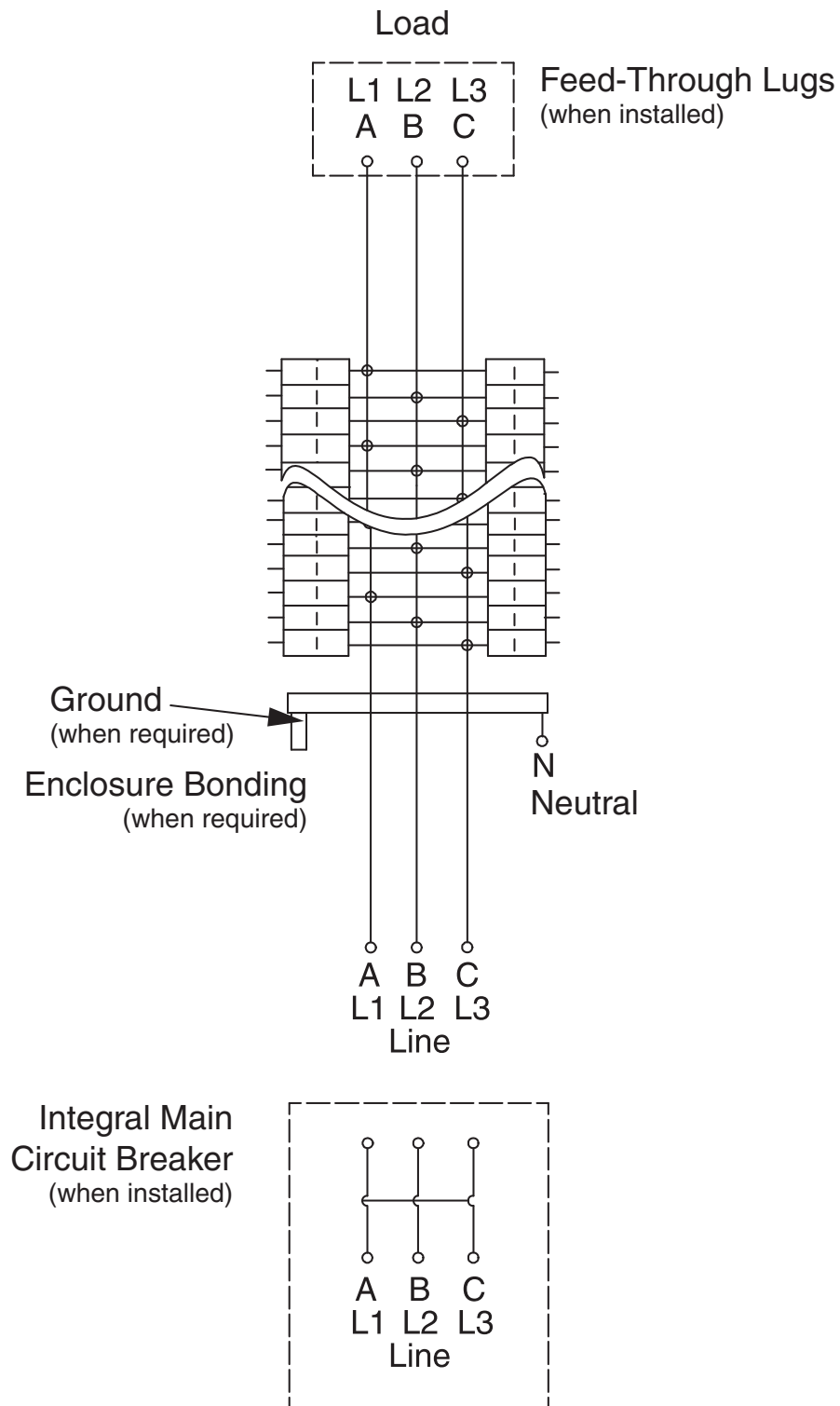


Figure 9: NQ Panelboard or QONQ Load Center 400–600 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram

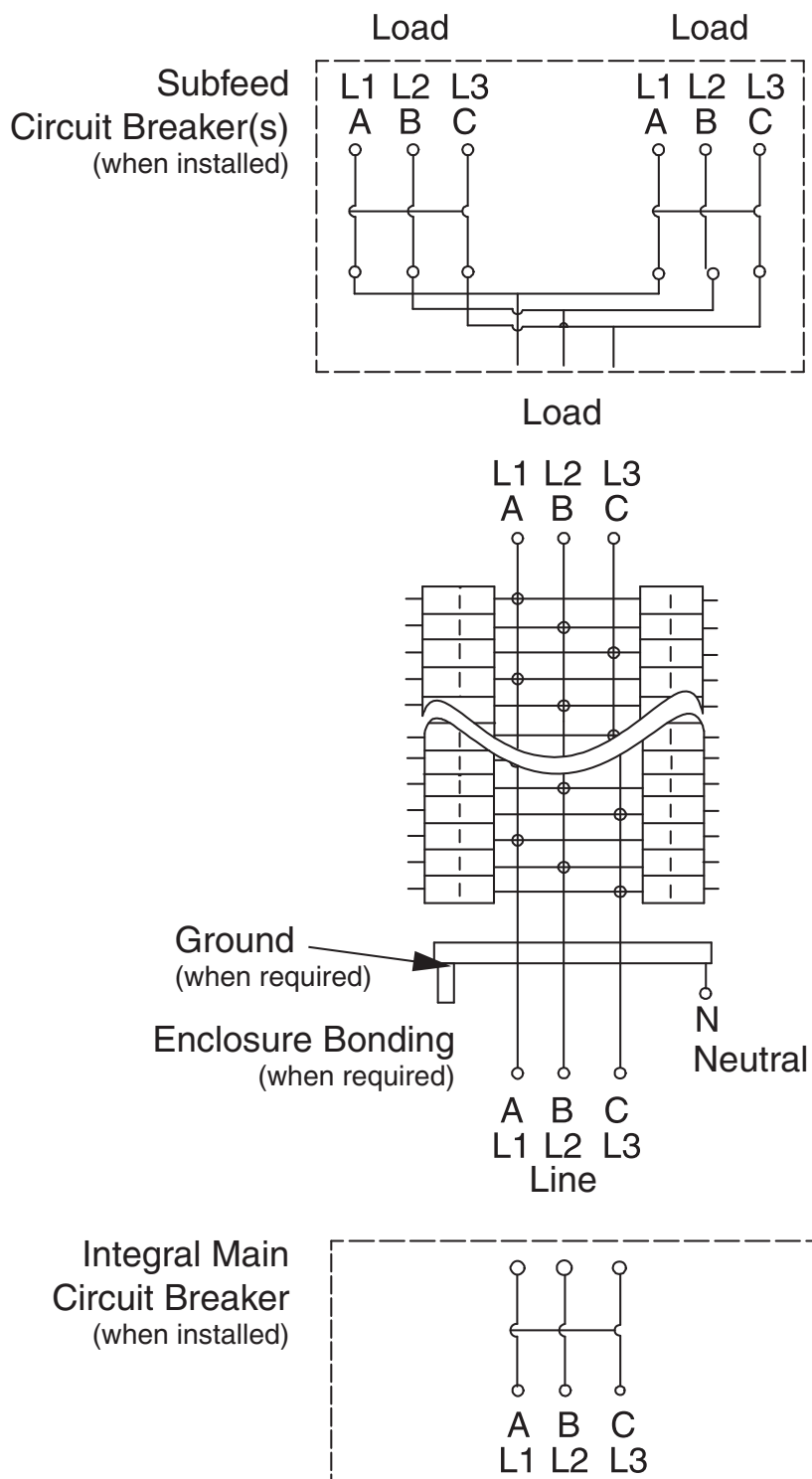
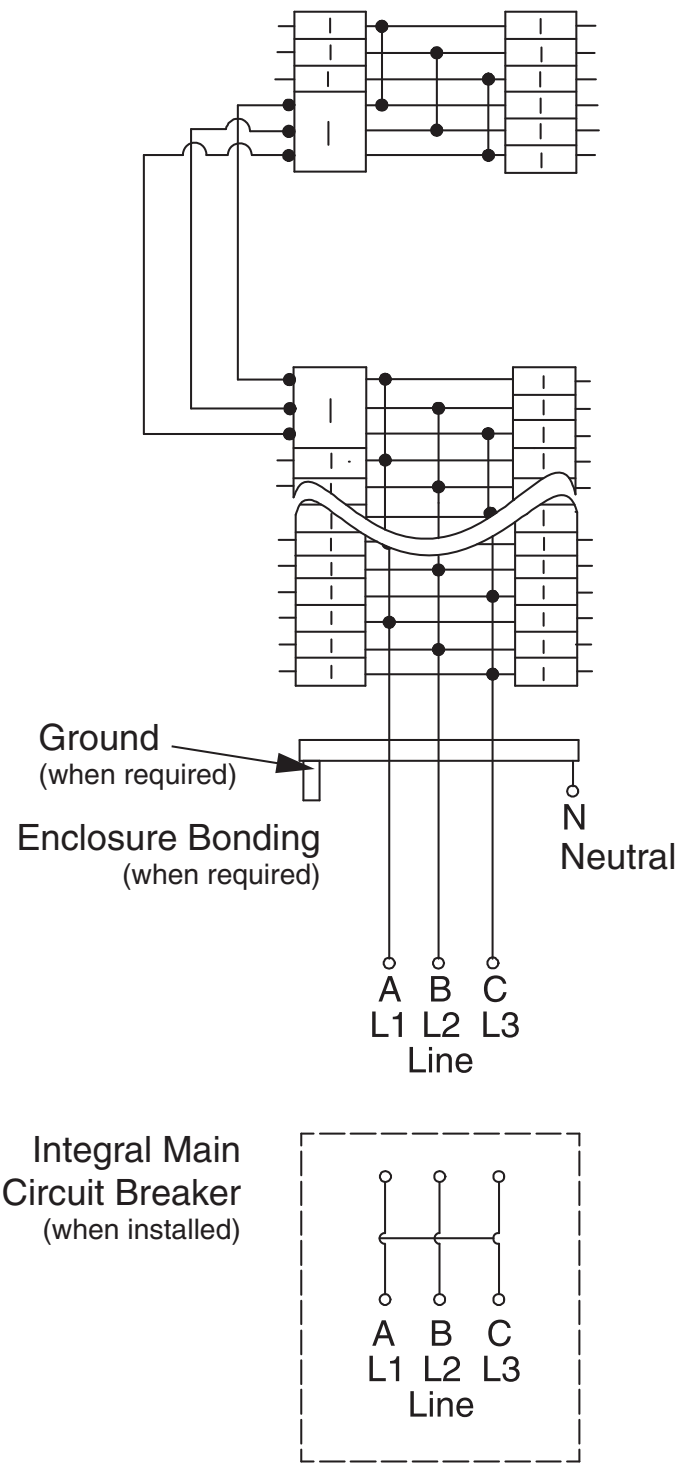


Figure 10: Typical NQ Panelboard with Split Bus Diagram



Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information. The series rated system label is located in the bag assembly.

Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	22,000	MG	QO (B)	15–30 A	—	—
	25,000	LD, HD, JD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	65,000	HG, JG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	—
	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	100,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	150 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	—
			QO (B) AS	15–30 A	15–30 A	—
			QO (B) VH	—	150 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
208Y/120 3P/4W	18,000	LA/LH (L) 34200MC	QO (B)	15–30 A	15–30 A	15–30 A
		LA/LH (L) 34225MC				
		LA/LH (L) 34250MC				
		LA/LH (L) 34400MC				

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	30,000	DJ-W 150 A MC ⁷	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 250 A MC ⁷	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 600 A MC ⁷	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges 3, 4, 5, 6			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	65,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LL	QO (B) GFI	—	—	15–30 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	15–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	22,000	QO (B) VH	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	25,000	QD	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		ED, FD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		KD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) AS	15–30 A	15–30 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		HD, JD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges 3, 4, 5, 6			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	42,000	LA, MA	Q2L-H	—	100–225 A	100–225 A
			QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B)	15–70 A	15–70 A	—
			QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		MG	QO (B) VH	15–30 A	15–30 A	15–30 A
			QO (B)	15–30 A	15–30 A	—
		LC 400 A	QO (B) VH	15–30 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	DJ_W	QO (B)	15–70 A	15–150 A	—
			QO (B)-VH	—	110–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
		EG, FG, KG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QG	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		HG, JG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		FC_ or KC_22_	QO (B)	15–70 A	15–100 A	15–100 A
			QO (B) AS	15–30 A	15–30 A	15–30 A

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges 3, 4, 5, 6			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_ or KC_22____ FC_ or KC_34____	QO (B) GFI	15–30 A	15–30 A	—
			QO (B) AFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		EJ	QO (B)	15–70 A	15–125 A	15–100 A
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	FI, KI, HR, JR	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
240 3P/3W or 240 1P/2W (two pole only)	22,000	QO (B) VH	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
			QO (B) PL	—	15–30 A	—
		Q2-H	QO (B)	—	—	15–30 A

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	25,000	QD	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) PL	—	15–60 A	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) GFI	—	—	15–50 A
		ED, FD	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
		KD	QO (B)	—	—	15–100 A
		HD, JD	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	—	15–50 A
	25,000	LD	QO (B) VH	—	—	15–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	42,000	LA, MA	QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–100 A
		MG	QO (B) VH	—	—	150 A
	65,000	LC 400 A	QO (B) VH	—	—	15–100 A
			QO (B) VH	—	—	15–30 A
		DJ 400 A	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		EG, FG, KG	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	65,000	QG	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		QG, HG, JG	QO (B) PL	—	—	15–30 A
		HG, JG	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		FC_or KC_22____ FC_or KC_34____	QO (B)	—	—	15–100 A
			QO (B) AS	—	15–30 A	15–30 A
		LG	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LJ	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_or KC_24____ FC_or KC_34____	QO (B) GFI	—	15–30 A	—
		DJ 400 A				
		DJ 400 A	QO (B) H	—	15–100 A	—
	100,000	EJ, FJ	QO (B)	—	—	15–100 A
		LJ	QO (B) VH	—	—	15–100 A
			QO (B) H	—	15–100 A	—
		HJ, JJ	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	125,000	HL, JL	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	200,000	FI, KI, HR, JR	QO (B)	—	—	15–100 A
120/240 1P/3W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–70 A	15–125 A	—
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
208Y/120 3P/4W	200,000	200 A Max. Class T6, J Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	—	—	15–50 A
			QO (B) EPD	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–30 A	15–125 A	—
	50,000	400 A Max. Class T3 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–125 A	—
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) AFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
			QOT	15–30 A	15–30 A	—
	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) (continued)

Max. System Voltage AC ^{1, 2}	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges ^{3, 4, 5, 6}			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	50,000	400 A Max. Class J or T6 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	—	—	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T6 Fuses	QO (B) VH	—	—	15–150 A
			QOB VH 1φ, 2W only	—	150 A	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	15–30 A
240 3P/3W or 240 1P/2W (two pole only)	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A

¹ For shown circuit breakers rated less than this maximum voltage, the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

² Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

³ Suffixes HID, SWD, and SWN may also be applied to the applicable branch circuit breakers shown above. Suffix SWN may **not** be applied in combination with LC main breakers.

⁴ Where QO (B) circuit breakers are shown above, QO (B) H, QO (B) VH, and QH (B) circuit breakers may also be used.

⁵ Where QO (B) GFI circuit breakers are shown above, QO (B) EPD and/or QO (B) EPE circuit breakers may also be used. QO-EPE only comes in 3 pole construction.

⁶ Where QO (B) AFI circuit breakers are shown above, QO (B) CAFI circuit breakers may also be used.

⁷ To achieve selective coordination, the rating of the DJ main circuit breaker must be at least two times greater than the ampere rating of any branch circuit breaker.

Table 3: NQ Panel Mission Critical Breaker Selectivity

Maximum SCCR (RMS Symmetrical)	Integral or Remote Main Circuit Breakers	Branch Circuit Breakers			
		Type	1-pole	2-pole	3-pole
Fully Rated and Selective to 10kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A L-W, 250 A	QO(B)	10–70	10–125	10–125
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 12kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–70	10–125	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 15kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–60	10–60	10–30
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 18kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–30	10–30	—
		QO(B)-H			
		QO(B)-VH			
		QH			
	L-W, 250 A	QO(B)	10–60	10–60	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 30kA at 208Y/120 Vac or at 240/120 Vac	L-W, 400 A L-W, 600 A	QO(B)	15–70	15–150	15–150
		QO(B)-H			
		QO(B)-VH			
		QH			

Including AFI, CAFI, EPD and GFI Circuit Breakers

Table 4: Short Circuit Current Rating¹ for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Maximum System Voltage AC	Maximum Current Rating	Branch Circuits	Application	Adder ²	Maximum Short Circuit Current Rating ³
240	100	18, 30	SFL and FTL	—	10,000
	225	30, 42, 54, 72, 84	SFL	6 inches (152.4 mm)	
		42	FTL	—	
		30, 54, 72, 84		6 inches (152.4 mm)	
	400	30, 42, 54, 72, 84	SFL	—	25,000
		30, 84	FTL	—	
		42, 54, 72		6 inches (152.4 mm)	
		30, 42, 54, 72, 84	FTL	12 inches (304.8 mm)	

¹ This rating applies to main lug interiors, equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D brand device. Use of a Square D brand main circuit breaker ahead of these lugs will result in a rating equal to the rating of the breaker. Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

² The adder is the additional length of the enclosure.

³ RMS symmetrical amperes, for three cycles.

CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards.

Main lug interiors with the "CE" mark have been tested to withstand 10,000 RMS symmetrical amperes for 30 cycles.

Interiors with the "CE" mark are only approved for use with QOXD or QOBXD branch circuit breakers which carry the "CE" mark.

Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NQ panelboards:

- Equipment Ground Bar Kits
- Oversized Lug Kits for 100–250 A Panelboards
- Sub-Feed Lug Kits for 100–400 A Panelboards
- Main Lug Kits
 - Mechanical Lug Kits—Aluminum
 - Mechanical Lug Kits—Copper
 - Versa-Crimp® Compression Lug Kits—Aluminum
 - Versa-Crimp Compression Lug Kits—Copper

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NQ panelboards and QONQ load centers.

Table 5: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	Mains Rating	Aluminum ¹	Copper ²
1–42	600 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

¹ Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

² Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol  stamped into the backwall of the enclosure.

Oversized Lug Kits for 100–250 A Panelboards

Oversized lug kits are available for applications where termination conductors of 3 AWG or larger are required for the neutral.

Table 6: Oversized Lug Kits for 100–250 A Panelboards Specifications

Circuit Breaker Rating	Kit Catalog Number	Wire Range
70 A	QO70AN	(1) 10–2 Al ([1] 5.76–33.6 mm ²) (1) 14–4 Cu ([1] 2.08–21.1 mm ²)
80–125 A	Q1100AN	(1) 4–1/0 Al/Cu ([1] 42.4–53.5 mm ²)
125–150 A	Q1150AN	(1) 1–4/0 Al/Cu ([1] 42.4–107 mm ²)

Sub-Feed Lug Kits for 100–400 A Panelboards

Sub-feed main lugs are available for 100, 225, or 400 A applications.

Table 7: Sub-Feed Lug Kits for 100–400 A Panelboards Specifications

Main Amps	Kit Catalog Number	Maximum Circuits
100	NQSFL1	18, 30
225	NQSFL2	30 ¹ , 42 ¹ , 54 ¹ , 72 ¹ , 84 ¹
400	NQSFL4	30, 42, 54, 72, 84

¹ These panels require an additional 6 inches (152.4 mm) for the box and trim, for proper wire bending space.

Main Lug Kits**Table 8: Mechanical Lug Kits — Aluminum**

Panelboard Amps	Kit Catalog Number	Wire Range
100	Standard	#6–2/0 AWG (13.3–67.43 mm ²)
225	Standard	#6–350 kcmil (13.3–177.3 mm ²)
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm ²) ([2] 53.48–177.3 mm ²)
600	Standard	(2) 1/0–750 kcmil ([2] 53.48–380 mm ²)
	NQALM6A	(3) #6–250 kcmil ([3] 13.3–127 mm ²)

Table 9: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
100	NQCUM1	#6–2/0 AWG (13.3–67.43 mm ²)
225	NQCUM2	#6–250 kcmil (13.3–127 mm ²)
400	NQCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm ²) ([2] 53.48–177.3 mm ²)
600	NQCUM6	

Table 10: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQALV1	#8–1/0 AWG (8.36–53.48 mm ²)	VC6 (All)
225	NQALV2	#4–300 kcmil (21.15–152 mm ²)	
400	NQALV4	(2) 2/0–500 kcmil ([2] 67.43–253.4 mm ²)	VC6-3, VC6-FT
600	NQALV6		

Table 11: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQCUV1	#6–1/0 AWG (13.30–53.48 mm ²)	VC6 (All), VC7 (All)
225	NQCUV2	2/0–300 kcmil (67.43–152 mm ²)	VC6-3, VC7, VC6-FT, VC7-FT
400	NQCUV4	400–750 kcmil (202.7–380 mm ²)	VC6-FT, VC7-FT, VC8
600	NQCUV6	(2) 250–500 kcmil [(2) 126.7–253.4 mm ²)	VC6-3, VC7, VC6-FT, VC7-FT

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www.us.SquareD.com

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*General Instructions for Proper Installation, Operation, and Maintenance of
Panelboards Rated 600 Volts or Less*

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Foreword

This publication is a guide of practical information containing instructions for the proper installation, operation, and maintenance of panelboards rated 600 volts or less.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency regarding installation, operation, or maintenance.

It is recommended that work described in this set of instructions be performed only by qualified personnel familiar with the construction and operation of panelboards and that such work be performed only after reading this complete set of instructions. For specific information not covered by these instructions, you are urged to contact the manufacturer of the panelboard directly.

In the preparation of this standards publication input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product section by contacting the following: These recommendations will be reviewed periodically and updated as necessary.

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This standards publication was developed by the Panelboard and Distribution Board Product Group of the LVDE Section. Product Group approval of the standard does not necessarily imply that all Product Group members voted for its approval or participated in its development. At the time it was approved, the Product Group was composed of the following members:

Eaton Corporation.—Pittsburgh, PA
GE Industrial Solutions—Plainville, CT
Hubbell, Inc.—Orange, CT
Milbank Manufacturing Company—Kansas City, MO
Penn Panel & Box Company—Collingdale, PA
Reliance Controls Corporation—Racine, WI
Siemens Industry, Inc.—Norcross, GA
Schneider Electric —Palatine, IL

Section 1

SCOPE

This publication covers single panelboards or groups of panel units suitable for assembly in the form of single panelboards, including buses, and with or without switches or automatic overload protective devices (fuses or circuit breakers), or both. These units are used in the distribution of electricity at 600 volts and less with:

- 1600—ampere mains or less
- 1200—ampere branch circuits or less

Specifically excluded are live-front panelboards, panelboards employing cast enclosures for special service conditions, and panelboards designed primarily for residential and light commercial service equipment.



Section 2 REFERENCES

National Fire Protection Association (NFPA)

Batterymarch Park
Quincy, MA 02269

NFPA 70
NFPA 70E

National Electrical Code®
Standard for Electrical Safety in the Workplace

National Electrical Manufacturers Association (NEMA)

1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

AB 4

*Guidelines for Inspection and Preventative Maintenance of Molded Case Circuit
Breakers Used in Commercial and Industrial Applications*

PB 2.2

Application Guide for Ground Fault Protective Devices for Equipment

Guidelines for Handling Water Damaged Electrical Products



Section 3 GENERAL

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS AND EQUIPMENT TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety-related work practices, as described in NFPA 70E, should be followed at all times. All requirements of the *National Electrical Code*® NFPA 70 should be followed.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE COMPONENTS DURING INSTALLATION OR MAINTENANCE.

3.1 SUCCESSFUL OPERATION OF PANELBOARDS

The successful operation of panelboards is dependent upon proper installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, death, or damage to electrical equipment or other property.

3.2 QUALIFIED PERSONNEL

Installation, operation, and maintenance of panelboards should be conducted only by qualified personnel.

3.3 DEFINITION OF QUALIFIED PERSONNEL

For purposes of these guidelines, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, the person is:

3.3.1 Requirements

Knowledgeable of the requirements of the *National Electrical Code*® and of all other applicable codes, laws, and standards.

3.3.2 Established Safety Practices

Trained and authorized to test, energize, clear, ground, tag, and lockout circuits and equipment in accordance with established safety practices.

3.3.3 Protective Equipment

Trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, and flash resistant clothing in accordance with established safety practices.

3.3.4 First Aid

Trained in rendering first aid.

3.4 SUITABLE RATINGS

Verify that all equipment being installed has ratings suitable for the installation.



Section 4

INSTALLATION OF PANELBOARD CABINETS (BOXES)

4.1 INSTALLATION INSTRUCTIONS

Installation of the cabinet in a neat and workmanlike manner. Follow the manufacturer's installation instructions.

4.2 LOCATION IN BUILDING

Locate the cabinet so that it is readily accessible and not exposed to physical damage.

4.3 FLAMMABLE MATERIAL

Locate the cabinet well away from flammable material.

4.4 UNUSUAL SERVICE CONDITIONS

Do not locate the cabinet where it will be exposed to ambient temperatures above 40°C (104°F), corrosive or explosive fumes, dust, vapors, dripping or standing water, abnormal vibration, mechanical shock, high humidity, tilting, or unusual operating conditions, unless the cabinet/panelboard combination has been designed and so identified by the manufacturer for these conditions.

4.5 INDOOR DAMP LOCATIONS

Locate or shield the cabinet so as to prevent moisture and water from entering and accumulating therein. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.6 WET LOCATIONS

Cabinets should be specifically approved for wet locations. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.7 CLEARANCE FROM CEILING

Do not locate the cabinet against a non-fireproof ceiling; allow a space of 3 feet between the ceiling and cabinet unless an adequate fireproof shield is provided.

4.8 SPACE AROUND THE CABINET

When selecting a location, provide sufficient access and working space around the cabinet (see Section 110.26 of the *National Electrical Code*®). The width of the working space in front of the panelboard should be at least 30 inches, or the width of the cabinet, whichever is greater, and this space should not be used as storage. The working space should have adequate lighting and a minimum head room of 6 feet 6 inches.

4.9 MOUNTING OF CABINET

The cabinet should be reliably secured to the mounting surface. Do not depend on wooden plugs driven into holes in masonry, concrete, plaster, or similar materials. (See Section 110.13 of the *National Electrical Code*®.)

4.10 FLUSH MOUNTING IN WALL

In walls of concrete, tile, or other noncombustible material, install the cabinet so that its front edge will not set back more than 1/4 inch from the finished surface. In walls of wood or other combustible material, cabinets should be flush with or project beyond the finished surface. (See Section 312.3 of the *National Electrical Code®*.)

4.11 UNUSED OPENINGS IN CABINET

Effectively close unused openings in the cabinet to provide protection which is substantially equivalent to that afforded by the wall of the cabinet.

4.12 GROUNDING OF PANELBOARD CABINETS

Ground the cabinet as specified in Article 250 of the *National Electrical Code®*. When the cabinet contains service equipment, it is necessary to bond the cabinet to the grounded (neutral) service conductor.



Section 5

INSTALLATION OF CONDUIT AND CONDUCTORS

5.1 CONDUITS INSTALLATION

Conduits should be installed so as to prevent moisture or water from entering and accumulating within the enclosure. Provision should be made to protect conductors from abrasion in accordance with Article 312 of the *National Electrical Code*®.

5.2 KNOCKOUTS REMOVAL

Knockouts should be removed as follows:

IMPORTANT—Remove knockouts, ONE AT A TIME, alternating INWARD and OUTWARD.

5.2.1 First Step—Remove Center Knockout

Remove center knockout INWARD.

5.2.1.1 Screwdriver Blade

Place screwdriver blade against point farthest from tie and strike INWARD (Figure 1). Bend back and forth to break tie.

5.2.2 Next Step—Remove Rings

Remove rings ONE AT A TIME without straining remaining rings.

5.2.2.1 Pry First Ring

Pry first ring OUTWARD with screwdriver midway between ties, using pliers flat against box under screwdriver (Figure 2). Bend ring sections OUTWARD with pliers, then back and forth to break ties (Figure 5-3).

5.2.2.2 Second Ring

Remove second ring INWARD by striking screwdriver (with blade against point midway between ties) then breaking ring sections inward and back and forth to break ties.

5.3 NATIONAL ELECTRICAL CODE®, ARTICLE 300

Refer to the *National Electrical Code*®, Article 300 for proper wiring methods. See 6.7 for making proper connections.

5.4 CONDUCTOR LENGTH

Keep conductor length to a minimum within the wiring gutter. Excessive conductor length will result in additional heating and may result in overheating. However, conductors should be long enough to reach the terminal location in a manner that avoids strain on the terminal.

5.5 EXERCISE CARE

Exercise care to maintain the largest practical bending radius of conductors; otherwise the insulation may be damaged and terminal connections may become loosened. Deflection of conductors shall comply with *NEC*® Section 312.6.

5.6 *NATIONAL ELECTRICAL CODE®*, SECTION 725.136

Refer to the *National Electrical Code®*, Section 725.136 for the separation requirements for conductors of Class 2 and Class 3 remote-control, signaling and power-limited circuits.



