
DEWALT
25'

		Base Material												Anchor Diameter											Head Style											Coating/Material								Building Code / Jurisdiction Recognition
		Concrete	Lightweight Concrete	Hollow Core Plank	Grout-filled Concrete Masonry	Hollow Concrete Masonry	Solid Brick	Hollow Brick	Stone	Structural Clay Tile	Wood	Steel		3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	7/8"	1" (24mm)	1-1/4" (28mm)		Finished Hex Head	Hex Head	Round/Acorn Head	Flat Head (Countersunk)	Mushroom Head	Removable	Tie-Wire Head	Tamperproof	Internal Thread		Coated/Plated Carbon Steel	Galvanized Carbon Steel	Type 303/304 Stainless Steel	Type 316 Stainless Steel	Type 410 Stainless Steel	Perma-Seal Coated	Nylon/Plastic	
	Atomic+ Undercut®	●	●														●	●	●	●					●										●			●				ICC-ES ESR-3067
Expansion Anchors	**Power-Stud®+ SD1**	●	●		●				○						●		●	●	●	●	●	●	●		●					●				●							ICC-ES ESR-2818 & 2966 IBC, NBC, City of LA, FBC, FM, UL
	Power-Stud®+ SD2	●	●		●				○								●	●	●	●					●									●								ICC-ES ESR-2502 IBC, NBC, City of LA, FBC, FM, UL
	Power-Stud®+ SD4/SD6	●	●		●				○						●		●	●	●	●						●											●	●				ICC-ES ESR-2502 IBC, NBC, City of LA, FBC
	Power-Stud® HD5	●	●		●												●	●	●	●															●							
	Power-Bolt®+	●	●		○				○						●		●	●	●	●					●					●					●							ICC-ES ESR-3260 IBC, City of LA
	Power-Bolt®	●	●	○	●	●	●	○	○								●	●	●						●			●		●					●			●				
	PB-PRO™	●	○																			●	●		●										●							
	Lok-Bolt AS®	●	○	○	●	●	●	○	○						●	●	●	●	●	●						●	●	●			●				●			●				
Screw Anchors	**Screw-Bolt+™**	●	●	○	●	○	●								●		●	●	●	●					●					●					●	●						ICC-ES ESR-3889 IBC, City of LA, FBC
	316 Stainless Steel Wedge-Bolt™	●			●		●								●		●	●							●					●								●			
	Snake+®	●	●												●		●	●												●			●		●						ICC-ES ESR-2272 IBC, City of LA, FM
Drop-in Anchors	**Steel Dropin™**	●	●						○						●		●	●	●	●													●		●	●					FM, UL
	Smart DI™	●	○						○						●		●	●															●								FM, UL
	Mini Dropin™	●	●	●	○				○						●		●	●															●								FM
	Hollow-Set Dropin™	●	○	●	●	●	●	○	○							●	●	●	●														●			●					UL
Rod Hanging System	**Hangermate®+**	●	●	○											●		●													●			●								ICC-ES ESR-3889 IBC, City of LA, FBC, FM
	Mini-Undercut+™	●		●													●																●								ICC-ES ESR-3912 IBC, City of LA
	Wood-Knocker II+®	●	●												●		●	●	●	●													●							●	ICC-ES ESR-3657 IBC, NBC, City of LA, FM, UL
	Bang-it+®	●	●												●		●	●	●	●													●							●	ICC-ES ESR-3657 IBC, NBC, City of LA, FM, UL
	DDI+™	●	●														●	●	●	●	●												●								ICC-ES ESR-3958 IBC, City of LA, FM

● Suitable ○ May be Suitable

GENERAL INFORMATION

ATOMIC+ UNDERCUT®

Heavy Duty Undercut Anchor

PRODUCT DESCRIPTION

The Atomic+ Undercut anchor is designed for applications in cracked and uncracked concrete. The anchors are is available in standard ASTM A 36 steel, high strength ASTM A 193 Grade B7 steel and Type 316 stainless steel in Class 1 and Class 2 strength 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 undercut drill bit supplied by DEWALT. 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, beam and column anchorage
- Safety related attachments
- Tension zone applications
- Heavy duty loading
- Pipe supports, strut & base mounts
- Suspended equipment
- Seismic and wind loading

FEATURE AND BENEFITS

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

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3067 Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, 2009 IRC, 2006 IBC, and 2006 IRC
- Tested in accordance with ACI 355.2/ASTM E488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 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: 03 16 00 – Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Undercut anchors shall be Atomic+ Undercut as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

ATOMIC+ UNDERCUT ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Zinc Plated Carbon Steel
- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 3/8" through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete

CODE LISTED
ICC-ES ESR-3067
CONCRETE

DDA DEWALT DESIGN ASSIST

MATERIAL SPECIFICATIONS

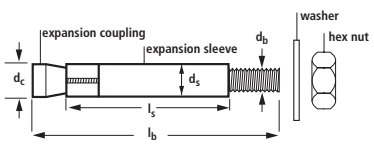
Anchor Component	Anchor Designation			
	Carbon Steel	High Strength Carbon Steel	Stainless Steel (Type 316)	High Strength Stainless Steel (Type 316)
Threaded Rod	ASTM A 36	ASTM A 193, Grade B7	ASTM A193, Grade B8M, Class 1	ASTM A193, Grade B8M, Class 2
Expansion Coupling (Cone)	ASTM A 108 12L14		ASTM A 274 S	
Expansion/Spacer Sleeve	ASTM A 513 Type 5		ASTM A 274 S	
Hex Nut	ASTM A 563, Grade C		ASTM A 194, Grade 8M	
Washer	ASTM F 844; Meets dimensional requirements of ANSI B18.22.1, Type A plain		Type 316 SS; Meets dimensional requirements of ANSI B18.22.1, Type A plain	
Plating	Zinc plating in accordance with ASTM B 633, SC1 (Fe/Zn 5) or equivalent; Minimum plating requirement for Mild Service Condition		Not applicable	

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	A 193, Grade B8M, Class 1	3/8	5-1/2	2-3/4	5/8	5/8	1-3/4
03602SD	Through bolt (TB)	A 193, Grade B8M, Class 1	3/8	5-1/2	4-1/2	5/8	5/8	1-3/4
03603SD	Standard	A193, Grade B8M, Class 2	3/8	6-3/4	4	5/8	5/8	1-3/4
03605SD	Through Bolt (TB)	A193, Grade B8M, Class 2	3/8	6-3/4	5-3/4	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	A 193, Grade B8M, Class 1	1/2	7	4	3/4	3/4	1-3/4
03610SD	Through bolt (TB)	A 193, Grade B8M, Class 1	1/2	7	5-3/4	3/4	3/4	1-3/4
03609SD	Standard	A193, Grade B8M, Class 2	1/2	8	5	3/4	3/4	1-3/4
03613SD	Through Bolt (TB)	A193, Grade B8M, Class 2	1/2	8	6-3/4	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	A 193, Grade B8M, Class 1	5/8	7-3/4	4-1/2	1	1	1-3/4
03622SD	Through bolt (TB)	A 193, Grade B8M, Class 1	5/8	7-3/4	6-1/4	1	1	1-3/4
03635SD	Standard	A193, Grade B8M, Class 2	5/8	10-3/4	7-1/2	1	1	1-3/4
03639SD	Through Bolt (TB)	A193, Grade B8M, Class 2	5/8	10-3/4	9-1/4	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	A 193, Grade B8M, Class 1	3/4	8-5/8	5	1-1/8	1-1/8	1-3/4
03634SD	Through bolt (TB)	A 193, Grade B8M, Class 1	3/4	8-5/8	6-3/4	1-1/8	1-1/8	1-3/4
03648SD	Standard	A193, Grade B8M, Class 2	3/4	13-5/8	10	1-1/8	1-1/8	1-3/4
03649SD	Through Bolt (TB)	A193, Grade B8M, Class 2	3/4	13-5/8	11-3/4	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)

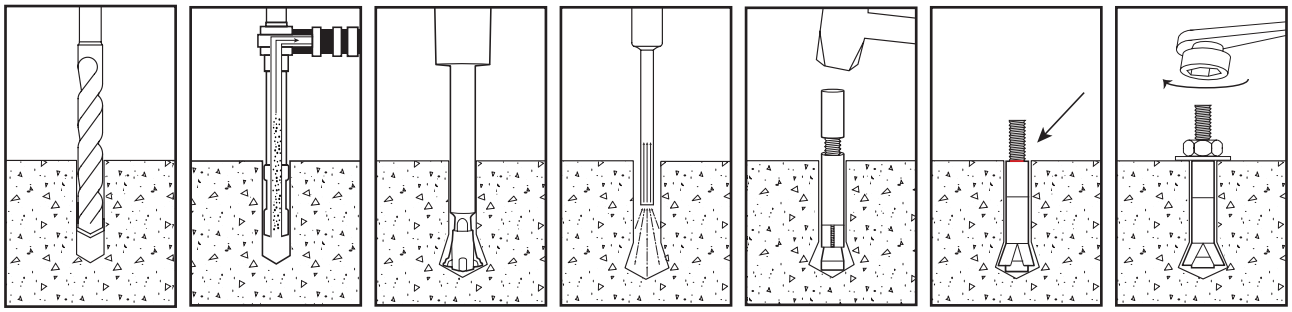
Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
From	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"	9-1/2"	10"	11"	12"
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"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"	12"	13"

Length identification mark indicates overall length of anchor.

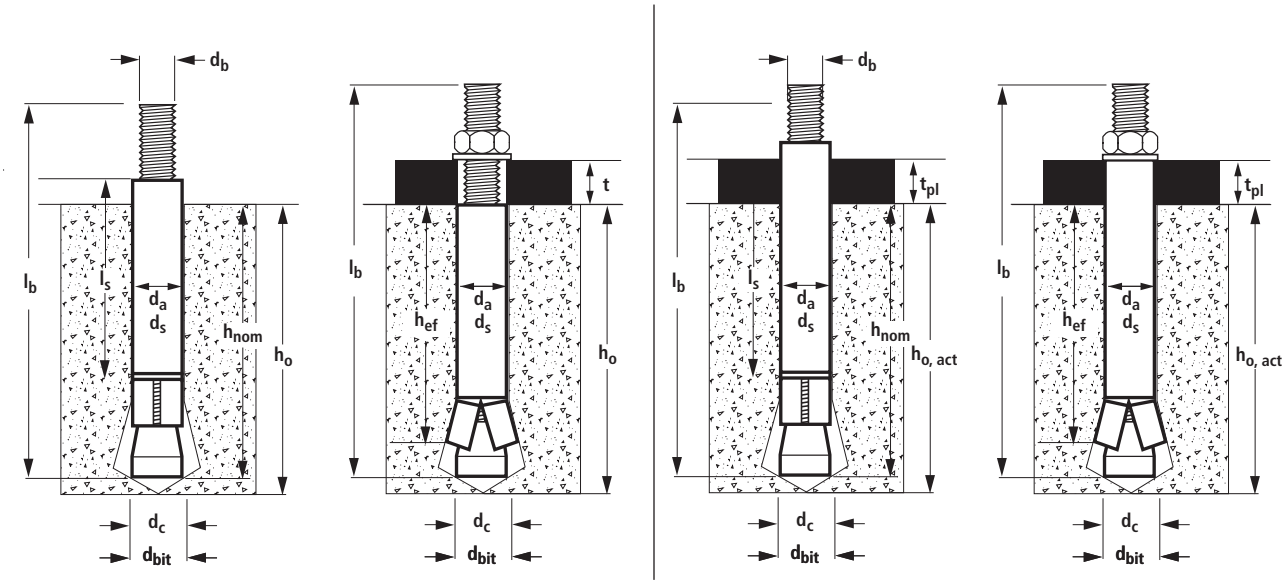
INSTALLATION INSTRUCTIONS

Installation Instructions for Atomic+ Undercut Anchors



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 during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.
3. Insert the undercut bit and start the rotohammer. Undercutting is complete when the stopper sleeve is fully compressed (gap closed)
4. Remove dust and debris from the hole following drilling (e.g. suction, forced 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; Do not exceed maximum torque.

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



Standard Type (Pre-set Version) | Through Bolt Type

Axial Stiffness Values, β, for Atomic+ Undercut Anchors in Normal-Weight Concrete[1]

Concrete State	Notation	Units	Nominal Anchor Size / Rod Diameter (inch)			
			3/8	1/2	5/8	3/4
Uncracked concrete	β_{min}	10^3 lbf/in	131			
	β_m	10^3 lbf/in	930			
	β_{max}	10^3 lbf/in	1,444			
Cracked concrete	β_{min}	10^3 lbf/in	91			
	β_m	10^3 lbf/in	394			
	β_{max}	10^3 lbf/in	1,724			

1. Valid for anchors with high strength threaded rod (A 193 Grade B7). For anchors with low strength threaded rod (A 36) values must be multiplied by 0.7.

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	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)	
Anchor rod designation, carbon steel	ASTM	-	A36	A193 Gr. B7	A36	A193 Grade B7		A36	A193 Grade B7		A36	A193 Gr. B7
Anchor rod designation, stainless steel	ASTM	-	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2	-	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2	-	A193 Gr. B8M Class 1	A193 Gr. B8M Class 2
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	For h_{min1}	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)
	$c_{ac,1} \geq$	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)
	For h_{min2}	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)
	$c_{ac,2} \geq$	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.	11/16		7/8			1-1/16			1-1/4	
Nut Height	-	in.	23/64		31/64			39/64			47/64	
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.

PERFORMANCE DATA

Tension and Shear Design Information For Atomic+ Undercut Anchor in Concrete (For use with load combinations taken from ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2)[1]

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][8]	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 (mm²)	0.0775 (50)		0.1419 (91)			0.2260 (146)			0.3345 (216)	
ASTM A36 ($f_y \geq 36$ ksi) ASTM A193 Grade B7 ($f_y \geq 105$ ksi)	Minimum specified yield strength of anchor rod[10]	f_y	ksi (N/mm²)	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}	ksi (N/mm²)	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}	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[9,10]	V_{sa}	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[9,10]	V_{eq}	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)
ASTM A193 Grade B8M, Class 1 ($f_y >= 30$ ksi) ASTM A193 Grade B8M, Class 2 ($f_y >= 95$ ksi)	Minimum specified yield strength of anchor rod (Type 316 stainless steel anchor)	$f_{y,ss}$	ksi (N/mm²)	30 (205)	95 (655)	30 (205)	95 (655)	-	30 (205)	95 (655)	-	30 (205)	95 (655)
	Minimum specified ultimate tensile strength of anchor rod (Type 316 stainless steel anchor)	$f_{uta,ss}$	ksi (N/mm²)	75 (515)	105 (760)	75 (515)	105 (760)	-	75 (515)	105 (760)	-	75 (515)	105 (760)
	Steel strength in tension, static (Type 316 stainless steel anchor)[11]	$N_{sa,ss}$	lb (kN)	4,415 (19.6)	8,525 (37.9)	8,085 (36.0)	15,610 (69.4)	-	12,880 (57.3)	24,860 (110.6)	-	19,065 (84.8)	36,795 (163.7)
	Steel strength in shear, static (Type 316 stainless steel anchor)[11]	$V_{sa,ss}$	lb (kN)	2,210 (9.8)	4,265 (19.0)	4,045 (18.0)	7,805 (34.7)	-	6,440 (28.6)	12,430 (55.3)	-	9,535 (42.4)	18,400 (81.8)
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]		$\Psi_{c,N}$	-	1.0 (See note 4)		1.0 (See note 4)			1.0 (See note 4)			1.0 (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}	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/mm²), 1 lbf = 0.0044 kN, 1 in² = 645 mm².

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
3. Anchors are considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
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 from table)*(specified concrete compressive strength/2,500)$^{0.5}$.
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 lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. The notation in brackets is for the 2006 IBC.
9. Shear strength values are based on standard (pre-set) installation, and must be used for both standard (pre-set) and through-bolt installations.
10. These values are only applicable to carbon steel anchors; values are not established for stainless steel anchors.
11. Calculated using $f_{uta,ss}$ = 57 ksi (1.9fy) in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

FACTORED DESIGN STRENGTH (ϕN_n AND ϕV_n) CALCULATED IN ACCORDANCE WITH ACI 318-14 CHAPTER 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min2}$, 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 times c_{a1}.

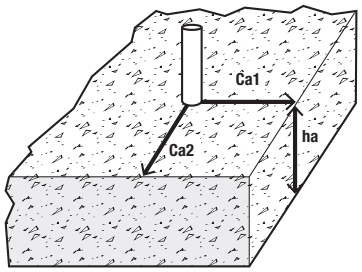
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



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

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	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	A 36	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460
	4-3/8	A 193, Gr. B7	5,850	3,175	6,410	3,175	7,265	3,175	7,265	3,175	7,265	3,175
1/2	4-1/4	A 36	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670
	5-1/4	A 193, Gr. B7	7,475	5,755	8,190	5,755	9,455	5,755	11,580	5,755	13,300	5,755
	7	A 193, Gr. B7	7,475	5,755	8,190	5,755	9,455	5,755	11,580	5,755	13,300	5,755
5/8	5	A 36	7,445	4,265	8,155	4,265	9,420	4,265	9,825	4,265	9,825	4,265
	8	A 193, Gr. B7	9,750	9,170	10,680	9,170	12,335	9,170	15,105	9,170	17,440	9,170
	9-1/2	A 193, Gr. B7	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	A 36	8,720	6,410	9,555	6,410	11,030	6,410	13,510	6,410	14,550	6,410
	10-7/8	A 193, Gr. B7	14,300	13,570	15,665	13,570	18,090	13,570	22,155	13,570	25,580	13,570

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

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

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	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	A 36	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460	3,370	1,460
	4-3/8	A 193, Gr. B7	7,265	3,175	7,265	3,175	7,265	3,175	7,265	3,175	7,265	3,175
1/2	4-1/4	A 36	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670	6,175	2,670
	5-1/4	A 193, Gr. B7	10,900	5,755	11,940	5,755	13,300	5,755	13,300	5,755	13,300	5,755
	7	A 193, Gr. B7	13,300	5,755	13,300	5,755	13,300	5,755	13,300	5,755	13,300	5,755
5/8	5	A 36	9,305	4,265	9,825	4,265	9,825	4,265	9,825	4,265	9,825	4,265
	8	A 193, Gr. B7	20,025	9,170	21,190	9,170	21,190	9,170	21,190	9,170	21,190	9,170
	9-1/2	A 193, Gr. B7	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	A 36	10,900	6,410	11,940	6,410	13,790	6,410	14,550	6,410	14,550	6,410
	10-7/8	A 193, Gr. B7	30,830	13,570	31,360	13,570	31,360	13,570	31,360	13,570	31,360	13,570

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

Converted Allowable Loads for Carbon Steel Atomic+ Undercut in Cracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ 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	3-1/8	A 36	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045
	4-3/8	A 193, Gr. B7	4,180	2,270	4,580	2,270	5,190	2,270	5,190	2,270	5,190	2,270
1/2	4-1/4	A 36	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905
	5-1/4	A 193, Gr. B7	5,340	4,110	5,850	4,110	6,755	4,110	8,270	4,110	9,500	4,110
	7	A 193, Gr. B7	5,340	4,110	5,850	4,110	6,755	4,110	8,270	4,110	9,500	4,110
5/8	5	A 36	5,320	3,045	5,825	3,045	6,730	3,045	7,020	3,045	7,020	3,045
	8	A 193, Gr. B7	6,965	6,550	7,630	6,550	8,810	6,550	10,790	6,550	12,455	6,550
	9-1/2	A 193, Gr. B7	6,965	6,550	7,630	6,550	8,810	6,550	10,790	6,550	12,455	6,550
3/4	5-7/8	A 36	6,230	4,580	6,825	4,580	7,880	4,580	9,650	4,580	10,395	4,580
	10-7/8	A 193, Gr. B7	10,215	9,695	11,190	9,695	12,920	9,695	15,825	9,695	18,270	9,695

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.

Converted Allowable Loads for Carbon Steel Atomic+ Undercut in Uncracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ 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	3-1/8	A 36	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045	2,405	1,045
	4-3/8	A 193, Gr. B7	5,190	2,270	5,190	2,270	5,190	2,270	5,190	2,270	5,190	2,270
1/2	4-1/4	A 36	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905	4,410	1,905
	5-1/4	A 193, Gr. B7	7,785	4,110	8,530	4,110	9,500	4,110	9,500	4,110	9,500	4,110
	7	A 193, Gr. B7	9,500	4,110	9,500	4,110	9,500	4,110	9,500	4,110	9,500	4,110
5/8	5	A 36	6,645	3,045	7,020	3,045	7,020	3,045	7,020	3,045	7,020	3,045
	8	A 193, Gr. B7	14,305	6,550	15,135	6,550	15,135	6,550	15,135	6,550	15,135	6,550
	9-1/2	A 193, Gr. B7	15,135	6,550	15,135	6,550	15,135	6,550	15,135	6,550	15,135	6,550
3/4	5-7/8	A 36	7,785	4,580	8,530	4,580	9,850	4,580	10,395	4,580	10,395	4,580
	10-7/8	A 193, Gr. B7	22,020	9,695	22,400	9,695	22,400	9,695	22,400	9,695	22,400	9,695

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.

FACTORED DESIGN STRENGTH (ϕN_n AND ϕV_n) CALCULATED IN ACCORDANCE WITH ACI 318-14 CHAPTER 17:

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = h_{min2}$, 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 times c_{a1}.

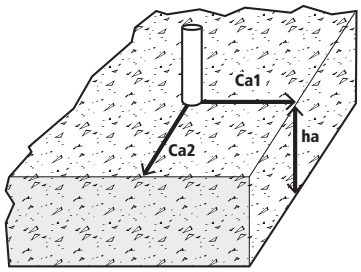
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



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

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	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	A 193, Gr. B8M Class 1	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435
	4-3/8	A 193, Gr. B8M Class 2	5,850	2,770	6,395	2,770	6,395	2,770	6,395	2,770	6,395	2,770
1/2	4-1/4	A 193, Gr. B8M Class 1	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625
	5-1/4	A 193, Gr. B8M Class 2	7,475	5,075	8,190	5,075	9,455	5,075	11,580	5,075	11,705	5,075
5/8	5	A 193, Gr. B8M Class 1	7,445	4,185	8,155	4,185	9,420	4,185	9,660	4,185	9,660	4,185
	8	A 193, Gr. B8M Class 2	9,750	8,080	10,680	8,080	12,335	8,080	15,105	8,080	17,440	8,080
3/4	5-7/8	A 193, Gr. B8M Class 1	8,720	6,195	9,555	6,195	11,030	6,195	13,510	6,195	14,300	6,195
	10-7/8	A 193, Gr. B8M Class 2	14,300	11,955	15,665	11,955	18,090	11,955	22,155	11,955	25,580	11,955

□ - Anchor Pullout/Pryout Strength Controls ▒ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

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

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	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	A 193, Gr. B8M Class 1	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435	3,310	1,435
	4-3/8	A 193, Gr. B8M Class 2	6,395	2,770	6,395	2,770	6,395	2,770	6,395	2,770	6,395	2,770
1/2	4-1/4	A 193, Gr. B8M Class 1	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625	6,065	2,625
	5-1/4	A 193, Gr. B8M Class 2	10,900	5,075	11,705	5,075	11,705	5,075	11,705	5,075	11,705	5,075
5/8	5	A 193, Gr. B8M Class 1	9,305	4,185	9,660	4,185	9,660	4,185	9,660	4,185	9,660	4,185
	8	A 193, Gr. B8M Class 2	18,645	8,080	18,645	8,080	18,645	8,080	18,645	8,080	18,645	8,080
3/4	5-7/8	A 193, Gr. B8M Class 1	10,900	6,195	11,940	6,195	13,790	6,195	14,300	6,195	14,300	6,195
	10-7/8	A 193, Gr. B8M Class 2	27,595	11,955	27,595	11,955	27,595	11,955	27,595	11,955	27,595	11,955

□ - Anchor Pullout/Pryout Strength Controls ▒ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Converted Allowable Loads for Stainless Steel Atomic+ Undercut in Cracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ 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	3-1/8	A 193, Gr. B8M Class 1	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025
	4-3/8	A 193, Gr. B8M Class 2	4,180	1,980	4,570	1,980	4,570	1,980	4,570	1,980	4,570	1,980
1/2	4-1/4	A 193, Gr. B8M Class 1	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875
	5-1/4	A 193, Gr. B8M Class 2	5,340	3,625	5,850	3,625	6,755	3,625	8,270	3,625	8,360	3,625
5/8	5	A 193, Gr. B8M Class 1	5,320	2,990	5,825	2,990	6,730	2,990	6,900	2,990	6,900	2,990
	8	A 193, Gr. B8M Class 2	6,965	5,770	7,630	5,770	8,810	5,770	10,790	5,770	12,455	5,770
3/4	5-7/8	A 193, Gr. B8M Class 1	6,230	4,425	6,825	4,425	7,880	4,425	9,650	4,425	10,215	4,425
	10-7/8	A 193, Gr. B8M Class 2	10,215	8,540	11,190	8,540	12,920	8,540	15,825	8,540	18,270	8,540

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.

Converted Allowable Loads for Stainless Steel Atomic+ Undercut in Uncracked Concrete[1,2]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Anchor Rod Designation (ASTM)	Minimum Concrete Compressive Strength									
			f 'c = 2,500 psi		f 'c = 3,000 psi		f 'c = 4,000 psi		f 'c = 6,000 psi		f 'c = 8,000 psi	
			$T_{allowable,ASD}$ 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	3-1/8	A 193, Gr. B8M Class 1	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025	2,365	1,025
	4-3/8	A 193, Gr. B8M Class 2	4,570	1,980	4,570	1,980	4,570	1,980	4,570	1,980	4,570	1,980
1/2	4-1/4	A 193, Gr. B8M Class 1	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875	4,330	1,875
	5-1/4	A 193, Gr. B8M Class 2	7,785	3,625	8,360	3,625	8,360	3,625	8,360	3,625	8,360	3,625
5/8	5	A 193, Gr. B8M Class 1	6,645	2,990	6,900	2,990	6,900	2,990	6,900	2,990	6,900	2,990
	8	A 193, Gr. B8M Class 2	13,320	5,770	13,320	5,770	13,320	5,770	13,320	5,770	13,320	5,770
3/4	5-7/8	A 193, Gr. B8M Class 1	7,785	4,425	8,530	4,425	9,850	4,425	10,215	4,425	10,215	4,425
	10-7/8	A 193, Gr. B8M Class 2	19,710	8,540	19,710	8,540	19,710	8,540	19,710	8,540	19,710	8,540

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.

ORDERING INFORMATION

Atomic+ Undercut Anchor Zinc Plated Carbon Steel

Cat. No.	Anchor Rod ASTM Designation	Nominal Anchor Diameter	Anchor Outside Diameter	Overall Length	Required Undercut Bit (Cat. No.)	Required Stop Bit (Cat. No.)	Anchor Type	Std. Box
03100SD	ASTM A36	3/8"	5/8"	5-1/2"	03200SD	03220SD	Standard	20
03102SD	ASTM A36	3/8"	5/8"	5-1/2"		*	Through Bolt	20
03104SD	ASTM A193 Gr. B7	3/8"	5/8"	6-3/4"		03221SD	Standard	20
03106SD	ASTM A193 Gr. B7	3/8"	5/8"	6-3/4"		*	Through Bolt	20
03108SD	ASTM A36	1/2"	3/4"	7"	03201SD	03222SD	Standard	15
03110SD	ASTM A36	1/2"	3/4"	7"		*	Through Bolt	15
03112SD	ASTM A193 Gr. B7	1/2"	3/4"	8"		03223SD	Standard	15
03114SD	ASTM A193 Gr. B7	1/2"	3/4"	8"		*	Through Bolt	15
03116SD	ASTM A193 Gr. B7	1/2"	3/4"	9-3/4"		03224SD	Standard	15
03118SD	ASTM A193 Gr. B7	1/2"	3/4"	9-3/4"		*	Through Bolt	15
03120SD	ASTM A36	5/8"	1"	7-3/4"	03202SD	03225SD	Standard	10
03122SD	ASTM A36	5/8"	1"	7-3/4"		*	Through Bolt	10
03124SD	ASTM A193 Gr. B7	5/8"	1"	10-3/4"		03226SD	Standard	10
03126SD	ASTM A193 Gr. B7	5/8"	1"	10-3/4"		*	Through Bolt	10
03128SD	ASTM A193 Gr. B7	5/8"	1"	12-1/4"		03227SD	Standard	10
03130SD	ASTM A193 Gr. B7	5/8"	1"	12-1/4"		*	Through Bolt	10
03132SD	ASTM A36	3/4"	1-1/8"	8-5/8"	03203SD	03228SD	Standard	8
03134SD	ASTM A36	3/4"	1-1/8"	8-5/8"		*	Through Bolt	8
03136SD	ASTM A193 Gr. B7	3/4"	1-1/8"	13-5/8"		03229SD	Standard	8
03138SD	ASTM A193 Gr. B7	3/4"	1-1/8"	13-5/8"		*	Through Bolt	8

For availability of all anchor lengths please contact DEWALT.
*Contact DEWALT for appropriate drilling method and hardware

Atomic+ Undercut Anchor Type 316 Stainless Steel

Cat. No.	Anchor Rod ASTM Designation	Nominal Anchor Diameter	Anchor Outside Diameter	Overall Length	Required Undercut Bit (Cat. No.)	Required Stop Bit (Cat. No.)	Anchor Type	Std. Box
03600SD	ASTM A193, Grade B8M, Class 1	3/8"	5/8"	5-1/2"	03200SD	03220SD	Standard	20
03602SD	ASTM A193, Grade B8M, Class 1	3/8"	5/8"	5-1/2"		*	Through Bolt	20
03603SD	ASTM A193, Grade B8M, Class 2	3/8"	5/8"	6-3/4"		03221SD	Standard	20
03605SD	ASTM A193, Grade B8M, Class 2	3/8"	5/8"	6-3/4"		*	Through Bolt	20
03608SD	ASTM A193, Grade B8M, Class 1	1/2"	3/4"	7"	03201SD	03222SD	Standard	15
03610SD	ASTM A193, Grade B8M, Class 1	1/2"	3/4"	7"		*	Through Bolt	15
03609SD	ASTM A193, Grade B8M, Class 2	1/2"	3/4"	8"		03223SD	Standard	15
03613SD	ASTM A193, Grade B8M, Class 2	1/2"	3/4"	8"		*	Through Bolt	15
03620SD	ASTM A193, Grade B8M, Class 1	5/8"	1"	7-3/4"	03202SD	03225SD	Standard	10
03622SD	ASTM A193, Grade B8M, Class 1	5/8"	1"	7-3/4"		*	Through Bolt	10
03635SD	ASTM A193, Grade B8M, Class 2	5/8"	1"	10-3/4"		03226SD	Standard	10
03639SD	ASTM A193, Grade B8M, Class 2	5/8"	1"	10-3/4"		*	Through Bolt	10
03632SD	ASTM A193, Grade B8M, Class 1	3/4"	1-1/8"	8-5/8"	03203SD	03228SD	Standard	8
03634SD	ASTM A193, Grade B8M, Class 1	3/4"	1-1/8"	8-5/8"		*	Through Bolt	8
03648SD	ASTM A193, Grade B8M, Class 2	3/4"	1-1/8"	13-5/8"		03229SD	Standard	8
03649SD	ASTM A193, Grade B8M, Class 2	3/4"	1-1/8"	13-5/8"		*	Through Bolt	8

For availability of all anchor lengths please contact DEWALT.
*Contact DEWALT for appropriate drilling method and hardware

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 DEWALT 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.

Setting Sleeve for Undercut Anchors

Cat.. No.	Corresponding Nominal Anchor Diameter	Std. Box
03210SD	3/8	1
03211SD	1/2	1
03218SD	5/8	1
03213SD	3/4	1

Replacement Blade Assemblies for Undercut Drill Bit

Cat.. No.	Description	Std. Tube
03205SD	Atomic+ (3/8") Cutter Blade - 5/8"	1
03206SD	Atomic+ (1/2") Cutter Blade - 3/4"	1
03208SD	Atomic+ (5/8") Cutter Blade - 1"	1
03209SD	Atomic+ (3/4") Cutter Blade - 1-1/8"	1

Replacement Bow Jaws for Undercut Drill Bit

Cat.. No.	Description	Std. Tube
03212SD	3/8" Bow Jaw for 5/8" Hole	1
03215SD	1/2" Bow Jaw for 3/4" Hole	1
03216SD	5/8" Bow Jaw for 1" Hole	1
03217SD	3/4" Bow Jaw for 1-1/8" Hole	1

GENERAL INFORMATION

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, sand-lightweight concrete, concrete over steel deck, and grouted concrete masonry. The anchor is manufactured with a zinc plated carbon steel body and expansion clip for premium performance. Nut and washer are included.

GENERAL APPLICATIONS AND USES

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

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 cracked and uncracked concrete
- International Code Council, Evaluation Service (ICC-ES), ESR-2966 for masonry
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2/ASTM E 488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 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)
- Tested in accordance with ICC-ES AC01 for use in masonry
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD1 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

POWER-STUD+ SD1 ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

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

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 1-1/4" diameter

SUITABLE BASE MATERIALS

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

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED ICC-ES ESR-2818 CONCRETE

CODE LISTED ICC-ES ESR-2966 MASONRY

DDA DEWALT DESIGN ASSIST

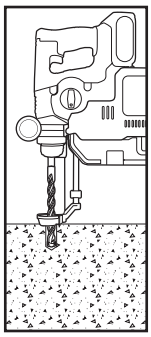
DUST X+ ANCHOR INSTALLATION SYSTEM

MATERIAL SPECIFICATIONS

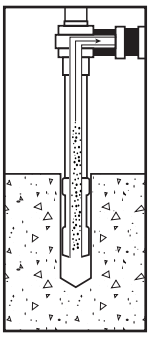
Anchor component	Specification
Anchor Body	Medium carbon steel
Hex nut	Carbon steel, ASTM A 563, Grade A
Washer	Carbon Steel, ASTM F 844; meets dimensional requirements of ANSI B18.22.2. Type A Plain
Expansion wedge (clip)	Carbon Steel
Plating	Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn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

INSTALLATION INSTRUCTIONS

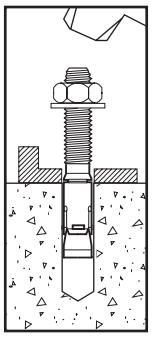
Installation Instructions for Power-Stud+ SD1



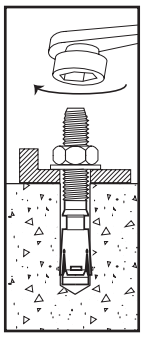
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove the dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

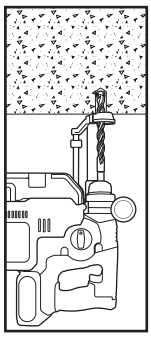


Step 3
Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_{nom}.

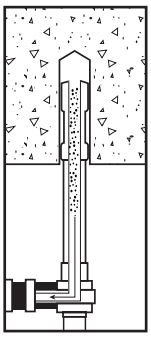


Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}. Note: The threaded stud will draw up during tightening of the nut; the expansion wedge (clip) remains in original position.

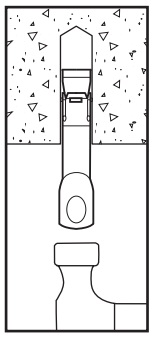
Installation Instructions for Power-Stud+ SD1 Tie Wire Version



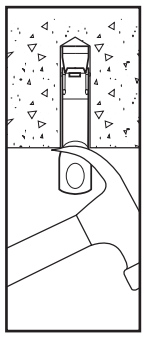
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove the dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

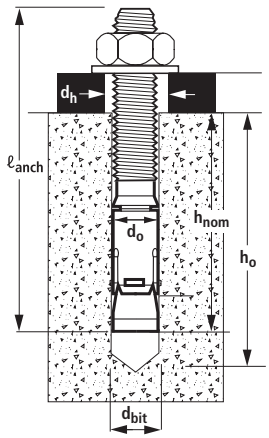


Step 3
Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.

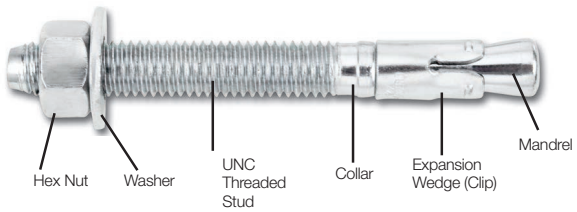


Step 4
Set the anchor with a prying action using a claw hammer.

Power-Stud+ SD1 Anchor Detail



Power-Stud+ SD1 Anchor Assembly



Head Marking

Legend

Letter Code = Length Identification Mark

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

Number Code 1 = Carbon Steel Body and Carbon Steel Expansion Clip (not on 1/4" diameter anchors)

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
From	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"	9-1/2"	10"	11"	12"
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"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"	12"	13"

Length identification mark indicates overall length of anchor.

REFERENCE DATA (ASD)

Installation Specifications for Power-Stud+ SD1 in Concrete[1,2]

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)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (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)	1 (25.4)	1-1/8 (28.6)	1-3/8 (34.9)
Nominal drill bit diameter	d_{bit}	in.	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)	1-1/8 (29)	1-5/8 (41)	2-1/4 (57)	2-3/4 (70)	3-3/8 (86)	4-1/2 (114)	4-1/2 (114)	6-1/2 (165)
Minimum hole depth	h_o	in. (mm)	1-1/4 (48)	1-3/4 (44)	2-1/2 (64)	3-1/8 (79)	3-5/8 (92)	4-7/8 (122)	4-7/8 (122)	7-1/4 (184)
Installation torque	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 minimum base material thickness should be $1.5h_{nom}$ or 3", whichever is greater.
2. See Performance Data in Concrete for additional embedment depths.

Ultimate Load Capacities for Power-Stud+ SD1 in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter in.	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	1-1/8 (28)	1,320 (5.9)	1,160 (5.2)	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	1-5/8 (41)	2,240 (10.9)	2,320 (10.3)	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	2-1/4 (57)	3,800 (16.9)	3,840 (17.1)	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	2-3/4 (70)	4,960 (22.1)	6,220 (27.7)	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	3-3/8 (86)	7,180 (31.9)	11,480 (51.5)	7,860 (32.2)	12,580 (56.0)	9,075 (40.5)	12,580 (56.0)	-	-
	4 (102)	9,530 (42.4)	12,580 (56.0)	10,440 (46.5)	12,580 (56.0)	12,060 (53.6)	12,580 (56.0)	14,770 (65.7)	12,580 (56.0)
	5-5/8 (143)	17,670 (78.6)	12,580 (56.0)	19,355 (86.1)	12,580 (56.0)	22,350 (99.4)	12,580 (56.0)	25,065 (111.5)	12,580 (56.0)
7/8	3-7/8 (98)	9,120 (40.6)	10,680 (47.5)	10,005 (44.5)	11,690 (52.0)	11,555 (51.4)	11,690 (52.0)	-	-
	4-1/2 (114)	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	4-1/2 (114)	12,400 (55.2)	19,320 (85.9)	13,580 (60.4)	21,155 (94.1)	15,680 (69.7)	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)
	8 (203)	19,640 (87.4)	21,155 (94.1)	21,530 (95.8)	21,155 (94.1)	24,865 (110.6)	21,155 (94.1)	-	-
1-1/4	5-1/2 (140)	18,520 (82.5)	26,560 (118.1)	20,275 (90.9)	29,105 (129.4)	23,410 (105.0)	29,105 (129.4)	-	-
	6-1/2 (165)	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. Tabulated load values are for anchors installed in uncracked concrete with no edge or spacing considerations. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working loads.

Allowable Load Capacities for Power-Stud+ SD1 in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter (in.)	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	1-1/8 (28)	330 (1.5)	290 (1.3)	360 (1.6)	315 (1.4)	415 (1.8)	315 (1.4)	-	-
	1-3/4 (44)	695 (3.1)	315 (1.4)	695 (3.1)	315 (1.4)	695 (3.1)	315 (1.4)	695 (3.1)	315 (1.4)
3/8	1-5/8 (41)	610 (2.7)	580 (2.6)	670 (3.0)	635 (2.8)	775 (3.4)	635 (2.8)	-	-
	2-3/8 (60)	870 (3.9)	635 (2.8)	955 (4.2)	635 (2.8)	1,105 (4.9)	635 (2.8)	1,350 (6.0)	635 (2.8)
1/2	2-1/4 (57)	950 (4.2)	960 (4.3)	1,040 (4.6)	1,050 (4.7)	1,200 (5.3)	1,050 (4.7)	-	-
	2-1/2 (64)	980 (4.4)	1,050 (4.7)	1,070 (4.8)	1,050 (4.7)	1,240 (5.5)	1,050 (4.7)	1,515 (6.7)	1,050 (4.7)
	3-3/4 (95)	1,990 (8.9)	1,050 (4.7)	2,180 (9.7)	1,050 (4.7)	2,515 (11.2)	1,050 (4.7)	3,080 (13.7)	1,050 (4.7)
5/8	2-3/4 (70)	1,240 (5.5)	1,555 (6.9)	1,360 (6.0)	1,705 (7.6)	1,570 (7.0)	1,705 (7.6)	-	-
	3-3/8 (86)	1,655 (7.4)	1,705 (7.6)	1,815 (8.1)	1,705 (7.6)	2,095 (9.3)	1,705 (7.6)	2,565 (11.4)	1,705 (7.6)
	4-5/8 (117)	2,815 (12.5)	1,705 (7.6)	3,085 (13.7)	1,705 (7.6)	3,560 (15.8)	1,705 (7.6)	3,615 (16.1)	1,705 (7.6)
3/4	3-3/8 (86)	1,795 (8.0)	2,870 (12.8)	1,965 (8.7)	3,145 (14.0)	2,270 (10.1)	3,145 (14.0)	-	-
	4 (102)	2,385 (10.6)	3,145 (14.0)	2,610 (11.6)	3,145 (14.0)	3,015 (13.4)	3,145 (14.0)	3,620 (16.1)	3,145 (14.0)
	5-5/8 (143)	4,420 (19.7)	3,145 (14.0)	4,840 (21.5)	3,145 (14.0)	5,590 (24.9)	3,145 (14.0)	6,265 (27.9)	3,145 (14.0)
7/8	3-7/8 (98)	2,280 (10.1)	2,670 (11.9)	2,500 (11.1)	2,925 (13.0)	2,890 (12.9)	2,925 (13.0)	-	-
	4-1/2 (114)	2,830 (12.6)	2,925 (13.0)	3,100 (13.8)	2,925 (13.0)	3,780 (16.8)	2,925 (13.0)	4,870 (21.7)	2,925 (13.0)
1	4-1/2 (114)	3,100 (13.8)	4,830 (21.5)	3,395 (15.1)	5,290 (23.5)	3,920 (17.4)	5,290 (23.5)	-	-
	5-1/2 (140)	4,135 (18.4)	5,290 (23.5)	4,530 (20.2)	5,290 (23.5)	5,230 (23.3)	5,290 (23.5)	6,405 (28.5)	5,290 (23.5)
	8 (203)	4,910 (21.8)	5,290 (23.5)	5,380 (23.9)	5,290 (23.5)	6,215 (27.6)	5,290 (23.5)	-	-
1-1/4	5-1/2 (140)	4,630 (20.6)	6,640 (29.5)	5,070 (22.6)	7,275 (32.4)	5,850 (26.0)	7,275 (32.4)	-	-
	6-1/2 (165)	5,620 (25.0)	7,275 (32.4)	6,160 (27.4)	7,275 (32.4)	7,110 (31.6)	7,275 (32.4)	9,340 (41.5)	7,275 (32.4)

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

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

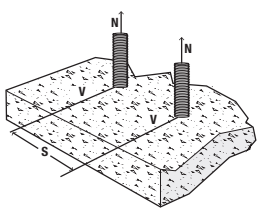
Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	3/4	7/8	1	1-1/4
h_{nom} (in.)		1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	5-5/8	4-1/2	5-1/2	6-1/2
s_{min} (in.)		2-1/4	3-1/2	4-1/2	5	6	4-1/4	6	6-1/2	6-1/2	8	8
Spacing Distance (inches)	2	-	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.78	-	-	-	-	-	-	-	-	-	-
	2-1/2	0.80	-	-	-	-	-	-	-	-	-	-
	2-3/4	0.83	-	-	-	-	-	-	-	-	-	-
	3	0.85	-	-	-	-	-	-	-	-	-	-
	3-1/2	0.90	0.84	-	-	-	-	-	-	-	-	-
	4	0.95	0.87	-	-	-	-	-	-	-	-	-
	4-1/4	0.98	0.89	-	-	-	0.72	-	-	-	-	-
	4-1/2	1.00	0.90	0.91	-	-	0.73	-	-	-	-	-
	5	1.00	0.94	0.94	0.79	-	0.75	-	-	-	-	-
	5-1/2	1.00	0.97	0.97	0.81	-	0.77	-	-	-	-	-
	6	1.00	1.00	1.00	0.83	0.88	0.79	0.87	-	-	-	-
	6-1/2	1.00	1.00	1.00	0.86	0.90	0.80	0.89	0.79	0.85	-	-
	7	1.00	1.00	1.00	0.88	0.93	0.82	0.91	0.81	0.87	-	-
	7-1/2	1.00	1.00	1.00	0.90	0.96	0.84	0.93	0.82	0.89	-	-
	8	1.00	1.00	1.00	0.92	0.99	0.86	0.95	0.83	0.91	0.84	0.82
	8-1/2	1.00	1.00	1.00	0.94	1.00	0.88	0.97	0.85	0.93	0.85	0.83
	9	1.00	1.00	1.00	0.97	1.00	0.89	0.99	0.86	0.94	0.87	0.84
	9-1/2	1.00	1.00	1.00	0.99	1.00	0.91	1.00	0.87	0.96	0.89	0.85
	10	1.00	1.00	1.00	1.00	1.00	0.93	1.00	0.89	0.98	0.90	0.86
	10-1/2	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.90	1.00	0.92	0.87
	11	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.91	1.00	0.93	0.88
	11-1/2	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.93	1.00	0.95	0.90
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.96	0.91
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.98	0.92
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	0.93
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.94
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.95
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

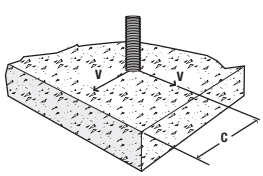
Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	3/4	7/8	1	1-1/4
h_{nom} (in.)		1-3/4	2-3/8	2-1/2	3-3/4	3-3/8	4-5/8	4	5-5/8	4-1/2	5-1/2	6-1/2
c_{ac} (in.)		3-1/2	6-1/2	8	8	6	10	11	16	11-1/2	12	20
c_{min} (in.)		1-3/4	2-1/4	3-1/4	2-3/4	5-1/2	4-1/4	5	6	7	8	8
Edge Distance (inches)	1-3/4	0.50	-	-	-	-	-	-	-	-	-	-
	2	0.57	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.64	0.35	-	-	-	-	-	-	-	-	-
	2-1/2	0.71	0.38	-	-	-	-	-	-	-	-	-
	2-3/4	0.79	0.42	-	0.34	-	-	-	-	-	-	-
	3	0.86	0.46	-	0.38	-	-	-	-	-	-	-
	3-1/4	0.93	0.50	0.41	0.41	-	-	-	-	-	-	-
	3-1/2	1.00	0.54	0.44	0.44	-	-	-	-	-	-	-
	4	1.00	0.62	0.50	0.50	-	-	-	-	-	-	-
	4-1/4	1.00	0.65	0.53	0.53	-	0.43	-	-	-	-	-
	4-1/2	1.00	0.69	0.56	0.56	-	0.45	-	-	-	-	-
	5	1.00	0.77	0.63	0.63	-	0.50	0.45	-	-	-	-
	5-1/2	1.00	0.85	0.69	0.69	0.92	0.55	0.50	-	-	-	-
	6	1.00	0.92	0.75	0.75	1.00	0.60	0.55	0.38	-	-	-
	6-1/2	1.00	1.00	0.81	0.81	1.00	0.65	0.59	0.41	-	-	-
	7	1.00	1.00	0.88	0.88	1.00	0.70	0.64	0.44	0.61	-	-
	7-1/2	1.00	1.00	0.94	0.94	1.00	0.75	0.68	0.47	0.65	-	-
	8	1.00	1.00	1.00	1.00	1.00	0.80	0.73	0.50	0.70	0.67	0.40
	8-1/2	1.00	1.00	1.00	1.00	1.00	0.85	0.77	0.53	0.74	0.71	0.43
	9	1.00	1.00	1.00	1.00	1.00	0.90	0.82	0.56	0.78	0.75	0.45
	9-1/2	1.00	1.00	1.00	1.00	1.00	0.95	0.86	0.59	0.83	0.79	0.48
	10	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.63	0.87	0.83	0.50
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.66	0.91	0.88	0.53
	11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.69	0.96	0.92	0.55
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.72	1.00	0.96	0.58
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.60
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.78	1.00	1.00	0.63
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.81	1.00	1.00	0.65
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.84	1.00	1.00	0.68
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.70
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.73
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	0.75
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	0.78
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80
	16-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85
	17-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
	18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
	18-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	19	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
	19-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	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	5-5/8	4-1/2	5-1/2	6-1/2
s_{min} (in.)		2-1/4	3-1/2	4-1/2	5	6	4-1/4	6	6-1/2	6-1/2	8	8
Spacing Distance (inches)	2-1/4	0.85	-	-	-	-	-	-	-	-	-	-
	2-1/2	0.87	-	-	-	-	-	-	-	-	-	-
	2-3/4	0.88	-	-	-	-	-	-	-	-	-	-
	3	0.90	-	-	-	-	-	-	-	-	-	-
	3-1/2	0.93	0.90	-	-	-	-	-	-	-	-	-
	4	0.97	0.92	-	-	-	-	-	-	-	-	-
	4-1/4	0.98	0.93	-	-	-	0.82	-	-	-	-	-
	4-1/2	1.00	0.94	0.95	-	-	0.82	-	-	-	-	-
	5	1.00	0.96	0.97	0.86	-	0.83	-	-	-	-	-
	5-1/2	1.00	0.98	0.98	0.87	-	0.85	-	-	-	-	-
	6	1.00	1.00	1.00	0.89	0.91	0.86	0.92	-	-	-	-
	6-1/2	1.00	1.00	1.00	0.90	0.93	0.87	0.93	0.88	0.91	-	-
	7	1.00	1.00	1.00	0.92	0.95	0.88	0.94	0.88	0.92	-	-
	7-1/2	1.00	1.00	1.00	0.93	0.97	0.89	0.96	0.89	0.93	-	-
	8	1.00	1.00	1.00	0.95	0.99	0.90	0.97	0.90	0.94	0.90	0.89
	8-1/2	1.00	1.00	1.00	0.96	1.00	0.92	0.98	0.91	0.96	0.91	0.90
	9	1.00	1.00	1.00	0.98	1.00	0.93	0.99	0.92	0.97	0.92	0.91
	9-1/2	1.00	1.00	1.00	0.99	1.00	0.94	1.00	0.92	0.98	0.93	0.91
	10	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.93	0.99	0.94	0.92
	10-1/2	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.94	1.00	0.95	0.93
	11	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.95	1.00	0.96	0.93
	11-1/2	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.96	1.00	0.97	0.94
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.98	0.95
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.99	0.95
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.96
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.97
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Dia. (in)		1/4	3/8	1/2	1/2	5/8	5/8	3/4	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	5-5/8	4-1/2	5-1/2	6-1/2
c_{min} (in.)		1-3/4	2-1/4	3-1/4	2-3/4	5-1/2	4-1/4	5	6	7	8	8
Edge Distance (inches)	1-3/4	0.39	-	-	-	-	-	-	-	-	-	-
	2	0.44	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.50	0.38	-	-	-	-	-	-	-	-	-
	2-1/2	0.56	0.42	-	-	-	-	-	-	-	-	-
	2-3/4	0.61	0.46	-	0.28	-	-	-	-	-	-	-
	3	0.67	0.50	-	0.31	-	-	-	-	-	-	-
	3-1/4	0.72	0.54	0.54	0.33	-	-	-	-	-	-	-
	3-1/2	0.78	0.58	0.58	0.36	-	-	-	-	-	-	-
	4	0.89	0.67	0.67	0.41	-	-	-	-	-	-	-
	4-1/4	0.94	0.71	0.71	0.44	-	0.35	-	-	-	-	-
	4-1/2	1.00	0.75	0.75	0.46	-	0.38	-	-	-	-	-
	5	1.00	0.83	0.83	0.51	-	0.42	0.53	-	-	-	-
	5-1/2	1.00	0.92	0.92	0.56	0.67	0.46	0.59	-	-	-	-
	6	1.00	1.00	1.00	0.62	0.73	0.50	0.64	0.42	-	-	-
	6-1/2	1.00	1.00	1.00	0.67	0.79	0.54	0.69	0.46	-	-	-
	7	1.00	1.00	1.00	0.72	0.85	0.58	0.75	0.49	0.67	-	-
	7-1/2	1.00	1.00	1.00	0.77	0.91	0.63	0.80	0.53	0.71	-	-
	8	1.00	1.00	1.00	0.82	0.97	0.67	0.85	0.56	0.76	0.61	0.50
	8-1/2	1.00	1.00	1.00	0.87	1.00	0.71	0.91	0.60	0.81	0.65	0.53
	9	1.00	1.00	1.00	0.92	1.00	0.75	0.96	0.63	0.86	0.69	0.56
	9-1/2	1.00	1.00	1.00	0.97	1.00	0.79	1.00	0.67	0.90	0.72	0.59
	10	1.00	1.00	1.00	1.00	1.00	0.83	1.00	0.70	0.95	0.76	0.62
	10-1/2	1.00	1.00	1.00	1.00	1.00	0.88	1.00	0.74	1.00	0.80	0.65
	11	1.00	1.00	1.00	1.00	1.00	0.92	1.00	0.77	1.00	0.84	0.68
	11-1/2	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.81	1.00	0.88	0.71
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.84	1.00	0.91	0.74
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	0.95	0.78
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.99	0.81
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.84
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.87
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	15-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	16-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

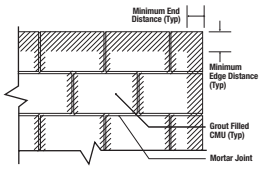




Ultimate and Allowable Load Capacities in Tension for Power-Stud+ SD1 in Grout Filled Concrete Masonry Wall Faces[1,2,3,4,5,6]

CODE LISTED
ICC-ES ESR-2966

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Min. Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Installation Torque T_{inst} ft-lbf (N-m)	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	3/8 ANSI	2-3/8 (60.3)	4 (101.6)	4 (101.6)	20 (27)	2,225 (10.0)	445 (2.0)	2,670 (12.0)	535 (2.4)
1/2	1/2 ANSI	2-1/2 (63.5)	4 (101.6)	4 (101.6)	40 (54)	2,650 (11.9)	530 (2.4)	3,180 (14.3)	635 (2.9)
5/8	5/8 ANSI	3-3/8 (85.7)	4 (101.6)	4 (101.6)	50 (68)	3,525 (15.9)	705 (3.2)	4,230 (19.0)	845 (3.8)
3/4	3/4 ANSI	3-3/8 (85.7)	12 (304.8)	12 (304.8)	80 (108)	7,575 (33.7)	1,515 (6.7)	8,175 (36.4)	1,635 (7.3)
			20 (508.0)	20 (508.0)	80 (108)	7,575 (33.7)	1,515 (6.7)	8,175 (36.4)	1,635 (7.3)
		4-3/4 (120.7)	12 (304.8)	12 (304.8)	80 (108)	7,580 (34.1)	1,515 (6.8)	8,755 (39.4)	1,750 (7.9)



Wall Face
Permissible Anchor Locations
(Un-hatched Area)

1. Tabulated load values for 3/8", 1/2" and 5/8" diameter anchors are installed in minimum 6" wide, 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 specified minimum at the time of installation.
2. Tabulated load values for 3/4" diameter anchors are installed in minimum 8" wide, 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 specified minimum at the time of installation.
3. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
4. The tabulated values are applicable for anchors installed into 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 minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied by a reduction factor 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.
5. 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.
6. 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

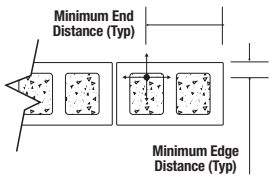
Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Min. Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Direction of Loading	Installation Torque T_{inst} ft-lbf (N-m)	Grout-Filled Concrete Masonry			
							f'm = 1,500 psi		f'm = 2,000 psi	
							Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)	Ultimate Load Shear lbs. (kN)	Allowable Load Shear lbs. (kN)
3/8	3/8 ANSI	2-3/8 (60.3)	4 (101.6)	4 (101.6)	Perpendicular or parallel to wall edge or end	20 (27)	2,975 (13.4)	595 (2.7)	3,570 (16.1)	715 (3.2)
1/2	1/2 ANSI	2-1/2 (63.5)	4 (101.6)	12 (304.8)	Perpendicular or parallel to wall edge or end	40 (54)	2,800 (12.6)	560 (2.5)	3,360 (15.1)	670 (3.0)
			12 (304.8)	4 (101.6)	Parallel to wall end		4,025 (18.1)	805 (3.6)	4,830 (21.7)	965 (4.3)
			4 (101.6)	12 (304.8)	Parallel to wall edge					
5/8	5/8 ANSI	3-3/8 (85.7)	4 (101.6)	4 (101.6)	Perpendicular or parallel to wall edge or end	50 (68)	3,425 (15.4)	685 (3.1)	4,110 (18.5)	820 (3.7)
			12 (304.8)	4 (101.6)	Parallel to wall end		5,325 (24.0)	1,065 (4.8)	6,390 (28.8)	1,280 (5.8)
			4 (101.6)	12 (304.8)	Parallel to wall edge					
3/4	3/4 ANSI	3-3/8 (85.7)	12 (304.8)	12 (304.8)	Perpendicular or parallel to wall edge or end	80 (108)	8,850 (39.4)	1,770 (7.9)	9,375 (41.7)	1,875 (8.3)
			20 (508.0)	20 (508.0)			10,200 (45.4)	2,040 (9.1)	10,800 (48.0)	2,160 (9.6)
		4-3/4 (120.7)	12 (304.8)	12 (304.8)			12,735 (56.7)	2,545 (11.3)	12,735 (56.7)	2,545 (11.3)

1. Tabulated load values for 3/8", 1/2" and 5/8" diameter anchors are installed in minimum 6" wide, 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 specified minimum at the time of installation.
2. Tabulated load values for 3/4" diameter anchors are installed in minimum 8" wide, 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 specified minimum at the time of installation.
3. Allowable load capacities listed are calculated using an applied safety factor of 5.0.
4. The tabulated values are applicable for anchors installed into 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 minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied by a reduction factor 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.
5. 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.

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

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Minimum Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Installation Torque T_{inst} ft-lbf (N-m)	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	3/8 ANSI	2-3/8 (60.3)	1-3/4 (44.5)	12 (304.8)	20 (27)	1,475 (6.6)	295 (1.3)	1,770 (8.0)	355 (1.6)
1/2	1/2 ANSI	2-1/2 (63.5)	2-1/4 (57.1)		40 (54)	2,225 (9.9)	445 (2.0)	2,575 (11.5)	515 (2.3)
		5 (127)				3,425 (15.4)	685 (3.1)	4,110 (18.5)	820 (3.7)
5/8	5/8 ANSI	3-3/8 (85.7)			50 (68)	3,825 (17.2)	765 (3.4)	4,590 (20.7)	920 (4.1)



Top of Wall

1. Tabulated load values are for anchors installed in minimum 8-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. Anchors must be installed in the grouted cells and the minimum edge and end distances must be maintained.
4. The tabulated values are applicable for anchors installed in top of grouted masonry walls at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter.

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

CODE LISTED
ICC-ES ESR-2966

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter in.	Minimum Embed. Depth in. (mm)	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	Direction of Loading	Installation Torque T_{inst} ft-lbf (N-m)	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	3/8 ANSI	2-3/8 (60.3)	1-3/4 (44.5)	12 (304.8)	Perpendicular to wall toward minimum edge	20 (27)	1,150 (5.2)	230 (1.0)	1,380 (6.2)	275 (1.2)
					Parallel to wall edge		2,425 (10.9)	485 (2.2)	2,910 (13.1)	580 (2.6)
1/2	1/2 ANSI	2-1/2 (63.5)	2-1/4 (57.1)	12 (304.8)	Any	40 (54)	1,150 (5.2)	230 (1.0)	1,380 (6.2)	275 (1.2)
		5 (127)			Perpendicular to wall toward minimum edge		1,400 (6.3)	280 (1.3)	1,680 (7.6)	325 (1.5)
					Parallel to wall edge		2,825 12.7	565 (2.5)	3,390 (15.3)	680 (3.1)
5/8	5/8 ANSI	3-3/8 (85.7)	2-1/4 (57.1)	12 (304.8)	Any	50 (68)	1,150 (5.2)	230 (1.0)	1,380 (6.2)	275 (1.2)
		6-1/4 (158.8)			Perpendicular to wall toward minimum edge		1,700 (7.7)	340 (1.5)	2,040 (9.2)	410 (1.8)
					Parallel to wall edge		3,525 (15.9)	705 (3.2)	4,230 (19.0)	845 (3.8)

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. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. 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 (SD)

Power-Stud+ SD1 Anchor Installation Specifications in Concrete[1]

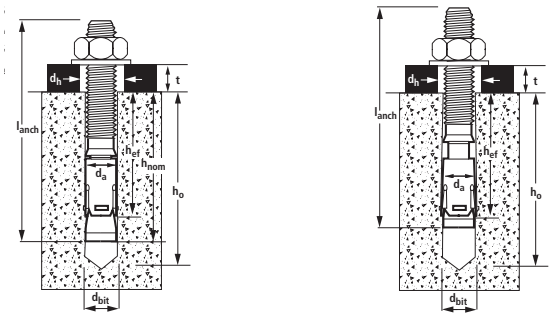
CODE LISTED
ICC-ES ESR-2818

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Diameter																					
			1/4 inch	3/8 inch			1/2 inch			5/8 inch			3/4 inch			7/8 inch	1 inch	1-1/4 inch					
Anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)			0.500 (12.7)			0.625 (15.9)			0.750 (19.1)			0.875 (22.2)	1.000 (25.4)	1.250 (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)			1 (25.4)	1-1/8 (28.6)	1-3/8 (34.9)					
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI			1/2 ANSI			5/8 ANSI			3/4 ANSI			7/8 ANSI	1 ANSI	1-1/4 ANSI					
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)	5-5/8 (143)		4-1/2 (114)	5-1/2 (140)	6-1/2 (165)					
Effective embedment depth	h_{ef}	in. (mm)	1.50 (38)	2.00 (51)			2.00 (51)	3.25 (83)		2.75 (70)	4.00 (102)		3.125 (79)	4.75 (114)		3.50 (89)	4.375 (111)	5.375 (137)					
Minimum hole depth	h_{hole}	in. (mm)	1-7/8 (48)	2-1/2 (64)			2-3/4 (70)	4 (102)		3-3/4 (95)	5 (127)		4-1/4 (108)	5-7/8 (149)		4-7/8 (124)	5-7/8 (149)	7-1/4 (184)					
Minimum overall anchor length[2]	ℓ_{anch}	in. (mm)	2-1/4 (57)	3 (76)			3-3/4 (95)	4-1/2 (114)		4-1/2 (114)	6 (152)		5-1/2 (140)	7 (178)		8 (203)	9 (229)	9 (229)					
Installation torque[6]	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					
Anchors Installed in Concrete Construction																								
Minimum member thickness	h_{min}	in. (mm)	3-1/4 (83)	3-3/4 (95)		4 (102)	4 (102)		6 (152)		6 (152)	7 (178)	6 (152)	10 (254)		10 (254)	10 (254)	12 (305)						
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (45)	6 (152)	2-3/4 (70)	2-1/4 (57)	6 (152)	3-1/4 (95)	4 (102)	2-3/4 (70)	6 (152)	5-1/2 (140)	4-1/4 (108)	5 (127)	6 (152)	7` (178)	8 (203)	8 (203)						
Minimum spacing distance	s_{min}	in. (mm)	2-1/4 (57)	3-1/2 (89)	9 (229)	3-3/4 (95)	4-1/2 (114)	10 (254)	5 (127)	6 (152)	6 (152)	11 (270)	4-1/4 (108)	6 (152)	6-1/2 (165)	6-1/2 (165)	8 (203)	8 (203)						
Critical edge distance (uncracked concrete only)	c_{ac}	in. (mm)	3-1/2 (89)	6-1/2 (165)			8 (203)		8 (203)		6 (152)		10 (254)	11 (279)	16 (406)	11-1/2 (292)	12 (305)	20 (508)						
Anchors Installed in the Topside of Concrete-filled Steel Deck Assemblies[3,4]																								
Minimum member topping thickness	$h_{min,deck}$	in. (mm)	3-1/4 (83)	3-1/4 (83)			3-1/4 (83)	See note 3		See note 3			See note 3			See note 3	See note 3	See note 3					
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	1-3/4 (45)	2-3/4 (70)			4-1/2 (114)																	
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	2-1/4 (57)	4 (102)			6-1/2 (165)																	
Critical edge distance (uncracked concrete only)	$c_{ac,deck,top}$	in. (mm)	3-1/2 (89)	6-1/2 (165)			6 (152)																	
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete[5]																								
Minimum member topping thickness (see detail in Figure 2A)	$h_{min,deck}$	in. (mm)	Not Applicable	3-1/4 (95)			3-1/4 (95)			3-1/4 (95)			3-1/4 (95)			Not Applicable	Not Applicable	Not Applicable					
Minimum edge distance, lower flute (see detail in Figure 2A)	c_{min}	in. (mm)		1-1/4 (32)			1-1/4 (32)			1-1/4 (32)			1-1/4 (32)											
Minimum axial spacing distance along flute (see detail in Figure 2A)	s_{min}	in. (mm)		6-3/4 (171)			6-3/4 (171)	9-3/4 (248)		8-1/4 (210	12 (305)		9-3/8 (238)	14-1/4 (362)										
Minimum member topping thickness (see detail in Figure 2B)	$h_{min,deck}$	in. (mm)		2-1/4 (57)			2-1/4 (57)			Not Applicable			Not Applicable			Not Applicable	Not Applicable	Not Applicable					
Minimum edge distance, lower flute (see detail in Figure 2B)	c_{min}	in. (mm)		3/4 (19)			3/4 (19)																	
Minimum axial spacing distance along flute (see detail in Figure 2B)	s_{min}	in. (mm)		6 (152)			6 (152)	9-3/4 (248)																

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

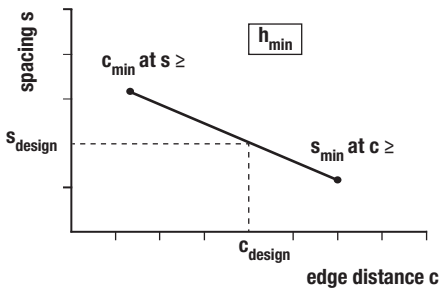
1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, nut height and washer thickness, and consideration of a possible fixture attachment.
3. The 1/4 -inch-diameter (6.4 mm) anchors may be installed in the topside of uncracked concrete-filled steel deck assemblies where concrete thickness above the upper flute meets the minimum member thicknesses specified in this table. The 3/8 -inch (9.5 mm) through 1-1/4 -inch-diameter (31.8 mm) anchors may be installed in the topside of cracked and uncracked concrete-filled steel deck assemblies where concrete thickness above the upper flute meets the minimum member thicknesses specified in this table under Anchors Installed in Concrete Construction.
4. For installations in the topside of concrete-filled steel deck assemblies, see the installation detail in Figure 1.
5. For installations through the soffit of steel deck assemblies into concrete, see the installation details in Figures 2A and 2B. In accordance with the figures, anchors shall have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
6. For installation of 5/8 -inch diameter anchors through the soffit of the steel deck into concrete, the installation torque is 50 ft.-lbf. For installation of 3/4-inch-diameter anchors through the soffit of the steel deck into concrete, installation torque is 80 ft.-lbf.

Power-Stud+ SD1 Anchor Detail



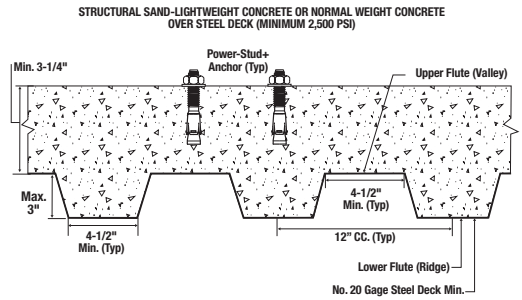
Application of Installation Torque

Interpolation of Minimum Edge Distance and Anchor Spacing



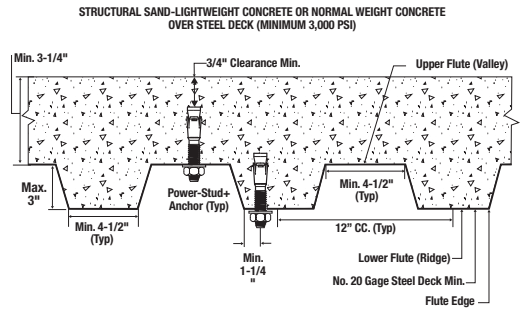
This interpolation applies to the cases when two sets of minimum edge distances, c_{min}, and minimum spacing distances, s_{min}, are given in the SD Installation Specifications for Concrete table for a given anchor diameter under the same effective embedment depth, h_{ef}, and corresponding minimum member thickness, h_{min}.

Figure 1 - Power-Stud+ SD1 Installation Detail for Anchors in the Topside Of Concrete Filled Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)



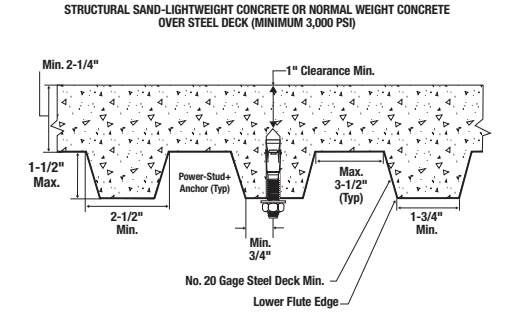
Anchors may be placed in the topside of steel deck profiles in accordance with Figure 1 provided the minimum member topping thickness, minimum spacing distance and minimum edge distance are satisfied as given in Installation Specifications.

Figure 2A - Power-Stud+ SD1 Installation Detail for Anchors in the Soffit Of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)



Anchors may be placed in the upper flute or lower flute of the steel deck profiles in accordance with Figure 2A provided the minimum hole clearance is satisfied. Anchors in the lower flute of Figure 2A 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. In addition, the anchors must have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Figure 2B - Power-Stud+ SD1 Installation Detail for Anchors in the Soffit Of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)



Anchors may be placed in the lower flute of the steel deck profiles in accordance with Figure 2B provided the minimum hole clearance is satisfied. Anchors in the lower flute of Figure 2B 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. In addition, the anchors must have an axial spacing along the flute equal to the greater of $3h_{ef}$ or 1.5 times the flute width. Anchors may be placed in the upper flute of the steel deck profiles in accordance with Figure 2B provided the concrete thickness above the upper flute is minimum 3-1/4-inch and a minimum hole clearance of 3/4-inch is satisfied.

