

Chem-Stud® Spin-Type Capsule Adhesive Anchor System

PRODUCT DESCRIPTION

The Chem-Stud anchor systems consists of self contained two-part glass capsules and matching chisel pointed anchor rods which are installed using a rotary hammer and rod adapters. The Chem-Stud adhesive, is an ester based resin material packaged in single use glass capsules designed for installation of 3/8" through 1-1/2" threaded rods in solid concrete and masonry materials. It can also be used with reinforcing bars.

Chem-Stud Capsule – The outer capsule contains epoxy acrylate resin (vinyl ester) in which quartz aggregate is suspended. The inner capsule contains a benzoyl peroxide hardening agent. When the components are combined, they form an adhesive mortar which mechanically bonds the anchor rod to solid base materials. This type of system must be used with a chisel pointed anchor rod and must be spun into the anchor hole using a rotary hammer drill.

Chem-Stud Chisel Pointed Hardware – The threaded anchor rods have a 45° chisel point cut on one end to properly mix the components contained in the capsule during installation. A 90° point is formed on the internally threaded inserts. The threaded rod or reinforcing bar used must have a chisel point to mix the components contained in the capsule during installation.

GENERAL APPLICATIONS AND USES

- Heavy duty anchoring such as threaded anchor rods and rebars in solid concrete.
- Steel erection including anchoring of equipment and column base plates.
- Resists vibratory loads introduced from machinery, moving vehicles, etc.
- Internally threaded inserts option for removable or adjustable anchorage.

FEATURES AND BENEFITS

- + High strength adhesive anchoring system
- + Pre-measured chemical component volumes – no waste and simplified placement
- + Fast cure minimizes downtime
- + Over 30 years of product installation history
- + Glass capsule fragments scrape and roughens hole during installation
- + Components are mixed mechanically during installation of rod or rebar
- + Excellent chemical resistance

APPROVALS AND LISTINGS

Independently tested and qualified to ASTM E1512 and AC58 Criteria, including creep resistance and freeze-thaw cycling
 Department of Transportation Listings - see www.powers.com or contact transportation agency

GUIDE SPECIFICATIONS

CSI Divisions: 03151-Concrete Anchoring, 04081-Masonry Anchorage and 05090-Metal Fastenings.
 Capsule adhesive anchoring system shall be Chem-Stud as supplied by Powers Fasteners, Inc., Brewster, NY

SECTION CONTENTS	Page No.
General Information.....	1
Material and Installation Specifications.....	2
Steel Element Specifications.....	4
Performance Data.....	5
Design Criteria.....	10
Ordering Information.....	13



Chem-Stud Capsule



Chisel Pointed Threaded Rod or Reinforcing Bar
 (Bar Not Pictured)



Internally Threaded Insert
 (Optional for Removability)
 Special Order

ANCHOR SIZE RANGE (TYP.)

3/8" to 1-1/2" diameter rod
 No.3 to No.11 reinforcing bar

SUITABLE BASE MATERIALS

Normal-weight Concrete
 Heavy-weight Concrete
 Grouted Concrete Masonry (CMU)

ADHESIVES

MATERIAL AND INSTALLATION SPECIFICATIONS

Physical Properties

Shelf Life	2 Years
Storage Conditions	Store dry at 40° to 90°F and keep out of direct sunlight
Installation Temperature	Condition material to 60°F minimum for best results
Color	Mixed adhesive mortar – amber
Consistency (mixed, prior to curing)	Mortar

Curing Times¹

Minimum Base Material Temperature	Minimum Curing Time
68°F (20°C)	20 minutes
50°F (10°C)	30 minutes
32°F (0°C)	1 hour
23°F (-5°C)	5 hours
14°F (-10°C)	10 hours

1. Cure time should be doubled for wet concrete.

Chem-Stud Capsule^{1,2}

Dimension	Chem-Stud Capsule, Nominal Size						
	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"
Capsule Diameter (in.)	0.43	0.51	0.67	0.87	0.87	0.95	1.30
Capsule Length (in.)	3.15	3.75	3.75	6.63	6.89	8.25	10.50
Mortar Volume (in ³)	0.35	0.55	0.95	2.55	3.25	4.65	11.70
Mortar Volume (fl. oz.)	0.19	0.30	0.52	1.40	1.79	2.56	6.44

1. The mortar volume listed is for the mixed material.
2. The diameter and length may be different than capsules offered by other suppliers because of variations in air content. When comparing capsules, use the installed mortar volume.

Chisel Pointed Threaded Rod in Normal-Weight Concrete¹

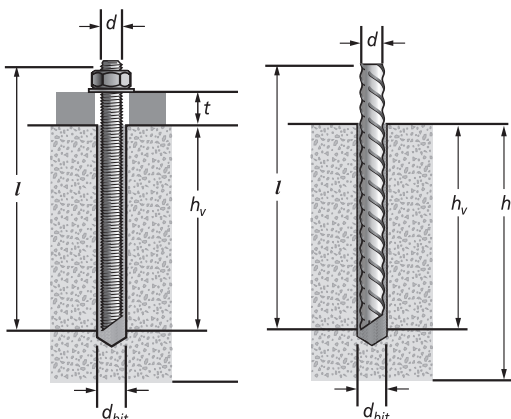
Dimension	Chisel Pointed Threaded Rod Diameter, <i>d</i>								
	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 3/8"	1 1/2"
A_{nom} = Nominal area of threaded rod (in ²)	0.111	0.196	0.307	0.442	0.601	0.785	1.227	1.484	1.766
A_{se} = Tensile stress area of rod (in ²)	0.078	0.142	0.226	0.335	0.462	0.606	0.969	1.155	1.405
d_{bit} = Nominal bit diameter (in.)	7/16	9/16	11/16	7/8	1	1 1/8	1 1/2	1 5/8	1 3/4
h_v = Minimum Embedment Depth (in.)	3 1/2	4 1/4	5	6 5/8	7	8 1/4	10 1/4	10 1/4	10 1/4
T_{max} = Max. tightening torque range (ft.-lbs.)	15-20	30-40	68-90	120-160	150-200	225-300	375-500	375-500	375-500
Mortar per inch (in ³)	0.094	0.133	0.184	0.326	0.390	0.478	0.917	1.042	1.133

1. All threaded rod must have a 45° chisel point to mix the components contained in the capsule during installation.

Reinforcing Bar in Normal-Weight Concrete¹

Dimension	Reinforcing Bar Size								
	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11
A_{nom} = Nominal area of threaded rod (in ²)	0.110	0.200	0.310	0.440	0.600	0.790	1.000	1.270	1.560
d_{bit} = Nominal bit diameter (in.)	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 5/8	1 3/4
h_v = Minimum Embedment Depth (in.)	3 1/2	4 1/2	5	7	7	8 1/2	9	10	10
Mortar per inch (in ³)	0.111	0.142	0.176	0.220	0.252	0.537	0.594	0.932	0.961

1. All reinforcing bar must have a 45° chisel point to mix the components contained in the capsule during installation. Adhesive mortar volume required for installation of reinforcing bar is based on smooth bars. Actual mortar volume required will be less due to raised deformations on bars.

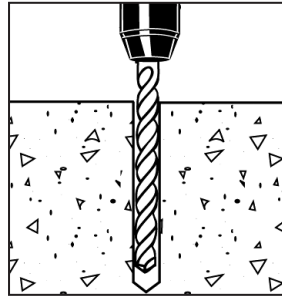


Nomenclature

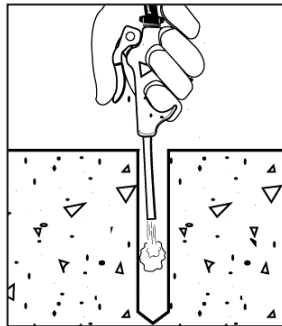
- d = Diameter of threaded rod or reinforcing bar (rebar)
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- h = Base material thickness.
The minimum value of h should be $1.5h_v$
- h_v = Minimum embedment depth
- l = Overall length of rod or rebar
- t = Fixture thickness
- T_{max} = Maximum tightening torque
(only possible after minimum curing time)

INSTALLATION GUIDELINES

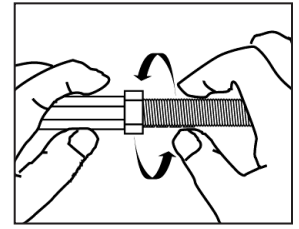
1. Drill a hole to the size and embedment required. The tolerances of the drill bit used should meet the requirements of ANSI B212.15.