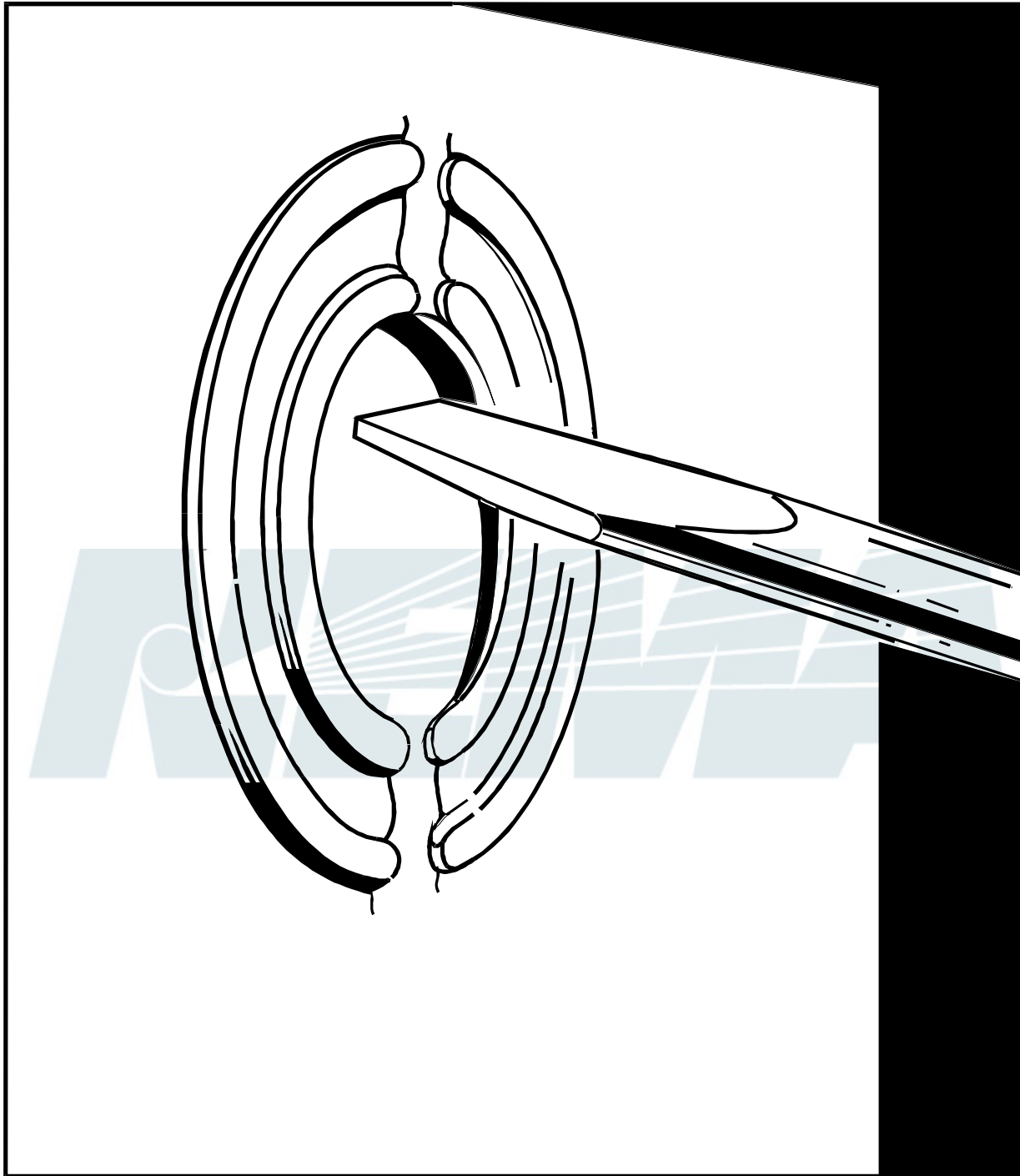


Figure 5-1
KNOCKOUT REMOVAL—STEP 1

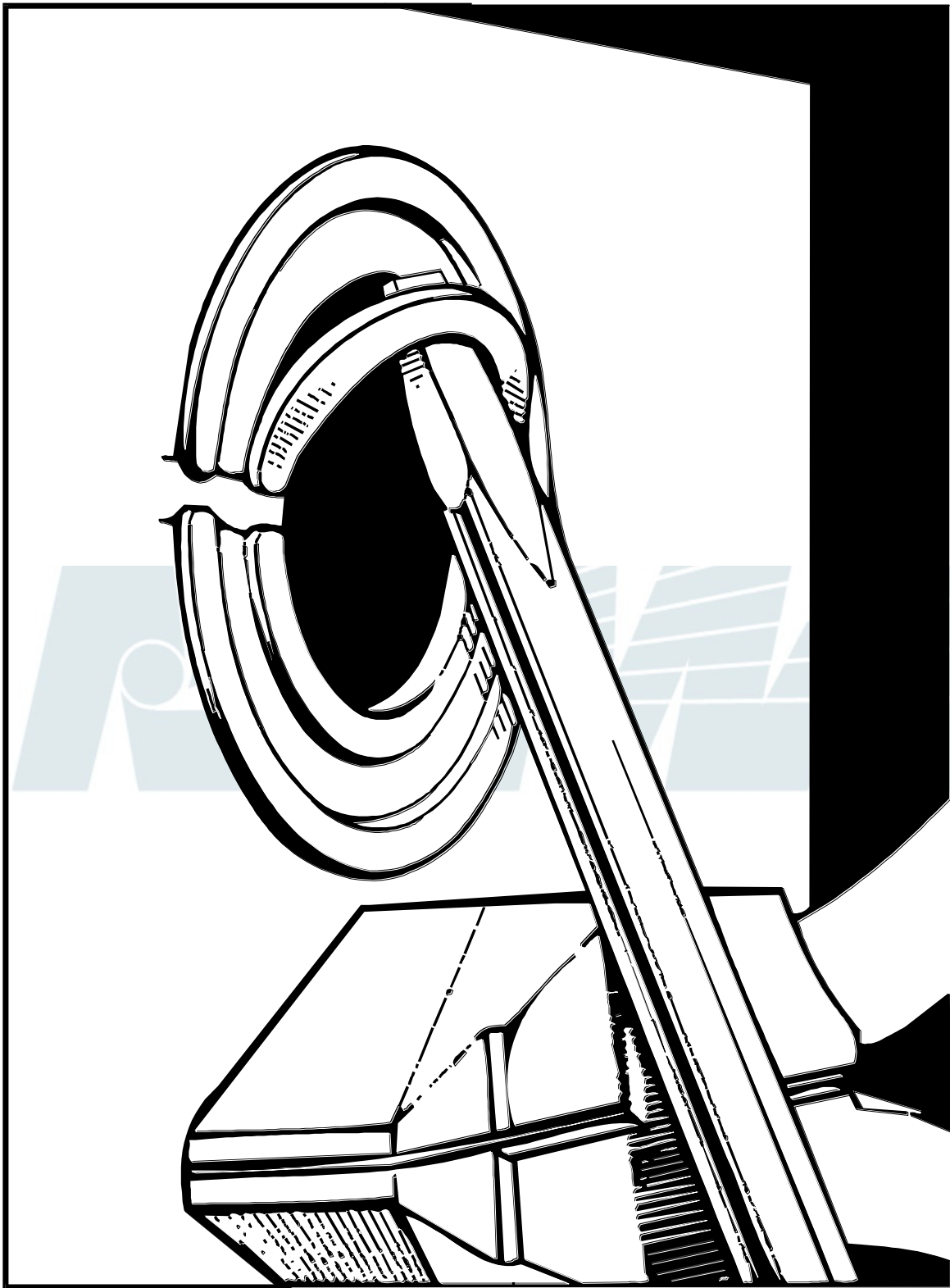


Figure 5-2
KNOCKOUT REMOVAL—STEP 2

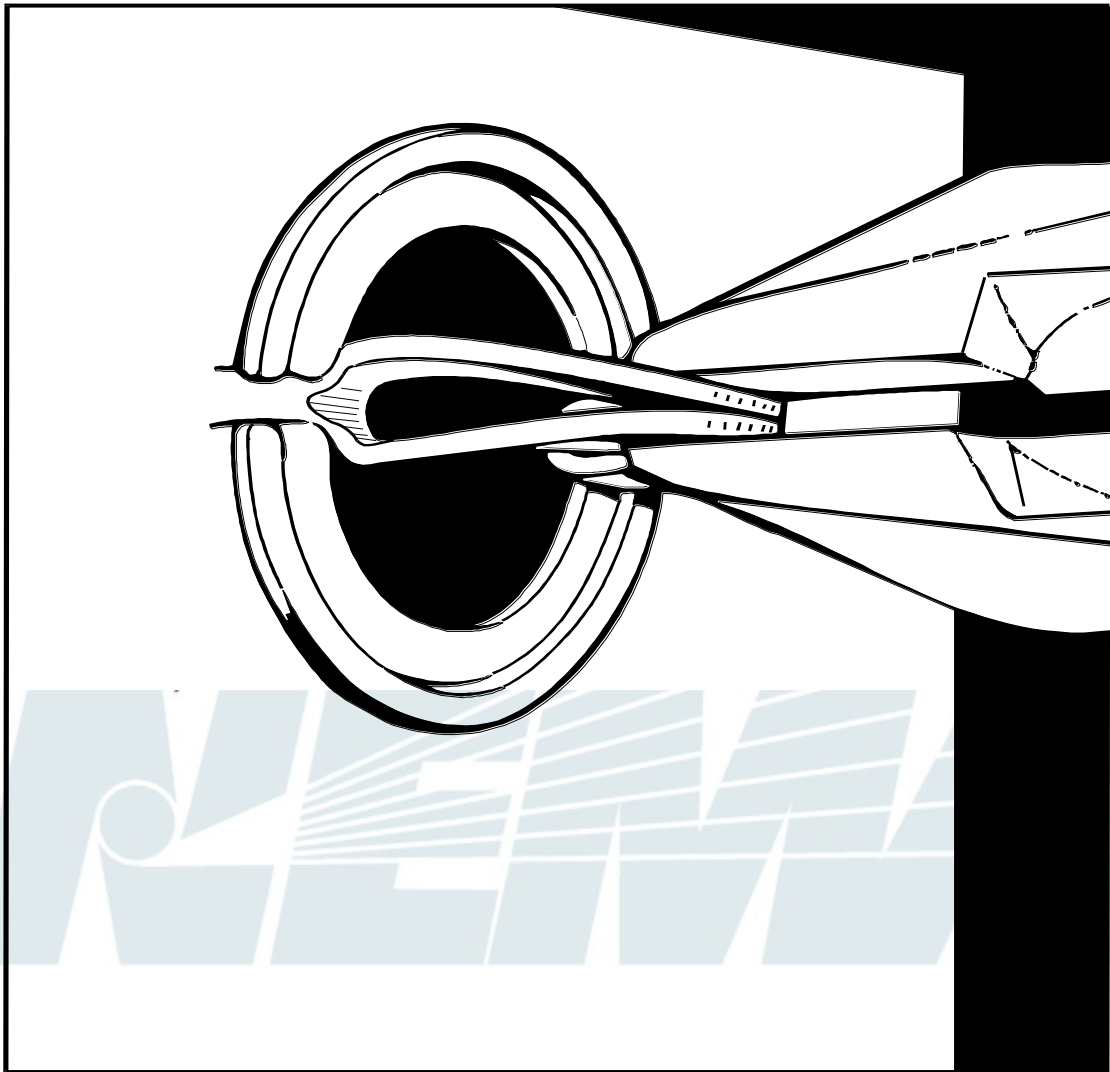


Figure 5-3
KNOCKOUT REMOVAL—STEP 3

Section 6

INSTALLATION OF PANELBOARD

6.1 PROPER STORAGE

Store the panelboard in a clean, dry place located so that mechanical damage from work personnel in the area is not likely to happen.

6.2 UNPACKING

Care should be exercised in unpacking the panelboard to prevent damage and loss of instruction materials and loose parts.

6.3 INSPECTION

Check for shipping damage and check to make sure that the panelboard is the correct one for installation in the cabinet.

6.4 CARE

Care should be taken to protect the panelboard internal parts from contamination during the installation process.

6.4.1 Cleaning

Clean the cabinet of all foreign materials. If parts at connection points are spattered with cement, plaster, paint, or other foreign material, remove the foreign materials with great care to avoid damage to the plating.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

6.5 MANUFACTURER'S INSTRUCTIONS

Carefully follow the manufacturer's instructions and labels.

6.6 INSTALLATION

6.6.1 Alignment Devices

Adjust the alignment devices where provided.

6.6.2 Panelboard

Install the panelboard, finalize its alignment, and tighten it securely in the cabinet.

6.6.3 Flange of Deadfront Shield

Unless otherwise instructed by the manufacturer, adjust the panelboard so that the flange of the deadfront shield is no more than 3/16 inch from (1) the front of the cabinet for surface mounting or (2) the surrounding wall surfaces for flush mounting.

6.7 LINE AND BRANCH CONDUCTORS

Connect Line and Branch Conductors

6.7.1 Conductors

Use care in stripping insulation from conductors so as not to nick or ring the conductor. For aluminum, clean all oxide from the stripped portion and apply an antioxidant compound.

6.7.1.1 Wiring Gutters

Distribute and arrange conductors neatly in the wiring gutters. (See Section 5.)

6.7.1.2 Types and Temperature Ratings

Care should be exercised to ensure that the types and temperature ratings of conductors being installed in the panelboard are suitable for use with the terminals, which have been provided.

6.7.1.3 Tighten All Terminals

Use the manufacturer's torque values. (See 7.1).

6.8 PANELBOARD GROUNDING AND BONDING

Ground the panelboard cabinet in accordance with 4.12. (See Section 408.40 of the *National Electrical Code*®.)

6.8.1 Equipment Grounding Conductors

Where separate equipment grounding conductors are used, prepare equipment grounding conductors in accordance with 6.7.1 and connect them to the equipment grounding terminal bar. Check to be sure that the terminal bar is securely bonded to the cabinet or panelboard frame and that it is not connected to the neutral bar except at service equipment (as permitted in Section 250.28 of the *National Electrical Code*®) or at separately derived systems (as permitted in Section 250.30 of the *National Electrical Code*®).

NOTE—An equipment grounding terminal bar is not always required. For example, when a properly installed metallic raceway is used as the equipment grounding path or when the grounded conductor terminals (neutral bar) complies with the conditions of the last sentence of Section 408.40 of the *National Electrical Code*®.

6.9 PROPER TYPE OR CLASS AND RATING

When installing circuit breakers or fuses, ensure that they are of the proper type or class and rating.

6.10 DEBRIS

Clean the cabinet of all debris, which has accumulated during the panelboard installation. Ensure that all foreign materials, including cement, plaster and paint (overspray) are cleaned and removed. Remove all such materials with great care to avoid damage to conductors, plating, etc. (see 6.4.1).

6.11 STEPS IN SECTION 7

If the job is complete, perform the steps in Section 7 and then install the cabinet front (see Section 8).

Section 7

STEPS TO BE TAKEN BEFORE ENERGIZING

7.1 ACCESSIBLE ELECTRICAL CONNECTIONS

Tighten all accessible electrical connections to the manufacturer's torque specifications. If such information is not provided with the equipment, consult the manufacturer.

7.2 BLOCKS AND PACKING MATERIALS

Make certain that all blocks and packing materials used for shipment have been removed from all component devices and the panelboard.

7.3 SWITCHES, CIRCUIT BREAKERS, AND OTHER OPERATING MECHANISMS

Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they operate freely. If devices with self-test function are installed, perform test and verify proper operation per the manufacturer's instructions.

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

7.4 SHORT CIRCUITS AND GROUND FAULTS

To make sure that the system is free from short circuits and ground faults, conduct an insulation resistance test phase to ground and phase to phase with the switches or circuit breakers in both the open and closed positions. If the resistance reads less than 1 megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated. If after investigation and possible correction, low readings are still observed, the manufacturer should be contacted. Some electronic equipment (metering, SPD, etc.) may be damaged by this testing. Refer to the manufacturers equipment markings for guidelines.

7.5 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code®* and NEMA PB 2.2, *Application Guide for Ground Fault Protective Devices for Equipment*.

7.6 ADJUSTABLE TIME CURRENT TRIP DEVICE SETTINGS

Set any adjustable time current trip device settings to the proper values.

NOTE—Experience has indicated that damage from overcurrent can be reduced if the devices used for overload and short-circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7.7 GROUNDING CONNECTIONS

Check to determine that all grounding connections are properly made. If the panelboard is used as service equipment, make certain that the neutral, if present, is properly bonded to the cabinet.

7.8 FOREIGN MATERIAL

Remove all foreign material from the panelboard and cabinet before installing the cabinet front. Make certain that all deadfront shields are properly aligned and tightened. Install the cabinet front in accordance with Section 8.



Section 8

INSTALLATION OF CABINET FRONT

8.1 CABINET FRONT OR TRIM PACKAGE

The cabinet front or trim package is designed to prevent damage to the front during shipment and handling.

8.2 UNPACKING

Care should be used when unpacking and handling the cabinet front.

8.3 COVERS AND DOORS

Install covers, close doors, and make certain that no conductors are pinched and that all enclosure parts are properly aligned and tightened. Hinged covers or doors must open a minimum of 90 degrees when installed.

8.4 TOUCH-UP

A suitable paint or other corrosion-resistant finish should be applied to those places where the finish is damaged.

8.5 FRONT ALIGNMENT

The cabinet front may be provided with an adjusting means to align it squarely with the building even though the cabinet may be slightly out of plumb with the building.

Section 9 ENERGIZING EQUIPMENT

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ENERGIZING A PANELBOARD FOR THE FIRST TIME AFTER INITIAL INSTALLATION OR MAINTENANCE IS POTENTIALLY DANGEROUS.

9.1 QUALIFIED PERSONNEL

Only qualified personnel should energize equipment for the first time. If short circuit conditions caused by damage or poor installation practices have not been detected in the procedures specified in Section 7, serious personal injury and damage can occur when the power is turned on.

9.2 LOAD ON THE PANELBOARD

There should be no load on the panelboard when it is energized. Turn off all of the downstream loads.

9.3 ENERGIZED IN SEQUENCE

The equipment should be energized in sequence by starting at the source end of the system and working towards the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices. Turn the devices on with a firm positive motion.

9.4 LOADS SUCH AS LIGHTING CIRCUITS, CONTACTORS, HEATERS, AND MOTORS

After all main, feeder, and branch circuit devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned on.

Section 10 MAINTENANCE

10.1 MAINTENANCE PROGRAM

A maintenance program for panelboards should be conducted on a regularly scheduled basis in accordance with the following:

10.2 PANELBOARD WHICH HAS BEEN CARRYING ITS REGULAR LOAD FOR AT LEAST 3 HOURS

A panelboard which has been carrying its regular load for at least 3 hours just prior to inspection should be field tested by feeling the deadfront surfaces of circuit breakers, switches, interior trims, doors, and enclosure sides with the palm of the hand. If the temperature of these surfaces does not permit you to maintain contact for at least 3 seconds, this may be an indication of trouble and investigation is necessary. Thermographic (infrared) scanning has become a useful method of investigating thermal performance.

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.3 INSPECT PANELBOARD ONCE EACH YEAR

Inspect the panelboard once each year or after any severe short circuit.

10.4 ACCUMULATION OF DUST AND DIRT

If there is an accumulation of dust and dirt, clean out the panelboard by using a brush, vacuum cleaner, or clean lint-free rags. Avoid blowing dust into circuit breakers or other components. Do not use a blower or compressed air.

10.4.1 Visible Electrical Joints and Terminals

Carefully inspect all visible electrical joints and terminals in the bus and wiring system.

10.4.2 Conductors and Connections

Visually check all conductors and connections to be certain that they are clean and secure. Loose and/or contaminated connections increase electrical resistance which can cause overheating. Such overheating is indicated by discoloration or flaking of insulation and/or metal parts. Pitting or melting of connecting surfaces is a sign of arcing due to a loose or otherwise poor connection. Parts which show evidence of overheating or looseness should be cleaned and re-torqued or replaced if damaged. Tighten bolts and nuts at bus joints to manufacturer's torque specifications.

CAUTION—DO NOT REMOVE PLATING FROM ALUMINUM PARTS IN JOINTS OR TERMINATIONS. DAMAGE TO PLATING CAN RESULT IN OVERHEATING. REPLACE DAMAGED ALUMINUM PARTS.

10.4.3 Fuse Clip Contact Pressure and Contact Means

Examine fuse clip contact pressure and contact means. If there is any sign of overheating or looseness, follow the manufacturer's maintenance instructions or replace the fuse clips. Loose fuse clips can result in overheating.

10.4.4 Plug Fuses

Re-tighten plug fuses.

10.4.5 Conditions Which Caused Overheating

Be sure that all conditions which caused the overheating have been corrected.

10.5 PROPER AMPERE, VOLTAGE, AND INTERRUPTING RATINGS

Check circuit breakers, switches, and fuses to ensure they have the proper ampere, voltage, and interrupting ratings. Ensure that non-current-limiting devices are not used as replacements for current-limiting devices. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the incorrect class of fuse.

10.5.1 Mechanisms Free and in Proper Working Order

Operate each switch or circuit breaker several times to ensure that all mechanisms are free and in proper working order. Replace as required. See NEMA AB-4 for maintenance of molded case circuit breakers.

10.6 OPERATION OF ALL MECHANICAL COMPONENTS

Check the operation of all mechanical components. Replace as required.

10.6.1 Switch Operating Mechanisms

Exercise switch operating mechanisms and external operators for circuit breakers to determine that they operate freely to their full on and off positions.

10.6.2 Integrity of Electrical and Mechanical Interlocks

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

10.6.3 Missing or Broken Parts

Whenever practical, check all devices for missing or broken parts, proper spring tension, free movement, corrosion, dirt, and excessive wear.

10.6.4 Manufacturer's Instructions

Adjust, clean, and lubricate or replace parts according to the manufacturer's instructions.

10.6.4.1 Clean Nonmetallic Light Grease or Oil

Use *clean* nonmetallic light grease or oil as instructed.

10.6.4.2 Molded Case Circuit Breakers

Do *not* oil or grease parts of molded case circuit breakers.

10.6.4.3 Clean, Light Grease

If no instructions are given on the devices, sliding copper contacts, operating mechanisms, and interlocks may be lubricated with clean, light grease.

10.6.4.4 Excess Lubrication

Wipe off excess lubrication to avoid contamination.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.6.5 Accessible Copper Electrical Contacts, Blades, and Jaws

Clean and dress readily accessible copper electrical contacts, blades, and jaws according to the manufacturer's instructions when inspection indicates the need.

10.7 DAMAGED INSULATING MATERIAL AND ASSEMBLIES

Look for and replace damaged insulating material and assemblies where sealing compounds have deteriorated.

10.8 MOISTURE OR SIGNS OF PREVIOUS WETNESS OR DRIPPING

Look for any moisture or signs of previous wetness or dripping inside the cabinet.

NOTE—Condensation in conduits or dripping from outside sources is one known cause of panelboard malfunction.

10.8.1 Conduits Which Have Dripped Condensate

Seal off any conduits which have dripped condensate, and provide means for further condensate to drain away from the panelboard.

10.8.2 Cracks or Openings

Seal off any cracks or openings which have allowed moisture to enter the enclosure. Eliminate the source of any dripping on the enclosure and any other source of moisture.

10.8.3 Insulating Material Which is Damp or Wet

Replace or thoroughly dry and clean any insulating material, which is damp or wet or shows an accumulation of deposited material from previous wettings.

10.8.4 Component Devices Which Show Evidence of Moisture Damage

Inspect all component devices. Replace any component device which shows evidence of moisture damage or has been subjected to water damage or flooding. Additional information may be found in the NEMA document "Guidelines for Handling Water Damaged Electrical Products."

10.9 BEFORE CLEANUP AND CORRECTIVE ACTION IS ATTEMPTED

In the event of water damage, e.g., flooding or sprinkler discharge, the manufacturer should be consulted before clean up and corrective action is attempted.

10.10 SEVERE ELECTRICAL SHORT CIRCUIT

If a severe electrical short circuit has occurred, the excessive currents may have resulted in structural component and/or bus and conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. Examine all devices and bus supports for cracks or breakage. The manufacturer should be consulted before cleanup and correction is attempted.

10.11 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code®* and NEMA PB 2.2 *Application Guide for Ground Fault Protective Devices for Equipment*.

10.12 INSULATION RESISTANCE

Check insulation resistance (see 7.4) under any of the following conditions:

10.12.1 Severe Short Circuit

If a severe short circuit has occurred (see 10.10);

10.12.2 Parts Replaced

If it has been necessary to replace parts or clean insulating surfaces;

10.12.3 Panelboard Exposed to High Humidity

If the panelboard has been exposed to high humidity, condensation, or dripping moisture.



Section 11

PERMISSIBLE LOADING OF PANELBOARDS

11.1 *NATIONAL ELECTRICAL CODE®*

In compliance with the *National Electrical Code®*, the normal continuous loads (3 hours or more) of panelboard circuits should be not more than 80 percent of the rating of the overcurrent protective device, unless the marking of the device indicates that it is suitable for continuous duty at 100 percent of its rating.

11.2 HARMONICS IN ELECTRICAL SYSTEM

Some types of electrical equipment cause harmonics in the electrical system, which may result in overheating. This condition should be considered when determining panelboard loading.

§



SurgeLogic™ I-Line™ Plug-on Surge Protective Device (SPD)

Retain for future use.

ENGLISH

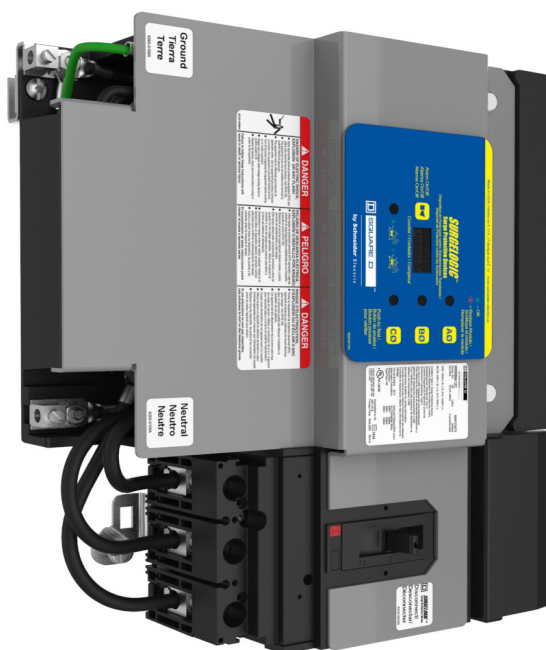


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Precautions

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Introduction

This bulletin provides instructions for installing I-Line™ Plug-on Units with Surgeloc™ Surge Protective Devices (SPDs) into I-Line panelboards and switchboards.

This is a supplement to the information manual provided with each panelboard and the instruction bulletin provided with each switchboard.

Note: For troubleshooting, call the Surgeloc Technical Assistance Group at 1-800-577-7353.

Proper installation is imperative to maximize the surge protective device's effectiveness and performance. To ensure proper installation, follow the steps outlined in this instruction bulletin. Read the entire instruction bulletin before beginning the installation. These instructions are not intended to replace national or local electrical codes. Check all applicable electrical codes to verify compliance. Installation of modular surge suppressors should only be performed by qualified electrical personnel.

Unpacking and Preliminary Inspection

Inspect the entire shipping container for damage or signs of mishandling before unpacking the device. Remove the packing material and further inspect the device for any obvious shipping damage. If any damage is found and is a result of shipping or handling, immediately file a claim with the shipping company.

Storage

The device should be stored in a clean, dry environment. Storage temperature is -40 °F to +149 °F (-40 °C to +65 °C). All of the packaging materials should be left intact until the device is ready for installation.

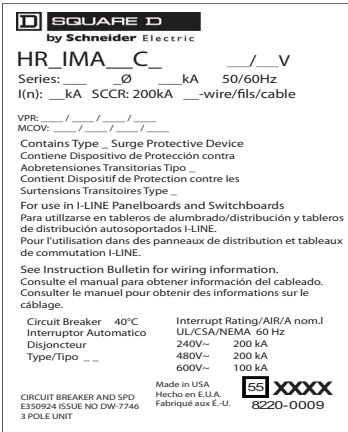
Safety Labels

English, Spanish, and French versions of all safety labels (Danger, Warning, and Notice) are provided.

Identification Nameplate

The identification nameplate is located on the front surface next to the diagnostic display.

Figure 1: Surge Protective Device Nameplate Example



⚠ CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Perform periodic inspection of the Surge Protective Device status indicator lights as part of the preventative maintenance schedule.
- Promptly service the Surge Protective Device when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple Surge Protective Devices to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

At end-of-life conditions, Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that will automatically disconnect the surge suppression elements from the mains should the surge suppression elements reach end of life. Also, at that time, tripping of the branch circuit breaker or fuse feeding the SPD can occur.

⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the Surge Protective Devices until the electrical system is completely installed, inspected, tested, and all conductors have been connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the Surge Protective Device.
- Disconnect the Surge Protective Device, including the neutral, from the power source before performing high-potential insulation testing or any tests where Surge Protective Device components will be subjected to voltages higher than their rated turn-on voltage.

Failure to follow these instructions can result in injury or equipment damage.

Location Considerations

Environment

The device is designed to operate in an ambient temperature range of -4 °F to +149 °F (-20 °C to +65 °C) with a relative humidity of 0 to 95% non-condensing. The operating temperature of the LCD on the diagnostic display panel is +14 °F to +140 °F (-10 °C to +60 °C). Refer to the product catalog for further details on enclosures. All I-Line devices operate normally without reduction in performance when subjected to shock and vibrations described in IEC 60721-3-3, Class 3M4.

Audible Noise

The device background noise is negligible and does not restrict the location of the installation.

Service Clearance

The service clearance should meet all applicable code requirements.

Electrical

Voltage Rating

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Confirm the Surge Protective Device voltage rating on the module or nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Prior to mounting the SPD, verify that the device has the same voltage rating as the power distribution system in which it is installed. Compare the nameplate voltage or model number on the SPD with the nameplate of the electrical distribution equipment.

The specifier or user of the device must be familiar with the configuration and arrangement of the power distribution system in which any SPD is to be installed. The system configuration of any power distribution system is based strictly on how the secondary windings of the transformer supplying the service entrance main or load are configured. This includes whether or not the transformer windings are referenced to earth via a grounding conductor. The system configuration is not based on how any specific load or equipment is connected to a particular power distribution system. See Table 1 for the service voltage of each SPD.

Table 1: Voltage Ratings

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Numbers ¹	
		HR Breaker SPD	HL Breaker SPD
120/240 V, 1-phase, 3-wire + ground	120	HR1IMA12C	HL1IMA12C
	160	HR1IMA16C	HL1IMA16C
	240	HR1IMA24C	HL1IMA24C
208Y/120 V, 3-phase, 4-wire + ground Wye ²	120	HR2IMA12C	HL2IMA12C
	160	HR2IMA16C	HL2IMA16C
	240	HR2IMA24C	HL2IMA24C
240/120 V, 3-phase, 4-wire + ground High-leg Delta ³	120	HR3IMA12C	HL3IMA12C
	160	HR3IMA16C	HL3IMA16C
	240	HR3IMA24C	HL3IMA24C
480Y/277 V, 3-phase, 4-wire + ground Wye ⁴	120	HR4IMA12C	HL4IMA12C
	160	HR4IMA16C	HL4IMA16C
	240	HR4IMA24C	HL4IMA24C
480 V Delta, 3-phase, 3-wire + ground Delta ⁵	100	HR5IMA10C	HL5IMA10C
	120	HR5IMA12C	HL5IMA12C
	160	HR5IMA16C	HL5IMA16C
	200	HR5IMA20C	HL5IMA20C
	240	HR5IMA24C	HL5IMA24C
240 V Delta, 3-phase, 3-wire + ground Delta	100	HR6IMA10C	HL6IMA10C
	120	HR6IMA12C	HL6IMA12C
	160	HR6IMA16C	HL6IMA16C
	200	HR6IMA20C	HL6IMA20C
	240	HR6IMA24C	HL6IMA24C
600Y/347 V, 3-phase, 4-wire + ground Wye	120	HR8IMA12C	—
	160	HR8IMA16C	—
	240	HR8IMA24C	—
600 V Delta, 3-phase, 3-wire + ground Delta ⁶	100	HR9IMA10C	—
	120	HR9IMA12C	—
	160	HR9IMA16C	—
	180	HR9IMA18C	—

¹ For Type 1 systems include a "1" at the end of the catalog numbers listed above.

² 208Y/120 series also applies to the following voltage 220Y/127.

³ Phase B modules are different than Phase A and Phase C modules.

⁴ 480Y/277 series applies to the following voltages 380Y/220, 400Y/230, and 415Y/240.

⁵ 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

⁶ 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

General

The I-Line device has SPD elements connected from phase to ground. To prevent hazardous touch voltage on the I-Line enclosure during normal operation or during SPD end-of-life, it is critical that there be a robust and effective connection to the building grounding structure. The grounding connection must utilize an equipment grounding conductor run with the phase and neutral (if present) connection of the power system. Do not connect the I-Line device to a separate isolated ground.

For best overvoltage suppression by the I-Line device, use a single-point ground system where the service entrance grounding electrode system is connected to and bonded to all other available electrodes, building steel, metal water pipes, driven rods, etc. (for reference, see NEC Art 250). The ground impedance measurement should be in compliance with all applicable codes.

Solidly-Grounded Power Systems

⚠ CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Do not connect devices rated for use on solidly-grounded power systems to resistance-grounded (for example, High Resistance Ground) or ungrounded power systems.
- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral terminal of the power system transformer feeding the device is bonded to system ground in accordance with all applicable codes.

Failure to follow these instructions can result in equipment damage.

SPDs rated for use on solidly-grounded power systems must not be connected to resistance-grounded or ungrounded power systems. Such a connection can result in damage to the SPD.

Always verify the power system grounding configuration prior to application of power to the device. Confirm that all ground bonds are installed at both the service entrance equipment and power system transformer prior to application of power.

Delta and Resistance-Grounded Power Systems

⚠ CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Ungrounded power systems are inherently unstable and can produce excessively high line-to-ground voltages during certain fault conditions. During these fault conditions any electrical equipment, including an SPD, may be subjected to voltages which exceed their designed ratings. This information is being provided to the user so that an informed decision can be made before installing any electrical equipment on an ungrounded power system.
- Resistance-grounded power systems must be maintained in an over-damped state to limit voltage overshoot and duration during operation.
- Perform verification and adjustment of correct power system damping:
 - Periodically as part of normal system maintenance.
 - Following power system modifications.

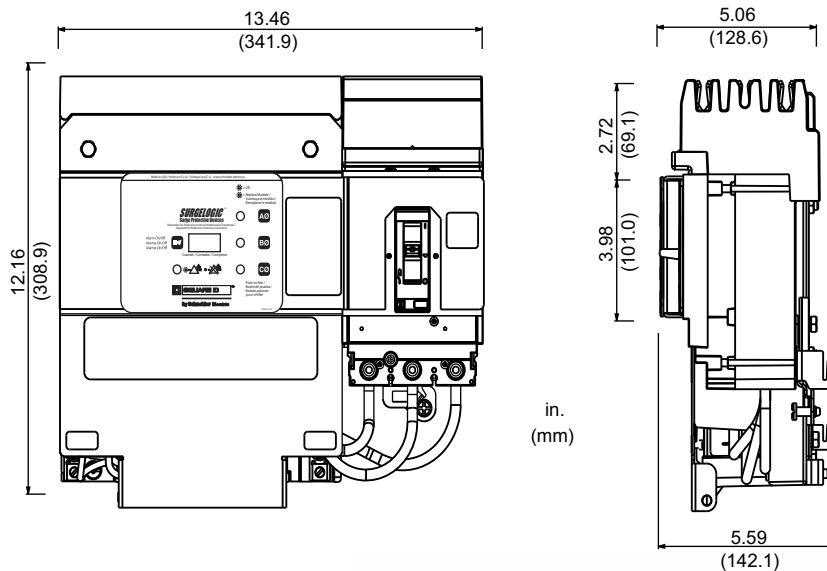
Failure to follow these instructions can result in equipment damage.

