Lok-Bolt™ *Sleeve Expansion Anchor*

PRODUCT DESCRIPTION

The Lok-Bolt is a pre-assembled single unit sleeve anchor available in carbon steel and stainless steel which can be used in concrete, block, brick, and stone. The Lok-Bolt is designed to draw the fixture into full bearing against the base material through the action of its unique and flexible compression ring. This helps to increase the resistance of the anchor to loosening when subjected to vibratory loads. As the anchor is being tightened, the nylon compression ring will compress if necessary, so that the fixture is tightly secured against the face of the base material. Under load, the specially tapered plow bolt is drawn further into the expansion sleeve to develop increased locking action against the walls of the hole. Extension sleeves are added for longer lengths.

GENERAL APPLICATIONS AND USES

- Door and Window Frame Installations
- Mounting fixtures on walls
- Mounting of Handrails and Fencing
- Shelving and Storage
- Masonry Applications
- Electrical and Mechanical Attachments

FEATURES AND BENEFITS

- Multiple head styles for multiple applications and finished appearance
- Fits standard fixture holes – No need to undersize anchors for proper fit
- Immediate Loading – Minimizes downtime
- Sleeve has 360° contact area and reduces concrete stress
- Versatile and ideal for concrete, or masonry
- Available in carbon steel and Type 304 stainless steel

APPROVALS AND LISTINGS

Factory Mutual Research Corporation (FM Approvals) Serial No. 26692, J.I. OJ8A1.AH, J.I. OJ9A9.AH

Underwriters Laboratory (UL Listed) File No. EX 1289 (N) See listing for applicable sizes and styles.

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Sleeve Anchors shall be Lok-Bolt anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

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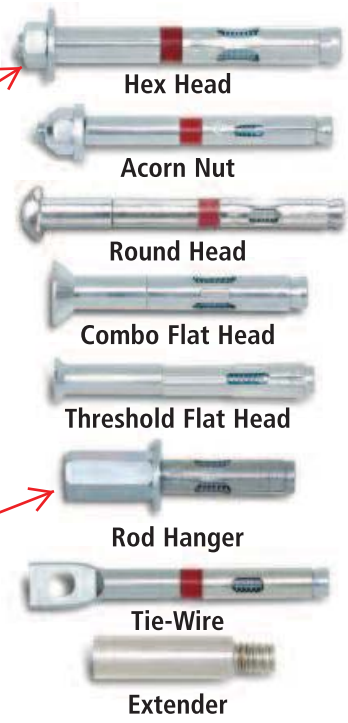


HEAD STYLES

Hex Head
Acorn Nut
Round Head
Combo Flat Head
Threshold Flat Head
Rod Hanger
Tie-Wire

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 5/8" length to
3/4" diameter x 7-1/2" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow Concrete Masonry

(b)

INSTALLATION SPECIFICATIONS

Acorn Nut and Hex Head Lok-Bolt

Dimension	Anchor Size, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16	9/16	11/16	15/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Nut Height (in.)	3/16	7/32	17/64	21/64	7/16	35/64
Washer O.D., d_w (in.)	1/2	5/8	13/16	1	1 3/8	1 3/4
Wrench Size (in.)	3/8	7/16	1/2	9/16	3/4	15/16

Round Head Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	5/16"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18
Head Height (in.)	11/64	13/64	15/64
Head Width, d_{hd} (in.)	29/64	9/16	43/64

Combo Flat Head Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	5/16"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18
Head Height (in.)	5/32	3/16	15/64
Head Width, d_{hd} (in.)	1/2	5/8	3/4

Rod Hanger Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2
Plow Bolt Size (UNC)	1/4-20	5/16-18	3/8-16
Coupling Height (in.)	7/8	1	1 1/4
Washer O.D., d_w (in.)	5/8	13/16	1
Coupling Wrench Size (in.)	7/16	1/2	11/16

Threshold Lok-Bolt

Dimension	Anchor Size, *d*
	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Fixture Clearance Hole, d_h (in.)	5/16
Plow Bolt Size (UNC)	10-24
Head Height (in.)	5/64
Head Width, d_{hd} (in.)	23/64

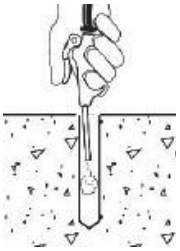
Tire-Wire Lok-Bolt

Dimension	Anchor Size, *d*
	5/16"
ANSI Drill Bit Size, d_{bit} (in.)	5/16
Fixture Clearance Hole, d_h (in.)	1/4
Plow Bolt Size (UNC)	1/4-20
Head Height (in.)	1 9/16
Head Width, d_{hd} (in.)	31/64

Installation Guidelines

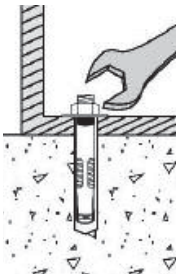
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

Blow the hole clean of dust and other material. Do not expand the anchor prior to installation.