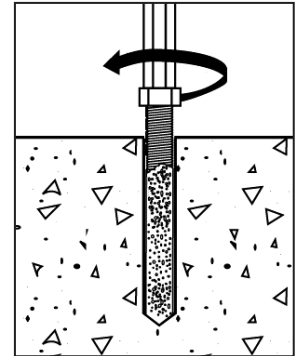
2. Starting from the bottom or back of the anchor hole, blow clean with compressed air, brush with a nylon or wire brush, and blow it clean again. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for most drilled anchor holes. Holes should be clean and sound. Anchor holes may be dry or damp, but should be free of standing water or frost. If using reinforcing bar, be sure the bar will fit into the drilled hole. If a larger hole is required, the diameter should be as close as possible to the diameter of the reinforcing bar. Prior to installing check the capsule to be sure it is not damaged and invert several times at 60°F or above to confirm all of the resin is in a liquid state. Insert the capsule into the hole. Either end of the capsule may be inserted first.



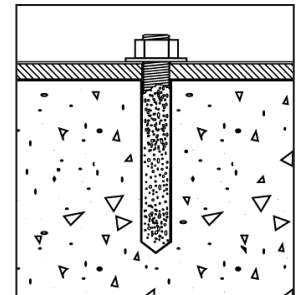
3. Select the drive unit, insert it into a rotary hammer drill and engage the coupling to be used. Insert the chisel point of the rod or rebar into the hole to break the glass capsule. Spin it into the capsule at a speed of 250 to 500 RPM until it is fully embedded.



4. Once the rod or bar is fully embedded, turn the rotary hammer drill off immediately. If installing threaded rod, pull the driver off the coupling while holding the rod. Hold the hex nut with a wrench to unthread the coupler. If using reinforcing bar, release the set lever and slide the coupler off the bar.



5. Allow the adhesive to cure for the specified time prior to applying any load. Do not disturb, torque or load the anchor until it is fully cured.



Note! Consideration must be given to installation direction. Overhead installations with glass capsules are sensitive and extremely dependent upon the skill and care taken by the user; additional equipment not supplied by Powers may be required. Consequently Powers does not recommend the use of the Chem-Stud for overhead applications at this time. Use of the product in adverse installation conditions should not be done without proper training and direct supervision by the Design Professional.

STEEL SPECIFICATIONS

Material Properties for Threaded Rod and Reinforcing Bar

Anchor Type	Steel Description	Steel Specification (ASTM)	Rod Dia. or Rebar Size (inch or No.)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Threaded Rod	Standard carbon rod	A36	All	36.0	58.0
		A 307, Grade C or F 1554, Grade 36	3/8 thru 4	36.0	58.0
	High strength carbon rod	A 193, Grade B7	3/8 thru 2 1/2	105.0	120.0
	Stainless Rod (Type 304 / 316 SS)	F 593, Condition CW	3/8 thru 5/8	65.0	100.0
3/4 thru 1 1/2			45.0	85.0	
Reinforcing Bar	Grade 40 Rebar	A 615, A 706, A 767 or A 996	All	40.0	70.0
	Grade 60 Rebar			60.0	90.0

Allowable Steel Strength Capacities for Threaded Rod

Anchor Diameter d in. (mm)	Allowable Tension				Allowable Shear			
	ASTM A36 lbs. (kN)	ASTM, A307 Grade C or F 1554, Grade 36 lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	ASTM A36 lbs. (kN)	ASTM, A307 Grade C or F 1554, Grade 36 lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
3/8 (9.5)	2,115 (9.5)	2,115 (9.5)	4,375 (19.7)	3,630 (16.3)	1,090 (4.9)	1,090 (4.9)	2,255 (10.1)	1,870 (8.4)
1/2 (12.7)	3,755 (16.9)	3,755 (16.9)	7,775 (35.0)	6,470 (29.1)	1,940 (8.7)	1,940 (8.7)	4,055 (18.2)	3,330 (15.0)
5/8 (15.9)	5,870 (26.4)	5,870 (26.4)	12,150 (54.7)	10,130 (45.6)	3,025 (13.6)	3,025 (13.6)	6,260 (28.2)	5,210 (23.4)
3/4 (19.1)	8,455 (38.0)	8,455 (38.0)	17,495 (78.7)	12,400 (55.8)	4,355 (19.6)	4,355 (19.6)	9,010 (40.5)	6,390 (28.8)
7/8 (22.2)	11,510 (51.8)	11,510 (51.8)	23,810 (107.1)	16,860 (75.9)	5,930 (26.7)	5,930 (26.7)	12,265 (55.2)	8,680 (39.1)
1 (25.4)	15,035 (67.7)	15,035 (67.7)	31,100 (140.0)	22,020 (99.1)	7,745 (34.9)	7,745 (34.9)	16,020 (72.1)	11,340 (51.0)
1 1/4 (31.8)	23,485 (105.7)	23,485 (105.7)	48,560 (218.5)	34,420 (154.9)	12,100 (54.5)	12,100 (54.5)	25,035 (112.7)	17,730 (79.8)
1 3/8 (34.9)	28,400 (127.8)	28,400 (127.8)	58,760 (264.4)	41,625 (187.3)	14,630 (65.8)	14,630 (65.8)	30,270 (136.2)	21,440 (96.5)
1 1/2 (38.1)	33,800 (152.1)	33,800 (152.1)	69,930 (314.7)	49,535 (222.9)	17,410 (78.3)	17,410 (78.3)	36,025 (162.1)	25,515 (114.8)

Allowable Steel Strength Capacities for Reinforcing Bar

Bar Size	Tension lbs. (kN)		Shear lbs. (kN)	
	Grade 40	Grade 60	Grade 40	Grade 60
No. 3 (3/8")	2,200 (9.9)	2,640 (11.9)	1,310 (5.9)	1,680 (7.6)
No. 4 (1/2")	4,000 (18.0)	4,800 (21.6)	2,380 (10.7)	3,060 (13.8)
No. 5 (5/8")	6,200 (27.9)	7,440 (33.5)	3,690 (16.6)	4,740 (21.3)
No. 6 (3/4")	8,800 (39.6)	10,560 (47.5)	5,235 (23.6)	6,730 (30.3)
No. 7 (7/8")	12,000 (54.0)	14,400 (64.8)	7,140 (32.1)	9,180 (41.3)
No. 8 (1")	15,800 (71.1)	18,960 (85.3)	9,400 (42.3)	12,085 (54.4)
No. 9 (1 1/8")	20,000 (90.0)	24,000 (108.0)	11,900 (53.6)	15,300 (68.9)
No. 10 (1 1/4")	25,400 (114.3)	30,480 (137.2)	15,115 (68.0)	19,430 (87.4)
No. 11 (1 3/8")	31,200 (140.4)	37,440 (168.5)	16,920 (76.1)	20,305 (91.4)

Allowable steel strength capacities are based on the requirements of ASTM A 615.

Note:

Allowable design load must be the lesser of allowable steel strength (as shown on this page) and the allowable bond capacities.

Allowable steel strength values for threaded rod are based on the following equations:

$$T = 0.33 * f_u * A_{nom}$$

$$V = 0.17 * f_u * A_{nom}$$

And, the allowable steel strength values for reinforcing bar are based on the following equations:

$$T = f_s * A_{br}$$

$$V = 0.17 * f_u * A_{br}$$

Where:

T = Allowable tension load (pounds).

V = Allowable shear load (pounds).

f_u = Minimum specified ultimate strength (psi)

f_s = Tensile stress area in reinforcement (psi)

A_{nom} = Nominal cross-sectional area of threaded rod (in²).

A_{br} = Nominal cross-sectional area of reinforcing bar (in²).

