

PERFORMANCE TABLES

C6+ Epoxy Adhesive Concrete Breakout and Bond Strength for Threaded Rod

Characteristic	Symbol	Units	Nominal Rod Diameter In. (mm)							
			Nominal Anchor Diameter	do	In. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)
Concrete Breakout										
Effectiveness factor for uncracked concrete	k_{uncr}	–	10							
Effectiveness factor for cracked concrete	k_{cr}	–	7							
Modification factor for resistance in tension to account for uncracked concrete	$\psi_{c,N}$	–	1							
Minimum concrete thickness	h_{min}	mm	$h_{ef} + 32$				$h_{ef} + 2d_o$			
Anchor embedment depth – minimum	$h_{ef,min}$	In. (mm)	1.5 (38)	2.0 (51)	2.5 (64)	3.0 (76)	3.5 (89)	4.0 (102)	5.0 (127.0)	
Minimum spacing	s_{min}	In. (mm)	0.9 (24)	1.5 (38)	2.5 (64)	3.0 (76)	3.5 (89)	4.0 (102)	5.0 (127.0)	
Minimum edge distance	c_{min}	In. (mm)	0.9 (24)	1.5 (38)	2.5 (64)	3.0 (76)	3.5 (89)	4.0 (102)	5.0 (127.0)	
Critical edge distance	c_{ac}	In.	See Section 4.1.10 of the evaluation report							
Material resistance factor for concrete	Φ_c	–	0.65							
Strength reduction factor for tension, concrete failure modes	R	Cond. A	1.15							
	R	Cond. B	1							
Strength reduction factor for shear, concrete failure modes	R	Cond. A	1.15							
	R	Cond. B	1							
Modification Factor for concrete density	λ	–	1							
Bond Strength										
Temperature Range A ²	Characteristic Bond Strength for Uncracked Concrete	$T_{k,uncr}$	MPa (psi)	17.0 (2,470)	16.5 (2,390)	16.0 (2,315)	15.4 (2,240)	14.9 (2,160)	14.4 (2,085)	13.3 (1,930)
	Characteristic Bond Strength for Cracked Concrete	$T_{k,cr}$	MPa (psi)	7.8 (1,125)	7.8 (1,125)	7.8 (1,125)	8.7 (1,255)	8.7 (1,255)	8.7 (1,255)	9.4 (1,370)
Temperature Range B ^{3,4}	Characteristic Bond Strength for Uncracked Concrete	$T_{k,uncr}$	MPa (psi)	14.5 (2,110)	14.1 (2,040)	13.6 (1,975)	13.2 (1,910)	12.7 (1,845)	12.3 (1,780)	11.3 (1,645)
	Characteristic Bond Strength for Cracked Concrete	$T_{k,cr}$	MPa (psi)	6.6 (960)	6.6 (960)	6.6 (960)	7.4 (1,070)	7.4 (1,070)	7.4 (1,070)	8.1 (1,170)
Continuous Inspection	Strength Reduction Factor – Dry Concrete	$\Phi_{dry,ci}$	–	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor – Water-Saturated Concrete	$\Phi_{sat,ci}$	–	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor – Water-Filled Holes	$\Phi_{wf,ci}$	–	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor – Submerged Concrete	$\Phi_{sub,ci}$	–	0.65	0.65	0.55	0.55	0.55	0.55	0.55
Periodic Inspection	Strength Reduction Factor – Dry Concrete	$\Phi_{dry,pi}$	–	0.65	0.65	0.65	0.55	0.55	0.55	0.55
	Strength Reduction Factor – Water-Saturated Concrete	$\Phi_{sat,pi}$	–	0.65	0.65	0.65	0.55	0.55	0.55	0.65
	Strength Reduction Factor – Water-Filled Holes	$\Phi_{wf,pi}$	–	0.55	0.55	0.55	0.55	0.55	0.55	0.55
	Strength Reduction Factor – Submerged Concrete	$\Phi_{sub,pi}$	–	0.55	0.55	0.55	0.45	0.45	0.45	0.45
Submerged installation reduction factor			–	1.00	1.00	1.00	1.00	1.00	0.81	1.00
Reduction factor for seismic tension		$a_{N,seis}$	–	0.95	0.98	0.96	0.96	0.94	0.94	0.94

1 Bond strength values correspond to concrete compressive strengths ranging from 17.2 Mpa (2,500 psi) to 55.2 Mpa (8,000psi).

