Vermont Agency of Transportation
29c Scupper Repair Response rev1.pdf

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ON: March 24, 2016

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CONFORMANCE

BY: ABC DATE:

MONOKO, LLC

1037 Peninsula Avenue
Tarpon Springs, FL 34689-2125
E-mail Address: MonokoLLC@aol.com
(727) 940-3244
(727) 279-8795 Fax

Submittal No.: 29c, Drawings Steel Repair Bridge 58 S, rev 2

Date: January 08, 2015

Vermont Department of Transportation
Northeast Regional Construction Office
Attn: Mr. Ron Gray
347 Emerson Falls Road, Suite 5
St. Johnsbury, VT 05819
(Phone) (802) 751-3295; (Cell) (802) 793-3161
(Fax) (802) 751-3297; Ron.Gray@state.vt.us

Description: Proposal/Contract Number: Bradford-Newbury IM BPNT (14)
Letting Date: 10/10/14; Award Date: 11/03/14
Project Description: Bridge Painting of Five Bridges
In the Towns of Bradford & Newbury, VT
Contract Amount: $4,327,785.00; Completion Date: 08/26/16

Contractor: **MONOKO, LLC**

Reviewed & Approved By: *Keri Monokandilos*
Keri Monokandilos, Manager

Date: 01/08/2015

Engineer: Peter Hodgson, Resident Engineer
347 Emerson Falls Road, Suite 5
St. Johnsbury, VT 05819
802-748-2447; 802-793-1878 cell
pete.hodgson@state.vt.us
Mark.Sargent@state.vt.us
pmcdonald@gpinet.com
ron.gray@state.vt.us

Revision #3

SUBMITTAL REVIEW

Review is only for general conformity to the contract drawings and specifications and shall not relieve the contractor of his entire responsibility under the contract, including among other things, dimensions to be confirmed and correlated at the job site, and information that pertains to the fabrication processes or to techniques of construction.

☒ NO EXCEPTIONS TAKEN
☐ MAKE CORRECTIONS NOTED
RESUBMITTAL NOT REQUIRED
☐ AMEND AND RESUBMIT
☐ REJECTED - SEE REMARKS

PB AMERICAS, INC.
BY: [illegible] 4/1/16
DATE:

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WELDING PROCEDURE SPECIFICATION (WPS)
PREQUALIFIED ☐ QUALIFIED BY TESTING ■
or PROCEDURE QUALIFICATION RECORDS (PQR) Yes ☐
AASHTO/AWS D1.5 Qualification Type 5.12.1 ☐ – 5.12.2 ☐ – 5.13 ☐

Contractor/
Organization MERRIMACK SHEET METAL
Welding Process(es) GMAW
Type: Manual ☐ Semiautomatic ■
Machine ☐ Automatic ☐
Tandem ☐ Parallel ☐

Identification LA-5
Revision 0 Date 6/1/2010 By KK
Authorized by KK Date 6/1/2010
Supporting PQR No.(s) PQLA1

JOINT DESIGN USED
Single ■ Double Weld ■
Backing: Yes ☐ No ■ Material
Root Opening NA Root Face Dimension NA
Groove Angle NA Radius (J–U)
Backgouging: Yes ☐ No ■ Method
Root Treatment CLEAN TO BRIGHT METAL

POSITION
Position of Groove NA Fillet 1F or 2F
Vertical Progression: Up ■ Down ☐

ELECTRICAL CHARACTERISTICS
Transfer Mode (GMAW): Globular ☐ Spray ■
Current: AC ☐ DCEP ■ DCEN ☐ Pulsed ☐
Electrical Stick Out 3/4
Other

BASE METALS
Material Spec. A36 ; A588 ; A709
Type or Grade G50
Thickness: Groove NA Fillet UNLIMITED
Diameter (Pipe) NA

TECHNIQUE
Stringer or Weave Bead BOTH
Multi-pass or Single Pass (per side) BOTH
Number of Electrodes 1
Electrode Spacing: Longitudinal NA
Lateral NA Angle NA
Interpass Cleaning CLEAN WITH WIRE BRUSH

FILLER METALS
AWS Specification A5.29
AWS Classification ER80S-Ni1
Manufacturer Trade Name LINCOLN SUPERARC LA-75

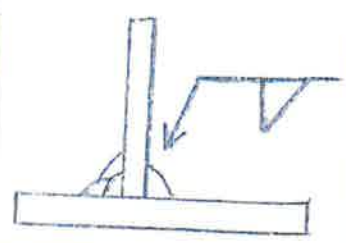
PREHEAT
Preheat Temp., Min. 70 F
Interpass Temp., Min. 70 F
Interpass Temp., Max. 400 F

SHIELDING
Flux NA Mfg. Trade Name NA
Electrode-Flux (Class) NA
Gas Composition 90% ARGON / 10% CO2
Flow Rate 45 CFH Gas Cup Size 3/4

POSTWELD HEAT TREATMENT
Temp. NA Hold Time NA
Heating/Cooling Rate NA

HEAT INPUT
Calculated Heat Input Value: kJ/in ■ kJ/mm ☐
Max. Heat Input 42.7 Min. Heat Input 22.5

WELDING PROCEDURE

Pass or Weld Layer(s)	Process	Filler Metals	Current		Volts	Travel Speed	Joint Details
		Diam.	Type & Polarity	Amps or Wire Feed Speed			
ROOT 3/16	GMAW	.045	DCEP	220- 260	26-29	15-18 IPM	LA-5-1F 
ROOT 1/4	GMAW	.045	DCEP	220- 260	26-29	14-17 IPM	
ROOT 5/16	GMAW	.045	DCEP	220-270	26-29	13-16 IPM	
ROOT 3/8	GMAW	.045	DCEP	220-270	26-29	12-15 IPM	
2ND 3/8	GMAW	.045	DCEP	220-270	26-29	11-14 IPM	
3RD 3/8	GMAW	.045	DCEP	220-270	26-29	11-14 IPM	
ROOT 7/16	GMAW	.045	DCEP	220-270	26-29	12-15 IPM	
2ND 7/16	GMAW	.045	DCEP	220-270	26-29	12-14 IPM	
3RD 7/16	GMAW	.045	DCEP	220-270	26-29	12-15 IPM	

Form L-2

Form L-2—Sample Welding Procedure Specification

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PREQUALIFIED ☒ QUALIFIED BY TESTING ☐
or PROCEDURE QUALIFICATION RECORDS (PQR) Yes ☐
AASHTO/AWS D1.5 Qualification Type 5.12.1 ☐ – 5.12.2 ☐ – 5.13 ☐

Contractor/
Organization MERRIMACK SHEET METAL
Welding Process(es) GMAW
Type: Manual ☐ Semiautomatic ☒
Machine ☐ Automatic ☐
Tandem ☐ Parallel ☐

Identification LA-18
Revision 0 Date 6/1/2010 By KK
Authorized by KK Date 6/1/2010
Supporting PQR No.(s) PQLA1

JOINT DESIGN USED
Single ☒ Double Weld ☐
Backing: Yes ☐ No ☒ Material
Root Opening 0- 1/8 Root Face Dimension 1/8 MIN
Groove Angle 45 DEGREE Radius (J–U)
Backgouging: Yes ☐ No ☒ Method
Root Treatment CLEAN TO BRIGHT METAL

POSITION
Position of Groove 1G Fillet 1F
Vertical Progression: Up ☒ Down ☐

ELECTRICAL CHARACTERISTICS
Transfer Mode (GMAW): Globular ☐ Spray ☒
Current: AC ☐ DCEP ☒ DCEN ☐ Pulsed ☐
Electrical Stick Out 3/4
Other

BASE METALS
Material Spec. A36 ; A588 ; A709 ;
Type or Grade G50
Thickness: Groove 1/4 TO UNLIMITED Fillet
Diameter (Pipe) NA

TECHNIQUE
Stringer or Weave Bead STRINGER
Multi-pass or Single Pass (per side) SINGLE
Number of Electrodes 1
Electrode Spacing: Longitudinal NA
Lateral NA Angle NA
Interpass Cleaning CLEAN WITH WIRE BRUSH

FILLER METALS
AWS Specification A5.28
AWS Classification ER80S-Ni1
Manufacturer Trade Name LINCOLN SUPERARC LA-75

PREHEAT
Preheat Temp., Min. 70 F
Interpass Temp., Min. 70 F
Interpass Temp., Max. 400 F

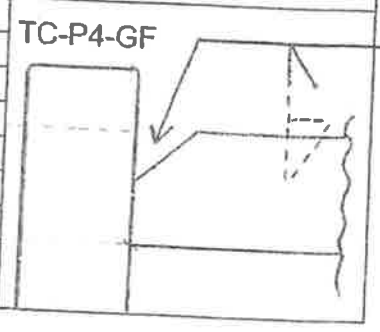
SHIELDING
Flux NA Mfg. Trade Name NA
Electrode-Flux (Class) NA
Gas Composition 90% ARGON / 10% CO2
Flow Rate 45 CFH Gas Cup Size 3/4

