

**Power-Stud+™ SD1 Wedge Expansion Anchor**

**PRODUCT DESCRIPTION**

The Power-Stud+ SD1 anchor is a fully threaded, torque-controlled, wedge expansion anchor which is designed for consistent performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete, structural sand-lightweight concrete and concrete over steel deck. The anchor is manufactured with a zinc plated carbon steel body and expansion clip. Nut and washer are included.

**GENERAL APPLICATIONS AND USES**

- Structural connections, i.e., beam and column anchorage
- Safety-related attachments
- Interior applications / low level corrosion environment
- Tension zone applications, i.e., cable trays and strut, pipe supports, fire sprinklers
- Seismic and wind loading

**FEATURES AND BENEFITS**

- + Consistent performance in high and low strength concrete
- + Nominal drill bit size is the same as the anchor diameter
- + Anchor can be installed through standard 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

**APPROVALS AND LISTINGS**

International Code Council, Evaluation Service (ICC-ES), ESR-2818 for concrete  
Code compliant with the 2009 IBC, 2009 IRC, 2006 IBC, 2006 IRC, 2003 IBC, 2003 IRC and 1997 UBC  
International Code Council, Evaluation Service (ICC-ES), ESR-2966 for masonry Code compliant with the 2006 IBC, 2006 IRC, 2003 IBC, 2003 IRC, 2000 IBC, and 1997 UBC  
Tested in accordance with ACI 355.2 and ICC-ES AC 193 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)  
FM Global (Factory Mutual) - File No. 3033795, 3/8" and 1/2" diameters Pipe hanger components for automatic sprinkler systems  
Underwriters Laboratories (UL Listed) - File No. EX1289. See listing for sizes.

**GUIDE SPECIFICATIONS**

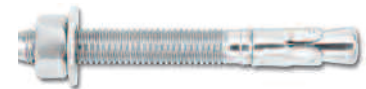
**CSI Divisions:** 03151-Concrete Anchoring, 04081-Masonry Anchorage and 05090-Metal Fastenings.  
Expansion anchors shall be Power-Stud+ SD1 as supplied by Powers Fasteners, Inc., Brewster, NY.  
Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

**MATERIAL SPECIFICATIONS**

Anchor component	Specification
Anchor body	Medium carbon steel
Hex nut	Carbon steel, ASTM A 563, Grade A
Washer	Carbon steel, ASTM F 844; meets dimensional requirements of ANSI B18.22.2, Type A plain
Expansion wedge (clip)	Carbon steel
Plating	Zinc plating according to ASTM B 633, SC1, Type III (Fe/Zn 5) Minimum plating requirement for Mild Service Condition

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**Power-Stud+ SD1 Assembly**

**THREAD VERSION**

UNC threaded stud

**ANCHOR MATERIALS**

Zinc plated carbon steel body and expansion clip, nut and washer

**ANCHOR SIZE RANGE (TYP.)**

1/4" diameter (uncracked concrete only)  
 3/8" diameter through 1-1/4" diameter

**SUITABLE BASE MATERIALS**

Normal-weight concrete  
 Structural sand-lightweight concrete  
 Concrete over steel deck  
 Grouted concrete masonry (CMU)



This Product Available In



**Powers Design Assist**  
 Real Time Anchor Design Software  
[www.powersdesignassist.com](http://www.powersdesignassist.com)

**INSTALLATION SPECIFICATIONS**

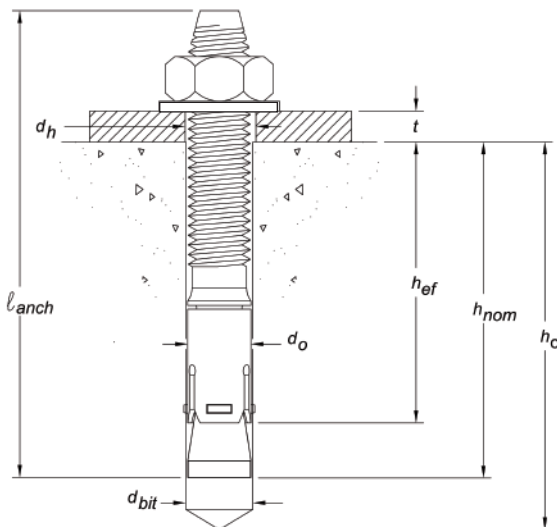
**Installation Table for Power-Stud+ SD1<sup>1</sup>**

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter									
			1/4	3/8	1/2		5/8		3/4	7/8	1	1-1/4
Anchor diameter	$d_o$	in. (mm)	0.25 (6.4)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)		0.75 (19.1)	0.875 (22.2)	1 (25.4)	1.25 (31.8)
Minimum diameter of hole clearance in fixture	$d_h$	in. (mm)	5/16 (7.5)	7/16 (11.1)	9/16 (14.3)		11/16 (17.5)		13/16 (20.6)	15/16 (23.8)	1-1/8 (28.6)	1-3/8 (34.9)
Nominal drill bit diameter	$d_{bit}$	in. (mm)	1/4" ANSI	3/8" ANSI	1/2" ANSI		5/8" ANSI		3/4" ANSI	7/8" ANSI	1" ANSI	1-1/4" ANSI
Minimum nominal embedment depth	$h_{nom}$	in. (mm)	1-3/4 (44)	2-3/8 (60)	2-1/2 (64)	3-3/4 (95)	3-3/8 (86)	4-5/8 (117)	4 (102)	4-1/2 (114)	5-1/2 (140)	6-1/2 (165)
Effective embedment	$h_{ef}$	in. (mm)	1.5 (38)	2 (51)	2 (51)	3.25 (83)	2.75 (70)	4 (102)	3.125 (79)	3.5 (89)	4.375 (111)	5.375 (137)
Minimum hole depth <sup>2</sup>	$h_o$	in. (mm)	2 (51)	2-5/8 (67)	2-3/4 (70)	4 (102)	3-3/4 (95)	5 (127)	4-1/4 (108)	4-13/16 (122)	4-7/8 (124)	7-1/4 (184)
Minimum member thickness <sup>2</sup>	$h_{min}$	in. (mm)	4 (102)	4 (102)	5 (127)	6 (152)	6 (152)	7 (178)	6 (152)	10 (254)	10 (254)	12 (305)
Minimum overall anchor length	$\ell_{anch}$	in. (mm)	2-1/4 (57)	3 (76)	3-3/4 (95)	5-1/2 (140)	4-1/2 (114)	6 (152)	5-1/2 (140)	6 (152)	9 (229)	9 (229)
Minimum edge distance <sup>2</sup>	$c_{min}$	in. (mm)	1-3/4 (44)	2-1/4 (57)	5-1/4 (133)	4 (102)	5-1/2 (140)	4-1/4 (108)	5 (127)	7 (178)	8 (203)	8 (203)
Minimum spacing distance <sup>2</sup>	$s_{min}$	in. (mm)	2-1/4 (57)	3-3/4 (95)	7-1/4 (184)	5 (127)	11 (279)	4-1/4 (108)	6 (152)	6-1/2 (165)	8 (203)	8 (203)
Critical edge distance <sup>2</sup>	$c_{ac}$	in. (mm)	3-1/2 (89)	6-1/2 (165)	8-1/2 (216)	8 (203)	6 (152)	10 (254)	11 (279)	12 (305)	12 (305)	15 (381)
Installation torque <sup>3</sup>	$T_{inst}$	ft.-lbf. (N-m)	4 (5)	20 (27)	40 (54)		80 (108)		110 (149)	175 (237)	225 (305)	375 (508)
Torque wrench/socket size	-	in.	7/16	9/16	3/4		15/16		1-1/8	1-5/16	1-1/2	1-7/8
Nut height	-	ln.	7/32	21/64	7/16		35/64		41/64	3/4	55/64	1-1/16