The I-Line product is intended for use on resistance-grounded power systems where the power system has been set for, and is maintained in, an over-damped state. For the power system to be over-damped, the current through the grounding resistor during a bolted phase-to-ground fault must be significantly greater than the total charging current of the system.

Periodic engineering evaluation of the power system is required to determine the worst-case charging current of the system and to adjust the grounding resistance accordingly. As the power system is modified, the value of the grounding resistor must be evaluated and adjusted to maintain the system in the over-damped state.

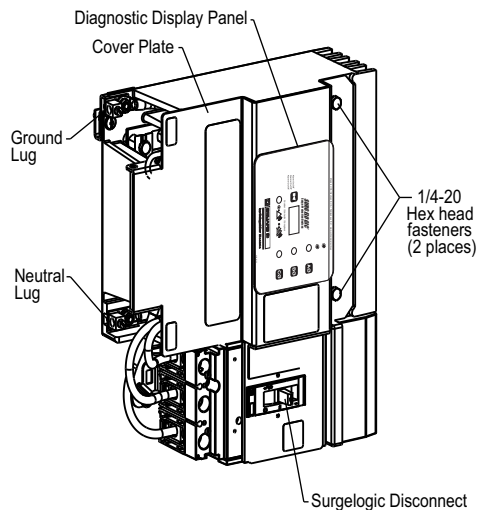
Dimensions

Figure 2: Dimensions.



I-Line Surgelologic Installation

Figure 3: I-Line Surgelologic Components



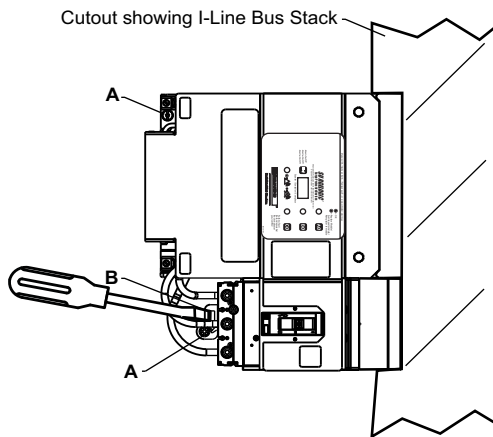
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Figure 4: Racking the Device onto the Bus



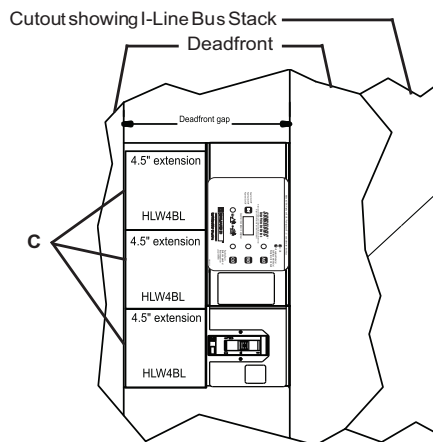
CAUTION

LOSS OF SURGE SUPPRESSION

- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral bonding jumper is installed at the service entrance in accordance with all applicable codes.
- When neutral is not present at the I-Line panel, connect Surge Protective Device neutral and ground together with a minimum 10 AWG wire.

Failure to follow these instructions can result in equipment damage.

Figure 5: Blank Extensions in Deadfront



Turn off all power supplying the panelboard or switchboard before working on or installing the I-Line Surgelologic device.

1. Turn off all power supplying the panelboard or switchboard before working on or installing the I-Line Surgelologic device.
2. Loosen the retaining screws (A) (see Figure 4).
3. Place the device on the I-Line pan with the jaws pushed against the bus.
4. Insert a flat-head screwdriver into the screwdriver slot (B). Rack the device onto the bus.
5. Tighten the two retaining screws (A).
6. Use 6 AWG copper wire to connect the ground and neutral assembly from the SPD to the panelboard or switchboard neutral and ground.
Note: The wires should be as short as possible. Torque each neutral and ground connection to 35 lb-in. (4 N•m).
7. Close all openings around the Surgelologic device.
8. Ensure blank extensions (C) are installed into the deadfront whenever the I-Line Surgelologic device is placed on the wide side of the bus stack (see Figure 5).

Access to MA Modules and Back of Diagnostic Display Panel

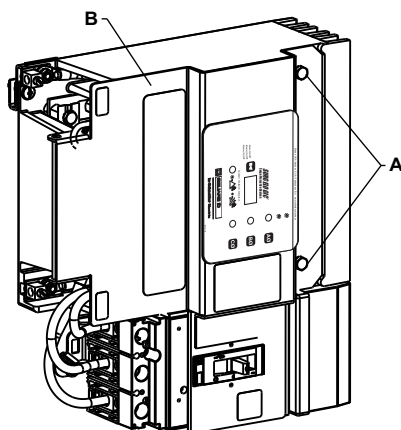
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- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Figure 6: I-Line Surgellogic Components



1. Turn off all power supplying the panelboard or switchboard before working on the I-Line Surgellogic device.
2. Remove the two 1/4-20 hex head fasteners (A) shown in Figure 6 and open the cover plate (B).
3. When finished accessing the MA modules, close the cover plate and replace fasteners. Torque fasteners to 32 lb-in. (3.6 N•m).

Operation

⚠ DANGER

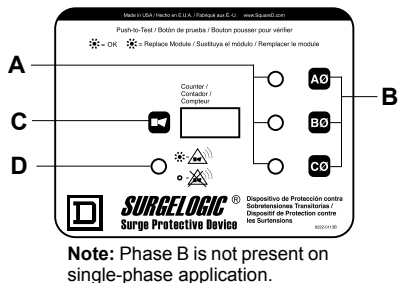
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

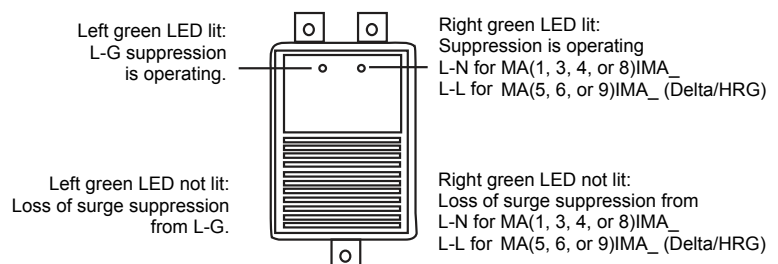
Figure 7: Three-Phase Diagnostic Display Panel with Surge Counter (TVS3DSPHC; TVS1DSPHC for TVS1 series devices)



The SPD diagnostic display panel shows the status of each MA module with diagnostically controlled green/red LEDs (**A**). If a unit is operating correctly, all the phase LEDs will be illuminated green. To test the integrity of the diagnostics for each phase, push the corresponding phase button (**B**) on the diagnostic display panel. If the alarm is enabled, the green LEDs will turn red, the dry contacts will change state, and the alarm will sound. Releasing the test button (**B**) will complete the test; the LEDs will turn green, the dry contacts will change back to a normal state, and the alarm will shut off (see Figure 7).

If an inoperable condition occurs on any phase, the audible alarm sounds (if enabled), the dry contacts will switch to an error state and the corresponding phase LED (**A**) on the diagnostic display panel is illuminated red. This indicates that the device needs service by qualified electrical personnel. The audible alarm can be silenced by pressing the alarm enable/disable button (**C**). The alarm will silence and the green alarm LED (**D**) will not be illuminated. The red phase LED will continue to be illuminated until the inoperative condition has been cleared (see Figure 7).

Figure 8: MA Module LEDs



On an MA module (see Figure 8), when the power is applied, if the left green LED is not lit, it indicates a loss of suppression from line-to-ground for that phase. If the right green LED is not lit, it indicates a loss of suppression from line-to-neutral for that phase. If either LED is not lit the module should be replaced.

When power is applied to the SPD and one or more of the diagnostic display panel LEDs are red, and one or more MA module LEDs are out, the appropriate MA module should be replaced. (see Table 2).

Refer to "Maintenance and Troubleshooting" on page 16 for proper troubleshooting procedures. If the module LEDs are green and the diagnostic display LEDs are red, please call SPD TAG at 1-800-577-7353.

Power System Grounding

In addition to the power system configuration and voltage, the power system grounding method must be considered when selecting the appropriate I-Line device. Refer to the following chart for information concerning the suitability of I-Line device to specific power system grounding method.

Table 2: I-Line Series Replacement Modules

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Numbers ¹		
		A	B	C
120/240 V, 1-phase, 3-wire + ground	120	MA11MA12	—	MA11MA12
	160	MA11MA16	—	MA11MA16
	240	MA11MA24	—	MA11MA24
208Y/120 V, 3-phase, 4-wire + ground Wye ²	120	MA11MA12	MA11MA12	MA11MA12
	160	MA11MA16	MA11MA16	MA11MA16
	240	MA11MA24	MA11MA24	MA11MA24
240/120 V, 3-phase, 4-wire + ground High-leg Delta ³	120	MA11MA12	MA31MA12	MA11MA12
	160	MA11MA16	MA31MA16	MA11MA16
	240	MA11MA24	MA31MA24	MA11MA24
480Y/277 V, 3-phase, 4-wire + ground Wye ⁴	120	MA41MA12	MA41MA12	MA41MA12
	160	MA41MA16	MA41MA16	MA41MA16
	240	MA41MA24	MA41MA24	MA41MA24
480 V Delta, 3-phase, 3-wire + ground Delta ⁵	100	MA51MA10	MA51MA10	MA51MA10
	120	MA51MA12	MA51MA12	MA51MA12
	160	MA51MA16	MA51MA16	MA51MA16
	200	MA51MA20	MA51MA20	MA51MA20
	240	MA51MA24	MA51MA24	MA51MA24
240 V Delta, 3-phase, 3-wire + ground Delta	100	MA61MA10	MA61MA10	MA61MA10
	120	MA61MA12	MA61MA12	MA61MA12
	160	MA61MA16	MA61MA16	MA61MA16
	200	MA61MA20	MA61MA20	MA61MA20
	240	MA61MA24	MA61MA24	MA61MA24
600Y/347 V, 3-phase, 4-wire + ground Wye	120	MA81MA12	MA81MA12	MA81MA12
	160	MA81MA16	MA81MA16	MA81MA16
	240	MA81MA24	MA81MA24	MA81MA24
600 V Delta, 3-phase, 3-wire + ground Delta ⁶	100	MA91MA10	MA91MA10	MA91MA10
	120	MA91MA12	MA91MA12	MA91MA12
	160	MA91MA16	MA91MA16	MA91MA16
	180	MA91MA18	MA91MA18	MA91MA18

¹ For Type 1 systems include a "1" at the end of the catalog numbers listed above.

² 208Y/120 series also applies to the following voltage 220Y/127.

³ Phase B modules are different than Phase A and Phase C modules.

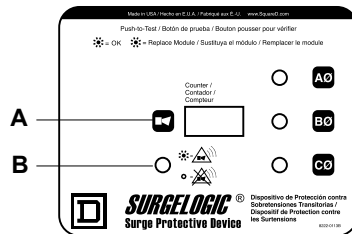
⁴ 480Y/277 series applies to the following voltages 380Y/220, 400Y/230, and 415Y/240.

⁵ 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

⁶ 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

Audible Alarm

Figure 9: Alarm Enable/Disable



Note: Phase B is not present on single-phase application.

Push the alarm enable/disable button (A, Figure 9), to enable or disable the alarm.

- If the green LED (B) is illuminated the alarm is enabled.
- If the green LED (B) is not illuminated the alarm is disabled.

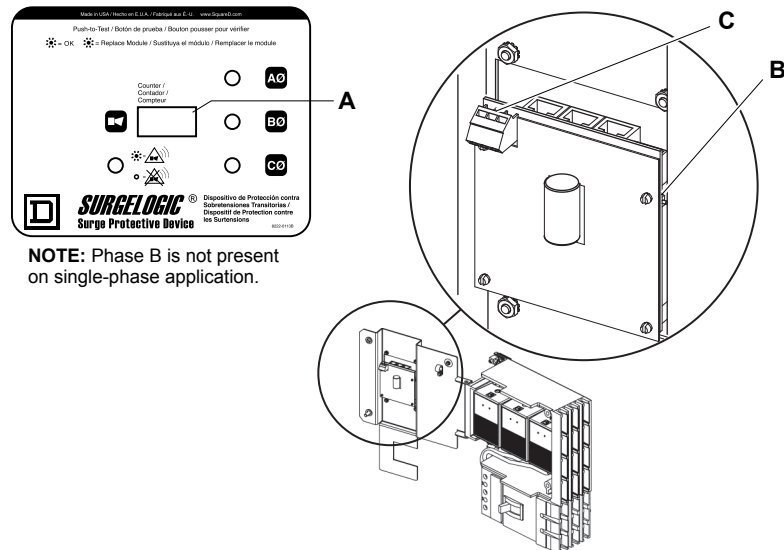
Surge Counter

Note: Refer to “Access to MA Modules and Back of Diagnostic Display Panel” on page 11, for instructions on accessing the rear of the diagnostic display panel to reset the surge counter.

The surge counter (A, Figure 10), displays the number of transient voltage surges since the counter was last reset. The counter is battery powered to retain memory in the event of a power loss to the diagnostic display panel.

To reset the counter to zero, press the counter reset button (B) located inside the unit on the underside of the diagnostic circuit board.

Figure 10: Three-Phase Diagnostic Display Panel with Surge Counter



NOTE: Phase B is not present on single-phase application.

Dry Contacts

The I-Line series Surge Protective Device (SPD) is provided with dry contacts. The connection for the dry contacts (C, Figure 10), is located and labeled on the back of the diagnostic display panel and will accept 22-14 AWG stranded or solid wire. The dry contacts are three-position, Form “C” type with Normally Open, Normally Closed and Common connections. The unpowered state shall be closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (see Table 3).

Table 3: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Applied
NO to COM	Closed
NC to COM	Open

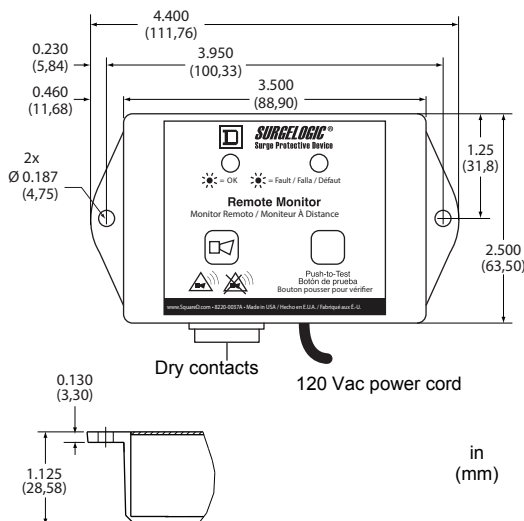
These contacts can be used for remote indication of the SPD's operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described below.

Care must be taken when installing the dry contact wiring because the terminals are on a moving door. Avoid the door hinge, any switches, and the high voltage areas of the enclosure when routing the wiring. To avoid the door hinge, tie wrap any dry contact wiring to the existing cable harness which crosses the hinge. Once the dry contact wiring is secured on a non-moving point of the enclosure, it is the user's responsibility to maintain at least 1.0 in. (25 mm) separation between 600 Vac rated dry contact wiring and the power wiring in the enclosure.

The contacts are designed for a maximum voltage of 24 Vdc / 24 Vac and a maximum current of 2 A. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD's relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the SurgeLogic Technical Assistance Group at 1-800-577-7353.

Remote Monitor Option

Figure 11: Remote Monitor Option (TVS12RMU)



The remote monitor option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is an illuminated green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch. If the alarm is enabled, the green LED will turn off, the red LED will turn on, and the alarm will sound. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off.

If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm will sound. The audible alarm can be silenced by pushing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be illuminated. The red LED will continue to be illuminated until the inoperative condition has been cleared.

The remote monitor includes a 120 Vac to 12 Vdc adapter with a six-foot power cord. Connections are made to the SPD diagnostic panel with Form "C", three-position dry contacts (provided), and the appropriate length of solid or stranded 22–14 AWG wire up to 1000 ft. (305 m), not provided.

Maintenance and Troubleshooting

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

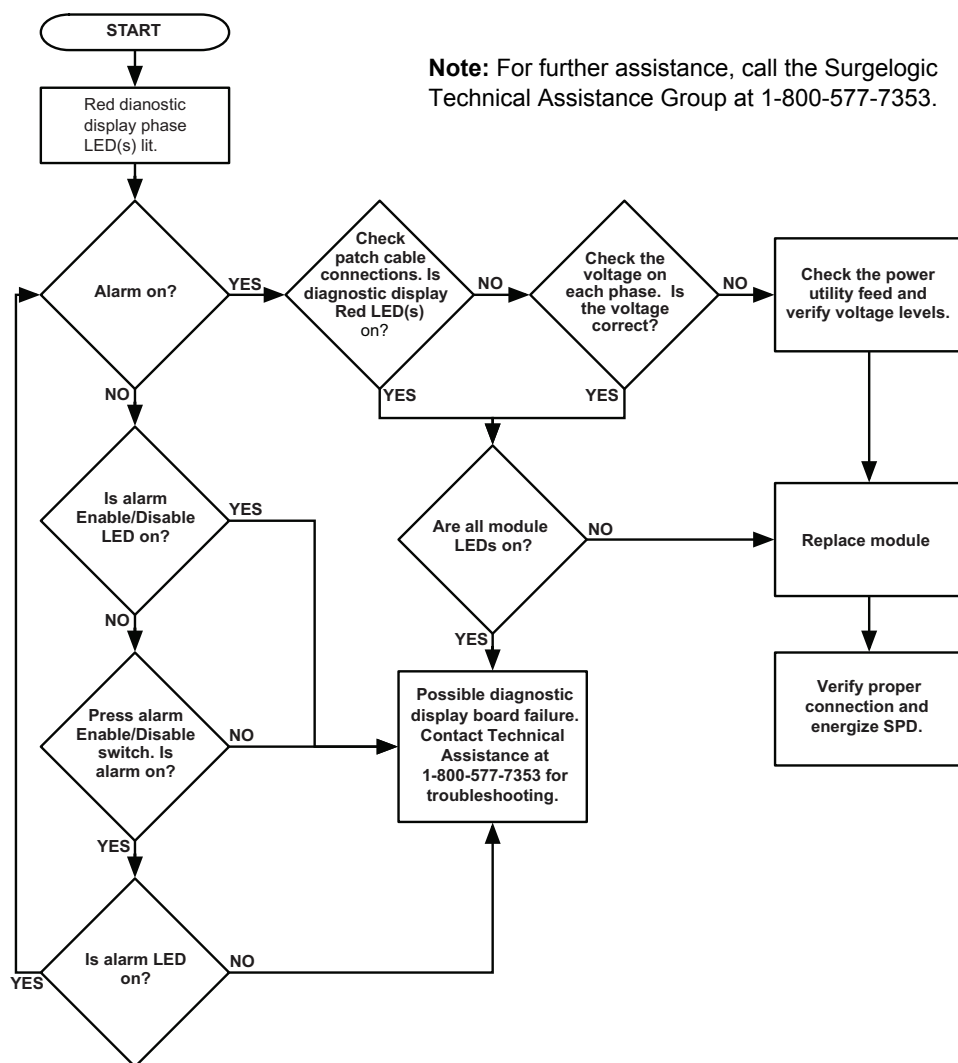
Preventive Maintenance

Inspect the SPD periodically to maintain reliable system performance and continued surge protection. Periodically check the state of the diagnostic display panel LED status indicators. Routinely use the built-in diagnostics to inspect for inoperative modules.

Troubleshooting

If a module shows two green indicator lights and the diagnostic display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 12 below.

Figure 12: Troubleshooting Flowchart



Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- **MA modules.** Replacement instructions are included with the replacement parts.
- **Diagnostic display panel assemblies.** Replacement instructions are included with the replacement parts.

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888-778-2733
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Surgelogic®

IMA Surge Protective Device (SPD)



Instruction Bulletin

8222-0050E

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SQUARE D

by **Schneider** Electric

Precautions

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Ensure that the branch circuit breaker or fuse trip characteristic has been coordinated with the overcurrent components inside the SPD (See Tables 1 and 2).
- Perform periodic inspection of the SPD status indicator lights as part of the preventative maintenance schedule.
- Promptly service the SPD when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple SPDs to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that will automatically disconnect the surge suppression elements from the mains should the surge suppression elements reach end of life. Tripping of the branch circuit breaker or fuse feeding the SPD can occur when the surge suppression elements reach end of life. Mitigate the tripping of the branch circuit breaker or fuse feeding the SPD by coordinating the surge suppression elements with the branch circuits.

For the purposes of coordination, the SPD is equipped with overcurrent components that will limit the per phase I_{2t} , $I_{apparent}$, I_p , and I_{th} values to those listed in tables 1 and 2 when connected to a power system with a short-circuit current rating not exceeding 200,000 A.

Table 1: SPD Without Optional Sine Wave Tracking Module

SPD Device	Per Phase I_2t	I_{apparent}	I_p	I_{th}
TVS_IMA12 through TVS_IMA24	175 kA ² seconds	17,000 A RMS	40,000 A RMS	220 A
TVS_IMA32 through TVS_IMA48	700 kA ² seconds	34,000 A RMS	80,000 A RMS	440 A

Table 2: SPD With Optional Sine Wave Tracking Module

SPD Device	Per Phase I_2t	I_{apparent}	I_p	I_{th}
TVS_IMA12 through TVS_IMA24 and	240 kA ² seconds	21,500 A RMS	48,000 A RMS	260 A
TVS_IMA32 through TVS_IMA48	825 kA ² seconds	37,500 A RMS	88,000 A RMS	480 A

⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the SPDs until the electrical system is completely installed, inspected, tested, and all conductors connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the surge protective device.
- Perform high-potential insulation testing, or any other tests where SPD components will be subjected to voltages higher than their rated turn-on voltage, with the neutral and SPD disconnected from the power source.

Failure to follow these instructions can result in injury or equipment damage.

Operation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

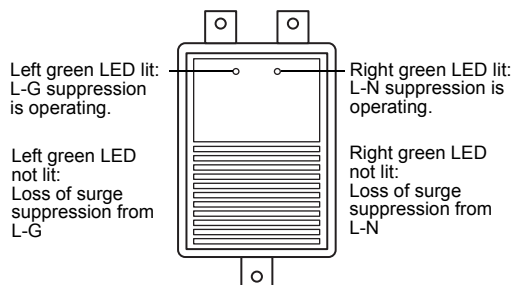
The SPD diagnostic display panel shows the status of each MA module with diagnostically controlled green/red LEDs. If a unit is operating correctly, all the phase LEDs will be illuminated green. To test the integrity of the diagnostics for each phase, push the button below the phase LEDs on the diagnostic display panel. The green LED will turn red and the alarm will sound, if the alarm is enabled. Releasing the test button will complete the test; the red LED will turn green and the alarm will shut off.

If an inoperable condition occurs on any phase, the audible alarm sounds and the corresponding phase LED on the diagnostic display panel is illuminated red. This indicates that the device needs service by qualified electrical personnel. The audible alarm can be silenced, until a qualified person is able to evaluate and service the SPD, by pressing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red phase LED will continue to be illuminated until the inoperative condition has been cleared.

On an MA module (see Figure 1), if either LED is not lit, the module should be replaced. If both green LEDs are not lit and the diagnostic display panel has power, then power has been lost to that phase or the module should be replaced (refer to Table 4 on page 7). Refer to the final equipment instruction bulletin for MA module disconnection and access instructions.

When power is applied to the SPD and one or more of the diagnostic display panel LEDs are red, and one or more MA module LEDs are out, the appropriate MA module should be replaced. Refer to "Troubleshooting" on page 8 for proper troubleshooting procedures.

Figure 1: MA Module LEDs



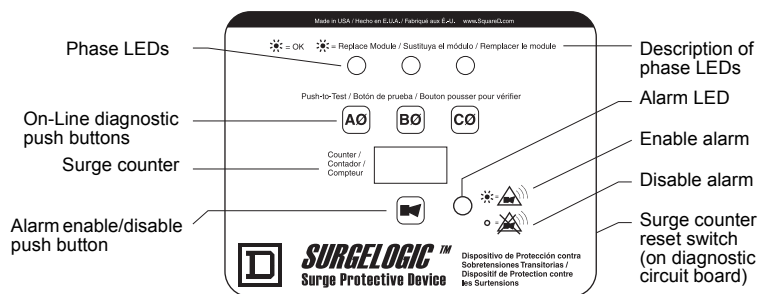
Surge Counter

The surge counter displays the number of transient voltage surges since the counter was last reset. The counter is battery powered to retain memory in the event of a power loss to the diagnostic display panel.

To reset the surge counter to zero:

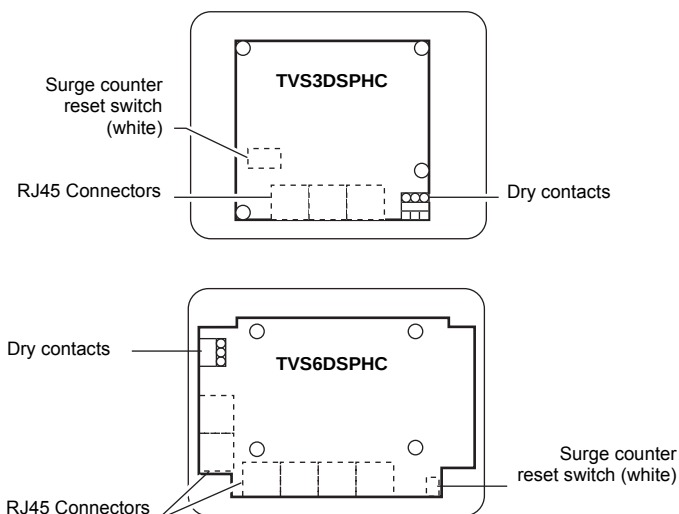
1. Remove all power from this equipment.
2. Remove covers as necessary to gain access to the diagnostic circuit board.
3. Press the small switch located on the underside of the diagnostic circuit board (near the RJ45 connectors; see Figure 3:). This will reset the counter to zero.

Figure 2: Three-Phase Diagnostic Display Panel with Surge Counter



NOTE: Phase B is not present on single-phase applications.

Figure 3: Rear of Diagnostic Circuit Board



Dry Contacts

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use 600 Vac rated dry contact wiring.
- Dry contact wiring must have less than 1/16 in. (1.6 mm) exposed wire from the dry contact block.
- Maintain at least 1.0 in. (25 mm) separation between dry contact wiring and the power wiring in the enclosure.

Failure to follow these instructions will result in death or serious injury.

The IMA series SPD is provided with dry contacts. The connection for the dry contacts is located on the back of the diagnostic display panel (lower right corner). The dry contacts are 3-position, Form "C" type with Normally Open, Normally Closed and Common connections. The unpowered state shall be closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (See Table 3).

Table 3: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Removed
NC	Normally closed
COM	Common
NO	Normally open

These contacts can be used for remote indication of the SPD device's operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described below.

The contacts are designed for a maximum voltage of 24 Vdc / 24 Vac and a maximum current of 2 A. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD's relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the SurgeLogic Technical Assistance Group at 1-800-577-7353.

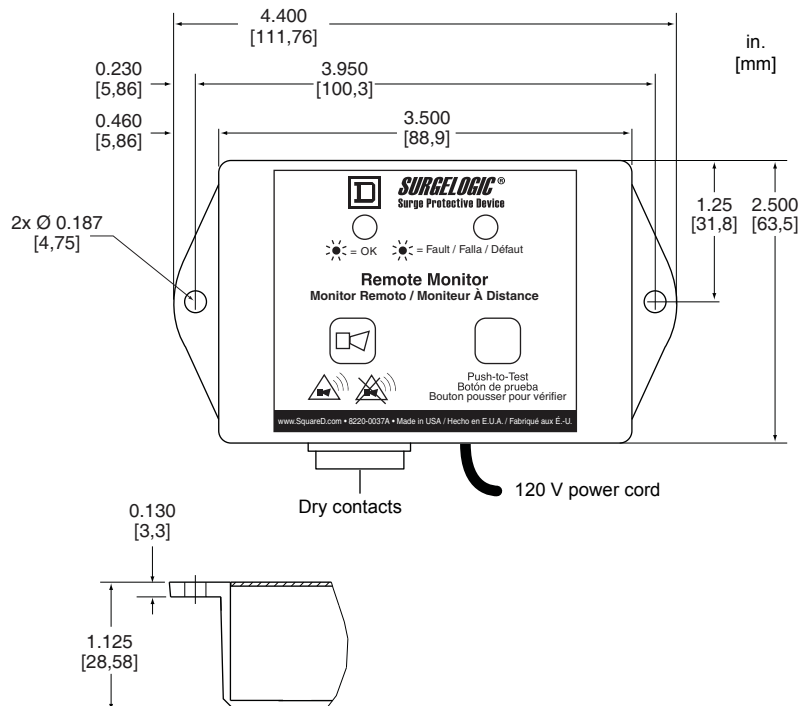
Remote Monitor Option

The option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is a lit green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch.

The green LED will turn off, the red LED will turn on, and the alarm will sound, if the alarm is enabled. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off. If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm sounds. The audible alarm can be silenced by moving the alarm enable/disable switch to the disable position. The alarm will silence and the green alarm LED will not be lit. The red LED will continue to be illuminated until the inoperative condition had been cleared.

The remote monitor includes a 120 Vac to 12 Vdc adapter with a six-foot power cord. Connections are made to the SPD diagnostic display panel with Form "C", 3-position dry contacts (provided) and the appropriate length of solid or stranded 30 to 14 AWG wire (not provided).

Figure 4: Remote Monitor Option (TVS12RMU)



Maintenance and Troubleshooting

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Preventive Maintenance

Inspect the SPD periodically to maintain reliable system performance and continued transient voltage surge suppression. Periodically check the state of the diagnostic display panel LED status indicators. Routinely use the built-in diagnostics to inspect for inoperative modules.

Replacement Modules

Table 4: EMA Series Replacement Modules

System Voltage	Peak Surge Current Rating (kA)	Phase A	Phase B	Phase C
120/240 V, 1-phase, 3-wire	120	MA1IMA12	—	MA1IMA12
	160	MA1IMA16	—	MA1IMA16
	240	MA1IMA24	—	MA1IMA24
208Y/120 V, 3-phase, 4-wire ¹	120	MA1IMA12	MA1IMA12	MA1IMA12
	160	MA1IMA16	MA1IMA16	MA1IMA16
	240	MA1IMA24	MA1IMA24	MA1IMA24
120/240 V, 3-phase, 4-wire ²	120	MA1IMA12	MA3IMA12	MA1IMA12
	160	MA1IMA16	MA3IMA16	MA1IMA16
	240	MA1IMA24	MA3IMA24	MA1IMA24
480Y/277 V, 3-phase, 4-wire ³	120	MA4IMA12	MA4IMA12	MA4IMA12
	160	MA4IMA16	MA4IMA16	MA4IMA16
	240	MA4IMA24	MA4IMA24	MA4IMA24
600/347 V, 3-phase, 4-wire	120	MA8IMA12	MA8IMA12	MA8IMA12
	160	MA8IMA16	MA8IMA16	MA8IMA16
	240	MA8IMA24	MA8IMA24	MA8IMA24

¹ 208Y/120 series also applies to the following voltage 220Y/127.