POSTWELD HEAT TREATMENT
Temp. NA Hold Time NA
Heating/Cooling Rate NA

HEAT INPUT
Calculated Heat Input Value: kJ/in ☒ kJ/mm ☐
Max. Heat Input 35.0 Min. Heat Input 20.2

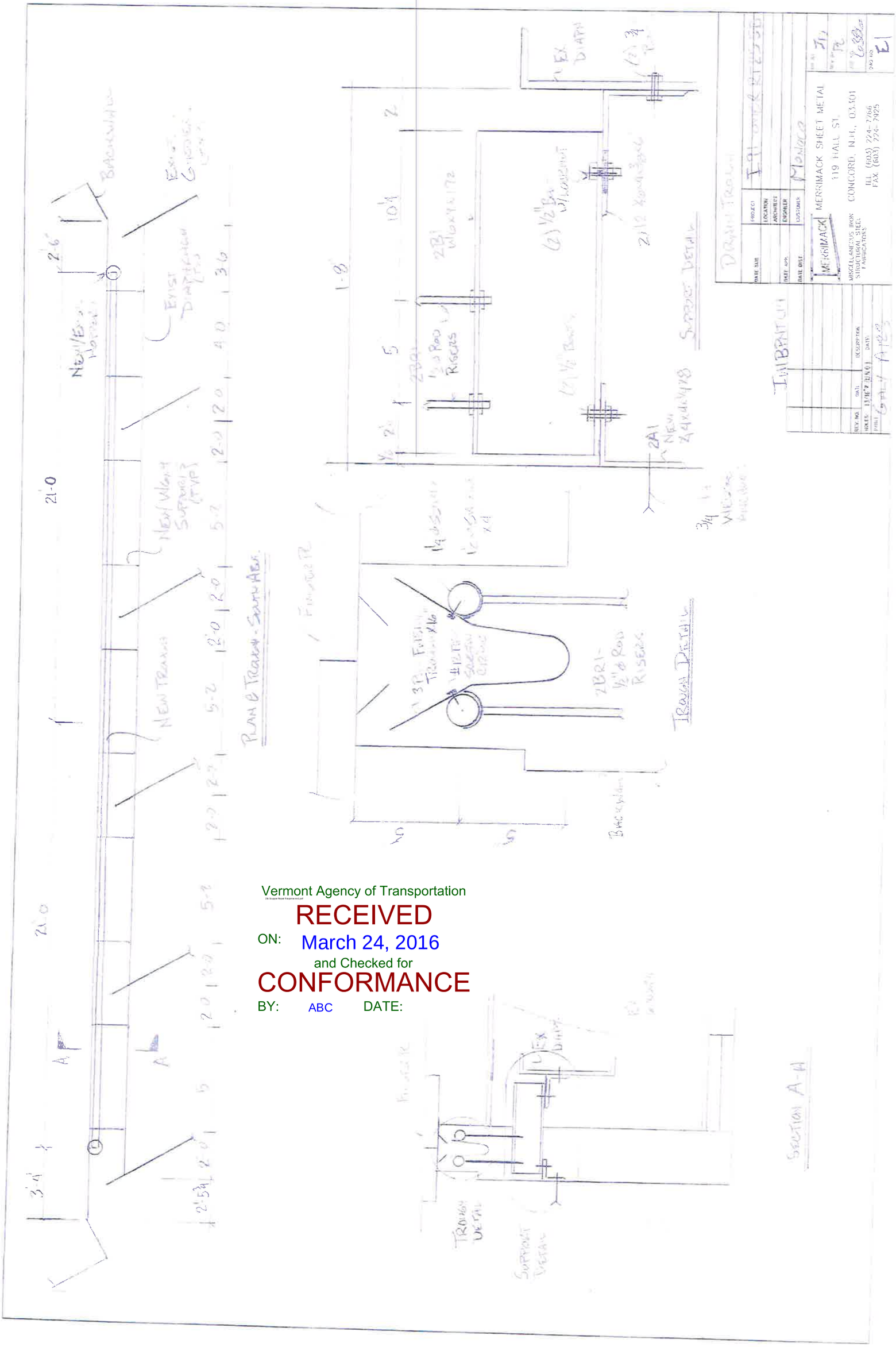
WELDING PROCEDURE

Pass or Weld Layer(s)	Process	Filler Metals	Current		Volts	Travel Speed	Joint Details
		Diam.	Type & Polarity	Amps or Wire Feed Speed			
3/16	GMAW	.045	DCEP	220-250	26-28	15-17 IPM	TC-P4-GF
1/4	GMAW	.045	DCEP	220-250	26-28	14-16 IPM	
5/16	GMAW	.045	DCEP	220-250	26-28	12-14 IPM	



Form L-2

Form L-2—Sample Welding Procedure Specification



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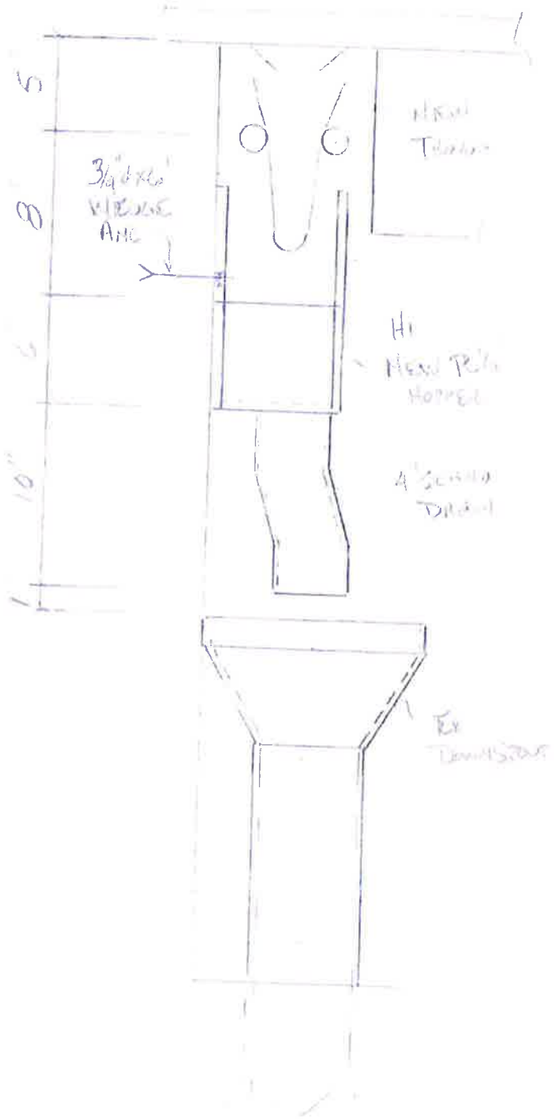
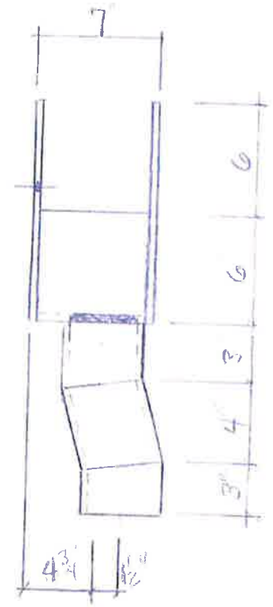
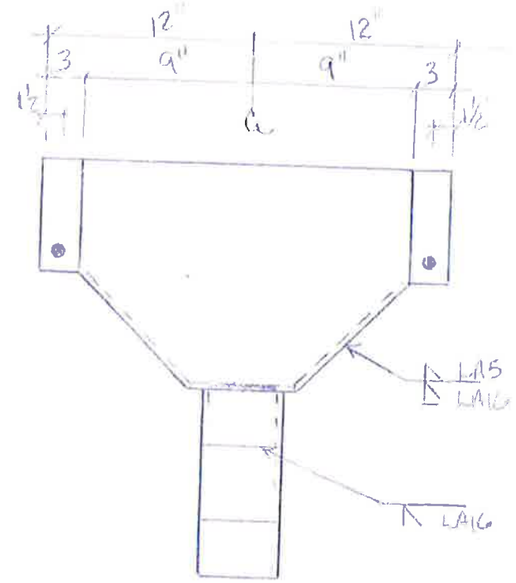
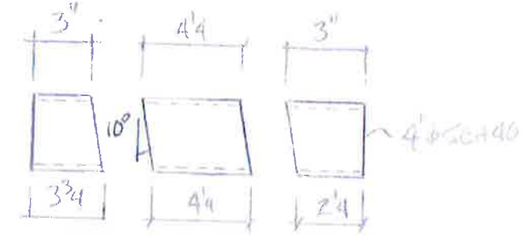


Hopper Section (Typ)