ADHESIVES

PERFORMANCE DATA

Ultimate Load Capacities for Threaded Rod Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete^{1,2}

ADHESIVES

Anchor Dia. <i>d</i> in. (mm)	Min. Embed. Depth <i>h_v</i> in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (<i>f'_c</i>)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	6,300 (28.4)	6,660 (30.0)	7,540 (33.9)	6,660 (30.0)	7,840 (3.5)	6,660 (30.0)	7,840 (35.0)	6,660 (30.0)	7,840 (35.0)	6,660 (30.0)
	5 1/4 (133.4)	Two 3/8"	9,450 (42.5)	6,660 (30.0)	11,295 (50.8)	6,660 (30.0)	11,760 (52.5)	6,660 (30.0)	11,760 (52.5)	6,660 (30.0)	11,760 (52.5)	6,660 (30.0)
	7 (177.8)	Two 3/8"	12,600 (56.7)	6,660 (30.0)	15,060 (67.8)	6,660 (30.0)	15,680 (70.0)	6,660 (30.0)	15,680 (70.0)	6,660 (30.0)	15,680 (70.0)	6,660 (30.0)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	10,040 (45.2)	11,655 (52.4)	11,880 (53.5)	11,655 (52.4)	12,680 (56.8)	11,655 (52.4)	12,680 (56.8)	11,655 (52.4)	12,680 (56.8)	11,655 (52.4)
	6 3/8 (161.9)	One 1/2" & One 3/8"	15,060 (67.8)	11,655 (52.4)	17,700 (79.7)	11,655 (52.4)	19,040 (85.0)	11,655 (52.4)	19,040 (85.0)	11,655 (52.4)	19,040 (85.0)	11,655 (52.4)
	8 1/2 (215.9)	Two 1/2"	20,080 (90.4)	11,655 (52.4)	23,600 (106.2)	11,655 (52.4)	25,380 (113.3)	11,655 (52.4)	25,380 (113.3)	11,655 (52.4)	25,380 (113.3)	11,655 (52.4)
5/8 (15.9)	5 (127.0)	One 5/8"	13,840 (62.3)	18,745 (84.4)	16,240 (73.1)	18,745 (84.4)	18,620 (83.8)	18,745 (84.4)	18,660 (83.3)	18,745 (84.4)	18,660 (83.3)	18,745 (84.4)
	7 1/2 (190.5)	One 5/8" & One 1/2"	20,760 (93.4)	18,745 (84.4)	24,345 (109.6)	18,745 (84.4)	27,930 (125.7)	18,745 (84.4)	27,980 (124.9)	18,745 (84.4)	27,980 (124.9)	18,745 (84.4)
	10 (254.0)	Two 5/8"	27,680 (124.6)	18,745 (84.4)	32,460 (146.1)	18,745 (84.4)	37,240 (167.6)	18,745 (84.4)	37,320 (166.6)	18,745 (84.4)	37,320 (166.6)	18,745 (84.4)
3/4 (19.1)	6 5/8 (168.3)	One 3/4"	22,300 (100.4)	30,060 (135.3)	26,100 (117.5)	30,060 (135.3)	28,540 (128.4)	30,060 (135.3)	29,660 (132.4)	30,060 (135.3)	29,660 (132.4)	30,060 (135.3)
	10 (254.0)	One 3/4" & One 5/8"	33,660 (151.5)	30,060 (135.3)	38,235 (172.1)	30,060 (135.3)	42,810 (192.6)	30,060 (135.3)	44,780 (199.9)	30,060 (135.3)	44,780 (199.9)	30,060 (135.3)
	13 1/4 (336.6)	Two 3/4"	44,600 (200.7)	30,060 (135.3)	50,840 (228.8)	30,060 (135.3)	57,080 (256.9)	30,060 (135.3)	59,340 (264.9)	30,060 (135.3)	59,340 (264.9)	30,060 (135.3)
7/8 (22.2)	7 (177.8)	One 7/8"	23,480 (105.7)	36,065 (162.3)	28,020 (126.1)	36,065 (162.3)	32,560 (146.5)	36,065 (162.3)	36,580 (163.3)	36,065 (162.3)	36,580 (163.3)	36,065 (162.3)
	10 1/4 (260.4)	Two 3/4"	35,220 (158.5)	36,065 (162.3)	42,030 (189.1)	36,065 (162.3)	48,840 (219.8)	36,065 (162.3)	53,560 (239.1)	36,065 (162.3)	53,560 (239.1)	36,065 (162.3)
	14 (355.6)	Two 7/8"	46,960 (211.3)	36,065 (162.3)	56,040 (252.2)	36,065 (162.3)	65,120 (293.0)	36,065 (162.3)	73,140 (326.5)	36,065 (162.3)	73,140 (326.5)	36,065 (162.3)
1 (25.4)	8 1/4 (209.6)	One 1"	32,360 (145.6)	53,135 (239.1)	39,540 (177.9)	53,135 (239.1)	46,700 (210.2)	53,135 (239.1)	49,260 (219.9)	53,135 (239.1)	49,260 (219.9)	53,135 (239.1)
	12 3/8 (314.3)	One 1" & One 7/8"	48,530 (218.4)	53,135 (239.1)	59,290 (266.8)	53,135 (239.1)	70,050 (315.2)	53,135 (239.1)	73,900 (329.9)	53,135 (239.1)	73,900 (329.9)	53,135 (239.1)
	16 1/2 (419.1)	Two 1"	64,700 (291.2)	53,135 (239.1)	79,050 (355.7)	53,135 (239.1)	93,400 (420.3)	53,135 (239.1)	98,520 (439.8)	53,135 (239.1)	98,520 (439.8)	53,135 (239.1)
1 1/4 (31.8)	10 1/4 (260.4)	One 1 1/4"	58,380 (262.7)	68,000 (306.0)	64,900 (292.1)	68,000 (306.0)	71,400 (321.3)	68,000 (306.0)	76,500 (341.5)	68,000 (306.0)	76,500 (341.5)	68,000 (306.0)
	15 (381.0)	One 1 1/4" & One 1"	85,435 (384.5)	68,000 (306.0)	94,355 (424.6)	68,000 (306.0)	103,280 (464.8)	68,000 (306.0)	111,240 (500.6)	68,000 (306.0)	119,200 (536.4)	68,000 (306.0)
	20 1/2 (520.7)	Two 1 1/4"	116,760 (525.4)	68,000 (306.0)	129,780 (584.0)	68,000 (306.0)	140,200 (630.9)	68,000 (306.0)	141,390 (636.3)	68,000 (306.0)	142,580 (641.6)	68,000 (306.0)
1 3/8 (34.9)	10 1/4 (260.4)	One 1 1/4"	63,000 (283.5)	82,000 (369.0)	68,500 (308.3)	82,000 (369.0)	74,000 (333.0)	82,000 (369.0)	84,160 (375.7)	82,000 (369.0)	84,160 (375.7)	82,000 (369.0)
	15 (381.0)	One 1 1/4" & One 1"	92,225 (415.0)	82,000 (369.0)	100,155 (450.7)	82,000 (369.0)	108,085 (486.4)	82,000 (369.0)	116,540 (524.4)	82,000 (369.0)	123,160 (549.8)	82,000 (369.0)
	20 1/2 (520.7)	Two 1 1/4"	126,040 (567.2)	82,000 (369.0)	134,270 (604.2)	82,000 (369.0)	142,500 (641.3)	82,000 (369.0)	145,750 (655.9)	82,000 (369.0)	149,000 (670.5)	82,000 (369.0)
1 1/2 (38.1)	10 1/4 (260.4)	One 1 1/4"	67,000 (301.5)	94,500 (425.3)	72,500 (326.3)	94,500 (425.3)	78,000 (351.0)	94,500 (425.3)	88,000 (396.0)	94,500 (425.3)	91,800 (409.8)	94,500 (425.3)
	15 (381.0)	One 1 1/4" & One 1"	100,460 (452.1)	94,500 (425.3)	108,725 (489.3)	94,500 (425.3)	116,995 (526.5)	94,500 (425.3)	127,195 (572.4)	94,500 (425.3)	134,360 (599.8)	94,500 (425.3)
	20 1/2 (520.7)	Two 1 1/4"	134,000 (603.0)	94,500 (425.3)	139,500 (627.8)	94,500 (425.3)	145,000 (652.5)	94,500 (425.3)	147,000 (661.5)	94,500 (425.3)	149,000 (670.5)	94,500 (425.3)

1. Ultimate load capacities 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 or overhead.
 2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Threaded Rod Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete^{1,2,3}

