

C6+ Adhesive Anchor - Technical Data

PERFORMANCE TABLE

C6+ Epoxy Adhesive

Allowable Tension Loads^{1,2,3} for Threaded Rod Installed in Solid Concrete

THREADED ROD DIA. In. (mm)	EMBEDMENT DEPTH In. (mm)	ALLOWABLE TENSION LOAD BASED ON ADHESIVE BOND STRENGTH			ALLOWABLE TENSION LOAD BASED ON STEEL STRENGTH		
		2000 PSI (13.8 MPa) CONCRETE Lbs. (kN)	4000 PSI (27.6 MPa) CONCRETE Lbs. (kN)	6000 PSI (41.4 MPa) IN CONCRETE Lbs. (kN)	ASTM A307 (SAE 1018) Lbs. (kN)	ASTM A193 GR. B7 (SAE 4140) Lbs. (kN)	ASTM F593 AISI 304 SS Lbs. (kN)
3/8 (9.5)	3-3/8 (85.7)	1,800 (8.0)	2,110 (9.4)	2,655 (11.8)	2,080 (9.3)	4,340 (19.3)	3,995 (17.8)
	4-1/2 (114.3)	2,080 (9.2)	2,505 (11.1)	2,655 (11.8)	2,080 (9.3)	4,340 (19.3)	3,995 (17.8)
1/2 (12.7)	4-1/2 (114.3)	3,315 (14.8)	4,420 (19.7)	4,420 (19.7)	3,730 (16.6)	7,780 (34.6)	7,155 (31.8)
	6 (152.4)	4,780 (21.3)	4,900 (21.8)	4,900 (21.8)	3,730 (16.6)	7,780 (34.6)	7,155 (31.8)
5/8 (15.9)	5-5/8 (142.9)	4,425 (19.7)	6,130 (27.3)	6,130 (27.3)	5,870 (26.1)	12,230 (54.4)	11,250 (50.0)
	7-1/2 (190.5)	5,660 (25.2)	7,190 (32.0)	7,364 (32.8)	5,870 (26.1)	12,230 (54.4)	11,250 (50.0)
3/4 (19.1)	6-3/4 (171.5)	7,195 (32.0)	7,885 (35.1)	8,440 (37.5)	8,490 (37.8)	17,690 (78.7)	14,860 (66.1)
	9 (228.6)	7,940 (35.3)	10,345 (46.0)	10,345 (46.0)	8,490 (37.8)	17,690 (78.7)	14,860 (66.1)
7/8 (22.2)	7-7/8 (200.0)	8,810 (39.2)	9,430 (41.9)	10,260 (45.6)	11,600 (51.6)	25,510 (113.5)	20,835 (92.7)
	10-1/2 (266.7)	N/A	12,080 (57.0)	12,805 (57.0)	11,600 (51.6)	25,510 (113.5)	20,835 (92.7)
1 (25.4)	9 (228.6)	10,085 (44.9)	11,970 (53.3)	11,970 (53.0)	15,180 (67.5)	31,620 (140.7)	26,560 (118.1)
	12 (304.8)	12,180 (54.2)	15,545 (69.2)	15,760 (70.1)	15,180 (67.5)	31,620 (140.7)	26,560 (118.1)
1-1/4 (31.8)	11-1/4 (285.8)	13,915 (61.9)	14,245 (63.4)	14,245 (63.4)	23,800 (105.9)	49,580 (220.6)	34,670 (154.2)
	15 (381.0)	16,340 (72.7)	19,930 (88.7)	19,930 (88.7)	23,800 (105.9)	49,580 (220.6)	34,670 (154.2)

1 Use lower value of either bond or steel strength for allowable tensile load.

2 Allowable loads taken from ICC Evaluation Report #4285 (formerly ICBO).

3 Linear interpolation may be used for intermediate spacing and edge distances (see below).

PERFORMANCE TABLE

C6+ Epoxy Adhesive

Average Ultimate Tension and Shear Loads^{1,2,3} for Threaded Rod Installed in Grout Filled Concrete Block

