SHOP DRAWING REVIEW FORM AND TRANSMITTAL

DATE: **November 16, 2021**

TO: Carl Hendrickson
Project Manager
Veolia Water
825 West Water Street
Taunton, MA 02780

FROM: Michael Andrus, P.E.
Project Manager
BETA Group, Inc.
701 George Washington Hwy
Lincoln, Rhode Island 02865

RE: City of Taunton, MA
WWTF Phase 1 Improvements
Contract S-2021-1

Shop Drawing No. 11200-01 REV 0 – Lever Operated Skimmer

BETA COMMENTS:

Item	Action Code	Description/Comments
1	**1**	**Lever Operated Skimmer (AMWELL)** 1. Acceptable as submitted.

Action Codes
1 - No Exception Taken
2 - Make Corrections Noted
3 - Amend and Resubmit
4 - Rejected, See Remarks

a. Installation shall proceed only when Action Code is '1' or '2'.
b. Submittals action coded '3' shall be resubmitted within time limit set in Contract.
c. Review does not relieve Contractor from responsibility of compliance with the Contract Documents.

Hart Engineering Corporation

SUBMITTAL:
11200-01

PROJECT: 9900. - Veolia/Taunton WWTF Phase 1 Improvements **DATE: 11/09/2021**

SUBMITTAL: 11200-01 - Lever Operated Skimmer
REVISION: 0
STATUS: Eng
SPEC #: 11200

TO:
Michael Andrus
Beta Group Inc.
6 Blackstone Place
Lincoln, RI 02865
MAndrus@BETA-Inc.com

FROM:
Ryan Murphy
Hart Engineering Corporation
800 Scenic View Drive
Cumberland, RI 02864
rmurphy@hartcompanies.com

Item	Revision	Description	Status	Date Sent	Date Returned
11200-01	0	Lever Operated Skimmer	Eng	11/09/2021	
Notes:					

SHOP DRAWING REVIEW

☑ 1 – Approved ☐ 2 – Approved as Noted
☐ 3 – Revise and Resubmit ☐ 4 - Rejected
☐ 5 – Record File Only – No Action Taken

(Above Check Designates Action Code – See Review Comments)

IMPORTANT NOTE FOR CONTRACTOR

Review is only for general compliance with the design concept and information provided in Contract Documents. Corrections and comments made on the Shop Drawings during review do not relieve the Contractor from compliance with the requirements of the plans and specifications. Review and/or approval of a specific item shall not include review or approval of an assembly of which the item is a component. No approval or correction of a Shop Drawing shall be construed as an order for extra work. The Contractor is responsible for: all quantities and dimensions to be confirmed and correlated; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the Work with that of all trades and subcontractors; and performing all Work in a safe and satisfactory manner.

BETA GROUP, INC. Checked By: BM

By: Mike Andrus Date: 11/16/2021

Additional Notes:

Status Codes
1-APP – No Exceptions Taken
2-ANR – Make Corrections Noted
3-R&R – Revise and Resubmit
4-REJ – Rejected
5-IPO – For Information Purposes Only
6-NRR – Not Required for Review
ENG – Submitted to Engineer

Sincerely,
Hart Engineering Corporation

DATE: 11/09/2021

AMWELL®
A DIVISION OF McNISH CORPORATION

161 S. LINCOLNWAY ST., STE. 310
NORTH AURORA, ILLINOIS 60542
PHONE (630) 898-6900
FAX (630) 898-6901
E-MAIL amwell@amwell-inc.com

November 8, 2021

VIA E-mail: rmurphy@hartcompanies.com
jdeluca@aquasolutionsinc.net

Hart Engineering Corporation
800 Scenic View Drive
Cumberland, RI 02864

Attention: Ryan Murphy

Subject: Taunton, Massachusetts
Waste Water Treatment Plant Phase 1
P.O. No.: 9900.105 & Dated 9/18/2021
Spec. Section 11200 – Lever Operated Skimmer
Model "PSL" Pipe Skimmers
AMWELL S.O. A22140-12
Submittal Details

Dear Mr. Murphy:

In accordance with our proposal 21-0070 we are pleased to submit a pdf copy of the submittal details for the Model "PSL" Pipe Skimmer equipment we are furnishing on the subject project.

Please have one (1) set returned marked with the Engineer's approval for our records.

Feel free to call if you have any questions or if we can be of any further assistance.

Sincerely,

AMWELL®
A Division of McNish Corporation

Arthur L. Benner
Engineering Manager

ALB/jlb

AMWELL®
Aurora, Illinois

TAUNTON, MASSACHUSETTS

WASTEWATER TREATMENT PLANT – PHASE 1
SPEC. SECTION 11200 – LEVER OPERATED SKIMMER
MODEL “PSL” PIPE SKIMMERS

AMWELL S.O. A22140-12

AMWELL®
A DIVISION OF McNISH CORPORATION

161 S. LINCOLNWAY ST., STE. 310
NORTH AURORA, ILLINOIS 60542
PHONE (630) 898-6900
FAX (630) 898-6901
E-MAIL amwell@amwell-inc.com

APPROVAL DETAILS

PROJECT ..... WASTE WATER TREATMENT PLANT – PHASE 1
TAUNTON, MASSACHUSETTS

ENGINEER ..... BETA ENGINEERING

CUSTOMER/CONTRACTOR ..... HART ENGINEERING CORPORATION
800 SCENIC VIEW DRIVE
CUMBERLAND, RI 02864

CONTACT: RYAN MURPHY
PHONE: (774) 218-6296

P.O. NO.: 9900.105 & DATED 9/28/2021

AREA REPRESENTATIVE ..... AQUA SOLUTIONS, INC.
154 WEST GROVE STREET, UNIT D
MIDDLEBORO, MA 02346

CONTACT: JIM DELUCA
PHONE: (508) 947-5777
FAX: (508) 861-0733

SPECIFICATION REFERENCE ..... SECTION 11200 – LEVER OPERATED SKIMMER

AMWELL IDENTIFICATION NO. ..... S.O. A22140-12 – TWO (2) MODEL “PSL” PIPE SKIMMER MECHANISMS

SUBMITTED ..... NOVEMBER 8, 2021

TABLE OF CONTENTS

No. of Pages/Dwg. No.

EQUIPMENT SPECIFICATIONS

APPROVAL SPECIFICATIONS
FOR
MODEL "PSL" LEVER OPERATED SKIMMERS

Project ..... Waste Water Treatment Plant – Phase 1
Taunton, MA

Date ..... November 8, 2021

General Arrangement Drawing D211-84994-768

Number of Units ..... Two (2)

Size ..... 10" diameter x 12'-0" long

EACH UNIT SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:

Pipe..... One (1) 10" diameter SCH 20 (0.250" wall) 316 stainless steel pipe and shall be complete with opening slots cut on a 60° angle as measured on the chord of the arc in 30" intervals with 2" wide stiffening bands. Pipe when tipped shall receive the floating debris.