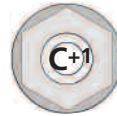
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

- The information presented in this table is to be used in conjunction with the design criteria of ACI 318 Appendix D.
- For installations through the soffit of steel into concrete, see the installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from the center of the flute. In addition, anchors must have an axial spacing along the flute equal to the greater of  $3h_{ef}$  or 1.5 times the flute width.
- For installation of 5/8-inch diameter anchor through the soffit of the steel deck into structural sand-lightweight concrete, installation torque is 50 ft.-lbf. For installation of 3/4-inch diameter anchor through the soffit of the steel deck into structural sand-lightweight concrete, installation torque is 80 ft.-lbf.

**Power-Stud+ SD1 Anchor Detail**



**Head Marking**



**Legend**

- Letter Code = Length Identification Mark
- '+' Symbol = Strength Design Compliant Anchor (see ordering information)
- Number Code = Carbon Steel Body and Expansion Clip (not on 1/4" diameter anchors)

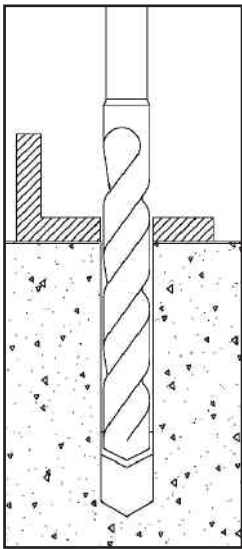
**Length Identification**

Mark	A	B	C	D	E	F		
From	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"		
Up to but not including	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"		
Mark	G	H	I	J	K	L		
From	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"		
Up to but not including	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"		
Mark	M	N	O	P	Q	R	S	T
From	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"	12"
Up to but not including	8"	8-1/2"	9"	9-1/2"	10"	11"	12"	13"

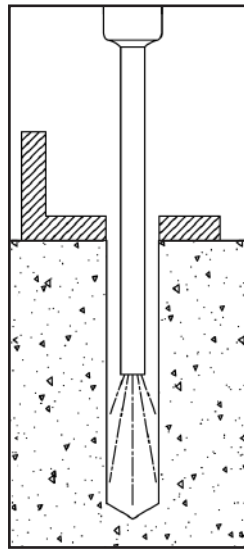
Length identification mark indicates overall length of anchor.

**INSTALLATION INSTRUCTIONS**

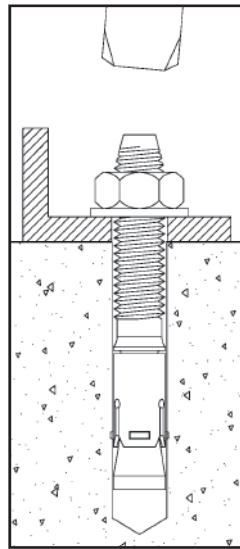
**Installation Instructions for Power-Stud+™ SD1**



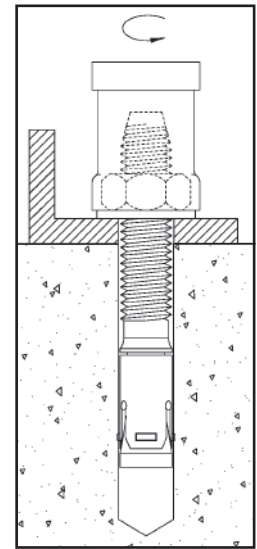
1.) Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



2.) Remove dust and debris from the hole using a hand pump, compressed air or a vacuum.

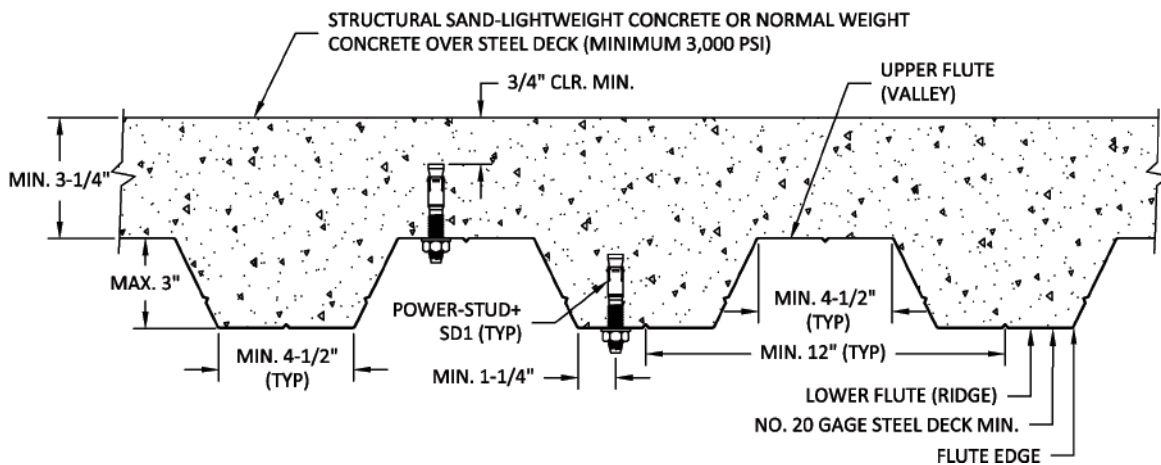


3.) Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth,  $h_{nom}$ .



