



The following excerpt are pages from the North American Product Technical Guide, Volume 2: Anchor Fastening, Edition 22.

Please refer to the publication in its entirety for complete details on this product including data development, product specifications, general suitability, installation, corrosion and spacing and edge distance guidelines.

US&CA: <https://submittals.us.hilti.com/PTGVol2/>

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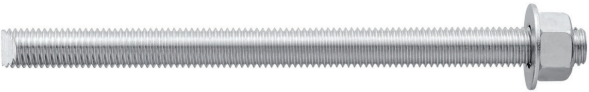

US: 877-749-6337 or HNATechnicalServices@hilti.com

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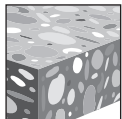
3.2.5 HIT-ICE ADHESIVE ANCHORING SYSTEM

PRODUCT DESCRIPTION

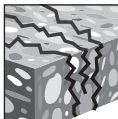
HIT-ICE with Threaded Rod, Rebar, and HIS-N Inserts

Mortar Systems	Features and Benefits
 <p>Hilti HIT-ICE Cartridge</p>	<ul style="list-style-type: none"> • Winter formulation for base material temperatures down to -10°F (-23°C) • Two hole cleaning options including the Hilti SafeSet™ System using the TE-CD or TE-YD Hollow Drill Bit in conjunction with a Hilti Vacuum to remove the dust as you drill. • Small edge distance and anchor spacing allowance • Mixing tube provides proper mixing and accurate dispensing of mixed resin • Contains no styrene and virtually odorless • Cures quickly over a large range of base material temperatures • Excellent weathering resistance and resistance to high temperatures • High load capacities
 <p>Rebar</p>	
 <p>Hilti HAS Threaded Rod</p>	
 <p>Hilti HIS-N</p>	

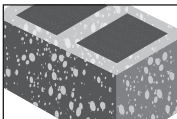
3.2.5



Uncracked concrete



Cracked concrete



Grout-filled concrete masonry



SafeSet™ System with Hollow Drill Bit



Profis Anchor design software

Approvals/Listings	
U.S. Green Building Council	LEED® Credit 4.1-Low Emitting Materials

MATERIAL SPECIFICATIONS

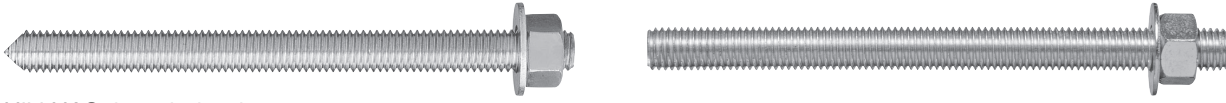
Table 1 - Material properties of cured HIT-ICE adhesive

Compressive strength	72 MPa	10,440 psi
Tensile strength	12 MPa	1,740 psi
Water absorption DIN 53495	2.4%	
Electrical resistance DIN/VDE 0303T3	2x10 ¹¹ OHM/cm	5.1x10 ¹¹ OHM/in.

For material specifications for anchor rods and inserts, please refer to section 3.2.8 of the Hilti North American Tech Guide volume 2: Anchor Fastening Technical Guide, Edition 17.

TECHNICAL DATA

Hilti HIT-ICE with HAS Threaded Rod



Hilti HAS threaded rod

Figure 1 — Hilti HAS threaded rod installation conditions

Permissible concrete conditions	Uncracked concrete	Dry concrete	Permissible drilling method	Hammer drilling with carbide tipped drill bit
	Cracked concrete	Water saturated concrete		Hilti TE-CD or TE-YD Hollow Drill Bit

Table 2 — Hilti HAS Rod installation specifications installed with Hilti HIT-ICE adhesive system

Setting information	Symbol	Units	Nominal rod diameter						
			3/8	1/2	5/8	3/4	7/8	1	1-1/4
Nominal bit diameter	d_o	in.	7/16	9/16	3/4	7/8	1	1-1/8	1-3/8
Effective embedment	minimum	$h_{ef,min}$	in. (60)	2-3/8 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
	maximum	$h_{ef,max}$	in. (191)	7-1/2 (254)	10 (318)	12-1/2 (381)	15 (445)	17-1/2 (508)	20 (635)
Minimum diameter of fixture hole	through-set		in.	1/2	5/8	13/16 ¹	15/16 ¹	1-1/8 ¹	1-1/4 ¹
	preset		in.	7/16	9/16	11/16	13/16	15/16	1-1/8
Installation torque	T_{inst}	ft-lb (Nm)	15 (20)	30 (40)	60 (80)	100 (136)	125 (169)	150 (203)	200 (271)
Minimum concrete thickness	h_{min}	in. (mm)	$h_{ef} + 1-1/4$ ($h_{ef} + 30$)			$h_{ef} + 2 \cdot d_o$			
Minimum edge distance ²	c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)
Minimum anchor spacing	s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)

1 Install using (2) washers. See Figure 3.

2 Edge distance of 1-3/4-inch (44mm) is permitted provided the installation torque is reduced to 0.30 T_{inst} for 5d < s < 16-in. and to 0.5T_{inst} for s > 16-in.