THREADED ROD DIA.	DRILL HOLE DIAMETER In. (mm)	EMBEDMENT DEPTH In. (mm)	ANCHOR LOCATION In. (mm)	ULTIMATE TENSION Lbs. (kN)	ULTIMATE SHEAR Lbs. (kN)
3/8 (9.5)	7/16 (11.1)	3 (76.2)	GROUTED CELL	4,862 (21.6)	N/A
1/2 (12.7)	5/8 (15.9)	3 (76.2)	GROUTED CELL	4,953 (22.0)	N/A
1/2 (12.7)	5/8 (15.9)	6 (152.4)	GROUTED CELL	8,214 (36.5)	N/A
5/8 (15.9)	3/4 (19.1)	5 (127.0)	GROUTED CELL	7,355 (32.7)	N/A
3/4 (19.1)	7/8 (22.2)	6 (152.4)	Note 1	17,404 (77.4)	19,588 (87.1)
3/4 (19.1)	7/8 (22.2)	6 (152.4)	Note 2	17,404 (77.4)	8,668 (38.6)

1 Anchor can be located in grouted cell, "T" joint, or bed joint.

2 Anchor can be located in first grouted cell from edge.

3 Allowable working loads for the single installations under static loading should not exceed 25% (an industry standard) capacity or the allowable load of the anchor rod. Loads based upon testing with ASTM A193, Grade B7 rods.

C6+ Epoxy Adhesive

Average Ultimate Tension Loads^{1,2,3} for Threaded Rod Installed in Solid Concrete, Shallow Embedment

ANCHOR DIAMETER In. (mm)	DRILL HOLE DIAMETER In. (mm)	EMBEDMENT IN CONCRETE In. (mm)	3500 PSI (24.2 MPa) ULTIMATE TENSION Lbs. (kN)
1/4 (6.4)	5/16 (7.9)	1 (25.4)	1,653 (7.4)
		2-1/4 (57.2)	2,818 (12.5)
		3 (76.2)	3,599 (16.0)
3/8 (9.5)	7/16 (11.1)	1-1/2 (38.1)	3,426 (15.2)
1/2 (12.7)	9/16 (14.3)	2 (50.8)	6,100 (27.1)
5/8 (15.9)	3/4 (19.1)	2-1/2 (63.5)	8,775 (39.0)
3/4 (19.1)	7/8 (22.2)	3 (76.2)	12,625 (56.2)
7/8 (22.2)	1 (25.4)	3-1/2 (88.9)	18,650 (83.0)
1 (25.4)	1-1/8 (28.6)	4 (101.6)	25,034 (111.4)
1-1/4 (31.8)	1-3/8 (34.9)	5 (127.0)	37,100 (165.0)

1 Allowable working loads for the single installations under static loading should not exceed 25% capacity or the allowable load of the anchor rod.

2 Ultimate load values in 2000, 4000, and 6000 psi stone aggregate concrete. Ultimate loads are indicated for the embedment shown in the Embedment in Concrete column. Performance values are based on the use of high strength threaded rod (ASTM A193 Gr. B7). The use of lower strength rods will result in lower ultimate tension and shear loads.