2 Temperature range A: Maximum short term temperature of 61°C (142°F) and maximum long term temperature of 43°C (110°F).

3 Temperature range B: Maximum short term temperature of 74°C (165°F) and maximum long term temperature of 43°C (110°F).

4 For structures assigned to IBC or IRC Seismic Design Category C, D, E, or F, bond strength values must be multiplied by $a_{N,seis}$.

5 Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member except where pullout or pryout resistance governs

6 Condition B applies where supplementary reinforcement is not provided or where pullout or pryout strength governs

7 Bond strength values correspond to anchors installed in holes drilled with a hammer drill and carbide bit

Combined Tension and Shear Loading—for C6+ 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. For combined tension and shear loading, please see Section 4.2.2 of ICC ESR 4046

PERFORMANCE TABLES

C6+ Epoxy Adhesive Factored Steel Strength for Reinforcing Bars, kN (lbf)

US Rebar Size	ASTM A615 Grade 60 Rebar			CA Rebar Size	CSA G30.18 Grade 400		
	Tension In. (mm)	Shear In. (mm)	Seismic Shear In. (mm)		Tension In. (mm)	Shear In. (mm)	Seismic Shear In. (mm)
No. 3	29.9 (6,732)	16.8 (3,787)	135.6 (3,446)	10M	37 (8,255)	21 (4,643)	14 (3,250)
No. 4	54.4 (12,240)	30.6 (6,885)	28.0 (6,265)	15M	73 (16,510)	41 (9,287)	29 (6,501)
No. 5	84.4 (18,972)	47.5 (10,672)	43.0 (9,711)	20M	110 (24,765)	62 (13,930)	43 (9,751)
No. 6	119.8 (26,928)	67.4 (15,147)	61.0 (13,632)	25M	184 (41,275)	103 (23,217)	72 (16,252)
No. 7	163.3 (36,720)	91.9 (20,655)	83.0 (18,590)	30M	257 (57,785)	145 (32,504)	101 (22,753)
No. 8	215.1 (48,348)	121.0 (27,196)	86.0 (19,309)	1 Values correspond to a ductile steel element per standards above			
No. 9	272.2 (61,200)	153.1 (34,425)	109.0 (24,442)	2 Tension values calculated according to Cl. D6.1.2 in CSA A23.3-14 Annex D			
No. 10	345.7 (77,724)	194.5 (43,720)	138.0 (31,041)	3 Shear values calculated according to Cl. D7.1.2 in CSA A23.3-14 Annex D			
				4 Seismic shear was calculated according to $V_{sar} \cdot a_{V,seis}$			

C6+ Epoxy Adhesive Concrete Breakout and Bond Strength for Reinforcing Bars, kN (lbf)