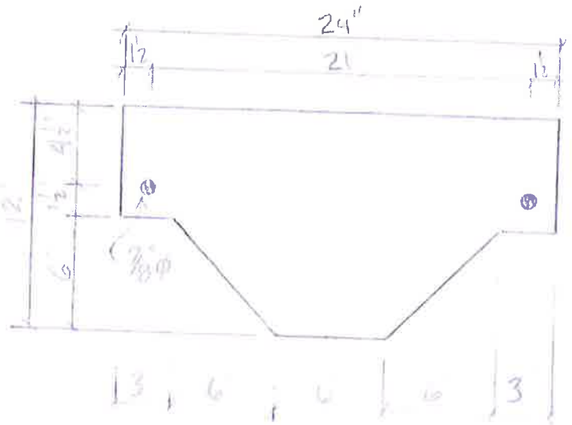




(2)~HI Hopper
GALV



(2)~IRI DRAIN ASSEM
A53



(2)~IP1 PL¼x12x24
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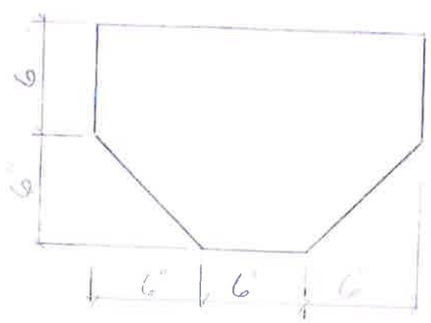
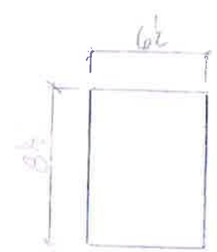
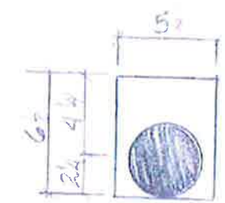


(2)~IP2 PL¼x12x18
A36



(4)~IP3 PL¼x6½x8½
A36



(2)~IP4 PL¼x5½x6½
A36

(2)~3/4"ø x 6" WELDED ANG
30 LF

IMBPNT.CM

Hopper

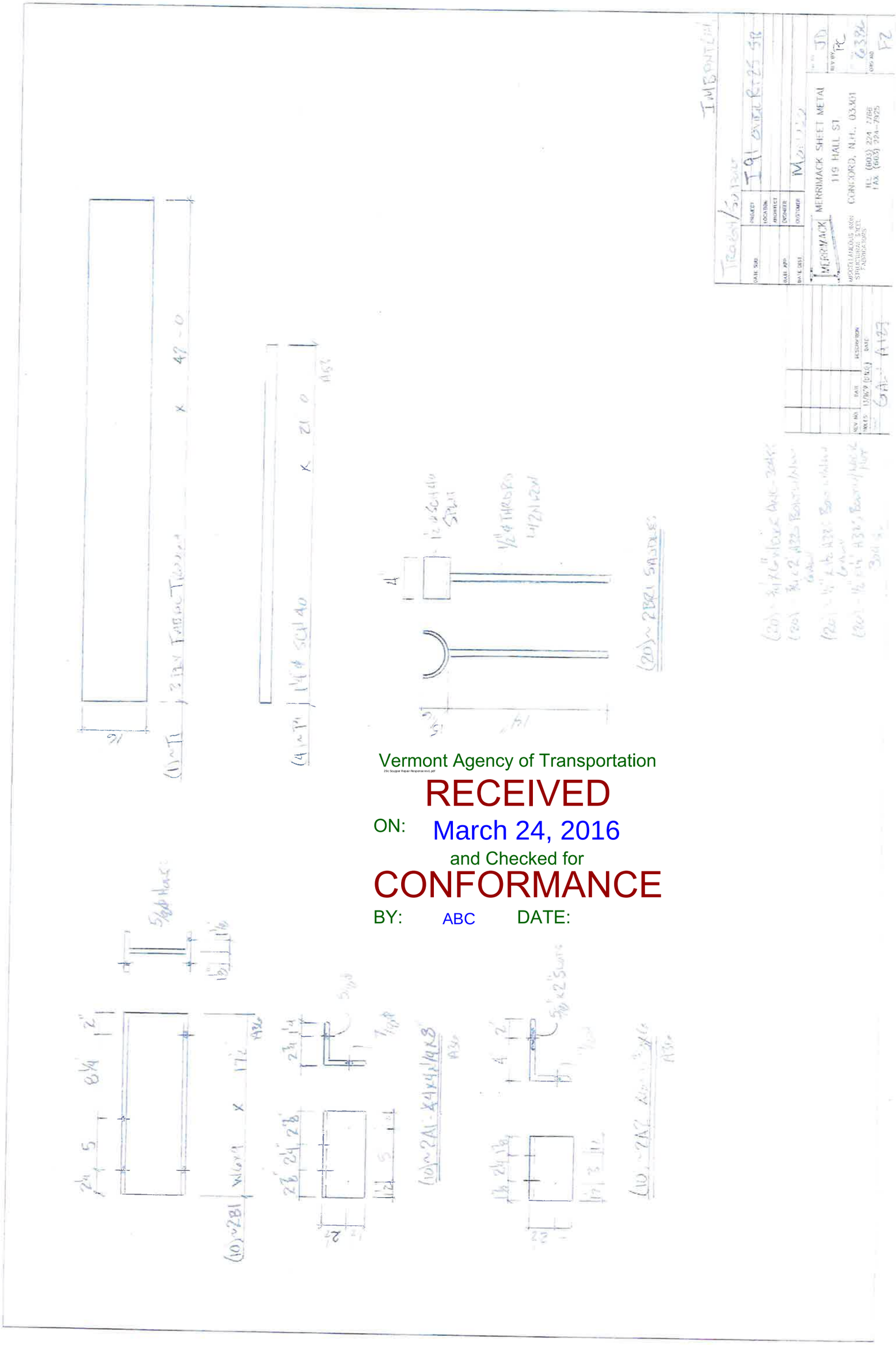
DATE SUB	PROJECT	I-91 over Rt 2, SB
	LOCATION	
	ARCHITECT	
DATE APP.	ENGINEER	
DATE DIST	CUSTOMER	Monarch

REV NO	DATE	DESCRIPTION
NOTES:	12/16/97 (JNB)	DATE
Paint	Galv	A123

MERRIMACK
MISCELLANEOUS IRON STRUCTURAL STEEL FABRICATORS

MERRIMACK SHEET METAL
119 HALL ST.
CONCORD, N.H. 03301
TEL (603) 224-2706
FAX (603) 224-7925

DR BY JD
CK BY PC
JOB NO 63336
DWG NO F1



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MONOKO, LLC

1037 Peninsula Avenue
Tarpon Springs, FL 34689-2125
E-mail Address: MonokoLLC@aol.com
(727) 940-3244
(727) 279-8795 Fax

Submittal No.: 29d, Steel Repair - Anchor Specifications

Date: March 05, 2016

Vermont Department of Transportation
Northeast Regional Construction Office
Attn: Ms. Ann Gammell
347 Emerson Falls Road, Suite 5
St. Johnsbury, VT 05819
(Phone) (802) 751-3295; (Cell) (802) 793-3161
(Fax) (802) 751-3297; Ann.Gammell@vermont.gov

Description: Proposal/Contract Number: Bradford-Newbury IM BPNT (14)
Letting Date: 10/10/14; Award Date: 11/03/14
Project Description: Bridge Painting of Five Bridges
In the Towns of Bradford & Newbury, VT
Contract Amount: $4,327,785.00; Completion Date: 08/26/16

Contractor: **MONOKO, LLC**

Reviewed & Approved By: *Keri Monokandilos*
Keri Monokandilos, Manager

Date: **03/05/2016**

Engineer: Peter Hodgson, Resident Engineer
347 Emerson Falls Road, Suite 5
St. Johnsbury, VT 05819
802-748-2447; 802-793-1878 cell
pete.hodgson@state.vt.us
Mark.Sargent@state.vt.us
pmcdonald@gpinet.com
Ann.Gammell@vermont.gov

Additional Information: Anchors

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Powers FASTENERS

MECHANICAL ANCHORS

Power-Stud™ *Wedge Expansion Anchor*

Mechanically Galvanized and Stainless Steel Versions

PRODUCT DESCRIPTION

The Power-Stud anchor, is a fully threaded, torque-controlled, wedge expansion anchor. It is available in a threaded version suitable for applications in solid concrete and grout-filled concrete masonry. The threaded version is produced in mechanically galvanized carbon steel and stainless steel to offer various levels of corrosion resistance depending on use.

GENERAL APPLICATIONS AND USES

- Lighting Standards and Base Plates
- Sills and Support Ledgers
- Retrofit Projects and Machinery Anchorage
- Food and Beverage Facilities
- Water Treatment Plants and Marine Applications

FEATURES AND BENEFITS

+ Fully threaded, medium duty all-purpose anchor
+ Length ID stamped on each threaded anchor
+ Anchors can be installed through the fixture for hole spotting not required
+ Chamfered impact section prevents damage to threads
+ Clip design prevents spinning during installation
+ Nominal drill bit diameter same as anchor diameter (threaded version)

APPROVALS AND LISTINGS

Tested in accordance with ASTM E488 and AC01 criteria
FM Global (Factory Mutual) – File No. J.I. OK3A9.AH (see ordering information)
Underwriters Laboratory (UL Listed) – File No. EX1289 (see ordering information)
Federal GSA Specification
Meets the descriptive and proof load requirements of CID A-A-1923A, Type 4

GUIDE SPECIFICATIONS

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

SECTION CONTENTS Page No.