Tension Design Information for Power-Stud+ SD1 Anchor in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

CODE LISTED
ICC-ES ESR-2818

Design Characteristic	Notation	Units	Nominal Anchor Diameter											
			1/4 inch	3/8 inch	1/2 inch		5/8 inch		3/4 inch		7/8 inch	1 inch	1-1/4 inch	
Anchor category	1, 2 or 3	-	1	1	1		1		1		1	1	1	
STEEL STRENGTH IN TENSION[4]														
Minimum specified yield strength	f_{ya}	ksi (N/mm²)	88.0 (606)	88.0 (606)	80.0 (551)		80.0 (551)		64.0 (441)		58.0 (400)	58.0 (400)	58.0 (400)	
Minimum specified ultimate tensile strength (neck)	f_{uta}[12]	ksi (N/mm²)	110.0 (758)	110.0 (758)	100.0 (689)		100.0 (689)		80.0 (552)		75.0 (517)	75.0 (517)	75.0 (517)	
Effective tensile stress area (neck)	$A_{se,N}$	in² (mm²)	0.0220 (14.2)	0.0531 (34.3)	0.1018 (65.7)		0.1626 (104.9)		0.2376 (150.9)		0.327 (207.5)	0.430 (273.1)	0.762 (484)	
Steel strength in tension[4]	N_{sa}[12]	lb (kN)	2,255 (10.0)	5,455 (24.3)	9,080 (40.4)		14,465 (64.3)		19,000 (84.5)		24,500 (109.0)	32,250 (143.5)	56,200 (250)	
Reduction factor for steel strength[3]	ϕ	-	0.75											
CONCRETE BREAKOUT STRENGTH IN TENSION[8]														
Effective embedment depth	h_{ef}	in. (mm)	1.50 (38)	2.00 (51)	2.00 (51)	3.25 (83)	2.75 (70)	4.00 (102)	3.125 (79)	4.75 (114)	3.50 (89)	4.375 (111)	5.375 (137)	
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24		24		24	24	24	24	27	
Effectiveness factor for cracked concrete	k_{cr}	-	Not Applicable	17	17		17		21	17	21	24	24	
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$[12]	-	1.0	1.0	1.0		1.0		1.0		1.0	1.0	1.0	
Critical edge distance (uncracked concrete only)	c_{ac}	in. (mm)	See Installation Specifications											
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)											
PULLOUT STRENGTH IN TENSION (NON SEISMIC-APPLICATIONS)[8,9]														
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	11,350 (50.5)	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)											
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[8,9]														
Characteristic pullout strength, seismic (2,500 psi)[6,10]	$N_{p,eq}$[12]	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	11,350 (50.5)	
Reduction factor for pullout strength, seismic[3]	ϕ	-	0.65 (Condition B)											
PULLOUT STRENGTH IN TENSION FOR ANCHORS INSTALLED THROUGH THE SOFFIT OF SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK														
Characteristic pullout strength, uncracked concrete over steel deck(Figure 2A)[6,11]	$N_{p,deck,uncr}$	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 (Figure 2A)[6,11]	$N_{p,deck,cr}$	lb (kN)		1,375 (6.1)	2,390 (10.6)		1,980 (8.8)		2,825 (12.4)					
Characteristic pullout strength, cracked concrete over steel deck, seismic (Figure 2A)[6,11]	$N_{p,deck,eq}$	lb (kN)		1,375 (6.1)	2,390 (10.6)		1,980 (8.8)		2,825 (12.4)					
Characteristic pullout strength, uncracked concrete over steel deck (Figure 2B)[6,11]	$N_{p,deck,uncr}$	lb (kN)		1,665 (7.4)	1,900 (8.5)		Not Applicable		Not Applicable					
Characteristic pullout strength, cracked concrete over steel deck (Figure 2B)[6,11]	$N_{p,deck,cr}$	lb (kN)		1,180 (5.2)	1,420 (6.3)									
Characteristic pullout strength, cracked concrete over steel deck, seismic (Figure 2B)[6,11]	$N_{p,deck,eq}$	lb (kN)		1,180 (5.2)	1,420 (6.3)									
Reduction factor for pullout strength, steel deck[3]	ϕ	-	0.65 (Condition B)											

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318 -11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, 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, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
4. The Power-Stud+ SD1 is considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable. Tabulated values for steel strength in tension are based on test results per ACI 355.2 and 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 from table)*(specified concrete compressive strength/2,500)$^{0.5}$. For concrete over steel deck the value of 2,500 must be replaced with the value of 3,000.
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 lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
9. For anchors in the topside of concrete-filled steel deck assemblies, see Figure 1.
10. 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.
11. Values for $N_{p,deck}$ are for 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 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, is not required for anchors installed in the deck soffit (flute).

Shear Design Information for Power-Stud+ SD1 Anchor in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

CODE LISTED ICC-ES ESR-2818

Design Characteristic	Notation	Units	Nominal Anchor Diameter										
			1/4 inch	3/8 inch	1/2 inch		5/8 inch		3/4 inch		7/8 inch	1 inch	1-1/4 inch
Anchor category	1, 2 or 3	-	1	1	1		1		1		1	1	1
STEEL STRENGTH IN SHEAR[4]													
Minimum specified yield strength (threads)	f_{ya}	ksi (N/mm²)	70.0 (482)	80.0 (552)	70.4 (485)		70.4 (485)		64.0 (441)		58.0 (400)	58.0 (400)	58.0 (400)
Minimum specified ultimate strength (threads)	f_{uta}	ksi (N/mm²)	88.0 (606)	100.0 (689)	88.0 (607)		88.0 (607)		80.0 (552)		75.0 (517)	75.0 (517)	75.0 (517)
Effective tensile stress area (threads)	$A_{se,V}$	in² (mm²)	0.0318 (20.5)	0.0775 (50.0)	0.1419 (91.5)		0.2260 (145.8)		0.3345 (212.4)		0.462 (293.4)	0.6060 (384.8)	0.969 (615)
Steel strength in shear[5]	V_{sa}	lb (kN)	925 (4.1)	2,990 (13.3)	4,620 (20.6)		9,030 (40.2)		10,640 (47.3)	11,655 (54.8)	8,820 (39.2)	10,935 (48.6)	17,750 (79.0)
Reduction factor for steel strength[3]	ϕ	-	0.65										
CONCRETE BREAKOUT STRENGTH IN SHEAR[6,7]													
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	in. (mm)	1.50 (38)	2.00 (51)	2.00 (51)	3.25 (83)	2.75 (70)	4.00 (102)	3.125 (79)	4.75 (114)	3.50 (88.9)	4.375 (111)	5.375 (137)
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)		0.750 (19.1)		0.875 (22.2)	1.000 (25.4)	1.25 (31.8)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)										
PRYOUT STRENGTH IN SHEAR[6,7]													
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	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	2.00 (51)	2.00 (51)	3.25 (83)	2.75 (70)	4.00 (102)	3.125 (79)	4.75 (114)	3.50 (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[8]	$V_{sa,eq}$	lb (kN)	N/A	2,440 (10.9)	3,960 (17.6)		6,000 (26.7)		8,580 (38.2)	9,635 (42.9)	8,820 (39.2)	9,845 (43.8)	17,750 (79.0)
Reduction factor for steel strength in shear for seismic[3]	ϕ	-	0.65										
STEEL STRENGTH IN SHEAR FOR FOR ANCHORS INSTALLED THROUGH THE SOFFIT OF SAND-LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9,10]													
Steel strength in shear, concrete over steel deck (Figure 2A)[9]	$V_{sa,deck}$	lb (kN)	Not Applicable	2,120 (9.4)	2,290 (10.2)		3,710 (16.5)		5,505 (24.5)		Not Applicable	Not Applicable	Not Applicable
Steel strength in shear, concrete over steel deck, seismic (Figure 2A)[9]	$V_{sa,deck,eq}$	lb (kN)		2,120 (9.4)	2,290 (10.2)		3,710 (16.5)		4,570 (20.3)				
Steel strength in shear, concrete over steel deck (Figure 2B)[9]	$V_{sa,deck}$	lb (kN)		2,120 (9.4)	2,785 (12.4)		Not Applicable		Not Applicable				
Steel strength in shear, concrete over steel deck, seismic (Figure 2B)[9]	$V_{sa,deck,eq}$	lb (kN)		2,120 (9.4)	2,785 (12.4)								
Reduction factor for steel strength in shear, steel deck[3]	ϕ	-	0.65										

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, must apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
4. The Power-Stud+ SD1 is considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
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.
6. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
7. For anchors in the topside of concrete-filled steel deck assemblies, see Figure 1.
8. 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.
9. Tabulated values for $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for sand-lightweight concrete (f'c, min = 3,000 psi); additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, are not required for anchors installed in the deck soffit (flute).
10. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.

STRENGTH DESIGN PERFORMANCE DATA

Factored design strength ϕN_n and ϕV_n
Calculated in accordance with ACI 318-14 Chapter 17
Compliant with the International Building Code

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 = 2,500 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi		f'_c = 8,000 psi	
		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	1,685	1,450	1,845	1,675	1,945	2,050	1,945	2,365	1,945
1/2	2-1/2	1,565	1,685	1,710	1,845	1,975	2,130	2,420	2,605	2,795	3,005
	3-3/4	1,630	3,005	1,785	3,005	2,060	3,005	2,520	3,005	2,915	3,005
5/8	3-3/8	2,520	3,125	2,760	3,425	3,185	3,955	3,905	4,845	4,505	5,590
	4-5/8	2,895	5,870	3,170	5,870	3,660	5,870	4,480	5,870	5,175	5,870
3/4	4	3,770	6,210	4,130	6,800	4,770	6,915	5,840	6,915	6,735	6,915
	5-5/8	5,720	7,575	6,265	7,575	7,235	7,575	8,860	7,575	10,230	7,575
7/8	4-1/2	4,470	5,735	4,895	5,735	5,655	5,735	6,925	5,735	7,995	5,735
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	7,380	11,540	8,080	11,540	9,330	11,540	11,430	11,540	13,195	11,540

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

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 = 2,500 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi		f'_c = 8,000 psi	
		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	600	1,570	600	1,690	600	1,690	600	1,690	600
3/8	2-3/8	1,860	1,945	2,040	1,945	2,335	1,945	2,885	1,945	3,330	1,945
1/2	2-1/2	2,095	2,375	2,295	2,605	2,645	3,005	3,240	3,005	3,745	3,005
	3-3/4	3,595	3,005	3,940	3,005	4,545	3,005	5,570	3,005	6,430	3,005
5/8	3-3/8	3,555	4,375	3,895	4,795	4,500	5,535	5,510	5,870	6,365	5,870
	4-5/8	6,240	5,870	6,835	5,870	7,895	5,870	9,665	5,870	10,850	5,870
3/4	4	4,310	6,915	4,720	6,915	5,450	6,915	6,675	6,915	7,710	6,915
	5-5/8	8,075	7,575	8,845	7,575	10,215	7,575	12,510	7,575	14,250	7,575
7/8	4-1/2	5,105	5,735	5,595	5,735	6,460	5,735	7,910	5,735	9,135	5,735
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	10,935	11,540	11,980	11,540	13,830	11,540	16,940	11,540	19,560	11,540

- Anchor Pullout/Pryout Strength Controls - Concrete Breakout Strength Controls - Steel 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 times c_{a1}.

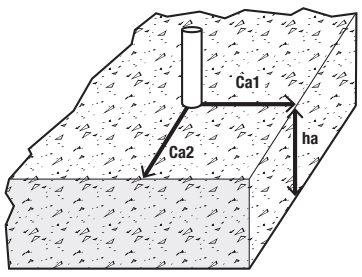
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength 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 (ø) were based on ACI 318-14 Section 5.3 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



ORDERING INFORMATION

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

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt./100 (lbs.)	Suggested ANSI Carbide Drill Bit Cat. No.				
						Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7400SD1	1/4" x 1-3/4"	3/4"	100	600	3	DW5517	DW5416	-	-	-
7402SD1	1/4" x 2-1/4"	1-1/4"	100	600	4	DW5517	DW5417	-	-	-
7404SD1	1/4" x 3-1/4"	2-1/4"	100	600	5	DW5517	DW5417	-	-	-
7410SD1	3/8" x 2-1/4"	7/8"	50	300	8	DW5527	DW5427	-	-	-
7412SD1	3/8" x 2-3/4"	1-3/8"	50	300	9	DW5527	DW5427	-	-	-
7413SD1	3/8" x 3"	1-5/8"	50	300	10	DW5527	DW5427	-	-	-
7414SD1	3/8" x 3-1/2"	2-1/8"	50	300	12	DW5527	DW5427	-	-	-
7415SD1	3/8" x 3-3/4"	2-3/8"	50	300	13	DW5527	DW5427	-	-	-
7416SD1	3/8" x 5"	3-5/8"	50	300	15	DW55300	DW5429	-	-	-
7417SD1	3/8" x 7"	5-5/8"	50	300	21	DW55300	DW5429	-	-	-
7420SD1	1/2" x 2-3/4"	1"	50	200	19	DW5537	DW5437	DW5803	DWA54012	-
7422SD1	1/2" x 3-3/4"	2"	50	200	23	DW5537	DW5437	DW5803	DWA54012	-
7423SD1	1/2" x 4-1/2"	2-3/4"	50	200	27	DW5539	DW5438	DW5803	DWA54012	-
7424SD1	1/2" x 5-1/2"	3-3/4"	50	150	30	DW5539	DW5438	DW5803	DWA54012	-
7426SD1	1/2" x 7"	5-1/4"	25	100	38	DW5539	DW5438	DW5803	DWA54012	-
7427SD1	1/2" x 8-1/2"	6-3/4"	25	100	44	DW5539	DW5439	DW5804	DWA54012	-
7428SD1	1/2" x 10"	8-1/4"	25	100	53	DW5539	DW5439	DW5804	DWA54012	-
7430SD1	5/8" x 3-1/2"	1-1/2"	25	100	37	-	DW5446	DW5806	DWA54058	DWA54058
7432SD1	5/8" x 4-1/2"	2-1/2"	25	100	43	-	DW5446	DW5806	DWA54058	DWA54058
7433SD1	5/8" x 5"	3"	25	100	47	-	DW5446	DW5806	DWA54058	DWA54058
7434SD1	5/8" x 6"	4"	25	75	53	-	DW5446	DW5806	DWA54058	DWA54058
7436SD1	5/8" x 7"	5"	25	75	60	-	DW5447	DW5806	DWA54058	DWA54058
7438SD1	5/8" x 8-1/2"	6-1/2"	25	50	70	-	DW5447	DW5809	DWA54058	DWA54058
7439SD1	5/8" x 10"	8"	25	75	87	-	DW5447	DW5809	DWA54058	DWA54034
7440SD1	3/4" x 4-1/4"	1-3/4"	20	60	63	-	DW5453	DW5810	DWA54034	DWA54034
7441SD1	3/4" x 4-3/4"	2-1/4"	20	60	68	-	DW5453	DW5810	DWA54034	DWA54034
7442SD1	3/4" x 5-1/2"	3"	20	60	76	-	DW5453	DW5810	DWA54034	DWA54034
7444SD1	3/4" x 6-1/4"	3-3/4"	20	60	83	-	DW5455	DW5810	DWA54034	DWA54034
7446SD1	3/4" x 7"	4-1/2"	20	60	91	-	DW5455	DW5810	DWA54034	DWA54034
7448SD1	3/4" x 8-1/2"	6"	10	40	107	-	DW5455	DW5812	DWA54034	DWA54034
7449SD1	3/4" x 10"	7-1/2"	10	30	123	-	DW5455	DW5812	DWA54034	DWA54034
7451SD1	3/4" x 12"	9-1/2"	10	30	144	-	DW5456	DW5812	DWA54034	DWA54034
7450SD1	7/8" x 6"	2-3/4"	10	20	128	-	-	DW5815	-	DWA54078
7452SD1	7/8" x 8"	4-3/4"	10	40	161	-	-	DW5815	-	DWA54078
7454SD1	7/8" x 10"	6-3/4"	10	30	187	-	-	DW5816	-	DWA54078
7461SD1	1" x 6"	2-3/8"	10	30	168	-	-	DW5818	-	DWA58001
7463SD1	1" x 9"	5-3/8"	10	30	234	-	-	DW5819	-	DWA58001
7465SD1	1" x 12"	8-3/8"	5	15	307	-	-	DW5819	-	DWA58001
7473SD1	1-1/4" x 9"	4-3/4"	5	15	374	-	-	DW5820	-	-
7475SD1	1-1/4" x 12"	7-3/4"	5	15	476	-	-	DW5825	-	-

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

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt./100 (lbs.)
7409SD1	1/4" x 2"	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 (not including tie wire version).
See the DEWALT website or Buyers Guide for additional information on carbide drill bits.
A manual hand pump is available (Cat. No. 08280).
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

GENERAL INFORMATION

POWER-STUD® +SD2

High Performance 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, 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 cracked and uncracked concrete
- Code Compliant with the 2015, IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 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: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 09 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD2 as supplied by DEWALT, Towson, MD. 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 requirements 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
- Sand-lightweight concrete
- Concrete over steel deck
- Grouted-filled concrete masonry (CMU)

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-2502
CONCRETE

DDA
DEWALT DESIGN ASSIST

DUST X+
ANCHOR INSTALLATION SYSTEM

INSTALLATION SPECIFICATIONS

Installation Table for Power-Stud+ SD2[4]

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size									
			3/8"	1/2"				5/8"			3/4"	
Anchor diameter	d_a	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[1]	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[2]	h_o	in. (mm)	2-5/8 (67)	2-3/4 (70)		4 (102)		4-1/4 (108)	5-1/4 (133)		5 (127)	6-1/4 (159)
Minimum concrete member thickness	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[3]	ℓ_{anch}	in. (mm)	3 (76.2)	3-3/4 (95)		4-1/2 (114)		4-3/4 (121)	6 (152)		5-1/2 (140)	7 (178)
Minimum edge distance[2]	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[2]	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[2]	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	

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

1. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
2. For installations through the soffit of steel deck into concrete see the installation details in Figure A, B, and C. 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. The hole diameter in the steel deck must not exceed the hole diameter in the concrete by more than 1/8-inch (3.2 mm).
3. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth and possible fixture attachment.
4. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with the installation specifications and design information provided the concrete thickness above the upper flute meets the minimum thicknesses specified in the tables; see Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies table and installation detail D.

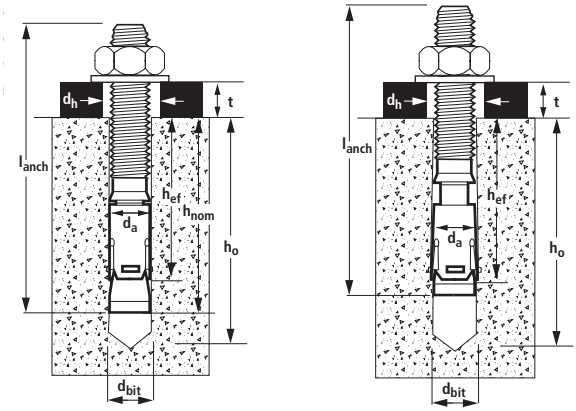
Anchor Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies[3,4]

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size (inch)			
			3/8"		1/2"	
Nominal drill bit diameter	d_{bit}	in.	3/8 ANSI		1/2 ANSI	
Minimum nominal embedment depth[1]	h_{nom}	in. (mm)	2-3/8 (60)		2-1/2 (64)	
Effective embedment	h_{ef}	in. (mm)	2.00 (51)		2.00 (51)	
Minimum concrete member thickness[2]	$h_{min,deck}$	in. (mm)	2-1/2 (64)		2-1/2 (64)	
Critical edge distance	$c_{ac,deck,top}$	in. (mm)	8 (203)		9 (229)	
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	4 (102)	2-3/4 (70)	4 (102)	8 (203
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	3-1/2 (89)	6 (152)	8 (203)	4 (102)
Minimum hole depth	h_o	in. (mm)	2-1/2 (64)		2-1/2 (64)	
Installation torque	T_{inst}	ft.-lb. (N-m)	20 (27)		40 (54)	
Torque wrench socket size	-	in.	9/16		3/4	
Nut height	-	in.	21/64		7/16	

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

1. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
2. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies provided the concrete thickness above the upper flute meets the minimum thicknesses specified in this table. Minimum concrete member thickness refers to the concrete thickness above the upper flute (topping thickness). See Installation Detail D.
3. For all other anchor diameters and embedment depths, refer to the installation table for applicable values of h_{min}, c_{min} and s_{min}.
4. Design capacities shall be based on calculations according to values in Tension and Shear Design Information for Anchors in Concrete tables.

Power-Stud+ SD2 Anchor Detail



Before

After

Head Marking

Legend

Letter Code = Length Identification Mark

'+' Symbol = Strength Design Compliant Anchor

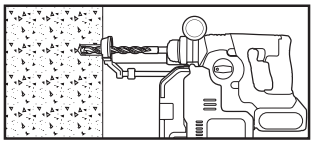
Number Code 2 = Carbon Steel Body and Stainless Steel Expansion Clip

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
From	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"
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"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"
Length identification mark indicates overall length of anchor.																

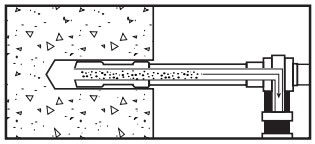
INSTALLATION INSTRUCTIONS

Installation Instructions for Power-Stud+ SD2



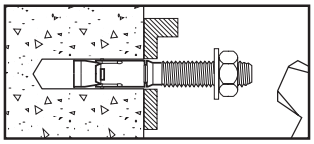
Step 1

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



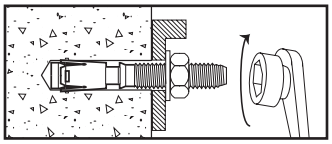
Step 2

Remove dust and debris from the hole during drilling, (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Step 3

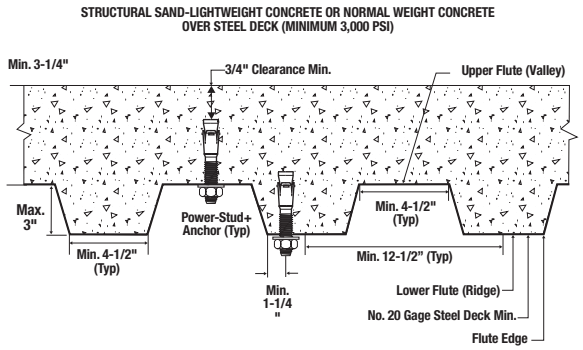
Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_{nom}.



Step 4

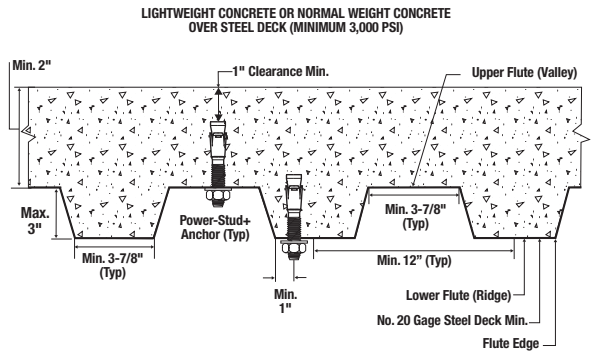
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

Installation Detail A: Power-Stud+ SD2 Installed in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies (see dimensional profile requirements)[1]



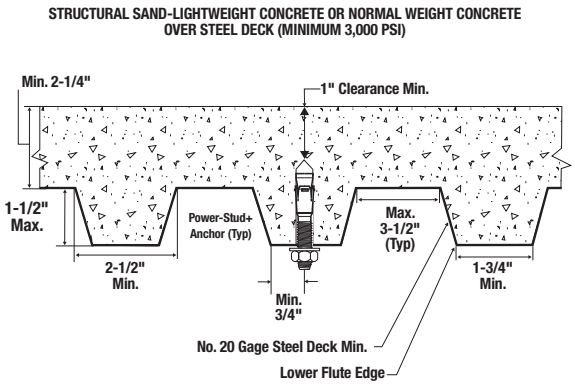
1. Anchors may be placed in the upper flute or lower flute of the steel deck profiles in accordance with installation Detail A provided the minimum hole clearance is satisfied. Anchors in the lower flute of installation Detail A profiles may be installed with a maximum 1-inch offset in either direction 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.

Installation Detail B: Power-Stud+ SD2 Installed in the Soffit of Concrete Over Steel Deck Floor and Roof Assemblies (see dimensional profile requirements)[1]



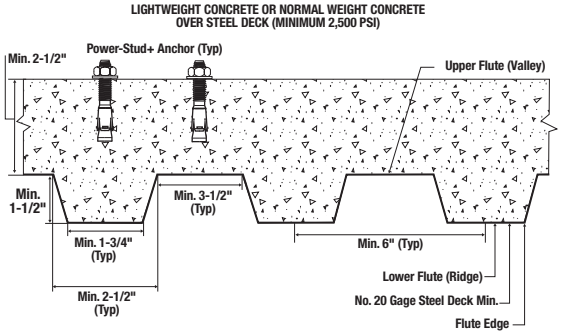
1. Anchors may be placed in the upper flute or lower flute of the steel deck profiles in accordance with Detail B provided the minimum hole clearance is satisfied. Anchors in the lower flute of Detail B profiles may be installed with a maximum 15/16 -inch offset in either direction from the center of 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.

Installation Detail C: Power-Stud+ SD2 Installed in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)[1,2]



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

Installation Detail D: Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies (see dimensional profile requirements)[1,2]



1. Anchors may be placed in the top side of concrete over steel deck profiles in accordance with Detail D provided the minimum concrete thickness above the upper flute (topping thickness) is as illustrated and the minimum spacing distance and minimum edge distances are satisfied as given in Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies Table.
2. For anchors installed in the top of concrete over steel deck profiles with concrete thickness above the upper flute (topping thickness) greater than or equal to the minimum concrete member thicknesses specified in Installation Table for the Power-Stud+ SD2, the minimum spacing distance and minimum edge distances may be used from this table, as applicable.

PERFORMANCE DATA

Tension Design Information[1,2,12]

CODE LISTED
ICC-ES ESR-2502

Design Characteristic	Notation	Units	Nominal Anchor Diameter (inch)							
			3/8	1/2		5/8		3/4		
Anchor category	1,2 or 3	-	1	1		1		1		
STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)[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 tensile strength (neck)	f_{uta}	ksi (N/mm²)	120.0 (827)	106.0 (731)		106.0 (731)		90.0 (620)		
Effective tensile stress area (neck)	$A_{se,\,N}$	in² (mm²)	0.0552 (35.6)	0.1007 (65.0)		0.1619 (104.5)		0.2359 (153.2)		
Steel strength in tension[5]	N_{sa}	lb (kN)	6,625 (29.4)	10,445 (46.5)		13,080 (58.2)		21,230 (94.4)		
Reduction factor for steel strength[3]	ϕ	-	0.75							
CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)[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_{ucr}	-	24	24		24		24		
Effectiveness factor for cracked concrete	k_{cr}	-	17	17		17		17		
Modification factor for cracked and uncracked concrete[6]	$\psi_{c,N}$	-	1.0 See note 5	1.0 See note 6		1.0 See note 6		1.0 See note 6		
Critical edge distance	c_{ac}	in. (mm)	See Installation Table							
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)							
PULLOUT STRENGTH IN TENSION (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)[9]										
Characteristic pullout strength, uncracked concrete (2,500 psi)[7]	$N_{p,uncr}$	lb (kN)	2,775 (12.3)	See note 8	6,615 (29.4)	See note 8	See note 8	See note 8	See note 8	
Characteristic pullout strength, cracked concrete (2,500 psi)[7]	$N_{p,cr}$	lb (kN)	2,165 (9.6)	See note 8	4,375 (19.5)	See note 8	See note 8	See note 8	7,795 (35.1)	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)							
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.5.3.3.3)[9]										
Characteristic pullout strength, seismic (2,500 psi)[7,10]	$N_{p,eq}$	lb (kN)	2,165 (9.6)	See note 8	4,375 (19.5)	See note 8	See note 8	See note 8	7,795 (35.1)	
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)							
Mean axial stiffness values service load range[11] — Uncracked concrete	β	lbf/in (kN/mm)	865,000 (151)	717,00 (126)		569,000 (100)		420,000 (74)		
Mean axial stiffness values service load range[11] — Cracked concrete	β	lbf/in (kN/mm)	49,500 (9)	57,000 (10)		64,500 (11)		72,000 (13)		

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318 D.3.3, as applicable, shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used.
4. The Power-Stud+ SD2 is considered a ductile steel element in tension as defined by ACI 318-14 2.3 or ACI 318 D.1, as applicable.
5. Tabulated values for steel strength in tension are based on test results per ACI 355.2 and must be used for design in lieu of calculation.
6. For all design cases use $\psi_{c,N} = 1.0$. Select appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}).
7. For all design cases use $\psi_{c,P} = 1.0$. For concrete compressive strength greater than 2,500 psi, $N_{pn} = (\text{pullout strength value from table}) * (\text{specified concrete compressive strength}/2500)^n$. 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.
8. Pullout strength does not control design of indicated anchors. Do not calculate pullout strength for indicated anchor size and embedment.
9. Anchors are permitted to be used in sand-lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
10. Tabulated values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.
11. Mean values shown; actual stiffness varies considerable depending on concrete strength, loading and geometry of application.
12. Anchors are permitted for use in concrete-filled steel deck floor and roof assemblies; see installation details A, B, C and D.

Shear Design Information[1,2,8]

CODE LISTED
ICC-ES ESR-2502

Design Characteristic	Notation	Units	Nominal Anchor Diameter (inch)						
			3/8	1/2		5/8		3/4	
Anchor category	1,2 or 3	-	1	1		1		1	
STEEL STRENGTH IN SHEAR (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)[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 tensile strength (threads)	f_{uta}	ksi (N/mm²)	100.0 (690)	88.0 (607)		88.0 (607)		80.0 (551)	
Effective tensile stress area (threads)	$A_{se,\,V}$	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)	3,115 (13.9)	4,815 (21.4)		10,170 (45.2)		12,610 (56.1)	
Reduction factor for steel strength[3]	ϕ	-	0.65						
CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)[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 (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)[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 pullout strength[3]	ϕ	-	0.70 (Condition B)						
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)									
Steel Strength in shear, seismic[7]	$V_{sa,\,eq}$	lb (kN)	2,460 (11.0)	4,815 (21.4)		6,770 (30.1)		8,060 (35.9)	
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 318-14 Chapter 17 or ACI 318 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318 D.3.3 shall apply, as applicable.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2 are used.
4. The Power-Stud+ SD2 is considered a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
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.
6. Anchors are permitted to be used in sand-lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
7. Reported values for steel strength in shear for seismic applications are based on test results per ACI 355.2, Section 9.6.
8. Anchors are permitted for use in concrete-filled steel deck floor and roof assemblies; see installation details A, B, C and D.

Tension and Shear Design Data for Power-Stud+ SD2 Anchors in the Soffit of Concrete-Filled Steel Deck Assemblies[1,2,7]

CODE LISTED
ICC-ES ESR-2502

Design Characteristics		Notation	Units	Nominal Anchor Size (inch)					
				0.375	0.5		0.625		0.75
Anchor Category		1, 2 or 3	-	1	1		1		1
Effective Embedment		h_{ef}	in. (mm)	2.00 (51)	2.00 (51)	3.25 (83)	3.25 (83)	4.25 (108)	3.75 (95)
Minimum Nominal Embedment Depth		h_{nom}	in. (mm)	2-3/8 (60)	2-1/2 (64)	3-3/4 (83)	3-7/8 (98)	4-7/8 (124)	4-1/2 (114)
Minimum Hole Depth		h_o	in. (mm)	2-5/8 (67)	2-3/4 (70)	4 (102)	4-1/4 (108)	5-1/4 (133)	5 (27)
PULLOUT STRENGTH IN TENSION FOR ANCHORS IN SOFFIT OF SAND LIGHTWEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[1]									
According to Detail A 4-1/2-inch-wide deck flute	Characteristic pullout strength, uncracked concrete over steel deck[2]	$N_{p,deck,uncr}$	lbf (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[2,3]	$N_{p,deck,cr}$	lbf (kN)	1,445 (6.4)	1,465 (6.5)	2,600 (11.6)	3,305 (14.7)	5,215 (23.2)	3,470 (15.4)
According to Detail B 3-7/8-inch-wide deck flute	Characteristic pullout strength, uncracked concrete over steel deck[2]	$N_{p,deck,uncr}$	lbf (kN)	2,235 (9.9)	2,785 (12.4)	5,600 (24.9)	4,480 (19.9)	7,265 (32.3)	Not Applicable
	Characteristic pullout strength, cracked concrete over steel deck[2,3]	$N_{p,deck,cr}$	lbf (kN)	1,745 (7.8)	1,975 (8.8)	3,695 (16.4)	3,175 (14.1)	5,145 (22.9)	Not Applicable
According to Detail C 1-3/4-inch-wide deck flute	Characteristic pullout strength, uncracked concrete over steel deck[2]	$N_{p,deck,uncr}$	lbf (kN)	1,600 (7.1)	2,025 (9.0)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Characteristic pullout strength, cracked concrete over steel deck[2,3]	$N_{p,deck,cr}$	lbf (kN)	1,250 (5.6)	1,435 (6.4)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Reduction factor for pullout strength[6]		ϕ	-	0.65					
STEEL STRENGTH IN SHEAR FOR ANCHORS IN SOFFIT OF SAND-LIGHTWEIGHT AND NORMAL WEIGHT CONCRETE OVER STEEL DECK[4,5]									
According to Detail A 4-1/2-inch-wide deck flute	Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lbf (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, seismic, concrete over steel deck	$V_{sa,deck,eq}$	lbf (kN)	1,715 (7.6)	3,815 (17.0)	5,040 (22.4)	2,675 (11.9)	4,445 (19.8)	2,820 (12.5)
According to Detail B 3-7/8-inch-wide deck flute	Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lbf (kN)	3,040 (13.5)	2,675 (11.9)	4,930 (21.9)	Not Applicable	Not Applicable	Not Applicable
	Steel strength in shear, seismic, concrete over steel deck	$V_{sa,deck,eq}$	lbf (kN)	2,400 (10.6)	2,675 (11.9)	4,930 (21.9)	Not Applicable	Not Applicable	Not Applicable
According to Detail C 1-3/4-inch-wide deck flute	Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lbf (kN)	2,170 (9.7)	2,880 (12.8)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Steel strength in shear, seismic, concrete over steel deck	$V_{sa,deck,eq}$	lbf (kN)	1,715 (7.6)	2,880 (12.8)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Reduction factor for steel strength in shear, concrete over steel deck[6]		ϕ	-	0.65					

1. For all design cases $\Psi_{c,P} = 1.0$. For concrete compressive strength greater than 3,000 psi, N_{pn}=(pullout strength value from table) * (specified concrete compressive strength/2500)^n. For all anchors n=1/2 with exception of the 3/8-inch-diameter anchor size, where n=1/3.
2. Values for $N_{p,deck}$ are for 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 318-14 17.4.2 or ACI 318 D.5.2, as applicable, is not required for anchors installed in the deck soffit (flute).
3. Values for $N_{p,deck,cr}$ are applicable for seismic loading.
4. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
5. Values for $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for 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 318-14 17.5.2 or ACI 318 D.6.2, as applicable and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, is not required for anchors installed in the deck soffit (flute).
6. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4.
7. Anchors shall have an axial spacing along the flute soffit equal to the greater of $3h_{ef}$ or 1.5 times the flute width.

Factored Design Strength (ϕN_n and ϕV_n) Calculated in Accordance with ACI 318-14 Chapter 17:

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 times c_{a1}.

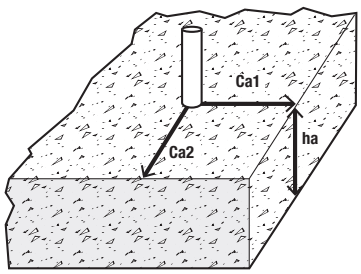
2- Calculations were performed according to ACI 318-18 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength 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 (ø) were based on ACI 318-14 Section 5.3 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



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

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		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	1,685	1,495	1,845	1,645	2,025	1,885	2,025	2,075	2,025
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	3,130	3,115	3,130	3,595	3,130	4,405	3,130	5,085	3,130
5/8	3-7/8	3,235	4,220	3,545	4,620	4,095	5,335	5,015	6,535	5,790	6,610
	4-7/8	4,840	6,610	5,305	6,610	6,125	6,610	7,500	6,610	8,660	6,610
3/4	4-1/2	4,010	7,590	4,395	8,195	5,075	8,195	6,215	8,195	7,175	8,195
	5-3/4	5,065	8,195	5,550	8,195	6,410	8,195	7,850	8,195	9,065	8,195

□ - Anchor Pullout/Pryout Strength Controls ▒ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

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

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		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	2,025	1,975	2,025	2,280	2,025	2,795	2,025	3,225	2,025
1/2	2-1/2	2,205	2,375	2,415	2,605	2,790	3,005	3,420	3,130	3,945	3,130
	3-3/4	4,300	3,130	4,710	3,130	5,440	3,130	6,660	3,130	7,690	3,130
5/8	3-7/8	4,570	5,905	5,005	6,470	5,780	6,610	7,080	6,610	8,175	6,610
	4-7/8	6,835	6,610	7,485	6,610	8,645	6,610	9,810	6,610	9,810	6,610
3/4	4-1/2	5,665	8,195	6,205	8,195	7,165	8,195	8,775	8,195	10,130	8,195
	5-3/4	8,720	8,195	9,555	8,195	11,030	8,195	13,510	8,195	15,600	8,195

□ - Anchor Pullout/Pryout Strength Controls ▒ - Concrete Breakout Strength Controls ■ - Steel 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 or contact DEWALT for more information regarding the procedure to convert factored design strengths to allowable loads.

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 = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ 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	1,205	1,070	1,320	1,175	1,445	1,345	1,445	1,480	1,445
1/2	2-1/2	1,120	1,205	1,220	1,320	1,410	1,520	1,730	1,860	1,995	2,150
	3-3/4	2,030	2,235	2,225	2,235	2,570	2,235	3,145	2,235	3,630	2,235
5/8	3-7/8	2,310	3,015	2,530	3,300	2,925	3,810	3,580	4,670	4,135	4,720
	4-7/8	3,455	4,720	3,790	4,720	4,375	4,720	5,355	4,720	6,185	4,720
3/4	4-1/2	2,865	5,420	3,140	5,855	3,625	5,855	4,440	5,855	5,125	5,855
	5-3/4	3,620	5,855	3,965	5,855	4,580	5,855	5,605	5,855	6,475	5,855

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.

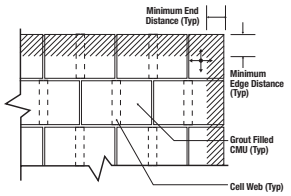
Converted Allowable Loads for Power-Stud+ SD2 in Uncracked Concrete[1,2]

Nominal Anchor Size (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ 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	1,445	1,410	1,445	1,630	1,445	1,995	1,445	2,305	1,445
1/2	2-1/2	1,575	1,695	1,725	1,860	1,995	2,145	2,445	2,235	2,820	2,235
	3-3/4	3,070	2,235	3,365	2,235	3,885	2,235	4,755	2,235	5,495	2,235
5/8	3-7/8	3,265	4,220	3,575	4,620	4,130	4,720	5,055	4,720	5,840	4,720
	4-7/8	4,880	4,720	5,345	4,720	6,175	4,720	7,005	4,720	7,005	4,720
3/4	4-1/2	4,045	5,855	4,430	5,855	5,120	5,855	6,270	5,855	7,235	5,855
	5-3/4	6,230	5,855	6,825	5,855	7,880	5,855	9,650	5,855	11,145	5,855

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 Grouted 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/End 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/End 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)



Face Shell
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.)	Suggested ANSI Carbide Drill Bit Cat. No.				
						Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7413SD2	3/8" x 3"	1-3/4"	50	300	10	DW5527	DW5427	-	-	-
7414SD2	3/8" x 3-1/2"	2-1/4"	50	300	12	DW5527	DW5427	-	-	-
7415SD2	3/8" x 3-3/4"	2-1/2"	50	300	13	DW5527	DW5427	-	-	-
7416SD2	3/8" x 5"	3-3/4"	50	300	16	DW55300	DW5429	-	-	-
7422SD2	1/2" x 3-3/4"	2-1/8"	50	200	23	DW5537	DW5437	DW5803	DWA54012	-
7423SD2	1/2" x 4-1/2"	2-7/8"	50	200	28	DW5539	DW5438	DW5803	DWA54012	-
7424SD2	1/2" x 5-1/2"	3-7/8"	50	150	32	DW5539	DW5438	DW5803	DWA54012	-
7426SD2	1/2" x 7"	5-3/8"	25	100	44	DW5539	DW5438	DW5803	DWA54012	-
7427SD2	1/2" x 8-1/2"	6-7/8"	25	100	46	DW5539	DW5439	DW5804	DWA54012	-
7435SD2	5/8" x 4-3/4"	2-7/8"	25	100	52	-	DW5446	DW5806	DWA54058	DWA58058
7433SD2	5/8" x 5"	3-1/8"	25	50	57	-	DW5446	DW5806	DWA54058	DWA58001
7434SD2	5/8" x 6"	4-1/8"	25	75	64	-	DW5446	DW5806	DWA54058	DWA58001
7436SD2	5/8" x 7"	5-1/8"	25	75	72	-	DW5447	DW5806	DWA54058	DWA58001
7438SD2	5/8" x 8-1/2"	6-5/8"	25	75	84	-	DW5447	DW5809	DWA54058	DWA58001
7442SD2	3/4" x 5-1/2"	3-1/4"	20	60	88	-	DW5453	DW5810	DWA54074	DWA58034
7444SD2	3/4" x 6-1/4"	4"	20	60	90	-	DW5455	DW5810	DWA54074	DWA58034
7446SD2	3/4" x 7"	4-3/4"	20	60	95	-	DW5455	DW5810	DWA54074	DWA58034
7448SD2	3/4" x 8-1/2"	6-1/4"	10	40	95	-	DW5455	DW5812	DWA54074	DWA58034

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

All anchors are packaged with nuts and washers.

A manual hand pump is available (Cat. No. 08280).
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

GENERAL INFORMATION

POWER-STUD®+ SD4/SD6

Stainless Steel Wedge Expansion Anchors

PRODUCT DESCRIPTION

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

GENERAL APPLICATIONS AND USES

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

FEATURES AND BENEFITS

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

APPROVALS AND LISTINGS

- International Code Council Evaluation Service (ICC-ES), ESR-2502 for cracked and uncracked concrete
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2/ASTM E 488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 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: 03 16 00-Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud+ SD4 and Power-Stud+ SD6 as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

POWER-STUD+ STAINLESS STEEL ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Stainless steel body and expansion clip, nut and washer

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Grouted Concrete Masonry (CMU)

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-2502
CONCRETE

DDA DEWALT DESIGN ASSIST

DUST X+ ANCHOR INSTALLATION SYSTEM

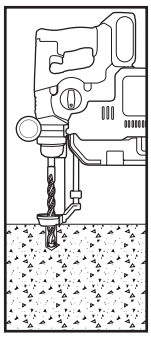
MATERIAL SPECIFICATIONS

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

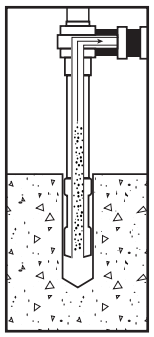
1. Domestically manufactured anchors are available upon request (see ordering information for details).

INSTALLATION INSTRUCTIONS

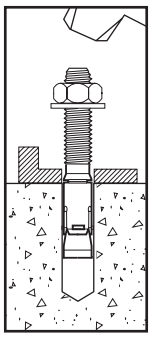
Installation Instructions for Power-Stud+ SD4 and Power-Stud+ SD6



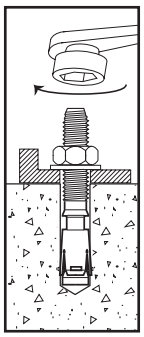
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling, (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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

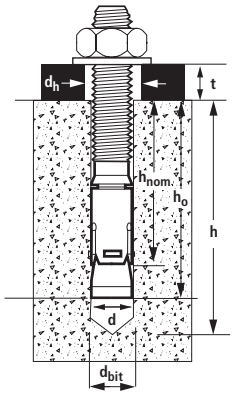


Step 4
Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}.

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
From	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"	9-1/2"	10"
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"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"
Length identification mark indicates overall length of anchor.																		

Anchor Detail



Nomenclature

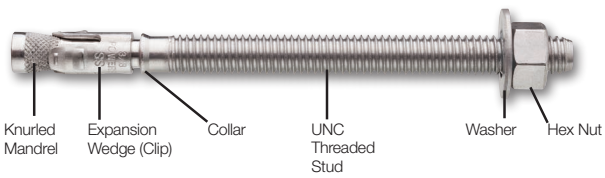
d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
h = Base material thickness
The minimum value of h should be $1.5h_{nom}$ or 3" whichever is greater
h_{nom} = Minimum embedment depth

Head Marking

Legend

Letter Code = Length Identification Mark
'+' Symbol = Strength Design Compliant Anchor (see ordering information, symbol not on 1/4" diameter anchors)
Number Code = Stainless Steel Body Type (4 or 6)

Anchor Assembly



REFERENCE DATA (ASD)

Installation Specifications Table for Power-Stud+ SD4 and Power-Stud+ SD6 in Concrete

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)	9/16 (14.3)	11/16 (17.5)	13/16 (20.6)
Minimum embedment depth	h_{nom}	in. (mm)	1-1/8 (29)	1-3/8 (41)	1-7/8 (48)	2-1/2 (64)	3-3/8 (86)
Minimum hole depth	h_o	in. (mm)	1-1/4 (32)	1-1/2 (38)	2 (51)	2-5/8 (67)	3-1/2 (89)
Installation torque	T_{inst}	ft.-lbf. (N-m)	6 (8)	25 (34)	40 (54)	60 (81)	110 (149)
Torque wrench/socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8
Nut height	-	in.	7/32	21/64	7/16	35/64	41/64
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.							

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

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

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

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

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

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

SPACING DISTANCE AND EDGE DISTANCE ADJUSTMENT FACTORS FOR NORMAL WEIGHT CONCRETE - TENSION (F_{NS}, F_{NC})

Spacing Reduction Factors - Tension (F_{NS})

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

Edge Distance Reduction Factors- Tension (F_{NC})

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

SPACING DISTANCE AND EDGE DISTANCE ADJUSTMENT FACTORS FOR NORMAL WEIGHT CONCRETE - SHEAR (F_{VS}, F_{VC})

Spacing Reduction Factors - Shear (F_{VS})

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

Edge Distance Reduction Factors - Shear (F_{VC})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embed. h_{nom} (in)		1-3/4	1-7/8	2-1/2	3-1/4	4-1/2
Min. Edge Distance, c_{min} (in)		1-3/4	3	3	4-1/2	5
Edge Distance (inches)	1-1/2	-	-	-	-	-
	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/4	0.50	-	-	-	-
	2-1/2	0.56	-	-	-	-
	2-3/4	0.61	-	-	-	-
	3	0.67	0.67	0.50	-	-
	3-1/2	0.78	0.78	0.58	-	-
	4	0.89	0.89	0.67	-	-
	4-1/2	1.00	1.00	0.75	0.55	-
	5	1.00	1.00	0.83	0.61	0.44
	5-1/2	1.00	1.00	0.92	0.67	0.49
	6	1.00	1.00	1.00	0.73	0.53
	6-1/2	1.00	1.00	1.00	0.79	0.58
	7	1.00	1.00	1.00	0.85	0.62
	7-1/2	1.00	1.00	1.00	0.91	0.67
	8	1.00	1.00	1.00	0.97	0.71
	8-1/4	1.00	1.00	1.00	1.00	0.73
	8-1/2	1.00	1.00	1.00	1.00	0.76
	9	1.00	1.00	1.00	1.00	0.80
	9-1/2	1.00	1.00	1.00	1.00	0.84
	10	1.00	1.00	1.00	1.00	0.89
	10-1/2	1.00	1.00	1.00	1.00	0.93
	11	1.00	1.00	1.00	1.00	0.98
	11-1/4	1.00	1.00	1.00	1.00	1.00

PERFORMANCE DATA

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

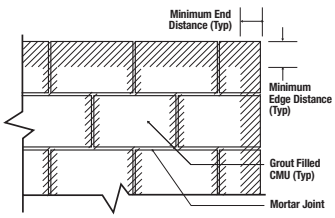
Nominal Anchor Diameter in.	Minimum Embedment h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Tension Load lb (kN)	Direction of Shear Loading	Ultimate Shear Load lb (kN)
1/2	2-3/8 (60)	3 (76.2)	3 (76.2)	1,695 (7.5)	Any	2,080 (9.3)
		12 (304.8)	12 (304.8)	2,425 (10.8)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

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

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

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

1. Tabulated load values are for anchors installed in minimum 8 inch wide, minimum Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending upon the application such as life safety.
3. The tabulated values are applicable for anchors installed in grouted masonry wall faces at a critical spacing distance, s_{cr}, between anchors of 16 times the anchor diameter. The spacing distance between two anchors may be reduced to a minimum distance, s_{min}, of 8 times the anchor diameter provided the allowable tension loads are multiplied a reduction factor of 0.80 and allowable shear loads are multiplied by a reduction factor of 0.90. Linear interpolation for calculation of allowable loads may be used for intermediate anchor spacing distances.
4. Anchors may be installed in the grouted cells and in cell webs and bed joints not closer than 1-3/8" from head joints. The minimum edge and end distances must also be maintained.
5. Allowable tension values for anchors installed into bed joints of grouted masonry wall faces with a minimum of 12" edge and end distance may be increased by 20 percent for the 1/2-inch diameter and 10 percent for the 5/8-inch diameter.



Wall Face
Permissible Anchor Locations
(Un-hatched Area)

STRENGTH DESIGN (SD)

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

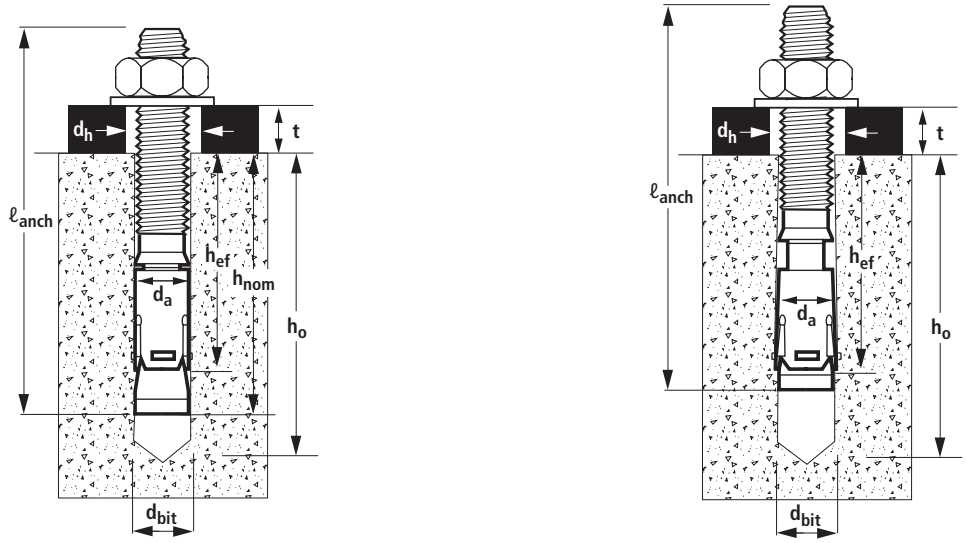
CODE LISTED
ICC-ES ESR-2502

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

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.
3. The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth and possible fixture attachment.
4. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with the following: the 1/4-inch diameter anchors must be installed in uncracked normal-weight or sand-lightweight concrete; 3/8-inch to 3/4-inch diameter anchors must be installed in cracked and uncracked normal-weight or sand-lightweight concrete over steel deck having a minimum specified compressive strength, f'c, of 3,000 psi (20.7 MPa) provided the concrete thickness above the upper flute meets the minimum thickness specified in this table.

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



Application of Installation Torque

Tension Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,8]

CODE LISTED ICC-ES ESR-2502

Design Characteristic	Notation	Units	Nominal Anchor Diameter				
			1/4	3/8	1/2	5/8	3/4
Anchor category	1,2 or 3	-	1	1	1	1	1
Nominal embedment depth	h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN TENSION (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)							
Minimum specified yield strength (neck	f_y	ksi (N/mm^2)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate tensile strength (neck)	f_{uta}	ksi (N/mm^2)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (neck)	$A_{se,N}$	in^2 (mm^2)	0.0249 (16.1)	0.0530 (34.2)	0.1020 (65.8)	0.1630 (105.2)	0.2380 (151)
Steel strength in tension	N_{sa}	lb (kN)	2,240 (10.0)	4,780 (21.3)	9,160 (40.8)	14,635 (65.1)	21,380 (95.1)
Reduction factor for steel strength[2,3]	ϕ	-	0.75				
CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)[8]							
Effective embedment	h_{ef}	in. (mm)	1.50 (38)	1.50 (38)	2.00 (51)	2.75 (70)	3.75 (95)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24	24	24	24	24
Effectiveness factor for cracked concrete	k_{cr}	-	Not Applicable	17	21	21	21
Modification factor for cracked and uncracked concrete	$\psi_{c,N}$	-	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5	1.0 See Note 5
Critical edge distance (uncracked concrete only)	c_{ac}	in. (mm)	5 (127)	5 (127)	7-1/2 (191)	9-1/2 (241)	9 (229)
Reduction factor for concrete breakout strength[4]	ϕ	-	0.65 (Condition B)				
PULLOUT STRENGTH IN TENSION (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)[8]							
Characteristic pullout strength, uncracked concrete (2,500 psi)[5]	$N_{p,uncr}$	lb (kN)	1,510 (6.7)	See Note 7	See Note 7	See Note 7	8,520 (37.8)
Characteristic pullout strength, cracked concrete (2,500 psi)[5]	$N_{p,cr}$	lb (kN)	Not Applicable	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 (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)[8]							
Characteristic pullout strength, seismic (2,500 psi)[6,9]	$N_{p,eq}$	lb (kN)	Not Applicable	1,645 (7.3)	See Note 7	See Note 7	See Note 7
Reduction factor for pullout strength[4]	ϕ	-	0.65 (Condition B)				
Mean axial stiffnes values for service load range — Uncracked concrete	β	lbf/in (kN/mm)	171,400 (30,060)	490,000 (86,000)	459,000 (80,500)	234,000 (41,000)	395,000 (69,300)
Mean axial stiffnes values for service load range — Cracked concrete	β	lbf/in (kN/mm)	Not Applicable	228,000 (40,000)	392,000 (68,800)	193,000 (33,800)	76,600 (13,400)

For SI: 1 inch = 25.4 mm; 1 ft-lbf = 1.356 N-m; 1 ksi = 6.894 N/mm^2; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4.
3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
4. The tabulated value of ϕ for concrete breakout strength and pullout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength and pullout strength must be determined in accordance with ACI 318-11 D.4.4.
5. 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.
6. 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/2,500)$^{0.5}$.
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 lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
9. Tabulated values for characteristic pullout strength in tension are for seismic applications and are based on test results per ACI 355.2, Section 9.5.
10. Actual stiffness of the mean value varies depending on concrete strength, loading and geometry of application.

Shear Design Information for Power-Stud+ SD4 and Power-Stud+ SD6 Anchors in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,7]

CODE LISTED
ICC-ES ESR-2502

Design Characteristic	Notation	Units	Nominal Anchor Diameter				
			1/4	3/8	1/2	5/8	3/4
Anchor category	1, 2 or 3	-	1	1	1	1	1
Nominal embedment depth	h_{nom}	in.	1-3/4	1-7/8	2-3/8	3-1/4	4-1/2
STEEL STRENGTH IN SHEAR (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)[4]							
Minimum specified yield strength (threads)	f_y	ksi (N/mm²)	60 (414)	60 (414)	60 (414)	60 (414)	60 (414)
Minimum specified ultimate strength (threads)	f_{uta}	ksi (N/mm²)	90 (621)	90 (621)	90 (621)	90 (621)	90 (621)
Effective tensile stress area (threads)	$A_{se,V}$ [A_{se}][8]	in² (mm²)	0.0318 (20.5)	0.078 (50.3)	0.142 (91.6)	0.226 (145.8)	0.334 (212)
Steel strength in shear[6]	V_{sa}	lb (kN)	1,115 (5.0)	1,470 (6.6)	3,170 (14.3)	7,455 (33.6)	11,955 (53.2)
Reduction factor for steel strength[2,3]	ϕ	-	0.65				
CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)							
Load bearing length of anchor (h_{ef} or $8d_a$, whichever is less)	ℓ_e	in. (mm)	1.50 (38.1)	1.50 (38.1)	2.00 (50.8)	2.75 (69.9)	3.75 (95)
Nominal anchor diameter	d_a	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[4]	ϕ	-	0.70 (Condition B)				
CONCRETE PRYOUT STRENGTH IN SHEAR (ACI 318-14 17.2.3.3 or ACI 318-11 D.6.3)							
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	2.0
Effective embedment	h_{ef}	in. (mm)	1.50 (38.1)	1.50 (38.1)	2.00 (50.8)	2.75 (69.9)	3.75 (95)
Reduction factor for pryout strength[5]	ϕ	-	0.70 (Condition B)				
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)							
Steel strength in shear, seismic[8]	$V_{sa,eq}$	lb (kN)	Not Applicable	1,305 (5.9)	2,765 (12.3)	5,240 (23.3)	7,745 (34.5)
Reduction factor for steel strength in shear for seismic[2]	ϕ	-	0.65				

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

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.4.
3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
4. The tabulated value of ϕ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 14.3.3 or ACI 318-11 D.4.3, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4.
5. The tabulated value of for pryout strength applies if the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for pryout strength must be determined in accordance with ACI 318-11 D.4.4, Condition B.
6. Tabulated values for steel strength in shear must be used for design.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. Tabulated values for steel strength in shear are for seismic applications are based on test results per ACI 355.2, Section 9.6.

STRENGTH DESIGN PERFORMANCE DATA

Factored design strength ϕN_n and ϕV_n
Calculated in accordance with ACI 318-14 Chapter 17
Compliant with the International Building Code

Tension and Shear Design Strengths Installed in Cracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/4	-	-	-	-	-	-	-	-	-	-	-
3/8	1-7/8	1,015	955	1,110	955	1,285	955	1,570	955	1,815	955
1/2	2-1/2	1,930	2,060	2,115	2,060	2,440	2,060	2,990	2,060	3,455	2,060
5/8	3-1/4	3,110	4,520	3,410	4,845	3,935	4,845	4,820	4,845	5,570	4,845
3/4	4-1/2	4,955	5,270	5,430	5,770	6,270	6,665	7,680	7,770	8,865	7,770

□ - Anchor Pullout/Pryout Strength Controls □ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths Installed in Uncracked Concrete[1-6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{sa}, ϕN_{cb} or ϕN_{cp} Tension (lbs.)	ϕV_{sa}, ϕV_{cb} or ϕV_{cp} Shear (lbs.)
1/4	1-3/4	980	725	1,075	725	1,240	725	1,520	725	1,680	725
3/8	1-7/8	1,435	955	1,570	955	1,815	955	2,220	955	2,565	955
1/2	2-1/2	2,205	2,060	2,415	2,060	2,790	2,060	3,420	2,060	3,945	2,060
5/8	3-1/4	3,555	4,845	3,895	4,845	4,500	4,845	5,510	4,845	6,365	4,845
3/4	4-1/2	5,540	7,375	6,065	7,770	7,005	7,770	8,580	7,770	9,905	7,770

□ - Anchor Pullout/Pryout Strength Controls □ - Concrete Breakout Strength Controls ■ - Steel 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 times c_{a1}.

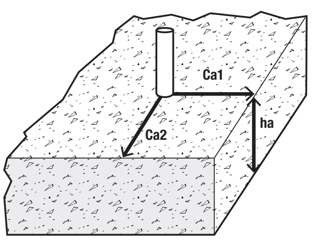
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength 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 (ø) were based on ACI 318-14 Section 5.3 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



ORDERING INFORMATION

Power-Stud+ SD4 (Type 304 Stainless Steel Body) and Power-Stud+ SD6 (Type 316 Stainless Steel Body)

Cat. No.		Anchor Size	Thread Length	Box Qty.	Carton Qty.	Suggested ANSI Carbide Drill Bit Cat. No.				
Type 304 SS	Type 316 SS					Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7300SD4	7600SD6	1/4" x 1-3/4"	3/4"	100	600	DW5517	DW5416	-	-	-
7302SD4	7602SD6	1/4" x 2-1/4"	1-1/4"	100	600	DW5517	DW5417	-	-	-
7304SD4	7604SD6	1/4" x 3-1/4"	2-1/4"	100	600	DW5517	DW5417	-	-	-
-	7610SD6	3/8" x 2-1/4"	7/8"	50	300	DW5527	DW5427	-	-	-
-	7612SD6	3/8" x 2-3/4"	1-3/8"	50	300	DW5527	DW5427	-	-	-
7313SD4	7613SD6	3/8" x 3"	1-5/8"	50	300	DW5527	DW5427	-		
-	7614SD6	3/8" x 3-1/2"	2-1/8"	50	300	DW5527	DW5427	-	-	-
7315SD4	7615SD6	3/8" x 3-3/4"	2-3/8"	50	300	DW5527	DW5427	-	-	-
7316SD4	7616SD6	3/8" x 5"	3-5/8"	50	300	DW55300	DW5429	-	-	-
-	7617SD6	3/8" x 7"	5-5/8"	50	200	DW55300	DW5429	-	-	-
-	7620SD6	1/2" x 2-3/4"	1"	50	200	DW5537	DW5437	DW5803	DWA54012	-
7322SD4	7622SD6	1/2" x 3-3/4"	2"	50	200	DW5537	DW5437	DW5803	DWA54012	-
7323SD4	7623SD6	1/2" x 4-1/2"	2-3/4"	50	200	DW5539	DW5438	DW5803	DWA54012	-
7324SD4	7624SD6	1/2" x 5-1/2"	3-3/4"	50	100	DW5539	DW5438	DW5803	DWA54012	-
7326SD4	7626SD6	1/2" x 7"	5-1/4"	25	100	DW5539	DW5438	DW5803	DWA54012	-
-	7630SD6	5/8" x 3-1/2"	1-1/2"	25	100	-	DW5446	DW5806	DWA54058	DWA54058
-	7632SD6	5/8" x 4-1/2"	2-1/2"	25	100	-	DW5446	DW5806	DWA54058	DWA54058
7333SD4	7633SD6	5/8" x 5"	3"	25	100	-	DW5446	DW5806	DWA54058	DWA54058
7334SD4	7634SD6	5/8" x 6"	4"	25	75	-	DW5446	DW5806	DWA54058	DWA54058
-	7636SD6	5/8" x 7"	5"	25	75	-	DW5447	DW5806	DWA54058	DWA54058
7338SD4	7638SD6	5/8" x 8-1/2"	6-1/2"	25	50	-	DW5447	DW5809	DWA54058	DWA54058
-	7640SD6	3/4" X 4-1/4"	1-7/8"	20	60	-	DW5453	DW5810	DWA54034	DWA54034
-	7641SD6	3/4" X 4-3/4"	2-3/8"	20	60	-	DW5453	DW5810	DWA54034	DWA54034
7342SD4	7642SD6	3/4" X 5-1/2"	3-1/8"	20	60	-	DW5453	DW5810	DWA54034	DWA54034
-	7644SD6	3/4" X 6-1/4"	3-7/8"	20	60	-	DW5455	DW5810	DWA54034	DWA54034
-	7646SD6	3/4" X 7"	4-5/8"	20	60	-	DW5455	DW5810	DWA54034	DWA54034
7348SD4	7648SD6	3/4" X 8-1/2"	6-1/8"	10	40	-	DW5455	DW5812	DWA54034	DWA54034

Power-Stud+ SD4 and Power-Stud+ SD6 anchors can be domestically manufactured (assembled in the USA with foreign and domestic components) and are available for special order only. Call for details.

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.

A manual hand pump is available (Cat. No. 08280).

Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

GENERAL INFORMATION

POWER-STUD® HD5

Hot-Dip Galvanized Wedge Expansion Anchor

PRODUCT DESCRIPTION

The Power-Stud HD5 anchor is a fully threaded, torque-controlled, wedge expansion anchor. Suitable base materials include normal-weight concrete, sand-lightweight concrete and grouted concrete masonry. The anchor is manufactured with a hot-dip galvanized carbon steel body and stainless steel expansion clip. Nut and washer are included.

GENERAL APPLICATIONS AND USES

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

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

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 Post - Installed Concrete Anchors. Expansion Anchors shall be Power-Stud HD5 as supplied by DEWALT, Towson, MD. 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 304 Stainless Steel
Plating (anchor, body, nut, washer)	Zinc Galvanized According to ASTM A 153 Class C or D

SECTION CONTENTS

POWER-STUD HD5 ASSEMBLY

THREAD VERSION

- UNC Threaded Stud

ANCHOR MATERIALS

- Hot-dip galvanized carbon steel body, stainless steel expansion clip, hot-dip galvanized nut and washer

ROD/ANCHOR SIZE RANGE (TYP.)

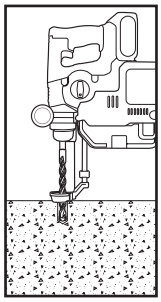
- 3/8" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

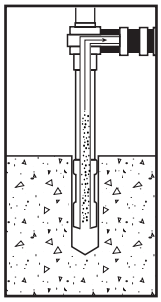
- Normal-weight concrete
- Sand-lightweight concrete
- Grouted concrete masonry (CMU)

INSTALLATION INSTRUCTIONS

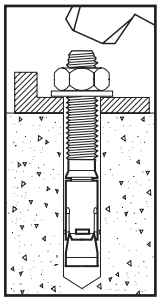
Installation Instructions for Power-Stud HD5



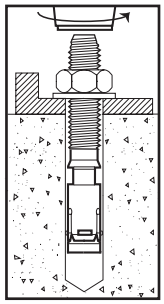
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

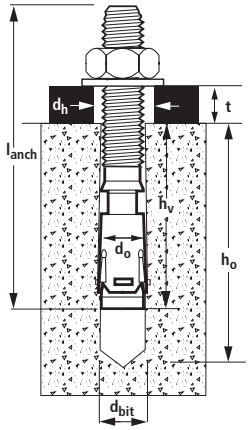


Step 3
Position the washer on the anchor and thread on the nut. If installing through a fixture, drive the anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_v.



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

Anchor Specifications



Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
From	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	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"

Length identification mark indicates overall length of anchor.

REFERENCE DATA (ASD)

Installation Specification for Power-Stud HD5 in Concrete

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Diameter (inch)									
			3/8		1/2			5/8			3/4	
Anchor outside diameter	d	in. (mm)	0.375 (9.525)		0.500 (12.7)			0.625 (15.9)			0.750 (19.05)	
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. (mm)	3/8 ANSI		1/2 ANSI			5/8 ANSI			3/4 ANSI	
Minimum nominal embedment depth	h_v	in. (mm)	1-3/4 (44)	2-3/8 (60)	2 (51)	2-1/2 (64)	3-3/4 (95)	2-3/8 (60)	3-3/8 (86)	4-5/8 (117)	3-3/8 (66)	5 (127)
Minimum hole depth	h_o	in. (mm)	2 (51)	2-5/8 (67)	2-1/2 (64)	3 (76)	4-1/4 (108)	2-7/8 (73)	3-7/8 (98)	5-1/8 (130)	3-7/8 (98)	5-1/2 (140)
Minimum member thickness	h_{min}	in. (mm)	3-1/4 (83)	4 (102)	4 (102)	5 (127)	6 (152)	5 (127)	6 (152)	7 (178)	6 (152)	10 (254)
Minimum overall anchor length[1]	ℓ_{anch}	in. (mm)	3 (76)	3 (76)	2-3/4 (70)	3-3/4 (95)	4-1/2 (114)	3-1/2 (89)	5 (127)	6 (152)	4-3/4 (121)	5-1/2 (140)
Minimum edge distance	c_{min}	in. (mm)	3 (76)	2-1/4 (57)	4 (102)	5-1/4 (133)	4 (102)	4-1/4 (108)	5-1/2 (140)	4-1/4 (108)	5 (127)	4-1/2 (114)
Minimum spacing distance	s_{min}	in. (mm)	5-1/4 (133)	3-3/4 (95)	6 (152)	7-1/4 (184)	5 (127)	7-1/8 (181)	10-1/8 (257)	4-1/4 (108)	9 (229)	6 (152)
Critical edge distance	c_{ac}	in. (mm)	5 (127)	6-1/2 (165)	8 (203)	8-1/2 (216)	8 (203)	8 (203)	6 (152)	10 (254)	5 (127)	12 (305)
Installation torque (Normal-weight concrete)	T_{inst}	ft.-lbf. (N-m)	20 (27)		40 (54)			60 (81)			110 (149)	
Installation torque (Grout Filled CMU)	T_{inst}	ft.-lbf. (N-m)	20 (27)		40 (54)			50 (68)			80 (108)	
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	

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

1. The listed minimum overall anchor length is based on anchor sizes available at the time of publication compared with the requirements for the minimum nominal embedment depth and fixture attachment.