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

**Installation Detail Power-Stud+ SD1 Installed Through Soffit of Steel Deck into Concrete**



**STRENGTH DESIGN PERFORMANCE DATA**

Factored design strength  $\phi N_n$  and  $\phi V_n$   
Calculated in accordance with ACI 318 Appendix D  
Compliant with the International Building Code



**Tension and Shear Design Strengths for Power-Stud+ SD1 in Cracked Concrete<sup>1-6</sup>**

Nominal Anchor Diameter (in.)	Nominal Embed. $h_{nom}$ (in.)	Minimum Concrete Compressive Strength, $f'_c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)
1/4	1-3/4	-	-	-	-	-	-	-	-	-	-
3/8	2-3/8	1,325	1,380	1,450	1,380	1,675	1,380	2,050	1,380	2,365	1,380
1/2	2-1/4	1,565	1,685	1,710	1,845	1,975	2,130	2,420	2,290	2,795	2,290
1/2	3-3/4	1,630	2,290	1,785	2,290	2,060	2,290	2,520	2,290	2,915	2,290
5/8	3-3/8	2,520	3,185	2,760	3,185	3,185	3,185	3,905	3,185	4,505	3,185
5/8	4-5/8	2,895	3,185	3,170	3,185	3,660	3,185	4,480	3,185	5,175	3,185
3/4	4	4,135	4,460	4,530	4,460	5,230	4,460	6,405	4,460	7,395	4,460
7/8	4-1/2	3,620	5,730	3,965	5,730	4,575	5,730	5,605	5,730	6,470	5,730
1	5-1/2	7,140	7,110	7,820	7,110	9,030	7,110	11,060	7,110	12,770	7,110
1 1/4	6-1/2	9,720	11,540	10,650	11,540	12,295	11,540	15,060	11,540	17,390	11,540

**Tension and Shear Design Strengths for Power-Stud+ SD1 in Uncracked Concrete<sup>1-6</sup>**

Nominal Anchor Diameter (in.)	Nominal Embed. $h_{nom}$ (in.)	Minimum Concrete Compressive Strength, $f'_c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$\Phi V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)	$N_n$ Tension (lbs.)	$V_n$ Shear (lbs.)
1/4	1-3/4	1,435	595	1,570	595	1,765	595	1,765	595	1,765	595
3/8	2-3/8	1,860	1,380	2,040	1,380	2,355	1,380	2,885	1,380	3,330	1,380
1/2	2-1/4	2,095	2,290	2,295	2,290	2,645	2,290	3,240	2,290	3,745	2,290
1/2	3-3/4	3,590	2,290	3,935	2,290	4,545	2,290	5,565	2,290	6,425	2,290
5/8	3-3/8	3,555	3,185	3,895	3,185	4,500	3,185	5,510	3,185	6,365	3,185
5/8	4-5/8	6,240	3,185	6,835	3,185	7,895	3,185	9,665	3,185	10,850	3,185
3/4	4	4,310	4,460	4,720	4,460	5,450	4,460	6,675	4,460	7,710	4,460
7/8	4-1/2	5,105	5,730	5,595	5,730	6,460	5,730	7,910	5,730	9,135	5,730
1	5-1/2	7,140	7,110	7,820	7,110	9,030	7,110	11,060	7,110	12,770	7,110
1 1/4	6-1/2	9,720	11,540	10,650	11,540	12,295	11,540	15,060	11,540	17,390	11,540

**Legend**

Steel Strength Controls    Concrete Breakout Strength Controls    Anchor Pullout/Pryout Strength Controls

1. Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight-concrete with minimum slab thickness,  $h_a = h_{min}$ , and with the following conditions:

- $c_{a1}$  is greater than or equal to the critical edge distance,  $c_{ac}$  (table values based on  $c_{a1} = c_{ac}$ ).
- $c_{a2}$  is greater than or equal to  $1.5 c_{a1}$ .

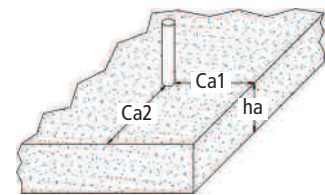
2. Calculations were performed according to ACI 318-05 Appendix D. The load level corresponding to the controlling failure mode is listed. (e.g. For *tension*: steel, concrete breakout and pullout; For *shear*: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values,  $h_{ef}$ , for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3. Strength reduction factors ( $\phi$ ) were based on ACI 318 Section 9.2 for load combinations. Condition B is assumed.

4. Tabular values are permitted for static loads only, seismic loading is not considered with these tables.

5. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318 Appendix D.

6. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318 Appendix D. For other design conditions including seismic considerations please see ACI 318 Appendix D.



**REFERENCE PERFORMANCE DATA**

**Ultimate Load Capacities for Power-Stud+ SD1 in Normal-Weight Concrete<sup>1</sup>**

Nominal Anchor Diameter in. (mm)	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength							
		f <sub>c</sub> = 2,500 psi (17.3 MPa)		f <sub>c</sub> = 3,000 psi (20.7 MPa)		f <sub>c</sub> = 4,000 psi (27.6 MPa)		f <sub>c</sub> = 6,000 psi (41.4 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)
1/4 (6.3)	1-1/8 (28)	-	-	1,435 (6.4)	1,255 (5.6)	1,660 (7.4)	1,255 (5.6)	-	-
	1-3/4 (44)	2,775 (12.4)	1,255 (5.6)	2,775 (12.4)	1,255 (5.6)	2,775 (12.4)	1,255 (5.6)	2,775 (12.4)	1,255 (5.6)
3/8 (9.5)	1-5/8 (48)	-	-	2,685 (12)	2,540 (11.3)	3,100 (13.8)	2,540 (11.3)	-	-
	2-3/8 (60)	3,485 (15.5)	2,540 (11.3)	3,815 (17)	2,540 (11.3)	4,410 (19.6)	2,540 (11.3)	5,400 (24)	2,540 (11.3)
1/2 (12.7)	2-1/4 (57)	-	-	4,155 (18.5)	4,195 (18.7)	4,800 (21.4)	4,195 (18.7)	-	-
	2-1/2 (64)	3,910 (17.4)	4,195 (18.7)	4,285 (19.1)	4,195 (18.7)	4,950 (22)	4,195 (18.7)	6,060 (27)	4,195 (18.7)
	3-3/4 (95)	7,955 (35.4)	4,195 (18.7)	8,715 (38.8)	4,195 (18.7)	10,065 (44.8)	4,195 (18.7)	12,325 (54.8)	4,195 (18.7)
5/8 (15.9)	2-3/4 (70)	-	-	5,440 (24.3)	6,815 (30.3)	6,285 (28)	6,815 (30.3)	-	-
	3-3/8 (86)	6,625 (29.5)	6,815 (30.3)	7,260 (32.3)	6,815 (30.3)	8,380 (37.3)	6,815 (30.3)	10,265 (45.7)	6,815 (30.3)
	4-5/8 (117)	11,260 (50.1)	6,815 (30.3)	12,335 (54.9)	6,815 (30.3)	14,245 (63.4)	6,815 (30.3)	14,465 (65.7)	6,815 (30.3)
3/4 (19.1)	3-3/8 (86)	-	-	7,860 (32.2)	12,685 (56.4)	9,075 (40.5)	12,685 (56.4)	-	-
	4 (102)	9,530 (42.4)	12,685 (56.4)	10,440 (46.5)	12,685 (56.4)	12,060 (53.6)	12,685 (56.4)	14,770 (65.7)	12,685 (56.4)
7/8 (22.2)	3-1/2 (89)	11,320 (50.4)	11,690 (52.0)	12,405 (55.2)	11,690 (52.0)	15,125 (67.3)	11,690 (52.0)	19,470 (86.6)	11,690 (52.0)
1 (25.4)	4-1/2 (114)	-	-	13,850 (61.8)	21,155 (94.1)	20,915 (93.4)	21,155 (94.1)	-	-
	5-1/2 (140)	16,535 (73.6)	21,155 (94.1)	18,115 (80.6)	21,155 (94.1)	20,915 (93)	21,155 (94.1)	25,615 (114)	21,155 (94.1)
1 1/4 (31.8)	5-3/8 (137)	22,485 (100.0)	29,105 (129.4)	24,630 (109.6)	29,105 (129.4)	28,440 (126.5)	29,105 (129.4)	37,360 (166.2)	29,105 (129.4)

1. The tabulated load values are applicable to single anchors installed in uncracked concrete with no edge or spacing considerations.



