Hammer-Capsule® *Drive-In Capsule Adhesive*

PRODUCT DESCRIPTION

The Hammer-Capsule system consists of a self contained, single use, two-part glass capsule into which threaded anchor rod or reinforcing bars can be directly driven without the need for a chisel point or spinning action. It is designed for use in the installation of 3/8" through 1" diameter threaded rod in solid concrete and masonry materials. It can also be used to install reinforcing bars.

A mixture of hardener and quartz aggregate is contained in the upper portion of the capsule while the lower portion contains an epoxy acrylate resin. Unlike traditional capsule anchors which required the use of chisel-pointed anchor rod and special installation tools, the Hammer-Capsule is designed for use with straight cut anchor rod.

GENERAL APPLICATIONS AND USES

- Anchoring rebar (doweling), and threaded anchor rods in solid concrete and grouted concrete masonry
- Steel erection including anchoring of equipment and column base plates
- Resists vibratory loads introduced from machinery, moving vehicles, etc
- Barriers, fencing and railing attachments

FEATURES AND BENEFITS

- Fast, easy installation - no special tools required for setting
- Suitable for diamond cored holes
- Excellent chemical resistance
- Components are mixed during installation of rod or rebar
- Pre-measured chemical component volumes – no waste
- Ideal for small projects
- Independently tested to ASTM E1512 and AC58 Criteria

APPROVALS AND LISTINGS

Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

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

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Hammer-Capsule

Straight Cut Threaded Rod
(Supplied by Powers Fasteners or equivalent by installer)

ANCHOR SIZE RANGE (TYP.)

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

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Grouted Concrete Masonry

MATERIAL SPECIFICATIONS

Physical Properties

Shelf Life	2 Years
Storage Conditions	Store dry at 40° to 90°F and out of direct sunlight
Installation Temperature	Condition capsules to 60°F minimum for best results
Color	Mixed adhesive mortar – amber
Consistency	Paste mortar

Setting Times

Minimum Base Material Temperature	Minimum Curing Time
68°F (20°C)	1 hour
50°F (10°C)	2 hours
32°F (0°C)	5 hours
23°F (-5°C)	10 hours
14°F (-10°C)	24 hours

Cure time should be doubled for wet concrete.

INSTALLATION SPECIFICATIONS

Hammer-Capsule[1,2]

Dimension	Hammer-Capsule, Nominal Size					
	3/8"	1/2"	5/8"	3/4"	7/8"	1"
Capsule Diameter (in.)	0.43	0.51	0.67	0.78	0.87	0.95
Capsule Length (in.)	3.50	4.30	5.00	5.50	6.89	8.25
Mortar Volume (in^3)	0.40	0.70	1.40	2.05	3.25	4.50
Mortar Volume (fl. oz.)	0.22	0.39	0.77	1.13	1.79	2.48

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

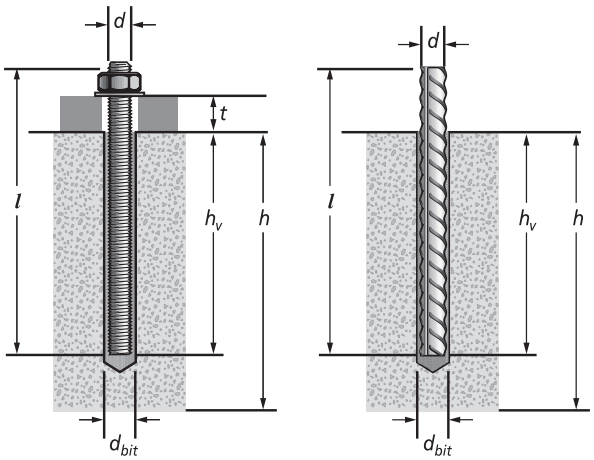
Threaded Rod in Normal-Weight Concrete

Dimension	Hammer-Capsule, Nominal Size					
	3/8"	1/2"	5/8"	3/4"	7/8"	1"
A_{nom} = Nominal area of threaded rod (in^2)	0.111	0.196	0.307	0.442	0.601	0.785
A_{se} = Tensile stress area of rod (in^2)	0.078	0.142	0.226	0.335	0.462	0.606
d_{bit} = Nominal bit diameter (in.)	7/16	9/16	11/16	7/8	1	1 1/8
h_v = Minimum Embedment Depth (in.)	3 1/2	4 1/4	5	6 5/8	7	8 1/4
T_{max} = Max. tightening torque range (ft.-lbs.)	7.5-10	11-15	26-35	56-75	75-100	112-150
Mortar per inch (in^3)	0.094	0.133	0.184	0.326	0.390	0.478

Reinforcing Bar in Normal-Weight Concrete[1]

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

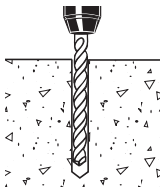
1. Adhesive mortar volumes for reinforcing bar are based on smooth bars. Actual mortar volume required will be less due to raised deformations on bars.