Ultimate Load Capacities for Power-Stud HD5 in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)
3/8	1-3/4	2,470	3,925	2,710	3,925	3,130	3,925	3,220	3,925	3,715	3,925
	2-3/8	3,620	3,925	3,965	3,925	4,580	3,925	5,470	3,925	6,320	3,925
1/2	2	2,690	4,195	2,950	4,195	3,405	4,195	4,170	4,195	4,815	4,195
	2-1/2	4,140	4,195	4,540	4,195	5,240	4,195	6,415	4,195	7,410	4,195
	3-3/4	8,580	4,195	9,400	4,195	10,300	4,195	10,300	4,195	10,300	4,195
5/8	2-1/2	4,115	6,815	4,505	6,815	5,200	6,815	6,370	6,815	7,355	6,815
	3-3/8	7,305	6,815	8,000	6,815	9,240	6,815	11,315	6,815	13,065	6,815
	4-5/8	11,715	6,815	12,830	6,815	14,815	6,815	16,400	6,815	16,400	6,815
3/4	3-3/8	7,080	11,570	7,750	11,570	8,955	11,570	12,125	11,570	14,000	11,570
	5	16,965	11,570	18,580	11,570	21,330	11,570	21,330	11,570	21,330	11,570

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

Allowable Load Capacities for Power-Stud HD5 in Normal-Weight Concrete[1]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)	Tension (lbs)	Shear (lbs)
3/8	1-3/4	620	980	680	980	785	980	805	980	930	980
	2-3/8	905	980	990	980	1,145	980	1,370	980	1,580	980
1/2	2	675	1,050	740	1,050	850	1,050	1,045	1,050	1,205	1,050
	2-1/2	1,035	1,050	1,135	1,050	1,310	1,050	1,605	1,050	1,855	1,050
	3-3/4	2,145	1,050	2,350	1,050	2,575	1,050	2,575	1,050	2,575	1,050
5/8	2-1/2	1,030	1,705	1,125	1,705	1,300	1,705	1,595	1,705	1,840	1,705
	3-3/8	1,825	1,705	2,000	1,705	2,310	1,705	2,830	1,705	3,265	1,705
	4-5/8	2,930	1,705	3,210	1,705	3,705	1,705	4,100	1,705	4,100	1,705
3/4	3-3/8	1,770	2,895	1,940	2,895	2,240	2,895	3,030	2,895	3,500	2,895
	5	4,240	2,895	4,645	2,895	5,335	2,895	5,335	2,895	5,335	2,895

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
2. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

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

Spacing Distance -Tension (F_{NS})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedment, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Spacing, s_{min} (in)		5-1/4	3-3/4	6	7-1/4	5	7-1/8	10-1/8	4-1/4	9	6
Spacing Distance (inches)	3-3/4	-	0.80	-	-	-	-	-	-	-	-
	4	-	0.82	-	-	-	-	-	-	-	-
	4-1/4	-	0.83	-	-	-	-	-	0.69	-	-
	4-1/2	-	0.85	-	-	-	-	-	0.70	-	-
	5	-	0.88	-	-	0.75	-	-	0.71	-	-
	5-1/2	1.00	0.91	-	-	0.77	-	-	0.73	-	-
	6	1.00	0.93	1.00	-	0.79	-	-	0.74	-	0.74
	6-1/2	1.00	0.96	1.00	-	0.81	-	-	0.76	-	0.75
	7	1.00	0.99	1.00	-	0.83	-	-	0.78	-	0.77
	7-1/4	1.00	1.00	1.00	0.99	0.84	-	-	0.78	-	0.78
	7-1/2	1.00	1.00	1.00	1.00	0.85	1.00	-	0.79	-	0.78
	8	1.00	1.00	1.00	1.00	0.87	1.00	-	0.81	-	0.80
	8-1/2	1.00	1.00	1.00	1.00	0.89	1.00	-	0.83	-	0.81
	9	1.00	1.00	1.00	1.00	0.91	1.00	-	0.84	0.94	0.83
	9-1/2	1.00	1.00	1.00	1.00	0.93	1.00	-	0.86	0.97	0.84
	10	1.00	1.00	1.00	1.00	0.95	1.00	-	0.87	0.99	0.86
	10-1/2	1.00	1.00	1.00	1.00	0.97	1.00	1.00	0.89	1.00	0.87
	11	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.91	1.00	0.88
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	0.90
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.91
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.93
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.94
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.96
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Edge Distance - Tension (F_{NC})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedmend, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Edge Distance, c_{min} (in)		3	2-1/4	4	5-1/4	4	4-1/4	5-1/2	4-1/4	5	4-1/2
Edge Distance (inches)	2-1/4	-	0.35	-	-	-	-	-	-	-	-
	2-1/2	-	0.38	-	-	-	-	-	-	-	-
	3	0.60	0.46	-	-	-	-	-	-	-	-
	3-1/2	0.70	0.54	-	-	-	-	-	-	-	-
	4	0.80	0.62	0.50	-	0.50	-	-	-	-	-
	4-1/4	0.85	0.65	0.53	-	0.53	0.53	-	0.43	-	-
	4-1/2	0.90	0.69	0.56	-	0.56	0.56	-	0.45	-	0.38
	5	1.00	0.77	0.63	-	0.63	0.63	-	0.50	1.00	0.42
	5-1/4	1.00	0.81	0.66	0.62	0.66	0.66	-	0.53	1.00	0.44
	5-1/2	1.00	0.85	0.69	0.65	0.69	0.69	0.92	0.55	1.00	0.46
	6	1.00	0.92	0.75	0.71	0.75	0.75	1.00	0.60	1.00	0.50
	6-1/2	1.00	1.00	0.81	0.76	0.81	0.81	1.00	0.65	1.00	0.54
	7	1.00	1.00	0.88	0.82	0.88	0.88	1.00	0.70	1.00	0.58
	7-1/2	1.00	1.00	0.94	0.88	0.94	0.94	1.00	0.75	1.00	0.63
	8	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.80	1.00	0.67
	8-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	1.00	0.71
	9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	0.75
	9-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.79
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
	11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

Spacing Distance - Shear (F_{VS})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedment, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Spacing, s_{min} (in)		5-1/4	3-3/4	6	7-1/4	5	7-1/8	11	4-1/4	9	6
Spacing Distance (inches)	3-3/4	-	0.87	-	-	-	-	-	-	-	-
	4	-	0.88	-	-	-	-	-	-	-	-
	4-1/4	-	0.89	-	-	-	-	-	0.78	-	-
	4-1/2	-	0.90	-	-	-	-	-	0.79	-	-
	5	-	0.92	-	-	0.82	-	-	0.80	-	-
	5-1/2	1.00	0.94	-	-	0.84	-	-	0.81	-	-
	6	1.00	0.96	1.00	-	0.85	-	-	0.82	-	0.82
	6-1/2	1.00	0.98	1.00	-	0.87	-	-	0.83	-	0.83
	7	1.00	1.00	1.00	-	0.88	-	-	0.84	-	0.84
	7-1/2	1.00	1.00	1.00	1.00	0.89	1.00	-	0.85	-	0.85
	8	1.00	1.00	1.00	1.00	0.91	1.00	-	0.87	-	0.86
	8-1/2	1.00	1.00	1.00	1.00	0.92	1.00	-	0.88	-	0.87
	9	1.00	1.00	1.00	1.00	0.94	1.00	-	0.89	0.96	0.88
	9-1/2	1.00	1.00	1.00	1.00	0.95	1.00	-	0.90	0.98	0.89
	10	1.00	1.00	1.00	1.00	0.96	1.00	-	0.91	1.00	0.90
	10-1/2	1.00	1.00	1.00	1.00	0.98	1.00	-	0.92	1.00	0.91
	11	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.93	1.00	0.92
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.93
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	0.94
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.95
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.96
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.97
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

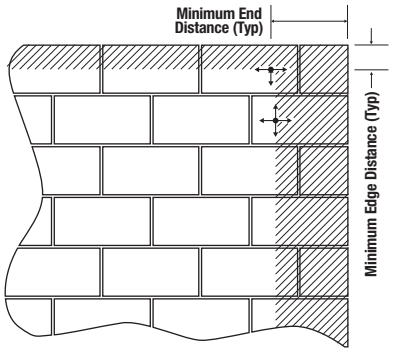
Edge Distance - Shear (F_{VC})											
Diameter, d (in)		3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4
Minimum Embedment, h_v (in)		1-3/4	2-3/8	2	2-1/2	3-3/4	2-3/8	3-3/8	4-5/8	3-3/8	5
Minimum Edge Distance, c_{min} (in)		5	6-1/2	6	8-1/2	8	7-1/8	6	10	5	12
Edge Distance (inches)	5	0.95	-	-	-	-	-	-	-	0.49	-
	5-1/2	1.00	-	-	-	-	-	-	-	0.54	-
	6	1.00	-	1.00	-	-	-	0.59	-	0.59	-
	6-1/2	1.00	0.91	1.00	-	-	-	0.64	-	0.64	-
	7	1.00	0.98	1.00	-	-	-	0.69	-	0.69	-
	7-1/2	1.00	1.00	1.00	-	-	1.00	0.74	-	0.74	-
	8	1.00	1.00	1.00	-	0.71	1.00	0.79	-	0.79	-
	8-1/2	1.00	1.00	1.00	1.00	0.76	1.00	0.84	-	0.84	-
	9	1.00	1.00	1.00	1.00	0.80	1.00	0.89	-	0.89	-
	9-1/2	1.00	1.00	1.00	1.00	0.84	1.00	0.94	-	0.94	-
	10	1.00	1.00	1.00	1.00	0.89	1.00	0.99	0.72	0.99	-
	10-1/2	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.76	1.00	-
	11	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.79	1.00	-
	11-1/4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.81	1.00	-
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83	1.00	-
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	1.00	0.80
	12-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	0.83
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.87
	13-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.90
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	14-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

MASONRY PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Power-Stud HD5 in Grout-filled Concrete Masonry[1,2,3]

Anchor Diameter d in.	Minimum Embed. h_v in. (mm)	Nominal Drill Bit Diameter in.	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Ultimate Loads		Allowable Loads	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8	1-1/2 (38.1)	3/8 ANSI	4 (102)	4 (102)	1,185 (5.3)	1,340 (6.0)	235 (1.0)	270 (1.2)
1/2	2 (50.8)	1/2 ANSI	4 (102)	4 (102)	1,670 (7.4)	2,110 (9.4)	335 (1.5)	420 (1.9)
			12 (305)	12 (305)	1,860 (8.3)	2,560 (11.4)	370 (1.6)	510 (2.3)
5/8	2-3/8 (60.3)	5/8 ANSI	4 (102)	4 (102)	2,155 (9.6)	2,110 (9.4)	430 (1.9)	420 (1.9)
			12 (305)	12 (305)	2,850 (12.7)	5,225 (23.2)	570 (2.5)	1,045 (4.6)
3/4	3-3/8 (85.7)	3/4 ANSI	12 (305)	12 (305)	5,660 (25.2)	8,115 (36.1)	1,130 (5.0)	1,625 (7.2)
			20 (508)	20 (508)	5,660 (25.2)	9,360 (41.6)	1,130 (5.0)	1,870 (8.3)

1. Tabulated load values are for anchors installed in minimum 6-inch 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.
3. The tabulated values are for anchors installed at a minimum spacing 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. Anchors with 3/4-inch diameter are limited to one anchor per cell.



ORDERING INFORMATION

Power-Stud HD5 (Carbon Steel Body and Stainless Steel Expansion Clip)

Cat. No.	Anchor Size	Thread Length	Box Qty.	Carton Qty.	Wt/100 (lbs.)	Suggested ANSI Carbide Drill Bit Cat. No.				
						Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
7713HD5	3/8" x 3"	1-1/2"	50	300	10	DW5527	DW5427	-	-	-
7715HD5	3/8" x 3-3/4"	2-3/8"	50	300	13	DW5527	DW5427	-	-	-
7716HD5	3/8" x 5"	3-1/2"	50	300	15	DW55300	DW5429	-	-	-
7717HD5	3/8" x 7"	5-1/2"	50	200	21	DW55300	DW5429	-	-	-
7720HD5	1/2" x 2-3/4"	1"	50	200	21	DW5537	DW5437	DW5803	DWA54012	-
7722HD5	1/2" x 3-3/4"	2"	50	200	19	DW5537	DW5437	DW5803	DWA54012	-
7723HD5	1/2" x 4-1/2"	2-3/4"	50	200	23	DW5539	DW5438	DW5803	DWA54012	-
7724HD5	1/2" x 5-1/2"	3-3/4"	50	150	27	DW5539	DW5438	DW5803	DWA54012	-
7726HD5	1/2" x 7"	5-1/4"	25	100	30	DW5539	DW5438	DW5803	DWA54012	-
7730HD5	5/8" x 3-1/2"	1-1/2"	25	100	44	-	DW5446	DW5806	DWA54058	DWA58058
7733HD5	5/8" x 5"	3"	25	100	43	-	DW5446	DW5806	DWA54058	DWA58058
7734HD5	5/8" x 6"	4"	25	75	47	-	DW5446	DW5806	DWA54058	DWA58058
7738HD5	5/8" x 8-1/2"	6-1/2"	25	50	60	-	DW5447	DW5809	DWA54058	DWA58058
7741HD5	3/4" x 4-3/4"	2-1/4"	20	60	68	-	DW5453	DW5810	DWA54034	DWA58034
7742HD5	3/4" x 5-1/2"	3"	20	60	76	-	DW5453	DW5810	DWA54034	DWA58034
7746HD5	3/4" x 7"	4-1/2"	20	60	92	-	DW5455	DW5810	DWA54034	DWA58034
7748HD5	3/4" x 8-1/2"	6"	10	40	107	-	DW5455	DW5812	DWA54034	DWA58034

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

All anchors are packaged with nuts and washers.

A manual hand pump is available (Cat. No. 08280).
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012).

GENERAL INFORMATION

POWER-STUD®

Stainless Steel Wedge Expansion Anchor

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 Type 304 and Type 316 stainless steel.

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

FEATURE 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
- Underwriters Laboratory (UL Listed) – File No. EX1289 (see listing)
- Federal GSA Specification
  Meets the descriptive and proof load requirements of CID A-A-1923A, Type 4

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Stud as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

THREADED POWER-STUD ASSEMBLY

HEAD STYLES

- Threaded Stud

ANCHOR MATERIALS

- Type 304 Stainless Steel
- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 1" diameter

SUITABLE BASE MATERIALS

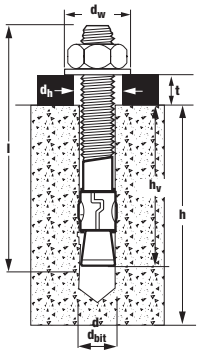
- Normal-weight Concrete
- Structural Lightweight Concrete
- Grouted Concrete Masonry (CMU)

INSTALLATION SPECIFICATIONS

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.

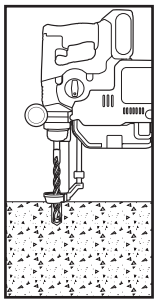


Nomenclature

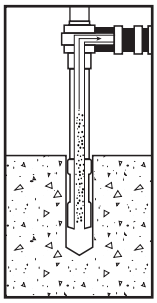
d = Diameter of anchor
d_{bit} = Diameter of drill bit
d_h = Diameter of fixture clearance hole
d_w = Diameter of washer
h = Base material thickness
The minimum value of h should be $1.5h_v$ or 3" whichever is greater
h_v = Minimum embedment depth
l = Overall length of anchor
t = Fixture thickness

INSTALLATION PROCEDURE

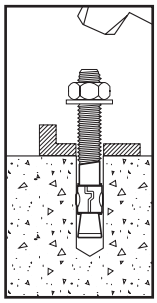
Threaded Stud Version



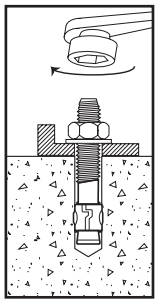
Step 1
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



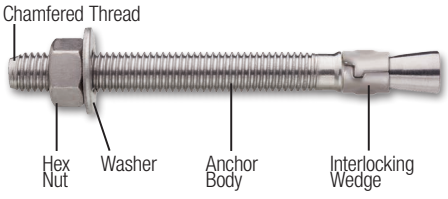
Step 3
Position the washer on the anchor and thread on the nut. Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Step 4
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	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 up to 7")	
Nut	Type 18-8 (300 Series) Stainless Steel	Type 316 Stainless Steel
Washer	Type 18-8 (300 Series) Stainless Steel	Type 316 Stainless Steel
Expansion Wedge	Type 18-8 (300 Series) 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 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)	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)	9,860 (44.4)	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.

Allowable Load Capacities for Stainless 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)
	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 concrete compressive strength.

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

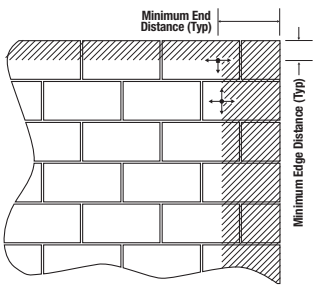
Anchor Diameter d in. (mm)	Install Torque T_{inst} ft.-lbs.	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f´c)						Shear, lbs (kN)	
			Tension, lbs (kN)							
			3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		f´c ≥ 3,000 psi (20.7 MPa)	
			Ultimate Load	Allowable 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.

Ultimate and Allowable Load Capacities for 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 ≥ 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 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 ≥ 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. 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:

$$\left(\frac{Nu}{Nn}\right)^{\frac{5}{3}} + \left(\frac{Vu}{Vn}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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	$s_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.75$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.75$

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	$s_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.95$
	Shear	$c_{cr} = 12d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.30$

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.

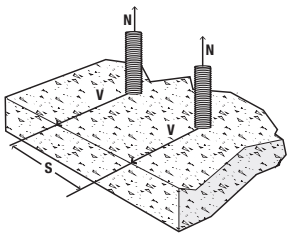
Spacing Load Adjustment Factors for Normal-Weight and Lightweight Concrete (Continued Below)

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	1.00	0.92	0.69	0.50	0.85	0.69	-	-	0.61	-	-	-	-	0.50	-	-	-	-
	3	1.00	1.00	0.75	0.55	0.92	0.75	0.50	-	0.67	0.50	-	-	-	0.55	-	-	-	-
	3-1/4	1.00	1.00	0.81	0.59	1.00	0.81	0.54	-	0.72	0.54	-	-	-	0.59	-	-	-	-
	3-1/2	1.00	1.00	0.88	0.64	1.00	0.88	0.58	-	0.78	0.58	-	-	-	0.64	0.50	-	-	-
	4	1.00	1.00	1.00	0.73	1.00	1.00	0.67	-	0.89	0.67	0.50	-	-	0.73	0.57	0.50	-	-
	4-1/4	1.00	1.00	1.00	0.77	1.00	1.00	0.71	0.50	0.94	0.71	0.53	-	-	0.77	0.61	0.53	-	-
	4-1/2	1.00	1.00	1.00	0.82	1.00	1.00	0.75	0.53	1.00	0.75	0.56	-	-	0.82	0.64	0.56	-	-
	5	1.00	1.00	1.00	0.91	1.00	1.00	0.83	0.59	1.00	0.83	0.63	0.50	-	0.91	0.71	0.63	0.50	-
	5-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.65	1.00	0.92	0.69	0.55	-	1.00	0.79	0.69	0.55	-
	6	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.71	1.00	1.00	0.75	0.60	0.50	1.00	0.86	0.75	0.60	-
	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.82	1.00	1.00	0.88	0.70	0.58	1.00	1.00	0.88	0.70	0.50
	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.80	0.67	1.00	1.00	1.00	0.80	0.57
	8-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	0.71	1.00	1.00	1.00	0.85	0.61
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83	1.00	1.00	1.00	1.00	0.71
	11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	1.00	1.00	0.79
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

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

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.

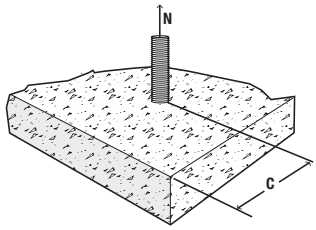


Edge Distance Load Adjustment Factors for Normal-Weight Concrete

Edge Distance, Tension (F_{NC})								
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	1.00	0.87	0.79	0.75	-	-	-
	3-3/4	1.00	0.93	0.84	0.79	0.75	-	-
	4	1.00	0.95	0.86	0.80	0.76	-	-
	4-3/8	1.00	0.99	0.88	0.82	0.78	0.75	-
	4-1/2	1.00	1.00	0.89	0.83	0.79	0.76	-
	5	1.00	1.00	0.93	0.86	0.81	0.78	0.75
	6	1.00	1.00	1.00	0.91	0.86	0.82	0.79
	6-1/4	1.00	1.00	1.00	0.93	0.87	0.83	0.79
	7	1.00	1.00	1.00	0.97	0.90	0.86	0.82
	7-1/2	1.00	1.00	1.00	1.00	0.93	0.88	0.84
	8	1.00	1.00	1.00	1.00	0.95	0.90	0.86
	9	1.00	1.00	1.00	1.00	1.00	0.94	0.89
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.95
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	15	1.00	1.00	1.00	1.00	1.00	1.00	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.

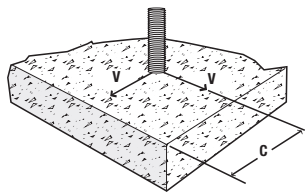
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 75% of load.



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

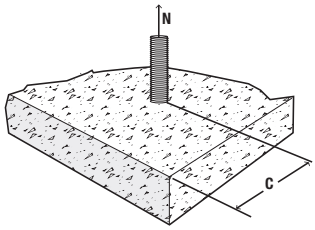


Edge Distance Load Adjustment Factors for Lightweight Concrete

Edge Distance, Tension (F_{NC})								
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	1.00	0.97	0.96	0.95	-	-	-
	3-3/4	1.00	0.99	0.97	0.96	0.95	-	-
	4	1.00	0.99	0.97	0.96	0.95	-	-
	4-3/8	1.00	1.00	0.98	0.96	0.96	0.95	-
	4-1/2	1.00	1.00	0.98	0.97	0.96	0.95	-
	5	1.00	1.00	0.99	0.97	0.96	0.96	0.95
	6	1.00	1.00	1.00	0.98	0.97	0.96	0.96
	6-1/4	1.00	1.00	1.00	0.99	0.97	0.97	0.96
	7	1.00	1.00	1.00	0.99	0.98	0.97	0.96
	7-1/2	1.00	1.00	1.00	1.00	0.99	0.98	0.97
	8	1.00	1.00	1.00	1.00	0.99	0.98	0.97
	9	1.00	1.00	1.00	1.00	1.00	0.99	0.98
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

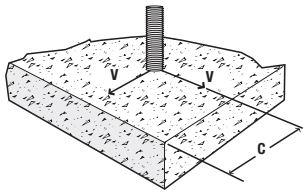
Minimum edge distance (cmin) is equal to 5 anchor diameters (5d) at which the anchor achieves 95% of load.



Edge Distance, Shear (F_{VC})								
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	1.00	0.63	0.43	0.30	-	-	-
	3-3/4	1.00	0.80	0.55	0.40	0.30	-	-
	4	1.00	0.87	0.60	0.44	0.33	-	-
	4-3/8	1.00	0.97	0.68	0.50	0.38	0.30	-
	4-1/2	1.00	1.00	0.70	0.52	0.40	0.31	-
	5	1.00	1.00	0.80	0.60	0.47	0.37	0.30
	6	1.00	1.00	1.00	0.76	0.60	0.49	0.40
	6-1/4	1.00	1.00	1.00	0.80	0.63	0.51	0.43
	7	1.00	1.00	1.00	0.92	0.73	0.60	0.50
	7-1/2	1.00	1.00	1.00	1.00	0.80	0.66	0.55
	8	1.00	1.00	1.00	1.00	0.87	0.71	0.60
	9	1.00	1.00	1.00	1.00	1.00	0.83	0.70
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.85
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

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



ORDERING INFORMATION

Stainless Steel Power-Stud

Cat. No.		Anchor Size	Min.-Embed.	Thread-Length	Std. Box	Std. Carton	Wt./100
Type 304 SS	Type 316 SS						
7300	7600	1/4" x 1-3/4"	1-1/8"	3/4"	100	500	3
7302	7602	1/4" x 2-1/4"	1-1/8"	1-1/4"	100	500	3-1/2
7304	7604	1/4" x 3-1/4"	1-1/8"	2-1/4"	100	500	4-3/4
7310	7610	3/8" x 2-1/4"	1-5/8"	1-1/4"	50	250	8-3/4
7312	7612	3/8" x 2-3/4"	1-5/8"	1-5/8"	50	250	9-1/2
7313	7613	3/8" x 3"	1-5/8"	1-7/8"	50	250	10-3/4
7314	7614	3/8" x 3-1/2"	1-5/8"	2-3/8"	50	250	12
7315	7615	3/8" x 3-3/4"	1-5/8"	2-5/8"	50	250	12-3/4
7316	7616	3/8" x 5"	1-5/8"	3-1/8"	50	250	15-1/2
7320	7620	1/2" x 2-3/4"	2-1/4"	1-3/8"	50	200	18
7322	7622	1/2" x 3-3/4"	2-1/4"	2-3/8"	50	200	23
7323	7623	1/2" x 4-1/2"	2-1/4"	3-1/8"	50	200	30
7324	7624	1/2" x 5-1/2"	2-1/4"	4-1/8"	50	150	34
7326	7626	1/2" x 7"	2-1/4"	5-5/8"	25	100	44
7330	7630	5/8" x 3-1/2"	2-3/4"	2"	25	100	40
7332	7632	5/8" x 4-1/2"	2-3/4"	3"	25	100	54
7333	7633	5/8" x 5"	2-3/4"	3-1/2"	25	100	57
7334	7634	5/8" x 6"	2-3/4"	4-1/2"	25	75	64
7336	7636	5/8" x 7"	2-3/4"	5-1/2"	25	75	72
7338	7638	5/8" x 8 1/2"	2-3/4"	7"	25	75	84
7340	7640	3/4" x 4 1/4"	3-3/8"	2-3/8"	20	60	70
7341	7641	3/4" x 4 3/4"	3-3/8"	2-7/8"	20	60	76
7342	7642	3/4" x 5 1/2"	3-3/8"	3-5/8"	20	60	85
7344	7644	3/4" x 6-1/4"	3-3/8"	4-3/8"	20	60	95
7346	7646	3/4" x 7"	3-3/8"	5-1/8"	20	60	105
7348	7648	3/4" x 8-1/2"	3-3/8"	6-5/8"	10	40	120
7349	-	3/4" x 10"	3-3/8"	8-1/8"	10	30	135
7352	-	7/8" x 8"	3-7/8"	4-3/4"	10	40	160
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.

GENERAL INFORMATION

DOMESTIC WEDGE ANCHOR

Carbon Steel and Stainless Steel Wedge Expansion Anchors

Anchor produced in the U.S.A., nut and washer made in Taiwan or China*

PRODUCT DESCRIPTION

The Domestic Wedge Anchor is a threaded, torque-controlled, carbon steel or stainless steel wedge expansion anchor which is designed for consistent performance in concrete. Suitable base materials are normal-weight and sand-lightweight concrete. The anchor is manufactured with carbon steel body and expansion clip or a stainless steel body and expansion clip. Nut and washer are included.

GENERAL APPLICATIONS AND USES

- Steel fixtures
- Support connections
- Equipment and railing

FEATURES AND BENEFITS

+ Anchors made in the U.S.A., nut and washer made in Taiwan or China, domestic nut and washer available upon request.
+ Nominal drill bit size is the same as the anchor diameter
+ Anchor can be installed through standard size fixture clearance holes
+ Length ID code and identifying marking stamped on head of each anchor
+ Corrosion resistant stainless steel anchors available

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E 488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Domestic Wedge Anchor as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor component	Specification		
	Carbon Steel[1]	Type 303	Type 316
Anchor body	AISI C12L14	Type 303 Stainless Steel	Type 316 Stainless Steel
Washer	AISI C1010-1018	300 Series Stainless Steel	Type 316 Stainless Steel
Hex Nut	Low Carbon Steel, ASTM A563, Grade A	Type 18-8	Type 316 Stainless Steel
Expansion wedge (clip)	AISI C1010-1018 1037	Type 18-8	Type 316 Stainless Steel

1. Plated with Zinc in accordance with ASTM B 633, SC1 Type III.
* Domestic nut and washer available upon request.

SECTION CONTENTS

DOMESTIC WEDGE ANCHOR ASSEMBLY

THREAD VERSION

- UNC threaded stud

ANCHOR MATERIALS

- Carbon Steel Type 303 Stainless Steel, or Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

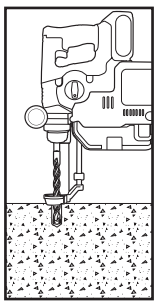
- 1/4" diameter through 1-1/4" diameter

SUITABLE BASE MATERIALS

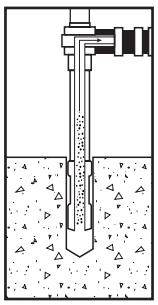
- Normal-weight Concrete
- Lightweight Concrete

INSTALLATION INSTRUCTIONS

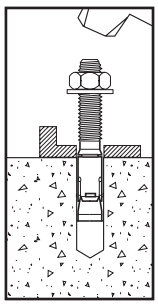
Installation Instructions for Domestic Wedge Anchor



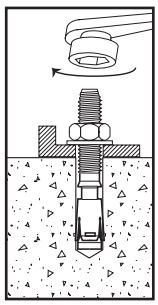
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Step 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.



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

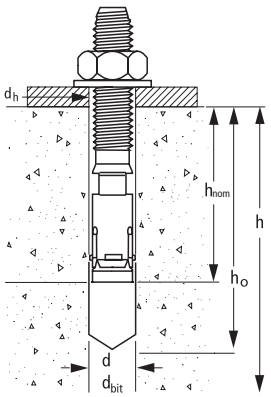
Installation Table for Domestic Wedge Anchor

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Diameter (inch)							
			1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
Anchor outside diameter	d	in.	0.25	0.375	0.500	0.625	0.750	0.875	1.000	1.250
Nominal drill bit diameter	d_{bit}	in.	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 diameter of hole clearance in fixture	d_h	in.	5/16	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
Minimum nominal embedment depth	h_{nom}	in.	1-1/8	1-1/2	2-1/4	2-3/4	3-1/4	3-7/8	4-1/2	5-1/2
Minimum hole depth	h_o	in.	1-3/8	1-7/8	2-3/4	3-1/4	3-3/4	4-3/8	5	6
Minimum member thickness	h_{min}	in.	3	3	3-3/8	4-1/8	4-7/8	5-13/16	6-3/4	8-1/4
Installation torque	T_{inst}	ft.-lbf.	5-10	25-30	50-60	75-90	150-175	200-250	250-300	400-450
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.										

Length Identification

Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
From	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"	9-1/2	10"	11"
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"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2	10"	11"	12"
Length identification mark indicates overall length of anchor.																			

Installation Detail



Nomenclature

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

REFERENCE PERFORMANCE DATA

Ultimate Load Capacities for Domestic Wedge Anchor in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Concrete Compressive Strength, f'c					
		2,000 psi		4,000 psi		6,000 psi	
		Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)
1/4	1-1/8	1,170	1,445	1,770	1,815	2,775	2,635
	1-3/4	1,840		2,410		2,775	
	2-3/4	1,975		2,750		2,830	
3/8	1-1/2	1,630	4,320	3,640	5,120	4,450	6,235
	3	3,230		5,655		5,975	
	5	4,075		6,330		6,360	
1/2	2-1/4	4,000	7,420	6,715	9,380	9,615	9,890
	4	6,335		8,945		10,190	
	6	6,900		10,175		12,065	
5/8	2-3/4	5,000	8,265	8,750	12,930	9,760	16,375
	5	8,855		15,590		16,800	
	7	9,380		16,710		17,735	
3/4	3-1/4	6,640	12,505	11,315	17,050	16,230	22,965
	6	10,085		18,410		21,095	
	8	11,170		19,805		22,525	
7/8	3-7/8	8,395	18,250	16,355	20,235	16,800	23,980
	5-3/4	12,065		18,250		23,405	
1	4-1/2	9,775	23,620	18,250	27,605	27,460	28,910
	7-1/2	11,890		26,725		34,960	
	10	15,590		30,490		37,840	
1-1/4	5-1/2	17,550	32,275	22,970	42,690	32,370	55,565
	7	21,050		27,845		48,365	
	10	27,895		34,790		61,270	

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

Allowable Load Capacities for Carbon Steel and Stainless Steel Domestic Wedge Anchor in Normal-Weight Concrete[1,2,3]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Concrete Compressive Strength, f'c					
		2,000 psi		4,000 psi		6,000 psi	
		Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)
1/4	1-1/8	295	360	445	455	695	660
	1-3/4	460		600		695	
	2-3/4	495		690		710	
3/8	1-1/2	410	1,080	910	1,280	1,115	1,560
	3	810		1,415		1,495	
	5	1,020		1,580		1,590	
1/2	2-1/4	1,000	1,855	1,680	2,345	2,405	2,475
	4	1,585		2,235		2,550	
	6	1,725		2,545		3,015	
5/8	2-3/4	1,250	2,065	2,190	3,235	2,440	4,095
	5	2,215		3,900		4,200	
	7	2,345		4,180		4,435	
3/4	3-1/4	1,660	3,125	2,830	4,265	4,060	5,740
	6	2,520		4,600		5,275	
	8	2,795		4,950		5,630	
7/8	3-7/8	2,100	4,565	4,090	5,060	4,200	5,995
	5-3/4	3,015		4,565		5,850	
1	4-1/2	2,445	5,905	4,565	6,900	6,865	7,230
	7-1/2	2,975		6,685		8,740	
	10	3,900		7,625		9,460	
1-1/4	5-1/2	4,390	8,070	5,745	10,675	8,095	13,890
	7	5,265		6,960		12,095	
	10	6,975		8,700		15,320	

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Allowable loads for lightweight concrete may be determined by multiplying the tabulated allowable load capacities for normal weight concrete by 0.60.

ORDERING INFORMATION

*Domestic Wedge Anchor (Carbon Steel)

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Ctn.
7400USA	1/4" x 1-3/4"	1-1/8"	3/4"	100	500
7402USA	1/4" x 2-1/4"	1-1/8"	3/4"	100	500
7404USA	1/4" x 3-1/4"	1-1/8"	3/4"	100	500
7410USA	3/8" x 2-1/4"	1-1/2"	7/8"	50	250
7412USA	3/8" x 2-3/4"	1-1/2"	1-1/8"	50	250
7413USA	3/8" x 3"	1-1/2"	1-1/8"	50	250
7415USA	3/8" x 3-3/4"	1-1/2"	1-1/8"	50	250
7416USA	3/8" x 5"	1-1/2"	1-1/8"	50	250
7417USA	3/8" x 6-1/2"	1-1/2"	1-1/8"	50	200
7420USA	1/2" x 2-3/4"	2-1/4"	1-1/4"	50	200
7422USA	1/2" x 3-3/4"	2-1/4"	1-1/4"	50	200
7423USA	1/2" x 4-1/2"	2-1/4"	1-1/4"	50	200
7424USA	1/2" x 5-1/2"	2-1/4"	1-1/4"	50	150
7428USA	1/2" x 10"	2-1/4"	1-1/4"	25	100
7430USA	5/8" x 3-1/2"	2-3/4"	2"	25	100
7432USA	5/8" x 4-1/2"	2-3/4"	2"	25	100
7433USA	5/8" x 5"	2-3/4"	2"	25	100
7434USA	5/8" x 6"	2-3/4"	2"	25	75
7436USA	5/8" x 7"	2-3/4"	2"	25	75
7440USA	3/4" x 4-1/4"	3-1/4"	2"	20	60
7441USA	3/4" x 4-3/4"	3-1/4"	2"	20	60
7442USA	3/4" x 5-1/2"	3-1/4"	2"	20	60
7444USA	3/4" x 6-1/4"	3-1/4"	2"	20	60
7446USA	3/4" x 7"	3-1/4"	2"	20	60
7449USA	3/4" x 10"	3-1/4"	2"	10	30
7461USA	1" x 6"	4-1/2"	2-1/4"	10	40
7475USA	1-1/4" x 12"	5-1/2"	3-1/4"	5	15

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

*Made to Order

The published size includes the diameter and the overall length of the carbon and stainless steel anchors.

All anchors are packaged with nuts and washers.

*Domestic Wedge Anchor (Type 303 Stainless Steel)

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Ctn.
7300USA	1/4" x 1-3/4"	1-1/8"	3/4"	100	500
7304USA	1/4" x 3-1/4"	1-1/8"	3/4"	100	500
7312USA	3/8" x 2-3/4"	1-1/2"	1-1/8"	50	250
7313USA	3/8" x 3"	1-1/2"	1-1/8"	50	250
7314USA	3/8" x 3-1/2"	1-1/2"	1-1/8"	50	250
7315USA	3/8" x 3-3/4"	1-1/2"	1-1/8"	50	250
7316USA	3/8" x 5"	1-1/2"	1-1/8"	50	250
7320USA	1/2" x 2-3/4"	2-1/4"	1-1/4"	50	200
7323USA	1/2" x 4-1/2"	2-1/4"	1-1/4"	50	200
7324USA	1/2" x 5-1/2"	2-1/4"	1-1/4"	50	150
7326USA	1/2" x 7"	2-1/4"	1-1/4"	25	100
7332USA	5/8" x 4-1/2"	2-3/4"	2"	25	100
7341USA	3/4" x 4-3/4"	3-1/4"	2"	20	60
7348USA	3/4" x 8-1/2"	3-1/4"	2"	10	40
7349USA	3/4" x 10"	3-1/4"	2"	10	30

*Domestic Wedge Anchor (Type 316 Stainless Steel)

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Ctn.
7600USA	1/4" x 1-3/4"	1-1/8"	3/4"	100	500
7602USA	1/4" x 2-1/4"	1-1/8"	3/4"	100	500
7610USA	3/8" x 2-1/4"	1-1/2"	7/8"	50	250
7612USA	3/8" x 2-3/4"	1-1/2"	1-1/8"	50	250
7613USA	3/8" x 3"	1-1/2"	1-1/8"	50	250
7614USA	3/8" x 3-1/2"	1-1/2"	1-1/8"	50	250
7615USA	3/8" x 3-3/4"	1-1/2"	1-1/8"	50	250
7616USA	3/8" x 5"	1-1/2"	1-1/8"	50	250
7626USA	1/2" x 7"	2-1/4"	1-1/4"	25	100
7632USA	5/8" x 4-1/2"	2-3/4"	2"	25	100
7633USA	5/8" x 5"	2-3/4"	2"	25	100
7634USA	5/8" x 6"	2-3/4"	2"	25	75
7636USA	5/8" x 7"	2-3/4"	2"	25	75
7638USA	5/8" x 8-1/2"	2-3/4"	2"	25	75
7642USA	3/4" x 5-1/2"	3-1/4"	2"	20	60
7646USA	3/4" x 7"	3-1/4"	2"	20	60

GENERAL INFORMATION

POWER-BOLT®+

Heavy Duty Sleeve Anchor

PRODUCT DESCRIPTION

The Power-Bolt+ anchor is a torque controlled, heavy duty sleeve style anchor which is designed for consistent performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete and sand-lightweight concrete. The anchor is manufactured with a zinc plated carbon steel bolt, sleeve, cone and expansion clip. The Power-Bolt+ has a low profile finished hex head.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related attachments and tension zone applications
- Interior applications / low level corrosion environment
- Heavy duty applications

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
+ High shear load capacity

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3260 for cracked and uncracked concrete - 1/2", 5/8" and 3/4" diameters
- Code compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ACI 355.2 and ICC-ES AC193 (including ASTM E 488) for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 (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): 1/2", 5/8" and 3/4" diameters

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchoring and 05 05 19 - Post-Installed Concrete Anchors Expansion anchors shall be Power-Bolt+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

POWER-BOLT+ ASSEMBLY

HEAD STYLES

- Finished Hex Head

ANCHOR MATERIALS

- Zinc plated carbon steel bolt, washer, cone, sleeve, and expansion clip; assembled with a plastic compression ring and retainer nut

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 3/4" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

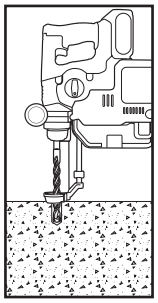
CODE LISTED ICC-ES ESR-3260 CONCRETE

DDA DEWALT DESIGN ASSIST

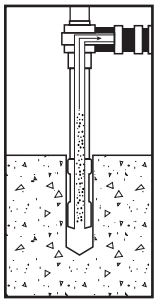
DUSTX+ ANCHOR INSTALLATION SYSTEM

INSTALLATION INSTRUCTIONS

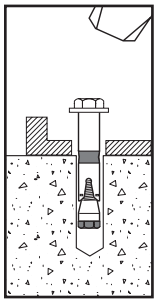
Installation Instructions for Power-Bolt+ Anchor



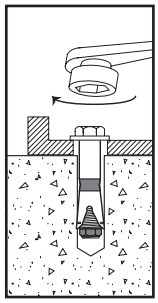
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.. Ensure the cone is snug and uniformly under the expansion wedge (clip) with the clip fingers overlapping the anchor cone, prior to installation using the retention nut (see photo below).



Step 3
Drive anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_{nom} .



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

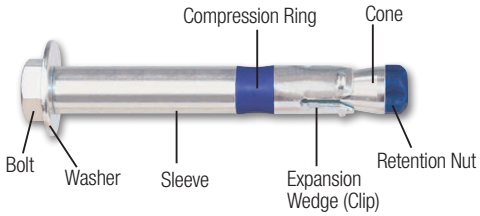
Head Marking

Legend

'PB+' Symbol = Power-Bolt+ Strength Design Compliant (see ordering information)

Letter Code = Length Identification Mark

Power-Bolt+ Anchor Assembly



Length Identification

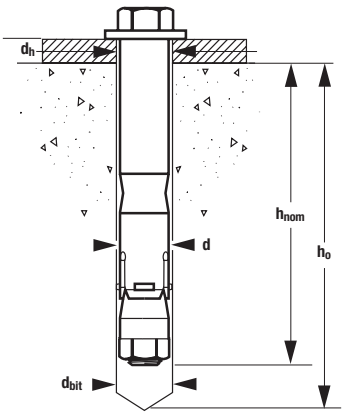
Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
From	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"
Up to but not including	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"	10"	11"

Length identification mark indicates overall length of anchor.

INSTALLATION SPECIFICATIONS

Power-Bolt+ Anchor Installation Specifications

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (in.)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Internal Bolt Diameter (UNC)	-	in. (mm)	#8 (4)	1/4 (6.4)	3/8 (9.5)	7/16 (11.1)	9/16 (14.3)
Nominal drill bit diameter	d_{bit}	in. (mm)	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (8)	7/16 (11)	9/16 (14)	11/16 (17)	13/16 (21)
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-1/4 (32)	1-5/8 (41)	2-1/2 (64)	2-3/4 (70)	3 (76.2)
Minimum hole depth	h_o	in. (mm)	1-1/2 (38)	1-7/8 (48)	3 (76)	3-1/4 (83)	3-5/8 (92)
Minimum member thickness	h_{min}	in. (mm)	3-1/2 (89)	4-1/2 (114)	5 (127)	6-1/2 (165)	7 (178)
Minimum edge distance	c_{min}	in. (mm)	1-3/4 (44)	2-3/4 (70)	3-1/4 (83)	4-1/2 (114)	6 (152)
Minimum spacing distance	s_{min}	in. (mm)	2 (51)	3-1/2 (89)	4-1/2 (114)	6 (152)	6 (152)
Installation torque	T_{inst}	ft.-lbf. (N-m)	4 (5)	20 (27)	40 (54)	60 (81)	110 (149)
Torque wrench/socket size	-	in.	3/8	1/2	5/8	3/4	15/16
Bolt Head Height	-	in. (mm)	1/8 (3)	13/64 (5)	9/32 (7)	5/16 (8)	3/8 (10)



REFERENCE PERFORMANCE DATA

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

Nominal Anchor Diameter d in.	Minimum Embed. Depth in. (mm) h_{nom}	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	1-1/4 (32)	1,245 (5.5)	1,670 (7.4)	1,260 (5.6)	1,670 (7.4)	1,290 (5.7)	1,670 (7.4)	1,345 (6.0)	1,670 (7.4)	1,397 (6.2)	1,670 (7.4)
	1-3/4 (44)	1,740 (7.7)	1,670 (7.4)	1,905 (8.5)	1,670 (7.4)	1,945 (8.7)	1,670 (7.4)	1,945 (8.7)	1,670 (7.4)	1,945 (8.7)	1,670 (7.4)
3/8	1-5/8 (41)	1,420 (6.3)	2,420 (10.8)	1,555 (6.9)	2,460 (10.9)	1,795 (8.0)	2,460 (10.9)	2,105 (9.4)	2,470 (11.0)	2,430 (10.8)	2,810 (12.5)
	2 (51)	2,740 (12.2)	3,990 (17.7)	3,000 (13.3)	3,990 (17.7)	3,465 (15.4)	3,990 (17.7)	4,140 (18.4)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)
	2-3/4 (70)	4,130 (18.4)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)	4,425 (19.7)	3,990 (17.7)
1/2	2-1/2 (64)	3,880 (17.3)	7,420 (33.0)	4,250 (18.9)	8,030 (35.7)	4,905 (21.8)	8,030 (35.7)	5,150 (22.9)	8,030 (35.7)	5,518 (24.5)	8,030 (35.7)
	3 (76)	5,190 (23.1)	8,030 (35.7)	5,685 (25.3)	8,030 (35.7)	6,560 (29.2)	8,030 (35.7)	7,985 (35.5)	8,030 (35.7)	9,065 (40.3)	8,030 (35.7)
	3-1/4 (83)	7,120 (31.7)	8,030 (35.7)	7,660 (34.1)	8,030 (35.7)	8,645 (38.5)	8,030 (35.7)	9,400 (41.8)	8,030 (35.7)	10,835 (48.2)	8,030 (35.7)
5/8	2-3/4 (70)	4,745 (21.1)	9,975 (44.4)	5,195 (23.1)	10,930 (48.6)	6,000 (26.7)	12,620 (56.1)	6,845 (30.4)	13,155 (58.5)	7,200 (32.0)	13,155 (58.5)
	3-1/2 (89)	6,995 (31.1)	9,975 (44.4)	7,660 (34.1)	10,930 (48.6)	8,845 (39.3)	12,620 (56.1)	11,325 (50.4)	13,155 (58.5)	12,900 (57.4)	13,155 (58.5)
	3-3/4 (95)	8,710 (38.7)	12,015 (53.4)	9,545 (42.5)	14,320 (63.7)	11,020 (49.0)	16,535 (73.6)	12,820 (57.0)	18,250 (81.2)	14,800 (65.8)	18,250 (81.2)
3/4	3 (76)	5,655 (25.2)	10,950 (48.7)	6,195 (27.6)	11,995 (53.4)	7,155 (31.8)	13,850 (61.6)	8,385 (37.3)	18,510 (82.3)	9,685 (43.1)	21,370 (95.1)
	4-3/8 (111)	10,870 (48.4)	18,635 (82.9)	11,910 (53.0)	20,415 (90.8)	13,750 (61.2)	23,575 (104.9)	14,705 (65.4)	23,575 (104.9)	16,975 (75.5)	23,575 (104.9)
	7 (178)	18,145 (80.7)	24,290 (108.0)	19,880 (88.4)	24,290 (108.0)	22,955 (102.1)	24,290 (108.0)	28,445 (126.5)	24,290 (108.0)	29,863 (132.8)	24,290 (108.0)

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

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

Nominal Anchor Diameter d in.	Minimum Embed. Depth in. (mm) h_{nom}	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	1-1/4 (32)	310 (1.4)	420 (1.9)	315 (1.4)	420 (1.9)	325 (1.4)	420 (1.9)	335 (1.5)	420 (1.9)	350 (1.6)	420 (1.9)
	1-3/4 (44)	435 (1.9)	420 (1.9)	475 (2.1)	420 (1.9)	485 (2.2)	420 (1.9)	485 (2.2)	420 (1.9)	485 (2.2)	420 (1.9)
3/8	1-5/8 (41)	355 (1.6)	605 (2.7)	390 (1.7)	615 (2.7)	450 (2.0)	615 (2.7)	525 (2.3)	620 (2.8)	610 (2.7)	705 (3.1)
	2 (51)	685 (3.0)	1,000 (4.4)	750 (3.3)	1,000 (4.4)	865 (3.8)	1,000 (4.4)	1,035 (4.6)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)
	2-3/4 (70)	1,035 (4.6)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)	1,105 (4.9)	1,000 (4.4)
1/2	2-1/2 (64)	970 (4.3)	1,855 (8.3)	1,065 (4.7)	2,010 (8.9)	1,225 (5.4)	2,010 (8.9)	1,290 (5.7)	2,010 (8.9)	1,380 (6.1)	2,010 (8.9)
	3 (76)	1,300 (5.8)	2,010 (8.9)	1,420 (6.3)	2,010 (8.9)	1,640 (7.3)	2,010 (8.9)	1,995 (8.9)	2,010 (8.9)	2,265 (10.1)	2,010 (8.9)
	3-1/4 (83)	1,780 (7.9)	2,010 (8.9)	1,915 (8.5)	2,010 (8.9)	2,160 (9.6)	2,010 (8.9)	2,350 (10.5)	2,010 (8.9)	2,710 (12.1)	2,010 (8.9)
5/8	2-3/4 (70)	1,185 (5.3)	2,495 (11.1)	1,300 (5.8)	2,735 (12.2)	1,500 (6.7)	3,155 (14.0)	1,710 (7.6)	3,290 (14.6)	1,800 (8.0)	3,290 (14.6)
	3-1/2 (89)	1,750 (7.8)	2,495 (11.1)	1,915 (8.5)	2,735 (12.2)	2,210 (9.8)	3,155 (14.0)	2,830 (12.6)	3,290 (14.6)	3,225 (14.3)	3,290 (14.6)
	3-3/4 (95)	2,180 (9.7)	3,005 (13.4)	2,385 (10.6)	3,580 (15.9)	2,755 (12.3)	4,135 (18.4)	3,205 (14.3)	4,565 (20.3)	3,700 (16.5)	4,565 (20.3)
3/4	3 (76)	1,415 (6.3)	2,740 (12.2)	1,550 (6.9)	3,000 (13.3)	1,790 (8.0)	3,465 (15.4)	2,095 (9.3)	4,630 (20.6)	2,420 (10.8)	5,345 (23.8)
	4-3/8 (111)	2,720 (12.1)	4,660 (20.7)	2,980 (13.3)	5,105 (22.7)	3,440 (15.3)	5,895 (26.2)	3,675 (16.3)	5,895 (26.2)	4,245 (18.9)	5,895 (26.2)
	7 (178)	4,535 (20.2)	6,075 (27.0)	4,970 (22.1)	6,075 (27.0)	5,740 (25.5)	6,075 (27.0)	7,110 (31.6)	6,075 (27.0)	7,465 (33.2)	6,075 (27.0)

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

Spacing Reduction Factors - Tension (F_{NS})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Spacing s_{min} (in)		2	3-1/2	4-1/2	6	5
Spacing Distance (inches)	2	0.78	-	-	-	-
	2-1/2	0.82	-	-	-	-
	3	0.87	-	-	-	-
	3-1/2	0.91	0.80	-	-	-
	4	0.96	0.83	-	-	-
	4-1/2	1.00	0.86	0.83	-	-
	5	1.00	0.89	0.85	-	0.77
	5-1/2	1.00	0.92	0.88	-	0.79
	6	1.00	0.95	0.91	0.85	0.81
	6-1/2	1.00	0.98	0.93	0.87	0.83
	7	1.00	1.00	0.96	0.90	0.85
	7-1/2	1.00	1.00	0.98	0.92	0.87
	8	1.00	1.00	1.00	0.95	0.89
	8-1/2	1.00	1.00	1.00	0.97	0.92
	9	1.00	1.00	1.00	1.00	0.94
	9-1/2	1.00	1.00	1.00	1.00	0.96
	10	1.00	1.00	1.00	1.00	0.98
	10-1/2	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Tension (F_{NC})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Edge Distance c_{min} (in)		1-3/4	2-3/4	3-1/4	4-1/2	6
Edge Distance (inches)	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/2	0.56	-	-	-	-
	3	0.67	0.46	-	-	-
	3-1/4	0.72	0.50	0.41	-	-
	3-1/2	0.78	0.54	0.44	-	-
	4	0.89	0.62	0.50	-	-
	4-1/2	1.00	0.69	0.56	0.75	-
	5	1.00	0.77	0.63	0.83	-
	5-1/2	1.00	0.85	0.69	0.92	-
	6	1.00	0.92	0.75	1.00	0.75
	6-1/2	1.00	1.00	0.81	1.00	0.81
	7	1.00	1.00	0.88	1.00	0.88
	7-1/2	1.00	1.00	0.94	1.00	0.94
	8	1.00	1.00	1.00	1.00	1.00

Spacing Reduction Factors - Shear (F_{VS})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Spacing s_{min} (in)		2	3-1/2	4-1/2	6	5
Spacing Distance (inches)	2	0.86	-	-	-	-
	2-1/2	0.89	-	-	-	-
	3	0.92	-	-	-	-
	3-1/2	0.94	0.88	-	-	-
	4	0.97	0.90	-	-	-
	4-1/2	1.00	0.91	0.89	-	-
	5	1.00	0.93	0.91	-	0.84
	5-1/2	1.00	0.95	0.93	-	0.86
	6	1.00	0.97	0.94	0.89	0.87
	6-1/2	1.00	0.99	0.96	0.91	0.88
	7	1.00	1.00	0.97	0.93	0.90
	7-1/2	1.00	1.00	0.99	0.94	0.91
	8	1.00	1.00	1.00	0.96	0.93
	8-1/2	1.00	1.00	1.00	0.98	0.94
	9	1.00	1.00	1.00	1.00	0.96
	9-1/2	1.00	1.00	1.00	1.00	0.97
	10	1.00	1.00	1.00	1.00	0.99
	10-1/2	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

Diameter (in)		1/4	3/8	1/2	5/8	3/4
Nominal Embedment h_{nom} (in)		1-1/4	2	2-1/2	2-3/4	3
Minimum Edge Distance c_{min} (in)		1-3/4	2-3/4	3-1/4	4-1/2	6
Edge Distance (inches)	1-3/4	0.39	-	-	-	-
	2	0.44	-	-	-	-
	2-1/2	0.56	-	-	-	-
	3	0.67	0.44	-	-	-
	3-1/4	0.72	0.48	0.41	-	-
	3-1/2	0.78	0.52	0.44	-	-
	4	0.89	0.59	0.51	-	-
	4-1/2	1.00	0.67	0.57	0.50	-
	5	1.00	0.74	0.63	0.56	-
	5-1/2	1.00	0.81	0.70	0.61	-
	6	1.00	0.89	0.76	0.67	0.57
	6-1/2	1.00	0.96	0.83	0.72	0.62
	7	1.00	1.00	0.89	0.78	0.67
	7-1/2	1.00	1.00	0.95	0.83	0.71
	8	1.00	1.00	1.00	0.89	0.76
	8-1/2	1.00	1.00	1.00	0.94	0.81
	9	1.00	1.00	1.00	1.00	0.86
	9-1/2	1.00	1.00	1.00	1.00	0.90
	10	1.00	1.00	1.00	1.00	0.95
	10-1/2	1.00	1.00	1.00	1.00	1.00

STRENGTH DESIGN INFORMATION

CODE LISTED
ICC-ES ESR-3260

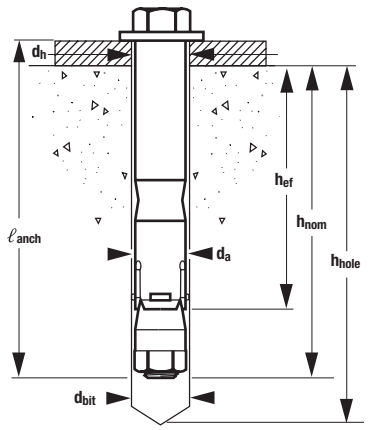
Power-Bolt+ Anchor Installation Specifications[1]

Anchor Property/Setting Information	Notation	Units	Norminal Anchor Diameter (in.)			
			1/2	5/8	3/4	
Anchor outside diameter	d_a	in. (mm)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	
Internal bolt diameter (UNC)	-	in. (mm)	3/8 (9.5)	7/16 (11.1)	9/16 (14.3)	
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	9/16 (14.3)	11/16 (17.5)	13/16 (21.6)	
Nominal drill bit diameter	d_{bit}	in.	1/2 ANSI	5/8 ANSI	3/4 ANSI	
Minimum nominal embedment depth	h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/8 (111)	
Effective embedment	h_{ef}	in. (mm)	2-5/8 (67)	3 (76)	3-1/2 (89)	
Minimum hole depth	h_{hole}	in. (mm)	3-3/4 (95)	4-1/4 (108)	5 (127)	
Minimum member thickness	h_{min}	in. (mm)	5 (127)	6-1/2 (165)	7 (178)	
Minimum overall anchor length[2]	ℓ_{anch}	in. (mm)	3-1/2 (89)	4 (102)	5-1/4 (133)	
Minimum edge distance	c_{min}	in. (mm)	3-1/4 (83)	4-1/2 (114)	6 (152)	8 (203)
Minimum spacing distance	s_{min}	in. (mm)	4-1/2 (114)	6 (152)	6 (152)	5 (127)
Critical edge distance	c_{ac}	in. (mm)	8 (203)	6 (152)	8 (203)	
Installation torque	T_{inst}	ft.-lbf. (N-m)	40 (54)	60 (81)	110 (149)	
Bolt Head Height	-	in. (mm)	9/32 (7.1)	5/16 (7.9)	3/8 (9.6)	
Torque wrench/socket size	-	in.	5/8	3/4	15/16	

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 318-14 Chapter 17 or ACI 318-11 Appendix D.
2. The listed minimum overall anchor length is based on anchor sizes available at the time of publication compared with the requirements for the minimum nominal embedment depth and fixture attachment.

Power-Bolt+ Anchor Detail



Tension Design information for Power-Bolt+ Anchor in Concrete (for use with load combinations taken form ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

CODE LISTED ICC-ES ESR-3260

Design Characteristic	Notation	Units	Nominal Anchor Diameter		
			1/2	5/8	3/4
Anchor category	1,2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/8 (111)
STEEL STRENGTH IN TENSION[4]					
Minimum specified yield strength	f_y	ksi (N/mm²)	130 (896)	130 (896)	130 (896)
Minimum specified ultimate tensile strength[8]	f_{uta}	ksi (N/mm²)	150 (1,034)	150 (1,034)	150 (1,034)
Effective tensile stress area (threads)	$A_{se,\,N}$	in² (mm²)	0.0775 (50)	0.1063 (68.6)	0.1820 (117.4)
Steel strength in tension	N_{sa}	lb (kN)	9,685 (43.1)	13,285 (59.1)	27,300 (121.4)
Reduction factor for steel strength[3]	ϕ	-	0.75		0.65
CONCRETE BREAKOUT STRENGTH IN TENSION[7]					
Effective embedment	h_{ef}	in. (mm)	2.625 (67)	3.000 (76)	3.500 (89)
Effectiveness factor for uncracked concrete	k_{ucr}	-	27 (11.3)	27 (11.3)	24 (10.0)
Effectiveness factor for cracked concrete	k_{cr}	-	17 (7.1)	17 (7.1)	17 (7.1)
Modification factor for cracked and uncracked concrete[5]	$\psi_{c,N}$	-	1.0	1.0	1.0
Critical edge distance (uncracked concrete)	c_{ac}	in. (mm)	8 (203)	6 (152)	8 (203)
Reduction factor for concrete breakout strength[4]	ϕ	-	0.65 (Condition B)		
PULLOUT STRENGTH IN TENSION (NON-SEISMIC APPLICATIONS)[7]					
Characteristic pullout strength, uncracked concrete (2,500 psi)	$N_{p,uncr}$	lb (kN)	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
Characteristic pullout strength, cracked concrete (2,500 psi)	$N_{p,cr}$	lb (kN)	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
Reduction factor for pullout strength	ϕ	-	0.65 (Condition B)		
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[7]					
Characteristic pullout strength, seismic (2,500 psi)	$N_{p,eq}$	lb (kN)	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
Reduction factor for pullout strength	ϕ	-	0.65 (Condition B)		

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with the manufacturer's published installation instructions.
3. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, except for the 3/4-inch-diameter, which is considered a brittle steel element for the purposes of design.
4. The tabulated value of ϕ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3,, as applicable, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4.
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. Pullout strength does not control design.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. In accordance with ACI 318-14 17.4.1.2 and Eq. 17.4.1.2 or ACI 318-11 D.5.1.2 and Eq. D-2, as applicable, the nominal steel strength in tension is calculated using a limited value of f_{uta} of 125 ksi.

Mean Axial Stiffness Values, β, for Power-Bolt+ Anchors in Normal-Weight Concrete[1]

Concrete State	Units	Nominal Anchor Diameter		
		1/2 inch	5/8 inch	3/4 inch
Uncracked concrete	10^3 lbf/in. (kN/mm)	366 (63)	871 (150)	256 (44)
Cracked concrete	10^3 lbf/in. (kN/mm)	64 (11)	94 (16)	27 (5)

1. Mean values shown; actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Shear Design information for Power-Bolt+ Anchor in Concrete (For use with load combinations taken from ACI 318-14, Section 5.3 or ACI 318-11, Section 9.2)[1,2]

CODE LISTED ICC-ES ESR-3260

Design Characteristic	Notation	Units	Nominal Anchor Diameter		
			1/2	5/8	3/4
Anchor category	1, 2 or 3	-	1	1	1
Nominal embedment depth	h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-3/8 (111)
STEEL STRENGTH IN SHEAR					
Minimum specified yield strength	f_y	ksi (N/mm^2)	130 (896)	130 (896)	130 (896)
Minimum specified ultimate strength	f_{uta}	ksi (N/mm^2)	150 (1,034)	150 (1,034)	150 (1,034)
Effective shear stress area	$A_{se,v}$	in^2 (mm^2)	0.1069 (69.0)	0.1452 (93.7)	0.2410 (153)
Steel strength in shear[6]	V_{sa}	lb (kN)	6,005 (26.7)	13,415 (59.7)	14,820 (65.9)
Reduction factor for steel strength[3]	ϕ	-	0.65		0.60
CONCRETE BREAKOUT STRENGTH IN SHEAR[7]					
Load bearing length of anchor	ℓ_e	in (mm)	1.00 (25)	1.25 (32)	1.50 (51)
Nominal anchor diameter	d_a	in (mm)	0.500 (12.7)	0.625 (15.9)	0.750 (19.05)
Reduction factor for concrete breakout[4]	ϕ	-	0.70 (Condition B)		
PRYOUT STRENGTH IN SHEAR[7]					
Coefficient for pryout strength (1.0 for $h_{ef} < 2.5$ in., 2.0 for $h_{ef} \geq 2.5$ in.)	k_{cp}	-	2.0	2.0	2.0
Effective embedment	h_{ef}	in (mm)	2.625 (675)	3.000 (76)	3.500 (89)
Reduction factor for pryout strength[5]	ϕ	-	0.70 (Condition B)		
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS					
Steel strength in shear, seismic[8]	$V_{sa,\,eq}$	lb (kN)	4,565 (20.3)	7,425 (33.0)	14,820 (65.9)
Reduction factor for steel strength in shear for seismic[3]	ϕ	-	0.65		0.60

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm^2; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with the manufacturer's published installation instructions.
3. The tabulated value of ϕ for steel strength applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for steel strength must be determined in accordance with ACI 318-11 D.4.3. The anchors are ductile steel elements as defined in ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, except for the 3/4-inch-diameter which is considered a brittle steel element for the purposes of design.
4. The tabulated value of ϕ for concrete breakout strength applies when both the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for Condition B are satisfied. If the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for Condition A are satisfied, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for concrete breakout strength must be determined in accordance with ACI 318-11 D.4.4.
5. The tabulated value of for pryout strength applies if the load combinations of Section 1605.2 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2, as applicable, are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ for pryout strength must be determined in accordance with ACI 318-11 D.4.4, for condition B.
6. Tabulated values for steel strength in shear must be used for design. The tabulated values for the shear stress area are listed conservatively and the results for the steel strength will be more conservative when using ACI 318-14 Eq. 17.5.1.2b or ACI 318-11 Eq. D-29, as applicable.
7. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318.
8. 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.

STRENGTH DESIGN PERFORMANCE DATA

Factored design strength ΦNn and ΦVn
Calculated in accordance with ACI 318-14 Chapter 17
Tested to the International Building Code

Tension and Shear Design Strengths for Power-Bolt+ in Cracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)
1/2	3-1/4	2,350	2,905	2,575	3,185	2,970	3,675	3,640	3,905	4,205	3,905
5/8	3-3/4	2,870	2,780	3,145	3,045	3,630	3,515	4,450	4,305	5,135	4,970
3/4	4-3/8	3,620	4,210	3,965	4,615	4,575	5,330	5,605	6,525	6,470	7,535

□ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for Power-Bolt+ in Uncracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength, f'c (psi)									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)	ΦNn Tension (lbs.)	ΦVn Shear (lbs.)
1/2	3-1/4	3,730	3,905	4,090	3,905	4,720	3,905	5,780	3,905	6,675	3,905
5/8	3-3/4	4,560	3,890	4,995	4,260	5,770	4,920	7,065	6,025	8,155	6,960
3/4	4-3/8	5,105	5,895	5,595	6,460	6,460	7,460	7,910	8,690	9,135	8,690

□ - Concrete Breakout Strength Controls ■ - Steel 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 times c_{a1}.

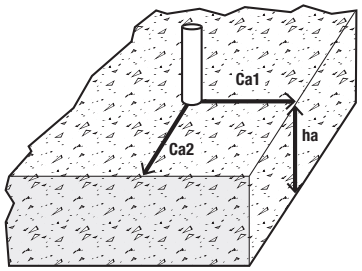
2- Calculations were performed according to ACI 318-14- Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength 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 (ø) were based on ACI 318-14 Section 5.3 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 318-14- Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14- Chapter 17. For other design conditions including seismic considerations please see ACI 318-14- Chapter 17.



ORDERING INFORMATION

Power-Bolt+ (Carbon Steel Finished Hex Head)

Cat. No.	Anchor Size	Maximum Fixture Thickness	Box Qty.	Carton Qty.	Suggested ANSI Carbide Drill Bit Cat. No.				
					Full Head SDS-Plus	SDS-Plus	SDS-Max	Hollow Bit SDS-Plus	Hollow Bit SDS-Max
6902SD	1/4" X 1-3/4"	1/2"	100	600	-	-	-	-	-
6906SD	1/4" X 3"	1-3/4"	100	600	-	-	-	-	-
6911SD	3/8" x 1-7/8"	1/4"	50	300	DW5527	DW5427	-	-	-
6910SD	3/8" X 2-1/4"	1/4"	50	300	DW5527	DW5427	-	-	-
6913SD	3/8" X 3"	1"	50	300	DW5527	DW5427	-	-	-
6914SD	3/8" X 3-1/2"	1-1/2"	50	300	DW5527	DW5427	-	-	-
6916SD	3/8" X 4"	2"	50	300	DW5527	DW5427	-	-	-
6930SD	1/2" x 2-3/4"	1/4"	50	200	DW5537	DW5429	DW5803	DWA54012	-
6932SD	1/2" x 3-1/2"	1/4"	50	200	DW5537	DW5429	DW5803	DWA54012	-
6934SD	1/2" x 4-3/4"	1-1/2"	25	150	DW5537	DW5429	DW5803	DWA54012	-
6936SD	1/2" x 5-3/4"	2-1/2"	25	150	DW5537	DW5429	DW5803	DWA54012	-
6940SD	5/8" x 3"	1/4"	20	120	-	DW5446	DW5806	DWA54058	DWA54058
6942SD	5/8" x 4"	1/4"	15	90	-	DW5446	DW5806	DWA54058	DWA54058
6944SD	5/8" x 5"	1-1/4"	15	90	-	DW5446	DW5806	DWA54058	DWA58058
6945SD	5/8" x 6"	2-1/4"	15	90	-	DW5446	DW5806	DWA54058	DWA58058
6947SD	5/8" x 8-1/2"	4-3/4"	10	40	-	DW5447	DW5809	DWA54058	DWA58058
6950SD	3/4" x 3-1/4"	1/4"	15	90	-	DW5453	DW5809	DWA54034	DWA54034
6952SD	3/4" x 4-1/2"	1-1/2"	10	60	-	DW5453	DW5809	DWA54034	DWA54034
6954SD	3/4" x 5-1/4"	7/8"	10	60	-	DW5453	DW5809	DWA54034	DWA54034
6956SD	3/4" x 7-1/4"	2-7/8"	10	40	-	DW5453	DW5809	DWA54034	DWA54034
6957SD	3/4" x 8-1/4"	3-7/8"	10	40	-	DW5455	DW5809	DWA54034	DWA54034

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 length which is measured from below the washer to the end of the anchor.
A manual hand pump is available (Cat. No. 08280)
Hollow drill bits must be used with a dust extraction vacuum (Cat. No. DW012)

GENERAL INFORMATION

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. The bolt and cone remain locked together which resists 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

FEATURE 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

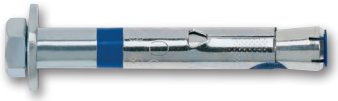
APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors, and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Power-Bolt as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



HEX HEAD
POWER-BOLT ASSEMBLY

FLAT HEAD
POWER-BOLT ASSEMBLY

HEAD STYLES

- Finished Hex Head
- Flat Head

ANCHOR MATERIALS

- Type 304 Stainless Steel (Hex Head)
- Zinc Plated Carbon Steel (Flat Head)

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 5/8" diameter

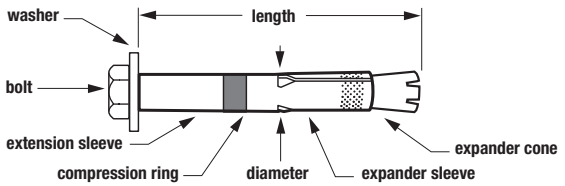
SUITABLE BASE MATERIALS

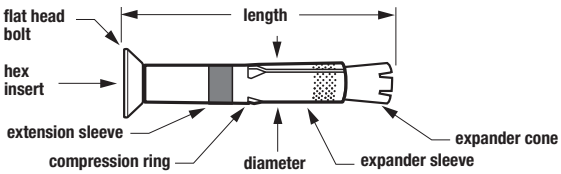
- Normal-weight concrete
- Lightweight concrete
- Grouted Concrete Masonry (CMU)
- Hollow CMU
- Brick Masonry
- Stone

MATERIAL SPECIFICATIONS

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

** Manufactured with a minimum yield strength of 65,000 psi. Stainless steel anchor components are passivated. The stainless steel expander cone is zinc plated.





INSTALLATION SPECIFICATIONS

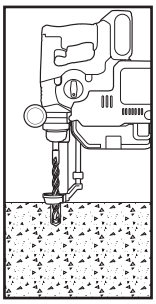
Carbon Steel Flat Head Power-Bolt (80°– 82° head)

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

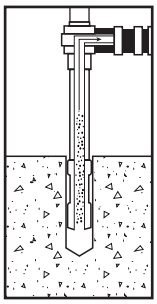
Stainless Steel Hex Head Power-Bolt

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

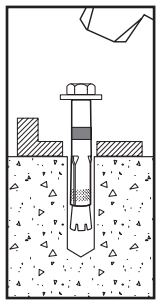
Installation Procedure



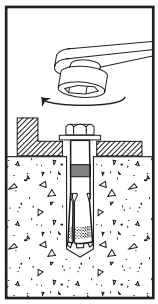
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



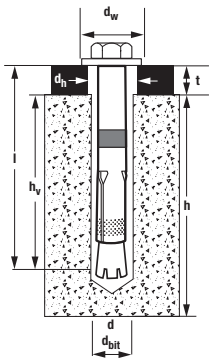
Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Do not modify the anchor or advance the bolt in the anchor assembly prior to installation.

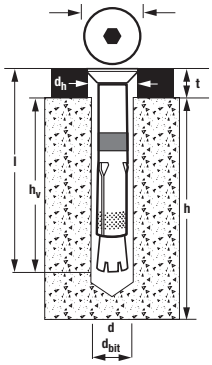


Step 3
Drive the anchor through the fixture into the anchor hole until the bolt head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Step 4
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 = Overall length of anchor
- t = Fixture thickness

Length Identification

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"

PERFORMANCE DATA

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

Anchor Diameter d in.	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	1-1/4 (31.8)	945 (4.2)	1655 (7.4)	1105 (4.9)	1680 (7.5)	1265 (5.6)	1705 (7.6)	1330 (5.9)	1705 (7.6)
	1-3/4 (44.5)	1120 (5.0)	1655 (7.4)	1240 (5.5)	1845 (8.2)	1360 (6.0)	2030 (9.0)	1490 (6.6)	2030 (9.0)
	2-1/2 (63.5)	1505 (6.7)	1655 (7.4)	1550 (6.9)	2185 (9.7)	1600 (7.1)	2710 (12.1)	1680 (7.5)	2710 (12.1)
3/8	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	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	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)

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 and Stainless Steel Power-Bolt in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in.	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	1-1/4 (31.8)	235 (1.0)	415 (1.8)	275 (1.2)	420 (1.9)	315 (1.4)	425 (1.9)	335 (1.5)	425 (1.9)
	1-3/4 (44.5)	280 (1.2)	415 (1.8)	310 (1.4)	460 (2.0)	340 (1.5)	510 (2.3)	375 (1.7)	510 (2.3)
	2-1/2 (63.5)	375 (1.7)	415 (1.8)	390 (1.7)	545 (2.4)	400 (1.8)	680 (3.0)	420 (1.9)	680 (3.0)
3/8	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	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	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)

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 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.

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

Anchor Diameter d in.	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	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	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	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	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)

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 Lightweight Concrete[1,2,3,4]

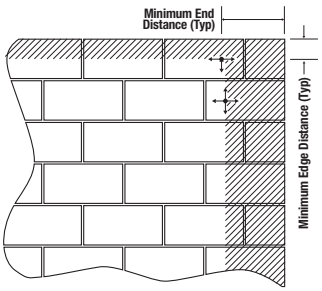
Anchor Diameter d in.	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage Metal Deck, f´c ≥ 3,000 (20.7 MPa)							
		Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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	2-3/4 (88.9)	-	-	-	-	2,000 (9.0)	4,440 (20.0)	500 (2.3)	1,110 (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.
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 Power-Bolt in Grout-Filled Concrete Masonry[1,2,3,4]

Anchor Diameter d in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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	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)

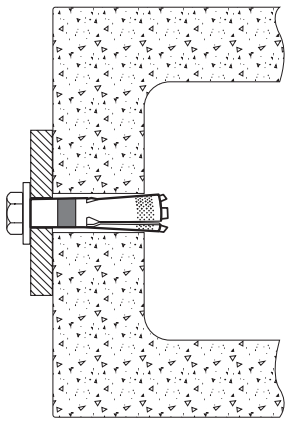
1. Tabulated load values are for carbon steel and stainless steel anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 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.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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)

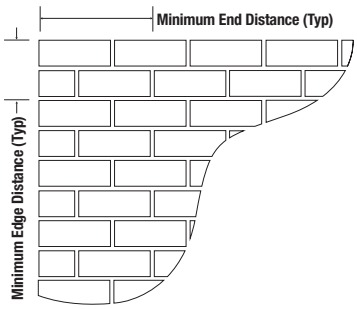
1. Tabulated load values are for carbon steel and stainless steel anchors installed in minimum 6-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 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. A suitable anchor length must be selected which included consideration of fixture to engage the base material at the minimum embedment depth when anchoring into hollow concrete masonry.
(e.g. attachment thickness + embedment + one half inch = suitable anchor length)



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

Anchor Dia. d in.	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance	Min. End Distance	Min. Spacing Distance	Structural Brick Masonry f'm ≥ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	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	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	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	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)

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. 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:

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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	$s_{cr} = 2.0h_v$	$FN_s = FV_s = 1.0$	$s_{min} = h_v$	$FN_s = FV_s = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$FN_c = 1.0$	$c_{min} = 5d$	$FN_c = 0.70$
	Shear	$c_{cr} = 12d$	$FV_c = 1.0$	$c_{min} = 5d$	$FV_c = 0.35$

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	$s_{cr} = 2.0h_v$	$FN_s = FV_s = 1.0$	$s_{min} = h_v$	$FN_s = FV_s = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$FN_c = 1.0$	$c_{min} = 5d$	$FN_c = 0.80$
	Shear	$c_{cr} = 12d$	$FV_c = 1.0$	$c_{min} = 5d$	$FV_c = 0.40$

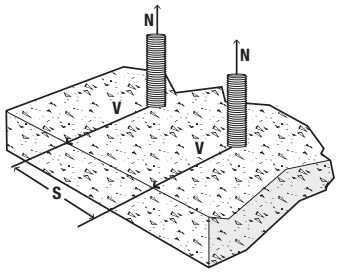
1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an 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.

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})													
Dia. (in.)		1/4			3/8			1/2			5/8		
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
s_{cr} (in.)		2-1/2	3-1/2	5	4	5	7	5	7	10	5-1/2	8	12
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
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	1.00	0.79	0.55	0.69	0.55	-	0.55	-	-	0.50	-	-
	3	1.00	0.86	0.60	0.75	0.60	-	0.60	-	-	0.55	-	-
	3-1/2	1.00	1.00	0.70	0.88	0.70	0.50	0.70	0.50	-	0.64	-	-
	4	1.00	1.00	0.80	1.00	0.80	0.57	0.80	0.57	-	0.73	0.50	-
	4-1/2	1.00	1.00	0.90	1.00	0.90	0.64	0.90	0.64	-	0.82	0.56	-
	5	1.00	1.00	1.00	1.00	1.00	0.71	1.00	0.71	0.50	0.91	0.63	-
	5-1/2	1.00	1.00	1.00	1.00	1.00	0.79	1.00	0.79	0.55	1.00	0.69	-
	6	1.00	1.00	1.00	1.00	1.00	0.86	1.00	0.86	0.60	1.00	0.75	0.50
	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.70	1.00	0.88	0.58
	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.67
	9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.75
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

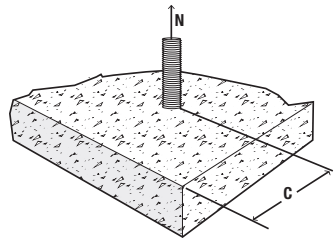
Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.