Wall Bearings..... The open end of the skimmer pipe shall be supported by fabricated 316 stainless steel wall bearing. The wall bearing shall have oversized holes to assist alignment. Each bearing end to have a virgin UHMW-PE bearing bar which assists in the turning of the skimmer pipe. Both ends of the pipe skimmer shall have end bearings unless one (1) end is closed. Bearings with renewable seals and neoprene wall fillers.

End Bracket ..... The closed end of the skimmer pipe shall be supported with an end bracket if the end of the pipe is closed. The end brackets shall be made of fabricated 316 stainless steel with oversized holes to assist alignment. The brackets shall also have a virgin UHMW-PE wear pad fastened to the surfaces contacted by the pipe to aid in turning.

Seal ..... A 1” wide Buna-N seal is provided to keep debris out of the bearing area. The seal is not affected by grease, mild acids or alkalis and is easily replaceable without removing the skimmer pipe from the wall bearing.

Operating Lever ..... Each skimmer pipe shall be provided with a handle of a length suitable for turning the skimmer pipe from the operating floor. The handle shall be 1 1/2” SCH40 316 stainless steel pipe with capped end.

Anchor Bolts ..... One (1) lot of 316 stainless steel anchor bolts, nuts and washers necessary for the equipment furnished.

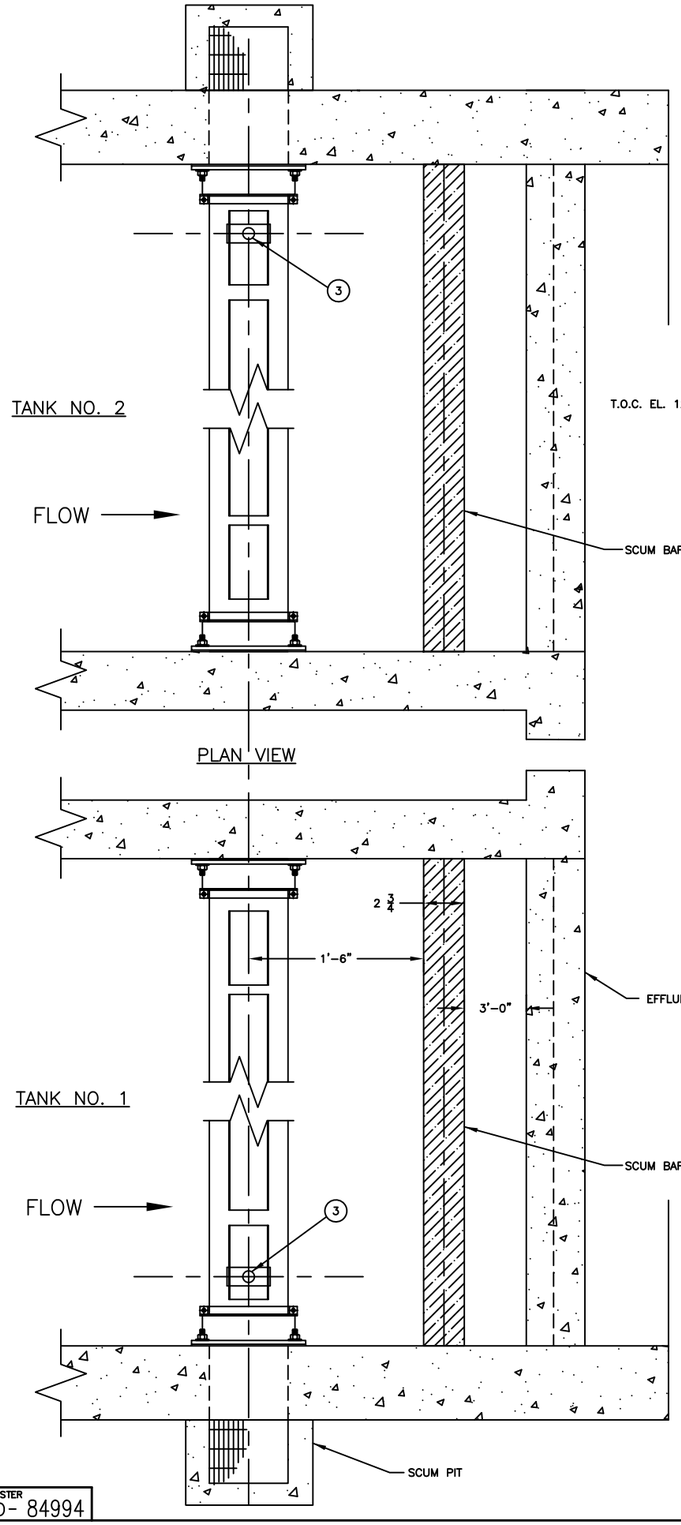
Painting ..... All stainless steel surfaces shall be acid passivated after welding for corrosion resistance and to provide a superior surface finish by full dipping of weldments; or by using an acid passivation paste in the weld and heat affected areas and spray-on acid solutions elsewhere. After passivation, the weldments shall be thoroughly rinsed with clean water and allowed to air dry. Reference ASTM Standards A380-06 and A967-05EL.

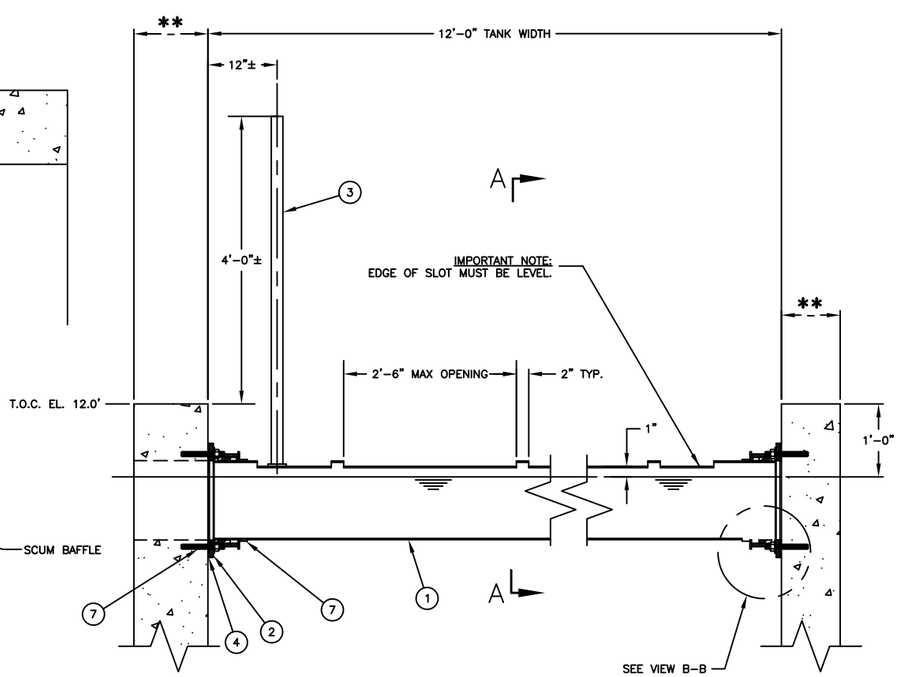
Spare Parts ..... Furnish one (1) set of seals per skimmer.