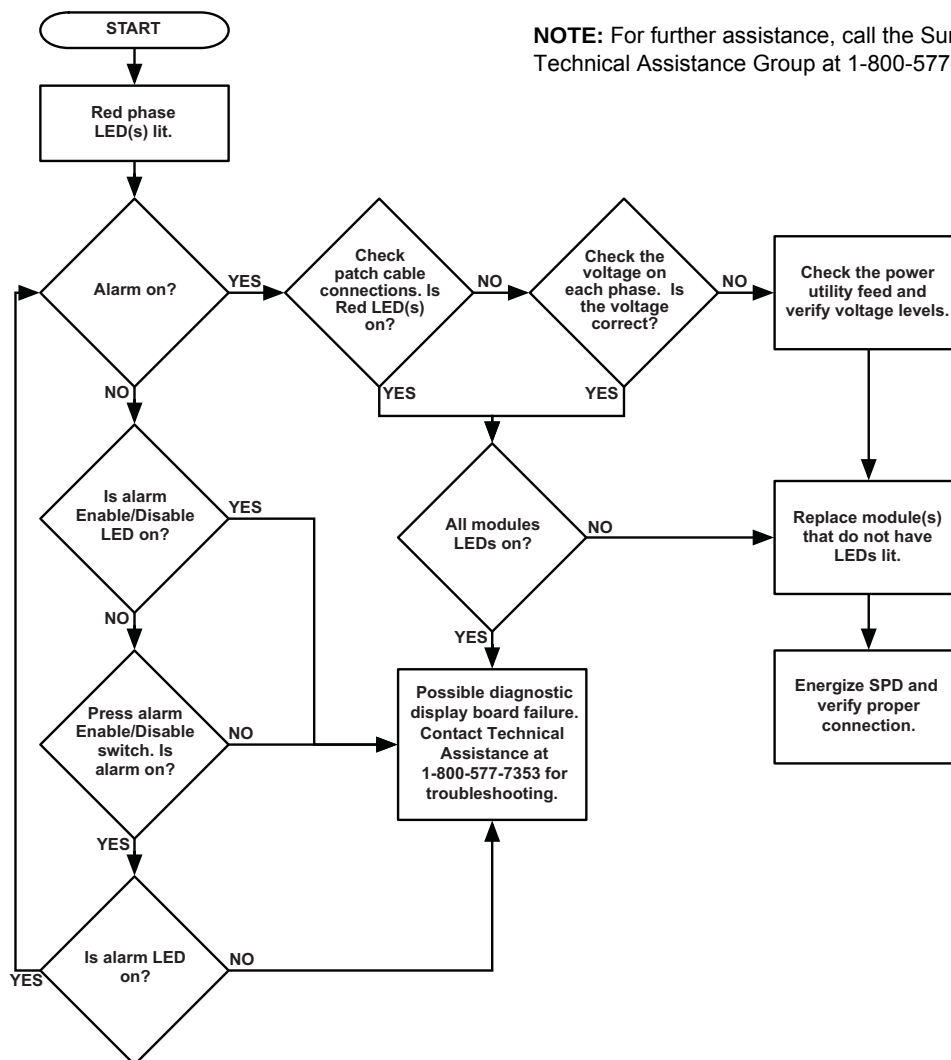
² High-leg delta (Phase B modules are different than Phase A and Phase C modules).

³ 480Y/277 series applies to the following voltages 380Y/220, 400Y/230, and 415Y/240.

Troubleshooting

If a module shows two green indicator lights and the display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 5 below.

Figure 5: Troubleshooting Flow Chart



Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- MA modules. Replacement instructions are included with the replacement parts.
- Diagnostic display panel assemblies. Replacement instructions are included with the replacement parts.

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SurgeLogic™

NQ SurgeLoc™ Brick Assembly

Surge Protective Devices (SPDs)



Instruction Bulletin
Directives d'utilisation

8400-0002A

11/2014

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by Schneider Electric

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Precautions

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Ensure that the branch circuit breaker or fuse trip characteristic has been coordinated with the overcurrent components inside the Surge Protective Device (See Tables 1 and 2).
- Perform periodic inspection of the Surge Protective Device status indicator lights as part of the preventative maintenance schedule.
- Promptly service the Surge Protective Device when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple Surge Protective Devices to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

At end-of-life conditions, Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that disconnect the surge suppression elements from the electrical supply should the surge suppression elements reach end of life. Tripping of the branch circuit breaker or fuse feeding the SPD can occur when the surge suppression elements reach end of life.

The SPD is equipped with overcurrent components that will limit the per phase I^2t , I_{apparent} , I_p , and I_{th} values to those listed in Tables 1 and 2 when connected to a power system with a short-circuit current rating not exceeding 200,000 A.

Table 1: SPD Operational Limits

SPD Device	Per Phase I_{2t}	I_{apparent}	I_p	I_{th}
SSP01BIA08 through ¹ SSP01BIA24	153 kA ² seconds	17,000 A RMS	43,000 A RMS	160 A
SSP02BIA08 through SSP02BIA24				
SSP03BIA08 through SSP03BIA24				

¹ Catalog numbers are representational. Model numbers are not recognized in the Schneider Electric™ ordering system until a suffix code is applied.

⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the Surge Protective Devices until the electrical system is completely installed, inspected, tested, and all conductors have been connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the Surge Protective Device.
- Perform high-potential insulation testing, or any other tests where Surge Protective Device components will be subjected to voltages higher than their rated turn-on voltage, with the neutral and Surge Protective Device disconnected from the power source.

Failure to follow these instructions can result in injury or equipment damage.

Introduction

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

NOTE: For troubleshooting, call the Surgelocic Technical Assistance Group at 1-800-577-7353.

Proper installation is imperative to maximize the NQ SurgeLoc Assembly SPD's effectiveness and performance. The installer should follow the steps outlined in this instruction bulletin to ensure proper installation. Read the entire instruction bulletin before beginning the installation. These instructions are not intended to replace national or local electrical codes. Check all applicable electrical codes to verify compliance. Installation of NQ brick surge suppressors should only be performed by qualified electrical personnel.

Unpacking and Preliminary Inspection

Inspect the entire shipping container for damage or signs of mishandling before unpacking the device. Remove the packing material and further inspect the device for any obvious shipping damage. If any damage is found and is a result of shipping or handling, immediately file a claim with the shipping company.

Storage

The device should be stored in a clean, dry environment. Storage temperature is -40 °F to +149 °F (-40 °C to +65 °C). All of the packaging materials should be left intact until the device is ready for installation.

Safety Labels

English, Spanish, and French versions of all safety labels (Danger, Warning, and Notice) are provided.

Surge Protective Device (SPD) Location Considerations

Environment

The device is designed to operate in an ambient temperature range of -4 °F to +104 °F (-20 °C to +40 °C) with a relative humidity of 0 to 95% non-condensing. The operating temperature of the LCD on the diagnostic display panel is +14 °F to +140 °F (-10 °C to +60 °C). All NQ SurgeLoc devices operate normally without reduction in performance when subjected to shock and vibrations described in IEC 60721-3-3, Class 3M4.

Audible Noise

The device background noise is negligible and does not restrict the location of the installation.

Mounting

Refer to Figure 11 found on page 17 for typical mounting dimensions and weight.

Service Clearance

The service clearance should meet all applicable code requirements.

Equipment Performance

To obtain the maximum system performance, locate the device as close to the circuit being addressed as possible, to minimize the interconnecting wiring length. For every foot of wire length, approximately 160 Volts (6 kV / 3 kA, 8/20 microsecond) is added to the suppressed voltage. The Voltage Protection Rating (VPR) is located on the device nameplate and is measured six inches from the enclosure sidewall, according to UL® 1449 Third Edition.

Electrical

Voltage Rating

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Prior to mounting the SPD, verify that the device has the same voltage rating as the power distribution system in which it is installed. Compare the nameplate voltage on the SPD with the nameplate of the electrical distribution equipment.

The specifier or user of the device must be familiar with the configuration and arrangement of the power distribution system in which any SPD is to be installed. The system configuration of any power distribution system is based strictly on how the secondary windings of the transformer supplying the service entrance main or load are configured. This includes whether or not the transformer windings are referenced to earth via a grounding conductor. The system configuration is not based on how any specific load or equipment is connected to a particular power distribution system. See Table 2 for the service voltage of each SPD.

Table 2: Voltage Ratings

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Number
120/240 V ¹ , 1-phase, 3-wire + ground	80 kA	SSP01BIA08PBQ1
	100 kA	SSP01BIA10PBQ1
	120 kA	SSP01BIA12PBQ1
	160 kA	SSP01BIA16PBQ1
	200 kA	SSP01BIA20PBQ1
	240 kA	SSP01BIA24PBQ1
120/208 V ¹ , 3-phase, 4 wire + ground	80 kA	SSP02BIA08PBQ1
	100 kA	SSP02BIA10PBQ1
	120 kA	SSP02BIA12PBQ1
	160 kA	SSP02BIA16PBQ1
	200 kA	SSP02BIA20PBQ1
	240 kA	SSP02BIA24PBQ1
240/120 V, High-leg Delta, 3-phase, 4-wire + ground	80 kA	SSP03BIA08PBQ1
	100 kA	SSP03BIA10PBQ1
	120 kA	SSP03BIA12PBQ1
	160 kA	SSP03BIA16PBQ1
	200 kA	SSP03BIA20PBQ1
	240 kA	SSP03BIA24PBQ1

¹ Catalog numbers are representational. Model numbers are not recognized in the Schneider Electric ordering system until a suffix code is applied.

Terminals, Wire Size, and Installation Torque

This SPD is designed to work in Square D™ Type NQ panelboards. Only panelboard bus screws should be used to connect the phase ring terminals to the bus bar.

Table 3: Terminal Torque

Power Connection	Torque
AØ, BØ, CØ and N	18 lb-in. (2 N•m)
Ground	

Branch Circuit Overcurrent Protection

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use conductors rated for the Overcurrent Protection Device (OCPD) per applicable codes.
- Use conductors rated for the application per applicable codes.

Failure to follow these instructions will result in death or serious injury.

UL 1449 Type 1 SPDs have been designed and approved for line side applications prior to the main service disconnect without supplemental overcurrent protection.

Type 1 SPDs can also be used in Type 2 applications (load side of OCPD). When either Type 1 or Type 2 SPDs are used on the load side, they must be installed per local codes.

Since the current drawn by the SPD device during standby operation is negligible, the SPD device can be connected to a dedicated, separate branch circuit or connected to a suitable existing branch circuit.

- When connecting to a separate, dedicated branch circuit, the OCPD setting must be selected to protect the conductors feeding the SPD device.
- When connecting to an existing branch circuit, the conductors connected to the SPD device must have an ampacity not less than the setting of the existing OCPD. (No larger than 30 A).

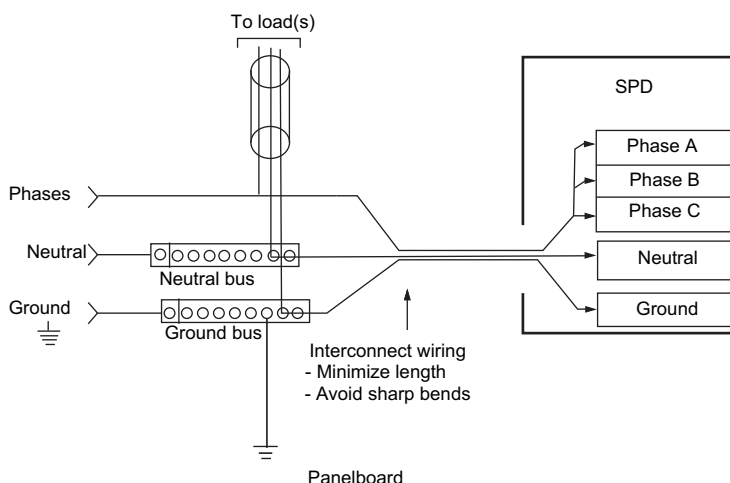
During overvoltage surge diversion, current will flow through the SPD device. The branch circuit OCPD must pass this current without tripping for the SPD device to function properly.

For further information concerning coordination of the OCPD with the SPD device, refer to Table 1.

Location of Surge Protective Device (SPD)

Locate the SPD as close as possible to the circuit being addressed to minimize the wire length and optimize SPD performance. Avoid long wire runs so that the device will perform as intended. Avoid sharp bends in the conductors. See Figure 1.

Figure 1: Surge Protective Device Wiring Practice



Grounding

⚠ WARNING

HAZARDOUS TOUCH VOLTAGE

- Connect the Surge Protective Device ground terminal to the building grounding grid structure.
- Use an appropriately sized equipment grounding conductor.
- Do not use a separate isolated ground for the NQ SurgeLoc Assembly device.
- Verify proper equipment connection to the grounding system.
- Verify ground grid continuity by performing regularly scheduled inspections and testing as part of a comprehensive electrical maintenance program.

Failure to follow these instructions can result in death or serious injury.

General

The NQ SPD has SPD elements connected from phase to ground. It is critical that there be a robust and effective connection to the building grounding structure. The grounding connection must utilize an equipment grounding conductor run with the phase and neutral (if present) connection of the power system. The SPD device should not be connected to a separate isolated ground.

For best overvoltage suppression by the NQ SPD, use a single-point ground system where the service entrance grounding electrode system is connected to and bonded to all other available electrodes, building steel, metal water pipes, driven rods, etc. (for reference, see IEEE 142-2007). The ground impedance measurement of the electrical system should be as low as possible, and in compliance with all applicable codes.

Solidly-Grounded Power Systems

NOTICE

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Do not connect devices rated for use on solidly-grounded power systems to resistance-grounded (for example, High Resistance Ground) or ungrounded power systems.
- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral terminal of the power system transformer feeding the device is bonded to system ground in accordance with all applicable codes.

Failure to follow these instructions can result in equipment damage.

SPDs rated for use on solidly-grounded power systems must not be connected to resistance-grounded (for example, HRG) or ungrounded power systems. Such a connection can result in damage to the SPD.

Always verify the power system grounding configuration prior to application of power to the device. Confirm that all ground bonds are installed at both the service entrance equipment and power system transformer prior to application of power.

Installation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

UL Conditions of Acceptability

For use only in equipment where the acceptability of the combination is determined by Underwriters Laboratories®. When installed in the end-use equipment, the following are among the considerations to be made:

1. A suitable electrical enclosure shall be provided in the end-use product.
2. The device is intended for factory and field installations with the suitability of the connections (including spacing's between factory connectors) determined in the end-use application.
3. The Voltage Protection Rating (VPR) shall be determined in the end-product where applicable.
4. The SPD unit has been subjected to the following tests of UL 1449, 3rd Edition:
 - a. Surge Testing (VPR)
 - b. Nominal Discharge Current Test (20 kA)
 - c. Dielectric Voltage Withstand
 - d. Current Testing (200 kA Short Circuit Current, Intermediate Protective Devices (OCPD) or external enclosures.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Follow the steps listed below when making wiring connections:

If you have any questions pertaining to the installation of this device, contact the Surgelocic Technical Assistance Group at 1-800-577-7353.

SurgeLoc Assembly Installation

1. Turn off all power supplying this equipment before working on or inside any enclosure containing this equipment.
2. Confirm the SPD assembly has the same voltage rating and configuration as the system voltage and power system configuration to which it will be connected.
3. Remove panel door, dead front, and trim.
4. For best performance locate the SPD immediately adjacent to the main bus terminals. Note, keep ground and neutral wires as short as possible.
5. Facing the panel snap in mounting bracket, leading with the left edge of the SPD. Rotate the mounting bracket into place. See Figure 2.
6. Install four mounting screws provided. See Figure 3.

Figure 2: Mount Installation

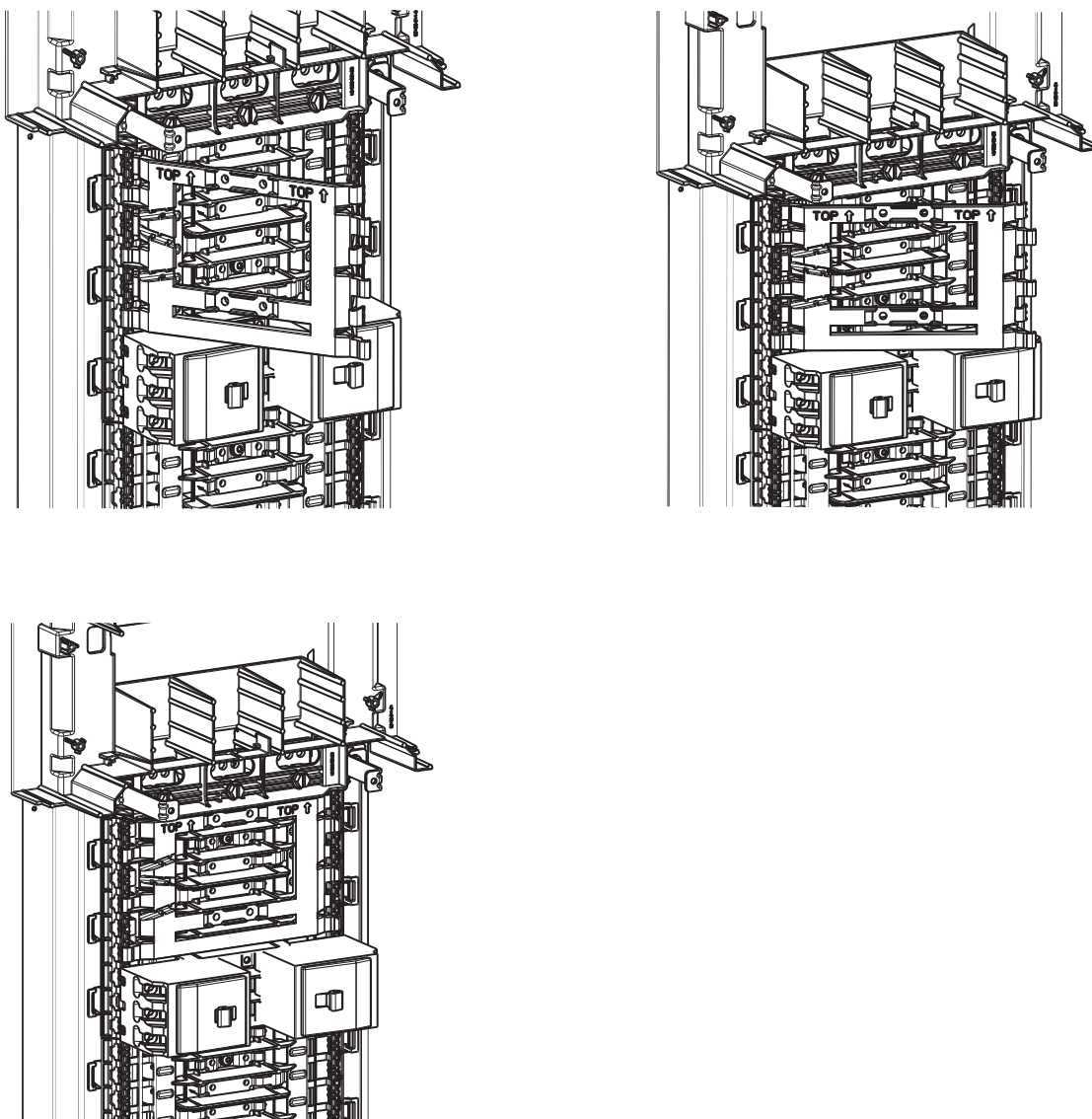
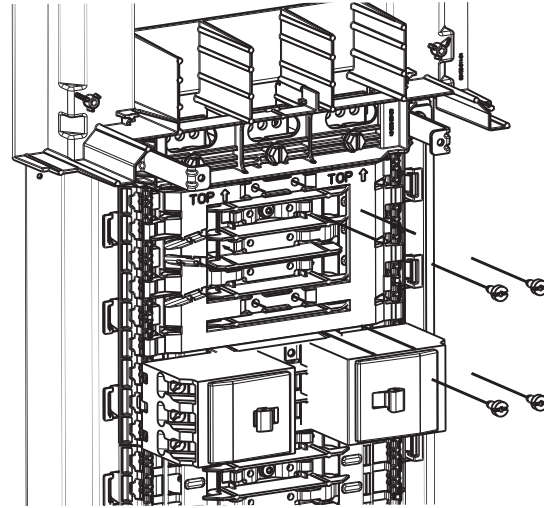


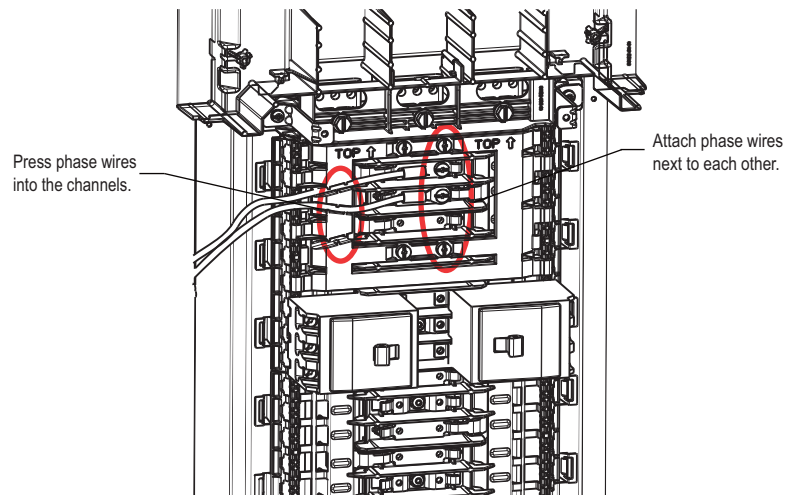
Figure 3: Mount Screws



Connecting SPD Directly to the Bus

7. Attach the phase wires per the phase requirements:
 - a. Split phase direct bus installation.
 - i. Attach phase wires to buses next to each other as shown in Figure 4.

Figure 4: Split Phase Wire Connection



- ii. Ensure phase A and B wires are connected to the corresponding buses.

NOTE: The third row has no connection.

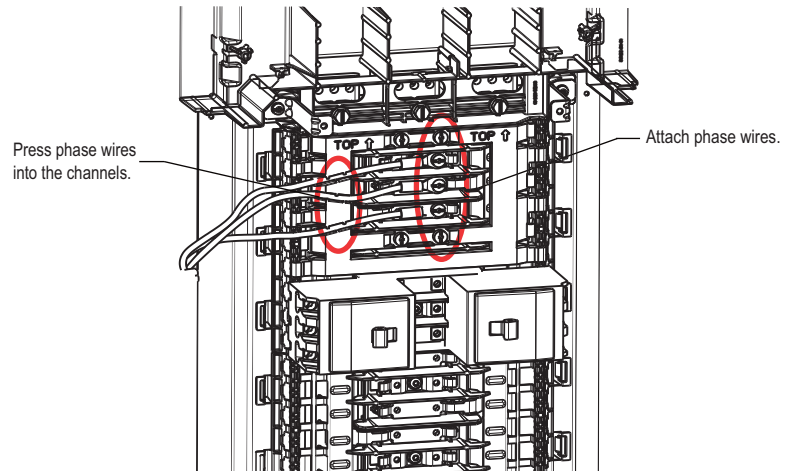
iii. Press phase wires into wire channels on mount bracket as shown in Figure 4.

NOTE: Ensure that the phase wires are not pinched between the mounting bracket and the SPD housing.

b. Three (3) phase WYE direct bus installation.

i. Attach phase wires to buses as shown in Figure 5.

Figure 5: WYE/Delta Phase Wire Connection



c. Three (3) phase high leg delta direct bus installation.

i. Attach phase wires to buses as shown in Figure 5.

NOTE: The orange wire must connect to the high leg bus.

ii. Ensure phase A, B, and C wires are connected to the corresponding buses.

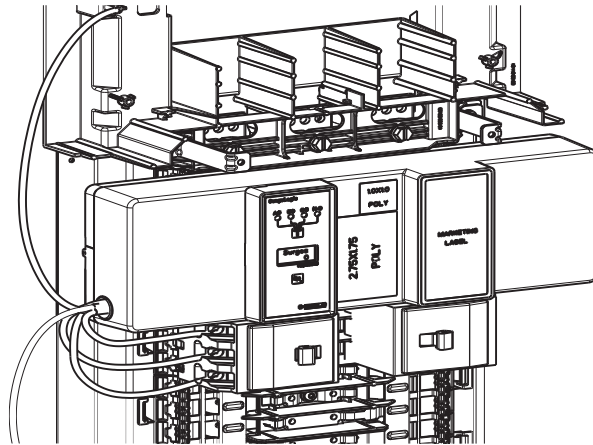
Connecting SPD through an OCPD (Disconnect)

d. Connecting SPD through a OCPD (Disconnect)

i. Cut phase wire to length and strip insulation per circuit breaker manufacture instructions.

ii. Ensure phase A, B, and C (as required) wires are connected to the dedicated OCPD. See Figure 6.

Figure 6: Generic Circuit Breaker Connection

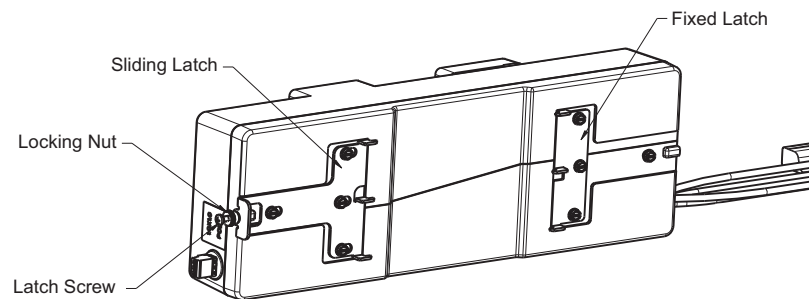


Installing SPD

e. Installing SPD

- i. Refer to Figure 7 for instruction to secure SPD to the mount bracket.

Figure 7: SPD Mounting Brackets



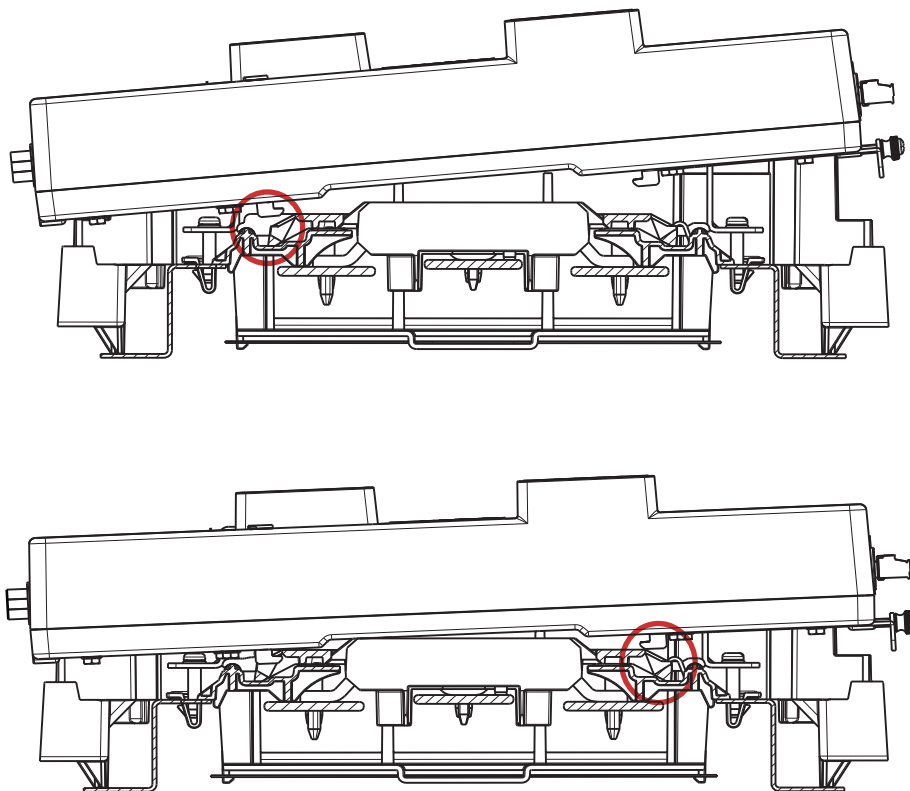
- ii. Unlock the sliding latch by turning the locking nut counterclockwise until it contacts the latch screw head.

NOTE: Do not loosen the latch screw.

- iii. Pull the sliding latch outward to the unlocked position approximately 1/4 in. (7 mm).

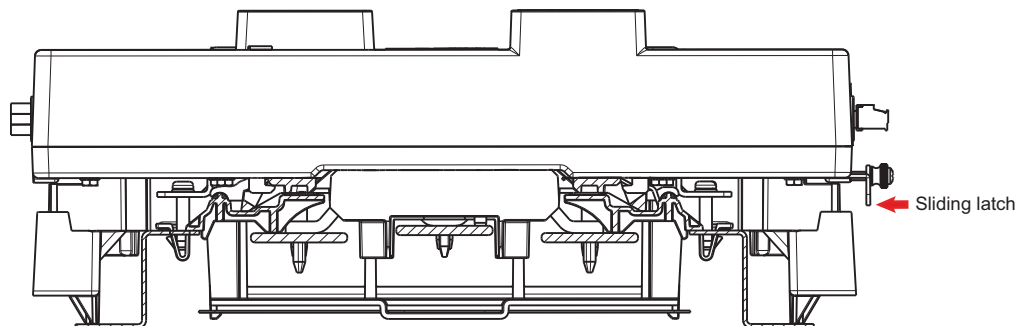
- 8. Engage the fixed latch with slots in the mount bracket. See Figure 8.

Figure 8: SPD Mount Interlocks



9. Snap the SPD into the left hand slots of the mounting bracket.

Figure 9: Sliding Latch Engagement



10. Push the sliding latch inward into the locked position and tighten the nut.

11. Connect the neutral wire to the neutral bus and the ground wire to the ground bus. For best performance keep wires as short as possible with no sharp bends.

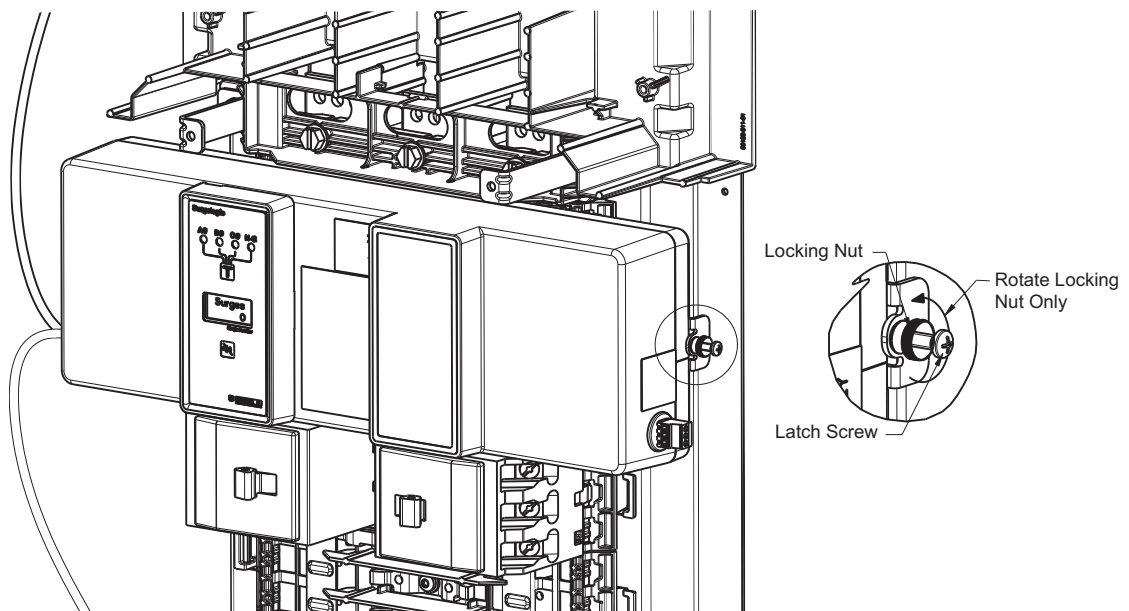
NOTE: This product will not work properly without neutral and ground connections.

12. Check that all connections are secure. Remove all tools and discarded hardware from the unit.
13. If necessary remove twelve (12) twist outs, six (6) per side, from the dead front to correlate with the SPD bezel.
14. Replace the deadfront, cover/door, and/or trim to the equipment.
15. Equipment may be re-energized after all of the above steps are complete.