Nominal Anchor Size	Symbol	Units	Nominal Rod Diameter									
			No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10		
Concrete Breakout												
Effectiveness factor for uncracked concrete	k_{uncr}	–	10									
Effectiveness factor for cracked concrete	k_{cr}	–	7									
Minimum concrete thickness	h_{min}	mm	$h_{ef} + 32$				$h_{ef} + 2do$					
Modification factor for resistance in tension to account for uncracked concrete	$h_{ef,min}$	In. (mm)	2.4 (60.3)	2.8 (69.9)	3.1 (79.4)	3.5 (88.9)	3.5 (88.9)	4.0 (101.6)	4.5 (114.3)	5.0 (127.0)		
Minimum spacing	s_{min}	In. (mm)	0.9 (23.8)	1.5 (38.1)	25 (63.5)	3.0 (76.2)	3.5 (88.9)	4.0 (101.6)	4.5 (114.3)	5.0 (127.0)		
Minimum edge distance	c_{min}	In. (mm)	0.9 (23.8)	1.5 (38.1)	25 (63.5)	3.0 (76.2)	3.5 (88.9)	4.0 (101.6)	4.5 (114.3)	5.0 (127.0)		
Critical edge distance	c_{ac}	In. (mm)	See Section 4.1.10 of the evaluation report									
Material resistance factor for concrete	Φ_c	–	0.65									
Strength reduction factor for tension, concrete failure modes	R	Cond. A	1.15									
	R	Cond. B	1									
Strength reduction factor for shear, concrete failure modes	R	Cond. A	1.15									
	R	Cond. B	1									
Modification Factor for concrete density	λ	–	1									
Bond Strength												
Nominal Anchor Size				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	
Temperature Range A ²	Characteristic Bond Strength for Uncracked Concrete		$T_{k,uncr}$	MPa (psi)	16.3 (2,365)	15.7 (2,275)	15.0 (2,180)	14.4 (2,085)	13.7 (1,990)	13.1 (1,895)	12.4 (1,805)	11.8 (1,710)
	Characteristic Bond Strength for Cracked Concrete		$T_{k,cr}$	MPa (psi)	7.8 (1,125)	7.8 (1,125)	7.7 (1,110)	8.2 (1,190)	7.9 (1,140)	7.5 (1,090)	7.2 (1,040)	7.4 (1,080)
Temperature Range B ^{3,4}	Characteristic Bond Strength for Uncracked Concrete		$T_{k,uncr}$	MPa (psi)	13.9 (2,020)	13.4 (1,940)	12.8 (1,860)	12.3 (1,780)	11.7 (1,700)	11.2 (1,620)	10.6 (1,540)	10.1 (1,460)
	Characteristic Bond Strength for Cracked Concrete		$T_{k,cr}$	MPa (psi)	6.6 (960)	6.6 (960)	6.5 (945)	7.0 (1,015)	6.7 (975)	6.4 (930)	6.1 (890)	6.4 (930)
Continuous Inspection	Strength Reduction Factor – Dry Concrete		$\Phi_{dry,ci}$	–	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor – Water-Saturated Concrete		$\Phi_{sat,ci}$	–	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor – Water-Filled Holes		$\Phi_{wf,ci}$	–	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Strength Reduction Factor – Submerged Concrete		$\Phi_{sub,ci}$	–	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.55
Periodic Inspection	Strength Reduction Factor – Dry Concrete		$\Phi_{dry,pi}$	–	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.55
	Strength Reduction Factor – Water-Saturated Concrete		$\Phi_{sat,pi}$	–	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.65
	Strength Reduction Factor – Water-Filled Holes		$\Phi_{wf,pi}$	–	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
	Strength Reduction Factor – Submerged Concrete		$\Phi_{sub,pi}$	–	0.55	0.65	0.55	0.45	0.45	0.45	0.45	0.45
Submerged installation reduction factor				1.00	1.00	1.00	1.00	1.00	0.81	0.81	1.00	
Reduction factor for seismic tension			$a_{N,seis}$	–	0.88	0.88	0.88	0.84	0.84	0.84	0.84	0.95

1 Bond strength values correspond to concrete compressive strengths ranging from 17.2 Mpa (2,500 psi) to 55.2 Mpa (8,000psi).

2 Temperature range A: Maximum short term temperature of 61°C (142°F) and maximum long term temperature of 43°C (110°F).

3 Temperature range B: Maximum short term temperature of 74°C (165°F) and maximum long term temperature of 43°C (110°F).

4 For structures assigned to IBC or IRC Seismic Design Category C, D, E, or F, bond strength values must be multiplied by $a_{N,seis}$.

5 Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member except where pullout or pryout resistance governs

6 Condition B applies where supplementary reinforcement is not provided or where pullout or pryout strength governs

7 Bond strength values correspond to anchors installed in holes drilled with a hammer drill and carbide bit

PERFORMANCE TABLES

C6+ Epoxy Adhesive

Factored Concrete Breakout/Bond Failure Strength for Threaded Rod Installed in Holes Drilled with a Hammer Drill and a Carbide Bit