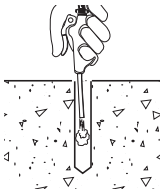
Nomenclature

- d = Diameter of anchor
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- d_w = Diameter of washer
- h = Base material thickness. The minimum value of h should be $1.5h_v$
- h_v = Minimum embedment depth
- l = Overall length of anchor
- t = Fixture thickness
- T_{max} = Maximum tightening torque

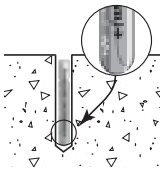
Installation Guidelines



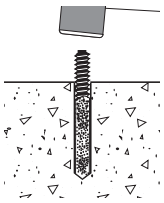
Drill a hole using a carbide tipped bit meeting the diameter requirements of ANSI B212.15 to the minimum depth required as shown in the chart.



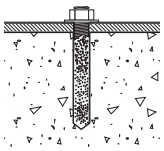
Starting from the bottom or back of the anchor hole, blow clean with compressed air, brush the hole with a nylon brush, and blow it clean again. Anchor holes may be dry or damp, but should be free of standing water or frost. Vacuuming only is not sufficient. Blow out bulbs generally do not provide enough dust removal for most drilled anchor holes. Holes should be clean and sound.



Prior to installation 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. Be careful to observe the direction of insertion. The arrow on the capsule should point toward the bottom of the hole.



Drive the threaded rod or reinforcing bar into the anchor hole through the capsule until it is fully embedded. A 2-pound hammer and eye protection are recommended. A rotary hammer set in the hammering only mode and Chem-Stud drive adapters can also be used. Stop driving immediately upon reaching the bottom of the anchor hole.



Allow the Hammer-Capsule to cure for specified time before loading anchor. Do not disturb the rod once the material has begun to set.

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	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 616, A 617, A 706 or A 767	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 lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)	ASTM A36 lbs. (kN)	ASTM A307 Grade C lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
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)

Steel strength capacities are based on the design criteria listed in the *AISC Manual of Steel Construction*.

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)

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:

$T = f_s * A_{br}$

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

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 (in^2).
A_{br} = Nominal cross-sectional area of reinforcing bar (in^2).

PERFORMANCE DATA

Ultimate Load Capacities for Threaded Rod Installed with Hammer-Capsule in Normal-Weight Concrete[1,2]

