Mechanical anchors are available in many variations and choices and can usually be loaded immediately after installation which may be an advantage in many applications. Steel mechanical anchors also generally have a greater resistance to the effects of elevated temperature when compared with adhesives such as ester based resins or epoxies. Mechanical anchors can also be described by their style (e.g. undercut, expansion, screw, etc.).

Undercut anchors

Undercut anchors expand at the bottom of the drilled hole similar to a compression type anchor except that the actual diameter of the expanded area is wider than the drilled hole, undercutting the base material similar to a dove tail slot. Anchors of this type can be self undercutting or may require a secondary drilling operation to form the undercut at the bottom of the drilled hole. During installation, as the expansion mechanism undercuts the base material, it forms a large bearing area which can transfer greater load to the base material.

Expansion anchors

Expansion anchors can be used to describe the majority of concrete and masonry anchors. Anchors of this type are designed with an expansion mechanism that compresses against the base material.

The expansion mechanism may be a sleeve, slotted shell, slotted stud, or wedge assembly which is actuated by a tapered cone, tapered plug, nail, bolt, or screw depending upon the anchor style. The compression of the expansion mechanism against the wall of the drilled hole allows the anchor to transfer the load to the base material. Anchors which are expanded by tightening a bolt or nut are considered to be torque controlled while those that are actuated by driving a nail or plug are considered to be deformation controlled. A deformation controlled anchor can develop a higher initial compression force when compared to a torque controlled anchor. Compression anchors may also be pre-expanded and/or used in conjuction with a drive nail. The expansion mechanism on an anchor of this style is actuated as it is compressed during the driving operation into the anchor hole.

Screw anchors

Screw anchors develop their load capacity by tapping into and creating an interlock between the anchor and the base material. In the most common systems, an undersized hole is drilled into the base material. As the anchor is driven in, a keying/friction force is developed between the shank of the anchor and the base material. This type of anchor can be suitable for sustaining light to heavy duty loads depending on the anchor design.

SECTION CONTENTS

MECHANICAL ANCHOR SELECTION GUIDE

Legend ■ Suitable □ May be Suitable

Anchor Category		Undercut Anchors	Expansion Anchors					Screw Anchors					Dropin Anchors		
Product		Atomic+ Undercut	Power-Bolt	Power-Stud+ SD1	Power-Stud+ SD2	Power-Stud (MG, SS)	Lok-Bolt AS	Wedge-Bolt+	Wedge-Bolt (OT,SS)	Tapper+	Tapper (SS)	Snake+	Steel Dropin	Mini Dropin	Hollow-Set Dropin
Page		34	43	54	66	74	89	96	113	130	139	146	155	162	166
Base Material	Concrete	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Lightweight Concrete	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Hollow Core Plank		□				□	□		■		□		■	■
	Grout-filled Concrete Masonry		■	■	■	□	■	■	■	■	■	□		□	■
	Hollow Concrete Masonry		□				■	□		■					■
	Solid Brick		■				■	■	■	■	■				■
	Hollow Brick		□				□			□					□
	Stone	□	□	□	□	□	□			□			□	□	□
	Structural Clay Tile						□			□					
	Wood									■					
	Steel														
Anchor Diameter	#8-32														
	#10-24														
	3/16"									■	■				
	1/4"		■	■		■	■	■	■	■	■	■	■	■	■
	5/16"		■				■								■
	3/8"	■	■	■	■	■	■	■	■			■	■	■	■
	1/2"	■	■	■	■	■	■	■	■			■	■	■	■
	5/8"	■	■	■	■	■	■	■	■				■		■
	3/4"	■	■	■	■	■	■	■	■				■		
	7/8"			■		■									
	1"			■		■									
	1-1/4"			■											
Head Style	Stud	■				■	■								
	Finished Hex Head		■	■	■			■	■	■	■				
	Round / Acorn Nut						■								
	Flat Head (Countersunk)		■				■			■	■				
	Mushroom Head														
	Tie-Wire Head			■			■								
	Tamperproof														
	Female / Rod Coupler						■								
	Flush Mount											■			
	Removable		■					■	■	■	■	■	■	■	■
Working Load (Concrete)	Under 500 lbs.	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	500 lbs. to 5,000 lbs.	■	■	■	■	■	■	■	■	■		■	■	■	■
	Over 5,000 lbs.	■	■	■	■	■		■	■						
Coating / Material	Zinc Plated Carbon Steel	■	■	■	■		■	■	■			■	■	■	■
	Galvanized Steel					■		■							
	Type 303/304 Stainless Steel		■			■	■				■		■		■
	Type 316 Stainless Steel	■				■							■		
	Type 410 Stainless Steel								■		■				
	Zamac Alloy														■
	Perma-Seal Coated									■					
	Nylon / Plastic														
	Lead														

MECHANICAL ANCHOR SELECTION GUIDE

Legend ■ Suitable □ May be Suitable

Anchor Category		Bolt/Shield Anchors				Rod Hanger Anchors			Pin / Nail Anchors					
Product		Double	Single	Calk-In	Lag Shield	Vertigo+	Vertigo	Bang-It / Woodknocker	Spike	Drive	Heli-Pin	Safe-T+ Pin	Zamac Hammer-Screw	Zamac Nailin
Page		173	177	179	182	185	194	200	207	221	225	228	232	236
Base Material	Concrete	■	■	■		■	■	■	■	■	■	■	■	■
	Lightweight Concrete	■	□	□		■	■	■	■	□	■	■	□	□
	Hollow Core Plank						■						□	□
	Grout-filled Concrete Masonry	■	□	■					■	□	■	■	■	■
	Hollow Concrete Masonry	■		□							■		■	■
	Solid Brick	■	□	■					□	□	■	■	■	■
	Hollow Brick										■		□	□
	Stone	□	□	□					□	□	■	□	□	□
	Structural Clay Tile										□			
	Wood						■				■			
	Steel						■				□			
Anchor Diameter	#8-32			■										
	#10-24			■										
	3/16"			■					■	■				
	1/4"	■	■	■		■	■	■	■	■	8mm	8mm		
	5/16"	■	■	■										
	3/8"	■	■	■		■	■	■	■	■				
	1/2"	■	■	■		■	■	■	■	■				
	5/8"	■	■					■						
	3/4"	■	■					■						
	7/8"							■						
	1"													
	1-1/4"													
Head Style	Stud													
	Finished Hex Head													
	Round / Acorn Nut									■				
	Flat Head (Countersunk)							■		■				■
	Mushroom Head							■					■	■
	Tie-Wire Head							■		■				
	Tamperproof							■			■			
	Female / Rod Coupler					■	■							
	Flush Mount	■	■	■				■			■			
	Removable					■	■						■	
Working Load (Concrete)	Under 500 lbs.	■	■	■		■	■	■	■	■	■	■	■	■
	500 lbs. to 5,000 lbs.	■		■		■	■	■	■					
	Over 5,000 lbs.													
Coating / Material	Zinc Plated Carbon Steel					■	■	■	■	■		■	■	■
	Galvanized Steel													
	Type 303/304 Stainless Steel										■			
	Type 316 Stainless Steel								■					
	Type 410 Stainless Steel													
	Zamac Alloy	■		■									■	■
	Perma-Seal Coated												■	
	Nylon / Plastic							■						
	Lead			■										

Atomic+ Undercut™ *Anchor*

PRODUCT DESCRIPTION

The Atomic+ Undercut anchor is designed for applications in cracked and uncracked concrete. The anchors are available in standard ASTM A 36 steel, high strength ASTM A 193 Grade B7 high strength steel and Type 316 stainless steel designations.

The Type 316 stainless steel version can be considered for exterior use and industrial applications where a high level of corrosion resistance is required.

The Atomic+ Undercut anchor is installed into a pre-drilled hole which has been enlarged at the bottom in the shape of a reversed cone using the Powers Undercut drill bit. The result is an anchor which transfers load mainly through bearing, and unlike a typical expansion anchor is not dependent upon friction between the expansion sleeve and the concrete. Due to the use of a thick walled expansion sleeve, the load is distributed to a large area which can provide ductile behavior of the anchor even at relatively shallow embedments.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e. beam and column anchorage
- Safety related attachments
- Tension zone applications, i.e. cable trays and strut, pipe supports, fire sprinkler
- Seismic and wind loading
- Heavy duty loading

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ Anchors available for standard installations and for through bolt applications where the fixture is already in place
+ Length ID code and identifying marking stamped on head of each anchor
+ Load transfers to concrete through bearing, not friction
+ Bearing load transfer allows for closer spacing and edge distances.
+ Can be designed for predictable ductile steel performance behaves like a cast in place bolt.
+ Undercut created in seconds with durable tool

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES), ESR-3067
Code compliant with the 2009 IBC, 2009 IRC, 2006 IBC, 2006 IRC, 2003 IBC, and 2003 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: 03151-Concrete Anchoring and 05090 - Metal Fastening.
Undercut anchors shall be Atomic+ Undercut anchors as supplied by Powers Fasteners, Inc., Brewster, NY. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

AnchorComponent	Anchor Designation		
	Standard ASTM A 36	High Strength ASTM A 193 Grade B7	Type 316 Stainless Steel
Threaded Rod	ASTM A 36	ASTM A 193 Grade B7	Type 316 Stainless Steel
Expansion Coupling	ASTM A 108 12L14	ASTM A 108 12L14	Type 316 Stainless Steel
Expansion/Spacer Sleeve	ASTM A 513 Type 5	ASTM A 513 Type 5	Type 316 Stainless Steel
Hex Nuts	Carbon Steel, ASTM A 563, Grade A		Type 316 Stainless Steel, ASTM A 563, Grade A
Washer	Carbon Steel, ASTM A 844; Meets dimensional requirments of ANSI B18. 2.22.2, Type A Plain		Type 316 Stainless Steel, ASTM F 844, meets dimensional requirements of ANSI B18,22.2, Type A
Plating	Zinc Plating according to ASTM B 633, SC1, Type III (Fe/Zn 5) Minimum plating requirement for Mild Service Condition		N/A

SECTION CONTENTS

Atomic+ Undercut Assembly

THREAD VERSION

UNC threaded stud

ANCHOR MATERIALS

Carbon Steel
High Strength Carbon Steel
Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

3/8" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

Normal-weight concrete
Structural sand-lightweight concrete

This Product Available In

PDA®

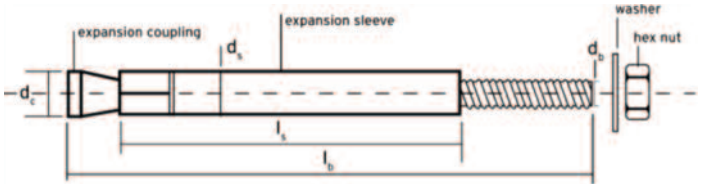
Powers Design Assist
Real Time Anchor Design Software
www.powersdesignassist.com

ANCHOR SPECIFICATIONS

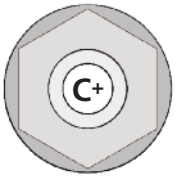
Dimensional Characteristics Table for Atomic+ Undercut

Anchor Designation	Anchor Type	Anchor Rod ASTM Designation	Rod Diameter, d_b (inch)	Anchor Length, l_b (inches)	Sleeve Length, l_s (inches)	Sleeve Diameter, d_s (inch)	Expansion Coupling Diameter d_c (inch)	Max. Fixture Thickness, t (inches)
03100SD	Standard	A 36	3/8	5-1/2	2-3/4	5/8	5/8	1-3/4
03102SD	Through bolt (TB)	A 36	3/8	5-1/2	4-1/2	5/8	5/8	1-3/4
03600SD	Standard	Type 316 SS	3/8	5-1/2	2-3/4	5/8	5/8	1-3/4
03602SD	Through bolt (TB)	Type 316 SS	3/8	5-1/2	4-1/2	5/8	5/8	1-3/4
03104SD	Standard	A 193, Grade B7	3/8	6-3/4	4	5/8	5/8	1-3/4
03106SD	Through bolt (TB)	A 193, Grade B7	3/8	6-3/4	5-3/4	5/8	5/8	1-3/4
03108SD	Standard	A 36	1/2	7	4	3/4	3/4	1-3/4
03110SD	Through bolt (TB)	A 36	1/2	7	5-3/4	3/4	3/4	1-3/4
03608SD	Standard	Type 316 SS	1/2	7	4	3/4	3/4	1-3/4
03610SD	Through bolt (TB)	Type 316 SS	1/2	7	5-3/4	3/4	3/4	1-3/4
03112SD	Standard	A 193, Grade B7	1/2	8	5	3/4	3/4	1-3/4
03114SD	Through bolt (TB)	A 193, Grade B7	1/2	8	6-3/4	3/4	3/4	1-3/4
03116SD	Standard	A 193, Grade B7	1/2	9-3/4	6-3/4	3/4	3/4	1-3/4
03118SD	Through bolt (TB)	A 193, Grade B7	1/2	9-3/4	8-1/2	3/4	3/4	1-3/4
03120SD	Standard	A 36	5/8	7-3/4	4-1/2	1	1	1-3/4
03122SD	Through bolt (TB)	A 36	5/8	7-3/4	6-1/4	1	1	1-3/4
03620SD	Standard	Type 316 SS	5/8	7-3/4	4-1/2	1	1	1-3/4
03622SD	Through bolt (TB)	Type 316 SS	5/8	7-3/4	6-1/4	1	1	1-3/4
03124SD	Standard	A 193, Grade B7	5/8	10-3/4	7-1/2	1	1	1-3/4
03126SD	Through bolt (TB)	A 193, Grade B7	5/8	10-3/4	9-1/4	1	1	1-3/4
03128SD	Standard	A 193, Grade B7	5/8	12-1/4	9	1	1	1-3/4
03130SD	Through bolt (TB)	A 193, Grade B7	5/8	12-1/4	10-3/4	1	1	1-3/4
03132SD	Standard	A 36	3/4	8-5/8	5	1-1/8	1-1/8	1-3/4
03134SD	Through bolt (TB)	A 36	3/4	8-5/8	6-3/4	1-1/8	1-1/8	1-3/4
03632SD	Standard	Type 316 SS	3/4	8-5/8	5	1-1/8	1-1/8	1-3/4
03634SD	Through bolt (TB)	Type 316 SS	3/4	8-5/8	6-3/4	1-1/8	1-1/8	1-3/4
03136SD	Standard	A 193, Grade B7	3/4	13-5/8	10	1-1/8	1-1/8	1-3/4
03138SD	Through bolt (TB)	A 193, Grade B7	3/4	13-5/8	11-3/4	1-1/8	1-1/8	1-3/4

Atomic+ Undercut Anchor Detail



Head Marking



Legend

Letter Code = Length Identification Mark

'+' Symbol = Strength Design Compliant Anchor (see ordering information)

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	W	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 SPECIFICATIONS

Installation Specifications for Atomic+ Undercut Anchors

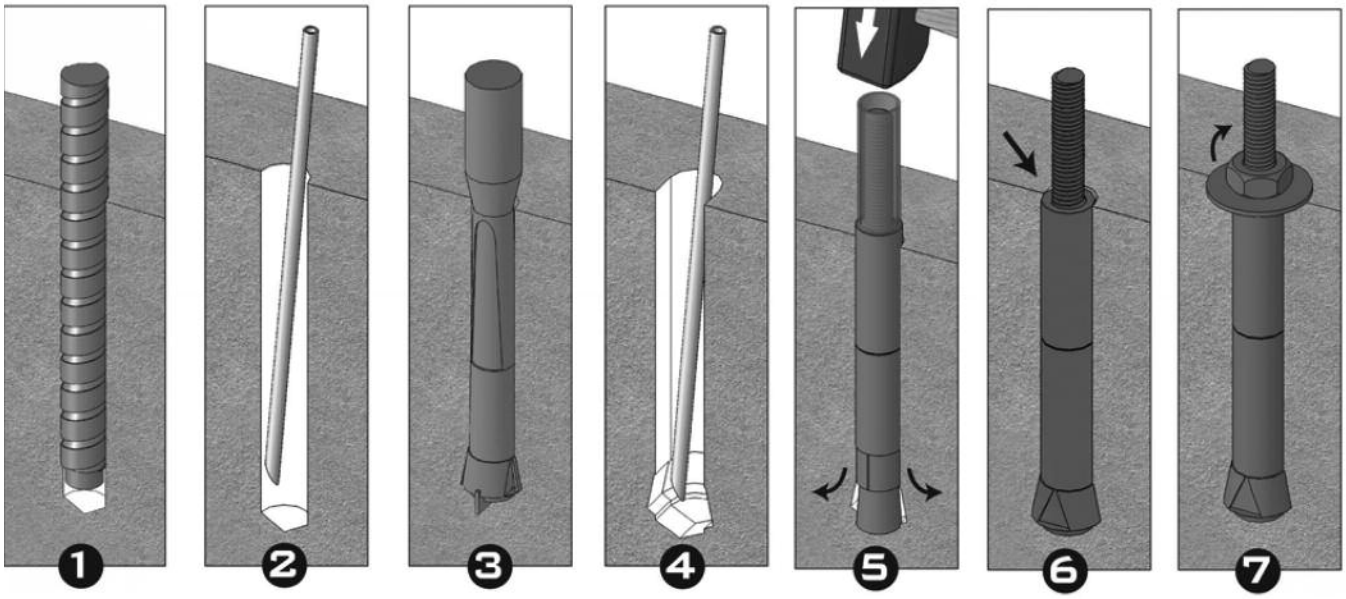
Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter									
			3/8 inch		1/2 inch			5/8 inch			3/4 inch	
Outside anchor diameter	d_a [d_0][3]	in. (mm)	0.625 (15.9)		0.750 (19.1)			1.000 (25.4)			1.125 (28.6)	
Minimum diameter of hole clearance in fixture[2]	d_h	in. (mm)	7/16 (11.1)		9/16 (14.3)			11/16 (17.5)			13/16 (20.6	
Minimum nominal embedment depth	h_{nom}	in. (mm)	3-1/8 (79)	4-3/8 (111)	4-1/4 (108)	5-1/4 (133)	7 (178)	5 (127)	8 (203)	9-1/2 (241)	5-7/8 (149)	10-7/8 (276)
Effective embedment	h_{ef}	in. (mm)	2-3/4 (68)	4 (102)	4 (102)	5 (127)	6-3/4 (171)	4-1/2 (114)	7-1/2 (190)	9 (229)	5 (127)	10 (254)
Minimum hole depth[1]	h_o	in. (mm)	3-1/8 (79)	4-3/8 (111)	4-1/4 (108)	5-1/4 (133)	7 (178)	5 (127)	8 (204)	9-1/2 (241)	5-7/8 (149)	10-7/8 (276)
Minimum concrete member thickness	h_{min}	in. (mm)	5-1/2 (140)	8 (204)	8 (204)	10 (254)	13-1/2 (343)	9 (229)	15 (381)	18 (457)	10 (254)	20 (508)
	for $c_{ac} \geq$	in. (mm)	4-1/8 (105)	6 (152)	6 (152)	7-1/2 (190)	10-1/8 (257)	6-3/4 (171)	11-1/4 (256)	13-1/2 (343)	7-1/2 (190)	15 (381)
	h_{min}	in. (mm)	4-3/8 (111)	6 (152)	6 (152)	7-1/2 (190)	10-1/8 (257)	6-3/4 (171)	11-1/4 (256)	13-1/2 (343)	7-1/2 (190)	15 (381)
	for $c_{ac} \geq$	in. (mm)	5-1/2 (140)	10-1/4 (260)	9-1/4 (235)	13 (330)	20-1/4 (514)	9-1/2 (241)	21 (533)	27 (686)	10-1/2 (267)	30 (762)
Minimum edge distance	c_{min}	in. (mm)	2-1/4 (57)	3-1/4 (82)	3-1/4 (82)	4 (102)	5-3/8 (86)	3-5/8 (92)	6 (152)	7-1/4 (184)	4 (102)	8 (204)
Minimum spacing distance	s_{min}	in. (mm)	2-3/4 (70)	4 (102)	4 (102)	5 (127)	6-3/4 (171)	4-1/2 (114)	7-1/2 (190)	9 (229)	5 (127)	10 (254)
Maximum thickness of fixture	t	in. (mm)	1-3/4 (44)		1-3/4 (44)			1-3/4 (44)			1-3/4 (44)	
Maximum torque	T_{inst}	ft.-lbf.	26		44			60			133	
Torque wrench / socket size	-	in.	9/16		3/4			15/16			1-1/8	
Nut Height	-	in.	21/64		7/16			35/64			41/64	
Stop Drill Bit												
Nominal stop drill bit diameter	d_{bit}	in.	5/8 ANSI		3/4 ANSI			1 ANSI			1-1/8 ANSI	
Stop drill bit for anchor installation	-	-	3220SD	3221SD	3222SD	3223SD	3224SD	3225SD	3226SD	3227SD	3228SD	3229SD
Drilled hole depth of stop bit[1]	-	-	3-1/8	4-3/8	4-1/4	5-1/4	7	5	8	9-1/2	5-7/8	10-7/8
Stop drill bit shank type	-	-	SDS		SDS			SDS-Max			SDS-Max	
Undercut Drill Bit												
Nominal undercut drill bit diameter	d_{uc}	in.	5/8		3/4			1			1-1/8	
Undercut drill bit designation	-	-	3200SD		3201SD			3202SD			3203SD	
Maximum depth of hole for undercut drill bit	-	in. (mm)	9 (229)		10-1/4 (260)			12-1/4 (311)			13-1/2 (343)	
Undercut drill bit shank type	-	-	SDS		SDS			SDS-Max			SDS-Max	
Required impact drill energy	-	ft.-lbf.	1.6		2.5			3.2			4.0	
Setting Sleeve												
Recommended setting sleeve	-	-	3210SD		3211SD			3212SD			3213SD	

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

1. For through bolt applications the actual hole depth is given by the minimum hole depth plus the maximum thickness of fixture less the thickness of the actual part(s) being fastened to the base material ($h_{o,act} = h_o + t - t_{pl}$).
2. For through bolt applications the minimum diameter of hole clearance in fixture is 1/16-inch larger than the nominal outside anchor diameter.
3. The notation in brackets is for the 2006 IBC.

INSTALLATION INSTRUCTIONS

Installation Instructions for Atomic+ Undercut Anchors



1.) *Drill the hole to proper depth and diameter per specifications using roto-hammer and stop drill.*

2.) *Clean the hole using a blow-out bulb or compressed air.*

3.) *Insert the undercut bit and start the rotohammer. Undercutting is complete when the stopper sleeve is fully compressed (gap closed)*

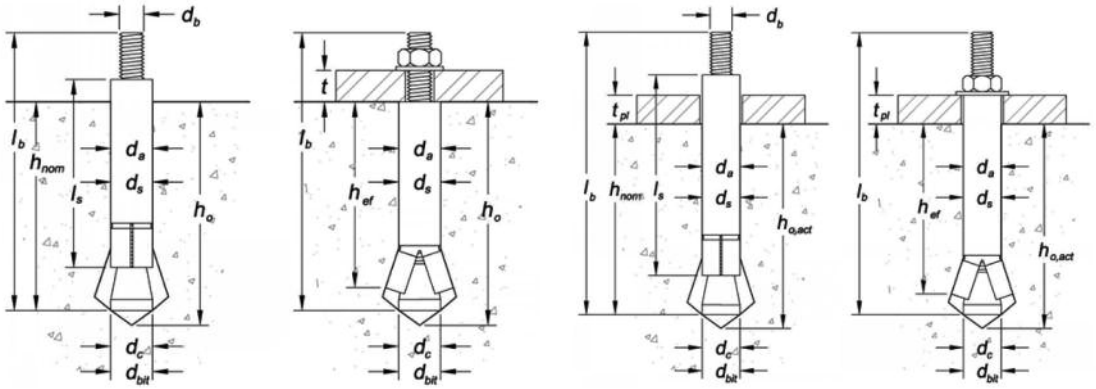
4.) *Clean the hole using a blow-out bulb or compressed air.*

5.) *Insert anchor into hole. Place setting sleeve over anchor and drive the expansion sleeve over the expansion coupling.*

6.) *Verify that the setting mark is visible on the theaded rod above the sleeve.*

7.) *Apply proper torque.*

Atomic+ Undercut Anchor Detail (before and after application of setting sleeve and attachment)



PERFORMANCE DATA

Tension and Shear Design Information For Atomic+ Undercut Anchor in Concrete (For use with load combinations taken from ACI 318 Section 9.2)[1,2,3]

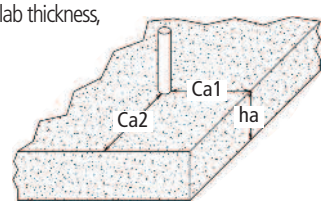
Anchor Property / Setting Information	Notation	Units	Nominal Anchor Diameter									
			3/8 inch		1/2 inch			5/8 inch			3/4 inch	
Anchor category	1,2 or 3	-	1									
Outside anchor diameter	d_a [d_O][9]	in. (mm)	0.625 (15.9)		0.750 (19.1)			1.000 (25.4)			1.125 (28.6)	
Effective embedment	h_{ef}	in. (mm)	2-3/4 (68)	4 (102)	4 (102)	5 (127)	6-3/4 (171)	4-1/2 (114)	7-1/2 (190)	9 (229)	5 (127)	10 (254)
STEEL STRENGTH IN TENSION AND SHEAR[3]												
Tensile stress area of anchor rod steel	A_{se}	in.^{2} (mm^2)	0.0775 (50)		0.1419 (91)			0.2260 (146)			0.3345 (216)	
Minimum specified yield strength of anchor rod[10]	f_y	ksi (N/mm^2)	36 (248)	105 (723)	36 (248)	105 (723)	105 (723)	36 (248)	105 (723)	105 (723)	36 (248)	105 (723)
Minimum specified ultimate tensile strength of anchor rod[10]	f_{uta}[8]	ksi (N/mm^2)	58 (400)	125 (860)	58 (400)	125 (860)	125 (860)	58 (400)	125 (860)	125 (860)	58 (400)	125 (860)
Steel strength in tension, static[10]	N_{sa}[8]	lb (kN)	4,495 (20.1)	9,685 (43.2)	8,230 (36.7)	17,735 (79.1)	17,735 (79.1)	13,100 (58.5)	28,250 (126.1)	28,250 (126.1)	19,400 (86.3)	41,810 (186.0)
Steel strength in shear, static[10]	V_{sa}[8]	lb (kN)	2,245 (10.0)	4,885 (21.7)	4,110 (18.4)	8,855 (39.5)	8,855 (39.5)	6,560 (29.3)	14,110 (63.0)	14,110 (63.0)	9,685 (43.2)	20,875 (93.2)
Steel strength in shear, seismic[10]	V_{eq}[8]	lb (kN)	2,245 (10.0)	4,885 (21.7)	4,110 (18.4)	8,855 (39.5)	8,855 (39.5)	6,560 (29.3)	14,110 (63.0)	14,110 (63.0)	9,685 (43.2)	20,875 (93.2)
Minimum specified yield strength of anchor rod (Type 316 stainless steel anchor)	$f_{y,ss}$	ksi (N/mm^2)	30 (205)	-	30 (205)	-	-	30 (205)	-	-	30 (205)	-
Minimum specified ultimate tensile strength of anchor rod (Type 316 stainless steel anchor)	$f_{uta,ss}$[8]	ksi (N/mm^2)	75 (515)	-	75 (515)	-	-	75 (515)	-	-	75 (515)	-
Steel strength in tension, static (Type 316 stainless steel anchor)[11]	$N_{sa,ss}$[8]	lb (kN)	4,415 (19.6)	-	8,085 (36.0)	-	-	12,880 (57.3)	-	-	19,065 (84.8)	-
Steel strength in shear, static (Type 316 stainless steel anchor) [11]	$V_{sa,ss}$[8]	lb (kN)	2,650 (11.8)	-	4,850 (21.6)	-	-	7,725 (34.4)	-	-	11,440 (50.9)	-
Reduction factor for steel strength in tension[2]	ϕ	-	0.75									
Reduction factor for steel strength in shear[2]	ϕ	-	0.65									
CONCRETE BREAKOUT STRENGTH IN TENSION AND SHEAR[7]												
Effectiveness factor for uncracked concrete	k_{uncr}	-	30		30			30			30	
Effectiveness factor for cracked concrete	k_{cr}	-	24		24			24			24	
Modification factor for cracked and uncracked concrete[4]	$\Psi_{c,N}$[8]	-	1 (See note 4)		1 (See note 4)			1 (See note 4)			1 (See note 4)	
Reduction factor for concrete breakout strength in tension[2]	ϕ	-	0.65 (Condition B)									
Reduction factor for concrete breakout strength in shear[2]	ϕ	-	0.70 (Condition B)									
PULLOUT STRENGTH IN TENSION[7]												
Characteristic pullout strength, uncracked concrete (2,500 psi)[5]	$N_{p,uncr}$	lb (kN)	See note 6		See note 6			See note 6			See note 6	
Characteristic pullout strength, cracked concrete (2,500 psi)[5]	$N_{p,cr}$	lb (kN)	See note 6	9,000 (40.2)	See note 6	11,500 (51.3)		See note 6	15,000 (67.0)		See note 6	22,000 (98.2)
Characteristic pullout strength, seismic (2,500 psi)[5,10]	N_{eq}[8]	lb (kN)	See note 6	9,000 (40.2)	See note 6	11,500 (51.3)		See note 6	15,000 (67.0)		See note 6	22,000 (98.2)
Reduction factor for pullout strength[2]	ϕ	-	0.65 (Condition B)									
PRYOUT STRENGTH IN SHEAR[7]												
Coefficient for pryout strength	k_{cp}	-	2.0		2.0			2.0			2.0	
Reduction factor for pryout strength[2]	ϕ	-	0.70 (Condition B)									

For SI: 1 inch = 25.4 mm, 1 ksi = 6.895 MPa (N/mm^2), 1 lbf = 0.0044 kN, 1 in^2 = 645 mm^2.

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. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318 Section 9.2 or UBC Section 1612.2. If the load combinations of ACI 318 Appendix C or IBC Section 1909.2 are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate $\varnothing$ factor.
3. Anchors are considered a ductile steel element as defined by ACI 318 D.1.
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 2,500 psi, N_{pn} = (pullout strength value from table)*(specified concrete compressive 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 structural sand-lightweight concrete provided that N_b, N_{eq} and N_{pn} mulitplied by a factor of 0.60.
8. For 2003 IBC code basis, f_{uta} replaces f_{ut}; N_{sa} replaces N_s; $\Psi_{c,N}$ replaces Ψ_3; and N_{eq} replaces $N_{p,seis}$; and V_{eq} replaces $V_{sa,seis}$.
9. The notation in brackets is for the 2006 IBC.
10. Only Applicapable for carbon steel anchors.
11. Calculated using $f_{uta,ss}$ = 57 ksi (1.9 f_y) in accordance with ACI 318 Appendix D.

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318 Appendix D:

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 (ϕ) 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.



Tension and Shear Design Strength for Carbon Steel Atomic+ Undercut in Cracked Concrete

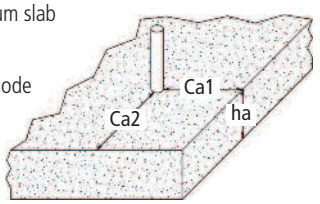
Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, f'c (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460
3/8	4-3/8	5,850	3,155	6,410	3,155	7,265	3,155	7,265	3,155	7,265	3,155
1/2	4-1/4	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670
1/2	5-1/4	7,475	5,755	8,190	5,755	9,455	5,755	11,580	5,755	13,300	5,755
1/2	7	7,475	5,755	8,190	5,755	9,455	5,755	11,580	5,755	13,300	5,755
5/8	5	7,445	4,265	8,155	4,265	9,420	4,265	9,825	4,265	9,825	4,265
5/8	8	9,750	9,170	10,680	9,170	12,335	9,170	15,105	9,170	17,440	9,170
5/8	9-1/2	9,750	9,170	10,680	9,170	12,335	9,170	15,105	9,170	17,440	9,170
3/4	5-7/8	8,720	6,295	9,555	6,295	11,030	6,295	13,510	6,295	14,550	6,295
3/4	10-7/8	14,300	13,570	15,665	13,570	18,090	13,570	22,155	13,570	25,580	13,570

Tension and Shear Design Strength for Carbon Steel Atomic+ Undercut in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, f'c (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460
3/8	4-3/8	7,265	3,155	7,265	3,155	7,265	3,155	7,265	3,155	7,265	3,155
1/2	4-1/4	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670
1/2	5-1/4	10,900	5,755	11,940	5,755	13,300	5,755	13,300	5,755	13,300	5,755
1/2	7	13,300	5,755	13,300	5,755	13,300	5,755	13,300	5,755	13,300	5,755
5/8	5	9,305	4,265	9,825	4,265	9,825	4,265	9,825	4,265	9,825	4,265
5/8	8	20,025	9,170	21,190	9,170	21,190	9,170	21,190	9,170	21,190	9,170
5/8	9-1/2	21,190	9,170	21,190	9,170	21,190	9,170	21,190	9,170	21,190	9,170
3/4	5-7/8	10,900	6,295	11,940	6,295	13,790	6,295	14,550	6,295	14,550	6,295
3/4	10-7/8	30,830	13,570	31,360	13,570	31,360	13,570	31,360	13,570	31,360	13,570

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

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318 Appendix D:



1. Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, ha = hmin, and with the following conditions: c_{a1} is greater than or equal to the critical edge distance, c_{ac} (table values based on $c_{a1} = c_{ac}$) and 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 (ϕ) 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 stainless steel Atomic+ Undercut anchors.
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.

Tension and Shear Factored Design Strength for Stainless Steel Atomic+ Undercut Anchor in Cracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, f'c (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	3,310	1,725	3,310	1,725	3,310	1,725	3,310	1,725	3,310	1,725
1/2	4-1/4	6,065	3,155	6,065	3,155	6,065	3,155	6,065	3,155	6,065	3,155
5/8	5	7,445	5,020	8,155	5,020	9,420	5,020	9,660	5,020	9,660	5,020
3/4	5-7/8	8,720	7,425	9,555	7,425	11,030	7,425	13,510	7,425	14,275	7,425

Tension and Shear Factored Design Strength for Stainless Steel Atomic+ Undercut Anchor in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, f'c (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	3-1/8	3,310	1,725	3,310	1,725	3,310	1,725	3,310	1,725	3,310	1,725
1/2	4-1/4	6,065	3,155	6,065	3,155	6,065	3,155	6,065	3,155	6,065	3,155
5/8	5	9,305	5,020	9,660	5,020	9,660	5,020	9,660	5,020	9,660	5,020
3/4	5-7/8	10,900	7,425	11,940	7,425	13,790	7,425	14,275	7,425	14,275	7,425

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

ORDERING INFORMATION

Atomic+ Undercut Anchor A 36 Steel

Cat. No.	Nominal Anchor Diameter	Overall Length	Required Undercut Bit (Cat. No.)	Recommended Stop Bit (Cat. No.)	Anchor Type	Std. Box
03100SD	3/8"	5-1/2"	03200SD	03220SD	Standard	20
03102SD	3/8"	5-1/2"		*	Through bolt	20
03108SD	1/2"	7"	03201SD	03222SD	Standard	15
03110SD	1/2"	7"		*	Through bolt	15
03120SD	5/8"	7-3/4"	03202SD	03225SD	Standard	10
03122SD	5/8"	7-3/4"		*	Through bolt	10
03132SD	3/4"	8-5/8"	03203SD	03228SD	Standard	8
03134SD	3/4"	8-5/8"		*	Through bolt	8

For availability of all anchors lengths please contact Powers Fasteners.
*Contact Powers Fasteners for appropriate drilling method and hardware.

Atomic+ Undercut Anchor High Strength A 193, Grade B7 Steel

Cat. No.	Nominal Anchor Diameter	Overall Length	Required Undercut Bit (Cat. No.)	Recommended Stop Bit (Cat. No.)	Anchor Type	Std. Box
03104SD	3/8"	6-3/4"	03200SD	03221SD	Standard	20
03106SD	3/8"	6-3/4"		*	Through bolt	20
03112SD	1/2"	8"	03201SD	03223SD	Standard	15
03114SD	1/2"	8"		*	Through bolt	15
03116SD	1/2"	9-3/4"		03224SD	Standard	15
03118SD	1/2"	9-3/4"		*	Through bolt	15
03124SD	5/8"	10-3/4"	03202SD	03226SD	Standard	10
03126SD	5/8"	10-3/4"		*	Through bolt	10
03128SD	5/8"	12-1/4"		03227SD	Standard	10
03130SD	5/8"	12-1/4"		*	Through bolt	10
03136SD	3/4"	13-5/8"	03203SD	03229SD	Standard	8
03138SD	3/4"	13-5/8"		*	Through bolt	8

For availability of all anchors lengths please contact Powers Fasteners.
*Contact Powers Fasteners for appropriate drilling method and hardware.

Atomic+ Undercut Anchor Type 316 Stainless Steel

Cat. No.	Nominal Anchor Diameter	Overall Length	Required Undercut Bit (Cat. No.)	Recommended Stop Bit (Cat. No.)	Anchor Type	Std. Box
03600SD	3/8"	5-1/2"	03200SD	03220SD	Standard	20
03602SD	3/8"	5-1/2"		*	Through bolt	20
03608SD	1/2"	7"	03201SD	03222SD	Standard	15
03610SD	1/2"	7"		*	Through bolt	15
03620SD	5/8"	7-3/4"	03202SD	03225SD	Standard	10
03622SD	5/8"	7-3/4"		*	Through bolt	10
03632SD	3/4"	8-5/8"	03203SD	03228SD	Standard	8
03634SD	3/4"	8-5/8"		*	Through bolt	8

For availability of all anchors lengths please contact Powers Fasteners.
*Contact Powers Fasteners for appropriate drilling method and hardware.

ORDERING INFORMATION

Stop Drill Bits

Cat. No.	Nominal Stop Drill Bit Diameter	Corresponding Nominal Anchor Diameter	Max. Drill Depth	Shank Type	Std. Tube
03220SD	5/8	3/8	3-1/8"	SDS	1
03221SD	5/8	3/8	4-3/8"	SDS	1
03222SD	3/4	1/2	4-1/4"	SDS	1
03223SD	3/4	1/2	5-1/4"	SDS	1
03224SD	3/4	1/2	7"	SDS	1
03225SD	1	5/8	5"	SDS-Max	1
03226SD	1	5/8	8"	SDS-Max	1
03227SD	1	5/8	9-1/2"	SDS-Max	1
03228SD	1-1/8	3/4	5-13/16"	SDS-Max	1
03229SD	1-1/8	3/4	10-13/16"	SDS-Max	1

The Stop Drill Bit creates a drill hole to the proper depth for standard installations of the Atomic+ Undercut anchor (for through bolt applications please contact Powers Fasteners for appropriate drilling method and hardware).

Undercut Drill Bits

Cat. No.	Nominal Undercut Drill Bit Diameter	Corresponding Nominal Anchor Diameter	Maximum Depth of Hole	Shank Type	Std. Tube
03200SD	5/8	3/8	9"	SDS	1
03201SD	3/4	1/2	10-1/4"	SDS	1
03202SD	1	5/8	12-1/4"	SDS-Max	1
03203SD	1-1/8	3/4	13-1/2"	SDS-Max	1

The Undercut Drill Bit has a unique design that enlarges the bottom of the drill hole creating a reverse cone sized to receive the Atomic+ Undercut anchor.

Undercut Setting Sleeve

CAT. NO.	Corresponding Nominal Anchor Diameter	Std. Box
03210SD	3/8	1
03211SD	1/2	1
03212SD	5/8	1
03213SD	3/4	1

Note: One Undercut Setting Sleeve is packaged with each box of Atomic+ Undercut anchors.

Power-Bolt™ *Heavy-Duty Sleeve Anchor*

PRODUCT DESCRIPTION

The Power-Bolt anchor is a heavy duty sleeve style, self-locking anchor which is vibration resistant and removable. It is available with a finished hex head or flat head with a hex key insert and can be used in concrete, block, brick, or stone.

Expansion occurs at two locations within the drilled hole. First, the cone is pulled into the large triple-tined expansion sleeve, developing a mid-level, compression force. Further turning causes the threaded bolt to advance into the threads of the expander cone, forcing its four sections outward. This action engages the base material deep in the anchor hole, greatly increasing the holding power of the Power-Bolt. The bolt and cone remain locked together which prevents loosening under vibratory conditions.

The Power-Bolt is also designed to draw the fixture into full bearing against the base material through the action of its flexible compression ring. As the anchor is being tightened, the compression ring will crush if necessary to tightly secure the fixture against the face of the base material.

The internal bolt of the Power-Bolt is removable and reusable in the same anchor sleeve making it suitable for applications such as mounting machinery which may need to be removed for service and for temporary applications such as heavy duty form work.

GENERAL APPLICATIONS AND USES

- Column Base Plates and Mechanical Equipment
- Dock Bumpers and Support Ledgers
- Racking and Railing Attachments

FEATURES AND BENEFITS

+ High load capacity
+ Two-level expansion mechanism
+ Internal high strength bolt is removable and reusable
+ Compression zone in sleeve clamps fixture to the base material
+ Low profile finished head design

TESTING, APPROVALS AND LISTINGS

Tested in accordance with ASTM E488 and AC01 criteria
FM Global (Factory Mutual) – File No. J.I. 1K8A3.AH (See report for sizes)
Underwriters Laboratories (UL Listed) – File No. EX1289 (See listing for sizes)

APPROVALS AND LISTINGS

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

SECTION CONTENTS

Hex Head Power-Bolt Assembly

Flat Head Power-Bolt Assembly

HEAD STYLES

Finished Hex Head
Flat Head

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry (CMU)
Hollow CMU
Brick Masonry
Stone

INSTALLATION SPECIFICATIONS

Carbon Steel Hex Head Power-Bolt

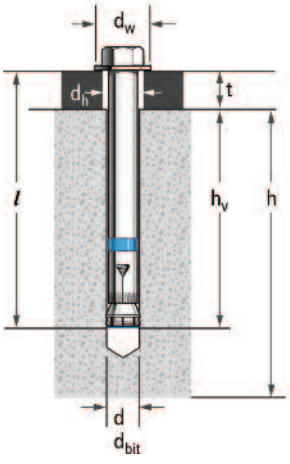
Dimension	Anchor Diameter, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/15	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16	9/16	11/16	13/16
Internal Bolt Size (UNC)	10-24	1/4-20	5/16-18	3/8-16	1/2-13	1/2-13
Head Height (in.)	7/64	11/64	13/64	15/64	5/16	25/64
Washer O.D., d_w (in.)	1/2	5/8	13/16	1	1-1/4	1-1/2
Wrench Size (in.)	5/16	7/16	1/2	9/16	3/4	15/16
Max Bolt Torque, T_{max} (ft-lbs)	4	12	25	45	100	120

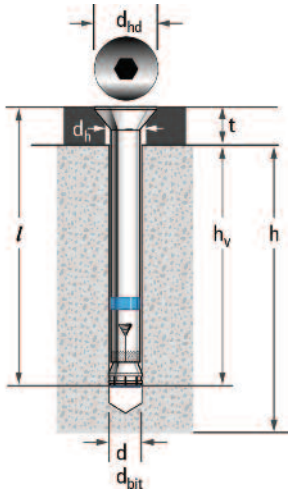
Carbon Steel Flat Head Power-Bolt (80°– 82° head)

Dimension	Anchor Diameter, *d*		
	3/8"	1/2"	5/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8
Fixture Clearance Hole, d_h (in.)	7/16	9/16	11/16
Internal Bolt Size (UNC)	5/16-18	3/8-16	1/2-13
Head Height (in.)	15/64	1/4	21/64
Head Diameter, d_{hd} (in.)	3/4	7/8	1-1/8
Allen Wrench Size (in.)	7/32	5/16	3/8
Max Bolt Torque, T_{max} (ft-lbs)	25	45	100

Stainless Steel Hex Head Power-Bolt

Dimension	Anchor Diameter, *d*				
	1/4"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16
Internal Bolt Size (UNC)	10-24	5/16-18	3/8-16	1/2-13	5/8-11
Head Height (in.)	7/64	13/64	15/64	5/16	25/64
Washer O.D., d_w (in.)	1/2	13/16	1	1-1/4	1-1/2
Wrench Size (in.)	5/16	1/2	9/16	3/4	15/16
Max Bolt Torque, T_{max} (ft-lbs)	3	12	25	60	90

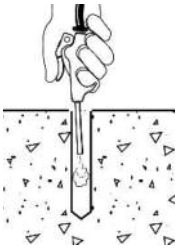




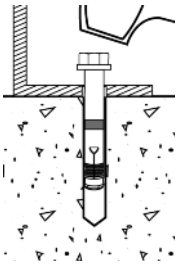
Installation Procedure

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.

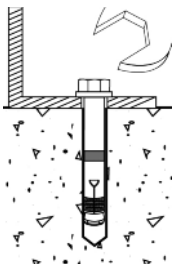
Blow the hole clean of dust and other material. Do not modify the anchor or advance the bolt in the anchor assembly prior to installation.



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



Tighten the anchor by turning the head 3 to 4 turns past finger tight.



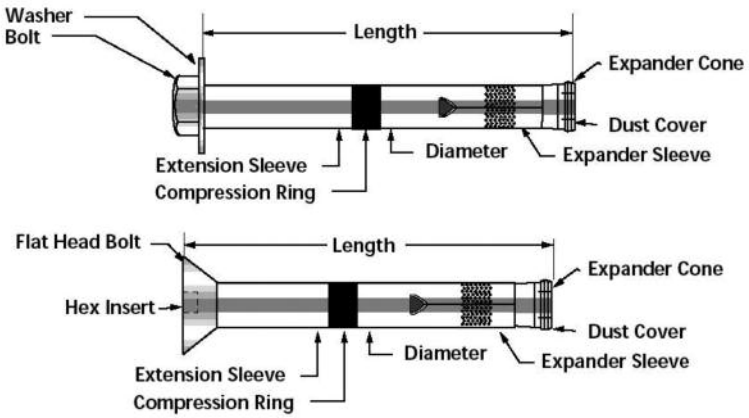
Nomenclature

- d = Diameter of anchor
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- d_{hd} = Flat head diameter
- d_w = Diameter of washer
- h = Base material thickness. The minimum value of h should be $1.5h_v$ or 3", whichever is greater
- h_v = Minimum embedment depth
- l = Length of anchor
- t = Fixture thickness

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel Hex Head	Carbon Steel Flat Head	Stainless Steel Hex Head
Internal Bolt	*SAE Grade 5	SAE Grade 5	**Type 304 SS
Washer	AISI 1040	N/A	Type 18-8 SS
Expander Sleeve	AISI 1010	AISI 1010	Type 304 SS
Extension Sleeve	AISI 1010	AISI 1010	Type 304 SS
Expander Cone	AISI 12L14	AISI 12L14	Type 303 SS
Compression Ring	Nylon	Nylon	Nylon
Dust Cap	Nylon	Nylon	Nylon
Zinc Plating	ASTM B 633, SC1, Type III (Fe/Zn 5) – Mild Service Condition		N/A

*1/4" and 5/16" Diameter Power-Bolts are manufactured with SAE Grade 8 internal bolts.
**Manufactured with a minimum yield strength of 65,000 psi.
Stainless steel anchor components are passivated. The stainless steel expander cone is zinc plated.



Length Identification

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

PERFORMANCE DATA

Ultimate Load Capacities for Carbon and Stainless Steel Power-Bolt 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)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**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 (6.4)	1-1/4 (31.8)	1,180 (5.3)	2,070 (9.3)	1,380 (6.2)	2,100 (9.5)	1,580 (7.1)	2,130 (9.6)	1,660 (7.5)	2,130 (9.6)
	1-3/4 (44.5)	1,400 (6.3)	2,070 (9.3)	1,550 (7.0)	2,305 (10.4)	1,700 (7.7)	2,540 (11.4)	1,860 (8.4)	2,540 (11.4)
	2-1/2 (63.5)	1,880 (8.5)	2,070 (9.3)	1,940 (8.7)	2,730 (12.3)	2,000 (9.0)	3,385 (15.2)	2,100 (9.5)	3,385 (15.2)
5/16 (7.9)	1-1/2 (38.1)	2,320 (10.4)	2,800 (12.6)	2,430 (10.9)	3,000 (13.5)	2,540 (11.4)	3,200 (14.4)	2,620 (11.8)	3,200 (14.4)
	2 (50.8)	2,640 (11.9)	3,280 (14.8)	2,880 (13.0)	3,755 (16.9)	3,120 (14.0)	4,230 (19.0)	3,270 (14.7)	4,230 (19.0)
	3 (76.2)	2,880 (13.0)	3,440 (15.5)	3,330 (15.0)	4,410 (19.8)	3,780 (17.0)	5,380 (24.2)	4,260 (19.2)	5,380 (24.2)
3/8 (9.5)	2 (50.8)	3,500 (15.8)	3,985 (17.9)	4,045 (18.2)	5,205 (23.4)	4,585 (20.6)	6,425 (28.9)	5,915 (26.6)	7,440 (33.5)
	2-1/2 (63.5)	3,800 (17.1)	4,380 (19.7)	4,330 (19.5)	5,770 (26.0)	4,855 (21.8)	7,160 (32.2)	6,665 (30.0)	7,960 (35.8)
	3-1/2 (88.9)	4,395 (19.8)	4,980 (22.4)	5,195 (23.4)	6,815 (30.7)	5,995 (27.0)	8,650 (38.9)	7,150 (32.2)	8,650 (38.9)
1/2 (12.7)	2-1/2 (63.5)	4,900 (22.1)	6,840 (30.8)	5,710 (25.7)	7,535 (33.9)	6,520 (29.3)	8,225 (37.0)	7,320 (32.9)	8,225 (37.0)
	3-1/2 (88.9)	6,140 (27.6)	8,540 (38.4)	7,590 (34.2)	9,200 (41.4)	9,040 (40.7)	9,860 (44.4)	9,890 (44.5)	10,780 (48.5)
	5 (127.0)	7,260 (32.7)	10,140 (45.6)	8,480 (38.2)	11,230 (50.5)	9,700 (43.7)	12,320 (55.4)	10,935 (49.2)	12,315 (55.4)
5/8 (15.9)	2-3/4 (69.9)	5,360 (24.1)	7,970 (35.9)	6,535 (29.4)	9,970 (44.9)	7,705 (34.7)	11,970 (53.9)	8,490 (38.2)	11,970 (53.9)
	4 (101.6)	6,460 (29.1)	10,860 (48.9)	8,210 (36.9)	12,710 (57.2)	9,960 (44.8)	14,560 (65.5)	13,110 (59.0)	15,900 (71.6)
	6 (152.4)	9,400 (42.3)	13,780 (62.0)	10,570 (47.6)	16,230 (73.0)	11,740 (52.8)	18,680 (84.1)	15,580 (70.1)	18,670 (84.0)
3/4 (19.1)	3 (76.2)	7,660 (34.5)	12,375 (55.7)	8,580 (38.6)	14,245 (64.1)	9,500 (42.8)	16,110 (72.5)	10,780 (48.5)	16,110 (72.5)
	4-1/2 (114.3)	10,060 (45.3)	16,900 (76.1)	11,200 (50.4)	20,250 (91.1)	12,340 (55.5)	23,600 (106.2)	16,240 (73.1)	23,600 (106.2)
	7 (177.8)	11,780 (53.0)	22,640 (101.9)	13,440 (60.5)	25,880 (116.5)	15,100 (68.0)	29,120 (131.0)	21,980 (98.9)	29,120 (131.0)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

PERFORMANCE DATA

Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt 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)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**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 (6.4)	1-1/4 (31.8)	295 (1.3)	515 (2.3)	345 (1.6)	525 (2.4)	395 (1.8)	535 (2.4)	415 (1.9)	530 (2.4)
	1-3/4 (44.5)	350 (1.6)	515 (2.3)	390 (1.8)	575 (2.6)	425 (1.9)	635 (2.9)	465 (2.1)	635 (2.9)
	2-1/2 (63.5)	470 (2.1)	515 (2.3)	485 (2.2)	680 (3.1)	500 (2.3)	845 (3.8)	525 (2.4)	845 (3.8)
5/16 (7.9)	1-1/2 (38.1)	580 (2.6)	700 (3.2)	610 (2.7)	750 (3.4)	635 (2.9)	800 (3.6)	655 (2.9)	800 (3.6)
	2 (50.8)	660 (3.0)	820 (3.7)	720 (3.2)	940 (4.2)	780 (3.5)	1,060 (4.8)	820 (3.7)	1,060 (4.8)
	3 (76.2)	720 (3.2)	860 (3.9)	835 (3.8)	1,105 (5.0)	945 (4.3)	1,345 (6.1)	1,065 (4.8)	1,345 (6.1)
3/8 (9.5)	2 (50.8)	875 (3.9)	995 (4.5)	1,010 (4.5)	1,300 (5.9)	1,145 (5.2)	1,605 (7.2)	1,480 (6.7)	1,860 (8.4)
	2-1/2 (63.5)	950 (4.3)	1,095 (4.9)	1,080 (4.9)	1,445 (6.5)	1,215 (5.5)	1,790 (8.1)	1,665 (7.5)	1,990 (9.0)
	3-1/2 (88.9)	1,100 (5.0)	1,245 (5.6)	1,300 (5.9)	1,705 (7.7)	1,500 (6.8)	2,165 (9.7)	1,790 (8.1)	2,165 (9.7)
1/2 (12.7)	2-1/2 (63.5)	1,225 (5.5)	1,710 (7.7)	1,430 (6.4)	1,885 (8.5)	1,630 (7.3)	2,055 (9.2)	1,830 (8.2)	2,055 (9.2)
	3-1/2 (88.9)	1,535 (6.9)	2,135 (9.6)	1,900 (8.6)	2,300 (10.4)	2,260 (10.2)	2,465 (11.1)	2,470 (11.1)	2,695 (12.1)
	5 (127.0)	1,815 (8.2)	2,535 (11.4)	2,120 (9.5)	2,810 (12.6)	2,425 (10.9)	3,080 (13.9)	2,735 (12.3)	3,080 (13.9)
5/8 (15.9)	2-3/4 (69.9)	1,340 (6.0)	1,995 (9.0)	1,635 (7.4)	2,495 (11.2)	1,925 (8.7)	2,995 (13.5)	2,125 (9.6)	2,995 (13.5)
	4 (101.6)	1,615 (7.3)	2,715 (12.2)	2,055 (9.2)	3,180 (14.3)	2,490 (11.2)	3,640 (16.4)	3,275 (14.7)	3,975 (17.9)
	6 (152.4)	2,350 (10.6)	3,445 (15.5)	2,645 (11.9)	4,060 (18.3)	2,935 (13.2)	4,670 (21.0)	3,895 (17.5)	4,670 (21.0)
3/4 (19.1)	3 (76.2)	1,915 (8.6)	3,095 (13.9)	2,145 (9.7)	3,560 (16.0)	2,375 (10.7)	4,025 (18.1)	2,695 (12.1)	4,025 (18.1)
	4-1/2 (114.3)	2,515 (11.3)	4,225 (19.0)	2,800 (12.6)	5,065 (22.8)	3,085 (13.9)	5,900 (26.6)	4,060 (18.3)	5,900 (26.6)
	7 (177.8)	2,945 (13.3)	5,660 (25.5)	3,360 (15.1)	6,470 (29.1)	3,775 (17.0)	7,280 (32.8)	5,495 (24.7)	7,280 (32.8)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt in Structural Lightweight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		3,000 psi (20.7 MPa)				5,000 psi (34.5 MPa)			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1-1/4 (31.8)	1,000 (4.5)	1,520 (6.8)	250 (1.1)	380 (1.7)	1,320 (5.9)	1,520 (6.8)	330 (1.5)	380 (1.7)
	2 (50.8)	1,510 (6.8)	1,540 (6.9)	380 (1.7)	385 (1.7)	–	–	–	–
3/8 (9.5)	2 (50.8)	2,160 (9.7)	2,780 (12.5)	540 (2.4)	695 (3.1)	3,240 (14.6)	2,780 (12.5)	810 (3.6)	695 (3.1)
	3-1/2 (88.9)	4,200 (18.9)	4,980 (22.4)	1,050 (4.7)	1,245 (5.6)	–	–	–	–
1/2 (12.7)	2-1/2 (63.5)	3,680 (16.6)	4,615 (20.8)	920 (4.1)	1,155 (5.2)	4,920 (22.1)	4,615 (20.8)	1,230 (5.5)	1,155 (5.2)
	5 (127.0)	5,540 (24.9)	8,730 (39.3)	1,385 (6.2)	2,185 (9.8)	–	–	–	–
5/8 (15.9)	2-3/4 (69.9)	3,120 (14.0)	6,840 (30.8)	780 (3.5)	1,710 (7.7)	5,240 (23.6)	6,840 (30.8)	1,310 (5.9)	1,710 (7.7)
	6 (152.4)	6,730 (30.3)	14,340 (64.5)	1,685 (7.6)	3,585 (16.1)	–	–	–	–
3/4 (19.1)	3 (76.2)	5,600 (25.2)	8,765 (39.4)	1,400 (6.3)	2,190 (9.9)	7,880 (35.5)	8,765 (39.4)	1,970 (8.9)	2,190 (9.9)
	7 (177.8)	9,860 (44.4)	19,740 (88.8)	2,465 (11.1)	4,935 (22.2)	–	–	–	–

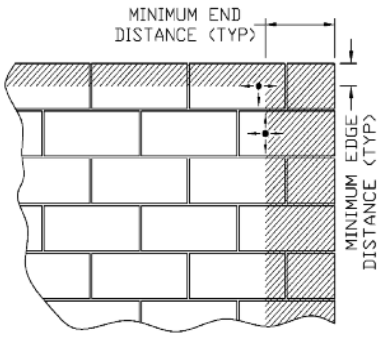
1. Tabulated load values are for anchors installed in sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedments and compressive strengths.

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

Anchor Diameter d in. (mm)	Minimum Embedment 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)	1-1/4 (31.8)	720 (3.2)	2,360 (10.6)	180 (0.8)	590 (2.7)	920 (4.1)	2,360 (10.6)	230 (1.0)	590 (2.7)
3/8 (9.5)	2 (50.8)	720 (3.2)	2,740 (12.3)	180 (0.8)	685 (3.1)	1,840 (8.3)	2,740 (12.3)	460 (2.1)	685 (3.1)
1/2 (12.7)	2-1/2 (63.5)	1,640 (7.4)	2,740 (12.3)	410 (1.8)	685 (3.1)	2,000 (9.0)	4,400 (19.8)	500 (2.3)	1,100 (5.0)
5/8 (15.9)	2-3/4 (88.9)	–	–	–	–	2,000 (9.0)	4,440 (20.0)	500 (2.3)	1,110 (5.0)
3/4 (19.1)	3 (76.2)	–	–	–	–	4,960 (22.3)	4,480 (20.2)	1,240 (5.6)	1,120 (5.0)

1. Tabulated load values are for anchors installed in sand-lightweight concrete over steel deck. 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. Consideration of safety factors of 10 or higher may be necessary depending upon 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 for Power-Bolt.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.

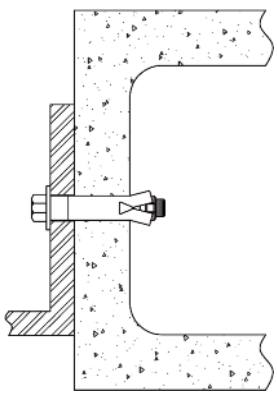
PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Power-Bolt in Grout-Filled Concrete Masonry[1,2,3,4]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1-1/8 (28.6)	3-3/4 (95.3)	3-3/4 (95.3)	1,215 (5.5)	1,185 (5.3)	245 (1.1)	235 (1.1)
	2-1/2 (63.5)	5-1/4 (133.4)	3-3/4 (95.3)	1,760 (7.9)	1,185 (5.3)	350 (1.6)	235 (1.1)
3/8 (9.5)	2 (50.8)	5-5/8 (142.9)	5-5/8 (142.9)	1,985 (8.9)	3,065 (13.8)	395 (1.8)	615 (2.8)
	3-1/2 (88.9)	7 7/8 (200.0)	5-5/8 (142.9)	2,120 (9.5)	3,065 (13.8)	425 (1.9)	615 (2.8)
1/2 (12.7)	2-1/2 (63.5)	7-1/2 (190.5)	7-1/2 (190.5)	2,435 (11.0)	5,650 (25.4)	485 (2.2)	1,130 (5.1)
	4 (101.6)	10-1/2 (266.7)	7-1/2 (190.5)	2,690 (12.1)	5,650 (25.4)	540 (2.4)	1,130 (5.1)
5/8 (15.9)	2-3/4 (69.9)	9 3/8 (238.1)	9 3/8 (238.1)	2,560 (11.5)	9,000 (40.5)	510 (2.3)	1,800 (8.1)
	5 (127.0)	13-1/8 (333.4)	9 3/8 (238.1)	2,975 (13.4)	9,000 (40.5)	595 (2.7)	1,800 (8.1)
3/4 (19.1)	3 (76.2)	11-1/4 (285.8)	11-1/4 (285.8)	3,345 (15.0)	9,870 (44.4)	670 (3.0)	1,975 (8.9)
	5 (127.0)	15-3/4 (400.1)	11-1/4 (285.8)	4,250 (19.1)	9,870 (44.4)	850 (3.8)	1,975 (8.9)

1. Tabulated load values are for carbon steel and stainless steel 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 cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
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 or overhead.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

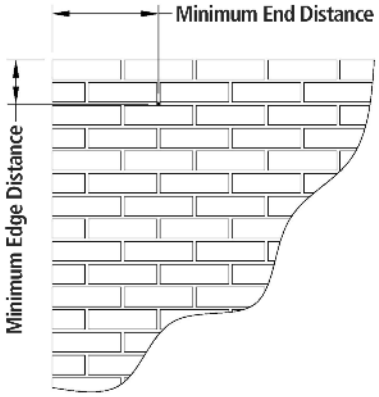


Ultimate and Allowable Load Capacities for Power-Bolt in Hollow Concrete Masonry[1,2,3,4,5]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	3-3/4 (95.3)	3-3/4 (95.3)	600 (2.7)	765 (3.4)	120 (0.5)	155 (0.7)
	1-1/4 (31.8)	3-3/4 (95.3)	8 (203.2)	825 (3.7)	1,055 (4.8)	165 (0.7)	210 (0.9)
	1-1/2 (38.1)	3-3/4 (95.3)	12 (304.8)	1,130 (5.1)	1,230 (5.5)	225 (1.0)	245 (1.1)
3/8 (9.5)	1-1/4 (31.8)	12 (304.8)	8 (203.2)	1,360 (6.1)	2,150 (9.7)	270 (1.2)	430 (1.9)
	1-1/2 (38.1)	12 (304.8)	12 (304.8)	1,470 (6.6)	2,600 (11.7)	295 (1.3)	520 (2.3)
1/2 (12.7)	1-1/4 (31.8)	12 (304.8)	8 (203.2)	2,560 (11.5)	2,150 (9.7)	590 (2.4)	430 (1.9)
	1-1/2 (38.1)	12 (304.8)	12 (304.8)	2,560 (11.5)	3,385 (15.2)	510 (2.3)	675 (3.0)

1. Tabulated load values are for carbon steel and stainless steel 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 cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
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 or overhead.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 8 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.
5. Anchors length shall be of suitable length for the concrete masonry unit wall thickness and consideration of a fixture to engage the base material at the minmum embedment depth.

PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Power-Bolt in Clay Brick Masonry[1,2,3]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance	Min. End Distance	Min. Spacing Distance	Structural Brick 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)	7/8 (22.2)	8 (203.2)	4 (101.6)	6 (152.4)	1,090 (4.9)	1,160 (5.2)	220 (1.0)	230 (1.0)
	1-1/2 (38.1)				1,455 (6.6)	1,265 (5.7)	290 (1.3)	255 (1.1)
3/8 (9.5)	2 (50.8)	12 (304.8)	6 (152.4)	8 (203.2)	2,015 (9.1)	3,655 (16.5)	405 (1.8)	730 (3.3)
1/2 (12.7)	2-1/2 (63.5)		8 (203.2)	10 (254.0)	3,110 (14.0)	4,585 (20.6)	620 (2.8)	915 (4.1)
5/8 (15.9)	2-3/4 (69.9)	16 (406.4)	10 (254.0)	12 (304.8)	4,535 (20.4)	5,470 (24.6)	905 (4.1)	1,095 (4.9)
3/4 (19.1)	3 (76.2)		12 (304.8)	16 (406.4)	5,930 (26.7)	6,770 (30.5)	1,185 (5.3)	1,355 (6.1)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
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 or overhead.
3. Spacing between anchors may be reduced to half the listed distances provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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[1]

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	$c_{cr} = 12d$	$F_{N_C} = 1.0$	$c_{min} = 5d$	$F_{N_C} = 0.70$
	Shear	$c_{cr} = 12d$	$F_{V_C} = 1.0$	$c_{min} = 5d$	$F_{V_C} = 0.35$

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	$c_{cr} = 12d$	$F_{N_C} = 1.0$	$c_{min} = 5d$	$F_{N_C} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{V_C} = 1.0$	$c_{min} = 5d$	$F_{V_C} = 0.40$

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

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

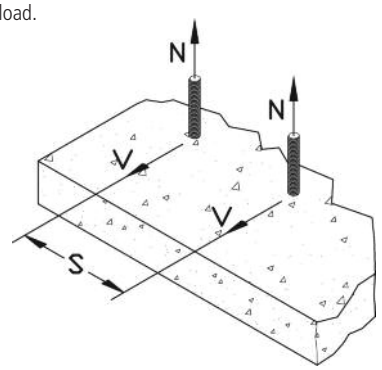
Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})

Dia. (in.)		1/4			3/8			1/2			5/8			3/4		
h_v (in.)		1-1/4	1-3/4	2-1/2	2	2-1/2	3-1/2	2-1/2	3-1/2	5	2-3/4	4	6	3	4-1/2	7
s_{cr} (in.)		2-1/2	3-1/2	5	4	5	7	5	7	10	5-1/2	8	12	6	9	14
s_{min} (in.)		1-1/4	1-3/4	2-1/2	2	2-1/2	3-1/2	2-1/2	3-1/2	5	2-3/4	4	6	3	4-1/2	7
Spacing, s (inches)	1-1/4	0.50														
	1-3/4	0.70	0.50													
	2	0.80	0.57		0.50											
	2-1/2	1.00	0.71	0.50	0.63	0.50		0.50								
	2-3/4		0.79	0.55	0.69	0.55		0.55			0.50					
	3		0.86	0.60	0.75	0.60		0.60			0.55			0.50		
	3-1/2		1.00	0.70	0.88	0.70	0.50	0.70	0.50		0.64			0.58		
	4			0.80	1.00	0.80	0.57	0.80	0.57		0.73	0.50		0.67		
	4-1/2			0.90		0.90	0.64	0.90	0.64		0.82	0.56		0.75	0.50	
	5			1.00		1.00	0.71	1.00	0.71	0.50	0.91	0.63		0.83	0.56	
	5-1/2						0.79		0.79	0.55	1.00	0.69		0.92	0.61	
	6						0.86		0.86	0.60		0.75	0.50	1.00	0.67	
	7						1.00		1.00	0.70		0.88	0.58		0.78	0.50
	8									0.80		1.00	0.67		0.89	0.57
	9									0.90			0.75		1.00	0.64
	10									1.00			0.83			0.71
	12												1.00			0.86
	14															1.00

Notes: For anchors loaded in tension and shear, the critical spacing *(s_{cr})* is equal to 2 embedment depths ($2\,h_v$) at which the anchor achieves 100% of load.