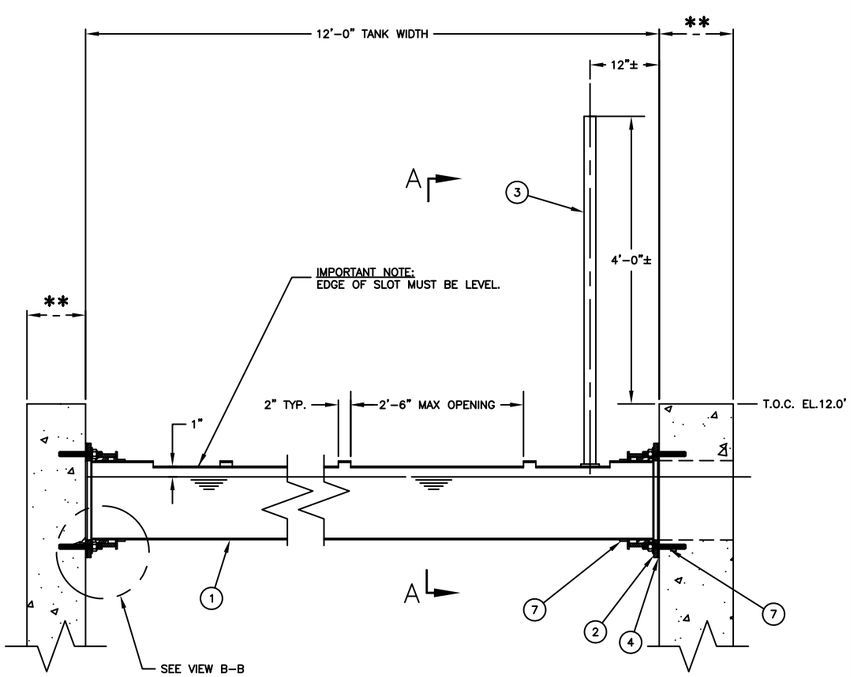
THE FOLLOWING ITEMS ARE NOT FURNISHED BY AMWELL:

Lubricating oils or grease, grease or grease lines, field painting or welding, unloading storage, concrete work, handrail, wall sleeves, connecting elbows or anything not specifically mentioned above.

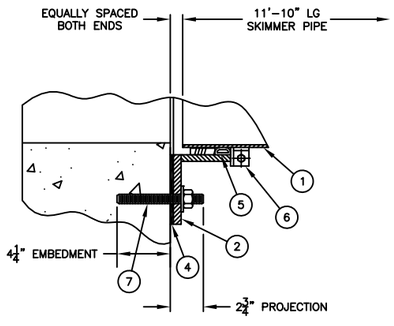
GENERAL ARRANGEMENT DRAWING



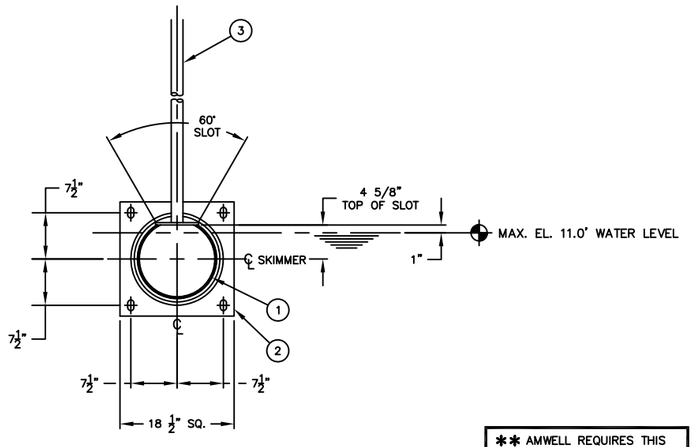




ELEVATION



VIEW B-B



SECTION A-A

NOMENCLATURE

1. SKIMMER PIPE
2. WALL BEARING W/UHMW WEARING BAR
3. 1 1/2" DIA. PIPE OPERATING LEVER
4. GASKET
5. BUNA D SEAL – TYPICAL
6. CLAMP COLLAR
7. 3/4" X 7" LG. 316 S.S. EXPANSION ANCHORS DRILL 3/4" DIA. HOLES X 4 1/2" DEEP (4) PER WALL BEARING

** AMWELL REQUIRES THIS ELEVATION OR DIMENSION

AMWELL REQUIRES ALL TANK DIMENSIONS & ELEVATIONS BE CONFIRMED OR REVISED

PROJECT:
TAUNTON WASTEWATER TREATMENT FACILIY IMPROVEMENTS
TAUNTON, MASSACHUSETTS

MICROFILMED

AMWELL
A Division of McNish Corporation
AURORA, ILLINOIS, USA
(ORIGINALLY AMERICAN WELL WORKS – EST. 1868)

SYM	REVISION	BY	DATE	CHKD
D				
C				
B				
A				

AMWELL FURNISHES MECHANISM TO FIT TANK OF DIMENSIONS GIVEN, BUT IS NOT RESPONSIBLE FOR CONCRETE DESIGN. CUSTOMER TO FURNISH NECESSARY REINFORCING STEEL AND TO DETERMINE SIZE AND PLACEMENT OF FOOTINGS TO SUIT LOCAL CONDITIONS.

AMWELL DOES NOT FURNISH PIPING (EXCEPT AS NOTED) FLOOR RAILS, TROUGHS, GRATINGS, WEIR PLATES, OIL OR GREASE FOR LUBRICATION, ANY WIRING OR CONDUITS BETWEEN MOTORS, CONTROLS AND ALARMS OR ANY ELECTRICAL EQUIPMENT OF ANY KIND EXCEPT AS SPECIFICALLY STATED IN AMWELL SPECIFICATIONS.

DRAWN	PSP
CHECKED	
APP'D.	
DATE	11-03-21
S.O.	A22140-12
SCALE	NONE

DESCRIPTION: GENERAL ARRANGEMENT
MODEL 'PSL' 10" PIPE SKIMMER

DRAWING NO. D,2,1,1|8,4,9,9,4|7,6,8 REV.

MASTER D- 84994

CAD FILE: D84994 PLOT SCALE = 0.0833

EXPANSION ANCHOR INFORMATION

Power-Stud+® SD4 & SD6

Stainless Steel Wedge Expansion Anchors

- **Consistent performance in high & low strength concrete**
- **Nominal bit size matches anchor diameter; anchor can be installed through standard fixture holes**
- **Allows follow-up expansion after setting under tensile loading**
- **Now Available in 3/4"**

NEW!