SurgeLoc Assembly Removal

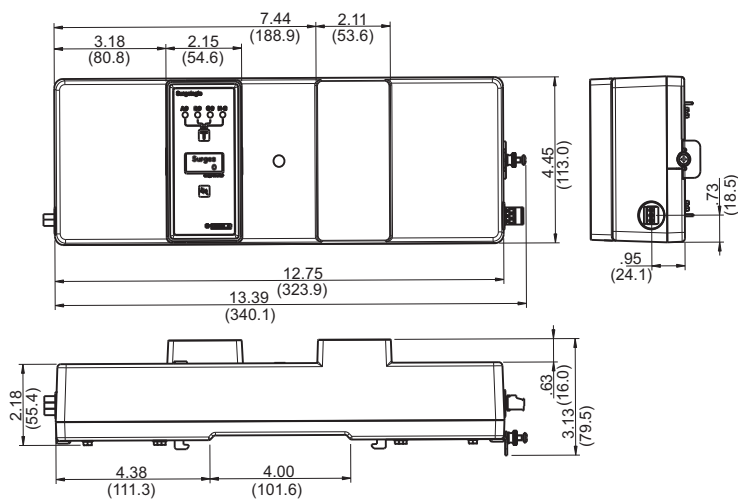
1. Turn off all power supplying this equipment before working on or inside any enclosure containing this equipment.
2. Remove any doors, trims, and the deadfront panel, per the panelboard instruction, so as to expose the SPD.
3. Loosen the locking nut by rotating it counter-clockwise until the nut reaches the latch screw head. Do not remove or loosen the latch screw. See Figure 10 and Figure 7 for part nomenclature. Pull the right side of the brick unit forward approximately 1/4 in. (7 mm) to release the sliding latch from the mount bracket slots.
4. Move the entire SPD to the left approximately 1/2 in. (13 mm) to release the fixed latch.
5. Remove the three phase screws to disconnect the three phase wires and secure the SPD.
6. Disconnect the ground and neutral wires.
7. Remove the SPD assembly.

Figure 10: Latch Nut Disengagement



Dimensions and Weights

Figure 11: 12 in. x 12 in. NEMA 1 / 3R / 12 Enclosures



Approximate Weight	7 lb. ± 1 lb.
Door Depth	0.5 in. [12.7 mm]
Total Depth	6.24 in. (158.5)

Wiring Diagrams

Figure 12: Split-Phase Three-Wire Grounded Installation

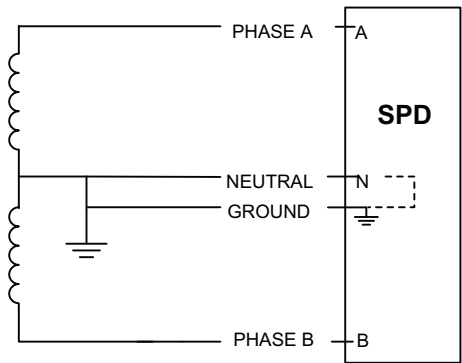


Figure 13: Three-Phase, Four-Wire, Grounded Wye Installation

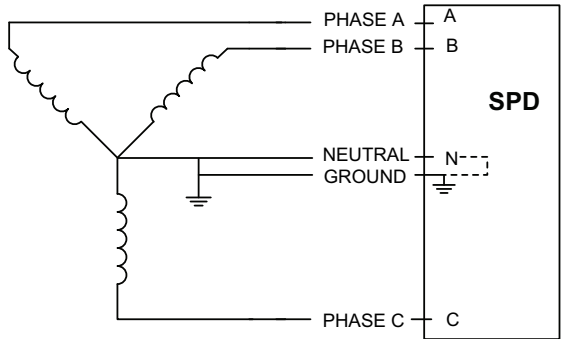
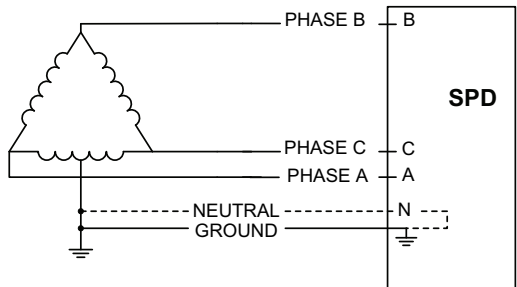


Figure 14: Three-Phase, Four-Wire, High-Leg Delta Installation



Wiring Diagrams With Circuit Breaker Connection Switch

Figure 15: Split-Phase, Three-Wire, Grounded Installation Circuit Breaker Connection

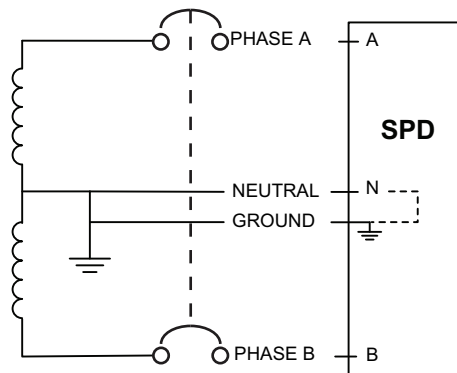


Figure 16: Three-Phase, Four-Wire, Grounded Wye Installation with Circuit Breaker Connection

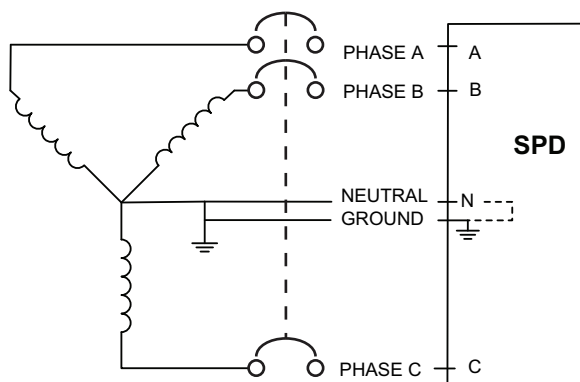
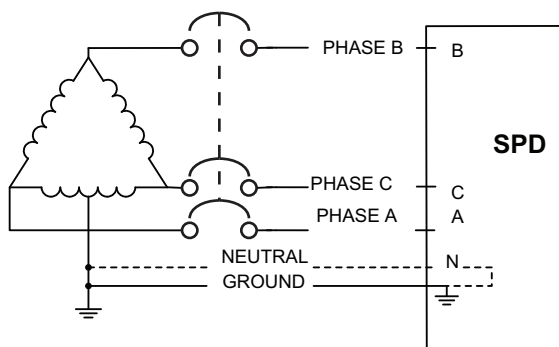


Figure 17: Three-Phase, Four-Wire, High-Leg Delta Installation with Circuit Breaker Connection



Operation

LED Status Indicators

⚠ DANGER

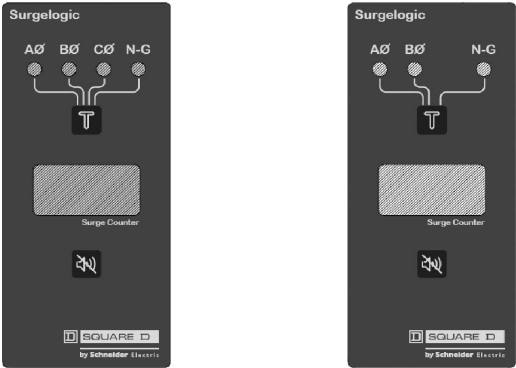
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

The SPD diagnostic display panel shows the status of each phase with green/red LEDs (see Figure 18). If the SPD is operating correctly, all of the phase LEDs will be illuminated green. If the LEDs are not illuminated in green follow the Troubleshooting flow chart, Figure 20.

Figure 18: MA Module LEDs



Audible Alarm

Push the alarm enable/disable button to enable or disable the alarm (see Figure 18). If the green alarm LED is lit the alarm is enabled. If the green alarm LED is not lit the alarm is disabled.

Surge Counter

The surge counter displays the number of transient voltage surges since the counter was last reset. To reset the surge counter press and hold the “Test” button for approximately 6 seconds.

Dry Contacts

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use 600 Vac rated dry contact wiring.
- Dry contact wiring must have less than 1/16 in. (1.6 mm) exposed wire from the dry contact block.
- Maintain at least 1.0 in. (25 mm) separation between dry contact wiring and the power wiring in the enclosure.

Failure to follow these instructions will result in death or serious injury.

The NQ SurgeLoc series SPD comes equipped with dry contacts. The dry contacts are three-position, Form "C" type with Normally Open, Normally Closed, and Common connections.

In the unpowered state the contact is closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (See Table 4).

These contacts can be used for remote indication of the SPD's operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described in the next section.

Table 4: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Applied
NO to COM	Closed
NC to COM	Open

The dry contacts are designed for a maximum voltage of 250 Vac / 30 Vdc and a maximum current of 6 A. Minimum switching load is 10 mA at 5 Vdc. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the SurgeLogic Technical Assistance Group at 1-800-577-7353.

Remote Monitor Option

The remote monitor option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is a lit green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch. If the alarm is enabled, the green LED will turn off, the red LED will turn on, and the alarm will sound. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off.

If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm will sound. The audible alarm can be silenced by pushing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red LED will continue to be illuminated until the inoperative condition has been cleared.

The remote monitor includes a 120 Vac to 12 Vdc adapter with a six-foot power cord. Connections are made to the SPD diagnostic panel with Form "C", 3-position dry contacts (provided) and the appropriate length of solid or stranded 22–14 AWG wire up to 1000 ft. (305 m) not provided.

Technical drawing of the SurgeLogic Remote Monitor, showing front and side views with dimensions in inches and millimeters.

Front View Dimensions:

- Overall Width: 4.400 (111,76)
- Overall Height: 2.500 (63,5)
- Top Mounting Hole Spacing: 3.950 (100,3)
- Bottom Mounting Hole Spacing: 3.500 (88,9)
- Top Mounting Hole Diameter: 0.230 (5,8)
- Bottom Mounting Hole Diameter: 0.460 (5,86)
- Mounting Hole Pattern: 2x Ø 0.187 (4,75)
- Right Side Mounting Hole Diameter: 1.25 (31,8)

Front View Labels:

- SURGELOGIC®**
Surge Protective Device
- ☀ = OK ☀ = Fault / Falla / Défaut
- Remote Monitor**
Monitor Remoto / Moniteur À Distance
- Push-to-Test
Botón de prueba
Bouton pousser pour vérifier
- www.SquareD.com • 6220-0027A • Made in USA / Hecho en E.U.A. / Fabriqué aux E.-U.

Side View Dimensions:

- Top Flange Thickness: 0.130 (3,3)
- Overall Depth: 1.125 (28,58)

Other Labels:

- 120 Vac power cord**
- Dry contacts**

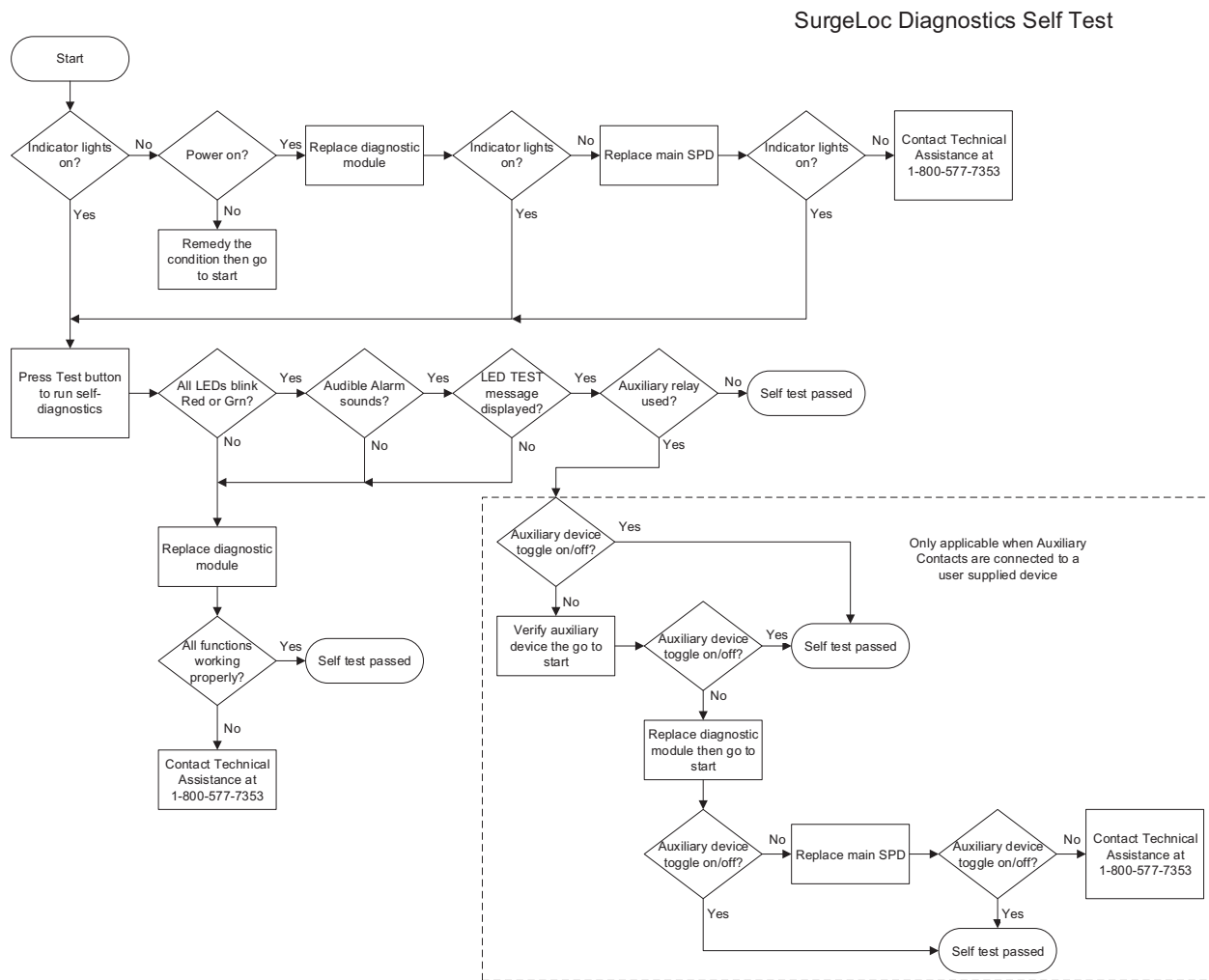
For troubleshooting, call the Surgelologic Technical Assistance Group at 1-800-577-7353.

Troubleshooting

If a module shows two green indicator lights and the display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 20.

Figure 20: Troubleshooting Flow Chart

NOTE: For further assistance, call the Surgelogic Technical Assistance Group at 1-800-577-7353.



Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- SSP1DSPBIA - Split phase 2 wire diagnostic
- SSP3DSPBIA - Three phase 3 & 4 wire diagnostic

NQ SurgeLoc Assembly Surge Protective Devices (SPDs)
Instruction Bulletin

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888-778-2733
www.schneider-electric.us

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8222-0002A, 11/2014



**30 Ampere Disconnect Switches with Flange Mounted Operating Mechanism
Used in Classes 8538 and 8738 —
Type SB Series C Size 0 and Type SC Series C Size 1
3-Pole AC Combination Starters**

WARNING: Be sure to open the back-up disconnect device ahead of the combination starter before inspecting or servicing the disconnect switch. Do not operate starter or disconnect switch with arc chamber cover or arc suppressor removed.

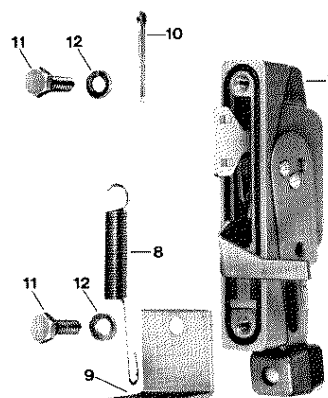
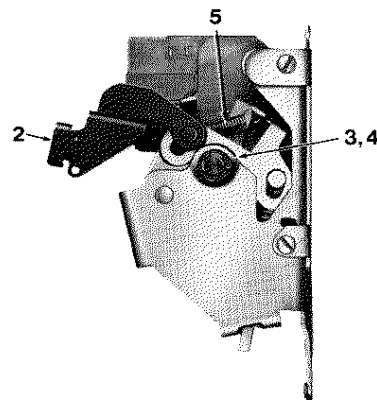
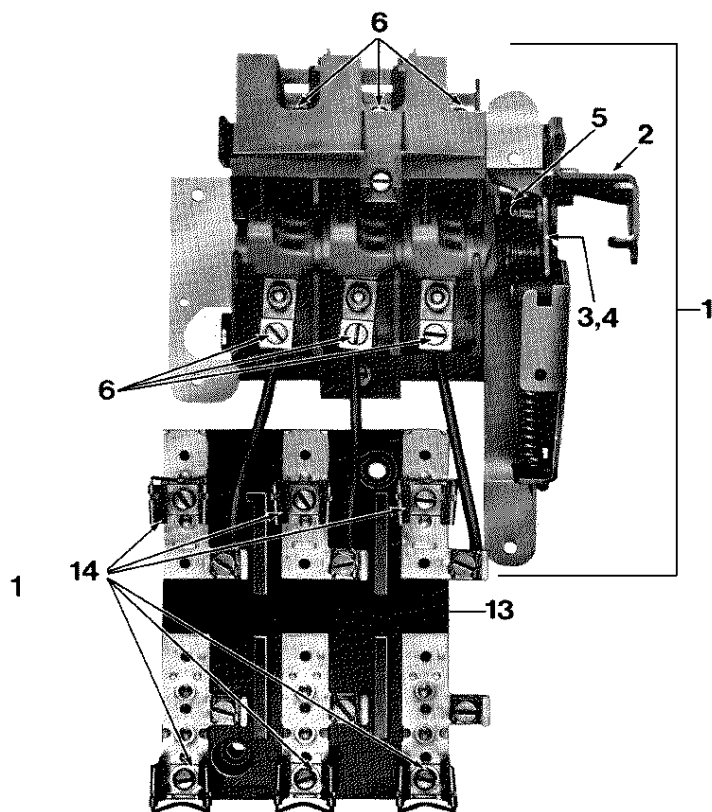


TABLE I PARTS LIST

Item No.	Description	Part Number	Quantity Required
1	Complete Disconnect Switch Assembly with operating mechanism — includes Items 2-6	31301-014-52	1
2	Link Assembly	31301-012-50	1
3	Washer	31301-006-01	2
4	E-Ring	29907-016-10	1
5	Spring	31301-010-01	1
6	Lug	25065-03800	6
7	Handle Assembly		
	For NEMA Type 1 or 12 enclosure	31055-229-51	1
	For NEMA Type 4 enclosure	31055-229-52	1
8	Return Spring	30017-143-01	1
9	Spring Holder	31055-249-01	1
10	Cotter Pin	24201-08400	1
11	Hex. Head Cap Screw	21401-20200	2
12	Lock Washer	23701-00200	2
13	Fuse Block	9999 SF-1	1
14	Fuse Clips	See Table 2	

**TABLE 2 FUSE CLIP KITS† — For use with 30 Ampere Disconnect Switch**

INTERCHANGEABLE					NON-INTERCHANGEABLE		
NEMA Starter Size	Class H Fuses			Class J Fuses		Class R Fuses⊕	
	Fuse Clip Rating — Amps.		Class 9999 Type	Fuse Clip Rating — Amps. 600 V. Max.	Class 9999 Type	Fuse Clip Rating — Amps.	
	250 V. Max.	600 V. Max.				250 V. Max.	600 V. Max.
0 & 1	0-30	...	S-1	...	...	0-30	...
0	...	0-30	S-2	0-30	SJ-2	...	0-30
1	31-60	0-30	S-2	0-30	SJ-2	31-60	0-30
							SR-1
							SR-2
							SR-2

† Each kit includes six fuse clips, mounting hardware, and instruction sheet.

⊕ Clips cannot be removed, once installed.

ELECTRICAL INTERLOCK

A one or two pole electrical interlock kit may be added to the switch operating mechanism. The snap switch in the interlock kit may be replaced on existing installations. See table 3.

TABLE 3

Electrical Interlock Type	Electrical Interlock Mechanism Complete		Replacement Snap Switch Only	
	Class	Type	Class	Type
Single pole	9999	R45	9007	AO-1
Double pole	9999	R46	9007	CO-3

ORDERING INSTRUCTIONS

Specify quantity, part number and description of part.



AC Magnetic Contactors and Starters Contactores y arrancadores magnéticos de ca (~) Contacteurs et démarreurs magnétiques CA

Class Clase Classe	Type Tipo Type	Series Serie Série	Size Tamaño Taille	Poles (P) Pôles (P) Polos (P)
8502 & 8536	SC	A & B	1 & 1P	2 & 3

INTRODUCTION

This bulletin provides assembly, modification, and parts ordering instructions.

INTRODUCCION

Este boletín incluye instrucciones de montaje, modificación y solicitud de piezas.

INTRODUCTION

Ce bulletin contient les directives pour assembler, modifier et commander des pièces.

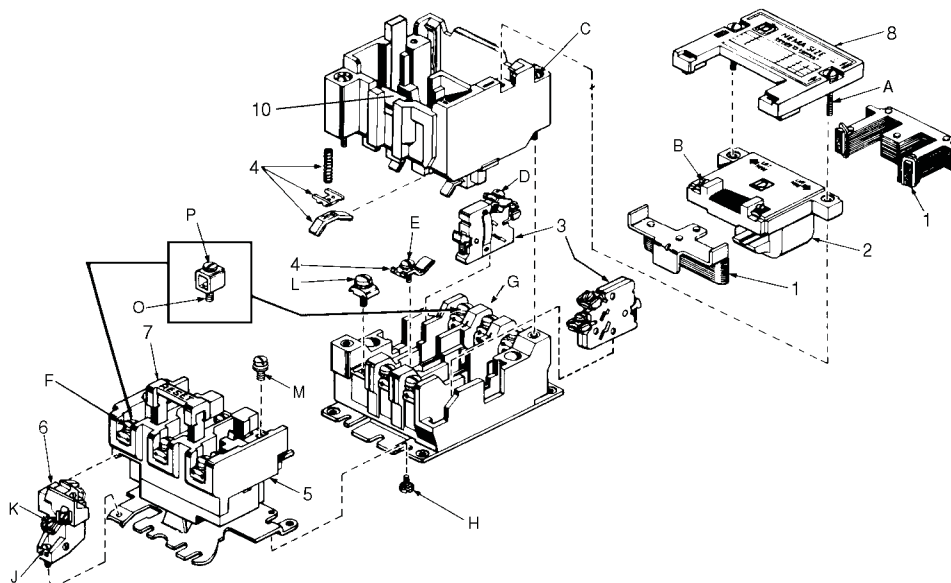


Figure / Figura / Figure 1 : Contactor and Starter Assembly / Montaje de contactores y arrancadores
Assemblage de contacteur et de démarreur

⚠ DANGER / PELIGRO / DANGER

HAZARDOUS VOLTAGE

Disconnect all power before working on equipment.

Electric shock will result in death or serious injury.

TENSION PELIGROSA

Desconecte toda la alimentación antes de efectuar cualquier trabajo en el equipo.

Las descargas eléctricas podrán causar la muerte o lesiones serias.

TENSION DANGEREUSE

Coupez toute l'alimentation avant de travailler sur cet appareil.

Une électrocution entraînera la mort ou des blessures graves.

SERIES

Series B applies only to the Type S, Form B starter (three ambient-compensated overloads). All parts of Form B, Series A and B starters are interchangeable; only the overload relay block differs. If replacing the overload relay block of a Form B, Series A starter with a Series B block, the overload relay

SERIE

La serie B se aplica solamente a los arrancadores tipo S, forma B (tres sobrecargas compensadas por temperatura). Todas las piezas de los arrancadores forma B, series A y B son intercambiables; solamente el bloque del relevador de sobrecarga es diferente. Si reemplaza el bloque del relevador de sobrecarga de un arrancador forma B,

SÉRIE

La série B n'est destinée qu'aux démarreurs type S, forme B (trois surcharges stabilisées en température). Toutes les pièces des démarreurs de forme B sont interchangeables pour les séries A et B ; seul le bloc-relais de surcharge est différent. Si on remplace le bloc-relais de surcharge d'un démarreur de forme B, série A par un



thermal units must be selected from the Series B tables for proper motor protection.

AUXILIARY CONTACTS

All contactors and starters feature a normally open (N.O.) holding circuit contact. N.O. or normally closed (N.C.) auxiliary contacts can be added in the field. Table 5 lists the Class and Type. Bulletin 30072-013-21 and the Square D Digest contain application information.

COVER-MOUNTED CONTROL UNITS

NEMA Type 1 general purpose enclosures with slip-on or hinged covers contain knockouts for field addition of the kits listed in Table 1.

OVERLOAD RELAYS

Standard

Melting alloy overload relay: incorporates one or three thermal units. Its contact unit (item 6 in Figure 1) is available with a N.O. or N.C. isolated alarm contact, in addition to the

serie A con un bloque de la serie B, deberá seleccionar los elementos térmicos del relevador de sobrecarga de la tabla de selección de elementos térmicos de la serie B para proporcionar una protección adecuada al motor.

CONTACTOS AUXILIARES

Todos los contactores y arrancadores contienen un contacto de circuito de sostén normalmente abierto (N.A.). Los contactos auxiliares normalmente cerrados (N.C.) o N.A. se pueden instalar en el local del cliente. La tabla 5 enumera su clase y tipo. El boletín 30072-013-21 y el Digest de Square D contienen información sobre su aplicación.

UNIDADES DE CONTROL PARA MONTAJE EN LA CUBIERTA

Los gabinetes NEMA tipo 1 para uso general con cubiertas deslizantes o abisagradas contienen agujeros ciegos para la adición de los accesorios enumerados en la tabla 1 los cuales pueden ser instalados en el local del cliente.

RELEVADORES DE SOBRECARGA

Estándar

Relevador de sobrecarga de aleación fusible: incorpora uno o tres elementos térmicos. Su unidad de contacto (artículo 6 en la figura 1) se encuentra disponible con un contacto de alarma aislado N.A. o N.C., además del contacto

bloc-relais de série B, les unités thermiques du relais de surcharge doivent être sélectionnées dans les tableaux de sélection des unités thermiques de série B pour assurer une protection adéquate du moteur.

CONTACTS AUXILIAIRES

Tous les contacteurs et démarreurs sont dotés d'un contact de circuit de retenue normalement ouvert (N.O.). Des contacts auxiliaires N.O. ou des contacts normalement fermés (N.F.) peuvent être ajoutés sur place. Le tableau 5 dresse la liste des classes et des types autorisés. Le bulletin 30072-013-21 et le Digest de Square D contiennent des renseignements relatifs aux applications.

UNITÉS DE COMMANDE MONTÉES SUR COUVERCLE

Les coffrets à usage général NEMA type 1 avec des couvercles à glissières ou à charnières contiennent des débouchures permettant l'ajout sur place des kits figurant au tableau 1.

RELAIS DE SURCHARGE

Standard

Relais de surcharge à fusion d'alliage : incorpore une ou trois unités thermiques. Son unité de contact (article 6, figure 1) est disponible avec un contact d'alarme isolé N.O. ou N.F. en plus du contact N.F. standard. L'unité

Table / Tabla / Tableau 1 : Field Modification Kits, Class 9999 / Accesorios para la modificación en el local del cliente, clase 9999 / Kits de modification sur place, classe 9999

Kit / Accesorio / Kits	Slip-On Cover Cubierta deslizante Couvercle à glissières	Hinged Cover Cubierta abisagrada Couvercle à charnières	Form (Factory Mod.) Forma (modelo de fábrica) Forme (mod. d'usine)
Push button, Start-Stop / Botón pulsador, arranque-parada Bouton-poussoir, Démarrage-Arrêt	SA2	SA3	A
Push button, On-Off / Botón pulsador, encendido-apagado Bouton-poussoir, Marche-Arrêt	SA10	SA3	A3
Selector switch, Hand-Off-Auto / Interruptor selector, manual-apagado-auto / Interrupteur de sélection, Manuel-Arrêt-Auto	SC2	SC8	C
Selector switch, On-Off / Interruptor selector, encendido-apagado Interrupteur de sélection, Marche-Arrêt	SC22	—	C6
Red pilot light / Lámpara piloto roja / Lampe témoin rouge	SP2R	SP28R ^[1]	P1

^[1] For 120 V~ only. For other voltages, use Class 9001, Type KP units. / Para 120 V~ solamente. Para otras tensiones, utilice las unidades clase 9001, tipo KP. Pour 120 V~ seulement. Autres tensions : utiliser les unités de classe 9001, type KP.

standard N.C. contact. The contact unit with alarm circuit contacts is field-installable (see Table 5).

Optional

Non-temperature compensated bimetallic overload relay: Form B1 incorporates two thermal units; Form B2 incorporates three thermal units.

Ambient-temperature compensated bimetallic overload relay (Form B): incorporates three thermal units.

SPDT contact (all Type S bimetallic overload relays): The N.O. contact can be used in an alarm circuit, and its wiring polarity must match that of the N.C. contact. Contacts are not replaceable. Use Table 5 to order replacement bimetallic overload relays.

Overload relays are not field-repairable. Do not disassemble them.

TERMINALS

Use only **copper** wire on device power and control terminals. Pressure wire power terminals are suitable for wire sizes 14–8 AWG (2.5–6 mm²), solid or stranded. Pressure wire control terminals are suitable for wire sizes 16–12 AWG (1.5–4 mm²), solid or stranded.

CONTACT INSPECTION AND REPLACEMENT

Discoloration and slight pitting do not harm contacts. **Do not file contacts**; this wastes contact material. Replace contacts (item 4 in Table 5) only when worn thin.

To inspect or replace contacts, disconnect all power. Do not remove any wiring. Loosen the two captive screws (C) holding the contact actuator to the contact block. Lift the contact actuator to expose the contacts.

estándar N.C. La unidad de contacto con los contactos de circuito de alarma se puede instalar en el local del cliente (vea la tabla 5).

Opcional

Relevador de sobrecarga bimetalico no compesado por temperatura: La forma B1 incorpora dos elementos térmicos; la forma B2 incorpora tres elementos térmicos.

Relevador de sobrecarga compensado por la temperatura ambiente (forma B): incorpora tres elementos térmicos.

Contacto 1P2T (todos los relevadores de sobrecarga bimetalicos tipo S): El contacto N.A. puede ser usado en un circuito de alarma y su polaridad de cableado debe corresponder con la polaridad del contacto N.C. Los contactos no se pueden reemplazar. Utilice la tabla 5 para solicitar repuestos de los relevadores de sobrecarga bimetalicos.

Los relavadores de sobrecarga no se pueden reparar en el local del cliente. No los desmonte.

TERMINALES

Utilice sólo conductores de **cobre** en las terminales de alimentación y control del dispositivo. Las terminales de alimentación de los conductores a presión son adecuadas para tamaños de cables calibre 14–8 (2,5–6 mm²), sencillo o múltiple. Las terminales de control de los conductores a presión son adecuadas para tamaños de cables calibre 16–12 (1,5–4 mm²), sencillo o múltiple.

INSPECCION Y REEMPLAZO DE CONTACTOS

La descoloración y picadura liviana no dañan los contactos. **No lime los contactos**; esto desperdicia el material del contacto. Reemplace los contactos (artículo 4 en la tabla 5) sólo cuando estén desgastados.

Para inspeccionar o reemplazar los contactos, desconecte toda la alimentación. No retire el cableado. Desatornille los dos tornillos imperdibles (C) sosteniendo el actuador de contacto

de contact avec les contacts de circuit d'alarme peut être installée sur place (voir le tableau 5).

En option

Relais de surcharge bimétallique non stabilisé en température : La forme B1 incorpore deux unités thermiques, la forme B2 incorpore trois unités thermiques.

Relais de surcharge bimétallique stabilisé en température (forme B) : incorpore trois unités thermiques.

Contact UPBD (tous les relais de surcharge bimétalliques de type S) : Le contact N.O. peut être utilisé dans un circuit d'alarme et la polarité de son câblage doit correspondre à celle du contact N.F. Les contacts ne peuvent pas être remplacés. Utiliser le tableau 5 pour commander des relais de surcharge bimétalliques de rechange.

Les relais de surcharge ne peuvent pas être réparés sur place. Ne pas les démonter.

BORNES

Utiliser uniquement des fils de **cuivre** sur les bornes d'alimentation et de commande du dispositif. Les bornes d'alimentation des fils à pression conviennent pour des fils de calibre 14–8 AWG (2,5 – 6 mm²), à un ou plusieurs brins. Les bornes de commande des fils à pression conviennent pour des fils de calibre 16–12 AWG (1,5 – 4 mm²), à un ou plusieurs brins.

INSPECTION ET REMPLACEMENT DES CONTACTS

La décoloration ou de légères piqures de surface n'altèrent en rien les contacts. **Ne pas limer les contacts** ; ceci abîme le matériau du contact. Ne remplacer les contacts que lorsqu'ils sont usés (article 4, tableau 5).