3 Linear interpolation may be used for intermediate spacing and edge distances (see page 35).

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PERFORMANCE TABLE

Bond Strength Design Information For Fractional Threaded Rod ^{1,7}

Design Information		Symbol	Units	Nominal Threaded Rod Diameter							
					3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
Minimum Effective Installation Depth		$h_{ef,min}$	in mm		1-5/8"	2"	2-1/2"	3-1/2"	4	4	5
Maximum Effective Installation Depth		$h_{ef,max}$	in mm		7-1/2	10	12-1/2	15	17-1/2	20	25
Temperature Range A, ^{2,3}	Characteristic Bond Strength in Uncracked Concrete	$\tau_{k,uncr}$	psi N/mm ²		1,350 9.3						
	Characteristic Bond Strength in Cracked Concrete	$\tau_{k,cr}$	psi N/mm ²		1,150	1,090	1,025	965	900	840	715
					7.9	7.5	7.1	5.1	4.7	4.4	3.8
					1,030 7.1						
Temperature Range B, ^{3,5}	Characteristic Bond Strength in Uncracked Concrete	$\tau_{k,uncr}$	psi N/mm ²		1,350 9.3						
	Characteristic Bond Strength in Cracked Concrete	$\tau_{k,cr}$	psi N/mm ²		875	830	780	735	685	640	545
					6.1	5.7	5.4	5.1	4.7	4.4	3.8
					1,030 7.1						
Temperature Range C, ^{4,5}	Characteristic Bond Strength in Uncracked Concrete	$\tau_{k,uncr}$	psi N/mm ²		725 5.0						
	Characteristic Bond Strength in Cracked Concrete	$\tau_{k,cr}$	psi N/mm ²		620	620	620	620	620	620	620
					4.3	4.3	4.3	4.3	4.3	4.3	4.3
					725 5.0						
Permissible Installation Conditions ⁶	Dry Concrete	ϕ_d	Periodic Inspection		0.65						
	Water-saturated Concrete	ϕ_{ws}			0.55						
	Water-filled Hole	ϕ_{wf}			0.65						
	Submerged Concrete	ϕ_{sub}			0.65						
	Dry Concrete	ϕ_d	Continuous Inspection		0.65						
	Water-saturated Concrete	ϕ_{ws}			0.65						
	Water-filled Hole	ϕ_{wf}			0.65						
	Submerged Concrete	ϕ_{sub}			0.65						
	Dry Concrete	ϕ_d			0.65						
	Water-saturated Concrete	ϕ_{ws}			0.65						
	Water-filled Hole	ϕ_{wf}			0.65						
	Submerged Concrete	ϕ_{sub}			0.65						

For SI: 1 inch = 25.4 mm, 1 in.² = 645.16 mm², 1 lb = 0.004448 kN

¹ Bond strength values correspond to concrete compressive strength $f_c = 2,500$ psi. Bond strength values must not be increased for increased concrete compressive strength.

² Temperature Range A = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 130°F (55°C)

³ Temperature Range B = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 162°F (72°C)

⁴ Temperature Range C = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 176°F (80°C) Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.

⁵ 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.

⁷ For sustained loads, bond strengths must be multiplied by 0.73.

⁸ See ICC-ES ESR 3577 for further design information in accordance with ACI 318

Bond Strength Design Information For Fractional Reinforcing Bar ^{1,7}

Design Information		Symbol	Units	Nominal Threaded Bar Diameter							
					No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 10
Minimum Effective Installation Depth		$h_{ef,min}$	in mm		1-5/8"	2"	2-1/2"	3-1/2"	4	4	5
Maximum Effective Installation Depth		$h_{ef,max}$	in mm		7-1/2	10	12-1/2	15	17-1/2	20	25
Temperature Range A, ^{2,3}	Characteristic Bond Strength in Uncracked Concrete	$\tau_{k,uncr}$	psi N/mm ²		1,350 9.3						
	Characteristic Bond Strength in Cracked Concrete	$\tau_{k,cr}$	psi N/mm ²		1,150	1,090	1,025	965	900	840	715
					7.9	7.5	7.1	5.1	4.7	4.4	3.8
					1,030 7.1						
Temperature Range B, ^{3,5}	Characteristic Bond Strength in Uncracked Concrete	$\tau_{k,uncr}$	psi N/mm ²		1,350 9.3						
	Characteristic Bond Strength in Cracked Concrete	$\tau_{k,cr}$	psi N/mm ²		875	830	780	735	685	640	545
					6.1	5.7	5.4	5.1	4.7	4.4	3.8
					1,030 7.1						
Temperature Range C, ^{4,5}	Characteristic Bond Strength in Uncracked Concrete	$\tau_{k,uncr}$	psi N/mm ²		725 5.0						
	Characteristic Bond Strength in Cracked Concrete	$\tau_{k,cr}$	psi N/mm ²		620	620	620	620	620	620	620
					4.3	4.3	4.3	4.3	4.3	4.3	4.3
					725 5.0						
Permissible Installation Conditions ⁶	Dry Concrete	ϕ_d	Periodic Inspection		0.65						
	Water-saturated Concrete	ϕ_{ws}			0.55						
	Water-filled Hole	ϕ_{wf}			0.65						
	Submerged Concrete	ϕ_{sub}			0.65						
	Dry Concrete	ϕ_d	Continuous Inspection		0.65						
	Water-saturated Concrete	ϕ_{ws}			0.65						
	Water-filled Hole	ϕ_{wf}			0.65						
	Submerged Concrete	ϕ_{sub}			0.65						
	Dry Concrete	ϕ_d			0.65						
	Water-saturated Concrete	ϕ_{ws}			0.65						
	Water-filled Hole	ϕ_{wf}			0.65						
	Submerged Concrete	ϕ_{sub}			0.65						