Nominal anchor diameter In. (mm)	Effective Embedment In. (mm)	Tension, kn (lbf)					
		UNCRACKED			CRACKED		
		f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)	f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)
3/8 (9.5)	2-3/8 (60)	13.6 (3,060)	16.7 (3,750)	19.3 (4,330)	9.1 (2,045)	9.1 (2,045)	9.1 (2,045)
	3-3/8 (86)	23.1 (5,185)	28.3 (6,355)	28.4 (6,385)	12.9 (2,910)	12.9 (2,910)	12.9 (2,910)
	4-1/2 (114)	35.5 (7,985)	37.9 (8,510)	37.9 (8,510)	17.2 (3,875)	17.2 (3,875)	17.2 (3,875)
	7-1/2 (191)	63.1 (14,185)	63.1 (14,185)	63.1 (14,185)	28.7 (6,460)	28.7 (6,460)	28.7 (6,460)
1/2 (12.7)	2-3/4 (70)	17.0 (3,815)	20.8 (4,670)	24.0 (5,395)	11.9 (2,670)	14.1 (3,160)	14.1 (3,170)
	4-1/2 (114)	35.5 (7,985)	43.5 (9,780)	48.8 (10,980)	23.0 (5,170)	23.0 (5,170)	23.0 (5,170)
	6 (152)	54.7 (12,295)	65.1 (14,640)	65.1 (14,640)	30.7 (6,890)	30.7 (6,890)	30.7 (6,890)
	10 (254)	108.5 (24,400)	108.5 (24,400)	108.5 (24,400)	51.1 (11,485)	51.1 (11,485)	51.1 (11,485)
5/8 (15.9)	3-1/8 (79)	20.6 (4,620)	25.2 (5,660)	29.1 (6,535)	14.4 (3,235)	17.6 (3,960)	20.0 (4,485)
	5-5/8 (143)	49.6 (11,160)	60.8 (13,670)	70.2 (15,785)	34.8 (7,810)	35.9 (7,810)	35.9 (7,810)
	7-1/2 (191)	76.4 (17,185)	93.6 (21,045)	98.6 (22,160)	47.9 (10,770)	47.9 (10,770)	47.9 (10,770)
	12-1/2 (318)	164.3 (36,930)	164.3 (36,930)	164.3 (36,930)	79.8 (17,950)	79.8 (17,950)	79.8 (17,950)
3/4 (19.1)	3-1/2 (89)	24.4 (5,480)	29.8 (6,710)	34.5 (7,745)	17.1 (3,835)	20.9 (4,695)	24.1 (5,425)
	6-3/4 (171)	65.3 (14,670)	79.9 (17,970)	92.3 (20,745)	45.7 (10,270)	55.9 (12,575)	57.7 (12,975)
	9 (229)	100.5 (22,585)	123.1 (27,665)	137.3 (30,875)	70.3 (15,810)	76.9 (17,300)	76.9 (17,300)
	15 (381)	216.2 (48,600)	228.9 (51,460)	228.9 (51,460)	128.2 (28,830)	128.2 (28,830)	128.2 (28,830)
7/8 (22.2)	3-1/2 (89)	24.4 (5,480)	29.8 (6,710)	34.5 (7,745)	17.1 (3,835)	20.9 (4,695)	24.1 (5,425)
	7-7/8 (200)	82.2 (18,485)	100.7 (22,640)	116.3 (26,145)	57.6 (12,940)	70.5 (15,850)	78.6 (17,660)
	10-1/2 (267)	126.6 (28,465)	155.1 (34,860)	179.1 (40,255)	88.6 (19,925)	104.7 (23,545)	104.7 (23,545)
	17-1/2 (445)	272.4 (61,240)	300.4 (67,540)	300.4 (67,540)	174.6 (39,240)	174.6 (39,240)	174.6 (39,240)
1 (25.4)	4 (102)	29.8 (6,690)	36.5 (8,195)	42.1 (9,465)	20.8 (4,685)	25.5 (5,740)	29.5 (6,625)
	9 (229)	100.5 (22,585)	123.1 (27,665)	142.1 (31,945)	70.3 (15,810)	86.1 (19,365)	99.5 (22,360)
	12 (305)	154.7 (34,775)	189.5 (45,590)	218.8 (49,180)	108.3 (24,340)	132.6 (29,815)	136.8 (30,755)
	20 (508)	332.8 (78,825)	378.8 (85,155)	378.8 (85,155)	228.0 (51,255)	228.0 (51,255)	228.0 (51,255)
1-1/4 (31.8)	5 (127)	41.6 (9,355)	51.0 (11,455)	58.8 (13,225)	29.1 (6,545)	35.7 (8,020)	41.2 (9,260)
	11-1/4 (286)	140.4 (31,565)	172.0 (38,660)	198.6 (44,640)	98.3 (22,095)	120.4 (27,060)	139.0 (31,250)
	15 (381)	216.2 (48,600)	264.8 (59,520)	305.7 (68,730)	151.3 (34,020)	185.3 (41,665)	214.0 (48,110)
	25 (635)	465.1 (104,570)	547.8 (123,160)	547.8 (123,160)	325.6 (73,200)	388.9 (87,425)	388.9 (87,425)