Pour inspecter ou remplacer les contacts, mettre l'ensemble hors tension. Ne pas retirer le câblage. Desserrer les deux vis prisonnières (C) en maintenant l'actionneur de contact

The Class 9998, Type SL22 kit contains replacement contacts and springs for power pole kits only. Each N.O. or N.C. contact requires one kit.	al bloque de contactos. Levante el actuador de contacto para exponer los contactos. El accesorio clase 9998, tipo SL22 contiene contactos y resortes de repuesto solamente para los accesorios de los polos de potencia . Cada contacto N.A. o N.C. requiere un accesorio.	contre le bloc à contacts. Soulever l'actionneur des contacts pour faire apparaître ces derniers. Le kit de classe 9998, type SL22 contient des contacts et des ressorts de rechange uniquement pour des kits de pôles d'alimentation . Chaque contact N.O. ou N.F. requiert un kit.
MANUAL OPERATION	FUNCIONAMIENTO MANUAL	FONCTIONNEMENT MANUEL

⚠ WARNING / ADVERTENCIA / AVERTISSEMENT		
UNINTENDED EQUIPMENT OPERATION Disconnect all power before manually operating equipment to avoid contact arcing and unexpected load energization. Failure to observe this precaution can result in death, serious injury, or equipment damage.	OPERACION INVOLUNTARIA DEL EQUIPO Desconecte toda la alimentación antes de hacer funcionar manualmente el equipo, para evitar la formación de arcos en los contactos y la energización inesperada de carga. El incumplimiento de esta precaución puede causar la muerte, lesiones serias o daños al equipo.	FONCTIONNEMENT INVOLONTAIRE DE L'APPAREIL Coupez l'alimentation avant d'actionner manuellement cet appareil, pour éviter la formation d'arcs électriques sur les contacts ou une alimentation inattendue de la charge. Si cette précaution n'est pas respectée, cela peut entraîner la mort, des blessures graves ou des dommages matériels.

Manually operate the contactor or starter with a screwdriver by pushing down the contact carrier. The coil cover has a slot for this use.	Haga funcionar manualmente el contactor o arrancador con un desarmador oprimiendo el portacontacto hacia abajo. La cubierta de la bobina tiene una ranura para este uso.	Actionner manuellement le contacteur ou le démarreur en poussant le porte-contact vers le bas avec un tournevis. Le couvercle de la bobine possède une fente réservée à cet usage.
COIL REPLACEMENT To remove the coil, loosen the two captive cover screws (item A, Figure 1). Disconnect the wires from the coil terminals and remove the cover. Remove and disassemble the magnet, coil, and armature. To replace the coil, first assemble the magnet, replacement coil, and armature. Manually operate the contact carrier (described in "Manual Operation") and insert the complete unit. Before installing the cover, manually operate the device to ensure that all parts function properly. Use the tightening torques listed in Table 2 when reassembling the device.	REEMPLAZO DE LA BOBINA Para retirar la bobina, desatornille los dos tornillos imperdibles de la cubierta (artículo A en la figura 1). Desconecte los cables de las terminales de la bobina y quite la cubierta. Retire y desmonte la bobina, el imán y la armadura. Para reemplazar la bobina, ensamble el imán, la bobina de repuesto y la armadura. Haga funcionar manualmente el portacontacto (descrito en "Funcionamiento manual") y coloque la unidad completa. Antes de instalar la cubierta, haga funcionar manualmente el dispositivo y asegúrese de que todos sus componentes estén funcionando adecuadamente. Utilice los pares de apriete enumerados en la tabla 2 cuando vuelva a montar el dispositivo.	REEMPLACEMENT DE LA BOBINE Pour retirer la bobine, desserrer les deux vis prisonnières du couvercle (article A, figure 1). Débrancher les fils des bornes de la bobine et ôter le couvercle. Enlever et démonter l'aimant, la bobine et l'armature. Pour remplacer la bobine, assembler l'aimant, la bobine de rechange et l'armature. Actionner manuellement le porte-contact (comme décrit dans «Fonctionnement manuel») et insérer l'unité complète. Avant d'installer le couvercle, actionner manuellement le dispositif pour s'assurer que toutes les pièces fonctionnent correctement. Pour remonter le dispositif, utiliser les couples de serrage figurant au tableau 2.
ASSEMBLY Figure 1 illustrates the contactor or starter assembly. Table 2 and the device instructions list factory-recommended	ENSAMBLE La figura 1 ilustra el ensamble del arrancador o del contactor. La tabla 2 y las instrucciones del dispositivo	ASSEMBLAGE La figure 1 représente l'assemblage du contacteur ou démarreur. Le tableau 2 et les directives du dispositif donnent la

**Table / Tabla / Tableau 2 : Factory Recommended Tightening Torques / Pares de apriete recomendados de fábrica
Couples de serrage recommandés par l'usine**

Item Art.	Description	Descripción	Description	Tightening Torque Par de apriete Couple de serrage	
				lb-in / lb-pulg lb-po	N•m
A	Cover screw (2 per cover)	Tornillo de la cubierta (2 por cubierta)	Vis de couvercle (2 par couvercle)	18–21	2,0–2,3
B	Coil terminal pressure wire connector (2 per coil)	Conector de los conductores a presión de la terminal de la bobina (2 por bobina)	Connecteur des fils à pression aux bornes de la bobine (2 par bobine)	9–12	1,0–1,3
C	Power plant screws (4 per device)	Tornillo de la planta de alimentación (4 por dispositivo)	Vis du groupe électrogène (4 par dispositif)	18–21	2,0–2,3
D	Internal auxiliary contact pressure wire connector (2 per contact)	Conector de los conductores a presión del contacto auxiliar interno (2 por contacto)	Connecteur des fils à pression du contact auxiliaire interne (2 par contact)	9–12	1,0–1,3
E	Stationary contact fastener (2 per pole)	Sujetador del contacto estacionario (2 por polo)	Attache du contact stationnaire (2 par pôle)	6–9	0,68–1,0
F	Lug screw (2 per pole)	Tornillo de la zapata (2 por polo)	Vis de cosse (2 par pôle)	[1]	[1]
G	Auxiliary wire binding screw	Tornillo de sujeción de los conductores auxiliar	Vis de fixation du fil auxiliaire	18–21	2,0–2,3
H	Overload relay fastening screw (2 per overload block)	Tornillo sujetador del relevador de sobrecarga (2 por bloque de sobrecarga)	Vis de fixation du relais de surcharge (2 par bloc de surcharge)	18–21	2,0–2,3
J	Overload switch module fastening screw (1 per module)	Tornillo sujetador del módulo del interruptor de sobrecarga (1 por módulo)	Vis de fixation du module d'interrupteur de surcharge (1 par module)	9–12	1,0–1,3
K	Switch module pressure wire connector (2 per module standard; 4 per module with alarm circuit contact)	Conector de los conductores a presión del módulo del interruptor (2 por módulo estándar; 4 por módulo con contacto de circuito de alarma)	Connecteur des fils à pression du module d'interrupteur (2 par module en standard; 4 par module avec contact de circuit d'alarme)	9–12	1,0–1,3
L	Overload-to-contactor fastening screw (1 per pole)	Tornillo sujetador del relevador de sobrecarga al contactor (1 por polo)	Vis de fixation du relais de surcharge au contacteur (1 par pôle)	18–21 [2]	2,0–2,3 [2]
M	Overload thermal unit fastening screw (2 per pole)	Tornillo sujetador del elemento térmico de sobrecarga (2 por polo)	Vis de fixation de l'unité thermique de surcharge (2 par pôle)	18–21	2,0–2,3 [2]
O	Lug retaining screw—Size 1P only (1 per pole)	Tornillo sostenedor de la zapata—Tamaño 1P solamente (1 por polo)	Vis de retenue de cosse—Taille 1P seulement (1 par pôle)	18–21	2,0–2,3 [2]

[1] See instructions supplied with the device. / Siga las instrucciones que vienen incluidas con el dispositivo. / Voir les directives accompagnant le dispositif.

[2] For contactor, see instructions supplied with the device. / Para el contactor, siga las instrucciones que vienen incluidas con el dispositivo. / Pour le contacteur, voir les directives accompagnant le dispositif.

torques for mechanical, electrical, and pressure wire connections. Use these torques to ensure proper device operation.

SHORT-CIRCUIT PROTECTION

Provide branch-circuit overcurrent protection for starters, referring to the instructions supplied with the thermal unit selection table. Provide branch-circuit overcurrent protection for contactors (Class 8502 or 8702) in accordance with the National Electrical Code (NEC). Do not exceed the maximum protective device ratings listed in Table 3.

proporcionan los pares de apriete recomendados por el fabricante para las conexiones mecánicas, eléctricas y de los conductores a presión. Utilice estos pares de apriete para asegurar el funcionamiento correcto del dispositivo.

PROTECCION CONTRA CORTOCIRCUITO

Proporcione protección contra sobrecorriente de circuito de derivación a los arrancadores, consultando las instrucciones incluidas con la tabla de selección del elemento térmico. Proporcione protección contra sobrecorriente de circuito de derivación a los contactores (clase 8502 ó 8702) de acuerdo con el código nacional eléctrico de EUA (NEC). No exceda los valores nominales máx. del dispositivo protector que se enumeran en la tabla 3.

liste des couples de serrage recommandés par l'usine pour des connexions mécaniques, électriques et des fils à pression. Utiliser ces couples pour assurer un fonctionnement correct du dispositif.

PROTECTION CONTRE LES COURTS-CIRCUITS

Fournir un dispositif de protection d'artère pour démarreurs, conformément aux directives figurant dans le tableau de sélection de l'unité thermique. Fournir un dispositif de protection d'artère pour contacteurs (classe 8502 ou 8702) conformément au Code national de l'électricité (CNÉ). Ne pas dépasser l'intensité nominale maximale du dispositif de protection figurant au tableau 3.

Provide overcurrent protection for control circuits in accordance with the NEC and/or other applicable electrical codes. For applications requiring compliance with I.E.C. 947-5-1, use only Class CC fuses or better, 30 A maximum.

DISTANT CONTROL

Depending upon the voltage, wire size, and number of control wires used, series impedance or shunt capacitance may limit the maximum distance of the wire run for remotely operated contactors and starters. If distances to start or stop stations exceed those listed in Table 4, analyze the wire-run configuration and materials. For further information, request data bulletin M379 from D-FAX (document #1188), the Square D website (www.squared.com), or your local Square D field office.

Proporcione protección contra sobrecorriente en los circuitos de control de acuerdo con el NEC y/u otros códigos eléctricos aplicables. Utilice solamente fusibles clase CC o mejores, de 30 A como máximo, en las aplicaciones que requieran el cumplimiento de la norma 947-5-1 de I.E.C.

CONTROL A DISTANCIA

Dependiendo de la tensión, del calibre del conductor y de la cantidad de conductores de control que se usan, la impedancia en serie o la capacitancia en derivación puede limitar la distancia máxima del tendido de cables de contactores y arrancadores que se hacen funcionar remotamente. Si las distancias a las estaciones de arranque o parada exceden aquéllas enumeradas en la tabla 4, analice la configuración del tendido de cables y los materiales. Para obtener más información, solicite el boletín de datos del producto M379 de su oficina local de ventas de Square D.

Fournir un dispositif de protection contre la surcharge aux circuits de commande selon le CNÉ et d'autres codes électriques applicables. Pour les applications devant être conformes à la norme 947-5-1 de I.E.C. (CEI : Commission électronique internationale) utiliser uniquement les fusibles Classe CC ou supérieurs, de 30 A au maximum.

COMMANDE À DISTANCE

Selon la tension, le calibre du fil et le nombre de fils de commande utilisés, l'impédance de série ou la capacité shunt peut limiter la longueur maximale du câblage des contacteurs et des démarreurs commandés à distance. Si les distances aux postes de départ ou d'arrêt dépassent celles figurant dans le tableau 4, analyser la configuration et les matériaux du câblage des conducteurs. Pour de plus amples informations, consulter le bulletin M379 sur les données des produits, auprès du bureau local de ventes de Square D.

Table / Tabla / Tableau 3 : Maximum Ampere Ratings / Valores nominales máx. en amperes
Valeurs nominales maximales de courant

Maximum Voltage Tensión máxima Tension maximal	Class K5, RK5 or RK1 Fuse Fusible clase K5, RK5 o RK1 Fusible de classe K5, RK5 ou RK1	Class J or T Fuse Fusible clase J o T Fusible de classe J ou T	Inverse-Time Circuit Breaker Interruptor automático de retardo inverso Disjoncteur à retard inverse
600 V~	30 A	60 A	40 A
250 V~	40 A	60 A	60 A

Table / Tabla / Tableau 4 : Maximum Control Distance for Copper Wire / Distancia máxima de control del conductor de cobre / Distance de commande maximale pour fil de cuivre

Coil Voltage @ 60 Hz Tensión de la bobina @ 60 Hz Tension de bobine à 60 Hz	Maximum Control Distance / Distancia máxima de control / Distance maximale de commande			
	14 AWG (2,08 mm ²)		12 AWG (3,3 mm ²)	
	ft / pies / pieds	m	ft / pies / pieds	m
120 V~	845	258	1300	396
240 V~	595	181	495	151
480 V~	145	44	120	36

PARTS ORDERING

Specify the quantity, the part number or Class and Type, and the part description, giving complete nameplate data of the device (e.g., one armature and magnet kit 31041-605-50 for a Class 8536, Type SCO3, Series A starter).

SOLICITUD DE PIEZAS

Especifique la cantidad, el número de pieza o clase y tipo, y descripción de la pieza, proporcionando los datos completos de la placa de identificación del dispositivo (p.ej., un accesorio de imán y armadura 31041-605-50 para un arrancador clase 8536, tipo SCO3, serie A).

COMMANDE DE PIÈCES

Spécifier la quantité, le numéro de pièce ou la classe et le type, ainsi que la description de la pièce, en donnant tous les renseignements figurant sur la plaque signalétique du dispositif (par ex., kit d'armature et d'aimant 31041-605-50 pour un démarreur de classe 8536, type SCO3, série A).

Table / Tabla / Tableau 5 : Parts List / Lista de piezas / Liste de pièces

Item Art.	Description	Descripción	Description	Part Number Número de pieza N° de pièce	Quantity / Cantidad Quantité				
					1 P	2 P	3 P	4 P	5 P
1	Armature and magnet kit	Accesorio de imán y armadura	Kit d'armature et d'aimant	31041-605-50	1	1	1	1	1
2	Coil	Bobina	Bobine	See Table 6 / Vea la tabla 6 Voir le tableau 6	1	1	1	1	1
3	Internal auxiliary contact N.O. N.C.	Contacto auxiliar interno N.A. N.C.	Contact auxiliaire interne N.O. N.F.	Class / Clase / Classe 9999 Type / tipo / type SX11 Type / tipo / type SX12	[3]	[3]	1	1	1
4	Contact kit	Accesorio de contacto	Kit de contact	Class / Clase / Classe 9998 Type / tipo / type SL3 Type / tipo / type SL13 Type / tipo SL13 & SL22	1	1	1	—	—
5	Melting alloy overload relay assembly 1 Element 2 or 3 Element	Ensamblaje del relevador de sobrecarga de aleación fusible 1 elemento 2 ó 3 elementos	Assemblage de relais de surcharge à fusion d'alliage 1 élément 2 ou 3 éléments	Class / Clase / Classe 9065 Type / tipo / type SDO4 Type / tipo / type SDO5	1	1	—	—	—
5 [1]	Bimetallic overload relay Non-compensated 2 Element (Form B1) 3 Element (Form B2) Compensated 3 Element (Form B)	Relevador de sobrecarga bimetalico No compensado 2 elementos (forma B1) 3 elementos (forma B2) Compensado 3 elementos (forma B)	Relais de surcharge bimétallique Non compensé en température 2 éléments (forme B1) 3 éléments (forme B2) Compensé en température 3 éléments (forme B)	Class / Clase / Classe 9065 Type / tipo / type SDO5B1 Type / tipo / type SDO6B2 Class / Clase / Classe 9065 Type / tipo / type SDO6B	—	—	1	1	1
6	Melting alloy overload contact unit	Unidad de contacto de sobrecarga de aleación fusible	Unité de contact de surcharge à fusion d'alliage	Class / Clase / Classe 9998 Type / tipo / type SO1	1	1	1	1	1
6 [1]	Melting alloy overload contact unit w/alarm circuit N.O. alarm contact N.C. alarm contact	Unidad de contacto de sobrecarga de aleación fusible con circuito de alarma Contacto de alarma N.A. Contacto de alarma N.C.	Unité de contact de surcharge à fusion d'alliage avec circuit d'alarme Contact d'alarme N.O. Contact d'alarme N.F.	Class / Clase / Classe 9999 Type / tipo / type SO4 Type / tipo / type SO5	—	—	—	—	—
7	Reset bar	Barra de restablecimiento	Barre de réarmement	31034-042-01	1	1	1	1	1
8	Cover only (nameplate not included)	Cubierta solamente (placa de identificación no incluida)	Couvercle seulement (plaque signalétique non incluse)	31127-013-01	1	1	1	1	1
[1]	External auxiliary contact 1 N.O. 1 N.C. 1 N.O. and 1 N.C. 1 N.O., overlapping 1 N.C., overlapping	Contacto auxiliar externo 1 N.A. 1 N.C. 1 N.A. y 1 N.C. 1 N.A., con recubrimiento 1 N.C., con recubrimiento	Contact auxiliaire externe 1 N.O. 1 N.F. 1 N.O. et 1 N.F. 1 N.O., chevauchement 1 N.F., chevauchement	Class / Clase / Classe 9999 Type / tipo / type SX6 Type / tipo / type SX7 Type / tipo / type SX8 Type / tipo / type SX9 Type / tipo / type SX10	—	—	—	—	—
[1]	Power pole kit 1 N.O. 2 N.O.	Accesorio del polo de potencia 1 N.A. 2 N.A.	Kit de pôle d'alimentation 1 N.O. 2 N.O.	Class / Clase / Classe 9999 Type / tipo / type SB6 Type / tipo / type SB9	—	—	—	1	—
10 [2]	Lever bearing	Cojinete de la palanca	Galet du levier	31041-032-01	1	1	1	1	1
A	Cover screw	Tornillo de la cubierta	Vis de couvercle	21937-14341	2	2	2	2	2
B	Coil terminal pressure wire connector	Conector de los conductores a presión de las terminales de la bobina	Connecteur des fils à pression aux bornes de la bobine	31051-007-50	2	2	2	2	2
C	Power plant screw	Tornillo de la planta de alimentación	Vis du groupe électrogène	21916-14501	2	2	2	2	2

[1] Not shown.

[2] To ensure proper device operation: when installing the lever bearing onto the lever, the oval concavity on the inside surface of one leg of the bearing must mate with the corresponding oval convexity on the bottom of the lever.

[3] Furnished on 2-pole starters; however, 1- and 2-pole contactors are furnished with a holding circuit contact rated the same as a power pole.

[1] No se muestra.

[2] Para asegurarse de que el dispositivo está funcionando adecuadamente al instalar el cojinete de la palanca en la misma; la concavidad ovalada en la superficie interior de uno de los pies del cojinete debe corresponder con la convexidad ovalada correspondiente en la parte inferior de la palanca.

[3] Incluida con los arrancadores de 2 polos; sin embargo, los contactores de 1 y 2 polos incluyen un contacto de circuito de sostén con el mismo valor nominal de un polo de potencia.

[1] Non montré.

[2] Pour assurer un fonctionnement correct du dispositif : lors de l'installation du galet du levier sur ce dernier, veiller à faire correspondre la cavité ovale située sur la surface interne d'un pied du galet avec la forme convexe située au bas du levier.

[3] Fourni sur les démarreurs à 2 pôles ; toutefois, les contacteurs à 1 et 2 pôles sont fournis avec un contact de circuit de retenue de la même valeur nominale qu'un pôle d'alimentation.

Table / Tabla / Tableau 5 : Parts List / Lista de piezas / Liste de pièces (cont. / cont. / suite)

Item Art.	Description	Descripción	Description	Part Number Número de pieza N° de pièce	Quantity / Cantidad Quantité				
					1 P	2 P	3 P	4 P	5 P
F	Wire clamp and screw Size 1 contactor Size 1 starter	Pinza y tornillo del conductor Contactador tamaño 1 Arrancador de tamaño 1	Vis de fixation et serre-fil Contacteur de taille 1 Démarreur de taille 1	30018-018-50	— —	— 2	— 3	2 5	4 7
G	Auxiliary wire binding screw	Tornillo de sujeción del conductor auxiliar	Vis de fixation du fil auxiliaire	21819-25081	2	2	2	2	2
L	Wire clamp and screw Size 1 contactor Size 1 starter	Pinza y tornillo del conductor Contactador de tamaño 1 Arrancador de tamaño 1	Vis de fixation et serre-fil Contacteur de taille 1 Démarreur de taille 1	30018-070-50	2 —	4 4	6 6	6 6	6 6
M	Overload thermal unit fastening screw	Tornillo sujetador del elemento térmico de sobrecarga	Vis de fixation de l'unité thermique de surcharge	21920-16160	—	4	6	6	6
O	Screw assembly (Size 1P only)	Ensamble del tornillo (Tamaño 1P solamente)	Assemblage des vis (Taille 1P seulement)	30018-066-50	—	4	—	—	—
P	Lug screw (Size 1P only)	Tornillo de la zapata (Tamaño 1P solamente)	Vis de cosse (Taille 1P seulement)	25054-13600	—	4	—	—	—

The complete coil part number contains a prefix and a suffix (e.g., for a 120 V~, 60 Hz coil, select 31041-400-42). When ordering replacement coils, give the part number, voltage, and frequency of the coil being replaced.

El número de pieza completo de la bobina contiene un prefijo y un sufijo (es decir, una bobina de 120 V~, 60 Hz, el número de pieza es 31041-400-42). Cuando solicite las bobinas de repuesto, proporcione el número de pieza, la tensión y la frecuencia de la bobina que se está reemplazando.

Le numéro complet de la pièce de la bobine contient un préfixe et un suffixe (par ex., pour une bobine 120 V~, 60 Hz, sélectionner 31041-400-42). Pour commander des bobines de rechange, indiquer le numéro de pièce, la tension et la fréquence de la bobine à remplacer.

Table / Tabla / Tableau 6 : Magnet Coil Part Numbers / Números de piezas de la bobina magnética
Numéros de pièces des bobines d'aimant

Coil Prefix Prefijo de la bobina Préfixe de bobine	Hz	Coil Suffix / Sufijo de la bobina / Suffixe de bobine														VA~	
		24 V~	110 V~	120 V~	120/ 240 V~	208 V~	220 V~	240 V~	240/ 480 V~	277 V~	380 V~	440 V~	480 V~	550 V~	600 V~	Inrush Irrupción VA d'appel	Sealed Sellado Scellement
31041-400	60	20	Use Utilice Utiliser 120 V~	42	[1]	48	Use Utilice Utiliser 240 V~	51	[1]	52	56	Use Utilice Utiliser 480 V~	60	Use Utilice Utiliser 600 V~	62	245	27
	50	22	42	43	—	—	51	53	—	—	57	60	—	62	64	232	26

[1] Dual voltage coil. For 120/240 V~ 60 Hz, order 31041-402-02. For 240/480 V~ 60 Hz, order 31041-402-04.

[1] Bobina de tensión doble. Solicite 31041-402-02 para los modelos de 120/240 V~, 60 Hz. Solicite 31041-402-04 para los modelos de 240/480 V~, 60 Hz.

[1] Bobine à deux tensions. Commander 31041-402-02 pour les modèles à 120/240 V~, 60 Hz. Commander 31041-402-04 pour les modèles à 240/480 V~, 60 Hz.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Manual Starters Arrancadores manuales Démarreurs manuels

Class Clase Classe	Type Tipo Type	Series Serie Série	Size Tamaño Taille
2510	M & T	A	M-0, M-1 & M-1P

INTRODUCTION

This bulletin provides assembly, modification, and parts ordering instructions.

INTRODUCCION

Este boletín incluye instrucciones de montaje y modificación del arrancador y de solicitud de piezas de repuesto.

INTRODUCTION

Ce bulletin contient des directives pour assembler et modifier le démarreur et pour commander des pièces de rechange.

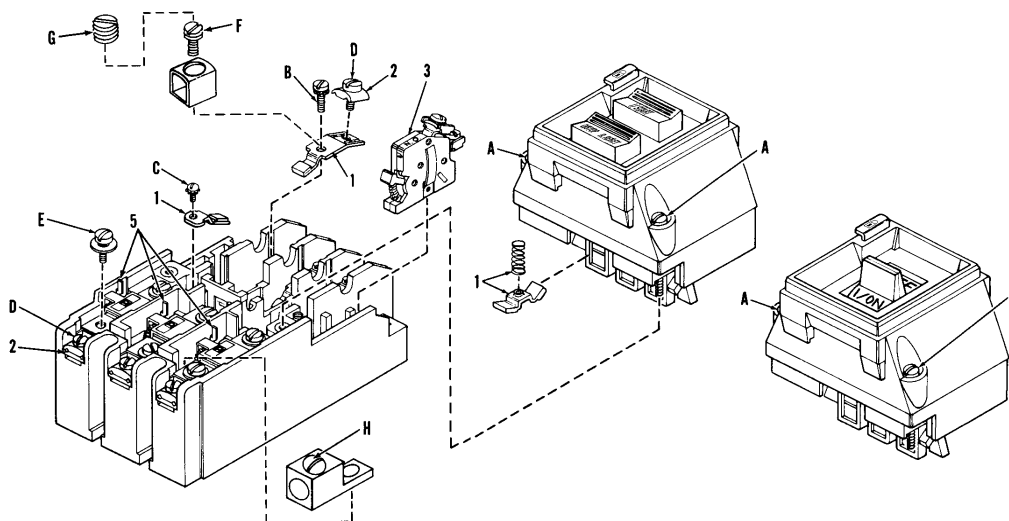


Figure / Figura / Figure 1 : Manual Starter Assembly / Montaje del arrancador manual / Assemblage du démarreur manuel

⚠ DANGER / PELIGRO / DANGER

HAZARDOUS VOLTAGE

Disconnect all power before working on equipment.

Failure to follow this instruction will result in death or serious injury.

TENSION PELIGROSA

Desconecte toda la alimentación antes de efectuar cualquier trabajo en el equipo.

El incumplimiento de esta precaución podrá causar la muerte o lesiones serias.

TENSION DANGEREUSE

Coupez l'alimentation avant de travailler sur cet appareil.

Si cette précaution n'est pas respectée, cela entraînera la mort ou des blessures graves.

CONTACT ACTUATOR

Movable contacts are operated by a push button or toggle operator.

ACTUADOR DE CONTACTOS

Los contactos móviles son activados por un operador, tipo botón pulsador o articulado.

ACTIONNEUR DE CONTACTS

Les contacts mobiles sont activés par un opérateur de type bouton-poussoir ou à bascule.

CONTACT INSPECTION

Loosen the two captive screws (A) holding the contact actuator mechanism to the contact block. Lift the contact actuator to expose the contacts.

INSPECCION DE CONTACTOS

Afloje los dos tornillos cautivos (A) sujetando el mecanismo del actuador de contactos contra el bloque de contactos. Levante el actuador de contactos para mostrar los contactos.

INSPECTION DES CONTACTS

Desserrer les deux vis imperdables (A) retenant le mécanisme de l'actionneur de contacts contre le bloc de contacts. Soulever l'actionneur pour exposer les contacts.



Discoloration and slight pitting do not harm silver alloy contacts. **Do not file contacts**; this wastes contact material. Replace contacts only when worn thin. Table 5 lists replacement parts.

CONTACT REPLACEMENTS

See Figure 1. To replace the contacts, loosen the two captive screws (A) and remove the contact actuator. Remove the movable contacts (1) from the yoke bar by compressing the contact spring and sliding the contact sideways. Change the contact springs before inserting new movable contacts. Remove the stationary contacts by loosening the contact mounting screws (B and C). Reassemble in reverse order.

WIRING

Use only copper wire on device power and control terminals.

OVERLOAD RELAYS

Standard: *Melting alloy thermal overload relays:* incorporate one or three thermal units. (Three-phase manual starters manufactured before mid-1972 had a shorting strap installed in the center leg of the overload relay. To convert these devices from two to three thermal units, remove the shorting strap and install a third thermal unit.)

NOTE: *Thermal units must be installed and the device reset before starter contacts will operate. Install thermal units so the type designation can be read and with the pawl (item 5) above the ratchet wheel as shown in Figure 1.*

Continued overcurrent through the thermal unit raises its temperature,

La decoloración y picaduras moderadas no dañan los contactos de aleación de plata. **No lime los contactos**; esto degasta el material del contacto. Reemplace los contactos sólo una vez que estén desgastados. La tabla 5 lista las piezas de repuesto.

REEMPLAZO DE CONTACTOS

Vea la figura 1. Para reemplazar los contactos, afloje los dos tornillos cautivos (A) y retire el actuador de contactos. Para retirar los contactos móviles (1) del yugo, comprima el resorte del contacto y deslice el contacto lateralmente. Cambie los resortes de los contactos antes de insertar los nuevos contactos móviles. Para retirar los contactos fijos, afloje los tornillos de montaje (B y C) de los contactos. Vuelva a montarlos en el orden inverso al de su instalación.

CABLEADO

Utilice conductores de cobre solamente en las terminales de alimentación y control del dispositivo.

RELEVADORES DE SOBRECARGA

Estándar: *Relevadores de sobrecarga térmica de aleación fusible:* incorporan uno ó tres elementos térmicos. (Los arrancadores manuales de tres fases fabricados en la primera mitad de 1972 tenían una cinta cortocircuitadora instalada en la parte central del relevador de sobrecarga. Para convertir estos dispositivos de dos a tres elementos térmicos, retire la cinta cortocircuitadora e instale un tercer elemento térmico.)

NOTA: *Es necesario instalar los elementos térmicos y restablecer el dispositivo antes de que los contactos del arrancador funcionen. Instale los elementos térmicos para que se pueda leer la designación de tipo y para que el trinquete (artículo 5) quede sobre la rueda dentada como se muestra en la figura 1.*

La presencia de sobrecorriente continua en los elementos térmicos

La décoloration ou les légères piqûres de surface n'altèrent en rien les contacts à alliage d'argent. **Ne pas limer les contacts**; cela abîme le matériau des contacts. Remplacer les contacts seulement lorsqu'ils sont usés. Le tableau 5 donne la liste des pièces de rechange.

REEMPLACEMENT DES CONTACTS

Voir la figure 1. Pour remplacer les contacts, desserrer les deux vis imperdables (A) et enlever l'actionneur de contacts. Retirer les contacts mobiles (1) de la barre de l'étrier en serrant le ressort du contact et en faisant glisser ce dernier latéralement. Remplacer les ressorts des contacts avant d'insérer les contacts mobiles neufs. Retirer les contacts fixes en desserrant les vis de montage (B et C). Les remonter dans l'ordre inverse.

CÂBLAGE

Utiliser seulement des fils en cuivre avec les bornes d'alimentation et de commande du dispositif.

RELAIS DE SURCHARGE

Standard : *Relais de surcharge thermique à fusion d'alliage :* comprennent de une ou trois unités thermiques. (Les démarreurs manuels triphasés fabriqués avant la mi-1972 avaient une bande de court-circuit installée dans la branche centrale du relais de surcharge. Pour convertir les dispositifs à deux unités thermiques en dispositifs à trois unités, retirer la bande de court-circuit et installer une troisième unité thermique.)

REMARQUE : *Pour que les contacts du démarreur soient fonctionnels les unités thermiques doivent être installées et le dispositif doit être réinitialisé. Installer les unités thermiques en s'assurant que l'indication du type est lisible et que le crochet (article 5) reste sur la roue à rochet conformément à la figure 1.*

Une surintensité continue dans l'unité thermique élève la température et

melting the alloy in its solder pot, allowing the ratchet wheel to rotate. This releases the overload relay pawl assembly, allowing the toggle spring to retract the contacts. This action also centers the push button or toggle operator, indicating the starter is tripped.