Drive the anchor through the fixture into the anchor hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.

Tighten the anchor by turning the nut of head 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.



MATERIAL SPECIFICATIONS

General Lok-Bolt Components

Anchor Component	Component Material	
	Carbon Steel	Stainless Steel
Plow Bolt	AISI 1010 / 1018	Type 18-8 SS
Expansion Sleeve	AISI 1010 / 1020	Type 304 SS
Extension Sleeve	AISI 1010 / 1020	Type 304 SS
Compression Ring	Nylon	Nylon
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A

Lok-Bolt Head Components

Anchor Component	Component Material	
	Carbon Steel	Stainless Steel
Hex Nut	ASTM A 563, Grade A	Type 304 SS
Acorn Nut	AISI 1010 / 1018	Type 304 SS
Washer	ASTM F 844	Type 18-8 SS
Round Head	AISI 1010 / 1018	Type 304 SS
Flat Head	AISI 1010 / 1018	Type 304 SS
Rod Coupling	AISI 12L14	Type 18-8 SS
Threshold	AISI 1010 / 1018	N/A
Tie-Wire	AISI 1010 / 1018	N/A
Zinc Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)	N/A

(b)

PERFORMANCE DATA

Ultimate Load Capacities for Carbon and Stainless Steel Lok-Bolt in Normal-Weight Concrete[1]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs. Carbon	Maximum Tightening Torque T_{max} ft.-lbs. Stainless	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3-4	2-3	540 (2.4)	1,000 (4.5)	620 (2.8)	1,200 (5.4)	680 (3.1)	1,200 (5.4)
	1 1/8 (28.6)			1,000 (4.5)	1,520 (6.8)	1,150 (5.1)	1,520 (6.8)	1,150 (5.1)	1,520 (6.8)
5/16 (7.9)	1 1/2 (38.1)	6-8	–	2,000 (8.9)	1,520 (6.8)	2,040 (9.0)	1,520 (6.8)	2,040 (9.0)	1,520 (6.8)
3/8 (9.5)	1 5/8 (41.3)	12-16	8-11	2,450 (11.1)	2,440 (11.0)	2,680 (12.1)	2,440 (11.0)	2,700 (12.2)	2,440 (11.0)
1/2 (12.7)	2 1/4 (57.2)	20-28	15-20	4,770 (21.5)	4,210 (19.0)	5,015 (22.6)	4,220 (19.0)	5,275 (23.7)	4,210 (19.0)
5/8 (15.9)	2 1/4 (57.2)	45-60	30-40	3,270 (14.7)	7,200 (32.4)	5,860 (26.4)	7,200 (32.4)	6,250 (28.1)	7,200 (32.4)
	2 3/4 (69.9)			6,060 (27.3)	7,820 (35.2)	6,620 (29.8)	7,820 (35.2)	6,800 (30.6)	7,810 (35.2)
3/4 (19.1)	2 1/4 (57.2)	70-90	45-60	4,480 (20.2)	9,840 (44.3)	8,420 (37.9)	11,670 (52.5)	8,940 (40.2)	11,670 (52.5)
	3 3/8 (85.7)			6,790 (30.6)	12,600 (56.7)	8,720 (39.2)	12,600 (56.7)	8,940 (40.2)	12,600 (56.7)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.

Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs. Carbon	Maximum Tightening Torque T_{max} ft.-lbs. Stainless	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi (13.8 MPa) Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi (27.6 MPa) Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi (41.4 MPa) Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3-4	2-3	135 (0.6)	250 (1.1)	155 (0.7)	300 (1.4)	170 (0.8)	300 (1.4)
	1 1/8 (28.6)			250 (1.0)	380 (1.7)	285 (1.3)	380 (1.7)	285 (1.8)	380 (1.7)
5/16 (7.9)	1 1/2 (38.1)	6-8	–	500 (2.2)	380 (1.7)	510 (2.2)	380 (1.7)	510 (2.2)	380 (1.7)
3/8 (9.5)	1 5/8 (41.3)	12-16	8-11	615 (2.2)	610 (2.7)	670 (3.0)	610 (2.7)	675 (3.0)	610 (2.7)
1/2 (12.7)	2 1/4 (57.2)	20-28	15-20	1,195 (5.4)	1,055 (4.7)	1,255 (5.6)	1,055 (4.7)	1,320 (5.9)	1,055 (4.7)
5/8 (15.9)	2 1/4 (57.2)	45-60	30-40	818 (3.7)	1,800 (8.1)	1,465 (6.6)	1,800 (8.1)	1,565 (7.0)	1,800 (8.1)
	2 3/4 (69.9)			1,515 (6.8)	1,955 (8.8)	1,655 (7.4)	1,955 (8.8)	1,700 (7.7)	1,955 (8.8)
3/4 (19.1)	2 1/4 (57.2)	70-90	40-60	1,120 (5.0)	2,460 (11.1)	2,105 (9.5)	2,918 (13.1)	2,235 (10.1)	2,920 (13.1)
	3 3/8 (85.7)			1,700 (7.7)	3,150 (14.2)	2,180 (9.8)	3,150 (14.2)	2,235 (10.1)	3,150 (14.2)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.

(b)

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt in Structural Lightweight Concrete[1,2]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Minimum Concrete Compressive Strength							
			f'_c = 3,000 psi (20.7 MPa)				f'_c = 5,000 psi (34.5 MPa)			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1/4 (6.4)	2-3	1,040 (4.7)	1,160 (5.2)	260 (1.2)	290 (1.3)	1,240 (5.6)	1,160 (5.2)	310 (1.4)	290 (1.3)
5/16 (7.9)	5/16 (7.9)	5-6	1,140 (5.1)	1,560 (7.0)	285 (1.3)	390 (1.8)	1,720 (7.7)	1,560 (7.0)	430 (1.9)	390 (1.8)
3/8 (9.5)	3/8 (9.5)	8-11	1,180 (5.3)	2,600 (11.7)	295 (1.3)	650 (2.9)	1,720 (7.7)	2,600 (11.7)	430 (1.9)	650 (2.9)
1/2 (12.7)	1/2 (12.7)	15-20	2,400 (10.8)	4,020 (18.1)	600 (2.7)	1,005 (4.5)	3,780 (17.0)	4,020 (18.1)	945 (4.3)	1,005 (4.5)
5/8 (15.9)	5/8 (15.9)	30-40	3,740 (16.8)	6,420 (28.9)	935 (4.2)	1,605 (7.2)	4,640 (20.9)	6,420 (28.9)	1,160 (5.2)	1,605 (7.2)
3/4 (19.1)	3/4 (19.1)	40-60	3,740 (16.8)	10,440 (47.0)	935 (4.2)	2,610 (11.7)	4,640 (20.9)	10,440 (47.0)	1,160 (5.2)	2,610 (11.7)

1. The values listed above are ultimate and allowable load capacities for anchors in sand-lightweight concrete.
2. Allowable load capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Lightweight Concrete Over Minimum 20 Ga. Metal Deck $f'_c \geq$ 3,000 (20.7 MPa)							
			Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	2-3	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
5/16 (7.9)	1 1/2 (38.1)	5-6	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
3/8 (9.5)	2 (50.8)	8-11	1,080 (4.9)	2,480 (11.2)	270 (1.2)	620 (2.8)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
1/2 (12.7)	2 1/2 (63.5)	15-20	1,940 (8.7)	2,480 (11.2)	485 (2.2)	620 (2.8)	2,840 (12.8)	4,640 (20.9)	710 (3.2)	1,160 (5.2)
5/8 (15.9)	2 3/4 (69.9)	30-40	–	–	–	–	2,840 (12.8)	4,640 (20.9)	710 (3.2)	1,160 (5.2)
3/4 (19.1)	3 (76.2)	40-60	–	–	–	–	4,440 (20.0)	9,060 (40.8)	1,110 (5.0)	2,265 (10.2)

1. The values listed above are ultimate and allowable load capacities for anchors in sand-lightweight concrete over metal deck.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing lightweight concrete table listed in the Design Criteria section.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installed procedures are maintained.