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

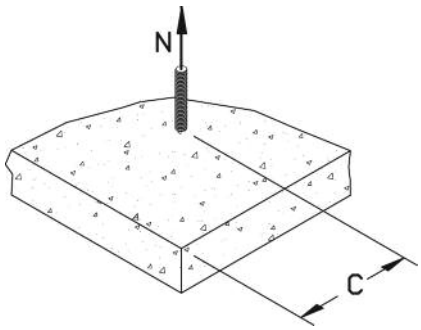


Edge Distance, Tension (F_{NC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4-1/2	6	7-1/2	9
c_{min} (in.)		1-1/4	1-7/8	2-1/2	3-1/8	3-3/4
Edge Distance, c (inches)	1-1/4	0.70				
	1-5/8	0.76				
	1-7/8	0.81	0.70			
	2	0.83	0.71			
	2-1/2	0.91	0.77	0.70		
	3	1.00	0.83	0.74		
	3-1/8		0.84	0.75	0.70	
	3-3/4		0.91	0.81	0.74	0.70
	4		0.94	0.83	0.76	0.71
	4-1/2		1.00	0.87	0.79	0.74
	5			0.91	0.83	0.77
	6			1.00	0.90	0.83
	6-1/4				0.91	0.84
	7				0.97	0.89
	7-1/2				1.00	0.91
	8					0.94
	9					1.00

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

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

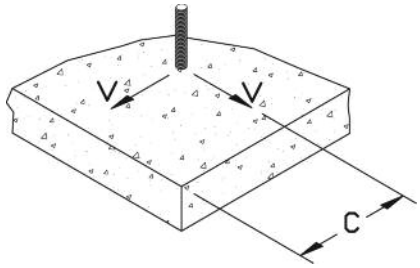


Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4-1/2	6	7-1/2	9
c_{min} (in.)		1-1/4	1-7/8	2-1/2	3-1/8	3-3/4
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
	4-1/2		1.00	0.72	0.55	0.44
	5			0.81	0.63	0.50
	6			1.00	0.78	0.63
	6-1/4				0.81	0.66
	7				0.93	0.75
	7-1/2				1.00	0.81
	8					0.88
	9					1.00

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

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



DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

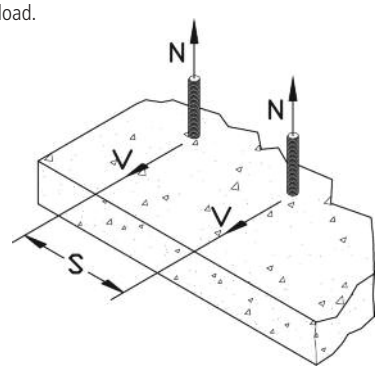
Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})

Dia. (in.)		1/4			3/8			1/2			5/8			3/4		
h_v (in.)		1-1/4	1-3/4	2-1/2	2	2-1/2	3-1/2	2-1/2	3-1/2	5	2-3/4	4	6	3	4-1/2	7
s_{cr} (in.)		2-1/2	3-1/2	5	4	5	7	5	7	10	5-1/2	8	12	6	9	14
s_{min} (in.)		1-1/4	1-3/4	2-1/2	2	2-1/2	3-1/2	2-1/2	3-1/2	5	2-3/4	4	6	3	4-1/2	7
Spacing, s (inches)	1-1/4	0.50														
	1-3/4	0.70	0.50													
	2	0.80	0.57		0.50											
	2-1/2	1.00	0.71	0.50	0.63	0.50		0.50								
	2-3/4		0.79	0.55	0.69	0.55		0.55			0.50					
	3		0.86	0.60	0.75	0.60		0.60			0.55			0.50		
	3-1/2		1.00	0.70	0.88	0.70	0.50	0.70	0.50		0.64			0.58		
	4			0.80	1.00	0.80	0.57	0.80	0.57		0.73	0.50		0.67		
	4-1/2			0.90		0.90	0.64	0.90	0.64		0.82	0.56		0.75	0.50	
	5			1.00		1.00	0.71	1.00	0.71	0.50	0.91	0.63		0.83	0.56	
	5-1/2						0.79		0.79	0.55	1.00	0.69		0.92	0.61	
	6						0.86		0.86	0.60		0.75	0.50	1.00	0.67	
	7						1.00		1.00	0.70		0.88	0.58		0.78	0.50
	8									0.80		1.00	0.67		0.89	0.57
	9									0.90			0.75		1.00	0.64
	10									1.00			0.83			0.71
	12												1.00			0.86
	14															1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 embedment depths ($2\,h_v$) at which the anchor achieves 100% of load.

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

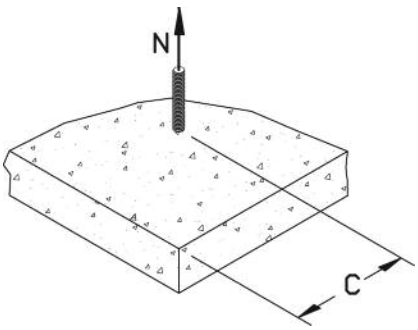


Edge Distance, Tension (F_{NC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4-1/2	6	7-1/2	9
c_{min} (in.)		1-1/4	1-7/8	2-1/2	3-1/8	3-3/4
Edge Distance, c (inches)	1-1/4	0.80				
	1-5/8	0.84				
	1-7/8	0.87	0.80			
	2	0.89	0.81			
	2-1/2	0.94	0.85	0.80		
	3	1.00	0.89	0.83		
	3-1/8		0.90	0.84	0.80	
	3-3/4		0.94	0.87	0.83	0.80
	4		0.96	0.89	0.84	0.81
	4-1/2		1.00	0.91	0.86	0.83
	5			0.94	0.89	0.85
	6			1.00	0.93	0.89
	6-1/4				0.94	0.90
	7				0.98	0.92
	7-1/2				1.00	0.94
	8					0.96
	9					1.00

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

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 80% of load.

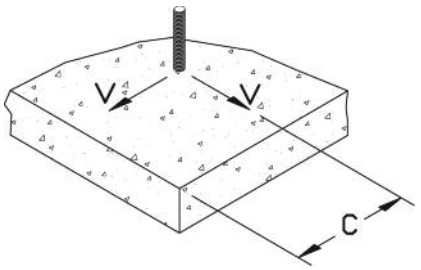


Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4-1/2	6	7-1/2	9
c_{min} (in.)		1-1/4	1-7/8	2-1/2	3-1/8	3-3/4
Edge Distance, c (inches)	1-1/4	0.40				
	1-5/8	0.53				
	1-7/8	0.61	0.40			
	2	0.66	0.43			
	2-1/2	0.83	0.54	0.40		
	3	1.00	0.66	0.49		
	3-1/8		0.69	0.51	0.40	
	3-3/4		0.83	0.61	0.49	0.40
	4		0.89	0.66	0.52	0.43
	4-1/2		1.00	0.74	0.59	0.49
	5			0.83	0.66	0.54
	6			1.00	0.79	0.66
	6-1/4				0.83	0.69
	7				0.93	0.77
	7-1/2				1.00	0.83
	8					0.89
	9					1.00

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

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



ORDERING INFORMATION

Carbon Steel Hex Head Power-Bolt

Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
6900	1/4" x 1"	1/4"	7/8"	100	600	2
6902	1/4" x 1-3/4"	1/4"	1-1/4"	100	600	3
6906	1/4" x 3"	1/4"	1-1/4"	100	600	5
6907	5/16" x 1-3/4"	5/16"	1-1/2"	100	600	5
6908	5/16" x 2-1/2"	5/16"	1-1/2"	50	300	6
6909	5/16" x 3-1/2"	5/16"	1-1/2"	50	300	8
6911*	3/8" x 1-7/8"	3/8"	1-1/4"	50	300	6
6910	3/8" x 2-1/4"	3/8"	2"	50	300	8
6913	3/8" x 3"	3/8"	2"	50	300	11
6914	3/8" x 3-1/2"	3/8"	2"	50	300	12
6916	3/8" x 4"	3/8"	2"	50	300	14
6930	1/2" x 2-3/4"	1/2"	2-1/2"	50	200	16
6932	1/2" x 3-3/4"	1/2"	2-1/2"	25	150	21
6934	1/2" x 4-3/4"	1/2"	2-1/2"	25	150	26
6936	1/2" x 5-3/4"	1/2"	2-1/2"	25	150	32
6940	5/8" x 3"	5/8"	2-3/4"	20	120	28
6942	5/8" x 4"	5/8"	2-3/4"	15	90	40
6944	5/8" x 5"	5/8"	2-3/4"	15	90	47
6945	5/8" x 6"	5/8"	2-3/4"	15	90	57
6947	5/8" x 8-1/2"	5/8"	2-3/4"	10	40	77
6950	3/4" x 3-1/4"	3/4"	3"	15	90	47
6952	3/4" x 4-1/4"	3/4"	3"	10	60	58
6954	3/4" x 5-1/4"	3/4"	3"	10	60	70 -
6956	3/4" x 7-1/4"	3/4"	3"	10	40	105
6957	3/4" x 8-1/4"	3/4"	3"	10	40	110

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

Carbon Steel Flat Head Power-Bolt

Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
6981	3/8" x 3-3/4"	3/8"	2"	50	300	14
6982	3/8" x 5"	3/8"	2"	50	300	17
6983	3/8" x 6"	3/8"	2"	50	300	20
6984	1/2" x 5"	1/2"	2-1/2"	25	150	26
6987	5/8" x 5-1/2"	5/8"	2-3/4"	15	90	57

The published length is the overall length of the anchor.
The flat head Power-Bolt anchor has a hex key insert formed in the head of the bolt.
Each box contains an Allen wrench which matches the insert size.

Stainless Steel Hex Head Power-Bolt

Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
5902	1/4" x 1-3/4"	1/4"	1-1/4"	100	600	3
5906	1/4" x 3"	1/4"	1-1/4"	100	600	5
5910	3/8" x 2-1/4"	3/8"	2"	50	300	10
5914	3/8" x 3-1/2"	3/8"	2"	50	300	12
5916	3/8" x 4"	3/8"	2"	50	300	14
5930	1/2" x 2-3/4"	1/2"	2-1/2"	50	200	16
5934	1/2" x 4-3/4"	1/2"	2-1/2"	25	150	26

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

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 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)
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

SECTION CONTENTS

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)

INSTALLATION SPECIFICATIONS

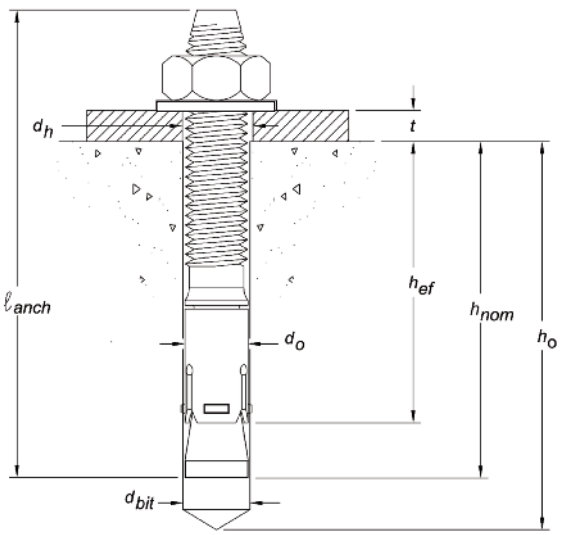
Installation Table for Power-Stud+ SD1[1]

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[2]	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[2]	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	ℓ_{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[2]	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[2]	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[2]	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[3]	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	-	In.	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.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318 Appendix D.
2. 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.
3. 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"

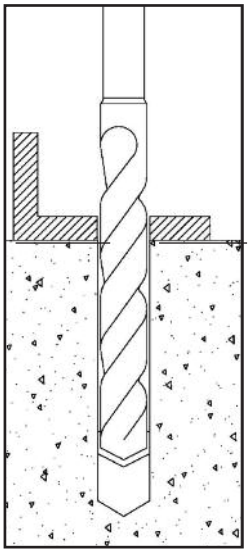
Mark	G	H	I	J	K	L
From	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"
Up to but not including	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"

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"

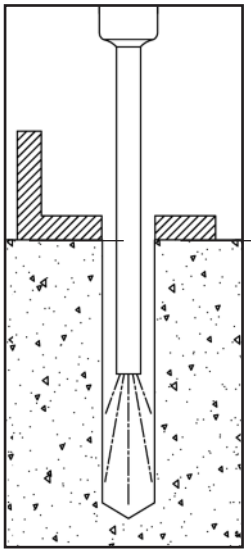
Length identification mark indicates overall length of anchor.

INSTALLATION INSTRUCTIONS

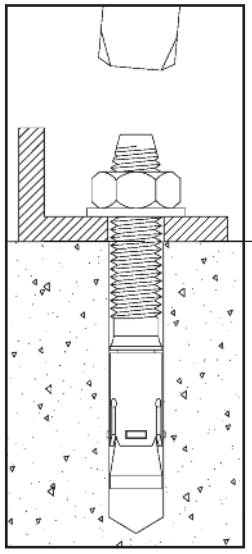
Installation Instructions for Power-Stud+™ SD1



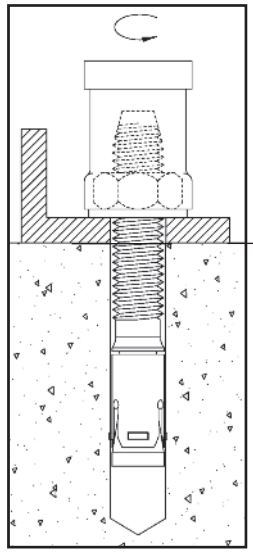
1.) *Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.*



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

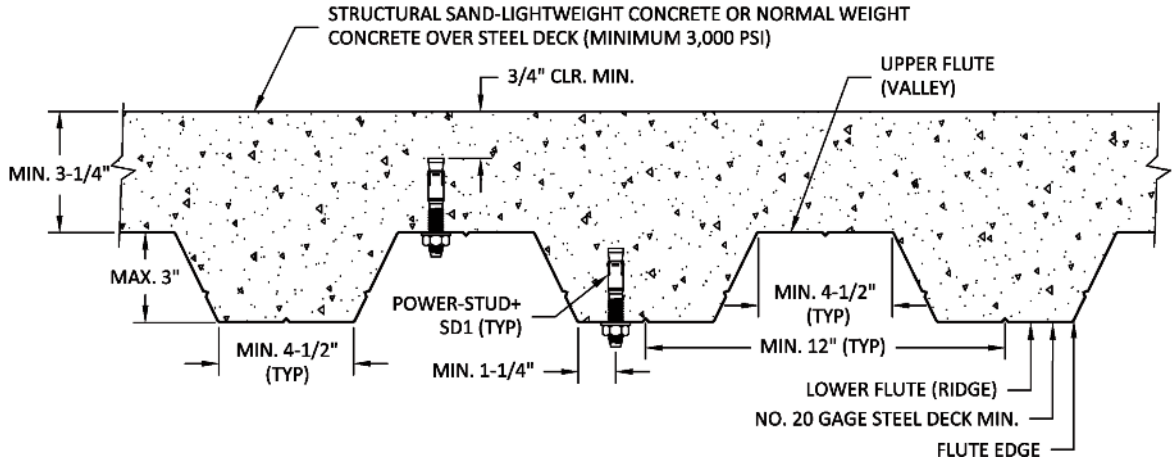


3.) *Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth,* h_{nom} .



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 ϕN_n and ϕV_n
Calculated in accordance with ACI 318 Appendix D
Compliant with the International Building Code

CODE LISTED ICC-ES ESR-2818 | PDA | SD1 STRENGTH DESIGN TABLES

Tension and Shear Design Strengths for Power-Stud+ SD1 in Cracked Concrete[1-6]

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	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_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**	4530	**4,460**	5230	**4,460**	6405	**4,460**	7395	**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**

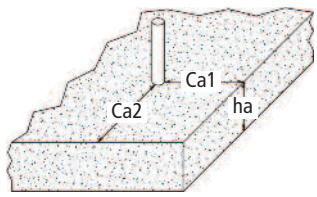
Tension and Shear Design Strengths for Power-Stud+ SD1 in Uncracked Concrete[1-6]

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	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.))	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_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 (ϕ) 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[1]

Nominal Anchor Diameter in. (mm)	Minimum Embedment Depth 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)	
		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[1,2]

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 compresive 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_{NS} , F_{NC}) 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_{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	0.75	-	-	-	-	-	-	-	-	-
	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	-	-	-	-	-	-	-	-	1.00	0.90

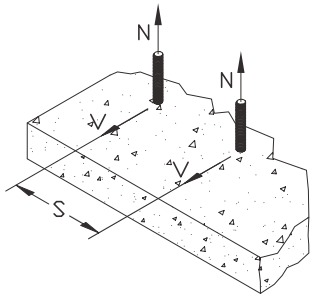
	Dia. (in)	1/4	3/8	1/2	1/2	5/8	5/8	3/4	7/8	1	1-1/4
	h_{nom} (in.)	1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4 5/8	4	4-1/2	5-1/2	6-1/2
	c_{ac} (in.)	3-1/2	6-1/2	8-1/2	8	6	10	11	12	12	12
	c_{min} (in.)	2-3/4	2-3/4	5-1/4	4	5-1/2	4-3/4	5	7	8	8
Edge Distance (inches)	2-3/4	0.79	0.43	-	-	-	-	-	-	-	-
	3	0.86	0.46	-	-	-	-	-	-	-	-
	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	0.67
	8-1/2	-	-	1.00	-	-	0.85	0.77	0.71	0.71	0.71
	9	-	-	-	-	-	0.90	0.82	0.75	0.75	0.75
	9-1/2	-	-	-	-	-	0.95	0.86	0.79	0.79	0.79
	10	-	-	-	-	-	1.00	0.91	0.83	0.83	0.83
	10-1/2	-	-	-	-	-	-	0.95	0.88	0.88	0.88
	11	-	-	-	-	-	-	1.00	0.92	0.92	0.92
	11-1/2	-	-	-	-	-	-	-	0.96	0.96	0.96
	12	-	-	-	-	-	-	-	1.00	1.00	1.00

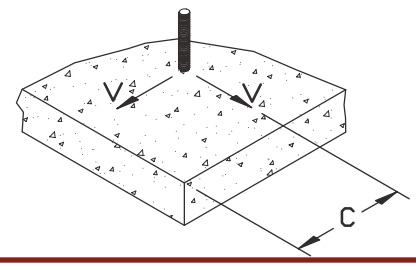
ALLOWABLE STRESS DESIGN (ASD) DESIGN CRITERIA

Spacing Distance Shear (F_{VS}) 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_{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
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	0.67
	8-1/2	-	-	0.77	0.85	-	0.80	0.78	0.70	0.68	0.68
	9	-	-	0.79	0.88	-	0.82	0.80	0.71	0.69	0.69
	9-1/2	-	-	0.80	0.90	-	0.83	0.82	0.73	0.70	0.70
	10	-	-	0.82	0.92	-	0.85	0.83	0.74	0.71	0.71
	10-1/2	-	-	0.83	0.94	-	0.87	0.85	0.75	0.72	0.72
	11	-	-	0.85	0.96	0.83	0.89	0.87	0.76	0.73	0.73
	11-1/2	-	-	0.87	0.98	0.85	0.90	0.88	0.77	0.74	0.74
	12	-	-	0.88	1.00	0.86	0.92	0.90	0.79	0.75	0.75
	12-1/2	-	-	0.90	-	0.88	0.94	0.92	0.80	0.76	0.76
	13	-	-	0.91	-	0.89	0.96	0.93	0.81	0.77	0.77
	13-1/2	-	-	0.93	-	0.91	0.97	0.95	0.82	0.78	0.78
	14	-	-	0.94	-	0.92	0.99	0.97	0.83	0.79	0.79
	14-1/2	-	-	0.96	-	0.94	-	0.98	0.85	0.80	0.80
	15	-	-	0.98	-	0.95	-	1.00	0.86	0.81	0.81
	15-1/2	-	-	0.99	-	0.97	-	-	0.87	0.82	0.82
	16	-	-	-	-	0.98	-	-	0.88	0.83	0.83
	16-1/2	-	-	-	-	1.00	-	-	0.89	0.84	0.84
	17	-	-	-	-	-	-	-	0.90	0.85	0.85
	18	-	-	-	-	-	-	-	0.93	0.88	0.88
	19	-	-	-	-	-	-	-	0.95	0.90	0.90
	20	-	-	-	-	-	-	-	0.98	0.92	0.92
	21	-	-	-	-	-	-	-	1.00	0.94	0.94
	22	-	-	-	-	-	-	-	-	0.96	0.96
	23	-	-	-	-	-	-	-	-	0.98	0.98
	24	-	-	-	-	-	-	-	-	1.00	1.00

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



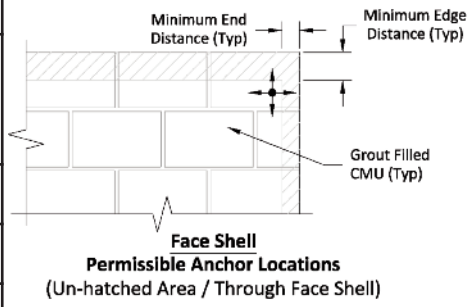


ALLOWABLE STRESS DESIGN (ASD) PERFORMANCE DATA

Ultimate and Allowable Load Capacities in Tension for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Faces[1,2,3,4,5]

CODE LISTED ICC-ES ESR-2966

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[1,2,3,4,5]

CODE LISTED ICC-ES ESR-2966

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				

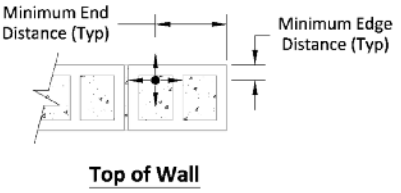
1. Tabulated load values are for anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of 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 anchorinstalled 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 sheer loads for inchors 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[1,2,3,4]

CODE LISTED ICC-ES ESR-2966

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 /14 (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)



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[1,2,3,4]

CODE LISTED ICC-ES ESR-2966

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)[1,2,3]

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
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
STEEL STRENGTH IN TENSION[4]												
Minimum specified yield strength	f_y	ksi (N/mm^2)	88 (606)	88 (606)	80 (551)		80 (551)		58 (400)	58 (400)	58 (400)	58 (400)
Minimum specified ultimate tensile strength (neck)	f_{uta}[11]	ksi (N/mm^2)	110 (758)	110 (758)	100 (689)		100 (689)		75 (517)	75 (517)	75 (517)	75 (517)
Effective tensile stress area (neck)	A_{se}	in^2 (mm^2)	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)
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)
Reduction factor for steel strength[3]	ϕ	-	0.75									
CONCRETE BREAKOUT STRENGTH IN TENSION[8]												
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
Effectiveness factor for cracked concrete	k_{cr}	-	Not Applicable	17	17		17		24	17	24	24
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$[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
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[3]	ϕ	-	0.65 (Condition B)									
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[8]												
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	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)[6]	$N_{p,cr}$	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[3]	ϕ	-	0.65 (Condition B)									
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8]												
Characteristic pullout strength, seismic (2,500 psi)[6,9]	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[3]	ϕ	-	0.65 (Condition B)									
PULLOUT STRENGTH IN TENSION FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK												
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
Characteristic pullout strength, cracked concrete over steel deck, according to Installation Detail [6,10]	$N_{p,deck,cr}$	lb (kN)	Not Applicable	1375 (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[3]	ϕ	-	0.65 (Condition B)									

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 must apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ 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 ϕ 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 Ø factor must be determined in accordance with ACI 318 D.4.4.
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.
5. 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.
6. For all design cases use $\Psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500 psi, N_{pn} = (pullout strength value from table)*(specified concrete compressive strength/2500)$^{0.5}$. For concrete over steel deck the value of 2500 must be replaced with the value of 3000.
7. Pullout strength will not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in structural sand-lightweight concrete provided that N_b, N_{eq} and N_{pn} are multiplied by a factor of 0.60.
9. 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.
10. 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).
11. For 2003 IBC, f_{uta} replaces f_{ut}; N_{sa} replaces N_s; $\Psi_{c,N}$ replaces Ψ_3, 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)[1,2]

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
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
STEEL STRENGTH IN SHEAR[4]												
Minimum specified yield strength (threads)	f_y	ksi (N/mm^2)	70 (482)	70 (482)	64 (441)		64 (441)		58 (400)	58 (400)	58 (400)	58 (400)
Minimum specified ultimate strength (threads)	f_{uta}[10]	ksi (N/mm^2)	88 (606)	88 (606)	80 (503)		80 (503)		75 (517)	75 (517)	75 (517)	75 (517)
Effective tensile stress area (threads)	A_{se}	in^2 (mm^2)	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)	0.969 (615)
Steel strength in shear[5]	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)	17,750 (79)
Reduction factor for steel strength[3]	ϕ	-	0.65									
CONCRETE BREAKOUT STRENGTH IN SHEAR[6]												
Load bearing length of anchor (hef or 8do, whichever is less)	ℓ_e[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)		0.75 (19.1)	0.875 (22.2)	1 (25.4)	1.25 (31.8)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)									
CONCRETE PRYOUT STRENGTH IN SHEAR[6]												
Coefficient for pryout 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 pryout strength[3]	ϕ	-	0.70 (Condition B)									
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS												
Steel strength in shear, seismic[7]	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)	17,750 (79)
Reduction factor for steel strength in shear for seismic[3]	ϕ	-	0.65									
STEEL STRENGTH IN SHEAR FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9]												
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
Reduction factor for steel strength in shear for concrete over steel deck[3]	ϕ	-	0.65									

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 must apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ 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 ϕ 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 ϕ factor must be determined in accordance with ACI 318 D.4.4.
4. The Power-Stud+ SD1 is considered a ductile steel element as defined by ACI 318 D.1.
5. 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.
6. Anchors are permitted to be used in structural sand-lightweight concrete provided that V_b, and V_{cp} and V_{cpg} are multiplied by a factor of 0.60.
7. 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.
8. 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 pryout capacity in accordance with Section D.6.3 are not required for anchors installed in the deck soffit (flute).
9. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
10. For the 2003 IBC f_{uta} replaces f_{ut}; V_{sa} replaces V_s; ℓ_e replaces ℓ; 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.	Ctn. 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 3-3/4″	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

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

Cat. No.	Anchor Size	Thread Length	Box Qty.	Ctn. Qty.	Wt./100 (lbs)
7409SD1	1/4″	N/A	100	500	3

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.

Power-Stud+® SD2 *Wedge Expansion Anchor*

PRODUCT DESCRIPTION

The Power-Stud+ SD2 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 stainless steel expansion clip for premium performance.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Utility and 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
- Medium to heavy duty purposes

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-2502 for concrete
Code compliant with the 2009 IBC, 2009 IRC, 2006 IBC, 2006 IRC, 2003 IBC, 2003 IRC and 1997 UBC
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)
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.

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, Masonry Anchorage and 05090-Metal Fastenings.*
Expansion anchors shall be Power-Stud+ SD2 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)	Type 316 stainless steel
Plating (anchor body, nut and washer)	Zinc plating according to ASTM B 633, SC1, Type III (Fe/Zn 5) Minimum plating requirment for Mild Service Condition

SECTION CONTENTS

Power-Stud+ SD2 Assembly

THREAD VERSION

UNC threaded stud

ANCHOR MATERIALS

Zinc plated carbon steel body with stainless steel expansion clip, zinc plated carbon steel nut and washer

ANCHOR SIZE RANGE (TYP.)

3/8" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

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

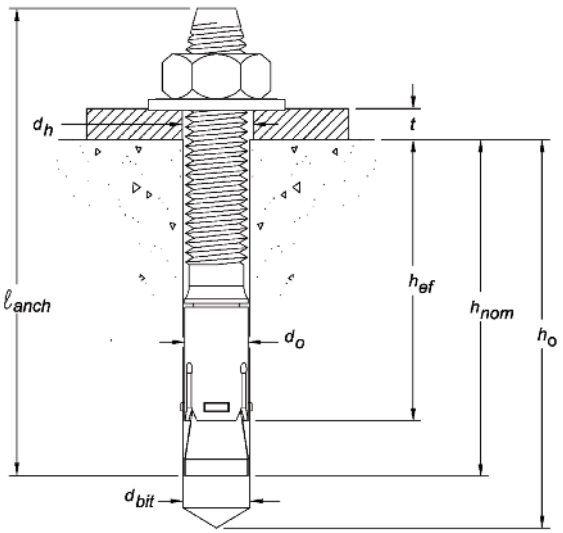
INSTALLATION SPECIFICATIONS

Installation Table for Power-Stud+ SD2[1]

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Size									
			3/8"	1/2"				5/8"			3/4"	
Anchor diameter	d_o	in. (mm)	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)	7/16 (11.1)	9/16 (14.3)				11/16 (17.5)			13/16 (20.6)	
Nominal drill bit diameter	d_{bit}	in.	3/8 ANSI	1/2 ANSI				5/8 ANSI			3/4 ANSI	
Minimum nominal embedment depth	h_{nom}	in. (mm)	2 3/8 (60)	2 1/2 (64)		3 3/4 (95)		3 7/8 (98)	4 7/8 (124)		4 1/2 (114)	5 3/4 (146)
Effective embedment	h_{ef}	in. (mm)	2 (51)	2 (51)		3 1/4 (83)		3 1/4 (83)	4 1/4 (108)		3 3/4 (95)	5 (127)
Minimum hole depth[1]	h_o	in. (mm)	2 5/8 (67)	2 3/4 (70)		4 (102)		4 1/4 (108)	5 1/4 (133)		4 3/4 (121)	6 (152)
Minimum concrete member thickness[1]	h_{min}	in. (mm)	4 (102)	4 1/2 (114)	6 (152)	5 3/4 (146)	5 3/4 (146)	5 3/4 (146)	6 1/2 (165)	8 (203)	7 (178)	10 (254)
Minimum overall anchor length	ℓ_{anch}	in. (mm)	3 (76.2)	3 3/4 (95)		4 1/2 (114)		4 3/4 (121)	6 (152)		6 1/4 (159)	7 (178)
Minimum edge distance[1]	c_{min}	in. (mm)	2 1/2 (63.5)	4 (102)	2 3/4 (70)	4 (102)	2 3/4 (70)	4 1/4 (108)	4 1/4 (108)		5 (127)	4 1/2 (114)
Minimum spacing distance[1]	s_{min}	in. (mm)	3 1/2 (88.9)	6 (152)	6 (152)	4 (102)	6 (152)	4 1/4 (108)	4 1/4 (108)		6 (152)	6 (152)
Critical edge distance[1]	c_{ac}	in. (mm)	6 1/2 (165.1)	8 (203)		10 (254)		8 (203)	15 3/4 (400)	10 (254)	12 (305)	12 (305)
Installation torque	T_{inst}	ft.-lb. (N-m)	20 (27)	40 (54)				60 (81)			110 (149)	
Torque wrench socket size	-	in.	9/16	3/4				15/16			1-1/8	
Nut height	-	in.	21/64	7/16				35/64			41/64	

1. For installations through the soffit of steel deck into concrete, see the installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Power-Stud+ SD2 Anchor Detail



Head Marking

Legend

Letter Code = Length Identification Mark

'+' Symbol = Strength Design Compliant Anchor

Number Code = Carbon Steel Body and Stainless Steel Expansion Clip

Length Identification

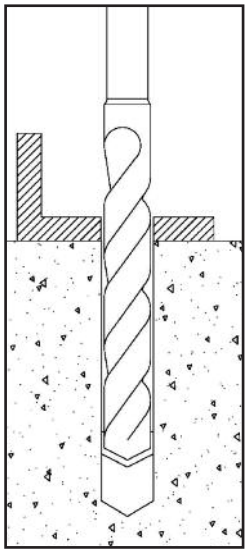
Mark	A	B	C	D	E	F	G	H	I	J
From	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"
Up to but not including	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"

Mark	K	L	M	N	O
From	6-1/2"	7"	7-1/2"	8"	8-1/2"
Up to but not including	7"	7-1/2"	8"	8-1/2"	9"

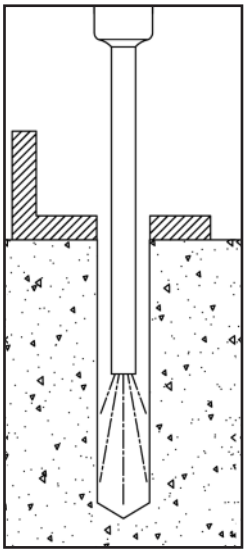
Length identification mark indicates overall length of anchor.

INSTALLATION INSTRUCTIONS

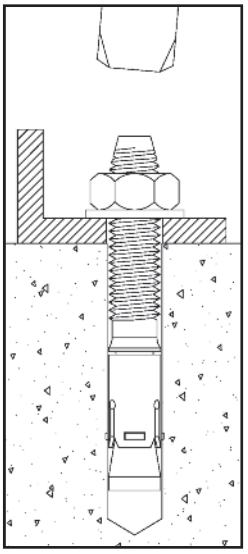
Installation Instructions for Power-Stud+ SD2



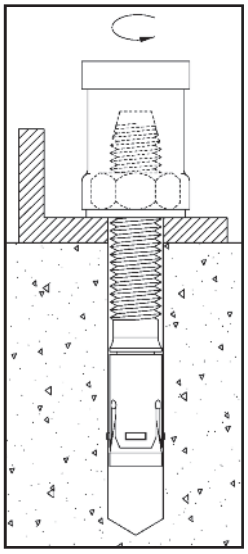
1.) *Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.*



2.) *Remove dust and debris from the hole.*

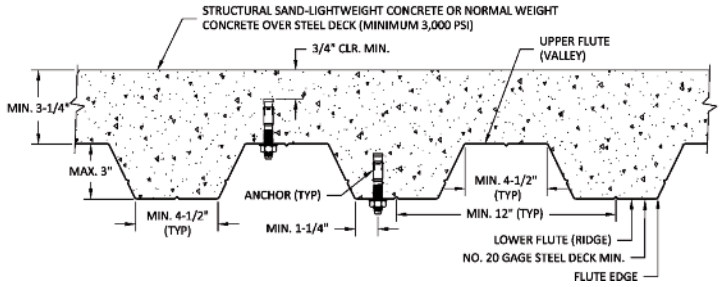


3.) *Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required nominal embedment depth,* h_{nom}

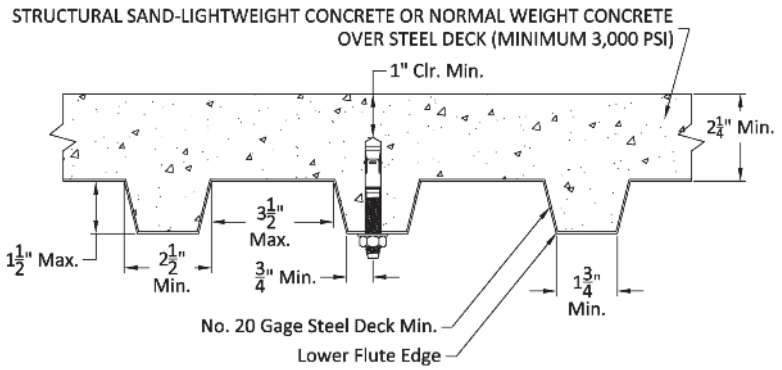


4.) *Tighten the anchor with a torque wrench by applying the required installation torque,* T_{inst} .

Installation Detail A: for Power-Stud+ SD2 Installed Through Soffit of Steel Deck into Concrete[1]



Installation Detail B: for Power-Stud+ SD2 Installed Through Soffit of Steel Deck into Concrete[2,3]



1. Anchors may be placed in the upper flute or lower flute of the steel deck profiles in accordance with installation Detail A provided the minimum hole clearance is satisfied. Anchors in the lower flute of installation Detail A profiles may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

2. Anchors may be placed in the lower flute of the steel deck profiles in accordance with installation Detail B provided the minimum hole clearance is satisfied. Anchors in the lower flute of installation Detail B profiles may be installed with a maximum 1/8-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

3. Anchors may be placed in the upper flute of the steel deck profiles in accordance with installation Detail B provided the concrete thickness above the upper flute is minimum 3-1/4-inch and a minimum hole clearance 3/4-inch is satisfied.

PERFORMANCE DATA

Tension Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2]

Design Characteristic	Notation	Units	Nominal Anchor Size			
			3/8″	1/2″	5/8″	3/4″
Anchor category	1, 2 or 3	-	1	1	1	1
STEEL STRENGTH IN TENSION[4]						
Minimum specified yield strength (neck)	f_y	ksi (N/mm²)	96.0 (662)	85.0 (586)	85.0 (586)	70.0 (483)
Minimum specified ultimate strength (neck)	f_{uta}	ksi (N/mm²)	120.0 (827)	106.0 (731)	106.0 (731)	90.0 (620)
Effective tensile stress area (neck)	A_{se}	in² (mm²)	0.0552 (35.6)	0.1007 (65.0)	0.1619 (104.5)	0.2359 (153.2)
Steel strength in tension	N_{sa}	lb (kN)	6,625 (29.4)	10,445 (48.0)	13,080 (58.2)	21,230 (94.4)
Reduction factor for steel strength[3]	ϕ	-	0.75			
CONCRETE BREAKOUT STRENGTH IN TENSION[8]						
Effective embedment	h_{ef}	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)	5.00 (127)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24		24		24	
Effectiveness factor for cracked concrete	k_{cr}	-	17	17		17		17	
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$	-	1.0 See note 5	1.0 See note 5		1.0 See note 5		1.0 See note 5	
Critical edge distance	c_{ac}	in. (mm)	8 (203)	8 (203)	10 (254)	8 (203)	15-3/4 (400)	12 (305)	12 (305)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[8]									
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	lb (kN)	2,775 (12.3)	See note 7	6,615 (29.4)	See note 7	See note 7	See note 7	See note 7
Characteristic pullout strength, cracked concrete (2,500 psi)[6]	$N_{p,cr}$	lb (kN)	2,165 (9.6)	See note 7	4,375 (19.5)	See note 7	4,980 (22.4)	See note 7	7,795 (35.1)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8]									
Characteristic pullout strength, seismic[6,9]	N_{eq} ($N_{p,seis}$)	lb (kN)	2,165 (9.6)	See note 7	4,375 (19.5)	See note 7	4,980 (22.4)	See note 7	7,795 (35.1)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION FOR STRUCTUAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK									
Characteristic pullout strength, uncracked concrete over steel deck, according to Installation Detail A[10]	$N_{p,deck,uncr}$	lb (kN)	1,855 (8.3)	2,065 (9.2)	3,930 (17.5)	4,665 (20.8)	7,365 (32.8)	4,900 (21.8)	
Characteristic pullout strength, cracked concrete over steel deck, according to Installation Detail A[10]	$N_{p,deck,cr}$	lb (kN)	1,445 (6.4)	1,465 (6.5)	2,600 (11.6)	3,305 (14.7)	3,490 (15.5)	3,470 (15.4)	
Characteristic pullout strength, uncracked concrete over steel deck, according to Installation Detail B[10]	$N_{p,deck,uncr}$	lb (kN)	1,600 (5.6)	2,025 (6.4)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Characteristic pullout strength, cracked concrete over steel deck, according to Installation Detail B[10]	$N_{p,deck,cr}$	lb (kN)	1,250 (5.6)	1,435 (6.4)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						

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. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of ACI 318 Section 9.2. If the load combinations of Appendix C are used, the appropriate value of ø must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ø factor.
4. The Power-Stud+ SD2 is considered a ductile steel element in tension as defined by ACI 318 D.1. Reported values for steel strength in tension are based on test results per ACI 355.2 and shall be used for design.
5. For all design cases use $\Psi_{c,N} = 1.0$. Select appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}).
6. For all design cases use $\Psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500 psi, N_{pn} = (pullout strength value from table)*(specified concrete compressive strength/2500)^n. For concrete over steel deck the value of 2500 must be replaced with the value of 3000. For all anchors $n = 1/2$ with the *exception* of the 3/8″ anchor size for cracked concrete where $n = 1/3$.
7. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in structural sand-lightweight concrete provided that N_b, N_{eq} and N_{pn} are multiplied by a factor of 0.60 (not required for steel deck).
9. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.
10. 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 flute (soffit).

PERFORMANCE DATA

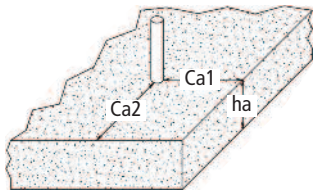
Shear Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2]

Design Characteristic	Notation	Units	Nominal Anchor Size						
			3/8″	1/2″		5/8″		3/4″	
Anchor category	1, 2 or 3	-	1	1		1		1	
STEEL STRENGTH IN SHEAR[4]									
Minimum specified yield strength (threads)	f_y	ksi (N/mm²)	76.8 (530)	68.0 (469)		68.0 (469)		56.0 (386)	
Minimum specified ultimate strength (threads)	f_{uta}	ksi (N/mm²)	96.0 (662)	84.8 (585)		84.8 (585)		72.0 (496)	
Effective tensile stress area (threads)	A_{se}	in² (mm²)	0.0775 (50.0)	0.1419 (65.7)		0.2260 (104.9)		0.3345 (215.8)	
Steel strength in shear[5]	V_{sa}	lb (kN)	2,190 (9.7)	4,640 (20.6)		9,800 (44.1)		10,175 (45.3)	
Reduction factor for steel strength[3]	ϕ	-	0.60	0.65					
CONCRETE BREAKOUT STRENGTH IN SHEAR[6]									
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)	5.00 (127)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.70 (Condition B)						
PRYOUT STRENGTH IN SHEAR[6]									
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in., 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-	1.0	1.0	2.0	2.0	2.0	2.0	2.0
Effective embedment	h_{ef}	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)	5.00 (127)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)						
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS[6]									
Steel strength in shear, seismic[7]	V_{eq} ($V_{sa,seis}$)	lb (kN)	1,955 (8.7)	4,640 (20.6)		6,530 (29.0)		6,635 (29.5)	
Reduction factor for steel strength in shear, seismic[3]	ϕ	-	0.60	0.65					
STEEL STRENGTH IN SHEAR FOR STRUCTUAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9]									
Steel strength in shear, concrete over steel deck according to installation Detail A[8]	$V_{sa,deck}$	lb (kN)	2,170 (9.7)	3,815 (17.0)	5,040 (22.4)	4,015 (17.9)	6,670 (29.7)	4,325 (19.2)	
Steel strength in shear, concrete over steel deck, according to Installation Detail B[3]	$V_{sa,deck}$	lb (kN)	2,170 (9.7)	2,880 (12.8)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Reduction factor for steel strength in shear for concrete over steel deck[3]	ϕ	-	0.60	0.65					

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 AC 318 D.3.3 shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of ACI 318 Section 9.2. If the load combinations of Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 Section D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. The Power-Stud+ SD2 is considered a ductile steel element as defined by ACI 318 D.1 with the exception of the 3/8″ anchor size in shear.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and shall be used for design. These reported values may be lower than calculated results using equation D-20 in ACI 318-05 D.6.1.2 and D-18 in ACI 318-02, D.6.1.2.
6. Anchors are permitted to used in structural sand-lightweight concrete provided that V_b and V_{cp} are multiplied by a factor of 0.60 (not required for steel deck).
7. Reported values for steel strength in shear for seismic applications are based on test results per ACI 355.2, Section 9.6.
8. Values for $V_{sa,\,deck}$ are for structual 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 pryout capacity in accordance with ACI 318 D.6.3 are not required for anchors installed in the flute (soffit).
9. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318 Appendix D:

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 (ϕ) 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.



Tension and Shear Design Strength for Power-Stud+ SD2 in Cracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.))	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	2-3/8	1,405	**1,315**	1,495	**1,315**	1,645	**1,315**	1,885	**1,315**	2,075	**1,315**
1/2	2-1/2	1,565	1,685	1,710	1,845	1,975	2,130	2,420	2,605	2,795	3,010
	3-3/4	2,845	**3,015**	3,115	**3,015**	3,595	**3,015**	4,405	**3,015**	5,085	**3,015**
5/8	3-7/8	3,235	3,575	3,545	3,920	4,095	4,525	5,015	5,540	5,790	**6,370**
	4-7/8	3,235	4,885	3,545	5,355	4,095	6,180	5,015	**6,370**	5,790	**6,370**
3/4	4-1/2	4,010	4,730	4,395	5,185	5,075	5,985	6,215	**6,615**	7,175	**6,615**
	5-3/4	5,065	**6,615**	5,550	**6,615**	6,410	**6,615**	7,850	**6,615**	9,065	**6,615**

Tension and Shear Design Strength for Power-Stud+ SD2 in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.))	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.))
3/8	2-3/8	1,805	**1,315**	1,975	**1,315**	2,280	**1,315**	2,795	**1,315**	3,225	**1,315**
1/2	2-1/2	2,205	2,375	2,415	2,605	2,790	3,005	2,795	**3,015**	3,945	**3,015**
	3-3/4	4,300	**3,015**	4,710	**3,015**	5,440	**3,015**	6,660	**3,015**	7,690	**3,015**
5/8	3-7/8	4,570	5,005	5,005	5,485	5,780	6,335	7,080	**6,370**	8,175	**6,370**
	4-7/8	6,835	**6,370**	7,485	**6,370**	8,645	**6,370**	**9,810**	**6,370**	**9,810**	**6,370**
3/4	4-1/2	5,665	**6,615**	6,205	**6,615**	7,165	**6,615**	8,775	**6,615**	10,130	**6,615**
	5-3/4	8,720	**6,615**	9,555	**6,615**	11,030	**6,615**	13,510	**6,615**	15,600	**6,615**

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

Factored design strengths may be converted to allowable loads using an appropriate conversion factor, α, for the controlling load combination. See ICC-ES ESR-2502.

Converted Allowable Loads for Power-Stud+ SD2 in Cracked Concrete[1,2]

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	2-3/8	1,005	940	1,065	940	1,175	940	1,345	940	1,480	940
1/2	2-1/2	1,115	1,205	1,220	1,315	1,410	1,520	1,730	1,860	1,995	2,150
	3-3/4	2,030	2,115	2,225	2,155	2,565	2,155	3,145	2,155	3,630	2,155
5/8	3-7/8	2,310	2,555	2,530	2,800	2,925	3,230	3,580	3,955	4,135	4,550
	4-7/8	2,310	3,490	2,530	3,825	2,925	4,415	3,580	4,550	4,135	4,550
3/4	4-1/2	2,865	3,380	3,140	3,705	3,625	4,275	4,440	4,725	5,125	4,725
	5-3/4	3,615	4,725	3,965	4,725	4,580	4,725	5,605	4,725	6,475	4,725

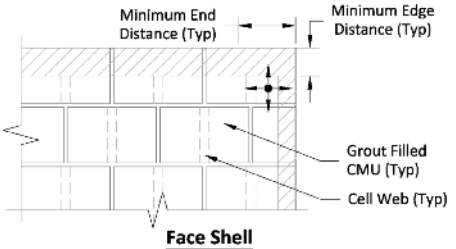
Converted Allowable Loads for Power-Stud+ SD2 in Uncracked Concrete[1,2]

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
3/8	2-3/8	1,290	940	1,410	940	1,630	940	1,995	940	2,305	940
1/2	2-1/2	1,575	1,695	1,725	1,860	1,990	2,145	1,995	2,155	2,815	2,155
	3-3/4	3,070	2,115	3,365	2,155	3,885	2,155	4,775	2,155	5,490	2,155
5/8	3-7/8	3,265	3,575	3,575	3,915	4,130	4,525	5,005	4,550	5,840	4,550
	4-7/8	4,880	4,550	5,345	4,550	6,175	4,550	7,560	4,550	8,730	4,550
3/4	4-1/2	4,045	4,725	4,430	4,725	5,115	4,725	6,265	4,725	7,235	4,725
	5-3/4	6,230	4,725	6,825	4,725	7,880	4,725	9,650	4,725	11,140	4,725

1. Allowable load values are calculated using a conversion factor, α, from Factored Design Strengths and conditions shown on the previous page.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination $1.2D + 1.6L$. Calculated weighted average for the conversion factor, α : 1.2(0.5) + 1.6(0.5) = 1.4.

Ultimate and Allowable Load Capacities for Power-Stud+ SD2 in Grout Filled Concrete Masonry[1,2,3]

Nominal Anchor Size in. (mm)	Minimum Embedment Depth (mm)	Installation Location[3]	Minimum Masonry Compressive Strength, f'_m = 1,500 psi (10.4 MPa)			
			Ulimate Load Tension lbs. (kN)	Allowable Load Tension lbs. (kN)	Ulimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8 (9.5)	2-1/2 (50.8)	Wall Face Min. 2-1/2" Edge and End Distances	1,670 (7.4)	335 (1.5)	2,075 (9.2)	415 (1.8)
1/2 (12.7)	2-1/2 (50.8)	Wall Face Min. 3" Edge and End Distances	2,295 (10.2)	460 (2.0)	1,310 (5.8)	260 (1.2)
	3-3/4 (95.3)	Top of Wall Min. 1-3/4" Edge and 4" Edge Distances	3,320 (14.8)	665 (3.0)	1,140 (5.1)	230 (1.0)



Permissible Anchor Locations
(Un-hatched Area / Through Face Shell)

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. Anchor installations into grouted masonry walls are limited to one per masonry cell.

ORDERING INFORMATION

Power-Stud+ SD2 (Carbon Steel Body with Stainless Steel Expansion Clip)

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt./100 (lbs)
7413SD2	3/8″ x 3″	1-3/4″	50	300	10
7414SD2	3/8″ x 3-1/2″	2-1/4″	50	300	12
7415SD2	3/8″ x 3-3/4″	2-1/2″	50	300	13
7416SD2	3/8″ x 5″	3-3/4″	50	300	16
7422SD2	1/2″ x 3-3/4″	2-1/8″	50	200	23
7423SD2	1/2″ x 4-1/2″	2-7/8″	50	200	28
7424SD2	1/2″ x 5-1/2″	3-7/8″	50	150	32
7426SD2	1/2″ x 7″	5-3/8″	25	100	44
7427SD2	1/2″ x 8-1/2″	6-7/8″	25	100	46
7435SD2	5/8″ x 4-3/4″	2-7/8″	25	100	52
7433SD2	5/8″ x 5″	3-1/8″	25	100	57
7434SD2	5/8″ x 6″	4-1/8″	25	75	64
7436SD2	5/8″ x 7″	5-1/8″	25	75	72
7438SD2	5/8″ x 8-1/2″	6-5/8″	25	75	84
7442SD2	3/4″ x 5-1/2″	3-1/4″	20	60	88
7444SD2	3/4″ x 6-1/4″	4″	20	60	90
7446SD2	3/4″ x 7″	4-3/4″	20	60	95
7448SD2	3/4″ x 8-1/2″	6-1/4″	10	40	95

The published size includes the diameter and the overall length of the anchor.
All anchors are packaged with nuts and washers.

Installation Accessories

Cat. No.	Description	Box Qty.
08465	Adjustable torque wrench with 1/2″ square drive (10 to 150 ft.-lbs.)	1
08280	Hand pump / dust blower	1

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

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

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

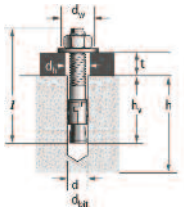
Normal-weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry (CMU)

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 $1.5h_v$ or 3" whichever is greater
- h_v = Minimum embedment depth
- l = Overall length of anchor
- t = Fixture thickness

Type 304 and Type 316 Stainless Steel Power-Stud

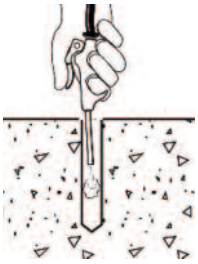
Dimension	Anchor Diameter, *d*						
	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16	15/16	1-1/8
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9	1-8
Nut Height (in.)	7/32	21/64	7/16	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.

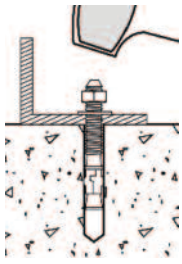
INSTALLATION PROCEDURES

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

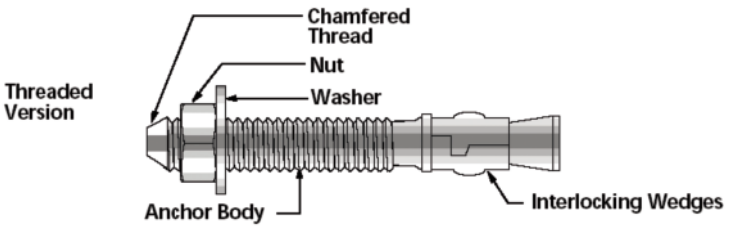
Tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.

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

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 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"

PERFORMANCE DATA

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

Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	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. Tabulated load values are for anchors installed in concrete. 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 load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

PERFORMANCE DATA

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)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**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 and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

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

Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	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 (43.2)	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. Tabulated load values are for anchors installed in concrete. 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 load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

PERFORMANCE DATA

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)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	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 and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Mechanically Galvanized 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)						Shear, lbs (kN)	
			Tension, 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)

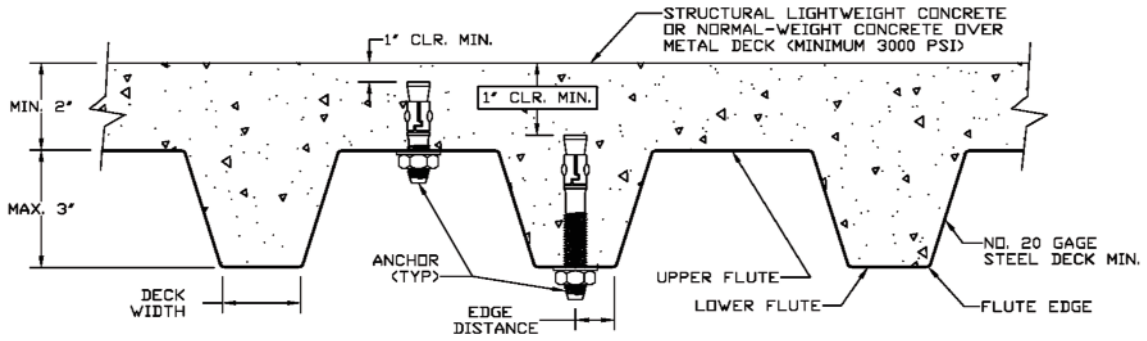
1. Tabulated load values are for anchors installed in sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

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)

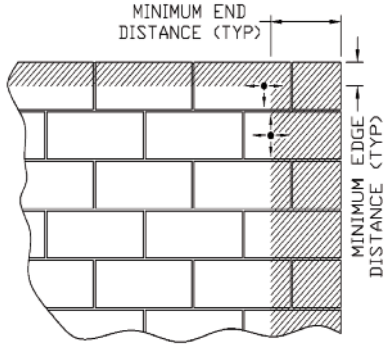
1. Tabulated load values are for anchors installed in sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher 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.



PERFORMANCE DATA

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.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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[1]

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	$c_{cr} = 12d$	$F_{V_C} = 1.0$	$c_{min} = 5d$	$F_{V_C} = 0.30$

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

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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

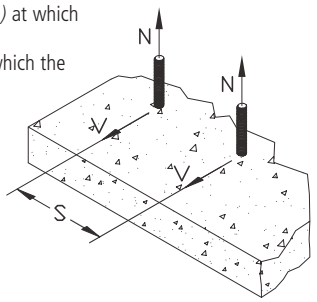
Spacing, Tension (F_{NS}) & Shear (F_{VS})																				
Dia. (in.)		1/4				3/8				1/2					5/8					
h_v (in.)		1-1/8	1-1/2	2	2-3/4	1-5/8	2	3	4-1/4	2-1/4	3	4	5	6	2-3/4	3-1/2	4	5	7	
s_{cr} (in.)		2-1/4	3	4	5-1/2	3-1/4	4	6	8-1/2	4-1/2	6	8	10	12	5-1/2	7	8	10	14	
s_{min} (in.)		1-1/8	1-1/2	2	2-3/4	1-5/8	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_v (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 *($2h_v$)* at which the anchor achieves 100% of load.

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



DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

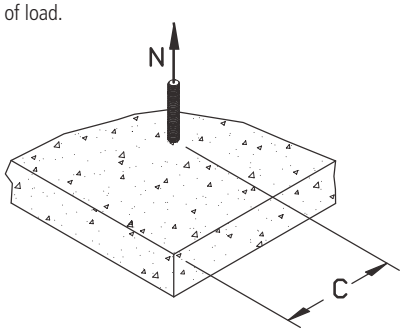
Edge Distance Load Adjustment Factors for Normal-Weight Concrete

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 (12d) at which the anchor achieves 100% of load.

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

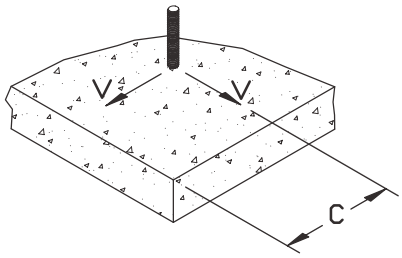


Edge Distance, Shear (F_{V_C})

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 (12d) at which the anchor achieves 100% of load.

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



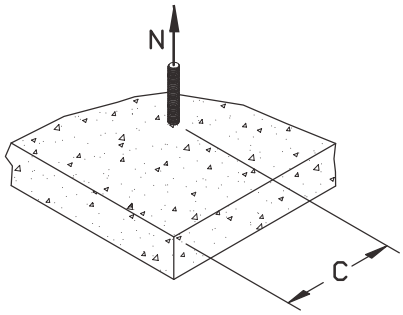
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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 (12d) at which the anchor achieves 100% of load.

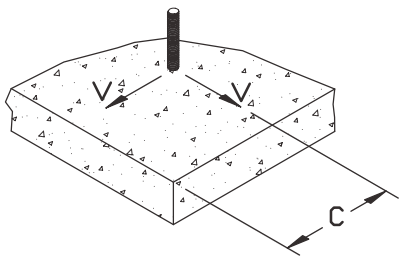
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 95% of load.



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 (12d) at which the anchor achieves 100% of load.

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



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
UL- Underwriters Laboratories Listed

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.

FM- Factory Mutual Approved
UL- Underwriters Laboratories Listed

Lok-Bolt AS® *Sleeve Anchor*

PRODUCT DESCRIPTION

The Lok-Bolt AS is an all steel pre-assembled single unit sleeve anchor which is designed for use in concrete or masonry base materials. The anchors are available in multiple head styles for multiple applications and a finished appearance. Anchor extender sleeves can be added to create longer lengths.

GENERAL APPLICATIONS AND USES

- Door and window frame installations
- Masonry applications
- Electrical / Mechanical applications
- Mounting fixtures on walls
- General purpose anchoring

FEATURES AND BENEFITS

+ Variety of head styles, lengths and sizes
+ All steel component design
+ Preassembled anchor for immediate installation
+ Sleeve keeps anchor centered in hole and has 360° contact area for even stress distribution
+ Versatile – can be used for solid and hollow concrete or masonry applications
+ Designed to allow fixture to draw snug against the base material during tightening

GUIDE SPECIFICATIONS

CSI Divisions: 03151–Concrete Anchoring, 04081-Masonry Anchorage, 5090-Metal Fastenings. Sleeve anchors shall be Lok-Bolt AS anchors supplied by Powers Fasteners, Inc.

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel Version	Stainless Steel Version
Plow-Bolt	AISI 1010/1018	Type 304 Stainless Steel
Expansion Sleeve	AISI 1010	Type 304 Stainless Steel
Extender	AISI 1010	N/A
Zinc Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)	N/A

SECTION CONTENTS

Hex Head

HEAD STYLES

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

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Grout-filled Concrete Masonry (CMU)
Hollow Concrete Masonry (CMU)
Brick Masonry

INSTALLATION SPECIFICATIONS

Acorn Nut and Hex Head Lok-Bolt AS

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

Round Head Lok-Bolt AS

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

Combo Flat Head Lok-Bolt AS

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

Rod Hanger Lok-Bolt AS

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

Threshold Lok-Bolt AS

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

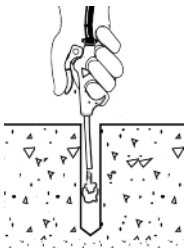
Tire-Wire Lok-Bolt AS

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

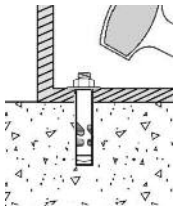
INSTALLATION INSTRUCTIONS

Hex/Acorn/Flat Round Head Versions

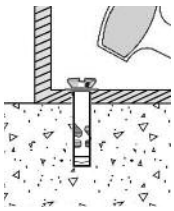
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



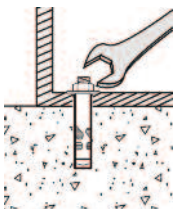
Blow the hole clean of dust and other material. Do not expand the anchor prior to installation



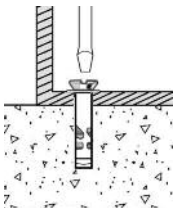
Hex Head/Acorn Nut
Position the washer on the anchor and thread on the nut.Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Flat Head/Round Head
Drive the achor through the fixture until the anchor is firmly seated. Be sure the anchor is driven to the required embedment depth.

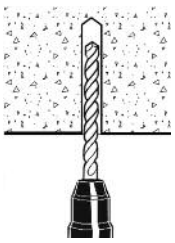


Hex Head/Acorn Nut
Tighten the anchor by turning the nut or head 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.

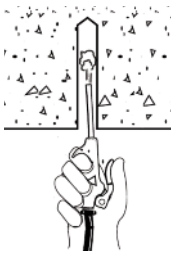


Flat Head/Round Head
Tighten the anchor by turning the head 3 to 5 turns past finger tight.

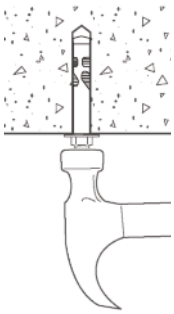
Rod Hanger Version



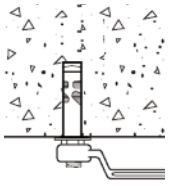
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



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

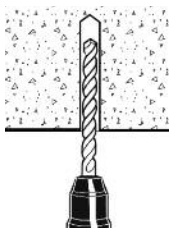


Drive the anchor into the hole until the anchor is at the required embedment depth.

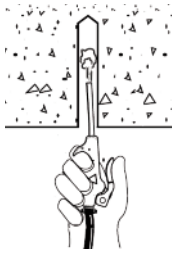


Tighten the coupler nut and washer up to the concrete surface and tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.

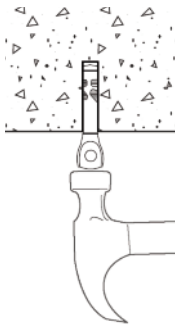
Tie-Wire Version



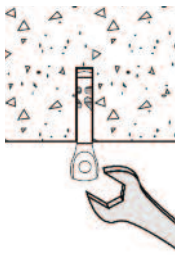
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



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



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



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

PERFORMANCE DATA

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

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Guide Installation Torque ft.-lbs.		Minimum Concrete Compressive Strength	
				3,500 psi (24.1 MPa)	
		Carbon	Stainless	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1/2 (12.7)	2	-	240 (1.0)	1,000 (4.4)
	1 (25.4)	6	4	980 (4.3)	1,120 (5.0)
5/16 (7.9)	1 (25.4)	12	-	1,300 (5.6)	2,360 (10.5)
3/8 (9.5)	1-1/4 (31.7)	18	18	2,040 (9.0)	4,110 (8.3)
1/2 (12.7)	1-1/2 (38.1)	26	26	2,420 (10.7)	4,860 (21.6)
5/8 (15.9)	2 (50.8)	50	40	4,750 (21.1)	4,860 (21.6)
3/4 (19.1)	2-1/4 (57.2)	90	60	5,020 (22.3)	11,040 (49.0)

1. The values listed above are ultimate load capacities which must 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. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 12 times the anchor diameter.

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

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Guide Installation Torque ft.-lbs.		Minimum Concrete Compressive Strength	
				3,500 psi (24.1 MPa)	
		Carbon	Stainless	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1/2 (12.7)	2	-	60 (0.27)	250 (1.1)
	1 (25.4)	6	4	245 (1.1)	280 (1.2)
5/16 (7.9)	1 (25.4)	12	-	325 (1.4)	590 (2.6)
3/8 (9.5)	1-1/4 (31.7)	18	18	510 (2.2)	1,028 (4.5)
1/2 (12.7)	1-1/2 (38.1)	26	36	605 (2.7)	1,215 (5.4)
5/8 (15.9)	2 (50.8)	50	40	1,185 (5.3)	1,215 (5.4)
3/4 (19.1)	2-1/4 (57.2)	90	60	1,255 (5.6)	2,760 (12.2)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 12 times the anchor diameter.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt AS Anchors in Hollow or Solid Concrete Masonry[1,2,3,4]

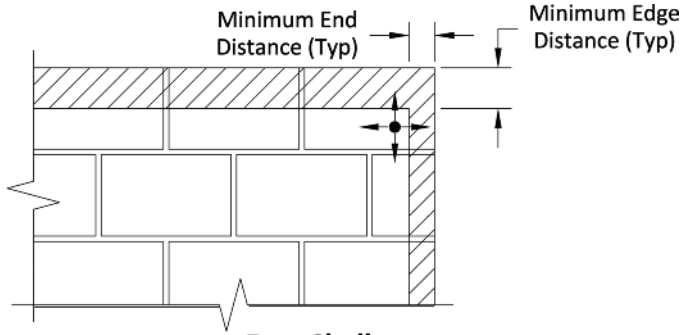
Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Guide Installation Torque ft.-lbs.	Minimum Edge Dist. in. (mm)	Minimum End Dist. in. (mm)	$f'm \geq$ 1,500 psi (10.4 MPa)			
					Ultimate		Allowable	
					Tension lbs. (kN)	Shear lbs. (kN	Tension lbs. (kN	Shear lbs. (kN
1/4 (6.4)	1 (25.4)	4	3-3/4 (95.3)	4 (101.3)	800 (3.6)	1,140 (5.1)	160 (3.6)	225 (1.0)
5/16 (7.9)	1 (25.4)	8			905 (4.0)	1,570 (7.0)	180 (0.80)	310 (1.4)
3/8 (9.5)	1-1/4 (31.7)	15			1,100 (4.8)	1,570 (7.0)	220 (0.97)	310 (1.4)
1/2 (12.7)	1-1/2 (38.1)	18			1,525 (6.7)	1,570 (7.0)	305 (1.3)	310 (1.4)

1. Tablulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, normal-weight concrete masonry units. Mortar must be minumum Type N,S or M. Masonry prism compressive stength must be 1,500 psi minimum at time of installation.
2. Allowable load capacities listed are calculated using a safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. A suitable anchor length must be selected which includes consideration of a fixture to engage the base material at the minimum embedment depth when anchoring into hollow concrete masonry.
4. The consistency of hollow concrete block masonry base materials can vary greatly. Consideration of job site testing should be given to verify conformance of base materials and anchor performance in actual conditions.

Ultimate and Allowable Load Capacties for Carbon or Stainless Steel Lok-Bolt AS Anchors in Solid Clay Brick Masonry[1,2]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Guide Installation Torque ft.-lbs.	Minimum End Dist. in. (mm)	Minimum End Dist. in. (mm)	$f'm \geq$ 1,500 psi (10.4 MPa)			
					Ultimate		Allowable	
					Tension lbs. (kN)	Shear lbs. (kN	Tension lbs. (kN	Shear lbs. (kN
1/4 (6.4)	1 (25.4)	4	4 (101.3)	1-1/2 (38.1)	800 (3.6)	950 (4.2)	160 (0.7)	190 (0.8)
3/8 (9.5)	1-1/4 (31.7)	15	8 (203.2)	8 (203.2)	1,100 (4.9)	3,000 (13.3)	220 (0.9)	600 (2.6)

1. Tablulated load values are for anchors installed in Grade SW, multiple wythe solid clay brick masonry conforming to ASTM C 62.
2. Allowable load capacities listed are calculated using a safety factor of 5.0 or greater. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.



