GENERAL INFORMATION

PURE50+™

Epoxy Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The Pure50+ is a two-component adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The Pure50+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in solid concrete base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry, wet, and water-filled holes
- Can be installed in a wide range of base material temperatures

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Evaluated and recognized for freeze/thaw performance
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Evaluated and recognized for long term and short term loading (see performance tables for applicable temperature ranges)

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-3576 for cracked and uncracked concrete.
- Code Compliant with the 2012 IBC, 2012 IRC, 2009 IBC, 2009 IRC, 2006 IBC, and 2006 IRC.
- Conforms to requirements of ASTM C 881, Types I, II, IV and V, Grade 3, Classes B & C (also meets Type III except for elongation)
- Department of Transportation listings - see www.powers.com or contact transportation agency
- Tested in accordance with ACI 355.4 / ASTM E488, and ICC-ES AC308 for use in concrete
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading
- Compliant with NSF/ANSI Standard 61 for Drinking Water System Components - Health Effects; minimum requirements for material in contact with potable water and water treatment

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors. and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be Pure50+ as supplied by Powers Fasteners Inc., Brewster, NY. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

This Product Available In

PDA®

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

SECTION CONTENTS

PURE50+ CARTRIDGE AND MIXING NOZZLE

PACKAGING

Coaxial Cartridge

- 9 fl. oz. (265ml) 1:1 mix ratio

Dual (side-by-side Cartridge)

1:1 mix ratio

- 21 fl. oz. (620 ml) 1:1 mix ratio
- 51 fl. oz. (1400 ml) 1:1 mix ratio

STORAGE LIFE & CONDITIONS

Two years in a dry, dark environment with temperature ranging from 41°F and 95°F (5°C to 35°C)

ANCHOR SIZE RANGE (TYP.)

- 3/8" to 1-1/4" diameter threaded rod
- No. 3 to No. 10 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete

PERMISSIBLE INSTALLATION CONDITIONS

- Dry Concrete
- Water Saturated Concrete
- Water-Filled Holes

TENSION ZONE CRACKED CONCRETE · SEISMIC REGION QUALIFICATION · NSF

CODE LISTED
ICC-ES ESR-3576
CONCRETE

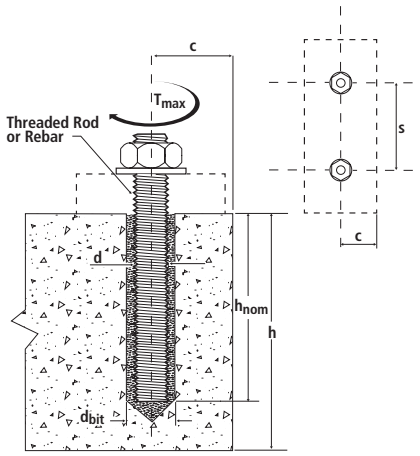
REFERENCE DATA (ASD)

Installation Table for Pure50+ (Solid Concrete Base Materials)

Dimension/Property	Notation	Units	Nominal Anchor Size								
Threaded Rod	-	-	3/8	1/2	5/8	3/4	7/8	1	-	1-1/4	-
Reinforcing Bar	-	-	#3	#4	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter	d	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.5)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size	d_{bit}	in.	7/16 ANSI	9/16 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Minimum embedment	h_{nom}	in. (mm)	2-3/8 (61)	2-3/4 (70)	3-1/8 (80)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Minimum spacing distance	s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)	3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Minimum edge distance	c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)	3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Maximum torque[1]	T_{max}	ft.-lb. (N-m)	15 (20)	30 (41)	60 (81)	105 (142)	125 (169)	165 (223)	200 (270)	280 (379)	280 (379)
Maximum torque (low strength rods)[1,2]	T_{max}	ft.-lb. (N-m)	5 (7)	20 (27)	40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-

1. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
2. These torque values apply to ASTM A 36 / F 1554, Grade 36 carbon steel threaded rods; ASTM F1554 Grade 55 carbon steel threaded rods; and ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rods.

Detail of Steel Hardware Elements used with Injection Adhesive System



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drilled hole
h = Base material thickness
The greater of:
[h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]
h_{nom} = Minimum embedment depth

Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon Steel	A 36 or F1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5.8	3/4 through 1-1/4	58.0	72.5
Stainless Steel	F 593, Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/A193M Grade B8/B8M2, Class 1	3/4 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 3/4 (#3 through #6)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Rod Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth h_{ef} in.	Minimum Concrete Compressive Strength			
			3,000 psi		4,000 psi	
			Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)
3/8	7/16	3-3/8	9,725	2,430	9,725	2,430
1/2	9/16	4-1/2	15,240	3,810	17,745	4,435
5/8	11/16 or 3/4	5-5/8	22,870	5,720	28,200	7,050
3/4	7/8	6-3/4	31,765	7,940	36,470	9,120
7/8	1	7-7/8	39,615	9,905	45,745	11,435
1	1-1/8	9	38,695	9,925	66,950	16,740
		10	56,665	15,005	69,305	17,325
1-1/4	1-3/8	11-1/4	76,985	19,245	88,895	22,225

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine 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 and where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}].
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in wet concrete or in water-filled holes may require a reduction in capacity. Contact Powers Fasteners for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Ultimate and Allowable Load Capacities for Pure50+ Installed with Reinforcing Bar into Normal-Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Bar Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth h_{ef} in.	Minimum Concrete Compressive Strength			
			3,000 psi		4,000 psi	
			Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)
#3	7/16	3-3/8	9,950	2,490	9,950	2,490
#4	9/16	4-1/2	16,340	4,085	18,045	4,510
#5	11/16 or 3/4	4	16,405	4,100	16,670	4,170
		5-5/8	22,955	5,740	25,345	6,335
#6	7/8	6-3/4	29,690	7,425	35,930	8,985
#8	1-1/8	9	48,465	12,115	65,270	16,320

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine 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 and where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in wet concrete or in water-filled holes may require a reduction in capacity. Contact Powers Fasteners for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Ultimate Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete, with 1-3/4" Edge Distance (Based on Bond Strength/Concrete Capacity)[1,2,3,4]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 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.)
3/8	3-3/8	6,460	7,200	6,700	7,200	7,100	7,200
1/2	4-1/2	9,625	9,925	9,980	9,925	10,570	9,925
5/8	5-5/8	11,610	12,785	12,040	12,785	12,750	12,785
3/4	6-3/4	12,390	10,360	12,850	10,360	13,615	10,360
1	9	12,390	-	12,850	-	13,615	-

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. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
2. Allowable bond strength/concrete capacity must be checked against allowable steel strength to determine the controlling allowable load.
3. The tabulated data is applicable to single anchors at critical edge distance in uncracked concrete, normal-weight concrete having a compressive strength as listed. Values are for dry concrete in holes drilled with a hammer drill and an ANSI carbide drill bit.
4. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete with 1-3/4" Edge Distance (Based on Bond Strength / Concrete Capacity)[1,2,3,4,5,6]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 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.)
3/8	3-3/8	1,615	1,800	1,675	1,800	1,775	1,800
1/2	4 1/2	2,405	2,480	2,495	2,480	2,645	2,480
5/8	5-5/8	2,900	3,195	3,010	3,195	3,190	3,195
3/4	6-3/4	3,100	2,590	3,215	2,590	3,405	2,590
1	9	3,100	-	3,215	-	3,405	-

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths..
3. The tabulated load values are applicable to single anchors where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in wet concrete or in water-filled holes may require a reduction in capacity. Contact Powers Fasteners for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.