For SI: 1 inch = 25.4 mm, 1 in.² = 645.16 mm², 1 lb = 0.004448 kN

¹ Bond strength values correspond to concrete compressive strength $f_c = 2,500$ psi. Bond strength values must not be increased for increased concrete compressive strength.

² Temperature Range A = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 130°F (55°C)

³ Temperature Range B = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 162°F (72°C)

⁴ Temperature Range C = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 176°F (80°C)

⁵ Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.

⁶ 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.

⁷ For sustained loads, bond strengths must be multiplied by 0.73.

⁸ See ICC-ES ESR 3577 for further design information in accordance with ACI 318

C6+ Adhesive Anchor - Technical Data

PERFORMANCE TABLE

C6+ Epoxy Adhesive		Allowable Shear Loads^{1,2,3} for Threaded Rod Installed in Solid Concrete					
THREADED ROD DIA. In. (mm)	MINIMUM EMBEDMENT DEPTH In. (mm)	ALLOWABLE SHEAR LOAD BASED ON CONCRETE STRENGTH			ALLOWABLE SHEAR LOAD BASED ON STEEL STRENGTH		
		2000 PSI (13.8 MPa) CONCRETE Lbs. (kN)	4000 PSI (27.6 MPa) CONCRETE Lbs. (kN)	6000 PSI (41.4 MPa) CONCRETE Lbs. (kN)	ASTM A307 (SAE 1018) Lbs. (kN)	ASTM A193 GR. B7 (SAE 4140) Lbs. (kN)	ASTM F593 AISI 304 SS Lbs. (kN)
3/8 (9.5)	3-3/8 (85.7)	1,300 (5.8)	1,465 (6.5)	1,500 (6.7)	1,040 (4.6)	2,170 (9.7)	1,995 (8.9)
1/2 (12.7)	4-1/2 (114.3)	2,855 (12.7)	3,145 (14.0)	3,145 (14.0)	1,870 (8.3)	3,895 (17.3)	3,585 (15.9)
5/8 (15.9)	5-5/8 (142.9)	4,575 (20.3)	4,950 (22.0)	4,950 (22.0)	2,940 (13.1)	6,125 (27.2)	5,635 (25.1)
3/4 (19.1)	6-3/4 (171.5)	6,430 (28.6)	6,430 (28.6)	6,430 (28.6)	4,250 (18.9)	8,855 (39.4)	7,440 (33.1)
7/8 (22.2)	7-7/8 (200.0)	N/A	7,575 (33.7)	8,140 (36.2)	5,800 (25.8)	12,760 (56.8)	10,730 (47.7)
1 (25.4)	9 (228.6)	9,630 (42.8)	10,085 (44.9)	11,600 (51.6)	7,590 (33.8)	15,810 (70.3)	13,285 (59.1)
1-1/4 (31.8)	11-1/4 (285.8)	16,270 (72.4)	16,270 (72.4)	16,270 (72.4)	11,900 (52.9)	24,790 (110.3)	18,840 (83.8)