Anchor Dia. *d* in. (mm)	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)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	4,920 (22.1)	4,440 (20.0)	5,880 (26.5)	4,440 (20.0)	6,120 (27.5)	4,440 (20.0)	7,175 (32.3)	4,440 (20.0)	8,210 (36.9)	4,440 (20.0)
	7 (177.8)	Two 3/8"	9,840 (44.3)	4,440 (20.0)	11,760 (52.9)	4,440 (20.0)	12,240 (55.1)	4,440 (20.0)	14,350 (64.6)	4,440 (20.0)	16,420 (73.9)	4,440 (20.0)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	8,235 (37.1)	10,720 (48.2)	10,355 (46.6)	10,720 (48.2)	11,480 (51.7)	10,720 (48.2)	12,840 (57.8)	10,720 (48.2)	14,200 (63.9)	10,720 (48.2)
	8 1/2 (215.9)	Two 1/2"	16,470 (74.1)	10,720 (48.2)	20,670 (93.0)	10,720 (48.2)	22,960 (103.3)	10,720 (48.2)	25,680 (115.6)	10,720 (48.2)	28,400 (127.8)	10,720 (48.2)
5/8 (15.9)	5 (127.0)	One 5/8"	10,160 (45.7)	17,160 (77.2)	13,080 (58.9)	17,160 (77.2)	15,160 (68.2)	17,160 (77.2)	17,410 (78.3)	17,160 (77.2)	19,660 (88.5)	17,160 (77.2)
	10 (254.0)	Two 5/8"	20,320 (91.4)	17,160 (77.2)	26,160 (117.7)	17,160 (77.2)	30,320 (136.4)	17,160 (77.2)	34,820 (156.7)	17,160 (77.2)	39,320 (176.9)	17,160 (77.2)
3/4 (19.1)	6 (152.4)	One 3/4"	13,080 (58.9)	24,990 (112.5)	17,125 (77.1)	24,990 (112.5)	17,990 (81.0)	24,990 (112.5)	19,190 (86.4)	24,990 (112.5)	20,390 (91.8)	24,990 (112.5)
	12 (304.8)	Two 3/4"	26,160 (117.7)	24,990 (112.5)	34,250 (154.1)	24,990 (112.5)	35,980 (161.9)	24,990 (112.5)	38,380 (172.7)	24,990 (112.5)	40,780 (183.5)	24,990 (112.5)
7/8 (22.2)	7 (177.8)	One 7/8"	16,265 (73.2)	35,600 (160.2)	21,065 (94.8)	35,600 (160.2)	24,640 (110.9)	35,600 (160.2)	28,425 (127.9)	35,600 (160.2)	32,210 (144.9)	35,600 (160.2)
	14 (355.6)	Two 7/8"	32,530 (146.4)	35,600 (160.2)	42,130 (189.6)	35,600 (160.2)	49,280 (221.8)	35,600 (160.2)	56,850 (255.8)	35,600 (160.2)	64,420 (289.9)	35,600 (160.2)
1 (25.4)	8 1/4 (209.6)	One 1"	28,720 (129.2)	46,840 (210.8)	32,265 (145.2)	46,840 (210.8)	32,495 (146.2)	46,840 (210.8)	35,205 (158.4)	46,840 (210.8)	37,920 (170.6)	46,840 (210.8)
	16 1/2 (419.1)	Two 1"	57,440 (258.5)	46,840 (210.8)	64,530 (290.4)	46,840 (210.8)	64,990 (292.5)	46,840 (210.8)	70,410 (316.8)	46,840 (210.8)	75,840 (341.3)	46,840 (210.8)

1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

Allowable Load Capacities for Threaded Rod Installed with Hammer-Capsule in Normal-Weight Concrete[1,2,3,4]

Anchor Dia. *d* in. (mm)	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)
3/8 (9.5)	3 1/2 (88.9)	One 3/8"	1,230 (5.5)	1,110 (5.0)	1,470 (6.6)	1,110 (5.0)	1,530 (6.9)	1,110 (5.0)	1,795 (8.1)	1,110 (5.0)	2,055 (9.2)	1,110 (5.0)
	7 (177.8)	Two 3/8"	2,460 (11.1)	1,110 (5.0)	2,940 (13.2)	1,110 (5.0)	3,060 (13.8)	1,110 (5.0)	3,590 (16.2)	1,110 (5.0)	4,105 (18.5)	1,110 (5.0)
1/2 (12.7)	4 1/4 (108.0)	One 1/2"	2,060 (9.3)	2,680 (12.1)	2,590 (11.7)	2,680 (12.1)	2,870 (12.9)	2,680 (12.1)	3,210 (14.4)	2,680 (12.1)	3,550 (16.0)	2,680 (12.1)
	8 1/2 (215.9)	Two 1/2"	4,120 (18.5)	2,680 (12.1)	5,170 (23.3)	2,680 (12.1)	5,740 (25.8)	2,680 (12.1)	6,420 (28.9)	2,680 (12.1)	7,100 (32.0)	2,680 (12.1)
5/8 (15.9)	5 (127.0)	One 5/8"	2,540 (11.4)	4,290 (19.3)	3,270 (14.7)	4,290 (19.3)	3,790 (17.1)	4,290 (19.3)	4,355 (19.6)	4,290 (19.3)	4,915 (22.1)	4,290 (19.3)
	10 (254.0)	Two 5/8"	5,080 (22.9)	4,290 (19.3)	6,540 (29.4)	4,290 (19.3)	7,580 (34.1)	4,290 (19.3)	8,705 (39.2)	4,290 (19.3)	9,830 (44.2)	4,290 (19.3)
3/4 (19.1)	6 (152.4)	One 3/4"	3,270 (14.7)	6,250 (28.1)	4,280 (19.3)	6,250 (28.1)	4,500 (20.3)	6,250 (28.1)	4,800 (21.6)	6,250 (28.1)	5,100 (23.0)	6,250 (28.1)
	12 (304.8)	Two 3/4"	6,540 (29.4)	6,250 (28.1)	8,565 (38.5)	6,250 (28.1)	8,995 (40.5)	6,250 (28.1)	9,595 (43.2)	6,250 (28.1)	10,195 (45.9)	6,250 (28.1)
7/8 (22.2)	7 (177.8)	One 7/8"	4,065 (18.3)	8,900 (40.1)	5,265 (23.7)	8,900 (40.1)	6,160 (27.7)	8,900 (40.1)	7,105 (32.0)	8,900 (40.1)	8,055 (36.2)	8,900 (40.1)
	14 (355.6)	Two 7/8"	8,135 (36.6)	8,900 (40.1)	10,535 (47.4)	8,900 (40.1)	12,320 (55.4)	8,900 (40.1)	14,215 (64.0)	8,900 (40.1)	16,105 (72.5)	8,900 (40.1)
1 (25.4)	8 1/4 (209.6)	One 1"	7,180 (32.3)	11,710 (52.7)	8,065 (36.3)	11,710 (52.7)	8,125 (36.6)	11,710 (52.7)	8,800 (39.6)	11,710 (52.7)	9,480 (42.7)	11,710 (52.7)
	16 1/2 (419.1)	Two 1"	14,360 (64.6)	11,710 (52.7)	16,135 (72.6)	11,710 (52.7)	16,250 (73.1)	11,710 (52.7)	17,605 (79.2)	11,710 (52.7)	18,960 (85.3)	11,710 (52.7)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
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 bond or allowable steel strength.
4. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA

Ultimate Load Capacities for Reinforcing Bar Installed with Hammer-Capsule in Normal-Weight Concrete[1,2]

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) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	7,840 (35.3)	6,600 (29.7)	10,520 (47.3)	6,600 (29.7)	13,200 (59.4)	6,600 (29.7)	13,200 (59.4)	6,600 (29.7)	13,200 (59.4)	6,600 (29.7)
	7 (177.8)	Two 3/8"	15,680 (70.6)	6,600 (29.7)	21,040 (94.7)	6,600 (29.7)	26,400 (118.8)	6,600 (29.7)	26,400 (118.8)	6,600 (29.7)	26,400 (118.8)	6,600 (29.7)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	12,720 (57.2)	12,000 (54.0)	14,125 (63.6)	12,000 (54.0)	15,190 (68.4)	12,000 (54.0)	15,190 (68.4)	12,000 (54.0)	15,190 (68.4)	12,000 (54.0)
	9 (228.6)	Two 1/2"	25,440 (114.5)	12,000 (54.0)	28,250 (127.1)	12,000 (54.0)	30,380 (136.7)	12,000 (54.0)	30,380 (136.7)	12,000 (54.0)	30,380 (136.7)	12,000 (54.0)
No.5 (5/8)	5 (127.0)	One 5/8"	16,160 (72.7)	18,600 (83.7)	18,280 (82.3)	18,600 (83.7)	20,280 (91.3)	18,600 (83.7)	21,840 (98.3)	18,600 (83.7)	23,400 (105.3)	18,600 (83.7)
	10 (254.0)	Two 5/8"	32,320 (145.4)	18,600 (83.7)	36,560 (164.5)	18,600 (83.7)	40,560 (182.5)	18,600 (83.7)	43,680 (196.6)	18,600 (83.7)	46,800 (210.6)	18,600 (83.7)
No.6 (3/4)	7 (177.8)	One 3/4"	18,840 (84.8)	26,400 (118.8)	20,480 (92.2)	26,400 (118.8)	21,220 (95.5)	26,400 (118.8)	28,600 (128.7)	26,400 (118.8)	34,330 (154.5)	26,400 (118.8)
	14 (355.6)	Two 3/4"	37,680 (169.6)	26,400 (118.8)	40,960 (184.3)	26,400 (118.8)	42,440 (191.0)	26,400 (118.8)	57,200 (257.4)	26,400 (118.8)	68,660 (309.0)	26,400 (118.8)
No.7 (7/8)	7 (177.8)	One 7/8"	21,200 (95.4)	36,000 (162.0)	22,660 (102.0)	36,000 (162.0)	25,730 (115.8)	36,000 (162.0)	34,920 (157.1)	36,000 (162.0)	38,400 (172.8)	36,000 (162.0)
	14 (355.6)	Two 7/8"	42,400 (190.8)	36,000 (162.0)	45,320 (203.9)	36,000 (162.0)	51,460 (231.6)	36,000 (162.0)	69,840 (314.3)	36,000 (162.0)	76,800 (345.6)	36,000 (162.0)
No.8 (1)	8 1/2 (215.9)	One 1"	22,520 (101.3)	47,400 (213.3)	26,290 (118.3)	47,400 (213.3)	35,070 (157.8)	47,400 (213.3)	38,905 (175.1)	47,400 (213.3)	47,600 (214.2)	47,400 (213.3)
	17 (431.8)	Two 1"	45,040 (202.7)	47,400 (213.3)	52,580 (236.6)	47,400 (213.3)	70,140 (315.6)	47,400 (213.3)	77,810 (350.1)	47,400 (213.3)	95,200 (428.4)	47,400 (213.3)