Figure 2 — HAS threaded rods

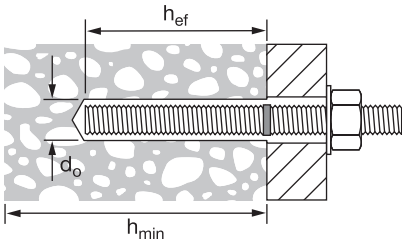


Figure 3 — Installation with (2) washers



DESIGN DATA IN CONCRETE PER ACI 318

ACI 318 Chapter 17 design

Load Resistance Factored Design of anchors is described in the provisions of ACI 318 Chapter 17 for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Load Resistance Factored Design tables with unfactored characteristic loads that are based on testing in accordance with ACI 355.4. These tables are followed by Hilti Simplified Design Tables. The load values in these tables were developed using the Strength Design parameters developed through testing per ACI 355.4 and the equations within ACI 318 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to the of the Hilti North American Product Technical Guide, Volume 2: Anchor Fastening Technical Guide.

For additional information or technical assistance, contact Hilti at 800-879-5000 (US) or 800-363-4459 (CA)

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Table 3 — Hilti HIT-ICE design information with HAS threaded rods in holes drilled with a hammer drill and carbide bit (or hollow drill bit) in accordance with ACI 318 Ch. 17¹

Design parameter	Symbol	Units	Nominal rod diameter (in.)							Ref ACI 318	
			3/8	1/2	5/8	3/4	7/8	1	1-1/4		
Nominal anchor diameter	d_a	in (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)	1 (25.4)	1-1/4 (31.8)		
Effective minimum embedment ²	$h_{ef,min}$	in (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)		
Effective maximum embedment ²	$h_{ef,max}$	in (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)		
Minimum concrete thickness ²	h_{min}	in (mm)	$h_{ef} + 1-1/4$ ($h_{ef} + 30$)		$h_{ef} + 2d_0^{(8)}$						
Critical edge distance	c_{ac}	in (mm)	$c_{ac} = h_{ef} * \left(\frac{T_{k,uncr}}{1160}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef,j}}\right] * \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $T_{k,uncr}$ need not be taken as greater than: $T_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$ $c_{ac} = h_{ef} * \left(\frac{T_{k,uncr}}{8}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef,j}}\right] * \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $T_{k,uncr}$ need not be taken as greater than: $T_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$								
Minimum edge distance ³	c_{min}	in (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	6-1/4 (159)		
Minimum anchor spacing	s_{min}	in (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	6-1/4 (159)		
Effectiveness factor for uncracked concrete ⁴	$k_{c,uncr}$	-	24 (10)							17.4.2.2	
Effectiveness factor for cracked concrete ⁴	$k_{c,cr}$	-	17 (7.1)							17.4.2.2	
Strength reduction factor for tension, concrete failure modes ⁵	$\Phi_{c,N}$	-	0.65							17.3.3	
Strength reduction factor for shear, concrete failure modes ⁵	$\Phi_{c,V}$	-	0.70							17.3.3	
Temperature range A ⁶	Characteristic bond stress in cracked concrete ⁷	$T_{k,cr}$	psi (MPa)	715 (4.9)	615 (4.2)	520 (3.6)	420 (2.9)	325 (2.2)	n/a	n/a	17.4.5
	Characteristic bond stress in uncracked concrete ⁷	$T_{k,uncr}$	psi (MPa)	1,215 (8.4)	1,200 (8.3)	1,185 (8.2)	1,075 (7.4)	1,060 (7.3)	1,050 (7.2)	1,020 (7.0)	17.4.5
Permissible installation conditions	Strength reduction factor for tension, bond failure modes, dry concrete	-	-	2	1	2	1	1	1	1	
	Strength reduction factor for tension, bond failure modes, water saturated concrete	-	-	0.55	0.65	0.55	0.65	0.65	0.65	0.65	
		-	-	2	1	2	1	1	1	1	
		-	-	0.55	0.65	0.55	0.65	0.65	0.65	0.65	

1 Design information in this table is based on testing in accordance with ACI 355.4.
 2 See figure 2 and 3 of this section.
 3 Minimum edge distance may be reduced to 1-3/4" (44mm) $\leq c_{min} < 5d$ provided T_{inst} is reduced to 0.30 T_{inst} for $5d < s < 16$ -in. and to 0.5 T_{inst} for $s > 16$ -in.
 4 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
 5 Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318 17.3.3.
 For cases where the presence of supplementary reinforcement can be verified, the reduction factors associated with Condition A may be used.
 6 Temperature range A: Max. short term temperature = 130°F (54°C), max. long term temperature = 110°F (43°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.
 7 Bond strength values corresponding to concrete compressive strength $f'_c = 2500$ psi (17.2 Mpa). For concrete compressive strength, f'_c , between 2,500 psi (17.2 Mpa) and 8,000 psi (55.2 Mpa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2,500)^{0.1}$ [for SI: $(f'_c / 17.2)^{0.1}$]
 8 d_0 = drilled hole diameter

Table 4 — Hilti HIT-ICE adhesive design strength with concrete / bond failure for threaded rod in uncracked concrete^{1,2,3,4,5,6,7,8}