Powers®

FASTENING INNOVATIONS

Power-Stud+® SD4 & SD6

Stainless Steel Wedge Expansion Anchor

THREAD VERSION
UNC Threaded stud

ANCHOR MATERIALS
Stainless steel body and expansion clip, nut and washer

ANCHOR SIZE RANGE (TYP.)
1/4" diameter through 3/4" diameter

SUITABLE BASE MATERIALS
Normal-weight concrete
Sand-lightweight concrete
Grouted Concrete Masonry

This Product Available In

PDA®

Powers Design Assist
Real Time Anchor Design Software
www.powersdesignassist.com

CODE LISTED
ICC-ES ESR-2502
CONCRETE

PRODUCT DESCRIPTION

The Power-Stud+ SD4 and Power-Stud+ SD6 anchors are fully threaded, torque-controlled, stainless steel wedge expansion anchors which are designed for consistent performance in cracked and uncracked concrete. Suitable base materials are normal-weight, sand-lightweight concrete, and grouted concrete masonry (CMU). The anchor is manufactured with a stainless steel body and expansion clip. Nut and washer are included.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related and common attachments
- Interior and exterior applications
- Tension zone applications, i.e., cable trays and strut, pipe supports, fire sprinklers

FEATURES AND BENEFITS

- Knurled mandrel design provides consistent performance in cracked concrete and helps prevent galling during service life.
- Nominal drill bit size is the same as the anchor diameter
- Anchor can be installed through standard clearance fixture holes
- Length ID code and identifying marking stamped on head of each anchor
- Anchor design allows for follow-up expansion after setting under tensile loading
- Corrosion resistant stainless steel anchors
- Domestically manufactured by request, call for details

APPROVALS AND LISTINGS

International Code Council Evaluation Service (ICC-ES), ESR-2502 for cracked and uncracked concrete [2012 IBC & IRC, 2009 IBC & IRC, and 2006 IBC & IRC]

Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318 (Strength Design method using Appendix D)

Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (Category 1 anchors)

GUIDE SPECIFICATIONS

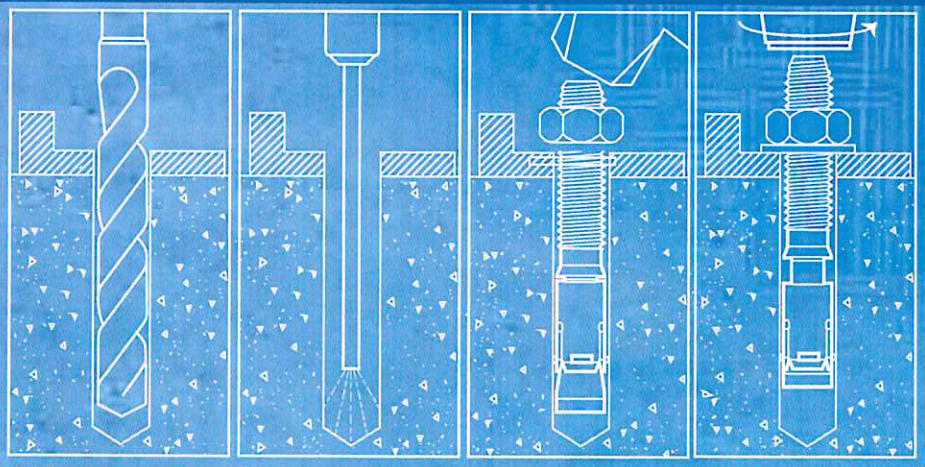
CSI Divisions: 031600-Concrete Anchors, 04 05 19.16 - Masonry Anchors and 050519 Post-installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD4 and Power-Stud+ SD6 as supplied by Powers Fasteners, Inc., Brewster, NY. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor component	Specification	
	SD4[1]	SD6[1]
Anchor body	Type 304 Stainless Steel	Type 316 Stainless Steel
Washer	300 Series Stainless Steel	Type 316 Stainless Steel
Hex Nut	Type 316 Stainless Steel	
Expansion wedge (clip)	Type 316 Stainless Steel	

1. Domestically manufactured anchors are available upon request (see ordering information for details).

INSTALLATION INSTRUCTIONS



Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.

Step 2
Remove dust and debris from the hole using a hand pump, compressed air or a vacuum to remove loose particles left from drilling.

Step 3
Position the supplied washer on the anchor and thread on the supplied nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth.

Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

Length Identification		
Mark	From	Up to but not including
A	1-1/2"	2"
B	2"	2-1/2"
C	2-1/2"	3"
D	3"	3-1/2"
E	3-1/2"	4"
F	4"	4-1/2"
G	4-1/2"	5"
H	5"	5-1/2"
I	5-1/2"	6"
J	6"	6-1/2"
K	6-1/2"	7"
L	7"	7-1/2"
M	7-1/2"	8"
N	8"	8-1/2"
O	8-1/2"	9"
P	9"	9-1/2"
Q	9-1/2"	10"
R	10"	10-1/2"

Length identification mark indicates overall length of anchor.

REFERENCE DATA (ASD)

Installation Table for Power-Stud+ SD4 & Power-Stud+ SD6

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.25 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)	9/16 (14.3)	11/16 (17.5)	13/16 (20.6)
Minimum embedment depth	h_{nom}	in. (mm)	1-3/4 (44)	1-7/8 (48)	2-1/2 (64)	3-1/4 (83)	3-3/4 (95)
Minimum hole depth	h_o	in. (mm)	1-7/8 (48)	2 (51)	2-5/8 (67)	3-1/2 (89)	4 (102)
Installation torque	T_{inst}	ft.-lbf. (N-m)	6 (8)	25 (34)	40 (54)	60 (81)	110 (149)
Torque wrench/socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8
Nut height	-	in.	7/32	21/64	7/16	35/64	41/64

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

Head Marking

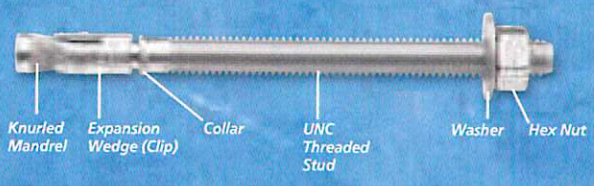
Legend

Letter Code = Length Identification Mark

'+' Symbol = Strength Design Compliant Anchor (see ordering information, symbol not on 1/4" diameter anchors)

Number Code = Stainless Steel Body Type (4, or 6)