**ALLOWABLE STRESS DESIGN (ASD) PERFORMANCE DATA**

**Allowable Load Capacities for Power-Stud+ SD1 in Normal-Weight Concrete<sup>1,2</sup>**

Nominal Anchor Diameter d (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)									
		2,500		3,000		4,000		6,000		8,000	
		Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)
1/4	1 3/4	895	370	980	370	1,055	370	1,055	370	1,055	370
3/8	2 3/8	1,165	640	1,275	700	1,470	810	1,805	860	2,080	860
1/2	2 1/2	1,310	915	1,435	1,005	1,655	1,160	2,025	1,420	2,340	1,430
1/2	3 3/4	2,245	1,430	2,460	1,430	2,840	1,430	3,480	1,430	4,020	1,430
5/8	3 3/8	2,225	1,990	2,435	1,990	2,810	1,990	3,445	1,990	3,975	1,990
5/8	4 5/8	3,900	1,990	4,270	1,990	4,935	1,990	6,040	1,990	6,780	1,990
3/4	4	2,695	2,210	2,950	2,420	3,405	2,785	4,170	2,785	4,820	2,785
7/8	4 1/2	3,190	3,585	3,495	3,585	4,040	3,585	4,945	3,585	5,710	3,585
1	5 1/2	4,460	4,440	4,885	4,440	5,645	4,440	6,910	4,440	7,980	4,440
1 1/4	6 1/2	6,075	7,210	6,655	7,210	7,685	7,210	9,410	7,210	10,865	7,210

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

**ALLOWABLE STRESS DESIGN (ASD) DESIGN CRITERIA**

**Edge Distance and Spacing Distance Tension (F<sub>ns</sub>, F<sub>nc</sub>) Adjustment Factors for Normal-Weight Concrete**

Dia. (in)	1/4	3/8	1/2	1/2	5/8	5/8	3/4	7/8	1	1 1/4	
h <sub>ef</sub> (in.)	1 3/4	2 3/8	2 1/2	3 3/4	3 3/8	4 5/8	4	4 1/2	5 1/2	6 1/2	
s <sub>min</sub> (in.)	2 1/4	3 3/4	7 1/4	5	11	4 1/4	6	6 1/2	8	8	
Spacing Distance (inches)	2 1/4	0.75	-	-	-	-	-	-	-	-	
	2 1/2	0.78	-	-	-	-	-	-	-	-	
	3	0.83	-	-	-	-	-	-	-	-	
	3 1/2	0.89	-	-	-	-	-	-	-	-	
	4	0.95	0.83	-	-	-	-	-	-	-	
	4 1/2	1.00	0.88	-	-	0.69	-	-	-	-	
	5	-	0.92	-	0.76	-	0.71	-	-	-	
	5 1/2	-	0.96	-	0.78	-	0.73	-	-	-	
	6	-	1.00	-	0.81	-	0.75	0.82	-	-	
	6 1/2	-	-	-	0.83	-	0.77	0.85	0.81	-	
	7	-	-	-	0.86	-	0.79	0.87	0.83	-	
	7 1/2	-	-	-	0.89	-	0.81	0.90	0.86	-	
	8	-	-	-	0.91	-	0.83	0.93	0.88	0.81	0.75
	8 1/2	-	-	-	0.94	-	0.85	0.95	0.91	0.82	0.76
9	-	-	-	0.96	-	0.88	0.98	0.93	0.84	0.78	
9 1/2	-	-	-	0.99	-	0.90	-	0.95	0.86	0.80	
10	-	-	-	-	-	0.92	-	0.98	0.88	0.81	
10 1/2	-	-	-	-	-	0.94	-	1.00	0.90	0.83	
11	-	-	-	-	-	0.96	-	-	0.92	0.84	
11 1/2	-	-	-	-	-	0.98	-	-	0.94	0.86	
12	-	-	-	-	-	1.00	-	-	0.96	0.87	
12 1/2	-	-	-	-	-	-	-	-	0.98	0.89	
13	-	-	-	-	-	-	-	-	0.00	0.90	

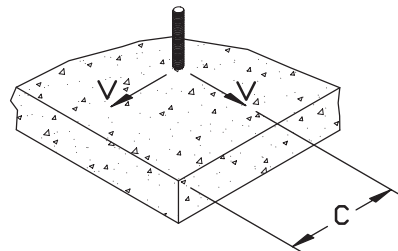
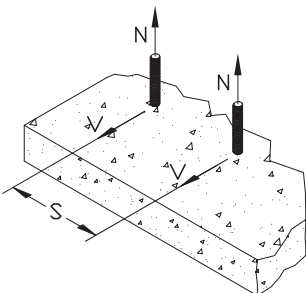
Dia. (in)	1/4	3/8	1/2	1/2	5/8	5/8	3/4	7/8	1	1 1/4
h <sub>nom</sub> (in.)	1 3/4	2 3/8	2 1/2	3 3/4	3 3/8	4 5/8	4	4 1/2	5 1/2	6 1/2
c <sub>ac</sub> (in.)	3 1/2	6 1/2	8 1/2	8	6	10	11	12	12	12
c <sub>min</sub> (in.)	2 3/4	2 3/4	5 1/4	4	5 1/2	4 3/4	5	7	8	8
Edge Distance (inches)	2 3/4	0.79	0.43	-	-	-	-	-	-	-
	3	0.86	0.46	-	-	-	-	-	-	-
	3 1/2	1.00	0.54	-	-	-	-	-	-	-
	4	-	0.62	-	0.52	-	-	-	-	-
	4 1/2	-	0.69	-	0.57	-	-	-	-	-
	4 3/4	-	0.73	-	0.60	-	0.50	-	-	-
	5	-	0.77	-	0.62	-	0.52	0.45	-	-
	5 1/4	-	0.81	0.62	0.66	-	0.54	0.48	-	-
	5 1/2	-	0.85	0.65	0.69	0.92	0.56	0.50	-	-
	6	-	0.92	0.71	0.75	1.00	0.60	0.55	-	-
	6 1/2	-	1.00	0.76	0.81	-	0.65	0.59	-	-
	7	-	-	0.82	0.88	-	0.70	0.64	0.58	-
	7 1/2	-	-	0.88	0.94	-	0.75	0.68	0.62	-
	8	-	-	0.94	1.00	-	0.80	0.73	0.67	0.67
8 1/2	-	-	1.00	-	-	0.85	0.77	0.71	0.71	
9	-	-	-	-	-	0.90	0.82	0.75	0.75	
9 1/2	-	-	-	-	-	0.95	0.86	0.79	0.79	
10	-	-	-	-	-	1.00	0.91	0.83	0.83	
10 1/2	-	-	-	-	-	-	0.95	0.88	0.88	
11	-	-	-	-	-	-	1.00	0.92	0.92	
11 1/2	-	-	-	-	-	-	-	0.96	0.96	
12	-	-	-	-	-	-	-	1.00	1.00	