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)
3/8	2-3/8 (60)	1,870 (8.3)	1,905 (8.5)	1,960 (8.7)	2,040 (9.1)	2,380 (10.6)	2,425 (10.8)	2,495 (11.1)	2,595 (11.5)
	3-3/8 (86)	2,655 (11.8)	2,705 (12.0)	2,785 (12.4)	2,900 (12.9)	6,765 (30.1)	6,890 (30.6)	7,090 (31.5)	7,380 (32.8)
	4-1/2 (114)	3,545 (15.8)	3,610 (16.1)	3,715 (16.5)	3,865 (17.2)	9,020 (40.1)	9,185 (40.9)	9,450 (42.0)	9,845 (43.8)
	7-1/2 (191)	5,905 (26.3)	6,015 (26.8)	6,190 (27.5)	6,445 (28.7)	15,030 (66.9)	15,305 (68.1)	15,755 (70.1)	16,405 (73.0)
1/2	2-3/4 (70)	3,370 (15.0)	3,430 (15.3)	3,530 (15.7)	3,680 (16.4)	7,255 (32.3)	7,390 (32.9)	7,605 (33.8)	7,920 (35.2)
	4-1/2 (114)	5,515 (24.5)	5,615 (25.0)	5,780 (25.7)	6,020 (26.8)	11,875 (52.8)	12,095 (53.8)	12,445 (55.4)	12,960 (57.6)
	6 (152)	7,350 (32.7)	7,485 (33.3)	7,705 (34.3)	8,025 (35.7)	15,835 (70.4)	16,125 (71.7)	16,595 (73.8)	17,280 (76.9)
	10 (254)	12,250 (54.5)	12,480 (55.5)	12,840 (57.1)	13,375 (59.5)	26,390 (117.4)	26,875 (119.5)	27,660 (123.0)	28,805 (128.1)
5/8	3-1/8 (79)	4,000 (17.8)	4,075 (18.1)	4,190 (18.6)	4,365 (19.4)	9,280 (41.3)	10,165 (45.2)	10,670 (47.5)	11,110 (49.4)
	5-5/8 (143)	7,200 (32.0)	7,330 (32.6)	7,545 (33.6)	7,855 (34.9)	18,325 (81.5)	18,660 (83.0)	19,205 (85.4)	20,000 (89.0)
	7-1/2 (191)	9,600 (42.7)	9,775 (43.5)	10,060 (44.7)	10,475 (46.6)	24,430 (108.7)	24,880 (110.7)	25,605 (113.9)	26,665 (118.6)
	12-1/2 (318)	15,995 (71.1)	16,290 (72.5)	16,765 (74.6)	17,460 (77.7)	40,720 (181.1)	41,465 (184.4)	42,675 (189.8)	44,445 (197.7)
3/4	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,040 (26.9)	6,290 (28.0)	11,000 (48.9)	12,050 (53.6)	13,010 (57.9)	13,545 (60.3)
	6-3/4 (171)	11,115 (49.4)	11,320 (50.4)	11,650 (51.8)	12,130 (54.0)	23,935 (106.5)	24,375 (108.4)	25,090 (111.6)	26,125 (116.2)
	9 (229)	14,820 (65.9)	15,090 (67.1)	15,530 (69.1)	16,175 (71.9)	31,915 (142.0)	32,500 (144.6)	33,450 (148.8)	34,835 (155.0)
	15 (381)	24,695 (109.8)	25,150 (111.9)	25,885 (115.1)	26,955 (119.9)	53,190 (236.6)	54,170 (241.0)	55,750 (248.0)	58,060 (258.3)
7/8	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,460 (28.7)	7,235 (32.2)	11,000 (48.9)	12,050 (53.6)	13,915 (61.9)	15,585 (69.3)
	7-7/8 (200)	14,915 (66.3)	15,190 (67.6)	15,635 (69.5)	16,280 (72.4)	32,125 (142.9)	32,715 (145.5)	33,670 (149.8)	35,065 (156.0)
	10-1/2 (267)	19,885 (88.5)	20,255 (90.1)	20,845 (92.7)	21,705 (96.5)	42,835 (190.5)	43,620 (194.0)	44,895 (199.7)	46,750 (208.0)
	17-1/2 (445)	33,145 (147.4)	33,755 (150.1)	34,740 (154.5)	36,175 (160.9)	71,390 (317.6)	72,700 (323.4)	74,825 (332.8)	77,920 (346.6)
1	4 (102)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,360 (41.6)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,165 (89.7)
	9 (229)	19,295 (85.8)	19,650 (87.4)	20,225 (90.0)	21,065 (93.7)	41,565 (184.9)	42,330 (188.3)	43,565 (193.8)	45,365 (201.8)
	12 (305)	25,730 (114.5)	26,205 (116.6)	26,970 (120.0)	28,085 (124.9)	55,420 (246.5)	56,435 (251.0)	58,085 (258.4)	60,490 (269.1)
	20 (508)	42,885 (190.8)	43,670 (194.3)	44,945 (199.9)	46,805 (208.2)	92,365 (410.9)	94,060 (418.4)	96,810 (430.6)	100,815 (448.4)
1-1/4	5 (127)	8,720 (38.8)	9,555 (42.5)	11,030 (49.1)	13,510 (60.1)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	29,100 (129.4)
	11-1/4 (286)	29,290 (130.3)	29,830 (132.7)	30,700 (136.6)	31,970 (142.2)	63,085 (280.6)	64,250 (285.8)	66,125 (294.1)	68,860 (306.3)
	15 (381)	39,055 (173.7)	39,770 (176.9)	40,935 (182.1)	42,625 (189.6)	84,115 (374.2)	85,665 (381.1)	88,165 (392.2)	91,810 (408.4)
	25 (635)	65,090 (289.5)	66,285 (294.8)	68,220 (303.5)	71,045 (316.0)	140,195 (623.6)	142,775 (635.1)	146,940 (653.6)	153,020 (680.7)