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

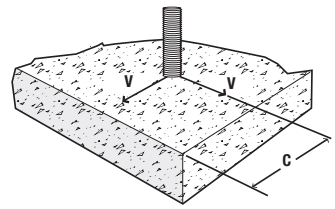
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_{VC})					
Dia. (in.)		1/4	3/8	1/2	5/8
c_{cr} (in.)		3	4-1/2	6	7-1/2
c_{min} (in.)		1-1/4	1-7/8	2-1/2	3-1/8
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	1.00	0.66	0.47	0.35
	3-3/4	1.00	0.81	0.58	0.44
	4	1.00	0.88	0.63	0.48
	4-1/2	1.00	1.00	0.72	0.55
	5	1.00	1.00	0.81	0.63
	6	1.00	1.00	1.00	0.78
	6-1/4	1.00	1.00	1.00	0.81
	7	1.00	1.00	1.00	0.93
	7-1/2	1.00	1.00	1.00	1.00
	8	1.00	1.00	1.00	1.00
	9	1.00	1.00	1.00	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.

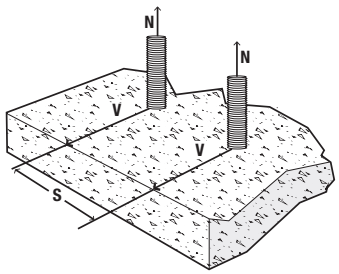


Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})													
Dia. (in.)		1/4			3/8			1/2			5/8		
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
s_{cr} (in.)		2-1/2	3-1/2	5	4	5	7	5	7	10	5-1/2	8	12
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
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	1.00	0.79	0.55	0.69	0.55	-	0.55	-	-	0.50	-	-
	3	1.00	0.86	0.60	0.75	0.60	-	0.60	-	-	0.55	-	-
	3-1/2	1.00	1.00	0.70	0.88	0.70	0.50	0.70	0.50	-	0.64	-	-
	4	1.00	1.00	0.80	1.00	0.80	0.57	0.80	0.57	-	0.73	0.50	-
	4-1/2	1.00	1.00	0.90	1.00	0.90	0.64	0.90	0.64	-	0.82	0.56	-
	5	1.00	1.00	1.00	1.00	1.00	0.71	1.00	0.71	0.50	0.91	0.63	-
	5-1/2	1.00	1.00	1.00	1.00	1.00	0.79	1.00	0.79	0.55	1.00	0.69	-
	6	1.00	1.00	1.00	1.00	1.00	0.86	1.00	0.86	0.60	1.00	0.75	0.50
	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.70	1.00	0.88	0.58
	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	1.00	1.00	0.67
	9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.75
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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

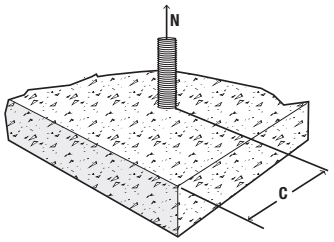
Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.



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

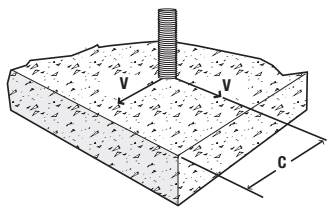
Minimum edge distance (c_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 80% of load.



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

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.

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.

GENERAL INFORMATION

PB-PRO™

Heavy Duty Sleeve Anchor

PRODUCT DESCRIPTION

The PB-PRO is a large diameter torque controlled, heavy duty sleeve anchor designed for concrete applications. Suitable base materials included normal-weight concrete. The anchor is manufactured with a zinc plated carbon steel bolt, sleeve, cone and expansion clip and plastic compression ring. The PB-PRO has a low profile finished hex head.

GENERAL APPLICATIONS AND USES

- Structural connections, i.e., beam and column anchorage
- Safety-related attachments and tension zone applications
- Interior applications / low level corrosion environment
- Heavy duty applications

FEATURES AND BENEFITS

+ Consistent performance in high and low strength concrete
+ High shear load capacity
+ Patented plastic retainer nut prevents loosening components during transport as well as spinning in the drill hole
+ Compression zone in sleeve clamps fixture to the base material

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchoring and 05 05 19 - Post Installed Concrete Anchors
Expansion anchors shall be PB-PRO as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

PB-PRO ASSEMBLY

HEAD STYLES

- Finished Hex Head

ANCHOR MATERIALS

- Zinc plated carbon steel bolt, washer, cone, sleeve, and expansion clip; assembled with a plastic compression ring and retainer nut

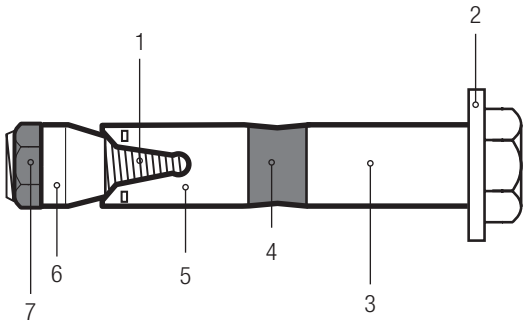
ANCHOR SIZE RANGE (TYP.)

- 16mm through 20mm

SUITABLE BASE MATERIALS

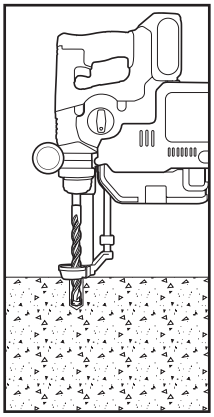
- Normal-weight concrete

MATERIAL SPECIFICATION

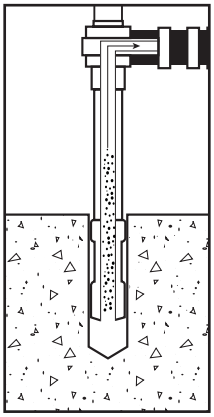


Part No.	Designation	Material	Protection
1	Threaded bolt	Medium Carbon Steel (Grade 8.8)	Zinc plated (5 µm)
2	Washer	Steel Property class 8.8 acc. to EN ISO 7093	Zinc plated (5 µm)
3	Distance sleeve	Medium Carbon Steel	Zinc plated (5 µm)
4	Compression ring	Plastic (HDPE)	-
5	Expansion sleeve	Medium Carbon Steel	Zinc plated (5 µm)
6	Cone nut	Medium Carbon Steel	Zinc plated (5 µm)
7	Retainer nut	Plastic (HDPE)	-

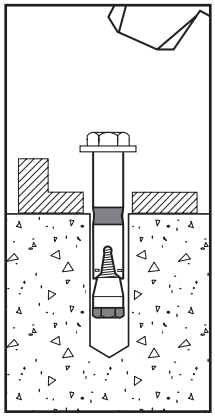
INSTALLATION INSTRUCTIONS



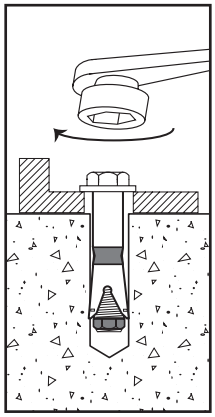
1. Using the proper drill bit size, drill a hole into the base material to the required depth.



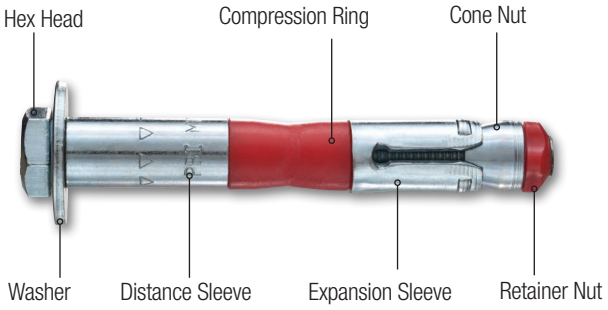
2. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



3. Drive the anchor into the hole through the fixture at least to the minimum required embedment depth.



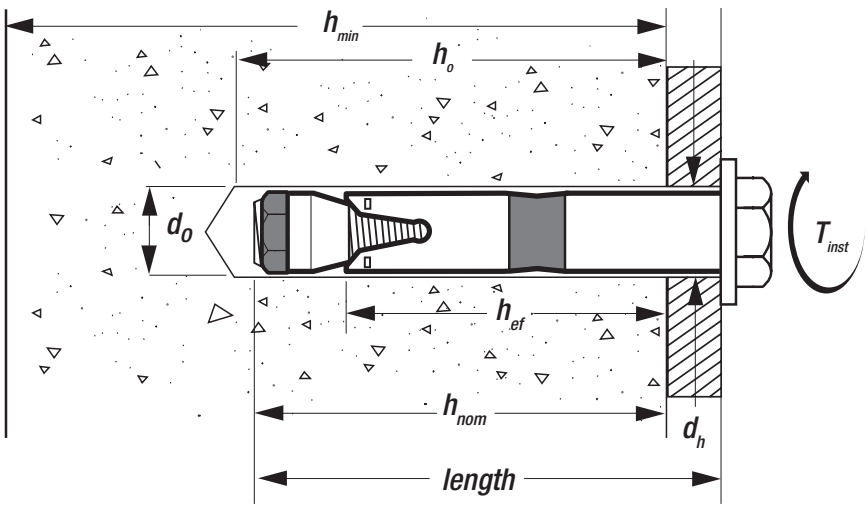
4. Tighten the anchor with a torque wrench by applying the required installation torque Tinst.



INSTALLATION INFORMATION

INSTALLATION DATA

Description	Notation	Unit	PB-PRO	
			M16	M20
Anchor diameter	d	mm (in)	24 (0.94)	28 (1.10)
Head height	-	mm (in)	10.0 (0.39)	12.5 (0.49)
Washer outside diameter	-	mm (in)	50 (1.97)	60 (236)
Internal bolt diameter	-	mm (in)	16 (0.63)	20 (0.79)
Minimum specified yield strength	f_y	MPa (ksi)	640 (92.8)	640 (92.8)
Minimum specified ultimate steel strength	f_{uta}	MPa (ksi)	800 (116)	800 (116)
Nominal drill bit diameter	d_{bit}	mm (in)	24 (0.94)	28 (1.10)
Diameter of hole clearance in fixture	d_h	mm (in)	26 (1.02)	31 (1.22)
Minimum nominal embedment depth	h_{nom}	mm (in)	128 (5.04)	160 (6.30)
Effective embedment depth	h_{ef}	mm (in)	100 (3.94)	125 (4.92)
Minimum hole depth	h_o	mm (in)	155 (6.10)	180 (7.09)
Minimum member thickness	h_{min}	mm (in)	200 (7.87)	250 (9.84)
Minimum spacing	s_{min}	mm (in)	130 (5.12)	140 (5.51)
Corresponding edge distance at s_{min}	for c ≥	mm (in)	240 (9.45)	300 (11.81)
Minimum edge distance	c_{min}	mm (in)	140 (5.51)	140 (5.51)
Corresponding spacing at c_{min}	for s ≥	mm (in)	230 (9.06)	300 (11.81)
Installation torque	T_{inst}	Nm (ft-lb)	130 (96)	200 (148)
Torque wrench socket size	-	mm	24	28



PERFORMANCE DATA

Ultimate Load Capacities for PB-PRO in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter d mm	Minimum Nominal Embed. Depth mm (in)	Minimum Concrete Compressive Strength									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
M16	128 (5.04)	9,135 (40.9)	16,505 (74.0)	10,005 (44.8)	18,080 (81.0)	11,555 (51.8)	20,880 (93.6)	14,145 (63.4)	24,600 (110.3)	16,337 (73.2)	24,600 (110.3)
M20	160 (6.30)	11,515 (51.6)	21,780 (97.6)	12,615 (56.5)	23,860 (106.9)	14,565 (65.3)	27,555 (123.5)	17,840 (80.0)	31,280 (140.2)	20,600 (92.3)	31,280 (140.2)

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 10 or higher may be necessary depending upon the application such as life safety or overhead.

Allowable Load Capacities for PB-PRO in Normal-Weight Concrete[1,2,3]

Nominal Anchor Diameter d mm	Minimum Nominal Embed. Depth mm (in)	Minimum Concrete Compressive Strength									
		2,500 psi		3,000 psi		4,000 psi		6,000 psi		8,000 psi	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
M16	128 (5.04)	2,285 (10.2)	4,125 (18.5)	2,500 (11.2)	4,520 (20.3)	2,890 (13.0)	5,220 (23.4)	3,535 (15.8)	6,150 (27.6)	4,085 (18.3)	6,150 (27.6)
M20	160 (6.30)	2,880 (12.9)	5,445 (24.4)	3,155 (14.1)	5,965 (26.7)	3,640 (16.3)	6,890 (30.9)	4,460 (20.0)	7,820 (35.1)	5,150 (23.1)	7,820 (35.1)

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 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.

Spacing Reduction Factors - Tension (F_{NS})

Nominal Anchor Size		M16	M20
Minimum Spacing s_{min} (mm)		130	140
Nominal Embedment h_{nom} (mm)		128	160
Spacing Distance (mm)	130	0.84	-
	140	0.85	0.80
	150	0.87	0.81
	175	0.91	0.84
	200	0.95	0.87
	225	0.99	0.90
	250	1.00	0.94
	275	1.00	0.97
	300	1.00	1.00

Edge Distance Reduction Factors - Tension (F_{NC})

Nominal Anchor Size		M16	M20
Minimum Edge Distance c_{min} (mm)		140	140
Nominal Embedment h_{nom} (mm)		128	160
Edge Distance (mm)	140	0.58	-
	150	0.63	0.50
	160	0.67	0.53
	175	0.73	0.58
	200	0.83	0.67
	225	0.94	0.75
	250	1.00	0.83
	275	1.00	0.92
	300	1.00	1.00

Spacing Reduction Factors - Shear (F_{VS})

Nominal Anchor Size		M16	M20
Minimum Spacing s_{min} (mm)		130	140
Nominal Embedment h_{nom} (mm)		128	160
Spacing Distance (mm)	130	0.86	-
	140	0.87	0.84
	150	0.88	0.85
	175	0.90	0.87
	200	0.92	0.88
	225	0.94	0.90
	250	0.96	0.92
	275	0.98	0.93
	300	1.00	0.95
	325	1.00	0.97
	350	1.00	0.98
	375	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

Nominal Anchor Size		M16	M20
Minimum Edge Distance c_{min} (mm)		140	140
Nominal Embedment h_{nom} (mm)		128	160
Edge Distance (mm)	140	0.47	0.37
	150	0.50	0.40
	160	0.53	0.43
	175	0.58	0.47
	200	0.67	0.53
	225	0.75	0.60
	250	0.83	0.67
	275	0.92	0.73
	300	1.00	0.80
	325	1.00	0.87
	350	1.00	0.93
	375	1.00	1.00

ORDERING INFORMATION

Carbon Steel Hex Head PB-PRO

Cat No.	Size (Diameter x Length)	Drill Dia	Length*	Std Box	Std Ctn
PFM1220650	PB-PRO 24-M16 x 148mm	24mm	148mm	5	20
PFM1220700	PB-PRO 24-M16 x 178mm	24mm	178mm	5	20
PFM1220750	PB-PRO 28-M20 x 170mm	28mm	170mm	5	15
PFM1220800	PB-PRO 28-M20 x 190mm	28mm	190mm	5	10
PFM1220850	PB-PRO 28-M20 x 220mm	28mm	220mm	5	10

*Length measured from underneath the washer to the end of the anchor.

PB-PRO ACCESSORIES

Metric Drill Bits

SDS-MAX Carbide Drill Bits – 4 Cutter

Cat No.	Size	Drill Dia	Length	Useable Length	Std. Tube
PPA1330220	M24x340x200	24mm	340mm	200mm	1
PPA1330290	M28x380x250	28mm	380mm	250mm	1

Installation Accessories

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

GENERAL INFORMATION

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 design keeps anchor centered in hole
+ Sleeve 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: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors, and 05 05 19 - Post-Installed Concrete Anchors Expansion anchors shall be Lok-Bolt AS as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

LOK-BOLT AS ASSEMBLY

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
- Grouted Concrete Masonry (CMU)
- Hollow Concrete Masonry (CMU)
- Brick Masonry

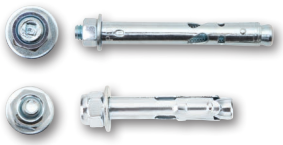
MATERIAL SPECIFICATIONS

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/Zn5)	N/A

INSTALLATION SPECIFICATIONS

Acorn Nut and Hex Head Lok-Bolt AS

Dimension	Nominal Anchor Diameter, d					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	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 Diameter, 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
Phillips Driver Size	#3	#3	#4

Combo Flat Head Lok-Bolt AS

Dimension	Nominal Anchor Diameter, 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
Phillips Driver Size	#2	#3	#4

Rod Hanger Lok-Bolt AS

Dimension	Nominal Anchor Diameter, d		
	1/4"	5/16"	3/8"
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.)	3/8	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

Tie-Wire Lok-Bolt AS

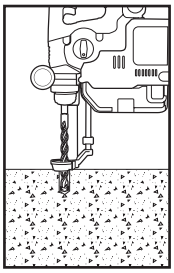
Dimension	Anchor Size, d
	5/16"
ANSI Drill Bit Size, d_{bit} (in.)	5/16
Fixture Clearance Hole, d_h (in.)	3/8
Plow Bolt Size (UNC)	1/4-20
Head Height (in.)	1-9/16
Head Width, d_{hd} (in.)	31/64

INSTALLATION INSTRUCTIONS

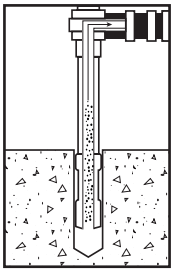
Hex/Acorn/Flat Head Round Versions

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

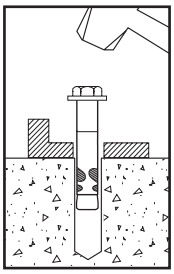


Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

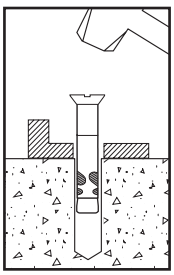


Hex Head/Acorn Nut
Position the washer on the anchor and thread on the nut.

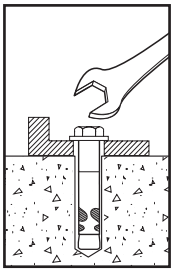
Drive the anchor through the fixture into the anchor hole until the nut and washer are firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



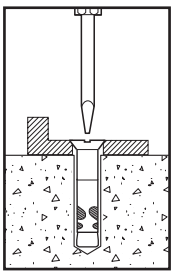
Flat Head/Round Head
Drive the anchor through the fixture until the anchor is firmly seated. Be sure the anchor is driven to the required embedment depth.



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.



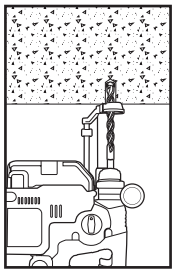
Flat Head/Round Head
Tighten the anchor by turning the head 3 to 5 turns past finger tight.



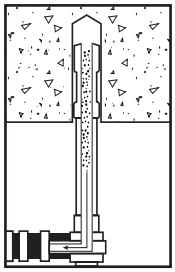
Rod Hanger Version

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.

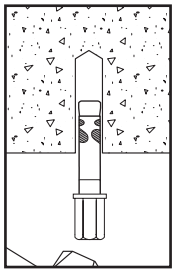
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



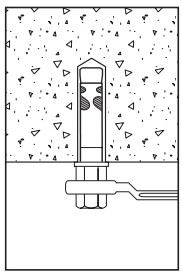
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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



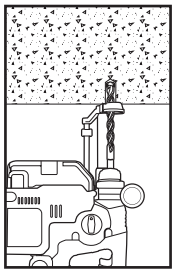
Tighten the coupler nut and washer up to the concrete surface and tighten the anchor by turning the nut 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.



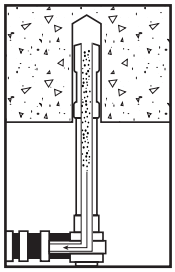
Tie-Wire Version

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.

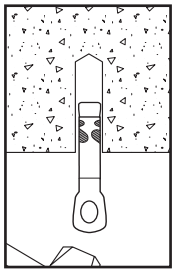
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



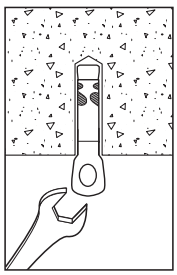
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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 and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt AS Anchors in Normal Weight Concrete[1,2,3,4]

Nominal Anchor Diameter d in.	Min. Embed. Depth h_v in.	Guide Installation Torque ft.-lbs.		Minimum Concrete Compressive Strength, f'c											
				3,000 psi				3,500 psi				4,000 psi			
				Ultimate		Allowable		Ultimate		Allowable		Ultimate		Allowable	
		Carbon	Stainless	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1/2	2	-	225	1,000	55	250	240	1,000	60	250	260	1,000	65	250
	1	6	4	910	1,120	230	280	980	1,120	245	280	1,050	1,120	265	280
5/16	1	12	-	1,205	2,360	300	590	1,300	2,360	325	590	1,390	2,360	350	590
3/8	1-1/4	18	18	1,875	4,110	470	1,030	2,040	4,110	510	1,030	2,165	4,110	540	1,030
1/2	1-1/2	26	26	2,235	4,860	560	1,215	2,420	4,860	605	1,215	2,580	4,860	645	1,215
5/8	2	50	40	4,870	4,860	1,220	1,215	5,260	4,860	1,315	1,215	5,625	4,860	1,405	1,215
3/4	2-1/4	90	60	5,045	11,040	1,260	2,760	5,450	11,040	1,365	2,760	5,825	11,040	1,455	2,760

1. The ultimate load values listed above 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. 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. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 12 times the anchor diameters.
4. The embedment depth is measured from the outside surface of the concrete member to the embedded end of the anchor prior to tightening.

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

Nominal Anchor Diameter d in.	Minimum Embed. Depth h_v in.	Guide Installation Torque ft.-lbs.	Minimum Edge Dist. in.	Minimum End Dist. in.	Ultimate Loads		Allowable Loads	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1	4	3-3/4	4	800	1,140	160	225
5/16	1	8			905	1,570	180	310
3/8	1-1/4	15			1,100	1,570	220	310
1/2	1-1/2	18			1,525	1,570	305	310
5/8	1-1/2	30			2,250	1,770	450	355

1. Tabulated load values are for anchors installed in minimum 6 inch wide, Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N, S, or M. Masonry prism compressive strength must be 1,500 psi minimum at 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.
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. (e.g. attachment thickness + face shell thickness embedment + one half inch = suitable anchor length)
4. The consistence of hollow concrete block masonry base material can vary greatly. Consideration of job site testing should be given to verify conformance of base materials and anchor performance in actual conditions.
5. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 16 times the anchor diameters.
6. The embedment depth is measured from the outside surface of the masonry member to the embedded end of the anchor prior to tightening.

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

Nominal Anchor Diameter d in.	Minimum Embed. Depth h_v in.	Guide Installation Torque ft.-lbs.	Minimum Edge Dist. in.	Minimum End Dist. in.	f'm ≥ 1,500 psi (10.4 MPa)			
					Ultimate		Allowable	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1	4	4	1-1/2	800	950	160	190
3/8	1-1/4	15	8	8	1,100	3,000	220	600
1/2	1-1/2	26	8	8	1,560	3,150	310	630
5/8	2	40	8	8	2,470	5,250	495	1,050

1. Tabulated 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 or overhead.
3. Tabulated load values are for anchors installed at a minimum spacing distance between anchors and an edge distance of 16 times the anchor diameters.
4. The embedment depth is measured from the outside surface of the brick masonry member to the embedded end of the anchor prior to tightening.

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

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

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

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

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

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

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

The published length is the overall length of the anchor

Threshold Flat Head Lok-Bolt AS

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

The published length is the overall length of the anchor

Rod Hanger Lok-Bolt AS

Cat #	Size	Drill Dia.	Std. Box	Std. Ctn.
5810S	1/4" x 1-1/2"	5/16"	50	250
5815S	3/8" x 1-7/8"	3/8"	50	250
5825S	1/2" x 2-1/4"	1/2"	25	125

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

Tie-Wire Lok-Bolt AS

Cat #	Size	Drill Dia.	Std. Box	Std. Ctn.
5700S	5/16" x 2-3/8"	5/16"	100	1000

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

Lok-Bolt AS Extenders

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

GENERAL INFORMATION

SET-BOLT™

Displacement-Controlled Expansion Anchor

PRODUCT DESCRIPTION

The Set-Bolt is a one piece, stud style anchor with an external bottom-bearing expansion plug. It is available in carbon steel for use in concrete, stone and solid masonry units. The design of the Set-Bolt provides an anchor which is ideal for applications in which it is desirable to minimize the clamping force on a fixture. The nut may be placed on finger tight if required to prevent damage to light duty fixtures such as aluminum extrusions or stone facades. Jacking or leveling equipment can easily be accomplished with the Set-Bolt.

GENERAL APPLICATIONS AND USES

- Structural Anchorage
- Mechanical Equipment
- Column Base Plates
- Fire Sprinkler
- Cable Trays and Strut
- Suspended Lighting

FEATURES AND BENEFITS

+ Fast installation with force-controlled setting mechanism
+ No torque wrench required

APPROVALS AND LISTINGS

- Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group VIII, Type 2, (superseded) and CID A-A-55614, Type 2.
- Various North American Departments of Transportation (DOT) – See www.DEWALT.com, including CalTrans listing for "Stud Mechanical Expansion Anchors"

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion Anchors shall be Set-Bolt as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

SET-BOLT

ANCHOR MATERIALS

- Carbon Steel

ANCHOR SIZE RANGE (TYP.)

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

SUITABLE BASE MATERIALS

- Normal-weight concrete

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specification

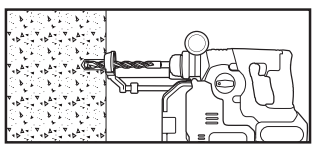
Dimension	Anchor Size, d		
	1/4"	3/8"	1/2"
ANSI Drill Bit Size, (in.)	1/4	3/8	1/2
Max. Tightening Torque, T_{max} (ft.-lbs)	5-7	15-20	22-30
Fixture Clearance Hole, (in.)	5/16	7/16	9/16
Thread Size (UNC)	1/4-20	3/8-16	1/2-13

Material Specification

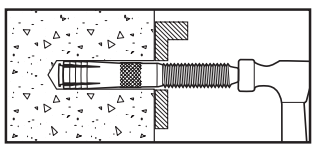
Anchor Component	Component Material
Anchor Body	AISI 12L14
Cone	AISI 12L14
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)

Installation Guidelines

Drill a hole into the base material to a depth that equals the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not over drill the hole. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Insert the anchor through the fixture into the hole. Set the anchor by driving the anchor body over the plug. Be sure the anchor is driven to the required embedment depth. A nut and washer (supplied separately) is applied to secure the fixture.



PERFORMANCE DATA

Ultimate Load Capacities for Set-Bolt Installed in Normal-Weight Concrete[1,2]

Anchor Diameter d in.	Minimum Embedment in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-3/8	1,150	1,780	1,935	2,070	2,320	2,070
3/8	1-5/8	2,605	3,705	3,600	4,185	3,850	4,185
1/2	1-7/8	3,595	5,140	5,000	6,000	5,265	6,000

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.

Allowable Load Capacities for Set-Bolt Installed in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in.	Minimum Embedment in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-3/8	290	445	485	520	580	520
3/8	1-5/8	650	925	900	1,045	965	1,045
1/2	1-7/8	900	1,285	1,250	1,500	1,315	1,500

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors 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:

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

Load Adjustment Factors for Spacing and Edge Distances

Anchor 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	$F_N = F_V$ =1.0	s_{min} = 5d	$F_N = F_V$ =0.50
Edge Distance (c)	Tension	c_{cr} = 12d	F_N = 1.0	c_{min} = 5d	F_N = 0.80
	Shear	c_{cr} = 12d	F_V = 1.0	c_{min} = 5d	F_V = 0.50

ORDERING INFORMATION

Set-Bolt

Cat. No.	Size	Min. Embed.	Thread Length	Std. Box	Std. Carton	Wt./100
7101	1/4" x 1-3/4"	1-3/8"	5/8"	100	1,000	2-1/4
7103	1/4" x 2-1/4"	1-3/8"	7/8"	100	500	2-3/4
7123	3/8" x 2-1/4"	1-5/8"	5/8"	50	250	6-1/2
7126	3/8" x 3"	1-5/8"	1-3/8"	50	250	8-1/2
7151	1/2" x 4-1/4"	1-7/8"	1-7/8"	25	125	24

GENERAL INFORMATION

SCREW-BOLT+™

High Performance Screw Anchor

PRODUCT DESCRIPTION

The Screw-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 patented thread design, designed for use with standard ANSI drill bits, reduces installation torque and enhances productivity. The steel threads along the anchor body tap into the hole during installation to provide keyed engagement and allow for reduced edge and spacing distances. The Screw-Bolt+ finish is available in bright zinc-plated and mechanically galvanized. Suitable base materials include normal-weight concrete, sand-lightweight concrete, concrete over steel deck, concrete masonry and solid clay brick.

GENERAL APPLICATIONS AND USES

- Racking, shelving and material handling
- Support ledgers and sill plate attachments
- Temporary attachments
- Glazing and window attachments
- Retrofits, repairs and maintenance
- Fencing and railing
- Cracked and uncracked concrete
- Seismic and wind loading

FEATURES AND BENEFITS

+ Designed for standard ANSI tolerance drill bits
+ Patented thread design offers toughened threads for tapping high strength concrete
+ Low installation torque in concrete and masonry
+ Universal product for concrete and grouted/solid masonry
+ Ratchet teeth on underside of hex washer head lock against the fixture
+ Can be installed closer to the edge than traditional expansion anchors
+ Fully removable and reinstallable in same hole
+ Fast installation with powered impact wrench, can also be installed manually
+ Diameter, length and identifying marking stamped on head of each anchor
+ One-piece, finished head design

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3889 for concrete. Code compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- International Code Council, Evaluation Service (ICC-ES), ESR-4042 for masonry. Code compliant with 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural applications in concrete under the design provisions of ACI 318 (Strength Design Method)
- 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

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Screw anchors shall be Screw-Bolt+ as supplied by DEWALT, Towson, MD. 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 (see minimum strength properties on the next page)
Plating	Standard zinc plated version	Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn 5). Minimum plating requirements for Mild Service Condition.
	Mechanically galvanized version	Mechanically Galvanized Zinc plating according to ASTM B 695, Class 55

SECTION CONTENTS

SCREW-BOLT+

HEAD STYLES

- Hex Washer Head

ANCHOR MATERIALS

- Zinc plated carbon steel or mechanically galvanized

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 3/4" diameter (see ordering information)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Lightweight concrete
- Concrete over steel deck
- Grouted Concrete Masonry (CMU)
- Brick Masonry

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED ICC-ES ESR-3889 CONCRETE

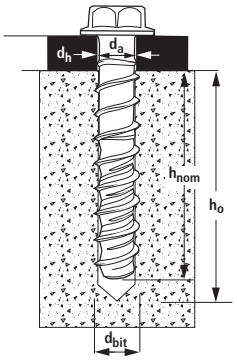
CODE LISTED ICC-ES ESR-4042 MASONRY

DDA DEWALT DESIGN ASSIST

DUSTX+ ANCHOR INSTALLATION SYSTEM

INSTALLATION SPECIFICATIONS (ASD)

Screw-Bolt+ Anchor Detail



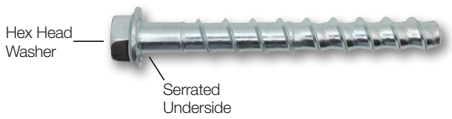
Nomenclature

d_a = Diameter of Anchor
d_{bit} = Diameter of Drill Bit
d_h = Diameter of Clearance Hole
h = Base Material Thickness. The value of h should be $1.5h_{nom}$ or 3", whichever is greater
h_{nom} = Minimum Nominal Embedment
h_o = Minimum Hole Depth

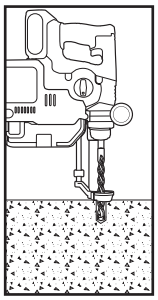
Hex Head Marking

Legend

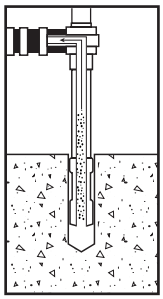
Diameter and Length Identification Mark



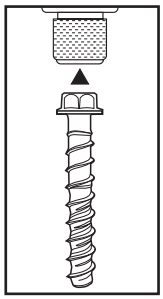
Installation Instructions for Screw-Bolt+



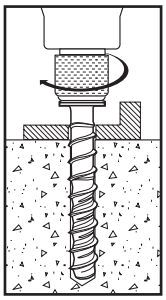
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI standard B212.15



Step 2
Remove dust and debris from hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created during drilling.



Step 3
Select a torque wrench or powered impact wrench and do not exceed the maximum torque, $T_{inst,max}$ or $T_{impact,max}$ respectively for the selected anchor diameter and embedment. Attach an appropriate sized hex socket/driver to the impact wrench. Mount the screw anchor head into the socket.



Step 4
Drive the anchor into the hole until the head of the anchor comes into contact with the fixture. The anchor must be snug after installation. Do not spin the hex socket off the anchor to disengage.

REFERENCE DATA (ASD)

Installation Specifications for Screw-Bolt+ in Concrete and Supplemental Information

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)				
			1/4	3/8	1/2	5/8	3/4
Anchor outside diameter	d	in. (mm)	0.250 (6.35)	0.375 (9.53)	0.500 (12.70)	0.625 (15.88)	0.750 (19.05)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI	3/8 ANSI	1/2 ANSI	5/8 ANSI	3/4 ANSI
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)
Minimum embedment depth[2]	h_{nom}	in. (mm)	1 (25)	1-1/2 (38)	1-3/4 (44)	2-1/2 (64)	2-1/2 (64)
Minimum hole depth	h_o	in. (mm)	1-3/8 (35)	1-7/8 (48)	2-1/8 (54)	2-7/8 (73)	2-7/8 (73)
Minimum member thickness[1]	h_{min}	in. (mm)	3 (76)	3 (76)	3 (76)	3-3/4 (95)	3-3/4 (95)
Minimum edge distance	c_{min}	in. (mm)	1-1/2 (38)	1-1/2 (38)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Minimum spacing	s_{min}	in. (mm)	1-1/2 (38)	2 (51)	2-3/4 (70)	2-3/4 (70)	3 (76)
Max Installation torque	$T_{inst,max}$	ft.-lbf. (N-m)	19 (26)	25 (34)	45 (61)	60 (81)	70 (95)
Max impact wrench power (torque)	$T_{impact,max}$	ft.-lbf. (N-m)	150 (203)	300 (407)	300 (407)	700 (950)	700 (950)
Impact wrench socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8
Maximum head height	-	in.	21/64	3/8	31/64	37/64	43/64
Maximum washer diameter	-	in.	37/64	3/4	1-1/16	1-1/8	1-13/32
Effective tensile stress area (screw anchor body)	A_{se}	in^2 (mm^2)	0.045 (29.0)	0.094 (60.6)	0.176 (113.5)	0.274 (176.8)	0.399 (257.4)
Minimum specified ultimate strength	f_{uta}	ksi (N/mm^2)	100 (690)	92.5 (638)	115 (794)	95 (656)	95 (656)
Minimum specified yield strength	f_y	ksi (N/mm^2)	80 (552)	74 (511)	92 (635)	76 (524)	76 (524)

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

1. The minimum base material thickness shall be the greater of $1.5 \bullet h_{nom}$ or 3 inches.
2. See load capacities in normal weight concrete for additional embedment depths.

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

Nominal Anchor Diameter in.	Minimum Nominal 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)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1 (25)	1,325 (5.9)	1,660 (7.4)	1,400 (6.2)	1,755 (7.8)	1,530 (6.8)	1,910 (8.5)	1,725 (7.7)	2,080 (9.3)	1,725 (7.7)	2,080 (9.3)
	1-5/8 (41)	2,835 (12.6)	1,660 (7.4)	2,995 (13.3)	1,755 (7.8)	3,265 (14.5)	1,910 (8.5)	3,265 (14.5)	2,080 (9.3)	3,265 (14.5)	2,080 (9.3)
	2-1/2 (64)	3,650 (16.2)	2,025 (9.0)	3,855 (17.1)	2,140 (9.5)	4,200 (18.7)	2,335 (10.4)	4,270 (19.0)	2,545 (11.3)	4,270 (19.0)	2,545 (11.3)
3/8	1-1/2 (38)	2,630 (11.7)	3,550 (15.8)	2,880 (12.8)	3,890 (17.3)	3,330 (14.8)	4,490 (20.0)	4,075 (18.1)	5,500 (24.5)	4,075 (18.1)	6,355 (28.3)
	2 (51)	3,670 (16.3)	4,320 (19.2)	4,020 (17.9)	4,735 (21.1)	4,645 (20.7)	5,465 (24.3)	4,725 (21.0)	6,345 (28.2)	5,455 (24.3)	6,345 (28.2)
	3-1/4 (83)	7,420 (33.0)	6,325 (28.1)	8,130 (36.2)	6,930 (30.8)	9,065 (40.3)	8,000 (35.6)	9,065 (40.3)	8,565 (38.1)	10,350 (46.0)	8,565 (38.1)
	4-1/2 (114)	10,905 (48.5)	6,325 (28.1)	11,945 (53.1)	6,930 (30.8)	13,795 (61.4)	8,000 (35.6)	15,075 (67.1)	8,565 (38.1)	15,075 (67.1)	8,565 (38.1)
1/2	1-3/4 (44)	2,840 (12.6)	5,985 (26.6)	3,115 (13.9)	6,555 (29.2)	3,595 (16.0)	7,570 (33.7)	4,400 (19.6)	9,270 (41.2)	4,400 (19.6)	10,705 (47.6)
	2-1/2 (64)	6,680 (29.7)	8,035 (35.7)	7,320 (32.6)	8,800 (39.1)	8,450 (37.6)	10,160 (45.2)	8,450 (37.6)	11,545 (51.4)	8,450 (37.6)	11,545 (51.4)
	4-1/4 (108)	13,260 (59.0)	9,395 (41.8)	14,525 (64.6)	10,290 (45.8)	16,480 (73.3)	11,885 (52.9)	16,480 (73.3)	13,520 (60.1)	16,480 (73.3)	13,520 (60.1)
	5-1/2 (140)	15,730 (70.0)	9,395 (41.8)	17,235 (76.7)	10,290 (45.8)	19,900 (88.5)	11,885 (52.9)	21,310 (94.8)	13,520 (60.1)	21,310 (94.8)	13,520 (60.1)
5/8	2-1/2 (64)	5,735 (25.5)	10,615 (47.2)	6,285 (28.0)	11,630 (51.7)	7,255 (32.3)	13,425 (59.7)	8,885 (39.5)	16,445 (73.2)	8,885 (39.5)	17,170 (76.4)
	3-1/4 (83)	9,755 (43.4)	12,065 (53.7)	10,685 (47.5)	13,220 (58.8)	12,340 (54.9)	15,265 (67.9)	12,340 (54.9)	17,170 (76.4)	12,340 (54.9)	17,170 (76.4)
	5 (127)	14,455 (64.3)	13,675 (60.8)	15,830 (70.4)	14,980 (66.6)	18,280 (81.3)	17,295 (76.9)	19,295 (85.8)	19,485 (86.7)	22,280 (99.1)	19,485 (86.7)
	6-1/4 (159)	20,520 (91.3)	13,675 (60.8)	22,475 (100.0)	14,980 (66.6)	25,955 (115.5)	17,295 (76.9)	31,785 (141.4)	19,485 (86.7)	31,785 (141.4)	19,485 (86.7)
3/4	2-1/2 (64)	6,035 (26.8)	11,615 (51.7)	6,610 (29.4)	12,725 (56.6)	7,635 (34.0)	14,690 (65.3)	9,350 (41.6)	17,995 (80.0)	9,350 (41.6)	20,775 (92.4)
	4-1/4 (108)	11,900 (52.9)	17,055 (75.9)	13,035 (58.0)	18,685 (83.1)	15,050 (66.9)	21,575 (96.0)	17,745 (78.9)	24,270 (108.0)	20,490 (91.1)	24,270 (108.0)
	5 (127)	19,020 (84.6)	17,055 (75.9)	20,835 (92.7)	18,685 (83.1)	24,055 (107.0)	21,575 (96.0)	29,460 (131.0)	24,270 (108.0)	29,460 (131.0)	24,270 (108.0)
	6-1/4 (159)	20,495 (91.2)	17,055 (75.9)	22,450 (99.9)	18,685 (83.1)	25,920 (115.3)	21,575 (96.0)	31,750 (141.2)	24,270 (108.0)	31,750 (141.2)	24,270 (108.0)

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

Allowable Load Capacities for Screw-Bolt+ in Normal-Weight Concrete[1,2,3,4,5]

Nominal Anchor Diameter in.	Minimum Nominal 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)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1 (25)	330 (1.5)	415 (1.8)	350 (1.6)	440 (2.0)	385 (1.7)	480 (2.1)	430 (1.9)	520 (2.3)	430 (1.9)	520 (2.3)
	1-5/8 (41)	710 (3.2)	415 (1.8)	750 (3.3)	440 (2.0)	815 (3.6)	480 (2.1)	815 (3.6)	520 (2.3)	815 (3.6)	520 (2.3)
	2-1/2 (64)	915 (4.1)	505 (2.2)	965 (4.3)	535 (2.4)	1,050 (4.7)	585 (2.6)	1,070 (4.8)	635 (2.8)	1,070 (4.8)	635 (2.8)
3/8	1-1/2 (38)	660 (2.9)	890 (4.0)	720 (3.2)	975 (4.3)	835 (3.7)	1,125 (5.0)	1,020 (4.5)	1,375 (6.1)	1,020 (4.5)	1,590 (7.1)
	2 (51)	920 (4.1)	1,080 (4.8)	1,005 (4.5)	1,185 (5.3)	1,160 (5.2)	1,365 (6.1)	1,180 (5.2)	1,585 (7.1)	1,365 (6.1)	1,585 (7.1)
	3-1/4 (83)	1,855 (8.3)	1,580 (7.0)	2,035 (9.1)	1,735 (7.7)	2,265 (10.1)	2,000 (8.9)	2,265 (10.1)	2,140 (9.5)	2,590 (11.5)	2,140 (9.5)
	4-1/2 (114)	2,725 (12.1)	1,580 (7.0)	2,985 (13.3)	1,735 (7.7)	3,450 (15.3)	2,000 (8.9)	3,770 (16.8)	2,140 (9.5)	3,770 (16.8)	2,140 (9.5)
1/2	1-3/4 (44)	710 (3.2)	1,495 (6.7)	780 (3.5)	1,640 (7.3)	900 (4.0)	1,895 (8.4)	1,100 (4.9)	2,320 (10.3)	1,100 (4.9)	2,675 (11.9)
	2-1/2 (64)	1,670 (7.4)	2,010 (8.9)	1,830 (8.1)	2,200 (9.8)	2,115 (9.4)	2,540 (11.3)	2,115 (9.4)	2,885 (12.8)	2,115 (9.4)	2,885 (12.8)
	4-1/4 (108)	3,315 (14.7)	2,350 (10.5)	3,630 (16.1)	2,575 (11.5)	4,120 (18.3)	2,970 (13.2)	4,120 (18.3)	3,380 (15.0)	4,120 (18.3)	3,380 (15.0)
	5-1/2 (140)	3,935 (17.5)	2,350 (10.5)	4,310 (19.2)	2,575 (11.5)	4,975 (22.1)	2,970 (13.2)	5,330 (23.7)	3,380 (15.0)	5,330 (23.7)	3,380 (15.0)
5/8	2-1/2 (64)	1,435 (6.4)	2,655 (11.8)	1,570 (7.0)	2,910 (12.9)	1,815 (8.1)	3,355 (14.9)	2,220 (9.9)	4,110 (18.3)	2,220 (9.9)	4,295 (19.1)
	3-1/4 (83)	2,440 (10.9)	3,015 (13.4)	2,670 (11.9)	3,305 (14.7)	3,085 (13.7)	3,815 (17.0)	3,085 (13.7)	4,295 (19.1)	3,085 (13.7)	4,295 (19.1)
	5 (127)	3,615 (16.1)	3,420 (15.2)	3,960 (17.6)	3,745 (16.7)	4,570 (20.3)	4,325 (19.2)	4,825 (21.5)	4,870 (21.7)	5,570 (24.8)	4,870 (21.7)
	6-1/4 (159)	5,130 (22.8)	3,420 (15.2)	5,620 (25.0)	3,745 (16.7)	6,490 (28.9)	4,325 (19.2)	7,945 (35.3)	4,870 (21.7)	7,945 (35.3)	4,870 (21.7)
3/4	2-1/2 (64)	1,510 (6.7)	2,905 (12.9)	1,655 (7.4)	3,180 (14.1)	1,910 (8.5)	3,675 (16.3)	2,340 (10.4)	4,500 (20.0)	2,340 (10.4)	5,195 (23.1)
	4-1/4 (108)	2,975 (13.2)	4,265 (19.0)	3,260 (14.5)	4,670 (20.8)	3,765 (16.7)	5,395 (24.0)	4,435 (19.7)	6,070 (27.0)	5,125 (22.8)	6,070 (27.0)
	5 (127)	4,755 (21.2)	4,265 (19.0)	5,210 (23.2)	4,670 (20.8)	6,015 (26.8)	5,395 (24.0)	7,365 (32.8)	6,070 (27.0)	7,365 (32.8)	6,070 (27.0)
	6-1/4 (159)	5,125 (22.8)	4,265 (19.0)	5,615 (25.0)	4,670 (20.8)	6,480 (28.8)	5,395 (24.0)	7,940 (35.3)	6,070 (27.0)	7,940 (35.3)	6,070 (27.0)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
5. Anchors may be used in lightweight concrete provided the allowable load capacities are multiplied by a reduction factor of 0.60.

LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Edge Distance Reduction Factors - Tension (F_{NC})

Diameter (in)		1/4			3/8				1/2				5/8				3/4			
Nominal Embedment h_{nom} (in)		1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
Min. Edge Distance c_{min} (in)		1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4
Edge Distance (inches)	1-1/2	1.00	0.77	0.64	0.85	0.74	0.59	0.55	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	1.00	0.83	0.67	0.93	0.79	0.62	0.57	0.87	0.71	0.58	0.54	0.73	0.65	0.56	0.53	0.73	0.59	0.56	0.53
	2	1.00	0.88	0.71	1.00	0.84	0.65	0.59	0.94	0.76	0.60	0.56	0.78	0.68	0.58	0.54	0.78	0.61	0.58	0.54
	2-1/4	1.00	0.94	0.75	1.00	0.89	0.68	0.61	1.00	0.80	0.63	0.57	0.82	0.71	0.60	0.56	0.82	0.63	0.60	0.56
	2-1/2	1.00	1.00	0.78	1.00	0.95	0.71	0.63	1.00	0.84	0.65	0.59	0.87	0.75	0.62	0.57	0.87	0.66	0.62	0.57
	2-3/4	1.00	1.00	0.82	1.00	1.00	0.74	0.65	1.00	0.88	0.67	0.61	0.91	0.78	0.64	0.59	0.91	0.68	0.64	0.59
	3	1.00	1.00	0.86	1.00	1.00	0.77	0.67	1.00	0.92	0.69	0.62	0.96	0.81	0.66	0.60	0.96	0.70	0.66	0.60
	3-1/2	1.00	1.00	0.93	1.00	1.00	0.83	0.71	1.00	1.00	0.74	0.65	1.00	0.87	0.69	0.63	1.00	0.75	0.69	0.63
	4	1.00	1.00	1.00	1.00	1.00	0.88	0.75	1.00	1.00	0.78	0.69	1.00	0.94	0.73	0.66	1.00	0.79	0.73	0.66
	4-1/2	1.00	1.00	1.00	1.00	1.00	0.94	0.79	1.00	1.00	0.82	0.72	1.00	1.00	0.77	0.69	1.00	0.84	0.77	0.69
	5	1.00	1.00	1.00	1.00	1.00	1.00	0.84	1.00	1.00	0.87	0.75	1.00	1.00	0.81	0.72	1.00	0.89	0.81	0.72
	5-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.91	0.79	1.00	1.00	0.85	0.75	1.00	0.93	0.85	0.75
	6	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	0.96	0.82	1.00	1.00	0.89	0.78	1.00	0.98	0.89	0.78
	6-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	0.85	1.00	1.00	0.92	0.81	1.00	1.00	0.92	0.81
	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	0.96	0.84	1.00	1.00	0.96	0.84
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	1.00	0.87	1.00	1.00	1.00	0.87
	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.90	1.00	1.00	1.00	0.90
	8-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.93	1.00	1.00	1.00	0.93
	9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	0.96
	9-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.99
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Spacing Reduction Factors - Tension (F_{NS})

Diameter (in)		1/4			3/8				1/2				5/8				3/4			
Nominal Embedment h_{nom} (in)		1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
Minimum Spacing s_{min} (in)		1-1/2	1-1/2	1-1/2	2	2	2	2	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	3	3	3	3
Spacing Distance (inches)	1-1/2	0.89	0.73	0.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	0.94	0.77	0.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	1.00	0.80	0.70	0.88	0.77	0.67	0.63	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/4	1.00	0.83	0.72	0.93	0.80	0.69	0.64	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/2	1.00	0.86	0.74	0.97	0.83	0.70	0.65	-	-	-	-	-	-	-	-	-	-	-	-
	2-3/4	1.00	0.89	0.76	1.00	0.86	0.72	0.66	0.92	0.78	0.67	0.64	0.80	0.73	0.65	0.63	-	-	-	-
	3	1.00	0.92	0.78	1.00	0.89	0.74	0.67	0.95	0.80	0.68	0.65	0.83	0.74	0.66	0.64	0.83	0.69	0.66	0.64
	3-1/2	1.00	0.99	0.82	1.00	0.94	0.77	0.70	1.00	0.85	0.71	0.67	0.88	0.78	0.68	0.65	0.88	0.71	0.68	0.65
	4	1.00	1.00	0.86	1.00	1.00	0.80	0.72	1.00	0.89	0.73	0.68	0.92	0.81	0.70	0.67	0.93	0.74	0.71	0.67
	4-1/2	1.00	1.00	0.90	1.00	1.00	0.83	0.74	1.00	0.93	0.75	0.70	0.97	0.85	0.72	0.68	0.97	0.76	0.73	0.69
	5	1.00	1.00	0.94	1.00	1.00	0.86	0.76	1.00	0.98	0.78	0.72	1.00	0.88	0.75	0.70	1.00	0.79	0.75	0.70
	5-1/2	1.00	1.00	0.97	1.00	1.00	0.89	0.78	1.00	1.00	0.80	0.74	1.00	0.92	0.77	0.72	1.00	0.81	0.77	0.72
	6	1.00	1.00	1.00	1.00	1.00	0.93	0.81	1.00	1.00	0.82	0.75	1.00	0.95	0.79	0.73	1.00	0.84	0.79	0.73
	6-1/2	1.00	1.00	1.00	1.00	1.00	0.96	0.83	1.00	1.00	0.85	0.77	1.00	0.98	0.81	0.75	1.00	0.86	0.81	0.75
	7	1.00	1.00	1.00	1.00	1.00	0.99	0.85	1.00	1.00	0.87	0.79	1.00	1.00	0.83	0.76	1.00	0.89	0.83	0.77
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	0.90	0.81	1.00	1.00	0.85	0.78	1.00	0.91	0.85	0.78
	8	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	0.92	0.83	1.00	1.00	0.87	0.80	1.00	0.94	0.87	0.80
	8-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	0.94	0.84	1.00	1.00	0.89	0.81	1.00	0.96	0.89	0.81
	9	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	0.97	0.86	1.00	1.00	0.91	0.83	1.00	0.99	0.91	0.83
	9-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	0.99	0.88	1.00	1.00	0.93	0.84	1.00	1.00	0.93	0.85
	10	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.90	1.00	1.00	0.95	0.86	1.00	1.00	0.95	0.86
	10-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	1.00	0.97	0.88	1.00	1.00	0.97	0.88
	11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.00	1.00	0.99	0.89	1.00	1.00	0.99	0.89
	11-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.91	1.00	1.00	1.00	0.91
	12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.92	1.00	1.00	1.00	0.93
	13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	0.96
	14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.99
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Edge Distance Reduction Factors - Shear (F_{VC})

Diameter (in)		1/4			3/8				1/2				5/8				3/4			
Nominal Embedment h_{nom} (in)		1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
Min. Edge Distance c_{min}(in)		1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4
Edge Distance (inches)	1-1/2	0.58	0.63	0.59	0.40	0.37	0.31	0.32	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	0.68	0.73	0.69	0.46	0.43	0.36	0.38	0.35	0.31	0.30	0.31	0.27	0.26	0.25	0.26	0.26	0.22	0.22	0.23
	2	0.78	0.84	0.78	0.53	0.49	0.41	0.43	0.41	0.35	0.35	0.36	0.30	0.29	0.29	0.30	0.30	0.25	0.26	0.27
	2-1/4	0.87	0.94	0.88	0.59	0.55	0.46	0.48	0.46	0.40	0.39	0.40	0.34	0.33	0.32	0.33	0.33	0.28	0.29	0.30
	2-1/2	0.97	1.00	0.98	0.66	0.61	0.51	0.54	0.51	0.44	0.43	0.45	0.38	0.36	0.36	0.37	0.37	0.31	0.32	0.33
	2-3/4	1.00	1.00	1.00	0.73	0.67	0.56	0.59	0.56	0.49	0.48	0.49	0.42	0.40	0.40	0.41	0.41	0.34	0.35	0.37
	3	1.00	1.00	1.00	0.79	0.73	0.61	0.64	0.61	0.53	0.52	0.54	0.46	0.44	0.43	0.45	0.44	0.38	0.39	0.40
	3-1/2	1.00	1.00	1.00	0.92	0.85	0.72	0.75	0.71	0.62	0.61	0.63	0.53	0.51	0.50	0.52	0.52	0.44	0.45	0.47
	4	1.00	1.00	1.00	1.00	0.97	0.82	0.86	0.81	0.71	0.69	0.72	0.61	0.58	0.57	0.59	0.59	0.50	0.51	0.53
	4-1/2	1.00	1.00	1.00	1.00	1.00	0.92	0.97	0.91	0.80	0.78	0.81	0.68	0.66	0.65	0.67	0.67	0.56	0.58	0.60
	5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.87	0.90	0.76	0.73	0.72	0.74	0.74	0.63	0.64	0.66
	5-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	0.99	0.84	0.80	0.79	0.82	0.82	0.69	0.71	0.73
	6	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.88	0.86	0.89	0.89	0.75	0.77	0.80
	6-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.95	0.93	0.97	0.96	0.81	0.84	0.86
	7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	0.90	0.93
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.96	1.00
	8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Spacing Reduction Factors - Shear (F_{VS})

Diameter (in)		1/4			3/8				1/2				5/8				3/4			
Nominal Embedment h_{nom} (in)		1	1-5/8	2-1/2	1-1/2	2	3-1/4	4-1/2	1-3/4	2-1/2	4-1/4	5-1/2	2-1/2	3-1/4	5	6-1/4	2-1/2	4-1/4	5	6-1/4
Minimum Spacing s_{min} (in)		1-1/2	1-1/2	1-1/2	2	2	2	2	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	2-3/4	3	3	3	3
Spacing Distance (inches)	1-1/2	0.60	0.60	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-3/4	0.61	0.62	0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	0.63	0.64	0.63	0.59	0.58	0.57	0.57	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/4	0.65	0.66	0.65	0.60	0.59	0.58	0.58	-	-	-	-	-	-	-	-	-	-	-	-
	2-1/2	0.66	0.67	0.66	0.61	0.60	0.59	0.59	-	-	-	-	-	-	-	-	-	-	-	-
	2-3/4	0.68	0.69	0.68	0.62	0.61	0.59	0.60	0.59	0.58	0.58	0.58	0.57	0.57	0.57	0.57	-	-	-	-
	3	0.69	0.71	0.70	0.63	0.62	0.60	0.61	0.60	0.59	0.59	0.59	0.58	0.57	0.57	0.57	0.57	0.56	0.56	0.57
	3-1/2	0.73	0.74	0.73	0.65	0.64	0.62	0.63	0.62	0.60	0.60	0.60	0.59	0.59	0.58	0.59	0.59	0.57	0.57	0.58
	4	0.76	0.78	0.76	0.68	0.66	0.64	0.64	0.64	0.62	0.62	0.62	0.60	0.60	0.60	0.60	0.60	0.58	0.59	0.59
	4-1/2	0.79	0.81	0.79	0.70	0.68	0.65	0.66	0.65	0.63	0.63	0.63	0.61	0.61	0.61	0.61	0.61	0.59	0.60	0.60
	5	0.82	0.85	0.83	0.72	0.70	0.67	0.68	0.67	0.65	0.64	0.65	0.63	0.62	0.62	0.62	0.62	0.60	0.61	0.61
	5-1/2	0.86	0.88	0.86	0.74	0.72	0.69	0.70	0.69	0.66	0.66	0.66	0.64	0.63	0.63	0.64	0.64	0.61	0.62	0.62
	6	0.89	0.92	0.89	0.76	0.74	0.70	0.71	0.70	0.68	0.67	0.68	0.65	0.65	0.64	0.65	0.65	0.63	0.63	0.63
	6-1/2	0.92	0.95	0.92	0.79	0.76	0.72	0.73	0.72	0.69	0.69	0.69	0.66	0.66	0.66	0.66	0.66	0.64	0.64	0.64
	7	0.95	0.99	0.96	0.81	0.78	0.74	0.75	0.74	0.71	0.70	0.71	0.68	0.67	0.67	0.67	0.67	0.65	0.65	0.66
	7-1/2	0.99	1.00	0.99	0.83	0.80	0.76	0.77	0.75	0.72	0.72	0.72	0.69	0.68	0.68	0.69	0.69	0.66	0.66	0.67
	8	1.00	1.00	1.00	0.85	0.82	0.77	0.79	0.77	0.74	0.73	0.74	0.70	0.69	0.69	0.70	0.70	0.67	0.67	0.68
	9	1.00	1.00	1.00	0.90	0.87	0.81	0.82	0.80	0.77	0.76	0.77	0.73	0.72	0.72	0.72	0.72	0.69	0.69	0.70
	10	1.00	1.00	1.00	0.94	0.91	0.84	0.86	0.84	0.80	0.79	0.80	0.75	0.74	0.74	0.75	0.75	0.71	0.71	0.72
	11	1.00	1.00	1.00	0.98	0.95	0.87	0.89	0.87	0.82	0.82	0.83	0.78	0.77	0.76	0.77	0.77	0.73	0.74	0.74
	12	1.00	1.00	1.00	1.00	0.99	0.91	0.93	0.91	0.85	0.85	0.86	0.80	0.79	0.79	0.80	0.80	0.75	0.76	0.77
	13	1.00	1.00	1.00	1.00	1.00	0.94	0.96	0.94	0.88	0.88	0.89	0.83	0.82	0.81	0.82	0.82	0.77	0.78	0.79
	14	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.97	0.91	0.90	0.92	0.85	0.84	0.84	0.85	0.85	0.79	0.80	0.81
	15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.93	0.95	0.88	0.86	0.86	0.87	0.87	0.81	0.82	0.83
	16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.96	0.98	0.91	0.89	0.88	0.90	0.90	0.83	0.84	0.85
	17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.93	0.91	0.91	0.92	0.92	0.86	0.86	0.88
	18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.94	0.93	0.95	0.94	0.88	0.89	0.90
	19	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95	0.97	0.97	0.90	0.91	0.92
	20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98	1.00	0.99	0.92	0.93	0.94
	21	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.95	0.97
	22	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.97	0.99
	23	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.99	1.00
	24	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Ultimate Load Capacities for Screw-Bolt+ in Normal-Weight Concrete at Minimum Edge[1,2]

Nominal Anchor Diameter d in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Edge Distance 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)	
			Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1-5/8 (41)	1-1/2 (38)	2,060 (9.2)	1,300 (5.8)	2,260 (10.1)	1,420 (6.3)	2,600 (11.6)	1,640 (7.3)
	2-1/2 (64)		3,380 (15.0)	1,580 (7.0)	3,700 (16.5)	1,740 (7.7)	4,280 (19.0)	2,000 (8.9)
3/8	1-1/2 (38)	1-1/2 (38)	2,120 (9.4)	1,060 (4.7)	2,320 (10.3)	1,160 (5.2)	2,680 (11.9)	1,340 (6.0)
	2 (51)		2,600 (11.6)	1,560 (6.9)	2,840 (12.6)	1,700 (7.6)	3,280 (14.6)	1,960 (8.7)
	3-1/4 (83)		4,460 (19.8)	2,080 (9.3)	4,880 (21.7)	2,280 (10.1)	5,640 (25.1)	2,640 (11.7)
	4-1/2 (114)		7,680 (34.2)	2,080 (9.3)	8,420 (37.5)	2,280 (10.1)	9,720 (43.2)	2,640 (11.7)
1/2	1-3/4 (44)	1-3/4 (38)	2,840 (12.6)	2,040 (9.1)	3,115 (13.9)	2,220 (9.9)	3,595 (16.0)	2,580 (11.5)
	2-1/2 (64)		3,820 (17.0)	2,360 (10.5)	4,180 (18.6)	2,580 (11.5)	4,820 (21.4)	2,980 (13.3)
	4-1/4 (108)		6,860 (30.5)	3,280 (14.6)	7,520 (33.5)	3,580 (15.9)	8,680 (38.6)	4,140 (18.4)
	5-1/2 (140)		12,600 (56.0)	3,280 (14.6)	13,800 (61.4)	3,580 (15.9)	15,940 (70.9)	4,140 (18.4)
5/8	3-1/4 (83)	1-3/4 (44)	5,260 (23.4)	2,800 (12.5)	5,760 (25.6)	3,060 (13.6)	6,640 (29.5)	3,540 (15.7)
	5 (127)		8,360 (37.2)	3,660 (16.3)	9,160 (40.7)	4,020 (17.9)	10,580 (47.1)	4,640 (20.6)
	6-1/4 (159)		10,240 (45.5)	3,660 (16.3)	11,200 (49.8)	4,020 (17.9)	12,940 (57.6)	4,640 (20.6)
3/4	4-1/4 (108)	1-3/4 (44)	7,240 (32.2)	3,460 (15.4)	7,920 (35.2)	3,780 (16.8)	9,160 (40.7)	4,360 (19.4)
	5 (127)		9,140 (40.7)	3,460 (15.4)	10,020 (44.6)	3,780 (16.8)	11,560 (51.4)	4,360 (19.4)
	6-1/4 (159)		14,420 (64.1)	3,460 (15.4)	15,800 (70.3)	3,780 (16.8)	18,240 (81.1)	4,360 (19.4)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. 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 Screw-Bolt+ in Normal-Weight Concrete at Minimum Edge[1,2,3,4,5]

Nominal Anchor Diameter d in.	Minimum Nominal Embedment Depth in. (mm)	Minimum Edge Distance 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)	
			Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4	1-5/8 (41)	1-1/2 (38)	515 (2.3)	325 (1.4)	565 (2.5)	355 (1.6)	650 (2.9)	410 (1.8)
	2-1/2 (64)		845 (3.8)	395 (1.8)	925 (4.1)	435 (1.9)	1,070 (4.8)	500 (2.2)
3/8	1-1/2 (38)	1-1/2 (38)	530 (2.4)	265 (1.2)	580 (2.6)	290 (1.3)	670 (3.0)	335 (1.5)
	2 (51)		650 (2.9)	390 (1.7)	710 (3.2)	425 (1.9)	820 (3.6)	490 (2.2)
	3-1/4 (83)		1,115 (5.0)	520 (2.3)	1,220 (5.4)	570 (2.5)	1,410 (6.3)	660 (2.9)
	4-1/2 (114)		1,920 (8.5)	520 (2.3)	2,105 (9.4)	570 (2.5)	2,430 (10.8)	660 (2.9)
1/2	1-3/4 (44)	1-3/4 (38)	710 (3.2)	510 (2.3)	780 (3.5)	555 (2.5)	900 (4.0)	645 (2.9)
	2-1/2 (64)		955 (4.2)	590 (2.6)	1,045 (4.6)	645 (2.9)	1,205 (5.4)	745 (3.3)
	4-1/4 (108)		1,715 (7.6)	820 (3.6)	1,880 (8.4)	895 (4.0)	2,170 (9.7)	1,035 (4.6)
	5-1/2 (140)		3,150 (14.0)	820 (3.6)	3,450 (15.3)	895 (4.0)	3,985 (17.7)	1,035 (4.6)
5/8	3-1/4 (83)	1-3/4 (44)	1,315 (5.8)	700 (3.1)	1,440 (6.4)	765 (3.4)	1,660 (7.4)	885 (3.9)
	5 (127)		2,090 (9.3)	915 (4.1)	2,290 (10.2)	1,005 (4.5)	2,645 (11.8)	1,160 (5.2)
	6-1/4 (159)		2,560 (11.4)	915 (4.1)	2,800 (12.5)	1,005 (4.5)	3,235 (14.4)	1,160 (5.2)
3/4	4-1/4 (108)	1-3/4 (44)	1,810 (8.1)	865 (3.8)	1,980 (8.8)	945 (4.2)	2,290 (10.2)	1,090 (4.8)
	5 (127)		2,285 (10.2)	865 (3.8)	2,505 (11.1)	945 (4.2)	2,890 (12.9)	1,090 (4.8)
	6-1/4 (159)		3,605 (16.0)	865 (3.8)	3,950 (17.6)	945 (4.2)	4,560 (20.3)	1,090 (4.8)

1. Tabulated load values are for anchors installed in uncracked concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less that critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
5. Anchors may be used in sand-lightweight concrete provided the allowable load capacities are multiplied by a reduction factor of 0.60.

Allowable Screw-Bolt+ Tension and Shear Load Capacities Installed into the face of Grout-Filled Concrete Masonry Units[1,2,3,4,5,6,7,8,9]

CODE LISTED
ICC-ES ESR-4042

Tension Load

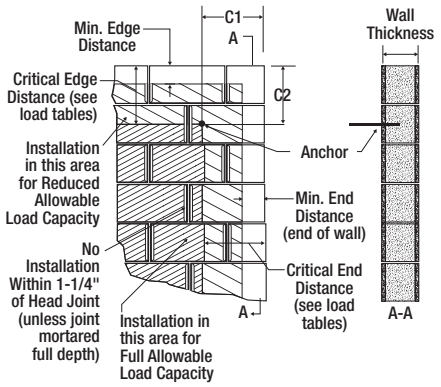
Anchor Diameter, d in.	Minimum Embedment h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} lbs (kN)	Spacing Distance, s			Edge or End Distance, c_2 or c_1 (see Illustration of Screw-Bolt+ Installed into Grouted Concrete Masonry Wall detail)		
			Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min}	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min}
1/4	1-5/8 (41.3)	315 (1.4)	4 (101.6)	2 (50.8)	1.00	3-3/4 (95.3)	1-1/4 (31.8)	0.60
	2-1/2 (63.5)	605 (2.7)						
3/8	2 (50.8)	450 (2.0)	6 (152.4)	3 (76.2)	1.00	6 (152.4)	1-1/2 (38.1)	0.70
	3-1/4 (82.6)	1,085 (4.8)						
1/2	2-1/2 (63.5)	610 (2.7)	8 (203.2)	4 (101.6)	1.00	8 (203.2)	2-5/8 (66.7)	0.75
	4-1/4 (108.0)	1,190 (5.3)						
5/8	3-1/4 (82.6)	880 (3.9)	10 (254.0)	4 (101.6)	1.00	10 (254.0)	3-3/8 (85.7)	0.90
	5 (127.0)	1,270 (5.6)						
3/4	4 (101.6)	1,150 (5.1)	12 (304.8)	4 (101.6)	1.00	12 (304.8)	4 (101.6)	1.00
	6-1/4 (158.8)	1,355 (6.0)						

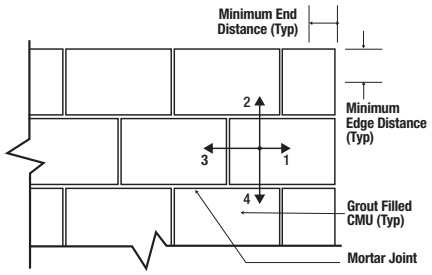
Shear Load

Anchor Diameter, d in.	Minimum Embedment h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} Direction 1 & 2 lbs[9] (kN)	Allowable Load at c_{cr} and s_{cr} Direction 3 & 4 lbs[9] (kN)	Spacing Distance, s			Edge or End Distance, c_2 or c_1 (see Illustration of Screw-Bolt+ Installed into Grouted Concrete Masonry Wall detail)			
				Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min}	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min}	
									Load Perpendicular to Edge or End (Direction 1 & 2)[9]	Load Perpendicular to Edge or End (Direction 3 & 4)[9]
1/4	1-5/8 (41.3)	400 (1.8)	400 (1.8)	4 (101.6)	2 (50.8)	1.00	3-3/4 (95.3)	1-1/4 (31.8)	0.35	1.00
	2-1/2 (63.5)	505 (2.2)	505 (2.2)							
3/8	2 (50.8)	815 (3.6)	815 (3.6)	6 (152.4)	3 (76.2)	1.00	6 (152.4)	1-1/2 (38.1)	0.27	1.00
	3-1/4 (82.6)	935 (4.2)	935 (4.2)							
1/2	2-1/2 (63.5)	1,380 (6.1)	1,380 (6.1)	8 (203.2)	4 (101.6)	1.00	8 (203.2)	2-5/8 (66.7)	0.20	1.00
	4-1/4 (108.0)	2,180 (9.7)	2,180 (9.7)							
5/8	3-1/4 (82.6)	2,090 (9.3)	2,225 (9.9)	10 (254.0)	4 (101.6)	1.00	10 (254.0)	3-3/8 (85.7)	0.23	1.00
	5 (127.0)	2,640 (11.7)	2,640 (11.7)							
3/4	4 (101.6)	2,800 (12.5)	3,330 (14.8)	12 (304.8)	4 (101.6)	1.00	12 (304.8)	4 (101.6)	0.25	1.00
	6-1/4 (158.8)	3,100 (13.8)	3,685 (16.4)							

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN, 1 psi = 0.006894 MPa.

1. All values are for anchors installed in fully grouted concrete masonry wall construction with materials meeting minimum compressive strength, f'm, of 1,500 psi (10.3 MPa). Concrete masonry units must be light-, medium, or normal-weight conforming to ASTM C90. Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the face of the masonry wall (cell, web, bed joint) except within 1-1/4-inch from the of the vertical mortar joint (head joint), center-to-center, provided the minimum edge and end distances are maintained. Anchors may not be placed in the head joint unless the vertical joint is mortared full-depth.
3. A maximum of two anchors may be installed in a single masonry cell in accordance with the spacing and edge or end distance requirements. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor. See the Illustration of Screw-Bolt+ Anchors Installed into Grouted Concrete Masonry Wall figure.
4. The critical spacing distance, s_{cr}, is the anchor spacing where full load values in the table may be used. The minimum spacing distance, s_{min}, is the minimum anchor spacing for which values are available and installation is permitted. Spacing distance is measured from the centerline to centerline between two anchors.
5. The critical edge or end distance, c_{cr}, is the distance where full load values in the table may be used. The minimum edge or end distance, c_{min}, is the minimum distance for which values are available and installation is permitted. Edge or end distance is measured from anchor centerline to the closest unrestrained edge.
6. The tabulated values are applicable for anchors installed into the ends of grout-filled concrete masonry units (e.g. wall opening) where minimum edge distances are maintained.
7. Load values for anchors installed less than s_{cr} and c_{cr} must be multiplied by the appropriate load reduction factor based on actual spacing (s) or edge distance (c). Load factors are multiplicative; both spacing and edge reduction factors must be considered.
8. Linear interpolation of load values between minimum spacing (s_{min}) and critical spacing (s_{cr}) and between minimum edge or end distance (c_{min}) and critical edge or end distance (c_{cr}) is permitted.
9. See the Direction of Shear Loading in Relation to Edge and End of Masonry Wall figure for illustration of shear load directions.