**ALLOWABLE STRESS DESIGN (ASD) DESIGN CRITERIA**

**Spacing Distance Shear ( $F_{vs}$ ,  $F_{vc}$ ) Adjustment Factors for Normal-Weight Concrete**

Di. (in.)	1/4	3/8	1/2	1/2	5/8	5/8	3/4	7/8	1	1 1/4
$h_{ef}$ (in.)	1 3/4	2 3/8	2 1/2	3 3/4	3 3/8	4 5/8	4	4 1/2	5 1/2	6 1/2
$s_{min}$ (in.)	2 1/4	3 3/4	7 1/4	5	11	4 1/4	6	6 1/2	8	8
Spacing Distance (inches)	2 1/4	0.64	-	-	-	-	-	-	-	-
	2 1/2	0.65	-	-	-	-	-	-	-	-
	3	0.68	-	-	-	-	-	-	-	-
	3 1/2	0.71	-	-	-	-	-	-	-	-
	4	0.74	0.74	-	-	-	-	-	-	-
	4 1/2	0.77	0.77	-	-	-	0.66	-	-	-
	5	0.80	0.80	-	0.71	-	0.68	-	-	-
	5 1/2	0.83	0.83	-	0.73	-	0.69	-	-	-
	6	0.86	0.86	-	0.75	-	0.71	0.70	-	-
	6 1/2	0.89	0.89	-	0.77	-	0.73	0.72	0.65	-
	7	0.92	0.92	-	0.79	-	0.75	0.73	0.67	-
	7 1/4	0.94	0.94	0.73	0.80	-	0.75	0.74	0.67	-
	7 1/2	0.95	0.95	0.74	0.81	-	0.76	0.75	0.68	-
	8	0.98	0.98	0.75	0.83	-	0.78	0.77	0.69	0.67
	8 1/2	-	-	0.77	0.85	-	0.80	0.78	0.70	0.68
	9	-	-	0.79	0.88	-	0.82	0.80	0.71	0.69
	9 1/2	-	-	0.80	0.90	-	0.83	0.82	0.73	0.70
	10	-	-	0.82	0.92	-	0.85	0.83	0.74	0.71
	10 1/2	-	-	0.83	0.94	-	0.87	0.85	0.75	0.72
	11	-	-	0.85	0.96	0.83	0.89	0.87	0.76	0.73
	11 1/2	-	-	0.87	0.98	0.85	0.90	0.88	0.77	0.74
	12	-	-	0.88	1.00	0.86	0.92	0.90	0.79	0.75
	12 1/2	-	-	0.90	-	0.88	0.94	0.92	0.80	0.76
	13	-	-	0.91	-	0.89	0.96	0.93	0.81	0.77
13 1/2	-	-	0.93	-	0.91	0.97	0.95	0.82	0.78	
14	-	-	0.94	-	0.92	0.99	0.97	0.83	0.79	
14 1/2	-	-	0.96	-	0.94	-	0.98	0.85	0.80	
15	-	-	0.98	-	0.95	-	1.00	0.86	0.81	
15 1/2	-	-	0.99	-	0.97	-	-	0.87	0.82	
16	-	-	-	-	0.98	-	-	0.88	0.83	
16 1/2	-	-	-	-	1.00	-	-	0.89	0.84	
17	-	-	-	-	-	-	-	0.90	0.85	
18	-	-	-	-	-	-	-	0.93	0.88	
19	-	-	-	-	-	-	-	0.95	0.90	
20	-	-	-	-	-	-	-	0.98	0.92	
21	-	-	-	-	-	-	-	1.00	0.94	
22	-	-	-	-	-	-	-	-	0.96	
23	-	-	-	-	-	-	-	-	0.98	
24	-	-	-	-	-	-	-	-	1.00	

NOTE: See installation table for Power-Stud+SD1 for minimum edge distances,  $C_{min}$



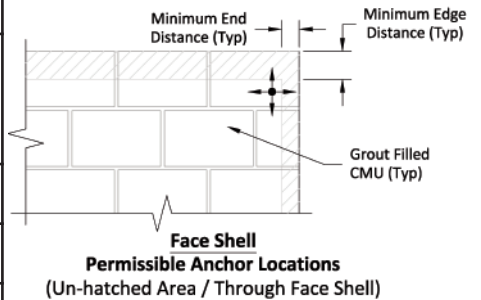
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**ALLOWABLE STRESS DESIGN (ASD) PERFORMANCE DATA**

**Ultimate and Allowable Load Capacities in Tension for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Faces<sup>1,2,3,4,5</sup>**



Anchor Diameter in. (mm)	Minimum Embedment Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Grout-Filled Concrete Masonry			
				$f'_m = 1,500$ psi		$f'_m = 2,000$ psi	
				Ultimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)	Ultimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)
3/8 (9.5)	2 3/8 (60.3)	4 (101.6)	4 (101.6)	2,225 (10.0)	445 (2.0)	2,600 (11.6)	520 (2.3)
1/2 (12.7)	2 1/2 (63.5)			2,650 (11.8)	530 (2.4)	3,075 (13.7)	615 (2.7)
5/8 (15.9)	3 3/8 (85.7)			3,525 (15.7)	705 (3.2)	4,100 (18.3)	820 (3.7)



1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or 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 and 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 by 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 distance and end distance may be increased by 20 percent for the 1/2-inch diameter and 10 percent for the 5/8-inch diameter.