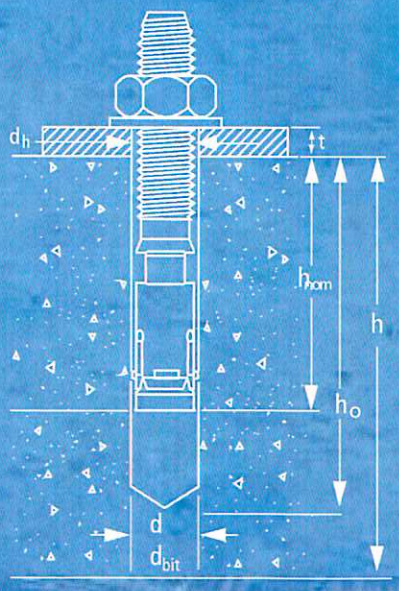
Anchor Assembly



ASD Installation Detail

Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
h = Base material thickness
The minimum value of h should be $1.5h_{nom}$ or 3" whichever is greater
h_{nom} = Minimum embedment depth



Power-Stud+® SD4 & SD6

REFERENCE DATA (ASD)

Ultimate Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter in.	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	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	1-1/8 (29)	1,095 (4.9)	2,135 (9.5)	1,200 (5.3)	2,135 (9.5)	1,390 (6.2)	2,135 (9.5)	1,455 (6.5)	2,135 (9.5)	1,680 (7.5)	2,135 (9.5)
	1-3/4 (44)	1,890 (8.4)	2,135 (9.5)	2,070 (9.2)	2,135 (9.5)	2,390 (10.6)	2,135 (9.5)	2,480 (11.0)	2,135 (9.5)	2,480 (11.0)	2,135 (9.5)
3/8	1-3/8 (41)	1,530 (6.8)	2,745 (12.2)	1,680 (7.5)	2,745 (12.2)	1,940 (8.6)	2,745 (12.2)	2,520 (11.2)	2,745 (12.2)	2,910 (12.9)	2,745 (12.2)
	1-7/8 (48)	2,790 (12.4)	2,745 (12.2)	3,060 (13.6)	2,745 (12.2)	3,530 (15.7)	2,745 (12.2)	4,195 (18.7)	2,745 (12.2)	4,840 (21.5)	2,745 (12.2)
	3 (76)	4,700 (20.9)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)	4,895 (21.8)	2,745 (12.2)
1/2	1-7/8 (48)	2,745 (12.2)	5,090 (22.6)	3,010 (13.4)	5,090 (22.6)	3,475 (15.5)	5,090 (22.6)	4,525 (20.1)	5,090 (22.6)	5,230 (23.3)	5,090 (22.6)
	2-3/8 (60)	5,370 (23.9)	5,090 (22.6)	5,880 (26.2)	5,090 (22.6)	6,790 (30.2)	5,090 (22.6)	6,790 (30.2)	5,090 (22.6)	7,845 (34.9)	5,090 (22.6)
	3-3/4 (95)	8,840 (39.3)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)	9,300 (41.4)	5,090 (22.6)
5/8	2-1/2 (64)	5,015 (22.3)	9,230 (41.1)	5,495 (24.4)	9,230 (41.1)	6,345 (28.2)	9,230 (41.1)	7,250 (32.2)	9,230 (41.1)	8,370 (37.2)	9,230 (41.1)
	3-1/4 (83)	6,760 (30.1)	9,230 (41.1)	7,405 (32.9)	9,230 (41.1)	8,560 (38.1)	9,230 (41.1)	9,615 (42.8)	9,230 (41.1)	11,105 (49.4)	9,230 (41.1)
	4-3/4 (121)	10,550 (46.9)	9,230 (41.1)	11,555 (51.4)	9,230 (41.1)	13,345 (59.4)	9,230 (41.1)	14,560 (64.8)	9,230 (41.1)	14,560 (64.8)	9,230 (41.1)
3/4	3-3/8 (86)	6,695 (29.8)	11,255 (50.1)	7,330 (32.6)	12,625 (56.2)	8,465 (37.7)	14,580 (64.9)	9,705 (43.2)	15,440 (68.7)	11,210 (49.9)	15,440 (68.7)
	4-1/2 (114)	10,800 (48.0)	15,440 (68.7)	11,830 (52.6)	15,440 (68.7)	13,575 (60.4)	15,440 (68.7)	17,110 (76.1)	15,440 (68.7)	19,760 (87.9)	15,440 (68.7)
	5-5/8 (143)	11,730 (52.2)	15,440 (68.7)	12,850 (57.2)	15,440 (68.7)	13,575 (60.4)	15,440 (68.7)	19,710 (87.7)	15,440 (68.7)	21,705 (96.5)	15,440 (68.7)

1. Tabulated load values are for anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working loads.

REFERENCE DATA (ASD)

Allowable Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	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	1-1/8 (28)	275 (1.2)	535 (2.4)	300 (1.3)	535 (2.4)	350 (1.6)	535 (2.4)	365 (1.6)	535 (2.4)	420 (1.9)	535 (2.4)
	1-3/4 (44)	475 (2.1)	535 (2.4)	520 (2.3)	535 (2.4)	600 (2.7)	535 (2.4)	620 (2.8)	535 (2.4)	620 (2.8)	535 (2.4)
3/8	1-3/8 (41)	385 (1.7)	685 (3.0)	420 (1.9)	685 (3.0)	485 (2.2)	685 (3.0)	630 (2.8)	685 (3.0)	730 (3.2)	685 (3.0)
	1-7/8 (60)	700 (3.1)	685 (3.0)	765 (3.4)	685 (3.0)	885 (3.9)	685 (3.0)	1,050 (4.7)	685 (3.0)	1,210 (5.4)	685 (3.0)
	3 (60)	1,175 (5.2)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)	1,225 (5.4)	685 (3.0)
1/2	1-7/8 (57)	685 (3.0)	1,275 (5.7)	755 (3.4)	1,275 (5.7)	870 (3.9)	1,275 (5.7)	1,130 (5.0)	1,275 (5.7)	1,310 (5.8)	1,275 (5.7)
	2-3/8 (64)	1,345 (6.0)	1,275 (5.7)	1,470 (6.5)	1,275 (5.7)	1,700 (7.6)	1,275 (5.7)	1,700 (7.6)	1,275 (5.7)	1,960 (8.7)	1,275 (5.7)
	3-3/4 (95)	2,210 (9.8)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)	2,325 (10.3)	1,275 (5.7)
5/8	2-1/2 (70)	1,255 (5.6)	2,310 (10.3)	1,375 (6.1)	2,310 (10.3)	1,585 (7.1)	2,310 (10.3)	1,815 (8.1)	2,310 (10.3)	2,095 (9.3)	2,310 (10.3)
	3-1/4 (86)	1,690 (7.5)	2,310 (10.3)	1,850 (8.2)	2,310 (10.3)	2,140 (9.5)	2,310 (10.3)	2,405 (10.7)	2,310 (10.3)	2,775 (12.3)	2,310 (10.3)
	4-3/4 (117)	2,640 (11.7)	2,310 (10.3)	2,890 (12.9)	2,310 (10.3)	3,335 (14.8)	2,310 (10.3)	3,640 (16.2)	2,310 (10.3)	3,640 (16.2)	2,310 (10.3)
3/4	3-3/8 (86)	1,675 (7.5)	2,815 (12.5)	1,835 (8.2)	3,155 (14.0)	2,115 (9.4)	3,645 (16.2)	2,425 (10.8)	3,860 (17.2)	2,805 (12.5)	3,860 (17.2)
	4-1/2 (114)	2,700 (12.0)	3,860 (17.2)	2,960 (13.2)	3,860 (17.2)	3,395 (15.1)	3,860 (17.2)	4,280 (19.0)	3,860 (17.2)	4,940 (22.0)	3,860 (17.2)
	5-5/8 (143)	2,935 (13.1)	3,860 (17.2)	3,215 (14.3)	3,860 (17.2)	3,395 (15.1)	3,860 (17.2)	4,930 (21.9)	3,860 (17.2)	5,425 (24.1)	3,860 (17.2)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