Anchor Dia. <i>d</i> in. (mm)	Min. Embed. Depth <i>h_v</i> in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (<i>f'_c</i>)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	1,575 (7.1)	1,665 (7.5)	1,885 (8.5)	1,665 (7.5)	1,960 (8.8)	1,665 (7.5)	1,960 (8.8)	1,665 (7.5)	1,960 (8.8)	1,665 (7.5)
	5 1/4 (133.4)	Two 3/8"	2,365 (10.6)	1,665 (7.5)	2,825 (12.7)	1,665 (7.5)	2,940 (13.1)	1,665 (7.5)	2,940 (13.1)	1,665 (7.5)	2,940 (13.1)	1,665 (7.5)
	7 (177.8)	Two 3/8"	3,150 (14.2)	1,665 (7.5)	3,765 (16.9)	1,665 (7.5)	3,920 (17.5)	1,665 (7.5)	3,920 (17.5)	1,665 (7.5)	3,920 (17.5)	1,665 (7.5)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	2,510 (11.3)	2,915 (13.1)	2,970 (13.4)	2,915 (13.1)	3,170 (14.2)	2,915 (13.1)	3,170 (14.2)	2,915 (13.1)	3,170 (14.2)	2,915 (13.1)
	6 3/8 (161.9)	One 1/2" & One 3/8"	3,765 (16.9)	2,915 (13.1)	4,425 (19.9)	2,915 (13.1)	4,760 (21.3)	2,915 (13.1)	4,760 (21.3)	2,915 (13.1)	4,760 (21.3)	2,915 (13.1)
	8 1/2 (215.9)	Two 1/2"	5,020 (22.6)	2,915 (13.1)	5,900 (26.6)	2,915 (13.1)	6,345 (28.3)	2,915 (13.1)	6,345 (28.3)	2,915 (13.1)	6,345 (28.3)	2,915 (13.1)
5/8 (15.9)	5 (127.0)	One 5/8"	3,460 (15.6)	4,685 (21.1)	4,060 (18.3)	4,685 (21.1)	4,655 (20.9)	4,685 (21.1)	4,665 (20.8)	4,685 (21.1)	4,665 (20.8)	4,685 (21.1)
	7 1/2 (190.5)	One 5/8" & One 1/2"	5,190 (23.4)	4,685 (21.1)	6,085 (27.4)	4,685 (21.1)	6,985 (31.4)	4,685 (21.1)	6,995 (31.2)	4,685 (21.1)	6,995 (31.2)	4,685 (21.1)
	10 (254.0)	Two 5/8"	6,920 (31.1)	4,685 (21.1)	8,115 (36.5)	4,685 (21.1)	9,310 (41.9)	4,685 (21.1)	9,330 (41.7)	4,685 (21.1)	9,330 (41.7)	4,685 (21.1)
3/4 (19.1)	6 5/8 (168.3)	One 3/4"	5,575 (25.1)	7,515 (33.8)	6,525 (29.4)	7,515 (33.8)	7,135 (32.1)	7,515 (33.8)	7,415 (33.1)	7,515 (33.8)	7,415 (33.1)	7,515 (33.8)
	10 (254.0)	One 3/4" & One 5/8"	8,415 (37.9)	7,515 (33.8)	9,560 (43.0)	7,515 (33.8)	10,705 (48.2)	7,515 (33.8)	11,195 (50.0)	7,515 (33.8)	11,195 (50.0)	7,515 (33.8)
	13 1/4 (336.6)	Two 3/4"	11,150 (50.2)	7,515 (33.8)	12,710 (57.2)	7,515 (33.8)	14,270 (64.2)	7,515 (33.8)	14,835 (66.2)	7,515 (33.8)	14,835 (66.2)	7,515 (33.8)
7/8 (22.2)	7 (177.8)	One 7/8"	5,870 (26.4)	9,015 (40.6)	7,005 (31.5)	9,015 (40.6)	8,140 (36.6)	9,015 (40.6)	9,145 (40.8)	9,015 (40.6)	9,145 (40.8)	9,015 (40.6)
	10 1/4 (260.4)	Two 3/4"	8,805 (39.6)	9,015 (40.6)	10,510 (47.3)	9,015 (40.6)	12,210 (54.9)	9,015 (40.6)	13,390 (59.8)	9,015 (40.6)	13,390 (59.8)	9,015 (40.6)
	14 (355.6)	Two 7/8"	11,740 (52.8)	9,015 (40.6)	14,010 (63.0)	9,015 (40.6)	16,280 (73.3)	9,015 (40.6)	18,285 (81.6)	9,015 (40.6)	18,285 (81.6)	9,015 (40.6)
1 (25.4)	8 1/4 (209.6)	One 1"	8,090 (36.4)	13,285 (59.8)	9,885 (44.5)	13,285 (59.8)	11,675 (52.5)	13,285 (59.8)	12,315 (55.0)	13,285 (59.8)	12,315 (55.0)	13,285 (59.8)
	12 3/8 (314.3)	One 1" & One 7/8"	12,135 (54.6)	13,285 (59.8)	14,825 (66.7)	13,285 (59.8)	17,515 (78.8)	13,285 (59.8)	18,475 (82.5)	13,285 (59.8)	18,475 (82.5)	13,285 (59.8)
	16 1/2 (419.1)	Two 1"	16,175 (72.8)	13,285 (59.8)	19,765 (88.9)	13,285 (59.8)	23,350 (105.1)	13,285 (59.8)	24,630 (110.0)	13,285 (59.8)	24,630 (110.0)	13,285 (59.8)
1 1/4 (31.8)	10 1/4 (260.4)	One 1 1/4"	14,595 (65.7)	17,000 (76.5)	16,225 (73.0)	17,000 (76.5)	17,850 (80.3)	17,000 (76.5)	19,125 (85.4)	17,000 (76.5)	19,125 (85.4)	17,000 (76.5)
	15 (381.0)	One 1 1/4" & One 1"	21,360 (96.1)	17,000 (76.5)	23,590 (106.2)	17,000 (76.5)	25,820 (116.2)	17,000 (76.5)	27,810 (125.1)	17,000 (76.5)	27,990 (125.0)	17,000 (76.5)
	20 1/2 (520.7)	Two 1 1/4"	29,190 (131.4)	17,000 (76.5)	32,445 (146.0)	17,000 (76.5)	35,050 (157.7)	17,000 (76.5)	35,350 (159.1)	17,000 (76.5)	35,645 (160.4)	17,000 (76.5)
1 3/8 (34.9)	10 1/4 (260.4)	One 1 1/4"	15,750 (70.9)	20,500 (92.3)	17,125 (77.1)	20,500 (92.3)	18,500 (83.3)	20,500 (92.3)	21,040 (93.9)	20,500 (92.3)	21,040 (93.9)	20,500 (92.3)
	15 (381.0)	One 1 1/4" & One 1"	23,055 (103.7)	20,500 (92.3)	25,040 (112.7)	20,500 (92.3)	27,020 (121.6)	20,500 (92.3)	29,135 (131.1)	20,500 (92.3)	30,790 (137.5)	20,500 (92.3)
	20 1/2 (520.7)	Two 1 1/4"	31,510 (141.8)	20,500 (92.3)	33,570 (151.1)	20,500 (92.3)	35,625 (160.3)	20,500 (92.3)	36,440 (164.0)	20,500 (92.3)	37,250 (167.6)	20,500 (92.3)
1 1/2 (38.1)	10 1/4 (260.4)	One 1 1/4"	16,750 (75.4)	23,625 (106.3)	18,125 (81.6)	23,625 (106.3)	19,500 (87.8)	23,625 (106.3)	22,000 (99.0)	23,625 (106.3)	22,950 (102.5)	23,625 (106.3)
	15 (381.0)	One 1 1/4" & One 1"	25,115 (113.0)	23,625 (106.3)	27,180 (122.3)	23,625 (106.3)	29,250 (131.6)	23,625 (106.3)	31,800 (143.1)	23,625 (106.3)	33,590 (150.0)	23,625 (106.3)
	20 1/2 (520.7)	Two 1 1/4"	33,500 (150.8)	23,625 (106.3)	34,875 (156.9)	23,625 (106.3)	36,250 (163.1)	23,625 (106.3)	36,750 (165.4)	23,625 (106.3)	37,250 (167.6)	23,625 (106.3)

ADHESIVES

1. Allowable bond capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
 2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
 3. Allowable design load should be the lesser of the allowable bond or allowable steel strength.

PERFORMANCE DATA

Ultimate Load Capacities for Reinforcing Bar Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete^{1,2}