*NOTE: Before resetting the relay, allow one to two minutes for the alloy to solidify. **Do not** disassemble the overload relay block because motor protection could be disabled, possibly damaging equipment.*

ELECTRICAL INTERLOCKS (FORM X)

One internal interlock (item 3), either normally open (N.O.) or normally closed (N.C.), can be added to all manual starters. It occupies either the upper right-hand or left-hand corner of the device, and is field installable. Table 1 lists location and replacement part numbers for Class 2510 starter interlocks. Table 5 lists replacement parts.

eleva su temperatura lo cual funde la aleación en su depósito para soldadura y permite la rotación de la rueda dentada. Esto libera el ensamble del trinquete del relevador de sobrecarga, y permite que el resorte articulado retire los contactos. Esta acción también centra el botón pulsador u operador articulado, lo cual indica que se ha disparado el arrancador.

*NOTA: Antes de restablecer el relevador, deje pasar de uno a dos minutos para que se solidifique la aleación. **No** desmonte el bloque del relevador de sobrecarga ya que puede inhabilitar la protección del motor y posiblemente dañar el equipo.*

ENTRELACES ELECTRICOS (FORMA X)

Es posible agregar un entrelace interno (artículo 3), o normalmente abierto (N.A.) o normalmente cerrado (N.C.) a todos los arrancadores manuales. Este se coloca en la esquina superior derecha o izquierda del dispositivo y puede ser instalado en campo. La tabla 1 lista la ubicación y los números de las piezas de repuesto de los entrelaces de los arrancadores clase 2510. La tabla 5 lista las piezas de repuesto.

provoque la fusión de l'alliage dans le pot à souder, entraînant la rotation de la roue à rochet. Ceci libère l'assemblage du crochet du relais de surcharge, permettant au ressort de la bascule de retirer les contacts. Cette action centre également le bouton-poussoir ou l'opérateur à bascule, indiquant que le démarreur est déclenché.

*REMARQUE : Avant de réarmer le relais, attendre une ou deux minutes que l'alliage se solidifie. **Ne pas** démonter le bloc de relais de surcharge car la protection du moteur serait désactivée et l'appareil pourrait être endommagé.*

INTERVERROUILLAGES ÉLECTRIQUES (FORME X)

Un interverrouillage interne (article 3), soit normalement ouvert (N.O.) ou normalement fermé (N.F.) peut être ajouté à tous les démarreurs manuels. Il est situé sur le coin supérieur droit ou gauche du dispositif et s'installe sur place. Le tableau 1 donne la liste des emplacements et des numéros des pièces de rechange des interverrouillages pour démarreurs de classe 2510. Le tableau 5 contient les pièces de rechange.

Table / Tableau / Tabla 1 Electrical Interlocks for Class 2510 Starters / Entrelaces eléctricos para arrancadores clase 2510
Interverrouillages électriques pour démarreurs classe 2510

Form ^[1] Forma ^[1] Forme ^[1]	Interlock Location / Ubicación del entrelace Emplacement de l'interverrouillage		Class 9999 Replacement Interlocks / Entrelaces de repuesto clase 9999 / Interverrouillages de rechange classe 9999	
	Left-hand / Izquierdo / Gauche	Right-hand / Derecho / Droite	Type / Tipo / Type SX11	Type / Tipo / Type SX12
X1	N.O. / N.A.	—	1	—
X2	—	N.C. / N.F.	—	1

^[1] Consult sales office for form designations for Class 2511 reversing and 2512 two-speed starters.

Comuníquese con la oficina de ventas para obtener las designaciones de forma para los arrancadores reversibles clase 2511 y de dos velocidades clase 2512.

Consulter le centre de ventes pour les désignations des formes des démarreurs inversibles classe 2511 et à deux vitesses classe 2512.

LOCK OFF MECHANISM

The starter can be locked only in the OFF position, by lifting the metal tab with the lock symbol on the contact actuator and placing a padlock through the hole in this tab. In the ON position, withdrawing the lock tab opens the contacts of the device.

MECANISMO DE BLOQUEO

El arrancador puede ser bloqueado solamente en la posición de desconectado (O), levantando la lengüeta de metal con el símbolo de candado en el actuador de contactos y colocando un candado a través del agujero en esta lengüeta. En la posición de conectado (I), se abren los contactos del dispositivo al retirar la lengüeta de bloqueo.

MÉCANISME DE VERROUILLAGE

Le démarreur ne peut être verrouillé que dans la position d'arrêt (O), en soulevant la languette métallique avec le symbole de cadenas sur l'actionneur de contacts et en faisant passer un cadenas par le trou de cette languette. Dans la position de marche (I), le retrait de la languette de blocage ouvre les contacts du dispositif.

PILOT LIGHT KIT (FORM P11)

A red pilot light usable on any voltage (110-600 V) may be factory installed. Kits may be field installed in the cover of Type 1 surface- and flush-mounting enclosures. Table 2 lists kits for field modification.

ACCESORIO DE LAMPARA PILOTO (FORMA P11)

Una lámpara piloto roja utilizable bajo cualquier tensión (110-600 V ~) puede haber sido instalada en la fábrica. Los accesorios pueden ser instalados en campo en la cubierta de los gabinetes de montaje para sobreponer o empotrar tipo 1. La tabla 2 lista los accesorios para la modificación en campo.

KIT DE LAMPE TÉMOIN (FORME P11)

Une lampe témoin rouge utilisable à toutes les tensions (110 à 600 V) peut avoir été installée en usine. Les kits peuvent être installés sur place dans le couvercle des coffrets type 1 montés en surface ou encastrés. Le tableau 2 contient la liste des kits à installer sur place.

Table / Table / Tableau 2 : Pilot Light Kits / Accesorios de lámpara piloto / Kits de lampe témoin

Class 9999 Kit / Accesorio clase 9999 / Kit de classe 9999		Voltage Range / Gama de tensión / Gamme de tension
Type	MP1	110 – 120 V
Tipo	MP2	208 – 240 V
Type	MP3	440 – 600 V

REPLACEMENT INTERIORS

Replacement interiors for Class 2510 NEMA 1 surface- and flush-mounted enclosures are available with either push button or toggle operation. Catalog 2510CT9701 and the Square D Digest list open-type replacement starters.

INTERIORES DE REPUESTO

Las interiores de repuesto se encuentran disponibles para gabinetes sobrepuestos y empotrados NEMA tipo 1 clase 2510 con un operador articulado o de botón pulsador. El catálogo 2510CT9701 y el compendiado de Square D listan los arrancadores de repuesto de tipo abierto.

INTÉRIEURS DE RECHANGE

Les intérieurs de rechange pour les coffrets NEMA type 1 classe 2510 montés en surface et encastrés sont disponibles avec un opérateur à bouton-poussoir ou à bascule. Le catalogue 2510CT9701 et le Digest Square D contiennent la liste des démarreurs de rechange de type ouvert.

Table / Table / Tableau 3 : Replacement Device Styles / Estilos de dispositivos de repuesto
Styles des dispositifs de rechange

Operator Type Tipo de operador Type d'opérateur			Type 1 Tipo 1 Type 1	Type 4 S. Steel Tipo 4 Acero inox. Type 4 Acier inox.	Type 4X Polyester Tipo 4X Poliéster Type 4X Polyester	Type 7 & 9 Cast Iron Tipo 7 y 9 Hierro fundido Type 7 et 9 Fonte	Type 4X, 7 & 9 Cast Aluminum Tipo 4X, 7 y 9 Aluminio fundido Type 4X, 7 et 9 Fonte d'aluminium	Type 12 Tipo 12 Type 12
Push Button	Botón pulsador	Bouton-poussoir	X	X	X	X	—	X
Toggle	Articulado	À bascule	X	—	—	—	X	—

MANUAL STARTERS CLASS 2511/2512

Class 2511 (reversing) and 2512 (two-speed) manual starters are mechanically interlocked through an interference-type mechanism, part number 31085-070-01. It mounts between the starters and engages the movable contact carriers. Since Classes 2511 and 2512 use a special contact actuator, the standard Class 2510 starter cannot be used for replacement. If either unit (right-hand or left-hand) needs replacement, order a complete starter (see Table 4).

ARRANCADORES MANUALES CLASE 2511/2512

Los arrancadores manuales clase 2511 (reversibles) y 2512 (de dos velocidades) están entrelazados mecánicamente a través de un mecanismo de interposición, número de pieza 31085-070-01 que se monta entre los arrancadores y engancha los portacontactos móviles. Puesto que las clases 2511 y 2512 utilizan un actuador especial de contactos, el arrancador clase 2510 no se puede utilizar como repuesto. Si cualquiera de las unidades (derecha o izquierda) tiene que ser reemplazada, solicite un arrancador completo (vea la tabla 4).

DÉMARREURS MANUELS CLASSE 2511/2512

Les démarreurs manuels classe 2511 (inversibles) et ceux de classe 2512 (à deux vitesses) sont mécaniquement interverrouillés par un mécanisme de serrage, n° de pièce 31085-070-01. Il se monte entre les démarreurs et engage les porte-contacts mobiles. Comme les démarreurs classes 2511 et 2512 utilisent un actionneur de contacts spécial, le démarreur classe 2510 ne peut pas être utilisé comme démarreur de rechange. Pour remplacer une unité (de droite ou de gauche), commander un démarreur complet (voir le tableau 4).

Table / Table / Tableau 4 : Complete Right-hand and Left-hand Replacement Starters / Arrancadores de repuesto derechos e izquierdos completos / Démarreurs de rechange de droite et gauche complets

Operator Type Tipo de operador Type d'opérateur			NEMA Size Tamaño Taille	For Reversing Manual Starter Para arrancadores manuales reversibles Pour démarreur manuel inversible Class / clase / classe 2511			For Two-Speed Manual Starter Para arrancadores manuales de dos velocidades Pour démarreur manuel à deux vitesses Class / clase/ classe 2512		
				Class / Clase Classe	Type/ Tipo Type	Form / Forma Forme	Class / Clase Classe	Type/ Tipo Type	Form / Forma Forme
Push Button	Botón pulsador	Bouton- poussoir	M-0	2510	MBO2	M3	2510	MBO2	M4
			M-1		MCO3			MCO3	
Toggle	Articulado	À bascule	M-0		TBO2			TBO2	
			M-1		TCO3			TCO3	

SHORT-CIRCUIT PROTECTION

Provide branch-circuit overcurrent protection for each contactor or starter. For contactors, provide branch circuit overcurrent protection in accordance with the National Electrical Code and local electrical codes. For starters, refer to instructions furnished with the thermal unit selection table.

ASSEMBLY

Table 6 and the device instruction sheet provide factory recommended tightening torques for mechanical, electrical and pressure wire connections. Follow these torques to ensure proper functioning of the device. If the contact actuator is removed for contact inspection or replacement, reset the device after reassembly.

PARTS ORDERING

Specify the quantity, part number and description of the part, giving complete nameplate data of the device; e.g., 1 contact kit Class 9998 Type ML2 for Class 2510 Type MCG3, Series A manual starter.

PROTECCION CONTRA CORTOCIRCUITO

Proporcione protección contra sobrecorriente en los circuitos en derivación a cada uno de los contactores o arrancadores. Proporcione la protección contra sobrecorriente en los circuitos en derivación a los contactores de acuerdo con el código nacional eléctrico de EUA (NEA) y/o con los códigos eléctricos locales. Para los arrancadores, consulte las instrucciones provistas con la tabla de selección del elemento térmico.

MONTAJE

La tabla 6 y la hoja de instrucciones del dispositivo proporcionan los pares de apriete recomendados de fábrica para las conexiones mecánicas, eléctricas y del conductor de presión. Utilice estos pares de apriete para asegurar el funcionamiento adecuado del dispositivo. Si se retira el actuador de contactos para realizar una inspección o reemplazo de los contactos, restablezca el dispositivo después de volverlo a montar.

SOLICITUD DE PIEZAS

Especifique la cantidad, número y descripción de la pieza, proporcionando los datos completos de la placa de identificación del dispositivo; por ejemplo, 1 accesorio de contactos clase 9998 tipo ML2 para arrancador manual serie A clase 2510 tipo MCG3.

PROTECTION CONTRE LES COURTS-CIRCUITS

Fournir une protection contre la surintensité des circuits d'artère pour chaque contacteur ou démarreur. Fournir aux contacteurs la protection contre la surintensité des circuits d'artère conformément au Code national de l'électricité (CNÉ) et aux normes locales de l'électricité. Pour les démarreurs, se reporter aux directives fournies avec le tableau de sélection de l'unité thermique.

ASSEMBLAGE

Le tableau 6 et la feuille de directives du dispositif donnent les couples de serrage recommandés pour les raccordements mécaniques, électriques et du fil à pression. Respecter ces couples de serrage pour assurer un fonctionnement correct du dispositif. Si l'actionneur de contacts est enlevé pour l'inspection ou le remplacement des contacts, réarmer le dispositif après le remontage.

COMMANDES DE PIÈCES

Spécifier la quantité, le numéro de pièce et la description de la pièce en donnant toutes les données de la plaque d'identification du dispositif (par ex., 1 kit de contact classe 9998 type ML2 pour démarreur manuel série A, classe 2510 type MCG3).

Table / Table / Tableau 5 : Parts List^[1] / Lista de piezas^[1] / Liste des pièces^[1]

Item Art.	Description / Descripción / Description	Part No No. de pieza N° de pièce	Quantity / Contenido / Quantité				
			Size / Tamaño / Taille				
			M-0		M-1		M-1P
			2-P	3-P	2-P	3-P	2-P
1	Contact kit Accesorio de contactos Kit de contacts	Class / Clase / Classe 9998 Type / Tipo / Type ML1 Type / Tipo / Type ML2	1 —	1 —	— 1	— 1	— 1
2	Wire clamp screw assy. / Ensemble del tornillo de la pinza del conductor / Assemblage de vis du serre-fils	30018-070-50	4	6	4	6	—
3 [2]	Internal interlock (N.O.) / Entrelace interno (N.A.) Interverrouillage interne (N.O.)	Class / Clase / Classe 9999 Type / Tipo / Type SX11 [2]	—	—	—	—	—
	Internal interlock (N.C.) / Entrelace interno (N.C.) Interverrouillage interne (N.F.)	Class / Clase / Classe 9999 Type / Tipo / Type SX12 [2]	—	—	—	—	—
E	Overload thermal unit fastening screw / Tornillo de fijación de unidad térmica de sobrecarga / Vis de fixation d'unité thermique de surcharge	21920-16160	4	6	4	6	4

^[1] For reversing and two-speed starters, refer to "MANUAL STARTERS CLASS 2511/2512" on page 4.

Para los arrancadores reversibles y de dos velocidades, vea la sección "ARRANCADORES MANUALES CLASE 2511/2512" en la página 4.

Pour démarreurs inversibles et à deux vitesses, se reporter à «DÉMARREURS MANUELS CLASSE 2511/2512» à la page 4.

^[2] A maximum of either 1 N.O. or 1 N.C. interlock may be added per starter. / Se puede agregar un máximo de 1 entrelace N.A. o 1 N.C. por arrancador.
Un seul interverrouillage N.O. ou 1 N.F. peut être ajouté par démarreur.

Table / Table / Tableau 6 : Factory Recommended Tightening Torques / Pares de apriete recomendados de fábrica
Couples de serrage recommandés par l'usine

Item Art.	Description / Descripción / Description			Tightening Torque / Par de apriete / Couple de serrage	
				lb-in / po / pulg	N•m
A	Contact actuator mechanism screws (2 per device)	Tornillos del mecanismo del actuador de contactos (2 por equipo)	Vis du mécanisme de l'actionneur de contacts (2 par dispositif)	18 – 21	2.0 – 2.4 2,0 – 2,4
B	Line side stationary contact fasteners (1 per pole)	Sujetadores de contactos fijos del lado de línea (1 por polo)	Attaches de contact fixe côté secteur (1 par pôle)	13 – 16	1.5 – 1.8 1,5 – 1,8
C	Load side stationary contact fasteners (1 per pole)	Sujetadores de contactos fijos del lado de carga (1 por polo)	Attaches de contact fixe côté charge (1 par pôle)	6 – 9	0.7 – 1.0 0,7 – 1,0
D	Pressure wire connector screw (2 per pole)	Tornillo conector del conductor de presión (2 por polo)	Vis connecteur du fil à pression (2 par pôle)	[1]	[1]
E	Overload thermal unit fastening screws (2 per element)	Tornillos sujetadores del elemento térmico de sobrecarga (2 por elemento)	Vis de fixation de l'unité thermique de surcharge (2 par élément)	18 – 21	2.0 – 2.4 2,0 – 2,4
F	Lug fastening screw (1 per pole)	Tornillo de sujeción de la zapata (1 por polo)	Vis de fixation de cosse (1 par pôle)	18 – 21	2.0 – 2.4 2,0 – 2,4
G	Wire pressure screw (1 per pole, line side)	Tornillo de presión del conductor (1 por polo, lado de línea)	Vis de pression de fils (1 par pôle, côté secteur)	[1]	[1]
H	Wire pressure screw (1 per pole, load side)	Tornillo de presión del conductor (1 por polo, lado de carga)	Vis de pression de fils (1 par pôle, côté charge)	[1]	[1]

^[1] Torque as recommended on the device instruction sheet. / Par de apriete recomendado en la hoja de instrucciones del dispositivo.
Couple recommandé sur la fiche de directives du dispositif.

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30–1200 A Safety Switches Maintenance Instructions

Instrucciones de servicio de mantenimiento para los interruptores de seguridad de 30 a 1 200 A

Directives d'entretien pour interrupteurs de sécurité, 30 à 1 200 A

Class
Clase
Classe
3100

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

INTRODUCTION

Safety switches are properly lubricated at the factory. However, periodic cleaning and lubrication may be required. The maintenance interval between lubrications depends on the amount of switch usage and the ambient operating conditions. The maximum maintenance interval should not exceed one year for mechanical or current-carrying parts.

For additional information, refer to publication NFPA-70B, "Recommended Practice for Electrical Equipment Maintenance".

Unusual Performance Conditions

Contact Square D for information regarding performance under unusual conditions. Examples of unusual conditions are shown in Table 1 below:

INTRODUCCIÓN

Los interruptores de seguridad han sido lubricados correctamente en la fábrica; sin embargo, es necesario realizar limpieza y lubricación periódicamente. El intervalo de servicio de mantenimiento entre lubricaciones depende del uso del interruptor y de las condiciones ambientales de funcionamiento. El intervalo de servicio de mantenimiento máximo no debe exceder un año para las piezas mecánicas o conductoras de corriente.

Si desea obtener información adicional, consulte la publicación NFPA-70B, "Recommended Practice for Electrical Equipment Maintenance" (prácticas recomendadas de servicio de mantenimiento para el equipo eléctrico).

Condiciones de funcionamiento poco comunes

Póngase en contacto con Square D para obtener información con respecto al funcionamiento de este equipo bajo condiciones poco comunes. La tabla 1 muestra ejemplos de condiciones poco comunes:

INTRODUCTION

Les interrupteurs de sécurité sont lubrifiés de façon appropriée à l'usine. Toutefois, un nettoyage et une lubrification périodiques peuvent être nécessaires. L'intervalle d'entretien entre les lubrifications dépend de la fréquence d'utilisation de l'interrupteur et des conditions ambiantes de fonctionnement. L'intervalle d'entretien maximum ne doit pas dépasser un an pour les pièces mécaniques ou porteuses de courant.

Pour avoir d'autres renseignements, se reporter à la publication NFPA-70B, « Recommended Practice for Electrical Equipment Maintenance » (Pratique recommandée pour l'entretien des appareils électriques).

Conditions de performance inhabituelles

Contactez Square D pour avoir des informations sur la performance dans des conditions inhabituelles. Des exemples de conditions inhabituelles sont données au tableau 1 ci-dessous :

Table / Tabla / Tableau 1 : Unusual Conditions / Condiciones poco comunes / Conditions inhabituelles

• Ambient temperatures below -22 °F (-30 °C) or above 104 °F (40 °C) /	• Temperatura ambiente inferior a -30 °C (-22 °F) o superior a 40 °C (104 °F) /	• Températures ambiantes inférieures à -30 °C (-22 °F) ou supérieures à 40 °C (104 °F)
• Altitudes over 6600 ft (2012 m) /	• Altitudes de más de 2 012 m (6 600 pies) /	• Altitudes dépassant 2 012 m (6 600 pieds)
• Corrosive or explosive environments /	• Entornos corrosivos o explosivos /	• Environnements corrosifs ou explosifs
• Abnormal vibration, shock, or tilting /	• Vibración, sacudidas o inclinaciones anormales /	• Vibrations, chocs ou inclinaison anormaux
• Unusual operating duties /	• Servicio de funcionamiento poco común /	• Facteurs de fonctionnement inhabituels



⚠ DANGER / PELIGRO / DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized switch with door open.
- Turn off switch before removing or installing fuses or making load side connections.
- Always use a properly rated voltage sensing device at all line and load fuse clips to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.
- Do not use renewable link fuses in fused switches.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía, consulte la norma 70E de NFPA.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Nunca haga funcionar el interruptor energizado con la puerta abierta.
- Desconecte el interruptor antes de retirar o instalar los fusibles o realizar las conexiones del lado de carga.
- Siempre utilice un dispositivo detector de tensión nominal adecuado en todos los clips para fusibles en los lados de línea y carga para confirmar la desenergización del interruptor.
- Desenergice el interruptor antes de realizar cualquier otro trabajo dentro o fuera de él.
- No use fusibles renovables en los interruptores fusibles.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Ne faites jamais fonctionner l'interrupteur sous tension avec la porte ouverte.
- Mettez l'interrupteur hors tension avant d'enlever ou d'installer des fusibles ou de faire des raccordements sur le côté charge.
- Utilisez toujours un dispositif de détection de tension ayant une valeur nominale appropriée sur tous les porte-fusibles du côté ligne et charge pour s'assurer que l'interrupteur soit hors tension.
- Coupez l'alimentation de l'interrupteur avant d'y faire tout autre travail.
- N'utilisez pas de fusibles renouvelables dans les interrupteurs à fusibles.

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

ANNUAL MAINTENANCE PROCEDURES

1. Turn off power supplying the switch before performing any work on or inside the switch.
2. Open the switch blades by moving the operating handle to the OFF (O) position.
3. Lock out or tag the switch, per local procedures.
4. Open the enclosure door.
5. Always use a properly rated voltage sensing device at all line and load-side lugs (terminals) to confirm power is off.

NOTE: Do not remove any parts from the switch or operating mechanism unless specifically instructed to do so in the following procedures. Vacuum any loose material from inside the switch. Wipe internal parts and the inside of the enclosure with a damp, lint-free cloth.

6. Visually inspect the switch for loose parts or hardware:
 - a. Retighten the hardware as needed. Refer to the wiring diagram.
 - b. Do not re-energize the switch if any worn or damaged parts are found. Replace them before re-energizing the switch.

PROCEDIMIENTOS DE SERVICIOS DE MANTENIMIENTO ANUALES

1. Desenergice el interruptor antes de realizar cualquier trabajo dentro o fuera de él.
2. Abra las cuchillas del interruptor moviendo la palanca de funcionamiento a la posición de abierto (O).
3. Bloquee o etiquete el interruptor de acuerdo con los procedimientos locales.
4. Abra la puerta del gabinete.
5. Siempre utilice un dispositivo detector de tensión nominal adecuado en todas las zapatas (terminales) del lado de línea y carga para confirmar la desenergización del equipo.

NOTA: No retire ninguna pieza del interruptor ni del mecanismo de funcionamiento a no ser que se le indique eso específicamente en los siguientes procedimientos. aspire el material suelto que se encuentra dentro del interruptor. Limpie las piezas internas y el interior del gabinete con una tela húmeda sin pelusas.

6. Realice una inspección visual al interruptor para ver si encuentra piezas o herrajes sueltos:
 - a. Vuelva a apretar los herrajes a medida que sea necesario. Consulte el diagrama de cableado.
 - b. No vuelva a energizar el interruptor si encuentra piezas desgastadas o dañadas; sustitúyalas antes de volver a energizar el interruptor.

PROCÉDURES D'ENTRETIEN ANNUEL

1. Couper l'alimentation de l'interrupteur avant d'effectuer tout travail sur ou à l'intérieur de l'interrupteur.
2. Ouvrir les lames de l'interrupteur en plaçant la manette de fonctionnement sur la position d'ARRÊT (O).
3. Verrouiller ou étiqueter l'interrupteur, selon les procédures locales.
4. Ouvrir la porte du coffret.
5. Toujours utiliser un dispositif de détection de tension à valeur nominale appropriée sur toutes les cosses (bornes) du côté ligne et charge pour s'assurer que l'interrupteur est hors tension.

REMARQUE : Ne retirer aucune pièce de l'interrupteur ou du mécanisme de fonctionnement sauf en cas d'instruction précise de le faire dans les procédures suivantes. Évacuer à l'aspirateur tous corps étrangers se trouvant à l'intérieur de l'interrupteur. Essuyer les pièces internes et l'intérieur du coffret à l'aide d'un chiffon mouillé, non pelucheux.

6. Inspecter visuellement l'interrupteur pour voir s'il y a des pièces ou de la quincaillerie desserrée :
 - a. Resserer la quincaillerie au besoin. Se reporter au schéma de câblage.
 - b. Ne pas remettre l'interrupteur sous tension en présence de pièces usées ou abîmées. Les remplacer avant de remettre l'interrupteur sous tension.

Parts Removal

1. Remove the arc supressor(s) or arc shield(s) from the switches by loosening the fastener(s) holding the suppressor(s) / shield(s) in place. See Figures 1 and 2.

Desmontaje de piezas

1. Retire el o los supresores o protectores de arco de los interruptores aflojando los sujetadores que los sostienen en su lugar. Vea las figuras 1 y 2.

Démontage des pièces

1. Retirer le ou les supresseurs ou blindages d'arc des interrupteurs en desserrant les attaches qui les maintiennent en place. Voir les figures 1 et 2.

CAUTION / PRECAUCIÓN / ATTENTION

HAZARD OF EQUIPMENT DAMAGE

Do not disassemble the switch line base assembly or remove the blade rotor when cleaning the line-side jaw or the switch blade. See Figure 3 on page 4.

Failure to follow this instruction can result in equipment damage.

PELIGRO DE DAÑO AL EQUIPO

No desmonte el ensamble de la base de línea del interruptor o retire el rotor de cuchilla al limpiar la mordaza del lado de línea o la cuchilla del interruptor, vea la figura 3 en la página 4.

El incumplimiento de esta instrucción puede causar daño al equipo.

RISQUE DE DOMMAGES MATÉRIELS

Ne démontez pas l'assemblage de la base de ligne de l'interrupteur ou ne retirez pas le rotor à lame lorsque vous nettoyez la mâchoire côté ligne ou la lame de l'interrupteur. Voir la figure 3 à la page 4.

Si cette précaution n'est pas respectée, cela peut entraîner des dommages matériels.

2. Remove old grease and other contaminants from the line-side jaws and switchblades with a clean, lint-free cloth. If the lubricant has dried, remove it with CRC®-type HF Contact Cleaner, or equivalent, sprayed on a cloth.

3. Relubricate the cleaned areas with a thin film of Dow Corning® BG20 grease only.

NOTE: Do not substitute any other lubricant. Other lubricants may not be suitable for electrical applications and could alter the performance of the switch. Dow Corning BG20 is available from Square D (part number SWLUB).

4. Exercise the operating mechanism to ensure proper operation by opening and closing the switch five times with the door closed. Open the switch blades.

2. Retire la grasa vieja y otros contaminantes de la mordaza del lado de línea y cuchillas del interruptor con una tela limpia sin pelusas. Si el lubricante se ha secado, retírelo con un limpiador de contacto CRC® tipo HF o uno equivalente, rociado en un pedazo de tela.

3. Vuelva a lubricar las áreas limpiadas con una capa delgada de grasa Dow Corning® BG20 solamente.

NOTA: No utilice otro tipo de lubricante; es posible que no sean adecuados para aplicaciones eléctricas y pueden alterar el funcionamiento del interruptor. La grasa Dow Corning BG20 se encuentra disponible de Square D (número de pieza SWLUB).

4. Realice una prueba al mecanismo de funcionamiento y asegúrese de que funciona correctamente abriendo y cerrando el interruptor cinco veces con la puerta cerrada. Abra las cuchillas del interruptor.

2. Retirer toute graisse ancienne et autres polluants des mâchoires côté ligne et des lames de l'interrupteur à l'aide d'un chiffon propre et non pelucheux. Si le lubrifiant a séché, l'enlever avec un nettoyant pour contact CRC® de type HF ou l'équivalent, vaporisé sur un chiffon.

3. Relubrifier les zones propres avec une fine pellicule de graisse Dow Corning® BG20 uniquement.

REMARQUE : Ne substituer aucun autre lubrifiant. D'autres lubrifiants pourraient ne pas convenir pour des applications électriques et pourraient altérer le fonctionnement de l'interrupteur. Le Dow Corning BG20 est disponible chez Square D (n° de pièce SWLUB).

4. Manœuvrer le mécanisme de fonctionnement pour s'assurer qu'il fonctionne correctement, en ouvrant et fermant l'interrupteur cinq fois avec la porte fermée. Ouvrir les lames de l'interrupteur.

FIG. 1 : Examples of Arc Suppressors /
Ejemplos de supresores de arco /
Exemples de supresseurs d'arc



FIG. 2 : Examples of Arc Shields /
Ejemplos de protectores de arco /
Exemples de blindages d'arc

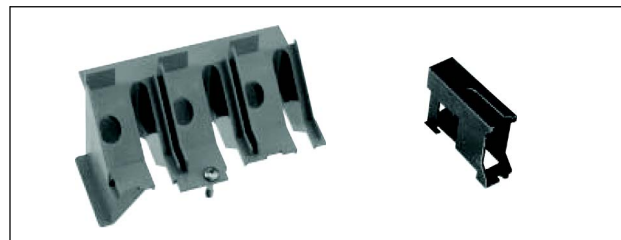


FIG. 3 : Examples of Line Base Assemblies /
Ejemplos de ensambles de la base de línea /
Exemples d'assemblages de la base de ligne

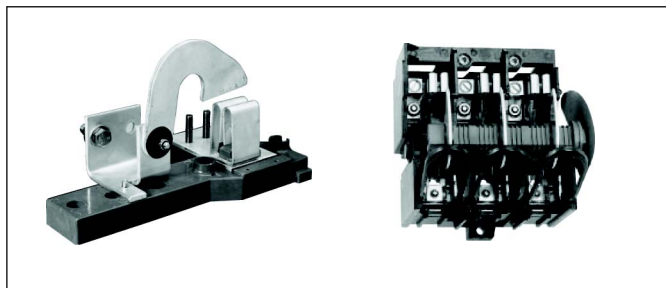
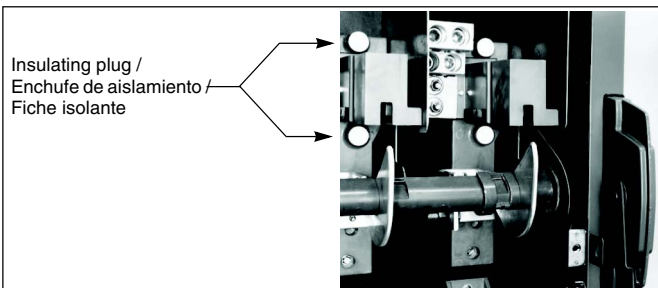


FIG. 4 : Insulating Plugs on Pole Unit /
Enchufes de aislamiento en la unidad de polos /
Fiches isolantes sur l'unité polaire



Parts Replacement

1. Reinstall the arc suppressor(s) or arc shield(s) according to the torque values in Table 2.
2. Ensure that the two insulating plugs in each phase (400–1200 A only) are firmly seated. See Figure 4.

Colocación de piezas

1. Vuelva a instalar el o los supresores o protectores de arco de acuerdo con los valores de par de apriete mostrados en la tabla 2.
2. Asegúrese de que los dos enchufes de aislamiento en cada fase (de 400 a 1 200 A solamente) estén bien apoyados, vea la figura 4.

Remise en place des pièces

1. Réinstaller le ou les supresseurs ou blindages d'arc conformément aux valeurs de couple indiquées au tableau 2.
2. S'assurer que les deux fiches isolantes de chaque phase (400 à 1 200 A seulement) sont bien en place. Voir la figure 4.