Allowable Load Capacities for Pure50+ Installed into Uncracked Normal-Weight Concrete with Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3]

Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar									
	A36 or F1554, Grade 36		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		Grade 60 Rebar		Grade 40 Rebar	
	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 or #3	2,115 (9.4)	1,090 (4.8)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	3,280 (14.6)	1,690 (7.5)	2,185 (9.7)	1,125 (5.0)
1/2 or #4	3,760 (16.7)	1,935 (8.6)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	5,830 (25.9)	3,005 (13.4)	3,890 (17.3)	2,005 (8.9)
5/8 or #5	5,870 (26.1)	3,025 (13.5)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	9,110 (40.5)	4,695 (20.9)	6,075 (27.0)	3,130 (13.9)
3/4 or #6	8,455 (37.6)	4,355 (19.4)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	13,120 (58.4)	6,760 (30.1)	8,745 (38.9)	4,505 (20.0)
7/8 or #7	11,510 (51.2)	5,930 (26.4)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	17,860 (79.4)	9,200 (40.9)	11,905 (53.0)	6,135 (27.3)
1 or #8	15,035 (66.9)	7,745 (34.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	23,325 (103.8)	12,015 (53.4)	15,550 (69.2)	8,010 (35.6)
#9	-	-		-	-	-	29,680 (132.0)	15,290 (68.0)	19,785 (88.0)	10,195 (45.3)
1-1/4	23,490 (104.5)	12,100 (53.8)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)	-	-	-	-
#10	-	-	-	-	-	-	37,625 (167.4)	19,380 (86.2)	25,080 (111.6)	12,920 (57.5)

1. AISC defined steel strength (ASD): Tensile = 0.33 • F_u • A_{nom}, Shear = 0.17 • F_u • A_{nom}
2. Allowable steel strength in tension must be checked against allowable bond strength/concrete capacity in tension to determine the controlling allowable load.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]

In-Service Temperature Chart For Allowable Load Capacities[1]

Base Material Temperature		Reduction Factor For Temperature
°F	°C	
32	0	0.92
41	5	1.00
50	10	1.00
70	20	1.00
110	43	1.00
130	54	0.85
150	66	0.76
180	82	0.51

1. Linear interpolation may be used to derive reduction factors for temperatures between those listed.

STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

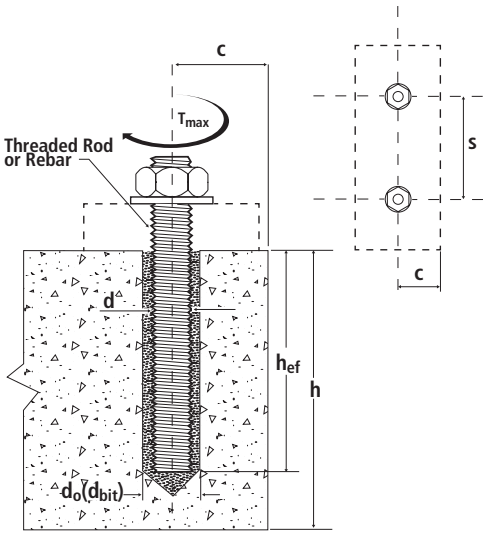
CODE LISTED
ICC-ES ESR-3576

Parameter	Symbol	Units	Fractional Nominal Rod Diameter (Inch) / Reinforcing Bar Size								
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4	#10
Threaded rod outside diameter	d	inch (mm)	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)	-
Rebar nominal outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	-	1.250 (31.8)
Carbide drill bit nominal size	d_o (d_{bit})	inch	7/16	9/16	11/16 or 3/4	7/8	1	1-1/8	1-3/8	1-3/8	1-1/2
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	25 (635)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		h_{ef} + $2d_o$						
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance	c_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Max. torque[2]	T_{max}	ft-lbs (N-m)	15 (20)	30 (41)	60 (81)	105 (142)	125 (169)	165 (221)	200 (280)	280 (379)	280 (379)
Max. torque[2,3] (low strength rods)	T_{max}	ft-lbs (N-m)	5 (7)	20 (27)	40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-
Minimum edge distance, reduced[5]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Max. torque, reduced[2]	$T_{max,red}$	ft-lbs (N-m)	7 [5][4]	14 (19)	27 (37)	47 (64)	56 (76)	74 (100)	90 (122)	126 (171)	126 (171)

For pound-inch units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf. For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. For use with the design provisions of ACI 318 Appendix D, ICC-ES AC308, Section 4.2 and ESR-3576
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
3. These torque values apply to ASTM A 36 / F 1554 Grade 36 carbon steel threaded rods; ASTM F 1554 Grade 55 carbon steel threaded rods; and ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
4. These torque values apply to ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
5. For Installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be max torque reduced, $T_{max,red}$.

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon rod	A 36 or F 1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5 8	3/4 through 1-1/4	58.0	72.5
Stainless rod	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/193M Grade B8/B8M, Class 1	3/8 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI318 Section 9.2)

CODE LISTED
ICC-ES ESR-3576

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	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)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		v_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,300 (41.4)	17,025 (75.7)	27,120 (120.6)	40,140 (178.5)	55,905 (248.7)	72,685 (323.3)	101,755 (452.6)
		V_{sa}	lbf (kN)	5,580 (24.8)	10,215 (45.4)	16,270 (72.4)	24,085 (107.1)	33,540 (149.2)	43,610 (194.0)	61,050 (271.6)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F568 Class 5.8 (ISO 898-1)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33,475 (148.9)	43,915 (195.4)	-[5]
		V_{sa}	lbf (kN)	3,370 (15.0)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,350 (117.2)	-[5]
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	-[5]
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A 193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20,715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29) except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318-11 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements
4. In accordance with ACI 318 D.5.1.2 and D.6.1.2 the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to 1.9fy or 57,000 psi (393 MPa).
5. The referenced standard includes rod diameters up to and including 1-inch (24 mm).

Steel Tension and Shear Design for Reinforcing Bars in Normal Weight Concrete (For use with load combinations taken from ACI318 Section 9.2)

CODE LISTED ICC-ES ESR-3576

Design Information		Symbol	Units	Nominal Reinforcing Bar Size (Rebar)[1]							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch² (mm²)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A 615 Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	11,000 (48.9)	20,000 (89.0)	31,000 (137.9)	44,000 (195.7)	60,000 (266.9)	79,000 (351.4)	100,000 (444.8)	127,000 (564.9)
		V_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	60,000 (266.9)	76,200 (338.9)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65							
	Strength reduction factor for shear[3]	ϕ	-	0.60							
ASTM A 615 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A 615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29).
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements.