Nominal anchor diameter In. (mm)	Effective Embedment In. (mm)	Shear, kn (lbf)					
		UNCRACKED			CRACKED		
		f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)	f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)
3/8 (9.5)	2-3/8 (60)	13.6 (3,060)	16.7 (3,750)	19.3 (4,330)	9.1 (2,045)	9.1 (2,045)	9.1 (2,045)
	3-3/8 (86)	46.1 (10,375)	56.5 (12,705)	56.8 (12,765)	25.9 (5,815)	25.9 (5,815)	25.9 (5,815)
	4-1/2 (114)	71.0 (15,970)	75.7 (17,025)	75.7 (17,025)	34.5 (7,755)	34.5 (7,755)	34.5 (7,755)
	7-1/2 (191)	126.2 (28,370)	126.2 (28,370)	126.2 (28,370)	57.5 (12,980)	57.5 (12,980)	57.5 (12,980)
1/2 (12.7)	2-3/4 (70)	33.9 (7,630)	41.6 (9,345)	48.0 (10,790)	23.8 (5,340)	28.1 (6,320)	28.1 (6,320)
	4-1/2 (114)	71.0 (15,970)	87.0 (19,560)	97.7 (21,960)	46.0 (10,340)	46.0 (10,340)	46.0 (10,340)
	6 (152)	109.4 (24,590)	130.3 (29,285)	130.3 (29,285)	61.3 (13,785)	61.3 (13,785)	61.3 (13,785)
	10 (254)	217.1 (48,805)	217.1 (48,805)	217.1 (48,805)	102.2 (22,975)	102.2 (22,975)	102.2 (22,975)
5/8 (15.9)	3-1/8 (79)	41.1 (9,245)	50.4 (11,320)	58.1 (13,070)	28.8 (6,470)	35.2 (7,925)	39.9 (8,975)
	5-5/8 (143)	99.3 (22,320)	121.6 (27,335)	140.4 (31,565)	69.5 (15,625)	71.9 (16,155)	71.9 (16,155)
	7-1/2 (191)	152.9 (34,365)	187.2 (42,090)	197.1 (44,320)	95.8 (21,535)	95.8 (21,535)	95.8 (21,535)
	12-1/2 (318)	328.6 (73,865)	328.6 (73,865)	328.6 (73,865)	159.7 (35,895)	159.7 (35,895)	159.7 (35,895)
3/4 (19.1)	3-1/2 (89)	48.7 (10,955)	59.7 (13,420)	68.9 (15,495)	34.1 (7,670)	41.8 (9,390)	48.2 (10,845)
	6-3/4 (171)	130.5 (29,340)	159.8 (35,935)	184.6 (41,495)	91.4 (20,540)	111.9 (25,155)	115.4 (25,950)
	9 (229)	200.9 (45,175)	246.1 (55,325)	274.7 (61,750)	140.7 (31,620)	153.9 (34,595)	153.9 (34,595)
	15 (381)	432.4 (97,200)	457.8 (102,920)	457.8 (102,920)	256.5 (57,660)	256.5 (57,660)	256.5 (57,660)
7/8 (22.2)	3-1/2 (89)	48.7 (10,955)	59.7 (13,420)	68.9 (15,495)	34.1 (7,670)	41.8 (9,390)	48.2 (10,845)
	7-7/8 (200)	164.5 (36,975)	201.4 (45,285)	232.6 (52,290)	115.1 (25,880)	141.0 (31,700)	157.1 (35,320)
	10-1/2 (267)	253.2 (56,925)	310.1 (69,720)	358.1 (80,505)	177.3 (39,850)	209.5 (47,090)	209.5 (47,090)
	17-1/2 (445)	544.8 (122,485)	600.9 (135,080)	600.9 (135,080)	349.1 (78,485)	349.1 (78,485)	349.1 (78,485)
1 (25.4)	4 (102)	59.5 (13,385)	72.9 (16,395)	84.2 (18,930)	41.7 (9,370)	51.0 (11,475)	58.9 (13,250)
	9 (229)	200.9 (45,175)	246.1 (55,325)	285.4 (63,885)	140.7 (31,620)	172.3 (38,730)	198.9 (44,720)
	12 (305)	309.4 (69,550)	378.9 (85,180)	437.5 (98,360)	216.6 (48,685)	265.2 (59,625)	273.6 (61,505)
	20 (508)	665.7 (149,650)	757.6 (170,305)	757.6 (170,305)	456.0 (102,510)	456.0 (102,510)	456.0 (102,510)
1-1/4 (31.8)	5 (127)	83.2 (18,705)	101.9 (22,910)	117.7 (26,455)	58.2 (13,095)	71.3 (16,035)	82.4 (18,520)
	11-1/4 (286)	280.8 (63,135)	343.9 (77,320)	397.1 (89,285)	196.6 (44,195)	240.8 (54,125)	278.0 (62,500)
	15 (381)	432.4 (97,200)	529.5 (119,045)	611.4 (137,460)	302.7 (68,040)	370.7 (83,330)	428.0 (96,220)
	25 (635)	930.3 (209,140)	1095.7 (246,320)	1095.7 (246,320)	651.2 (146,395)	777.8 (174,850)	777.8 (174,850)