1. Shear load perpendicular to End and parallel to Edge
2. Shear load perpendicular to Edge and parallel to End
3. Shear load parallel to Edge and perpendicular away from End
4. Shear load parallel to End and perpendicular to bottom of wall

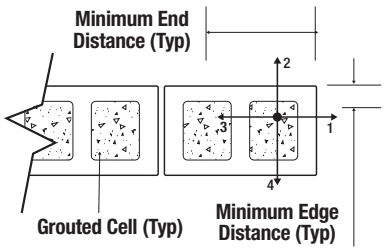
Allowable Screw-Bolt+ Tension and Shear Load Capacities Installed into the Tops of Grout-Filled Concrete Masonry Units[1,2,3,4,5,6,7,8,9,10]

CODE LISTED ICC-ES ESR-4042

Anchor Diameter d in.	Minimum Embedment h_{nom} in. (mm)	Minimum Spacing Distance in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension Load lbs (kN)	Shear Load, lb (kN)	
						Load Perpendicular to Edge of Masonry Wall (II to end)	Load Parallel to Edge of Masonry Wall (⊥ to end)
1/4	2-1/2 (63.5)	1-1/2 (38.1)	1-1/2 (38.1)	4 (101.6)	410 (1.8)	185 (0.8)	185 (0.8)
		1-1/2 (38.1)	3-1/2 (88.9)	4 (101.6)	485 (2.2)	215 (1.0)	215 (1.0)
3/8	3-1/4 (82.6)	2 (50.8)	1-1/2 (38.1)	4 (101.6)	625 (2.8)	505 (2.2)	505 (2.2)
		2 (50.8)	3-1/2 (88.9)	6 (152.4)	625 (2.8)	560 (2.5)	560 (2.5)
1/2	4-1/4 (108.0)	8 (203.2) (see Note 4 for reduced minimum spacing distances)	1-3/4 (44.5)	8 (203.2)	810 (3.6)	255 (1.1)	580 (2.6)
			3-3/4 (95.3)		1,210 (5.4)	255 (1.1)	580 (2.6)
5/8	5 (127.0)	10 (254.0)	1-3/4 (44.5)	10 (254.0)	900 (4.0)	260 (1.2)	950 (4.2)
3/4	6-1/4 (158.8)	12 (304.8)	1-3/4 (44.5)	12 (304.8)	1,215 (5.4)	260 (1.2)	990 (4.4)

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN, 1 psi = 0.006894 MPa.

1. All values are for anchors installed in fully grouted concrete masonry wall construction with materials meeting minimum compressive strength, f'm, of 1,500 psi (10.3 MPa). Concrete masonry units must be light-, medium, or normal-weight conforming to ASTM C90. Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the top of the masonry wall except within 1-1/4-inch from the of the mortar joint (head joint), provided the minimum edge and end distances are maintained.
3. A maximum of two anchors may be installed in a single masonry cell in accordance with the spacing and edge or end distance requirements. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor. See Screw-Bolt+ Anchors Installed into the Top of Grouted Concrete Masonry Wall figure.
4. Minimum spacing distance for 1/2-inch-diameter anchors shall be 8 inches and may be reduced to 2 inches provided the allowable load reduction factor of 0.40 is applied. Linear interpolation may be used to determine the reduction factor for intermediate anchor spacing distances between 8 inches and 2 inches.
5. Spacing distance is measured from the centerline to centerline between two anchors.
6. Linear interpolation may be used to for 1/4-inch and 3/8-inch-diameter anchors to determine allowable loads for edge distances between 3-1/2-inches and 1-1/2-inches.
7. Linear interpolation may be used to for 1/2-inch-diameter anchors to determine allowable loads for edge distances between 3-3/4-inches and 1-3/4-inches.
8. The edge and end distance is measured from the anchor centerline to the closest unrestrained edge and end of the CMU block, respectively. See Screw-Bolt+ Anchors Installed into the Top of Grouted Concrete Masonry Wall figure.
9. Spacing distance is measured from the centerline to centerline between two anchors.
10. Allowable shear loads parallel and perpendicular to the edge of a masonry wall may be applied in or out of plane, respectively. See Screw-Bolt+ Anchors Installed into the Top of Grouted Concrete Masonry Wall figure.



1. Shear load perpendicular to End and parallel to Edge
2. Shear load perpendicular to Edge and parallel to End
3. Shear load parallel to Edge and perpendicular away from End
4. Shear load parallel to End and perpendicular to bottom of wall

Allowable Screw-Bolt+ Tension and Shear Load Capacities Installed into the Face of Brick Masonry Walls[1,2,3,4,5,6,7,8]

Tension Load

Anchor Diameter, d in.	Minimum Embedment, h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} lbs (kN)	Spacing Distance, s			Edge or End Distance		
			Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min} in. (mm)	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min}
1/4	1-5/8 (41.3)	550 (2.4)	4 (101.6)	2 (50.8)	0.60	3-3/4 (95.3)	1-1/4 (31.8)	0.25
	2-1/2 (63.5)	830 (3.7)						
3/8	2 (50.8)	905 (4.0)	6 (152.4)	3 (76.2)	0.60	6 (152.4)	1-1/2 (38.1)	0.50
	3-1/4 (82.6)	1,115 (5.0)						
1/2	2-1/2 (63.5)	1,015 (4.5)	8 (203.2)	4 (101.6)	0.60	8 (203.2)	2-5/8 (66.7)	0.50
	4-1/4 (108.0)	1,495 (6.7)						
5/8	3-1/4 (82.6)	1025 (4.6)	10 (254.0)	5 (127.0)	0.50	10 (254.0)	3-3/8 (85.7)	0.50
	5 (127.0)	2,015 (9.0)						
3/4	4 (101.6)	1,815 (8.1)	12 (304.8)	6 (152.4)	0.50	12 (304.8)	4 (101.6)	0.50
	6-1/4 (158.8)	2,400 (10.7)						

Shear Load

Anchor Diameter, d in.	Minimum Embedment, h_{nom} in. (mm)	Allowable Load at c_{cr} and s_{cr} lbs (kN)	Spacing Distance, s			Edge or End Distance		
			Critical Distance, s_{cr} in. (mm)	Minimum Distance, s_{min} in. (mm)	Allowable Load Factor at s_{min} in. (mm)	Critical Distance, c_{cr} in. (mm)	Minimum Distance, c_{min} in. (mm)	Allowable Load Factor at c_{min} Load Perpendicular to Edge or End
1/4	1-5/8 (41.3)	405 (1.8)	4 (101.6)	2 (50.8)	0.70	3-3/4 (95.3)	1-1/4 (31.8)	0.20
	2-1/2 (63.5)	520 (2.3)						
3/8	2 (50.8)	930 (4.1)	6 (152.4)	3 (76.2)	0.70	6 (152.4)	1-1/2 (38.1)	0.20
	3-1/4 (82.6)	1,030 (4.6)						
1/2	2-1/2 (63.5)	1,055 (4.7)	8 (203.2)	4 (101.6)	0.65	8 (203.2)	2-5/8 (66.7)	0.25
	4-1/4 (108.0)	1,075 (4.8)						
5/8	3-1/4 (82.6)	1,700 (7.6)	10 (254.0)	5 (127.0)	0.50	10 (254.0)	3-3/8 (85.7)	0.40
	5 (127.0)	1,980 (8.8)						
3/4	4 (101.6)	1,700 (7.6)	12 (304.8)	6 (152.4)	0.50	12 (304.8)	4 (101.6)	0.55
	6-1/4 (158.8)	2,030 (9.0)						

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN, 1 psi = 0.006894 MPa.

1. All values are for anchors installed in minimum two-wythe, solid clay brick masonry walls conforming to ASTM C62, grade SW minimum. Mortar must be type N, S or M. The base material must have a minimum compressive strength, f'm, of 2,000 psi (13.8 MPa). Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the face of the masonry wall, provided the minimum edge and end distances are maintained.
3. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.
4. The critical spacing distance, s_{cr}, is the anchor spacing where full load values in the table may be used. The minimum spacing distance, s_{min}, is the minimum anchor spacing for which values are available and installation is permitted. Spacing distance is measured from the centerline to centerline between two anchors.
5. The critical edge or end distance, c_{cr}, is the distance where full load values in the table may be used. The minimum edge or end distance, c_{min}, is the minimum distance for which values are available and installation is permitted. Edge or end distance is measured from anchor centerline to the closest unrestrained edge.
6. The tabulated values are applicable for anchors installed into wall openings where minimum edge distances are maintained.
7. Load values for anchors installed less than s_{cr} and c_{cr} must be multiplied by the appropriate load reduction factor based on actual spacing (s) or edge distance (c). Load factors are multiplicative; both spacing and edge reduction factors must be considered.
8. Linear interpolation of load values between minimum spacing (s_{min}) and critical spacing (s_{cr}) and between minimum edge or end distance (c_{min}) and critical edge or end distance (c_{cr}) is permitted.

INSTALLATION SPECIFICATIONS (SD)

Screw-Bolt+ Installation Specifications in Concrete and Supplemental Information[1,2,3,4]

CODE LISTED ICC-ES ESR-3889

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Diameter (inch)												
			1/4		3/8			1/2			5/8			3/4	
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.35)		0.375 (9.525)			0.500 (12.7)			0.625 (15.9)			0.750 (19.05)	
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	3/8 (9.5)		1/2 (12.7)			5/8 (15.9)			3/4 (19.1)			7/8 (22.2)	
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI		3/8 ANSI			1/2 ANSI			5/8 ANSI			3/4 ANSI	
Minimum nominal embedment depth[5]	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)	
Effective Embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)	
Minimum hole depth	h_{hole}	in. (mm)	2 (51)	2-7/8 (73)	2-3/8 (60)	2-7/8 (73)	3-5/8 (92)	2-7/8 (73)	3-3/8 (86)	4-5/8 (117)	3-5/8 (92)	4-3/8 (111)	5-3/8 (137)	4-5/8 (117)	
Minimum concrete member thickness	h_{min}	in. (mm)	3-1/4 (83)	4 (102)	3-1/2 (89)	4 (102)	5 (127)	4-1/2 (114)	5-1/4 (133)	6-3/4 (171)	5 (127)	6 (152)	7 (178)	6 (152)	
Minimum edge distance[6]	c_{min}	in. (mm)	1-1/2 (38)		c_{min} = 1-1/2 (38) for $s_{min} \geq 3$ (76) s_{min} = 2 (51) for $c_{min} \geq 2$ (51)			1-3/4 (44)			1-3/4 (44)			1-3/4 (44)	
Minimum spacing distance[6]	s_{min}	in. (mm)	1-1/2 (38)					2-3/4 (70)			2-3/4 (70)			3 (76)	
Critical edge distance	c_{ac}	in. (mm)	4.30 (109)	6.10 (155)	5.00 (127)	6.30 (160)	7.80 (198)	3.30 (84)	5.90 (150)	8.10 (206)	6.30 (160)	7.90 (201)	10.10 (257)	10.90 (277)	
Minimum overall anchor length[7]	ℓ_{anch}	in. (mm)	1-3/4 (44)	3 (76)	2-1/2 (64)	3 (76)	4 (102)	3 (76)	4 (102)	5 (127)	4 (102)	5 (127)	6 (152)	5 (127)	
Maximum Installation torque	$T_{inst,max}$	ft.-lbf. (N-m)	19 (26)	25 (34)	25 (34)	25 (34)	40 (54)	45 (61)	45 (61)	60 (81)	60 (81)			70 (95)	
Maximum impact wrench power (torque)	$T_{impact,max}$	ft.-lbf (N-m).	150 (203)		300 (407)			300 (407)			700 (950)			700 (950)	
Impact wrench socket size	-	in.	7/16		9/16			3/4			15/16			1-1/8	
Maximum head height	-	in.	21/64		3/8			31/64			37/64			43/64	
Maximum washer diameter	-	in.	37/64		3/4			1-1/16			1-1/8			1-13/32	
Effective tensile stress area (screw anchor body)	A_{se}	in² (mm²)	0.045 (29.0)		0.094 (60.6)			0.176 (113.5)			0.274 (176.8)			0.399 (257.4)	
Minimum specified ultimate strength	f_{uta}	ksi (N/mm²)	100 (690)		92.5 (638)			115 (794)			95 (656)			95 (656)	
Minimum specified yield strength	f_y	ksi (N/mm²)	80 (552)		74 (511)			92 (635)			76 (524)			76 (524)	
Mean axial stiffness[8] Uncracked concrete	β_{uncr}	lbf/in (kN/mm)	1,252,000 (211)		1,157,000 (195)			1,014,000 (171)			919,000 (155)			1,028,000 (173)	
Mean axial stiffness[8] Cracked concrete	β_{cr}	lbf/in (kN/mm)	355,000 (60)		330,000 (56)			349,000 (59)			378,000 (64)			419,000 (71)	

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installations in the topside of concrete-filled steel deck assemblies with minimum concrete member thickness, $h_{min,deck}$, of 2.5 inches above the upper flute (topping thickness). See the table for anchor setting information for installation on the top of concrete-filled steel deck assemblies and the top of concrete over steel deck installation detail.
3. For installations in the topside of concrete-filled steel deck assemblies with sand-lightweight concrete fill, the maximum installation torque, $T_{inst,max}$, is 18 ft.-lb.
4. For installations through the soffit of steel deck assemblies into concrete, see the design information table for installation in the soffit of concrete-filled steel deck assemblies and the installation details in the soffit of concrete over steel deck for the applicable steel deck profile. Tabulated minimum spacing values are based on anchors installed along the flute with axial spacing equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
5. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
6. Additional combinations for minimum edge distance, c_{min}, and minimum spacing distance, s_{min}, may be derived by linear interpolation between the given boundary values for the 3/8-inch diameter anchors.
7. The listed minimum overall anchor length is based on the anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, including consideration of a fixture attachment. The minimum nominal anchor length is measured from under the head to the tip of the anchor.
8. Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Anchor Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies with Minimum Topping Thickness[1,2,3,4]

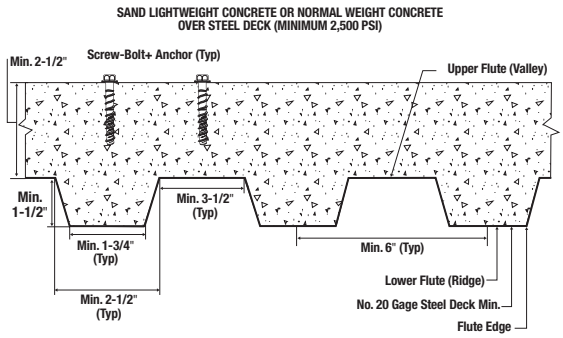
CODE LISTED
ICC-ES ESR-3889

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size (inch)			
			1/4		3/8	1/2
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)		0.375 (9.5)	0.500 (12.7)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	3/8 (9.5)		1/2 (12.7)	5/8 (15.9)
Nominal drill bit diameter	d_{bit}	in.	1/4 ANSI		3/8 ANSI	1/2 ANSI
Minimum nominal embedment depth[5]	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (33)	1.75 (44)
Minimum hole depth	h_o	in. (mm)	2 (51)	2-1/2 (64)	2-3/8 (60)	2-1/2 (64)
Minimum concrete member thickness (topping thickness)	$h_{min,deck}$	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	1-1/2 (38)		2 (51)	2-1/2 (64)
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	1-1/2 (38)		2 (51)	2-1/2 (64)
Critical edge distance	$c_{ac,deck,top}$	in. (mm)	3 (76)	4 (102)	3.5 (89)	6 (152)
Minimum nominal anchor length[6]	ℓ_{anch}	in. (mm)	1-3/4 (44)	3 (76)	2-1/2 (64)	3 (76)
Maximum impact wrench power (torque)	$T_{impact,max}$	ft.-lb. (N-m)	150 (203)		300 (407)	300 (407)
Max. installation torque	$T_{inst,max}$	ft.-lb. (N-m)	18[7] (26)	25 (34)	25 (34)	45 (61)
Wrench socket size	-	in.	7/16		9/16	3/4
Max. head height	-	in.	21/64		3/8	31/64
Max. washer diameter	-	in.	37/64		3/4	1-1/16

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

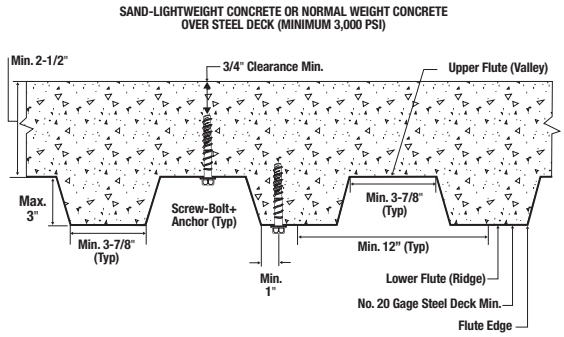
1. The anchors may be installed in the topside of concrete-filled steel deck floor and roof assemblies in accordance with this table, the anchor installation specifications in concrete table and the top of concrete over steel deck installation detail provided the concrete thickness above the upper flute meets the minimum thicknesses specified in this table. Minimum concrete member thickness, $h_{min,deck}$, refers to the concrete thickness above the upper flute (topping thickness). See the top of concrete over steel deck installation detail.
2. Applicable to the following conditions:
   For 1/4-inch-diameter anchors with 1-5/8-inch nominal embedment, 2-1/2-inch ≤ $h_{min,deck}$ < 3-1/4-inch.
   For 1/4-inch-diameter anchors with 2-1/2-inch nominal embedment, 2-1/2-inch ≤ $h_{min,deck}$ < 4-inch.
   For 3/8-inch-diameter anchors with 2-inch nominal embedment, 2-1/2-inch ≤ $h_{min,deck}$ < 3-1/2-inch.
   For 1/2-inch-diameter anchors with 2-1/2-inch nominal embedment, 2-1/2-inch ≤ $h_{min,deck}$ < 4-1/2-inch.
3. For all other anchor diameters and embedment depths, refer to the anchor installation specifications in concrete table for applicable values of h_{min}, c_{min} and s_{min}, which can be substituted for $h_{min,deck}$, $c_{min,deck,top}$ and $s_{min,deck,top}$, respectively.
4. Design capacities shall be based on calculations according to values in Tension Design Information and the Shear Design Information tables.
5. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
6. The listed minimum overall anchor length is based on the anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, including consideration of a fixture attachment for hex head anchors. The minimum nominal anchor length is measured from under the head to the tip of the anchor.
7. For installations in the topside of concrete-filled steel deck assemblies with normal-weight concrete fill, a maximum installation torque, $T_{inst,max}$, of 19 ft.-lb is allowed.

Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies with Minimum Topping Thickness (See Dimensional Profile Requirements)[1,2]



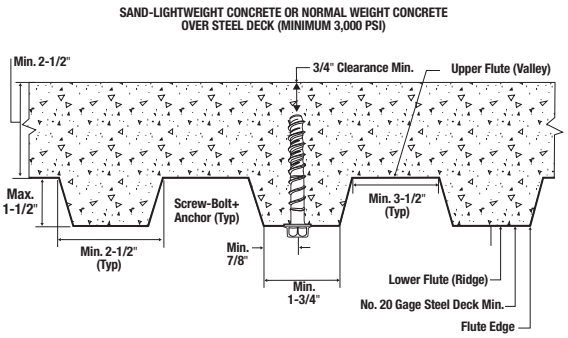
1. Anchors may be placed in the top side of concrete over steel deck profiles provided the minimum concrete thickness above the upper flute (topping thickness), minimum spacing distance and minimum edge distances are satisfied as given in Anchor Setting Information for Installation on the Top of Concrete-Filled Steel Deck Assemblies with Minimum Topping Thickness table.
2. For all other anchor diameters and embedment depths installed in the top of concrete over steel deck profiles with topping thickness greater than or equal to the minimum concrete member thicknesses given in the Installation Specifications in Concrete table, the minimum spacing distances and minimum edge distances must be used from the Installation Specifications in Concrete table, as applicable.

Screw-Bolt+ Installation Detail for Anchors in the Soffit of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed with a maximum 15/16 -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 (e.g. 1-1/4 -inch offset for 4-1/2-inch wide flute).
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

Screw-Bolt+ Installation Detail for Anchors in the Soffit of Concrete Over Steel Deck Floor and Roof Assemblies (See Dimensional Profile Requirements)[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of the concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed in the center of the flute. An offset distance may be given proportionally for profiles with flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

STRENGTH DESIGN (SD)

Tension Design Information For Screw-Bolt+ Anchor In Concrete[1,2]

CODE LISTED ICC-ES ESR-3889

Design Characteristic	Notation	Units	Nominal Anchor Diameter											
			1/4		3/8			1/2			5/8			3/4
Anchor category	1, 2 or 3	-	1		1			1			1			1
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)
Steel Strength in Tension (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)														
Steel strength in tension	N_{sa}[10]	lb (kN)	4,535 (20.2)		8,730 (38.8)			20,475 (91.1)			26,260 (116.8)			38,165 (169.8)
Reduction factor for steel strength[3,4]	ϕ	-	0.65											
Concrete Breakout Strength in Tension (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)														
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Critical edge distance	c_{ac}	in. (mm)	4.30 (109)	6.10 (155)	5.00 (127)	6.30 (160)	7.80 (198)	3.30 (84)	5.90 (150)	8.10 (206)	6.30 (160)	7.90 (201)	10.10 (257)	10.90 (277)
Critical edge distance, topside of concrete-filled steel decks with minimum topping thickness[9]	$c_{ac,deck,top}$	in. (mm)	3.00 (76)	4.00 (102)	3.50 (89)	-[11]	-[11]	6.00 (152)	-[11]	-[11]	-[11]	-[11]	-[11]	-[11]
Effectiveness factor for uncracked concrete	k_{uncr}	-	27	24	30	24	24	30	24	24	30	24	24	27
Effectiveness factor for cracked concrete	k_{cr}	-	17		17			17			21			17
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$	-	1.0		1.0			1.0			1.0			1.0
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)											
Pullout Strength in Tension (Non-Seismic Applications) (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)														
Characteristic pullout strength, uncracked concrete (2,500 psi)[6,10]	$N_{p,uncr}$	lb (kN)	See Note 7		See Note 7			See Note 7			See Note 7			See Note 7
Characteristic pullout strength, cracked concrete (2,500 psi)[6,10]	$N_{p,cr}$	lb (kN)	765 (3.4)	1,415 (6.3)	See Note 7			1,645 (7.3)	2,515 (11.2)	4,700 (20.9)	3,080 (13.7)	4,720 (21.0)	6,900 (30.7)	See Note 7
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)											
Pullout Strength in Tension for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)														
Characteristic pullout strength, seismic (2,500 psi)[6,8,10]	N_{eq}	lb	360 (1.6)	1,170 (5.2)	900 (4.0)	1,645 (7.3)	2,765 (12.3)	1,645 (7.3)	2,515 (11.2)	4,700 (20.9)	1,910 (8.5)	2,445 (10.9)	3,370 (15.0)	4,085 (18.2)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)											

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm^2; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 Section D.4.3(c), as applicable for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\Psi_{c,N} = 1.0$.
6. For all design cases $\Psi_{c,P} = 1.0$. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 2,500 psi for 1/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 2,500 psi for 3/8-inch- to 3/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.5}$ for psi or $(f'c / 17.2)^{0.5}$ for MPa.
7. Pullout strength does not control design of indicated anchors and does not need to be calculated 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.Y
9. Anchors are permitted in the topside of concrete-filled steel deck assemblies in accordance with the Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies with Minimum Topping Thickness.
10. Anchors are permitted to be used in lightweight concrete provided the modification factor λa equal to 0.8λ is applied to all values of f'c affecting N_n.
11. Tabulated critical edge distance values, $c_{ac,deck,top}$, are for anchors installed in the top of concrete over steel deck profiles with a minimum concrete thickness, $h_{min,deck}$, of 2.5 inches above the upper flute (topping thickness). For minimum topping thickness greater than or equal to the minimum concrete member thicknesses, h_{min}, given in the Installation Specifications table, the associated critical edge distance, c_{ac}, for indicated anchor diameters and embedment depths may be used in the calculation of $\Psi_{cp,N}$ as applicable.

Shear Design Information for Screw-Bolt+ Anchor in Concrete[1,2,7,8]

CODE LISTED ICC-ES ESR-3889

Design Characteristic	Notation	Units	Nominal Anchor Diameter											
			1/4		3/8			1/2			5/8			3/4
Anchor category	1, 2 or 3	-	1		1			1			1			1
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)
Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)														
Steel strength in shear[5]	V_{sa}	lb (kN)	1,635 (7.3)	2,040 (9.1)	3,465 (15.4)	3,465 (15.4)	4,345 (19.3)	8,860 (39.4)	8,860 (39.4)	11,175 (49.7)	12,310 (54.8)	12,310 (54.8)	15,585 (69.3)	19,260 (85.7)
Reduction factor for steel strength[3,4]	ϕ	-	0.60											
Steel Strength in Shear for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)														
Steel strength in shear, seismic[6]	V_{eq}	lb (kN)	1,360 (6.1)	1,700 (7.7)	2,415 (10.9)	2,415 (10.9)	3,030 (13.6)	7,090 (31.9)	7,090 (31.9)	8,940 (40.2)	9,845 (44.3)	9,845 (44.3)	12,465 (56.1)	15,405 (69.3)
Reduction factor for steel strength in shear for seismic[3,4]	ϕ	-	0.60											
Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)														
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)		0.375 (9.5)			0.500 (12.7)			0.625 (15.9)			0.750 (19.1)
Load bearing length of anchor	ℓ_e	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)											
Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)														
Coefficient for pryout strength	k_{cp}	-	1	1	1	1	1	1	1	2	1	2	2	2
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)											

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

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-17 17.2.3 or ACI 318-11 D.3.3, as applicable shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and must be used for design in lieu of the calculated results using equation 17.5.1.2(b) of ACI 318-14 or equation D-29 in ACI 318-11 D.6.1.2.
6. Reported values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6 and must be used for design.
7. Anchors are permitted in the topside of concrete-filled steel deck assemblies in accordance with the Installation Detail for Anchors in the Top of Concrete Over Steel Deck Floor and Roof Assemblies with Minimum Topping Thickness.
8. Anchors are permitted to be used in lightweight concrete in provided the modification factor λa equal to 0.8λ is applied to all values of f'c affecting N_n.

Tension and Shear Design Information for Screw-Bolt+ Anchor in the Soffit (Through the Underside) of Concrete-Filled Steel Deck Assemblies[1,2,3,4,5,6]

CODE LISTED ICC-ES ESR-3889

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Diameter (inch)											
			1/4		3/8			1/2			5/8			3/4
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3 (76)	4-1/4 (108)	3-1/4 (64)	4 (64)	5 (127)	4-1/4 (108)
Effective Embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)	1.33 (34)	1.75 (44)	2.39 (61)	1.75 (44)	2.17 (55)	3.23 (82)	2.24 (57)	2.88 (73)	3.73 (95)	3.08 (78)
Minimum hole depth	h_o	in. (mm)	1-3/4 (44)	2-5/8 (67)	2-1/8 (54)	2-5/8 (67)	3-3/8 (86)	2-5/8 (67)	3-1/8 (79)	4-3/8 (111)	3-3/8 (86)	4-1/8 (10.5)	5-1/8 (130)	4-3/8 (111)
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 3-7/8-inch-wide deck flute)														
Minimum concrete member thickness[7]	$h_{min,deck,total}$	in. (mm)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	5-1/2 (140)	6-1/4 (159)	6-1/4 (159)
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,430 (6.4)	2,555 (11.4)	2,275 (10.1)	2,655 (11.8)	3,235 (14.4)	2,600 (11.6)	3,555 (15.8)	5,975 (26.6)	2,610 (11.6)	4,150 (18.5)	6,195 (27.6)	6,085 (27.1)
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	615 (2.7)	1,115 (5.0)	1,290 (5.7)	1,880 (8.4)	2,290 (10.2)	1,230 (5.5)	2,330 (10.4)	4,030 (17.9)	1,600 (7.1)	3,340 (14.9)	4,945 (22.0)	3,835 (17.1)
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	290 (1.3)	920 (4.1)	890 (4.0)	1,570 (7.0)	2,015 (9.0)	1,230 (5.5)	2,330 (10.4)	4,030 (17.9)	990 (4.4)	1,730 (7.7)	2,415 (10.7)	3,410 (15.2)
Reduction factor for pullout strength[8]	ϕ	-	0.65											
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,155 (5.1)	2,595 (11.5)	2,470 (11.0)	2,470 (11.0)	3,225 (14.3)	2,435 (10.8)	2,435 (10.8)	5,845 (26.0)	2,650 (11.8)	2,650 (11.8)	6,325 (28.1)	5,175 (23.0)
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	960 (4.3)	2,165 (9.6)	1,725 (7.7)	1,900 (8.5)	2,250 (10.0)	1,950 (8.7)	2,095 (9.3)	4,675 (20.8)	2,120 (9.4)	2,325 (10.3)	5,060 (22.5)	4,140 (18.4)
Reduction factor for steel strength in shear for concrete over steel deck[8]	ϕ	-	0.60											
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 1-3/4-inch-wide deck flute)														
Minimum concrete member thickness[7]	$h_{min,deck,total}$	in. (mm)	4 (102)	4 (102)	4 (102)	4 (102)	4 (102)	4 (102)	N/A		N/A			N/A
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,760 (7.8)	2,075 (9.2)	1,440 (6.4)	2,135 (9.5)	3,190 (14.2)	1,720 (7.7)	N/A		N/A			N/A
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	760 (3.4)	910 (4.0)	815 (3.6)	1,510 (6.7)	2,260 (10.1)	1,280 (5.7)	N/A		N/A			N/A
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	355 (1.6)	750 (3.3)	565 (2.5)	1,260 (5.6)	1,985 (8.8)	1,280 (5.7)	N/A		N/A			N/A
Reduction factor for pullout strength[8]	ϕ	-	0.65						N/A		N/A			N/A
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,880 (8.4)	2,315 (10.3)	2,115 (9.4)	2,115 (9.4)	2,820 (12.5)	2,095 (9.3)	N/A		N/A			N/A
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	1,565 (7.0)	1,930 (8.6)	1,475 (6.6)	1,625 (7.2)	1,965 (8.7)	1,675 (7.5)	N/A		N/A			N/A
Reduction factor for steel strength in shear for concrete over steel deck[8]	ϕ	-	0.60		0.60			0.60	N/A		N/A			N/A

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

1. Installation must comply with published instructions and details.
2. Values for $N_{p,deck}$ and $N_{p,deck,cr}$ are for 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 318-14 17.4.2 or ACI 318 D.5.2, as applicable, is not required for anchors installed in the deck soffit (through underside).
3. Values for $N_{p,deck,eq}$ are applicable for seismic loading and must be used in lieu of $N_{p,deck,cr}$.
4. For all design cases $\Psi_{c,P} = 1.0$. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 3,000 psi for 1/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 3{,}000)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 3,000 psi for 3/8-inch- to 3/4-inch-diameter anchors may be increased by multiplying the value in the table by $(f'c / 3{,}000)^{0.5}$ for psi or $(f'c / 17.2)^{0.5}$ for MPa.
5. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
6. Values of $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for sand-lightweight concrete and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, are not required for anchors installed in the soffit (through underside).
7. The minimum concrete member thickness, $h_{min,deck,total}$, is the minimum overall thickness of the concrete-filled steel deck (depth and topping thickness).
8. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08).

FACTORED RESISTANCE STRENGTH (ϕN_n AND ϕV_n) CALCULATED IN ACCORDANCE WITH ACI 318-14 CHAPTER 17:

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 times c_{a1}.

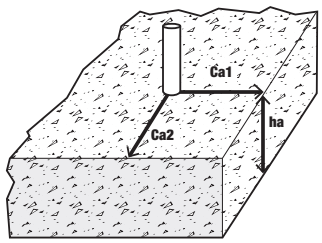
2- Calculations were performed according to ACI 318-14, Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength 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 (ø) were based on ACI 318-14 Section 5.3 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 318-14, Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14, Chapter 17. For other design conditions including seismic considerations please see ACI 318-14, Chapter 17.



Tension and Shear Design Strength Installed in Cracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		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	1-5/8	495	780	525	855	575	980	645	980	705	980
	2-1/2	920	1,225	970	1,225	1,060	1,225	1,195	1,225	1,305	1,225
3/8	2	845	915	930	1,000	1,070	1,155	1,315	1,415	1,515	1,635
	2-1/2	1,280	1,375	1,400	1,510	1,620	1,740	1,980	2,080	2,290	2,080
	3-1/4	2,040	2,200	2,235	2,410	2,580	2,605	3,165	2,605	3,650	2,605
1/2	2-1/2	1,070	1,270	1,170	1,395	1,355	1,610	1,655	1,970	1,915	2,275
	3	1,635	1,900	1,790	2,085	2,070	2,405	2,535	2,945	2,925	3,400
	4-1/4	3,055	4,325	3,345	4,735	3,865	5,470	4,735	6,695	5,465	6,705
5/8	3-1/4	1,850	1,995	2,030	2,185	2,345	2,525	2,870	3,090	3,315	3,570
	4	2,700	4,155	2,960	4,550	3,415	5,255	4,185	6,435	4,830	7,385
	5	3,980	6,040	4,360	6,615	5,035	7,640	6,165	9,350	7,120	9,350
3/4	4-1/4	2,985	6,135	3,270	6,720	3,780	7,760	4,625	9,505	5,340	10,975

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

Tension and Shear Design Strength Installed in Uncracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		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	1-5/8	1,155	980	1,265	980	1,460	980	1,785	980	2,065	980
	2-1/2	2,110	1,225	2,310	1,225	2,665	1,225	2,950	1,225	2,950	1,225
3/8	2	1,495	1,610	1,640	1,765	1,890	2,035	2,315	2,080	2,675	2,080
	2-1/2	1,805	1,945	1,980	2,080	2,285	2,080	2,795	2,080	3,230	2,080
	3-1/4	2,880	2,605	3,155	2,605	3,645	2,605	4,465	2,605	5,155	2,605
1/2	2-1/2	2,255	1,780	2,475	1,950	2,855	2,255	3,495	2,760	4,040	3,185
	3	2,495	2,685	2,730	2,940	3,155	3,395	3,865	4,160	4,460	4,805
	4-1/4	4,530	6,050	4,960	6,630	5,725	6,705	7,015	6,705	8,100	6,705
5/8	3-1/4	3,270	3,520	3,580	3,855	4,135	4,455	5,065	5,455	5,845	6,295
	4	3,810	5,815	4,175	6,370	4,820	7,355	5,905	7,385	6,820	7,385
	5	5,620	8,455	6,155	9,265	7,110	9,350	8,705	9,350	10,050	9,350
3/4	4-1/4	4,745	8,590	5,195	9,410	6,000	10,865	7,350	11,555	8,485	11,555

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

FACTORED RESISTANCE STRENGTH (ϕN_n AND ϕV_n) CALCULATED IN ACCORDANCE WITH ACI 318-14, CHAPTER 17:

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, c_{min} (table values based on $c_{a1} = c_{min}$).
- c_{a2} is greater than or equal to 1.5 times c_{a1}.

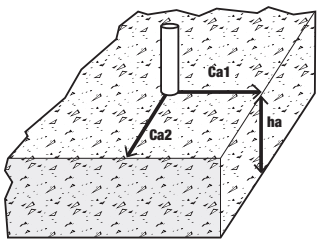
2- Calculations were performed according to ACI 318-14, Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength 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 (ø) were based on ACI 318-14 Section 5.3 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 318-14, Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14, Chapter 17. For other design conditions including seismic considerations please see ACI 318-14, Chapter 17.



Tension and Shear Design Strength at Minimum Edge Distance, c_{min} for Screw-Bolt+ in Cracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)
1/4	1-5/8	495	370	525	405	575	470	645	575	705	660
	2-1/2	920	450	970	495	1,060	570	1,195	700	1,305	810
3/8	2	785	445	860	485	990	560	1,215	685	1,405	790
	2-1/2	1,115	500	1,220	550	1,410	635	1,725	775	1,995	895
	3-1/4	1,685	595	1,845	650	2,130	755	2,610	920	3,015	1,065
1/2	2-1/2	1,070	675	1,170	740	1,355	855	1,655	1,045	1,915	1,205
	3	1,520	760	1,665	835	1,925	960	2,355	1,180	2,720	1,360
	4-1/4	2,595	935	2,840	1,025	3,280	1,180	4,015	1,445	4,640	1,670
5/8	3-1/4	1,585	800	1,735	875	2,005	1,010	2,455	1,240	2,835	1,430
	4	2,220	920	2,430	1,010	2,805	1,165	3,435	1,425	3,970	1,645
	5	3,160	1,045	3,460	1,145	3,995	1,325	4,895	1,620	5,650	1,870
3/4	4-1/4	2,430	985	2,660	1,080	3,075	1,245	3,765	1,525	4,345	1,760

□ - Anchor Pullout/Pryout Strength Controls ▢ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strength at Minimum Edge Distance, c_{min} for Screw-Bolt+ in Uncracked Concrete

Nominal Anchor Diameter (in.)	Nominal Embed. h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_{sn} Shear (lbs.)
1/4	1-5/8	460	495	505	540	580	625	710	765	820	885
	2-1/2	860	635	940	695	1,085	800	1,330	980	1,535	1,130
3/8	2	550	595	605	650	700	750	855	920	990	1,065
	2-1/2	655	700	720	765	830	885	1,015	1,085	1,175	1,250
	3-1/4	1,095	835	1,200	915	1,385	1,055	1,695	1,290	1,955	1,490
1/2	2-1/2	1,615	945	1,770	1,035	2,045	1,195	2,505	1,465	2,890	1,690
	3	1,185	1,065	1,300	1,165	1,500	1,345	1,835	1,650	2,120	1,905
	4-1/4	2,190	1,310	2,400	1,430	2,770	1,655	3,390	2,025	3,915	2,340
5/8	3-1/4	1,495	1,120	1,635	1,225	1,890	1,415	2,310	1,735	2,670	2,000
	4	1,715	1,290	1,875	1,410	2,165	1,630	2,655	1,995	3,065	2,305
	5	2,470	1,465	2,705	1,605	3,125	1,855	3,830	2,270	4,420	2,620
3/4	4-1/4	1,635	1,380	1,790	1,510	2,070	1,745	2,535	2,135	2,925	2,465

□ - Anchor Pullout/Pryout Strength Controls ▢ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

ORDERING INFORMATION

Screw-Bolt+

Cat. No.		Anchor Size	Box Qty.	Ctn. Qty.	20V Max* SDS Plus Rotary Hammers			Flexvolt SDS Max
					DCH273P2DH 1" L-Shape	DCH133M2 1" D-Handle	DCH293R2 1-1/8" L-Shape w/ E-Clutch	DCH481X2 1-9/16" w/ E-Clutch
Zinc Plated	Galvanized				Carbide Bits			
PFM1411000	-	1/4" x 1-1/4"	100	600	DW5517	DW5417	DW5417	-
PFM1411020	-	1/4" x 1-3/4"	100	600	DW5517	DW5417	DW5417	-
PFM1411060	-	1/4" x 2-1/4"	100	600	DW5517	DW5417	DW5417	-
PFM1411080	-	1/4" x 2-5/8"	100	500	DW5517	DW5417	DW5417	-
PFM1411100	-	1/4" x 3"	100	500	DW5517	DW5417	DW5417	-
PFM1411160	-	3/8" x 1-3/4"	50	300	DW5527	DW5427	DW5427	-
PFM1411220	-	3/8" x 2-1/2"	50	300	DW5527	DW5427	DW5427	-
PFM1411240	PFM1461240	3/8" x 3"	50	250	DW5527	DW5427	DW5427	-
PFM1411280	PFM1461280	3/8" x 4"	50	250	DW5527	DW5427	DW5427	-
PFM1411300	PFM1461300	3/8" x 5"	50	250	DW5529	DW5429	DW5429	-
PFM1411320	PFM1461320	3/8" x 6"	50	150	DW5529	DW5429	DW5429	-
PFM1411340	-	1/2" x 2"	50	200	DW5537	DW5437	DW5437	-
PFM1411360	-	1/2" x 2-1/2"	50	200	DW5537	DW5437	DW5437	-
PFM1411380	-	1/2" x 3"	50	150	DW5537	DW5437	DW5437	-
PFM1411420	PFM1461420	1/2" x 4"	50	150	DW5537	DW5437	DW5437	-
PFM1411460	PFM1461460	1/2" x 5"	25	100	DW5538	DW5438	DW5438	-
PFM1411480	PFM1461480	1/2" x 6"	25	75	DW5538	DW5438	DW5438	-
PFM1411520	PFM1461520	1/2" x 8"	25	100	DW5538	DW5438	DW5438	-
PFM1411540	-	5/8" x 3"	25	100	DW5471	DW5446	DW5471	DW5806
PFM1411580	-	5/8" x 4"	25	100	DW5471	DW5446	DW5471	DW5806
PFM1411600	PFM1461600	5/8" x 5"	25	75	DW5471	DW5446	DW5471	DW5806
PFM1411640	PFM1461640	5/8" x 6"	25	75	DW5471	DW5446	DW5471	DW5806
PFM1411680	PFM1461680	5/8" x 8"	25	50	DW5471	DW5447	DW5471	DW5806
PFM1411700	-	3/4" x 3"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411720	-	3/4" x 4"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411760	-	3/4" x 5"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411800	PFM1461800	3/4" x 6"	20	60	DW5474	DW5453	DW5474	DW5810
PFM1411840	PFM1461850	3/4" x 8"	10	40	DW5474	DW5455	DW5474	DW5810
PFM1411880	-	3/4" x 10"	10	20	DW5475	DW5455	DW5475	DW5812

Shaded catalog 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.

- Optimum Tool Match
- Maximum Tool Match
- Not Recommended

Suggested Impact Wrench and Socket

Nominal Anchor Size	Socket Size	Impact Rated Socket		20V Max* Impact Wrenches	
1/4	7/16	DWMT74479B		DCF890M2 3/8" Impact Wrench	
3/8	9/16	DWMT75122B		DCF894HP2 1/2" Impact Wrench	
1/2	3/4	DWMT75113B			
5/8	15/16	DWMT75104B		DCF899HP2 High Torque 1/2" (Use In Speed Setting #3)	
3/4	1-1/8	DWMT75125B			

GENERAL INFORMATION

316 STAINLESS STEEL WEDGE-BOLT™

Screw Anchor

PRODUCT DESCRIPTION

The 316 Stainless Steel Wedge-Bolt anchor is a one piece, heavy duty screw anchor with a finished hex head. It is simple to install, easy to identify, a fully removable.

The 316 Stainless Steel Wedge-Bolt has many unique features and benefits that make it well suited for many applications, both indoors and out. 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 316 Stainless Steel Wedge-Bolt can be installed with either a powered impact wrench or conventional hand socket.

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

316 Stainless Steel Wedge-Bolt screw anchors are not recommended for immersion in or long term exposure to chloride/chlorine environments.

GENERAL APPLICATIONS AND USES

- Interior and Exterior Applications
- Support Ledgers and Windows
- Railing and Fencing
- Storage Facilities
- Repairs & Retrofits
- Maintenance

FEATURES AND BENEFITS

+ High corrosion resistance of Type 316 stainless steel
+ Consistent performance in high and low strength concrete
+ Anchor can be installed through standard size fixture holes in steel
+ Diameter, length and identifying marking stamped on head of each anchor
+ Can be installed with an impact wrench or conventional hand socket
+ Fast installation and immediate loading minimizes downtime
+ Finished hex head provides attractive appearance and minimizes tripping hazard
+ Can be installed closer to the edge than traditional expansion anchors
+ Ratchet teeth on underside of hex washer head contact against the fixture
+ Removable

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Screw anchors shall be 316 Stainless Steel Wedge-Bolt as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

316 STAINLESS STEEL WEDGE-BOLT

HEAD STYLES

- Hex washer head

ANCHOR MATERIALS

- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 1/4" diameter through 1/2" diameter

SUITABLE BASE MATERIALS

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

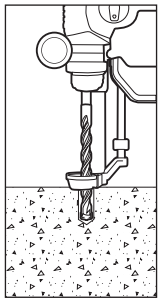
MATERIAL SPECIFICATIONS

Anchor component	Specification
Anchor Body and hex washer head	Type 316 Stainless Steel[1]

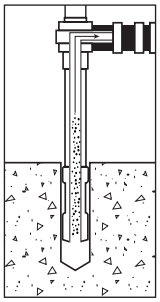
1. With sacrificial carbon steel drive tip and tapping threads.

INSTALLATION INSTRUCTIONS

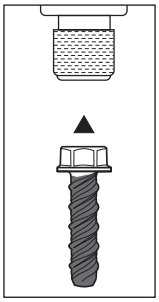
Installation Instructions for 316 Stainless Steel Wedge-Bolt



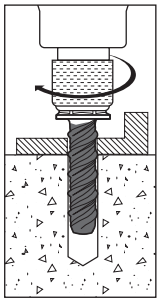
Step 1
Using the proper Wedge-bit size, drill a hole into the base material to the required depth. The tolerances of the Wedge-bit used must meet the requirements of the published Wedge-bit range.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

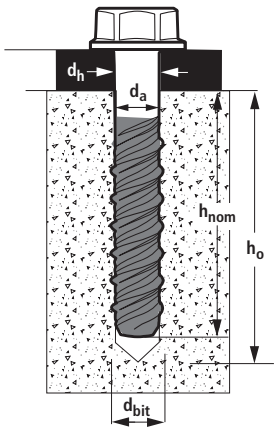


Step 3
Select a powered impact wrench that does not exceed the maximum torque, $T_{inst,max}$ or $T_{impact,max}$, for the selected anchor diameter. Attach an appropriate sized hex socket/driver to the impact wrench. Mount the screw anchor head into the socket.



Step 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.

316 Stainless Steel Wedge-Bolt Anchor Detail



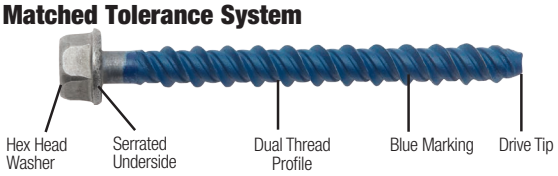
Nomenclature

d_a = Diameter of Anchor
d_{bit} = Diameter of Drill Bit
d_h = Diameter of Clearance Hole
h = Base Material Thickness. The value of h should be $1.5h_{nom}$ or 3", whichever is greater
h_{nom} = Minimum Nominal Embedment
h_o = Minimum Hole Depth

Hex Head Marking

Legend
Diameter, material, and length identification mark

Matched Tolerance System



BLUE WEDGE-BIT

Designed and tested as a system for consistency and reliability

REFERENCE DATA (ASD)

Installation Specifications for 316 Stainless Steel Wedge-Bolt in Concrete

Anchor Property / Setting Information	Notation	Units	Nominal Anchor Diameter		
			1/4	3/8	1/2
Anchor diameter	d_o	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)
Minimum diameter of hole clearance in fixture	d_h	in. (mm)	5/16 (7.9)	7/16 (11.1)	9/16 (14.3)
Nominal drill bit diameter	d_{bit}	in.	1/4 Wedge-Bit	3/8 Wedge-Bit	1/2 Wedge-Bit
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-3/4 (44)	2 (51)	2-3/4 (70)
Minimum hole depth	h_o	in. (mm)	2 (51)	2-1/4 (57)	3 (77)
Minimum overall anchor length	ℓ_{anch}	in. (mm)	2 (51)	2-1/2 (64)	3 (76)
Max installation torque	$T_{inst,max}$	in. (mm)	15 (20)	35 (47)	60 (81)
Max impact wrench power (torque)	$T_{impact,max}$	ft.-lbf. (N-m)	115 (156)	245 (332)	300 (407)
Torque wrench/socket size	-	in.	7/16	9/16	3/4
Head height	-	in.	7/32	21/64	7/16
Ultimate tensile strength	(UTS)	ksi	80	100	100
Approximate yield strength	(YS)	ksi	64	80	80

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

Ultimate Load Capacities for 316 Stainless Steel Wedge-Bolt in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter in.	Minimum Embedment Depth, h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	1-3/4 (44)	890 (4.0)	1,385 (6.2)	975 (4.3)	1,520 (6.8)	1,130 (5.0)	1,755 (7.8)	1,440 (6.4)	2,560 (11.4)	1,440 (6.4)	2,850 (12.7)
	2-1/2 (64)	2,485 (11.1)	1,385 (6.2)	2,720 (12.1)	1,520 (6.8)	3,145 (14.0)	1,755 (7.8)	3,150 (14.0)	2,560 (11.4)	3,150 (14.0)	2,850 (12.7)
3/8	2 (51)	735 (3.3)	1,675 (7.5)	805 (3.6)	1,833 (8.2)	930 (4.1)	2,115 (9.4)	1,180 (5.2)	2,710 (12.1)	1,210 (5.4)	3,295 (14.7)
	2-1/2 (64)	1,515 (6.7)	1,675 (7.5)	1,655 (7.4)	1,833 (8.2)	1,915 (8.5)	2,115 (9.4)	2,130 (9.5)	2,710 (12.1)	2,180 (9.7)	3,295 (14.7)
	3-1/2 (89)	3,525 (15.7)	1,675 (7.5)	3,860 (17.2)	1,833 (8.2)	4,455 (19.8)	2,115 (9.4)	4,570 (20.3)	2,710 (12.1)	4,680 (20.8)	3,295 (14.7)
1/2	2-3/4 (70)	3,000 (13.3)	4,675 (20.8)	3,285 (14.6)	5,120 (22.8)	3,790 (16.9)	5,915 (26.3)	5,975 (26.6)	7,560 (33.6)	6,900 (30.7)	9,205 (40.9)
	3-1/2 (89)	3,830 (17.0)	5,205 (23.2)	4,195 (18.7)	5,700 (25.4)	4,845 (21.6)	6,590 (29.3)	6,800 (30.2)	7,390 (32.9)	7,855 (34.9)	8,995 (40.0)
	4-1/2 (114)	5,680 (25.3)	5,205 (23.2)	6,220 (27.7)	5,700 (25.4)	7,180 (31.9)	6,590 (29.3)	9,760 (43.4)	7,390 (32.9)	11,265 (50.1)	8,995 (40.0)

1. Tabulated load values are for anchors installed in normal weight concrete. Concrete compressive strength must be at a 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 316 Stainless Steel Wedge-Bolt in Normal-Weight Concrete[1,2,3,4,5]

Nominal Anchor Diameter in.	Minimum Embedment Depth, h_{nom} in. (mm)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi (17.3 MPa)		f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)		f'c = 6,000 psi (41.4 MPa)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	1-3/4 (44)	225 (1.0)	345 (1.5)	245 (1.1)	380 (1.7)	285 (1.3)	440 (2.0)	360 (1.6)	640 (2.8)	360 (1.6)	715 (3.2)
	2-1/2 (64)	620 (2.8)	345 (1.5)	680 (3.0)	380 (1.7)	785 (3.5)	440 (2.0)	790 (3.5)	640 (2.8)	790 (3.5)	715 (3.2)
3/8	2 (51)	185 (0.8)	420 (1.9)	200 (0.9)	460 (2.0)	235 (1.0)	530 (2.4)	295 (1.3)	680 (3.0)	305 (1.4)	825 (3.7)
	2-1/2 (64)	380 (1.7)	420 (1.9)	415 (1.8)	460 (2.0)	480 (2.1)	530 (2.4)	535 (2.4)	680 (3.0)	545 (2.4)	825 (3.7)
	3-1/2 (89)	880 (3.9)	420 (1.9)	965 (4.3)	460 (2.0)	1,115 (5.0)	530 (2.4)	1,145 (5.1)	680 (3.0)	1,170 (5.2)	825 (3.7)
1/2	2-3/4 (70)	750 (3.3)	1,170 (5.2)	820 (3.6)	1,280 (5.7)	950 (4.2)	1,480 (6.6)	1,495 (6.7)	1,890 (8.4)	1,725 (7.7)	2,300 (10.2)
	3-1/2 (89)	960 (4.3)	1,300 (5.8)	1,050 (4.7)	1,425 (6.3)	1,210 (5.4)	1,650 (7.3)	1,700 (7.6)	1,850 (8.2)	1,965 (8.7)	2,250 (10.0)
	4-1/2 (114)	1,420 (6.3)	1,300 (5.8)	1,555 (6.9)	1,425 (6.3)	1,795 (8.0)	1,650 (7.3)	2,440 (10.9)	1,850 (8.2)	2,815 (12.5)	2,250 (10.0)

1. Tabulated load values are for anchors installed in normal weight concrete. Concrete compressive strength must be at a minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
5. Allowable loads for lightweight concrete may be determined by multiplying the tabulated allowable load capacities for normal weight concrete by 0.60.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

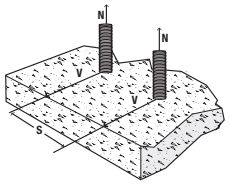
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension	s_{cr} = 12d	F_{NS} = 1.0	s_{min} = 4d	F_{NS} = 0.50
	Shear	s_{cr} = 12d	F_{VS} = 1.0	s_{min} = 4d	F_{VS} = 0.75
Edge Distance (c)	Tension	c_{cr} = 8d	F_{NC} = 1.0	c_{min} = 3d	F_{NC} = 0.70
	Shear	c_{cr} = 12d	F_{VC} = 1.0	c_{min} = 3d	F_{VC} = 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.

LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing, Tension (F_{NS})

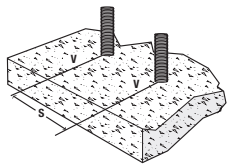
Dia. (in.)		1/4	3/8	1/2
s_{cr} (in.)		3	4-1/2	6
s_{min} (in.)		1	1-1/2	2
Spacing, s (inches)	1	0.50	-	-
	1-1/2	0.63	0.50	-
	2	0.75	0.58	0.50
	2-1/2	0.88	0.67	0.56
	3	1.00	0.75	0.63
	4-1/2	1.00	1.00	0.81
	6	1.00	1.00	1.00



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})

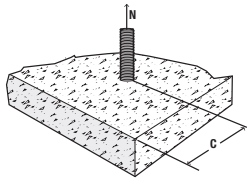
Dia. (in.)		1/4	3/8	1/2
s_{cr} (in.)		3	4-1/2	6
s_{min} (in.)		1	1-1/2	2
Spacing, s (inches)	1	0.75	-	-
	1-1/2	0.81	0.75	-
	2	0.88	0.79	0.75
	2-1/2	0.91	0.83	0.78
	3	1.00	0.88	0.81
	4-1/2	1.00	1.00	0.91
	6	1.00	1.00	1.00



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})

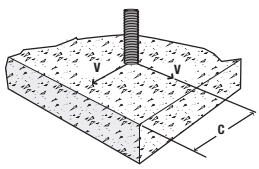
Dia. (in.)		1/4	3/8	1/2
c_{cr} (in.)		2	3	4
c_{min} (in.)		3/4	1-1/8	1-1/2
Edge Distance, c (in.)	3/4	0.70	-	-
	1-1/8	0.79	0.70	-
	1-1/2	0.88	0.76	0.70
	1-7/8	0.97	0.82	0.75
	2	1.00	0.84	0.76
	2-1/4	1.00	0.88	0.79
	3	1.00	1.00	0.88
	4	1.00	1.00	1.00



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
c_{cr} (in.)		3	4-1/2	6
c_{min} (in.)		3/4	1-1/8	1-1/2
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
	2-1/4	0.72	0.43	0.29
	3	1.00	0.62	0.43
	4-1/2	1.00	1.00	0.72
	6	1.00	1.00	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

MASONRY PERFORMANCE DATA

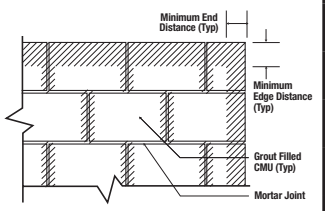
Ultimate Load Capacities for 316 Stainless Steel Wedge-Bolt installed into the Face or End of Grout Filled Concrete Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embed. h_{nom} 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 = 2,000 psi	Loading Direction	f'm = 1,500 psi	f'm = 2,000 psi
1/4	1-3/4 (44)	3-3/4 (95)	1-1/2 (38)	570 (2.5)	660 (2.9)	Perpendicular or parallel to wall edge or end	645 (2.9)	745 (3.3)
	2-1/4 (57)	3-3/4 (95)	1-1/2 (38)	1,145 (5.1)	1,325 (5.9)		910 (4.0)	1,050 (4.7)
3/8	2 (51)	3-3/4 (95)	1-1/2 (38)	1,535 (6.8)	1,775 (7.9)	Perpendicular or parallel to wall edge or end	775 (3.4)	895 (4.0)
	3 (76)	3-3/4 (95)	3-3/4 (95)	2,300 (10.2)	2,655 (11.8)	Perpendicular or parallel to wall edge or end	3,110 (13.8)	3,585 (15.9)
	3 (76)	3-3/4 (95)	11-1/4 (286)			Parallel to wall edge	3,325 (14.8)	3,835 (17.1)
1/2	2-3/4 (70)	3-3/4 (95)	1-3/4 (44)	1,330 (5.9)	1,535 (6.8)	Perpendicular or parallel to wall edge or end	2,050 (9.1)	2,365 (10.5)
	2-3/4 (70)	3-3/4 (95)	3-3/4 (95)				2,630 (11.7)	3,040 (13.5)
	4-1/2 (114)	3-3/4 (95)	11-1/4 (286)	4,680 (20.8)	5,400 (24.0)		2,630 (11.7)	3,040 (13.5)
	4-1/2 (114)	11-1/4 (286)	11-1/4 (286)				7,290 (32.4)	8,415 (37.4)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate strength 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.
3. The tabulated load values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screws anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at a minimum spacing between screw anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.

Allowable Load Capacities for 316 Stainless Steel Wedge-Bolt installed into the Face or End of Grout Filled Concrete Masonry[1,2,3,4,5]

Nominal Anchor Diameter d in.	Minimum Embed. h_{nom} 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 = 2,000 psi	Loading Direction	f'm = 1,500 psi	f'm = 2,000 psi
1/4	1-3/4 (44)	3-3/4 (95)	1-1/2 (38)	115 (0.5)	130 (0.6)	Perpendicular or parallel to wall edge or end	130 (0.6)	150 (0.7)
	2-1/4 (57)	3-3/4 (95)	1-1/2 (38)	230 (1.0)	265 (1.2)		180 (0.8)	210 (0.9)
3/8	2 (51)	3-3/4 (95)	1-1/2 (38)	305 (1.4)	355 (1.6)	Perpendicular or parallel to wall edge or end	155 (0.7)	180 (0.8)
	3 (76)	3-3/4 (95)	3-3/4 (95)	460 (2.0)	530 (2.4)	Perpendicular or parallel to wall edge or end	620 (2.8)	715 (3.2)
	3 (76)	3-3/4 (95)	11-1/4 (286)			Parallel to wall edge	665 (3.0)	765 (3.4)
1/2	2-3/4 (70)	3-3/4 (95)	1-3/4 (44)	265 (1.2)	305 (1.4)	Perpendicular or parallel to wall edge or end	410 (1.8)	475 (2.1)
	2-3/4 (70)	3-3/4 (95)	3-3/4 (95)				525 (2.3)	610 (2.7)
	4-1/2 (114)	3-3/4 (95)	11-1/4 (286)	935 (4.2)	1,080 (4.8)		525 (2.3)	610 (2.7)
	4-1/2 (114)	11-1/4 (286)	11-1/4 (286)				1,460 (6.5)	1,685 (7.5)

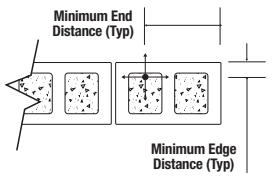


Wall Face
Permissible Anchor Locations
(Un-hatched Area)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, Grade N, Type II, normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate strength at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load capacities 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.
3. Linear interpolation for allowable loads for anchors at intermediate embedment depths may be used.
4. For installation in 3,000 psi grout filled concrete masonry (f'm = 3,000 psi) the load capacity in 1,500 psi grout filled concrete masonry (f'm = 1,500) may be increased by 40% and the load capacity in 2,000 psi grout concrete masonry (f'm = 2,000 psi) may be increased by 22%.
5. The tabulated load values are applicable for screw anchors installed at a critical spacing between screw anchors of 16 times the screws anchor diameter. Reduce the tabulated load capacities by 50 percent when anchors are installed at a minimum spacing between screw anchors of 8 times the screw anchor diameter. Linear interpolation may be used for intermediate spacing distances.

Ultimate and Allowable Load Capacities for 316 Stainless Steel Wedge-Bolt Installed in Grout Filled Concrete Masonry Wall Tops[1,2,3,4,5,6]

Nominal Anchor Diameter d in.	Minimum Nominal Embed. Depth h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Minimum Spacing Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	2-1/2 (64)	1-1/2 (38)	3 (76)	4 (102)	1,025 (4.6)	625 (2.8)	205 (0.9)	125 (0.6)
3/8	3 (76)	1-1/2 (38)	4 (102)	6 (152)	1,675 (7.5)	1,075 (4.8)	335 (1.5)	215 (1.0)
1/2	4-1/2 (114)	1-3/4 (44)	6 (152)	8 (203)	2,475 (11.0)	1,075 (4.8)	495 (2.2)	215 (1.0)

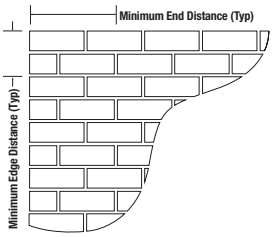


Top of Wall

1. All values are for anchors installed in fully grouted concrete masonry wall construction with materials meeting minimum compressive strength, f'm, of 1,500 psi (10.3 MPa). Concrete masonry units must be light-, medium, or normal-weight conforming to ASTM C90. Allowable loads are based on a safety factor of 5.0.
2. Anchors may be installed in any location in the top of the masonry wall except within 1-1/4-inch from the of the mortar joint (head joint), provided the minimum edge and end distances are maintained.
3. A maximum of two anchors may be installed in a single masonry cell in accordance with the spacing and edge or end distance requirements. Embedment is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.
4. Spacing distance is measured from the centerline to centerline between two anchors.
5. The edge and end distance is measured from the anchor centerline to the closest unrestrained edge and end of the CMU block, respectively.
6. Allowable shear loads may be applied in any direction.

Ultimate and Allowable Load Capacities for 316 Stainless Steel Wedge-Bolt Installed into Multiple Wythe Solid Clay Brick Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Nominal Embed. Depth h_{nom} in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Minimum Spacing Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	2-1/2 (64)	3-1/2 (89)	2-1/2 (64)	4 (102)	1,170 (5.2)	1,380 (6.1)	235 (1.0)	275 (1.2)
3/8	2-3/4 (70)	6 (152)	6 (152)	6 (152)	1,435 (6.4)	2,875 (12.8)	285 (1.3)	575 (2.6)
1/2	3-1/4 (83)	9-1/2 (241)	9-1/2 (241)	8 (203)	1,840 (8.2)	7,655 (34.1)	370 (1.6)	1,530 (6.8)



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 as 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.
3. Allowable load capacities listed are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be used depending on the application, such as life safety.

ORDERING INFORMATION

316 Stainless Steel Wedge-Bolt

Cat. No.	Anchor Size	Thread Length (inc)	Box Qty.	Ctn. Qty.	Wt./100 (lbs)	Suggested Wedge-Bit Cat. No.			
						SDS-Plus	SDS-Max	Spline	Straight Shank
07870	1/4 x 2	1-3/4	100	600	3.94	01312	-	-	01370
07872	1/4 x 3	2-3/4	100	500	5.16	01314	-	-	01372
07876	1/4 x 4	2-3/4	100	500	6.56	01314	-	-	01372
07878	1/4 x 5	2-3/4	100	500	7.20	01315	-	-	-
07880	3/8 x 2-1/2	2-1/4	50	300	10.42	01316	-	-	01380
07882	3/8 x 3	2-1/4	50	250	11.96	01316	-	-	01380
07884	3/8 x 4	3-1/2	50	250	15.06	01316	-	-	01380
07886	3/8 x 5	3-1/2	50	250	17.92	01318	-	-	01384
07888	1/2 x 3	2-3/4	50	150	21.17	01320	01354	01340	01390
07890	1/2 x 4	2-3/4	50	150	25.87	01320	01354	01340	01390
07892	1/2 x 5	3-3/4	25	100	31.70	01322	01354	01340	01394
07894	1/2 x 6	3-3/4	25	75	36.73	01322	01354	01340	01394

The published size includes the diameter and length of the anchor measured from under the head to the tip.
*316 Stainless Steel Wedge-Bolt has a blue marking and must be installed with a matched tolerance Wedge-Bit.

Wedge-Bit

Cat. No.	Wedge-Bit Description	Usable Length	Tube Qty.	Ctn. Qty.
01312	SDS 1/4" x 4"	2"	1	250
01314	SDS 1/4" x 6"	4"	1	100
01315	SDS 1/4" x 8"	6"	1	-
01316	SDS 3/8" x 6"	4"	1	200
01318	SDS 3/8" x 8"	6"	1	100
01332	SDS 3/8" x 12"	10"	1	50
01319	SDS 3/8" x 18"	16"	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
01340	Spline 1/2" x 13"	8"	1	20
01342	Spline 1/2" x 16"	11"	1	-
01354	SDS-Max 1/2" x 13"	8"	1	20
01370	HD Straight Shank 1/4" x 4"	2-3/4"	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

Suggested Impact Wrench and Socket

Nominal Anchor Size	Socket Size	Impact Rated Socket		20V Max* Impact Wrenches	
1/4	7/16	DWMT74479B		DCF883M2 3/8" Impact Wrench	
3/8	9/16	DWMT75122B		DCF880M2 1/2" Impact Wrench	
1/2	3/4	DWMT75113B		DCF894HP2 High Torque 1/2"	

GENERAL INFORMATION

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, 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
- Interior applications/low level corrosion environment
- Tension zone areas
- Pipe supports
- Seismic and wind loading applications
- Fire sprinklers
- Suspended lighting

FEATURE AND BENEFITS

+ Cracked concrete approved alternative to a dropin anchor
+ 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 for concrete. Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, 2009 IRC, 2006 IBC, and 2006 IRC.
- Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 (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. 3038104 (see report for sizes) www.approvalguide.com - Pipe hanger components for automatic sprinkler systems

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 09 - Post-Installed Concrete Anchors. Internally threaded anchors shall be Snake+ as supplied by DEWALT, Towson, MD. 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 B633, SC1, Type III (Fe/Zn 5) Minimum plating requirements 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
- Sand-lightweight concrete
- Concrete over steel deck

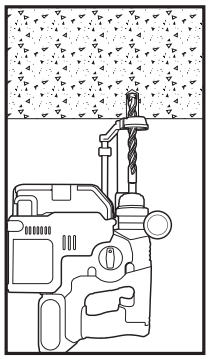
TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

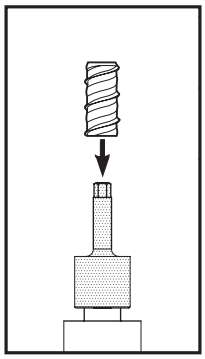
CODE LISTED
ICC-ES ESR-2272
CONCRETE

DDA
DEWALT DESIGN ASSIST

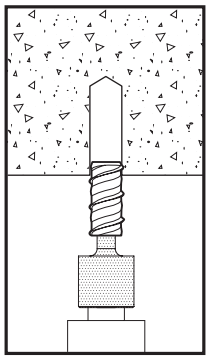
INSTALLATION INSTRUCTIONS



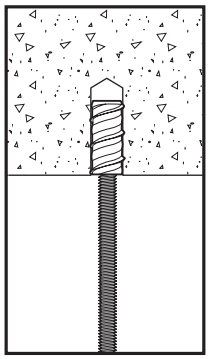
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth (e.g. dust extractor, hollow bit). The tolerances of the carbide drill bit used should meet the requirements of ANSI Standard B212.15.



Step 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 DEWALT to the impact wrench. Mount the anchor onto the setting tool.

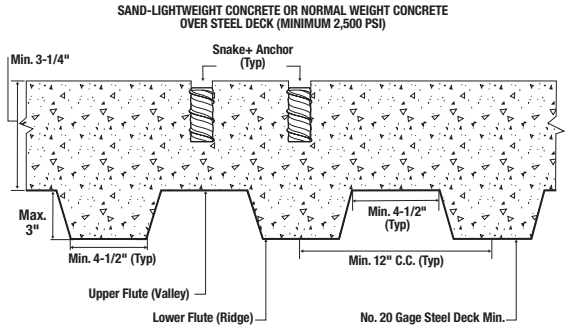


Step 3
Drive the anchor into the hole until the shoulder of the Snake+ setting tool comes into contact with the surface of the base material. Do not spin the setting tool off the anchor to disengage.



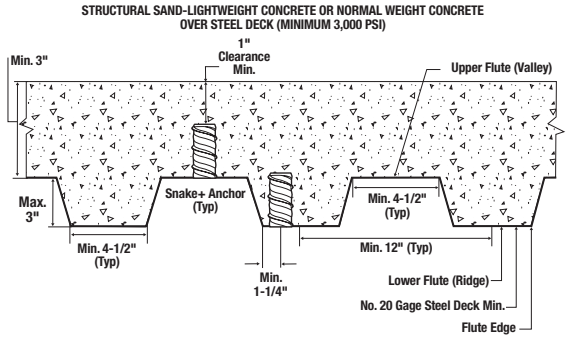
Step 4
Insert threaded rod or a bolt into the Snake+, taking care not to exceed the maximum specified tightening torque of the steel insert element, T_{max}. Minimum thread engagement should be at least one anchor diameter.

Installation Detail for Snake+ in the Topside of Concrete-Filled Steel Deck floor and Roof Assemblies[1]



1. 3/8-inch diameter anchors may be placed in the topside of steel deck profiles provided the minimum topping thickness, minimum spacing distance and minimum edge distance are satisfied as given in the installation information table.

Installation Detail for Snake+ Installed in the Soffit of Concrete over Steel Deck floor and Roof Assemblies[1]



1. Anchors may be placed in the upper flute or lower flute of the steel deck profiles provided in minimum hole clearance is satisfied. Anchors in the lower flute 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.

STRENGTH DESIGN (SD)

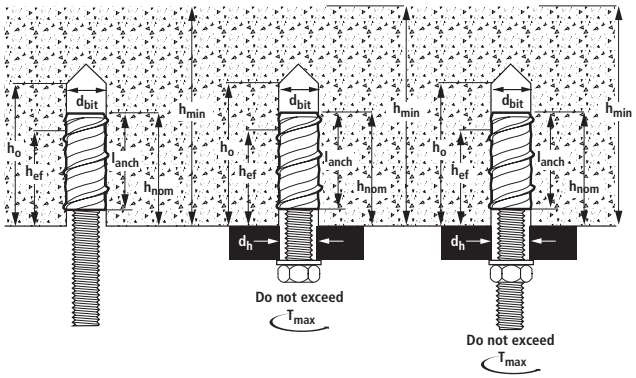
Installation Information for Snake+ Screw Anchor for Single Point Applications[1]

CODE LISTED ICC-ES ESR-2272

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (inch)		
			1/4	3/8	1/2
Nominal outside anchor diameter	$d_a(d_o)$[3]	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)
Minimum diameter of hole clearance in fixture for steel insert element (following anchor installation)	d_h	in.	5/16	7/16	9/16
Nominal 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)
Overall anchor length	ℓ_{anch}	in. (mm)	1-1/4 (32)	1-1/4 (32)	1-11/16 (43)
Minimum nominal embedment depth[2]	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-3/16 (55)
Effective embedment	h_{ef}	in. (mm)	Not Applicable[4]	1.10 (28)	1.54 (39)
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)	8 (11)	36 (49)
Anchors Installed in Concrete Construction[2]					
Minimum member thickness[2]	h_{min}	in. (mm)	Not Applicable[4]	4 (102)	4 (102)
Critical edge distance[2]	c_{ac}	in. (mm)	Not Applicable[4]	3 (76)	4 (102)
Minimum edge distance[2]	c_{min}	in. (mm)	Not Applicable[4]	3 (76)	4 (102)
Minimum spacing distance[2]	s_{min}	in. (mm)	Not Applicable[4]	3 (76)	4 (102)
Anchors Installed in the Topside of Concrete-Filled Steel Deck Assemblies[5]					
Minimum member topping thickness	$h_{min,deck}$	in. (mm)	Not Applicable[4]	3-1/4 (83)	Not applicable
Critical edge distance	$c_{ac,deck,top}$	in. (mm)	Not Applicable[4]	3 (76)	Not applicable
Minimum edge distance	$c_{min,deck,top}$	in. (mm)	Not Applicable[4]	3 (76)	Not applicable
Minimum spacing distance	$s_{min,deck,top}$	in. (mm)	Not Applicable[4]	3 (76)	Not applicable

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installations through the soffit of steel deck into concrete, see 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.
3. The notation in parenthesis is for the 2006 IBC.
4. The 1/4-inch diameter anchor is limited to redundant fastening design only.
5. For 3/8-inch diameters installed in the topside of concrete-filled steel deck assemblies, steel installation detail.