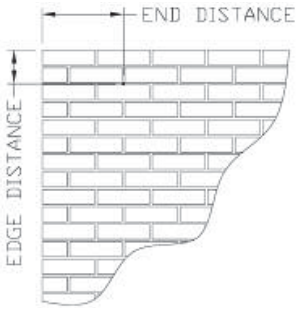
(b)

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Lok-Bolt in Hollow or Solid Concrete Masonry[1,2,3,4,5,6]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1-3	3 3/4 (95.3)	3 3/4 (95.3)	230 (1.0)	1,000 (4.5)	45 (0.2)	200 (0.9)
	1 1/8 (28.6)	1-3	3 3/4 (95.3)	8 (203.2)	1,200 (5.4)	1,270 (5.7)	240 (1.1)	255 (1.1)
5/16 (7.9)	1 1/2 (38.1)	4-6	3 3/4 (95.3)	8 (203.2)	1,430 (6.4)	1,970 (8.9)	285 (1.3)	395 (1.8)
3/8 (9.5)	1 1/2 (38.1)	8-11	12 (304.8)	12 (304.8)	1,700 (7.7)	2,180 (9.8)	340 (1.5)	435 (2.0)
1/2 (12.7)	1 1/2 (38.1)	16-20	12 (304.8)	12 (304.8)	2,460 (11.1)	2,840 (12.8)	490 (2.2)	570 (2.6)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Linear interpolation may be used for allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacings.
5. Anchors with diameters of 1/2" and larger installed in hollow concrete masonry units are limited to one anchor per unit cell.
6. Anchors shall be of suitable length for the masonry wall thickness and attachment.



Ultimate and Allowable Load Capacities for Lok-Bolt in Hollow or Solid Clay Brick Masonry[1,2,3,4]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1-3	4 (101.6)	4 (101.6)	800 (3.6)	1,120 (5.0)	160 (0.7)	225 (1.0)
	1 1/8 (28.6)	1-3			950 (4.3)	1,120 (5.0)	190 (0.9)	225 (1.0)
5/16 (7.9)	1 1/2 (38.1)	4-6			1,230 (5.5)	1,120 (5.0)	245 (1.1)	225 (1.0)
3/8 (9.5)	1 1/2 (38.1)	8-11	8 (203.2)	8 (203.2)	1,860 (8.4)	1,260 (5.7)	370 (1.7)	250 (1.1)
1/2 (12.7)	1 1/2 (38.1)	16-20			3,520 (15.8)	4,010 (18.0)	705 (3.2)	800 (3.6)

1. Tabulated load values are for carbon and stainless steel anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduces by 50 percent. Linear interpolation may be used for intermediate spacings.
4. Anchors length shall be of suitable length for the concrete masonry wall thickness and attachment.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.45$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.85$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.40$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

(b)

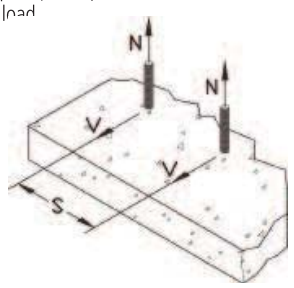
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
h_v (in.))		1 1/4	1 1/2	2	2 1/2	2 3/4	3
s_{cr} (in.)		3 3/4	4 1/2	6	7 1/2	8 1/4	9
s_{min} (in.)		1 7/8	2 1/4	3	3 3/4	4 1/8	4 1/2
Spacing, s (inches)	1 7/8	0.50					
	2 1/4	0.56	0.50				
	3	0.80	0.67	0.50			
	3 3/4	1.00	0.83	0.63	0.50		
	4		0.89	0.67	0.53		
	4 1/8		0.92	0.69	0.55	0.50	
	4 1/2		1.00	0.75	0.60	0.55	0.50
	6			1.00	0.80	0.73	0.67
	7 1/2				1.00	0.91	0.83
	8 1/4					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load.

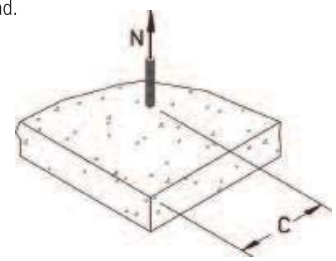
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.70					
	1 5/8	0.76	0.70				
	1 7/8	0.81	0.74	0.70			
	2 1/2	0.91	0.83	0.77	0.70		
	3	1.00	0.90	0.83	0.74		
	3 1/8		0.91	0.84	0.75	0.70	
	3 3/4		1.00	0.91	0.81	0.74	0.70
	4 1/2			1.00	0.87	0.79	0.74
	6				1.00	0.90	0.81
	7 1/2					1.00	0.84
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.45					
	1 5/8	0.57	0.45				
	1 7/8	0.65	0.53	0.45			
	2 1/2	0.84	0.69	0.58	0.45		
	3	1.00	0.81	0.69	0.53		
	3 1/8		0.84	0.71	0.55	0.45	
	3 3/4		1.00	0.84	0.65	0.53	0.45
	4 1/2			1.00	0.76	0.62	0.53
	6				1.00	0.81	0.69
	7 1/2					1.00	0.84
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 45% of load.