ADHESIVES

Rebar Size No. (in.)	Min. Embed. Depth <i>h_v</i> in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (<i>f'_c</i>)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	7,400 (33.3)	6,480 (29.2)	7,840 (35.0)	6,480 (29.2)	7,840 (35.0)	6,480 (29.2)	7,840 (35.0)	6,480 (29.2)	7,840 (35.0)	6,480 (29.2)
	5 1/4 (133.4)	Two 3/8"	11,100 (50.0)	6,480 (29.2)	11,760 (52.5)	6,480 (29.2)	11,760 (52.5)	6,480 (29.2)	11,760 (52.5)	6,480 (29.2)	11,760 (52.5)	6,480 (29.2)
	7 (177.8)	Two 3/8"	14,800 (66.6)	6,480 (29.2)	15,680 (70.0)	6,480 (29.2)	15,680 (70.0)	6,480 (29.2)	15,680 (70.0)	6,480 (29.2)	15,680 (70.0)	6,480 (29.2)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	10,450 (47.0)	11,120 (50.0)	12,680 (56.6)	11,120 (50.0)	12,680 (56.6)	11,120 (50.0)	12,680 (56.6)	11,120 (50.0)	12,680 (56.6)	11,120 (50.0)
	6 3/4 (171.5)	One 1/2" & One 3/8"	15,675 (70.5)	11,120 (50.0)	17,700 (79.7)	11,120 (50.0)	19,040 (85.0)	11,120 (50.0)	19,040 (85.0)	11,120 (50.0)	19,040 (85.0)	11,120 (50.0)
	9 (228.6)	Two 1/2"	20,900 (94.1)	11,120 (50.0)	23,600 (106.2)	11,120 (50.0)	25,380 (113.3)	11,120 (50.0)	25,380 (113.3)	11,120 (50.0)	25,380 (113.3)	11,120 (50.0)
No.5 (5/8)	5 (127.0)	One 5/8"	15,460 (69.6)	17,660 (79.5)	18,660 (83.3)	17,660 (79.5)	18,660 (83.3)	17,660 (79.5)	18,660 (83.3)	17,660 (79.5)	18,660 (83.3)	17,660 (79.5)
	7 1/2 (190.5)	One 5/8" & One 1/2"	23,190 (104.4)	17,660 (79.5)	27,980 (124.9)	17,660 (79.5)	27,980 (124.9)	17,660 (79.5)	27,980 (124.9)	17,660 (79.5)	27,980 (124.9)	17,660 (79.5)
	10 (254.0)	Two 5/8"	30,920 (139.1)	17,660 (79.5)	37,320 (166.6)	17,660 (79.5)	37,320 (166.6)	17,660 (79.5)	37,320 (166.6)	17,660 (79.5)	37,320 (166.6)	17,660 (79.5)
No.6 (3/4)	7 (177.8)	One 3/4"	22,760 (102.4)	21,900 (98.6)	27,890 (125.5)	21,900 (98.6)	29,660 (132.4)	21,900 (98.6)	29,660 (132.4)	21,900 (98.6)	29,660 (132.4)	21,900 (98.6)
	10 1/2 (266.7)	One 3/4" & One 5/8"	34,140 (153.6)	21,900 (98.6)	41,835 (188.3)	21,900 (98.6)	44,780 (199.9)	21,900 (98.6)	44,780 (199.9)	21,900 (98.6)	44,780 (199.9)	21,900 (98.6)
	14 (355.6)	Two 3/4"	45,520 (204.8)	21,900 (98.6)	55,780 (251.0)	21,900 (98.6)	59,340 (264.9)	21,900 (98.6)	59,340 (264.9)	21,900 (98.6)	59,340 (264.9)	21,900 (98.6)
No.7 (7/8)	7 (177.8)	One 7/8"	26,500 (119.3)	36,060 (162.3)	31,750 (142.9)	36,060 (162.3)	36,580 (163.3)	36,060 (162.3)	36,580 (163.3)	36,060 (162.3)	36,580 (163.3)	36,060 (162.3)
	10 1/2 (266.7)	Two 3/4"	39,750 (178.9)	36,060 (162.3)	47,625 (214.3)	36,060 (162.3)	53,560 (239.1)	36,060 (162.3)	53,560 (239.1)	36,060 (162.3)	53,560 (239.1)	36,060 (162.3)
	14 (355.6)	Two 7/8"	53,000 (238.5)	36,060 (162.3)	63,500 (285.8)	36,060 (162.3)	73,140 (326.5)	36,060 (162.3)	73,140 (326.5)	36,060 (162.3)	73,140 (326.5)	36,060 (162.3)
No.8 (1)	8 1/2 (215.9)	One 1"	36,650 (164.9)	53,140 (239.1)	45,075 (202.8)	53,140 (239.1)	49,260 (219.9)	53,140 (239.1)	49,260 (219.9)	53,140 (239.1)	49,260 (219.9)	53,140 (239.1)
	12 3/4 (323.9)	One 1" & One 3/4"	54,975 (247.4)	53,140 (239.1)	67,613 (304.3)	53,140 (239.1)	73,900 (329.9)	53,140 (239.1)	73,900 (329.9)	53,140 (239.1)	73,900 (329.9)	53,140 (239.1)
	17 (431.8)	Two 1"	73,300 (329.9)	53,140 (239.1)	90,150 (405.7)	53,140 (239.1)	98,520 (439.8)	53,140 (239.1)	98,520 (439.8)	53,140 (239.1)	98,520 (439.8)	53,140 (239.1)
No.9 (1 1/8)	9 (228.6)	One 1"	49,440 (222.5)	68,300 (307.4)	56,645 (254.9)	68,300 (307.4)	63,850 (287.3)	68,300 (307.4)	69,775 (314.0)	68,300 (307.4)	75,700 (340.7)	68,300 (307.4)
	13 1/2 (342.9)	One 1" & One 7/8"	74,160 (333.7)	68,300 (307.4)	84,968 (382.4)	68,300 (307.4)	95,775 (431.0)	68,300 (307.4)	104,663 (471.0)	68,300 (307.4)	111,960 (499.8)	68,300 (307.4)
	18 (457.2)	Two 1"	98,880 (445.0)	68,300 (307.4)	113,290 (509.8)	68,300 (307.4)	127,700 (574.7)	68,300 (307.4)	139,550 (628.0)	68,300 (307.4)	151,400 (681.3)	68,300 (307.4)
No.10 (1 1/4)	10 (254.0)	One 1 1/4"	57,000 (256.5)	83,460 (375.6)	64,735 (291.3)	83,460 (375.6)	72,470 (326.1)	83,460 (375.6)	82,435 (371.0)	83,460 (375.6)	84,160 (375.7)	83,460 (375.6)
	15 (381.0)	One 1 1/4" & One 7/8"	85,500 (384.8)	83,460 (375.6)	97,103 (437.0)	83,460 (375.6)	108,705 (489.2)	83,460 (375.6)	117,353 (528.1)	83,460 (375.6)	123,160 (549.8)	83,460 (375.6)
	20 (508.0)	Two 1 1/4"	114,000 (513.0)	83,460 (375.6)	129,470 (582.6)	83,460 (375.6)	144,940 (652.2)	83,460 (375.6)	148,470 (668.1)	83,460 (375.6)	152,000 (684.0)	83,460 (375.6)
No.11 (1 3/8)	10 (254.0)	One 1 1/4"	65,000 (292.5)	97,460 (438.6)	70,500 (317.3)	97,460 (438.6)	76,000 (342.0)	97,460 (438.6)	85,000 (382.5)	97,460 (438.6)	91,800 (409.8)	97,460 (438.6)
	15 (381.0)	One 1 1/4" & One 7/8"	92,000 (414.0)	97,460 (438.6)	103,000 (463.5)	97,460 (438.6)	114,000 (513.0)	97,460 (438.6)	119,000 (535.5)	97,460 (438.6)	124,000 (558.0)	97,460 (438.6)
	20 (508.0)	Two 1 1/4"	126,000 (567.0)	97,460 (438.6)	137,000 (616.5)	97,460 (438.6)	148,000 (666.0)	97,460 (438.6)	151,000 (679.5)	97,460 (438.6)	154,000 (693.0)	97,460 (438.6)

1. Ultimate load capacities 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 or overhead.
 2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Reinforcing Bar Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete^{1,2,3}