Table / Tabla / Tableau 2 : Arc Suppressor Screw Torque Values /
Valores de par de apriete del tornillo del supresor de arco /
Valeurs de couple de serrage des vis des supresseurs d'arc

Switch Type / Tipo de interruptor / Type d'interrupteur	Torque Value / Valor de par de apriete / Valeur de couple
30–100 A	5–10 lb-in / lbs-pulg / lb-po (0,57–1,13 N•m)
200 A, F Series / Serie F / Série F	10–20 lb-in / lbs-pulg / lb-po (1,13–2,26 N•m)
200 A, E Series / Serie E / Série E	20–25 lb-in / lbs-pulg / lb-po (2,26–2,83 N•m)
400–800 A General Duty / 400 a 800 A de uso general / 400 à 800 A, universel	20–25 lb-in / lbs-pulg / lb-po (2,26–2,83 N•m)
400–1200 A Heavy Duty / 400 a 1 200 A de uso pesado / 400 à 1 200 A, service intensif	30–40 lb-in / lbs-pulg / lb-po (3,39–4,52 N•m)

RE-ENERGIZE THE SWITCH

1. Close and latch the door.
2. Turn off all downstream loads.
3. Turn on power supplying the switch.
4. Turn on the switch.
5. Turn on all downstream loads.

RE-ENERGIZACIÓN DEL INTERRUPTOR

1. Cierre y ponga seguro a la puerta.
2. Desconecte todas las cargas descendentes.
3. Energice el interruptor.
4. Coloque el interruptor en la posición de cerrado (I).
5. Conecte todas las cargas descendentes.

REMISE DE L'INTERRUPTEUR SOUS TENSION

1. Fermer la porte de l'interrupteur.
2. Mettre hors tension toutes les charges en aval.
3. Mettre l'interrupteur sous tension.
4. Mettre l'interrupteur en position de marche (I).
5. Mettre sous tension toutes les charges en aval.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Schneider Electric USA
 1601 Mercer Road
 Lexington, KY 40511 USA
 1-888-SquareD (1-888-778-2733)
 www.us.SquareD.com

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Importado en México por:
Schneider Electric México, S.A. de C.V.
 Calz. J. Rojo Gómez 1121-A
 Col. Gpe. del Moral 09300 México, D.F.
 Tel. 55-5804-5000
 www.schneider-electric.com.mx

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

Schneider Electric Canada
 19 Waterman Avenue, M4B 1 Y2
 Toronto, Ontario
 1-800-565-6699
 www.schneider-electric.ca



EDB, EGB and EJB Circuit Breakers

Interruptores automáticos EDB, EGB y EJB

Disjoncteurs EDB, EGB et EJB

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía (consulte la norma NFPA 70E).
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ELECTROCUTION, D'EXPLOSION OU D'ECLAIR D'ARC

- Portez un équipement de protection personnel (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension à valeur nominale appropriée pour s'assurer que l'alimentation est coupée.
- Remplacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces précautions ne sont pas respectées, cela entraînera la mort ou des blessures graves.

CIRCUIT BREAKER INSTALLATION

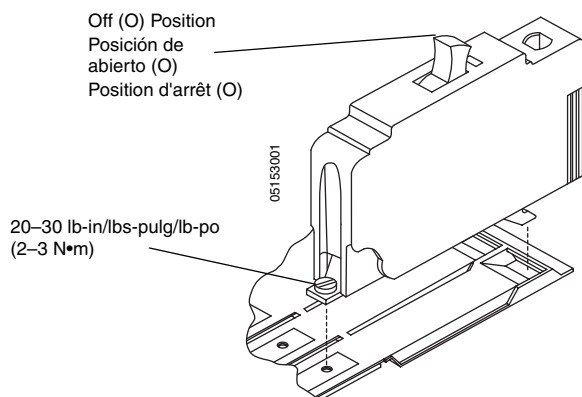
Turn off all power supplying this equipment before working on or inside equipment. Turn off circuit breaker.

INSTALACIÓN DEL INTERRUPTOR AUTOMÁTICO

Desenergice el equipo antes de realizar cualquier trabajo en él. Desconectar interruptor automático.

INSTALLATION DU DISJONCTEUR

Couper l'alimentation de l'appareil avant d'y travailler. Couper l'alimentation à disjoncteur.



WIRE INSTALLATION

INSTALACIÓN DE CABLES

INSTALLATION DES CÂBLES

CAUTION / PRECAUCIÓN / ATTENTION

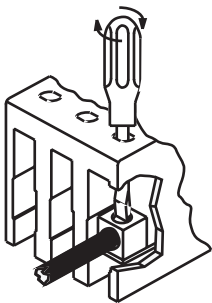
HAZARD OF EQUIPMENT DAMAGE	PELIGRO DE DAÑO AL EQUIPO	RISQUE DE DOMMAGES MATÉRIELS
Wire strands interfering with wire binding screws can cause false torque indication. Do not allow wire strands to interfere with threads of wire binding screws. Failure to follow these instructions can result in equipment damage.	Los hilos del cable que interfieren con los tornillos de sujeción de cables pueden dar una indicación falsa de par de apriete. No permita que los hilos del cable interfieran con las roscas de los tornillos de sujeción de cables. El incumplimiento de estas precauciones puede causar daño al equipo.	Les torons du conducteur interférant avec les vis de fixation de fils peuvent entraîner une indication erronée du couple. Ne laissez pas les torons du conducteur s'engager dans les filets des vis de fixation de fils. Si ces précautions ne sont pas respectées, cela peut entraîner des dommages matériels.

See circuit breaker faceplate label or optional lug instructions for wire size and torque.

Consulte la etiqueta de la placa frontal del interruptor automático o las instrucciones que acompañan a las zapatas opcionales para obtener el calibre del cable y el par de apriete.

Voir l'étiquette de la plaque avant du disjoncteur ou les directives fournies avec les cosses optionnelles pour obtenir le calibre de fils et le couple.

05153002



Strip Length
Sección sin aislamiento
Longueur de dénudage

15–30 A: 3/8 in./pulg/po [10 mm]
35–125 A: 5/8 in./pulg/po [16 mm]

CIRCUIT BREAKER REMOVAL

Remove circuit breaker in reverse order of installation.

CIRCUIT BREAKER OPERATION

DESMONTAJE DEL INTERRUPTOR AUTOMÁTICO

Desmante el interruptor automático en el orden inverso al de la instalación.

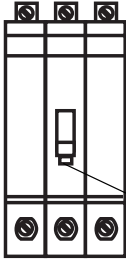
FUNCIONAMIENTO DEL INTERRUPTOR AUTOMÁTICO

DÉMONTAGE DU DISJONCTEUR

Démonter le disjoncteur en ordre inverse de l'installation.

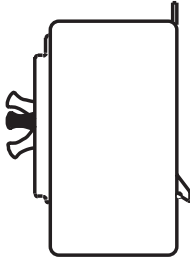
FONCTIONNEMENT DU DISJONCTEUR

05153003



On/Cerrado/Marche (I)
Tripped/Disparado/Déclenché
Off/Abierto/Arrêt (O)

VISI-TRIP®
(Red flag indicates that circuit breaker has tripped.
El indicador rojo indica que el interruptor automático se ha disparado.
L'indicateur rouge indique que le disjoncteur s'est déclenché.)



ELECTRICAL ACCESSORIES

Options:

- Auxiliary switch/alarm switch package
 - Shunt trip package
 - Auxiliary switch/alarm switch/shunt trip package
1. Turn off all power supplying this equipment before working on or inside equipment. Turn off circuit breaker.
 2. Use pull tab to remove connector from accessory receptacle.

ACCESORIOS ELÉCTRICOS

Opciones:

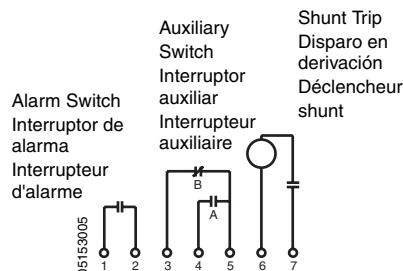
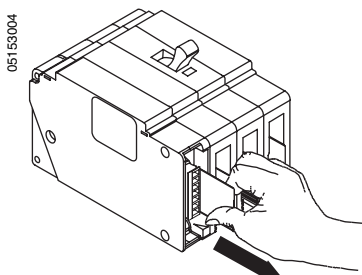
- Paquete de interruptor auxiliar e interruptor de alarma
 - Paquete de disparo en derivación
 - Paquete de interruptor auxiliar, interruptor de alarma y disparo en derivación
1. Desenergice el equipo antes de realizar cualquier trabajo en él. Descontar interruptor automático.
 2. Utilice la lengüeta de extracción para retirar el conector del receptáculo del accesorio.

ACCESSOIRES ÉLECTRIQUES

Options :

- Ensemble d'interrupteur auxiliaire/interrupteur d'alarme
 - Ensemble de déclencheur shunt
 - Ensemble d'interrupteur auxiliaire/interrupteur d'alarme/déclencheur shunt
1. Couper l'alimentation de l'appareil avant d'y travailler. Couper l'alimentation à disjoncteur.
 2. Tirer sur la languette pour retirer le connecteur du réceptacle de l'accessoire.

Factory-installed Electrical Accessories
Accesorios eléctricos instalados en la fábrica
Accessoires électriques installés en usine



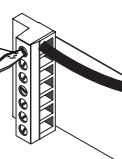
3. Insert connector wire(s) and tighten screws.

3. Inserte el(los) cable(s) del conector y apriete los tornillos.

3. Insérer le ou les fils du connecteur et serrer les vis.

4 lb-in./pulg/po
(0,5 N•m)

05153006



#22-#12 AWG
(0,5-2,5 mm²)

Strip Length
Sección sin aislamiento
Longueur de dénudage

0.210 in./pulg/po [5,3 mm] MIN. / MÍN.
0.340 in./pulg/po [8,6 mm] MAX. / MÁX.

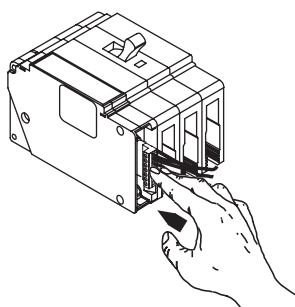
4. Replace connector in accessory receptacle

4. Vuelva a colocar el conector en el receptáculo del accesorio.

4. Replacer le connecteur dans le réceptacle de l'accessoire.

**Table/Tabla/Tableau 1: Electrical Accessory Ratings/
Accesorio especificaciones eléctricas/
Accessoire de valeur nominale électrique**

05153007



Auxiliary Switch/Interruptor auxiliar/ Interrupteur auxiliaire	Alarm Switch/Interruptor de alarma/ Interrupteur d'alarme	Shunt Trip/Disparo en derivación/ Déclencheur shunt
Max. Load = 10 A @ 120 V~ 50/60 Hz Carga máx. = 10 A @ 120 V~ 50/60 Hz Charge max. = 10 A @ 120 V~ 50/60 Hz	Max. Load = 7 A @ 120 V~ 50/60 Hz Carga máx. = 7 A @ 120 V~ 50/60 Hz Charge max. = 7 A @ 120 V~ 50/60 Hz	Coil Burden Max. = 288 VA Minimum Recommended Supply Transformer = 50 VA Voltage = 120 V~ 50/60 Hz Carga máx. de la bobina = 288 VA Val. nom. mín. recomendado para el transformador de alimentación = 50 VA Tensión = 120 V~ 50/60 Hz Charge max. de la bobine = 288 VA Val. nom. min. recommandée pour le transformateur d'alimentation = 50 VA Tension = 120 V~ 50/60 Hz

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Troubleshooting may require energizing auxiliary devices with test power supply. Make sure that the power supply is OFF before connecting or disconnecting it to auxiliary device.
- Do not touch the terminals of the device during the test.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía (consulte la norma NFPA 70E).
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Para realizar un diagnóstico de problemas es necesario energizar los dispositivos auxiliares con la fuente de alimentación de prueba. Asegúrese que la fuente de alimentación esté DESCONECTADA antes de conectar o desconectar el dispositivo auxiliar.
- No toque las terminales del dispositivo durante la prueba.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ELECTROCUTION, D'EXPLOSION OU D'ECLAIR D'ARC

- Portez un équipement de protection personnel (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Le dépannage peut nécessiter l'activation de dispositifs auxiliaires avec une alimentation d'essai. Assurez-vous que l'alimentation est désactivée (OFF) avant tout branchement ou débranchement avec le dispositif auxiliaire.
- Ne touchez pas aux bornes du dispositif penant l'essai.

Si ces précautions ne sont pas respectées, cela entraînera la mort ou des blessures graves.

TROUBLESHOOTING

If problems occur during installation, refer to the following guide. If trouble persists, contact the local field office.

CONDITION/CONDICION/CONDITION

Circuit breaker fails to stay closed.
 El interruptor automático no permanece cerrado.
 Le disjoncteur ne reste pas fermé.

Electrical accessories fail to operate or operate intermittently.
 Los accesorios eléctricos no funcionan o su funcionamiento es inconsistente.
 Les accessoires électriques ne fonctionnent pas ou fonctionnent d'une façon intermittente.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Schneider Electric USA
 3700 Sixth Street SW
 Cedar Rapids, Iowa 52404 USA
 1-888-SquareD (1-888-778-2733)
 www.us.SquareD.com

REPARACIÓN DE AVERÍAS

En caso de que suceda algún problema durante la instalación, consulte la guía a continuación. Si el problema persiste, póngase en contacto con la oficina local.

POSSIBLE CAUSES/CAUSAS POSIBLES/CAUSES POSSIBLES

1. Shunt trip energized.
El disparo en derivación está energizado.
Déclencheur shunt est sous tension.
2. Short circuit or overload on system.
Existe un cortocircuito o sobrecarga en el sistema.
Court-circuit ou surcharge dans le système.

1. Connector has become partially or fully disengaged from receptacle.
El conector se ha desenganchado parcial o completamente del receptáculo.
Le connecteur s'est partiellement ou entièrement débra
2. Control wires have become disconnected from connector or the connection has become loose.
Los cables de control se han desconectado del conector o la conexión se ha aflojado.
Les fils de commande se sont détachés du connecteur ou la connexion est devenue lâche.nché du réceptacle.

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Importado en México por:
Schneider Electric México, S.A. de C.V.
 Calz. J. Rojo Gómez 1121-A
 Col. Gpe. del Moral 09300 México, D.F.
 Tel. 55-5804-5000
 www.schneider-electric.com.mx

DÉPANNAGE

Si des problèmes surviennent pendant l'installation, se reporter aux consignes suivantes. Si les problèmes persistent, contacter le bureau de service local.

SOLUTION/SOLUCION/SOLUTION

1. De-energize shunt trip.
Desenergice el disparo en derivación.
Mettre le déclencheur shunt hors tension.
2. Check system for short circuit or overload.
Revise el sistema para ver si encuentra un cortocircuito o una sobrecarga.
Rechercher un court-circuit ou une surcharge dans le système.

1. Reinsert connector into receptacle.
Vuelva a insertar el conector en el receptáculo.
Réintroduire le connecteur dans le réceptacle.
2. Check for loose or disconnected control wires.
Revise el sistema para ver si encuentra cables de control sueltos o desconectados.
Rechercher des fils de commande lâches ou débranchés.

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Schneider Electric Canada
 19 Waterman Avenue, M4B 1 Y2
 Toronto, Ontario
 1-800-565-6699
 www.schneider-electric.ca



Replaces / Reemplaza / Remplace 48940-221-02 ECN909D, 11/2008

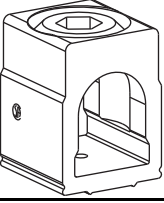
Mechanical Lug Kits for H- and J-Frame Molded Case Circuit Breakers

Kits de zapatas mecánicas para los interruptores automáticos en caja moldeada marcos H y J

Kits de cosses mécaniques pour disjoncteurs à boîtier moulé à châssis H et J

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

Table / Tabla / Tableau 1 : Lug Information / Información de zapatas / Renseignements sur les cosses

Lug / Zapata / Cosse	Catalog No. / Número de catálogo / Nº de catalogue	Lugs per Kit / Zapatas por kit / Cosses par kit	Frame / Marco / Châssis	Ampere Range / Gama en A / Gamme (A)	Conductor / Conductor / Conducteur				Wire Binding Screw Torque / Par de apriete del tornillo de sujeción del cable / Couple de la vis de fixation du fil
					Type / Tipo / Type	Number Per Lug / Cantidad por zapata / Nombre par cosses	Wire Range / Calibre del cable / Calibre des fils	Strip Length / Sección sin aislamiento / Longueur de dénudage	
	AL150HD, AL150HDS	3	HD, HG, HJ, HL	15–150	Al/Cu	1	14–10 AWG (2,5–6 mm ²)	.65 in. / pulg / po (16 mm)	50 lb-in / lbs-pulg / lb-po (5 N•m)
						1	8–3/0 AWG (10–95 mm ²)	.65 in. / pulg / po (16 mm)	120 lb-in / lbs-pulg / lb-po (14 N•m)
	CU150HD	3	HD, HG, HJ, HL	15–150	Cu	1	14–2/0 AWG (2,5–70 mm ²)	.65 in. / pulg / po (16 mm)	120 lb-in / lbs-pulg / lb-po (14 N•m)
	AL175JD	3	JD, JG, JJ, JL	150–175	Al/Cu	1	4–4/0 AWG (20–95 mm ²)	1 in. / pulg / po (25 mm)	225 lb-in / lbs-pulg / lb-po (26 N•m)
	AL250JD	3	JD, JG, JJ, JL	200–250	Al/Cu	1	3/0–350 kcmil (120–185 mm ²)	1 in. / pulg / po (25 mm)	225 lb-in / lbs-pulg / lb-po (26 N•m)
	CU250JD	3	JD, JG, JJ, JL	150–250	Cu	1	1/0–300 kcmil (50–185 mm ²)	1 in. / pulg / po (25 mm)	250 lb-in / lbs-pulg / lb-po (28 N•m)

Necessary Tools

Screwdriver, long-shanked slotted

Torque Wrench:

- 3/16 in. for AL150HD and CU150HD lug kits
- 5/32 in. (4 mm) for AL150HDS lug kits
- 5/16 in. (8 mm) for AL175JD, AL250JD and CU250JD lug kits

Herramientas necesarias

Destornillador de punta plana y cuerpo largo

Llave de apriete prefijado:

- de 5 mm (3/16 pulg) para los kits de zapatas AL150HD y CU150HD
- de 4 mm (5/32 pulg) para los kits de zapatas AL150HDS
- de 8 mm (5/16 pulg) para los kits de zapatas AL175JD, AL250JD y CU250JD

Outils nécessaires

Tournevis plat à longue tige

Clé dynamométrique :

- 5 mm (3/16 po) pour les kits de cosses AL150HD et CU150HD
- 4 mm (5/32 po) pour les kits de cosses AL150HDS
- 8 mm (5/16 po) pour les kits de cosses AL175JD, AL250JD et CU250JD

Installation

Instalación

Installation

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad en trabajos eléctricos establecidas por su Compañía, consulte la norma 70E de NFPA/Z462 de CSA y NOM-029-STPS.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E ou CSA Z462.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension à valeur nominale appropriée pour s'assurer que l'alimentation est coupée.
- Remplacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Verify circuit breaker is in off or tripped position.
3. Remove circuit breaker from enclosure, if installed.

1. Desenergice el equipo antes de realizar cualquier trabajo en él.
2. Asegúrese de que el interruptor esté en la posición de disparado o abierto (O).
3. Retire el interruptor automático del gabinete, si está instalado.

1. Couper l'alimentation de l'appareil avant d'y travailler.
2. S'assurer que le disjoncteur est en position d'arrêt (O) ou de déclenché.
3. Enlever le disjoncteur du coffret, s'il est installé.

Lug Installation

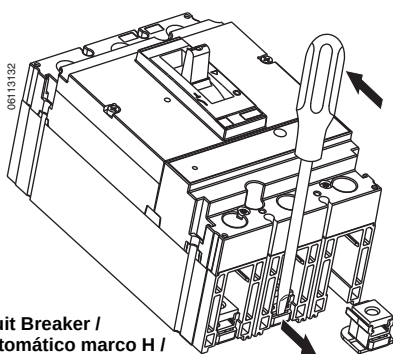
1. If installed, remove existing terminal plate assembly from circuit breaker using slotted screwdriver.

Instalación del ensamble de zapatas

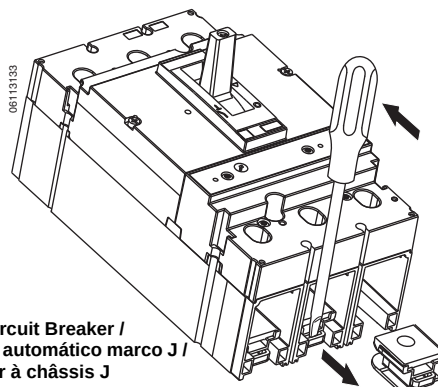
1. Si está instalada, retire el ensamble de placa terminal existente del interruptor utilizando un destornillador de punta plana.

Installation de l'assemblage de cosses

1. S'il a été installé, retirer l'assemblage de plaque de bornes existant du disjoncteur à l'aide d'un tournevis plat.



H-Frame Circuit Breaker /
Interruptor automático marco H /
Disjoncteur à châssis H

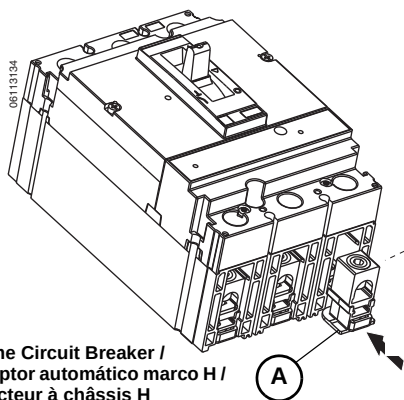


J-Frame Circuit Breaker /
Interruptor automático marco J /
Disjoncteur à châssis J

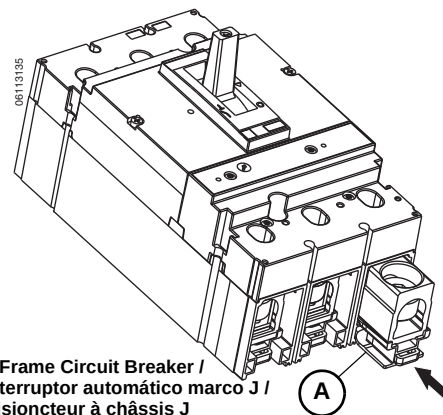
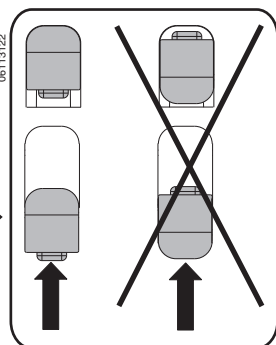
2. Install new lug assembly in circuit breaker. Align curved edge (A) of plastic lug retainer with curved edge of circuit breaker lug slot and snap into place.

2. Instale el ensamble de zapatas nuevo en el interruptor. Alinee el reborde curvado (A) del retén de plástico de la zapata con el reborde curvado de la ranura de la zapata del interruptor y encaje en su lugar.

2. Installer le nouvel assemblage de cosses dans le disjoncteur. Aligner le bord recourbé (A) du dispositif de retenue des cosses en plastique avec le bord recourbé de la fente pour cosse du disjoncteur et emboîter en place.



H-Frame Circuit Breaker /
Interruptor automático marco H /
Disjoncteur à châssis H



J-Frame Circuit Breaker /
Interruptor automático marco J /
Disjoncteur à châssis J

Conductor Connections

Conexiones de los conductores

Raccordements des conducteurs

NOTICE / AVISO / AVIS

HAZARD OF FALSE TORQUE INDICATION

Do not allow conductor strands to interfere with threads of wire binding screw.

HAZARD OF OVERHEATING OR WIRE DISCONNECTION DURING SHORT CIRCUIT

Existing lug information may include incorrect wire torque for this lug. Install lug information label supplied with this kit over existing lug information.

Failure to follow these instructions can result in equipment damage.

PELIGRO DE INDICACIÓN FALSA DE PAR DE APRIETE

No permita que los hilos del conductor interfieran con las roscas del tornillo de sujeción del cable.

PELIGRO DE SOBRECALENTAMIENTO O DESCONEXIÓN DEL CABLE DURANTE UN CORTOCIRCUITO

La información de la zapata existente puede incluir un valor incorrecto de par de apriete del cable para esta zapata. Instale la etiqueta de datos de la zapata incluida con este kit sobre la etiqueta existente.

El incumplimiento de estas instrucciones puede causar daño al equipo.

RISQUE D'INDICATION ERRONÉE DU COUPLE

Ne laissez pas les torons du conducteur s'engager dans les filets de la vis de fixation.

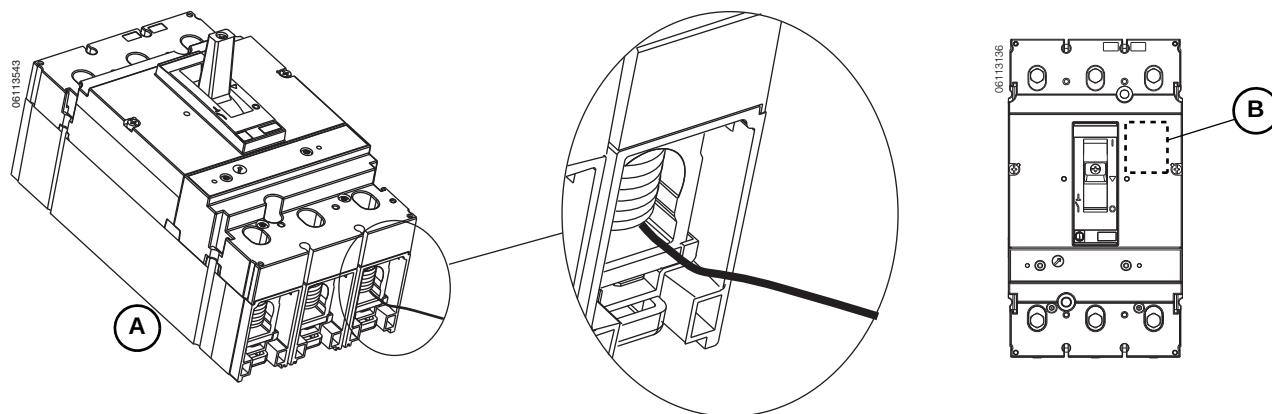
RISQUE DE SURCHAUFFE OU DE DÉCONNEXION DE FILS DURANT UN COURT-CIRCUIT

Les informations existantes sur les cosses peuvent comprendre un couple de fil incorrect pour cette cosse. Installez l'étiquette de données sur les cosses fournies avec ce kit par-dessus celle existante.

Si ces directives ne sont pas respectées, cela peut entraîner des dommages matériels.

- | | | |
|---|--|---|
| <ol style="list-style-type: none"> 1. Square conductor ends and preform conductors to final configuration. Using a proper insulation stripping tool, strip conductor ends as recommended in Table 1. Do not nick strands. 2. Install cables and tighten wire-binding screw as recommended in Table 1. <ul style="list-style-type: none"> — Wire larger than 12 AWG may be installed in center of channel. — Install smaller wire (14–12 AWG) on the side of channel (A) on all lugs as shown in Figure 1, to avoid damage to wire. 3. Install appropriate new lug data label (B), included in lug kit, over existing lug data on circuit breaker. | <ol style="list-style-type: none"> 1. Corte las puntas de los conductores en forma cuadrada y prefórmelos en la configuración final. Con una herramienta de desforramiento adecuada, pele las puntas de los conductores según la recomendación de la tabla 1. Tenga cuidado de no dañar los hilos. 2. Instale los cables y apriete los tornillos de sujeción según las recomendaciones de la tabla 1. <ul style="list-style-type: none"> — Es posible instalar un conductor más grande que 3,31 mm² (12 AWG) en el centro del canal. — Instale el conductor más pequeño de 2,08 a 3,31 mm² (14 a 12 AWG) en el costado del canal (A) en todas las zapatas para no dañar el conductor (vea la figura 1). 3. Instale la nueva etiqueta de datos de las zapatas (B), incluida con el kit de zapata, sobre la etiqueta existente en el interruptor automático. | <ol style="list-style-type: none"> 1. Couper les extrémités des conducteurs bien droit et leur donner leur configuration définitive. Au moyen d'un outil à dénuder l'isolation approprié, dénuder les extrémités des conducteurs comme recommandé au tableau 1. Ne pas entailler les torons. 2. Installer les câbles et serrer les vis de fixation des fils comme recommandé au tableau 1. <ul style="list-style-type: none"> — Du fil d'un calibre plus gros que 3,31 mm² (12 AWG) peut être installé au centre du profilé. — Installer le fil plus petit (calibre 2,08 à 3,31 mm² [14 à 12 AWG]) sur le côté du profilé (A), sur toutes les cosses pour éviter d'endommager les fils (voir la figure 1). 3. Installer la nouvelle étiquette de données des cosses (B), comprise avec le kit, sur les données de cosses existantes du disjoncteur. |
|---|--|---|

Figure / Figura / Figure 1 :



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Terminating the Communications Link

For proper RS-485 communications performance, you must terminate the last device on the communications link using one of these methods:

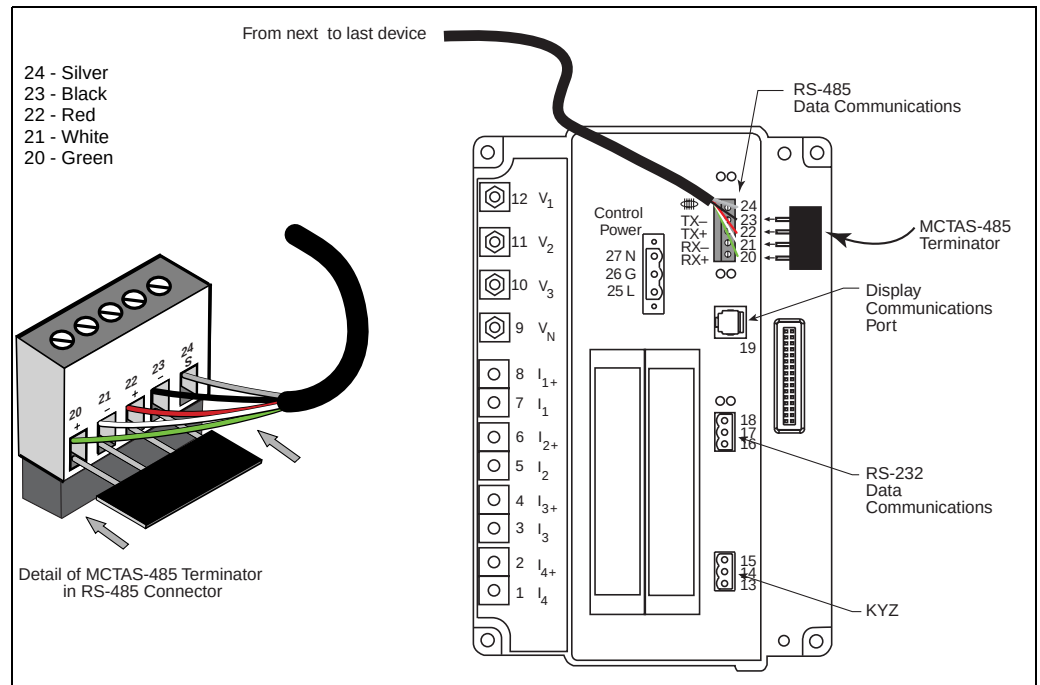
- Use the MCTAS-485 terminator, which inserts directly into the connector in the RS-485 port of the circuit monitor/power meter as illustrated in Figure 6–7.
- Use a terminal block and the MCT-485 terminator. In this method, communications wires route from the last device on a daisy chain to a 5-position terminal block. The terminator attaches to the terminal block. See Figure 6–8.

- Terminate **only the last device** on the link. If a link has only one device, terminate that device.
- Some PowerLogic devices use a removable communications connector. If the last device on the communications link is not a circuit monitor/power meter, refer to the instruction bulletin for that device for termination instructions.

Using the MCTAS-485 Terminator

To terminate the circuit monitor/power meter using the MCTAS-485 terminator, insert the wires of the terminator directly into terminals 20, 21, 22, and 23 of the RS-485 communications connector on the circuit monitor/power meter as shown in Figure 6–7.

Figure 6–7: Terminating the circuit monitor/power meter using the MCTAS-485 terminator



Using the MCT-485 Terminator

If the circuit monitor/power meter is the last device on the communication link, follow these instructions to terminate it using the MCT-485 terminator:

1. Route the communications wires from the last circuit monitor/power meter on a daisy chain to a 5-position terminal block.
2. Attach the terminator to the terminal block as shown in Figure 6–8.

Figure 6–8: Terminating the circuit monitor/power meter using the MCT-485 terminator and a terminal block