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



PERFORMANCE DATA

Tension Design Information (For use with load combinations taken from ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2)[1,2]

CODE LISTED
ICC-ES ESR-2272

Design Characteristic	Notation	Units		Nominal Anchor Diameter 3/8 inch	Nominal Anchor Diameter 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 TENSION[4]					
Minimum specified yield strength of steel insert element	f_y	ksi (N/mm^2)	ASTM A36	36.0 (248)	
			ASTM A193, Grade B7	105.0 (724)	-
Minimum specified ultimate strength of steel insert element	f_{uta}	ksi (N/mm^2)	ASTM A36	58.0 (400)	
			ASTM A193, Grade B7	125.0 (862)	-
Effective tensile stress area of steel insert element	$A_{se,N}$ (A_{se})[10]	in^2 (mm^2)		0.0775 (50)	0.1419 (92)
Steel strength in tension	N_{sa}	lb (kN)	ASTM A36	4,495 (20.0)	8,230 (37.0)
			ASTM A193, Grade B7	9,685 (43.1)	-
Reduction factor for steel strength[3]	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	k_{ucr}	-		24	30
Effectiveness factor for cracked concrete	k_{cr}	-		17	24
Modification factor for cracked and uncracked concrete[5]	$\psi_{c,N}$	-		Cracked concrete = 1.0 Uncracked concrete = 1.0	
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	1,665 (7.4)
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]	$N_{p,eq}$	lb (kN)		See note 7	1,665 (7.4)
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.65	
PULLOUT STRENGTH IN TENSION FOR SOFFIT OF SAND-LIGHT WEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK					
Characteristic pullout strength, uncracked concrete over steel deck[6,9]	$N_{p,deck,uncr}$	lb (kN)		1,515 (6.7)	1,625 (7.2)
Characteristic pullout strength, cracked concrete over steel deck[6,9]	$N_{p,deck,cr}$	lb (kN)		1,075 (4.8)	1,300 (5.8)
Characteristic pullout strength, cracked concrete over steel deck, seismic[6,9]	$N_{p,deck,eq}$	lb (kN)		1,075 (4.8)	1,300 (5.8)
Reduction factor for pullout strength, concrete over steel deck[3]	ϕ	-		Condition B = 0.65	

For SI: 1 inch = 25.4 mm, 1 ksi = 6.894 N/mm^2; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, must apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2. If the load combinations ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor is a ductile steel element with minimum specified properties as listed in the table or an equivalent steel element. The Snake+ anchor is considered a brittle steel element in tension as defined by ACI 318-14 2.3 or ACI 318-11D.1, as applicable. 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}) and 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 from table)*(specified concrete compressive strength/2,500)$^{0.5}$. For concrete over steel deck the value of 2,500 must be replaced with the value of 3,000.
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 lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318. For anchors installed in the soffit of sand-lightweight concrete-filled steel deck and floor and roof assemblies, further reduction of the pullout values provided in not required.
9. Values for $N_{p,deck}$ are for 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 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, is not required for anchors installed in the deck soffit (flute).
10. The notation in parenthesis is for the 2006 IBC.

Shear Design Information (For use with load combinations taken from ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2)[1,2]

CODE LISTED ICC-ES ESR-2272

Design Characteristic	Notation	Units		Nominal Anchor Diameter	
				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 (55)
STEEL STRENGTH IN SHEAR[4]					
Steel strength in shear[5]	V_{sa}	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
			ASTM A193, Grade B7	1,655 (7.4)	-
Reduction factor for steel strength[3]	ϕ	-		0.60	
CONCRETE BREAKOUT STRENGTH IN SHEAR[6]					
Nominal outside anchor diameter	$d_a(d_o)$[10]	in. (mm)		0.500 (12.7)	0.750 (19.1)
Load bearing length of anchor (h_{ef} or $8d_o$, whichever is less)	ℓ_e	-		1.10 (28)	1.54 (39)
Reduction factor for concrete breakout strength[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	1.0
Effective embedment	h_{ef}	in. (mm)		1.10 (28)	1.54 (39)
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.70	
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS					
Steel strength in shear, seismic[7]	$V_{sa,eq}$	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
			ASTM A193, Grade B7	1,655 (7.4)	-
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.60	
STEEL STRENGTH IN SHEAR FOR SOFFIT OF SAND-LIGHT WEIGHT AND NORMAL-WEIGHT CONCRETE OVER STEEL DECK[9]					
Steel strength in shear, concrete over steel deck[8]	$V_{sa,deck}$	lb (kN)	ASTM A36	770 (3.4)	1,995 (8.9)
			ASTM A193, Grade B7	1,655 (7.4)	-
Steel strength in shear, concrete over steel deck, seismic[8]	$V_{sa,deck,eq}$	lb (kN)	ASTM A36	770 (3)	1,995 (8.9)
			ASTM A193, Grade B7	1,665 (7.4)	-
Reduction factor for pullout strength[3]	ϕ	-		Condition B = 0.60	

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 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 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 IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that meets ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor will be a ductile steel element as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Tabulated values for steel strength in shear must be used for design. These tabulated values are lower than calculated results using equation 17.5.1.2b in ACI 318-14, D-29 in ACI 318-11, and ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable.
6. Anchors are permitted to be used in lightweight concrete provided the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n and V_n. λ shall be determined in accordance with the corresponding version of ACI 318. For anchors installed in the soffit of sand-lightweight concrete-filled steel deck and floor and roof assemblies, further reduction of the pullout values provided in not required.
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 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 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 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. The notation in parenthesis is for the 2006 IBC.

Factored Design Strength ($ØN_n$ And $ØV_n$) Calculated In Accordance With ACI 318-14 Chapter 17:

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 times c_{a1}.

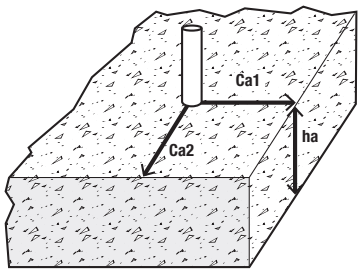
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



Tension and Shear Design Strengths Installed 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	
			ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn 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	1,065	1,140	1,075
1/2	2-3/16	ASTM A36	1,080	1,295	1,185	1,295	1,370	1,295	1,675	1,295	1,935	1,295

□ - Anchor Pullout/Pryout Strength Controls ▢ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths Installed 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	
			ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn 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	1,075	1,395	1,075	1,610	1,075
1/2	2-3/16	ASTM A36	1,865	1,295	2,040	1,295	2,355	1,295	2,885	1,295	3,335	1,295

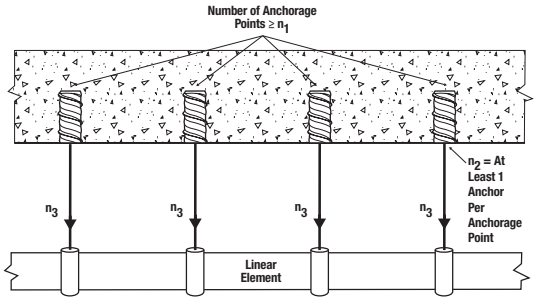
□ - Anchor Pullout/Pryout Strength Controls ▢ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

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 318-14 Section 5.3 or ACI 318 (-11,-08,-05) Section 9.2.

Strength Design (SD)

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

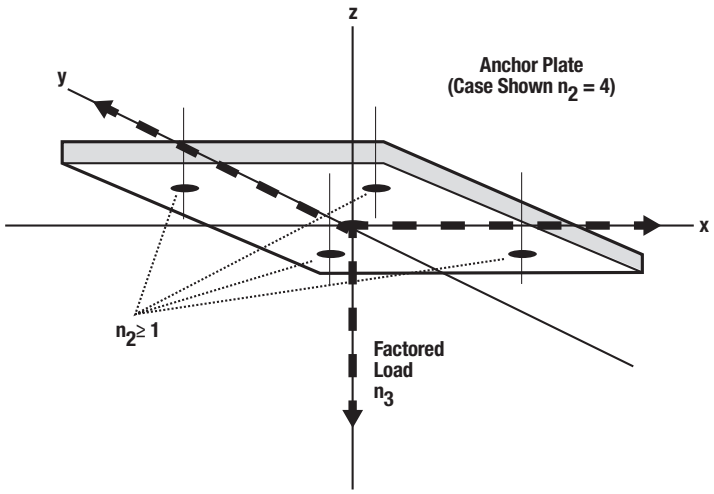
Allowable Stress Design (Redundant Fastening):

Design values for use with allowable stress design shall be established taking

$$R_d, ASD = \frac{\phi_{ra} \bullet F_{ra}}{\alpha}$$

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.

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



REDUNDANT FASTENING

Installation Information for Snake+ Screw Anchor in Redundant Fastening Applications

Anchor Property/ Setting Information	Notation	Units	Nominal Anchor Size / Threaded Coupler Diameter (inch)		
			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 legnth	ℓ_{anch}	in. (mm)	1-1/4 (32)	1-1/4 (32)	1-11/16 (43)
Minimum edge distance, redundant fastening[1]	$c_{min} = c_{ac}$	in. (mm)	4 (102)	4 (102)	4 (102)
Minimum spacing distance, redundant fastening[1]	s_{min}	in. (mm)	8 (203)	8 (203)	8 (203)
Maximum tightening torque of steel insert element (threaded rod or bolt)	T_{max}	ft.-lb. (N-m)	4 (6)	8 (11)	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]

Anchor Property/ Setting Information	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)
Strength reduction factor[3]	ϕ_{ra}	-	0.65					
CHARACTERISTIC STRENGTH (RESISTANCE) FOR SAND-LIGHTWEIGHT AND NORMAL WEIGHT CONCRETE OVER STEEL DECK[4,6]								
Resistance, cracked or uncracked concrete over steel deck (2,500 psi)	$F_{ra,deck}$	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					

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 Section 4.3 of this report; loads may be applied in tension, shear or any combination thereof.
2. Installation must comply with published instructions and this report.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 (-11, -08, -05) Section 9.2, as applicable.
4. It is assumed that the threaded rod or bolt used with the Snake+ anchor has properties as listed in Tension Design Information table.
5. Anchors are permitted to be used in lightweight concrete provided the design strength $\phi_{ra} F_{ra}$ is multiplied by the modification factor λ_a. The modification factor λ_a is equal to 0.8λ, λ shall be determined in accordance with the corresponding version of ACI 318. For anchors installed in the soffit of sand-lightweight concrete-filled steel deck and floor and roof assemblies, further reduction of the pullout values provided in not required.
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.

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

Nominal Anchor Diameter in.	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	1-5/8 (41)	2,130 (9.5)	1,045 (4.6)	2,335 (10.4)	1,045 (4.6)	-	-
3/8	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	2-3/16 (55)	5,590 (24.9)	2,050 (9.1)	6,125 (27.3)	2,050 (9.1)	7,240 (32.0)	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[1]	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

1. Each box comes with one free setting tool

Setting Tool for Snake+ Screw Anchor

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

Suggested Impact Wrench

20V Max* Impact Wrenches		
1/4	DCF880M2 1/2" Impact Wrench	
3/8		
3/8	DCF894HP2 3/8 and 1/2" Impact Wrench High Torque	
1/2		

GENERAL INFORMATION

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
- Fire Sprinkler
- Cable Trays and Strut
- Concrete Formwork
- Pipe Supports
- 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
- Underwriters Laboratory (UL Listed) – File No. EX1289 (N) (see ordering information)
- FM Approvals (Factory Mutual) – File No. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Dropin anchors shall be Steel Dropin as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

SMOOTH WALL DROPIN

FLANGE (LIPPED) DROPIN

THREAD VERSION

- UNC Coarse Thread
- Coil Thread

ANCHOR MATERIALS

- Zinc Plated Carbon Steel
- 303 Stainless Steel (Domestic)
- 304 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

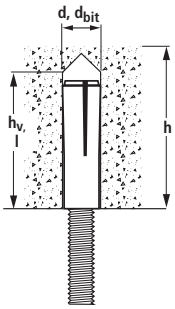
- Normal-weight Concrete
- Lightweight Concrete

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Type 303 Stainless Steel	Type 316 Stainless Steel
Anchor Body	AISI 1008	Type 303/304 Stainless Steel	Type 316 Stainless Steel
Plug	AISI 1018	Type 303/304 Stainless Steel	Type 316 Stainless Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A	
Stainless steel anchor components are passivated.			

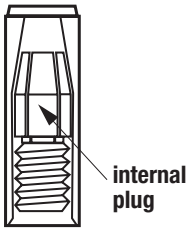
INSTALLATION SPECIFICATIONS

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	3/4-41/2
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



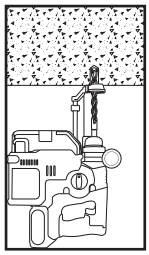
Nomenclature

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

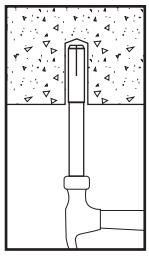


Installation Procedure

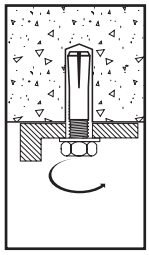
Using the proper drill bit size, drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Do not over drill the hole unless the application calls for a subset anchor.



Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and tap flush with surface. Using a DEWALT 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 DEWALT 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 and Allowable Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	Tension						Shear	
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)		f'c ≥ 2000 psi (20.7 MPa)	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	1 (25.4)	1,140 (5.1)	285 (1.3)	1,985 (8.9)	495 (2.2)	2,080 (9.4)	520 (2.3)	2,120 (9.5)	530 (2.4)
3/8 (9.5)	1-9/16 (39.7)	2,180 (9.8)	545 (2.5)	4,180 (18.8)	1,045 (4.7)	4,950 (22.3)	1,240 (5.6)	4,585 (20.6)	1,145 (5.2)
1/2 (12.7)	2 (50.8)	4,105 (18.5)	1,025 (4.6)	5,760 (25.9)	1,440 (6.5)	6,585 (29.6)	1,645 (7.4)	6,400 (28.8)	1,600 (7.2)
5/8 (15.9)	2-1/2 (63.5)	4,665 (21.0)	1,165 (5.2)	7,440 (33.5)	1,860 (8.4)	10,920 (49.1)	2,730 (12.3)	12,380 (55.7)	3,095 (13.9)
3/4 (19.1)	3-3/16 (81.0)	8,580 (38.6)	2,145 (9.7)	9,405 (41.8)	2,350 (10.5)	11,300 (50.3)	2,825 (12.6)	15,680 (70.6)	3,920 (17.6)

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.

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

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	Tension						Shear	
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)		f'c ≥ 2000 psi (20.7 MPa)	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	1 (25.4)	1,060 (4.8)	265 (1.2)	1,360 (6.1)	340 (1.5)	1,660 (7.5)	415 (1.9)	1,920 (8.6)	480 (2.2)
3/8 (9.5)	1-9/16 (39.7)	3,040 (13.7)	760 (3.4)	3,780 (17.0)	945 (4.3)	4,520 (20.3)	1,130 (5.1)	4,120 (18.5)	1,030 (4.6)
1/2 (12.7)	2 (50.8)	4,240 (19.1)	1,060 (4.8)	4,840 (21.8)	1,210 (5.4)	5,460 (24.6)	1,365 (6.1)	5,680 (25.6)	1,420 (6.4)
5/8 (15.9)	2-1/2 (63.5)	6,860 (30.9)	1,715 (7.7)	7,840 (35.3)	1,960 (8.8)	8,840 (39.8)	2,210 (9.9)	9,640 (43.4)	2,410 (10.8)
3/4 (19.1)	3-3/16 (81.0)	10,280 (45.7)	2,570 (11.4)	11,700 (52.7)	2,925 (13.0)	13,120 (59.0)	3,280 (14.6)	15,680 (70.6)	3,920 (17.9)

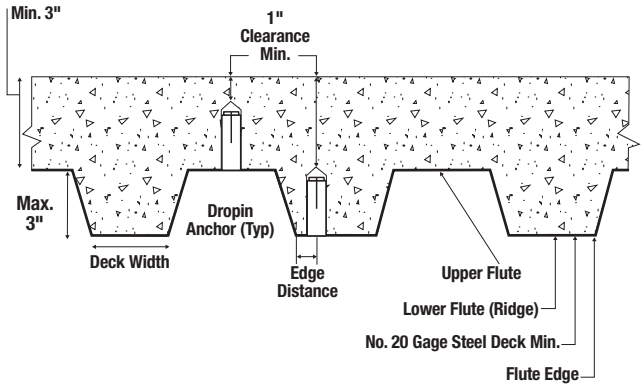
1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
3. Ultimate load capacities must be reduced by a minimum safety factor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

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

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over Steel Deck, f´c ≥ 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.

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MINIMUM 3,000 PSI)



DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 7d$	$F_{NC} = 0.90$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 7d$	$F_{VC} = 0.50$

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 7d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 7d$	$F_{VC} = 0.50$

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.

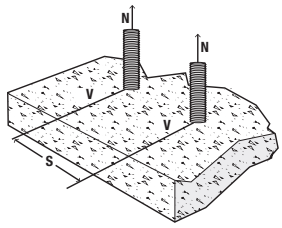
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT AND LIGHTWEIGHT CONCRETE

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 Distance (inches)	1-1/2	0.50	-	-	-	-
	2-1/4	0.75	0.50	-	-	-
	3	1.00	0.67	0.50	-	-
	3-3/4	1.00	0.83	0.63	0.50	-
	4	1.00	0.89	0.67	0.53	-
	4-1/2	1.00	1.00	0.75	0.60	0.50
	5	1.00	1.00	0.83	0.67	0.56
	6	1.00	1.00	1.00	0.80	0.67
	7-1/2	1.00	1.00	1.00	1.00	0.83
	9	1.00	1.00	1.00	1.00	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)

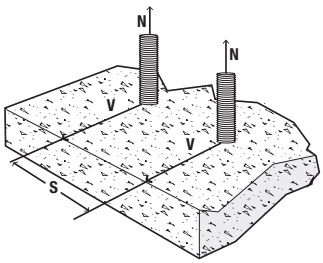
Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3-1/2	5-1/4	7	8-3/4	10-1/2
c_{min} (in.)		1-3/4	2-5/8	3-1/2	4-3/8	5-1/4
Edge Distance, c (inches)	1-3/4	0.90	-	-	-	-
	2	0.91	-	-	-	-
	2-5/8	0.95	0.90	-	-	-
	3	0.97	0.91	-	-	-
	3-1/2	1.00	0.93	0.90	-	-
	4-3/8	1.00	0.97	0.93	0.90	-
	5-1/4	1.00	1.00	0.95	0.92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

Notes: For anchors loaded in tension, the critical edge (c_{cr}) is equal to 14 anchors 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 light-weight 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	1.00	0.93	0.85	0.80	-
	5-1/4	1.00	1.00	0.90	0.84	0.80
	6	1.00	1.00	0.94	0.87	0.83
	7	1.00	1.00	1.00	0.92	0.87
	8	1.00	1.00	1.00	0.97	0.90
	8-3/4	1.00	1.00	1.00	1.00	0.93
	10-1/2	1.00	1.00	1.00	1.00	1.00

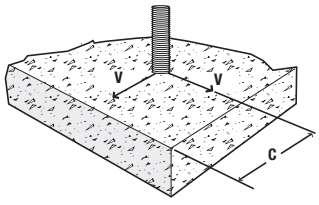


Edge Distance, Shear (F_{VC})

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	1.00	0.83	0.63	0.50	-
	5	1.00	0.95	0.71	0.57	-
	5-1/4	1.00	1.00	0.75	0.60	0.50
	6	1.00	1.00	0.86	0.69	0.57
	7	1.00	1.00	1.00	0.80	0.67
	8	1.00	1.00	1.00	0.91	0.76
	8-3/4	1.00	1.00	1.00	1.00	0.83
	10	1.00	1.00	1.00	1.00	0.95
	10-1/2	1.00	1.00	1.00	1.00	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.	Domestic Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6304	6304USA	1/4"	1"	7/16"	100	1000	2
6306	6306USA	3/8"	1-9/16"	5/8"	50	500	6
6308	6308USA	1/2"	2"	13/16"	50	250	12
6320	6320USA	5/8"	2-1/2"	1-3/16"	25	125	32
6312	6312USA	3/4"	3-13/16"	1-3/8"	10	50	48

Carbon Steel Knurled Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
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
6324	1/4"	1"	7/16"	100	1,000	2
6326	3/8"	1-9/16"	5/8"	50	500	6
6328	1/2"	2"	13/16"	50	300	12

Type 300 Series Stainless Steel Dropin

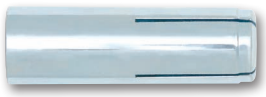
Cat. No. (Type 304)	Domestic Cat. No. (Type 303)	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6204	6204USA	1/4"	1"	7/16"	100	1000	2
6206	6206USA	3/8"	1-9/16"	5/8"	50	500	6
6208	6208USA	1/2"	2"	13/16"	50	250	12
6210	6210USA	5/8"	2-1/2"	1-3/16"	25	125	32
6212	6212USA	3/4"	3-13/16"	1-3/8"	10	50	48

Type 316 Stainless Steel Dropin

Cat. No.	Domestic Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6224	6224USA	1/4"	1"	7/16"	100	1000	2
6226	6226USA	3/8"	1-9/16"	5/8"	50	500	6
6228	6228USA	1/2"	2"	13/16"	50	250	12
6230	6230USA	5/8"	2-1/2"	1-3/16"	25	125	32
6232	6232USA	3/4"	3-13/16"	1-3/8"	10	50	48

Carbon Steel Coil Thread Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100
6330	1/2"	2"	13/16"	50	300	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"

Accu-Bit™ Drill Stop for Steel Dropin

Cat. No.	Rod/Anchor Size	Drill Depth	Std. Box
DWA5493	1/2" Accu-Bit for 3/8" Steel Dropin	1-13/16"	1
DWA5495	5/8" Accu-Bit for 1/2" Steel Dropin	2-3/8"	1

GENERAL INFORMATION

SMART DI™

Internally Threaded Expansion Anchor

PRODUCT DESCRIPTION

The Smart DI is an all-steel, machine bolt anchor available in carbon steel. It can be used in solid concrete, hard stone, and solid block base materials. The Smart DI is specifically designed to be easier to fully set during installation as a benefit to the user.

GENERAL APPLICATIONS AND USES

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

FEATURES AND BENEFITS

+ Installs with reduced effort compared to traditional drop in style anchors
+ Can be installed using the manual setting tool or Smart DI system with a hammer-drill
+ Setting indicater makes identification of properly set anchors easy (when installed using the smart tool and smart bit)
+ Internally threaded anchor for easy bolt removability and service work
+ Anchor can be installed through standard fixture holes

TESTING, APPROVALS AND LISTINGS

- FM Global (Factory Mutual) - File No. 3059197 (see ordering information)
- Underwriters Laboratory (UL Listed) – File No. EX1289 (N) (see ordering information)

GUIDE SPECIFICATIONS

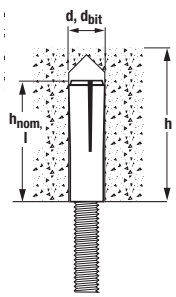
CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Dropin anchors shall be Smart DI as supplied by DEWALT, Towson, MD.

MATERIAL SPECIFICATIONS

Anchor component	Specification
Anchor Body	AISI 1008
Plug	AISI 1008
Zinc Plating	ASTM B 633, SC1 Type III (Fe/Zn 5)

INSTALLATION SPECIFICATIONS

Anchor (Rod) Size	1/4"	3/8"	1/2"
Nominal Outside Diameter d (in.)	0.375	0.500	0.625
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8
Maximum Tightening Torque, T_{max} (ft.-lbs.)	5	10	20
Thread Size (UNC)	1/4-20	3/8-16	1/2-13
Thread Depth (in.)	7/16	5/8	13/16
Anchor Length l, h_{nom} (in.)	1	1-9/16	2



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
h = Base material thickness. The minimum value of h should be 3" min. except for 1/2" size where minimum value of h should be 4"
h_{nom} = Minimum embedment depth
l = Overall length of anchor

SECTION CONTENTS

SMART DI (DROP-IN)

THREAD VERSION

Coarse (UNC)

ANCHOR MATERIALS

- Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4", 3/8" and 1/2" diameter (UNC)

SUITABLE BASE MATERIALS

- Normal-Weight Concrete

SMART DI DROP-IN

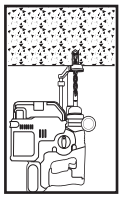
Anchor prior to installation

When properly set with Smart DI tool (system installation tool), anchor indicator will leave blue paint in recessed cavities. Note: Blue does not have to be removed from all four top surfaces to be fully set.

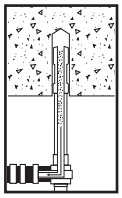
- Easier to Set
- More Expansion
- Expansion Indicator with a Smart DI System

INSTALLATION SPECIFICATIONS

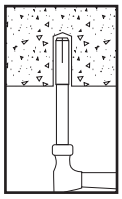
Manual Installation



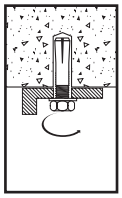
1. Using the proper drill bit size, drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Use any ANSI Standard carbide drill bit.



2. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and, if necessary tap flush with surface.

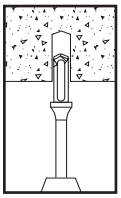


3. Using a DEWALT manual setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor. Anchor will not hold allowable loads required if shoulder of DEWALT manual setting tool does not seat against anchor. Proper manual installation may not remove blue indicator paint.

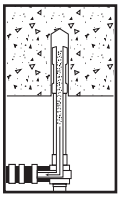


4. If using a fixture, position it, insert bolt and tighten so as not to exceed the maximum tightening torque. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

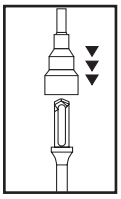
Smart DI System Installation



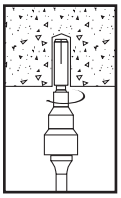
1. Using the proper drill bit size, drill a hole into the base material to the depth of embedment required using the appropriate DEWALT DI Stop Drill Bit. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Standard installation with a DI Stop Drill Bit may result in the anchor being slightly subset from the surface. Minimum published embedment depths must be achieved by using the shoulder of the DI Stop Drill Bit as a guide.



2. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and, if necessary, tap flush with the surface.

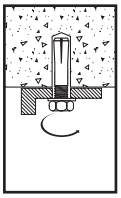


3. Slide the appropriate DEWALT DI Setting Tool over the DI Stop Drill Bit used to drill the hole and twist counterclockwise to lock the setting tool onto the bit. If tool does not fit snug onto bit it may be necessary to replace the internal rubber spring plug in the tool (see ordering information). Replacement kit sold separately.



4. Once attached, insert the tip of the setting tool into the Smart DI anchor and drive the internal plug fully using the rotation with hammer mode of the SDS+ drill (see table below for suggested tools).

5. For proper installation, the shoulder of the setting tool must come briefly in full contact with the Smart DI resulting in the blue indicator paint being removed from the raised top of the anchor. The paint will remain in the recessed portion of the top indicating full expansion.



6. If using a fixture, position it, insert the bolt and tighten so as not to exceed the maximum tightening torque. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

Recommended SDS+ Rotary Hammer Drill Specification for Smart DI Anchor (Drop-In) with Smart DI System Installation

Diameter	Concrete Compressive Strength (psi)	Rated Tool Impact Energy Suggested Range* (ft-lbs)	Recommended Rotary Hammer Tool Part Number
1/4"	2,500	1.3 - 2.6	DCH133M2, D25323K
	6,500	2.0 - 3.5	
3/8"	2,500	1.3 - 4.0	DCH293R2, D25263K
	6,500	2.1 - 4.0	
1/2"	2,500	2.0 - 4.0	DCH293R2, D25413K
	6,500	2.5 - 4.0	

* Local concrete conditions and rotary hammer impact efficiency vary greatly. Please verify that the tool impact energy is sufficient to fully set the internal plug of the Smart DI prior to using the system.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Smart DI Anchor (Drop-In) in Normal-Weight Concrete[1,2,3,4,5]

Nom. Anchor Dia. d in.	Min. Embed. Depth in. (mm)	Minimum Concrete Compressive Strength - f'c (psi)															
		2,500				3,000				4,000				6,000			
		Tension		Shear		Tension		Shear		Tension		Shear		Tension		Shear	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4	1 (25)	1,300 (5.8)	325 (1.4)	2,495 (11.1)	625 (2.8)	1,390 (6.2)	350 (1.6)	2,510 (11.2)	630 (2.8)	1,565 (7.0)	390 (1.7)	2,550 (11.3)	640 (2.8)	1,910 (8.5)	480 (2.1)	2,620 (11.7)	655 (2.9)
3/8	1-9/16 (40)	1,985 (8.6)	495 (2.2)	4,160 (18.5)	1,040 (4.6)	2,275 (10.1)	570 (2.5)	4,360 (19.4)	1,090 (4.6)	2,850 (12.7)	715 (3.2)	4,755 (21.2)	1,190 (5.3)	4,000 (17.5)	1,000 (4.4)	5,550 (24.7)	1,390 (5.2)
1/2	2 (51)	3,630 (16.1)	910 (4.0)	7,170 (31.9)	1,795 (8.0)	3,185 (14.2)	795 (3.5)	7,280 (32.4)	1,820 (8.1)	4,190 (18.6)	1,050 (4.7)	7,505 (33.4)	1,875 (8.3)	4,935 (22.0)	1,235 (8.3)	7,955 (35.4)	1,990 (8.9)

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.
3. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
4. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
5. 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:

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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]

NOTE: 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 Distance Adjustment Factors - Tension (F_{NS})

Dia. (in)		1/4"	3/8"	1/2"
h_v		1	1-9/16	2
s_{cr}		3	4-1/2	6
s_{min}		1-1/2	2-3/8	3
Spacing Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	0.90	-	-
	2	0.94	-	-
	2-1/2	0.97	0.84	-
	3	1.00	0.87	0.85
	3-1/2	1.00	0.91	0.88
	4	1.00	0.95	0.90
	4-1/2	1.00	1.00	0.93
	5	1.00	1.00	0.95
	5-1/2	1.00	1.00	0.98
	6	1.00	1.00	1.00

Spacing Distance Adjustment Factors - Shear (F_{VS})

Dia. (in)		1/4"	3/8"	1/2"
h_v		1	1-9/16	2
s_{cr}		3	5	6
s_{min}		1-1/2	2-3/8	3
Spacing Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	0.62	-	-
	2	0.75	-	-
	2-1/2	0.88	0.65	-
	3	1.00	0.73	0.62
	3-1/2	1.00	0.81	0.69
	4	1.00	0.89	0.75
	4-1/2	1.00	0.97	0.81
	5	1.00	1.00	0.88
	5-1/2	1.00	1.00	0.94
	6	1.00	1.00	1.00

Edge Distance Adjustment Factors - Tension (F_{NC})

Dia. (in)		1/4"	3/8"	1/2"
h_v		1	1-9/16	2
c_{cr}		2	4-11/16	6
c_{min}		2	3-1/8	4
Edge Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	-	-	-
	2	1.00	-	-
	2-1/2	1.00	-	-
	3	1.00	-	-
	3-1/2	1.00	0.98	-
	4	1.00	0.99	0.93
	4-1/2	1.00	1.00	0.95
	5	1.00	1.00	0.97
	5-1/2	1.00	1.00	0.98
	6	1.00	1.00	1.00

Edge Distance Adjustment Factors - Shear (F_{VC})

Dia. (in)		1/4"	3/8"	1/2"
h_v		1	1-9/16	2
c_{cr}		3	4-11/16	6
c_{min}		2	3-1/8	4
Edge Distance (inches)	1/2	-	-	-
	1	-	-	-
	1-1/2	-	-	-
	2	0.87	-	-
	2-1/2	0.94	-	-
	3	1.00	-	-
	3-1/2	1.00	0.96	-
	4	1.00	0.98	0.91
	4-1/2	1.00	1.00	0.93
	5	1.00	1.00	0.95
	5-1/2	1.00	1.00	0.98
	6	1.00	1.00	1.00

ORDERING INFORMATION

Smart DI Anchor (Drop-In) Carbon Steel Smooth Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Box	Wt./100	FM or UL
6304SD	1/4"	1"	7/16"	100	1,000	2	-
6306SD	3/8"	1-9/16"	5/8"	50	500	6	FM/UL
6308SD	1/2"	2"	13/16"	50	500	12	FM/UL

DI System Setting Tool

Cat. No.	00425SD	00427SD	00429SD
Rod/Anchor Size	1/4"	3/8"	1/2"
Pin Length	39/64"	61/64"	1-3/16"

DI Tool Replacement Parts

Cat. No.	00426SD	00428SD	00430SD
Kit Contents	2 Guide Screws 1 Rubber Spring Plug	2 Guide Screws 1 Rubber Spring Plug	2 Guide Screws 1 Rubber Spring Plug
Fits Tool No.	00425SD	00427SD	00429SD

DI Stop Drill Bit

Cat. No.	00391SD	00397SD	00410SD
Description	Smart Bit for 1/4"	Smart Bit for 3/8"	Smart Bit for 1/2"
Bit Diameter	3/8"	1/2"	5/8"

Manual Setting Tools for Smart DI Anchor (Drop-In)

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

Recommended Rotary Hammer Drills

Cat. No.	Description
DCH133M2	1" D-Handle SDS+ Brushless Rotary Hammer 20V Max
DCH293R2	1-1/8" SDS+ Brushless Rotary Hammer 3.5J w/ 6Ah Battery 20V Max
D25263K	1-1/8" SDS+ Rotary Hammer
D25323K	1" L-Shape SDS Rotary Hammer
D25413K	1-1/8" SDS Plus Rotary Hammer Kit

GENERAL INFORMATION

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

FEATURES AND BENEFITS

+ 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
+ Manual setting tool scores flange when set to verify proper expansion depth

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488 and AC01 criteria
- Factory Mutual Research Corporation (FM Approvals) – File No. 3059197
  See listing for applicable sizes - www.fmglobal.com

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Mini Dropin anchors as supplied by DEWALT, Towson, MD.

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
- 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)

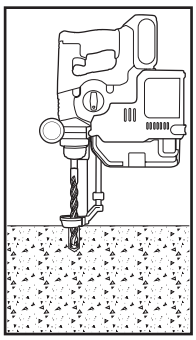
Installation Specification

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

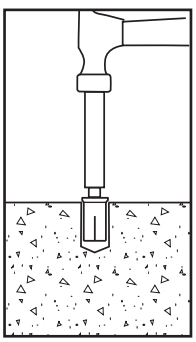
INSTALLATION PROCEDURES

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.

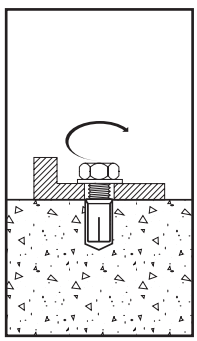
In post-tensioned concrete slabs, take care to avoid drilling into the post-tensioned cables.



Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Insert the anchor into the hole and tap flush with surface. Using a DEWALT 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 DEWALT 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)	1,100 (6.3)	1,260 (5.7)	1,150 (5.1)	1,650 (7.4)	1,200 (5.3)	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]

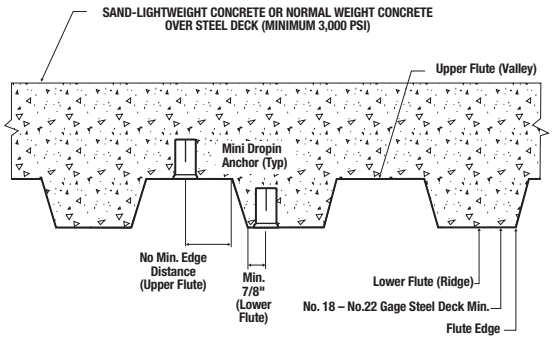
Rod/Anchor Size d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f´c)					
		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	275 (1.2)	315 (1.4)	285 (1.3)	415 (1.9)	300 (1.3)	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.

Ultimate and Allowable Load Capacities for Mini Dropin Installed Through Steel Deck into 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 ≥ 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)

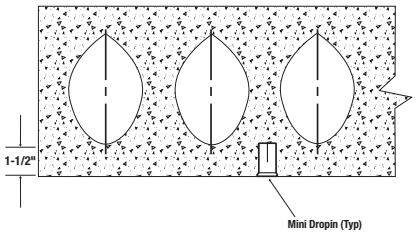
1. The metal deck shall be No. 22 gage to No. 18 gage thick steel [0.030-inch to 0.047-inch base metal thickness (0.75 mm to 1.20 mm)].
2. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
3. Tabulated load values are for anchors installed with a minimum edge distance 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.



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 ≥ 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)	1,400 (6.2)	1,840 (8.3)	350 (1.6)	460 (2.1)
3/8 (9.5)	3/4 (19.1)	4-1/2 (114)	4-1/2 (114)	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:

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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 DISTANCE[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	$s_{cr} = 3.0h_v$	$F_{NC} = F_{VC} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{NC} = F_{VC} = 1.0$	$c_{min} = 6d$	$F_{NC} = 0.90$
	Shear[1]	$c_{cr} = 12d$	$F_{NC} = F_{VC} = 1.0$	$c_{min} = 6d$	$F_{VC} = 0.75$

1. Allowable loads for anchors loaded in shear parallel to the edge have no load factor $F_{vc} = 1.0$ 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	$s_{cr} = 3.0h_v$	$F_{Ns} = F_{Vs} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{vs} = 0.50$

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.

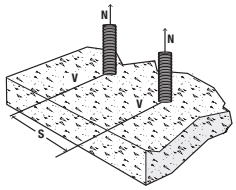
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT AND LIGHTWEIGHT CONCRETE

Spacing, Tension (F_{Ns}) & Shear (F_{Vs}) (Normal-weight & 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	1.00	0.89	0.67
	2-1/4	1.00	1.00	0.75
	2-1/2	1.00	1.00	0.83
	3	1.00	1.00	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.

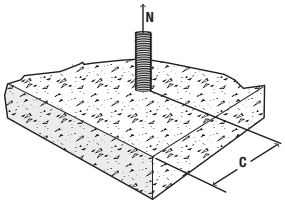


Edge Distance, Tension (F_{NC}) (Normal-weight concrete only)

Dia. (in.)		1/4	3/8	1/2
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	1.00	0.98	0.93
	4-1/2	1.00	1.00	0.95
	5	1.00	1.00	0.97
	6	1.00	1.00	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.

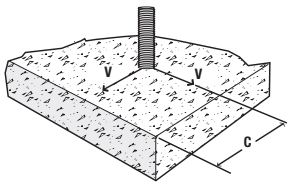


Edge Distance, Shear (F_{VC}) (Normal-weight concrete only)

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	1.00	0.94	0.83
	4-1/2	1.00	1.00	0.88
	5	1.00	1.00	0.92
	6	1.00	1.00	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	250

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	Drill Depth	Standard Box
DWA5491	3/8" Accu-Bit for 1/4" Mini Dropin	7/8"	1
DWA5492	1/2" Accu-Bit for 3/8" Mini Dropin	15/16"	1
DWA5494	5/8" Accu-Bit for 1/2" Mini Dropin	1-13/32"	1

GENERAL INFORMATION

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

FEATURE AND BENEFITS

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

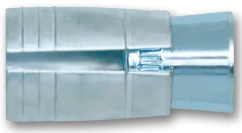
APPROVALS AND LISTINGS

- Underwriters Laboratories (UL) File EX 1289 (Hanger, Pipe): See listing for sizes.

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Dropin anchors shall be Hollow-Set Dropin as supplied by DEWALT, Towson, MD.

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" through 5/8" diameters

SUITABLE BASE MATERIALS

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

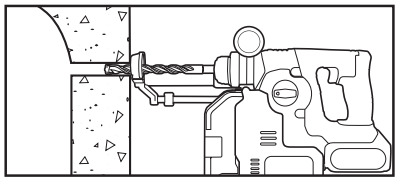
MATERIAL SPECIFICATIONS

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

INSTALLATION SPECIFICATIONS

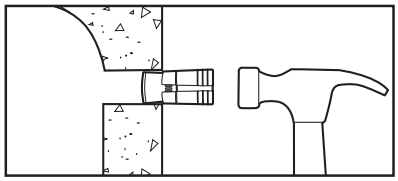
Dimension	Rod/Anchor Diameter, d				
	1/4"	5/16"	3/8"	1/2"	5/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	5/8	5/8	3/4	1
Maximum Tightening Torque, T_{max} (ft.-lbs)	3-4	5-7	8-10	15-20	30-40
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Overall Anchor Length (in.)	7/8	1-5/16	1-5/16	1-3/4	2
Sleeve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

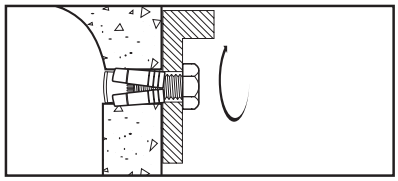


In hollow base materials, drill through into the cell or void. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.

Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

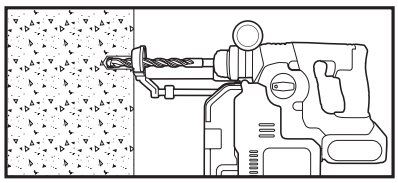


Do not expand the anchor prior to installation. Insert cone end and tap flush to surface.



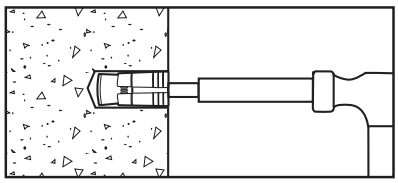
Position fixture, insert bolt and tighten. The bolt should engage a minimum of 2/3 of the anchor threads. The anchor can also be expanded using a Hollow-Set Tool. (If Hollow-Set Tool is used, thread anchor onto tool prior to tapping into anchor hole. When flush with surface, turn tool clockwise to tighten.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

Installation Instructions for Solid Base Materials



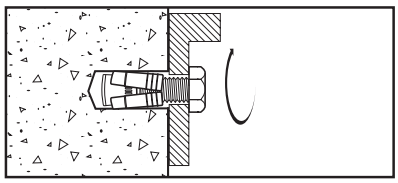
Drill a hole into the base material to the required embedment depth. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.

Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to ex tract loose particles created by drilling.



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.

PERFORMANCE DATA

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

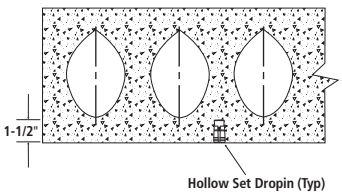
Rod/ Anchor Diameter d in. (mm)	Minimum Embed Depth h_v in. (mm)	Drill Bit Diameter ANSI in.	Minimum Concrete Compressive Strength, f 'c											
			2,000 psi				4,000 psi				6,000 psi			
			Tension		Shear		Tension		Shear		Tension		Shear	
			Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	3/4 (19)	3/8	760 (3.4)	150 (0.7)	1,200 (5.3)	240 (1.1)	1,140 (5.1)	230 (1.0)	1,200 (5.3)	240 (1.1)	1,440 (6.4)	290 (1.3)	1,200 (5.3)	240 (1.1)
	7/8 (22)		880 (3.9)	175 (0.8)	1,440 (6.4)	290 (1.3)	1,145 (5.1)	230 (1.0)	1,440 (6.4)	290 (1.3)	2,045 (9.1)	410 (1.8)	1,440 (6.4)	290 (1.3)
5/16 (6.4)	1 (25)	5/8	1,120 (5.0)	225 (1.0)	1,980 (8.8)	395 (1.8)	1,680 (7.5)	335 (1.5)	1,980 (8.8)	395 (1.8)	2,200 (9.8)	440 (2.0)	1,980 (8.8)	395 (1.8)
	1-1/2 (38)		2,205 (9.8)	440 (2.0)	2,740 (12.2)	550 (2.4)	2,775 (12.3)	555 (2.5)	2,740 (12.2)	550 (2.4)	4,825 (21.5)	965 (4.3)	2,740 (12.2)	550 (2.4)
3/8 (9.5)	1 (25)	5/8	1,370 (6.1)	275 (1.2)	2,550 (11.3)	510 (2.3)	2,070 (9.2)	415 (1.8)	2,550 (11.3)	510 (2.3)	2,290 (10.2)	460 (2.0)	2,550 (11.3)	510 (2.3)
	1-1/2 (38)		2,445 (10.9)	490 (2.2)	3,145 (14.0)	630 (2.8)	2,800 (12.5)	560 (2.5)	3,145 (14.0)	630 (2.8)	5,085 (22.6)	1,015 (4.5)	3,145 (14.0)	630 (2.8)
1/2 (12.7)	1-1/2 (38)	3/4	2,140 (9.5)	430 (1.9)	4,020 (17.9)	805 (3.6)	4,025 (17.9)	805 (3.6)	4,020 (17.9)	805 (3.6)	7,285 (32.4)	1,455 (6.5)	4,020 (17.9)	805 (3.6)
	2 (51)		2,780 (12.4)	555 (2.5)	4,020 (17.9)	805 (3.6)	4,375 (19.5)	875 (3.9)	4,020 (17.9)	805 (3.6)	9,455 (42.1)	1,890 (8.4)	4,020 (17.9)	805 (3.6)
5/8 (15.9)	2-1/4 (57)	1	5,725 (25.5)	1,145 (5.1)	6,400 (28.5)	1,280 (5.7)	9,410 (41.9)	1,880 (8.4)	6,400 (28.5)	1,280 (5.7)	10,500 (46.7)	2,100 (9.3)	6,400 (28.5)	1,280 (5.7)

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

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

Rod/ Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Drill Bit Diameter ANSI in.	Minimum Concrete Compressive Strength f'c ≥ 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)	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.
3. Minimum spacing distance must not be less than eight anchor diameters (8d).



Ultimate and Allowable Load Capacities for Hollow-Set Dropin in Hollow Concrete Masonry[1,2,3,4,5,6,7]

Rod/Anchor Diameter d in.	Minimum Embedment Depth hv in.	Drill Bit Diameter ANSI in.	Min. Edge Distance in. (mm)	Min. End Distance in. (mm)	f'm = 1,500 psi			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4	7/8* (22.2)	3/8	3-3/4 (95)	3-3/4 (95)	530 (2.4)	785 (3.5)	105 (0.5)	155 (0.7)
5/16	1* (25.4)	5/8	3-3/4 (95)	3-3/4 (95)	1,035 (4.6)	920 (4.1)	205 (0.9)	185 (0.8)
3/8	1* (25.4)	5/8	3-3/4 (95)	3-3/4 (95)	1,225 (5.4)	1,175 (5.2)	245 (1.1)	235 (1.0)
1/2	1-1/4* (31.8)	3/4	3-3/4 (95)	3-3/4 (95)	1,520 (6.8)	1,240 (5.5)	305 (1.4)	250 (1.1)
	1-1/4* (31.8)	3/4	11-1/4 (286)	11-1/4 (286)	1,520 (6.8)	1,825 (8.1)	305 (1.4)	365 (1.6)
5/8	1-1/2* (38.1)	1	11-1/4 (286)	11-1/4 (286)	1,790 (8.0)	1,870 (8.3)	360 (1.6)	375 (1.7)

1. Tabulated load values are applicable to anchors with carbon and stainless steel cones.
2. Tabulated load values for anchors are installed in minimum 6" 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 specified minimum at the time of installation.
3. Allowable load capacities listed are calculated using an 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. Allowable shear load values may be increased by 100% (multiplied by 2.0) provided the applied shear loads are not loaded toward the wall edge and end.
5. The tabulated values are applicable for anchors installed into grouted masonry wall faces or ends of block ends provided minimum edge and end distances are maintained.
6. The tabulated values are applicable to single anchors. Two anchors may be installed in the same cell provided the spacing distance between the anchors is a minimum of six diameters (6d) and the allowable loads are reduced by 50%.
7. Anchors were installed with sleeve flush to block surface and with setting tool for hollow base materials. Embedment is measured from the surface of the base material.

*Minimum face shell thickness must be minimum 1.25-inch-thick for 1/2-inch-diameter anchors and minimum 1.5-inch-thick for 5/8-inch diameter anchors.

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)	Drill Bit Diameter ANSI in.	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	f'm ≥ 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)	3/8	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)	5/8	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)	5/8	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)	3/4	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)	1	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 ≥ 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:

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 8d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 8d$	$F_{VC} = 0.50$

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.

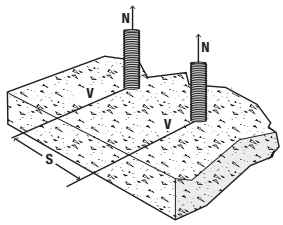
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

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	1.00	0.67	0.67	0.50	-
	3-3/8	1.00	0.75	0.75	0.56	0.50
	4	1.00	0.89	0.89	0.67	0.59
	4-1/2	1.00	1.00	1.00	0.75	0.67
	5	1.00	1.00	1.00	0.83	0.74
	6	1.00	1.00	1.00	1.00	0.89
	6-3/4	1.00	1.00	1.00	1.00	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.

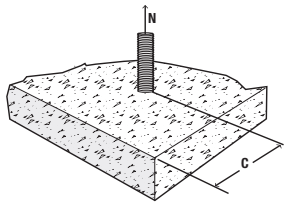


Edge Distance, Tension (F_{NC})

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	1.00	0.96	0.89	0.80	-
	4-3/8	1.00	1.00	0.92	0.83	-
	5	1.00	1.00	0.98	0.87	0.80
	5-1/4	1.00	1.00	1.00	0.88	0.81
	6	1.00	1.00	1.00	0.93	0.85
	7	1.00	1.00	1.00	1.00	0.91
	8	1.00	1.00	1.00	1.00	0.96
	8-3/4	1.00	1.00	1.00	1.00	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.

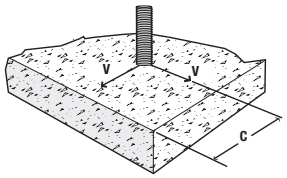


Edge Distance, Shear (F_{VC})

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	1.00	0.90	0.72	0.50	-
	4-3/8	1.00	1.00	0.81	0.56	-
	5	1.00	1.00	0.94	0.67	0.50
	5-1/4	1.00	1.00	1.00	0.71	0.53
	6	1.00	1.00	1.00	0.83	0.63
	7	1.00	1.00	1.00	1.00	0.77
	8	1.00	1.00	1.00	1.00	0.90
	8-3/4	1.00	1.00	1.00	1.00	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.

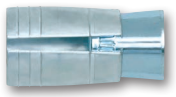
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 50% of load.



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.

GENERAL INFORMATION

CONCRETE HANGERMATE®+

Rod Hanging Anchor

PRODUCT DESCRIPTION

The Hangermate®+ concrete screw is a one piece, steel anchor designed for rod hanging applications such as fire protection systems, ventilation systems, electrical conduit, pipe hanging and cable trays. Tested and qualified for use in cracked concrete and seismic conditions. The concrete Hangermate®+ requires a 1/4" ANSI masonry bit for installation, accepts 1/4" and 3/8" diameter threaded rods and is also available in a 3/8" male thread version.

GENERAL APPLICATIONS AND USES

- Fire Sprinkler Pipes
- Ventilation Systems
- Cable Trays
- Suspended Ceilings
- Overhead Utilities
- Lighting Systems

FEATURES AND BENEFITS

+ Installs with standard ¼-inch ANSI drill bit
+ Faster installation resulting in labor savings
+ Patented thread design offers low installation torque
+ Tough threads for tapping high strength concrete

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES). ESR-3889 code compliant with the 2015 IBC/IRC, 2012 IBC/IRC, and 2009 IBC/IRC.
- FM Approvals (FM) - (see listing for applicable sizes and types).
- Tested in accordance with ACI 355.2/ASTM E 488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318-14, Chapter 17 and ACI-318-11/08 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.

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Concrete Hangermate+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instruction and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor component	Specification
Anchor Body	Case hardened low carbon steel
Plating	Zinc plating according to ASTM B 633, SC1 Type III (Fe/Zn 5). Minimum plating requirements for Mild Service Condition.

SECTION CONTENTS

CONCRETE HANGERMATE+ (INTERNALLY THREADED COUPLER HEAD)

CONCRETE HANGERMATE+ (EXTERNAL THREAD - STUD HEAD)

THREAD VERSION

- Unified Coarse Thread (UNC)

ANCHOR MATERIALS

- Zinc Plated Carbon Steel

ANCHOR SIZE RANGE (TYP.)

- 1/4" and 3/8" diameter (Threaded Heads)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Sand-lightweight concrete
- Concrete over steel deck

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-3889
CONCRETE

DDA DEWALT DESIGN ASSIST

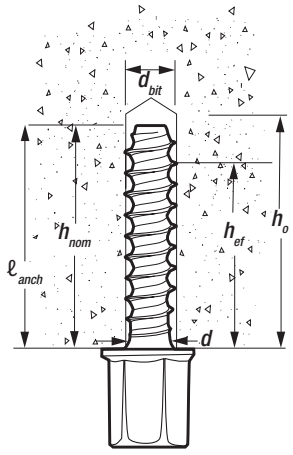
INSTALLATION SPECIFICATIONS

Installation Specifications for Hangermate+ in Concrete and Supplementary Information

Anchor Property/Setting Information		Notation	Units	Nominal Anchor Diameter (inch)	
				1/4	
Anchor outside diameter		d	in. (mm)	0.250 (6.35)	
Nominal drill bit diameter		d_{bit}	in. (mm)	1/4 ANSI	
Minimum embedment depth		h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Minimum hole depth		h_o	in. (mm)	2 (51)	2-7/8 (73)
Minimum member thickness		h_{min}	in. (mm)	3-1/4 (83)	4 (102)
Minimum edge distance		c_{min}	in. (mm)	1-1/2 (38)	
Minimum spacing		s_{min}	in. (mm)	1-1/2 (38)	
Max. Installation torque		$T_{inst,max}$	ft.-lbf. (N-m)	19 (26)	
Max impact wrench power (torque)		$T_{impact,max}$	ft.-lbf. (N-m)	150 (203)	
Internal Threaded Head	Wrench socket size	1/4 thread	in.	3/8	-
		3/8 thread		1/2	
	Maximum head height	1/4 thread	in.	33/64	-
		3/8 thread		43/64	
	Maximum washer diameter	1/4 thread	in.	1/2	-
		3/8 thread		21/32	
Externally Threaded Head	Wrench socket size	3/8 thread	in.	1/2	
	Maximum head height			1-3/16	
	Maximum washer diameter			21/32	
Effective tensile stress area (screw anchor body)		A_{se}	$in.^2$ (mm^2)	0.045 (29.0)	
Minimum specified ultimate strength		f_{uta}	ksi (N/mm^2)	100 (690)	
Minimum specified yield strength		f_y	ksi (N/mm^2)	80 (552)	

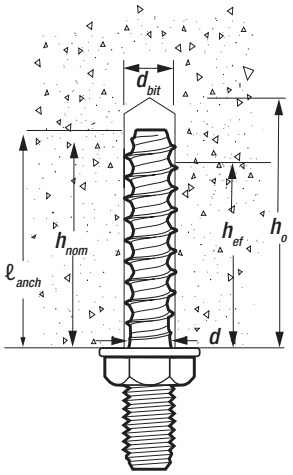
For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm^2; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

Hangermate+ Anchor Detail in Concrete



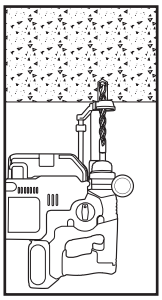
Internally Threaded

Nomenclature
d = Diameter of Anchor
d_{bit} = Diameter of Drill Bit
h_{nom} = Minimum Nominal Embedment
h_{ef} = Effective Embedment
h_o = Minimum Hole Depth
ℓ_{anch} = Nominal Anchor Length

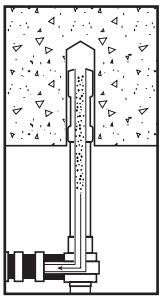


External Thread

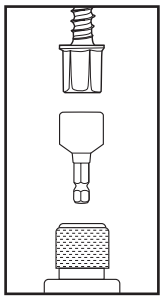
INSTALLATION INSTRUCTIONS



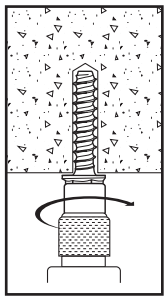
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



Step 2
Remove dust and debris from hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created during drilling.

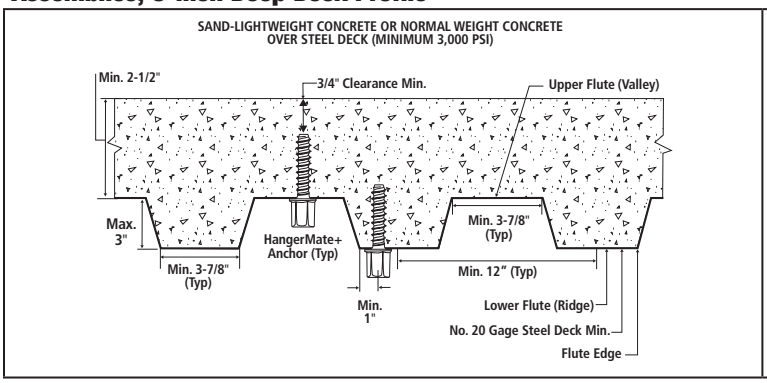


Step 3
Select a powered impact wrench or torque wrench and do not exceed the maximum torque, $T_{impact,max}$ or $T_{inst,max}$, repectively, for the selected anchor diameter and embedment (See Table 1). Attach an appropriate sized hex socket to the wrench. Mount the screw anchor head into the socket.



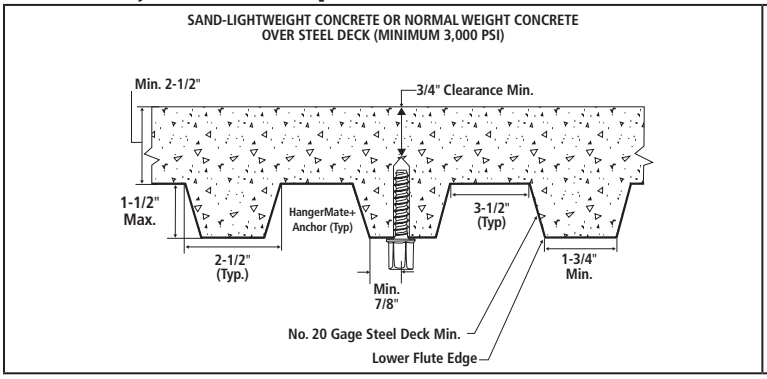
Step 4
Drive the anchor with an impact wrench or torque wrench through the fixture and into the hole until the head of the anchor comes into contact with the member surface. Do not spin the hex socket off the anchor to disengage. Insert threaded rod or threaded bolt element into Hangermate+.

Hangermate+ Installation Detail for Screw Anchors in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies, 3-inch Deep Deck Profile[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of the concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed with a maximum 15/16-inch offset in either directions 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. (e.g. 1-1/4-inch offset for 4-1/2-inch wide flute).
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

Hangermate+ Installation Detail for Screw Anchors in the Soffit of Concrete over Steel Deck Floor and Roof Assemblies, 1-1/2-inch Deep Deck Profile[1,2,3]



1. Anchors may be placed in the upper flute or lower flute of the concrete-filled steel deck profiles provided the minimum hole clearance of 3/4-inch is satisfied for the selected anchor. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table.
2. Anchors in the lower flute may be installed in the center of the flute. An offset distance may be given proportionally for profiles with flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.
3. See the Tension and Shear Design information for Anchors Installed in the Soffit of Concrete-Filled Steel Deck Assemblies table for design data.

REFERENCE DATA (ASD)

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

Nominal Anchor Diameter in.	Minimum Nominal 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)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4 (1/4 Thread)	1-5/8 (41)	2,835 (12.6)	1,485 (6.6)	2,995 (13.3)	1,525 (6.8)	3,265 (14.5)	1,525 (6.8)	3,265 (14.5)	1,525 (6.8)	3,265 (14.5)	1,525 (6.8)
1/4 (3/8 Thread)	1-5/8 (41)	2,835 (12.6)	2,035 (9.1)	2,995 (13.3)	2,090 (9.3)	3,265 (14.5)	2,090 (9.3)	3,265 (14.5)	2,090 (9.3)	3,265 (14.5)	2,090 (9.3)
	2-1/2 (64)	3,650 (16.2)	2,035 (9.1)	3,855 (17.1)	2,090 (9.3)	4,200 (18.7)	2,090 (9.3)	4,270 (19.0)	2,090 (9.3)	4,270 (19.0)	2,090 (9.3)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at a 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 Hangermate+ in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Minimum Nominal 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)		f'c = 8,000 psi (55.2 MPa)	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1/4 (1/4 Thread)	1-5/8 (41)	710 (3.2)	370 (1.6)	750 (3.3)	380 (1.7)	815 (3.6)	380 (1.7)	815 (3.6)	380 (1.7)	815 (3.6)	380 (1.7)
1/4 (3/8 Thread)	1-5/8 (41)	710 (3.2)	510 (2.3)	750 (3.3)	525 (2.3)	815 (3.6)	525 (2.3)	815 (3.6)	525 (2.3)	815 (3.6)	525 (2.3)
	2-1/2 (64)	915 (4.1)	510 (2.3)	965 (4.3)	525 (2.3)	1,050 (4.7)	525 (2.3)	1,070 (4.8)	525 (2.3)	1,070 (4.8)	525 (2.3)

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 4.0.
3. Allowable load capacities must be multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
4. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.

Edge Distance - Tension (F_{NC})

Diameter (in)		1/4		
Thread Diameter		1/4"	3/8"	3/8"
Nominal Embedment, h_{nom} (in)		1-5/8	1-5/8	2-1/2
Minimum Edge Distance, c_{min} (in)		1-1/2	1-1/2	1-1/2
Edge Distance (inches)	1-1/2	0.77	0.77	0.64
	1-3/4	0.83	0.83	0.67
	2	0.88	0.88	0.71
	2-1/4	0.94	0.94	0.75
	2-1/2	1.00	1.00	0.78
	2-3/4	1.00	1.00	0.82
	3	1.00	1.00	0.86
	3-1/2	1.00	1.00	0.93
	4	1.00	1.00	1.00

Spacing - Tension (F_{NS})

Diameter (in)		1/4		
Thread Diameter		1-5/8	1-5/8	2-1/2
Nominal Embedment, h_{nom} (in)		1-1/5	1-1/5	2
Minimum Spacing, s_{min} (in)		3-3/5	3-3/5	5-5/6
Spacing Distance (inches)	1-1/2	0.77	0.77	0.68
	1-3/4	0.80	0.80	0.70
	2	0.83	0.83	0.72
	2-1/4	0.86	0.86	0.74
	2-1/2	0.89	0.89	0.76
	2-3/4	0.92	0.92	0.78
	3	0.99	0.99	0.82
	3-1/2	1.00	1.00	0.86
	4	1.00	1.00	0.90
	4-1/2	1.00	1.00	0.94
	5	1.00	1.00	0.97
	5-1/2	1.00	1.00	1.00
	6	1.00	1.00	1.00

Edge Distance - Shear (F_{VC})

Diameter (in)		1/4		
Thread Diameter		1/4"	3/8"	3/8"
Nominal Embedment, h_{nom} (in)		1-5/8	1-5/8	2-1/2
Minimum Edge Distance, c_{min} (in)		1-1/2	1-1/2	1-1/2
Edge Distance (inches)	1-1/2	0.68	0.55	0.59
	1-3/4	0.79	0.64	0.68
	2	0.90	0.73	0.78
	2-1/4	1.00	0.82	0.88
	2-1/2	1.00	0.92	0.98
	2-3/4	1.00	1.00	1.00

Spacing - Shear (F_{VS})

Diameter (in)		1/4		
Thread Diameter		1/4"	3/8"	3/8"
Nominal Embedment, h_{nom} (in)		1-5/8	1-5/8	2-1/2
Minimum Spacing, s_{min} (in)		1-1/2	1-1/2	1-1/2
Spacing Distance (inches)	1-1/2	0.61	0.59	0.60
	1-3/4	0.63	0.61	0.61
	2	0.65	0.62	0.63
	2-1/4	0.67	0.64	0.65
	2-1/2	0.69	0.65	0.66
	2-3/4	0.71	0.67	0.68
	3	0.73	0.68	0.70
	3-1/2	0.76	0.71	0.73
	4	0.80	0.74	0.76
	4-1/2	0.84	0.77	0.79
	5	0.88	0.81	0.83
	5-1/2	0.91	0.84	0.86
	6	0.95	0.87	0.89
	6-1/2	0.99	0.90	0.92
	7	1.00	0.93	0.96
	7-1/2	1.00	0.96	0.99
	8	1.00	0.99	1.00
	9	1.00	1.00	1.00

PERFORMANCE DATA (SD)

Hangermate+ Installation Specifications in Concrete and Supplemental Information[1,2]

CODE LISTED
ICC-ES ESR-3889

Anchor Property/Setting Information		Notation	Units	Nominal Anchor Diameter (inch)	
				1/4	
Nominal anchor diameter		d_a	in. (mm)	0.250 (6.4)	
Nominal drill bit diameter		d_{bit}	in.	1/4 ANSI	
Minimum nominal embedment depth[3]		h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Effective Embedment		h_{ef}	in. (mm)	1.20 (30)	1.94 (49)
Minimum hole depth		h_o	in. (mm)	2 (51)	2-7/8 (73)
Minimum concrete member thickness		h_{min}	in. (mm)	3-1/4 (83)	4 (102)
Minimum edge distance		c_{min}	in. (mm)	1-1/2 (38)	
Minimum spacing distance		s_{min}	in. (mm)	1-1/2 (38)	
Critical edge distance		c_{ac}	in. (mm)	4.30 (109)	6.10 (155)
Minimum nominal anchor length[4]		ℓ_{anch}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Max Installation torque		$T_{inst,max}$	ft.-lb. (N-m)	19 (26)	25 (34)
Maximum impact wrench power (torque)		$T_{impact,max}$	ft.-lb. (N-m)	150 (203)	
Internal Threaded Head	Wrench socket size	1/4" thread	in.	3/8	-
		3/8" thread		1/2	
	Maximum head height	1/4" thread	in.	33/64	-
		3/8" thread		43/64	
	Maximum washer diameter	1/4" thread	in.	1/2	-
		3/8" thread		21/32	
Externally Threaded Head	Wrench socket size	3/8" thread	in.	1/2	
	Maximum head height			1-3/16	
	Maximum washer diameter			21/32	
Effective tensile stress area (screw anchor body)		A_{se}	in² (mm²)	0.045 (29.0)	
Minimum specified ultimate strength		f_{uta}	ksi (N/mm²)	100 (690)	
Minimum specified yield strength		f_y	ksi (N/mm²)	80 (552)	
Mean axial stiffness[5]	Uncracked concrete	β_{uncr}	lbf/in (kN/mm)	1,381,000 (242)	
	Cracked concrete	β_{cr}	lbf/in (kN/mm)	318,000 (56)	

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installations through the soffit of steel deck assemblies into concrete, see the design information table for installation in the soffit of concrete-filled steel deck assemblies and the installation details in the soffit of concrete over steel deck for the applicable steel deck profile. Tabulated minimum spacing values are based on anchors installed along the flute with axial spacing equal to the greater of $3h_{ef}$ or 1.5 times the flute width.
3. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
4. The listed minimum overall anchor length is based on the anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth, including consideration of a fixture attachment. The minimum nominal anchor length is measured from under the head to the tip of the anchor.
5. Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Tension Design Information for Hangermate+ Anchor is in Concrete[1,2]

CODE LISTED ICC-ES ESR-3889

Design Characteristic	Notation	Units	Nominal Anchor Diameter	
			1/4	
Anchor category	1, 2 or 3	-	1	
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)
Steel Strength in Tension (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)				
Steel strength in tension	N_{sa}[10]	lb (kN)	4,535 (20.2)	
Reduction factor for steel strength[3,4]	ϕ	-	0.65	
Concrete Breakout Strength in Tension (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)				
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.94 (49)
Critical edge distance	c_{ac}	in. (mm)	4.30 (109)	6.10 (155)
Effectiveness factor for uncracked concrete	k_{uncr}	-	27	24
Effectiveness factor for cracked concrete	k_{cr}	-	17	
Modification factor for cracked and uncracked concrete[5]	$\Psi_{c,N}$	-	1.0	
Reduction factor for concrete breakout strength[3]	ϕ	-	0.65 (Condition B)	
Pullout Strength in Tension (Non-Seismic Applications) (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)				
Characteristic pullout strength, uncracked concrete (2,500 psi)[6,9]	$N_{p,uncr}$	lb (kN)	See Note 7	
Characteristic pullout strength, cracked concrete (2,500 psi)[6,9]	$N_{p,cr}$	lb (kN)	765 (3.4)	1,415 (6.3)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	
Pullout Strength in Tension for Seismic Applications (ACI 318-14 17.2.3.3 Or ACI 318-11 D.3.3.3)				
Characteristic pullout strength, seismic (2,500 psi)[6,8,9]	$N_{p,eq}$	lb (kN)	360 (1.6)	1,170 (5.2)
Reduction factor for pullout strength[3]	ϕ	-	0.65 (Condition B)	

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm^2; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 Section D.4.3(c), as applicable for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1, as applicable.
5. Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\Psi_{c,N} = 1.0$.
6. For all design cases $\Psi_{c,P} = 1.0$. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 2,500 psi may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa.
7. Pullout strength does not control design of indicated anchors and does not need to be calculated 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 lightweight concrete provided the modification factor λa equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n.

Shear Design Information for Hangermate+ Anchor in Concrete[1,2,7,8]

CODE LISTED
ICC-ES ESR-3889

Design Characteristic	Notation	Units	Nominal Anchor Diameter		
			1/4		
Anchor category	1, 2 or 3	-	1	1	
Thread diameter	-	in.	1/4	3/8	
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-1/2 (64)
Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)					
Steel strength in shear[5]	V_{sa}	lb (kN)	860 (3.8)	1,545 (6.9)	1,545 (6.9)
Reduction factor for steel strength[3,4]	ϕ	-	0.60		
Steel Strength in Shear for Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)					
Steel strength in shear, seismic[6]	V_{eq}	lb (kN)	600 (2.7)	1,390 (6.2)	1,390 (6.2)
Reduction factor for steel strength in shear for seismic[3,4]	ϕ	-	0.60		
Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)					
Nominal anchor diameter	d_a	in. (mm)	0.250 (6.4)	0.250 (6.4)	
Load bearing length of anchor	ℓ_e	in. (mm)	1.20 (30)	1.20 (30)	1.94 (49)
Reduction factor for concrete breakout[3]	ϕ	-	0.70 (Condition B)		
Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)					
Coefficient for pryout strength	k_{cp}	-	1	1	1
Effective embedment	h_{ef}	in. (mm)	1.20 (30)	1.20 (30)	1.94 (49)
Reduction factor for pryout strength[3]	ϕ	-	0.70 (Condition B)		

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

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-17 17.2.3 or ACI 318-11 D.3.3, as applicable shall apply.
2. Installation must comply with published instructions and details.
3. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4. For reinforcement that complies with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D requirements for Condition A, see ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, for the appropriate ϕ factor when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2 are used.
4. The anchors are considered a brittle steel elements as defined by ACI 318-14 2.3 or ACI 318-11 D.1.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and must be used for design in lieu of the calculated results using equation 17.5.1.2(b) of ACI 318-14 or equation D-29 in ACI 318-11 D.6.1.2.
6. Reported values for steel strength in shear are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6 and must be used for design.
7. Anchors are permitted to be used in lightweight concrete in provided the modification factor λa equal to 0.8λ is applied to all values of $\sqrt{f'c}$ affecting N_n.
8. Shear values are for threaded rod or steel inserts with an ultimate strength, $F_u \geq 125$ ksi; threaded rod or steel inserts with an F_u less than 125 ksi are allowed provided the steel strength shear values are multiplied by the ratio of F_u (ksi) of the steel insert and 125 ksi.