Concrete Breakout Design Information for Threaded Rod and Reinforcing Bars (For use with loads combinations taken from ACI 318 Section 9.2)[1]

CODE LISTED
ICC-ES ESR-3576

Design Information	Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	17 (7.1)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
Minimum edge distance[2]	c_{min}	inch (mm)	5*d* where *d* is nominal outside diameter of the anchor							
Minimum edge distance, reduced[2]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$ where d_o is hole diameter;					
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{1160})^{0.4} \cdot [3.1\text{-}0.7 \frac{h}{h_{ef}}]$							
		(mm)	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{8})^{0.4} \cdot [3.1\text{-}0.7 \frac{h}{h_{ef}}]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \cdot \sqrt{h_{ef} \cdot f'_c}}{\pi \cdot d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318 D.4.3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.4. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

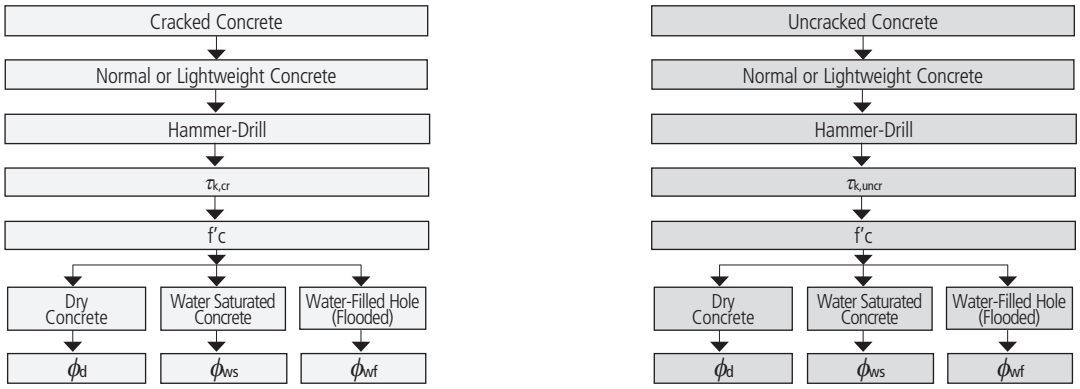
Bond Strength Design Information for Threaded Rods and Reinforcing Bars (For use with load combinations taken from ACI 318 Section 9.2)[1]

Design Information		Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
				3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
75°F (24°C) Maximum Long-Term Service Temperature; 104°F (40°C) Maximum Short-Term Service Temperature[5,10]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	688 (4.7)	662 (4.6)	636 (4.4)	612 (4.2)	588 (4.2)	565 (3.9)	565 (3.9)	565 (3.9)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,678 (11.6)	1,614 (11.1)	1,552 (10.7)	1,492 (10.3)	1,434 (9.9)	1,377 (9.5)	1,377 (9.5)	1,377 (9.5)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[3,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	684 (6.8)	658 (6.8)	632 (6.6)	608 (6.6)	585 (6.6)	562 (6.3)	562 (5.8)	562 (5.8)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,444 (12.1)	1,389 (11.5)	1,335 (11.1)	1,283 (10.7)	1,234 (10.4)	1,184 (10.2)	1,184 (10.0)	1,184 (9.8)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[4,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	475 (5.0)	457 (5.0)	439 (4.8)	422 (4.8)	406 (4.8)	390 (4.6)	390 (4.3)	390 (4.3)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,024 (8.8)	985 (8.4)	947 (8.1)	910 (7.6)	875 (7.6)	840 (7.4)	840 (7.3)	840 (7.1)
Permissible Installation Conditions[7]	Dry concrete	Anchor Category	-	1							
		ϕ_d	-	0.65							
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category	-	2							
		ϕ_{ws}, ϕ_{wf},	-	0.55							
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$	-	1							

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.23}$ [For SI: $(f'c / 17.2)^{0.23}$]. See Section 4.1.4 of this report for bond strength determination.
2. The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318 D.3.6, where applicable.
3. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
4. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
5. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.
6. Characteristic bond strengths are for sustained loads including dead and live loads.
7. Permissible installation conditions include dry concrete, water-saturated concrete, and water-filled holes. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
8. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.
9. For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.
10. **Room temperature range is not recognized by ACI 318-11 and does not meet the minimum temperature required from ACI 355.4, Table 8.1 and consequently is not applicable to design under ACI 318-11 or current and past editions of the International Building Code (IBC). The tabulated values are provided for analysis of existing conditions only.**

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Powers
FASTENING INNOVATIONS

Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 75°F (24°C) Maximum Long-Term Service Temperature; 104°F (40°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8]

STRENGTH DESIGN TABLES SD

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (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_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	2,855	2,570	3,125	2,920	3,400	3,490	3,730	4,020	3,990	4,295
	3	3,855	3,930	4,020	4,375	4,295	5,190	4,715	6,595	5,035	7,820
	4-1/2	5,780	7,170	6,030	7,990	6,440	9,470	7,070	12,040	7,555	14,275
	7-1/2	9,635	15,265	10,050	17,005	10,735	20,160	11,785	25,385	12,595	27,125
1/2 or #4	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	5,920	7,245
	4	6,240	6,700	6,835	7,610	7,345	9,045	8,060	11,500	8,615	13,635
	6	9,890	12,475	10,310	13,895	11,015	16,475	12,095	20,945	12,920	24,835
	10	16,480	26,570	17,185	29,600	18,360	35,095	20,155	43,410	21,535	46,380
5/8 or #5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,720	6,675	7,600	7,710	9,295
	5	8,720	9,985	9,555	11,345	11,030	13,875	12,115	17,645	12,940	20,920
	7-1/2	14,855	19,135	15,490	21,320	16,550	25,275	18,170	32,135	19,410	38,100
	12-1/2	24,760	40,780	25,820	45,430	27,585	53,865	30,285	65,225	32,355	69,685
3/4 or #6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	16,770	24,525	17,915	29,080
	9	20,565	26,600	21,445	29,635	22,915	35,135	25,155	44,670	26,875	52,960
	15	34,275	56,675	35,745	63,135	38,190	74,855	41,920	90,290	44,790	96,470
7/8 or #7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	21,935	30,405	23,435	36,050
	10-1/2	26,540	32,800	28,055	36,740	29,975	43,560	32,905	55,380	35,155	65,660
	17-1/2	44,840	70,270	46,760	78,280	49,960	92,815	54,840	117,995	58,595	126,200
1 or #8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	29,395	43,325
	12	32,425	39,005	35,190	44,150	37,595	52,350	41,270	66,550	44,090	78,905
	20	56,240	84,450	58,645	94,075	62,660	111,540	68,780	141,805	73,485	158,280
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,535	13,125	13,320	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	32,625	42,550	37,205	51,780
	13-1/2	38,690	45,540	42,380	51,740	47,580	62,575	52,230	79,550	55,805	94,320
	22-1/2	71,175	100,910	74,225	112,415	79,300	133,285	87,050	169,445	93,005	200,325
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,600	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	38,210	48,690	44,125	59,555
	15	45,315	52,110	49,640	59,200	57,320	72,410	64,485	92,960	68,895	110,220
	25	87,870	117,980	91,635	131,425	97,905	155,825	107,470	198,100	114,825	234,885
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,600	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	38,210	48,780	44,125	59,660
	15	45,315	52,205	49,640	59,310	57,320	72,545	64,485	93,135	68,895	110,425
	25	87,870	118,150	91,635	131,620	97,905	156,055	107,470	198,395	114,825	235,230