- See section 3.1.8 for explanation on development of load values.
- See Section 3.1.8 to convert design strength value to ASD value.
- Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- Apply spacing, edge distance, and concrete thickness factors in tables 7 - 18 as necessary to the above values. Compare to the steel values in table 6. The lesser of the values is to be used for the design.
- Data is for temperature range A: Max. short term temperature = 130°F (54°C), max. long term temperature = 110°F (43°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.
- Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength value by 0.85.
- Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
- Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_n as follows: For sand-lightweight, $\lambda_n = 0.51$. For all-lightweight, $\lambda_n = 0.45$.

Table 5 — Hilti HIT-ICE adhesive design strength with concrete / bond failure for threaded rod in cracked concrete^{1,2,3,4,5,6,7,8}

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)
3/8	2-3/8 (60)	1,100 (4.9)	1,120 (5.0)	1,155 (5.1)	1,200 (5.3)	1,400 (6.2)	1,425 (6.3)	1,470 (6.5)	1,530 (6.8)
	3-3/8 (86)	1,565 (7.0)	1,590 (7.1)	1,640 (7.3)	1,705 (7.6)	3,980 (17.7)	4,055 (18.0)	4,170 (18.5)	4,345 (19.3)
	4-1/2 (114)	2,085 (9.3)	2,125 (9.5)	2,185 (9.7)	2,275 (10.1)	5,305 (23.6)	5,405 (24.0)	5,560 (24.7)	5,790 (25.8)
	7-1/2 (191)	3,475 (15.5)	3,540 (15.7)	3,640 (16.2)	3,795 (16.9)	8,845 (39.3)	9,005 (40.1)	9,270 (41.2)	9,655 (42.9)
1/2	2-3/4 (70)	1,725 (7.7)	1,760 (7.8)	1,810 (8.1)	1,885 (8.4)	3,720 (16.5)	3,790 (16.9)	3,900 (17.3)	4,060 (18.1)
	4-1/2 (114)	2,825 (12.6)	2,880 (12.8)	2,960 (13.2)	3,085 (13.7)	6,085 (27.1)	6,200 (27.6)	6,380 (28.4)	6,645 (29.6)
	6 (152)	3,770 (16.8)	3,835 (17.1)	3,950 (17.6)	4,110 (18.3)	8,115 (36.1)	8,265 (36.8)	8,505 (37.8)	8,855 (39.4)
	10 (254)	6,280 (27.9)	6,395 (28.4)	6,580 (29.3)	6,855 (30.5)	13,525 (60.2)	13,775 (61.3)	14,175 (63.1)	14,760 (65.7)
5/8	3-1/8 (79)	1,755 (7.8)	1,785 (7.9)	1,840 (8.2)	1,915 (8.5)	4,465 (19.9)	4,550 (20.2)	4,680 (20.8)	4,875 (21.7)
	5-5/8 (143)	3,160 (14.1)	3,215 (14.3)	3,310 (14.7)	3,450 (15.3)	8,040 (35.8)	8,190 (36.4)	8,425 (37.5)	8,775 (39.0)
	7-1/2 (191)	4,210 (18.7)	4,290 (19.1)	4,415 (19.6)	4,595 (20.4)	10,720 (47.7)	10,920 (48.6)	11,235 (50.0)	11,700 (52.0)
	12-1/2 (318)	7,020 (31.2)	7,150 (31.8)	7,355 (32.7)	7,660 (34.1)	17,870 (79.5)	18,195 (80.9)	18,730 (83.3)	19,505 (86.8)
3/4	3-1/2 (89)	2,250 (10.0)	2,295 (10.2)	2,360 (10.5)	2,455 (10.9)	4,850 (21.6)	4,940 (22.0)	5,080 (22.6)	5,295 (23.6)
	6-3/4 (171)	4,340 (19.3)	4,420 (19.7)	4,550 (20.2)	4,740 (21.1)	9,350 (41.6)	9,525 (42.4)	9,800 (43.6)	10,205 (45.4)
	9 (229)	5,790 (25.8)	5,895 (26.2)	6,070 (27.0)	6,320 (28.1)	12,470 (55.5)	12,700 (56.5)	13,070 (58.1)	13,610 (60.5)
	15 (381)	9,650 (42.9)	9,825 (43.7)	10,115 (45.0)	10,530 (46.8)	20,780 (92.4)	21,165 (94.1)	21,780 (96.9)	22,685 (100.9)
7/8	3-1/2 (89)	2,030 (9.0)	2,070 (9.2)	2,130 (9.5)	2,220 (9.9)	4,380 (19.5)	4,460 (19.8)	4,590 (20.4)	4,780 (21.3)
	7-7/8 (200)	4,575 (20.4)	4,655 (20.7)	4,795 (21.3)	4,990 (22.2)	9,850 (43.8)	10,030 (44.6)	10,325 (45.9)	10,750 (47.8)
	10-1/2 (267)	6,095 (27.1)	6,210 (27.6)	6,390 (28.4)	6,655 (29.6)	13,135 (58.4)	13,375 (59.5)	13,765 (61.2)	14,335 (63.8)
	17-1/2 (445)	10,160 (45.2)	10,350 (46.0)	10,650 (47.4)	11,090 (49.3)	21,890 (97.4)	22,290 (99.2)	22,940 (102.0)	23,890 (106.3)