**Ultimate and Allowable Load Capacities in Shear for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Faces<sup>1,2,3,4,5</sup>**



Anchor Diameter in. (mm)	Minimum Embedment Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Direction of Loading	Grout-Filled Concrete Masonry			
					$f'_m = 1,500$ psi		$f'_m = 2,000$ psi	
					Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8 (9.5)	2 3/8 (60.3)	4 (101.6)	4 (101.6)	Perpendicular or parallel to wall edge or end	2,875 (12.8)	575 (2.6)	3,490 (15.6)	665 (3.0)
1/2 (12.7)	2 1/2 (63.5)	4 (101.6)	12 (304.8)	Perpendicular or parallel to wall edge or end	2,875 (12.8)	565 (2.7)	4,940 (22.1)	655 (2.9)
		12 (304.8)	4 (101.6)	Parallel to wall edge	4,050 (18.1)	810 (3.6)	3,435 (15.3)	940 (4.2)
		4 (101.6)	12 (304.8)	Parallel to wall end				
5/8 (15.9)	3 3/8 (85.7)	4 (101.6)	4 (101.6)	Perpendicular or parallel to wall edge or end	3,425 (15.3)	685 (3.1)	4,300 (19.2)	795 (3.5)
		12 (304.8)	4 (101.6)	Parallel to wall edge	5,350 (23.9)	1,070 (4.85)	6,530 (29.2)	1,240 (5.5)
		4 (101.6)	12 (304.8)	Parallel to wall end				

1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or 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 and 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 anchor 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 by 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 shear loads for inchor installed into grouted masonry wall faces may be applied in any direction.

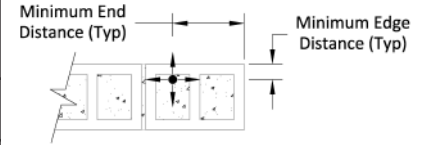


**ALLOWABLE STRESS DESIGN (ASD) PERFORMANCE DATA**

**Ultimate and Allowable Load Capacities in Tension for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Tops<sup>1,2,3,4</sup>**



Anchor Diameter in. (mm)	Minimum Embedment Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Grout-Filled Concrete Masonry			
				$f'm = 1,500$ psi		$f'm = 2,000$ psi	
				Ultimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)	Ultimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)
3/8 (9.5)	2 3/8 (60.3)	1 3/4 (44.5)	12 (304.8)	1,500 (6.7)	300 (1.3)	1,725 (7.7)	345 (1.5)
1/2 (12.7)	2 1/2 (63.5)	2 1/4 (57.1)		2,225 (9.9)	445 (2.0)	2,575 (11.5)	515 (2.3)
	5 (127)			3,400 (15.1)	680 (3.0)	3,925 (17.5)	785 (3.5)
5/8 (15.9)	3 3/8 (85.7)			3,825 (17.1)	765 (3.4)	4,425 (19.7)	885 (3.9)



**Top of Wall**

1. Tabulated load values are for anchors installed in minimum 8-inch wide, minimum Grade N, Type II, lightweight, medium-weight or 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 and 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. Anchors must be installed in the grouted cells and the minimum edge and end distances must be maintained.
4. The tabulated values are applicable for anchors installed in top of grouted masonry walls at a critical spacing distance,  $s_{cr}$ , between anchors of 16 times the anchor diameter.

**Ultimate and Allowable Load Capacities in Shear for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Tops<sup>1,2,3,4</sup>**



Anchor Diameter in. (mm)	Minimum Embedment Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Direction of Loading	Grout-Filled Concrete Masonry			
					$f'm = 1,500$ psi		$f'm = 2,000$ psi	
					Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8 (9.5)	2 3/8 (60.3)	1 3/4 (44.5)	12 (304.8)	Perpendicular to wall toward minimum edge	1,075 (4.8)	215 (1.0)	1,250 (5.6)	250 (1.3)
				Parallel to wall edge	2,300 (10.3)	460 (2.0)	2,650 (11.8)	530 (2.4)
1/2 (12.7)	2 1/2 (63.5)	2 1/4 (57.1)	12 (304.8)	Any	1,075 (4.8)	215 (1.0)	1,250 (5.6)	250 (1.3)
	5 (127)			Perpendicular to wall toward minimum edge	1,400 (6.2)	280 (1.2)	1,625 (7.2)	325 (1.4)
				Parallel to wall edge	2,800 (12.5)	560 (2.5)	3,250 (14.5)	650 (2.9)
5/8 (15.9)	3 3/8 (85.7)	2 1/4 (57.1)	12 (304.8)	Any	1,075 (4.8)	215 (1.0)	1,250 (5.6)	250 (1.3)
	6 1/4 (158.8)			Perpendicular to wall toward minimum edge	2,350 (10.5)	470 (2.1)	2,725 (12.1)	545 (2.4)
				Parallel to wall edge	3,500 (15.6)	700 (3.1)	4,075 (18.2)	815 (3.6)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, minimum Grade N, Type II, lightweight, medium-weight or 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 and 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. Anchors must be installed in the grouted cells and the minimum edge and end distances must be maintained.
4. The tabulated values are applicable for anchors installed in top of grouted masonry walls at a critical spacing distance,  $s_{cr}$ , between anchors of 16 times the anchor diameter.

**STRENGTH DESIGN INFORMATION**

**Tension Design Information for Power-Stud+ SD1 Anchor in Concrete (For use with load combinations taken from ACI 318, Section 9.2)<sup>1-4</sup>**