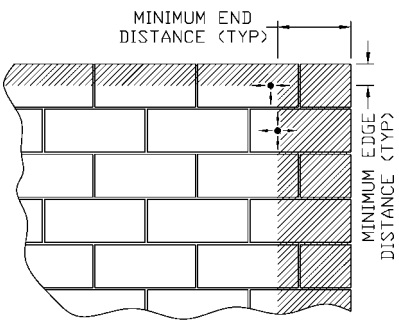
1. Ultimate load capacities should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate load capacities for intermediate embedments and compressive strengths.

Allowable Load Capacities for Reinforcing Bar Installed with Hammer-Capsule in Normal-Weight Concrete[1,2,3,4]

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) Tension lbs. (kN)	2,000 psi Shear lbs. (kN)	3,000 psi (20.7 MPa) Tension lbs. (kN)	3,000 psi Shear lbs. (kN)	4,000 psi (27.6 MPa) Tension lbs. (kN)	4,000 psi Shear lbs. (kN)	5,000 psi (34.5 MPa) Tension lbs. (kN)	5,000 psi Shear lbs. (kN)	6,000 psi (41.4 MPa) Tension lbs. (kN)	6,000 psi Shear lbs. (kN)
No.3 (3/8)	3 1/2 (88.9)	One 3/8"	1,960 (8.8)	1,650 (7.4)	2,630 (11.8)	1,650 (7.4)	3,300 (14.9)	1,650 (7.4)	3,300 (14.9)	1,650 (7.4)	3,300 (14.9)	1,650 (7.4)
	7 (177.8)	Two 3/8"	3,920 (17.6)	1,650 (7.4)	5,260 (23.7)	1,650 (7.4)	6,600 (29.7)	1,650 (7.4)	6,600 (29.7)	1,650 (7.4)	6,600 (29.7)	1,650 (7.4)
No.4 (1/2)	4 1/2 (114.3)	One 1/2"	3,180 (14.3)	3,000 (13.5)	3,530 (15.9)	3,000 (13.5)	3,800 (17.1)	3,000 (13.5)	3,800 (17.1)	3,000 (13.5)	3,800 (17.1)	3,000 (13.5)
	9 (228.6)	Two 1/2"	6,360 (28.6)	3,000 (13.5)	7,065 (31.8)	3,000 (13.5)	7,595 (34.2)	3,000 (13.5)	7,595 (34.2)	3,000 (13.5)	7,595 (34.2)	3,000 (13.5)
No.5 (5/8)	5 (127.0)	One 5/8"	4,040 (18.2)	4,650 (20.9)	4,570 (20.6)	4,650 (20.9)	5,070 (22.8)	4,650 (20.9)	5,460 (24.6)	4,650 (20.9)	5,850 (26.3)	4,650 (20.9)
	10 (254.0)	Two 5/8"	8,080 (36.4)	4,650 (20.9)	9,140 (41.1)	4,650 (20.9)	10,140 (45.6)	4,650 (20.9)	10,920 (49.1)	4,650 (20.9)	11,700 (52.7)	4,650 (20.9)
No.6 (3/4)	7 (177.8)	One 3/4"	4,710 (21.2)	6,600 (29.7)	5,120 (23.0)	6,600 (29.7)	5,305 (23.9)	6,600 (29.7)	7,150 (32.2)	6,600 (29.7)	8,585 (38.6)	6,600 (29.7)
	14 (355.6)	Two 3/4"	9,420 (42.4)	6,600 (29.7)	10,240 (46.1)	6,600 (29.7)	10,610 (47.7)	6,600 (29.7)	14,300 (64.4)	6,600 (29.7)	17,165 (77.2)	6,600 (29.7)
No.7 (7/8)	7 (177.8)	One 7/8"	5,300 (23.9)	9,000 (40.5)	5,665 (25.5)	9,000 (40.5)	6,435 (29.0)	9,000 (40.5)	8,730 (39.3)	9,000 (40.5)	9,600 (43.2)	9,000 (40.5)
	14 (355.6)	Two 7/8"	10,600 (47.7)	9,000 (40.5)	11,330 (51.0)	9,000 (40.5)	12,865 (57.9)	9,000 (40.5)	17,460 (78.6)	9,000 (40.5)	19,200 (86.4)	9,000 (40.5)
No.8 (1)	8 1/2 (215.9)	One 1"	5,630 (25.3)	11,850 (53.3)	6,575 (29.6)	11,850 (53.3)	8,770 (39.5)	11,850 (53.3)	9,725 (43.8)	11,850 (53.3)	11,900 (53.6)	11,850 (53.3)
	17 (431.8)	Two 1"	11,260 (50.7)	11,850 (53.3)	13,145 (59.2)	11,850 (53.3)	17,535 (78.9)	11,850 (53.3)	19,455 (87.5)	11,850 (53.3)	23,800 (107.1)	11,850 (53.3)