- 1 These load values are for the purposes of estimation only and should not be used in design
- 2 Assuming single anchor with no edge or spacing distances, nor environmental factors that would reduce the load.
- 3 Design loads include their respective Φ_c and Φ_s material resistance factors for concrete and steel from CSA A23.3-14 Cl. 8.4.2 and 8.4.3
- 4 Design loads include their respective strength reduction factor for dry, water saturated and water filled hole conditions. Refer to design information table for threaded rod for submerged conditions (Φ_{sub}).
- 5 All design loads are calculated according to Condition B for concrete failure mode factor R
- 6 Bond strength values used in these calculations correspond to temperature Range A (long term temperature 43°C, short term temperature 61°C)
- 7 Values for continuous inspection with dry, water saturated or water filled concrete installed in holes drilled with a hammer drill and carbide bit



PERFORMANCE TABLES

C6+ Epoxy Adhesive

Factored Concrete Breakout/Bond Failure Strength for Reinforcing Bars Installed in Holes Drilled with a Hammer Drill and a Carbide Bit

US Rebar Size (mm)	Effective Embedment In. (mm)	Tension, kn (lbf)					
		UNCRACKED			CRACKED		
		f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)	f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)
# 3 (9.5)	3-1/2 (89)	24.4 (5,480)	28.2 (6,340)	28.2 (6,340)	13.4 (3,015)	13.4 (3,015)	13.4 (3,015)
	4-1/2 (114)	35.5 (7,985)	36.3 (8,150)	36.3 (8,150)	17.2 (3,875)	17.2 (3,875)	17.2 (3,875)
	7-1/2 (191)	60.4 (13,585)	60.4 (13,585)	60.4 (13,585)	28.7 (6,460)	28.7 (6,460)	28.7 (6,460)
# 4 (12.7)	4-1/2 (114)	35.5 (7,985)	43.5 (9,780)	46.5 (10,455)	23.0 (5,170)	23.0 (5,170)	23.0 (5,170)
	6 (152)	54.7 (12,295)	62.0 (13,935)	62.0 (13,935)	30.7 (6,890)	30.7 (6,890)	30.7 (6,890)
	10 (254)	103.3 (23,230)	103.3 (23,230)	103.3 (23,230)	51.1 (11,485)	51.1 (11,485)	51.1 (11,485)