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked 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 according to ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls. **This temperature range is not recognized by ACI 318-11 and does not meet the minimum temperature requirements from ACI 355.4 Table 8.1 and consequently is not applicable to design under ACI 318-11 or current and past editions of the International Building Code (IBC). The Tabulated values are provided for analysis and evaluation of existing conditions only.**
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for short-term, static loads only, seismic loading is not considered with these tables.
6. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
7. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-3576.
8. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

PDA · STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (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_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	2,625	2,490	2,740	2,770	2,925	3,150	3,210	3,460	3,430	3,695
	3	3,315	3,700	3,460	4,120	3,695	4,885	4,055	6,210	4,335	7,365
	4-1/2	4,975	6,755	5,190	7,525	5,545	8,920	6,085	11,340	6,500	13,445
	7-1/2	8,295	14,375	8,650	16,010	9,240	18,985	10,145	21,845	10,835	23,340
1/2 or #4	2-3/4	3,555	3,305	3,895	3,755	4,345	4,525	4,770	5,755	5,095	6,825
	4	5,675	6,450	5,915	7,185	6,320	8,520	6,940	10,830	7,415	12,840
	6	8,510	11,750	8,875	13,085	9,480	15,515	10,405	19,725	11,120	23,390
	10	14,180	25,020	14,790	27,875	15,800	33,050	17,345	37,360	18,530	39,915
5/8 or #5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,720	6,430	7,525	6,835	8,920
	5	8,520	9,895	8,885	11,020	9,490	13,065	10,420	16,610	11,130	19,695
	7-1/2	12,780	18,020	13,325	20,070	14,235	23,800	15,630	30,255	16,700	35,870
	12-1/2	21,300	38,395	22,210	42,775	23,730	50,715	26,050	56,105	27,830	59,940
3/4 or #6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,635	9,255	8,265	11,245
	6	11,465	13,595	12,295	15,315	13,135	18,160	14,420	23,090	15,405	27,375
	9	17,685	25,045	18,440	27,900	19,705	33,080	21,630	42,050	23,110	49,775
	15	29,475	53,355	30,735	59,435	32,840	70,470	36,050	77,645	38,515	82,955
7/8 or #7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,350	9,100	7,975	11,130
	7	14,445	16,605	15,825	18,865	17,195	22,525	18,875	28,635	20,170	33,950
	10-1/2	23,150	31,060	24,145	34,595	25,795	41,020	28,315	52,150	30,250	61,830
	17-1/2	38,585	66,175	40,240	73,715	42,990	87,400	47,195	101,645	50,420	108,600
1 or #8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,190	11,280	9,980	13,800
	8	17,650	19,750	19,335	22,435	21,550	27,055	23,655	34,395	25,275	40,785
	12	29,015	37,310	30,255	41,560	32,325	49,280	35,485	62,650	37,910	74,280
	20	48,355	79,500	50,425	88,560	53,875	105,005	59,140	127,380	63,185	136,095
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,335	13,125	12,300	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	29,940	41,110	31,990	48,745
	13-1/2	36,720	44,600	38,290	49,680	40,910	58,905	44,910	74,885	47,985	88,790
	22-1/2	61,200	94,995	63,820	105,825	68,185	125,475	74,850	159,515	79,970	172,245
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,190	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	36,965	48,050	39,490	56,970
	15	45,315	52,110	47,275	58,060	50,510	68,835	55,445	87,515	59,240	103,760
	25	75,555	111,065	78,790	123,720	84,180	146,695	92,410	186,490	98,730	212,650
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,020	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	36,965	48,135	39,490	57,070
	15	45,315	52,205	47,275	58,165	50,510	68,965	55,445	87,675	59,240	103,955
	25	75,555	111,225	78,790	123,905	84,180	146,910	92,410	186,765	98,730	212,650

■ - Concrete Breakout Strength ■ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked 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 according to ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3576 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-11 D.4.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-3576.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

