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

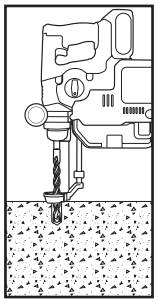
CODE LISTED
ICC-ES ESR-3260
CONCRETE

DDA
DEWALT DESIGN ASSIST™

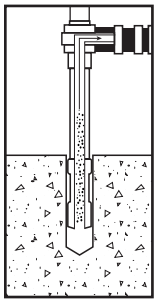
DUST X+
ANCHOR INSTALLATION SYSTEM

INSTALLATION INSTRUCTIONS

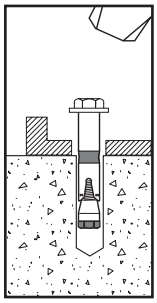
Installation Instructions for Power-Bolt+ Anchor



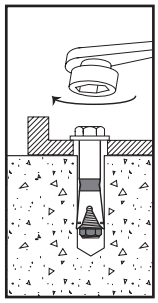
Step 1
Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



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}.

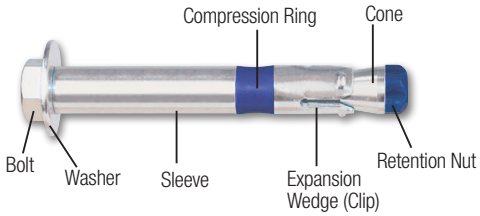
Head Marking

Legend

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

Letter Code = Length Identification Mark

Power-Bolt+ Anchor Assembly



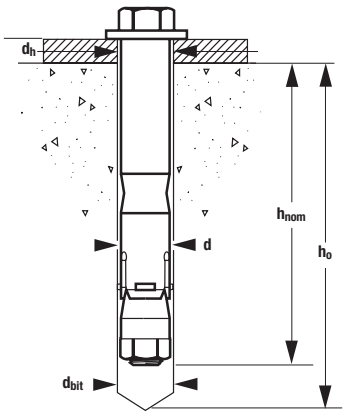
Length Identification

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

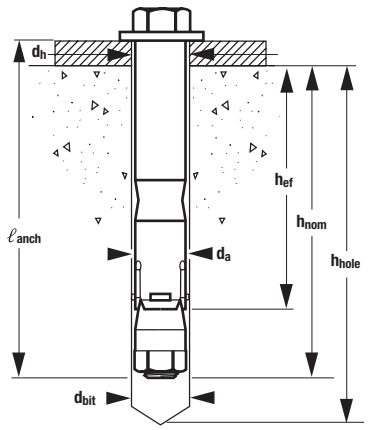
Power-Bolt+ Anchor Installation Specifications[1]

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}.

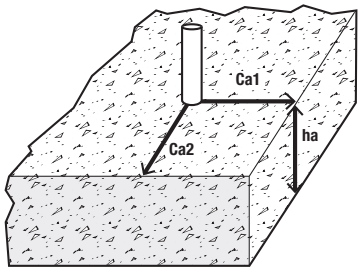
2- Calculations were performed according to ACI 318-14- Chapter 17. The load level corresponding to the controlling failure mode is listed. (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength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