1 Use lower value of either concrete or steel strength for allowable shear load.

2 Allowable loads taken from ICC Evaluation Report #4285 (formerly ICBO).

3 Linear interpolation may be used for intermediate spacing and edge distances.

PERFORMANCE TABLE

C6+ Epoxy Adhesive		Average Ultimate Tension Loads ^{1,2,3} for Reinforcing Bar Installed in Solid Concrete				
REINFORCING BAR In. (mm)	EMBEDMENT IN CONCRETE In. (mm)	2000 PSI (13.8 MPa) CONCRETE ULTIMATE TENSION Lbs. (kN)	4000 PSI (27.6 MPa) CONCRETE ULTIMATE TENSION Lbs. (kN)	ULTIMATE TENSILE AND YIELD STRENGTH GRADE 60 REBAR		
				MINIMUM YIELD STRENGTH Lbs. (kN)	MINIMUM ULTIMATE TENSILE STRENGTH Lbs. (kN)	
# 3 (9.5)	3-3/8 (85.7)	7,020 (31.2)	9,200 (40.9)	6,600 (29.4)	9,900 (44.0)	
	4-1/2 (114.3)	9,000 (40.1)	11,540 (51.3)	6,600 (29.4)	9,900 (44.0)	
# 4 (12.7)	4-1/2 (114.3)	11,940 (53.1)	15,140 (67.3)	12,000 (53.4)	18,000 (80.1)	
	6 (152.4)	16,703 (74.3)	18,880 (84.0)	12,000 (53.4)	18,000 (80.1)	
# 5 (15.9)	5-5/8 (142.9)	14,120 (62.8)	27,740 (123.4)	18,600 (82.7)	27,900 (124.1)	
	7-1/2 (190.5)	20,040 (89.1)	30,727 (136.7)	18,600 (82.7)	27,900 (124.1)	
# 6 (19.1)	6-3/4 (171.5)	17,940 (79.8)	29,200 (129.9)	26,400 (117.4)	39,600 (176.2)	
	9 (228.6)	25,520 (113.5)	41,640 (185.2)	26,400 (117.4)	39,600 (176.2)	
	10 (254.0)	N/A	45,000 (200.2)	26,400 (117.4)	39,600 (176.2)	
# 7 (22.2)	7-7/8 (200.0)	N/A	45,850 (204.0)	36,000 (160.1)	54,000 (240.2)	
	10-1/2 (266.7)	N/A	60,375 (268.6)	36,000 (160.1)	54,000 (240.2)	
	13 (330.2)	N/A	65,300 (290.5)	36,000 (160.1)	54,000 (240.2)	
# 8 (25.4)	9 (228.6)	30,960 (137.7)	54,180 (241.1)	47,400 (210.9)	71,100 (316.3)	
	12 (304.8)	30,960 (137.7)	65,420 (291.0)	47,400 (210.9)	71,100 (316.3)	
	16 (406.4)	N/A	86,700 (385.7)	47,400 (210.9)	71,100 (316.3)	
# 9 (28.6)	10-1/8 (257.2)	N/A	61,530 (273.7)	60,000 (266.9)	90,000 (400.4)	
	13-1/2 (342.9)	N/A	81,240 (361.4)	60,000 (266.9)	90,000 (400.4)	
	19 (482.6)	N/A	108,000 (480.4)	60,000 (266.9)	90,000 (400.4)	
# 10 (31.8)	11-1/4 (285.8)	44,600 (198.4)	76,500 (340.3)	76,200 (339.0)	114,300 (508.5)	
	15 (381.0)	49,220 (218.9)	82,320 (366.2)	76,200 (339.0)	114,300 (508.5)	
	19 (482.6)	N/A	120,000 (533.8)	76,200 (339.0)	114,300 (508.5)	

1 Allowable working loads for the single installations under static loading should not exceed 25% ultimate capacity or the allowable load of the anchor rod.

2 Ultimate load values in 2000 and 4000 psi stone aggregate concrete. Ultimate loads are indicated for the embedment shown in the Embedment in Concrete column. Performance values are based on minimum Grade 60 reinforcing bar. The use of lower strength rods will result in lower ultimate tension and shear loads.

3 SHEAR DATA: Provided the distance from the rebar to the edge of the concrete member exceeds 1.25 times the embedment depth of the rebar, calculate the ultimate shear load for the rebar anchorage as 60% of the ultimate tensile strength of the rebar.

Combined Tension and Shear Loading—for Adhesive Anchors

Allowable loads for anchors under tension and shear loading at the same time (combined loading) will be lower than the allowable loads for anchors subjected to 100% tension or 100% shear. Use the following equation to evaluate anchors in combined loading conditions:

$$\left(\frac{Na}{Ns}\right)^{5/3} + \left(\frac{Va}{Vs}\right)^{5/3} \leq 1$$

Na = Applied Service Tension Load

Ns = Allowable Tension Load

Va = Applied Service Shear Load

Vs = Allowable Shear Load