Power-Stud+® SD4 & SD6

REFERENCE DATA (ASD)

Spacing Distance and Edge Distance Adjustment Factors for Normal Weight Concrete - Tension (F_{NS}, F_{NC})

Spacing Reduction Factors - Tension (F_{NS})						
Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Minimum Spacing, s_{min} (in)		2	3	3	5	5
Spacing Distance (inches)	1-3/4	-	-	-	-	-
	2	0.79	-	-	-	-
	2-1/4	0.81	-	-	-	-
	2-1/2	0.83	-	-	-	-
	2-3/4	0.85	-	-	-	-
	3	0.87	0.87	0.82	-	-
	3-1/2	0.91	0.91	0.85	-	-
	4	0.96	0.96	0.88	-	-
	4-1/2	1.00	1.00	0.91	-	-
	5	1.00	1.00	0.94	0.85	0.76
	5-1/2	1.00	1.00	0.97	0.87	0.78
	6	1.00	1.00	1.00	0.90	0.80
	6-1/2	1.00	1.00	1.00	0.92	0.82
	7	1.00	1.00	1.00	0.94	0.84
	7-1/2	1.00	1.00	1.00	0.97	0.86
	8	1.00	1.00	1.00	0.99	0.87
	8-1/4	1.00	1.00	1.00	1.00	0.88
	8-1/2	1.00	1.00	1.00	1.00	0.89
	9	1.00	1.00	1.00	1.00	0.91
	9-1/2	1.00	1.00	1.00	1.00	0.93
	10	1.00	1.00	1.00	1.00	0.95
	10-1/2	1.00	1.00	1.00	1.00	0.97
	11	1.00	1.00	1.00	1.00	0.99
	11-1/4	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors- Tension (F_{NC})						
Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Critical Edge Distance, c_{ac} (in)		5	5	7-1/2	9-1/2	9
Min. Edge Distance, c_{min} (in)		1-3/4	3	3	4-1/2	5
Edge Distance (inches)	1-1/2	-	-	-	-	-
	1-3/4	0.35	-	-	-	-
	2	0.40	-	-	-	-
	2-1/4	0.45	-	-	-	-
	2-1/2	0.50	-	-	-	-
	2-3/4	0.55	-	-	-	-
	3	0.60	0.60	0.40	-	-
	3-1/2	0.70	0.70	0.47	-	-
	4	0.80	0.80	0.53	-	-
	4-1/2	0.90	0.90	0.60	0.47	-
	5	1.00	1.00	0.67	0.53	0.56
	5-1/2	1.00	1.00	0.73	0.58	0.61
	6	1.00	1.00	0.80	0.63	0.67
	6-1/2	1.00	1.00	0.87	0.68	0.72
	7	1.00	1.00	0.93	0.74	0.78
	7-1/2	1.00	1.00	1.00	0.79	0.83
	8	1.00	1.00	1.00	0.84	0.89
	8-1/2	1.00	1.00	1.00	0.89	0.94
	9	1.00	1.00	1.00	0.95	1.00
	9-1/2	1.00	1.00	1.00	1.00	1.00

Spacing Distance and Edge Distance Adjustment Factors for Normal Weight Concrete - Shear (F_{VS}, F_{VC})

Spacing Reduction Factors - Shear (F_{VS})						
Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Minimum Spacing, s_{min} (in)		2	3	3	5	5
Spacing Distance (inches)	1-3/4	-	-	-	-	-
	2	0.87	-	-	-	-
	2-1/4	0.88	-	-	-	-
	2-1/2	0.90	-	-	-	-
	2-3/4	0.91	-	-	-	-
	3	0.92	0.92	0.89	-	-
	3-1/2	0.95	0.95	0.91	-	-
	4	0.97	0.97	0.93	-	-
	4-1/2	1.00	1.00	0.95	-	-
	5	1.00	1.00	0.96	0.91	0.84
	5-1/2	1.00	1.00	0.98	0.93	0.85
	6	1.00	1.00	1.00	0.94	0.86
	6-1/2	1.00	1.00	1.00	0.95	0.88
	7	1.00	1.00	1.00	0.97	0.89
	7-1/2	1.00	1.00	1.00	0.98	0.90
	8	1.00	1.00	1.00	0.99	0.92
	8-1/4	1.00	1.00	1.00	1.00	0.92
	8-1/2	1.00	1.00	1.00	1.00	0.93
	9	1.00	1.00	1.00	1.00	0.94
	9-1/2	1.00	1.00	1.00	1.00	0.95
	10	1.00	1.00	1.00	1.00	0.97
	10-1/2	1.00	1.00	1.00	1.00	0.98
	11	1.00	1.00	1.00	1.00	0.99
	11-1/4	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})						
Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Min. Edge Distance, c_{min} (in)		1-3/4	3	3	4-1/2	5
Edge Distance (inches)	1-1/2	-	-	-	-	-
	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/4	0.50	-	-	-	-
	2-1/2	0.56	-	-	-	-
	2-3/4	0.61	-	-	-	-
	3	0.67	0.67	-	-	-
	3-1/2	0.78	0.78	-	-	-
	4	0.89	0.89	-	-	-
	4-1/2	1.00	1.00	-	0.55	-
	5	1.00	1.00	-	0.61	0.44
	5-1/2	1.00	1.00	-	0.67	0.49
	6	1.00	1.00	1.00	0.73	0.53
	6-1/2	1.00	1.00	1.00	0.79	0.58
	7	1.00	1.00	1.00	0.85	0.62
	7-1/2	1.00	1.00	1.00	0.91	0.67
	8	1.00	1.00	1.00	0.97	0.71
	8-1/4	1.00	1.00	1.00	1.00	0.73
	8-1/2	1.00	1.00	1.00	1.00	0.76
	9	1.00	1.00	1.00	1.00	0.80
	9-1/2	1.00	1.00	1.00	1.00	0.84
	10	1.00	1.00	1.00	1.00	0.89
	10-1/2	1.00	1.00	1.00	1.00	0.93
	11	1.00	1.00	1.00	1.00	0.98
	11-1/4	1.00	1.00	1.00	1.00	1.00