General Information 1
Installation Specifications 2
Material Specifications 4
Performance Data 5
Design Criteria 10
Ordering Information 14

Threaded Power-Stud Assembly

HEAD STYLES

Threaded Stud

ANCHOR MATERIALS

Mechanically Galvanized Carbon Steel
Type 304 Stainless Steel
Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter through 1" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
(uncracked base materials)

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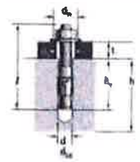
INSTALLATION SPECIFICATIONS

Mechanically Galvanized Carbon Steel Power-Stud

Dimension	Anchor Diameter, d				
	1/2"	5/8"	3/4"	7/8"	1"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	3/4	7/8	1
Fixture Clearance Hole, d_h (in.)	9/16	11/16	13/16	15/16	1-1/8
Thread Size (UNC)	1/2-13	5/8-11	3/4 -10	7/8-9	1-8
Nut Height (in.)	7/16	35/64	41/64	3/4	55/64
Washer O.D., d_w (in.)	1 1/16	1 3/4	2	2 1/4	2 1/2
Wrench Size (in.)	3/4	15/16	1 1/8	1 5/16	1 1/2
Tightening Torque, T_{inst} (ft-lbs)	60	90	175	250	300

Tightening torque is listed for anchors installed in normal-weight concrete. Consult performance data tables for other base materials.



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
d_w = Diameter of washer
h = Base material thickness. The minimum value of h should be $1.5h_e$ or 3" whichever is greater
h_e = Minimum embedment depth
l = Overall length of anchor
t = Fixture thickness

Type 304 and Type 316 Stainless Steel Power-Stud

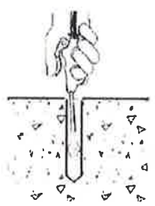
Dimension	Anchor Diameter, d						
	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16	15/16	1-1/8
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9	1-8
Nut Height (in.)	7/32	21/64	7/16	35/64	41/64	3/4	55/64
Washer O.D (304 SS)., d_w (in.)	5/8	13/16	1 1/16	1 3/4	2	2 1/4	2 1/2
Washer O.D (316 SS)., d_w (in.)	5/8	7/8	1 1/4	1 1/2	1 3/4	2	2
Wrench Size (in.)	7/16	9/16	3/4	15/16	1 1/8	1 5/16	1 1/2
Tightening Torque, T_{inst} (ft-lbs)	8	28	60	90	175	250	300

Tightening torque is listed for anchors installed in normal-weight concrete. Consult performance data tables for other base materials.

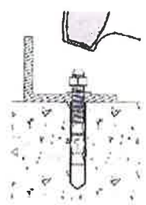
INSTALLATION PROCEDURES

Threaded Stud Version

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 must 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



Position the washer on the anchor and thread on the nut.
Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth

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

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(b1)

MATERIAL SPECIFICATIONS

Anchor Component	Mechanically Galvanized Carbon Steel Power-Stud
Anchor Body	AISI 1018 (1/2"– 3/4", lengths up to 7")
	AISI 12L14 (7/8"– 1" and all lengths over 7")
Nut	Carbon Steel, ASTM A563, Grade A
Washer	AISI 1010 Carbon Steel, Meets Dimensional Requirements of ANSI/ASME 18.22.1, Type A Plain
Expansion Wedge	Type 304 Stainless Steel
Zinc Plating	ASTM B695, Class 65, Type I

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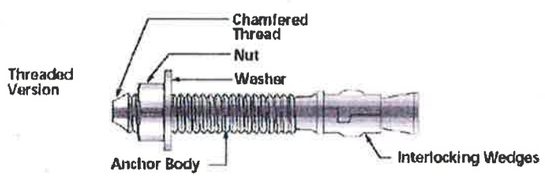
Anchor Component	Type 304 Stainless Steel Power-Stud	Type 316 Stainless Steel Power-Stud
Anchor Body	Type 304Cu (1/4"– 3/4", lengths up to 7")	Type 316 Stainless Steel
	Type 304 (7/8"– 1", lengths over to 7")	
Nut	Type 18-8 (300 Series) Stainless Steel	Type 316 Stainless Steel
Washer	Type 18-8 (300 Series) Stainless Steel	Type 316 Stainless Steel
Expansion Wedge	Type 304 Stainless Steel	Type 316 Stainless Steel

Stainless steel anchor components are passivated



Length Identification (threaded version)

Mark	♦	■	A	B	C	D	E	F	G	H	I
From	1/2"	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"
Up to but not including	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"

Mark	J	K	L	M	N	O	P	Q	R	S	T
From	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"	12"
Up to but not including	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"	12"	13"

(b1)

PERFORMANCE DATA

Ultimate Load Capacities for Mechanically Galvanized Carbon Steel Power-Stud in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	1,240 (5.6)	1,580 (7.1)	1,440 (6.5)	1,620 (7.3)	1,740 (7.8)	1,620 (7.3)
3/8 (9.5)	1 5/8 (41.3)	1,920 (8.6)	3,560 (16.0)	3,040 (13.7)	3,760 (16.9)	3,040 (13.7)	3,760 (16.9)
	2 (50.8)	2,800 (12.6)	3,560 (16.0)	3,850 (17.3)	3,760 (16.9)	4,075 (18.3)	3,760 (16.9)
1/2 (12.7)	2 1/4 (57.2)	3,440 (15.5)	6,540 (29.4)	5,560 (25.0)	6,800 (30.6)	6,540 (29.4)	6,800 (30.6)
	3 (76.2)	5,100 (23.0)	6,540 (29.4)	8,160 (36.7)	6,800 (30.6)	9,200 (41.4)	6,800 (30.6)
	4 (101.6)	5,700 (25.7)	6,540 (29.4)	8,160 (36.7)	6,800 (30.6)	9,200 (41.4)	6,800 (30.6)
5/8 (15.9)	2 3/4 (69.9)	6,240 (27.8)	9,280 (41.8)	8,300 (37.4)	11,900 (53.6)	9,860 (44.4)	11,900 (53.6)
	4 (101.6)	9,600 (43.2)	9,280 (41.8)	10,825 (48.7)	11,900 (53.6)	13,495 (60.7)	11,900 (53.6)
3/4 (19.1)	3 3/8 (85.7)	7,420 (33.0)	12,380 (55.7)	9,500 (42.3)	15,060 (67.8)	11,540 (51.3)	15,060 (67.8)
	5 (127.0)	10,640 (47.3)	12,380 (55.7)	14,630 (65.8)	15,060 (67.8)	14,630 (65.8)	15,060 (67.8)
7/8 (22.2)	3 7/8 (98.4)	7,600 (34.2)	17,960 (80.8)	12,300 (55.4)	24,160 (108.7)	17,300 (77.9)	24,160 (108.7)
	4 1/2 (114.3)	9,600 (43.2)	17,960 (80.8)	15,620 (70.3)	24,160 (108.7)	20,075 (90.3)	24,160 (108.7)
	5 3/4 (146.1)	10,640 (47.3)	17,960 (80.8)	19,880 (89.5)	24,160 (108.7)	25,625 (115.3)	24,160 (108.7)
1 (25.4)	4 1/2 (114.3)	8,740 (39.3)	26,420 (118.9)	13,820 (62.2)	31,100 (140.0)	21,220 (94.4)	31,100 (140.0)
	5 1/2 (139.7)	12,770 (57.5)	26,420 (118.9)	20,280 (91.3)	31,100 (140.0)	27,800 (123.7)	31,100 (140.0)
	6 1/2 (165.1)	16,605 (74.7)	26,420 (118.9)	25,485 (114.7)	31,100 (140.0)	34,360 (152.8)	31,100 (140.0)

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.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