Rebar Size No. (in.)	Min. Embed. Depth h_v in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (f'_c)									
			2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	1,850 (8.3)	1,620 (7.3)	1,960 (8.8)	1,620 (7.3)	1,960 (8.8)	1,620 (7.3)	1,960 (8.8)	1,620 (7.3)	1,960 (8.8)	1,620 (7.3)
	5 1/4 (133.4)	Two 3/8"	2,775 (12.5)	1,620 (7.3)	2,940 (13.1)	1,620 (7.3)	2,940 (13.1)	1,620 (7.3)	2,940 (13.1)	1,620 (7.3)	2,940 (13.1)	1,620 (7.3)
	7 (177.8)	Two 3/8"	3,700 (16.7)	1,620 (7.3)	3,920 (17.5)	1,620 (7.3)	3,920 (17.5)	1,620 (7.3)	3,920 (17.5)	1,620 (7.3)	3,920 (17.5)	1,620 (7.3)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	2,615 (11.8)	2,780 (12.5)	3,170 (13.2)	2,780 (12.5)	3,170 (13.2)	2,780 (12.5)	3,170 (13.2)	2,780 (12.5)	3,170 (13.2)	2,780 (12.5)
	6 3/4 (171.5)	One 1/2" & One 3/8"	3,920 (17.6)	2,780 (12.5)	4,425 (19.9)	2,780 (12.5)	4,760 (21.3)	2,780 (12.5)	4,760 (21.3)	2,780 (12.5)	4,760 (21.3)	2,780 (12.5)
	9 (228.6)	Two 1/2"	5,225 (23.5)	2,780 (12.5)	5,900 (26.6)	2,780 (12.5)	6,345 (28.3)	2,780 (12.5)	6,345 (28.3)	2,780 (12.5)	6,345 (28.3)	2,780 (12.5)
No.5 (5/8)	5 (127.0)	One 5/8"	3,865 (17.4)	4,415 (19.9)	4,665 (20.8)	4,415 (19.9)	4,665 (20.8)	4,415 (19.9)	4,665 (20.8)	4,415 (19.9)	4,665 (20.8)	4,415 (19.9)
	7 1/2 (190.5)	One 5/8" & One 1/2"	5,800 (26.1)	4,415 (19.9)	6,995 (31.2)	4,415 (19.9)	6,995 (31.2)	4,415 (19.9)	6,995 (31.2)	4,415 (19.9)	6,995 (31.2)	4,415 (19.9)
	10 (254.0)	Two 5/8"	7,730 (34.8)	4,415 (19.9)	9,330 (41.7)	4,415 (19.9)	9,330 (41.7)	4,415 (19.9)	9,330 (41.7)	4,415 (19.9)	9,330 (41.7)	4,415 (19.9)
No.6 (3/4)	7 (177.8)	One 3/4"	5,690 (25.6)	5,475 (24.6)	6,975 (31.4)	5,475 (24.6)	7,415 (33.1)	5,475 (24.6)	7,415 (33.1)	5,475 (24.6)	7,415 (33.1)	5,475 (24.6)
	10 1/2 (266.7)	One 3/4" & One 5/8"	8,535 (38.4)	5,475 (24.6)	10,460 (47.1)	5,475 (24.6)	11,195 (50.0)	5,475 (24.6)	11,195 (50.0)	5,475 (24.6)	11,195 (50.0)	5,475 (24.6)
	14 (355.6)	Two 3/4"	11,380 (51.2)	5,475 (24.6)	13,945 (62.8)	5,475 (24.6)	14,835 (66.2)	5,475 (24.6)	14,835 (66.2)	5,475 (24.6)	14,835 (66.2)	5,475 (24.6)
No.7 (7/8)	7 (177.8)	One 7/8"	6,625 (29.8)	9,015 (40.6)	7,940 (35.7)	9,015 (40.6)	9,145 (40.8)	9,015 (40.6)	9,145 (40.8)	9,015 (40.6)	9,145 (40.8)	9,015 (40.6)
	10 1/2 (266.7)	Two 3/4"	9,940 (44.7)	9,015 (40.6)	11,905 (53.6)	9,015 (40.6)	13,390 (59.8)	9,015 (40.6)	13,390 (59.8)	9,015 (40.6)	13,390 (59.8)	9,015 (40.6)
	14 (355.6)	Two 7/8"	13,250 (59.6)	9,015 (40.6)	15,875 (71.4)	9,015 (40.6)	18,285 (81.6)	9,015 (40.6)	18,285 (81.6)	9,015 (40.6)	18,285 (81.6)	9,015 (40.6)
No.8 (1)	8 1/2 (215.9)	One 1"	9,165 (41.2)	13,285 (59.8)	11,270 (50.7)	13,285 (59.8)	12,315 (55.0)	13,285 (59.8)	12,315 (55.0)	13,285 (59.8)	12,315 (55.0)	13,285 (59.8)
	12 3/4 (323.9)	One 1" & One 3/4"	13,745 (61.9)	13,285 (59.8)	16,905 (76.1)	13,285 (59.8)	18,475 (82.5)	13,285 (59.8)	18,475 (82.5)	13,285 (59.8)	18,475 (82.5)	13,285 (59.8)
	17 (431.8)	Two 1"	18,325 (82.5)	13,285 (59.8)	22,540 (101.4)	13,285 (59.8)	24,630 (110.0)	13,285 (59.8)	24,630 (110.0)	13,285 (59.8)	24,630 (110.0)	13,285 (59.8)
No.9 (1 1/8)	9 (228.6)	One 1"	12,360 (55.6)	17,075 (76.8)	14,160 (63.7)	17,075 (76.8)	15,965 (71.8)	17,075 (76.8)	17,445 (78.5)	17,075 (76.8)	18,925 (85.2)	17,075 (76.8)
	13 1/2 (342.9)	One 1" & One 7/8"	18,540 (83.4)	17,075 (76.8)	21,240 (95.6)	17,075 (76.8)	23,945 (107.8)	17,075 (76.8)	26,165 (117.7)	17,075 (76.8)	27,990 (125)	17,075 (76.8)
	18 (457.2)	Two 1"	24,720 (111.2)	17,075 (76.8)	28,325 (127.5)	17,075 (76.8)	31,925 (143.7)	17,075 (76.8)	34,890 (157.0)	17,075 (76.8)	37,850 (170.3)	17,075 (76.8)
No.10 (1 1/4)	10 (254.0)	One 1 1/4"	14,250 (64.1)	20,865 (93.9)	16,185 (72.8)	20,865 (93.9)	18,120 (81.5)	20,865 (93.9)	20,610 (92.7)	20,865 (93.9)	21,040 (93.9)	20,865 (93.9)
	15 (381.0)	One 1 1/4" & One 7/8"	21,375 (96.2)	20,865 (93.9)	24,275 (109.2)	20,865 (93.9)	27,175 (122.3)	20,865 (93.9)	29,340 (132.0)	20,865 (93.9)	30,790 (137.5)	20,865 (93.9)
	20 (508.0)	Two 1 1/4"	28,500 (128.3)	20,865 (93.9)	32,370 (145.7)	20,865 (93.9)	36,235 (163.1)	20,865 (93.9)	37,120 (167.0)	20,865 (93.9)	38,000 (171.0)	20,865 (93.9)
No.11 (1 3/8)	10 (254.0)	One 1 1/4"	16,250 (73.1)	24,365 (109.6)	17,625 (79.3)	24,365 (109.6)	19,000 (85.5)	24,365 (109.6)	21,250 (95.6)	24,365 (109.6)	22,950 (102.5)	24,365 (109.6)
	15 (381.0)	One 1 1/4" & One 7/8"	23,000 (103.5)	24,365 (109.6)	25,750 (115.9)	24,365 (109.6)	28,500 (128.3)	24,365 (109.6)	29,750 (133.9)	24,365 (109.6)	31,000 (139.5)	24,365 (109.6)
	20 (508.0)	Two 1 1/4"	31,500 (141.8)	24,365 (109.6)	34,250 (154.1)	24,365 (109.6)	37,000 (166.5)	24,365 (109.6)	37,750 (169.9)	24,365 (109.6)	38,500 (173.3)	24,365 (109.6)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
 2. Linear interpolation may be used to determine allowable bond capacities for intermediate embedments and compressive strengths.
 3. Allowable design load should be the lesser of the allowable bond or allowable steel strength.

ADHESIVES

PERFORMANCE DATA
Ultimate Load Capacities for Internally Threaded Inserts Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete^{1,2}

Anchor Dia. <i>d</i> in. (mm)	Drill Bit Dia. <i>d_{bit}</i> in.	Min. Embed. Depth <i>h_v</i> in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (<i>f'_c</i>)									
				2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	5/8	3 1/2 (88.9)	One 3/8"	7,630 (34.3)	6,480 (29.2)	7,935 (35.7)	6,480 (29.2)	8,240 (37.1)	6,480 (29.2)	9,050 (40.7)	6,480 (29.2)	9,860 (44.4)	6,480 (29.2)
1/2 (12.7)	11/16	4 1/4 (108.0)	One 1/2"	9,670 (43.5)	11,120 (50.0)	10,985 (49.4)	11,120 (50.0)	12,300 (55.4)	11,120 (50.0)	13,585 (61.1)	11,120 (50.0)	14,870 (66.9)	11,120 (50.0)
5/8 (15.9)	1	5 (127.0)	One 5/8"	15,230 (68.5)	17,650 (79.4)	18,340 (82.5)	17,650 (79.4)	21,450 (96.5)	17,650 (79.4)	22,445 (101.0)	17,650 (79.4)	23,440 (105.5)	17,650 (79.4)
3/4 (19.1)	1 1/8	6 5/8 (168.3)	One 3/4"	23,420 (105.4)	27,385 (123.2)	25,920 (116.6)	27,385 (123.2)	28,420 (127.9)	27,385 (123.2)	32,130 (144.6)	27,385 (123.2)	35,840 (161.3)	27,385 (123.2)

1. Ultimate load capacities 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. Linear interpolation may be used to determine ultimate load capacities for intermediate compressive strengths.