DESIGN CRITERIA

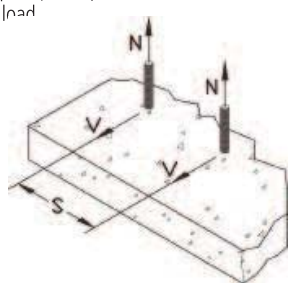
Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)

	Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
	h_v (in.)	1 1/4	1 1/2	2	2 1/2	2 3/4	3
	s_{cr} (in.)	3 3/4	4 1/2	6	7 1/2	8 1/4	9
	s_{min} (in.)	1 7/8	2 1/4	3	3 3/4	4 1/8	4 1/2
Spacing, s (inches)	1 7/8	0.50					
	2 1/4	0.56	0.50				
	3	0.80	0.67	0.50			
	3 3/4	1.00	0.83	0.63	0.50		
	4		0.89	0.67	0.53		
	4 1/8		0.92	0.69	0.55	0.50	
	4 1/2		1.00	0.75	0.60	0.55	0.50
	6			1.00	0.80	0.73	0.67
	7 1/2				1.00	0.91	0.83
	8 1/4					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_V$) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_V$) at which the anchor achieves 50% of load.

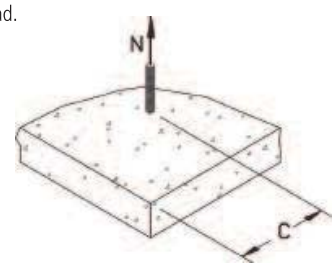


Edge Distance, Tension (F_N)

	Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3	3 3/4	4 1/2	6	7 1/2	9
	c_{min} (in.)	1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.85					
	1 5/8	0.88	0.85				
	1 7/8	0.90	0.87	0.85			
	2 1/2	0.96	0.91	0.89	0.85		
	3	1.00	0.95	0.91	0.87		
	3 1/8		0.96	0.92	0.88	0.85	
	3 3/4		1.00	0.96	0.90	0.87	0.85
	4 1/2			1.00	0.94	0.90	0.87
	6				1.00	0.95	0.91
	7 1/2					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 85% of load.

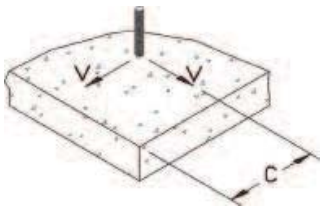


Edge Distance, Shear (F_V)

	Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
	c_{cr} (in.)	3	3 3/4	4 1/2	6	7 1/2	9
	c_{min} (in.)	1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.40					
	1 5/8	0.53	0.40				
	1 7/8	0.61	0.49	0.40			
	2 1/2	0.83	0.66	0.54	0.40		
	3	1.00	0.79	0.66	0.49		
	3 1/8		0.83	0.69	0.51	0.40	
	3 3/4		1.00	0.83	0.61	0.49	0.40
	4 1/2			1.00	0.74	0.59	0.49
	6				1.00	0.79	0.66
	7 1/2					1.00	0.83
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 40% of load.



(b)

ORDERING INFORMATION

Hex Nut Lok-Bolt

Catalog Number		Size	Bolt Length	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless							
5005	–	5/16" x 1-1/2"	1 13/16"	5/16"	1 3/8"	100	1,000	4 1/4
5010	–	5/16" x 2 3/8"	2 11/16"	5/16"	1 1/2"	100	500	5 3/4
5015	6152	3/8" x 1 7/8"	2 3/16"	3/8"	1 5/8"	50	500	7
5020	6153	3/8" x 3"	3 5/16"	3/8"	1 5/8"	50	500	10
5022	–	3/8" x 4"	4 5/16"	3/8"	1 5/8"	50	500	16
5025	6156	1/2" x 2 1/4"	2 7/8"	1/2"	2 1/8"	25	250	14
5030	6157	1/2" x 3"	3 3/8"	1/2"	2 1/4"	25	250	17 1/4
5034	6160	1/2" x 4"	4 3/8"	1/2"	2 1/4"	25	125	22
5033	–	1/2" x 5 1/4"	6 1/8"	1/2"	2 1/4"	25	125	27
5032	–	1/2" x 6"	6 3/4"	1/2"	2 1/4"	10	100	35
5035	–	5/8" x 2 1/4"	3 3/16"	5/8"	2 1/8"	25	125	25 1/2
5038	–	5/8" x 3"	3 3/4"	5/8"	2 3/4"	25	125	34
5040	6164	5/8" x 4 1/4"	5"	5/8"	2 3/4"	10	100	41
5045	–	5/8" x 6"	6 1/4"	5/8"	2 3/4"	10	100	49
5050	–	3/4" x 2 3/4"	3 5/8"	3/4"	2 1/8"	10	100	46
5055	6168	3/4" x 4 1/4"	5 1/8"	3/4"	3 3/8"	10	40	70
5060	–	3/4" x 6 1/4"	7 1/8"	3/4"	3 3/8"	10	30	90
5065	–	3/4" x 8 1/4"	9"	3/4"	3 3/8"	10	30	115