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Allowable Load Capacities for Mechanically Galvanized Carbon Steel Power-Stud in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	310 (1.4)	395 (1.8)	360 (1.6)	405 (1.8)	435 (2.0)	405 (1.8)
3/8 (9.5)	1 5/8 (41.3)	480 (2.2)	890 (4.0)	760 (3.4)	940 (4.2)	760 (3.4)	940 (4.2)
	2 (50.8)	700 (3.2)	890 (4.0)	965 (4.3)	940 (4.2)	1,020 (4.6)	940 (4.2)
1/2 (12.7)	2 1/4 (57.2)	860 (3.9)	1,635 (7.4)	1,390 (6.3)	1,700 (7.7)	1,635 (7.4)	1,700 (7.7)
	3 (76.2)	1,275 (5.7)	1,635 (7.4)	2,040 (9.2)	1,700 (7.7)	2,300 (10.4)	1,700 (7.7)
	4 (101.6)	1,425 (6.4)	1,635 (7.4)	2,040 (9.2)	1,700 (7.7)	2,300 (10.4)	1,700 (7.7)
5/8 (15.9)	2 3/4 (69.9)	1,560 (6.9)	2,320 (10.4)	2,075 (9.3)	2,975 (13.4)	2,465 (11.1)	2,975 (13.4)
	4 (101.6)	2,400 (10.8)	2,320 (10.4)	2,705 (12.2)	2,975 (13.4)	3,375 (15.2)	2,975 (13.4)
3/4 (19.1)	3 3/8 (85.7)	1,855 (8.3)	3,095 (13.9)	2,375 (10.6)	3,765 (16.9)	2,375 (10.6)	3,765 (16.9)
	5 (127.0)	2,660 (11.8)	3,095 (13.9)	3,660 (16.5)	3,765 (16.9)	3,660 (16.5)	3,765 (16.9)
7/8 (22.2)	3 7/8 (98.4)	1,900 (8.6)	4,490 (20.2)	3,075 (13.8)	6,040 (27.2)	4,325 (19.5)	6,040 (27.2)
	4 1/2 (114.3)	2,400 (10.8)	4,490 (20.2)	3,905 (17.6)	6,040 (27.2)	5,305 (23.6)	6,040 (27.2)
	5 3/4 (146.1)	2,660 (11.8)	4,490 (20.2)	4,970 (22.4)	6,040 (27.2)	6,950 (30.9)	6,040 (27.2)
1 (25.4)	4 1/2 (114.3)	2,185 (9.8)	6,605 (29.7)	3,455 (15.5)	7,775 (35.0)	5,305 (23.6)	7,775 (35.0)
	5 1/2 (139.7)	3,195 (14.4)	6,605 (29.7)	5,070 (22.8)	7,775 (35.0)	6,950 (30.9)	7,775 (35.0)
	6 1/2 (165.1)	4,150 (18.7)	6,605 (29.7)	6,370 (28.7)	7,775 (35.0)	8,590 (38.2)	7,775 (35.0)

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
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths

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Ultimate Load Capacities for Stainless Steel Power-Stud in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h, in. (mm)	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	1,240 (5.6)	1,580 (7.1)	1,440 (6.5)	1,620 (7.3)	1,740 (7.8)	1,620 (7.3)
	1 1/2 (38.1)	1,635 (7.4)	1,580 (7.1)	2,080 (9.4)	1,620 (7.3)	2,100 (9.5)	1,620 (7.3)
	2 (50.8)	1,900 (8.6)	1,580 (7.1)	2,080 (9.4)	1,620 (7.3)	2,100 (9.5)	1,620 (7.3)
3/8 (9.5)	1 5/8 (41.3)	1,920 (8.6)	3,560 (16.0)	3,040 (13.7)	3,760 (16.9)	3,040 (13.7)	3,760 (16.9)
	2 (50.8)	2,800 (12.6)	3,560 (16.0)	3,850 (17.3)	3,760 (16.9)	4,075 (18.3)	3,760 (16.9)
	3 (76.2)	4,100 (18.5)	3,560 (16.0)	4,200 (18.7)	3,760 (16.9)	4,200 (18.7)	3,760 (16.9)
1/2 (12.7)	2 1/4 (57.2)	3,440 (15.5)	6,540 (29.4)	5,560 (25.0)	6,800 (30.6)	6,540 (29.4)	6,800 (30.6)
	3 (76.2)	5,100 (23.0)	6,540 (29.4)	6,540 (29.4)	6,800 (30.6)	6,540 (29.4)	6,800 (30.6)
	4 (101.6)	5,700 (25.7)	6,540 (29.4)	6,540 (29.4)	6,800 (30.6)	6,540 (29.4)	6,800 (30.6)
5/8 (15.9)	2 3/4 (69.9)	6,240 (27.8)	9,280 (41.8)	8,300 (37.4)	11,900 (53.6)	8,860 (39.4)	11,900 (53.6)
	4 (101.6)	7,125 (31.7)	9,280 (41.8)	9,000 (40.0)	11,900 (53.6)	9,000 (40.0)	11,900 (53.6)
3/4 (19.1)	3 3/8 (85.7)	7,420 (33.0)	12,380 (55.7)	9,500 (42.3)	15,060 (67.8)	10,250 (45.6)	15,060 (67.8)
	5 (127.0)	10,640 (47.3)	12,380 (55.7)	10,640 (47.3)	15,060 (67.8)	10,640 (47.3)	15,060 (67.8)
7/8 (22.2)	3 7/8 (98.4)	7,600 (34.2)	17,960 (80.8)	12,300 (55.4)	24,160 (108.7)	12,500 (55.6)	24,160 (108.7)
	4 1/2 (114.3)	9,600 (43.7)	17,960 (80.8)	12,500 (55.6)	24,160 (108.7)	12,500 (55.6)	24,160 (108.7)
	5 3/4 (146.1)	10,640 (47.3)	17,960 (80.8)	12,500 (55.6)	24,160 (108.7)	12,500 (55.6)	24,160 (108.7)
1 (25.4)	4 1/2 (114.3)	8,740 (39.3)	26,420 (118.9)	13,820 (62.2)	31,100 (140.0)	17,125 (76.2)	31,100 (140.0)
	5 1/2 (139.7)	12,770 (57.5)	26,420 (118.9)	17,125 (76.2)	31,100 (140.0)	17,125 (76.2)	31,100 (140.0)
	6 1/2 (165.1)	16,605 (74.7)	26,420 (118.9)	17,125 (76.2)	31,100 (140.0)	17,125 (76.2)	31,100 (140.0)

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.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

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Allowable Load Capacities for Stainless Steel Power-Stud in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) 2,000 psi (13.8 MPa) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	310 (1.4)	395 (1.8)	360 (1.6)	405 (1.8)	435 (2.0)	405 (1.8)
	1 1/2 (38.1)	410 (1.8)	395 (1.8)	520 (2.3)	405 (1.8)	525 (2.4)	405 (1.8)
	2 (50.8)	475 (2.1)	395 (1.8)	520 (2.3)	405 (1.8)	525 (2.4)	405 (1.8)
3/8 (9.5)	1 5/8 (41.3)	480 (2.2)	890 (4.0)	760 (3.4)	940 (4.2)	760 (3.4)	940 (4.2)
	2 (50.8)	700 (3.2)	890 (4.0)	965 (4.3)	940 (4.2)	1,020 (4.6)	940 (4.2)
	3 (76.2)	1,025 (4.6)	890 (4.0)	1,050 (4.7)	940 (4.2)	1,050 (4.7)	940 (4.2)
1/2 (12.7)	2 1/4 (57.2)	860 (3.9)	1,635 (7.4)	1,390 (6.3)	1,700 (7.7)	1,635 (7.4)	1,700 (7.7)
	3 (76.2)	1,275 (5.7)	1,635 (7.4)	1,635 (7.3)	1,700 (7.7)	1,635 (7.3)	1,700 (7.7)
	4 (101.6)	1,425 (6.4)	1,635 (7.4)	1,635 (7.3)	1,700 (7.7)	1,635 (7.3)	1,700 (7.7)
5/8 (15.9)	2 3/4 (69.9)	1,560 (6.9)	2,320 (10.4)	2,075 (9.3)	2,975 (13.4)	2,215 (9.9)	2,975 (13.4)
	4 (101.6)	1,780 (7.9)	2,320 (10.4)	2,250 (10.0)	2,975 (13.4)	2,250 (10.0)	2,975 (13.4)
3/4 (19.1)	3 3/8 (85.7)	1,855 (8.3)	3,095 (13.9)	2,375 (10.6)	3,765 (16.9)	2,560 (11.4)	3,765 (16.9)
	5 (127.0)	2,660 (11.8)	3,095 (13.9)	2,660 (11.8)	3,765 (16.9)	2,660 (11.8)	3,765 (16.9)
7/8 (22.2)	3 7/8 (98.4)	1,900 (8.6)	4,490 (20.2)	3,075 (13.8)	6,040 (27.2)	3,125 (13.9)	6,040 (27.2)
	4 1/2 (114.3)	2,400 (10.8)	4,490 (20.2)	3,125 (13.9)	6,040 (27.2)	3,125 (13.9)	6,040 (27.2)
	5 3/4 (146.1)	2,660 (11.8)	4,490 (20.2)	3,125 (13.9)	6,040 (27.2)	3,125 (13.9)	6,040 (27.2)
1 (25.4)	4 1/2 (114.3)	2,185 (9.8)	6,605 (29.7)	3,455 (15.5)	7,775 (35.0)	4,280 (19.0)	7,775 (35.0)
	5 1/2 (139.7)	3,195 (14.4)	6,605 (29.7)	4,280 (19.0)	7,775 (35.0)	4,280 (19.0)	7,775 (35.0)
	6 1/2 (165.1)	4,150 (18.7)	6,605 (29.7)	4,280 (19.0)	7,775 (35.0)	4,280 (19.0)	7,775 (35.0)

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.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