3.2.5

- 1 See section 3.1.8 for explanation on development of load values.
- 2 See Section 3.1.8 to convert design strength value to ASD value.
- 3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- 4 Apply spacing, edge distance, and concrete thickness factors in tables 7-18 as necessary to the above values. Compare to the steel values in table 6. The lesser of the values is to be used for the design.
- 5 Data is for temperature range A: Max. short term temperature = 130°F (54°C), max. long term temperature = 110°F (43°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.
- 6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength value by 0.85.
- 7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
- 8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, $\lambda_a = 0.51$. For all-lightweight, $\lambda_a = 0.45$.
- 9 Tabular values are for static loads only. Seismic applications are not permitted.

Table 6 — Steel design strength for Hilti HAS threaded rods for use with ACI 318 Chapter 17

Nominal anchor diameter in.	HAS-V-36 / HAS-V-36 HDG ASTM F1554 Gr. 36 ^{4,5}			HAS-E-55 / HAS-E-55 HDG ASTM F1554 Gr. 55 ^{4,6}			HAS-B-105 and HAS-B-105 HDG ASTM A193 B7 and ASTM F 1554 Gr.105 ⁴			HAS-R stainless steel ASTM F593 (3/8-in to 1-in) ⁵ ASTM A193 (1-1/8-in to 2-in) ⁴		
	Tensile ¹ ΦN _{sa} lb (kN)	Shear ² ΦV _{sa} lb (kN)	Seismic Shear ³ ΦV _{sa,eq} lb (kN)	Tensile ¹ ΦN _{sa} lb (kN)	Shear ² ΦV _{sa} lb (kN)	Seismic Shear ³ ΦV _{sa,eq} lb (kN)	Tensile ¹ ΦN _{sa} lb (kN)	Shear ² ΦV _{sa} lb (kN)	Seismic Shear ³ ΦV _{sa,eq} lb (kN)	Tensile ¹ ΦN _{sa} lb (kN)	Shear ² ΦV _{sa} lb (kN)	Seismic Shear ³ ΦV _{sa,eq} lb (kN)
3/8	3,370 (15.0)	1,750 (7.8)	1,050 (4.7)	4,360 (19.4)	2,270 (10.1)	1,590 (7.1)	7,270 (32.3)	3,780 (16.8)	2,645 (11.8)	5,040 (22.4)	2,790 (12.4)	1,955 (8.7)
1/2	6,175 (27.5)	3,210 (14.3)	1,925 (8.6)	7,985 (35.5)	4,150 (18.5)	2,905 (12.9)	13,305 (59.2)	6,920 (30.8)	4,845 (21.6)	9,225 (41.0)	5,110 (22.7)	3,575 (15.9)
5/8	9,835 (43.7)	5,110 (22.7)	3,065 (13.6)	12,715 (56.6)	6,610 (29.4)	4,625 (20.6)	21,190 (94.3)	11,020 (49.0)	7,715 (34.3)	14,690 (65.3)	8,135 (36.2)	5,695 (25.3)
3/4	14,550 (64.7)	7,565 (33.7)	4,540 (20.2)	18,820 (83.7)	9,785 (43.5)	6,850 (30.5)	31,360 (139.5)	16,310 (72.6)	11,415 (50.8)	18,485 (82.2)	10,235 (45.5)	7,165 (31.9)
7/8	20,085 (89.3)	10,445 (46.5)	6,265 (27.9)	25,975 (115.5)	13,505 (60.1)	9,455 (42.1)	43,285 (192.5)	22,510 (100.1)	15,755 (70.1)	25,510 (113.5)	14,125 (62.8)	9,890 (44.0)
1	26,350 (117.2)	13,700 (60.9)	8,220 (36.6)	34,075 (151.6)	17,720 (78.8)	12,405 (55.2)	56,785 (252.6)	29,530 (131.4)	20,670 (91.9)	33,465 (148.9)	18,535 (82.4)	12,975 (57.7)
1-1/4	42,160 (187.5)	21,920 (97.5)	13,150 (58.5)	54,515 (242.5)	28,345 (126.1)	19,840 (88.3)	90,855 (404.1)	47,245 (210.2)	33,070 (147.1)	41,430 (184.3)	21,545 (95.8)	12,925 (57.5)

1 Tensile = $\phi A_{sa} f_{sa}$ as noted in ACI 318 17.4.1.2

2 Shear = $\phi 0.60 A_{sa} f_{sa}$ as noted in ACI 318 17.5.1.2b.

3 Seismic Shear = $\alpha_{V,seis} \phi V_{sa}$: Reduction factor for seismic shear only. See ACI 318 for additional information on seismic applications.