PERFORMANCE DATA

Ultimate Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 installed into the Face of Grout Filled Concrete Masonry[1,2]

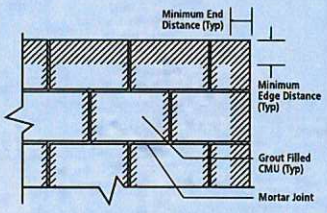
Nominal Anchor Diameter in.	Minimum Embedment h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Tension Load lb (kN)	Direction of Shear Loading	Ultimate Shear Load lb (kN)
1/2	2-3/8 (60)	3 (76.2)	3 (76.2)	1,695 (7.5)	Any	2,080 (9.3)
		12 (304.8)	12 (304.8)	2,425 (10.8)	Any	4,905 (21.8)
5/8	3-1/4 (83)	12 (304.8)	12 (304.8)	5,565 (24.8)	Any	7,944 (35.3)

1. Tabulated load values are for anchors installed in minimum 8 inch wide, minimum Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Stud+ SD4 and Power-Stud+ SD6 installed into the Face of Grout Filled Concrete Masonry[1,2,3,4,5]

Nominal Anchor Diameter in.	Minimum Embedment h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Allowable Tension Load lb (kN)	Direction of Shear Loading	Allowable Shear Load lb (kN)
1/2	2-3/8 (60)	3 (76.2)	3 (76.2)	340 (1.5)	Any	415 (1.8)
		12 (304.8)	12 (304.8)	485 (2.2)	Any	980 (4.4)
5/8	3-1/4 (83)	12 (304.8)	12 (304.8)	1,115 (5.0)	Any	1,590 (7.1)

1. Tabulated load values are for anchors installed in minimum 8 inch wide, minimum Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
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 upon the application such as life safety.
3. The tabulated values are applicable for anchors installed in grouted masonry wall faces at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to a minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied a reduction factor of 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.
4. Anchors may be installed in the grouted cells and in cell webs and bed joints not closer than 1-3/8" from head joints. The minimum edge and end distances must also be maintained.
5. Allowable tension values for anchors installed into bed joints of grouted masonry wall faces with a minimum of 12" edge and end distance may be increased by 20 percent for the 1/2-inch diameter and 10 percent for the 5/8-inch diameter.



Wall Face
Permissible Anchor Locations
(Un-hatched Area)

Power-Stud+® SD4 & SD6

STRENGTH DESIGN (SD)

CODE LISTED
ICC-ES ESR-2502

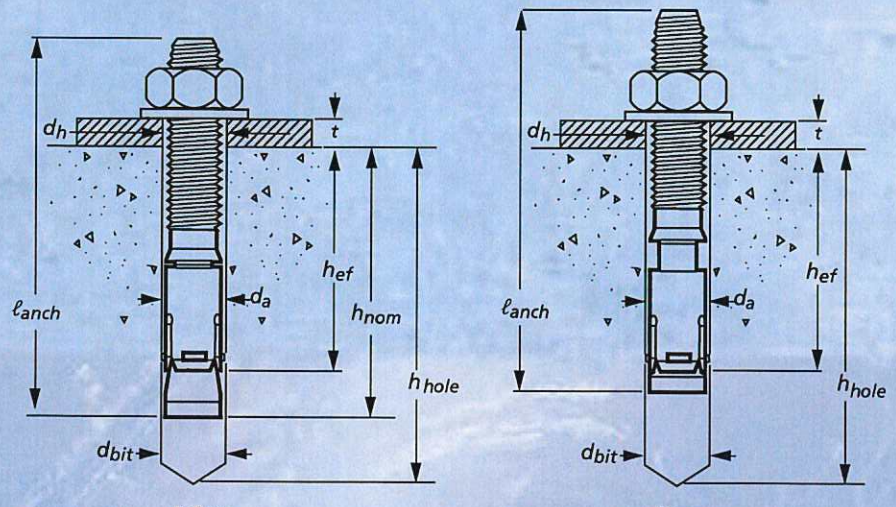
Strength Design Installation Table for Power-Stud+ SD4 and Power-Stud+ SD6[1,4]

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter									
			1/4	3/8		1/2		5/8		3/4		
Anchor outside diameter	d_a [d_o][5]	in. (mm)	0.250 (6.4)	0.375 (9.5)		0.500 (12.7)		0.625 (15.9)		0.750 (19.1)		
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)		9/16 (14.3)		11/16 (17.5)		13/16 (20.6)		
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI		1/2 ANSI		5/8 ANSI		3/4 ANSI		
Minimum nominal embedment depth[2]	h_{nom}	in. (mm)	1-3/4 (44)	1-7/8 (48)		2-1/2 (64)		3-1/4 (83)		4-1/2 (114)		
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	1.50 (38)		2.00 (51)		2.75 (70)		3-3/4 (95)		
Minimum hole depth	h_{hole}	in. (mm)	1-7/8 (48)	2 (51)		2-5/8 (67)		3-1/2 (89)		4-3/4 (121)		
Minimum member thickness	h_{min}	in. (mm)	3-1/4 (83)	3-1/4 (83)	4 (102)	4 (102)		5 (127)		6 (152)		
Minimum overall anchor length[3]	l_{anch}	in. (mm)	2-1/4 (57)	2-3/4 (70)		3-3/4 (95)		4-1/2 (114)		5-1/2 (140)		
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (44)	3 (76)	3-1/2 (89)	6 (152)	3 (76)	4-1/2 (114)	8-1/2 (216)	5 (127)	9 (229)	
Minimum spacing distance	s_{min}	in. (mm)	2 (51)	5-1/2 (140)	3 (76)	3 (76)	6 (152)	8-1/2 (216)	5 (127)	9 (229)	5 (127)	
Critical edge distance	c_{ac}	in. (mm)	5 (127)	5 (127)		7-1/2 (191)		9-1/2 (241)		9 (229)		
Installation torque	T_{inst}	ft.-lbf. (N-m)	6 (8)	25 (34)		40 (54)		60 (81)		110 (149)		
Torque wrench/socket size	-	in.	7/16	9/16		3/4		15/16		1-1/8		
Nut height	-	in.	7/32	21/64		7/16		35/64		41/64		

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m.

1. The information presented in this table is to be used in conjunction with ACI 318 Appendix D.
2. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
3. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth and possible fixture attachment.
4. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with the following: the 1/4-inch diameter anchors must be installed in uncracked normal-weight or sand-lightweight concrete; 3/8-inch to 3/4-inch diameter anchors must be installed in cracked and uncracked normal-weight or sand-lightweight concrete over steel deck having a minimum specified compressive strength, f'c, of 3,000 psi (20.7 MPa) provided the concrete thickness above the upper flute meets the minimum thickness specified in this table.
5. The notation in brackets is for the 2006 IBC.