Face Shell
Permissible Anchor Locations
(Un-hatched Area / Through Face Shell)

ORDERING INFORMATION

Hex Nut Lok-Bolt AS

Catalog Number		Size	Drill Dia.	Std. Box	Std.Ctn.
Carbon Steel	Stainless Steel				
5005S	-	5/16″ x 1-1/2″	5/16″	100	1000
5010S	-	5/16″ x 2-3/8″	5/16″	100	500
5015S	6152S	3/8″ x 1-7/8″	3/8″	50	500
5020S	6153S	3/8″ x 3″	3/8″	50	500
5022S	-	3/8″ x 4″	3/8″	50	250
5025S	6156S	1/2" x 2-1/2″	1/2″	25	250
5030S	6157S	1/2″ x 3″	1/2"	25	250
5034S	6160S	1/2" x 3-3/4″	1/2"	25	125
5033S	-	1/2" x 5-1/4″	1/2″	25	125
5032S	-	1/2″ x 6″	1/2"	10	100
5035S	-	5/8″ x 2-1/2″	5/8″	25	125
5038S	-	5/8″ x 3″	5/8″	25	125
5040S	6164S	5/8″ x 4-1/4″	5/8″	10	100
5045S	-	5/8″ x 5-3/4″	5/8″	10	100
5050S	-	3/4″ x 2-3/4″	3/4″	10	100
5055S	-	3/4" x 4-1/4″	3/4"	10	40
5060S	-	3/4″ x 6-1/4″	3/4"	10	30
5065S	-	3/4" x 8-1/4″	3/4"	10	30

Acorn Nut Lok-Bolt AS

Catalog Number		Size	Drill Dia.	Std. Box	Std.Ctn.
Carbon Steel	Stainless Steel				
5125S	-	1/4″ x 5/8″	1/4"	100	1000
5150S	6150S	1/4" x 1-3/8″	1/4"	100	1000
5175S	-	1/4" x 2-1/4″	1/4"	100	1000

Round Head Lok-Bolt AS, Slotted

Catalog Number		Size	Drill Dia.	Std. Box	Std.Ctn.
Carbon Steel	Stainless Steel				
5205S	-	1/4″ x 1-3/8″	1/4"	100	1000
5210S	6180S	1/4″ x 2-1/4″	1/4"	100	1000
5215S	-	1/4" x 3″	1/4"	100	1000
5220S	-	1/4" x 3-3/4″	1/4"	100	1000
5225S	-	5/16″ x 2-3/8″	5/16″	100	1000
5230S	-	5/16″ x 3-3/8″	5/16″	100	500
5235S	-	3/8″ x 2-3/4″	3/8″	50	500
5240S	-	3/8″ x 3-3/4″	3/8″	50	250

ORDERING INFORMATION

Combo Flat Head Lok-Bolt AS

Catalog Number		Size	Drill Dia.	Std. Box	Std.Ctn.
Carbon Steel	Stainless Steel				
5305S	-	1/4" x 1-1/2"	1/4"	100	1000
5310S	6170S	1/4" x 2-1/4"	1/4"	100	1000
5315S	6172S	1/4" x 3"	1/4"	100	1000
5320S	-	1/4" x 4"	1/4"	100	500
5325S	-	1/4" x 5-1/4"	1/4"	100	500
5330S	-	5/16" x 2-1/2"	5/16"	100	1000
5340S	-	3/8" x 2-3/4"	3/8"	50	500
5345S	6174S	3/8" x 4"	3/8"	50	250
5350S	6175S	3/8" x 5"	3/8"	50	250
5360S	6176S	3/8" x 6"	3/8"	50	250

Threshold Flat Head Lok-Bolt AS

Cat #	Size	Drill Dia	Std. Box	Std. Ctn
5500S	1/4" x 2"	1/4"	100	1000

Rod Hanger Lok-Bolt AS

Cat #	Size	Drill Dia	Std. Box	Std. Ctn
5810S	1/4" x 1-1/2"	1/4"	50	250
5815S	3/8" x 1-7/8"	3/8"	50	250
5825S	1/2" x 2-1/4"	1/2"	25	125

Tie-Wire Lok-Bolt AS

Cat #	Size	Drill Dia	Std. Box	Std. Ctn
5700S	5/16" x 1-1/2"	5/16"	100	1000

Lok-Bolt AS Extenders

Cat #	Size	Drill Dia	Std. Box	Std. Ctn
5684S	3/8" x 1-1/4"	3/8"	50	500

Wedge-Bolt+ *Screw Anchor*

PRODUCT DESCRIPTION

The Wedge-Bolt+ anchor is a one piece, heavy duty screw anchor with a finished hex head. It is simple to install, easy to identify and fully removable. The Wedge-Bolt+ has features and benefits that make it well suited for many applications. The steel threads along the anchor body tap into the hole during installation to provide keyed engagement. Suitable base materials include normal-weight concrete, structural sand-lightweight concrete, concrete over steel deck, concrete masonry and solid clay brick. The anchor is designed for structural loading in cracked and uncracked concrete.

GENERAL APPLICATIONS AND USES

- Racking, shelving and material handling
- Support ledgers and temporary attachments
- Interior applications/low level corrosion environment
- Retrofits, repairs and maintenance
- Fencing and railing
- Seismic and wind loading

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ Anchor can be installed through standard fixture holes
+ Wedge-bit size is matched to the nominal anchor diameter
+ Diameter, length and identifying marking stamped on head of each anchor
+ Fast installation with a powered impact wrench
+ One-piece, finished head design eliminates improper assembly or missing components

APPROVALS AND LISTINGS[1]

International Code Council, Evaluation Service (ICC-ES), ESR-2526 for concrete.
International Code Council, Evaluation Service (ICC-ES), ESR-1678 for concrete masonry.
Code compliant with the 2009 IBC, 2009 IRC, 2006 IBC, 2006 IRC, 2003 IBC, 2003 IRC and 1997 UBC
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)
Evaluated and qualified by an accredited independent testing labortatory for reliability against brittle failure, e.g. hydrogen embrittlement
Tested in accordance with ASTM E488 and AC106 criteria

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081 Masonry Anchoring and 05090-Metal Fastenings.*
Screw anchors shall be Wedge-Bolt+ 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 and hex washer head	Case hardened low carbon steel
Plating	Zinc plating according to ASTM B 633, SC1, Type III (Fe/Zn 5) Minimum plating requirement for Mild Service Condition
	Mechanically Galvanized Zinc plating according to ASTM B 695, Class 55

1. Approvals and listings pending for mechanically galvanized Wedge-Bolt+ in concrete.

SECTION CONTENTS

Wedge-Bolt+

ANCHOR MATERIALS

Zinc plated carbon steel body and hex washer head or mechanically galvanized carbon steel body and hex washer head

ANCHOR SIZE RANGE (TYP.)

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

SUITABLE BASE MATERIALS

Normal-weight concrete
Structural sand-lightweight concrete
Concrete over steel deck
Grout-filled concrete masonry (CMU)
Solid clay brick

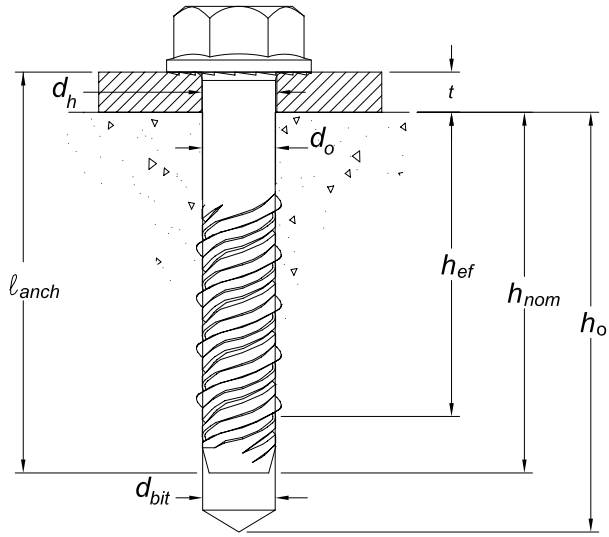
INSTALLATION SPECIFICATIONS

Installation Table for Wedge-Bolt+ (Design Provisions of ACI 318 Appendix D)

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Size									
			1/4"	3/8"	1/2"		5/8"				3/4"	
Nominal anchor diameter	d_o	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 Wedge-bit	3/8 Wedge-bit	1/2 Wedge-bit		5/8 Wedge-bit				3/4 Wedge-bit	
Wedge-bit tolerance range	-	in.	0.255 to 0.259	0.385 to 0.389	0.490 to 0.495		0.600 to 0.605				0.720 to 0.725	
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-3/4 (44)	2-1/8 (54)	2-1/2 (64)	3-1/2 (89)	3-1/4 (83)		4-3/8 (111)		4-1/4 (108)	
Effective embedment	h_{ef}	in. (mm)	1.100 (28)	1.425 (36)	1.650 (42)	2.500 (64)	2.145 (55)		3.100 (79)		2.910 (74)	
Minimum concrete member thickness[1]	h_{min}	in. (mm)	3-1/4 (83)	4 (102)	5 (127)	6 (152)	6 (152)		7 (178)		7 (178)	
Critical edge distance[1]	c_{ac}	in. (mm)	2-1/2 (64)	2-3/4 (70)	3-1/4 (83)	4-1/2 (114)	4 (102)	5 (127)	5 (127)		6 (152)	
Minimum edge distance[1]	c_{min}	in. (mm)	1-1/2 (38)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	4 (102)	1-3/4 (44)	1-3/4 (44)		1-3/4 (44)	
Minimum spacing distance[1]	s_{min}	in. (mm)	2 (51)	2-1/2 (64)	3-1/2 (89)	2-1/2 (64)	5 (127)	3-3/4 (95)	3 (76)		4-1/2 (114)	
Minimum hole depth[1]	h_o	in. (mm)	2-1/4 (57)	2-1/2 (64)	3 (76)	4 (102)	4 (102)		5 (127)		5 (127)	
Minimum overall anchor length	ℓ_{anch}	in. (mm)	2-1/4 (57)	2-1/2 (64)	3 (76)	4 (102)	4 (102)		5 (127)		5 (127)	
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	115 (156)	245 (332)	300 (407)		350 (475)				400 (542)	
Impact wrench socket size	-	in.	7/16	9/16	3/4		15/16				1-1/8	
Head height	-	in.	7/32	21/64	7/16		1/2				19/32	

1. For installations through the soffit of steel deck into concrete, see the installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Wedge-Bolt+ Anchor Detail



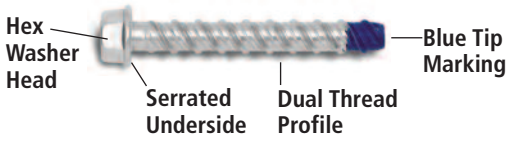
Hex Head Marking

Legend

Diameter and Length Identification Mark

'+' Symbol = Strength Design Compliant Anchor (see ordering information)

Matched Tolerance System

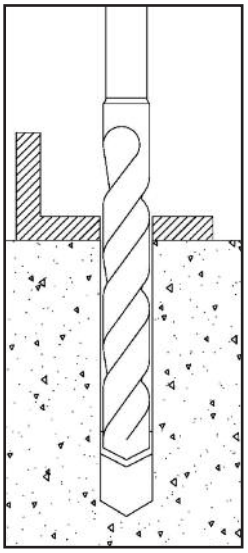


Blue Wedge-bit

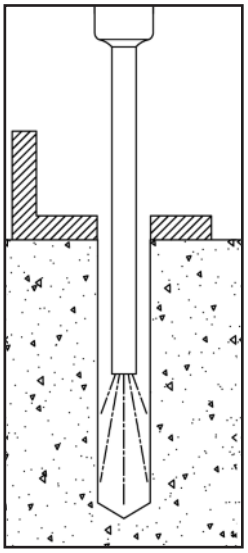
Designed and tested as a system for consistency and reliability

INSTALLATION INSTRUCTIONS

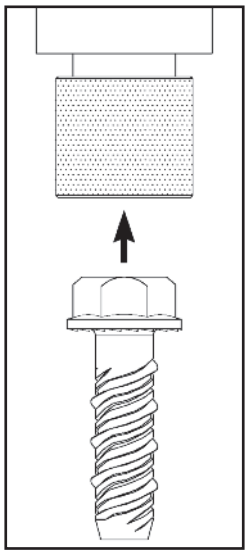
Installation Instructions for Wedge-Bolt+



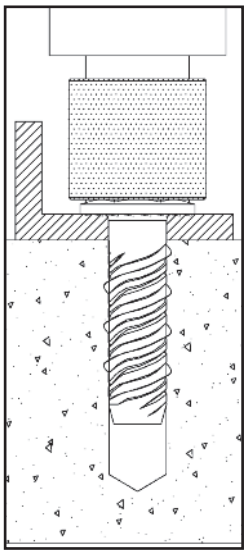
1.) *Using the proper Wedge-bit size, drill a hole into the base material to the required depth. The tolerances of the carbide Wedge-bit used must meet the requirements of the published Wedge-bit range.*



2.) *Remove dust and debris from the hole.*

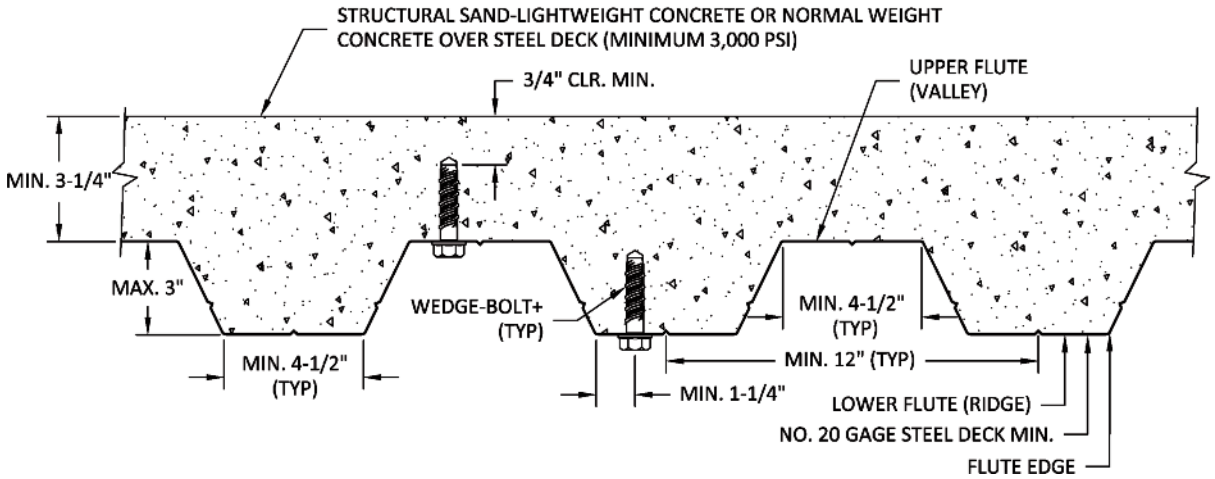


3.) *Select a powered impact wrench that does not exceed the maximum torque, T_{screw}, for the selected anchor diameter. Attach an appropriate sized hex socket to the impact wrench. Mount the screw anchor head into the socket.*



4.) *Drive the anchor through the fixture and into the hole until the head of the anchor comes into contact with the fixture. The anchor should be snug after installation. Do not spin the hex socket off the anchor to disengage.*

Installation Detail for Wedge-Bolt+ Installed Through Soffit of Steel Deck into Concrete



SD PERFORMANCE DATA

Tension Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2,3]

Design Characteristic	Notation	Units	Nominal Anchor Size						
			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	2-1/8	2-1/2	3-1/2	3-1/4	4-3/8	4-1/4
STEEL STRENGTH IN TENSION[4]									
Minimum specified ultimate strength	f_{uta}	ksi (N/mm²)	100.0 (990)	100.0 (990)	100.0 (990)		100.0 (990)		100.0 (990)
Effective tensile stress area	A_{se}	in² (mm²)	0.044 (1.10)	0.103 (2.66)	0.168 (4.28)		0.249 (6.41)		0.371 (9.53)
Steel strength in tension	N_{sa}	lb (kN)	4,400 (19.6)	10,300 (45.8)	16,800 (74.7)		24,900 (110.7)		37,100 (164.9)
Reduction factor for steel strength[3]	ϕ	-	0.65						
CONCRETE BREAKOUT STRENGTH IN TENSION[8]									
Effective embedment	h_{ef}	in. (mm)	1.100 (28)	1.425 (36)	1.650 (42)	2.500 (64)	2.145 (54)	3.100 (79)	2.910 (74)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24		24		24
Effectiveness factor for cracked concrete	k_{cr}	-	Not Applicable	17	17		17		17
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$	-	1.0 See note 5	1.0 See note 5	1.0 See note 5		1.0 See note 5		1.0 See note 5
Critical edge distance	c_{ac}	in. (mm)	2-1/2 (64)	2-3/4 (70)	3-1/4 (83)	4-1/2 (114)	4 (102)	5 (127)	6 (152)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[8]									
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	lb (kN)	See note 7	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)[6]	$N_{p,cr}$	lb (kN)	No Data	See note 7	See note 7	2,965 (13.2)	3,085 (13.7)	4,290 (19.1)	See note 7
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8]									
Characteristic pullout strength, seismic[6,](2,500 psi)[9]	N_{eq}	lb (kN)	No Data	1,085 (4.8)	1,350 (6.0)	2,520 (11.2)	3,085 (13.7)	4,290 (19.1)	4,270 (19.0)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						
PULLOUT STRENGTH IN TENSION FOR STRUCTUAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK									
Characteristic pullout strength, uncracked concrete over steel deck[10]	$N_{p,deck,uncr}$	lb (kN)	Not Applicable	2,010 (8.9)	2,480 (11.0)	3,760 (16.7)	4,095 (18.2)		Not Applicable
Characteristic pullout strength, cracked concrete over steel deck[10]	$N_{p,deck,cr}$	lb (kN)	Not Applicable	1,425 (6.3)	1,755 (7.8)	3,045 (13.5)	2,665 (11.9)		Not Applicable
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)						

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. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of ACI 318 Section 9.2. If the load combinations of Appendix C are used, the appropriate value of Ø must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. The Wedge-Bolt+ is considered a brittle steel element as defined by ACI 318 D.1.
5. For all design cases use $\Psi_{c,N}$ = 1.0. Select appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}).
6. For all design cases use $\Psi_{c,P}$ = 1.0. For concrete compressive strength greater than 2,500 psi, N_{pn} = (pullout strength value from table)*(specified concrete compressive strength/2500)$^{0.5}$.
7. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.
9. Anchors are permitted to be used in structural sand-lightweight concrete provided that N_b and N_{pn} are multiplied by a factor of 0.60 (not required for steel deck).
10. 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 flute (soffit).

SD PERFORMANCE DATA

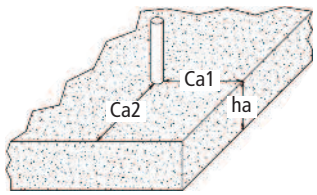
Shear Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2]

Design Characteristic	Notation	Units	Nominal Anchor Size						
			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	2-1/8	2-1/2	3-1/2	3-1/4	4-3/8	4-1/4
STEEL STRENGTH IN SHEAR[4,10]									
Steel strength in shear[5]	V_{sa}	lb (kN)	2,475 (11.0)	4,825 (21.5)	7,980 (35.5)		11,990 (53.3)		19,350 (86.1)
Reduction factor for steel strength [3]	ϕ	-	0.60						
CONCRETE BREAKOUT STRENGTH IN SHEAR[6,10]									
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	in. (mm)	1.100 (28)	1.425 (36)	1.650 (42)	2.500 (64)	2.145 (54)	3.100 (79)	2.910 (74)
Nominal anchor diameter	d_o	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)		0.750 (19.1)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.70 (Condition B)						
CONCRETE PRYOUT STRENGTH IN SHEAR[6]									
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in., 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-	1.0	1.0	1.0	2.0	1.0	2.0	2.0
Effective embedment	h_{ef}	in. (mm)	1.100 (28)	1.425 (36)	1.650 (42)	2.500 (64)	2.145 (54)	3.100 (79)	2.910 (74)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)						
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS[10]									
Steel strength in shear, seismic[7]	V_{eq}	lb (kN)	No Data	3,670 (16.3)	7,980 (35.5)		11,990 (53.3)		12,970 (57.7)
Reduction factor for steel strength in shear for seismic[3]	ϕ	-	0.60						
STEEL STRENGTH IN SHEAR FOR STRUCTUAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9]									
Steel strength in shear, concrete over steel deck[8]	$V_{sa,deck}$	lb (kN)	No Data	1,640 (7.3)	3,090 (13.7)		3,140 (14.0)	3,305 (14.7)	No Data
Reduction factor for steel strength in shear for steel deck[3]	ϕ	-	0.60						

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. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of ACI 318 Section 9.2. If the load combinations of Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. The Wedge-Bolt+ is considered a brittle steel element as defined by ACI 318 D.1.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, 9.4 and shall be used for design. These reported values may be lower than calculated results using equation D-20 in ACI 318-05 D.6.1.2 and D-18 in ACI 318-02, D.6.1.2.
6. Anchors are permitted to used in structural sand-lightweight concrete provided that V_b and V_{cp} are multiplied by a factor of 0.60 (not required for steel deck).
7. Reported values for steel strength in shear for seismic applications are based on test results per ACI 355.2, 9.6.
8. Values for $V_{sa,deck}$ are for structual 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 pryout capacity in accordance with ACI 318 D.6.3 are not required for anchors installed in the flute (soffit).
9. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
10. For 2003 IBC code base replace V_{sa} with V_s; and ℓ_e *with* ℓ with V_{eq} with $V_{sa,\,seis}$

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318 Appendix D:

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 (ϕ) 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.



Tension and Shear Design Strength for Wedge-Bolt+ in Cracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	1-3/4	-	-	-	-	-	-	-	-	-	-
3/8	2-1/8	940	940	1,030	1,030	1,190	1,190	1,460	1,460	1,685	1,685
1/2	2-1/2	1,175	1,145	1,285	1,250	1,485	1,445	1,815	1,770	2,100	2,045
	3-1/2	1,925	1,915	2,110	2,095	2,440	2,420	2,985	2,965	3,450	3,420
5/8	3-1/4	1,735	1,870	1,905	2,050	2,195	2,365	2,690	2,900	3,105	3,345
	4-3/8	2,790	2,785	3,055	3,050	3,525	3,520	4,320	4,325	4,990	4,980
3/4	4-1/4	2,740	3,180	3,005	3,485	3,465	4,025	4,245	4,925	4,905	5,690

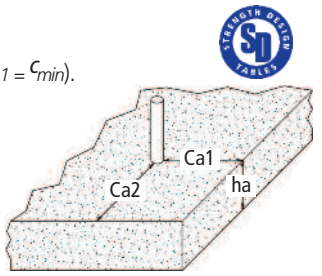
Tension and Shear Design Strength for Wedge-Bolt+ in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	1-3/4	900	970	985	1,060	1,140	1,225	1,395	**1,485**	1,610	**1,485**
3/8	2-1/8	1,330	1,320	1,455	1,445	1,680	1,670	2,060	2,045	2,375	2,360
1/2	2-1/2	1,655	1,600	1,815	1,755	2,095	2,025	2,565	2,480	2,965	2,865
	3-1/2	3,085	2,680	3,380	2,935	3,905	3,385	4,780	4,150	5,520	**4,780**
5/8	3-1/4	2,450	2,640	2,685	2,895	3,100	3,340	3,800	4,090	4,385	4,725
	4-3/8	4,260	3,900	4,670	4,270	5,390	4,930	6,600	6,040	7,625	6,975
3/4	4-1/4	3,870	4,455	4,240	4,880	4,895	5,635	5,995	6,900	6,925	7,965

Legend

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

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318 Appendix D:



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 minimum edge distance, close edge condition c_{min} (table values based on $c_{a1} = c_{min}$).
   - 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 (ϕ) 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.

Tension and Shear Design Strength with 1-3/4" Edge Distance for Wedge-Bolt+ in Cracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	1-3/4	-	-	-	-	-	-	-	-	-	-
3/8	2-1/8	395	455	435	495	500	575	615	705	710	810
1/2	2-1/2	400	510	440	560	505	645	620	790	715	910
	3-1/2	425	555	465	605	535	700	655	855	760	990
5/8	3-1/4	415	575	450	630	520	725	640	890	740	1,025
	4-3/8	445	620	490	675	565	780	690	955	795	1,105
3/4	4-1/4	440	645	480	705	555	815	680	1,000	785	1,150

Tension and Shear Design Strength with 1-3/4" Edge Distance for Wedge-Bolt+ in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
		2,500		3,000		4,000		6,000		8,000	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	1-3/4	390	535	425	585	490	675	600	825	695	955
3/8	2-1/8	435	635	475	695	550	805	675	985	780	1,135
1/2	2-1/2	430	715	470	780	545	900	665	1,105	770	1,275
	3-1/2	560	775	545	850	630	980	775	1,200	895	1,385
5/8	3-1/4	500	805	640	880	735	1,015	900	1,245	1,040	1,435
	4-3/8	585	865	640	945	740	1,095	905	1,340	1,045	1,545
3/4	4-1/4	450	900	495	990	570	1,140	695	1,395	805	1,615

Legend

Concrete Breakout Strength Controls

ASD PERFORMANCE DATA

Ultimate Load Capacities for Wedge-Bolt+ Installed into Normal-Weight Concrete at Critical Spacing and Edge Distances[1,2,3]

Anchor Diameter in. (mm)	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 Mpa)		4,000 psi (27.6 Mpa)		6,000 psi (41.4 Mpa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	720 (3.2)	920 (4.0)	1,340 (6.0)	1,880 (8.3)	1,660 (7.5)	2,160 (9.6)
	1-1/2 (38.1)	1,440 (6.5)	2,000 (8.8)	2,140 (9.6)	2,080 (9.2)	2,480 (11.2)	2,260 (10.0)
	2 (50.8)	2,400 (10.8)	2,000 (8.8)	3,940 (17.7)	2,080 (9.2)	4,980 (22.4)	2,680 (11.9)
	2-1/2 (63.5)	3,520 (15.8)	2,000 (8.8)	4,660 (21.0)	2,080 (9.2)	5,260 (23.7)	2,680 (11.9)
3/8 (9.5)	1-1/2 (38.1)	1,900 (8.6)	2,760 (12.2)	2,520 (11.3)	3,440 (15.3)	3,040 (13.7)	5,600 (24.9)
	2 (50.8)	3,000 (13.5)	3,100 (13.7)	3,920 (17.6)	3,440 (15.3)	5,200 (23.4)	5,600 (24.9)
	2-1/2 (63.5)	4,100 (18.5)	3,440 (15.3)	5,320 (23.9)	3,440 (15.3)	7,340 (33.0)	5,600 (24.9)
	3 (76.2)	5,800 (26.1)	4,120 (18.3)	7,740 (34.8)	4,320 (19.2)	9,900 (44.6)	5,600 (24.9)
	3-1/2 (88.9)	7,500 (33.8)	4,820 (21.4)	10,140 (45.6)	5,200 (23.1)	12,440 (56.0)	5,600 (24.9)
1/2 (12.7)	2 (50.8)	2,860 (12.9)	4,960 (22.0)	3,940 (17.7)	5,680 (25.2)	4,780 (21.5)	7,600 (33.8)
	2-1/2 (63.5)	4,100 (18.5)	5,800 (25.8)	5,200 (23.4)	6,480 (28.8)	6,480 (28.8)	7,960 (35.4)
	3 (76.2)	5,920 (26.6)	6,200 (27.5)	7,800 (35.1)	7,240 (32.2)	9,380 (42.2)	7,960 (35.4)
	3-1/2 (88.9)	6,060 (27.3)	8,020 (35.6)	8,480 (38.2)	8,160 (36.2)	11,900 (53.6)	8,600 (38.2)
	4 (101.6)	7,560 (34.0)	8,660 (39.0)	12,620 (56.8)	9,080 (40.9)	12,620 (56.8)	9,600 (43.2)
5/8 (15.9)	2-1/2 (63.5)	3,420 (15.4)	7,200 (32.4)	4,720 (21.2)	10,240 (45.5)	6,900 (31.1)	10,180 (45.2)
	3 (76.2)	4,560 (20.5)	7,920 (35.2)	7,380 (33.2)	10,240 (45.5)	8,960 (40.3)	11,400 (50.7)
	3-1/2 (88.9)	5,720 (25.7)	8,640 (38.4)	10,040 (45.2)	10,240 (45.5)	11,040 (49.7)	11,400 (50.7)
	4 (101.6)	8,240 (37.1)	9,540 (42.4)	12,760 (57.4)	11,140 (49.5)	14,320 (64.4)	12,080 (53.7)
	4-1/2 (114.3)	10,780 (48.5)	10,460 (46.5)	15,500 (69.8)	12,040 (53.5)	17,600 (79.2)	12,760 (56.7)
	5 (127.0)	13,300 (59.9)	11,360 (50.5)	18,220 (82.0)	12,960 (57.6)	20,860 (93.9)	13,480 (59.9)
3/4 (19.1)	3 (76.2)	4,320 (19.4)	9,480 (42.1)	6,480 (29.2)	12,120 (53.9)	8,700 (39.2)	14,800 (65.8)
	3-1/2 (88.9)	5,720 (25.7)	10,460 (46.5)	9,320 (41.9)	14,820 (65.9)	11,360 (51.1)	16,400 (72.9)
	4 (101.6)	7,120 (32.0)	11,460 (50.9)	12,140 (54.6)	17,520 (77.9)	14,020 (63.1)	18,000 (80.0)
	4-1/2 (114.3)	9,240 (41.6)	13,120 (58.3)	13,580 (61.1)	18,660 (83.0)	16,720 (75.2)	19,840 (88.2)
	5 (127.0)	11,340 (51.0)	14,780 (65.7)	15,020 (67.6)	19,740 (89.8)	19,400 (87.3)	21,700 (96.5)
	5-1/2 (139.7)	13,440 (60.5)	16,640 (74.0)	16,460 (74.1)	20,840 (92.7)	22,080 (99.4)	23,560 (104.8)
	6 (152.4)	15,540 (69.9)	18,120 (80.6)	17,900 (80.6)	21,960 (97.6)	24,760 (111.4)	25,420 (113.0)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

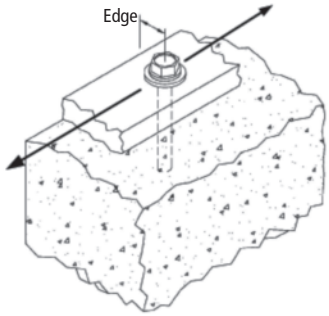
ASD PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wedge-Bolt+ Installed in Structural Lightweight Concrete[1,2,3,4]

Nominal Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength $f'_c \geq$ 3,000 psi (20.7 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	3,320 (14.9)	2,720 (12.1)	830 (3.7)	680 (3.0)
3/8 (9.5)	1-1/2 (38.1)	2,220 (10.0)	2,200 (9.9)	555 (2.5)	550 (2.5)
	3 (76.2)	5,280 (23.8)	4,660 (20.7)	1,320 (5.9)	1,165 (5.1)
1/2 (12.7)	2 (50.8)	2,920 (13.1)	5,360 (23.6)	730 (3.3)	1,340 (5.9)
	4 (101.6)	7,720 (34.7)	9,260 (41.1)	1,930 (8.7)	2,315 (10.2)
5/8 (15.9)	2-1/2 (63.5)	3,720 (16.7)	9,240 (41.6)	930 (4.2)	2,310 (10.4)
	5 (127.0)	12,160 (54.7)	14,940 (66.4)	3,040 (13.7)	3,735 (16.6)
3/4 (19.1)	5-1/4 (133.4)	13,320 (59.9)	17,780 (79.0)	3,330 (15.0)	4,445 (19.7)

1. Tabulated load values are for anchors installed in structuarl sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation for allowable loads for anchors at intermediate embedment depths may also be used.

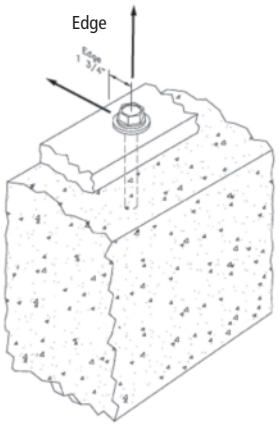
ASD PERFORMANCE DATA



Ultimate and Allowable Shear Load Capacities for Wedge-Bolt+ at 1-3/4" Edge of Normal-Weight Concrete[1,2]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	$f'_c \geq$ 2,000 psi (13.8 MPa) Parallel to the Free Edge	
			Ultimate Shear lbs. (kN)	Allowable Shear lbs. (kN)
1/2 (12.7)	3-3/8 (85.7)	1-3/4 (44.5)	5,020 (22.6)	1,255 (5.6)
5/8 (15.9)	3-3/8 (85.7)	1-3/4 (44.5)	5,420 (24.4)	1,355 (6.1)
3/4 (19.1)	3-3/8 (85.7)	1-3/4 (44.5)	5,660 (25.5)	1,415 (6.4)

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 calculated using an applied safety factor of 4.0.



Allowable Load Capacities for Wedge-Bolt+ Installed at 1-3/4" Edge of Normal-Weight Concrete Stem Walls[1,2,3]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	$f'_c \geq$ 2,500 psi (17.2 MPa)		
			Tension lbs. (kN)	Parallel to the Free Edge Shear lbs. (kN)	Towards the Free Edge Shear lbs. (kN)
1/2 (12.7)	4 (101.6)	1-3/4 (44.5)	1,270 (5.7)	1,425 (6.4)	470 (2.1)
5/8 (15.9)	2-1/2 (63.5)	1-3/4 (44.5)	610 (2.7)	1,155 (5.2)	380 (1.7)
	3-3/4 (95.3)		1,310 (5.9)	1,330 (6.0)	490 (2.2)
	5 (127.0)		2,015 (9.1)	1,505 (6.8)	600 (2.7)

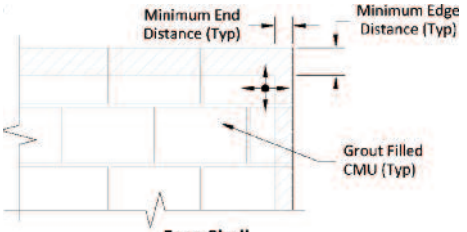
1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Allowable load capacities may also be applied to conditions at the edge of normal-weight concrete slabs.

MASONRY PERFORMANCE DATA

Allowable Load Capacities for Wedge-Bolt+ Anchors Installed into the Face of Grout Filled Concrete Masonry[1,2,3,4]

Anchor Diameter d (in.) (mm)	Minimum Embed. h_v (in.) (mm)	Minimum Edge Distance (in.) (mm)	Minimum End Distance (in.) (mm)	Tension lbs. (kN)		Shear lbs. (kN)	
				f'_m = 1,500 psi	$f'_m \geq$ 2,000 psi	f'_m = 1,500 psi	$f'_m \geq$ 2,000 psi
1/4 (6.4)	1 (25.4)	3-3/4 (95.3)	3-3/4 (95.3)	80 (0.4)	80 (0.4)	150 (0.7)	150 (0.7)
	2 (50.8)	1-1/2 (38.1)	2-3/4 (69.9)	230 (1.0)	265 (1.2)	165 (0.7)	190 (0.8)
	2 (50.8)	3-3/4 (95.3)	3-3/4 (95.3)	340 (1.5)	340 (1.5)	340 (1.5)	340 (1.5)
3/8 (9.5)	1-1/2 (38.1)	3-3/4 (95.3)	12 (304.8)	210 (0.9)	210 (0.9)	400 (1.8)	400 (1.8)
	2-1/2 (63.5)	1-3/4 (44.5)	3-3/4 (95.3)	295 (1.3)	340 (1.5)	210 (0.9)	245 (1.1)
	2-1/2 (63.5)	7-7/8 (200.0)		750 (3.4)	750 (3.4)	655 (2.9)	655 (2.9)
	2-1/2 (63.5)	12 (304.8)	12 (304.8)	615 (2.7)	710 (3.1)	915 (4.0)	1055 (4.7)
	3-1/2 (88.9)	12 (304.8)		1,290 (5.8)	1,290 (5.8)	910 (4.0)	910 (4.0)
1/2 (12.7)	2 (50.8)	3-3/4 (95.3)	12 (304.8)	335 (1.5)	335 (1.5)	720 (3.2)	720 (3.2)
	3 (76.2)	7-7/8 (200.0)		930 (4.2)	930 (4.2)	900 (4.0)	900 (4.0)
	3-1/2 (88.9)	2-3/4 (69.9)	3-3/4 (95.3)	595 (2.6)	685 (3.0)	405 (1.8)	470 (2.1)
	4 (101.6)	12 (304.8)	12 (304.8)	1,525 (6.9)	1,525 (6.9)	1,085 (4.8)	1,085 (4.8)
5/8 (15.9)	2-1/2 (63.5)	3-3/4 (95.3)	12 (304.8)	455 (2.0)	455 (2.0)	1,085 (4.8)	1,085 (4.8)
	3-1/4	7-7/8 (200.0)		885 (4.0)	885 (4.0)	1,085 (4.8)	1,085 (4.8)
	4 (101.6)	12 (304.8)		1,310 (5.9)	1,310 (5.9)		
	5 (127.0)			1,940 (8.7)	1,940 (8.7)	1,255 (5.6)	1,255 (5.6)
3/4 (19.1)	3 (76.2)	3-3/4 (95.3)	12 (304.8)	615 (2.8)	615 (2.8)	750 (3.4)	750 (3.4)
		12 (304.8)		615 (2.8)	615 (2.8)	1,320 (5.9)	1,320 (5.9)
	3-1/2 (88.9)	7-7/8 (200.0)		1,035 (4.7)	1,035 (4.7)	1,265 (5.7)	1,265 (5.7)
	4 (101.6)	12 (304.8)		1,455 (6.5)	1,455 (6.5)	1,320 (5.9)	1,320 (5.9)
	5 (127.0)			1,680 (7.6)	1,680 (7.6)	1,775 (7.9)	1,775 (7.9)

1. Tabulated load values are for anchors installed in minimum 6" wide, Grade N, Type II, lightweight 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. Linear interpolation for allowable loads for anchors at intermediate embedment depths may be used.
4. Allowable shear loads for 1/4" and 3/8" diameter anchor installations into the face shell of a masonry wall may be applied in any direction. Allowable shear loads for anchor diameters 1/2" and greater installed into the face shell may be applied in any direction provided the location is a minimum of 12" from the edge of the wall. For anchor diameters 1/2" and greater installed with an edge distance less than 12" the allowable shear loads may be applied in any direction except upward vertically.



Face Shell
Permissible Anchor Locations
(Un-hatched Area / Through Face Shell)

MASONRY PERFORMANCE DATA

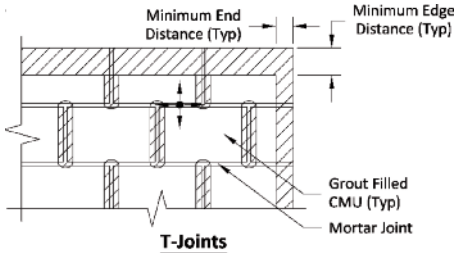
Allowable Load Capacities for Wedge-Bolt+ Anchors Installed into the Top of Grout-Filled Concrete Masonry Wall[1,2]

Nominal Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)		Shear (Toward Edge of Wall) lbs. (kN)		Shear (Toward End of Wall) lbs. (kN)	
				f'_m = 1,500 psi	$f'_m \geq$ 2,000 psi	f'_m = 1,500 psi	$f'_m \geq$ 2,000 psi	f'_m = 1,500 psi	$f'_m \geq$ 2,000 psi
3/8 (9.5)	2-1/2 (63.5)	1-1/2 (38.1)	3 (76.2)	310 (1.4)	355 (1.6)	140 (0.6)	160 (0.7)	250 (1.1)	290 (1.3)
	1-1/2 (38.1)	2 (50.8)	-		-	350 (1.6)	350 (1.6)	350 (1.6)	350 (1.6)
	2-1/2 (63.5)		-	570 (2.5)	570 (2.5)	380 (1.7)	380 (1.7)	380 (1.7)	380 (1.7)
1/2 (12.7)	3-1/2 (88.9)	1-3/4 (44.5)	3 (76.2)	535 (2.4)	620 (2.7)	260 (1.2)	305 (1.3)	240 (1.1)	275 (1.2)
	4-1/2 (114.3)	1-3/4 (44.5)	3 (76.2)	745 (3.3)	860 (3.8)	-	-	-	-
5/8 (15.9)	4-1/2 (114.3)	1-3/4 (44.5)	9 (228.6)	835 (3.7)	965 (4.3)	250 (1.1)	285 (1.2)	575 (2.6)	660 (2.9)
	5-1/2 (139.7)	2-3/4 (69.9)	9 (228.6)	1,005 (4.5)	1,165 (5.2)	420 (1.9)	490 (2.2)	-	-
	7-1/2 (190.5)	2-3/4 (69.9)	9 (228.6)	1,215 (5.4)	1,405 (6.2)	-	-	-	-

1. Tabulated load values are for carbon steel and stainless steel 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 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.

Allowable Load Capacities for Wedge-Bolt+ Anchors Installed into the T-Joint of Grout-Filled Concrete Masonry Wall[1,2,3,4]

Nominal Anchor Diameter in. (mm)	Minimum Embed. Depth in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	1-1/2 (38.1)	16 (406.4)	16 (406.4)	-	510 (2.3)
	3-1/2 (88.9)			830 (3.7)	
1/2 (12.7)	4 (101.6)			1,090 (4.9)	
5/8 (15.9)	4 (101.6)			840 (3.8)	1,225 (5.5)
3/4 (19.1)	2-1/2 (63.5)			-	
	4 (101.6)			890 (4.0)	



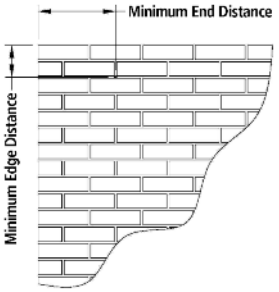
T-Joints
Permissible Anchor Locations
(Un-hatched Area / Into Horizontal Mortar Joint)

1. Tabulated load values are for carbon steel and stainless steel 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 ($f'_m \geq$ 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. Allowable shear loads for anchor installation into the horizontal and vertical mortar joints may be applied in any direction provided the anchor location is a minimum of 16" from the edge and end of the wall. For anchor installations with an edge diatance less than 16" the allowable shear loads may be applied in any direction except upward vertically.
4. Linear intepolation for allowable loads for anchors at intermediate embedment depths may be used.

MASONRY PERFORMANCE DATA

Allowable load capacities for Wedge-Bolt+ anchors installed into Multiple Wythe Solid Clay Brick Masonry[1,2]

Nominal Anchor Diameter in. (mm)	Minimum Embed. Depth in. (mm)	Minimum Edge & End Distance in. (mm)	Minimum Spacing Distance in.	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2-1/2 (63.5)	4 (101.6)	4" Any Direction	455 (2.0)	295 (1.3)
3/8 (9.5)	3-1/2 (88.9)	6 (152.4)	6" Any Direction	680 (3.1)	630 (2.8)
1/2 (12.7)	4 (101.6)	8 (203.2)	8" Any Direction	960 (4.3)	1,230 (5.5)
5/8 (15.9)	4 (101.6)	10 (254.0)	12" Any Direction	1,225 (5.5)	1,710 (7.6)
3/4 (19.1)	4 (101.6)	12 (304.8)	16" Any Direction	1,315 (5.9)	1,950 (8.7)



1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum 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.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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[1]

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	$s_{cr} = 12d$	$F_{N_S} = 1.0$	$s_{min} = 4d$	$F_{N_S} = 0.50$
	Shear	$s_{cr} = 12d$	$F_{V_S} = 1.0$	$s_{min} = 4d$	$F_{V_S} = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_{N_C} = 1.0$	$c_{min} = 3d$	$F_{N_C} = 0.70$
	Shear	$c_{cr} = 12d$	$F_{V_C} = 1.0$	$c_{min} = 3d$	$F_{V_C} = 0.15$

Anchor Installed in Structural Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension	$s_{cr} = 14.1d$	$F_{N_S} = 1.0$	$s_{min} = 4.7d$	$F_{N_S} = 0.50$
	Shear	$s_{cr} = 14.1d$	$F_{V_S} = 1.0$	$s_{min} = 4.7d$	$F_{V_S} = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 9.4d$	$F_{N_C} = 1.0$	$c_{min} = 3.5d$	$F_{N_C} = 0.70$
	Shear	$c_{cr} = 14.1d$	$F_{V_C} = 1.0$	$c_{min} = 3.5d$	$F_{V_C} = 0.15$

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

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

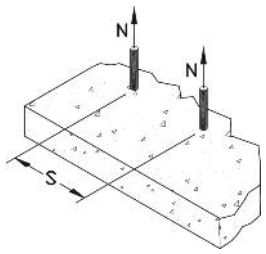
Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{NS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3	4-1/2	6	7-1/2	9
s_{min} (in.)		1	1-1/2	2	2-1/2	3
Spacing, s (inches)	1	0.50				
	1-1/2	0.63	0.50			
	2	0.75	0.58	0.50		
	2-1/2	0.88	0.67	0.56	0.50	
	3	1.00	0.75	0.63	0.55	0.50
	4-1/2		1.00	0.81	0.70	0.63
	6			1.00	0.85	0.75
	7-1/2				1.00	0.88
	9					1.00

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

Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 50% of load.

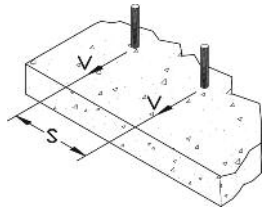


Spacing, Shear (F_{VS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3	4-1/2	6	7-1/2	9
s_{min} (in.)		1	1-1/2	2	2-1/2	3
Spacing, s (inches)	1	0.75				
	1-1/2	0.81	0.75			
	2	0.88	0.79	0.75		
	2-1/2	0.94	0.83	0.78	0.75	
	3	1.00	0.88	0.81	0.78	0.75
	4-1/2		1.00	0.91	0.85	0.81
	6			1.00	0.93	0.88
	7-1/2				1.00	0.94
	9					1.00

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

Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 75% of load.

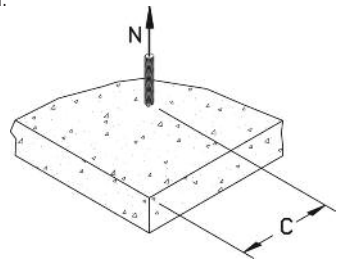


Edge Distance, Tension (F_{NC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		2	3	4	5	6
c_{min} (in.)		3/4	1-1/8	1-1/2	1-7/8	2-1/4
Edge Distance, c (in.)	3/4	0.70				
	1-1/8	0.79	0.70			
	1-1/2	0.88	0.76	0.70		
	1-7/8	0.97	0.82	0.75	0.70	
	2	1.00	0.84	0.76	0.71	
	2-1/4		0.88	0.79	0.74	0.70
	3		1.00	0.88	0.81	0.76
	4			1.00	0.90	0.84
	5				1.00	0.92
	6					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 8 anchor diameters (8d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3d) at which the anchor achieves 70% of load.

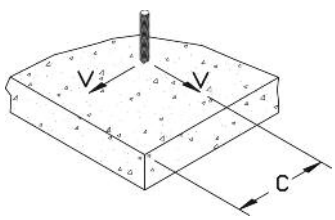


Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4-1/2	6	7-1/2	9
c_{min} (in.)		3/4	1-1/8	1-1/2	1-7/8	2-1/4
Edge Distance, c (in.)	3/4	0.15				
	1-1/8	0.29	0.15			
	1-1/2	0.43	0.24	0.15		
	1-7/8	0.58	0.34	0.22	0.15	
	2-1/4	0.72	0.43	0.29	0.21	0.15
	3	1.00	0.62	0.43	0.32	0.24
	4-1/2		1.00	0.72	0.55	0.43
	6			1.00	0.77	0.62
	7-1/2				1.00	0.81
	9					1.00

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

Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3d) at which the anchor achieves 15% of load

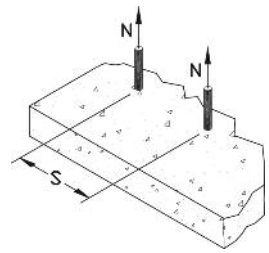


DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Structural Lightweight Concrete

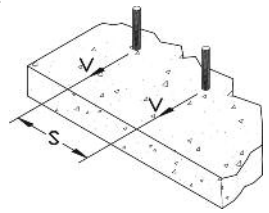
Spacing, Tension (F_{NS})						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3-1/2	5-1/4	7	8-7/8	10-1/2
s_{min} (in.)		1-1/4	1-3/4	2-3/8	3	3-1/2
Spacing, s (inches)	1-1/4	0.50				
	1-3/4	0.61	0.50			
	2-3/8	0.75	0.59	0.50		
	3	0.89	0.67	0.57	0.50	
	3-1/2	1.00	0.74	0.62	0.54	0.50
	5-1/4		1.00	0.82	0.70	0.63
	7			1.00	0.84	0.75
	8-7/8				1.00	0.88
	10-1/2					1.00

Notes: For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 14.1 anchor diameters (14.1d) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 4.7 anchor diameters (4.7d) at which the anchor achieves 50% of load.



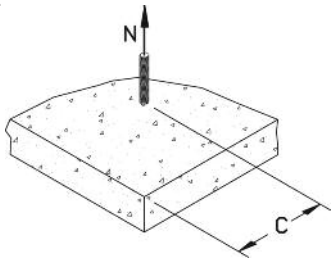
Spacing, Shear (F_{VS})						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3-1/2	5-1/4	7	8-7/8	10-1/2
s_{min} (in.)		1-1/4	1-3/4	2-3/8	3	3-1/2
Spacing, s (inches)	1-1/4	0.75				
	1-3/4	0.81	0.75			
	2-3/8	0.88	0.79	0.75		
	3	0.94	0.84	0.78	0.75	
	3-1/2	1.00	0.87	0.81	0.77	0.75
	5-1/4		1.00	0.91	0.85	0.82
	7			1.00	0.92	0.88
	8-7/8				1.00	0.94
	10-1/2					1.00

Notes: For anchors loaded in shear, the critical spacing (s_{cr}) is equal to 14.1 anchor diameters (14.1d) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 4.7 anchor diameters (4.7d) at which the anchor achieves 75% of load.



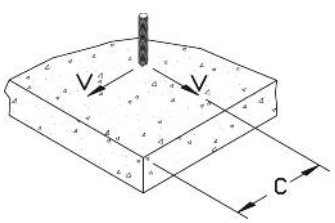
Edge Distance, Tension (F_{NC})						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		2-3/8	3-1/2	4-3/4	5-7/8	7
c_{min} (in.)		7/8	1-3/8	1-3/4	2-1/4	2-5/8
Edge Distance, c (in.)	7/8	0.70				
	1-3/8	0.80	0.70			
	1-3/4	0.88	0.76	0.70		
	2-1/4	0.98	0.83	0.75	0.70	
	2-3/8	1.00	0.84	0.76	0.72	
	2-5/8		0.88	0.79	0.74	0.70
	3-1/2		1.00	0.88	0.81	0.76
	4-3/4			1.00	0.91	0.84
	5-7/8				1.00	0.92
	7					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 9.4 anchor diameters (9.4d) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 3.5 anchor diameters (3.5d) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_{VC})						
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3-1/2	5-1/4	7	8-7/8	10-1/2
c_{min} (in.)		7/8	1-3/8	1-3/4	2-1/4	2-5/8
Edge Distance, c (in.)	7/8	0.15				
	1-3/8	0.31	0.15			
	1-3/4	0.43	0.24	0.15		
	2-1/4	0.59	0.35	0.23	0.15	
	2-5/8	1.00	0.43	0.29	0.21	
	3-1/2		0.62	0.43	0.32	0.15
	5-1/4		1.00	0.71	0.54	0.43
	7			1.00	0.77	0.62
	8-7/8				1.00	0.82
	10-1/2					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14.1 anchor diameters (14.1d) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 3.5 anchor diameters (3.5d) at which the anchor achieves 15% of load



ORDERING INFORMATION

Wedge-Bolt+ Screw Anchor (Carbon Steel with Blue Tip)

Cat. No.	Anchor Size	Box Qty.	Carton Qty.	Wt./100 (lbs)
7204SD	1/4" x 1-1/4"	100	600	3
7206SD	1/4" x 1-3/4"	100	600	4
7207SD	1/4" x 2"	100	600	4
7208SD	1/4" x 2-1/4"	100	600	4
7210SD	1/4" x 3"	100	500	5
7220SD	3/8" x 1-3/4"	50	300	9
7222SD	3/8" x 2-1/2"	50	300	10
7224SD	3/8" x 3"	50	250	12
7226SD	3/8" x 4"	50	250	15
7228SD	3/8" x 5"	50	250	18
7230SD	3/8" x 6"	50	150	22
7240SD	1/2" x 2"	50	200	15
7242SD	1/2" x 2-1/2"	50	200	17
7244SD	1/2" x 3"	50	150	20
7246SD	1/2" x 4"	50	150	26
7248SD	1/2" x 5"	25	100	30
7250SD	1/2" x 6"	25	75	35
7268SD	1/2" x 6-1/2"	25	75	37
7252SD	1/2" x 8"	25	75	43
7260SD	5/8" x 3"	25	100	35
7262SD	5/8" x 4"	25	100	41
7264SD	5/8" x 5"	25	75	48
7266SD	5/8" x 6"	25	75	54
7270SD	5/8" x 8"	25	75	65
7280SD	3/4" x 3"	20	60	50
7282SD	3/4" x 4"	20	60	60
7284SD	3/4" x 5"	20	60	71
7286SD	3/4" x 6"	20	60	81
7288SD	3/4" x 8"	10	40	103
7290SD	3/4" x 10"	10	30	100

Shaded catalogue numbers denote sizes which are less than the minimum standard anchor length for Strength Design.

The published size includes the diameter and length of the anchor measured from under the head.

Wedge-Bolt+ is marked with a blue tip and must be installed with a matched tolerance Wedge-bit.

Wedge-Bolt+ (Mechanically Galvanized)

Cat. No.	Anchor Size	Box Qty.	Carton Qty.
7726SD	3/8" x 4"	50	250
7728SD	3/8" x 5"	50	250
7730SD	3/8" x 6"	50	150
7746SD	1/2" x 4"	50	150
7748SD	1/2" x 5"	25	100
7750SD	1/2" x 6"	25	75
7751SD	1/2" x 6-1/2"	25	75
7752SD	1/2" x 8"	25	75
7764SD	5/8" x 5"	25	75
7766SD	5/8" x 6"	25	75
7768SD	5/8" x 6-1/2"	25	75
7770SD	5/8" x 8"	25	75
7786SD	3/4" x 6"	20	60
7789SD	3/4" x 8-1/2"	10	40
7790SD	3/4" x 10"	10	20

The published size includes the diameter and length of the anchor measured from under the head.

Wedge-Bolt+ is marked with a blue tip and must be installed with a matched tolerance Wedge-bit.

ORDERING INFORMATION (Continued)

Wedge-bits

Cat. No.	Wedge-bit Description	Usable Length	Tube Qty.	Carton Qty.
01312	SDS 1/4" x 4"	2″	1	250
01314	SDS 1/4" x 6"	4″	1	100
01316	SDS 3/8" x 6"	4″	1	200
01318	SDS 3/8" x 8"	6″	1	100
01319	SDS 3/8" x 18"	16″	1	50
01332	SDS 3/8" x 12"	10″	1	50
01320	SDS 1/2" x 6"	4″	1	150
01322	SDS 1/2" x 10"	8″	1	50
01334	SDS 1/2" x 12"	10″	1	50
01335	SDS 1/2" x 18"	16″	1	50
01324	SDS 5/8" x 8"	6″	1	75
01326	SDS 5/8" x 12"	10″	1	75
01336	SDS 5/8" x 18"	16″	1	50
01328	SDS 3/4" x 8"	6″	1	100
01330	SDS 3/4" x 12"	10″	1	50
01340	Spline 1/2" x 13"	8″	1	20
01342	Spline 1/2" x 16"	11″	1	-
01344	Spline 5/8" x 13"	8″	1	20
01348	Spline 3/4" x 13"	8″	1	20
01354	SDS-Max 1/2" x 13"	8″	1	20
01356	SDS-Max 5/8" x 13"	8″	1	20
01358	SDS-Max 3/4" x 13"	8″	1	20
01370	HD Straight Shank 1/4" x 4"	2-1/2″	1	100
01372	HD Straight Shank 1/4" x 6"	4″	1	-
01380	HD Straight Shank 3/8" x 6"	4″	1	-
01384	HD Straight Shank 3/8" x 13"	11″	1	-
01390	HD Straight Shank 1/2" x 6"	4″	1	-
01394	HD Straight Shank 1/2" x 13"	11″	1	50
01396	HD Straight Shank 5/8" x 13"	11″	1	-
01397	HD Straight Shank 3/4" x 13"	11″	1	-

Installation Accessories

Cat. No.	Description	Box Qty.
08280	Hand pump / dust blower	1

Wedge-Bolt® *Screw Anchor*

Carbon Steel OT and 410 Stainless Steel

PRODUCT DESCRIPTION

The Wedge-Bolt anchor is a one piece, heavy duty screw anchor with a finished hex head. It is simple to install, easy to identify, fully removable and vibration resistant. The Wedge-Bolt has many unique features and benefits that make it well suited for many applications in a variety of base materials. Optimum performance is obtained using a combination of patented design concepts. The steel threads along the anchor body self tap into the hole during installation and provide positive keyed engagement.

The benefit to the designer is higher load capacities, while the benefit to the user is ease of installation. The Wedge-Bolt can be installed with either a powered impact wrench or conventional hand socket.

Wedge-Bolt OT – The Wedge-Bolt OT is specifically engineered for use in fixture clearance holes sized a minimum of 1/8" over nominal. The Wedge-Bolt OT must be installed with an ANSI rotary drill bit.

410 Stainless Steel Wedge-Bolt – Wedge-Bolt screw anchors are designed to be used with a matched tolerance Wedge-Bit for optimum performance. The 410 Stainless Steel Wedge-Bolt works in fixture clearance holes that are 1/16" over nominal, which is typical of standard fixture holes used in steel fabrication.

GENERAL APPLICATIONS AND USES

- Racking and Shelving
- Support Ledgers
- Fencing
- Maintenance
- Material Handling
- Storage Facilities
- Repairs
- Retrofits

FEATURES AND BENEFITS

+ One-piece design eliminates possibility of lost anchor parts or improper assembly
+ Can be installed with an impact wrench or conventional hand socket
+ Fast installation and immediate loading minimizes downtime
+ High load capacities and full contact along thread length
+ Diameter and length ID stamped on head of each hex head anchor for easy inspection
+ Finished hex head provides attractive appearance and eliminates tripping hazard
+ Can be installed closer to the edge than traditional expansion anchors
+ Versatile installation in concrete, block and brick masonry
+ Ratchet teeth on underside of hex washer head lock against the fixture
+ Removable and will not leave components in the hole

TESTING, APPROVALS AND LISTINGS

Tested in accordance with ASTM E488 and AC106 criteria

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Screw anchors shall be Wedge-Bolt OT or 410 Stainless Steel Wedge-Bolt as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Carbon Steel Wedge-Bolt OT (ANSI)

410 Stainless Steel Wege-Bolt (Blue Tip)

HEAD STYLES

Hex Head

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 410 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" through 3/4" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry (CMU)
Brick Masonry

INSTALLATION SPECIFICATIONS

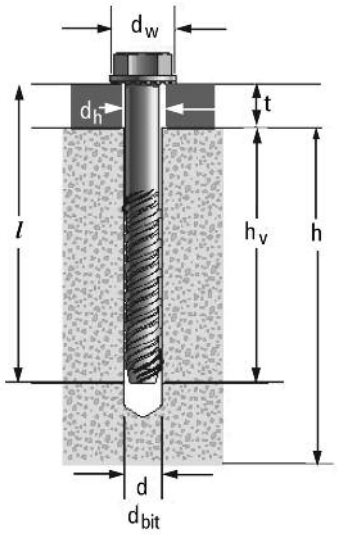
Carbon Steel Wedge-Bolt OT (Orange Tip)

Dimension	Nominal Anchor Diameter, *d*				
	1/4"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4
ANSI Drill Bit Size Range (in.)	0.260-0.268	0.390-0.398	0.520-0.530	0.650-0.660	0.775-0.787
Fixture Clearance Hole, d_h (in.)	3/8	1/2	5/8	3/4	7/8
Head Washer Height (in.)	7/32	21/64	7/16	1/2	19/32
Washer O.D., d_w (in.)	9/16	47/64	1	1-3/16	1-13/32
Wrench/Socket Size (in.)	7/16	9/16	3/4	15/16	1-1/8

410 Stainless Steel Wedge-Bolt (Blue Tip)

Dimension	Nominal Anchor Diameter, *d*		
	1/4"	3/8"	1/2"
Wedge-Bit Size, d_{bit} (in.)	1/4	3/8	1/2
Wedge-Bit Size Range (in.)	0.255-0.259	0.385-0.389	0.490-0.495
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16
Head Washer Height (in.)	7/32	21/64	7/16
Washer O.D., d_w (in.)	9/16	47/64	1
Wrench/Socket Size (in.)	7/16	9/16	3/4

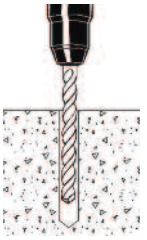
Must be used with a matched-tolerance Wedge-Bit.



Nomenclature

- d = Nominal 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 $1.5h_v$ or 3" minimum (whichever is greater)
- h_v = Minimum embedment depth
- l = Length of anchor
- t = Fixture thickness

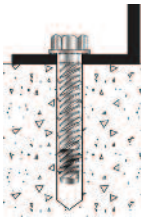
Installation Procedure



Select the proper diameter Wedge-Bit for 410 Stainless Steel Wedge-Bolt installations ***or*** proper diameter ANSI drill bit for Wedge-Bolt OT installations. ANSI drill bits must meet the requirements of ANSI Standard B212.15.

Using the proper drill bit, drill a hole into the base material to a depth of at least one anchor diameter deeper than the embedment required.

Insert the anchor through the fixture into the anchor hole. Begin tightening the anchor with socket wrench by rotating clockwise and applying pressure in toward the base material. A powered impact wrench may also be used. This will engage the first few threads as the anchor begins to advance.



Continue tightening the anchor until the head is firmly seated against the fixture while achieving the required embedment depth.

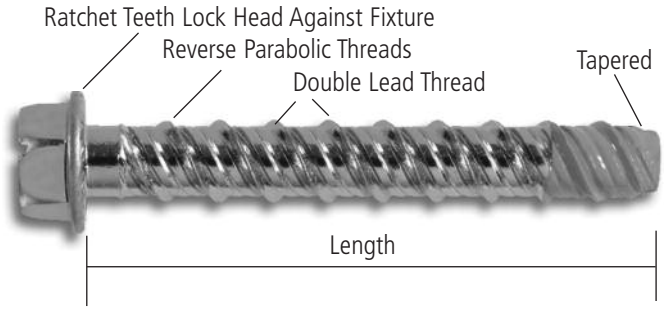
INSTALLATION SPECIFICATIONS

Maximum Clamping Torque (ft.-lbs.)

Base Material	Anchor Diameter				
	1/4"	3/8"	1/2"	5/8"	3/4"
2,000 psi Concrete	5	30	45	75	150
4,000 psi Concrete	10	40	60	95	200
6,000 psi Concrete	10	40	60	95	200
3,000 psi Lightweight Concrete	10	15	40	60	70
Grout Filled Block	10	15	40	60	70
Solid Red Brick	10	30	45	75	100

OT Carbon Steel

410 Stainless Steel



MATERIAL SPECIFICATIONS

Carbon Steel Wedge-Bolt OT

Anchor Component	Component Material
Anchor Body	Case Hardened Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5) Mimimum plating requirement for Mild Service Condition

410 Stainless Steel Wedge-Bolt

Anchor Component	Component Material
Anchor Body	Heat Treated 410 Stainless Steel
Coating	Class 4 Sealcoat (1500 hour rating for ASTM B 117 salt spray test, 20 hour rating for DIN 50018 2.0 S kesternich test undamaged coating reference).

PERFORMANCE DATA

Ultimate Load Capacities for Wedge-Bolt OT installed in Normal-Weight Concrete at Critical Spacing and Edge Distances[1,2,3]

Nominal Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	720 (3.2)	920 (4.0)	1,340 (6.0)	1,880 (8.3)	1,660 (7.5)	2,160 (9.6)
	1-1/2 (38.1)	1,440 (6.5)	2,000 (8.8)	2,140 (9.6)	2,080 (9.2)	2,480 (11.2)	2,260 (10.0)
	2 (50.8)	2,400 (10.8)	2,000 (8.8)	3,940 (17.7)	2,080 (9.2)	4,980 (22.4)	2,680 (11.9)
	2-1/2 (63.5)	3,520 (15.8)	2,000 (8.8)	4,660 (21.0)	2,080 (9.2)	5,260 (23.7)	2,680 (11.9)
3/8 (9.5)	1-1/2 (38.1)	1,900 (8.6)	2,760 (12.2)	2,520 (11.3)	3,440 (15.3)	3,040 (13.7)	5,600 (24.9)
	2 (50.8)	3,000 (13.5)	3,100 (13.7)	3,920 (17.6)	3,440 (15.3)	5,200 (23.4)	5,600 (24.9)
	2-1/2 (63.5)	4,100 (18.5)	3,440 (15.3)	5,320 (23.9)	3,440 (15.3)	7,340 (33.0)	5,600 (24.9)
	3 (76.2)	5,800 (26.1)	4,120 (18.3)	7,740 (34.8)	4,320 (19.2)	9,900 (44.6)	5,600 (24.9)
	3-1/2 (88.9)	7,500 (33.8)	4,820 (21.4)	10,140 (45.6)	5,200 (23.1)	12,440 (56.0)	5,600 (33.8)
1/2 (12.7)	2 (50.8)	2,860 (12.9)	4,960 (22.0)	3,940 (17.7)	5,680 (25.2)	4,780 (21.5)	7,600 (33.8)
	2-1/2 (63.5)	4,100 (18.5)	5,800 (25.8)	5,200 (23.4)	6,480 (28.8)	6,480 (29.2)	7,960 (35.4)
	3 (76.2)	5,920 (26.6)	6,200 (27.5)	7,800 (35.1)	7,240 (32.2)	9,380 (42.2)	7,960 (35.4)
	3-1/2 (88.9)	6,060 (27.3)	8,020 (35.6)	8,480 (38.2)	8,160 (36.2)	11,900 (53.6)	8,600 (38.2)
	4 (101.6)	7,560 (34.0)	8,660 (39.0)	12,620 (56.8)	9,080 (40.9)	12,620 (56.8)	9,600 (43.2)
5/8 (15.9)	2-1/2 (63.5)	3,420 (15.4)	7,200 (32.4)	4,720 (21.2)	10,240 (45.5)	6,900 (31.1)	10,180 (45.2)
	3 (76.2)	4,560 (20.5)	7,920 (35.2)	7,380 (33.2)	10,240 (45.5)	8,960 (40.3)	11,400 (50.7)
	3-1/2 (88.9)	5,720 (25.7)	8,640 (38.4)	10,040 (45.2)	10,240 (45.5)	11,040 (49.7)	11,400 (50.7)
	4 (101.6)	8,240 (37.1)	9,540 (42.4)	12,760 (57.4)	11,140 (49.5)	14,320 (64.4)	12,020 (53.7)
	4-1/2 (114.3)	10,780 (48.5)	10,460 (46.5)	15,500 (69.9)	12,040 (53.5)	17,600 (79.2)	12,760 (56.7)
	5 (127.0)	13,300 (59.9)	11,360 (50.5)	18,220 (82.0)	12,960 (57.6)	20,860 (93.9)	13,480 (59.9)
3/4 (19.1)	3 (76.2)	4,320 (19.4)	9,480 (42.1)	6,480 (29.2)	12,120 (53.9)	8,700 (39.2)	14,800 (65.8)
	3-1/2 (88.9)	5,720 (25.7)	10,460 (46.5)	9,320 (41.9)	14,820 (65.9)	11,360 (51.1)	16,400 (72.9)
	4 (101.6)	7,120 (32.0)	11,460 (50.9)	12,140 (54.6)	17,520 (77.9)	14,020 (63.1)	18,000 (80.0)
	4-1/2 (114.3)	9,240 (41.6)	13,120 (58.3)	13,580 (61.1)	18,660 (83.0)	16,720 (75.2)	19,840 (88.2)
	5 (127.0)	11,340 (51.0)	14,780 (65.7)	15,020 (67.6)	19,740 (87.8)	19,400 (87.3)	21,700 (96.5)
	5-1/2 (139.7)	13,440 (60.5)	16,640 (74.0)	16,460 (74.1)	20,840 (92.7)	22,080 (99.4)	23,560 (104.8)
	6 (152.4)	15,540 (69.9)	18,120 (80.6)	17,900 (80.6)	21,960 (97.6)	24,760 (111.4)	25,420 (113.0)

1. Tabulated load values are applicable for carbon steel anchors.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3 Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety, or overhead.