Allowable Load Capacities for Internally Threaded Inserts Installed with Chem-Stud Capsules in Normal-Weight and Heavy-weight Concrete^{1,2,3}

Anchor Dia. <i>d</i> in. (mm)	Drill Bit Dia. <i>d_{bit}</i> in.	Min. Embed. Depth <i>h_v</i> in. (mm)	Capsules Required	Minimum Concrete Compressive Strength (<i>f'_c</i>)									
				2,000 psi (13.8 MPa)		3,000 psi (20.7 MPa)		4,000 psi (27.6 MPa)		5,000 psi (34.5 MPa)		6,000 psi (41.4 MPa)	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	5/8	3 1/2 (88.9)	One 3/8"	1,910 (8.6)	1,620 (7.3)	1,985 (8.9)	1,620 (7.3)	2,060 (9.3)	1,620 (7.3)	2,265 (10.2)	1,620 (7.3)	2,465 (11.1)	1,620 (7.3)
1/2 (12.7)	11/16	4 1/4 (108.0)	One 1/2"	2,420 (10.9)	2,780 (12.5)	2,745 (12.4)	2,780 (12.5)	3,075 (13.8)	2,780 (12.5)	3,395 (15.3)	2,780 (12.5)	3,720 (16.7)	2,780 (12.5)
5/8 (15.9)	1	5 (127.0)	One 5/8"	3,810 (17.1)	4,415 (19.9)	4,585 (20.6)	4,415 (19.9)	5,365 (24.1)	4,415 (19.9)	5,610 (25.2)	4,415 (19.9)	5,860 (26.4)	4,415 (19.9)
3/4 (19.1)	1 1/8	6 5/8 (168.3)	One 3/4"	5,855 (26.3)	6,845 (30.8)	6,480 (29.2)	6,845 (30.8)	7,105 (32.0)	6,845 (30.8)	8,035 (36.2)	6,845 (30.8)	8,960 (40.3)	6,845 (30.8)

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

2. Linear interpolation may be used to determine allowable bond capacities for intermediate compressive strengths.

3. Allowable design load should be the lesser of the allowable bond or allowable steel strength.

DESIGN CRITERIA

Ultimate and Allowable Load Capacities for Chem-Stud in Grout-filled Concrete Masonry^{1,2}

ANCHORS INSTALLED INTO TOPS OF GROUTED MASONRY WALLS ³									
Anchor Diameter <i>d</i> in. (mm)	Minimum Embedment Depth, <i>h_v</i> in. (mm)	Capsules Required	Minimum Edge Distance inches (mm)	Minimum End Distance inches (mm)	Minimum Masonry Compressive Strength, <i>f'_m</i> = 1,500 psi (10.4 MPa)				
					Tension		Shear		
					Ultimate Load lbs. (kN)	Allowable Load lbs. (kN)	Ultimate Load lbs. (kN)	Allowable Load lbs. (kN)	Direction of Loading
3/8 (9.5)	3-1/2 (88.9)	One 3/8"	1-3/4 (44)	4 (101)	2,830 (12.6)	565 (2.5)	1,155 (5.1)	230 (1.0)	Any
1/2 (12.7)	4-1/4 (108.0)	One 1/2"	1-3/4 (44)	4 (101)	3,515 (15.6)	700 (3.1)	1,155 (5.1)	230 (1.0)	Any
5/8 (15.9)	5 (127.0)	One 5/8"	1-3/4 (44)	4 (101)	5,165 (23.0)	1,035 (4.6)	1,155 (5.1)	230 (1.0)	Any
							2,015 (9.0)	400 (1.8)	∥ to Wall Edge
							2,070 (9.0)	415 (1.9)	⊥ to Wall Edge, To Opposite Edge
	10 (254.0)	Two 5/8"	1-3/4 (44)	11-1/4 (286)	10,035 (44.4)	2,005 (8.9)	1,155 (5.1)	230 (1.0)	Any
							2,015 (9.0)	400 (1.8)	∥ to Wall Edge
							2,070 (9.0)	415 (1.9)	⊥ to Wall Edge, To Opposite Edge
2-3/4 (70)	11-1/4 (286)	10,035 (44.4)	2,005 (8.9)	1,155 (5.1)	230 (1.0)	Any			
				4,950 (22.0)	990 (4.4)	∥ to Wall Edge			
3/4 (19.1)	6-5/8 (168.3)	One 3/4"	1-3/4 (44)	4 (101)	6,160 (27.4)	1,230 (5.5)	1,155 (5.1)	230 (1.0)	Any
							2,015 (9.0)	400 (1.8)	∥ to Wall Edge
							2,450 (10.9)	490 (2.2)	⊥ to Wall Edge, To Opposite Edge
	13-1/4 (336.6)	Two 3/4"	2-3/4 (70)	11-1/4 (286)	10,240 (45.6)	2,045 (9.1)	1,155 (5.1)	230 (1.0)	Any
							4,950 (22.0)	990 (4.4)	∥ to Wall Edge
7/8 (22.2)	7 (177.8)	One 7/8"	2-3/4 (70)	11-1/4 (286)	8,715 (38.8)	1,740 (7.7)	2,135 (9.5)	425 (1.9)	Any
1 (25.4)	8-1/4 (209.6)	One 1"	2-3/4 (70)	11-1/4 (286)	8,840 (39.3)	1,765 (7.9)	2,450 (10.9)	490 (2.2)	Any
1-1/4 (31.2)	10-1/4 (260.4)	One 1-1/4"	2-3/4 (70)	11-1/4 (286)	6,625 (29.5)	1,325 (5.9)	2,955 (13.1)	590 (2.6)	Any
			3-1/4 (83)	11-1/4 (286)	9,895 (44.0)	1,980 (8.8)			

ADHESIVES

1. Tabulated load capacities are for anchors installed in minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90 that are fully grouted and have reached a designated minimum compressive strength at the time of installation. Mortar must be Types N, S or M.
 2. The allowable loads are calculated using a safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
 3. Masonry members must have a minimum nominal width of 8 inches with the exception of 3/8" and 1/2" diameter anchors which may be installed in minimum nominal 6-inch width masonry members.

NOTE:
 ∥ Denotes Parallel
 ⊥ Denotes Perpendicular

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

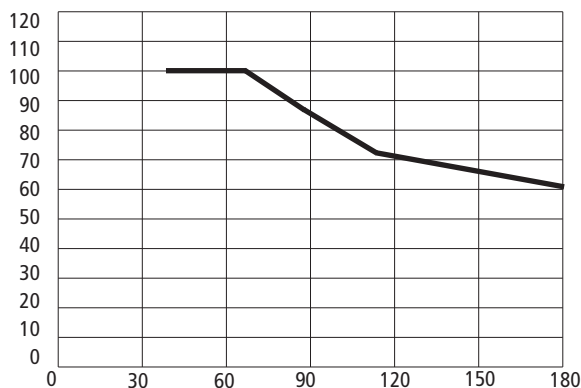
For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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

In-Service Temperature

Allowable tension and shear load bond strength reduction based on in-service temperature for the Chem-Stud capsule adhesive.



Temperature Conversion		
Degree Fahrenheit (°F)	Degree Celsius (°C)	Percent Allowable Load (%)
40	5	100
70	21	100
90	32	87
120	49	72
150	65	66
180	82	62

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete ¹					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 16d$	$F_{N_s} = F_{V_s} = 1.0$	$s_{min} = 8d$	$F_{N_s} = F_{V_s} = 0.65$
	Tension	$c_{cr} = 10d$	$F_{N_c} = 1.0$	$c_{min} = 4d$	$F_{N_c} = 0.65$
Edge Distance (c)	Shear ²	$c_{cr} = 12d$	$F_{V_c} = 1.0$	$c_{min} = 4d$	$F_{V_c} = 0.20$

1. Minimum anchor spacing distance (s_{min}) for tension in normal-weight concrete may be further reduced from 8 diameters (8d) to 4 diameters (4d) provided that the allowable load values in the table are reduced by an additional 15 percent. Linear interpolation is allowed for spacing distances between 8 diameters and 4 diameters.
 2. Minimum edge distance (c_{min}) for anchors loaded in shear parallel to the edge is equal to 4 anchor diameters (4d) at which the anchor achieves 60% of load.