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

Anchor Diameter d in. (mm)	Install Torque T_{inst} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c) Tension, lbs (kN)						Shear, lbs (kN)	
			3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		$f'_c \geq$ 3,000 psi (20.7 MPa)	
			Ultimate Load	Allowable Load	Ultimate Load	Allowable Load	Ultimate Load	Allowable Load	Ultimate Load	Allowable Load
1/4 (6.4)	4	1 1/8 (28.6)	720 (3.2)	180 (0.8)	960 (4.3)	240 (1.1)	1,200 (5.4)	300 (1.4)	720 (3.2)	180 (0.8)
3/8 (9.5)	20	1 5/8 (41.3)	1,600 (7.2)	400 (1.8)	1,940 (8.7)	485 (2.2)	2,300 (10.4)	575 (2.6)	1,840 (8.3)	460 (2.1)
		3 (76.2)	–	–	2,860 (12.9)	715 (3.2)	–	–	1,840 (8.3)	460 (2.1)
1/2 (12.7)	30	2 1/4 (57.2)	2,820 (12.7)	705 (3.2)	3,180 (14.3)	795 (3.6)	3,560 (16.0)	890 (4.0)	5,040 (22.7)	1,260 (5.7)
		4 (101.6)	–	–	4,200 (18.9)	1,050 (4.7)	–	–	5,040 (22.7)	1,260 (5.7)
5/8 (15.9)	65	2 3/4 (69.9)	4,380 (19.7)	1,095 (4.9)	4,980 (22.4)	1,245 (5.6)	5,580 (25.1)	1,395 (6.3)	6,940 (31.2)	1,735 (7.8)
		5 (127.0)	–	–	6,920 (31.1)	1,730 (7.8)	–	–	6,940 (31.2)	1,735 (7.8)
3/4 (19.1)	90	3 3/8 (85.7)	5,060 (22.8)	1,265 (5.7)	5,600 (25.2)	1,400 (6.3)	6,140 (27.6)	1,535 (6.9)	9,880 (44.5)	2,470 (11.1)
		5 (127.0)	–	–	9,300 (41.9)	2,325 (10.5)	–	–	9,880 (44.5)	2,470 (11.1)

1. The values listed above are ultimate and allowable load capacities for anchors installed 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.

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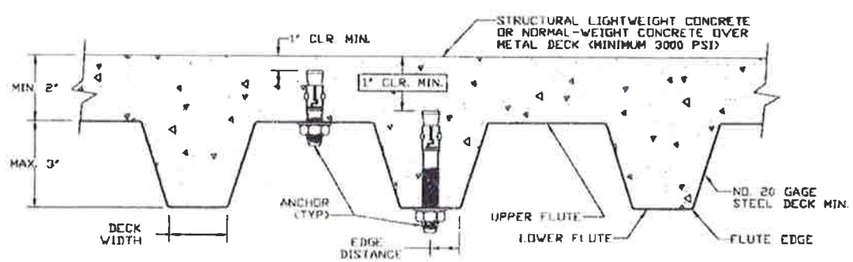
Ultimate and Allowable Load Capacities for Carbon Steel Power-Stud Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Diameter d in. (mm)	Install Torque T_{inst} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage 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)	4	1 1/8 (28.6)	880 (4.0)	1,840 (8.3)	220 (1.0)	460 (2.1)	880 (4.0)	1,840 (8.3)	220 (1.0)	460 (2.1)
3/8 (9.5)	20	1 5/8 (41.3)	880 (4.0)	2,800 (12.6)	220 (1.0)	700 (3.2)	1,520 (6.8)	2,800 (12.6)	380 (1.7)	700 (3.2)
		3 (76.2)	880 (4.0)	2,800 (12.6)	220 (1.0)	700 (3.2)	4,480 (20.2)	3,840 (17.3)	1,120 (5.0)	960 (4.3)
1/2 (12.7)	30	2 1/4 (57.2)	1,400 (6.3)	2,800 (12.6)	350 (1.6)	700 (3.2)	3,200 (14.4)	4,780 (21.5)	800 (3.6)	1,195 (5.4)
		4 (101.6)	1,400 (6.3)	2,800 (12.6)	350 (1.6)	700 (3.2)	6,360 (28.6)	7,540 (33.9)	1,590 (7.2)	1,885 (8.5)
5/8 (15.9)	65	2 3/4 (69.9)	–	–	–	–	3,200 (14.4)	4,780 (21.5)	800 (3.6)	1,195 (5.4)
		5 (127.0)	–	–	–	–	9,200 (41.4)	10,940 (49.2)	2,300 (10.4)	2,735 (12.3)
3/4 (19.1)	90	3 3/8 (85.7)	–	–	–	–	2,740 (12.3)	7,000 (31.5)	685 (3.1)	1,750 (7.9)
		5 (127.0)	–	–	–	–	10,840 (48.8)	12,570 (56.6)	2,710 (12.2)	3,140 (14.1)

1. The values listed above are ultimate and allowable load capacities for anchors installed in sand-lightweight concrete.
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 table for lightweight concrete listed in the Design Criteria section. Linear interpolation may be used for flute edge distances between those listed. Flute edge distance equals one-half the minimum deck width.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.



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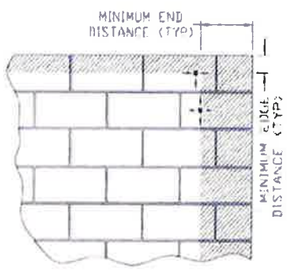

Ultimate and Allowable Load Capacities for Mechanically Galvanized and Stainless Steel Power-Stud in Grout-Filled Concrete Masonry[1,2,3]

Anchor Dia. d in. (mm)	Install Torque T_{inst} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Grout-Filled Concrete Masonry $f'_m \geq$ 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)	4	1 1/8 (28.6)	3 3/4 (95.3)	3 3/4 (95.3)	1,230 (5.5)	1,230 (5.5)	245 (1.1)	245 (1.1)
		2 (50.8)	5 1/4 (133.4)	3 3/4 (95.3)	1,670 (7.5)	1,230 (5.5)	335 (1.5)	245 (1.1)
3/8 (9.5)	20	1 5/8 (41.3)	5 5/8 (142.9)	5 5/8 (142.9)	1,990 (9.0)	3,240 (14.6)	400 (1.8)	650 (2.9)
		3 (76.2)	7 7/8 (200.0)	5 5/8 (142.9)	2,200 (9.9)	3,240 (14.6)	440 (2.0)	650 (2.9)
1/2 (12.7)	30	2 1/4 (57.2)	7 1/2 (190.5)	7 1/2 (190.5)	2,260 (10.2)	6,230 (28.0)	450 (2.0)	1,245 (5.6)
		4 (101.6)	10 1/2 (266.7)	7 1/2 (190.5)	2,620 (11.8)	6,230 (28.0)	525 (2.4)	1,245 (5.6)
5/8 (15.9)	65	2 3/4 (69.9)	9 3/8 (238.1)	9 3/8 (238.1)	3,170 (14.3)	7,830 (35.2)	635 (2.9)	1,565 (7.0)
		5 (127.0)	13 1/8 (333.4)	9 3/8 (238.1)	3,780 (17.0)	7,830 (35.2)	755 (3.4)	1,565 (7.0)
3/4 (19.1)	90	3 3/8 (85.7)	11 1/4 (285.8)	11 1/4 (285.8)	4,085 (18.4)	9,760 (43.9)	815 (3.7)	1,950 (8.8)
		5 (127.0)	15 3/4 (400.1)	11 1/4 (285.8)	4,420 (19.9)	9,760 (43.9)	885 (4.0)	1,950 (8.8)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq$ 1,500 psi).
2. Allowable load capacities listed 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 reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

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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	$s_{cr} = 2.0h_v$	$F_{N_S} = F_{V_s} = 1.0$	$s_{min} = h_v$	$F_{N_S} = F_{V_s} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{N_C} = 1.0$	$c_{min} = 5d$	$F_{N_C} = 0.75$
	Shear	$c_{cr} = 12d$	$F_{V_C} = 1.0$	$c_{min} = 5d$	$F_{V_C} = 0.75$

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	$s_{cr} = 2.0h_v$	$F_{N_S} = F_{V_s} = 1.0$	$s_{min} = h_v$	$F_{N_S} = F_{V_s} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{N_C} = 1.0$	$c_{min} = 5d$	$F_{N_C} = 0.95$
	Shear	$c_{cr} = 12d$	$F_{V_C} = 1.0$	$c_{min} = 5d$	$F_{V_C} = 0.30$

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DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Spacing Load Adjustment Factors for Normal-Weight and Lightweight Concrete (Continued Below)