The published minimum length is measured from below the washer to the end of the anchor. Actual anchor lengths may be slightly longer.

Acorn Nut Lok-Bolt

Catalog Number		Size	Bolt Length	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless							
*5125	–	1/4" x 5/8"	1 1/32"	1/4"	1/2"	100	1,000	2
5150	6150	1/4" x 1 3/8"	1 21/32"	1/4"	1 1/8"	100	1,000	2 3/4
5175	–	1/4" x 2 1/4"	2 9/16"	1/4"	1 1/8"	100	1,000	3 1/4

The published minimum length is measured from below the washer to the end of the anchor. Actual anchor lengths may be slightly longer.
*This size does not have a compression ring.

Round Head Lok-Bolt, Slotted

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
*5205	–	1/4" x 1 1/8"	5/16"	1 3/8"	100	1,000	4 1/4
5210	6180	1/4" x 2"	5/16"	1 1/2"	100	500	5 3/4
5215	–	1/4" x 2 3/4"	3/8"	1 5/8"	50	500	7
5235	–	3/8" x 2 1/2"	1/2"	2 1/4"	25	250	17 1/4
5240	–	3/8" x 3 3/4"	1/2"	2 1/4"	25	125	22

The published length is measured from below the head to the end of the anchor.
*This size does not have a compression ring.

ORDERING INFORMATION

Combo Flat Head Lok-Bolt

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5305	–	1/4" x 1 1/8"	1/4"	1"	100	1,000	2
5310	6170	1/4" x 2"	1/4"	1 1/8"	100	1,000	2 3/4
5315	6172	1/4" x 3"	1/4"	1 1/8"	100	1,000	3 3/4
5320	–	1/4" x 4"	1/4"	1 1/8"	100	500	4 1/2
5325	–	1/4" x 5 1/4"	1/4"	1 1/8"	100	500	6 1/2
5330	–	5/16" x 2 1/2"	5/16"	1 1/2"	100	1,000	4 1/2
5340	–	3/8" x 2 3/4"	3/8"	1 5/8"	50	500	7 1/2
5345	6174	3/8" x 4"	3/8"	1 5/8"	50	250	10 3/4
5350	6175	3/8" x 5"	3/8"	1 5/8"	50	250	14
5360	6176	3/8" x 6"	3/8"	1 5/8"	50	250	16

The published length is the minimum overall length of the anchor. Combo Flat Head Lok-Bolts do not have a compression ring.

Threshold Flat Head Lok-Bolt, Slotted

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5500	–	1/4" x 2"	1/4"	1 1/8"	100	1,000	2 1/2

The published length is the minimum overall length of the anchor. Threshold Flat Head Lok-Bolts do not have a compression ring.

Rod Hanger Lok-Bolt

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5810	–	1/4" x 1 1/2"	5/16"	1 1/2"	50	250	5 1/2
5815	–	3/8" x 1 7/8"	3/8"	1 5/8"	50	250	9
5825	–	1/2" x 2 1/4"	1/2"	2 1/4"	25	125	21

The published length is measured from below the washer to the end of the anchor.
Rod Hanger Lok-Bolts do not have a compression ring.

Tie-Wire Lok-Bolt

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5700	–	5/16" x 1 1/2"	5/16"	1 1/2"	100	1,000	5 1/4

The published length is measured from below the head to the end of the anchor.

Lok-Bolt Extenders

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5684	5689	3/8" x 1"	3/8"	1 5/8"	50	500	3

Extenders are used for added length on all head styles.