4 HAS-V, HAS-E (3/8-in to 1-1/4-in), HAS-B, and HAS-R (Class 1; 1-1/4-in) threaded rods are considered ductile steel elements (including HDG rods).

5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements.

6 3/8-inch dia. threaded rods are not included in the ASTM F1554 standard. Hilti 3/8-inch dia. HAS-V, HAS-E, and HAS-E-B (incl. HDG) threaded rods meet the chemical composition and mechanical property requirements of ASTM F1554.

Table 7 – Load adjustment factors for 3/8-in. diameter threaded rods in uncracked concrete^{1,2,3}

Embedment <i>h_{ef}</i>	3/8-in. threaded rods uncracked concrete	Spacing factor in tension <i>f_{AN}</i>				Edge distance factor in tension <i>f_{RN}</i>				Spacing factor in shear ⁴ <i>f_{AV}</i>				Edge distance in shear								Concrete thickness factor in shear ⁵ <i>f_{HV}</i>			
														⊥ Toward edge <i>f_{RV}</i>				∥ To edge <i>f_{RV}</i>							
		in. (mm)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)
1-3/4 (44)	n/a	n/a	n/a	n/a	0.44	0.32	0.23	0.13	n/a	n/a	n/a	n/a	0.30	0.11	0.08	0.05	0.44	0.22	0.16	0.10	n/a	n/a	n/a	n/a	
1-7/8 (48)	0.61	0.59	0.57	0.54	0.46	0.33	0.24	0.14	0.58	0.54	0.53	0.52	0.33	0.12	0.09	0.05	0.46	0.24	0.18	0.10	n/a	n/a	n/a	n/a	
2 (51)	0.62	0.60	0.57	0.54	0.48	0.34	0.25	0.14	0.59	0.54	0.54	0.53	0.36	0.13	0.10	0.06	0.48	0.27	0.20	0.12	n/a	n/a	n/a	n/a	
3 (76)	0.69	0.65	0.61	0.57	0.61	0.43	0.31	0.18	0.63	0.57	0.55	0.54	0.66	0.25	0.18	0.11	0.61	0.43	0.31	0.18	n/a	n/a	n/a	n/a	
3-5/8 (92)	0.72	0.68	0.63	0.58	0.71	0.50	0.36	0.21	0.65	0.58	0.56	0.55	0.88	0.33	0.24	0.15	0.71	0.49	0.36	0.21	0.78	n/a	n/a	n/a	
4 (102)	0.74	0.70	0.65	0.59	0.79	0.53	0.38	0.22	0.67	0.59	0.57	0.55	1.00	0.38	0.28	0.17	0.79	0.53	0.38	0.23	0.82	n/a	n/a	n/a	
4-5/8 (117)	0.78	0.73	0.671	0.60	0.91	0.61	0.44	0.26	0.70	0.60	0.58	0.56		0.47	0.35	0.21	0.91	0.61	0.44	0.26	0.89	0.63	n/a	n/a	
5 (127)	0.80	0.75	0.69	0.61	0.98	0.66	0.48	0.28	0.71	0.61	0.60	0.56		0.53	0.40	0.24	0.98	0.66	0.48	0.28	0.92	0.66	n/a	n/a	
5-3/4 (146)	0.85	0.78	0.71	0.68	1.00	0.75	0.55	0.32	0.74	0.63	0.60	0.57		0.65	0.49	0.30	1.00	0.75	0.55	0.32	0.99	0.71	0.64	n/a	
6 (152)	0.86	0.80	0.72	0.63		0.79	0.57	0.332	0.75	0.63	0.61	0.58		0.69	0.52	0.31		0.79	0.57	0.33	1.00	0.72	0.66	n/a	
7 (178)	0.93	0.85	0.76	0.66		0.92	0.67	0.39	0.80	0.65	0.63	0.59		0.87	0.65	0.40		0.92	0.67	0.39		0.78	0.71	n/a	
8 (203)	0.99	0.90	0.80	0.68		1.00	0.76	0.44	0.84	0.67	0.64	0.60		1.00	0.80	0.48		1.00	0.76	0.44		0.83	0.76	n/a	
8-3/4 (222)	1.00	0.93	0.82	0.69			0.84	0.48	0.87	0.69	0.66	0.61			0.91	0.55			0.84	0.48		0.87	0.80	0.67	
9 (229)		0.94	0.83	0.70			0.86	0.50	0.88	0.70	0.66	0.62			0.95	0.57			0.86	0.50		0.88	0.80	0.68	
10 (254)		0.99	0.87	0.72			0.96	0.55	0.92	0.72	0.68	0.63			1.00	0.67			0.96	0.55		0.93	0.85	0.71	
11 (279)		1.00	0.91	0.74			1.00	0.61	0.97	0.74	0.70	0.64				0.77			1.00	0.61		0.98	0.89	0.75	
12 (305)			0.94	0.77				0.66	1.00	0.76	0.72	0.65				0.88				0.66		1.00	0.93	0.78	
14 (356)								0.78	0.80	0.75	0.68					1.00				0.78			1.00	0.85	
16 (406)				0.86				0.88	0.85	0.79	0.70									0.89				0.91	
18 (457)				0.90				1.00	0.89	0.82	0.73									1.00				0.96	
24 (610)				1.00						1.00	0.93	0.81								1.00				1.00	
30 (762)											1.00	0.88													
36 (914)												0.96													
>48 (1219)												1.00													