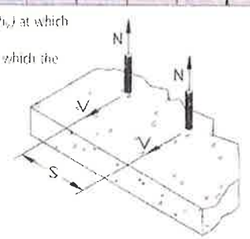
Spacing, Tension (F_{NS}) & Shear (F_{VS})																			
Dia. (in.)		1/4				3/8				1/2					5/8				
h_{ef} (in.)		1 1/8	1 1/2	2	2 3/4	1 5/8	2	3	4 1/4	2 1/4	3	4	5	6	2 3/4	3 1/2	4	5	7
s_{cr} (in.)		2 1/4	3	4	5 1/2	3 1/4	4	6	8 1/2	4 1/2	6	8	10	12	5 1/2	7	8	10	14
s_{min} (in.)		1 1/8	1 1/2	2	2 3/4	1 5/8	2	3	4 1/4	2 1/4	3	4	5	6	2 3/4	3 1/2	4	5	7
Spacing, s (inches)	1 1/8	0.50																	
	1 1/2	0.67	0.50																
	1 5/8	0.72	0.54			0.50													
	2	0.89	0.67	0.50		0.62	0.50												
	2 1/4	1.00	0.75	0.56		0.69	0.56			0.50									
	2 3/4		0.92	0.69	0.50	0.85	0.69			0.61					0.50				
	3		1.00	0.75	0.55	0.92	0.75	0.50		0.67	0.50				0.55				
	3 1/4			0.81	0.59	1.00	0.81	0.54		0.72	0.54				0.59				
	3 1/2			0.88	0.64		0.88	0.58		0.78	0.58				0.64	0.50			
	4			1.00	0.73		1.00	0.67		0.89	0.67	0.50			0.73	0.57	0.50		
	4 1/4				0.77			0.71	0.50	0.94	0.71	0.53			0.77	0.61	0.53		
	4 1/2				0.82			0.75	0.53	1.00	0.75	0.56			0.82	0.64	0.56		
	5				0.91			0.83	0.59		0.83	0.63	0.50		0.91	0.71	0.63	0.50	
	5 1/2				1.00			0.92	0.65		0.92	0.69	0.55		1.00	0.79	0.69	0.55	
	6							1.00	0.71		1.00	0.75	0.60	0.50		0.86	0.75	0.60	
	7								0.82			0.88	0.70	0.58		1.00	0.88	0.70	0.50
	8								0.94			1.00	0.80	0.67			1.00	0.80	0.57
	8 1/2								1.00				0.85	0.71				0.85	0.61
	10												1.00	0.83				1.00	0.71
	11													0.92					0.79
	12													1.00					0.86
	13																		0.93
	14																		1.00

Spacing Load Adjustment Factors for Normal-Weight and Lightweight Concrete (Continued from Above)

Spacing, Tension (F_{NS}) & Shear (F_{VS})																
Dia. (in.)		3/4					7/8					1				
h_{ef} (in.)		3 3/8	4	5	6	8	3 7/8	4 1/2	5 3/4	7	8	4 1/2	5 1/2	6 1/2	8	9
s_{cr} (in.)		6 3/4	8	10	12	16	7 3/4	9	11 1/2	14	16	9	11	13	16	18
s_{min} (in.)		3 3/8	4	5	6	8	3 7/8	4 1/2	5 3/4	7	8	4 1/2	5 1/2	6 1/2	8	9
Spacing, s (inches)	3 3/8	0.50														
	3 7/8	0.57					0.50									
	4	0.59	0.50				0.52									
	4 1/2	0.67	0.56				0.58	0.50				0.50				
	5	0.74	0.63	0.50			0.65	0.56				0.56				
	5 1/2	0.81	0.69	0.55			0.71	0.61				0.61	0.50			
	5 3/4	0.85	0.72	0.58			0.74	0.64	0.50			0.64	0.52			
	6	0.89	0.75	0.60	0.50		0.77	0.67	0.52			0.67	0.55			
	6 1/2	0.96	0.81	0.65	0.54		0.84	0.72	0.57			0.72	0.59	0.50		
	6 3/4	1.00	0.84	0.68	0.56		0.87	0.75	0.59			0.75	0.61	0.52		
	7		0.88	0.70	0.58		0.90	0.78	0.61	0.50		0.78	0.64	0.54		
	7 3/4		0.97	0.78	0.65		1.00	0.86	0.67	0.55		0.86	0.70	0.60		
	8		1.00	0.80	0.67	0.50		0.89	0.70	0.57	0.50	0.89	0.73	0.62	0.50	
	9			0.90	0.75	0.56		1.00	0.78	0.64	0.56	1.00	0.82	0.69	0.56	0.50
	10			1.00	0.83	0.63			0.87	0.71	0.63		0.91	0.77	0.63	0.56
	11				0.92	0.69			0.96	0.79	0.69		1.00	0.85	0.69	0.61
	11 1/2				0.96	0.72			1.00	0.82	0.72			0.88	0.72	0.64
	12				1.00	0.75				0.86	0.75			0.92	0.75	0.67
	13					0.81				0.93	0.81			1.00	0.81	0.72
	14					0.88				1.00	0.88				0.88	0.78
	16					1.00					1.00				1.00	0.89
	18															1.00
	20															

Notes: Critical spacing (s_{cr}) is equal to 2 embedment depths ($2h_{ef}$) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 1 embedment depth (h_{ef}) at which the anchor achieves 50% of load.



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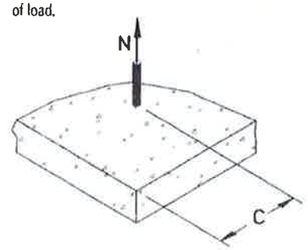
Edge Distance Load Adjustment Factors for Normal-Weight Concrete

Edge Distance, Tension (F_{N_C})

Diameter (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)		3	4 1/2	6	7 1/2	9	10 1/2	12
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5
Edge Distance, c (inches)	1 1/4	0.75						
	1 5/8	0.80						
	1 7/8	0.84	0.75					
	2	0.86	0.76					
	2 1/2	0.93	0.81	0.75				
	3	1.00	0.86	0.79				
	3 1/8		0.87	0.79	0.75			
	3 3/4		0.93	0.84	0.79	0.75		
	4		0.95	0.86	0.80	0.76		
	4 3/8		0.99	0.88	0.82	0.78	0.75	
	4 1/2		1.00	0.89	0.83	0.79	0.76	
	5			0.93	0.86	0.81	0.78	0.75
	6			1.00	0.91	0.86	0.82	0.79
	6 1/4				0.93	0.87	0.83	0.79
	7				0.97	0.90	0.86	0.82
	7 1/2				1.00	0.93	0.88	0.84
	8					0.95	0.90	0.86
	9					1.00	0.94	0.89
	10 1/2						1.00	0.95
	12							1.00
	15							

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

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 75% of load.

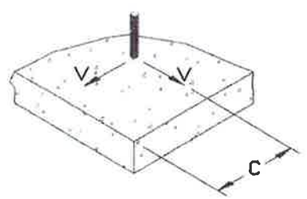


Edge Distance, Shear (F_{V_C})

Diameter (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)		3	4 1/2	6	7 1/2	9	10 1/2	12
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5
Edge Distance, c (inches)	1 1/4	0.35						
	1 5/8	0.49						
	1 7/8	0.58	0.35					
	2	0.63	0.38					
	2 1/2	0.81	0.50	0.35				
	3	1.00	0.63	0.44				
	3 1/8		0.66	0.47	0.35			
	3 3/4		0.81	0.58	0.44	0.35		
	4		0.88	0.63	0.48	0.38		
	4 3/8		0.97	0.70	0.54	0.43	0.35	
	4 1/2		1.00	0.72	0.55	0.44	0.36	
	5			0.81	0.63	0.50	0.42	0.35
	6			1.00	0.78	0.63	0.52	0.44
	6 1/4				0.81	0.66	0.55	0.47
	7				0.93	0.75	0.63	0.54
	7 1/2				1.00	0.81	0.68	0.58
	8					0.88	0.73	0.63
	9					1.00	0.84	0.72
	10 1/2						1.00	0.86
	12							1.00
	15							

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

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 35% of load.



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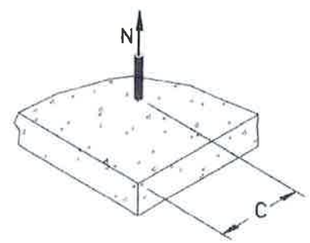
Edge Distance Load Adjustment Factors for Lightweight Concrete

Edge Distance, Tension (F_{N_C})

Diameter (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)	3	4 1/2	6	7 1/2	9	10 1/2	12
c_{min} (in.)	1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5
Edge Distance, c (inches)							
1 1/4	0.95						
1 5/8	0.96						
1 7/8	0.97	0.95					
2	0.97	0.95					
2 1/2	0.99	0.96	0.95				
3	1.00	0.97	0.96				
3 1/8		0.97	0.96	0.95			
3 3/4		0.99	0.97	0.96	0.95		
4		0.99	0.97	0.96	0.95		
4 3/8		1.00	0.98	0.96	0.96	0.95	
4 1/2		1.00	0.98	0.97	0.96	0.95	
5			0.99	0.97	0.96	0.96	0.95
6			1.00	0.98	0.97	0.96	0.96
6 1/4				0.99	0.97	0.97	0.96
7				0.99	0.98	0.97	0.96
7 1/2				1.00	0.99	0.98	0.97
8					0.99	0.98	0.97
9					1.00	0.99	0.98
10 1/2						1.00	0.99
12							1.00
15							

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

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 95% of load.