PDA® STRENGTH DESIGN SD TABLES

Tension and Shear Design Strength Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (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_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	1,860	2,005	1,940	2,090	2,075	2,235	2,280	2,455	2,435	2,620
	3	2,350	3,225	2,455	3,590	2,620	4,260	2,875	5,415	3,075	6,420
	4-1/2	3,530	5,885	3,680	6,555	3,930	7,775	4,315	9,295	4,610	9,930
	7-1/2	5,880	12,525	6,135	13,210	6,550	14,115	7,195	15,490	7,685	16,550
1/2 or #4	2-3/4	2,765	2,985	2,885	3,325	3,080	3,945	3,385	5,015	3,615	5,945
	4	4,025	5,620	4,195	6,260	4,480	7,425	4,920	9,440	5,255	11,190
	6	6,035	10,240	6,295	11,405	6,725	13,525	7,380	15,895	7,885	16,985
	10	10,055	21,660	10,490	22,590	11,205	24,135	12,300	26,495	13,140	28,305
5/8 or #5	3-1/8	3,775	3,905	3,940	4,350	4,210	5,160	4,620	6,560	4,935	7,775
	5	6,045	8,625	6,300	9,605	6,735	11,390	7,390	14,480	7,895	17,010
	7-1/2	9,065	15,705	9,455	17,495	10,100	20,745	11,085	23,880	11,845	25,515
	12-1/2	15,110	32,540	15,755	33,935	16,835	36,255	18,480	39,800	19,740	42,520
3/4 or #6	3-1/2	4,700	4,925	4,885	5,485	5,195	6,505	5,660	8,270	6,020	9,805
	6	8,360	11,985	8,720	13,350	9,315	15,830	10,225	20,125	10,925	23,535
	9	12,545	21,830	13,080	24,315	13,975	28,830	15,340	33,040	16,390	35,305
	15	20,905	45,025	21,800	46,955	23,290	50,165	25,570	55,070	27,320	58,840
7/8 or #7	3-1/2	4,545	4,930	4,795	5,605	5,125	6,695	5,590	8,510	5,945	10,095
	7	10,945	14,860	11,415	16,555	12,195	19,630	13,385	24,955	14,300	29,585
	10-1/2	16,415	27,065	17,120	30,150	18,290	35,750	20,080	43,245	21,450	46,205
	17-1/2	27,360	57,670	28,530	61,455	30,485	65,655	33,465	72,075	35,750	77,005
1 or #8	4	5,690	6,115	5,995	6,945	6,460	8,385	7,045	10,660	7,490	12,640
	8	13,720	17,855	14,310	19,890	15,290	23,585	16,785	29,985	17,930	35,550
	12	20,585	32,525	21,465	36,230	22,935	42,955	25,175	54,225	26,895	57,935
	20	34,305	69,300	35,775	77,055	38,225	82,325	41,960	90,370	44,830	96,555
#9	4-1/2	7,005	7,110	7,380	8,080	8,020	9,880	8,810	12,700	9,370	15,055
	9	17,370	21,345	18,110	23,775	19,350	28,190	21,240	35,840	22,695	42,490
	13-1/2	26,050	38,875	27,165	43,310	29,025	51,350	31,860	65,280	34,040	73,320
	22-1/2	43,420	82,810	45,280	92,250	48,375	104,195	53,105	114,380	56,735	122,200
1-1/4	5	8,650	8,170	9,115	9,285	9,900	11,355	11,040	14,905	11,740	17,670
	10	21,440	24,945	22,360	27,790	23,890	32,945	26,225	41,885	28,020	49,660
	15	32,160	45,430	33,540	50,610	35,835	60,005	39,335	76,285	42,025	90,450
	25	53,605	96,815	55,900	107,850	59,725	127,875	65,560	141,205	70,045	150,865
#10	5	8,550	8,160	9,005	9,270	9,785	11,335	10,905	14,880	11,600	17,640
	10	21,440	24,990	22,360	27,835	23,890	33,005	26,225	41,960	28,020	49,750
	15	32,160	45,515	33,540	50,705	35,835	60,115	39,335	76,425	42,025	90,520
	25	53,605	96,955	55,900	108,010	59,725	128,060	65,560	141,205	70,045	150,865

▢ - Concrete Breakout Strength ▢ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked 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 according to ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3576 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-11 D.4.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-3576.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 75°F (24°C) Maximum Long-Term Service Temperature; 104°F (40°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8]

STRENGTH DESIGN TABLES SD

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (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_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	1,250	1,350	1,305	1,405	1,395	1,500	1,530	1,650	1,635	1,760
	3	1,580	2,805	1,650	3,125	1,760	3,705	1,935	4,165	2,065	4,450
	4-1/2	2,370	5,105	2,470	5,325	2,640	5,690	2,900	6,245	3,100	6,675
	7-1/2	3,950	8,510	4,120	8,875	4,400	9,480	4,835	10,410	5,165	11,120
1/2 or #4	2-3/4	1,830	2,360	1,930	2,680	2,070	3,280	2,275	4,355	2,430	5,175
	4	2,705	4,785	2,820	5,435	3,010	6,460	3,305	7,120	3,535	7,610
	6	4,055	8,735	4,230	9,110	4,520	9,730	4,960	10,685	5,300	11,415
	10	6,760	14,560	7,050	15,180	7,530	16,220	8,265	17,805	8,830	19,025
5/8 or #5	3-1/8	2,250	2,940	2,375	3,340	2,585	4,085	2,910	5,430	3,170	6,640
	5	4,060	7,135	4,230	8,105	4,520	9,740	4,965	10,690	5,305	11,425
	7-1/2	6,090	13,110	6,350	13,675	6,785	14,610	7,445	16,035	7,955	17,135
	12-1/2	10,145	21,855	10,580	22,790	11,305	24,350	12,410	26,730	13,260	28,555
3/4 or #6	3-1/2	2,675	3,580	2,820	4,070	3,065	4,980	3,450	6,610	3,750	8,075
	6	5,625	9,710	5,865	11,035	6,265	13,495	6,880	14,815	7,350	15,830
	9	8,435	18,170	8,795	18,945	9,400	20,245	10,315	22,220	11,025	23,740
	15	14,060	30,280	14,660	31,580	15,665	33,740	17,195	37,035	18,370	39,570
7/8 or #7	3-1/2	2,610	3,525	2,750	4,000	2,980	4,895	3,340	6,500	3,620	7,800
	7	7,355	11,860	7,670	13,475	8,195	16,485	8,995	19,375	9,610	20,700
	10-1/2	11,030	23,430	11,505	24,780	12,290	26,475	13,490	29,060	14,415	31,050
	17-1/2	18,385	39,600	19,175	41,295	20,485	44,120	22,485	48,435	24,025	51,745
1 or #8	4	3,270	4,365	3,440	4,960	3,730	6,065	4,185	8,060	4,535	9,770
	8	9,230	14,105	9,625	16,025	10,285	19,600	11,290	24,315	12,060	25,980
	12	13,845	27,860	14,440	31,095	15,425	33,225	16,935	36,470	18,090	38,965
	20	23,075	49,700	24,065	51,830	25,710	55,375	28,220	60,785	30,155	64,945
#9	4-1/2	4,045	5,080	4,255	5,770	4,610	7,060	5,165	9,375	5,600	11,465
	9	11,680	16,465	12,180	18,710	13,015	22,880	14,285	30,390	15,265	32,880
	13-1/2	17,525	32,530	18,275	36,955	19,525	42,050	21,430	46,160	22,895	49,315
	22-1/2	29,205	62,900	30,455	65,595	32,540	70,080	35,720	76,935	38,160	82,195
1-1/4	5	4,995	5,835	5,255	6,630	5,695	8,110	6,380	10,775	6,915	13,175
	10	14,420	18,845	15,040	21,410	16,070	26,185	17,640	34,780	18,845	40,590
	15	21,635	37,220	22,560	42,285	24,100	51,720	26,460	56,985	28,270	60,885
	25	36,055	77,655	37,600	80,980	40,170	86,520	44,095	94,980	47,115	101,475
#10	5	4,945	5,830	5,200	6,620	5,635	8,100	6,310	10,755	6,840	13,155
	10	14,420	18,880	15,040	21,445	16,070	26,230	17,640	34,840	18,845	40,590
	15	21,635	37,290	22,560	42,365	24,100	51,815	26,460	56,985	28,270	60,885
	25	36,055	77,655	37,600	80,980	40,170	86,520	44,095	94,980	47,115	101,475

□ - Concrete Breakout Strength □ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked 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 according to ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls. **This temperature range is not recognized by ACI 318-11 and does not meet the minimum temperature requirements from ACI 355.4 Table 8.1 and consequently is not applicable to design under ACI 318-11 or current and past editions of the International Building Code (IBC). The Tabulated values are provided for analysis and evaluation of existing conditions only.**
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for short-term, static loads only, seismic loading is not considered with these tables.
6. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
7. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-3576.
8. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