3.2.5

Table 8 – Load adjustment factors for 3/8-in. diameter threaded rods in cracked concrete^{1,2,3}

Embedment <i>h_{ef}</i>	3/8-in. threaded rods cracked concrete	Spacing factor in tension <i>f_{AN}</i>				Edge distance factor in tension <i>f_{RN}</i>				Spacing factor in shear ⁴ <i>f_{AV}</i>				Edge distance in shear								Concrete thickness factor in shear ⁵ <i>f_{HV}</i>			
														⊥ Toward edge <i>f_{RV}</i>				∥ To edge <i>f_{RV}</i>							
		in. (mm)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)
1-3/4 (44)	n/a	n/a	n/a	n/a	0.59	0.54	0.49	0.43	n/a	n/a	n/a	n/a	0.36	0.13	0.10	0.06	0.59	0.27	0.20	0.12	n/a	n/a	n/a	n/a	
1-7/8 (48)	0.61	0.59	0.57	0.54	0.61	0.56	0.50	0.44	0.59	0.55	0.54	0.53	0.40	0.15	0.11	0.07	0.61	0.30	0.22	0.13	n/a	n/a	n/a	n/a	
2 (51)	0.62	0.60	0.57	0.54	0.63	0.57	0.51	0.44	0.60	0.55	0.54	0.53	0.44	0.16	0.12	0.07	0.63	0.32	0.24	0.15	n/a	n/a	n/a	n/a	
3 (76)	0.68	0.65	0.61	0.57	0.79	0.70	0.60	0.49	0.64	0.57	0.56	0.54	0.81	0.30	0.22	0.13	0.79	0.59	0.45	0.27	n/a	n/a	n/a	n/a	
3-5/8 (92)	0.72	0.68	0.63	0.58	0.91	0.79	0.66	0.53	0.67	0.59	0.57	0.55	1.00	0.40	0.30	0.18	0.91	0.79	0.59	0.36	0.84	n/a	n/a	n/a	
4 (102)	0.74	0.70	0.65	0.59	0.98	0.84	0.70	0.55	0.69	0.60	0.58	0.56		0.46	0.34	0.21	0.98	0.84	0.69	0.41	0.88	n/a	n/a	n/a	
4-5/8 (117)	0.78	0.73	0.67	0.60	1.00	0.93	0.76	0.58	0.72	0.61	0.59	0.57		0.57	0.43	0.26	1.00	0.93	0.76	0.51	0.94	0.68	n/a	n/a	
5 (127)	0.804	0.75	0.69	0.61		0.99	0.80	0.60	0.74	0.62	0.61	0.57		0.64	0.48	0.29		0.99	0.80	0.58	0.98	0.70	n/a	n/a	
5-3/4 (146)	0.85	0.78	0.71	0.63		1.00	0.89	0.65	0.78	0.64	0.62	0.58		0.79	0.59	0.36		1.00	0.89	0.65	1.00	0.75	0.69	n/a	
6 (152)	0.86	0.80	0.72	0.63			0.91	0.66	0.79	0.65	0.62	0.59		0.84	0.63	0.38			0.91	0.66		0.77	0.70	n/a	
7 (178)	0.93	0.85	0.76	0.66			1.00	0.72	0.84	0.67	0.64	0.60		1.00	0.79	0.48			1.00	0.72		0.83	0.76	n/a	
8 (203)	0.99	0.90	0.80	0.68				0.78	0.89	0.70	0.66	0.62			0.97	0.58				0.78		0.89	0.81	n/a	
8-3/4 (222)	1.00	0.93	0.82	0.69				0.83	0.92	0.72	0.68	0.63			1.00	0.67				0.83	0.68	0.93	0.85	0.71	
9 (229)		0.94	0.83	0.70				0.85	0.93	0.72	0.68	0.63				0.70				0.85	0.94	0.86	0.72		
10 (254)		0.99	0.87	0.72				0.91	0.98	0.75	0.70	0.65				0.81				0.91	0.99	0.90	0.76		
11 (279)		1.00	0.91	0.74				0.98	1.00	0.77	0.73	0.66				0.92				0.98	1.00	0.95	0.80		
12 (305)			0.94	0.76				1.00	0.80	0.75	0.67					1.00				1.00		0.99	0.84		
14 (356)				1.00	0.81					0.85	0.79	0.70											1.000	0.90	
16 (406)				0.86						0.90	0.83	0.73												0.96	
18 (457)				0.90						0.95	0.87	0.76												1.00	
24 (610)				1.00						1.00	0.99	0.85													
30 (762)											1.00	0.94													
36 (914)												1.00													
>48 (1219)																									

1 Linear interpolation not permitted
 2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
 3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
 4 Spacing factor reduction in shear applicable when c < 3*h_{ef}. *f_{AV}* is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then *f_{AV}* = *f_{AN}*.
 5 Concrete thickness reduction factor in shear, *f_{HV}*, is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then *f_{HV}* = 1.0.