1. Allowable bond capacities are calculated using an applied safety factor of 4.0.
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 bond or allowable steel strength.
4. Critical and minimum spacing and edge distances as well as reduction factors for intermediate spacing and edge distances are listed in the Design Criteria section.

PERFORMANCE DATA



Allowable Load Capacities for Threaded Rod Installed with Hammer-Capsule in Grout-Filled Concrete Masonry[1,2,3,4]

Anchor Installed Through Face Shell						
Anchor Diameter d in. (mm)	Drill Bit Diameter d_{bit} in.	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)
3/8 (9.5)	7/16	3 1/2 (88.9)	4 (101.6)	12 (304.8)	1,063 (4.8)	1,125 (5.1)
1/2 (12.7)	9/16	4 1/4 (108.0)	6 (152.4)	12 (304.8)	1,988 (8.9)	1,614 (7.3)
5/8 (15.9)	11/16	5 (127.0)	8 (203.2)	12 (304.8)	2,655 (11.9)	2,365 (10.6)
3/4 (19.1)	7/8	6 (152.4)	12 (304.8)	12 (304.8)	2,865 (12.9)	2,960 (13.3)

1. Tabulated load values are for anchors installed in minimum Grade N, Type II, lightweight, medium-weight and normal-weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation ($f'm \geq 1{,}500$ psi).
2. Allowable design load should be the lesser of the bond or allowable steel strength.
3. The critical spacing is 16 diameters for full capacity. The minimum spacing is 8 diameters for 50 percent reduction in load. Linear interpolation may be used to determine reduction factors for intermediate spacing distances.
4. Allowable bond capacities are calculated using an applied safety factor of 5.0.

DESIGN CRITERIA

Combined Loading

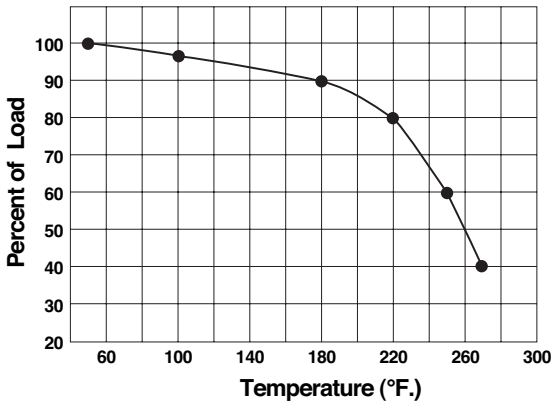
For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

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

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 Hammer-Capsule adhesive.