PDA

STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (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_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	1,245	1,340	1,295	1,395	1,385	1,495	1,520	1,640	1,625	1,750
	3	1,570	2,645	1,640	2,945	1,750	3,490	1,920	4,140	2,055	4,425
	4-1/2	2,355	4,825	2,460	5,295	2,625	5,655	2,885	6,210	3,080	6,635
	7-1/2	3,930	8,460	4,095	8,825	4,375	9,425	4,805	10,350	5,135	11,055
1/2 or #4	2-3/4	1,850	2,360	1,925	2,680	2,060	3,235	2,260	4,110	2,415	4,875
	4	2,685	4,605	2,800	5,130	2,995	6,085	3,285	7,080	3,510	7,565
	6	4,030	8,390	4,205	9,055	4,490	9,675	4,930	10,620	5,265	11,345
	10	6,720	14,470	7,005	15,090	7,485	16,120	8,215	17,700	8,780	18,910
5/8 or #5	3-1/8	2,365	2,940	2,500	3,340	2,720	4,085	3,045	5,375	3,235	6,375
	5	4,035	7,065	4,205	7,870	4,495	9,335	4,935	10,625	5,270	11,350
	7-1/2	6,050	12,870	6,310	13,590	6,740	14,515	7,400	15,935	7,905	17,025
	12-1/2	10,085	21,715	10,515	22,645	11,235	24,195	12,330	26,560	13,175	28,375
3/4 or #6	3-1/2	2,805	3,580	2,955	4,070	3,215	4,980	3,620	6,610	3,920	8,035
	6	5,585	9,710	5,825	10,940	6,225	12,970	6,835	14,720	7,300	15,725
	9	8,380	17,890	8,740	18,825	9,335	20,110	10,250	22,075	10,950	23,585
	15	13,970	30,085	14,565	31,370	15,560	33,520	17,085	36,795	18,250	39,310
7/8 or #7	3-1/2	2,720	3,525	2,860	4,000	3,105	4,895	3,485	6,500	3,780	7,950
	7	7,315	11,860	7,630	13,475	8,150	16,090	8,950	19,275	9,560	20,595
	10-1/2	10,975	22,185	11,445	24,650	12,230	26,340	13,425	28,910	14,340	30,890
	17-1/2	18,290	39,400	19,075	41,085	20,380	43,895	22,370	48,185	23,905	51,485
1 or #8	4	3,405	4,365	3,585	4,960	3,890	6,065	4,365	8,060	4,735	9,855
	8	9,180	14,105	9,575	16,025	10,230	19,325	11,230	24,185	11,995	25,840
	12	13,770	26,650	14,360	29,685	15,345	33,050	16,845	36,280	17,995	38,760
	20	22,950	49,435	23,935	51,555	25,575	55,080	28,070	60,465	29,995	64,600
#9	4-1/2	4,205	5,080	4,425	5,770	4,800	7,060	5,380	9,375	5,840	11,465
	9	11,620	16,465	12,115	18,710	12,945	22,880	14,210	29,365	15,185	32,705
	13-1/2	17,430	31,855	18,175	35,485	19,420	41,825	21,315	45,915	22,775	49,055
	22-1/2	29,050	62,570	30,295	65,245	32,365	69,710	35,530	76,525	37,960	81,760
1-1/4	5	5,190	5,835	5,465	6,630	5,925	8,110	6,645	10,775	7,210	13,175
	10	14,345	18,845	14,960	21,410	15,985	26,185	17,545	34,320	18,745	40,375
	15	21,520	37,220	22,440	41,470	23,975	49,170	26,320	56,685	28,120	60,560
	25	35,865	77,245	37,400	80,550	39,955	86,060	43,865	94,475	46,865	100,935
#10	5	5,135	5,830	5,405	6,620	5,860	8,100	6,570	10,755	7,130	13,155
	10	14,345	18,880	14,960	21,445	15,985	26,230	17,545	34,380	18,745	40,375
	15	21,520	37,290	22,440	41,545	23,975	49,260	26,320	56,685	28,120	60,560
	25	35,865	77,245	37,400	80,550	39,955	86,060	43,865	94,475	46,865	100,935

□ - Concrete Breakout Strength □ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked 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 according to ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3576 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-11 D.4.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-3576.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

PDA | STRENGTH DESIGN SD TABLES

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (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_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8 or #3	2-3/8	865	930	900	970	960	1,035	1,055	1,140	1,130	1,215
	3	1,090	2,305	1,140	2,450	1,215	2,620	1,335	2,875	1,425	3,070
	4-1/2	1,635	3,525	1,705	3,675	1,825	3,930	2,000	4,310	2,140	4,605
	7-1/2	2,730	5,875	2,845	6,125	3,040	6,545	3,335	7,185	3,565	7,680
1/2 or #4	2-3/4	1,285	2,135	1,340	2,375	1,430	2,820	1,570	3,380	1,675	3,610
	4	1,865	4,015	1,945	4,190	2,080	4,480	2,285	4,915	2,440	5,255
	6	2,800	6,030	2,920	6,290	3,120	6,720	3,425	7,375	3,660	7,880
	10	4,665	10,050	4,865	10,480	5,200	11,195	5,705	12,290	6,095	13,135
5/8 or #5	3-1/8	1,750	2,790	1,825	3,110	1,950	3,685	2,140	4,610	2,290	4,930
	5	2,800	6,035	2,920	6,290	3,120	6,725	3,425	7,380	3,660	7,885
	7-1/2	4,200	9,050	4,380	9,440	4,680	10,085	5,140	11,070	5,490	11,825
	12-1/2	7,005	15,085	7,305	15,730	7,805	16,805	8,565	18,450	9,150	19,710
3/4 or #6	3-1/2	2,180	3,515	2,265	3,920	2,410	4,645	2,625	5,655	2,790	6,010
	6	3,880	8,350	4,045	8,710	4,320	9,305	4,745	10,215	5,065	10,915
	9	5,815	12,530	6,065	13,065	6,480	13,960	7,115	15,325	7,600	16,370
	15	9,695	20,880	10,110	21,775	10,800	23,265	11,855	25,540	12,670	27,285
7/8 or #7	3-1/2	2,110	3,525	2,225	4,000	2,380	4,785	2,595	5,585	2,760	5,940
	7	5,080	10,615	5,295	11,405	5,660	12,185	6,210	13,375	6,635	14,290
	10-1/2	7,615	16,405	7,945	17,110	8,485	18,280	9,315	20,065	9,955	21,440
	17-1/2	12,695	27,345	13,240	28,515	14,145	30,465	15,525	33,440	16,590	35,730
1 or #8	4	2,640	4,365	2,785	4,960	3,000	5,990	3,270	7,045	3,480	7,490
	8	6,370	12,755	6,645	14,210	7,100	15,290	7,790	16,785	8,325	17,930
	12	9,555	20,585	9,965	21,465	10,650	22,935	11,690	25,175	12,490	26,895
	20	15,930	34,305	16,610	35,775	17,745	38,225	19,480	41,960	20,815	44,830
#9	4-1/2	3,250	5,080	3,425	5,770	3,720	7,060	4,090	8,810	4,350	9,370
	9	8,065	15,245	8,410	16,985	8,985	19,350	9,860	21,240	10,535	22,695
	13-1/2	12,095	26,050	12,615	27,165	13,475	29,025	14,795	31,860	15,805	34,040
	22-1/2	20,160	43,420	21,020	45,280	22,460	48,375	24,655	53,105	26,340	56,735
1-1/4	5	4,015	5,835	4,230	6,630	4,595	8,110	5,125	10,645	5,450	11,740
	10	9,955	17,820	10,380	19,850	11,090	23,535	12,175	26,225	13,010	28,020
	15	14,930	32,160	15,570	33,540	16,635	35,835	18,265	39,335	19,515	42,025
	25	24,885	53,605	25,955	55,900	27,730	59,725	30,440	65,560	32,520	70,045
#10	5	3,970	5,830	4,180	6,620	4,540	8,100	5,065	10,630	5,385	11,600
	10	9,955	17,850	10,380	19,885	11,090	23,575	12,175	26,225	13,010	28,020
	15	14,930	32,160	15,570	33,540	16,635	35,835	18,265	39,335	19,515	42,025
	25	24,885	53,605	25,955	55,900	27,730	59,725	30,440	65,560	32,520	70,045