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WM TAO & ASSOCIATES
CONSULTING ENGINEERS

Shop Drawing Submittal Review

Transmitted To: Cannon Design

Date: December 15, 2016

Attention: **stl-cac@cannondesign.com**

Contact Person / WTA Field Inspector: Patrick Garner

Project Name: Webster University-**ISB**

Reviewed by: Mike Whitworth (WES)

Project No. WT 14127.01
WES 607

[ ] UPS [ ] Courier [X] **Email**

Copies	No.	Description
1 PDF	210523F01	(Submittal No.'s:)
		(Cannon #210548-001) - (Paric #15051-0351) – (WES #607)
		➢ **Seismic Controls for Fire Protection Piping Product Data**

*Remarks: See Submittal Review from Webb Enginnering.

c: **Kelvin Patel**
Kpatel@cannondesign.com

[X] ***Reviewed**

[X] ***No Exceptions Taken**

[ ]

[ ] *Make Corrections As Noted, No Resubmittal Required

Corrections or comments made on shop drawings during this review do not relieve contractor from compliance with requirements of drawings and specifications. This check is only for review of general conformance with the design concept of project and general compliance with information given in contract documents. Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

WEBB ENGINEERING SERVICES INC.

1400 S. 3rd Street, Suite 201
St. Louis, Missouri 63104
Phone: (314) 588-0600
Fax: (314) 588-0604

Letter of Transmittal

To: wtashop@wmtao.com

From: Mike Whitworth

Date: December 11, 2016

Re: Webster University ISB

WES No: 607

☐ For your Files ☐ For Review ☐ Please Comment ☐ Please Reply

Item No.	Description	No. of Copies	Date
1	Shop Drawing Review – (210548-001) 210548 Vibration and Seismic Controls for Fire Suppression Piping and Equipment	1	12/11/16

•Signature: Mike Whitworth

WEBB ENGINEERING SERVICES INC.
www.webb-engineering.com

1400 S. 3rd Street, Suite 201 • St. Louis, Missouri 63104 • 314.588.0600 • *fax* 314.588.0604

The review of this submittal is limited to the general conformance with the designated design concept and intent of this project and with the general compliance of the information provided in the contract documents. All comments, remarks and notations made on the submittal(s) as a result of this review do not relieve the contractor from full compliance with requirements of the contract documents. Approval for a specific item shall not include approval of an assembly of which the item is not a component. The contractor is solely responsible for rough-in and installation confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordination of this work with that of other trades on this project; and in a safe and satisfactory manner. All work shall be installed in full compliance with the manufacturer's recommendation, Federal, State and Local rules and regulation and the Authority Having Jurisdiction (AHJ) and applicable adopted codes and standards.

PROJECT NAME:	Webster University ISB
LOCATION:	St. Louis Missouri
CLIENT PROJ. NO.:	N/A
WES PROJ. NO.:	607
SPECIFICATION SECTION:	210548 Vibration and Seismic Controls for Fire-Suppression Piping and Equipment
SUBMITTAL ITEM:	See Below -

CONTRACTOR:	J.F. Ahern Co.
CTR. SUBMITTAL #:	21 0523-002
SUBMITTAL DATE:	November 29, 2016
DATE RECEIVED:	December 07, 2016
RECEIVED VIA:	E-Mail
RECEIVED FROM:	WTA
DATE RETURNED:	DECEMBER 11, 2016
RETURNED VIA:	E-MAIL
RETRURNED TO:	WTASHOP@WMTAO.COM

STATUS KEY:

NO EXCEPTION TAKEN
MAKE CORRECTIONS NOTED, NO RESUBMITTAL:
AMEND AND RESUBMIT
REJECTED, SEE REMARKS:
REVIEWED ONLY

NEC	MCN	AAR	REJ	REV	ITEM	REMARKS
X					Schedule 40 Pipe Various Manufacturers	
X					Riser Clamp PHD Manufacturing Inc. Model – Fig. 550, 551, 553	
X					Pipe Clamp B-Line Model – B3140	
X					Sleeve Expansion Anchor Powers Fasteners Models – Lok-Bolt Hex Head and Rod Hanger	
X					Surge Restraint Caddy Model – SR6	
X					Bar Joist Attachment Caddy Model - CSBBARJEG	

WEBB ENGINEERING SERVICES INC.
1400 S. 3rd Street, Suite 201 • St. Louis, Missouri 63104 • 314.588.0600 • *fax* 314.588.0604
www.webb-engineering.com

X					Universal Structural Attachment Caddy Models – CSBUNIV050EG and CSBUNI075EG	
X					Easy Universal Sway Brace Caddy Model - CSBEZU0XXXEG – for pipe sizes 1" thru 6"	
X					Standard Universal Sway Brace Caddy Models – CSBSTU0800EG and CSBSTU1000EG	
X					Quick Grip Jr. Lateral Sway Brace Caddy Model – CSBQIKCL0XXXEG – for pipe sizes 1" THRU 2"	
X					Quick Grip Lateral Sway Brace Caddy Model – CSBQG0XXXEG – for pipe sizes 2.5" thru 8"	

REVIEWED BY: Michael R. Whitworth DATE: December 11, 2016

THESE COMMENTS ARE TO BE ATTACHED TO ALL COPIES OF THE SHOP DRAWING REFERENCED ABOVE.