# 5 (15.9)	5-3/4 (146)	51.3 (11,535)	62.8 (14,125)	71.2 (16,000)	36.2 (8,145)	36.2 (8,145)	36.2 (8,145)
	7-1/2 (191)	76.4 (17,185)	92.8 (20,865)	92.8 (20,865)	47.3 (10,625)	47.3 (10,625)	47.3 (10,625)
	12-1/2 (318)	154.7 (34,780)	154.7 (34,780)	154.7 (34,780)	78.8 (17,710)	78.8 (17,710)	78.8 (17,710)
# 6 (19.1)	6-3/4 (171)	65.3 (14,670)	79.9 (17,970)	92.3 (20,745)	54.7 (12,300)	54.7 (12,300)	54.7 (12,300)
	9 (229)	100.5 (22,585)	123.1 (27,665)	127.8 (28,740)	73.0 (16,405)	73.0 (16,405)	73.0 (16,405)
	15 (381)	213.1 (47,900)	213.1 (47,900)	213.1 (47,900)	121.6 (27,340)	121.6 (27,340)	121.6 (27,340)
# 7 (22.2)	8 (203)	84.2 (18,930)	103.1 (23,185)	119.1 (26,770)	72.5 (16,295)	72.5 (16,295)	72.5 (16,295)
	10-1/2 (267)	126.6 (28,465)	155.1 (34,860)	166.1 (37,335)	95.1 (21,390)	95.1 (21,390)	95.1 (21,390)
	17-1/2 (445)	272.4 (61,240)	276.8 (62,225)	276.8 (62,225)	158.6 (35,645)	158.6 (35,645)	158.6 (35,645)
# 8 (25.4)	9 (229)	100.5 (22,585)	123.1 (27,665)	142.1 (31,945)	89.1 (20,030)	89.1 (20,030)	89.1 (20,030)
	13 (330)	174.4 (39,210)	213.6 (48,025)	223.8 (50,305)	128.7 (28,935)	128.7 (28,935)	128.7 (28,935)
	20 (508)	332.8 (74,825)	344.3 (77,395)	344.3 (77,395)	198.0 (44,515)	198.0 (44,515)	198.0 (44,515)
# 9 (28.6)	10-1/2 (267)	126.6 (28,465)	155.1 (34,860)	179.1 (40,255)	111.6 (14,110)	111.6 (14,110)	111.6 (14,110)
	13-1/2 (343)	184.6 (41,495)	226.1 (50,820)	249.0 (55,980)	143.5 (18,145)	143.5 (18,145)	143.5 (18,145)
	20 (508)	332.8 (74,825)	368.9 (82,935)	368.9 (82,935)	212.6 (47,785)	212.6 (47,785)	212.6 (47,785)
# 10 (32.2)	12 (305)	154.7 (34,775)	189.5 (42,590)	218.8 (49,180)	147.2 (33,080)	147.2 (33,080)	147.2 (33,080)
	15 (381)	216.2 (48,600)	264.8 (59,520)	291.2 (65,475)	183.9 (41,350)	183.9 (41,350)	183.9 (41,350)
	25 (635)	465.1 (104,570)	485.4 (109,120)	485.4 (109,120)	306.6 (68,920)	306.6 (68,920)	306.6 (68,920)

C6+ Epoxy Adhesive

Factored Concrete Breakout/Bond Failure Strength for Reinforcing Bars Installed in Holes Drilled with a Hammer Drill and a Carbide Bit