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked 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 according to ACI 318-11 Appendix D and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318 Section 9.2 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3576.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3576 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-11 D.4.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-11 Appendix D.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-11 Appendix D, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-11 Appendix D and ICC-ES AC308 and ESR-3576.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension Design of Steel Elements (Steel Strength)[1,2]

Steel Elements - Threaded Rod and Reinforcing Bar												
Nominal Rod/Rebar Size (in. or No.)	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)	ØN$_{sa}$ Tension (lbs.)
3/8 or #3	3,370	4,360	7,265	6,975	3,655	5,040	3,315	5,525	7,150	7,425	6,600	4,950
1/2 or #4	6,175	7,980	13,300	12,770	6,690	9,225	6,070	10,110	13,000	13,500	12,000	9,000
5/8 or #5	9,835	12,715	21,190	20,340	10,650	14,690	9,660	16,105	20,150	20,925	18,600	13,950
3/4 or #6	14,550	18,815	31,360	30,105	15,765	18,480	14,300	23,830	28,600	29,700	26,400	19,800
7/8 or #7	20,085	25,970	43,285	41,930	21,760	25,510	19,735	32,895	39,000	40,500	36,000	-
1 or #8	26,350	34,070	56,785	54,515	28,545	33,465	25,895	43,160	51,350	53,325	47,400	-
#9	-	-	-	-	-	-	-	-	65,000	67,500	60,000	-
1-1/4 or #10	42,160	54,510	9,100	76,315	-	53,540	41,430	69,050	82,550	85,725	76,200	-

■ - Steel Strength

1. Steel tensile design strength according to ACI 318 Appendix D, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Shear Design of Steel Elements (Steel Strength)[1,2]

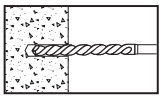
Steel Elements - Threaded Rod and Reinforcing Bar												
Nominal Rod/Rebar Size (in. or No.)	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)	ØV$_{sa}$ Shear (lbs.)
3/8 or #3	1,755	2,265	3,775	3,625	2,025	2,790	1,725	2,870	3,960	3,860	3,430	2,575
1/2 or #4	3,210	4,150	6,915	6,640	3,705	5,110	3,155	5,255	7,200	7,020	6,240	4,680
5/8 or #5	5,115	6,610	11,020	10,575	5,900	8,135	5,025	8,375	11,160	10,880	9,670	7,255
3/4 or #6	7,565	9,785	16,305	15,655	8,730	10,235	7,435	12,390	15,840	15,445	13,730	10,295
7/8 or #7	10,445	13,505	22,505	21,805	12,050	14,130	10,265	17,105	21,600	21,060	18,720	-
1 or #8	13,700	17,715	29,525	28,345	15,810	18,535	13,465	22,445	28,440	27,730	24,650	-
#9	-	-	-	-	-	-	-	-	36,000	35,100	31,200	-
1-1/4 or #10	21,920	28,345	4,735	39,685	-	29,655	21,545	35,905	45,720	44,575	39,625	-

■ - Steel Strength

1. Steel shear design strength according to ACI 318 Appendix D, $\phi V_{sa} = \phi \bullet 0.60 \bullet A_{se,V} \bullet f_{uta}$
2. The tabulated steel design strength in shear must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

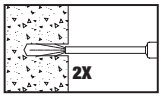
DRILLING



1- Drill a hole into the base material with a rotary hammer drill tool to the size and embedment required by the selected steel anchor element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bit must meet ANSI Standard B212.15.

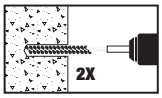
- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

HOLE CLEANING DRY OR WET/WATER-SATURATED HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)



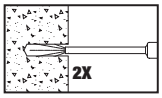
2a- Starting from the bottom or back of the drilled anchor hole, blow the hole clean (free of noticeable dust) a minimum of two times (2x).

- Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar).



2b- Determine wire brush diameter (see installation specifications) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by Powers Fasteners) must be used for holes drilled deeper than the listed brush length.

- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if it does not come into contact with the sides of the drilled hole, the brush is too small and must be replaced.



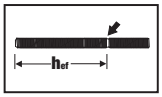
2c- Repeat Step 2a- again by blowing the hole clean a minimum of two times (2x).

- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

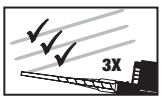
PREPARING

3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 50°F - 104°F (10°C - 40°C) when in use; for overhead applications cartridge temperature must be between 50°F - 90°F (10°C - 30°C). Review published working and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For permitted range of the base material temperature, see published gel and curing times.

- Attach a supplied mixing nozzle to the cartridge. Do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



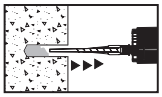
4- Prior to inserting the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesives must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **GRAY** color.

- Review and note the published working and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

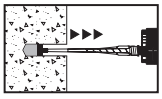
INSTALLATION

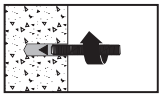


6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. For embedment depth greater than 8 inches an extension nozzle must be used with the mixing nozzle.

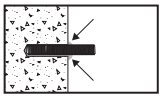
- Piston plugs (see adhesive piston plug table) must be used with and attached to the mixing nozzle and extension tube for horizontal installations where embedment is greater than 8 inches and overhead installations in concrete with anchor rod from 1/2" to 1-1/4" diameter and rebar sizes #4 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.
- **Attention!** Do not install anchors overhead without proper training and installation hardware provided by the Powers Fasteners. Contact Powers for details prior to use.