PERFORMANCE DATA

Allowable Load Capacities for Wedge-Bolt OT installed in Normal-Weight Concrete at Critical Spacing and Edge Distances[1,2,3,4]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	180 (0.8)	230 (1.0)	335 (1.5)	470 (2.0)	415 (1.9)	540 (2.4)
	1-1/2 (38.1)	360 (1.6)	500 (2.2)	535 (2.4)	520 (2.3)	620 (2.8)	565 (2.5)
	2 (50.8)	600 (2.7)	500 (2.2)	985 (4.4)	520 (2.3)	1,245 (5.6)	670 (2.9)
	2-1/2 (63.5)	880 (4.0)	500 (2.2)	1,165 (5.2)	520 (2.3)	1,315 (5.9)	670 (2.9)
3/8 (9.5)	1-1/2 (38.1)	475 (2.1)	690 (3.0)	630 (2.8)	860 (3.8)	760 (3.4)	1,400 (6.2)
	2 (50.8)	750 (3.4)	775 (3.4)	980 (4.4)	860 (3.8)	1,300 (5.9)	1,400 (6.2)
	2-1/2 (63.5)	1,025 (4.6)	860 (3.8)	1,330 (6.0)	860 (3.8)	1,835 (8.3)	1,400 (6.2)
	3 (76.2)	1,450 (6.5)	1,030 (4.5)	1,935 (8.7)	1,080 (4.8)	2,475 (11.1)	1,400 (6.2)
	3-1/2 (88.9)	1,875 (8.4)	1,205 (5.3)	2,535 (11.4)	1,300 (5.7)	3,110 (14.0)	1,400 (6.2)
1/2 (12.7)	2 (50.8)	715 (3.2)	1,240 (5.5)	985 (4.4)	1,420 (6.3)	1,195 (5.4)	1,900 (8.4)
	2-1/2 (63.5)	1,025 (4.6)	1,450 (6.4)	1,300 (5.9)	1,620 (7.2)	1,620 (7.3)	1,990 (8.8)
	3 (76.2)	1,480 (6.7)	1,550 (6.8)	1,950 (8.8)	1,810 (8.0)	2,345 (10.6)	1,990 (8.8)
	3-1/2 (88.9)	1,515 (6.8)	2,005 (8.9)	2,120 (9.5)	2,040 (9.0)	2,975 (13.4)	2,150 (9.5)
	4 (101.6)	1,890 (8.5)	2,165 (9.7)	3,155 (14.2)	2,270 (10.2)	3,155 (14.2)	2,400 (10.8)
5/8 (15.9)	2-1/2 (63.5)	855 (3.8)	1,800 (8.1)	1,180 (5.3)	2,560 (11.3)	1,725 (7.8)	2,545 (11.3)
	3 (76.2)	1,140 (5.1)	1,980 (8.8)	1,845 (8.3)	2,560 (11.3)	2,240 (10.1)	2,850 (12.6)
	3-1/2 (88.9)	1,430 (6.4)	2,160 (9.6)	2,510 (11.3)	2,560 (11.3)	2,760 (12.4)	2,850 (12.6)
	4 (101.6)	2,060 (9.3)	2,385 (10.6)	3,190 (14.4)	2,785 (12.3)	3,580 (16.1)	3,020 (13.4)
	4-1/2 (114.3)	2,695 (12.1)	2,615 (11.6)	3,875 (17.4)	3,010 (13.4)	4,400 (19.8)	3,190 (14.2)
	5 (127.0)	3,325 (15.0)	2,840 (12.6)	4,555 (20.5)	3,240 (14.4)	5,215 (23.5)	3,370 (14.9)
3/4 (19.1)	3 (76.2)	1,080 (4.9)	2,370 (10.5)	1,620 (7.3)	3,030 (13.4)	2,175 (9.8)	3,700 (16.4)
	3-1/2 (88.9)	1,430 (6.4)	2,615 (11.6)	2,330 (10.5)	3,705 (21.1)	2,840 (12.8)	4,100 (18.2)
	4 (101.6)	1,780 (8.0)	2,865 (12.7)	3,035 (13.7)	4,380 (19.4)	3,505 (15.8)	4,500 (20.0)
	4-1/2 (114.3)	2,310 (10.4)	3,280 (14.5)	3,395 (15.3)	4,665 (20.8)	4,180 (18.8)	4,960 (22.0)
	5 (127.0)	2,835 (12.8)	3,695 (16.4)	3,755 (16.9)	4,935 (21.9)	4,850 (21.8)	5,425 (24.4)
	5-1/2 (139.7)	3,360 (15.1)	4,160 (18.5)	4,115 (18.5)	5,210 (23.1)	5,520 (24.8)	5,890 (26.2)
	6 (152.4)	3,885 (17.5)	4,530 (20.1)	4,475 (20.1)	5,490 (24.4)	6,190 (27.9)	6,355 (28.2)

1. Tabulated load values are applicable for carbon steel anchors.
2. 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.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Ultimate Load Capacities for Wedge-Bolt OT installed in Normal-Weight Concrete at 16 Diameters Spacing and Edge Distances[1,2,3]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Spacing and Edge Distance at 16*d* in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
			2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	4 (101.6)	920 (4.1)	920 (4.0)	1,520 (6.8)	1,900 (8.4)	1,650 (7.4)	2,220 (9.8)
	1-1/2 (38.1)		1,760 (7.9)	2,340 (10.4)	2,360 (10.6)	2,520 (11.2)	2,480 (11.2)	2,440 (10.8)
	2 (50.8)		2,800 (12.6)	2,520 (11.2)	4,230 (19.0)	2,520 (11.2)	4,980 (22.4)	3,058 (13.6)
	2-1/2 (63.5)		4,220 (19.0)	2,800 (12.4)	4,900 (22.1)	2,800 (12.4)	5,260 (23.7)	3,330 (14.8)
3/8 (9.5)	1-1/2 (38.1)	6 (152.4)	2,140 (9.6)	2,940 (13.1)	2,660 (12.0)	3,990 (17.7)	3,030 (13.6)	6,018 (26.7)
	2 (50.8)		3,300 (14.9)	3,700 (16.4)	4,120 (18.5)	4,515 (20.0)	5,185 (23.3)	6,018 (26.7)
	2-1/2 (63.5)		4,460 (20.1)	4,460 (19.8)	5,550 (25.0)	5,045 (22.4)	7,340 (33.0)	6,018 (26.7)
	3 (76.2)		6,180 (27.8)	5,200 (23.1)	7,970 (35.9)	5,570 (24.7)	9,890 (44.5)	6,125 (27.2)
	3-1/2 (88.9)		7,900 (35.6)	5,960 (26.5)	10,390 (46.8)	6,100 (27.1)	12,440 (56.0)	6,240 (27.7)
1/2 (12.7)	2 (50.8)	8 (203.2)	2,960 (13.3)	5,700 (25.4)	3,930 (17.7)	6,450 (28.6)	4,780 (21.5)	7,830 (34.8)
	2-1/2 (63.5)		4,100 (18.5)	6,450 (28.6)	5,200 (23.4)	6,940 (30.8)	6,480 (29.2)	8,440 (37.5)
	3 (76.2)		5,910 (26.6)	6,690 (29.7)	7,800 (35.1)	7,595 (33.7)	9,380 (42.2)	8,440 (37.5)
	3-1/2 (88.9)		6,060 (27.3)	7,670 (34.1)	8,480 (38.2)	8,400 (37.3)	11,890 (53.5)	8,595 (38.2)
	4 (101.6)		7,620 (34.3)	8,650 (38.4)	13,260 (59.7)	8,400 (37.3)	13,260 (59.7)	9,600 (43.2)
5/8 (15.9)	2-1/2 (63.5)	10 (254.0)	3,420 (15.4)	7,790 (35.1)	4,720 (21.2)	10,760 (47.8)	6,900 (31.1)	10,340 (45.9)
	3 (76.2)		4,560 (20.5)	8,590 (38.2)	7,380 (33.2)	10,760 (47.8)	8,960 (40.3)	10,870 (48.3)
	3-1/2 (88.9)		5,720 (25.7)	9,390 (41.7)	10,040 (45.2)	10,760 (47.8)	11,040 (49.7)	11,400 (50.7)
	4 (101.6)		8,280 (37.3)	11,430 (50.8)	12,760 (57.4)	11,700 (52.0)	14,320 (64.4)	12,095 (53.8)
	4-1/2 (114.3)		10,860 (48.9)	11,470 (51.0)	15,500 (69.8)	12,640 (56.2)	17,600 (79.2)	12,790 (56.9)
	5 (127.0)		13,440 (60.5)	12,520 (55.6)	18,220 (82.0)	13,580 (60.4)	20,860 (93.9)	13,490 (60.0)
3/4 (19.1)	3 (76.2)	12 (304.8)	4,320 (19.4)	9,690 (43.1)	6,480 (29.2)	12,245 (54.4)	10,260 (46.2)	14,825 (65.9)
	3-1/2 (88.9)		5,760 (25.9)	11,010 (48.9)	9,320 (41.9)	14,225 (63.1)	12,140 (54.6)	16,590 (73.8)
	4 (101.6)		7,200 (32.4)	12,330 (54.8)	12,140 (54.6)	18,175 (80.8)	14,020 (63.1)	18,025 (80.1)
	4-1/2 (114.3)		9,800 (44.1)	14,780 (65.7)	13,640 (61.4)	19,660 (87,4)	16,720 (75.2)	19,870 (88.4)
	5 (127.0)		12,400 (55.8)	17,230 (76.6)	15,120 (68.0)	21,150 (94,0)	19,400 (87.3)	21,720 (96.6)
	5-1/2 (139.7)		15,000 (67.5)	19,680 (87.5)	16,600 (74.7)	22,640 (100.7)	22,080 (99.4)	23,570 (104.8)
	6 (152.4)		17,570 (79.1)	22,140 (98.4)	18,080 (81.4)	24,130 (107.3)	24,760 (111.4)	25,420 (113.0)

1. Tabulated load values are applicable for carbon steel anchors.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3 Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety, or overhead.

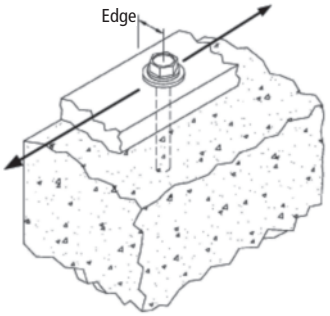
PERFORMANCE DATA

Allowable Load Capacities for Wedge-Bolt OT installed in Normal-Weight Concrete at 16 Diameters Spacing and Edge Distances[1,2,3,4]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Spacing and Edge Distance at 16*d* in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
			2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	4 (101.6)	230 (1.0)	230 (1.0)	380 (1.7)	475 (2.1)	415 (1.9)	555 (2.4)
	1-1/2 (38.1)		440 (2.0)	585 (2.6)	590 (2.7)	630 (2.8)	620 (2.8)	610 (2.7)
	2 (50.8)		700 (3.2)	630 (2.8)	1,060 (4.8)	630 (2.8)	1,245 (5.6)	765 (3.4)
	2-1/2 (63.5)		1,055 (4.7)	701 (3.1)	1,225 (5.5)	700 (3.1)	1,315 (5.9)	835 (3.7)
3/8 (9.5)	1-1/2 (38.1)	6 (152.4)	535 (2.4)	735 (3.2)	665 (3.0)	998 (4.3)	760 (3.4)	1,505 (6.6)
	2 (50.8)		825 (3.7)	925 (4.1)	1,030 (4.6)	1,130 (5.0)	1,300 (5.9)	1,505 (6.6)
	2-1/2 (63.5)		1,115 (5.0)	1,115 (4.9)	1,390 (6.3)	1,265 (5.6)	1,835 (8.3)	1,505 (6.6)
	3 (76.2)		1,545 (7.0)	1,300 (5.7)	1,995 (9.0)	1,395 (6.2)	2,475 (11.1)	1,535 (6.8)
	3-1/2 (88.9)		1,975 (8.9)	1,490 (6.6)	2,600 (11.7)	1,525 (6.7)	3,110 (14.0)	1,560 (6.9)
1/2 (12.7)	2 (50.8)	8 (203.2)	740 (3.3)	1,425 (6.3)	985 (4.4)	1,615 (7.1)	1,195 (5.4)	1,960 (8.7)
	2-1/2 (63.5)		1,025 (4.6)	1,615 (7.1)	1,300 (5.9)	1,735 (7.7)	1,620 (7.3)	2,110 (9.3)
	3 (76.2)		1,480 (6.7)	1,675 (7.4)	1,950 (8.8)	1,900 (8.4)	2,345 (10.6)	2,110 (9.3)
	3-1/2 (88.9)		1,515 (6.8)	1,920 (8.5)	2,120 (9.5)	2,100 (9.3)	2,975 (13.4)	2,150 (9.5)
	4 (101.6)		1,905 (8.6)	2,165 (9.7)	3,315 (14.9)	2,100 (9.3)	3,315 (14.9)	2,400 (10.8)
5/8 (15.9)	2-1/2 (63.5)	10 (254.0)	855 (3.8)	1,950 (8.8)	1,180 (5.3)	2,690 (11.9)	1,725 (7.8)	2,585 (11.4)
	3 (76.2)		1,140 (5.1)	2,150 (9.5)	1,845 (8.3)	2,690 (11.9)	2,240 (10.1)	2,720 (12.0)
	3-1/2 (88.9)		1,430 (6.4)	2,350 (10.4)	2,510 (11.3)	2,690 (11.9)	2,760 (12.4)	2,850 (12.6)
	4 (101.6)		2,070 (9.3)	2,610 (11.6)	3,190 (14.4)	2,925 (13.0)	3,580 (16.1)	3,025 (13.4)
	4-1/2 (114.3)		2,715 (12.2)	2,870 (12.7)	3,875 (17.4)	3,160 (14.0)	4,400 (19.8)	3,200 (14.2)
	5 (127.0)		3,360 (15.1)	3,130 (13.9)	4,555 (20.5)	3,395 (15.1)	5,215 (23.5)	3,375 (15.0)
3/4 (19.1)	3 (76.2)	12 (304.8)	1,080 (4.9)	2,425 (10.7)	1,620 (7.3)	3,065 (13.6)	2,565 (11.5)	3,710 (16.5)
	3-1/2 (88.9)		1,440 (6.5)	2,755 (12.2)	2,330 (10.5)	3,560 (15.8)	3,035 (13.7)	4,150 (18.4)
	4 (101.6)		1,800 (8.1)	3,085 (13.7)	3,035 (13.7)	4,545 (20.2)	3,505 (15.8)	4,510 (20.0)
	4-1/2 (114.3)		2,450 (11.0)	3,695 (16.4)	3,410 (15.3)	4,915 (21.8)	4,180 (18.8)	4,970 (22.1)
	5 (127.0)		3,100 (14.0)	4,310 (19.1)	3,780 (17.0)	5,290 (23.5)	4,850 (21.8)	5,430 (24.1)
	5-1/2 (139.7)		3,750 (16.9)	4,920 (21.8)	4,150 (18.7)	5,660 (25.1)	5,520 (24.8)	5,895 (26.2)
	6 (152.4)		4,395 (19.8)	5,535 (24.6)	4,520 (20.3)	6,030 (26.8)	6,190 (27.9)	6,355 (28.2)

1. Tabulated load values are applicable for carbon steel anchors.
2. 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.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
4. Tabular loads are for anchors installed at a minimum spacing distance between anchors and an edge distance of 16 times the anchor diameter.

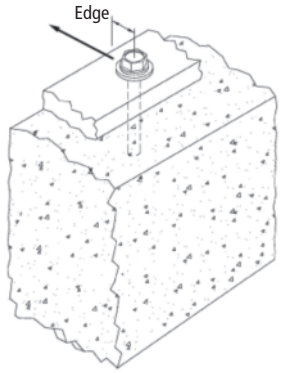
PERFORMANCE DATA



Ultimate and Allowable Shear Load Capacities for Wedge-Bolt OT at 1-3/4" Edge of Normal-Weight Concrete[1,2,3]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	$f'_c \geq$ 2,000 psi (13.8 MPa) Parallel to the Free Edge	
			Ultimate Shear lbs. (kN)	Allowable Shear lbs. (kN)
1/2 (12.7)	3-3/8 (85.7)	1-3/4 (44.5)	5,020 (22.6)	1,255 (5.6)
5/8 (15.9)	3-3/8 (85.7)	1-3/4 (44.5)	5,420 (24.4)	1,355 (6.1)
3/4 (19.1)	3-3/8 (85.7)	1-3/4 (44.5)	5,660 (25.5)	1,415 (6.4)

1. Tabulated load values are applicable to carbon steel anchors.
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.
3. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.



Allowable Load Capacities for Wedge-Bolt OT Installed at 1-3/4" Edge of Normal-Weight Concrete Stem Walls[1,2,3,4]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	$f'_c \geq$ 2,500 psi (17.2 MPa)		
			Tension lbs. (kN)	Parallel to the Free Edge Shear lbs. (kN)	Towards the Free Edge Shear lbs. (kN)
1/2 (12.7)	4 (101.6)	1-3/4 (44.5)	1,270 (5.7)	1,425 (6.4)	470 (2.1)
5/8 (15.9)	2-1/2 (63.5)	1-3/4 (44.5)	610 (2.7)	1,155 (5.2)	380 (1.7)
	3-3/4 (95.3)		1,310 (5.9)	1,330 (6.0)	490 (2.2)
	5 (127.0)		2,015 (9.1)	1,505 (6.8)	600 (2.7)

1. Tabulated load values are applicable to carbon steel anchors.
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.
3. Allowable load capacities may also be applied to conditions at the edge of normal-weight concrete slabs.
4. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wedge-Bolt OT installed in Structural Lightweight Concrete[1,2,3,4,5]

Nominal Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength $f'_c \geq$ 3,000 psi (20.7 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	3,320 (14.9)	2,720 (12.1)	830 (3.7)	680 (3.0)
3/8 (9.5)	1-1/2 (38.1)	2,220 (10.0)	2,200 (9.9)	555 (2.5)	550 (2.5)
	2-1/4 (57.2)	3,760 (16.9)	3,240 (14.4)	940 (4.2)	810 (3.6)
	3 (76.2)	5,280 (23.8)	4,660 (20.7)	1,320 (5.9)	1,165 (5.1)
1/2 (12.7)	2 (50.8)	2,920 (13.1)	5,360 (23.6)	730 (3.3)	1,340 (5.9)
	3 (76.2)	5,320 (23.9)	7,320 (32.5)	1,330 (6.0)	1,830 (8.1)
	4 (101.6)	7,720 (34.7)	9,260 (41.1)	1,930 (8.7)	2,315 (10.2)
5/8 (15.9)	2-1/2 (63.5)	3,720 (16.7)	9,240 (41.6)	930 (4.2)	2,310 (10.4)
	3-3/4 (95.3)	7,940 (35.7)	10,960 (48.7)	1,985 (8.9)	2,740 (12.1)
	5 (127.0)	12,160 (54.7)	14,940 (66.4)	3,040 (13.7)	3,735 (16.6)
3/4 (19.1)	5-1/4 (133.4)	13,320 (59.9)	17,780 (79.0)	3,330 (15.0)	4,445 (19.7)

1. Tabulated load values are for anchors installed in sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
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.
3. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.
4. Linear interpolation for allowable loads for anchors at intermediate embedment depths may also be used.
5. Tabulated load values are applicable to carbon steel anchors.

PERFORMANCE DATA

Ultimate Load Capacities for 410 Stainless Steel Wedge-Bolt in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)			
		2,500 psi (17.3 MPa)		3,000 psi (20.7 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.3)	1 (25.4)	880 (3.9)	1,535 (6.8)	960 (4.3)	1,680 (7.5)
3/8 (9.5)	1-1/2 (38.1)	1,615 (7.3)	3,590 (16.2)	1,770 (8.0)	3,930 (17.7)
	2-1/8 (54.0)	3,400 (15.3)	4,584 (20.7)	3,725 (18.0)	5,025 (22.6)
1/2 (12.7)	2-1/2 (63.5)	3,650 (16.4)	7,335 (33.0)	4,000 (18.0)	8,035 (36.2)
	3-1/2 (88.9)	7,495 (33.8)	9,880 (44.5)	8,210 (37.0)	10,825 (48.8)

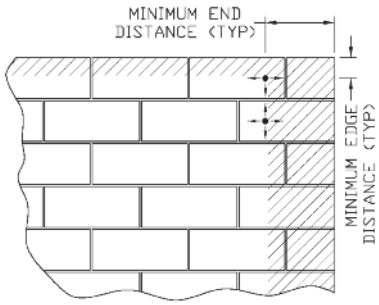
1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.

Allowable Load Capacities for 410 Stainless Steel Wedge-Bolt in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)			
		2,500 psi (17.3 MPa)		3,000 psi (20.7 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.3)	1 (25.4)	220 (1.0)	380 (1.7)	240 (1.1)	420 (1.9)
3/8 (9.5)	1-1/2 (38.1)	405 (1.8)	900 (4.1)	445 (2.0)	985 (4.4)
	2-1/8 (54.0)	850 (3.8)	1,145 (5.2)	930 (4.2)	1,255 (5.7)
1/2 (12.7)	2-1/2 (63.5)	915 (4.1)	1,835 (8.3)	1,000 (4.5)	2,010 (9.1)
	3-1/2 (88.9)	1,875 (8.4)	2,470 (11.1)	2,055 (9.3)	2,705 (12.2)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA



Face Shell
(Grouted Cell)
Permissible Anchor Locations
(Unshaded Area)

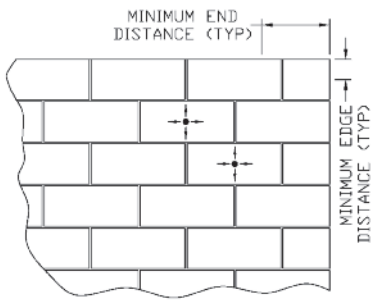
Allowable Load Capacities for Wedge-Bolt OT Anchors Installed in Grout-Filled Concrete Masonry[1,2,3,4,5,6]

Anchor Installed Through Face Shell Into Grouted Cell					
Nominal Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	3-3/4 (95.3)	3-3/4 (95.3)	80 (0.4)	150 (0.7)
	2 (50.8)			340 (1.5)	310 (1.4)
3/8 (9.5)	1-1/2 (38.1)	2 (50.8)	3-3/4 (95.3)	210 (0.9)	340 (1.5)
	1-1/2 (38.1)	3-3/4 (95.3)	12 (304.8)	210 (0.9)	400 (1.8)
	2-1/2 (63.5)	2 (50.8)	3-3/4 (95.3)	670 (3.0)	340 (1.5)
	2-1/2 (63.5)	7 7/8 (200.0)	12 (304.8)	750 (3.4)	655 (2.9)
	3-1/2 (88.9)	12 (304.8)		1,290 (5.8)	910 (4.0)
1/2 (12.7)	2 (50.8)	3-3/4 (95.3)	12 (304.8)	335 (1.5)	720 (3.2)
	3 (76.2)	7 7/8 (200.0)		930 (4.2)	900 (4.0)
	4 (101.6)	12 (304.8)		1,525 (6.9)	1,085 (4.8)
5/8 (15.9)	2-1/2 (63.5)	3-3/4 (95.3)	12 (304.8)	455 (2.0)	1,085 (4.8)
	3-1/4 (82.6)	7 7/8 (200.0)		885 (4.0)	1,085 (4.8)
	4 (101.6)	12 (304.8)		1,310 (5.9)	1,085 (4.8)
	5 (127.0)			1,940 (8.7)	1,255 (5.6)
3/4 (19.1)	3 (76.2)	3-3/4 (95.3)	12 (304.8)	615 (2.8)	750 (3.4)
		12 (304.8)		615 (2.8)	1,320 (5.9)
	3-1/2 (88.9)	7 7/8 (200.0)		1,035 (4.7)	1,265 (5.7)
	4 (101.6)	12 (304.8)		1,455 (6.5)	1,320 (5.9)
	5 (127.0)			1,680 (7.6)	1,775 (7.9)

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 ($f'm \geq$ 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. Tabulated load values are applicable for screw anchors installed at a critical spacing between anchors of 16 times the anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at minimum spacing between anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.
4. Linear interpolation for allowable loads for anchors at intermediate embedment depths may be used.
5. Allowable shear loads for 1/4" and 3/8" diameter anchor installations into the face shell of a masonry wall may be applied in any direction. Allowable shear loads for anchor diameters 1/2" and greater installed into the face shell may be applied in any direction provided the location is a minimum of 12" from the edge and end of the wall. For anchors diameters 1/2" and greater installed with an edge distance less than 12" the allowable shear loads may be applied in any direction except upward vertically.
6. Tabulated load values are applicable to carbon steel anchors.

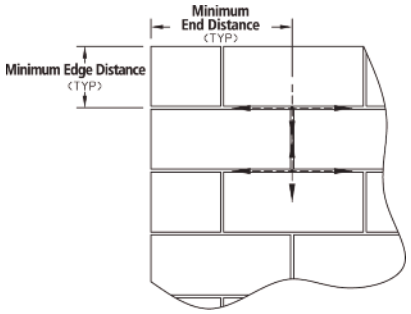
PERFORMANCE DATA

Allowable Load Capacities for Wedge-Bolt OT Anchors Installed in Grout-Filled Concrete Masonry[1,2,3,4]



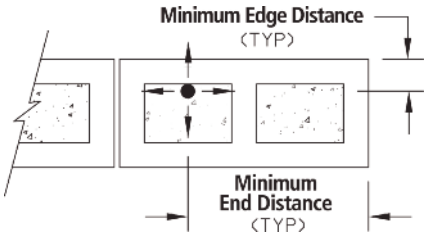
Face Shell
(Cell Web)

Anchor Installed Through Face Shell Into Cell Web[5]					
Nominal Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	3-1/2 (25.4)	16 (406.4)	16 (406.4)	870 (3.9)	910 (4.0)
1/2 (12.7)	4 (101.6)			1,110 (5.0)	1,085 (4.8)
5/8 (15.9)	4 (101.6)			1,205 (5.4)	1,085 (4.8)
3/4 (19.1)	4 (101.6)			1,310 (5.9)	1,320 (5.9)



T-Joints
Permissible Anchor Locations

Anchor Installed In Joint[6,7]					
Nominal Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	1-1/2 (38.1)	16 (406.4)	16 (406.4)	–	510 (2.3)
	3-1/2 (88.9)			830 (3.7)	
1/2 (12.7)	4 (101.6)			1,090 (4.9)	
5/8 (15.9)	4 (101.6)			840 (3.8)	1,225 (5.5)
3/4 (19.1)	2-1/2 (63.5)			–	
	4 (101.6)			890 (4.0)	

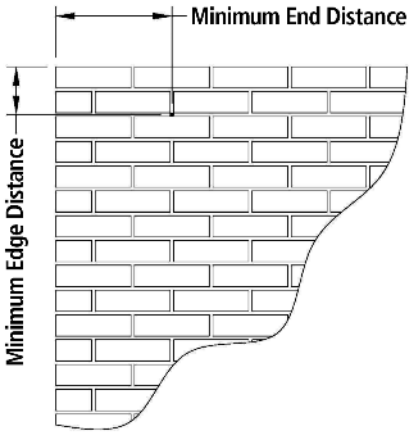


Top of Wall

Anchor Installed in Cell Opening (Top of Wall)				
Nominal Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	2-1/2 (63.5)	1-1/2 (38.1)	300 (1.6)	240 (1.1)
	1-1/2 (38.1)	2 (50.8)	–	350 (1.6)
	2-1/2 (63.5)		570 (2.5)	380 (1.7)

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 ($f'_m \geq 1{,}500$ 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. Tabulated load values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screw anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at minimum spacing between anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.
4. Linear interpolation for allowable loads for anchors at intermediate embedment depths may be used.
5. Allowable shear loads for anchor installations into the cell web may be applied in any direction.
6. Allowable shear loads for anchor installation into the horizontal and vertical mortar joints may be applied in any direction provided the anchor location is a minimum of 16" from the edge and end of the wall. For anchor installations with an edge distance less than 16" the allowable shear loads may be applied in any direction except upward vertically.
7. Allowable tension load values for anchors installed into horizontal mortar (bed) joint locations may be increased by 35 percent.
8. Tabulated load values are applicable to carbon steel anchors.

PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Wedge-Bolt OT Anchors Installed in Multiple Wythe Brick Masonry[1,2,3]

Nominal Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge and End Distance in. (mm)	Minimum Spacing Distance in. (mm)	Structural Brick 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)	2-1/2 (63.5)	4 (101.6)	4 (101.6)	2,280 (10.3)	1,480 (6.7)	455 (2.0)	295 (1.3)
3/8 (9.5)	3-1/2 (88.9)	6 (152.4)	6 (152.4)	3,390 (15.3)	3,830 (17.2)	680 (3.1)	765 (3.4)
1/2 (12.7)	4 (101.6)	8 (203.2)	8 (203.2)	4,800 (21.6)	7,060 (31.8)	960 (4.3)	1,410 (6.3)
5/8 (15.9)	4 (101.6)	10 (254.0)	12 (304.8)	6,120 (27.5)	11,250 (50.6)	1,225 (5.5)	2,250 (10.1)
3/4 (19.1)	4 (101.6)	12 (304.8)	16 (406.4)	8,580 (29.6)	12,340 (55.5)	1,315 (5.9)	2,470 (11.1)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'm \geq$ 1,500 psi).
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 or overhead.
3. Tabulated load values are applicable to carbon steel anchors.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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[1]

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	$s_{cr} = 12d$	$F_{N_S} = 1.0$	$s_{min} = 4d$	$F_{N_S} = 0.50$
	Shear	$s_{cr} = 12d$	$F_{V_S} = 1.0$	$s_{min} = 4d$	$F_{V_S} = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_{N_C} = 1.0$	$c_{min} = 3d$	$F_{N_C} = 0.70$
	Shear	$c_{cr} = 12d$	$F_{V_C} = 1.0$	$c_{min} = 3d$	$F_{V_C} = 0.15$

Anchor Installed in Structural Lightweight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension	$s_{cr} = 14.1d$	$F_{N_S} = 1.0$	$s_{min} = 4.7d$	$F_{N_S} = 0.50$
	Shear	$s_{cr} = 14.1d$	$F_{V_S} = 1.0$	$s_{min} = 4.7d$	$F_{V_S} = 0.75$
Edge Distance (c)	Tension	$c_{cr} = 9.4d$	$F_{N_C} = 1.0$	$c_{min} = 3.5d$	$F_{N_C} = 0.70$
	Shear	$c_{cr} = 14.1d$	$F_{V_C} = 1.0$	$c_{min} = 3.5d$	$F_{V_C} = 0.15$

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

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

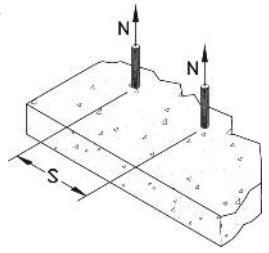
Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{NS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3	4-1/2	6	7-1/2	9
s_{min} (in.)		1	1-1/2	2	2-1/2	3
Spacing, s (inches)	1	0.50				
	1-1/2	0.63	0.50			
	2	0.75	0.58	0.50		
	2-1/2	0.88	0.67	0.56	0.50	
	3	1.00	0.75	0.63	0.55	0.50
	4-1/2		1.00	0.81	0.70	0.63
	6			1.00	0.85	0.75
	7-1/2				1.00	0.88
	9					1.00

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

Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 50% of load.

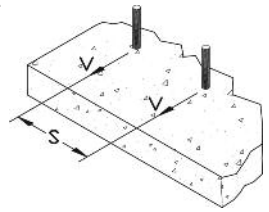


Spacing, Shear (F_{VS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3	4-1/2	6	7-1/2	9
s_{min} (in.)		1	1-1/2	2	2-1/2	3
Spacing, s (inches)	1	0.75				
	1-1/2	0.81	0.75			
	2	0.88	0.79	0.75		
	2-1/2	0.94	0.83	0.78	0.75	
	3	1.00	0.88	0.81	0.78	0.75
	4-1/2		1.00	0.91	0.85	0.81
	6			1.00	0.93	0.88
	7-1/2				1.00	0.94
	9					1.00

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

Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 75% of load.

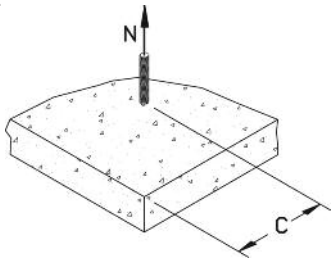


Edge Distance, Tension (F_{NC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		2	3	4	5	6
c_{min} (in.)		3/4	1-1/8	1-1/2	1-7/8	2-1/4
Edge Distance, c (in.)	3/4	0.70				
	1-1/8	0.79	0.70			
	1-1/2	0.88	0.76	0.70		
	1-7/8	0.97	0.82	0.75	0.70	
	2	1.00	0.84	0.76	0.71	
	2-1/4		0.88	0.79	0.74	0.70
	3		1.00	0.88	0.81	0.76
	4			1.00	0.90	0.84
	5				1.00	0.92
	6					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 8 anchor diameters (8d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3d) at which the anchor achieves 70% of load.

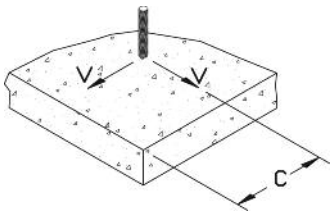


Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4-1/2	6	7-1/2	9
c_{min} (in.)		3/4	1-1/8	1-1/2	1-7/8	2-1/4
Edge Distance, c (in.)	3/4	0.15				
	1-1/8	0.29	0.15			
	1-1/2	0.43	0.24	0.15		
	1-7/8	0.58	0.34	0.22	0.15	
	2-1/4	0.72	0.43	0.29	0.21	0.15
	3	1.00	0.62	0.43	0.32	0.24
	4-1/2		1.00	0.72	0.55	0.43
	6			1.00	0.77	0.62
	7-1/2				1.00	0.81
	9					1.00

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

Minimum edge distance (c_{min}) is equal to 3 anchor diameters (3d) at which the anchor achieves 15% of load



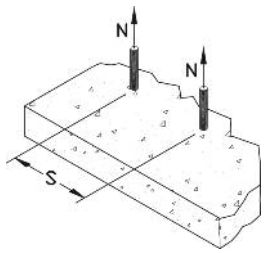
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_{NS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3-1/2	5-1/4	7	8-7/8	10-1/2
s_{min} (in.)		1-1/4	1-3/4	2-3/8	3	3-1/2
Spacing, s (inches)	1-1/4	0.50				
	1-3/4	0.61	0.50			
	2-3/8	0.75	0.59	0.50		
	3	0.89	0.67	0.57	0.50	
	3-1/2	1.00	0.74	0.62	0.54	0.50
	5-1/4		1.00	0.82	0.70	0.63
	7			1.00	0.84	0.75
	8-7/8				1.00	0.88
	10-1/2					1.00

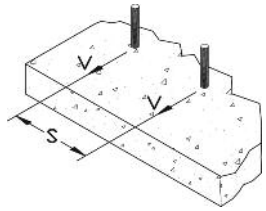
Notes: For anchors loaded in tension, the critical spacing (s_{cr}) is equal to 14.1 anchor diameters (14.1d) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 4.7 anchor diameters (4.7d) at which the anchor achieves 50% of load.



Spacing, Shear (F_{VS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
s_{cr} (in.)		3-1/2	5-1/4	7	8-7/8	10-1/2
s_{min} (in.)		1-1/4	1-3/4	2-3/8	3	3-1/2
Spacing, s (inches)	1-1/4	0.75				
	1-3/4	0.81	0.75			
	2-3/8	0.88	0.79	0.75		
	3	0.94	0.84	0.78	0.75	
	3-1/2	1.00	0.87	0.81	0.77	0.75
	5-1/4		1.00	0.91	0.85	0.82
	7			1.00	0.92	0.88
	8-7/8				1.00	0.94
	10-1/2					1.00

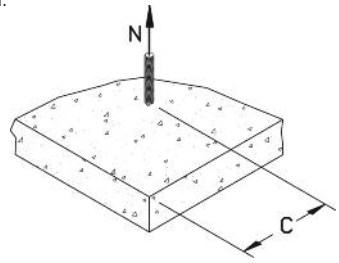
Notes: For anchors loaded in shear, the critical spacing (s_{cr}) is equal to 14.1 anchor diameters (14.1d) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 4.7 anchor diameters (4.7d) at which the anchor achieves 75% of load.



Edge Distance, Tension (F_{NC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		2-3/8	3-1/2	4-3/4	5-7/8	7
c_{min} (in.)		7/8	1-3/8	1-3/4	2-1/4	2-5/8
Edge Distance, c (in.)	7/8	0.70				
	1-3/8	0.80	0.70			
	1-3/4	0.88	0.76	0.70		
	2-1/4	0.98	0.83	0.75	0.70	
	2-3/8	1.00	0.84	0.76	0.72	
	2-5/8		0.88	0.79	0.74	0.70
	3-1/2		1.00	0.88	0.81	0.76
	4-3/4			1.00	0.91	0.84
	5-7/8				1.00	0.92
	7					1.00

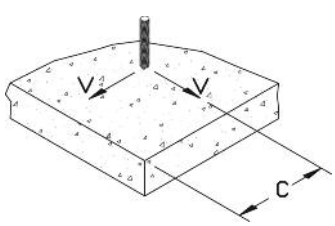
Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 9.4 anchor diameters (9.4d) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 3.5 anchor diameters (3.5d) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3-1/2	5-1/4	7	8-7/8	10-1/2
c_{min} (in.)		7/8	1-3/8	1-3/4	2-1/4	2-5/8
Edge Distance, c (in.)	7/8	0.15				
	1-3/8	0.31	0.15			
	1-3/4	0.43	0.24	0.15		
	2-1/4	0.59	0.35	0.23	0.15	
	2-5/8	1.00	0.43	0.29	0.21	
	3-1/2		0.62	0.43	0.32	0.15
	5-1/4		1.00	0.71	0.54	0.43
	7			1.00	0.77	0.62
	8-7/8				1.00	0.82
	10-1/2					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14.1 anchor diameters (14.1d) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 3.5 anchor diameters (3.5d) at which the anchor achieves 15% of load.



ORDERING INFORMATION

Carbon Steel Wedge-Bolt OT

Catalog Number	Size	Drill Bit Diameter	Clearance Hole Diameter	Minimum Embedment	Thread Length	Standard Box	Standard Carton
7215	1/4" x 3"	1/4"	3/8"	1"	2-3/4"	100	500
7216	3/8" x 4"	3/8"	1/2"	1-1/2"	3-3/4"	50	250
7217	1/2" x 4"	1/2"	5/8"	1-3/4"	3-3/4"	50	150
7218	1/2" x 5"	1/2"	5/8"	1-3/4"	3-3/4"	25	100
7214	1/2" x 6"	1/2"	5/8"	1-3/4"	3-3/4"	25	75
7233	1/2" x 6-1/2"	1/2″	5/8″	1-3/4″	3-3/4"	25	75
7219	5/8" x 4"	5/8"	3/4"	2-1/2"	3-3/4"	25	100
7221	5/8" x 5"	5/8"	3/4"	2-1/2"	3-3/4"	25	75
7227	5/8" x 6"	5/8"	3/4"	2-1/2"	3-3/4"	25	75
7229	5/8" x 7"	5/8"	3/4"	2-1/2"	3-3/4"	25	75
7231	3/4" x 6"	3/4″	7/8″	2-1/2″	4-1/2″	20	60
7232	3/4" x 8"	3/4″	7/8″	2-1/2″	6	10	40

Installation is recommended with the use of an ANSI bit.

410 Stainless Steel Wedge-Bolt

Catalog Number	Size	Wedge Bit Diameter	Clearance Hole Diameter	Minimum Embedment	Thread Length	Standard Box	Standard Carton
7701N	1/4" x 1-3/4"	1/4"	5/16"	1"	1-5/8"	100	500
7702N	3/8" x 1-3/4"	3/8"	5/16"	1"	1-5/8"	50	500
7705N	3/8" x 2-1/2"	3/8"	7/16"	1-1/2"	2-1/4"	50	250
7706N	3/8" x 3"	3/8"	7/16"	1-1/2"	2-3/4"	50	250
7707N	3/8″ x 4″	3/8"	7/16"	1-1/2"	3-3/4"	50	250
7708N	3/8″ x 5″	3/8"	7/16"	1-1/2"	3-3/4"	50	150
7710N	1/2" x 3"	1/2"	9/16"	1-3/4"	2-3/4"	50	150
7711N	1/2" x 4"	1/2"	9/16"	1-3/4"	3-3/4"	50	150
7712N	1/2" x 5"	1/2"	9/16"	1-3/4"	3-3/4"	50	150

A Wedge-Bit is required for installation.

ORDERING INFORMATION

SDS-Plus Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1312	1/4" SDS-Plus Wedge-Bit	2	4	1
1314	1/4" SDS-Plus Wedge-Bit	4	6	1
1316	3/8" SDS-Plus Wedge-Bit	4	6	1
1318	3/8" SDS-Plus Wedge-Bit	6	8	1
1332	3/8" SDS-Plus Wedge-Bit	10	12	1
1320	1/2" SDS-Plus Wedge-Bit	4	6	1
1322	1/2" SDS-Plus Wedge-Bit	8	10	1
1334	1/2" SDS-Plus Wedge-Bit	10	12	1

Heavy Duty Straight Shank Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1370	1/4" Heavy Duty Straight Shank	2-3/4	4	1
1372	1/4" Heavy Duty Straight Shank	4	6	1
1380	3/8" Heavy Duty Straight Shank	4	6	1
1384	3/8" Heavy Duty Straight Shank	11	13	1
1390	1/2" Heavy Duty Straight Shank	4	6	1
1394	1/2" Heavy Duty Straight Shank	11	13	1

Spline Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1340	1/2" Spline Wedge-Bit	8	13	1
1342	1/2" Spline Wedge-Bit	11	16	1

SDS-Max Wedge-Bit

Catalog Number	Size	Usable Length Inches	Overall Length Inches	Standard Pouch
1354	1/2" SDS-Max Wedge-Bit	8	13	1

Tapper+® *Concrete Screw Anchor*

PRODUCT DESCRIPTION

The Tapper+ fastening system is a complete family of screw anchors for light to medium duty applications in concrete, masonry block, brick, and wood base materials. The Tapper+ is fast and easy to install and provides a neat, finished appearance. The Tapper+ screw anchor is engineered with matched tolerance drill bits and installation tools designed to meet the needs of the user and also provide optimum performance. The Tapper+ features a gimlet point for self-drilling into wood base materials without pre-drilling.

The Tapper+ screw anchor is available in carbon steel with a Perma-Seal climate coating in several colors. Head styles include a slotted hex washer head, Phillips flat head, trim Phillips flat head and Hex flange washer head.

GENERAL APPLICATIONS AND USES

Perma-Seal Tappers+

- Window installations
- Interior hand rails
- Metal door frames
- Joint flashing
- Storm shutters
- Interior lighting fixtures
- Thresholds
- Screened Enclosures

FEATURES AND BENEFITS

+ Available in several head styles
+ Several colors and finishes to match application
+ Removable (reusable in wood)
+ High-low thread design for greater stability and grip
+ Does not exert expansion forces
+ No hole spotting required
+ Good corrosion protection with Perma-Seal coating
+ Gimlet point for self drilling into wood base material

APPROVALS

International Code Council, Evaluation Service (ICC-ES), ESR-3068 for uncracked concrete. Code compliant with the 2009 IBC, 2009 IRC, 2006 IBC, 2006 IRC, 2003 IBC, 2003 IRC and 1997 UBC
Compliant with the 2007 Florida building code (Building and Residential)
Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete, ICC-ES AC106 for use in masonry, ICC-ES AC233 for use in wood, and ICC-ES AC257 for use in pressure treated lumber
Evaluated and qualified by an accredited independent testing labortatory for reliability against brittle failure, e.g. hydrogen embrittlement
Miami-Dade County Notice of Acceptance (NOA) 10-0505.05

GUIDE SPECIFICATIONS

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

MATERIAL SPECIFICATIONS

Anchor Component	Perma-Seal Tapper
Anchor Body	Case hardened carbon steel
Coating/Plating/Finish	Perma-Seal coating (various colors)

SECTION CONTENTS

Perma-Seal Coated Carbon Steel Tapper+

ANCHOR MATERIALS

Carbon Steel with Perma-Seal Coating

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 1-1/4" length to
1/4" diameter x 6" length

SUITABLE BASE MATERIALS

Normal-weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry (CMU)
Hollow Concrete Masonry
(Lightweight & Normal weight)
Solid Brick Masonry
Wood

This Product Available In

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

INSTALLATION SPECIFICATIONS

Perma-Seal Carbon Steel Hex Head Tapper+

Dimension	Anchor Diameter, *d*	
	3/16"	1/4"
Tapper Drill Bit Size, d_{bit} (in.)	5/32	3/16
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Hex Head Wrench/Socket Size	1/4	5/16
Washer O.D., d_w (in.)	11/32	13/32
Washer Thickness, (in.)	1/32	1/32

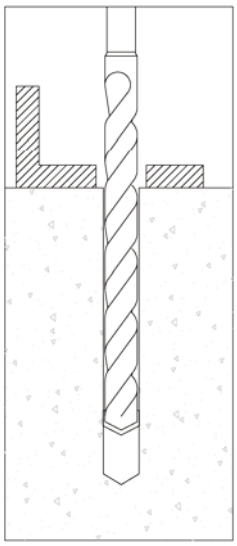
1/4" flange hex head parts have a washer O.D. of 39/64".

Perma-Seal Carbon Steel Flat Head Tapper+

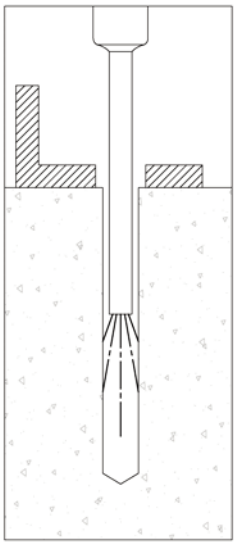
Dimension	Anchor Diameter, *d*	
	3/16"	1/4"
Tapper Drill Bit Size, d_{bit} (in.)	5/32	3/16
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Phillips Head O.D., (in.)	3/8	1/2
Phillips Head Height, (in.)	9/64	3/16
Phillips Bit Size (No.)	2	3

1/4" trim flat head parts have a head height of 5/32" and a head width of 13/32".

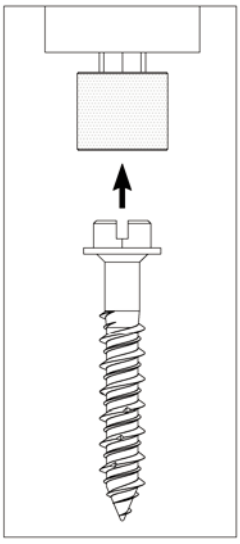
Installation Procedure



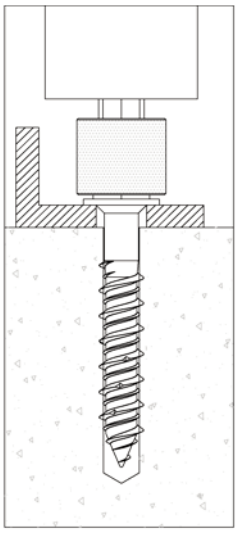
1.) Using the proper Tapper+ drill bit size, drill a hole into the base material to the required depth. The tolerances of the Tapper+ bit used must meet the requirements of the published range in Table 1.



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



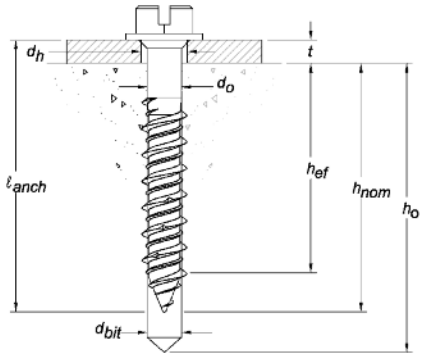
3.) Attach a Tapper 1000 installation socket tool for the selected anchor size to a percussion drill and set the drill to rotary only mode. Mount the screw anchor head into the socket. For flat head versions a phillips bit tip must be used with the socket tool.



4.) Place the point of the Tapper+ anchor through the fixture into the predrilled hole and drive the anchor until it is fully seated at the proper embedment. The socket tool will automatically disengage from the head of the Tapper+.

Note: Step #1 and #2 not applicable for wood base materials, drill bit not applicable for wood base materials.

Tapper+ Anchor Detail

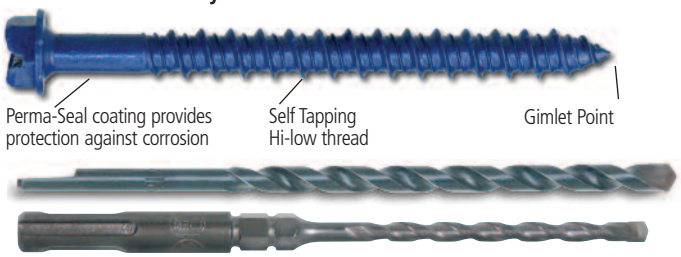


(Slotted hex head version pictured, flat head length measured from bottom of head to tip of anchor)

Head Marking

Legend
'P' Marking = Powers Tapper +
'+' Symbol = Strength Design Compliant Anchor
Length Identification Mark

Matched Tolerance System



Designed and tested as a system for consistency and reliability

Tapper+ Length Code Identification System

Length ID marking on head		☐	A	B	C	D	E	F	G	H	I	J
Overall anchor length ℓ_{anch}, (inches)	From	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6
	Up to but not including	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6	6-1/2

INSTALLATION SPECIFICATIONS

Installation Table for Tapper+ in Concrete (Design Provisions of ACI 318 Appendix D)

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Size (in.)	
			3/16	1/4
Nominal outside anchor diameter	d_a [d_o][1]	in. (mm)	0.145 (3.7)	0.185 (4.7)
Nominal drill bit diameter	d_{bit}	in. (mm)	3/16 Tapper+ bit	1/4 Tapper+ bit
Tapper+ bit tolerance range	-	in.	0.170 to 0.176	0.202 to 0.207
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-3/4 (44.4)	1-3/4 (44.4)
Effective embedment	h_{ef}	in. (mm)	1.23 (31.2)	1.23 (31.2)
Minimum hole depth	h_o	in. (mm)	2 (50.8)	2 (50.8)
Minimum concrete member thickness	h_{min}	in. (mm)	3-1/4 (82.5)	3-1/4 (82.5)
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (44.4)	1-3/4 (44.4)
Minimum spacing distance	s_{min}	in. (mm)	1 (25.4)	2 (50.8)
Critical edge distance	c_{ac}	in. (mm)	3 (76.2)	3 (76.2)

Installation Table for Tapper+ in Masonry

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Size (in.)	
			3/16	1/4
Nominal outside anchor diameter	d	in. (mm)	0.145 (3.7)	0.185 (4.7)
Nominal drill bit diameter	d_{bit}	in. (mm)	3/16 Tapper+ bit	1/4 Tapper+ bit
Tapper+ bit tolerance range	-	in.	0.170 to 0.176	0.202 to 0.207
Minimum nominal embedment depth	h_v	in. (mm)	1-1/2 (38.1)	1-1/2 (38.1)
Minimum hole depth	h_o	in. (mm)	2 (50.8)	2 (50.8)

Installation Table for Tapper+ in Wood

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Size (in.)	
			3/16	1/4
Nominal outside anchor diameter	d_o	in. (mm)	0.145 (3.7)	0.185 (4.7)
Nominal drill bit diameter	d_{bit}	in. (mm)	Pre-drilling is not required for Tapper+ into wood	

1. Notation in parenthesis is for the 2006 IBC.

STRENGTH DESIGN PERFORMANCE DATA

TENSION DESIGN INFORMATION FOR TAPPER+ ANCHOR IN CONCRETE (For use with load combinations taken from ACI 318, Section 9.2)[1,2,3,4,5,6,7,8,9]

Design Characteristic	Notation	Units	Nominal Anchor Size (Inch)	
			3/16	1/4
Anchor category	1,2 or 3	-	1	1
Nominal embedment depth	h_{nom}	in. (mm)	1-3/4 (4.4)	1-3/4 (4.4)
STEEL STRENGTH IN TENSION[4]				
Minimum specified ultimate tensile strength (neck)	f_{uta}[8]	ksi (N/mm^2)	100 (689)	100 (689)
Effective tensile stress area (neck)	$A_{se,N}$ (A_{se})[9]	in^2 (mm^2)	0.0162 (10.4)	0.0268 (17.3)
Steel strength in tension	N_{sa}[8]	lb (kN)	1,620 (7.2)	2,680 (12.0)
Reduction factor for steel strength[3]	ϕ	-	0.65	
CONCRETE BREAKOUT STRENGTH IN TENSION[7]				
Effective embedment	h_{ef}	in. (mm)	1.23 (31.2)	1.23 (31.2)
Effectiveness factor for concrete breakout	k_{uncr}	-	24	24
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$[9]	-	1.0 See note 5	1.0 See note 5
Critical edge distance	c_{ac}	in. (mm)	3.0 (76.2)	3.0 (76.2)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)	
PULLOUT STRENGTH IN TENSION[7]				
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	lb (kN)	635 (2.8)	940 (4.2)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	

For SI: 1 inch = 25.4 mm, 1 ksi = 6.895 N/mm2, 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of UBC 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 ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D. 4.4 for the appropriate ϕ factor.
4. The Tapper+ anchor is considered a brittle steel element as defined by ACI 318 D.1. Tabulated values for steel strength in tension must be used for design.
5. For all design cases use $\Psi_{c,N} = 1.0$. The appropriate effectiveness factor for uncracked concrete (k_{uncr}) must be used.
6. For all design cases use $\Psi_{c,P} = 1.0$. For calculation of Npn, see Section 4.1.3 of this report.
7. Anchors are permitted to be used in structural sand-lightweight concrete in accordance with Section 4.1.10 of this report. Provided the modification factor λ for concrete breakout strength is taken as 0.6. In addition, the pullout strength, $N_{p,uncr}$ must be muliplied by 0.6. as applicable. For ACI 318-05, the values N_b and $N_{p,uncr}$ must be multiplied by 0.6, in Lieu of ACI 318 D.3.4
8. For 2003 IBC, f_{uta} replaces f_{ut}; N_{sa} replaces N_s; and $\Psi_{c,N}$ replaces Ψ_3.
9. The notation in parenthesis is for the 2006 IBC.

PERFORMANCE DATA

SHEAR DESIGN INFORMATION FOR TAPPER+ ANCHOR IN CONCRETE (For use with load combinations taken from ACI 318, Section 9.2)[1,2,3,4,5,6,7,8]

Design Characteristic	Notation	Units	Nominal Anchor Diameter	
			3/16"	1/4"
Anchor category	1, 2 or 3	-	1	1
Nominal embedment depth	h_{nom}	in.	1-3/4	1-3/4
STEEL STRENGTH IN SHEAR[4]				
Steel strength in shear[5]	V_{sa}	lb (kN)	810 (3.6)	1,180 (5.3)
Reduction factor for steel strength[3]	ϕ	-	0.60	
CONCRETE BREAKOUT STRENGTH IN SHEAR[6]				
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	Ψ_e	in. (mm)	1.23 (32)	1.23 (32)
Nominal anchor diameter	d_a (d_o)	in. (mm)	0.145 (3.7)	0.185 (4.7)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)	
PRYOUT STRENGTH IN SHEAR[6]				
Coefficient for pryout strength (1.0 for hef < 2.5 in., 2.0 for hef ≥ 2.5 in.)	k_{cp}	-	1.0	1.0
Effective embedment	h_{ef}	in. (mm)	1.23 (31.2)	1.23 (31.2)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)	

For SI: 1 inch = 25.4 mm, 1 lbf = 0. 0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318 Appendix D.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of UBC 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 ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. The Tapper+ anchor is considered a brittle steel element as defined by ACI 318 D.1.
5. Tabulated values for steel strength in shear must be used for design.
6. Anchors are permitted to be used in structural sand-lightweight concrete, for ACI 318-05, the values V_b must be multiplied by 0.60, in lieu of ACI 318 D.3.4.
7. For 2003 IBC, V_{sa} replaces V_s; and ℓ_e replaces ℓ.
8. The notation in parenthesis is for the 2006 IBC.

PERFORMANCE DATA

Ultimate Load Capacities for Tapper+ in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-3/4 (44.4)	1,240 (5.5)	985 (4.4)	1,310 (5.8)	985 (4.4)	1,430 (6.4)	985 (4.4)	1,615 (7.2)	985 (4.4)
1/4 (6.3)	1-3/4 (44.4)	1,855 (8.3)	1,500 (6.7)	1,995 (8.9)	1,500 (6.7)	2,235 (10.0)	1,500 (6.7)	2,630 (11.7)	1,500 (6.7)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Tapper+ in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-3/4 (44.4)	310 (1.4)	245 (1.1)	325 (1.4)	245 (1.1)	360 (1.6)	245 (1.1)	400 (1.8)	245 (1.1)
1/4 (6.3)	1-3/4 (44.4)	460 (2.0)	375 (1.7)	495 (2.2)	375 (1.7)	555 (2.5)	375 (1.7)	655 (2.9)	375 (1.7)

1. Allowable load capacities listed are calculated using and 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 compressive strengths.
3. Allowable load capacities are multiplied by load adjustment factors found when anchor spacing or edge distances are less than critical distances.

Load Adjustment Factors for Normal Weight Concrete

Edge Distance, Tension (F_N)			
Dia		3/16	1/4
c_{cr}		3	3
c_{min}		1	1
Edge Distance, c (inches)	1	0.73	0.56
	1.25	0.76	0.62
	1.5	0.79	0.67
	1.75	0.83	0.73
	2	0.86	0.78
	2.25	0.90	0.84
	2.5	0.93	0.89
	2.75	0.97	0.95
	3	1.00	1.00

Spacing Distance, Tension (F_N)			
Dia		3/16	1/4
s_{cr}		3.75	3.75
s_{min}		1	2
Spacing Distance, s (inches)	1	0.76	-
	1.25	0.78	-
	1.5	0.81	-
	1.75	0.83	-
	2	0.85	0.72
	2.25	0.87	0.76
	2.5	0.89	0.80
	2.75	0.91	0.84
	3	0.94	0.88
	3.25	0.96	0.92
	3.5	0.98	0.96
	3.75	1.00	1.00

Edge Distance, Shear (F_V)			
Dia		3/16	1/4
c_{cr}		3	3
c_{min}		1	1
Edge Distance, c (inches)	1	0.58	0.35
	1.25	0.63	0.43
	1.5	0.68	0.51
	1.75	0.74	0.59
	2	0.79	0.67
	2.25	0.84	0.76
	2.5	0.89	0.84
	2.75	0.95	0.92
	3	1.00	1.00

Spacing Distance, Shear (F_V)			
Dia		3/16	1/4
s_{cr}		3.75	3.75
s_{min}		1	2
Spacing Distance, s (inches)	1	0.70	-
	1.25	0.73	-
	1.5	0.76	-
	1.75	0.78	-
	2	0.81	0.95
	2.25	0.84	0.95
	2.5	0.87	0.96
	2.75	0.89	0.97
	3	0.92	0.98
	3.25	0.95	0.98
	3.5	0.97	0.99
	3.75	1.00	1.00

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Tapper+ Anchors Installed into the Face of Hollow Concrete Masonry[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embed. h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	ASTM C-90 Block Type	Ultimate Loads		Allowable Loads	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1 (25.4)	2 (50.8)	2 (50.8)	Light Weight [4]	340 (1.5)	460 (2.1)	65 (0.3)	90 (0.4)
	1-1/4 (31.8)			Normal Weight [5]	575 (2.6)	700 (3.1)	115 (0.5)	140 (0.6)
1/4 (6.4)	1 (25.4)	2 (50.8)	2 (50.8)	Light Weight [4]	495 (2.2)	530 (2.4)	100 (0.4)	90 (0.4)
	1-1/4 (31.8)			Normal Weight [6]	950 (4.2)	740 (3.3)	190 (0.8)	150 (0.7)

1. Tabulated load values are for anchors installed in minimum 8" wide, Grade N, Type II, light-weight or 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 ≥ 1,700 psi). Cells maybe grouted.
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. Allowable shear loads into the face shell of a masonry wall may be applied in any direction.
4. The tabulated values for the 3/16-inch and 1/4-inch diameter Tapper+ in light-weight block are applicable for anchors installed at a critical spacing between anchors of 16 times the anchor diameter. The anchors may be reduced to a minimum spacing distance of 8 times the anchor diameter provided the allowable tension loads are reduced by 12 percent. Allowable shear loads do not need to be reduced.
5. The tabulated values for the 3/16-inch diameter Tapper+ in normal weight block are applicable for anchors installed at a critical spacing between anchors of 8 times the anchor diameter.
6. The tabulated values for the 1/4-inch Tapper+ in normal weight block are applicable for anchors installed at a critical spacing between anchors of 16 times the anchor diameter. The anchors may be reduced to a minimum spacing distance of 8 times the anchor diameter provided the allowable tension loads are reduced by 20 percent. Allowable shear loads do not need to be reduced.

Allowable Load Capacities for Tapper+ Anchors Installed in Clay Brick Masonry[1,2,3,4]

Anchor Diameter *d* in. (mm)	Minimum Embed. h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Installation Location	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-1/2 (38.1)	1-3/4 (44.5)	1-3/4 (44.5)	Face	380 (1.7)	165 (0.7)
3/16 (4.8)	1-1/2 (38.1)	1-3/4 (44.5)	1-3/4 (44.5)	Mortar Joint	300 (1.3)	190 (0.8)
1/4 (6.4)	1-1/2 (38.1)	1-3/4 (44.5)	1-3/4 (44.5)	Face	605 (2.7)	270 (1.2)
1/4 (6.4)	1-1/2 (38.1)	1-3/4 (44.5)	1-3/4 (44.5)	Mortar Joint	200 (0.9)	155 (0.7)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq 1{,}500$ psi).
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 or overhead.
3. Allowable shear loads into the face or mortar joint of the brick masonry wall may be applied in any direction.
4. The tabulated values are applicable for anchors installed at a critical spacing between anchors of 12 times the anchor diameter.

Average Withdrawal Capacity and Average Bending Yield Moment of Tapper+ in Wood[1]

Anchor Diameter *d* in. (mm)	Minimum Embed. h_v in. (mm)	Minimum Edge Distance in. (mm)	Withdrawal Capacity[1] lbs. (kN)	Bending Yield Moment psi (MPa)
3/16 (4.8)	1 (25.4)	1-3/4 (44.5)	540 (2.4)	67,000 (464)
3/16 (4.8)	1-1/2 (38.1)	1-3/4 (44.5)	820 (3.7)	67,000 (464)
1/4 (6.4)	1 (25.4)	1-3/4 (44.5)	680 (3.0)	107,000 (740)
1/4 (6.4)	1-1/2 (38.1)	1-3/4 (44.5)	1,050 (4.7)	107,000 (740)

1. Tests in Douglas-Fir Larch with Specific Gravity of 0.42; screw oriented tangental to wood grain.

ORDERING INFORMATION

(HWH)

(PFH)

BLUE PERMA-SEAL TAPPER - STANDARD PACK*				
Cat No.		Screw Size	Quantities	
HWH	PFH		Box	Carton
2700SD	2740SD	3/16" x 1-1/4"	100	500
2702SD	2742SD	3/16" x 1-3/4"	100	500
2704SD	2744SD	3/16" x 2-1/4"	100	500
2706SD	2746SD	3/16" x 2-3/4"	100	500
2708SD	2748SD	3/16" x 3-1/4"	100	500
2710SD	2750SD	3/16" x 3-3/4"	100	500
2712SD	2752SD	3/16" x 4"	100	500
2720SD	2760SD	1/4" x 1-1/4"	100	500
2722SD	2762SD	1/4" x 1-3/4"	100	500
2724SD	2764SD	1/4" x 2-1/4"	100	500
2726SD	2766SD	1/4" x 2-3/4"	100	500
2728SD	2768SD	1/4" x 3-1/4"	100	500
2730SD	2770SD	1/4" x 3-3/4"	100	500
2732SD	2772SD	1/4" x 4"	100	500
2734SD	2774SD	1/4" x 5"	100	100
2736SD	2776SD	1/4" x 6"	100	100

BLUE PERMA-SEAL TAPPER - MASTER PACK**					
Cat No.		Screw Size	Quantities	Drill Bit References	
HWH	PFH			Straight	SDS Hex
9462SD	9476SD	3/16" x 1-1/4"	2000	2781	2793
9463SD	9477SD	3/16" x 1-3/4"	2000	2781	2793
9464SD	9478SD	3/16" x 2-1/4"	2000	2782	2793
9465SD	9479SD	3/16" x 2-3/4"	2000	2782	2793
9466SD	9480SD	3/16" x 3-1/4"	1000	2783	2794
9467SD	9481SD	3/16" x 3-3/4"	1000	2783	2794
9468SD	9482SD	3/16" x 4"	1000	2783	2794
9469SD	9483SD	1/4" x 1-1/4"	2000	2785	2796
9470SD	9484SD	1/4" x 1-3/4"	2000	2785	2796
9471SD	9485SD	1/4" x 2-1/4"	1000	2786	2796
9472SD	9486SD	1/4" x 2-3/4"	1000	2786	2796
9473SD	9487SD	1/4" x 3-1/4"	1000	2787	2797
9474SD	9488SD	1/4" x 3-3/4"	1000	2787	2797
9475SD	9489SD	1/4" x 4"	1000	2787	2797
	9490SD	1/4" x 5"	1000	2788	2797
	9491SD	1/4" x 6"	1000	2789	2797

Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design.
HWH = Hex Washer Head (slotted) ; PFH = Phillips Flat Head ; TFH = Trim Flat Head ; FHH = Flange Hex Head.
Tapper+ parts have an "SD" designation added to the catalog number.
* - One Tapper+ drill bit included in each standard box.
** - Drill bit not included with master pack.

Carbide Drill Bits for Perma-Seal TAPPER+ - Straight Shank				
Cat. No.	Size	Usable Length	Std. Tube	Wt./ 10
2781SD	5/32" x 3-1/2"	2	10	1/4
2782SD	5/32" x 4-1/2"	3	10	1/4
2783SD	5/32" x 5-1/2"	4	10	1/4
2785SD	3/16" x 3-1/2"	2	10	1/4
2786SD	3/16" x 4-1/2"	3	10	1/4
2787SD	3/16" x 5-1/2"	4	10	1/2
2788SD	3/16" x 6-1/2"	5	10	1/2
2789SD	3/16" x 7-1/2"	6	10	1/2

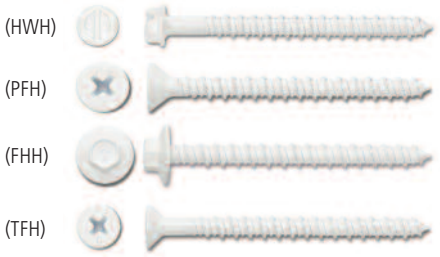
Carbide Drill Bits for Perma-Seal TAPPER+ - Hex Shank SDS-Plus				
Cat. No.	Size	Usable Length	Std. Tube	Wt./ 10
2793SD	5/32" x 5"	3	1	1
2794SD	5/32" x 7"	5	1	1
2796SD	3/16" x 5"	3	1	1
2797SD	3/16" x 7"	5	1	1

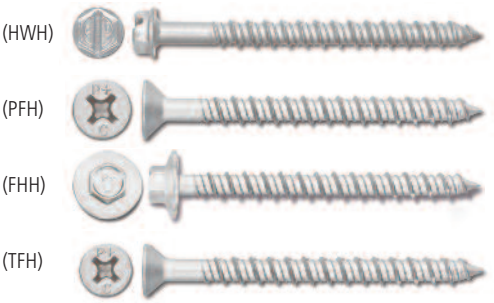
ACCESSORIES

Installation Tools for 3/16" and 1/4" TAPPER+					
Cat. No.	Description	Max Screw Length	Max Bit Length	Std. Box	Wt./ Each
2791	*Combo TAPPER 1000 Tool	4"	5-1/2"	1	3/4
2795	1000 SDS Extension (8")	6"	7-1/2"	1	1/2

* This tool cannot be used with SDS Drill Bits or PFH screws.