Power-Stud+ SD4 & Power-Stud+ SD6 Anchor Detail



STRENGTH DESIGN (SD)

CODE LISTED
ICC-ES ESR-2502

Tension Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318, Section 9.2)[1,7]

Design Characteristic	Notation	Units	Nominal Anchor Diameter				
			1/4	3/8	1/2	5/8	3/4
Anchor category	1,2 or 3	-	1	1	1	1	1
Nominal embedment depth	h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN TENSION[4]							
Minimum specified yield strength (neck)	f_y	ksi (N/mm²)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate tensile strength (neck)	f_{uta}	ksi (N/mm²)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (neck)	$A_{se,N}$ [A_{sa}][9]	in² (mm²)	0.0249 (16.1)	0.0530 (34.2)	0.1020 (65.8)	0.1630 (105.2)	0.2380 (151)
Steel strength in tension	N_{sa}	lb (kN)	2,240 (10.0)	4,780 (21.3)	9,160 (40.8)	14,635 (65.1)	21,380 (95.1)
Reduction factor for steel strength[2]	ϕ	-	0.75				
CONCRETE BREAKOUT STRENGTH IN TENSION							
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	1.50 (38)	2.00 (51)	2.75 (70)	3.75 (95)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24	24	24
Effectiveness factor for cracked concrete	k_{cr}	-	Not Applicable	17	21	21	21
Modification factor for cracked and uncracked concrete	$\psi_{c,N}$	-	1.0 See Note 4	1.0 See Note 4	1.0 See Note 4	1.0 See Note 4	1.0 See Note 4
Critical edge distance (uncracked concrete only)	c_{ac}	in. (mm)	5 (127)	5 (127)	7-1/2 (191)	9-1/2 (241)	9 (229)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)							
Characteristic pullout strength, uncracked concrete (2,500 psi)[5]	$N_{p,uncr}$	lb (kN)	1,510 (6.7)	See Note 6	See Note 6	See Note 6	8,520 (37.8)
Characteristic pullout strength, cracked concrete (2,500 psi)[5]	$N_{p,cr}$	lb (kN)	Not Applicable	See Note 6	See Note 6	See Note 6	See Note 6
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS8							
Characteristic pullout strength, seismic (2,500 psi)[5,8]	$N_{p,eq}$	lb (kN)	Not Applicable	1,645 (7.3)	See Note 6	See Note 6	See Note 6
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)				

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m; 1 ksi = 6.894 N/mm²; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D; for anchors resisting seismic load combinations the additional requirements of ACI 318 D.3.3 shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.5). The anchors are ductile steel elements as defined in ACI 318 D.1.
3. The tabulated value of ϕ for concrete breakout strength and pullout strength applies when both the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4). If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 or -05 D.4.5).
4. For all design cases $\psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
5. For all design cases $\psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500psi, N_{pn} = (pullout strength value from table)*(specified concrete strength/2500)$^{0.5}$.
6. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
7. Anchors are permitted to be used in sand-lightweight concrete provided that the modification factor λ_a (ACI 318-11) or λ (ACI 318-08) for concrete breakout strength is taken as 0.6 in lieu of ACI 318-11 D.3.6 (2012 IBC) or ACI 318-08 D.3.4 (2009 IBC). In addition, the pullout strength $N_{p,cr}$, $N_{p,eq}$, $N_{p,uncr}$ must be multiplied by 0.6, as applicable. For ACI 318-05, the values N_b, $N_{p,eq}$, $N_{p,cr}$, $N_{p,uncr}$ and V_b must be multiplied by 0.6.
8. Tabulated values for characteristic pullout strength in tension are for seismic applications and based on test results per ACI 355.2 Section 9.5.
9. The notation in brackets is for the 2006 IBC.

Power-Stud+® SD4 & SD6

STRENGTH DESIGN (SD)

CODE LISTED
ICC-ES ESR-2502

Tension Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318, Section 9.2)[1,7]

Design Characteristic	Notation	Units	Nominal Anchor Diameter				
			1/4	3/8	1/2	5/8	3/4
Anchor category	1,2 or 3	-	1	1	1	1	1
Nominal embedment depth	h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN TENSION[4]							
Minimum specified yield strength (neck	f_y	ksi (N/mm²)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate tensile strength (neck)	f_{uta}	ksi (N/mm²)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (neck)	$A_{se,N}$ [A_{sa}][9]	in² (mm²)	0.0249 (16.1)	0.0530 (34.2)	0.1020 (65.8)	0.1630 (105.2)	0.2380 (151)
Steel strength in tension	N_{sa}	lb (kN)	2,240 (10.0)	4,780 (21.3)	9,160 (40.8)	14,635 (65.1)	21,380 (95.1)
Reduction factor for steel strength[2]	ϕ	-	0.75				
CONCRETE BREAKOUT STRENGTH IN TENSION							
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	1.50 (38)	2.00 (51)	2.75 (70)	3.75 (95)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24	24	24
Effectiveness factor for cracked concrete	k_{cr}	-	Not Applicable	17	21	21	21
Modification factor for cracked and uncracked concrete	$\psi_{c,N}$	-	1.0 See Note 4	1.0 See Note 4	1.0 See Note 4	1.0 See Note 4	1.0 See Note 4
Critical edge distance (uncracked concrete only)	c_{ac}	in. (mm)	5 (127)	5 (127)	7-1/2 (191)	9-1/2 (241)	9 (229)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)							
Characteristic pullout strength, uncracked concrete (2,500 psi)[5]	$N_{p,uncr}$	lb (kN)	1,510 (6.7)	See Note 6	See Note 6	See Note 6	8,520 (37.8)
Characteristic pullout strength, cracked concrete (2,500 psi)[5]	$N_{p,cr}$	lb (kN)	Not Applicable	See Note 6	See Note 6	See Note 6	See Note 6
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8]							
Characteristic pullout strength, seismic (2,500 psi)[5,8]	$N_{p,eq}$	lb (kN)	Not Applicable	1,645 (7.3)	See Note 6	See Note 6	See Note 6
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)				

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m; 1 ksi = 6.894 N/mm²; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D; for anchors resisting seismic load combinations the additional requirements of ACI 318 D.3.3 shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.5). The anchors are ductile steel elements as defined in ACI 318 D.1.
3. The tabulated value of ϕ for concrete breakout strength and pullout strength applies when both the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4). If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 or -05 D.4.5).
4. For all design cases $\psi_{c,N}$ = 1.0. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
5. For all design cases $\psi_{c,P}$ = 1.0. For concrete compressive strength greater than 2,500psi, N_{pn} = (pullout strength value from table)*(specified concrete strength/2500)$^{0.5}$.
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8. Tabulated values for characteristic pullout strength in tension are for seismic applications and based on test results per ACI 355.2 Section 9.5.
9. The notation in brackets is for the 2006 IBC.