WITH PISTON PLUG:



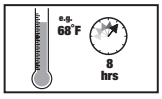


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



8- Ensure that the anchor element is installed to the specific embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive. For all installations the anchor element must be fully restrained from movement throughout the specified curing period, where necessary through the use of temporary wedges, external supports, or other methods. Minor adjustment to the position of the anchor element may be performed during the gel time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.

10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

REFERENCE INSTALLATION TABLES

Gel (working) Time and Curing Table

Temperature of base material		Gel (working) time	Full curing time
°F	°C		
50	10	90 minutes	24 hours
68	20	25 minutes	8 hours
86	30	20 minutes	8 hours
95	35	15 minutes	6 hours
104	40	12 minutes	4 hours

Linear interpolation for intermediate base material temperature is possible.

Hole Cleaning Equipment Selection Table for Pure50+

Rod Diameter (inch)	Rebar Size (No.)	ANSI Drill Bit Diameter[1] (inch)	Min. Brush Diameter, D_{min} (inches)	Brush Length, L (inches)	Steel Wire Brush[2,3] (Cat. #)	Blowout Tool	Number of cleaning actions
Solid Base Material							
3/8	#3	7/16	0.475	6-3/4	08284	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
1/2	#4	9/16	0.600	6-3/4	08285		
-	#4	5/8	0.670	6-3/4	08275		
5/8	#5	11/16	0.735	7-7/8	08286		
		3/4	0.790	7-7/8	08278		
3/4	#6	7/8	0.920	7-7/8	08287		
7/8	#7	1	1.045	11-7/8	08288		
1	#8	1-1/8	1.175	11-7/8	08289		
1-1/4	#9	1-3/8	1.425	11-7/8	08290		
-	#10	1-1/2	1.550	11-7/8	08291		

3. For installations with 5/8-inch threaded rod and #5 rebar size, the preferred ANSI drill bit diameter is 3/4-inch. If an 11/16-inch ANSI drill bit is used the user must check before injecting the adhesive to verify that the steel anchor element can be inserted into the cleaned borehole without resistance.
4. An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.
5. A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

Adhesive Piston Plugs[1,2,3,4]

Rod Diameter (inch)	Rebar Size (No.)	ANSI Drill Bit Diameter (inch)	Plug Size (inch)	Plastic Plug (Cat. #)	Piston Plug
Solid Base Materials					
1/2	#4	9/16	9/16	08302	
-	#4	5/8	5/8	08304	
5/8	#5	11/16	11/16	08258	
		3/4	3/4	08259	
3/4	#6	7/8	7/8	08300	
7/8	#7	1	1	08301	
1	#8	1-1/8	1-1/8	08303	
1-1/4	#9	1-3/8	1-3/8	08305	
-	#10	1-1/2	1-1/2	08309	

1. All overhead installations require the use of piston plugs where one is tabulated together with the anchor size.
2. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.
3. The use of piston plugs is also recommended for underwater installations where one is tabulated together with the anchor size.
4. A flexible plastic extension tube (cat# 08297) or equivalent approved by Powers must be used with piston plugs.

PERMISSIBLE INSTALLATION CONDITIONS

Dry Concrete: cured concrete that, at the time of adhesive anchor installation, has not been exposed to water for the preceding 14 days.
Water-Saturated Concrete (wet): cured concrete that, at the time of adhesive anchor installation, has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into the concrete pore structure to a depth equal to the anchor embedment depth.
Water-Filled Holes (flooded): cured concrete that is water-saturated and where the drilled hole contains standing water at the time of anchor installation.

ORDERING INFORMATION

Pure50+ Cartridges

Cat No.	Description	Std. Carton	Pallet
08600	Pure50+ 9 fl. oz Quik-Shot cartridge	12	432
08605	Pure50+ 21 fl. oz. cartridge	12	540
08651	Pure50+ 51 fl. oz. cartridge	8	216

One Pure50+ mixing nozzle is packaged with each cartridge.
Pure50+ mixing nozzles must be used to ensure complete and proper mixing of the adhesive.

Cartridge System Mixing Nozzles

Cat. No.	Description	Std. Pkg.	Std. Ctn.
08294	Extra mixing nozzle (with 8" extension) for Pure50+ Quik-Shot	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 20" long	1	12
08609	Extra high flow mixing nozzle (with 8" extension) for Pure50+ dual cartridge	2	24

Dispensing Tools for Injection Adhesive

Cat No.	Description	Std. Box	Std. Carton
08437	Manual caulking gun for Quik-Shot	1	12
08479	High performance caulking gun for Quik-Shot	1	12
08409	21 fl. oz. Standard metal manual tool	1	10
08421	21 fl. oz. High performance manual tool	1	10
08442	21 fl. oz. Battery powered tool (cordless)	1	-
08459	21 fl. oz. Pneumatic tool	1	-
08438	51 fl. oz. Pneumatic tool	1	-

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16"ANSI hole (3/8" rod or #3 rebar), 6-3/4" length	1
08285	Wire brush for 9/16"ANSI hole (1/2" rod or #4 rebar), 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole (#4 rebar), 6-3/4" length	1
08286	Wire brush for 11/16"ANSI hole (5/8" rod or #5 rebar), 7-7/8" length	1
08278	Wire brush for 3/4"ANSI hole (5/8" rod or #5 rebar), 7-7/8" length	1
08287	Wire brush for 7/8"ANSI hole (3/4" rod or #6 rebar), 7-7/8" length	1
08288	Wire brush for 1"ANSI hole (7/8" rod or #7 rebar), 11-7/8" length	1
08289	Wire brush for 1-1/8"ANSI hole (1" rod or #8 rebar), 11-7/8" length	1
08290	Wire brush for 1-3/8"ANSI hole (1-1/4" rod or #9 rebar), 11-7/8" length	1
08291	Wire brush for 1-1/2"ANSI hole (#10 rebar), 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08292	Air compressor nozzle with extension, 18" length	1
08465	Adjustable torque wrench with 1/2" square drive (10 to 150 ft.-lbs.)	1
08466	Adjustable torque wrench with 1/2" square drive (25 to 250 ft.-lbs.)	1

Adhesive Piston Plugs

Cat No.	Description	ANSI Drill Bit Dia.	Threaded Rod Dia.	Reinforcing Bar Size	Std. Bag
08302	9/16" Plug	9/16"	1/2"	#4	10
08304	5/8" Plug	5/8"	-	#4	10
08258	11/16" Plug	11/16"	5/8"	#5	10
08259	3/4" Plug	3/4"	5/8"	#5	10
08300	7/8" Plug	7/8"	3/4"	#6	10
08301	1" Plug	1"	7/8"	#7	10
08303	1-1/8" Plug	1-1/8"	1"	#8	10
08305	1-3/8" Plug	1-3/8"	1-1/4"	#9	10
08309	1-1/2" Plug	1-1/2"	-	#10	10