ORDERING INFORMATION





WHITE PERMA-SEAL TAPPER+ - STANDARD PACK*						
Cat No.				Screw Size	Quantities	
HWH	PFH	FHH	TFH		Box	Carton
2400SD	2440SD			3/16" x 1-1/4"	100	500
2402SD	2442SD			3/16" x 1-3/4"	100	500
2404SD	2444SD			3/16" x 2-1/4"	100	500
2406SD	2446SD			3/16" x 2-3/4"	100	500
2408SD	2448SD			3/16" x 3-1/4"	100	500
2410SD	2450SD			3/16" x 3-3/4"	100	500
2412SD	2449SD			3/16" x 4"	100	500
2420SD	2460SD			1/4" x 1-1/4"	100	500
2422SD	2462SD	8706SD	8710SD	1/4" x 1-3/4"	100	500
2424SD	2464SD	8707SD	8711SD	1/4" x 2-1/4"	100	500
2426SD	2466SD	8708SD	8712SD	1/4" x 2-3/4"	100	500
2428SD	2468SD	8709SD	8713SD	1/4" x 3-1/4"	100	500
2430SD	2470SD		8714SD	1/4" x 3-3/4"	100	500
2435SD	2472SD			1/4" x 4"	100	500

WHITE PERMA-SEAL TAPPER+ - MASTER PACK**					
Cat No.		Screw Size	Quantities	Drill Bit References	
HWH	PFH			Straight	SDS Hex
	9191SD	3/16" x 1-1/4"	2000	2781	2793
	9192SD	3/16" x 1-3/4"	2000	2781	2793
	9193SD	3/16" x 2-1/4"	2000	2782	2793
	9194SD	3/16" x 2-3/4"	2000	2782	2793
	9195SD	3/16" x 3-1/4"	1000	2783	2794
	9196SD	3/16" x 3-3/4"	1000	2783	2794
	9197SD	3/16" x 4"	1000	2783	2794
9923SD	9951SD	1/4" x 1-1/4"	2000	2785	2796
9924SD	9952SD	1/4" x 1-3/4"	2000	2785	2796
9925SD	9953SD	1/4" x 2-1/4"	1000	2786	2796
9926SD	9954SD	1/4" x 2-3/4"	1000	2786	2796
9927SD	9955SD	1/4" x 3-1/4"	1000	2787	2797
9928SD	9956SD	1/4" x 3-3/4"	1000	2787	2797
9929SD	9957SD	1/4" x 4"	1000	2787	2797

Shaded catalog numbers denote sizes which are less than the minimum standard anchor length for strength design.

Flange Hex Head parts are not included in the scope of ESR-3068

SILVER PERMA-SEAL TAPPER - STANDARD PACK*						
Cat No.				Screw Size	Quantities	
HWH	PFH	FHH	TFH		Box	Carton
	2498SD			3/16" x 1-1/4"	100	500
	2500SD			3/16" x 1-3/4"	100	500
	2501SD			3/16" x 2-1/4"	100	500
	2502SD			3/16" x 2-3/4"	100	500
	2503SD			3/16" x 3-1/4"	100	500
	2504SD			3/16" x 3-3/4"	100	500
	2505SD			3/16" x 4"	100	500
2486SD	2506SD			1/4" x 1-1/4"	100	500
2488SD	2507SD	8715SD	8719SD	1/4" x 1-3/4"	100	500
2490SD	2508SD	8716SD	8720SD	1/4" x 2-1/4"	100	500
2492SD	2509SD	8717SD	8721SD	1/4" x 2-3/4"	100	500
2494SD	2510SD	8718SD	8722SD	1/4" x 3-1/4"	100	500
2495SD	2511SD		8723SD	1/4" x 3-3/4"	100	500
2496SD	2512SD			1/4" x 4"	100	500

SILVER PERMA-SEAL TAPPER - MASTER PACK**					
Cat No.		Screw Size	Quantities	Drill Bit References	
HWH	PFH			Straight	SDS Hex
	8757SD	3/16" x 1-1/4"	2000	2781	2793
	8758SD	3/16" x 1-3/4"	2000	2781	2793
	8759SD	3/16" x 2-1/4"	2000	2782	2793
	8760SD	3/16" x 2-3/4"	2000	2782	2793
	8761SD	3/16" x 3-1/4"	1000	2783	2794
	8762SD	3/16" x 3-3/4"	1000	2783	2794
	8763SD	3/16" x 4"	1000	2783	2794
8750SD	8764SD	1/4" x 1-1/4"	2000	2785	2796
8751SD	8765SD	1/4" x 1-3/4"	2000	2785	2796
8752SD	8766SD	1/4" x 2-1/4"	1000	2786	2796
8753SD	8767SD	1/4" x 2-3/4"	1000	2786	2796
8754SD	8768SD	1/4" x 3-1/4"	1000	2787	2797
8755SD	8769SD	1/4" x 3-3/4"	1000	2787	2797
8756SD	8770SD	1/4" x 4"	1000	2787	2797

BRONZE PERMA-SEAL TAPPER - STANDARD PACK*				
Cat No.		Screw Size	Quantities	
PFH	FHH		Box	Carton
9975SD	9977SD	1/4" x 1-3/4"	100	500
9976SD	9978SD	1/4" x 2-1/4"	100	500

Tapper® *Concrete Screw Anchor*

Type 410 & 304 Stainless Steel

PRODUCT DESCRIPTION

The Tapper fastening system is a family of screw anchors for light to medium duty applications in concrete, masonry block and brick base materials. The Tapper is fast and easy to install and provides a neat, finished appearance. The Tapper screw anchor is engineered with matched tolerance drill bits and installation tools designed to meet the needs of the user and also provide optimum performance.

For every project, it is important to consider several things before making a selection: The proper head style, the color or finish that is desired, and the required level of corrosion resistance. The Tapper screw anchor is available in 410 and 304 stainless steels. Head styles include a hex head and Phillips flat head.

GENERAL APPLICATIONS AND USES

410 Stainless Steel Tappers

- Screen Enclosures
- Exterior Metal Lighting or Fixtures
- Storm Shutters
- Light Duty Industrial Applications

304 Stainless Steel Tappers

- Exterior Applications
- Marine Applications
- Food and Beverage Facilities
- Waste and Water Treatment Plants

FEATURES AND BENEFITS

- Tested in accordance with ASTM E488 and AC106 criteria
- Available in several head styles
- High-low thread design
- Does not exert expansion forces
- No hole spotting required
- Available in 410 and 304 stainless steel

APPROVALS AND LISTINGS

Miami-Dade County Notice of Acceptance (NOA) 09-0714.04

GUIDE SPECIFICATIONS

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

SECTION CONTENTS

410 Stainless Steel Tapper

304 Stainless Steel Tapper

ANCHOR MATERIALS

Type 410 Stainless Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 1-1/4" length to 2-3/4" length
1/4"diameter x 1-1/4" length to 6" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Hollow Concrete Masonry (CMU)
Solid Brick Masonry

INSTALLATION SPECIFICATIONS

304 Stainless Steel Tapper

Dimension	Anchor Diameter, *d*	
	1/4" HEX	1/4" PFH
Tapper Drill Bit Size, d_{bit} (in.)	3/16	3/16
Fixture Clearance Hole, d_h (in.)	5/16	5/16
Thread Size (UNC)	1/4-14	1/4-14
Head Height (in.)	9/64	3/16
Head Width (in.)	5/16	1/2 O.D.
Washer O.D., d_w (in.)	13/32	N/A
Washer Thickness, (in.)	1/32	N/A
Hex Driver (in.) / Phillips Driver	3/8	#3

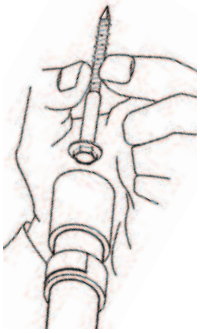
410 Stainless Steel Tapper

Dimension	Anchor Diameter, *d*	
	1/4" HEX	1/4" PFH
Tapper Drill Bit Size, d_{bit} (in.)	3/16	3/16
Fixture Clearance Hole, d_h (in.)	5/16	5/16
Thread Size (UNC)	1/4-14	1/4-14
Head Height (in.)	9/64	3/16
Head Width (in.)	5/16	1/2 O.D.
Washer O.D., d_w (in.)	13/32	N/A
Washer Thickness, (in.)	1/32	N/A
Hex Driver (in.) / Phillips Driver	3/8	#3

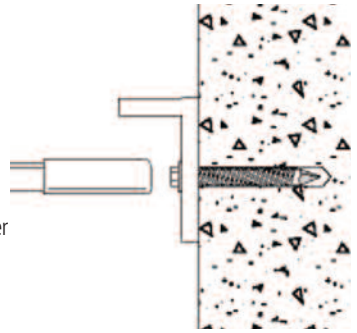
Installation Procedure

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/4" deeper than the embedment required. The Tapper drill bit must be used. Blow the hole clean of dust and other material.

Select the Tapper installation tool and drive socket to be used. Insert the head of the Tapper into the hex head socket or Phillips head driver. Set the drill motor to the "rotation only" mode.



Place the point of the Tapper through the fixture into the pre-drilled hole and drive the anchor in one steady continuous motion until it is fully seated at the proper embedment. The driver will automatically disengage from the head of the Tapper.



MATERIAL SPECIFICATIONS

Anchor Component	304 Stainless Steel	410 Stainless Steel
Anchor Body	Type 304 Stainless Steel	Type 410 Stainless Steel
Coating/Plating/Finish	Passivated	Class 4 Sealcoat (1500 hour rating for ASTM B 117 salt test, 20 hour rating for DIN 50018.2.05 kesternich-test undamaged coating reference).

PERFORMANCE DATA

Ultimate Load Capacities for Stainless Steel Tapper Screw Anchors in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Anchor Material	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**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 (6.4)	Type 304 Stainless Steel	1 (25.4)	500 (2.3)	1,180 (5.3)	600 (2.7)	1,180 (5.3)	700 (3.2)	1,180 (5.3)	700 (3.2)	1,180 (5.3)
		1-1/4 (31.8)	855 (3.8)	1,265 (5.7)	855 (3.8)	1,265 (5.7)	1,015 (4.6)	1,340 (6.0)	1,215 (5.5)	1,340 (6.0)
		1-1/2 (38.1)	1,140 (5.1)	1,340 (6.0)	1,220 (5.5)	1,340 (6.0)	1,320 (5.9)	1,340 (6.0)	1,320 (5.9)	1,340 (6.0)
		1-3/4 (44.5)	1,440 (6.5)	1,640 (7.4)	1,520 (6.8)	1,640 (7.4)	1,580 (7.1)	1,640 (7.4)	1,580 (7.1)	1,640 (7.4)
3/16 (4.7)	Type 410 Stainless Steel	7/8 (22.2)	–	–	220 (1.0)	865 (3.8)	250 (1.1)	1,000 (4.4)	–	–
		1-1/4 (31.8)	–	–	465 (2.0)	1,115 (5.0)	540 (2.9)	1,285 (5.7)	–	–
1/4 (6.4)		1-1/2 (38.1)	–	–	2,160 (9.7)	2,420 (10.9)	2,160 (9.7)	2,420 (10.9)	2,160 (9.7)	2,420 (10.9)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Stainless Steel Tapper Screw Anchors in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Anchor Material	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**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 (6.4)	Type 304 Stainless Steel	1 (25.4)	125 (0.6)	295 (1.3)	150 (0.7)	295 (1.3)	175 (0.8)	295 (1.3)	175 (0.8)	295 (1.3)
		1-1/4 (31.8)	215 (1.0)	315 (1.4)	215 (1.0)	315 (1.4)	255 (1.1)	335 (1.5)	305 (1.4)	335 (1.5)
		1-1/2 (38.1)	285 (1.3)	335 (1.5)	305 (1.4)	335 (1.5)	330 (1.5)	335 (1.5)	330 (1.5)	335 (1.5)
		1-3/4 (44.5)	360 (1.6)	410 (1.8)	380 (1.7)	410 (1.8)	395 (1.8)	410 (1.8)	395 (1.8)	410 (1.8)
3/16 (4.7)	Type 410 Stainless Steel	7/8 (22.2)	–	–	55 (0.25)	215 (0.9)	64 (0.3)	250 (1.1)	–	–
		1-1/4 (31.8)	–	–	115 (0.5)	280 (1.3)	135 (0.6)	320 (1.4)	–	–
1/4 (6.4)		1-1/2 (38.1)	–	–	540 (2.4)	605 (2.7)	540 (2.4)	605 (2.7)	540 (2.4)	605 (2.7)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

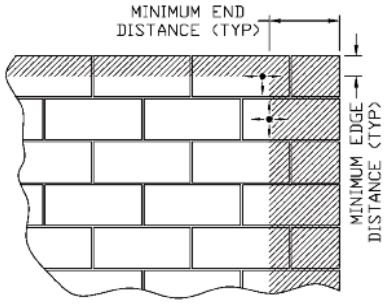
Ultimate and Allowable Load Capacities for Tapper Screw Anchors in Structural Lightweight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Anchor Material	Minimum Embed. Depth h_v in. (mm)	Tension, lbs (kN) — Minimum Concrete Compressive Strength (f'_c)						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)	Type 304 Stainless Steel	1-1/2 (38.1)	270 (1.2)	70 (0.3)	300 (1.4)	75 (0.3)	325 (1.5)	80 (0.4)	520 (2.3)	130 (0.6)

1. Tabulated load values are for anchors installed in structuarl sand-lightweight 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. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Allowable Load Capacities for Tapper Screw Anchors in Hollow Block[1,2,3,4,5]

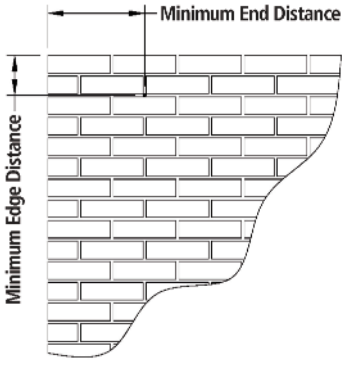
Anchor Diameter *d* in. (mm)	Anchor Material	Minimum Embedment Depth h_v in. (mm)	Lightweight, Medium & Normal Weight CMU — $f'_m \geq$ 2,000 psi (13.8 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	Type 410 Stainless Steel	1 (25.4)	140 (0.6)	210 (0.9)
	Type 304 and Type 410 Stainless Steel	1-1/4 (31.8)	120 (0.5)	205 (0.9)
		1-1/2 (38.1)	145 (0.7)	245 (1.1)
		1-3/4 (44.5)	145 (0.7)	245 (1.1)



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 (f'm ≥ 2,000 psi).
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
3. The tabulated values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screw anchor diameter. The screw anchors may be reduced to a minimum spacing distance of 8 times the screw diameter provided the allowable loads are reduced by 70 percent. Linear interpolation for allowable loads may be used for intermediate spacing distances.
4. The tabulated values are applicable for screw anchors installed at a minimum edge distance of 12 times the screw anchor diameter unless otherwise noted.
5. The tabulated values are applicable for installations into the face shell of the masonry member. The face shell thickness must be able to accomodate the specified embedment depth. Masonry cells may be grouted.

Allowable Load Capacities for Tapper Screw Anchors in Brick Masonry[1,2,3,4,5]

Anchor Diameter *d* in. (mm)	Anchor Material	Minimum Embedment Depth h_v in. (mm)	Brick Masonry — $f'_m \geq$ 1,300 psi (9.0 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	Type 410 Stainless Steel	1 (25.4)	145 (0.7)	288 (1.3)
	Type 304 and Type 410 Stainless Steel	1-1/4 (31.8)	160 (0.7)	330 (1.5)
		1-1/2 (38.1)	190 (0.9)	345 (1.6)
		1-3/4 (44.5)	190 (0.9)	345 (1.6)



1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,300 psi).
2. Allowable load capacities are calculated using an applied safety factor of 5.0.
3. Linear interpolation may be used to determine allowable load capacities for intermediate embedments.
4. The tabulated values are for anchors installed at a minimum edge and end distance of 4 inches.
5. 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 distances.

DESIGN CRITERIA

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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 in Normal-Weight Concrete[1]

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	$s_{cr} = 12d$	$F_{N_s} = F_{V_s} = 1.0$	$s_{min} = 6d$	$F_{N_s} = F_{V_s} = 0.50$
Edge Distance (c)	Tension and Shear	$c_{cr} = 12d$	$F_{N_c} = F_{V_c} = 1.0$	$c_{min} = 6d$	$F_{N_c} = F_{V_c} = 0.50$

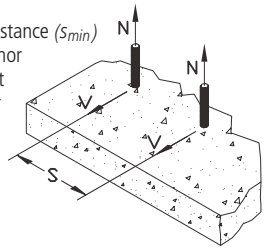
1. Load values, found in the Performance Data Tables, are multiplied by the reduction factors when spacing edge distances are less than critical distances. Linear interpolation is allowed for spacing and edge distances that fall between critical and minimum distances. When a group of anchors is affected by both reduced spacing and edge distance, the spacing and edge distance reduction factors must be combined (multiplied).

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{N_s}) & Shear (F_{V_s})				
Dia. (in.)		3/16	1/4	3/8
s_{cr} (in.)		2-1/4	3	4-1/2
s_{min} (in.)		1-1/8	1-1/2	2-1/4
Spacing, s (in.)	1-1/8	0.50		
	1-1/2	0.67	0.50	
	2	0.89	0.67	
	2-1/4	1.00	0.75	0.50
	2-1/2		0.83	0.56
	3		1.00	0.67
	3-1/2			0.78
	4			0.89
	4-1/2			1.00

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

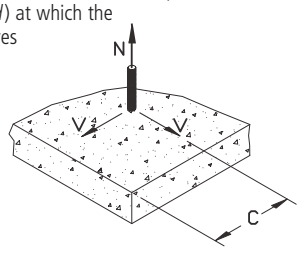
Minimum edge distance (s_{min}) is equal to 6 anchor diameters ($6d$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{N_c}) & Shear (F_{V_c})				
Dia. (in.)		3/16	1/4	3/8
c_{cr} (in.)		2-1/4	3	4-1/2
c_{min} (in.)		1-1/8	1-1/2	2-1/4
Spacing, s (in.)	1-1/8	0.50		
	1-1/2	0.67	0.50	
	2	0.89	0.67	
	2-1/4	1.00	0.75	0.50
	2-1/2		0.83	0.56
	3		1.00	0.67
	3-1/2			0.78
	4			0.89
	4-1/2			1.00

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

Minimum edge distance (c_{min}) is equal to 6 anchor diameters ($6d$) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Hex head Tapper anchors are measured from below the washer while flat head Tapper anchors are measured end to end. To select the proper minimum anchor length, determine the embedment depth required to obtain the desired load capacity. Then add the thickness of the fixture, including any spacers or shims, to the embedment depth.

Do not select a length that will result in an embedment into the base material which is greater than 1-3/4" to 2".
Most concrete screw anchors cannot be properly driven to a depth of more than 2", especially in denser base materials.

Type 304 Stainless Steel Tapper, Hex Head & Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
2880	2887	1/4" x 1-1/4"	100	500	1-1/2	2894	2790
2881	2888	1/4" x 1-3/4"	100	500	1-3/4	2894	2790
2882	2889	1/4" x 2-1/4"	100	500	2	2895	2790
2883	2890	1/4" x 2-3/4"	100	500	2-3/4	2895	2790

One drill bit is packaged in each box of tappers.

Type 410 Stainless Steel Tapper, Hex Head & Flat Head

Catalog Number		Size	Standard Box	Standard Carton	Wt./ 100	Drill Bit Reference	
HEX	PFH					Straight	SDS HEX
4180	4185	3/16" x 1-1/4"	100	500	1-1/2	2781	2796
4181	4186	3/16" x 1-3/4"	100	500	1-3/4	2781	2796
4182	4187	3/16" x 2-1/4"	100	500	2	2782	2796
4183	4188	3/16" x 2-3/4"	100	500	2-3/4	2782	2796
4110	4118	1/4" x 1-1/4"	100	500	2-3/4	2785	2796
4112	4120	1/4" x 1-3/4"	100	500	2-3/4	2785	2796
4114	4123	1/4" x 2-1/4"	100	500	2-3/4	2786	2796
4116	4124	1/4" x 2-3/4"	100	500	2-3/4	2786	2796
4117	4125	1/4" x 3-1/4"	100	500	2-3/4	2785	2796
4119	-	1/4" x 3-3/4"	100	500	2-3/4	2785	2796
4127	-	1/4" x 4"	100	500	2-3/4	2786	2797
4128	-	1/4" x 5"	100	500	2-3/4	2788	-
4129		1/4" x 6"	100	500	2-3/4	2788	-

One drill bit is packaged in each box of tappers.

ORDERING INFORMATION

Carbide Drill Bits for 410 Stainless Steel Tapper
(Do not use with Type 304 Stainless Steel)

Straight Shank

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2781	5/32" x 3-1/2"	0.168"– 0.175"	2"	10	1/4
2782	5/32" x 4-1/2"		3"	10	1/4
2783	5/32" x 5-1/2"		4"	10	1/4
2785	3/16" x 3-1/2"	0.202"– 0.204"	2"	10	1/4
2786	3/16" x 4-1/2"		3"	10	1/4
2787	3/16" x 5-1/2"		4"	10	1/2
2788	3/16" x 6-1/2"		5"	10	1/2
2789	3/16" x 7-1/2"		6"	10	1/2

Hex Shank SDS-Plus

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2793	5/32" x 5"	0.168"– 0.175"	3"	1	1
2794	5/32" x 7"		5"	1	1
2796	3/16" x 5"	0.202"– 0.204"	3"	1	1
2797	3/16" x 7"		5"	1	1

Carbide Drill Bits for Type 304 Stainless Steel Tapper

Straight Shank

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2894	3/16" x 3-1/2"	0.215"– 0.216"	2"	10	1/4
2895	3/16" x 4-1/2"		3"	10	1/4

Hex Shank SDS-Plus

Catalog Number	Size	Drill Bit Range	Usable Length	Standard Tube	Wt./ 10
2790	3/16" x 5-1/2"	0.215"– 0.216"	2-1/2"	1	1

Installation Tools for 1/4" Tapper

Catalog Number	Description	Max. Screw Length	Max. Bit Length	Standard Box	Wt./ Each
2791	Tapper 1000 Tool Kit	4"	5-1/2"	1	3/4
2795	1000 SDS Extension (8")	6"	7-1/2"	1	1/2

Snake+® *Internally Threaded Screw Anchor*

PRODUCT DESCRIPTION

The Snake+ anchor is an internally threaded, self-tapping screw anchor designed for performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete, structural sand-lightweight concrete and concrete over steel deck. The Snake+ screw anchor is installed into a drilled hole with a power tool and a Snake+ setting tool. After installation a steel element is threaded into the anchor body.

GENERAL APPLICATIONS AND USES

- Suspending conduit
- Cable trays and strut
- Pipe supports
- Fire sprinklers
- Interior applications/low level corrosion environment
- Tension zone areas
- Seismic and wind loading applications
- Suspended lighting

FEATURES AND BENEFITS

+ Designed for use in holes drilled with standard ANSI carbide drill bits
+ Anchor design allows for shallow embedment and mechanically interlocks with base material
+ Internally threaded anchor for easy adjustment and removability of threaded rod or bolt
+ Fast anchor installation with a powered impact wrench
+ Hammer not used for installation

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES), ESR-2272
Code compliant with the IBC, and IRC (see report for applicable code editions)
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 anchor)
Evaluated and qualified by an accredited independent testing laboratory for reliability against brittle failure, e.g. hydrogen embrittlement
Evaluated and qualified by an accredited independent testing laboratory for supplemental recognition in redundant fastening applications
FM Global (Factory Mutual) - File No. 3024502 (see report for sizes)
www.approvalguide.com - Pipe hanger components for automatic sprinkler systems

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring and 05090-Metal Fastenings.*
Internally threaded anchors shall be Snake+ 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	Case hardened carbon steel
Plating	Zinc plating according to ASTM B 633, SC1, Type III (Fe/Zn 5) Minimum plating requirement for Mild Service Condition

SECTION CONTENTS

Snake+

INTERNAL THREAD VERSION

Unified coarse thread (UNC)

ANCHOR MATERIALS

Zinc plated carbon steel body

ANCHOR SIZE RANGE (TYP.)

1/4", 3/8" and 1/2" diameters

SUITABLE BASE MATERIALS

Normal-weight concrete
Structural sand-lightweight concrete
Concrete over steel deck

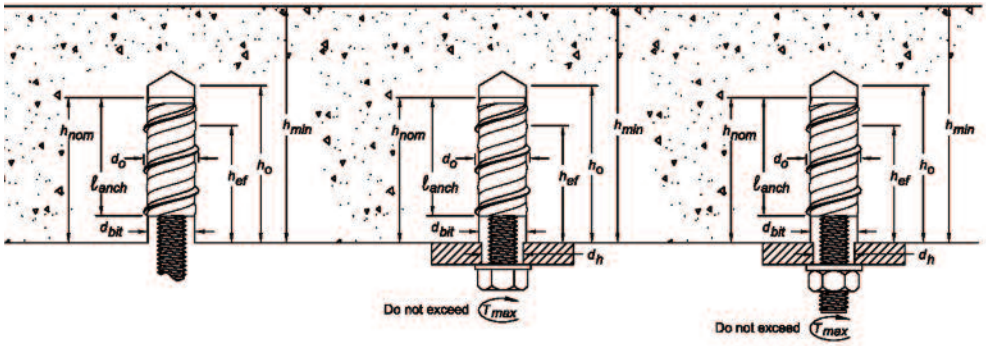
INSTALLATION SPECIFICATIONS

Installation Information for Snake+ Screw Anchor for Single Point Applications[1,3]

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size		
			1/4"	3/8"	1/2"
Nominal outside anchor diameter	(d_a)	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.750 (19.1)
Internal thread diameter (UNC)	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)
Drill bit diameter	d_{bit}	in.	3/8 ANSI	1/2 ANSI	3/4 ANSI
Minimum hole depth	h_o	in. (mm)	2 (51)	2 (51)	2-1/2 (64)
Minimum concrete member thickness[2]	h_{min}	in. (mm)	3 (76)	4 (102)	4 (102)
Overall anchor length	ℓ_{anch}	in. (mm)	1-1/4 (32)	1-1/4 (32)	1-11/16 (43)
Nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-3/16 (55)
Effective embedment	h_{ef}	in. (mm)	Not Applicable	1.10 (28)	1.54 (39)
Minimum edge distance[2]	c_{min}	in. (mm)	Not Applicable	3 (76)	4 (102)
Minimum spacing distance[2]	s_{min}	in. (mm)	Not Applicable	3 (76)	4 (102)
Critical edge distance[2]	c_{ac}	in. (mm)	Not Applicable	3 (76)	4 (102)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	120 (163)	345 (468)	345 (468)
Maximum tightening torque of steel insert element (threaded rod or bolt)	T_{max}	ft.-lb. (N-m)	4 (6)	14 (19)	36 (49)

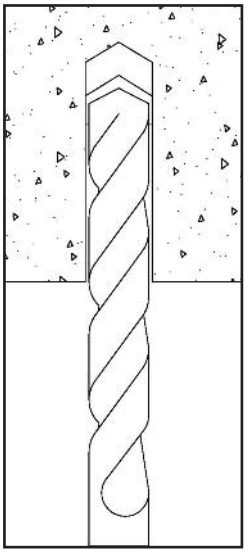
1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318 Appendix D.
2. For installations through the soffit of steel deck into concrete, see illustration detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
3. The notation in parenthesis is for the 2009 IBC.

Dimensional Sketch for Snake+ Screw Anchor Installed with Steel Insert Element

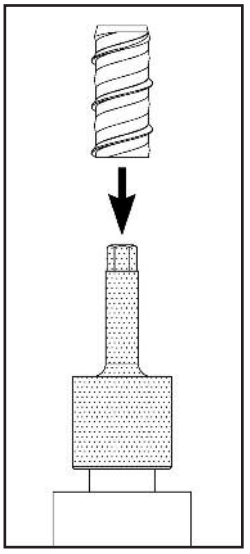


INSTALLATION INSTRUCTIONS

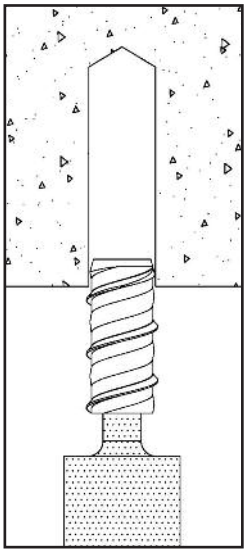
Installation Instructions for Snake+ Screw Anchor



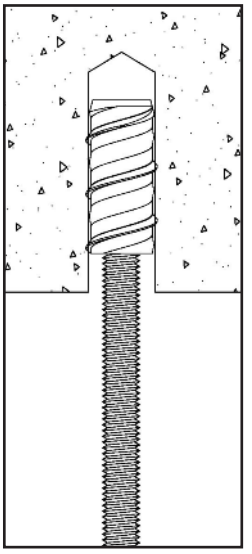
1.) *Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the carbide drill bit used should meet the requirements of ANSI Standard B212.15.*



2.) *Select a powered impact wrench that does not exceed the maximum torque, T_{screw}, for the selected anchor diameter. Attach the Snake+ setting tool supplied by Powers Fasteners to the impact wrench. Mount the anchor onto the setting tool.*

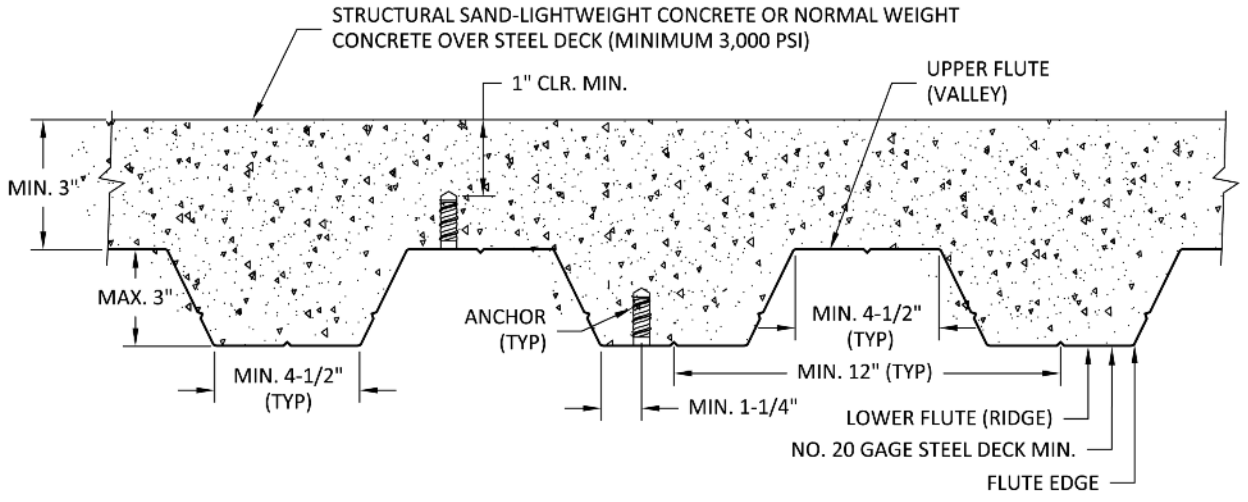


3.) *Drive the anchor into the hole until the shoulder of the Snake+ setting tool comes into contact with the surface of the base material. Do not spin the setting tool off the anchor to disengage.*



4.) *Insert threaded rod or a bolt into the Snake+, taking care not to exceed the maximum specified tightening torque of the steel insert element, T_{max}. Minimum thread engagement should be at least one anchor diameter.*

Installation Detail for Snake+ Installed Through Soffit of Steel Deck into Concrete



PERFORMANCE DATA

Tension Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2]

Design Characteristic	Notation	Units		Nominal Anchor Size	
				3/8 inch	1/2 inch
Anchor category	1, 2 or 3	-		1	1
Nominal embedment depth	h_{nom}	in. (mm)		1-5/8 (41)	2-3/16 (41)
STEEL STRENGTH IN TENSION[4]					
Minimum specified yield strength of steel insert element	f_y	ksi (N/mm²)	ASTM A36	36.0 (248)	
		ksi (N/mm²)	ASTM A193, Grade B7	105.0 (724)	-
Minimum specified ultimate strength of steel insert element	f_{ut}[11]	ksi (N/mm²)	ASTM A36	58.0 (400)	
		ksi (N/mm²)	ASTM A193, Grade B7	125.0 (862)	-
Effective tensile stress area of steel insert element	A_{se}	in² (mm²)		0.0775 (50)	0.1419 (50)
Steel strength in tension	N_{sa}[11]	lb (kN)	ASTM A36	4,495 (20.0)	8,230 (37.0)
		lb (kN)	ASTM A193, Grade B7	9,685 (43.1)	-
Reduction factor for steel strength[3,4]	ϕ	-		0.65	
CONCRETE BREAKOUT STRENGTH IN TENSION[8]					
Effective embedment	h_{ef}	in. (mm)		1.10 (28)	1.54 (39)
Effectiveness factor for uncracked concrete[3]	k_{uncr}	-		24	30
Effectiveness factor for cracked concrete[5]	k_{cr}	-		17	24
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$[11]	-		Cracked concrete = 1.0 Uncracked concrete = 1.4	
Critical edge distance	c_{ac}	in. (mm)		3 (76)	4 (102)
Reduction factor for concrete breakout strength[3]	ϕ	-		Condition B = 0.65	
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[8]					
Characteristic pullout strength, uncracked concrete (2,500 PSI)[6]	$N_{p,uncr}$	lb (kN)		See note 7	See Note 7
Characteristic pullout strength, cracked concrete (2,500 PSI)[6]	$N_{p,cr}$	lb (kN)		See note 7	See Note 7
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.65	
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8]					
Characteristic pullout strength, seismic(2,500PSI)[6,9]	N_{eq}	lb (kN)		See note 7	See Note 7
Reduction factor for pullout strength seismic[3]	ϕ	-		Condition B = 0.65	
PULLOUT STRENGTH IN TENSION FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK					
Characteristic pullout strength, uncracked concrete over steel deck[6,10]	$N_{p,deck,uncr}$	lb (kN)		1,515 (6.7)	1,625 (7.2)
Characteristic pullout strength, cracked concrete over steel deck[6,10]	$N_{p,deck,cr}$	lb (kN)		1,075 (4.8)	1,300 (5.8)
Reduction factor for steel deck[3]	ϕ	-		Condition B = 0.65	

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 Section D.3.3 shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 Section D.4.5.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor will be a steel element as defined by ACI 318 Section D.1. However, the anchor steel is classified as non-ductile in seismic tension calculations. Steel failure does not control in this condition.
5. For all design cases use $\Psi_{c,N} = 1.0$. Select appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}).
6. For all design cases use $\Psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500 psi, N_{pn} = (Pullout strength value from table)*(specified concrete compressive strength/2500)$^{0.5}$.
7. Pullout strength will not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors are permitted to be used in structural sand-lightweight concrete provided that N_b and N_{pn} are multiplied by a factor of 0.60 (not required for steel deck).
9. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.
10. 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 Section D.5.2 is not required for anchors installed in the flute (soffit).
11. For 2003 IBC, f_{uta} replaces f_{ut}; N_{sa} replaces Ns; $\Psi_{c,N}$ replaces Ψ_3; and Neq replaces $N_{p,seis}$.
12. The notation in brackets is for the 2009 IBC.

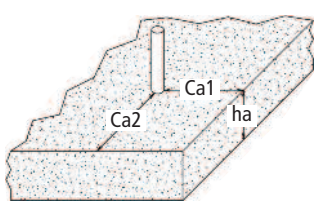
PERFORMANCE DATA

Shear Design Information (For use with load combinations taken from ACI 318 Section 9.2)[1,2]

Design Characteristic	Notation	Units		Nominal Anchor Size 3/8 inch	Nominal Anchor Size 1/2 inch
Anchor category	1, 2 or 3	-		1	1
Nominal embedment depth	h_{nom}	in. (mm)		1-5/8 (41)	2-3/16 (55)
STEEL STRENGTH IN SHEAR[4]					
Minimum specified yield strength of steel insert element	f_y	ksi (N/mm²)	ASTM A36	36.0 (248)	
		ksi (N/mm²)	ASTM A193, Grade B7	105.0 (724)	-
Minimum specified ultimate strength of steel insert element	f_{ut}	ksi (N/mm²)	ASTM A36	58.0 (400)	
		ksi (N/mm²)	ASTM A193, Grade B7	125.0 (862)	-
Effective tensile stress area of steel insert element	A_{se}	in² (mm²)		0.0775 (50)	0.1419 (50)
Steel strength in shear[5]	V_{sa}[10]	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
		lb (kN)	ASTM A193, Grade B7	1,655 (7.4)	-
Reduction factor for steel strength[3]	ϕ	-		0.60	
CONCRETE BREAKOUT STRENGTH IN SHEAR[6]					
Effective embedment	h_{ef}	in. (mm)		1.10 (28)	1.54 (39)
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e[10]	in. (mm)		1.10 (28)	1.54 (39)
Critical edge distance	ϕ	-		3 (76)	4 (102)
Reduction factor for concrete breakout[3]	ϕ	-		Condition B = 0.70	
PRYOUT STRENGTH IN SHEAR[6]					
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in, 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-		1.0	2.0
Reduction factor for pryout strength[3]	ϕ	-		Condition B = 0.70	
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS[5]					
Steel strength in shear, seismic	V_{eq}[10]	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
		lb (kN)	ASTM A193, Grade B7	1,655 (7.4)	-
Reduction factor for steel strength[3]	ϕ	-		Condition B = 0.60	
STEEL STRENGTH IN SHEAR FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[8]					
Steel strength in shear, concrete over steel deck[8]	$V_{sa,deck}$	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
		lb (kN)	ASTM A193, Grade B7	1,655 (7.4)	-
Reduction factor for steel strength in shear concrete over stud deck	ϕ	-		Condition B = 0.60	

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. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of UBC 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 ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor will be a steel element as defined by ACI 318 D.1.
5. 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 318-08 (ACI 318-05) and ACI 318 D.6.1.2.
6. Anchors are permitted to be used in structural sand-lightweight concrete in accordance with Section 4.1.11 of this report.
7. 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.
8. Tabulated values for Vsa,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 pryout capacity in accordance with ACI 318 D.6.3 are not required for anchors installed in the deck soffit (flute).
9. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
10. For 2003 IBC, f_{uta} replaces f_{ut}; Vsa replaces V_s; ℓ_e replaces ℓ; and V_{eq} replaces $V_{s,seis}$.
11. The notation in parenthesis is for the 2009 IBC.

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318-05 Appendix D:



1. Tabular values are are provided for illustration and 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 (ϕ) 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.

Tension and Shear Factored Design Strength for Snake+ in Cracked Concrete

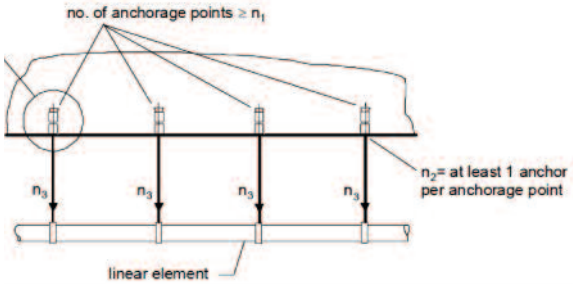
Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element *(Threaded Rod or Bolt)*	Minimum Concrete Compressive Strength, $f'c$ (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	1-5/8	ASTM A36	635	**500**	700	**500**	805	**500**	985	**500**	1,140	**500**
		ASTM A193 Grade B7	635	685	700	750	805	870	985	970	1,140	1,065
1/2	2-3/16	ASTM A36	1,490	**1,195**	1,635	**1,195**	1,885	**1,195**	2,310	**1,195**	2,665	**1,195**

Tension and Shear Factored Design Strength for Snake+ in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element *(Threaded Rod or Bolt)*	Minimum Concrete Compressive Strength, $f'c$ (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
3/8	1-5/8	ASTM A36	900	**500**	985	**500**	1,140	**500**	1,395	**500**	1,610	**500**
		ASTM A193 Grade B7	900	970	985	1,060	1,140	**1,080**	1,395	**1,080**	1,610	**1,080**
1/2	2-3/16	ASTM A36	1,865	**1,195**	2,040	**1,195**	2,355	**1,195**	2,885	**1,195**	3,335	**1,195**

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

REDUNDANT FASTENING APPLICATIONS



For an anchoring system designed with redundancy, the load maintained by an anchor that experiences failure or excessive deflection can be transmitted to neighboring anchors without significant consequences to the fixture or remaining resistance of the anchoring system. In addition to the requirements for anchors, the fixture being attached shall be able to resist the forces acting on it assuming one of the fixing points is not carrying load. It is assumed that by adhering to the limits placed on n_1, n_2 and n_3 below, redundancy will be satisfied.

Anchors qualified for redundant applications may be designed for use in normal weight and sand-lightweight cracked and uncracked concrete. Concrete compressive strength of 2,500 psi shall be used for design. No increase in anchor capacity is permitted for concrete compressive strengths greater than 2,500 psi. The anchor installation is limited to concrete with a compressive strength of 8,500 psi or less.

Redundant applications shall be limited to structures assigned to Seismic Design Categories A or B only.

Redundant applications shall be limited to support of nonstructural elements.

Strength Design (Redundant Fastening):

For strength design, a redundant system is achieved by specifying and limiting the following variables

n_1 = the total number of anchorage points supporting the linear element

n_2 = number of anchors per anchorage point

n_3 = factored load at each anchorage point, lbs., using load combinations from IBC Section 1605.2.1 or ACI 318 Section 9.2

STRENGTH DESIGN (SD)

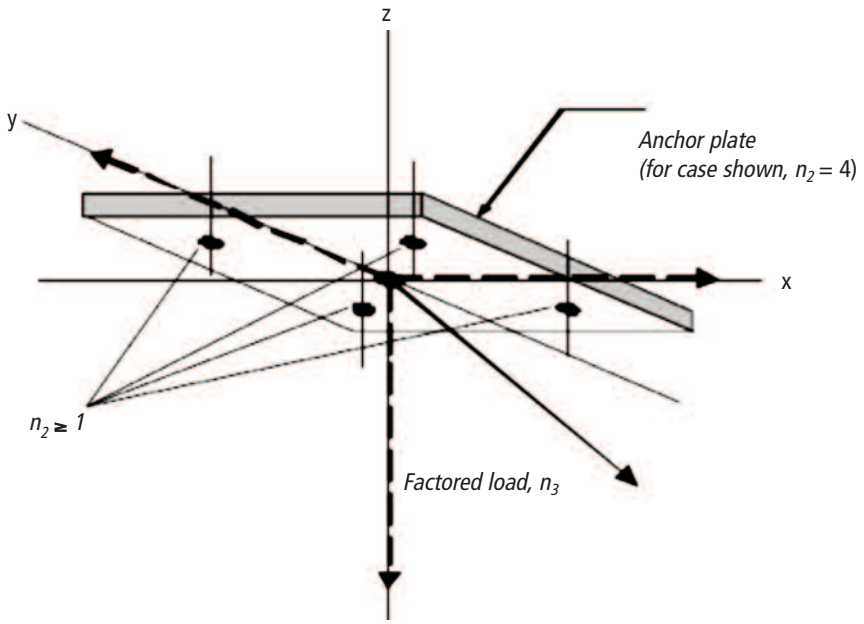
Design values for use with strength design shall be established taking $\phi_{ra} . F_{ra}$.

See redundant fastening design information table for Snake+ design resistance.

Allowable Stress Design (Redundant Fastening):

Design values for use with allowable stress design shall be established taking R_d, ASD = $\frac{\phi_{ra} . F_{ra}}{\alpha}$

Where α is the conversion factor calculated as the weighted average of the load factors from the controlling load combination. The conversion factor, α is equal to 1.4 assuming all dead load.



Installation Table for Snake+ Screw Anchor in Redundant Fastening Applications

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size		
			1/4"	3/8"	1/2"
Nominal drill bit diameter	d_{bit}	in.	3/8" ANSI	1/2" ANSI	3/4" ANSI
Nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-3/16 (55)
Effective embedment	h_{ef}	in. (mm)	1.10 (28)	1.10 (28)	1.54 (39)
Minimum hole depth	h_o	in. (mm)	2 (51)	2 (51)	2-1/2 (64)
Minimum concrete member thickness	h_{min}	in. (mm)	3 (76.2)	3 (76.2)	3 (76.2)
Overall anchor length	ℓ_{anch}	in. (mm)	1.10 (28)	1.10 (28)	1.54 (39)
Minimum edge distance redundant fastening[1]	C_{min}= C_{ac}	in. (mm)	4 (102)	4 (102)	4 (102)
Mininum spacing distance, redundant fastening[1]	S_{min}	in. (mm)	8 (203)	8 (203)	8 (203)
Maximum tightening torque	T_{max}	ft.-lb. (N-m)	4 (6)	14 (19)	36 (49)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	120 (163)	345 (468)	345 (468)

1. Tabulated minimum spacing and edge distances are applicable only for redundant fastening applications.

Redundant Fastening Design Information For Snake+ Anchors[1,2,3]

Design Characteristic	Notation	Units	Nominal Anchor Size					
			1/4"		3/8"		1/2"	
Anchor category	1, 2 or 3	-	1		1		1	
Nominal embedment depth	h_{nom}	in (mm)	1-5/8 (41)		1-5/8 (41)		2 3/16 (55)	
CHARACTERISTIC STRENGTH (RESISTANCE) INSTALLED IN CONCRETE[4,5]								
Resistance, cracked or uncracked concrete (2,500psi)	F_{ra}	lb (kN)	Number of anchorage points		Number of anchorage points		Number of anchorage points	
			$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$
			550 (2.5)	360 (1.6)	675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)
Effective tensile stress area	ϕ_{ra}	-	0.65					
CHARACTERISTIC STRENGTH (RESISTANCE) FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL WEIGHT CONCRETE OVER STEEL DECK[4]								
Resistance, cracked or uncracked concrete over steel deck (2,500 psi)	F_{ra}	lb (kN)	Number of anchorage points		Number of anchorage points		Number of anchorage points	
			$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$
			550 (2.5)	360 (1.6)	675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)
Strength reduction factor[3]	ϕ_{ra}	-	0.65					

1. The data in this table is intended to be used with the design provisions of this product; loads may be applied in any direction.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of UBC Section 1605.2.1, UBC Section 1612.2.1, or ACI 318 Section 9.2.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor has minimum specified properties as listed in the table above or an equivalent steel element.
5. Anchors are permitted to be used in structural sand-lightweight concrete, provided the resistance value is multiplied by 0.6.

Ultimate Tension Load Capacities for Snake+ in Normal-Weight Uncracked Concrete[1,2,3,4]

Anchor Diameter in. (mm)	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength					
		f'_c = 2,500 psi (17.2 MPa)		f'_c = 3,000 psi (20.7 MPa)		f'_c = 6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.3)	1-5/8 (41)	2,130 (9.5)	1,045 (4.6)	2,335 (10.4)	1,045 (4.6)	-	-
3/8 (9.5)	1-5/8 (41)	2,165 (9.7)	1,045 (4.6)	2,370 (10.6)	1,045 (4.6)	3,190 (14.2)	1,045 (4.6)
1/2 (12.7)	2-3/16 (55)	5,590 (24.9)	2,050 (9.1)	6,125 (27.3)	2,050 (9.1)	7,425 (33.1)	2,050 (9.1)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.
3. The tabulated load values are applicable to single anchors in uncracked concrete installed at critical spacing distance between anchors and at critical edge distance.
4. Ultimate shear capacity is controlled by steel strength of ASTM A36 element (or equivalent).

ORDERING INFORMATION

Carbon Steel Snake+ Screw Anchor

Cat. No.	Anchor Size	Embedment	Internal Thread Depth	Std. Box	Std. Ctn.
6400SD	1/4″	1-5/8″	11/32″	100	1,000
6401SD	3/8″	1-5/8″	23/32″	50	500
6403SD	1/2″	2-1/2″	15/16″	50	300

Setting Tool for Snake+ Screw Anchor

Cat. No.	Anchor Size	Std. Ctn.
6402SD	1/4″	1
6407SD	3/8″	1
6404SD	1/2″	1

Steel Dropin™ *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Steel Dropin is an all-steel, machine bolt anchor available in carbon steel and two types of stainless steel. It can be used in solid concrete, hard stone, and solid block base materials. A coil thread version for forming applications is also available.

GENERAL APPLICATIONS AND USES

- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Fire Sprinkler
- Concrete Formwork
- Suspended Lighting

FEATURES AND BENEFITS

+ Internally threaded anchor for easy bolt removability and service work
+ Flanged (lipped) version installs flush for easy inspection and standard embedment
+ Smooth wall dropin can be installed flush mounted or below the base material surface
+ Optionally available with a knurled body
+ Coil thread version accepts coil rod and typically used for concrete formwork applications

TESTING, APPROVALS AND LISTINGS

Tested in accordance with ASTM 488 and AC01 criteria
FM Global (Factory Mutual) - File No. J.I. OK4A9.AH (see ordering information)
Underwriters Laboratory (UL Listed) – File No. EX1289 (N) (see ordering information)

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.* Dropin anchors shall be Steel Dropin as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Smooth Wall Dropin

Flange (Lipped) Dropin

THREAD VERSION

UNC Coarse Thread
Coil Thread

ANCHOR MATERIALS

Zinc Plated Carbon Steel
303 Stainless Steel
316 Stainless Steel

ROD/ANCHOR SIZE RANGE (TYP.)

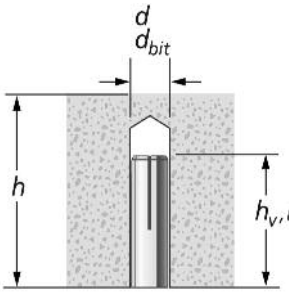
1/4" to 3/4" diameter UNC Coarse Thread
1/2" and 3/4" diameter Coil Thread

SUITABLE BASE MATERIALS

Normal-weight Concrete
Structural Lightweight Concrete

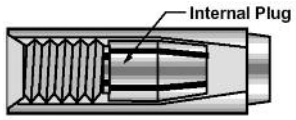
INSTALLATION SPECIFICATIONS

Anchor (Rod) Size	Rod/Anchor Diameter, *d*						
	1/4"	3/8"	1/2"	1/2" Coil Thread	5/8"	3/4"	3/4" Coil Thread
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8	5/8	7/8	1	1
Maximum Tightening Torque, T_{max} (ft.-lbs.)	5	10	20	20	40	80	80
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	1/2-6	5/8-11	3/4-10	3/4-4-1/2
Thread Depth (in.)	7/16	5/8	13/16	13/16	1-3/16	1-3/8	1-3/8
Flange Size (in.)	7/16	9/16	45/64	–	–	–	–
Anchor Length *l*, h_v (in.)	1	1-9/16	2	2	2-1/2	3-3/16	3-3/16

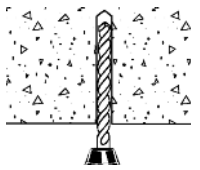


Nomenclature

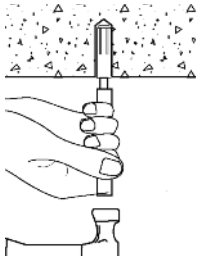
- *d* = Diameter of anchor
- d_{bit} = Diameter of drill bit
- *h* = Base material thickness. The minimum value of *h* should be 1.5h_v or 3" min. (whichever is greater)
- h_v = Minimum embedment depth
- *l* = Overall length of anchor
- T_{max} = Maximum tightening torque



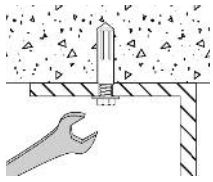
Installation Procedure



Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Do not over drill the hole unless the application calls for a subset anchor.



Blow the hole clean of dust and other materials. Insert the anchor into the hole and tap flush with surface. *Using a* ***Powers*** *setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor.* Anchor will not hold allowable loads required if shoulder of ***Powers*** setting tool does not seat against anchor.



If using a fixture, position it, insert bolt and tighten. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Type 303 Stainless Steel	Type 316 Stainless Steel
Anchor Body	AISI 1008	Type 303 Stainless Steel	Type 316 Stainless Steel
Plug	AISI 1018	Type 303 Stainless Steel	Type 316 Stainless Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A	

Stainless steel anchor components are passivated.

PERFORMANCE DATA

Ultimate Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	1,140 (5.1)	2,120 (9.5)	1,985 (8.9)	2,120 (9.5)	2,080 (9.4)	2,120 (9.5)
3/8 (9.5)	1 9/16 (39.7)	2,180 (9.8)	4,585 (20.6)	4,180 (18.8)	4,585 (20.6)	4,950 (22.3)	4,585 (20.6)
1/2 (12.7)	2 (50.8)	4,105 (18.5)	6,400 (28.8)	5,760 (25.9)	6,400 (28.8)	6,585 (29.6)	6,400 (28.8)
5/8 (15.9)	2-1/2 (63.5)	4,665 (21.0)	12,380 (55.7)	7,440 (33.5)	12,380 (55.7)	10,920 (49.1)	12,380 (55.7)
3/4 (19.1)	3-3/16 (81.0)	8,580 (38.6)	15,680 (70.6)	9,405 (41.8)	15,680 (70.6)	11,300 (50.3)	15,680 (70.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3,4]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	285 (1.3)	530 (2.4)	495 (2.2)	530 (2.4)	520 (2.3)	530 (2.4)
3/8 (9.5)	1-9/16 (39.7)	545 (2.5)	1,145 (5.2)	1,045 (4.7)	1,145 (5.2)	1,240 (5.6)	1,145 (5.2)
1/2 (12.7)	2 (50.8)	1,025 (4.6)	1,600 (7.2)	1,440 (6.5)	1,600 (7.2)	1,645 (7.4)	1,600 (7.2)
5/8 (15.9)	2-1/2 (63.5)	1,165 (5.2)	3,095 (13.9)	1,860 (8.4)	3,095 (13.9)	2,730 (12.3)	3,095 (13.9)
3/4 (19.1)	3-3/16 (81.0)	2,145 (9.7)	3,920 (17.6)	2,350 (10.5)	3,920 (17.6)	2,825 (12.6)	3,920 (17.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
4. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Steel Dropin in Structural Lightweight Concrete[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	1,060 (4.8)	1,920 (8.6)	1,360 (6.1)	1,920 (8.6)	1,660 (7.5)	1,920 (8.6)
3/8 (9.5)	1-9/16 (39.7)	3,040 (13.7)	4,120 (18.5)	3,780 (17.0)	4,120 (18.5)	4,520 (20.3)	4,120 (18.5)
1/2 (12.7)	2 (50.8)	4,240 (19.1)	5,680 (25.6)	4,840 (21.8)	5,680 (25.6)	5,460 (24.6)	5,680 (25.6)
5/8 (15.9)	2-1/2 (63.5)	6,860 (30.9)	9,640 (43.4)	7,840 (35.3)	9,640 (43.4)	8,840 (39.8)	9,640 (43.4)
3/4 (19.1)	3-3/16 (81.0)	10,280 (46.3)	15,680 (70.6)	11,700 (52.7)	15,680 (70.6)	13,120 (59.0)	15,680 (70.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Tabulated load values are for anchors installed in sand-lightweight concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

PERFORMANCE DATA

Allowable Load Capacities for Steel Dropin in Structural Lightweight Concrete[1,2,3,4]

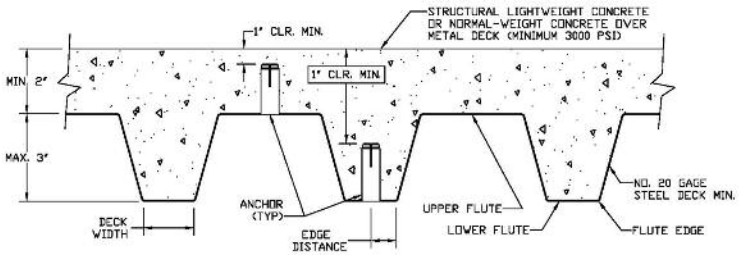
Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	265 (1.2)	480 (2.2)	340 (1.5)	480 (2.2)	415 (1.9)	480 (2.2)
3/8 (9.5)	1-9/16 (39.7)	760 (3.4)	1,030 (4.6)	945 (4.3)	1,030 (4.6)	1,130 (5.1)	1,030 (4.6)
1/2 (12.7)	2 (50.8)	1,060 (4.8)	1,420 (6.4)	1,210 (5.4)	1,420 (6.4)	1,365 (6.1)	1,420 (6.4)
5/8 (15.9)	2-1/2 (63.5)	1,715 (7.7)	2,410 (10.8)	1,960 (8.8)	2,410 (10.8)	2,210 (9.9)	2,410 (10.8)
3/4 (19.1)	3-3/16 (81.0)	2,145 (9.7)	3,920 (17.6)	2,350 (10.5)	3,920 (17.6)	2,825 (12.6)	3,920 (17.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
4. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

Ultimate and Allowable Load Capacities for Steel Dropin Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over Metal Deck, $f'_c \geq$ **3,000** (20.7 MPa)							
		Minimum 1-1/2" Wide Deck				**Minimum 4-1/2" Wide Deck**			
		Ultimate Load		**Allowable Load**		**Ultimate Load**		**Allowable Load**	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	400 (1.8)	2,040 (9.2)	100 (0.4)	510 (2.3)	760 (3.4)	2,040 (9.2)	190 (0.8)	510 (2.3)
3/8 (9.5)	1-9/16 (39.7)	600 (2.7)	2,760 (12.3)	150 (0.7)	690 (3.1)	960 (4.3)	2,760 (12.3)	240 (1.1)	690 (3.1)
1/2 (12.7)	2 (50.8)	-	-	-	-	2,740 (12.3)	5,560 (25.0)	685 (3.1)	1,390 (6.3)

1. Tabulated load values are for carbon steel and stainless steel anchors installed in sand-lightweight concrete over steel deck. 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. 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.
4. Flute edge distance equals one-half the minimum deck width.
5. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.



DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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[1]

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_{N_S} = F_{V_S} = 1.0$	$s_{min} = 1.5h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{N_C} = 1.0$	$c_{min} = 7d$	$F_{N_C} = 0.90$
	Shear	$c_{cr} = 14d$	$F_{V_C} = 1.0$	$c_{min} = 7d$	$F_{V_C} = 0.50$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_{N_S} = F_{V_S} = 1.0$	$s_{min} = 1.5h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{N_C} = 1.0$	$c_{min} = 7d$	$F_{N_C} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{V_C} = 1.0$	$c_{min} = 7d$	$F_{V_C} = 0.50$

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

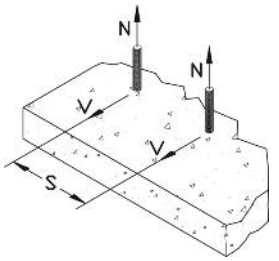
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight and Lightweight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
h_v (in.)		1	1-1/2	2	2-1/2	3
s_{cr} (in.)		3	4-1/2	6	7-1/2	9
s_{min} (in.)		1-1/2	2-1/4	3	3-3/4	4-1/2
Spacing, s (inches)	1-1/2	0.50				
	2-1/4	0.75	0.50			
	3	1.00	0.67	0.50		
	3-3/4		0.83	0.63	0.50	
	4		0.89	0.67	0.53	
	4-1/2		1.000	0.75	0.60	0.50
	5			0.83	0.67	0.56
	6			1.00	0.80	0.67
	7-1/2				1.00	0.83
	9					1.00

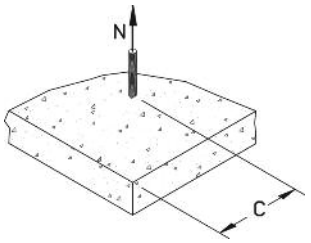
Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{NC}) (Normal-Weight concrete only)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3-1/2	5-1/4	7	8-3/4	10-1/2
c_{min} (in.)		1-3/4	2-5/8	3-1/2	4-3/8	5-1/4
Edge Distance, c (inches)	1-3/4	0.90				
	2	0.91				
	2-5/8	0.95	0.90			
	3	0.97	0.91			
	3-1/2	1.00	0.93	0.90		
	4-3/8		0.97	0.93	0.90	
	5-1/4		1.00	0.95	0.92	0.90
	6			0.97	0.94	0.91
	7			1.00	0.96	0.93
	8				0.98	0.95
	8-3/4				1.00	0.97
	10-1/2					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 90% of load for normal-weight concrete and 80% of load for lightweight concrete.



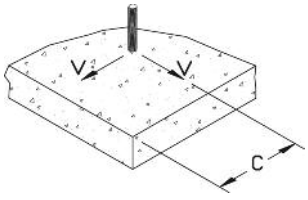
Edge Distance, Tension (F_{NC}) (Lightweight concrete only)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3-1/2	5-1/4	7	8-3/4	10-1/2
c_{min} (in.)		1-3/4	2-5/8	3-1/2	4-3/8	5-1/4
Edge Distance, c (inches)	1-3/4	0.80				
	2	0.83				
	2-5/8	0.90	0.80			
	3	0.94	0.83			
	3-1/2	1.00	0.87	0.80		
	4-3/8		0.93	0.85	0.80	
	5-1/4		1.00	0.90	0.84	0.80
	6			0.94	0.87	0.83
	7			1.00	0.92	0.87
	8				0.97	0.90
	8-3/4				1.00	0.93
	10-1/2					1.00

Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3-1/2	5-1/4	7	8-3/4	10-1/2
c_{min} (in.)		1-3/4	2-5/8	3-1/2	4-3/8	5-1/4
Edge Distance, c (inches)	1-3/4	0.50				
	2	0.57				
	2-5/8	0.75	0.50			
	3	0.86	0.57			
	3-1/2	1.00	0.67	0.50		
	4-3/8		0.83	0.63	0.50	
	5		0.95	0.71	0.57	
	5-1/4		1.00	0.75	0.60	0.50
	6			0.86	0.69	0.57
	7			1.00	0.80	0.67
	8				0.91	0.76
	8-3/4				1.00	0.83
	10					0.95
	10-1/2					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Carbon Steel Smooth Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6304	1/4"	1"	7/16"	100	1,000	2	-
6306	3/8"	1-9/16"	5/8"	50	500	6	FM/UL
6308	1/2"	2"	13/16"	50	250	12	FM/UL
6320	5/8"	2-1/2"	1-3/16"	25	125	32	FM/UL
6312	3/4"	3-3/16"	1-3/8"	10	50	48	FM/UL

Carbon Steel Knurled Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6340	1/4"	1"	7/16"	100	1,000	2	-
6342	3/8"	1-9/16"	5/8"	50	500	6	-
6344	1/2"	2"	13/16"	50	250	12	-

Carbon Steel Flanged Dropin (Lipped)

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6324	1/4"	1"	7/16"	100	1,000	2	-
6326	3/8"	1-9/16"	5/8"	50	500	6	FM/UL
6328	1/2"	2"	13/16"	50	250	12	FM/UL

Type 303 Stainless Steel Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6204	1/4"	1"	7/16"	100	1,000	2	-
6206	3/8"	1-9/16"	5/8"	50	500	6	FM/UL
6208	1/2"	2"	13/16"	50	250	12	FM/UL
6210	5/8"	2-1/2"	1-3/16"	25	125	32	FM/UL
6212	3/4"	3-3/16"	1-3/8"	10	50	48	FM/UL

Type 316 Stainless Steel Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6224	1/4"	1"	7/16"	100	1,000	2	-
6226	3/8"	1-9/16"	5/8"	50	500	6	FM/UL
6228	1/2"	2"	13/16"	50	250	12	FM/UL
6230	5/8"	2-1/2"	1-3/16"	25	125	32	FM/UL
6232	3/4"	3-3/16"	1-3/8"	10	50	48	FM/UL

Carbon Steel Coil Thread Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6330	1/2"	2"	13/16"	50	250	12	-
6332	3/4"	3-3/16"	1-3/8"	10	50	48	-

Setting Tools for Steel Dropin

Cat. No.	6305	6307	6309	6311	6313
Rod/Anchor Size	1/4"	3/8"	1/2"	5/8"	3/4"
Pin Length	39/64"	61/64"	1-3/16"	1-5/16"	1-61/64"

Mini Dropin™ *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Mini Dropin is a carbon steel machine bolt anchor for use in shallow embedment applications. In addition to solid concrete and precast hollow core plank, it can be used in post-tensioned concrete slabs and concrete pours over steel deck.

GENERAL APPLICATIONS AND USES

- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Fire Sprinkler
- Utilities
- Suspended Lighting

FEATURES AND BENEFITS

+ Anchor design allows for shallow embedment
+ Internally threaded anchor for easy bolt removability and service work
+ Ideal for precast hollow core plank and post-tensioned concrete slabs
+ Lip provides flush installation and consistent embedment
+ Setting tool scores flange when set to verify proper expansion depth

APPROVALS AND LISTINGS

Tested in accordance with ASTM E 488 and AC01 criteria
Factory Mutual Research Corporation (FM Approvals) – File No. J.I. 3002071
See listing for applicable sizes - www.fmglobal.com

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.* Anchors shall be Mini Dropin anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Mini Dropin

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" diameter to 1/2" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Structural Lightweight Concrete
Precast Hollow Core Plank
Concrete Over Steel Deck

MATERIAL AND INSTALLATION SPECIFICATIONS

Material Specification

Anchor Component	Carbon Steel
Anchor Body	SAE 1009
Plug	SAE 1009
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

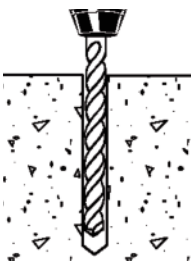
Installation Specification

Dimension	Rod/Anchor Diameter, *d*		
	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8
Maximum Tightening Torque, T_{max}, (ft-lbs)	3	5	10
Thread Size (UNC)	1/4-20	3/8-16	1/2-13
Thread Depth (in.)	3/8	13/32	5/8
Overall Anchor Length (in.)	5/8	3/4	1

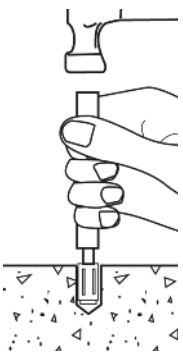
Installation Guidelines

Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.

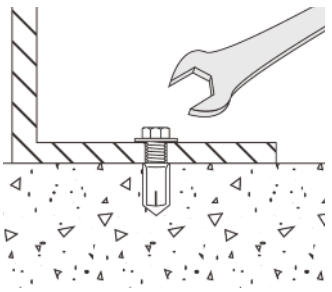
In post-tensioned concrete slabs, take care to avoid drilling into the post-tensioned cables.



Blow the hole clean of dust and other materials. Insert the anchor into the hole and tap flush with surface. Using a ***Powers*** setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor. Anchor will not hold allowable loads required if shoulder of ***Powers*** setting tool does not seat against anchor.



If using a fixture, position it, insert bolt and tighten. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.