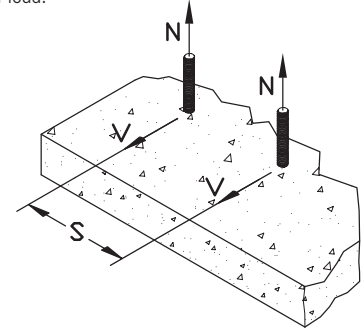
ADHESIVES

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

Spacing, Tension (F_{N_s}) & Shear (F_{V_s})										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
S_{cr} (in.)	4	6	8	10	12	14	16	20	22	24
S_{min} (in.)	2	3	4	5	6	7	8	10	11	12
Spacing, s (inches)	2	0.65								
	3	0.83	0.65							
	4	1.00	0.77	0.65						
	5		0.88	0.74	0.65					
	6		1.00	0.83	0.72	0.65				
	7			0.91	0.79	0.71	0.65			
	8			1.00	0.86	0.77	0.70	0.65		
	10				1.00	0.88	0.80	0.74	0.65	
	11					0.94	0.85	0.78	0.69	0.65
	12					1.00	0.90	0.83	0.72	0.68
	14						1.00	0.91	0.79	0.75
	16							1.00	0.86	0.81
	20								1.00	0.94
	22									1.00
	24									

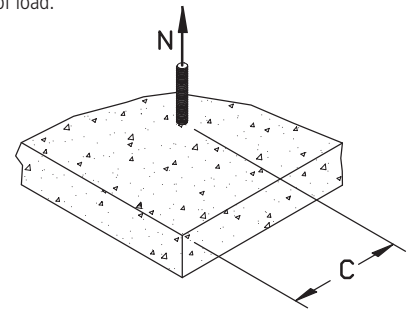
Notes: For anchors loaded in tension and shear, the critical spacing (S_{cr}) is equal to 16 anchor diameters ($16d$) at which the anchor achieves 100% of load. Minimum spacing (S_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 65% of load.



ADHESIVES

Edge Distance, (F_{N_c}) Tension										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
C_{cr} (in.)	2 1/2	3 3/4	5	6 1/4	7 1/2	8 3/4	10	12 1/2	13 3/4	15
C_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4	5	5 1/2	6
Edge Distance, c (inches)	1	0.65								
	1 1/2	0.77	0.65							
	2	0.88	0.73	0.65						
	2 1/2	1.00	0.81	0.71	0.65					
	3		0.88	0.77	0.70	0.65				
	3 1/2		0.96	0.83	0.74	0.69	0.65			
	3 3/4		1.00	0.85	0.77	0.71	0.67			
	4			0.88	0.79	0.73	0.68	0.65		
	5			1.00	0.88	0.81	0.75	0.71	0.65	
	5 1/2				0.93	0.84	0.78	0.74	0.67	0.65
	6				0.98	0.88	0.82	0.77	0.70	0.67
	6 1/4				1.00	0.90	0.83	0.78	0.71	0.68
	7 1/2					1.00	0.92	0.85	0.77	0.73
	8 3/4						1.00	0.93	0.83	0.79
	10							1.00	0.88	0.84
	12 1/2								1.00	0.95
	13 3/4									1.00
15										

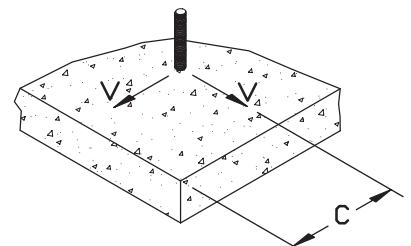
Notes: For anchors loaded in tension, the critical edge distance (C_{cr}) is equal to 10 anchor diameters ($10d$) at which the anchor achieves 100% of load. Minimum edge distance (C_{min}) is equal to 4 anchor diameters ($4d$) at which the anchor achieves 65% of load.



Edge Distance, Shear (F_{V_c})										
Dia. (in.)	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2
C_{cr} (in.)	3	4 1/2	6	7 1/2	9	10 1/2	12	15	16 1/2	18
C_{min} (in.)	1	1 1/2	2	2 1/2	3	3 1/2	4	5	5 1/2	6
Edge Distance, c (inches)	1	0.20								
	1 1/2	0.40	0.20							
	2	0.60	0.33	0.20						
	2 1/2	0.80	0.47	0.30	0.20					
	3	1.00	0.60	0.40	0.28	0.20				
	3 1/2		0.73	0.50	0.36	0.27	0.20			
	4		0.87	0.60	0.44	0.33	0.26	0.20		
	4 1/2		1.00	0.70	0.52	0.40	0.31	0.25		
	5			0.80	0.60	0.47	0.37	0.30	0.20	
	5 1/2			0.90	0.68	0.53	0.43	0.35	0.24	0.20
	6			1.00	0.76	0.60	0.49	0.40	0.28	0.24
	7 1/2				1.00	0.80	0.66	0.55	0.40	0.35
	9					1.00	0.83	0.70	0.52	0.45
	10 1/2						1.00	0.85	0.64	0.56
	12							1.00	0.76	0.67
	15								1.00	0.89
	16 1/2									1.00
	18									

Notes: For anchors loaded in shear, the critical edge distance (C_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load. Minimum edge distance (C_{min}) is equal to 4 anchor diameters ($4d$) at which the anchor achieves 20% of load.

Minimum edge distance (C_{min}) for anchors loaded in shear parallel to the edge is equal to 4 anchor diameters ($4d$) at which the anchor achieves 60% of load.



ORDERING INFORMATION

Chem-Stud Capsules

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
06502	3/8" Chem-Stud Capsule	10	500	4
06503	1/2" Chem-Stud Capsule	10	200	5
06504	5/8" Chem-Stud Capsule	10	200	9
06505	3/4" Chem-Stud Capsule	5	50	19
06506	7/8" Chem-Stud Capsule	5	50	20
06507	1" Chem-Stud Capsule	5	50	32
06508	1-1/4" Chem-Stud Capsule	5	25	84



**ASTM A307 Standard Carbon Steel, Chisel Pointed Threaded Rod
Zinc Plated (ASTM B633)**

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
06512	3/8" x 5-1/8"	10	50	12
06513	1/2" x 6-1/2"	10	50	28
06514	5/8" x 7-1/2"	10	40	51
06515	3/4" x 9-5/8"	10	40	96
06516	7/8" x 10-1/4"	-	10	140
06517	1" x 12"	-	10	213
06518	1-1/4" x 15"	-	5	433

Hex nut and washer included.



**ASTM A193 Grade B7 High Strength Carbon Steel, Chisel Pointed Threaded Rod
Zinc Plated (ASTM B633)**

Cat. No.	Description	Standard Box	Standard Carton	Wt./100
06523	1/2" x 6-1/2"	10	50	28
06524	5/8" x 7-1/2"	10	40	51

Hex nut and washer included.



Internally Threaded Inserts, Zinc Plated, Carbon Steel (Special Order)

Cat. No.	Description	O.D.	Min. Depth	Thread Depth	Std. Box	Std. Carton	Wt./100
06592	3/8" x 3-1/2"	0.55"	3 1/2"	1 1/2"	10	40	20
06593	1/2" x 4-1/4"	0.65"	4 1/4"	1 5/8"	10	40	44
06594	5/8" x 5"	0.90"	5"	2 3/8"	10	40	68
06595	3/4" x 6-5/8"	1.00"	6 5/8"	2 3/4"	10	40	125



ADHESIVES

ORDERING INFORMATION

Chisel Pointed Anchor Rod Installation Tools

Rod Couplers

Cat. No.	Description	Standard Box	Standard Carton
06562	3/8" Coupler	1	10
06563	1/2" Coupler	1	10
06564	5/8" Coupler	1	10
06565	3/4" Coupler	1	5
06566	7/8" Coupler	1	5
06567	1" Coupler	1	5
06568	1-1/4" Coupler	1	5



Drivers for Threaded Rod Couplers – Hex

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
06570	1/4"	3/8" to 5/8"	1	10
06572	3/8"	3/4" to 1-1/4"	1	10



Drivers for Threaded Rod Couplers – SDS Plus

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
06574	1/4"	3/8" to 5/8"	1	10
06576	3/8"	3/4" to 1-1/4"	1	10



Drivers for Threaded Rod Couplers – Spline

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
06580	1/4"	3/8" to 5/8"	1	10
06582	3/8"	3/4" to 1-1/4"	1	10



Drivers for Threaded Rod Couplers – SDS Max

Cat. No.	Hex Size	Fits Coupler Size	Standard Box	Standard Carton
06559	1/4"	3/8" to 5/8"	1	10
06561	3/8"	3/4" to 1-1/4"	1	10



Reinforcing Bar Installation Tools

Cat. No.	Description	Standard Box	Standard Carton
06533	#3 Coupler	1	10
06534	#4 Coupler	1	10
06535	#5 Coupler	1	10
06536	#6 Coupler	1	10
06537	#7 Coupler	1	10
06538	#8 Coupler	1	10
06539	#9 Coupler	1	10
06540	#10 Coupler	1	10
06590	Spline Driver Extension	1	1
06596	SDS-Max Driver Extension	1	1



Internally Threaded Insert Tools*

Cat. No.	Description	Standard Box	Standard Carton
06862	3/8"	1	1
06863	1/2"	1	1
06864	5/8"	1	1
06865	3/4"	1	1



*Use with drivers for threaded rod.

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