Tension and Shear Design Information for Hangermate+ Anchor in the Soffit (Through the Underside) of Concrete-Filled Steel Deck Assemblies[1,2,3,4,5,6,7]

CODE LISTED ICC-ES ESR-3889

Anchor Property/Setting Information	Notation	Units	Nominal Anchor Size (inch)		
Anchor Category	1, 2 or 3	-	1	1	
Head Style	-	-	Threaded		
Thread Diameter	-	in.	1/4	3/8	
Minimum nominal embedment depth	h_{nom}	in. (mm)	1-5/8 (41)	1-5/8 (41)	2-1/2 (64)
Effective Embedment	h_{ef}	in. (mm)	1.20 (30)	1.20 (30)	1.94 (49)
Minimum hole depth	h_o	in. (mm)	1-3/4 (44)	1-3/4 (44)	2-5/8 (67)
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 3-7/8-inch-wide deck flute)					
Minimum concrete member thickness[8]	$h_{min,deck,total}$	in. (mm)	5-1/2 (140)	5-1/2 (140)	
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,430 (6.4)	1,430 (6.4)	2,555 (11.4)
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	615 (2.7)	615 (2.7)	1,115 (5.0)
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	290 (1.3)	290 (1.3)	920 (4.1)
Reduction factor for pullout strength[9]	ϕ	-	0.65		
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,485 (6.6)	2,740 (12.2)	
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	1,040 (4.6)	2,465 (11.0)	
Reduction factor for steel strength in shear for concrete over steel deck[9]	ϕ	-	0.60		
Anchors Installed Through the Soffit of Steel Deck Assemblies into Concrete (Minimum 1-3/4-inch-wide deck flute)					
Minimum concrete member thickness[8]	$h_{min,deck,total}$	in. (mm)	4 (102)	4 (102)	
Characteristic pullout strength, uncracked concrete over steel deck, (3,000 psi)	$N_{p,deck,uncr}$	lb (kN)	1,760 (7.8)	1,760 (7.8)	2,075 (9.2)
Characteristic pullout strength, cracked concrete over steel deck, (3,000 psi)	$N_{p,deck,cr}$	lb (kN)	760 (3.4)	770 (3.4)	910 (4.0)
Characteristic pullout strength, cracked concrete over steel deck,seismic, (3,000 psi)	$N_{p,deck,eq}$	lb (kN)	355 (1.6)	635 (2.8)	750 (3.3)
Reduction factor for pullout strength[8]	ϕ	-	0.65		
Steel strength in shear, concrete over steel deck	$V_{sa,deck}$	lb (kN)	1,680 (7.5)	2,180 (9.7)	
Steel strength in shear, concrete over steel deck, seismic	$V_{sa,deck,eq}$	lb (kN)	1,175 (5.2)	1,960 (8.7)	
Reduction factor for steel strength in shear for concrete over steel deck[9]	ϕ	-	0.60		

For SI: 1 inch = 25.4 mm; 1 ksi = 6.894 N/mm^2; 1 ft-lb = 1.356 N-m; 1 lb = 0.0044 kN.

1. Installation must comply with published instructions and details.
2. Values for $N_{p,deck}$ and $N_{p,deck,cr}$ are for 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 318-14 17.4.2 or ACI 318 D.5.2, as applicable, is not required for anchors installed in the deck soffit (through underside).
3. Values for $N_{p,deck,eq}$ are applicable for seismic loading and must be used in lieu of $N_{p,deck,cr}$.
4. For all design cases $\Psi_{c,P} = 1.0$. The characteristic pullout strength, N_{pn}, for concrete compressive strengths greater than 3,000 psi anchors may be increased by multiplying the value in the table by $(f'c / 3{,}000)^{0.3}$ for psi or $(f'c / 17.2)^{0.3}$ for MPa.
5. Shear loads for anchors installed through steel deck into concrete may be applied in any direction.
6. Values of $V_{sa,deck}$ and $V_{sa,deck,eq}$ are for sand-lightweight concrete and additional lightweight concrete reduction factors need not be applied. In addition, evaluation for the concrete breakout capacity in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, and the pryout capacity in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, are not required for anchors installed in the soffit (through underside).
7. Shear values are for threaded rod or steel inserts with an ultimate strength, $F_u \geq 125$ ksi; threaded rod or steel inserts with an F_u less than 125 ksi are allowed provided the steel strength shear values are multiplied by the ratio of F_u (ksi) of the steel insert and 125 ksi.
8. The minimum concrete member thickness, $h_{min,deck,total}$, is the minimum overall thickness of the concrete-filled steel deck (depth and topping thickness).
9. All values of ϕ were determined from the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, then the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08).

Factored Resistance Strength ($ØN_n$ And $ØV_n$) Calculated In Accordance With ACI 318-14 Chapter 17:

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 times c_{a1}.

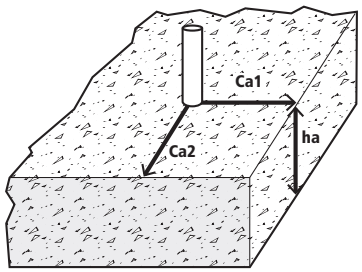
2- Calculations were performed according to ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout strength in shear are calculated using the effective embedment values, hef, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.

3- Strength reduction factors (ø) were based on ACI 318-14 Section 5.3 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.



Tension and Shear Design Strength Cracked Concrete

Nominal Anchor Diameter	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)
1/4" (1/4" thread)	1-5/8	495	515	525	515	575	515	645	515	705	515
1/4" (3/8" thread)	1-5/8	495	780	525	855	575	925	645	925	705	925
	2-1/2	920	925	970	925	1,060	925	1,195	925	1,305	925

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

Tension and Shear Design Strength Uncracked Concrete

Nominal Anchor Diameter	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 psi		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)	øNn Tension (lbs.)	øVn Shear (lbs.)
1/4" (1/4" thread)	1-5/8	1,155	515	1,265	515	1,460	515	1,785	515	2,065	515
1/4" (3/8" thread)	1-5/8	1,155	925	1,265	925	1,460	925	1,785	925	2,065	925
	2-1/2	2,110	925	2,310	925	2,665	925	2,950	925	2,950	925

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

ORDERING INFORMATION

Catalog Number	Screw Size	Hang	Rod Size	Socket Size	Box Qty.	Ctn. Qty.	20V Max* SDS Plus Rotary Hammers			20V Max* Impact Wrench
							 DCH273P2DH 1" L-Shape	 DCH133M2 1" D-Handle	 DCH293R2 1-1/8" L-Shape w/ E-Clutch"	 DCF883L2 3/8" Impact Wrench
							Carbide Bits			Impact Rated Socket
										
Hangermate+ Internal Thread 										
PFM2211100	1/4" x 1-5/8"	Vertical	1/4"	3/8"	25	125	DW5517	DW5417	DW5417	DWMT19051B
PFM2211200	1/4" x 1-5/8"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19169B
PFM2211250	1/4" x 2-1/2"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19169B
Hangermate+ External Thread 										
PFM1421000	1/4" x 1-5/8"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19052B
PFM1421050	1/4" x 2-1/2"	Vertical	3/8"	1/2"	25	125	DW5517	DW5417	DW5417	DWMT19052B
The published size includes the diameter and length of the anchor measured from under the head.							■ - Optimum Tool Match ■ - Maximum Tool Match			

Zinc Economy Rod Coupling Nuts

Catalog Number	Coupler Size	Box Qty.	Ctn. Qty.
030007	3/8" - 16 x 1/2" x 1-1/8"	100	1000

Zinc Reducing Rod Coupling Nuts

Catalog Number	Coupler Size	Box Qty.	Ctn. Qty.
030016	3/8"-16 - 1/4"-20	50	1000
030017	1/2"-13 - 3/8"-16	50	500

GENERAL INFORMATION

MINI-UNDERCUT+™

Internally Threaded Undercut Anchor

PRODUCT DESCRIPTION

The Mini-Undercut+ anchor is an internally threaded, self-undercutting anchor designed for performance in cracked and uncracked concrete. Suitable base materials include post-tension concrete (PT slabs), hollow-core precast concrete, normal-weight concrete, sand-lightweight concrete and concrete over steel deck. The Mini-Undercut+ anchor is installed into a pre-drilled hole with a power tool and a setting tool. The result is an anchor which can provide consistent behavior at shallow embedments as low as 3/4 of an inch. After installation a steel element is threaded into the anchor body.

GENERAL APPLICATIONS AND USES

- Tension zones, seismic and wind loading applications
- Suspended Conduit
- Cable Trays and Strut
- Suspended Lighting

FEATURE AND BENEFITS

+ Ideal for precast hollow-core plank and post-tensioned concrete slabs
+ Cracked concrete tested alternative to a mini dropin anchor
+ ANSI carbide stop bit with enlarged shoulder for accurate drill depth
+ Anchor design allows for shallow embedment as low as 3/4 of an inch
+ Internally threaded anchor for easy adjustment and removability of threaded rod or bolt
+ Drill and drive the anchor with one tool for fast anchor installation

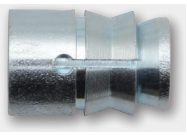
APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3912 for Concrete and Hollow-Core precast slabs, code compliant with the 2015, IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC.
- Tested in accordance with ACI 355.2 (including ASTM E 488) and ICC-ES AC193 for use in concrete under the design provisions of ACI 318-14 Chapter 17 or ACI 318-11/08 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: 03 16 00 - Concrete Anchoring and 05 05 19 - Post Installed Concrete Anchors. Expansion anchors shall be Mini-Undercut+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



MINI-UNDERCUT+

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Zinc plated carbon steel

ANCHOR SIZE RANGE (TYP.)

- 3/8"

SUITABLE BASE MATERIALS

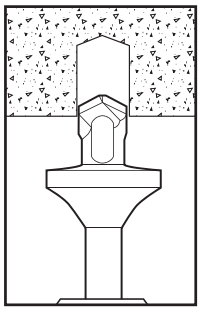
- Post-Tension Concrete
- Precast Hollow-Core Plank
- Normal-weight concrete

CODE LISTED
ICC-ES ESR-3912
CONCRETE

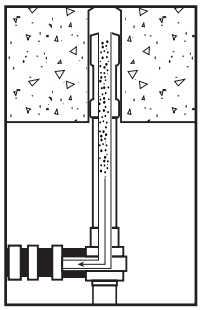
DDA
DEWALT DESIGN ASSIST

INSTALLATION INSTRUCTIONS

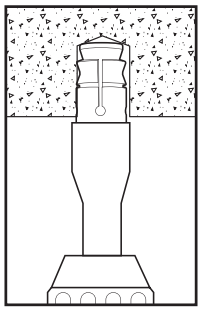
INSTALLATION PROCEDURE (USING SDS PLUS SYSTEM)



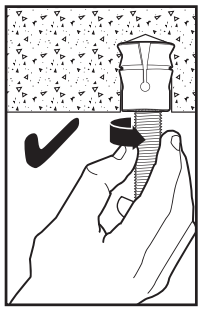
Using the required stop drill bit, drill a hole into the base material to the required depth using the shoulder of the drill bit as a guide. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



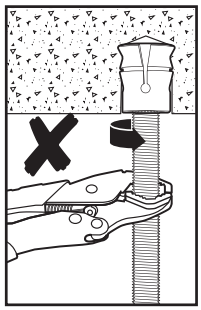
Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction forced air) to extract loose particles created by drilling.



Attach the required SDS setting tool to the hammer-drill. Mount the open end of the anchor onto the setting tool. Drive the anchor into the hole until the shoulder of the anchor is flush with the base material.



Thread the rod or bolt by hand until snug tight (minimum of 4 full rotations).



Do not further tighten with adjustable wrench or similar tool.

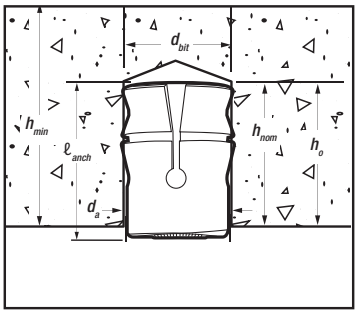
Installation Information for Mini-Undercut+ Anchor[1,2,3]

Anchor Property/Setting Information		Symbol	Units	Nominal Anchor Diameter (inch)
				3/8
Anchor outside diameter		d_a	in. (mm)	0.625 (15.9)
Internal thread diameter (UNC)		d	in. (mm)	3/8 (9.5)
Nominal drill bit diameter		d_{bit}	in. (mm)	5/8 ANSI
Minimum nominal embedment depth		h_{nom}	in. (mm)	3/4 (19)
Effective embedment depth		h_{ef}	in. (mm)	3/4 (19)
Hole depth		h_o	in. (mm)	3/4 (19)
Overall anchor length (before setting)		ℓ_{anch}	in. (mm)	15/16 (24)
Approximate tool impact power (hammer-drill)		-	J	2.1 to 2.8
Minimum diameter of hole clearance in fixture for steel insert element (following anchor installation)		d_h	in.	7/16
Minimum member thickness in normal-weight concrete		h_{min}	in. (mm)	2-1/2 (64)
Minimum cover thickness in hollow core concrete slabs (see Hollow-Core concrete figure)		$h_{min,core}$	in. (mm)	1-1/2 (38)
Critical edge distance		c_{ac}	in. (mm)	2-1/4 (57)
Minimum edge distance		c_{min}	in. (mm)	2-1/2 (64)
Minimum spacing distance		s_{min}	in. (mm)	3 (76)
Maximum installation torque		T_{max}	ft.-lb. (N-m)	5 (7)
Effective tensile stress area (undercut anchor body)		A_{se}	in.^{2} (mm^2)	0.044 (28.4)
Minimum specified ultimate strength		f_{uta}	psi (N/mm^2)	95,000 (655)
Minimum specified yield strength		f_{ya}	psi (N/mm^2)	76,000 (524)
Mean axial stiffness[4]	Uncracked concrete	β_{uncr}	lbf/in.	50,400
	Cracked concrete	β_{cr}	lbf/in.	29,120

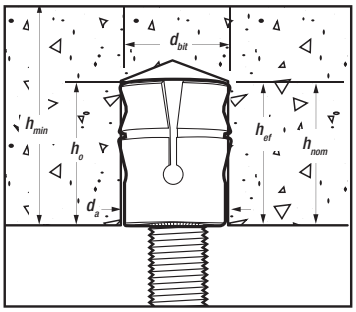
For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable.
2. For installation detail for anchors in hollow-core concrete slabs, see Hollow-Core concrete figure.
3. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor.
4. Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

Mini-Undercut+ Anchor Detail

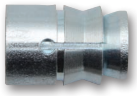


Before



After

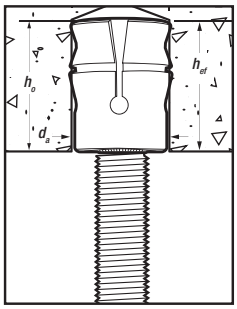
STOP DRILL BIT

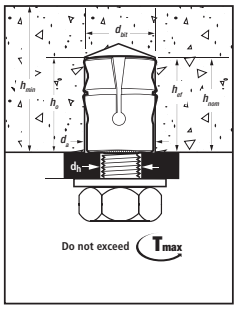


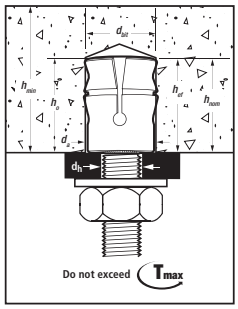
MINI-UNDERCUT+

SETTING TOOL

Mini-Undercut+ Anchor Installed with Steel Insert Element







REFERENCE DATA (ASD)

Ultimate and Allowable Tension Load Capacities for Mini-Undercut+ in Normal-Weight Concrete[1,2,3]

Nominal Rod/ Anchor Diameter d in.	Minimum Nominal Embed. Depth in. (mm)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi (20.7 MPa)				f'c = 4,000 psi (27.6 MPa)			
		Ultimate		Allowable		Ultimate		Allowable	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
3/8	3/4 (19)	1,535 (6.8)	1,975 (8.8)	385 (1.7)	495 (2.2)	1,770 (7.9)	2,275 (10.1)	445 (2.0)	570 (2.5)

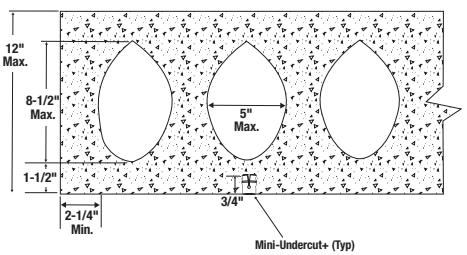
1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate and Allowable Tension Load Capacities for Mini-Undercut+ in Hollow-Core Plank[1,2,3]

Nominal Rod/ Anchor Diameter d in.	Minimum Nominal Embed. Depth in. (mm)	Minimum Concrete Compressive Strength											
		f'c = 5,000 psi (34.5 MPa)				f'c = 6,000 psi (41.4 MPa)				f'c = 8,000 psi (55.2 MPa)			
		Ultimate		Allowable		Ultimate		Allowable		Ultimate		Allowable	
		Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
3/8	3/4 (19)	1,855 (8.3)	2,590 (11.5)	465 (2.1)	650 (2.9)	2,035 (9.1)	2,835 (12.6)	510 (2.3)	710 (3.2)	2,345 (10.4)	3,275 (14.6)	585 (2.6)	820 (3.6)

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

Mini-Undercut+ Installed Detail for Anchor in the Underside of Hollow-Core Concrete slabs



STRENGTH DESIGN (SD)

Tension Design Information for Mini-Undercut+ Anchors in the Underside of Normal-weight Concrete and the Underside of Hollow-Core Concrete Slabs[1,2,3,4,5,6,7]

CODE LISTED
ICC-ES ESR-3912

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Rod Diameter (inch)
			3/8
Anchor category	1, 2 or 3	-	1
Nominal embedment depth	h_{nom}	in. (mm)	3/4 (19)
Steel Strength In Tension (ACI 318-14 17.4.1 or ACI 318-11 D.5.1)			
Steel strength in tension	N_{sa}	lb (kN)	4,180 (18.6)
Reduction factor for steel strength	ϕ	-	0.65
Concrete Breakout Strength In Tension (ACI 318-14 17.4.2 or ACI 318-11 D.5.2)			
Effective embedment	h_{ef}	in. (mm)	3/4 (19)
Effectiveness factor for uncracked concrete	k_{uncr}	-	24
Effectiveness factor for cracked concrete	k_{cr}	-	17
Modification factor for cracked and uncracked concrete	$\Psi_{c,N}$	-	1.0 (see note 5)
Critical edge distance	c_{ac}	in. (mm)	2-1/4 (57)
Reduction factor, concrete breakout strength[3]	ϕ	-	0.40
Pullout Strength In Tension (ACI 318-14 17.4.3 or ACI 318-11 D.5.3)			
Pullout strength, uncracked concrete	$N_{p,uncr}$	lb (kN)	See note 7
Pullout strength, cracked concrete	$N_{p,cr}$	lb (kN)	455 (2.0)
Reduction factor, pullout strength	ϕ	-	0.40
Pullout Strength In Tension For Seismic Applications (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)			
Characteristic pullout strength, seismic	$N_{p,eq}$	lb (kN)	410 (1.82)
Reduction factor, pullout strength, seismic	ϕ	-	0.40

For SI: 1 inch = 25.4 mm, 1 ksi = 6.894 N/mm²; 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with manufacturer's published installation instructions and details.
3. All values of ϕ are applicable with the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2.
4. The threaded rod or bolt strength must also be checked, and the controlling value of ϕN_{sa} between the anchor and rod must be used for design.
5. Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\Psi_{c,N} = 1.0$.
6. The characteristic pullout strength for concrete compressive strengths greater than 2,500 psi for anchors may be increased by multiplying the value in the table by $(f'c / 2{,}500)^{0.5}$ for psi or $(f'c / 17.2)^{0.5}$. For hollow-core concrete slabs the characteristic pullout strength for concrete compressive strengths greater than 6,000 psi for anchors may be increased by multiplying the value in the table by $(f'c / 6{,}000)^{0.5}$ for psi or $(f'c / 41.4)^{0.5}$.
7. Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5.

Shear Design Information for Mini-Undercut+ Anchors in the Underside of Normal-weight Concrete and the Underside of Hollow-Core Concrete Slabs[1,2,3,4,5,6]

CODE LISTED ICC-ES ESR-3912

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Rod Diameter (inch)
			3/8
Anchor category	1, 2 or 3	-	1
Nominal embedment depth	h_{nom}	in. (mm)	3/4 (19)
Steel Strength in Shear (ACI 318-14 17.5.1 or ACI 318-11 D.6.1)			
Steel strength in shear	V_{sa}	lb (kN)	985 (4.4)
Reduction factor, steel strength	ϕ	-	0.60
Steel Strength in Shear for Seismic (ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)			
Steel strength in shear, seismic	$V_{sa,\,eq}$	lb (kN)	895 (4.0)
Reduction factor, steel strength in shear, seismic	ϕ	-	0.60
Concrete Breakout Strength in Shear (ACI 318-14 17.5.2 or ACI 318-11 D.6.2)			
Load bearing length of anchor in shear	ℓ_e	in. (mm)	3/4 (19)
Nominal outside anchor diameter	d_a	in. (mm)	0.625 (15.9)
Reduction factor for concrete breakout strength	ϕ	-	0.45
Pryout Strength in Shear (ACI 318-14 17.5.3 or ACI 318-11 D.6.3)			
Coefficient for pryout strength	k_{cp}	-	1.0
Effective embedment	h_{ef}	in. (mm)	3/4 (19)
Reduction factor, pryout strength	ϕ	-	0.45

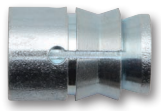
For SI: 1 inch = 25.4 mm, 1 lbf = 0.0044 kN.

1. The data in this table is intended to be used with the design provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-17 17.2.3 or ACI 318-11 D.3.3, as applicable shall apply
2. Installation must comply with manufacturer's published installation instructions and details.
3. All values of ϕ are applicable with the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3, or ACI 318-11 Section 9.2.
4. The strengths shown in the table are for the Mini-Undercut+ anchors only. Design professional is responsible for checking threaded rod strength in tension, shear, and combined tension and shear, as applicable.
5. Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 and must be used for design in lieu of the calculated results using equation 17.5.1.2b of ACI 318-14 or equation D-29 in ACI 318-11 D.6.1.2.
6. Reported values for steel strength in shear for the Mini-Undercut+ anchors are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6 and must be used for design.

ORDERING INFORMATION

Mini-Undercut+

Cat. No.	Anchor Size	Rod/Anchor Dia.	Drill Diameter	Overall Length	Box Qty.	Ctn. Qty.
PFM2111820	3/8" x 3/4"	3/8"	5/8"	3/4"	100	600



Accu-Bit™ for DEWALT Mini-Undercut+

Cat. No.	Mini-Undercut+ Size	Rod/Anchor Dia.	Drill Diameter	Drill Depth	Std. Pack
PPA2431720	5/8" x 3/4" Stop Drill Bit - PT Anchor	3/8"	5/8"	3/4"	1

SDS Plus Setting Tool for DEWALT Mini-Undercut+

Cat. No.	Mini-Undercut+ Size	Rod/Anchor Dia.	Std. Pack
PFM2101720	3/8" SDS+ Setting Tool - PT Anchor	3/8"	1

Mini-Undercut+ Ordering Matrix

Description	Anchor Cat No.	Accu-Bit™ Cat. No.	SDS Plus Setting Tool Cat. No.	Recommended SDS Hammer-Tools (DEWALT)
3/8" x 3/4" Mini-Undercut+	PFM2111820	PPA2431720	PFM2101720	DCH273, DCH133, D25133, D25262

GENERAL INFORMATION

WOOD-KNOCKER®II+

Concrete Inserts

PRODUCT DESCRIPTION

Wood-Knocker II concrete inserts are specifically designed to provide hangar attachments for mechanical, electrical, plumbing (MEP) and fire protection.

Wood-Knocker II+ 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, including a 3/8-1/2" multi insert. The hex impact plate offers resistance to rotation within the concrete as a steel threaded rod or threaded bolt is being installed.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- HVAC Ductwork and Strut Channels
- Suspending Trapeze and Cable Trays
- Mechanical Unit Overhead Utilities
- Conduit and Lighting System
- Seismic Loading and Cracked Concrete

FEATURES AND BENEFITS

+ Fast and simple to install, low installed cost
+ Color coded by size for simple identification
+ Wood-Knocker II+ can be installed in wood form pours only 3.5" thick
+ Hex head does not rotate when set
+ Insert design allows for full thread engagement
+ All sizes suitable for tension and shear loading

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3657 for concrete - approved for seismic and wind loading
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ASTM E488 and ICC-ES AC446 for use in concrete under the design provisions of ACI 318 (Strength Design method)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes. Also UL listed and recognized for use in air handling spaces.
- FM Approvals (Factory Mutual) – File No. J.I. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 15 19 - Cast-In Concrete Anchors and 03 16 00 - Concrete Anchors. Concrete inserts shall be Wood-Knocker II+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

WOOD-KNOCKER II+
WOOD FORM INSERT

ANCHOR MATERIALS

- Carbon Steel and Engineered Plastic

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4" to 3/4" threaded rod for Wood-Knocker Concrete Inserts

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-3657
CONCRETE

DDA
DEWALT DESIGN ASSIST

MATERIAL SPECIFICATIONS

Wood-Knocker II+

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel or equivalent
Flange	Engineered Plastic
Zinc Plating	ASTM B 633 (Fe/Zn5) Min. plating requirements for mild service condition

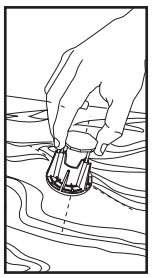
Material Properties for Threaded Rod

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 3/4	36.0	58.0
High strength carbon rod	A 193, Grade B7	1/4 to 3/4	105.0	125.0

INSTALLATION INSTRUCTIONS

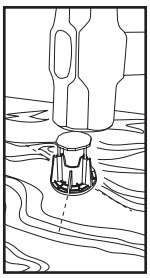
Installation Instructions for Wood-Knocker II+

Position



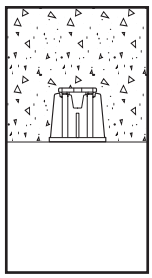
Step 1
Position insert on formwork plastic down.

Drive



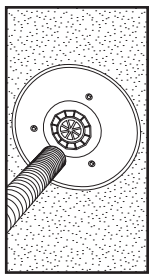
Step 2
Drive insert head down until head contacts plastic.

Prepare



Step 3
After formwork removal, remove nails as necessary (e.g. flush mounted fixtures).

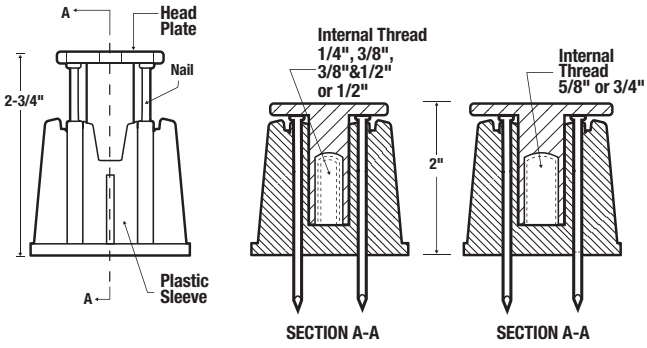
Attach



Step 4
After concrete pour and cure, install threaded steel element (rod/bolt) into the insert by firmly pushing threaded rod through plastic center to puncture thread seal. Attach fixture as applicable (e.g. seismic brace).

INSTALLATION SPECIFICATIONS

Wood-Knocker II+ Cast-In-Place Inserts for Form Pour Concrete

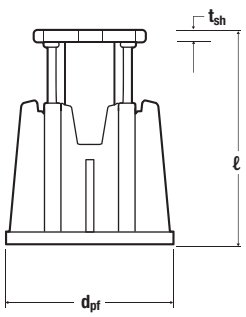


Before Setting

After Setting

Wood-Knocker II+

Dimension	Notation	Nominal Rod/Anchor Size						
		1/4"	3/8"	3/8" & 1/2" Multi		1/2"	5/8"	3/4"
Thread Size, UNC	-	1/4-20	3/8-16	3/8-16	1/2-13	1/2-13	5/8-11	3/4-10
Approx. Internal Thread Length (in.)	-	3/8	5/8	9/16	9/16	11/16	15/16	1-1/8
Approx. Internal Thread Standoff from Plastic Sleeve Bottom, after setting (in.)	-	3/8	3/8	15/16	3/8	3/8	3/8	3/8
Plastic Sleeve Flange Dia. (in.)	d_{pf}	2-3/8	2-3/8	2-3/8		2-3/8	2-3/8	2-3/8
Plastic Sleeve Flange Thickness (in.)	-	3/16	3/16	3/16		3/16	3/16	3/16
Overall Length, after setting (in.)	ℓ	2	2	2		2	2	2
Break-Off Nail Length (in.)	ℓ_n	3/4	3/4	3/4		3/4	3/4	3/4
Steel Head Plate Thickness (in.)	t_{sh}	1/8	1/8	1/8		1/8	1/8	1/8



REFERENCE DATA (ASD)

Ultimate and Allowable Load Capacities for Wood-Knocker II+ Inserts Installed in Normal-Weight Concrete[1,2,3]

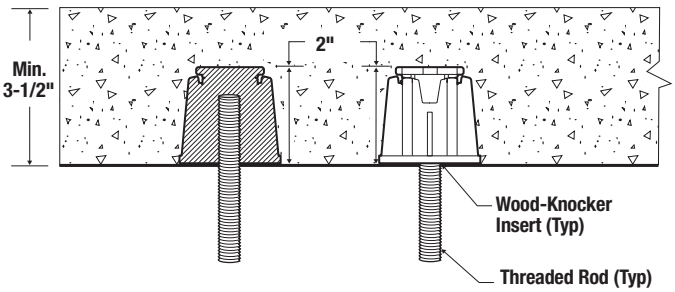
Rod/Insert Diameter d in.	Nominal Embedment Depth h_v in.	Insert Spacing in.	Edge Distance in.	Minimum Concrete Compressive Strength (f´c)							
				3,000 psi				4,500 psi			
				Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
				Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	2	6	6	3,720	1,490	1,240	495	4,250	1,610	1,415	535
3/8	2	6	6	4,820	5,330	1,605	1,775	7,190	5,620	2,395	1,875
1/2	2	6	6	4,820	7,400	1,605	2,465	7,190	8,590	2,395	2,865
5/8	2	6	6	4,650	11,360	1,550	3,785	7,350	13,010	2,450	4,335
3/4	2	6	6	4,650	11,360	1,550	3,785	7,350	14,590	2,450	4,865

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.

Ultimate and Allowable Load Capacities for Wood-Knocker II+ Inserts Installed in Sand-lightweight Concrete[1,2]

Rod/Insert Diameter d in.	Nominal Embedment Depth h_v in.	Insert Spacing in.	Edge Distance in.	f´c ≥ 3,000 psi			
				Ultimate Load		Allowable Load	
				Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	2	6	6	3,570	1,380	1,190	460
3/8	2	6	6	4,270	5,280	1,425	1,760
1/2	2	6	6	4,270	7,180	1,425	2,395
5/8	2	6	6	4,600	7,590	1,535	2,530
3/4	2	6	6	4,600	7,590	1,535	2,530

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. For 1/4", 3/8" and 1/2" diameters: When the inserts are spaced 3" center-to-center the inserts allowable tension capacity must be reduced by 25 percent and the allowable shear capacity reduced by 15 percent. When the inserts have a 3" edge distance the inserts allowable tension capacity does not require a reduction and the allowable shear capacity must be reduced by 40 percent.



Allowable Steel Strength for Threaded Rod

Anchor Diameter d in.	Nominal Area of Rod in.²	Allowable Tension			Allowable Shear		
		ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.	ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.
1/4	0.0491	940	940	2,160	485	485	1,030
3/8	0.1104	2,115	2,115	4,375	1,090	1,090	2,255
1/2	0.1963	3,755	3,755	7,775	1,940	1,940	4,055
5/8	0.3068	5,870	5,870	12,150	3,025	3,025	6,260
3/4	0.4418	8,455	8,455	17,495	4,355	4,355	9,010

Allowable tension = f_u (A_{nom}) (0.33); Allowable shear = f_u (A_{nom}) (0.17)

STRENGTH DESIGN (SD)

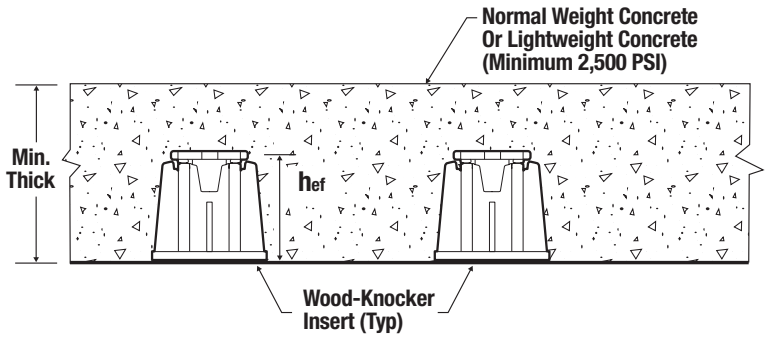
Wood-Knocker II+ Insert Design Information[1,2,3,4,5,6,7,8]

Design Information	Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Insert O.D.	d_a (d_o)	in. (mm)	0.7 (18)	0.7 (18)	0.7 (18)	1.0 (25)	1.0 (25)
Insert head net bearing area	A_{brg}	in² (mm²)	1.20 (762)	1.20 (762)	1.20 (762)	1.30 (839)	1.30 (839)
Effective embedment depth	h_{ef}	in. (mm)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)
Minimum member thickness	h_{min}	-	3.5 (89)	3.5 (89)	3.5 (89)	3.5 (89)	3.5 (89)
Effectiveness factor for cracked concrete	k_c	- (SI)	24 (10)	24 (10)	24 (10)	24 (10)	24 (10)
Modification factor for tension strength in uncracked concrete	$\Psi_{c,N}$	-	1.25	1.25	1.25	1.25	1.25
Nominal tension strength of single insert as governed by steel strength	$N_{sa,insert}$	lb (kN)	10,270 (45.7)	10,270 (45.7)	9,005 (40.1)	12,685 (56.4)	12,685 (56.4)
Nominal tension strength of single insert as governed by steel strength, for seismic loading	$N_{sa,insert,eq}$	lb (kN)	10,270 (45.7)	10,270 (45.7)	9,005 (40.1)	12,685 (56.4)	12,685 (56.4)
Nominal steel shear strength of single insert	$V_{sa,insert}$	lb (kN)	7,180 (31.9)	7,180 (31.9)	7,180 (31.9)	9,075 (40.4)	9,075 (40.4)
Nominal steel shear strength of single insert, for seismic loading	$V_{sa,insert,eq}$	lb (kN)	7,180 (31.9)	7,180 (31.9)	7,180 (31.9)	9,075 (40.4)	9,075 (40.4)

For SI: 1 inch = 25.4 mm, 1 inch² = 635 mm², 1 pound = 0.00445 kN, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

1. Concrete must have a compressive strength f'c of 2,500 psi minimum.
2. Design of headed cast-in specialty inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D for cast-in headed anchors.
3. Strength reduction factors (ø) for the inserts are based on ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.
4. The concrete tension strength of headed cast-in specialty inserts shall be calculated in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.
5. Insert O.D. is the outside diameter of the headed insert body.
6. Only the largest size of threaded rod or bolt for the 3/8 & 1/2 inch multi insert must be used for applications resisting shear loads.
7. Minimum spacing distance between anchors and minimum edge distance for cast-in Wood-Knocker II+ anchors shall be in accordance with ACI 318-14 17.7 or ACI 318-11 D.8.
8. The strengths shown in the table are for inserts only. Design professional is responsible for checking threaded rod or bolt strength in tension, shear, and combined tension and shear, as applicable. See Steel Design Information table for common threaded rod elements.

Wood-Knocker II+ Insert Installed in Soffit of Form Pour Concrete Floor and Roof Assemblies



Specifications And Physical Properties Of Common Carbon Steel Threaded Rod Elements[1]

Threaded Rod Specification		Units	Min. Specified Ultimate Strength, F_{uta}	Min. Specified Yield Strength 0.2 Percent Offset, F_{ya}	F_{uta} — F_{ya}	Elongation Minimum Percent[5]	Reduction Of Area Min. Percent	Related Nut Specification[6]
Carbon Steel	ASTM A36/A36M[2] and F1554[3] Grade 36	psi (MPa)	58,000 (400)	36,000 (248)	1.61	23	40 (50 for A36)	ASTM A194 / A563 Grade A
	ASTM F1554[3] Grade 105	psi (MPa)	125,000 (862)	105,000 (724)	1.19	15	45	ASTM A194 / A563 Grade DH
	ASTM A193/A193M[4] Grade B7	psi (MPa)	125,000 (860)	105,000 (720)	1.19	16	50	

For SI: 1 inch = 25.4 mm, 1 psi = 0.006897 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Inserts may be used in conjunction with all grades of continuously threaded carbon steels (all-thread) that comply with code reference standards and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series.
2. Standard Specification for Carbon Structural Steel.
3. Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
4. Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
5. Based on 2-inch (50 mm) gauge length except ASTM A193, which are based on a gauge length of 4d (d_{rod}).
6. Where nuts are applicable, nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable.

Steel Design Information For Common Threaded Rod Elements Used With Concrete Inserts[1,2,3,4]

Design Information	Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Threaded rod nominal outside diameter	d_{rod}	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Threaded rod effective cross-sectional area	A_{se}	in^2 (mm^2)	0.032 (21)	0.078 (50)	0.142 (92)	0.226 (146)	0.335 (216)
Nominal tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.3)
Nominal seismic tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36,eq}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.4)
Nominal tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal seismic tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7,eq}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36}$	lb (kN)	1,115 (4.9)	2,715 (12.1)	4,940 (22.0)	7,865 (35.0)	11,660 (51.9)
Nominal seismic shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36,eq}$	lb (kN)	780 (3.5)	1,900 (8.4)	3,460 (15.4)	5,505 (24.5)	8,160 (36.3)
Nominal shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7}$	lb (kN)	2,385 (10.6)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)
Nominal seismic shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7,eq}$	lb (kN)	1,680 (7.5)	4,095 (18.2)	7,455 (34.2)	11,865 (52.8)	17,590 (78.2)

For SI: 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 in^2 = 645.2 mm^2. For pound-inch unit: 1 mm = 0.03937 inches.

1. Values provided for steel element material types based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29).
2. ϕN_{sa} shall be the lower of the $\phi N_{sa,rod}$ or $\phi N_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi N_{sa,eq}$ shall be the lower of the $\phi N_{sa,rod,eq}$ or $\phi N_{sa,insert,eq}$.
3. ϕV_{sa} shall be the lower of the $\phi V_{sa,rod}$ or $\phi V_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi V_{sa,eq}$ shall be the lower of the $\phi V_{sa,rod,eq}$ or $\phi V_{sa,insert,eq}$.
4. Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for steel elements. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the threaded rod are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.

Tension and Shear Design Strengths for Wood-Knocker II+ Insert Installed in the Soffit of Form Poured Concrete and Roof Assemblies - Uncracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	2,665	2,420	3,075	2,795	3,765	3,425
3/8	1-3/4	2,665	2,420	3,075	2,795	3,765	3,425
1/2	1-3/4	2,665	2,420	3,075	2,795	3,765	3,425
5/8	1-3/4	2,665	2,665	3,075	3,075	3,765	3,765
3/4	1-3/4	2,665	2,665	3,075	3,075	3,765	3,765

□ - Anchor Pullout/Pryout Strength Controls ■ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for Wood-Knocker II+ Insert Installed in the Soffit of Form Poured Concrete and Roof Assemblies - Cracked Concrete[1,2,3,4,5,6]

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	2,130	1,730	2,460	2,000	3,015	2,445
3/8	1-3/4	2,130	1,730	2,460	2,000	3,015	2,445
1/2	1-3/4	2,130	1,730	2,460	2,000	3,015	2,445
5/8	1-3/4	2,130	2,130	2,460	2,460	3,015	3,015
3/4	1-3/4	2,130	2,130	2,460	2,460	3,015	3,015

□ - Anchor Pullout/Pryout Strength Controls ■ - Concrete Breakout Strength Controls ■ - Steel 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}.
- c_{a2} is greater than or equal to 1.5 times c_{a1}.

2- Calculations were performed following methodology in ACI 318-14 Chapter 17 or ACI 318-11 Appendix D. The load level corresponding to the failure mode listed [steel strength of insert ($N_{sa,insert}$, $V_{sa,insert}$), concrete breakout strength, or pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod type, ($N_{sa,rod}$, $V_{sa,rod}$), the lowest load level controls.

3- Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.70 for tension and 0.60 for shear; values correspond to brittle steel elements.

4- Tabular values are permitted for short-term 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 318-14 Chapter 17 or ACI 318-11 Appendix D.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

Tension and Shear Design Strength of Steel Elements (Steel Strength)[1,2,3,4]

Nominal Rod Diameter (in. or No.)	Steel Elements - Threaded Rod			
	ASTM A36 and ASTM F1554 Grade 36		ASTM A193 Grade B7 and ASTM F1554 Grade 105	
	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)
1/4	1,390	720	3,000	1,550
3/8	3,395	1,750	7,315	3,780
1/2	6,175	3,210	13,315	6,915
5/8	9,835	5,115	21,190	11,020
3/4	14,550	7,565	31,405	16,305

■ - Steel Strength Controls

1. Steel tensile design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pullout design strength to determine the controlling failure mode, the lowest load level controls.
3. Steel shear design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet 0.60 \bullet A_{se,N} \bullet f_{uta}$
4. The tabulated steel design strength in shear for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pryout design strength to determine the controlling failure mode, the lowest load level controls

ORDERING INFORMATION

Wood-Knocker® II+ Form Insert (UNC)

Cat No.	Description	Color Code	Std. Box
PFM2521100	1/4" Wood-Knocker II+ Insert	Brown	100
PFM2521150	3/8" Wood-Knocker II+ Insert	Green	100
PFM2521200	1/2" Wood-Knocker II+ Insert	Yellow	100
PFM2521250	5/8" Wood-Knocker II+ Insert	Red	100
PFM2521300	3/4" Wood-Knocker II+ Insert	Purple	100
PFM2521350	3/8"-1/2" Wood-Knocker II+ Multi Insert	Gray	100

Threaded Inserts are color coded to easily identify location and diameter of the internally threaded coupling, allowing multiple trades on the same job to suspend their systems with various size steel threaded rods.

Wood-Knocker® II+ Form Insert (UNC) with no nails

Cat No.	Description	Color Code	Std. Box
PFM2521100NN	1/4" Wood-Knocker II+ Insert with no nails	Brown	100
PFM2521150NN	3/8" Wood-Knocker II+ Insert with no nails	Green	100
PFM2521200NN	1/2" Wood-Knocker II+ Insert with no nails	Yellow	100
PFM2521250NN	5/8" Wood-Knocker II+ Insert with no nails	Red	100
PFM2521300NN	3/4" Wood-Knocker II+ Insert with no nails	Purple	100
PFM2521350NN	3/8-1/2" Wood-Knocker II+ Multi Insert with no nails	Gray	100

Wood-Knocker II+ Form Inserts with no nails must be screwed to the concrete form work (screws not included).

GENERAL INFORMATION

BANG-IT®+

Concrete Inserts

PRODUCT DESCRIPTION

Bang-It+ concrete inserts are specifically designed to provide hangar attachments for mechanical, electrical, plumbing (MEP) and fire protection.

Bang-It+ concrete inserts are designed for installation in and through composite steel deck (i.e. "pan-deck") used to support newly poured concrete floors or roof slabs.

After installation, the protective sleeve of the insert protrudes below the surface of the deck. The sleeves are color coded by size and allow overhead attachment of steel threaded rod in sizes ranging from 1/4" to 3/4" in diameter, including a 3/8-1/2" multi insert. 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. A hex impact plate offers resistance to rotation within the concrete as a steel threaded rod is being installed.

GENERAL APPLICATIONS AND USES

- Hanging Pipe and Sprinkler Systems
- HVAC Ductwork and Strut Channels
- Suspending Trapeze and Cable Trays
- Mechanical Unit Overhead Utilities
- Conduit and Lighting System
- Seismic Loading and Cracked Concrete

FEATURES AND BENEFITS

+ Fast and simple to install, low installed cost
+ Color coded by size for simple identification
+ Bang-It+ can be installed in lower flute of steel deck as little as 1.5" topping thickness (see installation details)
+ Hex head does not rotate when set
+ Insert design allows for full thread engagement
+ All sizes suitable for tension and shear loading

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3657 for concrete - Approved for seismic and wind loading
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Tested in accordance with ASTM E488 and ICC-ES AC446 for use in concrete under the design provisions of ACI 318 (Strength Design method)
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes Also UL listed and recognized for use in air handling spaces (i.e. plenum rated locations)
- FM Approvals (Factory Mutual) – File No. J.I. 3015153

GUIDE SPECIFICATIONS

CSI Divisions: 03 15 19 - Cast-In Concrete Anchors and 03 16 00 - Concrete Anchors. Concrete inserts shall be Bang-It+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

BANG-IT+
STEEL DECK INSERT

ANCHOR MATERIALS

- Carbon Steel and Engineered Plastic

ROD/ANCHOR SIZE RANGE (TYP.)

- 1/4" to 3/4" threaded rod for Bang-It Concrete Inserts

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete

TENSION ZONE CRACKED CONCRETE
SEISMIC REGION QUALIFICATION
CODE LISTED ICC-ES ESR-3657 CONCRETE
DDA DEWALT DESIGN ASSIST

MATERIAL SPECIFICATIONS

Bang-It+

Anchor Component	Component Material
Insert Body	AISI 1008 Carbon Steel or equivalent
Flange	AISI 1008 Carbon Steel or equivalent
Spring	Steel Music Wire
Protective Sleeve	Engineered Plastic
Zinc Plating	ASTM B 633 (Fe/Zn5) Min. Plating requirements for Mild Service Condition

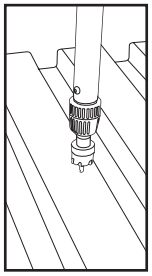
Material Properties for Threaded Rod

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 3/4	36.0	58.0
High strength carbon rod	A 193, Grade B7	1/4 to 3/4	105.0	125.0

INSTALLATION INSTRUCTIONS

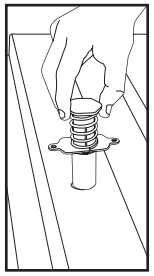
Installation Instructions for Bang-It+

Create Hole



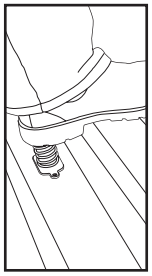
Step 1
Cut (e.g. drill/ punch) a hole in the steel deck to the hole size required by the insert.

Position



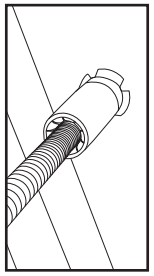
Step 2
Place the plastic sleeve of the insert through hole in steel deck.

Prepare



Step 3
Step on or impact the insert head to engage. Optionally, base plate of insert can also be screwed to steel deck.

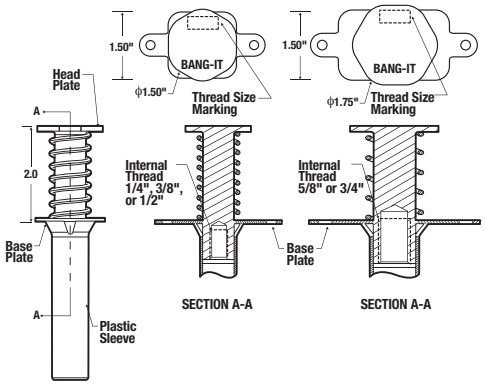
Attach



Step 4
After concrete pour and cure, install threaded steel element (rod/ bolt) into the insert. Trim away plastic sleeve as needed for application and attach fixture as applicable (e.g. seismic brace).

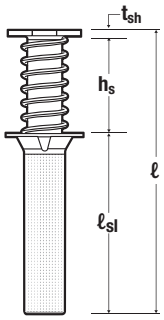
INSTALLATION SPECIFICATIONS

Bang-It+ Cast-In-Place Inserts for Concrete Filled Steel Deck Floor and Roof Assemblies



Bang-It+

Dimension	Notation	Nominal Rod/Anchor Size					
		1/4"	3/8"	3/8" & 1/2" Multi	1/2"	5/8"	3/4"
Metal Hole Saw Diameter (in.)	-	13/16 or 7/8				1-3/16 or 1-1/4	
Metal Hole Saw Drilling Speed (rpm)	-	700-900	700-900	700-900	700-900	500-700	500-700
Steel Head Plate Thickness (in.)	t_{sh}	1/8	1/8	1/8	1/8	1/8	1/8
Approx. Height of Spring (in.)	h_s	1-13/16	1-13/16	1-13/16	1-13/16	1-13/16	1-13/16
Base Plate Thickness (in.)	-	1/16	1/16	1/16	1/16	1/16	1/16
Thread Size, UNC	-	1/4-20	3-3/8	3/8-16	1/2-13	1/2-13	5/8-11	3/4-10
Approx. Internal Thread Length (in.)	-	3/8	5/8	9/16	9/16	11/16	15/16	1-1/8
Approx. Internal Thread Projection throught Deck Soffit, after setting (in.)	-	3/4	3/4	0	3/4	3/4	3/4	3/4
Length of Plastic Sleeve (in.)	ℓ_{sl}	3-3/8	3-3/8	3-3/8		3-3/8	3-3/8	3-3/8
Overall Insert Length (in.)	ℓ	5-7/16	5-7/16	5-7/16		5-7/16	5-7/16	5-7/16



REFERENCE DATA (ASD)

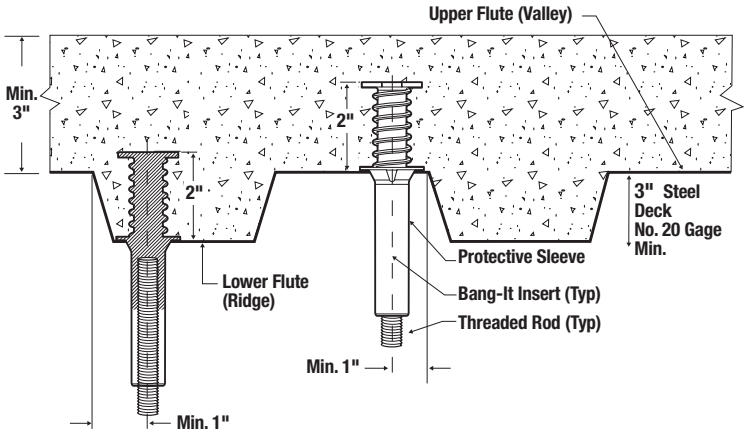
Ultimate and Allowable Load Capacities for Bang-It+ Inserts Installed in Sand-Lightweight Concrete or Normal Weight over Steel Deck[1,2,3]

Rod/Insert Diameter d in.	Nominal Embedment Depth h_v in.	Flute Location in Deck	Insert Spacing in.	End Distance in.	f'c ≥ 3,000 psi			
					Ultimate Load		Allowable Load	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	2	Upper	6	6	4,450	2,500	1,115	835
		Lower			3,320	2,500	830	625
3/8	2	Upper	6	6	5,750	3,350	1,915	1,115
		Lower			3,320	3,350	830	840
1/2	2	Upper	6	6	7,110	3,350	2,370	1,115
		Lower			3,320	3,350	830	840
5/8	2	Upper	6	6	8,810	3,350	2,935	1,115
		Lower	6		3,960	3,350	990	840
3/4	2	Upper	6	6	8,810	3,350	2,935	1,115
		Lower	6		3,960	3,350	990	840

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. For 1/4", 3/8" and 1/2" Bang-It Inserts:
   The allowable tension load for a single insert installed in the upper flute must be adjusted as follows for spacing less than 6 inches.
   When the insert are spaced 2" center-to-center across the flute the insert tension capacity must be reduced by 40 percent.
   When the insert are spaced 2" center-to-center along the flute the insert tension capacity must be reduced by 50 percent.

   The allowable tension load for a single insert installed into the lower flute must be adjusted as follows for spacing less than 6 inches.
   When the insert are spaced 2" center-to-center across the flute the insert tension capacity must be reduced by 30 percent.
   When the insert are spaced 2" center-to-center along the flute the insert tension capacity must be reduced by 35 percent.

Sand-Lightweight Concrete or Normal Weight Concrete over Steel Deck (Minimum 3,000 psi)



Allowable Steel Strength for Threaded Rod

Anchor Diameter d in.	Nominal Area of Rod in.^{2}	Allowable Tension			Allowable Shear		
		ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.	ASTM A36 lbs.	ASTM A307 Grade C lbs.	ASTM A193 Grade B7 lbs.
1/4	0.0491	940	940	2,160	485	485	1,030
3/8	0.1104	2,115	2,115	4,375	1,090	1,090	2,255
1/2	0.1963	3,755	3,755	7,775	1,940	1,940	4,055
5/8	0.3068	5,870	5,870	12,150	3,025	3,025	6,260
3/4	0.4418	8,455	8,455	17,495	4,355	4,355	9,010

Allowable tension = f_u (A_{nom}) (0.33); Allowable shear = f_u (A_{nom}) (0.17)

STRENGTH DESIGN (SD)

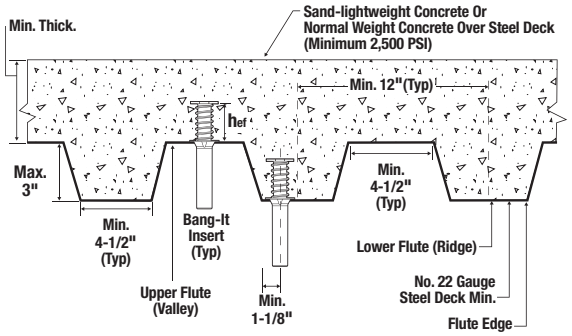
Bang-It+ Insert Design Information[1,2,3,4,5,6,7,8,9]

Design Information		Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Insert O.D.		d_a (d_o)	in. (mm)	0.7 (18)	0.7 (18)	0.7 (18)	1.0 (25)	1.0 (25)
Insert head net bearing area		A_{brg}	in² (mm²)	1.20 (762)	1.20 (762)	1.20 (762)	1.30 (839)	1.30 (839)
Effective embedment depth		h_{ef}	in. (mm)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)	1.75 (45)
Minimum member thickness		h_{min}	-	See Deck Figures as applicable				
Minimum spacing and edge distances	Upper flute	s_{min}, c_{min}	-	See ACI 318 Section D.8.1 and D.8.2				
	Lower flute	s_{min}, c_{min}	-	See Deck Figures as applicable				
Effectiveness factor for cracked concrete		k_c	- (SI)	24 (10)	24 (10)	24 (10)	24 (10)	24 (10)
Modification factor for tension strength in uncracked concrete		$\Psi_{c,N}$	-	1.25	1.25	1.25	1.25	1.25
Nominal tension strength of single insert in tension as governed by steel strength (4-1/2" W-Deck, B-Deck, 3-7/8" W-Deck)		$N_{sa,insert}$	lb (kN)	10,440 (46.4)	10,440 (46.4)	8,850 (43.5)	11,985 (53.3)	11,985 (53.3)
Nominal tension strength of single insert in tension as governed by steel strength, for seismic loading (4-1/2" W-Deck, B-Deck, 3-7/8" W-Deck)		$N_{sa,insert,eq}$	lb (kN)	10,440 (46.4)	10,440 (46.4)	8,850 (43.5)	11,985 (53.3)	11,985 (53.3)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, (4-1/2" W-Deck)		$V_{sa,insert,deck}$	lb (kN)	2,280 (10.2)	2,280 (10.2)	2,280 (10.2)	3,075 (13.7)	3,075 (13.7)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, for seismic loading, (4-1/2" W-Deck)		$V_{sa,insert,deck,eq}$	lb (kN)	2,280 (10.2)	2,280 (10.2)	2,280 (10.2)	2,695 (12.0)	2,695 (12.0)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, (B-Deck, 3-7/8" W-Deck)		$V_{sa,insert,deck}$	lb (kN)	2,080 (10.2)	2,080 (10.2)	2,080 (10.2)	2,975 (13.2)	2,975 (13.2)
Nominal steel shear strength of single insert in the soffit of concrete on steel deck, for seismic loading, (B-Deck, 3-7/8" W-Deck)		$V_{sa,insert,deck,eq}$	lb (kN)	2,080 (10.2)	2,080 (10.2)	2,080 (10.2)	2,695 (12.0)	2,695 (12.0)

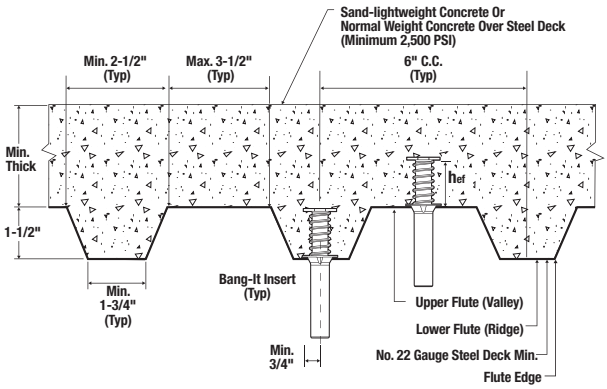
For SI: 1 inch = 25.4 mm, 1 inch² = 635 mm², 1 pound = 4.45 N, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

1. Concrete must have a compressive strength f'c of 2,500 psi minimum.
2. Design of headed cast-in specialty inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D for cast-in headed anchors.
3. Strength reduction factors (ø) for the inserts are based on ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.
4. The concrete tension strength of headed cast-in specialty inserts in concrete filled steel deck assemblies shall be calculated in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D and Deck Figures.
5. Insert O.D. is the outside diameter of the headed insert body.
6. Minimum spacing distance between anchors and minimum edge distances for cast-in Bang-It+ anchors shall be in accordance with Deck Figures, as applicable, and noted provisions.
7. Only the largest size of threaded rod or bolt for the 3/8 & 1/2 inch multi insert must be used for applications resisting shear loads.
8. The strengths shown in the table are for inserts only. Design professional is responsible for checking threaded rod strength in tension, shear, and combined tension and shear, as applicable. See Steel Design Information table for common threaded rod elements.
9. The tabulated insert strength values are applicable to installations in the lower flute or upper flute of the steel deck profiles; see Deck Figures.

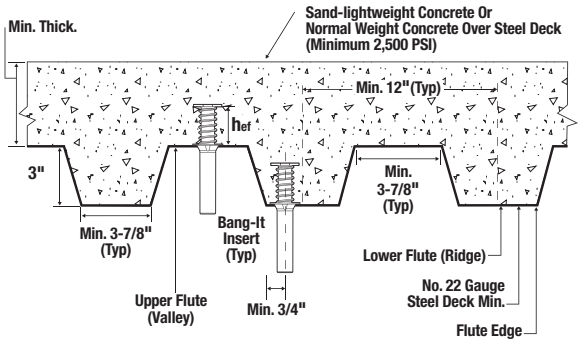
Bang-It+ Inserts Installed in Soffit of Concrete Filled Steel Deck Floor and Roof Assemblies, 4-1/2 -inch W-Deck[1,2,3,4]



Bang-It+ Inserts Installed in Soffit of Concrete Filled Steel Deck Floor and Roof Assemblies, B-Deck[1,2,3,4,5,6,7]



Bang-It+ Inserts Installed in Soffit of Concrete Filled Steel Deck Floor and Roof Assemblies, 3-7/8 -inch W-Deck[1,2,3,8]



1. Inserts may be placed in the upper flute or lower flute of the steel deck assembly. Inserts in the lower flute require a minimum 1.5" of concrete topping thickness (min. thick) from the top of the deck at the location of the installation. Upper flute installations require a minimum 3" topping thickness concrete (min. thick) from the top of the deck at the location of the installation.
2. Axial spacing for Bang-It inserts along the flute length shall be minimum $3h_{ef}$.
3. Upper flute Bang-It+ inserts are not subject to steel deck dimension limitations, or the minimum steel deck gauge limitations.
4. Inserts in the lower flute of 4-1/2-inch W-Deck may be installed with a maximum 1-1/8 -inch offset in either direction from the center of the flute. The offset distance may be increased for flute widths greater than those shown provided the minimum lower flute edge distance of 1-1/8 -inch is also satisfied.
5. Inserts in the lower flute of B-Deck 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 for flute widths greater than those shown provided the minimum lower flute edge distance of 3/4 -inch is also satisfied.
6. Lower flute installations of B-Deck with flutes widths greater than 1-3/4 -inch are permitted.
7. Lower flute installations of B-Deck in flute depths greater than 1-1/2 -inch are permitted provided the minimum edge distance of 3/4 -inch is met and the minimum lower flute width is increased proportionally (e.g. applicable to a lower flute depth of 2-inch with a minimum lower flute width of 2-1/4 -inch).
8. Inserts in the lower flute of 3-7/8-inch W-Deck may be installed with a maximum 1-3/16 -inch offset in either direction from the center of the flute.

Specifications And Physical Properties Of Common Carbon Steel Threaded Rod Elements[1]

Threaded Rod Specification		Units	Min. Specified Ultimate Strength, F_{uta}	Min. Specified Yield Strength 0.2 Percent Offset, F_{ya}	F_{uta} — F_{ya}	Elongation Minimum Percent[5]	Reduction Of Area Min. Percent	Related Nut Specification[6]
Carbon Steel	ASTM A36/A36M[2] and F1554[3] Grade 36	psi (MPa)	58,000 (400)	36,000 (248)	1.61	23	40 (50 for A36)	ASTM A194 / A563 Grade A
	ASTM F1554[3] Grade 105	psi (MPa)	125,000 (862)	105,000 (724)	1.19	15	45	ASTM A194 / A563 Grade DH
	ASTM A193/A193M[4] Grade B7	psi (MPa)	125,000 (860)	105,000 (720)	1.19	16	50	

For SI: 1 inch = 25.4 mm, 1 psi = 0.006897 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Inserts may be used in conjunction with all grades of continuously threaded carbon steels (all-thread) that comply with code reference standards and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series.
2. Standard Specification for Carbon Structural Steel.
3. Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
4. Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
5. Based on 2-inch (50 mm) gauge length except ASTM A193, which are based on a gauge length of 4d (d_{rod}).
6. Where nuts are applicable, nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable.

Steel Design Information For Common Threaded Rod Elements Used With Concrete Inserts[1,2,3,4]

Design Information	Symbol	Units	1/4-inch	3/8-inch	1/2-inch	5/8-inch	3/4-inch
Threaded rod nominal outside diameter	d_{rod}	in. (mm)	0.250 (6.4)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)
Threaded rod effective cross-sectional area	A_{se}	in² (mm²)	0.032 (21)	0.078 (50)	0.142 (92)	0.226 (146)	0.335 (216)
Nominal tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.3)
Nominal seismic tension strength of ASTM A36 threaded rod as governed by steel strength	$N_{sa,rod,A36,eq}$	lb (kN)	1,855 (8.2)	4,525 (20.0)	8,235 (36.6)	13,110 (58.3)	19,430 (86.4)
Nominal tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal seismic tension strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$N_{sa,rod,B7,eq}$	lb (kN)	4,000 (17.7)	9,750 (43.1)	17,750 (78.9)	28,250 (125.7)	41,875 (186.0)
Nominal shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36}$	lb (kN)	1,115 (4.9)	2,715 (12.1)	4,940 (22.0)	7,865 (35.0)	11,660 (51.9)
Nominal seismic shear strength of ASTM A36 threaded rod as governed by steel strength	$V_{sa,rod,A36,eq}$	lb (kN)	780 (3.5)	1,900 (8.4)	3,460 (15.4)	5,505 (24.5)	8,160 (36.3)
Nominal shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7}$	lb (kN)	2,385 (10.6)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)
Nominal seismic shear strength of ASTM A193, Gr. B7 threaded rod as governed by steel strength	$V_{sa,rod,B7,eq}$	lb (kN)	1,680 (7.5)	4,095 (18.2)	7,455 (34.2)	11,865 (52.8)	17,590 (78.2)

For SI: 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 in² = 645.2 mm². For pound-inch unit: 1 mm = 0.03937 inches.

1. Values provided for steel element material types based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29).
2. ϕN_{sa} shall be the lower of the $\phi N_{sa,rod}$ or $\phi N_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi N_{sa,eq}$ shall be the lower of the $\phi N_{sa,rod,eq}$ or $\phi N_{sa,insert,eq}$.
3. ϕV_{sa} shall be the lower of the $\phi V_{sa,rod}$ or $\phi V_{sa,insert}$ for static steel strength in tension; for seismic loading $\phi V_{sa,eq}$ shall be the lower of the $\phi V_{sa,rod,eq}$ or $\phi V_{sa,insert,eq}$.
4. Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for steel elements. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the threaded rod are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements. The value of ø applies when the load combinations of IBC Section 1605.2, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, then the appropriate value of ø must be determined in accordance with ACI 318-11 D4.4.

Tension and Shear Design Strengths for Bang-It+ Inserts Installed in the Soffit of Uncracked Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength f'c = 3,000 psi											
		4-1/2" W-Deck				B-Deck				3-7/8" W-Deck			
		Upper Flute		Lower Flute		Upper Flute		Lower Flute		Upper Flute		Lower Flute	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	2,665	1,370	1,340	1,370	2,265	1,250	595	1,250	2,265	1,250	1,145	1,250
3/8	1-3/4	2,665	1,370	1,340	1,370	2,265	1,250	595	1,250	2,265	1,250	1,145	1,250
1/2	1-3/4	2,665	1,370	1,340	1,370	2,265	1,250	595	1,250	2,265	1,250	1,145	1,250
5/8	1-3/4	2,665	1,845	1,340	1,845	2,265	1,785	595	1,785	2,265	1,785	1,145	1,785
3/4	1-3/4	2,665	1,845	1,340	1,845	2,265	1,785	595	1,785	2,265	1,785	1,145	1,785

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

Tension and Shear Design Strengths for Bang-It+ Inserts Installed in the Soffit of Cracked Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Nominal Anchor Diameter	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength f'c = 3,000 psi											
		4-1/2" W-Deck				B-Deck				3-7/8" W-Deck			
		Upper Flute		Lower Flute		Upper Flute		Lower Flute		Upper Flute		Lower Flute	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
1/4	1-3/4	1,810	1,370	1,070	1,370	1,810	1,250	475	1,250	1,810	1,250	915	1,250
3/8	1-3/4	1,810	1,370	1,070	1,370	1,810	1,250	475	1,250	1,810	1,250	915	1,250
1/2	1-3/4	1,810	1,370	1,070	1,370	1,810	1,250	475	1,250	1,810	1,250	915	1,250
5/8	1-3/4	1,810	1,845	1,070	1,845	1,810	1,785	475	1,785	1,810	1,785	915	1,785
3/4	1-3/4	1,810	1,845	1,070	1,845	1,810	1,785	475	1,785	1,810	1,785	915	1,785

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

1- Tabular values are provided for illustration and are applicable for single anchors installed in sand-lightweight 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}.
- c_{a2} is greater than or equal to 1.5 times c_{a1}.

2- Calculations were performed following methodology in ACI 318-14 Chapter 17 or ACI 318-11 Appendix D. The load level corresponding to the failure mode listed [steel strength of insert ($N_{sa,insert}$, $V_{sa,insert}$), concrete breakout strength, or pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod type, ($N_{sa,rod}$, $V_{sa,rod}$), the lowest load level controls.

3- Strength reduction factors shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 governed by steel strength of the insert are taken as 0.65 for tension and 0.60 for shear; values correspond to brittle steel elements.Tabular values are permitted for short-term static loads only, seismic loading is not considered with these tables.

4- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

5- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

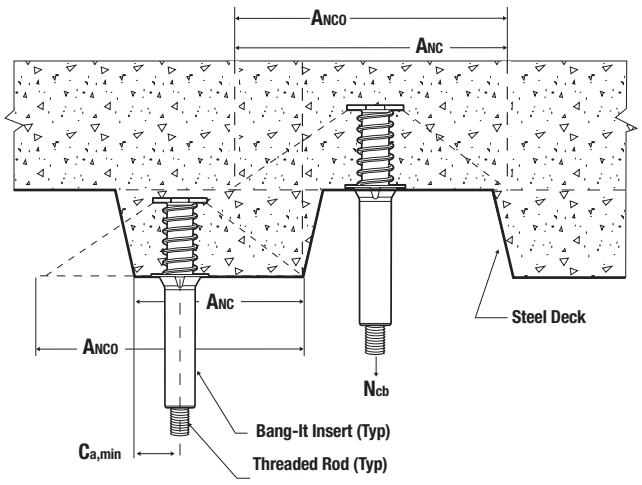
Tension and Shear Design Strength of Steel Elements (Steel Strength)[1,2,3,4]

Nominal Rod Diameter (in.)	Steel Elements - Threaded Rod			
	ASTM A36 and ASTM F1554 Grade 36		ASTM A193 Grade B7 and ASTM F1554 Grade 105	
	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)	$\phi N_{sa,rod}$ Tension (lbs.)	$\phi V_{sa,rod}$ Shear (lbs.)
1/4	1,390	720	3,000	1,550
3/8	3,395	1,750	7,315	3,780
1/2	6,175	3,210	13,315	6,915
5/8	9,835	5,115	21,190	11,020
3/4	14,550	7,565	31,405	16,305

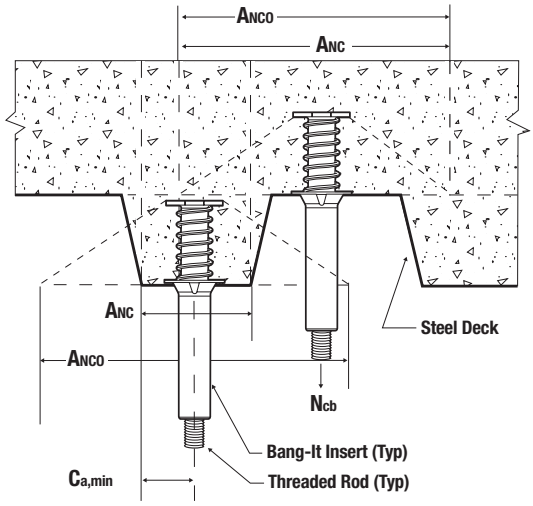
- Steel Strength Controls

1. Steel tensile design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pullout design strength to determine the controlling failure mode, the lowest load level controls.
3. Steel shear design strength according to ACI 318 Appendix D and ACI 318 Chapter 17, $\phi N_{sa} = \phi \bullet 0.60 \bullet A_{se,N} \bullet f_{uta}$
4. The tabulated steel design strength in shear for the threaded rod must be checked against the design strength of the steel insert, concrete breakout and pryout design strength to determine the controlling failure mode, the lowest load level controls.

Idealization of Concrete Filled Steel Decks for Determination of Concrete Breakout Strength in Accordance with ACI 318



Idealization of Standard Steel Deck Profiles



Idealization of B Deck Steel Deck Profiles

ORDERING INFORMATION

Bang-It®+ Deck Insert (UNC)

Cat.No.	Description	Color Code	Pre-Drilled Hole	Std. Box	Std. Pallet
7540	1/4" Bang-It+	Brown	13/16" or 7/8"	100	4,000
7542	3/8" Bang-It+	Green	13/16" or 7/8"	100	4,000
7544	1/2" Bang-It+	Yellow	13/16" or 7/8"	100	4,000
7546	5/8" Bang-It+	Red	1-3/16" or 1-1/4"	50	2,400
7548	3/4" Bang-It+	Purple	1-3/16" or 1-1/4"	50	2,400
7543	3/8-1/2" Bang-It+ Multi Insert	Gray	13/16" or 7/8"	100	4,000
Inserts are color coded to easily identify location and diameter of the internally threaded coupling.					

Bang-It®+ Installation Accessories

Cat.No.	Description	Std. 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
D180014IR	7/8" (22mm) Impact Ready® Hole Saw	1
D180020IR	1-1/4" (32mm) Impact Ready® Hole Saw	1
7566	Extra Carbide Hole Saw Center Bit	1
DWA1786IR	3/16" - 7/8" Impact Ready® Step Drill Bit	1
DWA1789IR	7/8" - 1-1/8" Impact Ready® Step Drill Bit	1
DCD980M2	20V Max* Lithium Ion Premium 3-Speed Drill/Driver Kit (4.0 Ah)	1
DWD220	1/2" VSR Pistol Grip Drill With E-Clutch Anti-Lock Control	1

GENERAL INFORMATION

DDI™+ (DECK INSERT)

Threaded Insert for Metal Deck

PRODUCT DESCRIPTION

The DDI+ (Deck Insert) is a concrete insert designed for installation in concrete-filled metal deck assemblies (i.e. “pan-deck”, “Q-deck”) applications. After installation, the threaded male hanger of the insert protrudes below the surface of the deck. The DDI+ comes in sizes ranging from 3/8" to 7/8" in diameter. The threaded bolt offers adjustability for precise height requirements and guarantees the minimum embedment depth. The longer "T" brace enables a variety of installation locations in across the deck.