PERFORMANCE DATA

Ultimate Load Capacities for Mini Dropin in Normal-Weight Concrete[1,2]

Rod/Anchor Size d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1,400 (6.3)	1,260 (5.7)	1,400 (6.3)	1,650 (7.4)	1,400 (6.3)	1,650 (7.4)
3/8 (9.5)	3/4 (19.1)	1,980 (8.9)	2,700 (12.2)	2,120 (9.5)	4,220 (19.0)	2,270 (10.2)	4,220 (19.0)
1/2 (12.7)	1 (25.4)	3,360 (15.1)	4,400 (19.8)	3,360 (15.1)	4,875 (21.9)	3,750 (16.9)	4,875 (21.9)

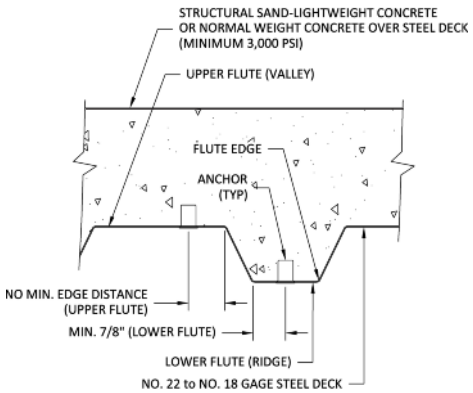
1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Mini Dropin in Normal-Weight Concrete[1,2]

Rod/Anchor Size d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	350 (1.6)	315 (1.4)	350 (1.6)	415 (1.9)	350 (1.6)	415 (1.9)
3/8 (9.5)	3/4 (19.1)	495 (2.2)	675 (3.0)	530 (2.4)	1,055 (4.7)	570 (2.6)	1,055 (4.7)
1/2 (12.7)	1 (25.4)	840 (3.8)	1,100 (5.0)	840 (3.8)	1,220 (5.5)	940 (4.2)	1,220 (5.5)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Installation Detail for Mini Dropin Installed Through Soffit of Steel Deck into Concrete



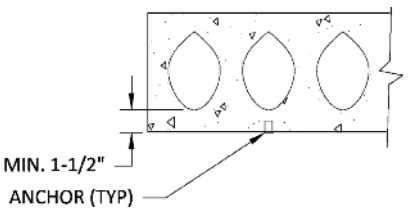
Ultimate and Allowable Load Capacities for Mini Dropin Installed Through Steel Deck into Structural Lightweight Concrete[1,2,3]

Rod/Anchor Size d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Lightweight Concrete Over Min. 20 Ga. Steel Deck. $f'_c \geq$ **3,000 psi** (20.7 MPa)			
		Minimum 1-3/4" Wide Deck			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	740 (3.3)	1,880 (8.5)	185 (0.8)	470 (2.1)
3/8 (9.5)	3/4 (19.1)	880 (4.0)	2,040 (9.2)	220 (1.0)	510 (2.3)
1/2 (12.7)	1 (25.4)	1,380 (6.2)	2,120 (9.5)	345 (1.6)	530 (2.4)

1. The metal deck shall be No. 22 gage to No. 18 gage thick steel [0.030-inch to 0.047-inch base metal thickness (0.75 mm to 1.20 mm)].
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Tabulated load values are for anchors installed with a minimum edge distance of 7/8" when installed through the lower flute. Anchors installed through the upper flute may be in any location provided the proper installation procedures are maintained.

PERFORMANCE DATA

Installation Detail for Mini Dropin Installed in Precast Hollow Core Concrete plank



Ultimate and Allowable Load Capacities for Mini Dropin in Precast Hollow Core Concrete Plank[1,2]

Rod/ Anchor Size d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Spacing in. (mm)	Minimum Edge Distance in. (mm)	Min. Concrete Compressive Strength $f'_c \geq$ 5,000 psi (34.5 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3 (76.2)	3 (76.2)	2,360 (10.6)	1,840 (8.3)	590 (2.7)	460 (2.1)
3/8 (9.5)	3/4 (19.1)	4-1/2 (114.3)	4-1/2 (114.3)	2,600 (11.7)	3,400 (15.3)	650 (2.9)	850 (3.8)
1/2 (12.7)	1 (25.4)	6 (152.4)	6 (152.4)	2,600 (11.7)	3,540 (15.9)	650 (2.9)	885 (4.0)

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 listed are calculated using and applied safety factor of 4.0.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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[1,2,3]

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_{N_S} = F_{V_S} = 1.0$	$s_{min} = 1.5h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{N_C} = F_{V_C} = 1.0$	$c_{min} = 6d$	$F_{N_C} = 0.90$
	Shear[1]	$c_{cr} = 12d$	$F_{N_C} = F_{V_C} = 1.0$	$c_{min} = 6d$	$F_{V_C} = 0.75$

1. Allowable loads for anchors loaded in shear parallel to the edge have no load factor $F_{V_C} = 1.0$ when installed at minimum edge distances.
2. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

Anchor Installed in Through Steel Deck Structural Lightweight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_{N_S} = F_{V_S} = 1.0$	$s_{min} = 1.5h_v$	$F_{N_S} = F_{V_S} = 0.50$

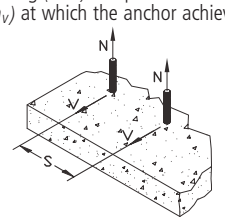
3. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing is less than critical distances. Linear interpolation is allowed for intermediate anchor spacing between critical and minimum distances. Multiple reduction factors for anchor spacing may be required depending on the anchor group configuration.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-weight and Lightweight Concrete

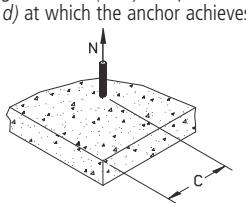
Spacing, Tension (F_{N_s}) & Shear (F_{V_s}) (Normal-weight and Lightweight Concrete over deck)				
Dia. (in.)		1/4	3/8	1/2
h_v (in.)		5/8	3/4	1
s_{cr} (in.)		1-7/8	2-1/4	3
s_{min} (in.)		1	1-1/8	1-1/2
Spacing, s (in.)	1	0.50		
	1-1/8	0.60	0.50	
	1-1/2	0.80	0.67	0.50
	1-7/8	1.00	0.83	0.63
	2		0.89	0.67
	2-1/4		1.00	0.75
	2-1/2			0.83
	3			1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load.
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



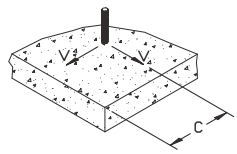
Edge Distance, Tension (F_{N_c}) (Normal-weight concrete only)				
Dia. (in.)		1/4	3/8	1/2
c_{cr} (in.)		3	4-1/2	6
c_{min} (in.)		1-1/2	2-1/4	3
Edge Distance, c (in)	1-1/2	0.90		
	2	0.93		
	2-1/4	0.95	0.90	
	2-1/2	0.97	0.91	
	3	1.00	0.93	0.90
	4		0.98	0.93
	4-1/2		1.00	0.95
	5			0.97
	6			1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.
Minimum edge distance (c_{min}) is equal to 6 anchor diameters ($6d$) at which the anchor achieves 90% of load.



Edge Distance, Shear (F_{V_c}) (Normal-weight concrete only)				
Dia. (in.)		1/4	3/8	1/2
c_{cr} (in.)		3	4-1/2	6
c_{min} (in.)		1-1/2	2-1/4	3
Edge Distance, c (in)	1-1/2	0.75		
	2	0.83		
	2-1/4	0.88	0.75	
	2-1/2	0.92	0.78	
	3	1.00	0.83	0.75
	4		0.94	0.83
	4-1/2		1.00	0.88
	5			0.92
	6			1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.
Minimum edge distance (c_{min}) is equal to 6 anchor diameters ($6d$) at which the anchor achieves 75% of load.



ORDERING INFORMATION

Carbon Steel Mini Dropin

Cat No.	Rod/Anchor Dia.	Drill Diameter	Overall Length	Standard Box	Standard Ctn.
6335	1/4"	3/8"	5/8"	100	1,000
6322	3/8"	1/2"	3/4"	100	1,000
6337	1/2"	5/8"	1"	50	500

Setting Tool for Mini Dropin

Cat No.	Mini Dropin Size	Standard Box	Standard Carton
6336	1/4"	1	50
6323	3/8"	1	50
6338	1/2"	1	50

Accu-Bit™ Drill Stop for Mini Dropin

Cat No.	Rod/Anchor Size	Standard Box
0398	1/2" Accu-Bit for 3/8" Mini-Dropin	1

Hollow-Set Dropin™ *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Hollow-Set Dropin anchor is designed for anchoring in hollow base materials such as hollow concrete block and precast hollow core plank. It can also be used in solid base materials.

Precast plank or concrete masonry blocks often have a maximum outer wall thickness of 1-1/2". During the drilling process, spalling on the back side of the wall often decreases the wall thickness, leaving only 1" or less for anchoring. The Hollow-Set Dropin is designed to perform in this environment, where most conventional style anchors will not function properly.

GENERAL APPLICATIONS AND USES

- Anchoring to Concrete Block
- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Fastening to Precast Hollow Core Plank
- Fire Sprinkler
- Suspended Lighting
- Removable Anchorage

FEATURES AND BENEFITS

+ Internally threaded anchor for easy bolt removability and service work
+ Unique expansion design allows for anchoring in thin-walled base materials such as hollow concrete block and precast hollow core plank
+ Versatile setting options allows for hollow or solid base materials
+ Tested in accordance with ASTM E488 and AC01 criteria

APPROVALS AND LISTINGS

FM Global (Factory Mutual) - File No. 15219/1952, 3/8", 1/2" and 5/8" diameters. Pipe hanger components for automatic sprinkler systems
Underwriters Laboratories (UL) File EX 1289 (Hanger, Pipe), 3/8", 1/2" and 5/8".

GUIDE SPECIFICATIONS

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

SECTION CONTENTS

Hollow-Set Dropin

ANCHOR MATERIALS

Zamac Alloy Anchor Body with
Carbon Steel Cone or
Type 304 Stainless Steel Cone

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 5/8" diameter

SUITABLE BASE MATERIALS

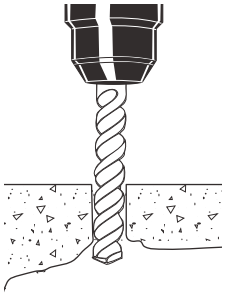
Normal-Weight Concrete
Precast Hollow Core Plank
Hollow Concrete Masonry (CMU)
Brick Masonry

INSTALLATION SPECIFICATIONS

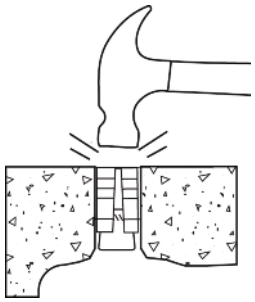
Dimension	Rod/Anchor Diameter, *d*				
	1/4"	5/16"	3/8"	1/2"	5/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	5/8	5/8	3/4	1
Maximum Tightening Torque, T_{max} (ft.-lbs)	3-4	5-7	8-10	15-20	30-40
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Overall Anchor Length (in.)	7/8	1-5/16	1-5/16	1-3/4	2
Sleeve Length (in.)	5/8	15/16	15/16	1-1/4	1-1/2
Thread Length In Cone (in.)	3/8	5/8	5/8	3/4	1

Installation Guidelines for Hollow Base Materials

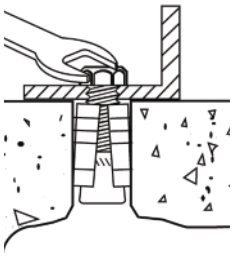
In hollow base materials, drill through into the cell or void. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



Blow the hole clean of dust and other materials. Do not expand the anchor prior to installation. Insert cone end and tap flush to surface.

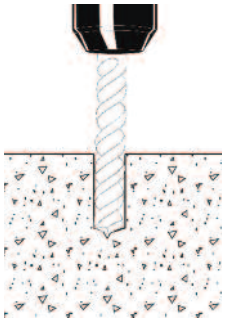


Position fixture, insert bolt and tighten. The bolt should engage a minimum of 2/3 of the anchor threads. The anchor can also be expanded using a Hollow-Set Tool. (If Hollow-Set Tool is used, thread anchor onto tool prior to tapping into anchor hole. When flush with surface, turn tool clockwise to tighten. Release tool from set anchor by turning counterclockwise. Fixture can then be attached).

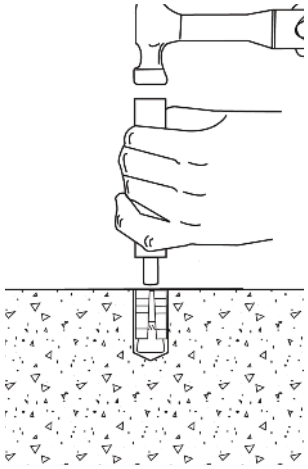


Installation Guidelines for Solid Base Materials

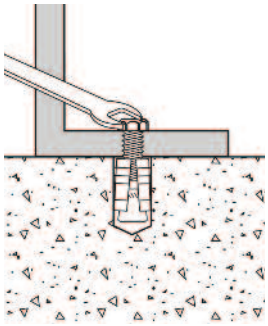
Drill a hole into the base material to the required embedment depth. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



Blow the hole clean of dust and other materials. Insert the anchor into the hole. Position the setting tool in the anchor.



Using the Solid Tool, set the anchor by driving the Zamac sleeve over the cone using several sharp hammer blows. Be sure the anchor is at the required embedment depth, so that anchor threads do not protrude above the surface of the base material. Position the fixture, insert bolt or threaded rod and tighten.



MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Stainless Steel
Anchor Body	Zamac Alloy	Zamac Alloy
Cone	AISI C 1008	Type 304 Stainless Steel
Plating (Cone)	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A

PERFORMANCE DATA

Ultimate Load Capacities for Hollow-Set Dropin in Normal-Weight Concrete[1,2,3]

Rod/ Anchor Diameter d in. (mm)	Min. Embed. Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Concrete Compressive Strength (f'_c)					
			2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/4 (19.1)	3/8	760 (3.4)	1,200 (5.4)	1,140 (5.1)	1,200 (5.4)	1,440 (6.5)	1,200 (5.4)
	7/8 (22.2)		880 (4.0)	1,440 (6.5)	1,145 (5.2)	1,440 (6.5)	2,045 (9.2)	1,440 (6.5)
5/16 (7.9)	1 (25.4)	5/8	1,120 (5.0)	1,980 (8.9)	1,680 (7.6)	1,980 (8.9)	2,200 (9.9)	1,980 (8.9)
	1-1/2 (38.1)		2,205 (9.9)	2,740 (12.3)	2,775 (12.5)	2,740 (12.3)	4,825 (21.7)	2,740 (12.3)
3/8 (9.5)	1 (25.4)	5/8	1,370 (6.2)	2,550 (11.5)	2,070 (9.3)	2,550 (11.5)	2,290 (10.3)	2,550 (11.5)
	1-1/2 (38.1)		2,445 (11.0)	3,145 (14.2)	2,800 (12.5)	3,145 (14.2)	5,085 (22.9)	3,145 (14.2)
1/2 (12.7)	1-1/2 (38.1)	3/4	2,140 (9.6)	4,020 (18.1)	4,025 (18.1)	4,020 (18.1)	7,285 (32.8)	4,020 (18.1)
	2 (50.8)		2,780 (12.5)	4,020 (18.1)	4,375 (19.7)	4,020 (18.1)	9,455 (42.5)	4,020 (18.1)
5/8 (15.9)	2-1/4 (57.2)	1	5,725 (25.8)	6,400 (28.8)	9,410 (42.3)	6,400 (28.8)	10,500 (46.6)	6,400 (28.8)

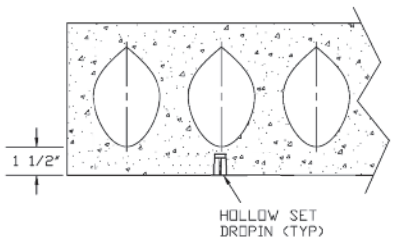
1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.

Allowable Load Capacities for Hollow-Set Dropin in Normal-Weight Concrete[1,2,3,4]

Rod/ Anchor Diameter d in. (mm)	Min. Embed. Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Concrete Compressive Strength (f'_c)					
			2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	3/4 (19.1)	3/8	190 (0.9)	300 (1.4)	285 (1.3)	300 (1.4)	360 (1.6)	300 (1.4)
	7/8 (22.2)		220 (1.0)	360 (1.6)	285 (1.3)	360 (1.6)	510 (2.3)	360 (1.6)
5/16 (7.9)	1 (25.4)	5/8	280 (1.3)	495 (2.2)	420 (1.9)	495 (2.2)	550 (2.5)	495 (2.2)
	1-1/2 (38.1)		550 (2.5)	685 (3.0)	695 (3.1)	685 (3.0)	1,205 (5.4)	685 (3.0)
3/8 (9.5)	1 (25.4)	5/8	345 (1.6)	640 (2.9)	520 (2.3)	640 (2.9)	575 (2.6)	640 (2.9)
	1-1/2 (38.1)		610 (2.7)	785 (3.5)	700 (3.0)	785 (3.5)	1,270 (5.7)	785 (3.5)
1/2 (12.7)	1-1/2 (38.1)	3/4	535 (2.4)	1,005 (4.5)	1,005 (4.5)	1,005 (4.5)	1,820 (8.2)	1,005 (4.5)
	2 (50.8)		695 (3.1)	1,005 (4.5)	1,095 (4.9)	1,005 (4.5)	2,365 (10.6)	1,005 (4.5)
5/8 (15.9)	2-1/4 (57.2)	1	1,430 (6.4)	1,600 (7.2)	2,355 (10.6)	1,600 (7.2)	2,625 (11.7)	1,600 (7.2)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
4. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

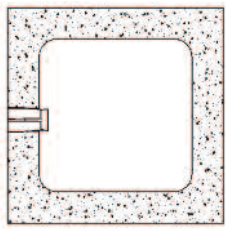
PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Hollow Core Plank[1,2]

Rod/ Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Concrete Compressive Strength $f'_c \geq$ 5,000 psi (34.5 MPa)			
			Ultimate Load		Allowable Load[2]	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	3/8	1,190 (5.4)	1,440 (6.5)	300 (1.4)	360 (1.6)
5/16 (7.9)	1 (25.4)	5/8	2,280 (10.3)	2,740 (12.3)	570 (2.6)	685 (3.1)
3/8 (9.5)	1 (25.4)	5/8	2,525 (11.4)	2,740 (12.3)	630 (2.8)	685 (3.1)
	1-1/2 (38.1)	5/8	3,620 (16.3)	3,145 (14.2)	905 (4.1)	785 (3.5)
1/2 (12.7)	1-1/4 (31.8)	3/4	5,420 (24.4)	5,580 (25.1)	1,355 (6.1)	1,395 (6.3)
5/8 (15.9)	1-1/2 (38.1)	1	6,560 (29.2)	8,320 (37.4)	1,640 (7.3)	2,080 (9.4)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones and set with sleeve flush to surface of the plank and with setting tool for solid base materials.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.



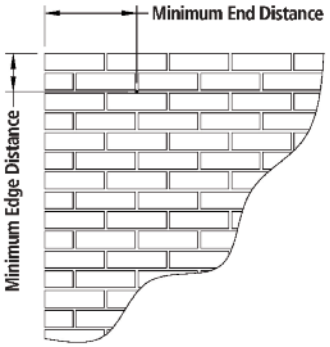
Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Hollow Concrete Masonry[1,2,3]

Rod/ Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Drill Bit Diameter d_{bit} in.	$f'_m \geq$ 1,500 psi (10.4 MPa)			
			Ultimate Load		Allowable Load[2]	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8* (22.2)	3/8	530 (2.4)	1,575 (7.1)	105 (0.5)	315 (1.4)
5/16 (7.9)	1* (25.4)	5/8	1,035 (4.7)	1,815 (8.2)	205 (0.9)	365 (1.6)
3/8 (9.5)	1* (25.4)	5/8	1,225 (5.5)	2,485 (11.2)	245 (1.1)	495 (2.2)
1/2 (12.7)	1-1/4* (31.8)	3/4	1,790 (8.1)	3,655 (16.4)	360 (1.6)	730 (3.3)
5/8 (15.9)	1-1/2* (38.1)	1	1,790 (8.1)	3,740 (16.8)	360 (1.6)	750 (3.4)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. 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 cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
3. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.

* Anchors were installed with sleeve flush to face shell surface and with setting tool for hollow base materials.

PERFORMANCE DATA



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

Rod/ Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Structural Brick 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)	7/8 (22.2)	6 (152.4)	8 (203.2)	880 (4.0)	1,640 (7.4)	175 (0.8)	330 (1.5)
5/16 (9.5)	1-1/4 (31.8)	8 (203.2)		1,460 (6.6)	2,230 (10.0)	290 (1.3)	445 (2.0)
3/8 (12.7)	1-1/4 (31.8)	8 (203.2)		1,860 (8.4)	2,980 (13.4)	370 (1.7)	595 (2.7)
1/2 (15.9)	1-1/2 (38.1)	10 (254.0)		3,240 (14.6)	4,230 (19.0)	650 (2.9)	845 (3.8)
5/8 (19.1)	2-1/4 (57.2)	12 (304.8)		4,680 (21.1)	6,420 (28.9)	935 (4.2)	1,605 (7.2)

1. Tabulated load values are for anchors with carbon or stainless steel cones.
2. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
3. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
4. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 8 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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[1]

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_{N_S} = F_{V_S} = 1.0$	$s_{min} = 1.5h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{N_C} = 1.0$	$c_{min} = 8d$	$F_{N_C} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{V_C} = 1.0$	$c_{min} = 8d$	$F_{V_C} = 0.50$

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

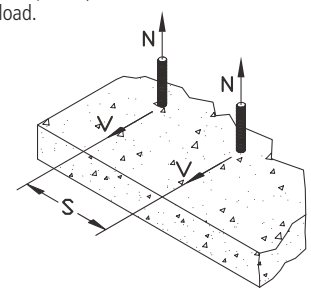
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})						
Dia. (in.)		1/4	5/16	3/8	1/2	5/8
h_v (in.)		7/8	1-1/2	1-1/2	2	2-1/4
s_{cr} (in.)		2-5/8	4-1/2	4-1/2	6	6-3/4
s_{min} (in.)		1-3/8	2-1/4	2-1/4	3	3-3/8
Spacing, s (inches)	1-3/8	0.50				
	2-1/4	0.86	0.50	0.50		
	2-5/8	1.00	0.58	0.58		
	3		0.67	0.67	0.50	
	3-3/8		0.75	0.75	0.56	0.50
	4		0.89	0.89	0.67	0.59
	4-1/2		1.00	1.00	0.75	0.67
	5				0.83	0.74
	6				1.00	0.89
	6-3/4					1.00

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

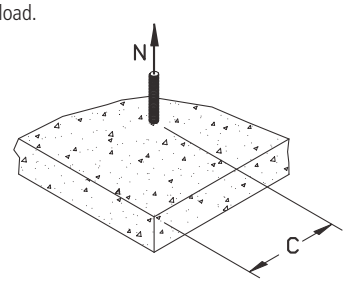
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{NC})						
Dia. (in.)		1/4	5/16	3/8	1/2	5/8
c_{cr} (in.)		3-1/2	4-3/8	5-1/4	7	8-3/4
c_{min} (in.)		2	2-1/2	3	4	5
Edge Distance, c (inches)	2	0.80				
	2-1/2	0.87	0.80			
	3	0.93	0.85	0.80		
	3-1/2	1.00	0.91	0.84		
	4		0.96	0.89	0.80	
	4-3/8		1.00	0.92	0.83	
	5			0.98	0.87	0.80
	5-1/4			1.00	0.88	0.81
	6				0.93	0.85
	7				1.00	0.91
	8					0.96
	8-3/4					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

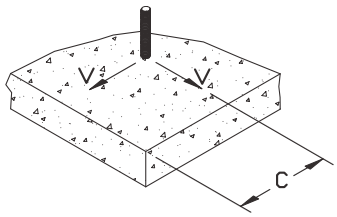
Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_{VC})						
Dia. (in.)		1/4	5/16	3/8	1/2	5/8
c_{cr} (in.)		3-1/2	4-3/8	5-1/4	7	8-3/4
c_{min} (in.)		2	2-1/2	3	4	5
Edge Distance, c (inches)	2	0.50				
	2-1/2	0.67	0.50			
	3	0.83	0.63	0.50		
	3-1/2	1.00	0.77	0.61		
	4		0.90	0.72	0.50	
	4-3/8		1.00	0.81	0.56	
	5			0.94	0.67	0.50
	5-1/4			1.00	0.71	0.53
	6				0.83	0.63
	7				1.00	0.77
	8					0.90
	8-3/4					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Hollow-Set Dropin with Carbon Steel Cone

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Sleeve Length	Std. Box	Std. Ctn.	Wt./ 100
9320	1/4"	3/8"	7/8"	5/8"	100	1,000	1-3/4
9330	5/16"	5/8"	1-5/16"	15/16"	50	500	5-1/2
9340	3/8"	5/8"	1-5/16"	15/16"	50	300	5-1/2
9350	1/2"	3/4"	1-3/4"	1-1/4"	50	250	9-1/2
9360	5/8"	1"	2"	1-1/2"	25	125	21

Hollow-Set Dropin with Stainless Steel Cone

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Sleeve Length	Std. Box	Std. Ctn.	Wt./ 100
9420	1/4"	3/8"	7/8"	5/8"	100	1,000	1-3/4
9440	3/8"	5/8"	1-5/16"	15/16"	100	500	5-1/2

Setting Tool for Solid Base Materials

Catalog Number	Size	Standard Box	Standard Carton
9322	1/4"	1	1
9342	5/16" and 3/8"	1	1
9352	1/2"	1	1
9362	5/8"	1	1

Setting Tool for Hollow Base Materials*

Catalog Number	Size	Standard Box	Standard Carton
9323	1/4"	1	1
9333	5/16"	1	1
9343	3/8"	1	1
9353	1/2"	1	1
9363	5/8"	1	1

* Hollow set tool for hollow block and clay brick masonry base materials.

Double *Shield Expansion Anchor*

PRODUCT DESCRIPTION

The Double is a dual expansion machine bolt anchor particularly suited for materials of questionable strength. It can be used in solid concrete, block, brick, and stone. Job site tests are recommended when used in base materials of questionable strength.

FEATURES AND BENEFITS

- Performs in base material of questionable strength
- Internally threaded anchor for easy removability and service work
- Corrosion resistant body

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 3

GUIDE SPECIFICATIONS

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

SECTION CONTENTS

Double

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Hollow Concrete Masonry (CMU)
Brick Masonry

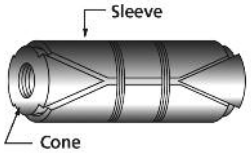
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	3/4	7/8	1	1-1/4
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Sleeve Length (in.)	1	1-3/16	1-9/16	2	2-1/4	3-1/4
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11	3/4-10
Thread Length In Cone (in.)	1/2	1/2	5/8	3/4	7/8	1-1/8
Overall Anchor Length (in.)	1-3/8	1-5/8	2	2-1/2	2-3/4	3 15/16

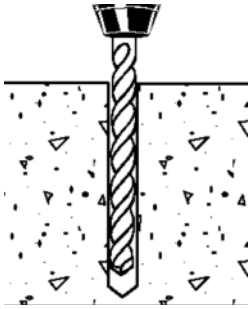
Material Specifications

Anchor Component	Component Material
Anchor Shield	Zamac Alloy
Cone	Zamac Alloy

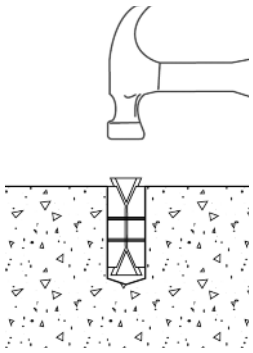


Installation Guidelines

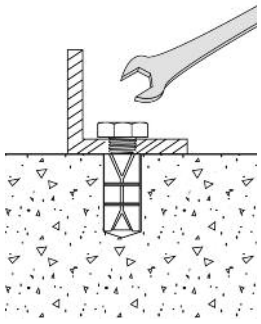
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not expand the anchor prior to installation. Do not over drill the hole unless the application calls for a subset anchor.



Insert anchor into the hole, threaded cone end first until the outer sleeve is flush with the surface of the base material.



Position fixture, then insert screw or bolt and tighten. For maximum expansion, the upper cone should protrude slightly before setting. The bolt must engage a minimum of 2/3 of the anchor threads.



PERFORMANCE DATA

Ultimate Load Capacities for Double Expansion Anchor in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1-1/4 (31.8)	710 (3.2)	1,110 (5.0)	900 (4.0)	1,135 (5.2)	1,220 (5.5)	1,335 (6.0)
5/16 (7.9)	1-1/2 (38.1)	1,130 (5.1)	1,735 (7.8)	1,500 (6.7)	2,020 (9.1)	2,160 (9.7)	2,155 (9.7)
3/8 (9.5)	1-3/4 (44.5)	1,365 (6.1)	2,690 (12.1)	2,000 (9.0)	3,000 (13.5)	3,085 (13.9)	4,030 (18.1)
1/2 (12.7)	2-1/4 (57.2)	2,590 (11.7)	3,740 (16.8)	3,550 (16.0)	4,310 (19.4)	4,645 (20.9)	6,930 (31.2)
5/8 (15.9)	2-1/2 (63.5)	4,290 (19.3)	9,640 (43.4)	6,150 (27.7)	10,270 (46.2)	6,890 (81.0)	11,580 (52.2)
3/4 (19.1)	3-1/2 (88.9)	6,000 (27.0)	10,920 (49.2)	8,150 (36.7)	13,330 (60.0)	11,510 (51.8)	14,480 (65.2)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.

Allowable Load Capacities for Double Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1-1/4 (31.8)	180 (0.8)	280 (1.3)	225 (1.0)	285 (1.3)	305 (1.4)	335 (1.5)
5/16 (7.9)	1-1/2 (38.1)	285 (1.3)	435 (20)	375 (1.7)	505 (2.3)	540 (2.4)	540 (2.4)
3/8 (9.5)	1-3/4 (44.5)	340 (1.5)	675 (3.0)	500 (2.3)	750 (3.4)	770 (3.5)	1,010 (4.5)
1/2 (12.7)	2-1/4 (57.2)	650 (2.9)	935 (4.2)	890 (4.0)	1,080 (4.9)	1,160 (5.2)	1,735 (7.8)
5/8 (15.9)	2-1/2 (63.5)	1,075 (4.8)	2,410 (10.9)	1,540 (6.9)	2,570 (11.6)	1,725 (20.3)	2,895 (13.1)
3/4 (19.1)	3-1/2 (88.9)	1,500 (6.8)	2,730 (12.3)	2,040 (9.2)	3,335 (15.0)	2,880 (13.0)	3,620 (16.3)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Double Expansion Anchor in Hollow Concrete Masonry[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1-1/4 (31.8)	885 (4.0)	1,350 (6.1)	175 (0.8)	270 (1.2)
5/16 (7.9)	1-1/2 (38.1)	1,295 (5.8)	1,635 (7.4)	260 (1.2)	325 (1.5)
3/8 (9.5)	1-1/2 (38.1)	1,575 (7.1)	2,160 (9.7)	315 (1.4)	430 (1.9)
1/2 (12.7)	1-1/2 (38.1)	2,710 (12.2)	3,130 (14.1)	540 (2.4)	625 (2.8)

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 cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
3. Anchors with diameters of 3/8" and 1/2" installed in hollow concrete masonry units are limited to one anchor per unit cell.

Ultimate and Allowable Load Capacities for Double Shell Expansion Anchor in Clay Brick Masonry[1,2]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Structural Brick 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)	1-1/4 (31.8)	1,175 (5.3)	1,585 (7.1)	235 (1.1)	315 (1.4)
5/16 (7.9)	1-1/2 (38.1)	1,585 (7.1)	2,040 (9.2)	315 (1.4)	410 (1.8)
3/8 (9.5)	1-3/4 (44.5)	1,830 (8.2)	3,590 (16.2)	365 (1.6)	720 (3.2)
1/2 (12.7)	2-1/4 (57.2)	3,420 (15.4)	5,185 (23.3)	685 (3.1)	1,035 (4.7)
5/8 (15.9)	2-1/2 (63.5)	4,460 (19.8)	6,055 (27.2)	890 (4.0)	1,210 (5.4)
3/4 (19.1)	3-1/2 (88.9)	6,000 (26.7)	7,935 (35.7)	1,200 (5.3)	1,585 (7.1)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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[1]

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	$s_{cr} = 10d$	$F_{Ns} = F_{vs} = 1.0$	$s_{min} = 5d$	$F_{Ns} = F_{Vc} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{Nc} = 1.0$	$c_{min} = 5d$	$F_{Nc} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{Vc} = 1.0$	$c_{min} = 5d$	$F_{Vc} = 0.50$

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

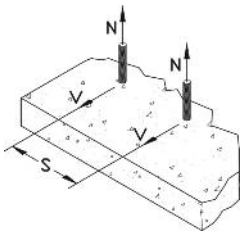
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{N_S}) & Shear (F_{V_S})							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
s_{cr} (in.)		2-1/2	3-1/8	3-3/4	5	6-1/4	7-1/2
s_{min} (in.)		1-1/4	1-9/16	1-7/8	2-1/2	3-1/8	3-3/4
Spacing, s (inches)	1-1/4	0.50					
	1-9/16	0.63	0.50				
	1-7/8	0.75	0.60	0.50			
	2-1/2	1.00	0.80	0.67	0.50		
	3-1/8		1.00	0.83	0.63	0.50	
	3-3/4			1.00	0.75	0.60	0.50
	5				1.00	0.80	0.67
	6-1/4					1.00	0.83
	7-1/2						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters ($10d$) at which the anchor achieves 100% of load.

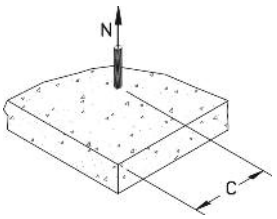
Minimum spacing (s_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{N_C})							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3-3/4	4-1/2	6	7-1/2	9
c_{min} (in.)		2	2-1/2	3	4	5	6
Edge Distance, c (inches)	2	0.80					
	2-1/2	0.90	0.80				
	3	1.00	0.88	0.80			
	3-3/4		1.00	0.90			
	4			0.93	0.80		
	4-1/2			1.00	0.85		
	5				0.90	0.80	
	6				1.00	0.88	0.80
	7-1/2					1.00	0.90
	9						1.00

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

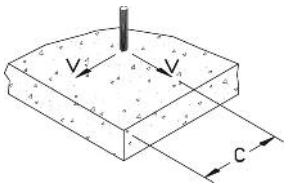
Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_{V_C})							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3-3/4	4-1/2	6	7-1/2	9
c_{min} (in.)		2	2-1/2	3	4	5	6
Edge Distance, c (inches)	2	0.50					
	2-1/2	0.75	0.50				
	3	1.00	0.70	0.50			
	3-3/4		1.00	0.75			
	4			0.83	0.50		
	4-1/2			1.00	0.63		
	5				0.75	0.50	
	6				1.00	0.70	0.50
	7-1/2					1.00	0.75
	9						1.00

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

Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Double Expansion Anchor

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Minimum Hole Depth	Standard Box	Standard Carton	Wt./ 100
9510	1/4"	1/2"	1-3/8"	1-1/4"	50	500	4
9515	5/16"	5/8"	1-5/8"	1-1/2"	50	500	7-1/2
9520	3/8"	3/4"	2"	1-3/4"	50	250	12-1/2
9525	1/2"	7/8"	2-1/2"	2-1/4"	25	250	18
9530	5/8"	1"	2-3/4"	2-1/2"	25	100	25-1/2
9535	3/4"	1-1/4"	3 15/16"	3-1/2"	10	50	54-1/2

Single *Shield Expansion Anchor*

PRODUCT DESCRIPTION

The Single is a machine bolt anchor designed for use in concrete, block, brick, and stone. The Single consists of a pre-assembled set of expansion shields and an expander cone formed from zamac alloy. As the anchor is tightened, the wedge-shaped cone is drawn into the shields, compressing them against the base material. The Single is not recommended for use in overhead applications.

FEATURES AND BENEFITS

- Readily accepts machine bolts
- Internally threaded anchor for easy removability and service work

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 2

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastening.*
Expansion anchors shall be Single as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Single

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 5/8" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete

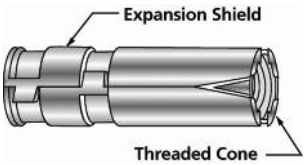
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, *d*				
	1/4"	5/16"	3/8"	1/2"	5/8"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	5/8	7/8	1
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Thread Length In Cone (in.)	5/16	5/16	5/16	7/16	5/8
Overall Anchor Length (in.)	1-5/16	1-1/2	1-1/2	2-1/16	2-5/8

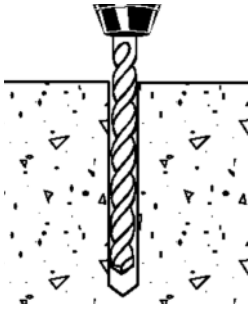
Material Specifications

Anchor Component	Component Material
Anchor Shield	Zamac Alloy
Cone	Zamac Alloy

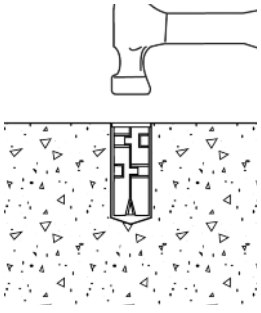


Installation Guidelines

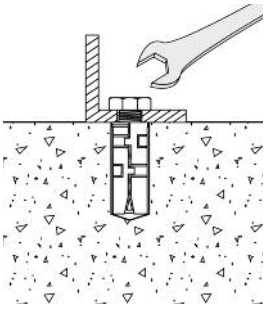
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Do not expand the anchor prior to installation. Insert anchor into the hole, threaded cone end first and tap it flush to the surface.



Position fixture, then insert bolt and tighten. The bolt must engage a minimum of 2/3 of the anchor threads.



PERFORMANCE DATA

Ultimate Load Capacities for Single Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1-3/8 (34.9)	175 (0.8)	555 (2.5)	400 (1.8)	565 (2.5)	460 (2.1)	670 (3.0)
5/16 (7.9)	1-5/8 (41.3)	830 (3.7)	1,535 (6.9)	1,260 (5.7)	1,780 (8.0)	1,475 (6.6)	1,900 (8.6)
3/8 (9.5)	1-5/8 (41.3)	1,160 (5.2)	3,050 (13.7)	2,030 (9.1)	3,225 (14.5)	2,360 (10.6)	4,570 (20.6)
1/2 (12.7)	2-1/2 (63.5)	1,495 (6.7)	3,475 (15.7)	2,450 (11.0)	4,000 (18.0)	2,550 (11.5)	6,435 (29.0)
5/8 (15.9)	2-3/4 (69.9)	2,230 (10.0)	6,425 (28.9)	3,690 (16.6)	6,845 (30.8)	3,975 (17.9)	7,720 (34.8)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Allowable Load Capacities for Single Expansion Anchor in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1-3/8 (34.9)	45 (0.2)	140 (0.6)	100 (0.5)	140 (0.6)	115 (0.5)	170 (0.8)
5/16 (7.9)	1-5/8 (41.3)	210 (0.9)	385 (1.7)	315 (1.4)	445 (2.0)	370 (1.7)	475 (2.1)
3/8 (9.5)	1-5/8 (41.3)	290 (1.3)	765 (3.4)	510 (2.3)	805 (3.6)	590 (2.7)	1,145 (5.1)
1/2 (12.7)	2-1/2 (63.5)	375 (1.7)	870 (3.9)	615 (2.8)	1,000 (4.5)	640 (2.9)	1,610 (7.2)
5/8 (15.9)	2-3/4 (69.9)	560 (2.5)	1,605 (7.2)	925 (4.2)	1,710 (7.7)	995 (4.5)	1,930 (8.7)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
2. Linear interpolation may be used to determine loads for intermediate compressive strenghts.

ORDERING INFORMATION

Single Expansion Anchor

Cat. No.	Rod/Anchor Dia.	Drill Diameter	Min. Hole Depth	Std. Box	Std. Carton	Wt./100
9650	1/4"	1/2"	1-3/8"	50	250	3-3/4
9655	5/16"	5/8"	1-5/8"	50	250	5-1/2
9665	3/8"	5/8"	1-5/8"	50	250	5-1/4
9675	1/2"	7/8"	2-1/2"	25	125	15-1/4
9685	5/8"	1"	2-3/4"	25	125	24

Calk-In *Machine Bolt Anchor*

PRODUCT DESCRIPTION

The Calk-In is a pre-assembled precision cast calking type machine bolt anchor which can be used in concrete, block, brick or stone. The Calk-In consists of an antimonial lead alloy calking sleeve and a Zamac alloy internally threaded expanded cone. This anchor is not recommended for use in overhead applications.

GENERAL APPLICATIONS AND USES

- Windows
- Screens
- Sliding Doors
- Shutters

FEATURES AND BENEFITS

+ Readily accepts machine bolts
+ Internally threaded anchor for easy removability and service work
+ Shallow embedment

APPROVALS AND LISTINGS

Federal GSA Specification – Meets descriptive and proof load requirements of CID A-A-1922A, Type 1

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastening.* Machine bolt anchors shall be Calk-In as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Calk-In

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Antimonial Lead Alloy Body and Zamac Alloy Cone

ROD/ANCHOR SIZE RANGE (TYP.)

No. 8 Screw to 1/2" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Grout-Filled Concrete Masonry (CMU)
Brick Masonry

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

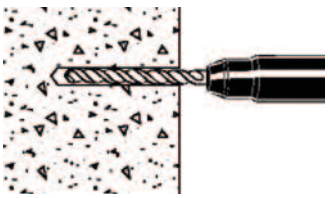
Dimension	Rod/Anchor Size					
	#8-32	#10-24	1/4"	5/16"	3/8"	1/2"
ANSI Drill Bit Size, (in.)	5/16	3/8	1/2	5/8	3/4	7/8
Max. Tightening Torque	15 (in.-lbs.)	20 (in.-lbs.)	60 (in.-lbs.)	7 (ft.-lbs.)	10 (ft.-lbs.)	15 (ft.-lbs.)
Thread Length in Cone (in.)	13/32	15/32	19/32	3/4	1	1-1/8

Material Specifications

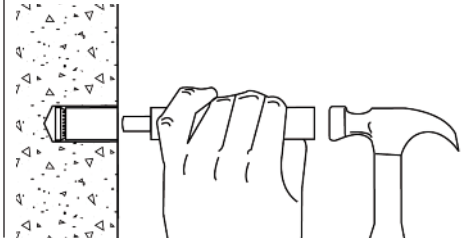
Anchor Component	Component Material
Anchor Sleeve (Body)	Antimonial Lead Alloy
Cone	Zamac Alloy

Installation Guidelines

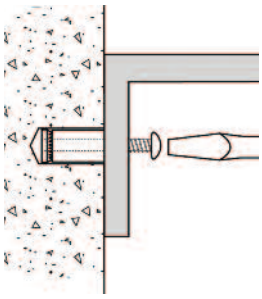
Drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not over drill the hole.



Blow the hole clean of dust and other material. Insert the anchor into the hole. Position the setting tool in the anchor.



Using the tool, set the anchor by driving the lead sleeve over the cone using several sharp hammer blows. Be sure the anchor is at the required embedment depth so that anchor threads do not protrude above the surface of the base material. Positions the fixture, insert screw or bolt and tighten.



PERFORMANCE DATA

Ultimate Load Capacities for Calk-In in Normal-Weight Concrete[1,2]

Rod/Anchor Size in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	335 (1.5)	310 (1.4)	365 (1.6)	360 (1.6)	380 (1.7)	360 (1.7)
#10-24	5/8 (15.9)	765 (3.4)	885 (4.0)	975 (4.3)	940 (4.2)	1,105 (4.9)	940 (4.2)
1/4-20	7/8 (22.2)	1,200 (5.3)	1,355 (6.1)	1,500 (6.7)	1,410 (6.3)	1,640 (7.3)	1,410 (6.3)
5/16-18	1 (25.4)	1,570 (7.0)	1,880 (8.5)	1,965 (8.7)	2,070 (9.3)	2,160 (9.6)	2,070 (9.3)
3/8-16	1-1/4 (31.8)	1,985 (8.8)	2,700 (12.2)	2,485 (11.1)	3,305 (14.9)	2,895 (12.9)	3,305 (14.9)
1/2-13	1-1/2 (38.1)	2,795 (12.4)	3,995 (18.0)	3,495 (15.5)	4,545 (20.5)	3,810 (16.9)	4,545 (20.5)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Allowable Load Capacities for Calk-In in Normal-Weight Concrete[1,2]

Rod/Anchor Size in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	85 (0.4)	75 (0.3)	90 (0.4)	90 (0.4)	95 (0.4)	90 (0.4)
#10-24	5/8 (15.9)	190 (0.8)	220 (1.0)	245 (1.1)	235 (1.1)	275 (1.2)	235 (1.1)
1/4-20	7/8 (22.2)	300 (1.3)	340 (1.5)	375 (1.7)	355 (1.6)	410 (1.8)	355 (1.6)
5/16-18	1 (25.4)	390 (1.7)	470 (2.1)	490 (2.2)	520 (2.3)	540 (2.4)	520 (2.3)
3/8-16	1-1/4 (31.8)	495 (2.2)	675 (3.0)	620 (2.8)	825 (3.7)	725 (3.2)	825 (3.7)
1/2-13	1-1/2 (38.1)	700 (3.1)	1,000 (4.5)	875 (3.9)	1,135 (5.1)	950 (4.2)	1,135 (5.1)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Calk-In in Grout-Filled Concrete Masonry[1,2]

Rod/Anchor Size in.	Minimum Embedment Depth in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	335 (1.5)	310 (1.4)	65 (0.3)	60 (0.3)
#10-24	5/8 (15.9)	740 (3.3)	885 (4.0)	150 (0.7)	175 (0.8)
1/4-20	7/8 (22.2)	880 (4.0)	1,250 (5.6)	175 (0.8)	250 (1.1)
5/16-18	1 (25.4)	1,470 (6.6)	1,585 (7.1)	295 (1.3)	315 (1.4)
3/8-16	1-1/4 (31.8)	1,700 (7.7)	2,265 (10.2)	340 (1.5)	455 (2.0)
1/2-13	1-1/2 (38.1)	2,360 (10.6)	3,210 (14.4)	470 (2.1)	640 (2.9)

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 (f'm ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Ultimate and Allowable Load Capacities for Calk-In in Clay Brick Masonry[1,2]

Rod/Anchor Size in.	Minimum Embedment Depth in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
#8-32	1/2 (12.7)	335 (1.5)	310 (1.4)	65 (0.3)	60 (0.3)
#10-24	5/8 (15.9)	765 (3.4)	890 (4.0)	150 (0.7)	180 (0.8)
1/4-20	7/8 (22.2)	1,460 (6.6)	1,480 (6.7)	290 (1.3)	295 (1.3)
5/16-18	1 (25.4)	1,730 (7.8)	1,995 (9.0)	345 (1.6)	400 (1.8)
3/8-16	1-1/4 (31.8)	2,200 (9.9)	3,600 (16.2)	440 (2.0)	720 (3.2)
1/2-13	1-1/2 (38.1)	3,200 (14.4)	4,535 (20.4)	640 (2.9)	905 (4.1)

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 ($f'm \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

ORDERING INFORMATION

Calk-In

Cat. No.	Size	Drill Diameter	Min. Hole Depth	Std. Box	Std. Carton	Wt./100
9205	#8-32	5/16"	1/2"	100	1,000	1
9210	#10-24	3/8"	5/8"	100	1,000	1-3/4
9220	1/4"-20	1/2"	7/8"	100	1,000	4-1/2
9225	5/16"-18	5/8"	1"	50	250	7-3/4
9230	3/8"-16	3/4"	1-1/4"	50	250	14
9240	1/2"-13	7/8"	1-1/2"	50	250	19

Setting Tools

Cat. No.	9201	9211	9221	9226	9231	9241
Size	#8	#10	1/4"	5/16"	3/8"	1/2"

Lag Shield *Shell Expansion Anchor*

PRODUCT DESCRIPTION

The Lag Shield is a screw style anchor designed for use with lag bolts. It is suitable for use in concrete and the mortar joints of block or brick walls. In harder masonry materials, short style Lag Shields are used to reduce drilling time. The long style version is used in soft or weak masonry to better develop strength. The Lag Shield is not recommended for overhead applications.

GENERAL APPLICATIONS AND USES

- Hard and Soft Base Materials
- Mortar Joints
- Shallow Attachments
- Masonry Anchorage

FEATURES AND BENEFITS

+ Ideal for use in masonry materials
+ Internally threaded anchor for easy removability and service work

TESTING, APPROVALS & LISTINGS

Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 1 Tested in accordance with ASTM E 488

GUIDE SPECIFICATIONS

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

SECTION CONTENTS

Short

Long

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry (CMU)
Brick Masonry

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

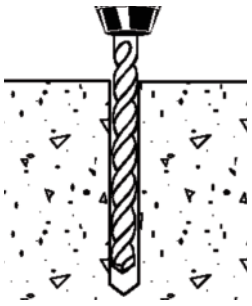
Dimension	Rod/Anchor Diameter, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	1/2	5/8	3/4	7/8	1
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Lag Bolt Size	1/4-10	5/16-9	3/8-7	1/2-6	5/8-5	3/4-4-1/2

Material Specifications

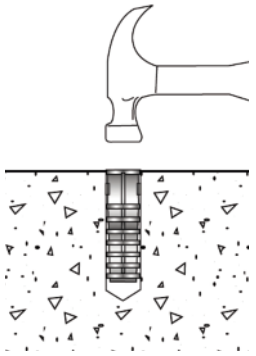
Anchor Component	Component Material
Anchor Body	Zamac Alloy

Installation Guidelines

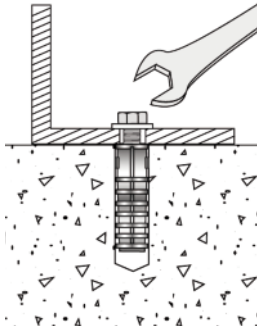
Drill a hole into the base material to the depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



Blow the hole clean of dust and other material. Insert the anchor into the hole until it is flush with the surface. If installing in a mortar joint, position the anchor to expand against the block or brick.



Position fixture, insert the lag bolt, and tighten. The lag bolt length selected should fully engage the entire anchor body.



PERFORMANCE DATA

Ultimate Load Capacities for Lag Shield in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	200 (0.9)	790 (3.5)	280 (1.2)	1,005 (4.1)	370 (1.6)	1,005 (4.5)
1/4 Long (6.4)	1-1/2 (38.1)	300 (1.3)	790 (3.5)	345 (1.5)	1,005 (4.1)	425 (1.9)	1,005 (4.5)
5/16 Short (7.9)	1-1/4 (31.8)	315 (1.4)	995 (4.4)	515 (2.3)	1,115 (4.9)	660 (2.9)	1,115 (4.9)
5/16 Long (7.9)	1-3/4 (44.5)	375 (1.7)	995 (4.4)	550 (2.4)	1,115 (4.9)	570 (2.5)	1,115 (4.9)
3/8 Short (9.5)	1-3/4 (44.5)	590 (2.6)	1,175 (5.2)	855 (3.8)	1,450 (6.4)	910 (4.0)	1,450 (6.4)
3/8 Long (9.5)	2-1/2 (63.5)	740 (3.3)	1,175 (5.2)	1,080 (4.8)	1,450 (6.4)	1,290 (5.7)	1,450 (64)
1/2 Short (12.7)	2 (50.8)	800 (3.6)	1,335 (5.9)	1,190 (5.3)	1,600 (7.1)	1,265 (5.6)	1,600 (7.1)
1/2 Long (12.7)	3 (76.2)	1,460 (6.5)	1,335 (5.9)	2,110 (9.4)	1,600 (7.1)	2,370 (10.5)	1,600 (7.1)
5/8 Short (15.9)	2 (50.8)	855 (3.8)	2,000 (8.9)	1,230 (5.5)	2,250 (10.0)	1,355 (6.0)	2,250 (10.0)
5/8 Long (15.9)	3-1/2 (88.9)	1,730 (7.7)	2,000 (8.9)	2,660 (10.8)	2,250 (10.0)	2,935 (13.0)	2,250 (10.0)
3/4 Short (19.1)	2 (50.8)	930 (4.1)	2,000 (8.9)	1,540 (6.8)	2,400 (10.6)	1,640 (17.3)	2,400 (10.6)
3/4 Long (19.1)	3-1/2 (88.9)	2,045 (9.1)	2,000 (8.9)	2,800 (12.5)	2,400 (10.6)	2,935 (13.0)	2,400 (10.6)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Allowable Load Capacities for Lag Shield in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	50 (0.2)	200 (0.9)	70 (0.3)	250 (1.1)	90 (0.4)	250 (1.1)
1/4 Long (6.4)	1-1/2 (38.1)	75 (0.3)	200 (0.9)	85 (0.4)	250 (1.1)	105 (0.5)	250 (1.1)
5/16 Short (7.9)	1-1/4 (31.8)	80 (0.3)	245 (1.1)	130 (0.6)	275 (1.2)	165 (0.7)	275 (1.2)
5/16 Long (7.9)	1-3/4 (44.5)	90 (0.4)	245 (1.1)	135 (0.6)	275 (1.2)	140 (0.6)	275 (1.2)
3/8 Short (9.5)	1-3/4 (44.5)	145 (0.6)	290 (1.3)	210 (0.9)	360 (1.6)	225 (1.0)	360 (1.6)
3/8 Long (9.5)	2-1/2 (63.5)	185 (0.8)	290 (1.3)	270 (1.2)	360 (1.6)	320 (1.4)	360 (1.6)
1/2 Short (12.7)	2 (50.8)	200 (1.9)	330 (1.5)	300 (1.3)	400 (1.8)	315 (1.4)	400 (1.8)
1/2 Long (12.7)	3 (76.2)	365 (1.6)	330 (1.5)	525 (2.3)	400 (1.8)	590 (2.6)	400 (1.8)
5/8 Short (15.9)	2 (50.8)	215 (1.9)	500 (2.2)	305 (1.1)	560 (2.5)	335 (1.5)	560 (2.5)
5/8 Long (15.9)	3-1/2 (88.9)	430 (1.9)	500 (2.2)	665 (3.0)	560 (2.5)	730 (3.2)	560 (2.5)
3/4 Short (19.1)	2 (50.8)	230 (1.0)	500 (2.2)	385 (1.7)	600 (2.7)	410 (1.8)	600 (2.7)
3/4 Long (19.1)	3-1/2 (88.9)	510 (2.3)	500 (2.2)	700 (3.1)	600 (2.7)	730 (3.2)	600 (2.7)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Lag Shield in Hollow Concrete Masonry[1,2,3,4]

Rod/Anchor Diameter *d* in. (mm)	Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	230 (1.0)	720 (3.2)	45 (0.2)	145 (0.7)
5/16 Short (7.9)	1-1/4 (31.8)	360 (1.6)	1,025 (4.6)	70 (0.3)	205 (0.9)
3/8 Short (9.5)	1-1/2 (38.1)	795 (3.6)	1,125 (5.1)	160 (0.7)	225 (1.0)
1/2 Short (12.7)	1-1/2 (38.1)	1,025 (4.6)	1,600 (7.2)	205 (0.9)	320 (1.4)

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 cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
3. Anchors with diameters of 3/8" and greater installed in hollow concrete masonry units are limited to one anchor per unit cell.
4. Anchors installed flush with face shell surface. The wall thickness of the masonry unit must be equal to or greater than the embedment depth.

Ultimate and Allowable Load Capacities for Lag Shield in Clay Brick Masonry[1,2]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 Short (6.4)	1 (25.4)	240 (1.1)	1,025 (4.6)	50 (0.2)	205 (0.9)
5/16 Short (7.9)	1-1/4 (31.8)	425 (1.9)	1,485 (6.7)	85 (0.4)	295 (1.3)
3/8 Short (9.5)	1-3/4 (44.5)	1,190 (5.4)	1,620 (7.3)	240 (1.1)	325 (1.5)
1/2 Short (12.7)	2 (50.8)	1,230 (5.5)	2,140 (9.6)	245 (1.1)	430 (1.9)

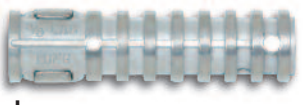
1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

ORDERING INFORMATION

Lag Shield Anchor

Catalog Number	Size	Drill Diameter	Length	Thread Length	Standard Box	Standard Carton	Wt./ 100
1051	1/4" Short	1/2"	1"	1/2"	50	500	3
1055	1/4" Long	1/2"	1-1/2"	1"	50	500	4
1101	5/16" Short	1/2"	1-1/4"	3/4"	50	500	3
1105	5/16" Long	1/2"	1-3/4"	1"	50	500	4-1/4
1151	3/8" Short	5/8"	1-3/4"	1"	50	500	6-3/4
1155	3/8" Long	5/8"	2-1/2"	1-1/2"	50	250	9-1/2
1201	1/2" Short	3/4"	2"	1-1/8"	50	500	9 1/4
1205	1/2" Long	3/4"	3"	1-7/8"	50	200	14-1/4
1251	5/8" Short	7/8"	2"	1"	25	125	13
1255	5/8" Long	7/8"	3-1/2"	2-1/4"	25	125	22
1301	3/4" Short	1"	2"	1-1/8"	25	125	16
1305	3/4" Long	1"	3-1/2"	2-1/4"	25	100	24-1/2

Short



Long

Vertigo+ *Rod Hanger Anchors*

PRODUCT DESCRIPTION

Vertigo+ is a one-piece, all steel threaded fastening system for suspending threaded rod in pipe hanging, fire protection, electrical conduit and cable-tray applications. They can be installed in a variety of base materials including normal-weight concrete, structural sand-lightweight concrete and concrete over steel deck. Vertigo+ accepts threaded rods and bolts in 1/4", 3/8" and 1/2" diameters. Vertigo+ anchors are designed for simple fast installations and for reliable performance in cracked and uncracked concrete.

GENERAL APPLICATIONS

- Hanging pipe and sprinkler systems
- Suspending conduit and cable trays
- Lighting systems and overhead utilities
- HVAC ductwork and strut channels
- Suspended ceilings

FEATURES AND BENEFITS

+ Simple system for all rod hanging applications in concrete
+ Internally threaded coupler for easy removability of service items
+ Ease and speed of installation and attachment
+ Lower in-place cost, when compared to traditional anchors
+ Can be installed with an adjustable torque impact driver
+ Consistent performance in high and low strength concrete

APPROVALS AND LISTINGS

International Code Concil, Evaluation Service (ICC-ES). ESR-2989 code compliant with the 2009 IBC, 2009 IRC, 2006 IBC, 2003 IBC, 2003 IRC and 1997 UBC
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)
Evaluated and qualified by an accredited independent testing laboratory for reliability against brittle failure, e.g. hydrogen embrittlement
Evaluated and qualified by an accredited independent testing laboratory for supplemental recognition in redundant fastening applications

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring and 05090-Metal Fastenings.*
Anchors shall be Vertigo+ 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 / Coupler head	Case hardened low carbon steel
Plating	Zinc plating according to ASTM B 633, SC1, Type II (Fe/Zn 5) Minimum plating requirement for Mild Service Condition

SECTION CONTENTS

Concrete Vertigo+

INTERNAL THREAD VERSION

Unified coarse thread (UNC)

ANCHOR MATERIALS

Zinc Plated Carbon Steel
(Yellow Dichromate Finish)

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" diameter through 1/2" diameter

SUITABLE BASE MATERIALS

Normal-weight concrete
Structural sand-lightweight concrete
Concrete over steel deck

This Product Available In

PDA®

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

INSTALLATION SPECIFICATIONS

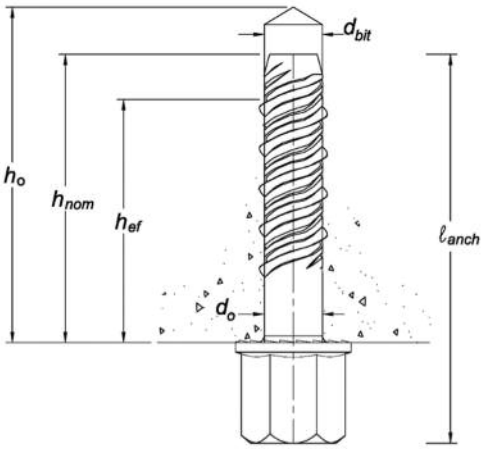
Installation Table for Vertigo+

Anchor Property/ Setting Information	Symbol	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4	3/8	1/2
Nominal anchor shank diameter	d_o	in.	0.375 (9.5)	0.375 (9.5)	0.375 (9.5)
Nominal drill bit diameter	d_{bit}	in.	3/8 Wedge-bit	3/8 Wedge-bit	3/8 Wedge-bit
Wedge-bit tolerance range	-	in.	0.385 to 0.389	0.385 to 0.389	0.385 to 0.389
Nominal embedment depth	h_{nom}	in. (mm)	2-1/8 (50.8)	2-1/8 (50.8)	2-1/8 (50.8)
Effective embedment	h_{ef}	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Minimum hole depth	h_o	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Minimum member thickness[1,2]	h_{min}	in. (mm)	4 (102)	4 (102)	4 (102)
Overall anchor length	ℓ_{anch}	in. (mm)	3 (76)	3 (76)	3 (76)
Minimum edge distance[1,2]	c_{min}	in. (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Minimum spacing distance[1,2]	s_{min}	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Critical edge distance[1,2]	c_{ac}	in. (mm)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	185 (250)	185 (250)	185 (250)
Impact wrench / socket size	d_h	in.	11/16	11/16	11/16
Head height	-	in.	3/4	3/4	3/4

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

1. For installations through the soffit of steel deck into concrete, see the installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
2. For use with the design provisions of ACI 318 Appendix D.

Vertigo+ Anchor Detail in Concrete



Hex Coupler Heads

1/4" 3/8" 1/2"

Matched Tolerance System

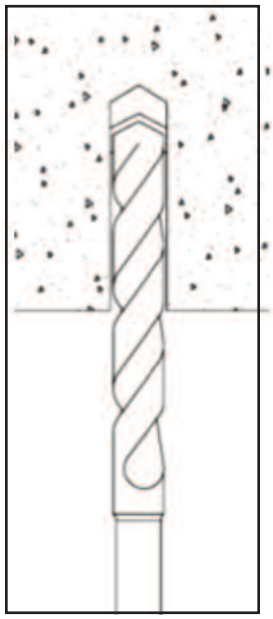
Blue tip

Blue Wedge-bit

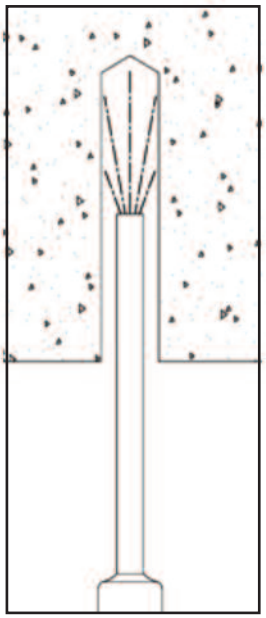
Designed and tested as a system for consistency and reliability

INSTALLATION INSTRUCTIONS

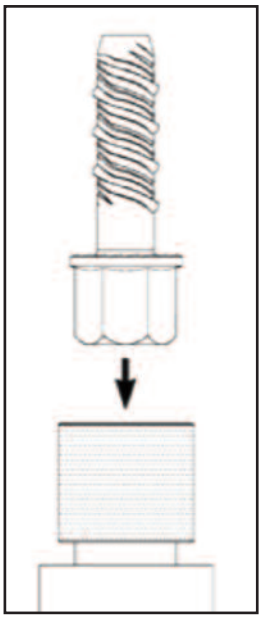
Installation Instructions for Vertigo+



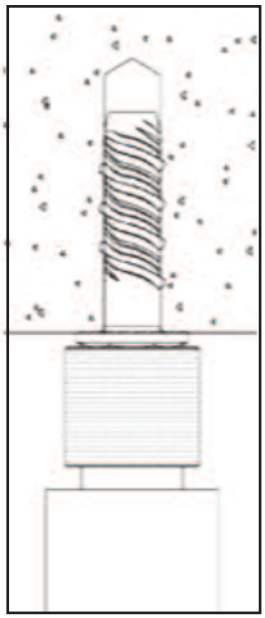
1.) Using the proper Wedge-bit size, drill a hole into the base material to the required depth. The tolerances of the Wedge-bit used must meet the requirements of the published Wedge-bit range.



2.) Remove dust and debris from the hole

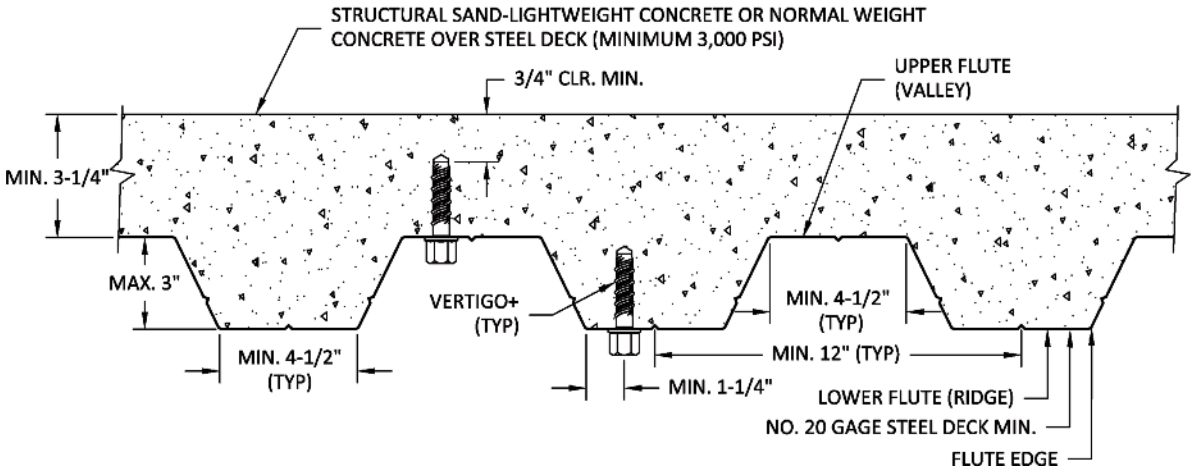


3.) Select a powered impact wrench that does not exceed the maximum torque, screw, for the selected anchor diameter. Attach an appropriate sized hex socket/driver to the impact wrench. Mount the screw anchor head into the socket.



4.) Drive the anchor into the hole until the head of the anchor comes into contact with the member surface. The anchor should be snug after installation. Do not spin the hex socket off the anchor to disengage. Insert threaded rod or bolt int Vertigo+.