Temperature Conversion		
Degree Fahrenheit (°F)	Degree Celsius (°C)	Percent Allowable Load (%)
50	10	100
100	38	97
180	82	90
220	104	80
250	121	60
270	132	40

Load Adjustment Factors for Spacing and Edge Distances

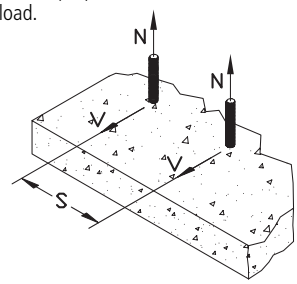
Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 8d$	$F_N = F_V = 1.0$	$s_{min} = 4d$	$F_N = F_V = 0.70$
Edge Distance (c)	Tension	$c_{cr} = 8d$	$F_N = 1.0$	$c_{min} = 4d$	$F_N = 0.60$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 4d$	$F_V = 0.50$

DESIGN CRITERIA

Load Adjustment Factors for Threaded Rod in Normal-Weight Concrete

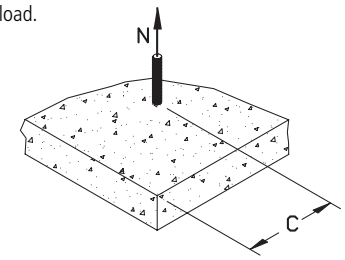
Spacing, Tension (F_N) & Shear (F_V)								
Dia. (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1
s_{cr} (in.)		2	3	4	5	6	7	8
s_{min} (in.)		1	1 1/2	2	2 1/2	3	3 1/2	4
Spacing, s (inches)	1	0.70						
	1 1/2	0.85	0.70					
	2	1.00	0.80	0.70				
	2 1/2		0.90	0.78	0.70			
	3		1.00	0.85	0.76	0.70		
	3 1/2			0.93	0.82	0.75	0.70	
	4			1.00	0.88	0.80	0.74	0.70
	5				1.00	0.90	0.83	0.78
	5 1/2					0.95	0.87	0.81
	6					1.00	0.91	0.85
	7						1.00	0.93
	8							1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 8 anchor diameters (8d) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 70% of load.



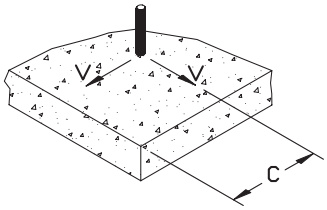
Edge Distance, Tension (F_N)								
Dia. (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)		2	3	4	5	6	7	8
c_{min} (in.)		1	1 1/2	2	2 1/2	3	3 1/2	4
Edge Distance, c (inches)	1	0.60						
	1 1/2	0.80	0.60					
	2	1.00	0.73	0.60				
	2 1/2		0.87	0.70	0.60			
	3		1.00	0.80	0.68	0.60		
	3 1/2			0.90	0.76	0.67	0.60	
	4			1.00	0.84	0.73	0.66	0.60
	5				1.00	0.87	0.77	0.70
	6					1.00	0.89	0.80
	7						1.00	0.90
	8							1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 8 anchor diameters (8d) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 60% of load.



Edge Distance, Shear (F_V)								
Dia. (in.)		1/4	3/8	1/2	5/8	3/4	7/8	1
c_{cr} (in.)		3	4 1/2	6	7 1/2	9	10 1/2	12
c_{min} (in.)		1	1 1/2	2	2 1/2	3	3 1/2	4
Edge Distance, c (inches)	1 1/2	0.63	0.50					
	2	0.75	0.58	0.50				
	2 1/2	0.88	0.67	0.56	0.50			
	3	1.00	0.75	0.63	0.55	0.50		
	3 1/2		0.83	0.69	0.60	0.54	0.50	
	4		0.92	0.75	0.65	0.58	0.54	0.50
	4 1/2		1.00	0.81	0.70	0.63	0.57	0.53
	5			0.88	0.75	0.67	0.61	0.56
	5 1/2			0.94	0.80	0.71	0.64	0.59
	6			1.00	0.85	0.75	0.68	0.63
	7 1/2				1.00	0.88	0.79	0.72
	9					1.00	0.89	0.81
	10 1/2						1.00	0.91
	12							1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 4 anchor diameters (4d) at which the anchor achieves 50% of load.



ORDERING INFORMATION

Hammer-Capsule

Cat. No.	Description	Standard Box	Std. Carton	Wt./100
6702	3/8" Hammer-Capsule	10	500	4
6703	1/2" Hammer-Capsule	10	200	5
6704	5/8" Hammer-Capsule	10	200	9
6705	3/4" Hammer-Capsule	5	50	19
6706	7/8" Hammer-Capsule	5	50	20
6707	1" Hammer-Capsule	5	50	32

For installation and hardware accessories, including straight cut threaded rod, please reference the Adhesive Anchoring Accessories product section.

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