GENERAL APPLICATIONS AND USES

- Seismic Loading and Cracked Concrete
- Hanging Pipe and Sprinkler Systems
- HVAC Ductwork and Strut Channels
- Suspending Trapeze and Cable Trays
- Mechanical Unit Overhead Utilities
- Conduit and Lighting System

FEATURE AND BENEFITS

+ Fast and simple to install, low installed cost
+ Pre-mounted self drilling screws for convenient installation
+ Fine-tuned thread length for guaranteed minimum embedment
+ Lengthened "T" brace for more flexible installation positions

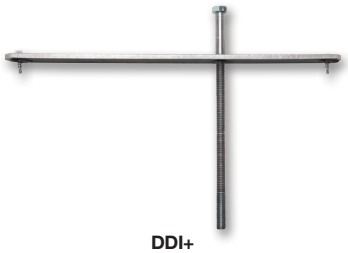
APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-3958 for concrete. Approved for seismic and wind loading
- Code compliant with the 2015 IBC, 2015 IRC, 2012 IBC, 2012 IRC, 2009 IBC, and 2009 IRC
- Underwriters Laboratories (UL Listed) - File No. EX1289, see listing for sizes.
- FM Approvals (Factory Mutual) – File No. J.I. 3059197

GUIDE SPECIFICATIONS

CSI Divisions: 03 15 19 - Cast-In Concrete Anchors and 03 16 00 - Concrete Anchors. Concrete inserts shall be DDI+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



DDI+

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

Plain and zinc plated carbon steel

ANCHOR SIZE RANGE

- 3/8" diameter through 7/8" diameter

SUITABLE BASE MATERIALS

- Concrete or lightweight concrete over metal deck

TENSION ZONE CRACKED CONCRETE

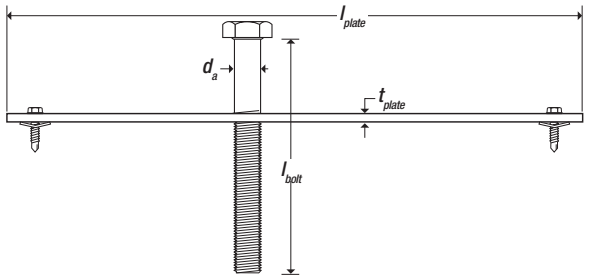
SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-3958
CONCRETE

DDA DEWALT DESIGN ASSIST™

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Metal Plate	ASTM A1011 Carbon Steel or equivalent (plain)
Hex Head Bolt	ASTM A307 Grade A (zinc plated)



DDI+ Insert Detail

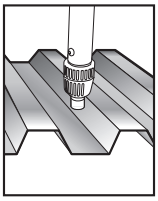
INSTALLATION SPECIFICATIONS

Dimension		Notation	Nominal Anchor Size				
			3/8"	1/2"	5/8"	3/4"	7/8"
Typical Drill Bit Diameter for Deck		in.	7/16 or 1/2	9/16 or 5/8	11/16 or 3/4	13/16 or 7/8	15/16 or 1
Overall Length of Metal Plate		in.	12	12	12	12	12
Approximate Width of Metal Plate		in.	1-1/4	1-1/4	1-1/4	2	2
Approximate Thickness of Metal Plate		in.	3/16	3/16	3/16	3/8	3/8
Bolt Thread Size (UNC)		in.	3/8-16	1/2-13	5/8-11	3/4-10	7/8-9
Length of Hex Head Bolt		in.	8	8	8	8	8
Effective Embedment Depth		in.	1-1/2	1-3/4	2	2-1/8	2-1/16
Nominal Embedment Depth		in.	1-3/4	2	2-3/8	2-5/8	2-5/8
Approx. Thread Projection (through 3-inch-deep deck)	Over Upper Flute	in.	6-1/4	6	5-5/8	5-3/8	5-3/8
	Over Lower Flute		3-1/4	3	2-5/8	2-3/8	2-3/8

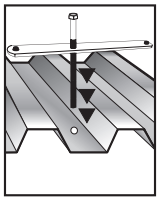
Dimension	Size	Point Style	Drill Range	RPM (Max)
Self-Drilling Screw	8-18	#2	18 Gage Max	2500

INSTALLATION INSTRUCTIONS

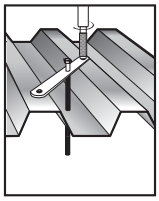
Cut (e.g. drill/punch) a hole in the steel deck to the hole size required by the threaded bolt of the insert.



Place the threaded bolt of the insert through the hole in the steel deck.



The metal plate of the insert must be on the top of the deck flutes. The metal plate can (optionally) be secured to the deck using the pre-assembled size drilling screws.



REFERENCE DATA (ASD)

Ultimate and Allowable Load Capacities for DDI+ (Deck Insert) Installed in the Soffit of Sand-lightweight or Normal Weight Concrete over Metal Deck Floor and Roof Assemblies[1,2,3,4]

Nominal Anchor Diameter in.	Nominal Embed. Depth h_{nom} (in.)	Min. Concrete Topping Thickness (in.)	Min. Insert Spacing (in.)	Min. End Distance (in.)	Normal-weight or Sand-lightweight concrete, f'c ≥ 3,000 psi											
					3-7/8" or 4-1/2" Wide Deck											
					Installed Over Upper Flute				Installed Over Flute Incline				Installed Over Lower Flute			
					Ultimate Load		Allowable Load		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
					Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/8	1-3/4	2	4-1/2	9	3,420	1,985	1,140	660	5,230	1,985	1,745	660	5,230	2,610	1,745	870
1/2	2	2-1/2	5-1/4	10-1/2	4,310	4,205	1,435	1,400	6,235	4,205	2,080	1,400	6,235	5,155	2,080	1,720
5/8	2-3/8	3-1/4	6	12	5,265	6,450	1,755	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
3/4	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275
7/8	2-5/8	3-1/4	6-3/8	12-3/4	5,770	6,450	1,925	2,150	8,630	6,450	2,875	2,150	8,630	6,820	2,875	2,275

1. Allowable load capacities listed are calculated using an applied safety factor of 3.0
2. Nominal embedment depth is measured from the bottom of the insert plate to the top of the insert bolt head.
3. Insert spacing and end distances are measured from the centerline of the insert bolt head.
4. Shear loads may be applied in any direction. For inserts installed over the upper flute, if the shear load is parallel to the flute the tabulated allowable load values may be increased by 20 percent (multiplied by 1.2)

STRENGTH DESIGN (SD)

CODE LISTED ICC-ES ESR-3958

DDI+ Insert Installation Information and Supplemental Information[1,2]

Design Information		Symbol	Units	3/8-inch	1/2-inch	5/8-inch
Nominal bolt diameter		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Length of insert bolt		ℓ_{bolt}	in (mm)	8 (203)	8 (203)	8 (203)
Typical drill bit diameter		d_{bit}	in.	7/16 or 1/2	9/16 or 5/8	11/16 or 3/4
Nominal overall length of insert plate		ℓ_{plate}	in.² (mm²)	12 (305)	12 (305)	12 (305)
Nominal width of insert plate		W_{plate}	in.² (mm²)	1-1/4 (32)	1-1/4 (32)	1-1/4 (32)
Approximate thickness of insert plate		t_{plate}	in. (mm)	3/16 (4.8)	3/16 (4.8)	3/16 (4.8)
Minimum nominal embedment depth	Over upper flute	$h_{nom\ (upperflute)}$	in. (mm)	1-3/4 (45)	2 (51)	2-3/8 (60)
	Over flute incline	$h_{nom\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{nom\ (lowerflute)}$	in. (mm)			
Minimum effective embedment depth	Over upper flute	$h_{ef\ (upperflute)}$	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	$h_{ef\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{ef\ (lowerflute)}$	in. (mm)			
Minimum concrete member thickness (topping thickness)	Over upper flute	$h_{min\ (upperflute)}$	in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)
	Over flute incline	$h_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$h_{min\ (lowerflute)}$	in. (mm)			
Minimum flute edge distance (insert bolt)	Over upper flute	$c_{min,deck\ (upperflute)}$	in. (mm)	N/A	N/A	N/A
	Over flute incline	$c_{min,deck\ (upperincline)}$	in. (mm)			
	Over lower flute	$c_{min,deck\ (lowerflute)}$	in. (mm)	See Figure 3C	See Figure 3C	See Figure 3C
Minimum spacing distance (bolt spacing, center-to-center)	Over upper flute	$s_{min\ (upperflute)}$	in. (mm)	4-1/2 (114)	5-1/4 (133)	6 (152)
	Over flute incline	$s_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$s_{min\ (lowerflute)}$	in. (mm)			
Minimum deck end distance	Over upper flute	$c_{min\ (upperflute)}$	in. (mm)	Specified cover requirements for reinforcement in accordance with ACI 318-14 17.7.2 or ACI 318-11 7.7, as applicable.		
	Over flute incline	$c_{min\ (upperincline)}$	in. (mm)			
	Over lower flute	$c_{min\ (lowerflute)}$	in. (mm)			
Effective tensile stress area (insert bolt)		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)	0.226 (146)
Insert head net bearing area		A_{brg}	in.² (mm²)	0.17 (110)	0.28 (181)	0.45 (290)
Minimum specified ultimate strength		f_{uta}	psi (N/mm²)	60,000 (400)		
Minimum specified yield strength		f_{ya}	psi (N/mm²)	36,000 (248)		

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

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable,
2. For installation detail for inserts in concrete-filled steel deck assemblies, see Figures A, B and C (i.e. over upper flute, over flute incline, over lower flute).

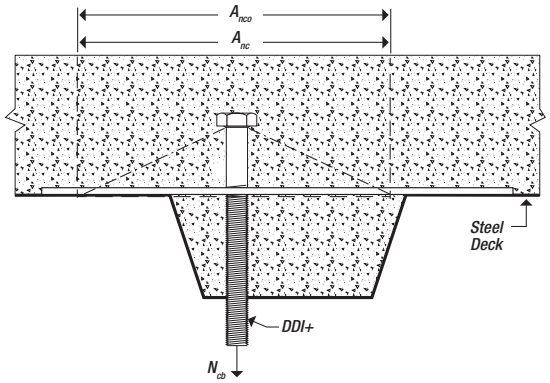
CODE LISTED
ICC-ES ESR-3958

DDI+ Insert Design Information[1,2,3,4,5,6]

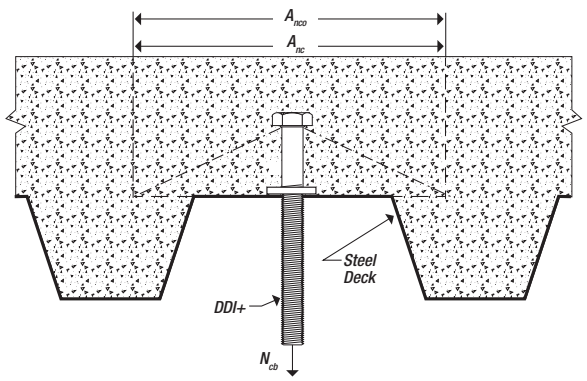
Design Information		Symbol	Units	3/8-inch	1/2-inch	5/8-inch
Insert O.D. (nominal bolt diameter)		d_a	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)
Insert head net bearing area		A_{brg}	in² (mm²)	0.17 (110)	0.28 (181)	0.45 (290)
Effective tensile stress area		A_{se}	in.² (mm²)	0.078 (50)	0.142 (92)	0.226 (146)
Effective embedment depth	Over upper flute	h_{ef} (upperflute)	in. (mm)	1.50 (38)	1.75 (45)	2.00 (51)
	Over flute incline	h_{ef} (fluteincline)	in. (mm)			
	Over lower flute	h_{ef} (lowerflute)	in. (mm)			
Minimum concrete member thickness (topping thickness over upper flute)		h_{min}	in. (mm)	2.00 (51)	2.50 (64)	3.25 (83)
Minimum spacing and edge distance		s_{min}, c_{min}	in. (mm)	See Installation Information Table and Figures A, B and C		
Effectiveness factor for cracked concrete		k_c	- (SI)	24 (10)		
Modification factor for tension strength in uncracked concrete		$\Psi_{C,N}$	-	1.25		
According to Figures A, B or C	Nominal tension strength of single insert as governed by steel strength	$N_{sa,insert}$	lb (kN)	4,650 (20.7)	8,520 (37.9)	13,560 (60.3)
	Nominal tension strength of single insert as governed by steel strength, seismic	$N_{sa,insert,eq}$	lb (kN)			
According to Figure A (over upper flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (upperflute)	lb (kN)	2,280 (10.1)	4,260 (18.9)	7,245 (32.2)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (upperflute)	lb (kN)	1,825 (8.1)	3,410 (15.2)	
According to Figure B (over flute incline)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (fluteincline)	lb (kN)	1,310 (5.8)	3,410 (15.2)	5,240 (23.3)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (fluteincline)	lb (kN)	1,045 (4.6)	2,860 (12.7)	
According to Figure C (over lower flute)	Nominal steel shear strength of single insert in the soffit of concrete on steel deck	$V_{sa,insert,deck}$ (lowerflute)	lb (kN)	2,280 (10.1)	4,260 (18.9)	5,735 (25.5)
	Nominal steel shear strength of single insert in the soffit of concrete on steel deck, seismic	$V_{sa,insert,deck,eq}$ (lowerflute)	lb (kN)	2,015 (9.0)	3,410 (15.2)	

For SI: 1 inch = 25.4 mm, 1 pound = 4.45 N, 1 psi = 0.006895 MPa. For pound-inch unit: 1 mm = 0.03937 inches.

1. Concrete must have a compressive strength f 'c of 3,000 psi (20.7 MPa) minimum.
2. Design of headed cast-in specialty inserts shall be in accordance with the provisions of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, for cast-in headed anchors. Concrete breakout strength must also be in accordance with the Idealization of Concrete Filled Steel Decks Figure.
3. Strength reduction factors for the inserts shall be taken from ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, for cast-in headed anchors. Strength reduction factors for load combinations in accordance with ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, governed by steel strength of the insert shall be taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements. The value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4.
4. Insert O.D. is the nominal bolt diameter of the insert.
5. Minimum spacing distance between anchors and minimum edge distances for cast-in headed DDI+ inserts shall be in accordance with the Installation Information Table, Design Information Table, Figures A, B and C and noted provisions.
6. Shear loads for concrete inserts in concrete-filled steel deck assemblies may be applied in any direction (i.e. over upper flute, over flute incline, over lower flute).



Idealization of Steel Deck Profile (over lower flute or over flute incline)



Idealization of Steel Deck Profile (over upper flute)

Idealization of Concrete Filled Steel Decks for Determination of Concrete Breakout Strength in Accordance with ACI 318

Tension and Shear Design Strengths for DDI+ Inserts Installed in Uncracked Lightweight Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Insert O.D. (Nominal Bolt Diameter) (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi					
		Upper Flute (Figure A)		Flute Incline (Figure B)		Lower Flute (Figure C)	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-3/4	1,795	1,480	1,795	850	1,795	1,480
1/2	1-3/4	2,265	2,770	2,265	2,215	2,265	2,770
5/8	1-3/4	2,765	4,710	2,765	3,405	2,765	3,730

□ - Anchor Pullout/Pryout Strength Controls ▢ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for DDI+ Inserts Installed in Cracked Lightweight Concrete Filled Steel Deck Floor and Roof Assemblies[1,2,3,4,5,6]

Insert O.D. (Nominal Bolt Diameter) (in.)	Embed. Depth hef (in.)	Minimum Concrete Compressive Strength					
		f'c = 3,000 psi					
		Upper Flute (Figure A)		Flute Incline (Figure B)		Lower Flute (Figure C)	
		ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)	ϕNn Tension (lbs.)	ϕVn Shear (lbs.)
3/8	1-3/4	1,435	1,480	1,435	850	1,435	1,480
1/2	1-3/4	1,810	2,770	1,810	2,215	1,810	2,770
5/8	1-3/4	2,210	4,710	2,210	3,405	2,210	3,730

□ - Anchor Pullout/Pryout Strength Controls ▢ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

1- Tabular values are provided for illustration and are applicable for single anchors installed in sand-lightweight concrete with minimum member thickness (topping thickness), $h_a = h_{min}$, and with the following conditions:
- For Upper Flute and Flute Incline: c_{a1} is greater than or equal to the critical edge distance, c_{ac}
- For Lower Flute: c_{a1} is equal to the minimum lower flute edge distance

2- Calculations were performed following methodology in ACI 318-14 Chapter 17. The load level corresponding to the controlling failure mode listed (e.g. For Tension: steel strength, concrete breakout strength, or pullout strength; For Shear: steel strength). Furthermore, the capacities for concrete breakout strength in tension are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information table. Please also reference the installation specifications for additional information.

3- Strength reduction factors (ø) for the inserts are based on ACI 318-14 17.3.3 for cast-in headed anchors. Condition B is assumed. Strength reduction factors for load combinations in accordance with ACI 318-14 Section 5.3 governed by steel strength of the insert are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements.

4- Tabular values are permitted for short-term 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 318-14 Chapter 17.

6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Chapter 17 and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Chapter 17.

Figure A

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Upper Flute)[1,2,3]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)

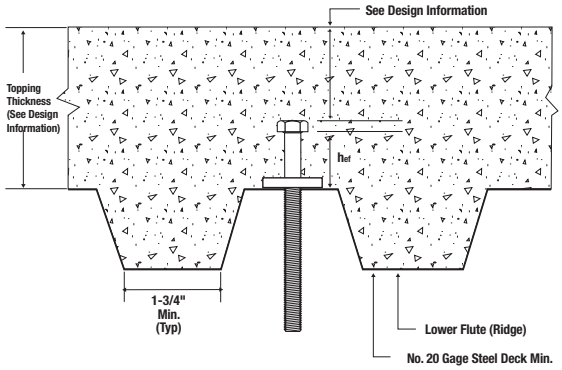


Figure B

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Flute Incline)[1,2,4]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)

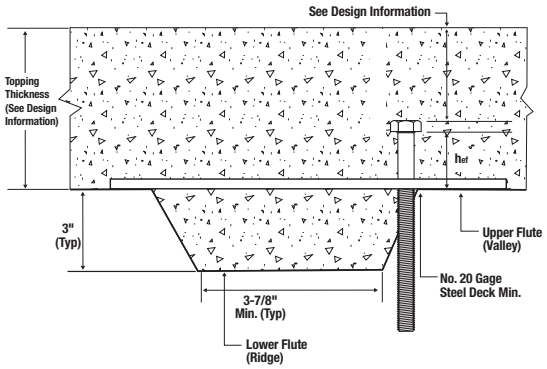
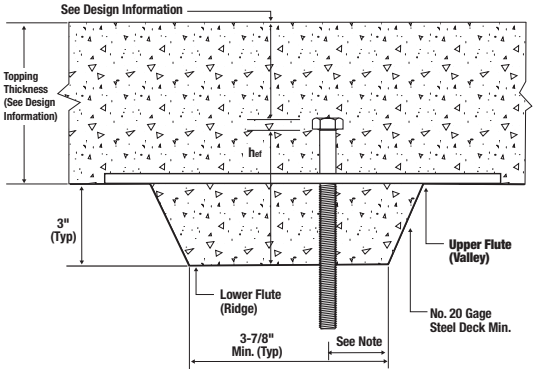


Figure C

DDI+ Concrete Inserts Installed Through the Soffit of Concrete-Filled Steel Deck Floor and Roof Assemblies (Over Lower Flute)[1,2,5]

SAND-LIGHTWEIGHT CONCRETE OR NORMAL WEIGHT CONCRETE OVER STEEL DECK (MIN. 3,000 PSI)



1. Installations require a minimum concrete member topping thickness from the top of the upper flute as given in the Design Information Table.
2. Inserts may be placed on the upper flute of the steel deck assembly; they may be installed anywhere across upper flute as follows:
   (Figure A) - Placed over the upper flute with threaded bolt installed through the upper flute or;
   (Figure B) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the inclined section or;
   (Figure C) - Placed over the upper flute spanning the lower flute with threaded bolt installed through the lower flute.
3. Inserts over the upper flute with threaded bolt installed through the upper flute may be placed in any location and orientation that meets the minimum deck end distance requirements (see Design Information Table). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
4. Inserts over the upper flute spanning the lower flute with threaded bolt installed through the inclined section may be placed in any location and orientation that meets the minimum deck end distance requirements (see Design Information Table). The minimum deck end distance is measured from deck end to the centerline of the insert bolt.
5. Inserts over the upper flute spanning the lower flute with threaded bolt installed through the lower flute may be placed in any location that meets the minimum deck end distance and minimum lower flute edge distance requirements. The minimum deck end distance is measured from deck end to the centerline of the insert bolt. For lower flute widths of 3-7/8-inch, a maximum 1-inch centerline bolt offset in either direction from the center of the flute. The offset distance may be increased for flute widths greater than those shown provided the minimum lower flute edge distance of 15/16 -inch is also satisfied.

ORDERING INFORMATION

DDI+ (Deck Insert)

Cat. No.	Anchor Size	Rod/Anchor Dia.	Typical Drill Diameter	Box Qty.
PFM2511100	3/8" Metal Deck Insert	3/8"	7/16" or 1/2"	20
PFM2511110	1/2" Metal Deck Insert	1/2"	9/16" or 5/8"	20
PFM2511120	5/8" Metal Deck Insert	5/8"	11/16" or 3/4"	20
PFM2511130	3/4" Metal Deck Insert	3/4"	13/16" or 7/8"	12
PFM2511140	7/8" Metal Deck Insert	7/8"	15/16" or 1"	12

Rod Coupling Nuts - Zinc

Cat. No.	Description	Rod/Anchor Dia.	Hex Diameter	Box Qty.	Ctn. Qty.
030007	3/8"-16 x 1/2" x 1-1/8"	3/8"	1/2"	100	1000
030009	1/2"-13 x 5/8" x 1-1/4"	1/2"	5/8"	50	500
030010	5/8"-13 x 13/16" x 2-1/8"	5/8"	13/16"	25	250
030011	3/4"-13 x 1" x 2-1/4"	3/4"	1"	25	250
030012	7/8"-13 x 1-1/4" x 2-1/2"	7/8"	1-1/4"	10	100

GENERAL INFORMATION

DOUBLE™

Shield Expansion Anchor

PRODUCT DESCRIPTION

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

FEATURE AND BENEFITS

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

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488
- Federal GSA Specification – Meets descriptive and proof load requirements of CID A-A-1923A, Type 3

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Double as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

DOUBLE

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Zamac Alloy

ANCHOR SIZE RANGE (TYP.)

- 1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

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

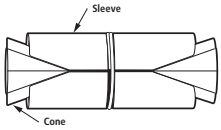
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, d					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size (in.)	1/2	5/8	3/4	7/8	1	1-1/4
Max. Tightening Torque, (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
Nominal outside diameter of anchor is the same as the corresponding ANSI drill bit size.						

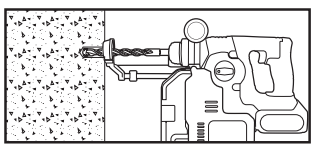
Material Specifications

Anchor Component	Component Material
Anchor Sleeve	Zamac Alloy
Cone	Zamac Alloy

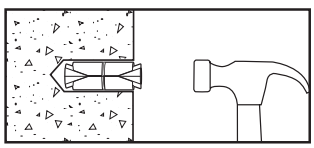


Installation Guidelines

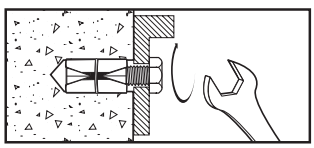
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not expand the anchor prior to installation. Do not over drill the hole unless the application calls for a subset anchor.



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 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)
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 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)
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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

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 ≥ 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 ≥ 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)	f´m ≥ 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 ≥ 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:

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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} = 8d	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.

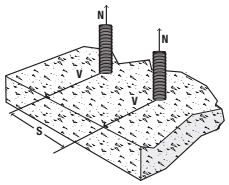
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing Distance, Tension (F_{NS} and F_{VS})

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
Edge Distance, c (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	1.00	0.83	0.63	0.50	-
	3-3/4	1.00	1.00	1.00	0.75	0.60	0.50
	5	1.00	1.00	1.00	1.00	0.80	0.67
	6-1/4	1.00	1.00	1.00	1.00	1.00	0.83
	7-1/2	1.00	1.00	1.00	1.00	1.00	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.

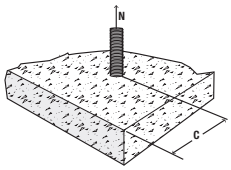


Edge Distance, Tension (F_{NC})

Dia. (in.)		1/4	5/8	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	1.00	0.90	-	-	-
	4	1.00	1.00	0.93	0.80	-	-
	4-1/2	1.00	1.00	1.00	0.85	-	-
	5	1.00	1.00	1.00	0.90	0.80	-
	6	1.00	1.00	1.00	1.00	0.88	0.80
	7-1/2	1.00	1.00	1.00	1.00	1.00	0.90
	9	1.00	1.00	1.00	1.00	1.00	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.

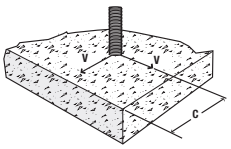


Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	5/8	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	1.00	0.75	-	-	-
	4	1.00	1.00	0.83	0.50	-	-
	4-1/2	1.00	1.00	1.00	0.63	-	-
	5	1.00	1.00	1.00	0.75	0.50	-
	6	1.00	1.00	1.00	1.00	0.70	0.50
	7-1/2	1.00	1.00	1.00	1.00	1.00	0.75
	9	1.00	1.00	1.00	1.00	1.00	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

GENERAL INFORMATION

SINGLE™

Shield Expansion Anchor

PRODUCT DESCRIPTION

The Single is a machine bolt anchor designed for use in concrete. 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 or life safety applications.

FEATURES AND BENEFITS

+ Readily accepts machine bolts
+ Internally threaded anchor for easy removability and service work
+ Corrosion resistant body

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488
- Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 2

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Expansion anchors shall be Single as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

SINGLE

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Zamac Alloy

ANCHOR SIZE RANGE (TYP.)

- 1/4" to 5/8" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

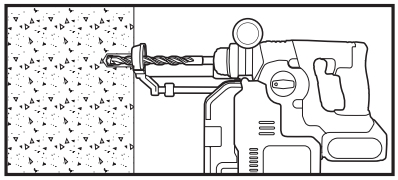
Dimension	Rod/Anchor Diameter, d				
	1/4"	5/16"	3/8"	1/2"	5/8"
ANSI Drill Bit Size, (in.)	1/2	5/8	5/8	7/8	1
Max. Tightening Torque, (ft.-lbs.)	5	7	10	20	30
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Thread Length In Cone (in.)	5/16	5/16	5/16	7/16	5/8
Overall Anchor Length (in.)	1-5/16	1-1/2	1-1/2	2-1/16	2-5/8
Nominal outside diameter of anchor is the same as the corresponding ANSI drill bit size					

Material Specifications

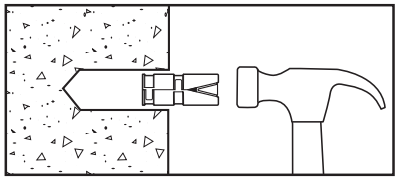
Anchor Component	Component Material
Anchor Sleeve	Zamac Alloy
Cone	Zamac Alloy

Installation Guidelines

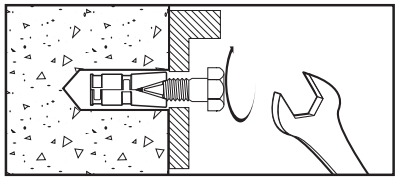
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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 Size 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[1,2,3]

Rod/Anchor Size 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. 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. 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. Linear interpolation may be used to determine loads for intermediate compressive strengths.

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

GENERAL INFORMATION

CALK-IN™

Mechanical 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 or for life safety.

GENERAL APPLICATIONS AND USES

- Windows
- Screens
- Sliding Doors
- Shutters

FEATURES AND BENEFITS

+ Readily accepts machine bolts
+ Internally threaded anchor for easy removability of attachment 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: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Machine bolt anchors shall be Calk-In as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

CALK-IN

THREAD VERSION

- UNC Thread

ANCHOR MATERIALS

- Antimonial Lead Alloy Body and Zamac Alloy Cone

ANCHOR SIZE RANGE (TYP.)

- No. 8 Screw to 1/2" diameter

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Grouted-filled Concrete Masonry (CMU)
- Brick Masonry

INSTALLATION AND MATERIAL SPECIFICATIONS

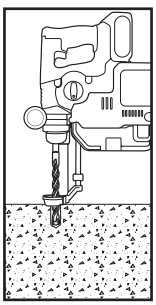
Installation Specifications

Dimension	Nominal Rod/Anchor Size					
	#8-32	#10-24	1/4"	5/16"	3/8"	1/2"
Nominal Length (in.)	1/2	5/8	7/8	1	1-1/4	1-1/2
ANSI Drill Bit Size, (in.)	5/16	3/8	1/2	5/8	3/4	7/8
Nominal Outside Dia. (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.)
Threaded Length in Cone (in.)	13/32	15/32	19/32	3/4	1	1-1/8

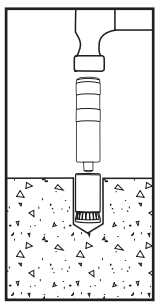
Material Specifications

Anchor Component	Component Material
Anchor Sleeve (Body)	Antimonial Lead Alloy
Cone	Zamac Alloy

Installation Instructions

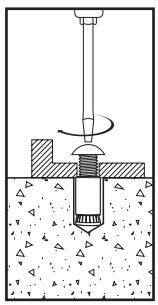


Step 1
Drill a hole into the base material to the required depth. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Do not over drill the hole.



Step 2
Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.

Insert the anchor into the hole, cone first. Position the setting tool in the anchor with shoulder in contact with the anchor sleeve. Using the tool, set the anchor by driving the sleeve using several sharp hammer blows.



Step 3
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. Do not exceed the maximum tightening torque.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Calk-In in Normal-Weight Concrete[1,2,3]

Rod / Anchor Size in.	Minimum Embed. Depth in.	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.
#8-32	1/2	335	85	310	75	365	90	360	90	380	95	360	90
#10-24	5/8	765	190	885	220	975	245	940	235	1,105	275	940	235
1/4-20	7/8	1,200	300	1,355	340	1,500	375	1,410	355	1,640	410	1,410	355
5/16-18	1	1,570	390	1,880	470	1,965	490	2,070	520	2,160	540	2,070	520
3/8-16	1-1/4	1,985	495	2,700	675	2,485	620	3,305	825	2,895	725	3,305	825
1/2-13	1-1/2	2,795	700	3,995	1,000	3,495	875	4,545	1,135	3,810	950	4,545	1,135

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 an 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 on the application such as in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable loads for anchors at intermediate embedment depths and compressive strengths.

Ultimate and Allowable Load Capacities for Calk-In in Grout-Filled Concrete Masonry[1,2]

Rod/Anchor Size in.	Minimum Embedment Depth in.	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
#8-32	1/2	335	310	65	60
#10-24	5/8	740	885	150	175
1/4-20	7/8	880	1,250	175	250
5/16-18	1	1,470	1,585	295	315
3/8-16	1-1/4	1,700	2,265	340	455
1/2-13	1-1/2	2,360	3,210	470	640

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.	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
#8-32	1/2	335	310	65	60
#10-24	5/8	765	890	150	180
1/4-20	7/8	1,460	1,480	290	295
5/16-18	1	1,730	1,995	345	400
3/8-16	1-1/4	2,200	3,600	440	720
1/2-13	1-1/2	3,200	4,535	640	905

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.

ORDERING INFORMATION

Calk-In Anchor and Setting Tools (Ordered Separately)

Anchor Cat. No.	Tool Cat. No.	Anchor Size	Drill Diameter	Min. Hole Depth	Std. Box	Std. Carton	Wt./100
9205	9201	#8-32	5/16"	1/2"	100	1,000	1
9210	9211	#10-24	3/8"	5/8"	100	1,000	1-3/4
9220	9221	1/4"-20	1/2"	7/8"	100	1,000	4-1/2
9225	9226	5/16"-18	5/8"	1"	50	250	7-3/4
9230	9231	3/8"-16	3/4"	1-1/4"	50	250	14
9240	9241	1/2"-13	7/8"	1-1/2	50	250	19

GENERAL INFORMATION

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 or life safety applications.

GENERAL APPLICATIONS AND USES

- Hard and Soft Base Materials
- Shallow Attachments
- Mortar Joints
- Masonry Anchorage

FEATURE AND BENEFITS

+ Ideal for use in masonry materials
+ Internally threaded anchor for easy removability and service work

APPROVALS AND LISTINGS

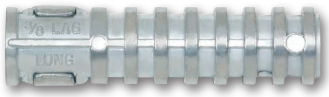
- Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 1
- Tested in accordance with ASTM E 488

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Shell Expansion Anchors shall be Lag Shield as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

LAG SHIELD - SHORT



LAG SHIELD - LONG

THREAD VERSION

- Lag Bolt

ANCHOR MATERIALS

- Zinc alloy

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

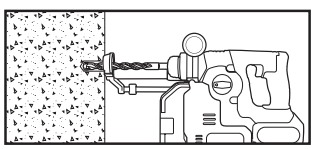
Installation Specifications						
Dimension	Rod/Anchor Diameter, d					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size (in.)	1/2	1/2	5/8	3/4	7/8	1
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Lag Bolt Size	1/4-10	5/16-9	3/8-7	1/2-6	5/8-5	3/4-4-1/2

Material Specifications

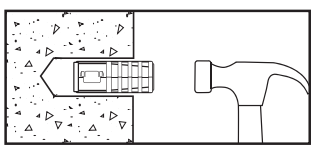
Anchor Component	Component Material
Anchor Sleeve	Zamac Alloy

Installation Guidelines

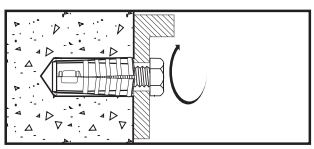
Drill a hole into the base material to the depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.



Remove dust and debris from the hole during drilling (e.g. dust extractor, hollow bit) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. 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 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 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 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 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.

Ultimate and Allowable Load Capacities for Lag Shield in Hollow Concrete Masonry[1,2,3,4]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	f´m ≥ 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 ≥ 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 ≥ 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)

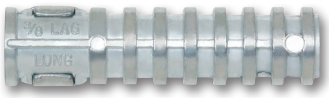
1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (f'm ≥ 1,500 psi).
2. Allowable load 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

GENERAL INFORMATION

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 tamperproof 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
- Cable trays and strut
- Available in corrosion resistance stainless steel for exterior applications
- Pipe hanging
- Metal track attachments
- Concrete formwork

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 a simple to install alternative to direct fastening (e.g. powder actuated)

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488 and AC01 criteria

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Pre-expanded anchors shall be Spike as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

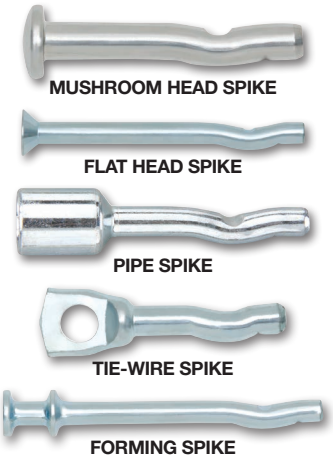
Carbon Steel (Mushroom Head, Flat Head, Pipe, Tie-Wire and Forming Spike)

Anchor Component	Component Material
Anchor Body	AISI 1038 Carbon Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn5)

Stainless Steel (Mushroom Head)

Anchor Component	Component Material
Anchor Body	Type 316L Stainless Steel

SECTION CONTENTS



HEAD STYLE

- Mushroom Head
- Flat Head
- Pipe (Coupler Head)
- Tie-Wire
- Forming

ANCHOR MATERIALS

- Zinc Plated Carbon Steel
- Type 316 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

- 3/16" diameter through 1/2" diameters

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- 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 (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole (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 (in.)	3/16	1/4	3/8
Fixture Clearance Hole (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 (in.)	3/16	1/4
Fixture Clearance Hole (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 (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 (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

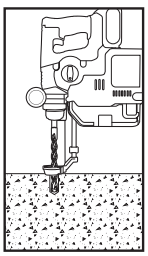
Dimension	Nominal Anchor Size, d	
	3/16"	1/4"
ANSI Drill Bit Size (in.)	3/16	1/4
Fixture Clearance Hole (in.)	1/4	5/16
Head Height (in.)	9/16	9/16
Head Size, O.D. (in.)	13/32	1/2

INSTALLATION INSTRUCTIONS

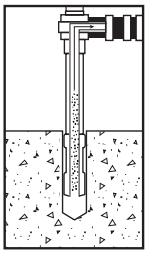
Mushroom/Flat Head Version

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

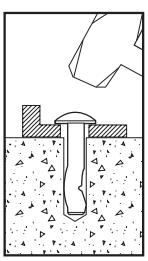
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



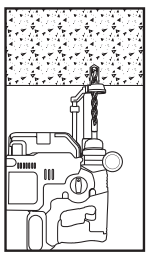
Drive the anchor through the fixture into the anchor hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



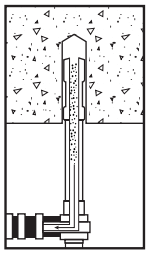
Pipe Spike Version

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

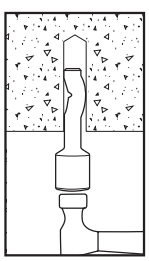
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



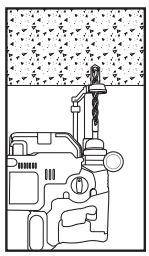
Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.



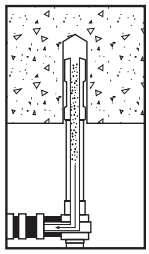
Tie-Wire Version

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

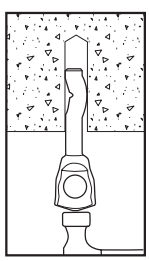
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



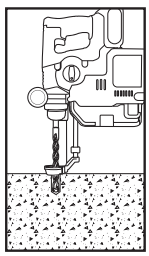
Drive the anchor into the hole until the head is firmly seated against the base material. Be sure the anchor is driven to the required embedment depth.



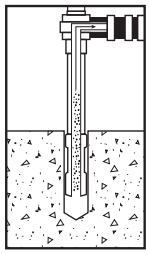
Forming Spike Version

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

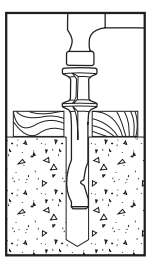
The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15



Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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 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 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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

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

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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 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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Carbon Steel Pipe Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Drill Bit Diameter in.	Minimum Embedment Depth 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 Diameter d in. (mm)	Drill Bit Diameter in.	Minimum Embedment Depth 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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors 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 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 , 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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Carbon Steel Forming Spike in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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 Embedment Depth 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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate Load Capacities for Spike in Lightweight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	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)	1-1/8 (28.6)	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 Lightweight Concrete[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth 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)	110 (0.5)	320 (1.4)	100 (0.5)	320 (1.4)	95 (0.4)	320 (1.4)
1/4 (6.4)	1-1/8 (28.6)	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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate and Allowable Load Capacities for Spike Anchors in Concrete Over Steel Deck[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	Lightweight Concrete Over Steel Deck f´c ≥ 3,000 psi (20.7 MPa) Minimum 1-1/2" Wide Deck, 20 Gage Minimum			
		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 lightweight concrete.
4. Anchors are permitted to be installed in the lower or upper flute of the steel deck provided the proper installation procedures are maintained. Minimum flute edge distance is 7/8-inch.

Ultimate and Allowable Load Capacities for Spike in Grouted Concrete Masonry[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth in. (mm)	f´m ≥ 1,500 psi (10.4 MPa) Minimum 6" Wide CMU							
		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, 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)
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 spacing and edge distance of 16 anchor diameters.

DESIGN CRITERIA

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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	$s_{cr} = 2.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 5d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 5d$	$F_{VC} = 0.50$

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	$s_{cr} = 3.0h_v$	$F_{NS} = F_{VS} = 1.0$	$s_{min} = 1.5h_v$	$F_{NS} = F_{VS} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{NC} = 1.0$	$c_{min} = 7d$	$F_{NC} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{VC} = 1.0$	$c_{min} = 7d$	$F_{VC} = 0.50$

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)

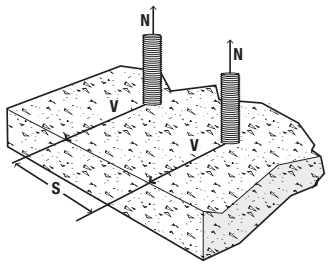
LOAD ADJUSTMENT FACTORS FOR NORMAL-WEIGHT CONCRETE

Spacing, Tension (F_{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
Distance (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	1.00	0.80	1.00	1.00	0.80	-	-
	2-1/2	1.00	1.00	1.00	1.00	1.00	1.00	0.50	-
	2-3/4	1.00	1.00	1.00	1.00	1.00	1.00	0.55	0.50
	3	1.00	1.00	1.00	1.00	1.00	1.00	0.60	0.55
	4	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.73
	5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91
	5-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes: For anchors loaded in tension and shear, the 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.

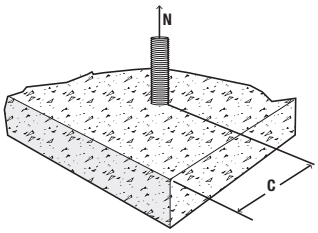


Edge Distance, Tension (F_{NC})

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
Distance (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	1.00	0.89	0.67	0.56
	3-1/2	1.00	1.00	0.74	0.61
	4	1.00	1.00	0.81	0.67
	5	1.00	1.00	0.96	0.78
	5-1/4	1.00	1.00	1.00	0.81
	6	1.00	1.00	1.00	0.89
	7	1.00	1.00	1.00	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.

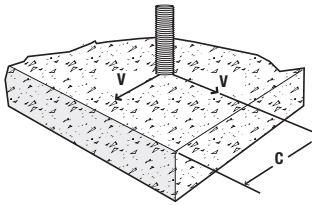


Edge Distance, Shear (F_{VC})

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
Distance (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	1.00	0.83	0.50	0.33
	3-1/2	1.00	1.00	0.61	0.42
	4	1.00	1.00	0.72	0.50
	5	1.00	1.00	0.94	0.67
	5-1/4	1.00	1.00	1.00	0.71
	6	1.00	1.00	1.00	0.83
	7	1.00	1.00	1.00	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.



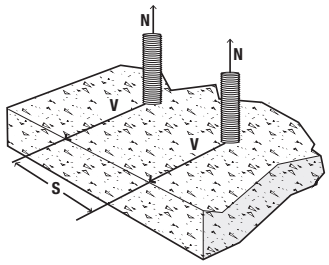
LOAD ADJUSTMENT FACTORS FOR LIGHTWEIGHT CONCRETE

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
Distance (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	1.00	0.80	1.00	1.00	0.80	-	-
	3-3/4	1.00	1.00	1.00	1.00	1.00	1.00	0.50	-
	4	1.00	1.00	1.00	1.00	1.00	1.00	0.53	-
	4-1/8	1.00	1.00	1.00	1.00	1.00	1.00	0.55	0.50
	5	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.61
	6	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.73
	7	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.85
	7-1/2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91
	8-1/4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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.

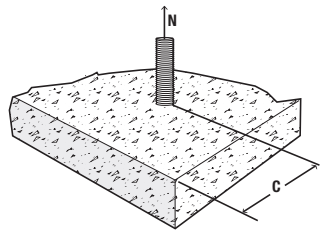


Edge Distance, Tension (F_{NC})

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
Distance (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	1.00	0.86	0.57	-
	3-1/2	1.00	1.00	0.67	0.50
	4	1.00	1.00	0.76	0.57
	5	1.00	1.00	0.95	0.71
	5-1/4	1.00	1.00	1.00	0.75
	6	1.00	1.00	1.00	0.86
	7	1.00	1.00	1.00	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.

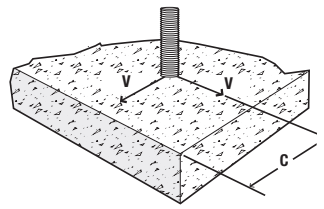


Edge Distance, Shear (F_{VC})

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
Distance (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	1.00	0.83	0.49	-
	3-1/2	1.00	1.00	0.60	0.40
	4	1.00	1.00	0.71	0.49
	5	1.00	1.00	0.94	0.66
	5-1/4	1.00	1.00	1.00	0.70
	6	1.00	1.00	1.00	0.83
	7	1.00	1.00	1.00	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 Spike (Tamperproof)

Carbon Steel Cat. No.	Stainless Steel Cat. No.	Anchor Size	Drill Diameter	Min. Embed.	Std. Box	Std. Carton	Wt./100
5502	6602	3/16" x 1"	3/16"	7/8"	100	1,000	1-1/4
5503	6603	3/16" x 1-1/4"	3/16"	7/8"	100	1,000	1-1/2
5504	6604	3/16" x 1-1/2"	3/16"	1-1/4"	100	1,000	1-3/4
5506	6606	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	600	2
5510	-	3/16" x 3"	3/16"	1-1/4"	100	600	2-1/2
5511	-	3/16" x 3-1/2"	3/16"	1-1/4"	100	600	3-1/2
5512	-	3/16" x 4"	3/16"	1-1/4"	100	600	4
5522	-	1/4" x 1"	1/4"	7/8"	100	1,000	1-1/2
5523	6623	1/4" x 1-1/4"	1/4"	1"	100	1,000	2-1/4
5524	6624	1/4" x 1-1/2"	1/4"	1-1/4"	100	1,000	2-1/2
5526	6626	1/4" x 2"	1/4"	1-1/4"	100	600	3
5528	6628	1/4" x 2-1/2"	1/4"	1-1/4"	100	600	4
5530	6630	1/4" x 3"	1/4"	1-1/4"	100	600	4-1/2
5531	-	1/4" x 3-1/2"	1/4"	1-1/4"	100	600	4-1/2
5532	-	1/4" x 4"	1/4"	1-1/4"	100	600	5-1/2
5546	6646	3/8" x 2"	3/8"	1-3/4"	25	250	7-1/2
5548	6648	3/8" x 2-1/2"	3/8"	1-3/4"	25	150	9
5550	6650	3/8" x 3"	3/8"	1-3/4"	25	150	10
5551	-	3/8" x 3-1/2"	3/8"	1-3/4"	25	150	11
5552	-	3/8" x 4"	3/8"	1-3/4"	25	150	11
5554	-	3/8" x 5"	3/8"	1-3/4"	25	150	11
5556	-	3/8" x 6"	3/8"	1-3/4"	25	125	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	125	13
5574	-	1/2" x 5"	1/2"	2-1/2"	25	125	13
5577	-	1/2" x 6-1/2"	1/2"	2-1/2"	25	100	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	600	2
5610	3/16" x 3"	3/16"	1-1/4"	100	600	2-1/2
5612	3/16" x 4"	3/16"	1-1/4"	100	600	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	600	3
5628	1/4" x 2-1/2"	1/4"	1-1/4"	100	600	3-3/4
5630	1/4" x 3"	1/4"	1-1/4"	100	600	4-1/2
5631	1/4" x 3-1/2"	1/4"	1-1/4"	100	600	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.

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	600	4
3758	3/8"	1/4"	1-3/4"	50	300	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	600	2
3759	1/4"	1/4"	1-1/8"	9/32"	100	600	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	600	2-1/2
3796	3/16" x 2"	3/16"	1-1/4"	100	600	3
3797	3/16" x 2-3/4"	3/16"	1-1/4"	100	600	4
3794	1/4" x 2-3/4"	1/4"	1-1/4"	100	500	5

Designed for concrete forming. The published length is measured from below the head to the end of the anchor.

GENERAL INFORMATION

DRIVE®

Pin Anchor

PRODUCT DESCRIPTION

The Drive is a one-piece, tamperproof, pre-formed anchor available in carbon steel for use in concrete. Tie-Wire Drive anchors are designed for suspended ceiling applications. The flat head (counter-sunk) 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

FEATURE AND BENEFITS

- Pre-expanded anchor design allows for easy installation
- Round And Flat Head Anchors Are Tamperproof

APPROVALS AND LISTINGS

- Tested in accordance with ASTM E488
- Underwriters Laboratory (UL Listed) – VFXT. EX1289

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors and 05 05 19 - Post-Installed Concrete Anchors. Pre-expanded anchors shall be Drive as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

MATERIAL SPECIFICATIONS

Anchor Component	Component Material
Anchor Body	Heat Treated Carbon Steel
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 (in.)	3/16	1/4	3/8	1/2
Fixture Clearance Hole (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

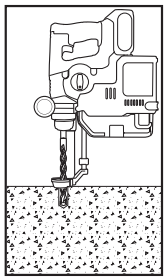
Dimension	Anchor Size, d	
	3/16"	1/4"
ANSI Drill Bit Size (in.)	3/16	1/4
Fixture Clearance Hole (in.)	1/4	5/16
Head Height (in.)	7/64	9/64
Head Width (in.)	3/8	1/2

Tie-Wire Drive

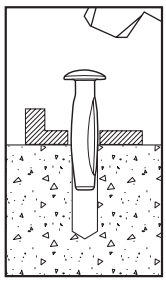
Dimension	Anchor Size, d
	1/4"
ANSI Drill Bit Size (in.)	1/4
Head Height (in.)	5/8
Tie-Wire Hole Diameter (in.)	13/64

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. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	7/8	700	1,100	1,080	1,365	1,080	1,370
1/4	1-1/8	1,320	1,665	1,760	2,090	1,760	2,090
3/8	1-7/8	2,275	5,580	4,240	7,030	4,240	7,030
1/2	2-5/8	2,560	7,945	4,960	10,205	4,960	10,205

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.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	7/8	175	275	270	340	270	345
1/4	1-1/8	330	415	440	525	440	525
3/8	1-7/8	570	1,395	1,060	1,760	1,060	1,760
1/2	2-5/8	640	1,985	1,240	2,550	1,240	2,550

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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors 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.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-1/8	1,320	1,100	1,760	1,560	1,760	1,560

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.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength (f´c)					
		2,000 psi		4,000 psi		6,000 psi	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
1/4	1-1/8	330	275	440	390	440	390

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. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors 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:

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

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

GENERAL INFORMATION

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 (see performance data section).

GENERAL APPLICATIONS AND USES

- Brick ties and masonry anchorage
- Electrical fixtures
- Signage
- Flashing
- Drywall track
- Maintenance
- Surveillance equipment
- Light gage attachments

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of base materials
+ Removable anchor - screw can be backed out with a Phillips head driver

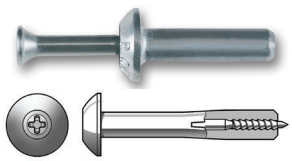
APPROVALS AND LISTINGS

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

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Zamac Hammer-Screw anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



ZAMAC HAMMER-SCREW

ANCHOR MATERIALS

- Zamac Alloy body 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
- Concrete Masonry (CMU)
- Brick Masonry
- Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

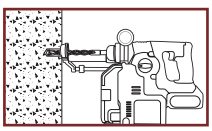
Dimension	Anchor Diameter, d
	1/4
ANSI Drill Bit Size (in.)	1/4
Fixture Clearance Hole (in.)	5/16
Head Height (in.)	9/64
Head Width (in.)	35/64

Material Specifications

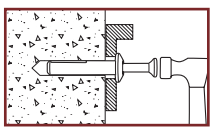
Anchor Component	Mushroom Head Carbon Steel Screw	Mushroom Head Perma-Seal Coated Screw
Anchor Body	Zamac Alloy	Zamac Alloy
Drive Screw	AISI 1018	AISI 1018
Screw Plating/ Coating	ASTM B 633, SC1, Type III (Fe/Zn5)	Perma-Seal™ coating

Installation Guidelines

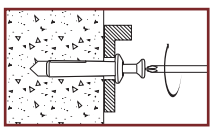
1. Drill a hole into the base material to a depth of at least 1/4" deeper than the required embedment. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



2. 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. Take care not to overdrive the screw. This anchor is not recommended for installations at an angle or for use overhead.



Optional: 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 and Allowable Load Capacities for Zamac Hammer-Screw in Normal-Weight Concrete[1,2,3,4,5]

Rod/ Anchor Diameter d in. (mm)	Min. Embed. Depth h_v in. (mm)	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
1/4 (6.4)	5/8 (16)	675 (3.0)	170 (0.8)	650 (2.9)	165 (0.7)	850 (3.8)	215 (1.0)	880 (3.9)	220 (1.0)	890 (4.0)	225 (1.0)	880 (3.9)	220 (1.0)
	3/4 (19)	790 (3.5)	200 (0.9)	805 (3.6)	200 (0.9)	1,135 (5.0)	285 (1.3)	1,115 (5.0)	280 (1.2)	1,190 (5.3)	300 (1.3)	1,115 (5.0)	280 (1.2)
	7/8 (22)	930 (4.1)	235 (1.0)	990 (4.4)	250 (1.1)	1,205 (5.4)	300 (1.3)	1,230 (5.5)	310 (1.4)	1,250 (5.6)	315 (1.4)	1,230 (5.5)	310 (1.4)
	1-1/8 (29)	1,220 (5.4)	305 (1.4)	1,365 (6.1)	340 (1.5)	1,350 (6.0)	340 (1.5)	1,470 (6.5)	370 (1.6)	1,450 (6.4)	365 (1.6)	1,470 (6.5)	370 (1.6)
	1-3/8 (35)	1,325 (5.9)	330 (1.5)	1,555 (6.9)	390 (1.7)	1,450 (6.4)	365 (1.6)	1,645 (7.3)	410 (1.8)	1,530 (6.8)	385 (1.7)	1,645 (7.3)	410 (1.8)
	1-3/4 (44)	1,480 (6.6)	370 (1.6)	1,840 (8.2)	460 (2.0)	1,600 (7.1)	400 (1.8)	1,910 (8.5)	480 (2.1)	1,660 (7.4)	415 (1.8)	1,910 (8.5)	480 (2.1)
	1-7/8 (48)	1,480 (6.6)	370 (1.6)	1,840 (8.2)	460 (2.0)	1,600 (7.1)	400 (1.8)	1,910 (8.5)	480 (2.1)	1,660 (7.4)	415 (1.8)	1,910 (8.5)	480 (2.1)

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. Allowable load capacities listed are calculated using an 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 on the application, such as in sustained tensile loading applications.
3. Linear interpolation may be used to determine allowable loads for anchors at intermediate embedment depths and compressive strengths.
4. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
5. Anchors installed flush with face or end of concrete surface.

Ultimate and Allowable Load Capacities for Zamac Hammer-Screw in Hollow Concrete Masonry[1,2,3,4]

Nominal Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	f´m ≥ 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. Hollow masonry cells may also be grouted or solid.
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 provided 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. 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.
4. Anchors installed flush with face or end of masonry surface.

Ultimate and Allowable Load Capacities for Zamac-Hammer Screw in Solid Clay Brick Masonry[1,2,3,4]

Nominal Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	f'm ≥ 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)	1,025 (4.6)	135 (0.6)	205 (0.9)
	3/4 (19.1)	930 (4.2)	1,200 (5.3)	185 (0.8)	240 (1.1)
	1 (25.4)	990 (4.5)	1,350 (6.0)	200 (0.9)	270 (1.2)
	1-1/8 (28.6)	1,040 (4.7)	1,350 (6.0)	210 (0.9)	270 (1.2)
	1-3/8 (34.9)	1,150 (5.2)	1,350 (6.0)	230 (1.0)	270 (1.2)
	1-1/2 (38.1)	1,260 (5.7)	1,350 (6.0)	250 (1.1)	270 (1.2)

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. 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.
3. 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.
4. Anchors installed flush with face or end of masonry surface.

DESIGN CRITERIA

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

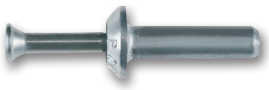
Load Adjustment Factors for Spacing and Edge Distances in Normal-Weight Concrete[1]

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} = 6d	$F_{NC} = 0.80$
	Shear	c_{cr} = 12d	$F_{VC} = 1.0$	c_{min} = 6d	$F_{VC} = 0.50$

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 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

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

Master Pack

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard Carton	Wt./ 100
2939	1/4" x 3/4"	1/4"	-	1,000	1-1/2
2940	1/4" x 1"	1/4"	-	1,000	1-3/4
2942	1/4" x 1-1/4"	1/4"	-	1,000	2-1/4
2944	1/4" x 1-1/2"	1/4"	-	1,000	2-1/2
2946	1/4" x 2"	1/4"	-	1,000	3
2948	1/4" x 2-1/4"	1/4"	-	1,000	3-1/2
2949	1/4" x 3"	1/4"	-	1,000	4-1/4

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

Mushroom Head with No. 2 Phillips Head Perma-Seal™ Coated 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	2-1/4

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

GENERAL INFORMATION

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 recommend for overhead, life-safety or sustained tensile loading applications (see performance data section).

GENERAL APPLICATIONS AND USES

- Roof Flashing
- Mechanical Attachments
- Brick Ties and Masonry Anchorage
- Furring Strips
- Electrical Fixtures
- Maintenance

FEATURES AND BENEFITS

+ General purpose anchoring
+ Installs in a variety of base materials

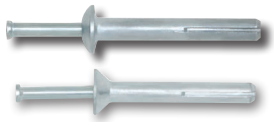
APPROVALS AND LISTINGS

- 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: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors, and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Zamac Nailin anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS



ZAMAC NAILIN

ANCHOR MATERIALS

Zamac Alloy body with Carbon or Stainless Steel Drive Nail

ANCHOR SIZE RANGE (TYP.)

- 3/16" diameter x 7/8" length to 1/4" diameter x 3" diameter

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Concrete Masonry (CMU)
- Brick Masonry
- Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

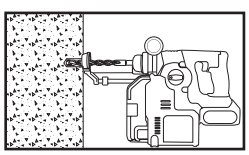
Dimension	Anchor Diameter, d		
	3/16" MH	1/4" MH	1/4" FH
ANSI Drill Bit Size (in.)	3/16	1/4"	1/4"
Fixture Clearance Hole (in.)	1/4	5/16	5/16
Head Height (in.)	7/64	9/64	3/16
Head Width (in.)	13/32	35/64	35/64
MH = Mushroom Head FH = Flat Head			

Material Specifications

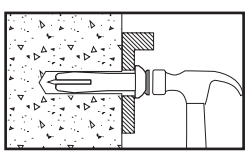
Anchor Component	Component Material		
	Mushroom Head CS Nail	Flat Head CS Nail	Mushroom Head SS Nail
Drive Nail	AISI 1018	AISI 1018	Type 304 SS
Anchor Body	Zamac Alloy	Zamac Alloy	Zamac Alloy
Nail Plating	ASTM B 633, SC1, Type III (Fe/Zn5)		N/A
CS = Carbon Steel SS = Stainless Steel			

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. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Insert the anchor through the fixture and into the drilled hole. 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 the nail. This anchor is not recommended for installations at an angle or for use overhead.



PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Zamac Nailin in Normal-Weight Concrete[1,2,3,4,5]

Nominal Anchor Diameter d in.	Min. Embed. Depth in. (mm)	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)	Ultimate lbs. (kN)	Allowable lbs. (kN)
3/16	3/4 (19)	285 (1.3)	70 (0.3)	415 (1.8)	105 (0.5)	400 (1.8)	100 (0.4)	560 (2.5)	140 (0.6)	480 (2.1)	120 (0.5)	560 (2.5)	140 (0.6)
1/4	5/8 (16)	410 (1.8)	105 (0.5)	440 (2.0)	110 (0.5)	580 (2.6)	145 (0.6)	655 (2.9)	165 (0.7)	580 (2.6)	145 (0.6)	655 (2.9)	165 (0.7)
	3/4 (19)	540 (2.4)	135 (0.6)	600 (2.7)	150 (0.7)	765 (3.4)	190 (0.8)	850 (3.8)	215 (1.0)	800 (3.6)	200 (0.9)	850 (3.8)	215 (1.0)
	1 (25)	620 (2.8)	155 (0.7)	640 (2.8)	160 (0.7)	875 (3.9)	220 (1.0)	890 (4.0)	225 (1.0)	895 (4.0)	225 (1.0)	890 (4.0)	225 (1.0)
	1-1/4 (32)	700 (3.1)	175 (0.8)	720 (3.2)	180 (0.8)	990 (4.4)	250 (1.1)	970 (4.3)	245 (1.1)	990 (4.4)	250 (1.1)	990 (4.4)	250 (1.1)

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. 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.
3. Linear interpolation may be used to determine allowable loads for anchors at intermediate embedment depths and compressive strengths.
4. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.
5. Anchors installed flush with face or end of concrete surface.

Ultimate and Allowable Load Capacities for Zamac Nailin in Hollow Concrete Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embedment Depth in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16	3/4 (19.1)	270 (1.2)	560 (2.5)	55 (0.2)	110 (0.5)
1/4	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 ≥ 1,500 psi). Hollow masonry cells may also be grouted or solid.
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 or end of masonry surface.

Ultimate and Allowable Load Capacities for Zamac Nailin in Solid or Hollow Clay Brick Masonry[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embedment Depth in. (mm)	f´m ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/16	3/4 (19.1)	460 (2.1)	550 (2.5)	90 (0.4)	110 (0.5)
1/4	5/8 (15.9)	570 (2.6)	750 (3.3)	115 (0.5)	150 (0.7)
	3/4 (19.1)	790 (3.6)	840 (3.7)	160 (0.7)	170 (0.8)
	1 (25.4)	820 (3.7)	840 (3.7)	165 (0.7)	170 (0.8)
	1-1/4 (31.7)	865 (3.9)	840 (3.7)	175 (0.8)	170 (0.8)

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. 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 or end of masonry surface.

DESIGN CRITERIA

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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

Load Adjustment Factors for Spacing and Edge Distances in Normal-Weight Concrete[1]

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 Distnace (c)	Tension	c_{cr} = 12d	$F_{NC} = 1.0$	c_{min} = 6d	$F_{NC} = 0.80$
	Shear	c_{cr} = 12d	$F_{VC} = 1.0$	c_{min} = 6d	$F_{VC} = 0.50$

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

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard 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

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

Master Pack Mushroom Head Zamac Nailin with Carbon Steel Nail

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard 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

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

Flat Head Zamac Nailin with Carbon Steel Nailin

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard 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

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

Mushroom Head Zamac Nailin with Stainless Steel Nailin

Catalog Number	Anchor Size	Drill Diameter	Standard Box	Standard 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

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

GENERAL INFORMATION

NYLON NAILIN®

Nail Anchor

PRODUCT DESCRIPTION

The Nylon Nailin is a nail drive anchor with a body formed from engineered plastic and drive nails available in carbon and stainless steel. The anchor can be used in concrete, block, brick or stone. The anchor is pre-assembled with either a carbon steel or stainless steel nail. This anchor is not recommended for overhead, life-safety or sustained tensile loading applications.

GENERAL APPLICATIONS AND USES

- Brick Ties and Masonry Anchorage
- Furring Strips
- Electrical Fixtures
- Maintenance
- Copper Flashing
- Aluminum Frames

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 4, (superseded) and CID A-A 1925A, Type 3 (mushroom head), Type 4 (flat head) and Type 5 (round head)

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Nylon Nailin anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

SECTION CONTENTS

ROUND HEAD NYLON NAILIN

FLAT HEAD NYLON NAILIN

MUSHROOM HEAD NYLON NAILIN

ANCHOR MATERIALS

- Nylon Body with Carbon or Stainless Steel Drive Nail

ANCHOR SIZE RANGE (TYP.)

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

SUITABLE BASE MATERIALS

- Normal-Weight Concrete
- Hollow Concrete Masonry
- Brick Masonry
- Stone

INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

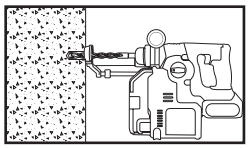
Dimension	Anchor Diameter, d					
	3/16"			1/4"		
	RH	FH	MH	RH	FH	MH
ANSI Drill Bit Size (in.)	3/16	3/16	3/16	1/4	1/4	1/4
Fixture Clearance Hole (in.)	1/4	1/4	1/4	5/16	5/16	5/16
Head Height (in.)	1/8	1/8	1/8	1/8	1/8	1/8
Head Width (in.)	3/8	3/8	9/16	7/16	7/16	9/16

Material Specifications

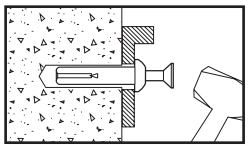
Anchor Component	Component Material			
	Round Head	Flat Head	Mushroom Head	
			Carbon	Stainless
Drive Nail	AISI 1018	AISI 1018	AISI 1018	Type 304 SS
Anchor Body	Nylon	Nylon	Nylon	Nylon
Nail Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)			N/A

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. Remove dust and debris from the hole during (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



Insert the anchor through the fixture and into the drilled hole. 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 the nail. This anchor is not recommended for installations at an angle or for use overhead.



PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Nylon Nailin in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in.	Minimum Embed. Depth in.	Minimum Concrete Compressive Strength, f 'c											
		2,000 psi				4,000 psi				6,000 psi			
		Tension		Shear		Tension		Shear		Tension		Shear	
		Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.	Ultimate lbs.	Allowable lbs.
3/16	3/4	180	45	280	70	195	50	320	80	200	50	320	80
	1	200	50	280	70	220	55	320	80	230	60	320	80
1/4	5/8	120	30	320	80	140	35	500	125	180	45	500	125
	3/4	200	50	320	80	220	55	500	125	240	60	500	125
	1	230	60	320	80	250	65	500	125	260	65	500	125
	1-1/2	240	60	320	80	270	70	500	125	280	70	500	125
	2	250	65	320	80	280	70	500	125	280	70	500	125

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 an applied safety factor of 4.0. Anchors are not recommended for use overhead or for life safety.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances. Allowable load capacities are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances.

Ultimate and Allowable Load Capacities for Nylon Nailin in Hollow Concrete Masonry[1,2]

Anchor Diameter d in.	Minimum Embedment Depth in.	f'm ≥ 1,500 psi			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	3/4	170	280	35	55
	1	180	280	35	55
1/4	5/8	110	320	20	65
	3/4	160	320	30	65
	1	170	320	35	65
	1-1/4	180	320	35	65
	1-1/2	200	320	40	65

1. Tabulated load values are for anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are based on average ultimate values using a safety factor of 5.0. Anchors are not recommended for use overhead or for life safety.

Ultimate and Allowable Load Capacities for Nylon Nailin in Solid or Hollow Clay Brick Masonry[1,2]

Anchor Diameter d in.	Minimum Embedment Depth in.	f'm ≥ 1,500 psi			
		Ultimate Load		Allowable Load	
		Tension lbs.	Shear lbs.	Tension lbs.	Shear lbs.
3/16	3/4	155	320	30	65
	1	170	320	35	65
1/4	5/8	150	500	30	100
	3/4	200	500	40	100
	1	220	500	45	100
	1-1/4	240	500	50	100
	1-1/2	250	500	50	100

1. Tabulated load values are for anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0. Anchors are not recommended for use overhead or for life safety.

DESIGN CRITERIA

Combined Loading

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

$$\left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

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 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	$F_N = F_V = 1.0$	s_{min} = 5d	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	c_{cr} = 12d	$F_N = 1.0$	c_{min} = 5d	$F_N = 0.80$
	Shear	c_{cr} = 12d	$F_V = 1.0$	c_{min} = 5d	$F_V = 0.50$

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

Round Head Nylon Nailin with Carbon Steel Nail

Catalog Number	Anchor Size	Drill Dia.	Std. Box	Std. Carton	Wt./100
2431	3/16" x 1	3/16"	100	1,000	1/2
2451	3/16" x 1-1/2"	3/16"	100	1,000	3/4
2521	1/4" x 1"	1/4"	100	1,000	3/4
2541	1/4" x 1-1/2"	1/4"	100	1,000	1
2561	1/4" x 2"	1/4"	100	1,000	1

Flat Head Nylon Nailin with Carbon Steel Nail

Catalog Number	Anchor Size	Drill Dia.	Std. Box	Std.Carton	Wt./100
2432	3/16" x 1"	3/16"	100	1,000	1/2
2452	3/16" x 1-1/2"	3/16"	100	1,000	3/4
2522	1/4" x 1"	1/4"	100	1,000	3/4
2542	1/4" x 1-1/2"	1/4"	100	1,000	1
2562	1/4" x 2"	1/4"	100	1,000	1

Mushroom Head Nylon Nailin

Catalog Number		Anchor Size	Drill Diameter	Std. Box	Std.Carton	Wt./100
Carbon	Stainless					
2433	–	3/16" x 1"	3/16"	100	1,000	1/2
2513	–	1/4" x 3/4"	1/4"	100	1,000	1/2
2523	2528	1/4" x 1"	1/4"	100	1,000	3/4
2543	2548	1/4" x 1-1/2"	1/4"	100	1,000	1
2563	–	1/4" x 2"	1/4"	100	1,000	1
2573	–	1/4" x 3"	1/4"	100	1,000	2-1/4
2583	–	1/4" x 4"	1/4"	100	1,000	2-3/4
2593	–	1/4" x 6"	1/4"	100	400	4

Mushroom Head Bodies Only

Catalog Number	Anchor Size	Drill Dia.	Std. Box	Std.Carton	Wt./100
2574	1/4" x 3"	1/4"	2500	2500	1/2

GENERAL INFORMATION

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, and brick.

GENERAL APPLICATIONS AND USES

- Electrical fixtures
- Signage
- Maintenance
- HVAC / Mechanical
- Drywall track
- Interior applications / low level corrosion environment

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

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 - Masonry Anchors and 05 05 19 - Post-Installed Concrete Anchors. Anchors shall be Safe-T Pin anchors as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

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

MATERIAL SPECIFICATIONS

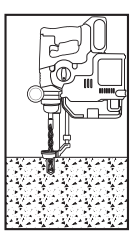
Anchor component	Specification
Anchor body	Low carbon steel (AISI 1008 or equivalent)
Zinc plating according to ASTM B 633 SC1, Type III. Minimum plating requirement for Mild Service Condition	

INSTALLATION SPECIFICATIONS

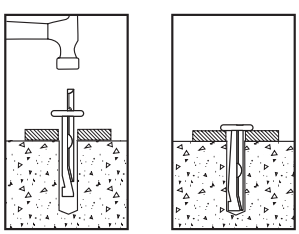
Anchor Property / Setting Information	Notation	Units	Nominal Anchor Size, d (inch)	
			1/4	
Nominal outside anchor diameter	d_o	in.	0.250	
Safe-T Pin drill bit diameter	d_{bit}	mm	6	
Safe-T Pin bit tolerance range	-	mm	5.9 to 6.4	
Nominal Embedment	h_{nom}	in.	1-3/16	2-1/2
Minimum hole depth	h_o	in.	1-1/2	2-3/4
Minimum concrete member thickness	h_{min}	in.	3	4
Minimum edge distance	c_{min}	in.	3-1/2	3-1/2
Minimum spacing distance	s_{min}	in.	3-1/2	3-1/2

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. Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.



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.



PERFORMANCE DATA

Ultimate Load Capacities for Safe-T Pin in Normal-Weight Concrete[1,2,3,4]

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength	
			f'c = 3,000 psi	
			Tension lbs.	Shear lbs.
1/4	6	1-3/16	1,330	1,745

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 Safe-T Pin in Grouted-filled Concrete Masonry[1,2,3]

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength	
			f'm = 1,500 psi	
			Tension lbs.	Shear lbs.
1/4	6	1-3/16	920	1,745

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 Safe-T Pin in Solid Clay Brick Masonry[1,2,3]

Nominal Anchor Diameter in.	Nominal Drill Bit Diameter (mm)	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength	
			f'm = 1,500 psi	
			Tension lbs.	Shear lbs.
1/4	6	1-3/16	1,100	1,745

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

Safe-T Pin

Cat. No.	Size	Std. Box[1]	Std. Ctn.
2800SD	1/4" (6mm) x 1-3/8"	100	600
2801SD	1/4" (6mm) x 2-1/2"	100	600

Drill Bit

Cat. No.	Size	Std. Box[1]	Std. Ctn.
2800	6 mm Drill Bit	1	50

GENERAL INFORMATION

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: 03 16 00 - Concrete Anchors and 04 05 19.16 - Masonry Anchors. Anchors shall be Heli-Pin as supplied by DEWALT, Towson, MD. 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

INSTALLATION AND MATERIAL SPECIFICATIONS

Material Specifications

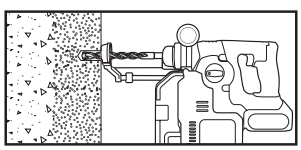
Anchor Component	Component Material
Anchor Body	Type 304 Stainless Steel

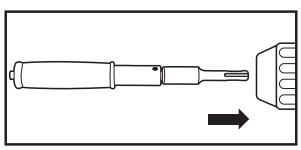
Installation Procedure

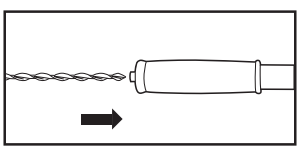
Using a proper diameter bit drill a pilot hole through façade material into backup base material to a depth at least ¼" deeper than the embedment required.

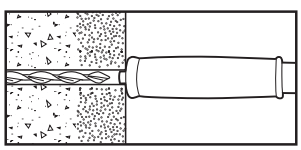
Mount installation tool on a rotary hammer drill. Position the Heli-Pin in the installation tool and insert into the pilot hole.

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 Performance 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.

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"

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"

ORDERING INFORMATION

Heli-Pin Anchors

Catalog Number	Description	Standard Box	Standard Carton
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

Heli-Pin Setting Tool

Catalog Number	Description	Standard Box	Standard Carton
08345	Heli-Pin Setting Tool	1	12
Essential for correct installation of Heli-Pins. The tool will automatically counter-sink the Heli-Pin, allowing for fast, efficient installation.			

NOTES