Installation Detail for Vertigo+ Installed Through Soffit or Steel Deck into Concrete



PERFORMANCE DATA

Tension Design Information For Vertigo+ Anchors in Concrete (For use with load combinations taken from ACI 318 Section 9.2) [1,2]

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4	3/8	1/2
Anchor category	1, 2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in.	2-1/8	2-1/8	2-1/8
STEEL STRENGTH IN TENSION[4]					
Minimum specified yield strength of steel insert element (threaded rod or bolt)	f_y	ksi (N/mm²)	36.0 (248)	36.0 (248)	36.0 (248)
Minimum specified ultimate strength of steel insert element (threaded rod or bolt)	f_{uta}[11]	ksi (N/mm²)	58.0 (400)	58.0 (400)	58.0 (400)
Effective tensile stress area of steel insert element (threaded rod or bolt)	$A_{se,N}$ [A_{se}][12]	in² (mm²)	0.0318 (20.5)	0.0775 (50)	0.1419 (91.6)
Steel strength in tension	N_{sa}[11]	lb (kN)	1,845 (8.2)	4,495 (20)	8,230 (36.6)
Reduction factor for steel strength[3]	ϕ	-	0.65	0.65	0.65
CONCRETE BREAKOUT IN TENSION[8]					
Effective embedment	h_{ef}	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24
Effectiveness factor for cracked concrete	k_{cr}	-	17	17	17
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$[11]	-	1 See note 5	1 See note 5	1 See note 5
Critical edge distance	c_{ac}	in. (mm)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)		
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[8]					
Characteristic pullout strength, uncracked concrete (2,500 psi)[6]	$N_{p,uncr}$	lb (kN)	See note 7	See note 7	See note 7
Characteristic pullout strength, cracked concrete (2,500 psi)[6]	$N_{p,cr}$	lb (kN)	See note 7	See note 7	See note 7
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)[6,9]	N_{eq}[11]	lb (kN)	1,085 (4.8)	1,085 (4.8)	1,085 (4.8)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)		
PULLOUT STRENGTH IN TENSION FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK					
Characteristic pullout strength, uncracked concrete over steel deck[6,10]	$N_{p,deck,uncr}$	lb (kN)	1,990 (8.9)	1,990 (8.9)	1,990 (8.9)
Characteristic pullout strength, cracked concrete over steel deck[6,10]	$N_{p,deck,cr}$	lb (kN)	1,410 (6.3)	1,410 (6.3)	1,410 (6.3)
Characteristic pullout strength, cracked concrete over steel deck seismic[6,10]	$N_{p,deck,eq}$	lb (kN)	1,060 (4.7)	1,060 (4.7)	1,060 (4.7)
Reduction factor for pullout strength[3]	ϕ	-			

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 must apply.
2. Installation must comply with printed instructions.
3. All values of ϕ were determined from the load combinations of UBC 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 ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Vertigo+ anchor will be a ductile steel element as defined by ACI 318 D.1.
5. For all design cases use $\Psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete (k_{cr}) and uncracked concrete (k_{uncr}) must be selected.
6. For all design cases use $\Psi_{c,p} = 1.0$. For concrete compressive strength greater than 2,500 psi, N_{pn} = (Pullout strength value from table)*(specified concrete compressive strength/$f'_{c,min}$)$^{0.5}$ where the value of $f'_{c,min}$ is 2500 except in concrete over steel deck where the value of $f'_{c,min}$ is 3000.
7. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
8. Anchors 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 (not required for steel deck).
9. 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.
10. 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 flute (soffit).
11. For 2003 IBC, f_{uta} replaces f_{ut}; N_{sa} replaces N_s; $\Psi_{c,N}$ replaces Ψ_3; and N_{eq} replaces $N_{p,seis}$.
12. The notation in brackets is for the 2006 ICBC.

PERFORMANCE DATA

Shear Design Information For Vertigo+ Anchors in Concrete (For use with load combinations taken from ACI 318 Section 9.2) [1,2]

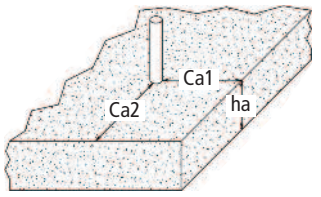
Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4"	3/8"	1/2"
Anchor category	1, 2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in.	2-1/8	2-1/8	2-1/8
STEEL STRENGTH IN SHEAR[4]					
Steel strength in shear[5]	V_{sa} [10]	lb (kN)	1,105 (4.9)	2,695 (12)	3,075 (13.7)
Reduction factor for steel strength[3]	ϕ	-	0.60	0.60	0.60
CONCRETE BREAKOUT IN SHEAR[6]					
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	Ψ_e [10]	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Nominal anchor diameter	d_a [d_o] [11]	in. (mm)	0.375 (9.5)	0.375 (9.5)	0.375 (9.5)
Reduction factor for concrete breakout strength[3]	ϕ	-	0.70 (Condition B)		
PRYOUT STRENGTH IN SHEAR[6]					
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in, 2.0 for $h_{ef} \geq 2.5$ in)	k_{cp}	-	1	1	1
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)		
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS					
Steel strength in shear, seismic[7]	V_{eq} [10]	lb (kN)	1,105 (4.9)	2,000 (8.9)	2,000 (8.9)
Reduction factor for steel strength in shear for seismic applications[3]	ϕ	-	0.60	0.60	0.60
STEEL STRENGTH IN SHEAR FOR STRUCTURAL SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9]					
Steel strength in shear, concrete over steel deck[8]	$V_{sa,deck}$	lb (kN)	1,105 (4.9)	1,975 (8.8)	2,495 (11.1)
Steel strength in shear, concrete over steel deck seismic[8]	$V_{sa,deck,eq}$	lb (kN)	1,105 (4.9)	1,480 (6.6)	1,620 (7.2)
Reduction factor for steel strength in shear for steel deck applications[3]	ϕ	-	0.60	0.60	0.60

For SI: 1 inch = 25.4 mm.

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. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of UBC 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 ϕ must be determined in accordance with ACI 318 D.4.5. For reinforcement that meets ACI 318 Appendix D requirements for Condition A, see ACI 318 D.4.4 for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Vertigo+ anchor will be a ductile steel element as defined by ACI 318 D.1.
5. 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 D.6.1.2 and D-18 in ACI 318-02, D.6.1.2.
6. Anchors are permitted to be used in structural sand-lightweight concrete provided that V_b and V_{cp} are multiplied by a factor of 0.60 (not required for steel deck).
7. Reported values for steel strength in shear for seismic applications are based on test results per ACI 355.2 Section 9.6.
8. 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 pryout capacity in accordance with ACI 318 D.6.3 are not required for anchors installed in the flute (soffit).
9. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
10. For 2003 IBC, f_{uta} replaces f_{ut}; V_{sa} replaces V_s; ℓ_e replaces ℓ; and V_{eq} replaces $V_{s,seis}$.
11. The notation in brackets is for the 2006 IBC.

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318 Appendix D:

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 (ϕ) 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.



Tension and Shear Design Strength for Vertigo+ in Cracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element (Threaded Rod or Bolt)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.))	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	2-1/8	$f_u \geq$ 58ksi	940	**665**	1,030	**665**	1,190	**665**	**1,200**	**665**	**1,200**	**665**
3/8	2-1/8		940	940	1,030	1,030	1,190	1,190	1,460	1,460	1,685	**1,615**
1/2	2-1/8		940	1,015	1,030	1,110	1,190	1,280	1,460	1,570	1,685	1,810

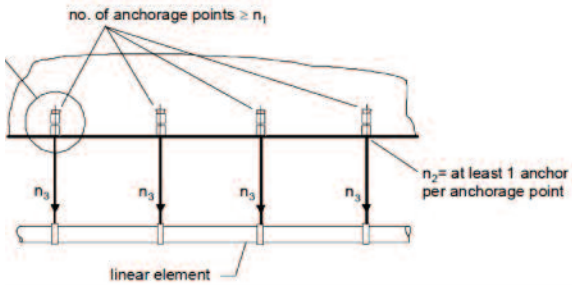
Tension and Shear Design Strength for Vertigo+ in Uncracked Concrete

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Steel Insert Element (Threaded Rod or Bolt)	Minimum Concrete Compressive Strength, $f'c$ (psi)									
			2,500		3,000		4,000		6,000		8,000	
			ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.))	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
1/4	2-1/8	$f_u \geq$ 58ksi	**1,200**	**665**	**1,200**	**665**	**1,200**	**665**	**1,200**	**665**	**1,200**	**665**
3/8	2-1/8		1,330	1,320	1,455	1,455	1,680	**1,615**	2,060	**1,615**	2,375	**1,615**
1/2	2-1/8		1,330	1,430	1,455	1,565	1,680	1,810	2,060	**1,845**	2,375	**1,845**

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

REDUNDANT FASTENING APPLICATIONS

For an anchoring system designed with redundancy, the load maintained by an anchor that experiences failure or excessive deflection can be transmitted to neighboring anchors without significant consequences to the fixture or remaining resistance of the anchoring system. In addition to the requirements for anchors, the fixture being attached shall be able to resist the forces acting on it assuming one of the fixing points is not carrying load. It is assumed that by adhering to the limits placed on n_1, n_2 and n_3 below, redundancy will be satisfied.



Anchors qualified for redundant applications may be designed for use in normal weight and sand-lightweight cracked and uncracked concrete. Concrete compressive strength of 2,500 psi shall be used for design. No increase in anchor capacity is permitted for concrete compressive strengths greater than 2,500 psi. The anchor installation is limited to concrete with a compressive strength of 8,500 psi or less.

Redundant applications shall be limited to structures assigned to Seismic Design Categories A or B only.

Redundant applications shall be limited to support of nonstructural elements.

Strength Design (Redundant Fastening):

For strength design, a redundant system is achieved by specifying and limiting the following variables

n_1 = the total number of anchorage points supporting the linear element

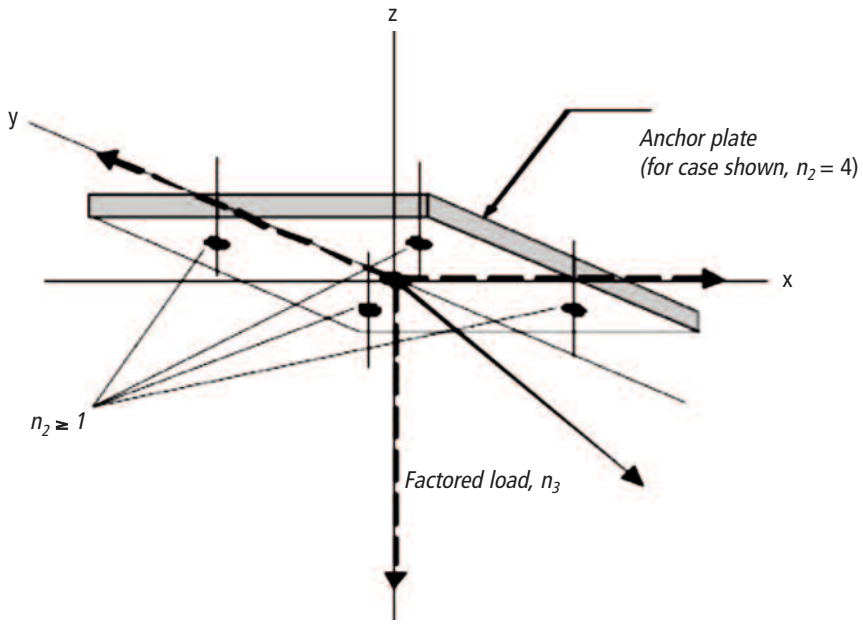
n_2 = number of anchors per anchorage point

n_3 = factored load at each anchorage point, lbs., using load combinations from IBC Section 1605.2.1 or ACI 318 Section 9.2

Allowable Stress Design (Redundant Fastening):

Design values for use with allowable stress design shall be established taking R_d, ASD = $\frac{\phi_{ra} . F_{ra}}{\propto}$

Where $\propto$ is the conversion factor calculated as the weighted average of the load factors from the controlling load combination. The conversion factor, $\propto$ is equal to 1.4 assuming all dead load.



INSTALLATION SPECIFICATIONS

Installation Table for Vertigo+ Anchor in Redundant Fastening Applications

Anchor Property/ Setting Information	Symbol	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)		
			1/4	3/8	1/2
Nominal anchor shank diameter	d_o	in. (mm)	0.375 (9.5)	0.375 (9.5)	0.375 (9.5)
Nominal drill bit diameter	d_{bit}	in.	3/8" Wedge-bit	3/8" Wedge-bit	3/8" Wedge-bit
Wedge-bit tolerance range	-	in.	0.385 to 0389	0.385 to 0389	0.385 to 0389
Minimum nominal embedment depth	h_{nom}	in. (mm)	2-1/8 (50.8)	2-1/8 (50.8)	2-1/8 (50.8)
Effective embedment	h_{ef}	in. (mm)	1.425 (36)	1.425 (36)	1.425 (36)
Minimum hole depth	h_o	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Minimum member thickness	h_{min}	in. (mm)	3 (76.2)	3 (76.2)	3 (76.2)
Overall anchor length	Ψ_{anch}	in. (mm)	3 (76)	3 (76)	3 (76)
Minimum edge distance	c_{min}	in. (mm)	4 (102)	4 (102)	4 (102)
Minimum spacing distance	s_{min}	in. (mm)	8 (204)	8 (204)	8 (204)
Maximum impact wrench power (torque)	T_{screw}	ft.-lb. (N-m)	245 (332)	245 (332)	245 (332)
Impact wrench/socket size	d_h	in.	11/16	11/16	11/16
Head height	-	in.	3/4	3/4	3/4

PERFORMANCE DATA FOR REDUNDANT FASTENING APPLICATIONS

Redundant Fastening Design Information for Vertigo+ Anchors in Normal Weight Concrete and for Sand-Lightweight and Normal Weight Concrete over Steel Deck[1,2,3,4,5,6]

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (in.)					
			1/4		3/8		1/2	
Anchor category	1, 2 or 3	-	1		1		1	
CHARACTERISTIC DESIGN STRENGTH (RESISTANCE) IN CRACKED OR UNCRACKED CONCRETE[4,5,6]								
Resistance, cracked or uncracked concrete (2,500psi)	F_{ra}	lb (kN)	Number of anchorage points		Number of anchorage points		Number of anchorage points	
			$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$	$n_1 \geq 4$	$n_1 \geq 3$
			675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)	675 (3.0)	450 (2.0)
Strength reduction factor	ϕ_{ra}	-	0.65		0.65		0.65	

1. The data in this table is intended to be used with the design provisions of this product; loads may be applied in any direction.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of UBC Section 1605.2.1, UBC Section 1612.2.1, or ACI 318 Section 9.2.
4. It is assumed that the threaded rod or bolt used with the Vertigo+ anchor has minimum specified properties as listed in the table above or an equivalent steel element.
5. Anchors are permitted to be used in structural sand-lightweight concrete provided the resistance value is multiplied by 0.6.
6. For installations through the soffit of steel deck into concrete see the installation detail. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from center of the flute. In addition, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

PERFORMANCE DATA (ALLOWABLE STRESS DESIGN)

Ultimate Load Capacities for Vertigo+ in Normal-Weight Concrete[1,2]

Nominal Anchor Size / Threaded Coupler Diameter in. (mm)	Nominal Anchor Shank Diameter d_o in. (mm)	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength f'_c							
			2,500 psi (17.2 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		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)	3/8 (9.5)	2-1/8 (54.0)	3,260 (14.5)	2,850 (12.7)	3,570 (15.9)	2,850 (12.7)	4,205 (18.8)	2,850 (12.7)	5,150 (23.0)	2,850 (12.7)
3/8 (9.5)	3/8 (9.5)	2-1/8 (54.0)	3,260 (14.5)	4,235 (18.9)	3,570 (15.9)	4,235 (18.9)	4,205 (18.8)	4,235 (18.9)	5,150 (23.0)	4,235 (18.9)
1/2 (12.7)	3/8 (9.5)	2-1/8 (54.0)	3,260 (14.5)	4,235 (18.9)	3,570 (15.9)	4,235 (18.9)	4,205 (18.8)	4,235 (18.9)	5,150 (23.0)	4,235 (18.9)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Vertigo+ in Normal-Weight Concrete[1]

Nominal Anchor Size / Threaded Coupler Diameter in. (mm)	Nominal Anchor Shank Diameter d_o in. (mm)	Minimum Embedment Depth h_{nom} in. (mm)	Minimum Concrete Compressive Strength f'_c							
			2,500 psi (17.2 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		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)	3/8 (9.5)	2-1/8 (54.0)	815 (3.6)	485 (2.2)	890 (4.0)	485 (2.2)	1,050 (4.7)	485 (2.2)	1,290 (5.7)	485 (2.2)
3/8 (9.5)	3/8 (9.5)	2-1/8 (54.0)	815 (3.6)	1,060 (4.7)	890 (4.0)	1,060 (4.7)	1,050 (4.7)	1,060 (4.7)	1,290 (5.7)	1,060 (4.7)
1/2 (12.7)	3/8 (9.5)	2-1/8 (54.0)	815 (3.6)	1,060 (4.7)	890 (4.0)	1,060 (4.7)	1,050 (4.7)	1,060 (4.7)	1,290 (5.7)	1,060 (4.7)

1. Allowable load capacities are calculated using an applied safety factor of 4.0.

ORDERING INFORMATION

Vertigo+ Rod Hanger (Carbon Steel w/Blue Tip)

Cat. No.	Rod Dia.	Screw Shank Size and Length	Thread Style	Pre-Drill Diameter	Std. Box	Std. Ctn.
7180SD	1/4"	3/8" x 2-1/8"	Wedge-Bolt+	3/8" Wedge-Bit	50	250
7181SD	3/8"					
7182SD	1/2"					
An SDS 3/8" x 6" Wedge-Bit (Cat# 01316 is included in each box of Vertigo+)						

Wedge-Bits

Cat. No.	Wedge-Bit Description	Usable Length	Std. Box	Std. Ctn.
01316	SDS 3/8" x 6"	4"	1	1
01380	HD Straight Shank 3/8" x 6"	4"	5	25

Vertigo® *Rod Hangers*

PRODUCT DESCRIPTION

Vertigo is an all steel threaded fastening system for suspending steel threaded rod vertically overhead in pipe hanging, fire protection, electrical conduit and cable-tray applications. Vertigo are available in three versions which can be installed in a variety of base materials including steel purlins, bar joists and beams, wood frame columns and beams, as well as concrete ceilings, beams and columns.

Steel threaded rods in 1/4", 3/8" and 1/2" diameters can be vertically suspended with Vertigo. In wood and steel base materials, Vertigo is also offered in a side mount style for lateral installation of 1/4" and 3/8" diameter steel threaded rods onto joists, columns and overhead members. For all steel and wood Vertigo fasteners, a universal Vertigo Socket Driver is recommended to provide proper installation with a screw gun or hammer drill. Concrete Vertigo fasteners should be installed with the appropriate size standard drive sockets and adjustable torque, battery powered screwgun or hammer drill.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- Lighting Systems and Overhead Utilities
- Suspended Ceilings
- Suspending Conduit and Cable Trays
- HVAC Ductwork and Strut Channels
- Mounting Security Equipment

FEATURES AND BENEFITS

+ One system for all rod hanging applications in steel, wood and concrete
+ Ease and speed of overhead installation
+ Lower in-place cost, when compared to beam clamps, lag bolts and dropins
+ Steel and wood Vertigo can be installed with a screw gun or hammer drill
+ Concrete Vertigo can be installed with an adjustable torque, battery powered screwgun or hammer drill
+ Side mount versions available for steel and wood Vertigo
+ The universal socket can be used for the steel and wood Vertigo

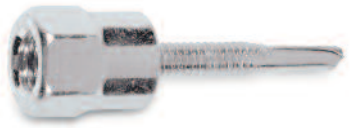
APPROVALS AND LISTINGS

Factory Mutual Research Corporation (FM Approvals) File No. J.I 3015153
Underwriters Laboratory (UL) File No. EX 1289 (N

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 05090-Metal Fastenings and 06060-Wood Connections and Fasteners.* Rod Hangers shall be Vertigo anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS



Steel Vertigo

Wood Vertigo

Concrete Vertigo (Wedge-Bolt OT)

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 1/2" for Steel
1/4" to 1/2" for Wood
1/4" to 1/2" for Concrete

SUITABLE BASE MATERIALS

Steel Purlins and Beams
Wood and Timber
Normal-weight Concrete
Structural Lightweight Concrete
Hollow Core Concrete Plank

INSTALLATION SPECIFICATIONS

Steel Vertigo

Point Style	#3	#5
Self Drilling Range	0.036" (20 gage) – 0.188" (3/16")	0.188" (3/16") – 0.500" (1/2")
Screw Size (UNC)	1/4-20 thread	1/4-20 thread
Root Diameter (in.)	13/64	13/64
Thread Length (in.)	1-3/16" (1-1/2"screw)	31/32" (1-1/2"screw)
Flange Thickness (in.)	1/16	1/16
Drill Speed (RPM)	500-1,500	500-1,500

Install with universal steel and wood socket.

Wood Vertigo

Screw Size	1/4" Thread Forming	5/16" Thread Forming
Pre-drill Diameter (in.) (if required)	1/8	1/8
Point Style	Type 17	Type 17
Root Diameter (in.)	3/16	7/32
Thread Length (in.)	Screw length less 5/16	Screw length less 5/16
Flange Thickness (in.)	1/16	1/16

Install with universal steel and wood socket.

Vertigo Couplings (Steel & Wood)

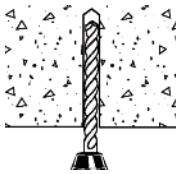
Coupling Size and Type	1/4" Vertical	3/8" Vertical	1/2" Vertical	1/4" Side	3/8" Side
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	1/4-20	3/8-16
Thread Depth (in.)	3/8	3/8	3/8	5/8 (through)	5/8 (through)
Width (flat to flat) (in.)	5/8	5/8	5/8	5/8	5/8
Height (in.)	13/16	13/16	13/16	13/16	13/16

Concrete Vertigo (Wedge-Bolt OT)

Rod Diameter/Anchor Size	1/4"	3/8"	1/2"
ANSI Drill Bit (in.)	1/4	1/4	3/8
Overall Screw Shank Length	1-1/4	1-1/2	2-3/4
Anchor Thread Length (in.)	1-1/8	1-3/8	2-1/2
Root Diameter (in.)	15/64	15/64	23/64
Coupling / Washer Height (in.)	27/64	9/16	53/64
Integral Washer O.D. (in.)	31/64	39/64	31/32
Coupling Thread Size (UNC)	1/4-20	3/8-16	1/2-13
Coupling Thread Depth (in.)	3/8	1/2	3/4
Socket Driver Size (in.)	3/8	1/2	11/16

Install with appropriate sized concrete socket.

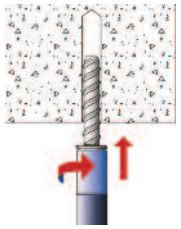
Installation Guidelines



When installing Vertigo fasteners, eye protection should be worn as a safety precaution.

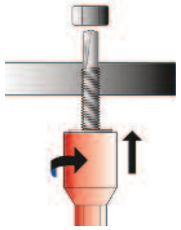
If pre-drilling is required (certain types of wood truss/wood joist and all concrete base materials), select the recommended drill bit type and diameter. For Concrete Vertigo only, drill to the appropriate embedment depth, adding at least one diameter (1/4" to 1/2") to the drilling depth to prevent the tip of the fastener from running into a dead end at the rear of the anchor hole.

Concrete



Select the appropriate socket driver for the anchor size and type to be installed and mount into chuck of installation tool. Insert the Vertigo fastener into the socket driver, and install perpendicular to the base material surface. Drive the fastener with a smooth steady motion until the coupling is firmly seated against the surface of the base material.

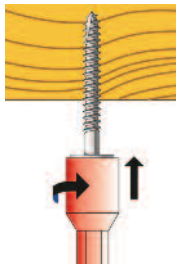
Steel



Thread the appropriate diameter steel threaded rod or threaded bolt into the coupling. The threaded rod or bolt should fully engage the thread length of the coupling on a vertical mount fastener. The threaded rod or threaded portion of the bolt can pass through coupling of a side mount fastener.

For UL and FM listings, Steel Vertigo should be installed with a retaining nut.

Wood



MATERIAL SPECIFICATIONS

Steel and Wood Vertigo

Component	Component Material
Screw Body	AISI 1018-1022 (Case Hardened)
Coupling	AISI 1018-1022 (Case Hardened)
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn5)

Concrete Vertigo (Wedge-Bolt OT)

Component	Component Material
Anchor Body	Case Hardened 10B21 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

PERFORMANCE DATA

Steel Vertigo – Ultimate Tension Load Capacities when Installed in Minimum ASTM A 36 Steel (Beams) and ASTM A 572 Steel (Purlins)[1,2]

Anchor Size/ Rod Diameter in. (mm)	Mount Direction	Screw Shank Size and Length	Minimum Steel Gage (Thickness)						
			20 0.036"	18 0.048"	16 0.060"	14 0.075"	12 0.105"	3/16" 0.187"	1/4" 0.250"
			lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)	lbs. (kN)
1/4 (6.4)	Vertical	1/4-20 x 1" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	-
	Vertical	1/4-20 x 1"	405 (1.8)	620 (2.8)	985 (4.4)	1,160 (5.2)	1,560 (7.0)	3,205 (14.4)	5,040 (22.7)
	Side	1/4-20 x 1" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	-
3/8 (9.5)	Vertical	1/4-20 x 1" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	-
	Side	1/4-20 x 1-1/2" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	-
	Vertical	1/4-20 x 1-1/2"	405 (1.8)	620 (2.8)	985 (4.4)	1,160 (5.2)	1,560 (7.0)	3,205 (14.4)	-
	Side	1/4-20 x 1-1/2"	405 (1.8)	620 (2.8)	985 (4.4)	1,160 (5.2)	1,560 (7.0)	1,965 (8.8)	-
	Vertical	1/4-20 x 2" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	-
1/2 (12.7)	Vertical	12-20 x 1-1/2"	495 (2.2)	710 (3.2)	920 (4.1)	1,560 (7.0)	2,050 (9.2)	3,280 (14.8)	5,040 (22.7)
	Vertical	12-20 x 1-1/2" (w/nut)	1,550 (7.0)	1,550 (7.0)	1,775 (8.0)	1,775 (8.0)	2,050 (9.2)	3,850 (17.3)	-

1. For Steel Vertigo loaded perpendicular to threaded rod (shear) the ultimate load capacity for the anchor is 1,965 lbs in nominal 20 gage steel (0.036").
2. Steel Vertigo are recommended to be installed with the Universal Steel & Wood Nut Driver.

Wood Vertigo – Ultimate Tension Load Capacities when Installed in Wood Base Materials (Structural Wood and Timber)[1,2]

Anchor Size/ Rod Diameter in. (mm)	Mount Direction	Screw Shank Size and Length	Embedment Depth in. (mm)	Wood Member (Type)		
				Fir	Pine	Spruce
				lbs. (kN)	lbs. (kN)	lbs. (kN)
1/4 (6.4)	Side	1/4 x 1"	1 (25.4)	685 (3.1)	650 (2.9)	650 (2.9)
	Vertical	1/4 x 2"	2 (50.8)	1,510 (6.8)	1,510 (6.8)	1,510 (6.8)
3/8 (9.5)	Vertical	1/4 x 1"	1 (25.4)	685 (3.1)	650 (2.9)	650 (2.9)
	Side	1/4 x 1"	1 (25.4)	685 (3.1)	650 (2.9)	650 (2.9)
	Vertical	1/4 x 2"	2 (50.8)	1,510 (6.8)	1,510 (6.8)	1,510 (6.8)
	Side	1/4 x 2"	2 (50.8)	1,800 (8.1)	1,800 (8.1)	1,800 (8.1)
	Vertical	1/4 x 3"	3 (76.2)	2,075 (9.3)	1,510 (6.8)	1,510 (6.8)
	Vertical	1/4 x 4"	4 (101.6)	2,075 (9.3)	1,510 (6.8)	1,510 (6.8)
	Vertical	5/16" x 2-1/2"	2-1/2 (63.5)	2,670 (12.0)	3,110 (14.0)	3,110 (14.0)
	Side	3/8" x 2-1/2"	2-1/2 (63.5)	1,450 (6.5)	1,530 (6.9)	1,380 (6.2)
1/2 (12.7)	Vertical	5/16" x 2-1/2"	2-1/2 (63.5)	2,670 (12.0)	3,110 (14.0)	3,110 (14.0)

1. Truss/joist manufacturers may require pre-drilled holes with wood depending on the location of the anchor installation. Consult with the truss/joist manufacturer for details.
2. Wood Vertigo are recommended to be installed with the Universal Steel & Wood Nut Driver.

PERFORMANCE DATA

Concrete Vertigo – Ultimate Load Capacities when Installed in Normal-Weight Concrete[1,2]

Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	ANSI Drill Bit Diameter d_{bit} in.	Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
					2,000 psi (13.8 MPa)		**4,000 psi** (20.7 MPa)		**6,000 psi** (41.4 MPa)	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	Vertical	1/4" x 1-1/4"	1/4"	1-1/4 (31.8)	1,390 (6.3)	1,810 (8.1)	1,950 (8.8)	2,440 (11.0)	2,070 (9.3)	2,570 (11.6)
3/8 (9.5)	Vertical	1/4" x 1-1/2"	1/4"	1-1/2 (38.1)	1,760 (7.9)	2,580 (11.6)	2,595 (11.7)	2,640 (11.9)	2,770 (12.5)	2,700 (12.2)
1/2 (12.7)	Vertical	3/8" x 2-3/4"	3/8"	2-3/4 (69.9)	5,320 (23.9)	5,250 (23.6)	6,050 (27.2)	6,330 (28.5)	8,620 (38.8)	7,410 (33.0)

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

Concrete Vertigo – Ultimate Load Capacities when Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5]

Anchor Size Rod Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Lightweight Concrete Over Minimum 20 Ga. Metal Deck $f'_c \geq$ **3,000 psi** (20.7 MPa)	
		Minimum 4-1/2" Wide Deck	
		Tension lbs. (kN)	Load at 45° lbs. (kN)
1/4 (6.4)	1-1/4 (31.8)	800 (3.6)	1,140 (5.1)
3/8 (9.5)	1-1/2 (38.1)	1,780 (8.0)	1,500 (6.8)
1/2 (12.7)	2-3/4 (69.9)	3,880 (17.5)	2,920 (13.1)

1. The values listed above are ultimate and allowable load capacities for Vertigo rod hangers installed in sand-lightweight concrete.
2. The metal deck shall be minimum No. 20 gage thick steel [(0.035-inch base metal thickness (0.89 mm)] conforming to ASTM A 653/ A 653M.
3. Allowable loads capacities are calculated using an applied safety factor of 4.0.
4. The tabulated load values are for anchors installed with a minimum flute edge distance of 1-1/2-inch.
5. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load where permitted by code.

Concrete Vertigo – Ultimate Tension Load Capacities when Installed in Hollow Core Concrete Plank[1,2]

Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	ANSI Drill Bit Diameter d_{bit} in.	Embed. Depth h_v in. (mm)	Center of Web	Center of Core
					lbs. (kN)	lbs. (kN)
1/4 (6.4)	Vertical	1/4" x 1-1/4"	1/4"	1-1/4 (31.8)	2,775 (12.3)	1,920 (8.5)
3/8 (9.5)	Vertical	1/4" x 1-1/2"	1/4"	1-1/2 (38.1)	3,700 (16.5)	2,570 (11.4)
1/2 (12.7)	Vertical	3/8" x 2-3/4"	3/8"	2-3/4 (69.9)	8,240 (36.7)	3,480 (15.5)

1. Tabulated load values are for anchors installed in 8-inch-thick hollow core plank with minimum compressive strength of 5,000 psi at the time of installation. The 4' x 6' normal-weight concrete members features include 1-1/2" cover above and below cores and a minimum web thickness of 1-1/2".
2. Depending on fastener application and governing building code, ultimate load capacities should be reduced by a minimum safety factor to determine the allowable working load. NFPA 13 Fire Protection requirements are 5 times the weight of the liquid (water) filled pipe plus 250 lbs. Consult the engineer of record.

PERFORMANCE DATA

Steel Vertigo – Ultimate Load Capacities for Factory Mutual (FM Global) and Underwriter's Laboratories (UL) Listings[1]

Catalog Number	Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	Point Style	Maximum Pipe Size in. (mm)	UL Minimum Steel Thickness in. (mm)	UL Test Load lbs. (kN)	FM Minimum Steel Thickness in. (mm)	FM Test Load lbs. (kN)
7158	3/8 (9.5)	Vertical	1/4-20 x 1"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7184		Side	1/4-20 x 1"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7160		Vertical	1/4-20 x 1-1/2"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7186		Side	1/4-20 x 1-1/2"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7154		Vertical	12-20 x 1-1/2"	#5	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7188		Side	1/4-20 x 2"	#3	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7201		Side	12-20 x 1-1/2"	#5	4 (101.6)	0.060 (1.5)	1,500 (6.8)	0.096 (2.4)	1,475 (6.6)
7161	1/2 (12.7)	Vertical	12-20 x 1-1/2"	#5	8 (203.2)	0.250 (6.4)	4,050 (18.2)	0.250 (6.4)	3,800 (17.1)

1. Steel Vertigo anchors are recommended to be installed with the Universal Steel & Wood Nut Driver. For UL and FM listings, Steel Vertigo must be installed with a retaining nut.

Wood Vertigo – Ultimate Load Capacities for Factory Mutual (FM Global) and Underwriter's Laboratories (UL) Listings[1]

Catalog Number	Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	Embedment Depth in. (mm)	UL Maximum Pipe Size in. (mm)	UL Test Load lbs. (kN)	FM Maximum Pipe Size in. (mm)	FM Test Load lbs. (kN)
7165	3/8 (9.5)	Vertical	1/4 x 2"	2 (50.8)	3 (76.2)	1,050 (4.7)	-	-
7170		Side	1/4 x 2"	2 (50.8)	3 (76.2)	1,050 (4.7)	-	-
7167		Vertical	1/4 x 3"	3 (76.2)	3 (76.2)	1,050 (4.7)	-	-
7169		Vertical	1/4 x 4"	4 (101.6)	3 (76.2)	1,050 (4.7)	-	-
7162		Vertical	5/16" x 2-1/2"	2-1/2 (63.5)	4 (101.6)	1,500 (6.8)	4 (101.6)	1,475 (6.6)
7156		Side	5/16" x 2-1/2"	2-1/2 (63.5)	4 (101.6)	1,500 (6.8)	-	-

1. Wood Vertigo anchors are recommended to be installed with the Universal Steel & Wood Nut Driver. No pre-drilling was done in the wood base materials.

Concrete Vertigo – Ultimate Load Capacities for Factory Mutual (FM Global) Listings[1]

Catalog Number	Anchor Size/ Rod Dia. in. (mm)	Mount Direction	Screw Shank Size and Length	ANSI Drill Bit Diameter d_{bit} in.	Embedment Depth in. (mm)	FM Maximum Pipe Size in. (mm)	FM Test Load lbs. (kN)
7173	3/8 (9.5)	Vertical	1/4" x 1-1/2"	1/4"	1-1/2 (38.1)	4 (101.6)	1,475 (6.6)
7175	1/2 (12.7)	Vertical	3/8" x 2-3/4"	3/8"	2-3/4 (69.9)	8 (203.2)	3,800 (17.1)

1. Tabulated load values are for anchors installed in 8 inch thick hollow core plank with minimum compressive strength of 4,000 psi at the time of installation. The 4' x 6' normal-weight concrete members features include 1-1/2" cover above and below cores and a minimum web thickness of 1-1/2".

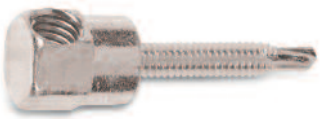
ORDERING INFORMATION

Steel Vertical Hanger (#3 for Purlins, #5 for Beams)

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Self Drilling Range	Std. Box	Std. Ctn.
7155	1/4"	1/4-20 x 1"	#3	0.036" (20 gage) to 0.188" (3/16")	100	500
7157	3/8"	1/4-20 x 2"	#3		100	500
7158	3/8"	1/4-20 x 1" (w/nut)	#3		100	500
7159	3/8"	1/4-20 x 1-1/2"	#3		100	500
7160	3/8"	1/4-20 x 1-1/2" (w/nut)	#3		100	500
7152	1/4"	12-20 x 1-1/2"	#5	0.188" (3/16") to 0.500" (1/2")	100	500
7154	3/8"	12-20 x 1-1/2" (w/nut)	#5		100	500
7161	1/2"	12-20 x 1-1/2" (w/nut)	#5		100	500

Steel Side Hanger (#3 for Purlins, #5 for Beams)

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Self Drilling Range	Std. Box	Std. Ctn.
7183	1/4"	1/4-20 x 1"	#3	0.036" (20 gage) to 0.188" (3/16")	100	500
7184	3/8"	1/4-20 x 1" (w/nut)	#3		100	500
7186	3/8"	1/4-20 x 1-1/2" (w/nut)	#3		100	500
7188	3/8"	1/4-20 x 2" (w/nut)	#3		100	500
7200	1/4"	12-20 x 1-1/2"	#5	0.188" (3/16") to 0.500" (1/2")	100	500
7201	3/8"	12-20 x 1-1/2" (w/nut)	#5		100	100



Wood Vertical Hanger

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Pre-Drill Diameter (If Required)	Std. Box	Std. Ctn.
7163	1/4"	1/4" x 2"	Type 17	1/8"	100	500
7203	3/8"	1/4" x 1"	Type 17		100	500
7165	3/8"	1/4" x 2"	Type 17		100	500
7167	3/8"	1/4" x 3"	Type 17		100	500
7169	3/8"	1/4" x 4"	Type 17		100	500
7162	3/8"	5/16" x 2-1/2"	Type 17		100	500
7164	1/2"	5/16" x 2-1/2"	Type 17		100	500

Wood Side Hanger

Cat. No.	Rod Dia.	Screw Shank Size and Length	Point Style	Pre-Drill Diameter (If Required)	Std. Box	Std. Ctn.
7185	1/4"	1/4" x 1"	Type 17	1/8"	100	500
7205	3/8"	1/4" x 1"	Type 17		100	500
7170	3/8"	1/4" x 2"	Type 17		100	500
7156	3/8"	5/16" x 2-1/2"	Type 17		100	500

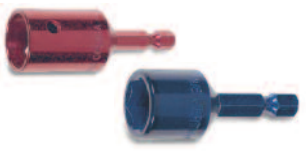
Concrete Vertical Hanger

Cat. No.	Rod Dia.	Screw Shank Size and Length	Thread Style	Pre-Drill Diameter	Std. Box	Std. Ctn.
7171	1/4"	1/4" x 1-1/4"	Wedge-Bolt OT	1/4" ANSI	100	500
7173	3/8"	1/4" x 1-1/2"	Wedge-Bolt OT	1/4" ANSI	100	500
7175	1/2"	3/8" x 2-3/4"	Wedge-Bolt OT	3/8" ANSI	50	250

For side mount concrete applications use Catalog Number 7185 and 7170 with a 1/4" ANSI drill bit.

Drive Sockets and Pole Tool

Cat. No.	Description	RPM	Std. Box	Std. Ctn.
7166	6'-12' Pole Tool (includes three Jaw Chuck)	N/A	1	1
7187	Universal Steel & Wood Socket (Red)	500 to 1500 RPM	5	25
7195	1/4" Concrete Socket (Blue)	–	5	25
7197	3/8" Concrete Socket (Blue)	–	5	25



Concrete Vertigo Installation Accessories

Cat. No.	Description	Maximum Bit Length	Std. Box	Wt./ Each
5864	1/4" and 3/8" Concrete Drive Sockets (Blue) Universal Steel & Wood Socket (Red) Sleeve Assembly (same as Cat# 5874)	6"	1	3/4
5874	Sleeve Assembly	6"	1	–
Cat. No.	**Description**	**Usable Length**	**Std.Tube**	**Wt./10**
5860	1/4" x 4-1/2" Straight Shank Drill Bit	3"	5	1/2
5866	1/4" x 6" Hex Shank SDS Drill Bit	4"	1	1/2

Bang-It™ and Wood-Knocker™ *Concrete Inserts*

PRODUCT DESCRIPTION

Bang-It concrete inserts are designed for installation in and through metal composite deck (i.e. "pan-deck") used to support newly poured concrete floors or roof slabs. After pre-drilling the deck and installation, the protective sleeve of the insert protrudes below the surface of the deck allowing overhead attachment of steel threaded rod in sizes ranging from 1/4" to 7/8" in diameter. The sleeve prevents sprayed fireproofing material and acoustical dampening products from clogging the internal threads of the insert. It also prevents burying, masking or losing the insert location. The hex impact plate offers resistance to rotation within the concrete as a steel threaded rod is being installed.

Wood-Knocker concrete inserts are installed onto wooden forms used to support newly poured concrete floor slabs, roof slabs or walls. When the forms are stripped, the color-coded flange is visibly embedded in the concrete surface. The inserts allow the attachment of steel threaded rod or threaded bolts in sizes ranging from 1/4" to 3/4" in diameter. The hex impact plate offers resistance to rotation within the concrete as a steel threaded rod or threaded bolt is being installed.

A coil thread design is available for Wood-Knocker upon request in 1/2" and 3/4" sizes for forming applications.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- Lighting Systems and Overhead Utilities
- Suspended Ceilings
- Suspending Conduit and Cable Trays
- HVAC Ductwork and Strut Channels
- Concrete Formwork

FEATURES AND BENEFITS

+ Hex head does not rotate when set
+ High load values due to full thread engagement
+ Color coded by size for simple identification
+ Low overall installed cost

APPROVALS AND LISTINGS

FM Global (Factory Mutual) File No. J.I 3015153
Underwriters Laboratories (UL) File No. EX 1289. Recognized also for use in air handling spaces.

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.* Concrete inserts shall be Bang-It and/or Wood-Knocker as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Bang-It Metal Deck Insert

Wood-Knocker Wood Form Insert

ANCHOR MATERIALS

Carbon Steel and Engineered Plastic

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 7/8" threaded rod for Bang-It Concrete Inserts
1/4" to 3/4" threaded rod for Wood-Knocker Concrete Inserts
1/2" and 3/4" coil thread for Wood-Knocker Concrete Inserts

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete

MATERIAL SPECIFICATIONS

Bang-It

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel
Flange	AISI 1008 Carbon Steel
Spring	Steel Music Wire
Zinc Plating	ASTM B 633 (Yellow Dichromate)
Protective Sleeve	Engineered Plastic

Wood-Knocker

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel
Flange	Engineered Plastic
Zinc Plating	ASTM B 633 (Yellow Dichromate)

STEEL SPECIFICATIONS

Material Properties for Threaded Rod

Steel Description	Steel Specification (ASTM)	Rod Diameter (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Standard carbon rod	A 36 or A 307, Grade C	1/4 to 7/8	36.0	58.0
High strength carbon rod	A 193, Grade B7	1/4 to 7/8	105.0	120.0
Stainless Rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 to 5/8	65.0	100.0
		3/4 to 7/8	45.0	85.0

Allowable Steel Strength for Threaded Rod

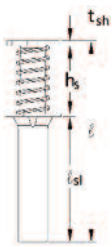
Anchor Diameter *d* in. (mm)	Area of Rod in.^{2} (mm^2)	Allowable Tension				Allowable Shear			
		ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
1/4 (6.4)	0.0491 (1.2)	940 (4.2)	940 (4.2)	2,160 (9.7)	1,210 (5.4)	485 (2.2)	485 (2.2)	1,030 (4.6)	625 (2.8)
3/8 (9.5)	0.1104 (2.8)	2,115 (9.5)	2,115 (9.5)	4,375 (19.7)	3,630 (16.3)	1,090 (4.9)	1,090 (4.9)	2,255 (10.1)	1,870 (8.4)
1/2 (12.7)	0.1963 (5.0)	3,755 (16.9)	3,755 (16.9)	7,775 (35.0)	6,470 (29.1)	1,940 (8.7)	1,940 (8.7)	4,055 (18.2)	3,330 (15.0)
5/8 (15.9)	0.3068 (7.8)	5,870 (26.4)	5,870 (26.4)	12,150 (54.7)	10,130 (45.6)	3,025 (13.6)	3,025 (13.6)	6,260 (28.2)	5,210 (23.4)
3/4 (19.1)	0.4418 (11.2)	8,455 (38.0)	8,455 (38.0)	17,495 (78.7)	12,400 (55.8)	4,355 (19.6)	4,355 (19.6)	9,010 (40.5)	6,390 (28.8)
7/8 (22.2)	0.6010 (15.3)	11,510 (51.8)	11,510 (51.8)	23,810 (107.1)	16,860 (75.9)	5,930 (26.7)	5,930 (26.7)	12,265 (55.2)	8,680 (39.1)

1. Allowable tension = f_u , $(A_{nom})(0.33)$ Allowable shear = f_u, $(A_{nom})(0.17)$

INSTALLATION SPECIFICATIONS

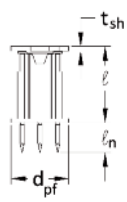
Bang-It

Dimension	Notation	Nominal Rod/Anchor Size 1/4"	3/8"	1/2"	5/8"	3/4"	7/8"
Metal Hole Saw Diameter (in.)	d_{bit}	13/16	13/16	13/16	1 3/16	1 3/16	1 3/16
Drilling Speed (rpm)	-	700-900	700-900	700-900	500-700	500-700	500-700
Height of Spring (in.)	h_a	2	2	2	2	2	2
Insert Thread Length (in.)	-	3/8	5/8	11/16	15/16	1-1/8	1-5/16
Length of Sleeve (in.)	ℓ_{sl}	3-3/8	3-3/8	3-3/8	3-3/8	3-3/8	3-3/8
Thread Size, UNC	-	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9
Overall Length (in.)	ℓ	5-5/16	5-5/16	5-5/16	5-5/16	5-5/16	5-5/16
Steel Flange Thickness (in.)	t_{sh}	5/64	5/64	5/64	5/64	5/64	5/64



Wood-Knocker

Dimension	Notation	Nominal Rod/Anchor Size 1/4"	3/8"	1/2"	5/8"	3/4"
Insert Thread Length (in.)	-	3/8	5/8	11/16	15/16	1-1/8
Plastic Flange Dia. (in.)	d_{pf}	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
Plastic Flange Thickness (in.)	t_{sh}	7/64	7/64	7/64	7/64	7/64
Thread Size, UNC	-	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10
Overall Length (in.)	ℓ	1-7/8	1-7/8	1-7/8	1-7/8	1-7/8
Break-Off Nail Length (in.)	ℓ_n	3/4	3/4	3/4	3/4	3/4
Steel Flange Thickness (in.)	t_{sh}	5/64	5/64	5/64	5/64	5/64



INSTALLATION GUIDELINES

Bang-It

Prior to pouring concrete, use the recommended diameter metal hole saw to drill a hole through the metal deck at the location the insert is needed. Typically, inserts are installed in the upper flute (valley) of the metal deck for easier access during installation. However, it is also acceptable to install the insert in the lower flute of the metal deck.(see detail)

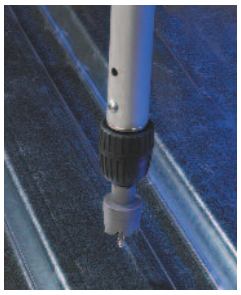
From the topside of the metal deck, place the Bang-It concrete insert's color-coded, plastic protective sleeve through the pre-drilled hole. The oversized steel flange will balance the spring-loaded impact plate and cause it to stand upright. Either step on the Bang-It with your foot or using a hand held hammer, strike the head of the Bang-It with enough force to cause the tapered portion of the protective plastic sleeve to push through the metal deck, clamping the deck surface between the sleeve and the flange. When all inserts are installed, concrete pouring may commence. The clamping pressure generated by the spring keeps the sleeve perpendicular to the deck surface during the pour.

Either before or after the concrete has been placed, tap the appropriate diameter steel threaded rod or threaded bolt through the opening at the end of the plastic sleeve and screw into the internally threaded insert. Minimum thread engagement should be one anchor diameter. Concrete should be allowed to properly cure and achieve its design compressive strength before loading the threaded rod with the intended assembly.

For safety purposes, it is best to wait until the insert is ready to be put in service before screwing the steel threaded rod into place.

Note: UL listing for 1/2" Bang-It is for the valley of the metal deck only. (see detail)


1. Chuck Carbide Hole Saw


2. Drill Deck Holes


3. Push Bang-It into Place


4. Set by Stepping on Bang-It


5. Pour Concrete. Allow to Cure. Then Install Rod

Wood-Knocker

Prior to pouring concrete over the wood form, place the Wood-Knocker concrete insert (break-off nails down) on the surface of the wood form at the desired location. Strike the impact plate of the insert with a hand held hammer, until the plastic color-coded flange is flush with the wood surface. When all inserts are installed, concrete pouring may commence.

After the wood forms are removed, the three break-off nails and color-coded flange are left exposed. Carefully remove any unbroken nails by swiping with a hammer. Eye protection should be worn when removing the break-off nails. The appropriate diameter steel rod or threaded bolt can be inserted into the opening of the flange and screwed into the internally threaded insert.

Minimum thread engagement should be one anchor diameter. Concrete should be allowed to properly cure and achieve its design compressive strength before loading the rod or threaded bolt with the intended assembly.

For safety purposes, it is best to wait until the insert is ready to be put in service before screwing the steel threaded rod into place.

Note: UL listing for 5/8" Wood-Knocker is for 8" pipe maximum.


1. Set Wood-Knocker into Place


2. Hammer in Insert


3. Pour Concrete and allow to Cure

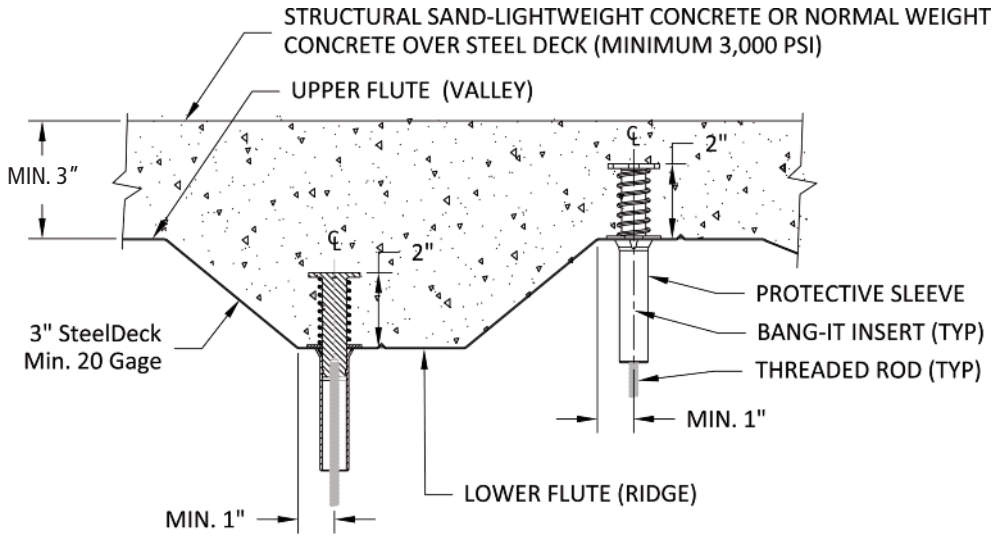

4. Install Rod

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Bang-It Inserts Installed in Structural Lightweight Concrete or Nominal Weight over Metal Deck[1,2,3]

Rod/Insert Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Flute Location in Deck	Minimum Insert Spacing in. (mm)	Minimum End Distance in. (mm)	$f'_c \geq$ 3,000 psi (20.7 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	4,450 (20.0)	2,500 (11.3)	1,115 (5.0)	835 (3.8)
		Lower			3,320 (14.9)	2,500 (11.3)	830 (3.7)	625 (2.8)
3/8 (9.5)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	5,750 (25.9)	3,350 (15.1)	1,915 (8.6)	1,115 (5.0)
		Lower			3,320 (14.9)	3,350 (15.1)	830 (3.7)	840 (3.8)
1/2 (12.7)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	7,110 (32.0)	3,350 (15.1)	2,370 (10.7)	1,115 (5.0)
		Lower			3,320 (14.9)	3,350 (15.1)	830 (3.7)	840 (3.8)
5/8 (15.9)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	8,810 (39.6)	3,350 (15.1)	2,935 (13.2)	1,115 (5.0)
		Lower	9 (228.6)		3,960 (17.8)	–	990 (4.5)	–
			12 (304.8)		3,960 (17.8)	3,350 (15.1)	990 (4.5)	840 (3.8)
3/4 (19.1)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	8,810 (39.6)	3,350 (15.1)	2,935 (13.2)	1,115 (5.0)
		Lower	9 (228.6)		3,960 (17.8)	–	990 (4.5)	–
			12 (304.8)		3,960 (17.8)	3,350 (15.1)	990 (4.5)	840 (3.8)
7/8 (22.2)	2 (50.8)	Upper	9 (228.6)	12 (304.8)	8,810 (39.6)	3,350 (15.1)	2,935 (13.2)	1,115 (5.0)
		Lower	9 (228.6)		3,960 (17.8)	–	990 (4.5)	–
			12 (304.8)		3,960 (17.8)	3,350 (15.1)	990 (4.5)	840 (3.8)

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0 for installations in the upper flute and 4.0 for installations in the lower flute.
2. The allowable working load must be the lesser of the insert capacity or the steel strength of the threaded rod.
3. NFPA 13 design requirements are five times the weight of the water filled pipe plus 250 pounds.



PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Wood-Knocker Inserts Installed in Normal-Weight Concrete[1,2,3,4]

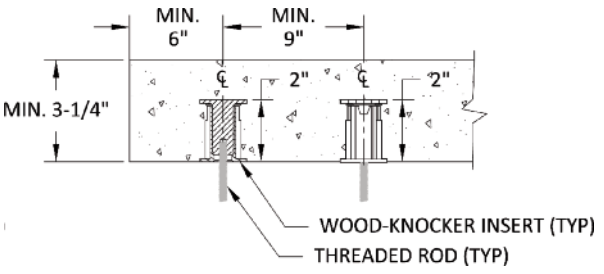
Rod/ Insert Diameter d in. (mm)	Embed. Depth h_v in. (mm)	Minimum Insert Spacing in. (mm)	Minimum End Distance in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
				3,000 psi (20.7 MPa)				**4,500 psi** (31.1 MPa)			
				Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	9 (228.6)	6 (152.4)	3,720 (16.7)	1,490 (6.7)	1,240 (5.6)	495 (2.2)	4,250 (19.1)	1,610 (7.2)	1,415 (6.4)	535 (2.4)
3/8 (9.5)	2 (50.8)	9 (228.6)	6 (152.4)	4,820 (21.7)	5,330 (24.0)	1,605 (7.2)	1,775 (8.0)	7,190 (32.4)	5,620 (25.3)	2,395 (10.8)	1,875 (8.4)
1/2 (12.7)	2 (50.8)	9 (228.6)	6 (152.4)	4,820 (21.7)	7,400 (33.3)	1,605 (7.2)	2,465 (11.1)	7,190 (32.4)	8,590 (38.7)	2,395 (10.8)	2,865 (12.9)
5/8 (15.9)	2 (50.8)	9 (228.6)	6 (152.4)	4,650 (20.9)	–	1,550 (7.0)	–	8,440 (38.0)	–	2,815 (12.7)	–
		12 (304.8)	9 (228.6)	4,650 (20.9)	11,360 (51.1)	1,550 (7.0)	3,785 (17.0)	8,440 (38.0)	13,010 (58.5)	2,815 (12.7)	4,335 (19.5)
3/4 (19.1)	2 (50.8)	9 (228.6)	6 (152.4)	4,650 (20.9)	–	1,550 (7.0)	–	7,350 (33.1)	–	2,450 (11.0)	–
		12 (304.8)	9 (228.6)	4,650 (20.9)	11,360 (51.1)	1,550 (7.0)	3,785 (17.0)	7,350 (33.1)	14,590 (65.7)	2,450 (11.0)	4,865 (21.9)

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0.
2. The allowable working load must be the lesser of the insert capacity or the steel strength of the threaded rod.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.
4. NFPA 13 design requirements are five times the weight of the water filled pipe plus 250 pounds.

Ultimate and Allowable Load Capacities for Wood-Knocker Inserts Installed in Structural Sand-Lightweight Concrete or Normal-Weight Concrete[1,2,3]

Rod/Insert Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Minimum Insert Spacing in. (mm)	Minimum End Distance in. (mm)	$f'_c \geq$ **3,000 psi** (20.7 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	2 (50.8)	9 (228.6)	6 (152.4)	4,270 (19.2)	1,680 (7.6)	1,425 (6.4)	560 (2.5)
3/8 (9.5)	2 (50.8)	9 (228.6)	6 (152.4)	4,270 (19.2)	5,280 (23.8)	1,425 (6.4)	1,760 (7.9)
1/2 (12.7)	2 (50.8)	9 (228.6)	6 (152.4)	4,270 (19.2)	7,180 (32.3)	1,425 (6.4)	2,395 (10.8)
5/8 (15.9)	2 (50.8)	9 (228.6)	6 (152.4)	4,600 (20.7)	–	1,535 (6.9)	–
		12 (304.8)	9 (228.6)	4,600 (20.7)	7,590 (34.2)	1,535 (6.9)	2,530 (11.4)
3/4 (19.1)	2 (50.8)	9 (228.6)	6 (152.4)	4,600 (20.7)	–	1,535 (6.9)	–
		12 (304.8)	9 (228.6)	4,600 (20.7)	7,590 (34.2)	1,535 (6.9)	2,530 (11.4)

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0.
2. The allowable working load must be the lesser of the insert capacity or the steel strength of the threaded rod.
3. NFPA 13 design requirements are five times the weight of the water filled pipe plus 250 pounds.



PERFORMANCE DATA

Underwriter's Laboratories (UL) and Factory Mutual (FM Global) Ultimate Load Capacities for Bang-It Inserts Installed in Lightweight Concrete over Metal Deck[1,2,3,4]

Rod/Insert Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Maximum Pipe Diameter in. (mm)	Flute Location in Deck	$f'_c \geq$ 3,000 psi (20.7 MPa)	
				UL Test[3] lbs. (kN)	FM Test[4] lbs. (kN)
3/8 (9.5)	2 (50.8)	4 (101.6)	Upper	1,500 (6.8)	1,450 (6.5)
			Lower	1,500 (6.8)	1,450 (6.5)
1/2 (12.7)	2 (50.8)	8 (203.2)	Upper	4,050 (18.2)	3,800 (17.1)
5/8 (15.9)	2 (50.8)	12 (304.8)	Upper	–	7,900 (35.6)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 3.0 or greater to determine the allowable working load.
2. NFPA 13 Fire protection fastening requirements are five times the weight of the liquid (water) filled pipe plus 250 lbs. Consult the Engineer of Record.
3. Underwriters Laboratories (UL) – File No. EX1289. Recognized and suitable for use in air handling spaces.
4. Factory Mutual (FM Approvals) – File No. J.I. 3015153.

Underwriter's Laboratories (UL) and Factory Mutual (FM Global) Ultimate Load Capacities for Wood-Knocker Inserts Installed in Normal-Weight Concrete[1,2,3,4]

Rod/Insert Diameter d in. (mm)	Embedment Depth h_v in. (mm)	Maximum Pipe Diameter in. (mm)	$f'_c \geq$ 3,000 psi (20.7 MPa)	
			UL Test[3] lbs. (kN)	FM Test[4] lbs. (kN)
3/8 (9.5)	2 (50.8)	4 (101.6)	1,500 (6.8)	1,450 (6.5)
1/2 (12.7)	2 (50.8)	8 (203.2)	4,050 (18.2)	3,800 (17.1)
5/8 (15.9)	2 (50.8)	8 (203.2)	4,050 (18.2)	–

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 3.0 or greater to determine the allowable working load.
2. NFPA 13 Fire protection fastening requirements are five times the weight of the liquid (water) filled pipe plus 250 lbs. Consult the Engineer of Record.
3. Underwriters Laboratories (UL) – File No. EX1289. Recognized and suitable for use in air handling spaces.
4. Factory Mutual (FM Approvals) – File No. J.I. 3015153.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

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

For spacing, edge and end distances reference the information in the performance data tables.

ORDERING INFORMATION

Bang-It Deck Insert (UNC)

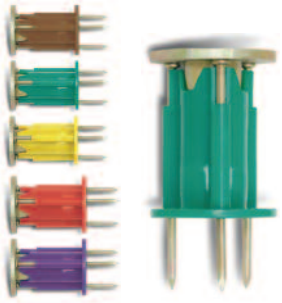
Cat. No.	Description	Color Code	Pre-Drilled Hole	Standard Box	Std. Pallet
7540	1/4" Bang-It	Brown	13/16"	100	4,000
7542	3/8" Bang-It	Green	13/16"	100	4,000
7544	1/2" Bang-It	Yellow	13/16"	100	4,000
7546	5/8" Bang-It	Red	1-3/16"	50	2,400
7548	3/4" Bang-It	Purple	1-3/16"	50	2,400
7549	7/8" Bang-It	Black	1-3/16"	50	2,400

Bang-It Installation Accessories

Cat. No.	Description	Standard Box
7560	Bang-It Stand Up Pole Tool	1
7562	13/16" Carbide Hole Saw for 1/4", 3/8" and 1/2" sizes	1
7564	1-3/16" Carbide Hole Saw for 5/8", 3/4" and 7/8" sizes	1
7566	Extra Carbide Hole Saw Center Bit	1

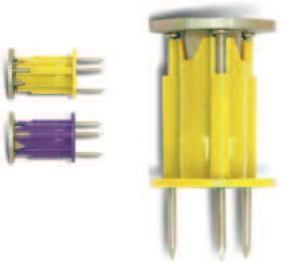
Wood-Knocker Form Insert (UNC)

Cat. No.	Description	Color Code	Standard Box	Std. Pallet
7550	1/4" Wood-Knocker	Brown	200	9,600
7552	3/8" Wood-Knocker	Green	200	9,600
7554	1/2" Wood-Knocker	Yellow	200	9,600
7556	5/8" Wood-Knocker	Red	150	6,000
7558	3/4" Wood-Knocker	Purple	150	6,000



Wood-Knocker Form Insert (Coil Thread)

Cat. No.	Description	Color Code	Standard Box	Std. Pallet
7567	1/2" Coil Thread Wood-Knocker	Yellow	200	9,600
7568	3/4" Coil Thread Wood-Knocker	Purple	150	6,000



Spike® *Pin Anchor*

PRODUCT DESCRIPTION

The Spike is a, one-piece, vibration resistant anchor for use in concrete block or stone. Several head styles, including tamperfroof versions, and anchor materials are available. The Spike anchor is formed with an "s" shaped configuration at the working end of the anchor to create an expansion mechanism. Since the anchor is pre-formed, there is no secondary tightening operation required which greatly reduces the overall cost of an anchor installation.

GENERAL APPLICATIONS AND USES

- Tamperproof Applications
- Exterior Applications
- Cable Trays and Strut
- Pipe Hanging
- Metal Track Attachments
- Concrete Formwork
- For roofing applications see the Roofing Spike product information

FEATURES AND BENEFITS

+ Pre-expanded anchor design allows for easy installation
+ Mushroom and flat head Spike anchors are tamper-proof
+ Forming Spike, which is removable, can be used for temporary installations
+ Pipe and Tie-wire Spike is an easy to install alternative to direct fastening

APPROVALS AND LISTINGS

Factory Mutual Research Corporation (FM Approvals) – J.I. ON5A1.AH, 3/8" diameter Pipe Spike *Pipe hanger components for Automatic Sprikler Systems.*
Tested in accordance with ASTM E488 and AC01 criteria

GUIDE SPECIFICATIONS

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

MATERIAL SPECIFICATIONS

Carbon Steel (Mushroom Head, Flat Head, Pipe, Tie-Wire and Forming Spike)

Anchor Component	Component Material
Anchor Body	AISI 1038 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

Stainless Steel (Mushroom Head)

Anchor Component	Component Material
Anchor Body	Type 316L Stainless Steel

SECTION CONTENTS


Mushroom Head Spike


Flat Head Spike


Pipe Spike


Tie-Wire Spike


Forming Spike

HEAD STYLES

Mushroom Head
Flat Head
Pipe
Tie-Wire
Forming

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

3/16" diameter to 1/2" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry (CMU)

INSTALLATION SPECIFICATIONS

Mushroom Head Carbon Steel Spike

Dimension	Nominal Anchor Size, *d*			
	3/16"	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole, d_h (in.)	1/4	5/16	7/16	9/16
Head Height (in.)	7/64	7/64	7/32	1/4
Head Size, O.D. (in.)	7/16	1/2	3/4	1

Mushroom Head Stainless Steel Spike

Dimension	Nominal Anchor Size, *d*		
	3/16"	1/4"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	3/8
Fixture Clearance Hole, d_h (in.)	1/4	5/16	7/16
Head Height (in.)	7/64	7/64	7/32
Head Size, O.D. (in.)	7/16	1/2	3/4

Flat Head Spike (80° – 82° Head)

Dimension	Nominal Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Head Size, O.D. (in.)	3/8	1/2

Pipe Spike

Dimension	Nominal Anchor Size, *d*	
	1/4"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
UNC Thread Size	1/4-20	3/8-16
Head Height (in.)	1/2	5/8
Head Size, O.D. (in.)	13/32	35/64

Tie-Wire Spike

Dimension	Nominal Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Tie-Wire Hole (in.)	3/16	9/32
Head Height (in.)	37/64	41/64
Head Width (in.)	9/64 x 7/16	3/16 x 9/16

Forming Spike

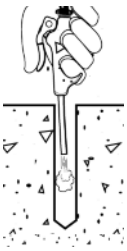
Dimension	Nominal Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Head Height (in.)	9/16	9/16
Head Size, O.D. (in.)	13/32	1/2

INSTALLATION SPECIFICATIONS

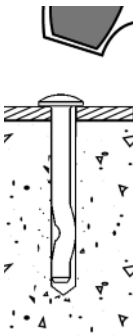
Mushroom/Flat Head Version

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.



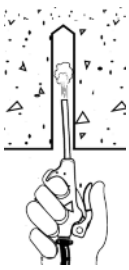
Drive the anchor through the fixture into the anchor hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



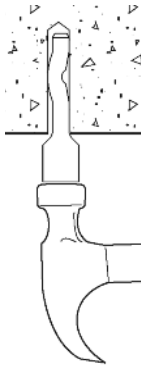
Pipe Spike Version

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.



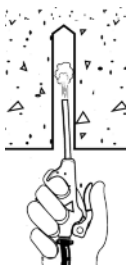
Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.



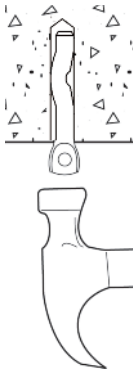
Tie-Wire Version

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.

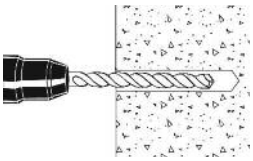


Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.

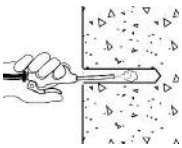


Forming Spike Version

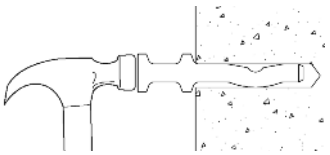
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required.
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



Blow the hole clean of dust and other material.