Design Characteristic	Notation	Units	Nominal Anchor Diameter									
			1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4		
Anchor category	1,2 or 3	-	1	1	1	1	1	1	1	1	1	
Nominal embedment depth	$h_{nom}$	in.	1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	4-1/2	5-1/2	6-1/2
<b>STEEL STRENGTH IN TENSION<sup>4</sup></b>												
Minimum specified yield strength	$f_y$	ksi (N/mm <sup>2</sup> )	88 (606)	88 (606)	80 (551)	80 (551)	80 (551)	58 (400)	58 (400)	58 (400)	58 (400)	
Minimum specified ultimate tensile strength (neck)	$f_{uta}^{11}$	ksi (N/mm <sup>2</sup> )	110 (758)	110 (758)	100 (689)	100 (689)	100 (689)	75 (517)	75 (517)	75 (517)	75 (517)	
Effective tensile stress area (neck)	$A_{se}$	in <sup>2</sup> (mm <sup>2</sup> )	0.022 (14.2)	0.0531 (34.3)	0.1018 (65.7)	0.1626 (104.9)	0.2376 (150.9)	0.327 (207.5)	0.43 (273.1)	0.762 (484)	0.762 (484)	
Steel strength in tension	$N_{sa}^{11}$	lb (kN)	2,255 (10)	5,455 (24.3)	9,080 (40.4)	14,465 (64.3)	17,820 (79.3)	24,503 (109.0)	32,250 (143.5)	56,202 (250)	56,202 (250)	
Reduction factor for steel strength <sup>3</sup>	$\phi$	-	0.75									
<b>CONCRETE BREAKOUT STRENGTH IN TENSION<sup>8</sup></b>												
Effective embedment	$h_{ef}$	in. (mm)	1.5 (38)	2 (51)	2 (51)	3.25 (83)	2.75 (70)	4 (102)	3.125 (79)	3.5 (89)	4.375 (111)	5.375 (137)
Effectiveness factor for uncracked concrete	$k_{uncr}$	-	24	24	24	24	24	24	24	24	24	
Effectiveness factor for cracked concrete	$k_{cr}$	-	Not Applicable	17	17	17	17	24	17	24	24	
Modification factor for cracked and uncracked concrete <sup>5</sup>	$\psi_{c,N}^{11}$	-	1 See note 5	1 See note 5	1 See note 5	1 See note 5	1 See note 5	1 See note 5	1 See note 5	1 See note 5	1 See note 5	
Critical edge distance	$c_{ac}$	in. (mm)	4 (102)	6-1/2 (165)	8-1/2 (216)	8 (203)	11 (280)	12 (305)	11 (280)	12 (305)	12 (305)	15 (381)
Reduction factor for concrete breakout strength <sup>3</sup>	$\phi$	-	0.65 (Condition B)									
<b>PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)<sup>8</sup></b>												
Characteristic pullout strength, uncracked concrete (2,500 psi) <sup>6</sup>	$N_{p,uncr}$	lb (kN)	See note 7	2,865 (12.8)	3,220 (14.3)	5,530 (24.6)	See note 7	See note 7	See note 7	See note 7	See note 7	See note 7
Characteristic pullout strength, cracked concrete (2,500 psi) <sup>6</sup>	$N_{p,cr}$	lb (kN)	Not Applicable	2,035 (9.1)	See note 7	2,505 (11.2)	See note 7	4,450 (19.8)	See note 7	See note 7	See note 7	See note 7
Reduction factor for pullout strength <sup>3</sup>	$\phi$	-	0.65 (Condition B)									
<b>PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS<sup>8</sup></b>												
Characteristic pullout strength, seismic (2,500 psi) <sup>6,9</sup>	$N_{eq}^{11}$	lb (kN)	Not Applicable	2,035 (9.1)	See note 7	2,505 (11.1)	See note 7	4,450 (19.8)	5,965 (26.5)	See note 7	See note 7	See note 7
Reduction factor for pullout strength <sup>3</sup>	$\phi$	-	0.65 (Condition B)									
<b>PULLOUT STRENGTH IN TENSION FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK</b>												
Characteristic pullout strength, uncracked concrete over steel deck, according to Installation Detail 6,10	$N_{p,deck,uncr}$	lb (kN)	Not Applicable	1,940 (8.6)	3,205 (14.2)	2,795 (12.4)	3,230 (14.4)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Characteristic pullout strength, cracked concrete over steel deck, according to Installation Detail 6,10	$N_{p,deck,cr}$	lb (kN)	Not Applicable	1,375 (6.1)	2,390 (10.6)	1,980 (8.8)	3,230 (14.4)	Not Applicable	Not Applicable	Not Applicable		
Reduction factor for pullout strength <sup>3</sup>	$\phi$	-	0.65 (Condition B)									

- 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 must apply.
- Installation must comply with published instructions and details.
- All values of  $\phi$  apply to the load combinations of IBC Section 1605.2.1, UBC Section 1612.2.1, or ACI 318 Section 9.2. If the load combinations of UBC Section 1902.2 or ACI 318 Appendix C are used, the appropriate value of  $\phi$  must be determined in accordance with ACI 318 D.4.5. For reinforcement that complies with ACI 318 Appendix D requirements for Condition A, the appropriate  $\phi$  factor must be determined in accordance with ACI 318 D.4.4.
- The Power-Stud+ SD1 is considered a ductile steel element as defined by ACI 318 D.1. Tabulated values for steel strength in tension must be used for design.
- For all design cases use  $\psi_{c,N} = 1.0$ . The appropriate effectiveness factor for cracked concrete ( $k_{cr}$ ) or uncracked concrete ( $k_{uncr}$ ) must be used.
- For all design cases use  $\psi_{c,p} = 1.0$ . For concrete compressive strength greater than 2,500 psi,  $N_{pn} = (\text{pullout strength value from table}) * (\text{specified concrete compressive strength}/2500)^{0.5}$ . For concrete over steel deck the value of 2500 must be replaced with the value of 3000.
- Pullout strength will not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
- Anchor are permitted to be used in structural sand-lightweight concrete provided that  $N_p$ ,  $N_{eq}$  and  $N_{pn}$  are multiplied by a factor of 0.60.
- Tabulated values for characteristic pullout strength in tension are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.5.
- Values for  $N_{p,deck}$  are for structural sand-lightweight concrete ( $f'_{c,min} = 3,000$  psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318 D.5.2 is not required for anchors installed in the deck soffit (flute).
- For 2003 IBC,  $f_{uta}$  replaces  $f_{ut}$ ;  $N_{sa}$  replaces  $N_s$ ;  $\psi_{c,N}$  replaces  $\psi_s$  and  $N_{eq}$  replaces  $N_{p,seis}$ .



**STRENGTH DESIGN INFORMATION**

**Shear Design Information for Power-Stud+ SD1 Anchor in Concrete (For use with load combinations taken from ACI 318, Section 9.2)<sup>1,2</sup>**

Design Characteristic	Notation	Units	Nominal Anchor Diameter									
			1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4		
Anchor category	1, 2 or 3	-	1	1	1	1	1	1	1	1	1	1
Nominal embedment depth	$h_{nom}$	in.	1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	4-1/2	5-1/2	6-1/2
<b>STEEL STRENGTH IN SHEAR<sup>4</sup></b>												
Minimum specified yield strength (threads)	$f_y$	ksi (N/mm <sup>2</sup> )	70 (482)	70 (482)	64 (441)	64 (441)	64 (441)	58 (400)	58 (400)	58 (400)	58 (400)	58 (400)
Minimum specified ultimate strength (threads)	$f_{uta}^{10}$	ksi (N/mm <sup>2</sup> )	88 (606)	88 (606)	80 (503)	80 (503)	80 (503)	75 (517)	75 (517)	75 (517)	75 (517)	75 (517)
Effective tensile stress area (threads)	$A_{se}$	in <sup>2</sup> (mm <sup>2</sup> )	0.0318 (20.5)	0.0775 (50)	0.1419 (91.5)	0.226 (145.8)	0.3345 (212.4)	0.462 (293.4)	0.606 (384.8)	0.606 (384.8)	0.969 (615)	0.969 (615)
Steel strength in shear <sup>5</sup>	$V_{sa}^{10}$	lb (kN)	915 (4.1)	2,120 (9.4)	3,520 (15.6)	4,900 (21.8)	6,860 (30.5)	8,819 (39.2)	10,935 (48.6)	10,935 (48.6)	17,750 (79)	17,750 (79)
Reduction factor for steel strength <sup>3</sup>	$\phi$	-	0.65									
<b>CONCRETE BREAKOUT STRENGTH IN SHEAR<sup>6</sup></b>												
Load bearing length of anchor (hef or 8d <sub>o</sub> , whichever is less)	$\ell^{10}$	in. (mm)	1.5 (38)	2 (51)	2 (51)	3.25 (83)	2.75 (70)	4 (102)	3.125 (79)	3.5 (88.9)	4.375 (111)	5.375 (137)
Nominal anchor diameter	$d_o$	in. (mm)	0.25 (6.4)	0.375 (9.5)	0.5 (12.7)	0.625 (15.9)	0.625 (15.9)	0.75 (19.1)	0.875 (22.2)	1 (25.4)	1 (25.4)	1.25 (31.8)
Reduction factor for concrete breakout <sup>3</sup>	$\phi$	-	0.70 (Condition B)									
<b>CONCRETE PRYOUT STRENGTH IN SHEAR<sup>6</sup></b>												
Coefficient for prout strength (1.0 for hef < 2.5 in., 2.0 for hef ≥ 2.5 in.)	$k_{cp}$	-	1	1	1	2	2	2	2	2	2	2
Effective embedment	$h_{ef}$	in. (mm)	1.5 (38)	2 (51)	2 (51)	3.25 (83)	2.75 (70)	4 (102)	3.125 (79)	3.5 (88.9)	4.375 (111)	5.375 (137)
Reduction factor for prout strength <sup>3</sup>	$\phi$	-	0.70 (Condition B)									
<b>STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS</b>												
Steel strength in shear, seismic <sup>7</sup>	$V_{eq}^{10}$	lb (kN)	Not Applicable	2,120 (9.4)	3,520 (15.6)	4,900 (21.8)	5,695 (25.3)	8,819 (39.2)	9,845 (43.8)	9,845 (43.8)	17,750 (79)	17,750 (79)
Reduction factor for steel strength in shear for seismic <sup>3</sup>	$\phi$	-	0.65									
<b>STEEL STRENGTH IN SHEAR FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK<sup>9</sup></b>												
Steel strength in shear, concrete over steel deck, according to Installation Detail 8,9	$V_{sa,deck}$	lb (kN)	Not Applicable	2,120 (9.4)	2,290 (10.2)	3,710 (15.6)	5,505 (24.5)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Reduction factor for steel strength in shear for concrete over steel deck <sup>3</sup>	$\phi$	-	0.65									