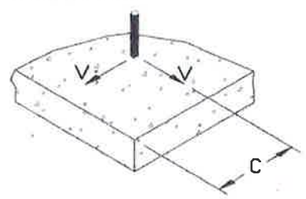


Edge Distance, Shear (F_{V_C})

Diameter (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)	3	4 1/2	6	7 1/2	9	10 1/2	12
c_{min} (in.)	1 1/4	1 7/8	2 1/2	3 1/8	3 3/4	4 3/8	5
Edge Distance, c (inches)							
1 1/4	0.30						
1 5/8	0.45						
1 7/8	0.55	0.30					
2	0.60	0.33					
2 1/2	0.80	0.47	0.30				
3	1.00	0.60	0.40				
3 1/8		0.63	0.43	0.30			
3 3/4		0.80	0.55	0.40	0.30		
4		0.87	0.60	0.44	0.33		
4 3/8		0.97	0.68	0.50	0.38	0.30	
4 1/2		1.00	0.70	0.52	0.40	0.31	
5			0.80	0.60	0.47	0.37	0.30
6			1.00	0.76	0.60	0.49	0.40
6 1/4				0.80	0.63	0.51	0.43
7				0.92	0.73	0.60	0.50
7 1/2				1.00	0.80	0.66	0.55
8					0.87	0.71	0.60
9					1.00	0.83	0.70
10 1/2						1.00	0.85
12							1.00
15							

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

Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5*d*) at which the anchor achieves 30% of load.



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ORDERING INFORMATION

Mechanically Galvanized Carbon Steel Power-Stud

Cat. No.	Anchor Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100	FM or UL
7720	1/2" x 2 3/4"	2 1/4"	1 3/8"	50	200	18	UL
7723	1/2" x 4 1/2"	2 1/4"	3 1/8"	50	200	30	FM/UL
7724	1/2" x 5 1/2"	2 1/4"	4 1/8"	50	150	34	FM/UL
7726	1/2" x 7"	2 1/4"	5 5/8"	25	100	34	UL
7730	5/8" x 3 1/2"	2 3/4"	2"	25	100	40	UL
7734	5/8" x 6"	2 3/4"	4 1/2"	25	75	64	FM/UL
7741	3/4" x 4 3/4"	3 3/8"	2 7/8"	20	60	76	UL
7742	3/4" x 5 1/2"	3 3/8"	3 5/8"	20	60	85	FM/UL
7748	3/4" x 8 1/2"	3 3/8"	6 5/8"	10	40	120	FM/UL
7750	7/8" x 6"	3 7/8"	2 3/4"	10	40	120	FM/UL
7752	7/8" x 8"	3 7/8"	4 3/4"	10	40	160	FM/UL
7763	1" x 9"	4 1/2"	5 3/8"	10	30	240	FM

The published length is the overall length of the anchor. Allow for fixture thickness plus one anchor diameter for the nut and washer thickness when selecting a length.

Type 304 Stainless Steel Power-Stud

Cat. No.	Anchor Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100	FM or UL
7300	1/4" x 1 3/4"	1 1/8"	3/4"	100	500	3	-
7302	1/4" x 2 1/4"	1 1/8"	1 1/4"	100	500	3 1/2	-
7304	1/4" x 3 1/4"	1 1/8"	2 1/4"	100	500	4 3/4	-
7310	3/8" x 2 1/4"	1 5/8"	1 1/4"	50	250	8 3/4	FM/UL
7312	3/8" x 2 3/4"	1 5/8"	1 5/8"	50	250	9 1/2	FM/UL
7313	3/8" x 3"	1 5/8"	1 7/8"	50	250	10 3/4	UL
7314	3/8" x 3 1/2"	1 5/8"	2 3/8"	50	250	12	FM/UL
7315	3/8" x 3 3/4"	1 5/8"	2 5/8"	50	250	12 3/4	UL
7316	3/8" x 5"	1 5/8"	3 1/8"	50	250	15 1/2	UL
7320	1/2" x 2 3/4"	2 1/4"	1 3/8"	50	200	18	FM/UL
7322	1/2" x 3 3/4"	2 1/4"	2 3/8"	50	200	23	FM/UL
7323	1/2" x 4 1/2"	2 1/4"	3 1/8"	50	200	30	UL
7324	1/2" x 5 1/2"	2 1/4"	4 1/8"	50	150	34	FM/UL
7326	1/2" x 7"	2 1/4"	5 5/8"	25	100	44	FM/UL
7330	5/8" x 3 1/2"	2 3/4"	2"	25	100	40	FM/UL
7332	5/8" x 4 1/2"	2 3/4"	3"	25	100	54	FM/UL
7333	5/8" x 5"	2 3/4"	3 1/2"	25	100	57	UL
7334	5/8" x 6"	2 3/4"	4 1/2"	25	75	64	FM/UL
7336	5/8" x 7"	2 3/4"	5 1/2"	25	75	72	UL
7338	5/8" x 8 1/2"	2 3/4"	7"	25	75	84	UL
7340	3/4" x 4 1/4"	3 3/8"	2 3/8"	20	60	70	UL
7341	3/4" x 4 3/4"	3 3/8"	2 7/8"	20	60	76	UL
7342	3/4" x 5 1/2"	3 3/8"	3 5/8"	20	60	85	FM/UL
7344	3/4" x 6 1/4"	3 3/8"	4 3/8"	20	60	95	UL
7346	3/4" x 7"	3 3/8"	5 1/8"	20	60	105	UL
7348	3/4" x 8 1/2"	3 3/8"	6 5/8"	10	40	120	UL
7349	3/4" x 10"	3 3/8"	8 1/8"	10	30	135	UL
7352	7/8" x 8"	3 7/8"	4 3/4"	10	40	160	UL
7361	1" x 6"	4 1/2"	2 3/8"	10	30	170	-
7363	1" x 9"	4 1/2"	5 3/8"	10	30	240	-
7365	1" x 12"	4 1/2"	8 3/8"	5	15	300	-

The published length is the overall length of the anchor. Allow for fixture thickness plus one anchor diameter for the nut and washer thickness when selecting a length.

FM - Factory Mutual Approved
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ORDERING INFORMATION

Type 316 Stainless Steel Power-Stud

Cat. No.	Anchor Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100	FM or UL
7600	1/4" x 1 3/4"	1 1/8"	3/4"	100	500	3 1/4	-
7602	1/4" x 2 1/4"	1 1/8"	1 1/4"	100	500	3 3/4	-
7604	1/4" x 3 1/4"	1 1/8"	2 1/4"	100	500	5 1/4	-
7610	3/8" x 2 1/4"	1 5/8"	1 1/4"	50	250	8 3/4	-
7612	3/8" x 2 3/4"	1 5/8"	1 5/8"	50	250	10 1/2	FM/UL
7613	3/8" x 3"	1 5/8"	1 7/8"	50	250	11	FM/UL
7614	3/8" x 3 1/2"	1 5/8"	2 3/8"	50	250	12	UL
7615	3/8" x 3 3/4"	1 5/8"	2 5/8"	50	250	13	FM/UL
7616	3/8" x 5"	1 5/8"	3 1/8"	50	250	17 1/4	UL
7620	1/2" x 2 3/4"	2 1/4"	1 3/8"	50	200	18	FM/UL
7622	1/2" x 3 3/4"	2 1/4"	2 3/8"	50	200	24	FM/UL
7623	1/2" x 4 1/2"	2 1/4"	3 1/8"	50	200	30	FM/UL
7624	1/2" x 5 1/2"	2 1/4"	4 1/8"	50	150	34	UL
7626	1/2" x 7"	2 1/4"	5 5/8"	25	100	44	FM/UL
7630	5/8" x 3 1/2"	2 3/4"	2"	25	100	40	FM/UL
7632	5/8" x 4 1/2"	2 3/4"	3"	25	100	54	FM/UL
7633	5/8" x 5"	2 3/4"	3 1/2"	25	100	57	UL
7634	5/8" x 6"	2 3/4"	4 1/2"	25	75	64	FM/UL
7636	5/8" x 7"	2 3/4"	5 1/2"	25	75	72	FM/UL
7638	5/8" x 8 1/2"	2 3/4"	7"	25	75	84	UL
7640	3/4" x 4 1/4"	3 3/8"	2 3/8"	20	60	70	UL
7641	3/4" x 4 3/4"	3 3/8"	2 7/8"	20	60	76	UL
7642	3/4" x 5 1/2"	3 3/8"	3 5/8"	20	60	85	FM/UL
7644	3/4" x 6 1/4"	3 3/8"	4 3/8"	20	60	95	UL
7646	3/4" x 7"	3 3/8"	5 1/8"	20	60	105	UL
7648	3/4" x 8 1/2"	3 3/8"	6 5/8"	10	40	120	UL

The published length is the overall length of the anchor. Allow for fixture thickness plus one anchor diameter for the nut and washer thickness when selecting a length.

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