CANNONDESIGN

SUBMITTAL IDENTIFICATION SHEET

To be completed by Contractor/CM

WEBSTER UNIVERSITY ISB
PROJECT NAME

8274 BIG BEND BLVD
ADDRESS

NUMBER

WEBSTER UNIVERSITY
OWNER

CANNON DESIGN
ARCHITECT / ENGINEER

Joe Voypick
SUBMITTED BY

210548-001
CONTRACTOR / CM SUBMITTAL NO.

CANNON DESIGN SUBMITTAL NO.

DRAWING / DETAIL REFERENCE

210548
SPECIFICATION SECTION / PARAGRAPH

Ahern Fire Protection
MANUFACTURER / SUPPLIER

ITEM / PRODUCT ID

REQUIRED DATE

PRIORITY

◯ CRITICAL

ITEM BEING SUBMITTED (check only one)

- ◯ Shop Drawings
- ◯ Samples (_____ copies)
- ◯ LEED Submittal
- ◯ Certification / Qualifications
- ◯ Record Documents
- ◉ Product Data
- ◯ Coordination Drawing
- ◯ Calculations
- ◯ Schedules
- ◯ O&M Manuals
- ◯ Other _____

ITEM BEING SUBMITTED FOR (check only one)

◉ Action ◯ Information Only ◯ Record

REMARKS OR DEVIATIONS

CONTRACTOR / CM CERTIFICATION
(SUBMITTALS NOT CERTIFIED WILL BE RETURNED WITHOUT REVIEW)

PARIC

PARIC CORPORATION
SUBMITTAL STAMP

THIS SHOP DRAWING HAS BEEN REVIEWED BY PARIC CORPORATION

Subcontractor remains responsible for dimensions, quantities, coordination with other trades and compliance with contract documents.

By:
Devin D. Gates

Joe Voypick
REVIEWED BY

11/30/16
DATE

To be completed by Reviewer

21 0548-001
CANNON DESIGN SUBMITTAL NUMBER

11/30/16
RECEIVED DATE

- ◯ A. No Exceptions Taken
  No further review of submittal is required.
- ◯ B. Make Corrections Noted
  Incorporate corrections in work; resubmission is not required.
- ◯ C. Revise and Resubmit
  Revise as noted, and resubmit for review.
- ◯ D. Rejected
  Submittal is not in compliance with Contract Documents; provide new submittal.
- ◯ E. For Record / Information Only
  Submittal was reviewed for Record / Information purposes only.
- ◯ F. Not Required for Review
  Submittal is not required by Contract Documents and has not been reviewed.

Review is for conformance with the design concept of this project and for general compliance with contract documents. Contractor is responsible for quantities, dimensions and compliance with contract documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if submittal deviates from contract documents and does not indicate or note deviations.

A/E COMMENTS ◯ See attached sheet(s) for additional comments

REVIEWED BY

DATE

77 Westport Plaza
Suite 250
St. Louis, MO 63146

TRANSMITTAL

No. 15051-0351

Paric Corporation

PROJECT: 15051-Webster University Interdisciplinary Science Building

DATE: 11/29/2016

TO: Cannon Design
1100 Clark Ave
St Louis MO 63102

Fax;
314-241-2203

RE: Seismic Controls for Fire Protection Piping Product Data

ATTN: Kelvin Patel

JOB: 15051

WE ARE SENDING:	SUBMITTED FOR:	ACTION TAKEN:
☐ Shop Drawings	☑ Approval	☐ Approved as Submitted
☐ Letter	☐ Your Use	☐ Approved as Noted
☐ Prints	☐ As Requested	☐ Returned After Loan
☐ Change Order	☐ Review and Comment	☐ Resubmit
☐ Plans		☐ Submit
☐ Samples	**SENT VIA:**	☐ Returned
☐ Specifications	☐ Attached	☐ Returned for Corrections
☑ Other: Product Data	☐ Separate Cover Via:	☐ Due Date:

Item	*Package*	*Code*	*Rev.*	*Copies*	*Date*	*Description*	*Status*
Submittal		210548-001	1		11/29/2016	Seismic Controls for Fire Protection Piping Product Data	Submitted

NOTES:

CC:

Signed: _____

Devin Gates