- 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 must apply.
- Installation must comply with published instructions and details.
- All values of  $\phi$  apply to the load combinations of IBC Section 1605.2.1, UBC Section 1612.2.1, or ACI 318 Section 9.2. If the load combinations of UBC Section 1902.2 or ACI 318 Appendix C are used, the appropriate value of  $\phi$  must be determined in accordance with ACI 318 D.4.5. For reinforcement that complies with ACI 318 Appendix D requirements for Condition A, the appropriate  $\phi$  factor must be determined in accordance with ACI 318 D.4.4.
- The Power-Stud+ SD1 is considered a ductile steel element as defined by ACI 318 D.1.
- Tabulated values for steel strength in shear must be used for design. These tabulated values are lower than calculated results using equation D-20 in ACI 318-05, ACI 318 D.6.1.2 and D-18 in ACI 318-02, D.6.1.2.
- Anchors are permitted to be used in structural sand-lightweight concrete provided that  $V_b$ , and  $V_{cp}$  and  $V_{cp,g}$  are multiplied by a factor of 0.60.
- Tabulated values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6.
- Tabulated values for  $V_{sa,deck}$  are for structural sand-lightweight concrete ( $f'_{c,min} = 3,000$  psi) and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318 D.6.2 and the prout capacity in accordance with Section D.6.3 are not required for anchors installed in the deck soffit (flute).
- Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
- For the 2003 IBC  $f_{uta}$  replaces  $f_{ut}$ ;  $V_{sa}$  replaces  $V_s$ ;  $\ell_e$  replaces  $\ell$ ; and  $V_{eq}$  replaces  $V_{sa,seis}$ .



**ORDERING INFORMATION**

**Power-Stud+ SD1 (Carbon Steel Body and Expansion Clip)**

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt./100 (lbs)
7400SD1	1/4" x 1-3/4"	3/4"	100	600	3
7402SD1	1/4" x 2-1/4"	1-1/4"	100	600	4
7404SD1	1/4" x 3-1/4"	2-1/4"	100	600	5
7410SD1	3/8" x 2-1/4"	7/8"	50	300	8
7412SD1	3/8" x 2-3/4"	1-3/8"	50	300	9
7413SD1	3/8" x 3"	1-5/8"	50	300	10
7414SD1	3/8" x 3-1/2"	2-1/8"	50	300	12
7415SD1	3/8" x 3-3/4"	2-3/8"	50	300	13
7416SD1	3/8" x 5"	3-5/8"	50	300	15
7417SD1	3/8" x 7"	5-5/8"	50	200	21
7420SD1	1/2" x 2-3/4"	1"	50	200	19
7422SD1	1/2" x 3-3/4"	2"	50	200	23
7423SD1	1/2" x 4-1/2"	2-3/4"	50	200	27
7424SD1	1/2" x 5-1/2"	3-3/4"	50	150	30
7426SD1	1/2" x 7"	5-1/4"	25	100	38
7427SD1	1/2" x 8-1/2"	6-3/4"	25	100	44
7430SD1	5/8" x 3-1/2"	1-1/2"	25	100	37
7432SD1	5/8" x 4-1/2"	2-1/2"	25	100	43
7433SD1	5/8" x 5"	3"	25	100	47
7434SD1	5/8" x 6"	4"	25	75	53
7436SD1	5/8" x 7"	5"	25	75	60
7438SD1	5/8" x 8-1/2"	6-1/2"	25	50	70
7439SD1	5/8" x 10"	8-1/2"	25	75	87
7440SD1	3/4" x 4-1/4"	2-3/8"	20	60	63
7441SD1	3/4" x 4-3/4"	2-7/8"	20	60	68
7442SD1	3/4" x 5-1/2"	3-5/8"	20	60	76
7444SD1	3/4" x 6-1/4"	3-3/8"	20	60	83
7446SD1	3/4" x 7"	3-3/8"	20	60	91
7448SD1	3/4" x 8-1/2"	3-3/8"	10	40	107
7449SD1	3/4" x 10"	3-3/8"	10	30	123
7451SD1	3/4" x 12"	3-3/8"	10	30	144
7450SD1	7/8" x 6"	2-3/4"	10	20	128
7452SD1	7/8" x 8"	4-3/4"	10	40	161
7454SD1	7/8" x 10"	6-3/4"	10	30	187
7461SD1	1" x 6"	4-1/2"	10	30	168
7463SD1	1" x 9"	4-1/2"	10	30	234
7465SD1	1" x 12"	4-1/2"	5	15	307
7473SD1	1-1/4" x 9"	4-3/4"	5	15	374
7475SD1	1-1/4" x 12"	7-3/4"	5	15	476



**Installation Accessories**

Cat. No.	Description	Box Qty.
08466	Adjustable torque wrench with 1/2" square drive (25 to 250 ft.-lbs.)	1
08280	Hand pump / dust blower	1



ICC-ES Pending

ICC-ES Pending

ICC-ES Pending

ICC-ES Pending

**Tie Wire Power-Stud+ SD1 (Carbon Steel Body and Expansion Clip)**

7409SD1	1/4"	N/A	100	500	3
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Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design.

The published size includes the diameter and the overall length of the anchor.

All anchors are packaged with nuts and washers.