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



PERFORMANCE DATA

Ultimate Load Capacities for Carbon Steel Spike 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)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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)
3/16 (4.8)	7/8 (22.2)	520 (2.3)	1,080 (4.9)	560 (2.5)	1,270 (5.7)	660 (2.9)	1,310 (5.9)	690 (3.1)	1,350 (6.1)
	1 (25.4)	540 (2.4)	1,230 (5.5)	620 (2.8)	1,725 (7.8)	780 (3.5)	1,860 (8.4)	795 (3.5)	1,860 (8.4)
	1-1/4 (31.8)	780 (3.5)	1,800 (8.1)	900 (4.0)	2,000 (9.0)	1,060 (4.7)	2,155 (9.7)	1,120 (5.0)	2,310 (10.4)
1/4 (6.4)	1 (25.4)	620 (2.8)	1,585 (7.1)	775 (3.4)	1,965 (8.8)	835 (3.7)	2,160 (9.7)	885 (3.9)	2,360 (10.6)
	1-1/4 (31.8)	830 (3.7)	1,815 (8.2)	1,100 (4.9)	2,020 (9.1)	1,210 (5.4)	2,220 (10.0)	1,320 (5.9)	2,585 (11.6)
3/8 (9.5)	1-3/4 (44.5)	1,785 (8.0)	3,645 (16.4)	2,120 (9.5)	4,480 (20.2)	2,630 (11.8)	5,025 (22.6)	2,875 (12.9)	5,075 (22.8)
1/2 (12.7)	2-1/2 (63.5)	3,215 (14.5)	5,345 (24.1)	3,620 (16.3)	8,460 (38.1)	4,015 (18.1)	10,320 (46.4)	4,410 (19.8)	10,860 (48.9)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Carbon Steel Spike 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)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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)
3/16 (4.8)	7/8 (22.2)	130 (0.6)	270 (1.2)	140 (0.6)	320 (1.4)	165 (0.7)	330 (1.5)	170 (0.8)	340 (1.5)
	1 (25.4)	135 (0.6)	310 (1.4)	155 (0.7)	430 (1.9)	195 (0.9)	465 (2.1)	200 (0.9)	465 (2.1)
	1-1/4 (31.8)	195 (0.9)	450 (2.0)	225 (1.0)	500 (2.3)	265 (1.2)	540 (2.4)	280 (1.2)	580 (2.6)
1/4 (6.4)	1 (25.4)	155 (0.7)	395 (1.8)	195 (0.9)	490 (2.2)	210 (0.9)	540 (2.4)	220 (1.0)	590 (2.7)
	1-1/4 (31.8)	210 (0.9)	455 (2.0)	275 (1.2)	505 (2.3)	300 (1.3)	555 (2.5)	330 (1.5)	645 (2.9)
3/8 (9.5)	1-3/4 (44.5)	445 (2.0)	910 (4.1)	530 (2.4)	1,120 (5.0)	660 (3.0)	1,255 (5.6)	720 (3.2)	1,270 (5.7)
1/2 (12.7)	2-1/2 (63.5)	805 (3.6)	1,335 (6.0)	905 (4.1)	2,115 (9.5)	1,005 (4.5)	2,580 (11.6)	1,105 (5.0)	2,715 (12.2)

1. 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.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate Load Capacities for Stainless Steel Spike 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)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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)
3/16 (4.8)	7/8 (22.2)	490 (2.2)	920 (4.1)	560 (2.5)	1,155 (5.2)	660 (2.9)	1,220 (5.5)	690 (3.1)	1,290 (5.8)
	1 (25.4)	500 (2.3)	1,175 (5.3)	620 (2.8)	1,650 (7.4)	780 (3.5)	1,740 (7.8)	795 (3.5)	1,830 (8.2)
	1-1/4 (31.8)	740 (3.3)	1,735 (7.8)	900 (4.0)	1,930 (8.7)	1,060 (4.7)	2,040 (9.2)	1,120 (5.0)	2,150 (9.7)
1/4 (6.4)	1 (25.4)	620 (2.8)	1,565 (7.0)	775 (3.4)	1,845 (8.3)	835 (3.7)	2,095 (9.4)	885 (3.9)	2,250 (10.1)
	1-1/4 (31.8)	795 (3.6)	1,765 (7.9)	1,080 (4.9)	1,965 (8.8)	1,175 (5.2)	2,145 (9.7)	1,280 (5.7)	2,325 (10.5)
3/8 (9.5)	1-3/4 (44.5)	1,575 (7.1)	3,155 (14.2)	1,990 (9.0)	3,880 (17.5)	2,420 (10.9)	4,150 (18.7)	2,570 (11.6)	4,425 (19.9)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Stainless Steel Spike 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)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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)
3/16 (4.8)	7/8 (22.2)	125 (0.6)	230 (1.0)	140 (0.6)	290 (1.3)	165 (0.7)	305 (1.4)	170 (0.8)	325 (1.5)
	1 (25.4)	125 (0.6)	295 (1.3)	155 (0.7)	415 (1.9)	195 (0.9)	435 (2.0)	200 (0.9)	460 (2.1)
	1-1/4 (31.8)	185 (0.8)	435 (2.0)	225 (1.0)	485 (2.2)	265 (1.2)	510 (2.3)	280 (1.7)	540 (2.4)
1/4 (6.4)	1 (25.4)	155 (0.7)	390 (1.8)	195 (0.9)	460 (2.1)	210 (0.9)	525 (2.4)	220 (1.0)	565 (2.5)
	1-1/4 (31.8)	200 (0.9)	440 (2.0)	270 (1.2)	490 (2.2)	295 (1.3)	535 (2.4)	320 (1.4)	580 (2.6)
3/8 (9.5)	1-3/4 (44.5)	395 (1.8)	790 (3.6)	500 (2.3)	970 (4.4)	605 (2.7)	1,040 (4.7)	645 (2.9)	1,105 (5.0)

1. 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.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate Load Capacities for Carbon Steel Pipe Spike in Normal-Weight Concrete[1,2]

Anchor Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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 (6.4)	3/16	1-1/4 (31.8)	780 (3.5)	975 (4.4)	1,260 (5.7)	975 (4.4)	1,260 (5.7)	975 (4.4)	1,260 (5.7)	975 (4.4)
3/8 (9.5)	1/4	1-3/4 (44.5)	1,100 (5.0)	1,815 (8.2)	1,660 (7.5)	2,020 (9.1)	2,000 (9.0)	2,100 (9.5)	2,000 (9.0)	2,180 (9.8)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Carbon Steel Pipe Spike in Normal-Weight Concrete[1,2,3]

Anchor Dia. d in. (mm)	Drill Bit Dia. d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
			2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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 (6.4)	3/16	1-1/4 (31.8)	195 (0.9)	245 (1.1)	315 (1.4)	245 (1.1)	315 (1.4)	245 (1.1)	315 (1.4)	245 (1.1)
3/8 (9.5)	1/4	1-3/4 (44.5)	275 (1.2)	455 (2.0)	415 (1.9)	505 (2.3)	500 (2.3)	525 (2.4)	500 (2.3)	545 (2.5)

1. 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.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Carbon Steel Tie-Wire Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-1/8 (28.6)	975 (4.4)	950 (4.3)	1,050 (4.7)	950 (4.3)	1,120 (5.0)	950 (4.3)
1/4 (6.4)	1-1/8 (28.6)	1,075 (4.8)	1,310 (5.9)	1,150 (5.2)	1,310 (5.9)	1,230 (5.5)	1,310 (5.9)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Carbon Steel Tie-Wire Spike 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)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-1/8 (28.6)	245 (1.1)	240 (1.1)	265 (1.2)	240 (1.1)	280 (1.3)	240 (1.1)
1/4 (6.4)	1-1/8 (28.6)	270 (1.2)	330 (1.5)	290 (1.3)	330 (1.5)	310 (1.4)	330 (1.5)

1. 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.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate Load Capacities for Carbon Steel Forming Spike in Normal-Weight Concrete[1,2]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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)
3/16 (4.8)	1-1/4 (31.8)	780 (3.5)	1,800 (8.1)	1,000 (4.5)	2,000 (9.0)	1,260 (5.7)	2,155 (9.7)	1,260 (5.7)	2,310 (10.4)
1/4 (6.4)	1-1/4 (31.8)	830 (3.7)	1,815 (8.2)	1,200 (5.4)	2,020 (9.1)	1,410 (6.3)	2,220 (10.0)	1,410 (6.3)	2,585 (11.6)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Carbon Steel Forming Spike in Normal-Weight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 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)
3/16 (4.8)	1-1/4 (31.8)	195 (0.9)	450 (2.0)	250 (1.1)	500 (2.3)	315 (1.4)	540 (2.4)	315 (1.4)	580 (2.6)
1/4 (6.4)	1-1/4 (31.8)	210 (0.9)	455 (2.0)	300 (1.4)	505 (2.3)	355 (1.6)	555 (2.5)	355 (1.6)	645 (2.9)

1. 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.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Spike in Structural Lightweight Concrete[1,2,3]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-1/4 (31.8)	440 (2.0)	1,280 (5.8)	400 (1.8)	1,280 (5.8)	380 (1.7)	1,280 (5.8)
1/4 (6.4)	1-1/4 (31.8)	480 (2.2)	1,720 (7.7)	440 (2.0)	1,720 (7.7)	400 (1.8)	1,720 (7.7)
3/8 (9.5)	1-3/4 (44.5)	1,140 (5.1)	3,000 (13.5)	960 (4.3)	3,000 (13.5)	800 (3.6)	3,000 (13.5)
1/2 (12.7)	2-1/2 (63.5)	1,860 (8.4)	6,440 (29.0)	1,860 (8.4)	6,440 (29.0)	1,860 (8.4)	6,440 (29.0)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Spike in Structural Lightweight Concrete[1,2,3,4]

Anchor Diameter *d* in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-1/4 (31.8)	110 (0.5)	320 (1.4)	100 (0.5)	320 (1.4)	95 (0.4)	320 (1.4)
1/4 (6.4)	1-1/4 (31.8)	120 (0.5)	430 (1.9)	110 (0.5)	430 (1.9)	100 (0.5)	430 (1.9)
3/8 (9.5)	1-3/4 (44.5)	285 (1.3)	750 (3.4)	240 (1.1)	750 (3.4)	200 (0.9)	750 (3.4)
1/2 (12.7)	2-1/2 (63.5)	465 (2.1)	1,610 (7.2)	465 (2.1)	1,610 (7.2)	465 (2.1)	1,610 (7.2)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
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.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.
4. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

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

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete Over Minimum 20 Ga. Steel Deck $f'_c \geq$ 3,000 psi (20.7 MPa)			
		Minimum 1-1/2" Wide Deck			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	1-1/4 (31.8)	560 (2.5)	2,000 (9.0)	140 (0.6)	500 (2.3)
1/4 (6.4)	1-1/4 (31.8)	560 (2.5)	2,000 (9.0)	140 (0.6)	500 (2.3)
3/8 (9.5)	1-3/4 (44.5)	600 (2.7)	2,620 (11.8)	150 (0.7)	655 (2.9)
1/2 (12.7)	2-1/2 (63.5)	1,120 (5.0)	3,020 (13.6)	280 (1.3)	755 (3.4)

1. Tabulated load values are for carbon steel and stainless steel anchors installed in sand-lightweight concrete over steel deck. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using a 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. Spacing distances shall be in accordance with the spacing table for structural lightweight concrete listed in the Design Criteria section.
4. Anchors are permitted to be installed in the lower or upper flute of the steel deck provided the proper installation procedures are maintained.

Ultimate and Allowable Load Capacities for Carbon Steel and Stainless Steel Spike in Grouted Concrete Masonry[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Normal-Weight CMU, $f'_m \geq$ 1,500 psi (10.4 MPa)							
		Ultimate Load				Allowable Load			
		Carbon Steel Spike		Stainless Steel Spike		Carbon Steel Spike		Stainless Steel Spike	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	7/8 (22.2)	280 (1.3)	540 (2.4)	280 (1.3)	540 (2.4)	55 (0.2)	110 (0.5)	55 (0.2)	110 (0.5)
	1 (25.4)	410 (1.8)	590 (2.7)	310 (1.4)	590 (2.7)	80 (0.4)	120 (0.5)	60 (0.3)	120 (0.5)
	1-1/4 (31.8)	740 (3.3)	1,090 (4.9)	730 (3.3)	1,980 (8.9)	150 (0.7)	420 (1.9)	145 (0.7)	395 (1.8)
1/4 (6.4)	1 (25.4)	670 (3.0)	1,840 (8.3)	645 (2.9)	1,620 (7.3)	135 (0.6)	370 (1.7)	130 (0.6)	325 (1.5)
	1-1/4 (31.8)	800 (3.6)	2,100 (9.5)	770 (3.5)	1,890 (8.5)	160 (0.7)	420 (1.9)	155 (0.7)	380 (1.7)

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 cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation ($f'm \geq$ 1,500 psi)..
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, and in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable load capacities for intermediate embedments.
4. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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 in Concrete

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	$s_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{N_C} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{V_C} = 0.50$

Anchor Installed in Structural Lightweight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5\ h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 7d$	$F_{N_C} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 7d$	$F_{V_C} = 0.50$

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

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

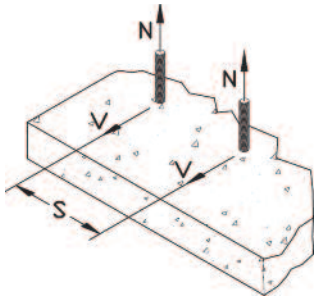
Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})

Dia. (in.)		3/16			1/4			3/8	1/2
h_v (in.)		7/8	1	1-1/4	7/8	1	1-1/4	2-1/2	2-3/4
s_{cr} (in.)		1-3/4	2	2-1/2	1-3/4	2	2-1/2	5	5-1/2
s_{min} (in.)		7/8	1	1-1/4	7/8	1	1-1/4	2-1/2	2-3/4
Spacing, s (inches)	7/8	0.50			0.50				
	1	0.57	0.50		0.57	0.50			
	1-1/4	0.71	0.63	0.50	0.71	0.63	0.50		
	1-1/2	0.86	0.75	0.60	0.86	0.75	0.60		
	1-3/4	1.00	0.88	0.70	1.00	0.88	0.70		
	2		1.00	0.80		1.00	0.80		
	2-1/2			1.00			1.00	0.50	
	2-3/4							0.55	0.50
	3							0.60	0.55
	4							0.80	0.73
	5							1.00	0.91
	5-1/2								1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 embedment depths ($2\,h_v$) at which the anchor achieves 100% of load.

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

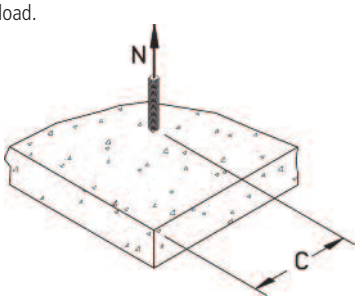


Edge Distance, Tension (F_{NC})

Dia. (in.)		3/16	1/4	3/8	1/2
c_{cr} (in.)		2-5/8	3-1/2	5-1/4	7
c_{min} (in.)		1	1-1/4	1-7/8	2-1/2
Edge Distance, c (inches)	1	0.50			
	1-1/4	0.59	0.50		
	1-7/8	0.78	0.64	0.50	
	2	0.81	0.67	0.52	
	2-1/2	0.96	0.78	0.59	0.50
	2-5/8	1.00	0.81	0.61	0.51
	3		0.89	0.67	0.56
	3-1/2		1.00	0.74	0.61
	4			0.81	0.67
	5			0.96	0.78
	5-1/4			1.00	0.81
	6				0.89
	7				1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 50% of load.

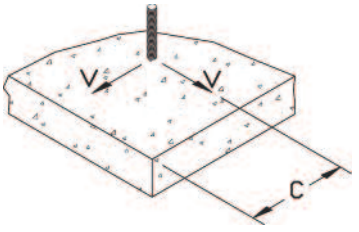


Edge Distance, Shear (F_{VC})

Dia. (in.)		3/16	1/4	3/8	1/2
c_{cr} (in.)		2-5/8	3-1/2	5-1/4	7
c_{min} (in.)		1	1-1/4	1-7/8	2-1/2
Edge Distance, c (inches)	1	0.25			
	1-1/4	0.39	0.25		
	1-7/8	0.67	0.46	0.25	
	2	0.72	0.50	0.28	
	2-1/2	0.94	0.67	0.39	0.25
	2-5/8	1.00	0.71	0.42	0.27
	3		0.83	0.50	0.33
	3-1/2		1.00	0.61	0.42
	4			0.72	0.50
	5			0.94	0.67
	5-1/4			1.00	0.71
	6				0.83
	7				1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 25% of load.



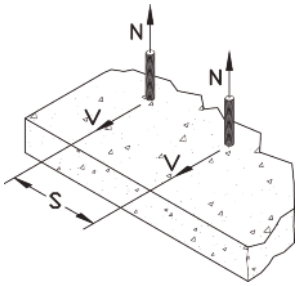
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Structural Lightweight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})

	Dia. (in.)	3/16			1/4			3/8	1/2
	h_v (in.)	7/8	1	1-1/4	7/8	1	1-1/4	2-1/2	2-3/4
	s_{cr} (in.)	2-5/8	3	3-3/4	2-5/8	3	3-3/4	7-1/2	8 1/4
	s_{min} (in.)	1-3/8	1-1/2	1-7/8	1-3/8	1-1/2	1-7/8	3-3/4	4-1/8
Spacing, s (inches)	1-3/8	0.50			0.50				
	1-1/2	0.57	0.50		0.57	0.50			
	1-7/8	0.71	0.63	0.50	0.71	0.63	0.50		
	1-1/2	0.57	0.50	0.40	0.57	0.50	0.40		
	2-5/8	1.00	0.88	0.70	1.00	0.88	0.70		
	3		1.00	0.80		1.00	0.80		
	3-3/4			1.00			1.00	0.50	
	4							0.53	
	4-1/8							0.55	0.50
	5							0.67	0.61
	6							0.80	0.73
	7							0.93	0.85
	7-1/2							1.00	0.91
	8 1/4								1.00

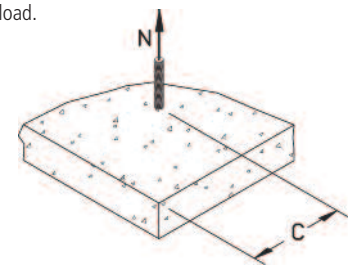
Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 1.5 embedment depth ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{NC})

	Dia. (in.)	3/16	1/4	3/8	1/2
	c_{cr} (in.)	2-5/8	3-1/2	5-1/4	7
	c_{min} (in.)	1-3/8	1-3/4	2-5/8	3-1/2
Edge Distance, c (inches)	1-3/8	0.50			
	1-3/4	0.67	0.50		
	2	0.76	0.57		
	2-5/8	1.00	0.75	0.50	
	3		0.86	0.57	
	3-1/2		1.00	0.67	0.50
	4			0.76	0.57
	5			0.95	0.71
	5-1/4			1.00	0.75
	6				0.86
	7				1.00

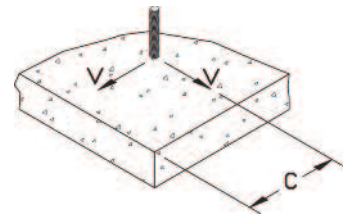
Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 50% of load.



Edge Distance, Shear (F_{VC})

	Dia. (in.)	3/16	1/4	3/8	1/2
	c_{cr} (in.)	2-5/8	3-1/2	5-1/4	7
	c_{min} (in.)	1-3/8	1-3/4	2-5/8	3-1/2
Edge Distance, c (inches)	1-3/8	0.40			
	1-3/4	0.60	0.40		
	2	0.71	0.49		
	2-5/8	1.00	0.70	0.40	
	3		0.83	0.49	
	3-1/2		1.00	0.60	0.40
	4			0.71	0.49
	5			0.94	0.66
	5-1/4			1.00	0.70
	6				0.83
	7				1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 40% of load.



ORDERING INFORMATION

Mushroom Head Carbon Steel Spike (Tamperproof)

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
5502	3/16" x 1"	3/16"	7/8"	100	1,000	1-1/4
5503	3/16" x 1-1/4"	3/16"	7/8"	100	1,000	1-1/2
5504	3/16" x 1-1/2"	3/16"	1-1/4"	100	1,000	1-3/4
5506	3/16" x 2"	3/16"	1-1/4"	100	1,000	2
5508	3/16" x 2-1/2"	3/16"	1-1/4"	100	1,000	2
5510	3/16" x 3"	3/16"	1-1/4"	100	1,000	2-1/2
5511	3/16" x 3-1/2"	3/16"	1-1/4"	100	1,000	3-1/2
5512	3/16" x 4"	3/16"	1-1/4"	100	500	4
5522	1/4" x 1"	1/4"	7/8"	100	1,000	1-1/2
5523	1/4" x 1-1/4"	1/4"	1"	100	1,000	2-1/4
5524	1/4" x 1-1/2"	1/4"	1-1/4"	100	1,000	2-1/2
5526	1/4" x 2"	1/4"	1-1/4"	100	1,000	3
5528	1/4" x 2-1/2"	1/4"	1-1/4"	100	1,000	4
5530	1/4" x 3"	1/4"	1-1/4"	100	1,000	4-1/2
5531	1/4" x 3-1/2"	1/4"	1-1/4"	100	1,000	4-1/2
5532	1/4" x 4"	1/4"	1-1/4"	100	1,000	5-1/2
5546	3/8" x 2"	3/8"	1-3/4"	25	250	7-1/2
5548	3/8" x 2-1/2"	3/8"	1-3/4"	25	250	9
5550	3/8" x 3"	3/8"	1-3/4"	25	250	10
5551	3/8" x 3-1/2"	3/8"	1-3/4"	25	250	11
5552	3/8″ x 4	3/8″	1-3/4″	25	250	11
5554	3/8″ x 5	3/8″	1-3/4″	25	250	11
5556	3/8″ x 6	3/8″	1-3/4″	25	250	11
5569	1/2″ x 2-3/4″	1/2″	2-1/2″	50	200	13
5571	1/2″ x 3-1/2″	1/2″	2-1/2″	50	150	13
5572	1/2″ x 4″	1/2″	2-1/2″	25	150	13
5574	1/2″ x 5″	1/2″	2-1/2″	25	150	13
5577	1/2″ x 6-1/2″	1/2″	2-1/2″	25	150	13

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

Flat Head Carbon Steel Spike (Tamperproof)

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
5608	3/16" x 2-1/2"	3/16"	1-1/4"	100	1,000	2
5610	3/16" x 3"	3/16"	1-1/4"	100	1,000	2-1/2
5612	3/16" x 4"	3/16"	1-1/4"	100	1,000	4
5624	1/4" x 1-1/2"	1/4"	1-1/4"	100	1,000	2-1/2
5626	1/4" x 2"	1/4"	1-1/4"	100	1,000	3
5628	1/4" x 2-1/2"	1/4"	1-1/4"	100	1,000	3-3/4
5630	1/4" x 3"	1/4"	1-1/4"	100	1,000	4-1/2
5631	1/4" x 3-1/2"	1/4"	1-1/4"	100	1,000	5
5632	1/4" x 4"	1/4"	1-1/4"	100	500	5-3/4

The published length is the overall length of the anchor.

ORDERING INFORMATION

Mushroom Head Type 316 Stainless Spike (Tamperproof)

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
6602	3/16" x 1"	3/16"	7/8"	100	1,000	1-1/4
6603	3/16" x 1-1/4"	3/16"	7/8"	100	1,000	1-1/2
6604	3/16" x 1-1/2"	3/16"	7/8"	100	1,000	1-3/4
6606	3/16" x 2"	3/16"	7/8"	100	1,000	2
6623	1/4" x 1-1/4"	1/4"	7/8"	100	1,000	2-1/4
6624	1/4" x 1-1/2"	1/4"	7/8"	100	1,000	2-1/2
6626	1/4" x 2"	1/4"	7/8"	100	1,000	3
6628	1/4" x 2-1/2"	1/4"	7/8"	100	1,000	4
6630	1/4" x 3"	1/4"	7/8"	100	1,000	4-1/2
6646	3/8" x 2"	3/8"	7/8"	25	250	7-1/2
6648	3/8" x 2-1/2"	3/8"	1-3/4"	25	250	9
6650	3/8" x 3"	3/8"	1-3/4"	25	250	10

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

Pipe Spike

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
3755	1/4"	3/16"	1-1/4"	100	1,000	4
3758	3/8"	1/4"	1-3/4"	50	500	6

Designed for rod hanging.

Tie-Wire Spike

Catalog Number	Anchor Size	Drill Diameter	Minimum Embed.	Tie Wire Hole Size	Standard Box	Standard Carton	Wt./100
3756	3/16"	3/16"	1-1/8"	3/16"	100	500	2
3759	1/4"	1/4"	1-1/8"	9/32"	100	500	2-1/2

Designed for suspended ceilings.

Forming Spike

Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
3795	3/16" x 1-1/2"	3/16"	1-1/4"	100	1,000	2-1/2
3796	3/16" x 2"	3/16"	1-1/4"	100	1,000	3
3797	3/16" x 2-3/4"	3/16"	1-1/4"	100	1,000	4
3794	1/4" x 2-3/4"	1/4"	1-1/4"	100	1,000	5

Designed for concrete forming. The published length is measured from below the head to the end of the anchor.

ORDERING INFORMATION

Spike Drivers

While the SPIKE anchor can easily be installed using a hammer, a specially designed series of drivers and manual tools provide a fast, easy to use method for installing SPIKE anchors into concrete and masonry materials. The tools allow the SPIKE anchor to be installed in confined areas and prevent damage to the fixture from stray hammer blows.

Catalog Number	Tool Description	Guide I.D.	Standard Box	Wt./100
3790	Spike Driver 1000	1/2"	1	1/4
3791	Spike Driver 2000	1/2"	1	1/4

The SPIKE Driver 1000 is a one piece tool with an SDS shank formed on one end and a retractable guide on the other. The driver is designed to fit directly into the chuck of an SDS rotary hammer drill to provide maximum impact energy for faster driving. Once the anchor hole is drilled, insert the SPIKE Driver 1000 into the chuck of the rotary hammer drill. Insert the tip of the SPIKE through the fixture into the anchor hole, then place the guide over the head of the SPIKE. Turn the rotary hammer on and drive the SPIKE until it is at the required embedment in the base material and seated flush against the fixture. As the SPIKE is driven into the base material, the guide retracts until the anchor is fully seated. This driver is normally used with a two person installation team where one installer is drilling the anchor holes while the other positions the fixture and sets the anchor.

The SPIKE Driver 2000 is a variation of the 1000 tool which is designed to be used in conjunction with a 3/16" x 4" or 1/4" x 4" SDS carbide tipped bit. The Driver has a recessed end which is slipped over the SDS bit on one end and a retractable guide on the other. Once the anchor hole is drilled, slip the SPIKE Driver 2000 over the 3/16" or 1/4" SDS bit. Drive the SPIKE anchor with the rotary hammer until it is seated flush against the fixture and at the required embedment in the base material. As the SPIKE is driven into the base material, the guide retracts until the anchor is fully seated. Once the SPIKE is installed,remove the driver from the SDS bit and drill the next anchor hole.

Pipe Spike Setting Tool

When installing the 3/8" Pipe SPIKE, this tool is designed to make driving easier. The tool has a guide tip on which the 3/8" Pipe SPIKE is mounted which helps to protect the internal threads during the driving operation. A large handle provides a convenient gripping area and a large bearing surface to accept the hammer blows. Simply position the 3/8" Pipe SPIKE on the tool and insert the tip of the anchor into the hole. Give the end of the handle several sharp hammer blows to drive the 3/8" Pipe SPIKE into the base material until it is at the required embedment.

Catalog Number	Tool Description	Tip O.D.	Standard Box	Wt./100
3760	Pipe Spike Setting Tool	5/16"	1	1

Spike Driver Selection Guide

Style	Size	1000	2000	Pipe
Mushroom	3/16"	X	X	
Mushroom	1/4"	X	X	
Flat Head	3/16"	X	X	
Flat Head	1/4"	X	X	
Pipe	1/4"	X	X	
Pipe	3/8"			X
Tie-Wire	3/16"	X	X	
Forming	3/16"	X	X	
Forming	1/4"	X	X	

Drive® *Pin Anchor*

PRODUCT DESCRIPTION

The Drive is a one-piece, tamperproof, pre-formed anchor available in carbon steel for use in concrete and stone. Tie-Wire Drive anchors are used for suspended ceiling applications. The flat head (countersunk) style is particularly suited for wood-to-concrete anchoring. The round head style can be used for other applications requiring fast, permanent installations.

GENERAL APPLICATIONS AND USES

- Tamperproof Applications
- Suspended Ceilings

FEATURES

+ Pre-expanded anchor design allows for easy installation.
+ Round and flat head anchors are tamperproof

APPROVALS AND LISTINGS

Underwriters Laboratory (UL Listed) – VFXT. EX1289
FM Global (Factory Mutual) J.I. OK4A9.AH

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.*
Pre-expanded anchors shall be Drive as supplied by Powers Fasteners, Inc., Brewster, NY.

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Heat Treated AISI 1018
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

SECTION CONTENTS

Round Head Drive

Flat Head Drive

Tie-Wire Drive

HEAD STYLES

Round Head
Flat Head
Tie-Wire

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

3/16" diameter to 1/2" diameter

SUITABLE BASE MATERIALS

Normal-Weight Concrete

INSTALLATION SPECIFICATIONS

Round Head Drive

Dimension	Anchor Size, *d*			
	3/16"	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole, d_h (in.)	1/4	5/16	7/16	9/16
Head Height (in.)	3/32	1/8	3/16	1/4
Head Width (in.)	3/8	1/2	3/4	1

Flat Head Drive

Dimension	Anchor Size, *d*	
	3/16"	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4
Fixture Clearance Hole, d_h (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Head Width (in.)	3/8	1/2

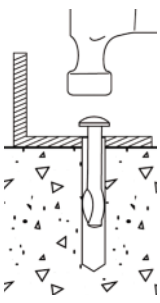
Tie-Wire Drive

Dimension	Anchor Size, *d*
	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Head Height (in.)	5/8
Tie-Wire Hole Diameter (in.)	13/64

Installation Guidelines

Drill a hole into the base material to a depth of at least 1/2" 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.

Drive the anchor into the hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth. The tie-wire Drive should be driven in until the head is flush against the surface of the base material.



PERFORMANCE DATA

Ultimate Load Capacities for Mushroom and Flat Head Drive 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)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
3/16 (4.8)	7/8 (22.2)	700 (3.2)	1,100 (5.0)	1,080 (4.9)	1,365 (6.1)	1,080 (4.9)	1,370 (6.2)
1/4 (6.4)	1-1/8 (28.6)	1,320 (5.9)	1,665 (7.5)	1,760 (7.9)	2,090 (9.4)	1,760 (7.9)	2,090 (9.4)
3/8 (9.5)	1-7/8 (47.6)	2,275 (10.2)	5,580 (25.1)	4,240 (19.1)	7,030 (31.6)	4,240 (19.1)	7,030 (31.6)
1/2 (12.7)	2-5/8 (66.7)	2,560 (11.5)	7,945 (35.8)	4,960 (22.3)	10,205 (45.9)	4,960 (22.3)	10,205 (45.9)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for Mushroom and Flat Head Drive 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)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)	**Tension** lbs. (kN)	**Shear** lbs. (kN)
3/16 (4.8)	7/8 (22.2)	175 (0.8)	275 (1.2)	270 (1.2)	340 (1.5)	270 (1.2)	345 (1.6)
1/4 (6.4)	1-1/8 (28.6)	330 (1.5)	415 (1.9)	440 (2.0)	525 (2.4)	440 (2.0)	525 (2.4)
3/8 (9.5)	1-7/8 (47.6)	570 (2.6)	1,395 (6.3)	1,060 (4.8)	1,760 (7.9)	1,060 (4.8)	1,760 (7.9)
1/2 (12.7)	2-5/8 (66.7)	640 (2.9)	1,985 (8.9)	1,240 (5.6)	2,550 (11.5)	1,240 (5.6)	2,550 (11.5)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Tie-Wire Drive 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)		**4,000 psi** (27.6 Mpa)		**6,000 psi** (41.4 Mpa)	
		Tension lbs. (kN)	**Shear lbs.** (kN)	**Tension lbs.** (kN)	**Shear lbs.** (kN)	**Tension lbs.** (kN)	**Shear lbs.** (kN)
1/4 (6.4)	1-1/8 (28.6)	1,320 (5.9)	1,100 (4.9)	1,760 (7.9)	1,560 (6.9)	1,760 (7.9)	1,560 (6.9)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.

Allowable Load Capacities for Tie-Wire Drive 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)		**4,000 psi** (27.6 Mpa)		**6,000 psi** (41.4 Mpa)	
		Tension lbs. (kN)	**Shear lbs.** (kN)	**Tension lbs.** (kN)	**Shear lbs.** (kN)	**Tension lbs.** (kN)	**Shear lbs.** (kN)
1/4 (6.4)	1-1/8 (28.6)	330 (1.5)	275 (1.2)	440 (2.0)	390 (1.7)	440 (2.0)	390 (1.7)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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[1]

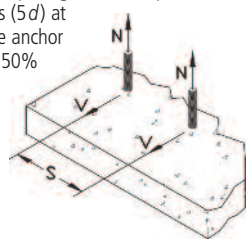
Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	**Load Type**	**Critical Distance (Full Anchor Capacity)**	**Critical Load Factor**	**Minimum Distance (Reduced Capacity)**	**Minimum Load Factor**
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_{Ns} = F_{vs} = 1.0$	$s_{min} = 5d$	$F_{Ns} = F_{Vc} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{Nc} = 1.0$	$c_{min} = 5d$	$F_{Nc} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{vc} = 1.0$	$c_{min} = 5d$	$F_{Vs} = 0.50$

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

Load Adjustment Factors for Normal-Weight Concrete

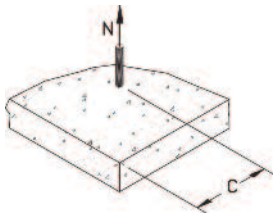
Spacing, Tension (F_{Ns}) & Shear (F_{vs})					
Dia. (in.)		3/16	1/4	3/8	1/2
s_{cr} (in.)		1-7/8	2-1/2	3-3/4	5
s_{min} (in.)		1	1-1/4	1-7/8	2-1/2
Spacing, s (inches)	1	0.50			
	1-1/4	0.67	0.50		
	1-7/8	1.00	0.75	0.50	
	2		0.80	0.53	
	2-1/2		1.00	0.67	0.50
	3			0.80	0.60
	3-3/4			1.00	0.75
	4				0.80
	5				1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters ($10d$) at which the anchor achieves 100% of load.
Minimum spacing (s_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{Nc})					
Dia. (in.)		3/16	1/4	3/8	1/2
c_{cr} (in.)		2-1/4	3	4-1/2	6
c_{min} (in.)		1	1-1/4	1-7/8	2-1/2
Edge Distance, c (inches)	1	0.80			
	1-1/4	0.85	0.80		
	1-7/8	0.94	0.87	0.80	
	2	0.96	0.89	0.81	
	2-1/4	1.00	0.91	0.83	
	2-1/2		0.94	0.85	0.80
	2-3/4		0.97	0.87	0.81
	3		1.00	0.89	0.83
	3-1/2			0.92	0.86
	4			0.96	0.89
	4-1/2			1.00	0.91
	5				0.94
	6				1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.
Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 80% of load.



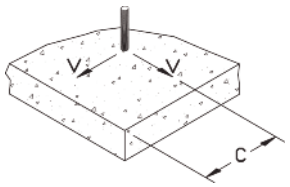
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight Concrete

Edge Distance, Shear (F_{vc})					
Dia. (in.)		3/16	1/4	3/8	1/2
c_{cr} (in.)		2-1/4	3	4-1/2	6
c_{min} (in.)		1	1-1/4	1-7/8	2-1/2
Edge Distance, c (inches)	1	0.50			
	1-1/4	0.62	0.50		
	1-7/8	0.86	0.68	0.50	
	2	0.90	0.71	0.52	
	2-1/4	1.00	0.79	0.57	
	2-1/2		0.86	0.62	0.50
	2-3/4		0.93	0.67	0.54
	3		1.00	0.71	0.57
	3-1/2			0.81	0.64
	4			0.90	0.71
	4-1/2			1.00	0.79
	5				0.86
	6				1.00

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

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Round Head Drive

Cat. No.	Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
3211	1/4" x 1-1/4"	1/4"	1-1/8"	100	1,000	1-3/4
3241	1/4" x 1-1/2"	1/4"	1-1/8"	100	1,000	2-1/2
3271	1/4" x 2"	1/4"	1-1/8"	100	1,000	3
3301	1/4" x 2-1/2"	1/4"	1-1/8"	100	1,000	3-3/4
3601	3/8" x 2"	3/8"	1-7/8"	25	250	7-1/2
3631	3/8" x 2-1/2"	3/8"	1-7/8"	25	250	8-1/2
3691	3/8" x 3-1/2"	3/8"	1-7/8"	25	250	11-3/4
3781	1/2" x 3"	1/2"	2-5/8"	25	125	25

Flat Head Drive

Cat. No.	Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
3092	3/16" x 1-1/2"	3/16"	7/8"	100	1,000	1-1/4
3122	3/16" x 2"	3/16"	7/8"	100	1,000	1-3/4
3152	3/16" x 2-1/2"	3/16"	7/8"	100	1,000	2
3162	3/16" x 3"	3/16"	7/8"	100	1,000	2-1/2
3242	1/4" x 1-1/2"	1/4"	1-1/8"	100	1,000	2-1/2
3272	1/4" x 2"	1/4"	1-1/8"	100	1,000	3
3302	1/4" x 2-1/2"	1/4"	1-1/8"	100	1,000	3-3/4
3332	1/4" x 3"	1/4"	1-1/8"	100	1,000	4-1/2
3362	1/4" x 3-1/2"	1/4"	1-1/8"	100	1,000	5
3392	1/4" x 4"	1/4"	1-1/8"	100	500	5-3/4

Tie-Wire Drive (13/64" Tie-Wire Hole)

Cat. No.	Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
3244	1/4" x 1-3/4" Master Pack	1/4"	1-1/8"	500	500	2-1/2
3245	1/4" x 1-3/4"	1/4"	1-1/8"	100	500	2-1/2
3250	Tie-Wire Setting Tool	–	–	1	1	1/4

Heli-Pin *Helical Facade Anchor*

PRODUCT DESCRIPTION

The Heli-Pin anchor is a one-piece stainless steel helical wall tie system used for anchoring existing brick veneers to the back-up structural members without exposing hardware. The helical design allows the tie to be driven quickly and easily into a predrilled pilot hole with a Heli-Pin setting tool and a roto-hammer drill (or embedded into mortar joints in new construction) to provide a reliable mechanical connection between a masonry façade and its backup material or between multiple wythes of brick. Existing façades constructed of various masonry materials can be reattached and reinforced using the Heli-Pin. They are ideal for stabilizing areas with missing or corroded wall ties as well as retrofits to multiple width masonry wall sections. Heli-Pin anchor performs in concrete and masonry as well as wood and steel studs.

GENERAL APPLICATIONS AND USES

- Mechanical connections between a masonry façade and its backup material
- Replace missing or corroded wall ties
- Used in new construction by being embedded into the mortar joint

FEATURES AND BENEFITS

+ Virtually invisible repairs to masonry building facades
+ Ease and speed of installation with a roto-hammer and available setting tool
+ Made of corrosion resistant stainless steel
+ Helical shaped tie is both tension and compression resistant, and provides solid connection with the base material.
+ Variety of lengths and diameters, for a broad range of applications
+ Reinforced central core for high shaft strength

APPROVALS AND LISTINGS

Tested in accordance with CSA A370

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage*
Anchors shall be Heli-Pin as supplied by Powers Fasteners, Inc., Brewster, NY.
Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

Heli-Pin

ANCHOR MATERIALS

Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

8mm (5/16") x 6" to 12"

SUITABLE BASE MATERIALS

Normal-weight Concrete
Grouted Concrete Masonry (CMU)
Hollow Concrete Masonry (CMU)
Brick Masonry
Wood Studs
Metal Studs
Natural Stone

MATERIAL SPECIFICATIONS

Anchor Component	Specification
Anchor body	Type 304 Stainless Steel

INSTALLATION PROCEDURE

Using a proper diameter bit drill a pilot hole through façade material into backup base material to a depth at least ¼" deeper than the embedment required.

Mount installation tool on a rotary hammer drill. Position the Heli-Pin in the installation tool and insert into the pilot hole.

Drive the pin until it is about ½" below the surface of the façade material (setting tool should be flush with face of base material). Patch hole with appropriate material.

PERFORMANCE DATA

Typical Peformance Characteristics for 8mm Heli-Pin[1]

Material	Minimum Effective Embedment Depth h_{ef} in.	Ultimate Tension/Compression lbs.
Mortar Joint	3	700
Brick (solid)	3-5/8	700
Brick (cavity)	3-5/8	1200
Hollow CMU 6" (normal wt. CMU)	1	800
Grouted CMU (lightweight block)	2	550
Concrete	1-1/4	1200
2x4 Wood Stud	3	520
2x6 Wood Stud	3	520
Metal Stud	16 gauge	300
Granite	1-1/8	500
Travertine	7/8	500
Limestone	3	600

1. The data reflects the results of lab, field and in-house testing and provided as a guideline for the designers. Site testing is suggested for verification of load carrying capacity.

PERFORMANCE DATA

8mm Heli-Pin Masonry Bit Size

Facade Material	Heli-Pin	Back-up Base Material						
		Mortar Joint	Brick	Hollow CMU	Solid CMU	Concrete	Wood Stud	Metal Stud
Mortar Joint	8mm	3/16"	1/4"	3/16"	3/16"	1/4"	3/16"	3/16"
Brick	8mm	1/4"	1/4"	1/4"	1/4"	1/4"	5/16"	1/4"
Hollow CMU	8mm	3/16"	1/4"	3/16"	3/16"	1/4"	3/16"	3/16"
Solid CMU	8mm	3/16"	1/4"	3/16"	3/16"	1/4"	3/16"	3/16"
Precast Concrete	8mm	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
Stone	8mm	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"

8mm Heli-Pin Length Selection

Nominal length	Minimum Drilled Hole Depth in.	Cavity Range	
		CMU (hollow or solid)	Concrete
6"	6-5/8	0 to 1"	0 to 1-1/2"
8"	8-5/8	0 to 3"	1-1/2" to 3-1/2"
10"	10-5/8	0 to 5"	3-1/2" to 5-1/2"
12"	12-5/8	0 to 7"	5-1/2" to 7-1/2"

ORDERING INFORMATION

Cat.No.	Item Description	Std.Box	Std.Ctn.
08341	Heli-Pin Anchor 8mm (5/16") x 6"	100	1000
08342	Heli-Pin Anchor 8mm (5/16") x 8"	100	1000
08343	Heli-Pin Anchor 8mm (5/16") x 10"	100	1000
08344	Heli-Pin Anchor 8mm (5/16") x 12"	50	500

Cat.No.	Item Description	Std.Box	Std.Ctn.
08345	Heli-Pin Setting Tool	1	12

Essential for correct installation of Heli-Pins. The tool will automaticaly counter-sink the Heli-Pin, allowing for fast, efficient installation.

Safe-T+ Pin *Nail Anchor*

PRODUCT DESCRIPTION

The Safe-T+ Pin is a small-steel nail anchor which is designed for use in a variety of applications and as an improved alternative to traditional zamac nailin anchors where overhead use is not recommended. The Safe-T+ Pin can be used pre-drilled holes in solid base materials such as concrete, grouted block, brick and stone. It can also be used in cracked concrete applications where the anchors are engineered for redundant fastening.

GENERAL APPLICATIONS AND USES

- Electrical fixtures
- Signage
- Maintenance
- Interior applications / low level corrosion environment
- HVAC / Mechanical
- Drywall track
- Redundant fastening

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of solid base materials
+ Suitable for overhead use where specified
+ All-steel anchor components

APPROVALS AND LISTINGS

Tested in accordance with ASTM E 488
Tested in accordance with ICC-ES AC193 for use in structural concrete
Evaluated and qualified by an accredited independent laboratory for recognition in redundant fastening applications in cracked and uncracked concrete

GUIDE SPECIFICATIONS

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

MATERIAL SPECIFICATIONS

Material Specifications

Anchor component	Specification
Anchor body	Low carbon steel (AISI 1008 or equivalent)
Zinc plating according to ASTM B 633 SC1, Type III Minimum plating requirement for Mild Service Condition	

SECTION CONTENTS

Safe-T+ Pin

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter (6mm) x 1-3/8" length
1/4" diameter (6mm) x 2-1/2" length

SUITABLE BASE MATERIALS

Normal-weight Concrete
Structural Sand-lightweight Concrete
Grout-filled Concrete Masonry
Brick Masonry
Stone

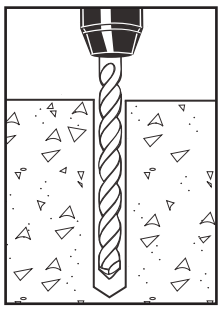
INSTALLATION SPECIFICATIONS

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size, *d* (inch)	
			1/4	
Nominal outside anchor diameter	d_0	in. (mm)	0.250 (6.4)	
Safe-T+ Pin drill bit diameter	d_{bit}	mm	6	
Safe-T+ Pin bit tolerance range	-	mm	5.9 to 6.4	
Nominal Embedment	h_{nom}	in. (mm)	1-3/16 (30)	2-1/2 (64)
Minimum hole depth	h_0	in. (mm)	1-1/2 (38)	2-3/4 (70)
Minimum concrete member thickness	h_{min}	in. (mm)	3 (76)	4 (102)
Minimum edge distance[1]	c_{min}	in. (mm)	3-1/2 (90)	3-1/2 (90)
Minimum spacing distance[2]	s_{min}	in. (mm)	3-1/2 (90)	3-1/2 (90)

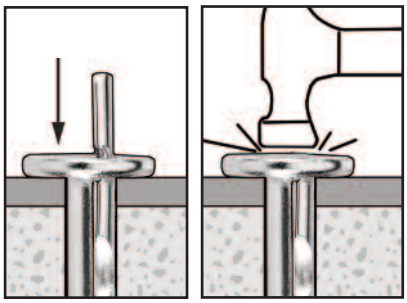
1. For redundant fastening design, edge distance must be a minimum of 4 inches.
2. For redundant fastening design, anchor spacing must be a minimum of 8 inches.

Installation Guidelines

Using the proper Safe-T+ Pin drill bit size, drill a hole into the base material to the required depth. The tolerances of the Safe-T+ Pin bit used must meet the requirements of the published range. Blow the hole clean of dust and other material.



Insert the anchor through the fixture. Drive the anchor pin into the anchor body to expand it. Be sure the head is seated firmly against the fixture and that the anchor is at the minimum required embedment.



REDUNDANT FASTENING APPLICATIONS

For an anchoring system designed with redundancy, the load maintained by an anchor that experiences failure or excessive deflection can be transmitted to neighboring anchors without significant consequences to the fixture or remaining resistance of the anchoring system. In addition to the requirements for anchors, the fixture being attached shall be able to resist the forces acting on it assuming one of the fixing points is not carrying load. It is assumed that by adhering to the limits placed on n_1, n_2 and n_3 below, redundancy will be satisfied.

Anchors qualified for redundant applications may be designed for use in normal weight and sand-lightweight cracked and uncracked concrete. Concrete compressive strength of 2,500 psi shall be used for design. No increase in anchor capacity is permitted for concrete compressive strengths greater than 2,500 psi. The anchor installation is limited to concrete with a compressive strength of 8,500 psi or less.

Redundant applications shall be limited to structures assigned to Seismic Design Categories A or B only.

Redundant applications shall be limited to support of nonstructural elements.

Strength Design (Redundant Fastening):

For strength design, a redundant system is achieved by specifying and limiting the following variables

n_1 = the total number of anchorage points supporting the linear element

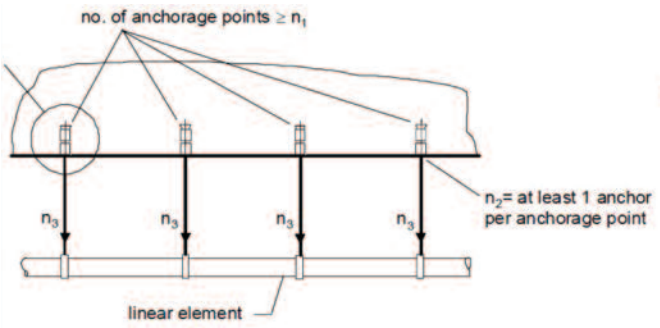
n_2 = number of anchors per anchorage point

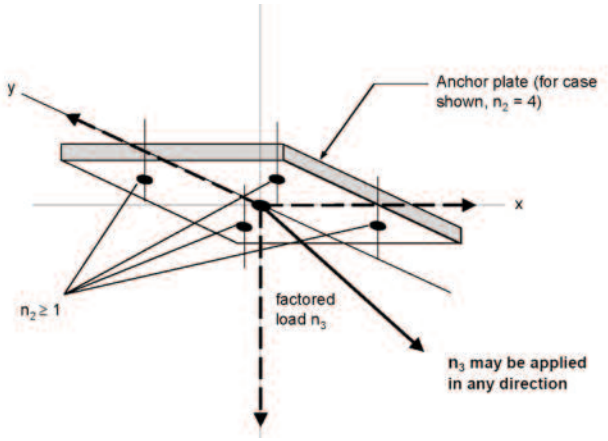
n_3 = factored load at each anchorage point, lbs., using load combinations from IBC Section 1605.2.1 or ACI 318 Section 9.2

Allowable Stress Design (Redundant Fastening):

Design values for use with allowable stress design shall be established taking R_d, ASD = $\dfrac{\phi_{ra} \cdot F_{ra}}{\alpha}$

Where α is the conversion factor calculated as the weighted average of the load factors from the controlling load combination. The conversion factor, α is equal to 1.4 assuming all dead load.





Redundant Fastening Design Information For Safe-T+ Pin Anchors[1,2]

Design Characteristic	Notation	Units	Nominal Anchor Size (inch)	
			1/4	
Anchor category	1, 2 or 3	-	3	
Minimum nominal embedment depth	h_{nom}	in (mm)	1-3/16 (41)	
Characteristic Strength (Resistance) Installed In Concrete[4]				
Resistance at each anchorage point, cracked or uncracked concrete (2,500 psi)	F_{ra}	lb (kN)	Number of Anchor Points	
			$n_1, \geq 4$	$n_1, \geq 3$
			675 (3.0)	450 (2.0)
Strength reduction factor[3]	ϕ_{ra}	-	0.45	

For SI: 1 inch = 25.4 mm, 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the redundant design provisions of this product section; design loads may be applied in any direction.
2. Installation must comply with published instructions and details.
3. All values of ø were determined from the load combinations of ACI 318 Section 9.2.
4. Anchors are permitted to be used in structural sand-lightweight concrete provided the design strength $\phi_{ra} F_{ra}$ must be multiplied by 0.6

PERFORMANCE DATA

Ultimate Load Capacities for Safe-T+ Pin in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in. (mm)	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength, f'_c 3,000 psi (20.7 MPa)	
			Ultimate Tension lbs. (kN)	Ultimate Shear lbs. (kN)
1/4 (6.3)	6	1-3/16 (30)	1,330 (5.9)	1,745 (7.8)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load.
3. The tabulated load values are applicable to single anchors in uncracked concrete.
4. Minimum spacing and edge distances for anchors is 4 inches.

Ultimate Load Capacities for the Safe-T+ Pin in Grout-filled Concrete Masonry[1,2,3]

Nominal Anchor Diameter in. (mm)	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength, f'_m 1,500 psi (10.3 MPa)	
			Ultimate Tension lbs. (kN)	Ultimate Shear lbs. (kN)
1/4 (6.3)	6	1-3/16 (30)	920 (4.1)	1,745 (7.8)

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. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Minimum spacing and edge distances for anchors is 4 inches.

Ultimate Load Capacities for the Safe-T+ Pin in Solid Clay Brick Masonry[1,2,3]

Nominal Anchor Diameter in. (mm)	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength, f'_m 1,500 psi (10.3 MPa)	
			Ultimate Tension lbs. (kN)	Ultimate Shear lbs. (kN)
1/4 (6.3)	6	1-3/16 (30)	1,100 (4.9)	1,745 (7.8)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Ultimate load capacities must be reduced by a minimum safety factor of 5.0 or greater to determine allowable working load. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Minimum spacing and edge distances for anchors is 4 inches.

ORDERING INFORMATION

Cat. No.	Size	Std. Box	Std. Carton
2800SD	1/4" (6mm) x 1-3/8"	100	600
2801SD	1/4" (6mm) x 2-1/2"	100	600

Cat. No.	Decription	Std. Box	Std. Carton
2800	6 mm Drill Bit	1	50

Zamac Hammer-Screw® *Nail Anchor*

PRODUCT DESCRIPTION

The Zamac Hammer-Screw is a unique, one-step nail drive anchor featuring a Phillips type head and a screw thread for use in concrete, block, brick or stone. It is available in 1/4" diameter and lengths ranging from 3/4" to 3". With a body formed from corrosion resistant Zamac alloy and a zinc plated carbon steel or Perma-Seal™ coated drive screw, this anchor has been developed as an improvement over standard nailin anchors.

The Zamac Hammer-Screw has been designed to provide a removable anchor with higher tension load capacities compared with traditional nailin when installed in concrete.

The anchor is not recommended for overhead, life-safety or sustained tensile loading applications unless special considerations are given to the allowable loads (see performance data section).

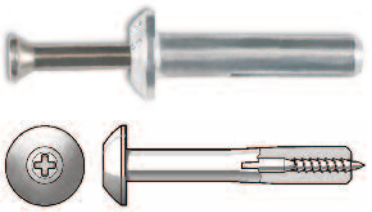
- Roof Flashings
- Brick Ties and Masonry Anchorage
- Electrical Fixtures
- Signage
- HVAC and Mechanical Attachments
- Drywall track
- Maintenance
- Surveillance equiptment

+ Installs in a variety of base materials
+ Removable anchor when screw is backed out with a Phillips head driver

Type 2, Class 3, (superseded) and CID A-A 1925A, Type 1

Metal Fastenings. Nail Anchors shall be Zamac Hammer-Screw anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS



Zamac Hammer-Screw

ANCHOR MATERIALS

Zamac Alloy with Carbon Steel Drive Screw or Perma-Seal™ Coated Carbon Steel Drive Screw

ANCHOR SIZE RANGE (TYP.)

1/4" x 3/4" to 1/4" x 3" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Hollow Concrete Masonry (CMU)
Brick Masonry
Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

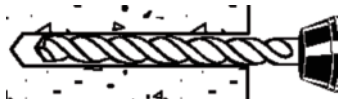
Dimension	Anchor Diameter, *d* 1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Fixture Clearance Hole (in.)	5/16
Head Height (in.)	9/64
Head Width d_{hd} (in.)	35/64

Material Specifications

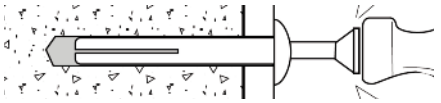
Anchor Component	Component Material: Mushroom Head Carbon Steel Screw
Drive Screw	AISI 1018
Anchor Body	Zamac Alloy
Screw Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)
Screw Coating	Perma-Seal Fluoropolymer

Installation Guidelines

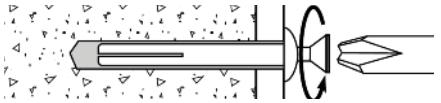
Drill a hole into the base material to a depth of at least 1/4" deeper than the required embedment. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Insert the anchor through the fixture. Drive the screw into the anchor body to expand it. Be sure the head is seated firmly against the fixture and that the anchor is at the proper embedment.



To remove – Press a Phillips screw driver firmly into the screw head and turn counterclockwise. Remove the screw from the anchor body, then pry out the fixture and anchor body simultaneously by working the claw of a hammer under the fixture



PERFORMANCE DATA

Ultimate Load Capacities for Zamac Hammer-Screw 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)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	675 (3.0)	650 (2.9)	850 (3.8)	880 (4.0)	890 (4.0)	880 (4.0)
	3/4 (19.1)	790 (3.6)	805 (3.6)	1,135 (5.1)	1,115 (5.0)	1,190 (5.4)	1,115 (5.0)
	7/8 (22.2)	930 (4.2)	990 (4.5)	1,205 (5.4)	1,230 (5.5)	1,250 (5.6)	1,230 (5.5)
	1-1/8 (28.6)	1,220 (5.5)	1,365 (6.1)	1,350 (6.1)	1,470 (6.6)	1,450 (6.5)	1,470 (6.6)
	1-3/8 (34.9)	1,325 (6.0)	1,555 (7.0)	1,450 (6.5)	1,645 (7.4)	1,530 (6.9)	1,645 (7.4)
	1-3/4 (44.5)	1,480 (6.7)	1,840 (8.3)	1,600 (7.2)	1,910 (8.6)	1,660 (7.5)	1,910 (8.6)
	1-7/8 (47.6)	1,480 (6.7)	1,840 (8.3)	1,600 (7.2)	1,910 (8.6)	1,660 (7.5)	1,910 (8.6)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.

Allowable Load Capacities for Zamac Hammer-Screw 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)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	170 (0.8)	165 (0.7)	215 (1.0)	220 (1.0)	225 (1.0)	220 (1.0)
	3/4 (19.1)	200 (0.9)	200 (0.9)	285 (1.3)	280 (1.3)	300 (1.4)	280 (1.3)
	7/8 (22.2)	235 (1.1)	250 (1.1)	300 (1.4)	310 (1.4)	315 (1.4)	310 (1.4)
	1-1/8 (28.6)	305 (1.4)	340 (1.5)	340 (1.5)	370 (1.7)	365 (1.6)	370 (1.7)
	1-3/8 (34.9)	330 (1.5)	390 (1.8)	365 (1.6)	410 (1.8)	385 (1.7)	410 (1.8)
	1-3/4 (44.5)	370 (1.7)	460 (2.1)	400 (1.8)	480 (2.2)	415 (1.9)	480 (2.2)
	1-7/8 (47.6)	370 (1.7)	460 (2.1)	400 (1.8)	480 (2.2)	415 (1.9)	480 (2.2)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Zamac Hammer-Screw in Hollow Concrete Masonry[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	420 (1.9)	1,160 (5.2)	85 (0.4)	230 (1.0)
	3/4 (19.1)	825 (3.7)	1,215 (5.5)	165 (0.7)	245 (1.1)
	1 (25.4)	1,000 (4.5)	1,265 (5.7)	200 (0.9)	255 (1.1)
	1-1/8 (28.6)	1,090 (4.9)	1,290 (5.8)	220 (1.0)	260 (1.2)
	1-3/8 (34.9)	1,145 (5.2)	1,345 (6.1)	230 (1.0)	270 (1.2)
	1-1/2 (38.1)	1,145 (5.2)	1,345 (6.1)	230 (1.0)	270 (1.2)

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight and lightweight concrete masonry units. Mortar must be Type N, S or M. Masonry compressive strength must be 1,500 psi minimum at the time of installation. Masonry cells may be grouted.
2. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 8 anchor diameters on center provied the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.
3. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.

Ultimate and Allowable Load Capacities for Zamac Hammer-Screw in Solid Clay Brick Masonry[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	680 (3.1)	1,400 (6.3)	135 (0.6)	280 (1.3)
	3/4 (19.1)	930 (4.2)	1,600 (7.2)	185 (0.8)	320 (1.4)
	1 (25.4)	990 (4.5)	1,600 (7.2)	200 (0.9)	320 (1.4)
	1-1/8 (28.6)	1,040 (4.7)	1,600 (7.2)	210 (0.9)	320 (1.4)
	1-3/8 (34.9)	1,150 (5.2)	1,600 (7.2)	230 (1.0)	320 (1.4)
	1-1/2 (38.1)	1,260 (5.7)	1,600 (7.2)	250 (1.1)	320 (1.4)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'm \geq$ 1,500 psi).
2. The tabulated values are for anchors installed at a minimum of 16 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 8 anchor diameters on center provied the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.
3. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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 in Concrete[1]

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	$s_{cr} = 10d$	$F_{N_s} = F_{V_s} = 1.0$	$s_{min} = 5d$	$F_{N_s} = F_{V_s} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{N_c} = 1.0$	$c_{min} = 6d$	$F_{N_c} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{V_c} = 1.0$	$c_{min} = 6d$	$F_{V_c} = 0.50$

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

ORDERING INFORMATION

Mushroom Head with No. 2 Phillips Head Screw

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2839	1/4" x 3/4"	1/4"	100	500	1-1/2
2840	1/4" x 1"	1/4"	100	500	1-3/4
2842	1/4' x 1-1/4"	1/4"	100	500	2-1/4
2844	1/4" x 1-1/2"	1/4"	100	500	2-1/2
2846	1/4" x 2"	1/4"	100	500	3
2848	1/4" x 2-1/4"	1/4"	100	500	3-1/2
2850	1/4" x 3"	1/4"	100	500	4-1/4

Master Pack

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2939	1/4" x 3/4"	1/4"	1,000	1,000	1-1/2
2940	1/4" x 1"	1/4"	1,000	1,000	1-3/4
2942	1/4' x 1-1/4"	1/4"	1,000	1,000	2-1/4
2944	1/4" x 1-1/2"	1/4"	1,000	1,000	2-1/2
2946	1/4" x 2"	1/4"	1,000	1,000	3
2948	1/4" x 2-1/4"	1/4"	1,000	1,000	3-1/2
2949	1/4" x 3"	1/4"	1,000	1,000	4-1/4

Mushroom Head with No. 2 Phillips Head Perma-Seal Screw

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2817	1/4" x 1-1/4"	1/4"	100	500	2-1/4
2818 Master Pack	1/4" x 1-1/4"	1/4"	1,000	1,000	2-1/4

Zamac Nailin® *Nail Anchor*

PRODUCT DESCRIPTION

The Zamac Nailin is a nail drive anchor which has a body formed from Zamac alloy. Drive nails are available in carbon or stainless steel. The anchor can be used in concrete, block, brick or stone.

A corrosion resistant Zamac alloy is used to form the anchor body with either a mushroom or flat head. The anchor can be used for light duty, tamperproof applications.

The anchor is not recommened for overhead, life-safety or sustained tensile loading applications unless special considerations are given to the allowable loads (see performance data section).

GENERAL APPLICATIONS AND USES

- Roof Flashing
- Brick Ties and Masonry Anchorage
- Electrical Fixtures
- Mechanical Attachments
- Furring Strips
- Maintenance

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of base materials

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group V, Type 2, Class 3, (superseded) and CID A-A 1925A, Type 1 (mushroom head) & Type 2 (flat head)

GUIDE SPECIFICATIONS

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

SECTION CONTENTS

Zamac Nailin

ANCHOR MATERIALS

Zamac Alloy with Carbon or Stainless Steel Drive Nail

ANCHOR SIZE RANGE (TYP.)

3/16" diameter x 7/8" length to 1/4" diameter x 3" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Hollow Concrete Masonry (CMU)
Brick Masonry
Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Anchor Diameter, *d*		
	3/16" MH	1/4" MH	1/4" FH
ANSI Drill Bit Size, d_{bit} (in.)	3/16	1/4	1/4
Fixture Clearance Hole (in.)	1/4	5/16	5/16
Head Height (in.)	7/64	9/64	3/16
Head Width d_{hd} (in.)	13/32	35/64	35/64

MH = Mushroom Head FH = Flat Head

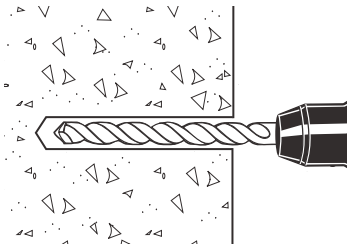
Material Specifications

Anchor Component	Component Material		
	Mushroom Head	Flat Head	Mushroom Head
	CS Nail	CS Nail	SS Nail
Drive Nail	AISI 1018	AISI 1018	Type 304 SS
Anchor Body	Zamac Alloy	Zamac Alloy	Zamac Alloy
Nail Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)		N/A

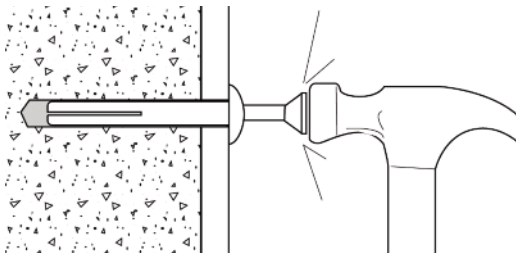
CS = Carbon Steel SS = Stainless Steel

Installation Guidelines

Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/4" deeper than the required embedment. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Blow the hole clean of dust and other material.



Insert the anchor through the fixture. Drive the nail into the anchor body to expand it. Be sure the head is seated firmly against the fixture and that the anchor is at the proper embedment. Take care not to overdrive. This anchor is not recommended for use overhead.



PERFORMANCE DATA

Ultimate Load Capacities for Zamac Nailin in Normal-Weight Concrete[1,2]

Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	285 (1.3)	415 (1.8)	400 (1.8)	560 (2.5)	480 (2.1)	560 (2.5)
1/4 (6.4)	5/8 (15.9)	410 (1.8)	440 (2.0)	580 (2.6)	655 (2.9)	580 (2.6)	655 (2.9)
	3/4 (19.1)	540 (2.4)	600 (2.7)	765 (3.4)	850 (3.8)	800 (3.6)	850 (3.8)
	1 (25.4)	620 (2.8)	640 (2.9)	875 (3.9)	890 (4.0)	895 (4.0)	890 (4.0)
	1-1/4 (31.7)	700 (3.1)	720 (3.2)	990 (4.4)	970 (4.3)	990 (4.4)	990 (4.4)

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. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

Allowable Load Capacities for Zamac Nailin in Normal-Weight Concrete[1,2,3]

Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	70 (0.3)	100 (0.5)	100 (0.5)	140 (0.6)	120 (0.5)	140 (0.6)
1/4 (6.4)	5/8 (15.9)	100 (0.5)	110 (0.5)	145 (0.6)	160 (0.7)	145 (0.6)	160 (0.7)
	3/4 (19.1)	135 (0.6)	150 (0.7)	190 (0.8)	210 (0.9)	200 (0.9)	210 (0.9)
	1 (25.4)	155 (0.7)	150 (0.7)	220 (1.0)	220 (1.0)	220 (1.0)	220 (1.0)
	1-1/4 (31.7)	175 (0.8)	180 (0.8)	245 (1.1)	240 (1.1)	245 (1.3)	240 (1.1)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Zamac Nailin in Hollow Concrete Masonry[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	270 (1.2)	560 (2.5)	55 (0.2)	110 (0.5)
1/4 (6.4)	5/8 (15.9)	360 (1.6)	655 (2.9)	70 (0.3)	130 (0.6)
	3/4 (19.1)	735 (3.3)	850 (3.8)	145 (0.7)	170 (0.8)
	1 (25.4)	835 (3.8)	890 (4.0)	165 (0.7)	180 (0.8)
	1-1/4 (31.7)	990 (4.4)	970 (4.3)	200 (0.9)	195 (0.9)

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 ($f'm \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.
3. Anchors installed flush with face shell surface.

Ultimate and Allowable Load Capacities for Zamac Nailin in Solid or Hollow Clay Brick Masonry[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16 (4.8)	3/4 (19.1)	460 (2.1)	920 (4.1)	90 (0.4)	185 (0.8)
1/4 (6.4)	5/8 (15.9)	570 (2.6)	1,250 (5.6)	115 (0.5)	250 (1.1)
	3/4 (19.1)	790 (3.6)	1,400 (6.3)	160 (0.7)	280 (1.3)
	1 (25.4)	820 (3.7)	1,400 (6.3)	165 (0.7)	280 (1.3)
	1-1/4 (31.7)	865 (3.9)	1,400 (6.3)	175 (0.8)	280 (1.3)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'm \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as in sustained tensile loading applications.

DESIGN CRITERIA

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

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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[1]

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	$s_{cr} = 10d$	$F_{Ns} = F_{Vs} = 1.0$	$s_{min} = 5d$	$F_{Ns} = F_{Vs} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{Nc} = 1.0$	$c_{min} = 5d$	$F_{Nc} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{Vc} = 1.0$	$c_{min} = 5d$	$F_{Vc} = 0.50$

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

ORDERING INFORMATION

Mushroom Head Zamac Nailin with Carbon Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2802	3/16" x 7/8"	3/16"	100	500	3/4
2806	1/4" x 3/4"	1/4"	100	500	1-1/2
2808	1/4" x 1"	1/4"	100	500	1-3/4
2814	1/4" x 1-1/4"	1/4"	100	500	2-1/4
2820	1/4" x 1-1/2"	1/4"	100	500	2-1/2
2826	1/4" x 2"	1/4"	100	500	3
2804	1/4" x 3"	1/4"	100	500	4

Master Pack Mushroom Head Zamac Nailin with Carbon Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2803	3/16" x 7/8"	3/16"	–	1,000	3/4
2807	1/4" x 3/4"	1/4"	–	1,000	1-1/2
2809	1/4" x 1"	1/4"	–	1,000	1-3/4
2815	1/4" x 1-1/4"	1/4"	–	1,000	2-1/4
2821	1/4" x 1-1/2"	1/4"	–	1,000	2-1/2
2827	1/4" x 2"	1/4"	–	1,000	3
2805	1/4" x 3"	1/4"	–	1,000	4

Flat Head Zamac Nailin with Carbon Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2836	1/4" x 1-1/2"	1/4"	100	500	2-1/2
2838	1/4" x 2"	1/4"	100	500	3

Mushroom Head Zamac Nailin with Stainless Steel Nail

Cat. No.	Anchor Size	Drill Diameter	Std. Box	Std. Carton	Wt./100
2858	1/4" x 1"	1/4"	100	500	1-3/4
2864	1/4" x 1-1/4"	1/4"	100	500	2-1/4
2870	1/4' x 1-1/2"	1/4"	100	500	2-1/2
2876	1/4" x 2"	1/4"	100	500	3