US Rebar Size (mm)	Effective Embedment In. (mm)	Shear, kn (lbf)					
		UNCRACKED			CRACKED		
		f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)	f'c = 20 Mpa (2900 psi)	f'c = 30 Mpa (4350 psi)	f'c = 40 Mpa (5800 psi)
# 3 (9.5)	3-1/2 (89)	48.7 (10,955)	56.4 (12,675)	56.4 (12,675)	26.8 (6,030)	26.8 (6,030)	26.8 (6,030)
	4-1/2 (114)	71.0 (15,970)	72.5 (16,300)	72.5 (16,300)	34.5 (7,755)	34.5 (7,755)	34.5 (7,755)
	7-1/2 (191)	120.8 (27,165)	120.8 (27,165)	120.8 (27,165)	57.5 (12,920)	57.5 (12,920)	57.5 (12,920)
# 4 (12.7)	4-1/2 (114)	71.0 (15,970)	87.0 (19,560)	93.0 (20,905)	46.0 (10,340)	46.0 (10,340)	46.0 (10,340)
	6 (152)	109.4 (24,590)	124.0 (27,875)	124.0 (27,875)	61.3 (13,785)	61.3 (13,785)	61.3 (13,785)
	10 (254)	206.6 (46,455)	206.6 (46,455)	206.6 (46,455)	102.2 (22,975)	102.2 (22,975)	102.2 (22,975)
# 5 (15.9)	5-3/4 (146)	102.6 (23,070)	125.7 (28,255)	142.3 (31,995)	71.8 (16,150)	72.5 (16,290)	72.5 (16,290)
	7-1/2 (191)	152.9 (34,365)	185.6 (41,735)	185.6 (41,735)	94.5 (21,250)	94.5 (21,250)	94.5 (21,250)
	12-1/2 (318)	309.4 (69,555)	309.4 (69,555)	309.4 (69,555)	157.5 (35,415)	157.5 (35,415)	157.5 (35,415)
# 6 (19.1)	6-3/4 (171)	130.5 (29,340)	159.8 (35,935)	184.6 (41,495)	91.4 (20,540)	109.4 (24,605)	109.4 (24,605)
	9 (229)	200.9 (45,175)	246.1 (55,325)	255.7 (57,480)	140.7 (31,620)	145.9 (32,805)	145.9 (32,805)
	15 (381)	426.1 (95,795)	426.1 (95,795)	426.1 (95,795)	243.2 (54,675)	243.2 (54,675)	243.2 (54,675)
# 7 (22.2)	8 (203)	168.4 (37,860)	206.2 (46,365)	238.2 (53,540)	117.9 (26,500)	144.4 (32,455)	145.0 (32,590)
	10-1/2 (267)	253.2 (56,925)	310.1 (69,720)	332.1 (74,670)	177.3 (39,850)	190.3 (42,775)	190.3 (42,775)
	17-1/2 (445)	544.8 (122,485)	553.6 (124,450)	553.6 (124,450)	317.1 (71,295)	317.1 (71,295)	317.1 (71,295)
# 8 (25.4)	9 (229)	200.9 (45,175)	246.1 (55,325)	284.2 (63,885)	140.7 (31,620)	172.3 (38,730)	178.2 (40,065)
	13 (330)	348.8 (78,420)	427.2 (96,045)	447.5 (100,610)	244.2 (54,895)	257.4 (57,870)	257.4 (57,870)
	20 (508)	665.7 (149,650)	688.5 (154,785)	688.5 (154,785)	396.0 (89,035)	396.0 (89,035)	396.0 (89,035)
# 9 (28.6)	10-1/2 (267)	253.2 (56,925)	310.1 (69,720)	358.1 (80,505)	177.3 (39,850)	217.1 (48,805)	223.2 (50,175)
	13-1/2 (343)	369.2 (82,990)	452.1 (101,640)	498.0 (111,960)	258.4 (58,095)	286.9 (64,510)	286.9 (64,510)
	20 (508)	665.7 (149,650)	737.8 (165,865)	737.8 (165,865)	425.1 (95,570)	425.1 (95,570)	425.1 (95,570)
# 10 (32.2)	12 (305)	309.4 (69,550)	378.9 (85,180)	437.5 (98,360)	216.6 (48,685)	265.2 (59,625)	294.3 (66,160)
	15 (381)	432.4 (97,200)	529.5 (119,045)	582.5 (130,945)	302.7 (68,040)	367.9 (82,705)	367.9 (82,705)
	25 (635)	930.3 (209,140)	970.8 (218,245)	970.8 (218,245)	613.1 (137,840)	613.1 (137,840)	613.1 (137,840)

1 These load values are for the purposes of estimation only and should not be used in design
 2 Submerged installation reduction factor
 3 Design loads include their respective ϕ_c and ϕ_s material resistance factors for concrete and steel from CSA A23.3-14 Cl. 8.4.2 and 8.4.3
 4 Design loads include their respective strength reduction factor for dry, water saturated and water filled hole conditions. Refer to design information table for threaded rod for submerged conditions (ϕ_{sub}).

5 All design loads are calculated according to Condition B for concrete failure mode factor R
 6 Bond strength values used in these calculations correspond to temperature Range A (long term temperature 43°C, short term temperature 61°C)
 7 Values for continuous inspection with dry, water saturated or water filled concrete installed in holes drilled with a hammer drill and carbide bit