Table 9 — Load adjustment factors for 1/2-in. diameter threaded rods in uncracked concrete^{1,2,3}

1/2-in. threaded rods uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear ⁴ f_{AV}				Edge distance in shear								Concrete thickness factor in shear ⁵ f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
														2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10				
Embedment h_{ef} in. (mm)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	
1-3/4 (44)	n/a	n/a	n/a	n/a	0.404	0.275	0.20	0.12	n/a	n/a	n/a	n/a	0.11	0.07	0.05	0.03	0.22	0.14	0.11	0.06	n/a	n/a	n/a	n/a	
2-1/2 (64)	0.62	0.59	0.57	0.54	0.49	0.32	0.24	0.14	0.55	0.54	0.53	0.52	0.19	0.12	0.09	0.06	0.37	0.25	0.18	0.11	n/a	n/a	n/a	n/a	
3 (76)	0.64	0.61	0.58	0.55	0.54	0.35	0.26	0.15	0.57	0.55	0.54	0.53	0.24	0.16	0.12	0.07	0.49	0.32	0.24	0.15	n/a	n/a	n/a	n/a	
4 (102)	0.68	0.65	0.61	0.57	0.67	0.42	0.31	0.18	0.59	0.57	0.55	0.54	0.38	0.25	0.19	0.11	0.67	0.42	0.31	0.18	0.59	n/a	n/a	n/a	
5 (127)	0.73	0.69	0.64	0.58	0.83	0.49	0.36	0.21	0.61	0.58	0.57	0.55	0.53	0.35	0.26	0.16	0.83	0.49	0.36	0.21	0.66	n/a	n/a	n/a	
5-3/4 (146)	0.76	0.71	0.66	0.60	0.96	0.55	0.41	0.24	0.63	0.59	0.58	0.56	0.65	0.43	0.32	0.19	0.96	0.55	0.41	0.24	0.71	0.62	n/a	n/a	
6 (152)	0.78	0.72	0.67	0.60	1.00	0.58	0.42	0.25	0.63	0.60	0.58	0.56	0.69	0.46	0.34	0.21	1.00	0.58	0.42	0.25	0.72	0.63	n/a	n/a	
7 (178)	0.82	0.76	0.69	0.62		0.67	0.49	0.29	0.65	0.62	0.60	0.57	0.87	0.57	0.43	0.26		0.67	0.49	0.29	0.78	0.68	n/a	n/a	
7-1/4 (184)	0.83	0.77	0.70	0.62		0.70	0.5	0.30	0.66	0.62	0.60	0.57	0.92	0.60	0.45	0.27		0.69	0.51	0.30	0.79	0.69	0.63	n/a	
8 (203)	0.87	0.80	0.72	0.63		0.77	0.56	0.33	0.67	0.63	0.61	0.58	1.00	0.70	0.53	0.32		0.77	0.56	0.33	0.83	0.73	0.66	n/a	
9 (229)	0.91	0.83	0.75	0.65		0.86	0.63	0.37	0.70	0.65	0.62	0.59		0.84	0.63	0.38		0.86	0.63	0.37	0.88	0.77	0.70	n/a	
10 (254)	0.96	0.87	0.78	0.67		0.96	0.70	0.41	0.72	0.66	0.64	0.60		0.98	0.73	0.44		0.96	0.70	0.41	0.93	0.81	0.74	n/a	
11-1/4 (286)	1.00	0.92	0.81	0.69		1.00	0.79	0.46	0.74	0.69	0.65	0.61		1.00	0.88	0.53		1.00	0.79	0.46	0.99	0.86	0.78	0.66	
12 (305)		0.94	0.83	0.70			0.85	0.49	0.76	0.70	0.66	0.62			0.97	0.58			0.85	0.49	1.00	0.89	0.81	0.69	
14 (356)		1.00	0.89	0.73			0.99	0.58	0.80	0.73	0.69	0.64			1.00	0.73			0.99	0.58		0.96	0.87	0.74	
16 (406)			0.94	0.77			1.00	0.66	0.85	0.76	0.72	0.65				0.89			1.00	0.66		1.00	0.93	0.79	
18 (457)			1.00	0.80				0.74	0.89	0.80	0.74	0.67				1.00				0.74			0.99	0.83	
20 (508)				0.83				0.82	0.93	0.83	0.77	0.69								0.82			1.00	0.88	
22 (559)				0.87				0.91	0.98	0.86	0.80	0.71								0.91				0.92	
24 (610)				0.90				0.99	1.00	0.89	0.83	0.73								0.99				0.96	
30 (762)				1.00				1.00		0.99	0.91	0.79								1.00				1.00	
36 (914)										1.00	0.99	0.85													
>48 (1219)											1.00	0.96													

Table 10 — Load adjustment factors for 1/2-in. diameter threaded rods in cracked concrete^{1,2,3}

1/2-in. threaded rods cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear ⁴ f_{AV}				Edge distance in shear								Concrete thickness factor in shear ⁵ f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
														2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10				
Embedment h_{ef} in. (mm)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	(70)	(114)	(152)	(254)	
1-3/4 (44)	n/a	n/a	n/a	n/a	0.526	0.49	0.45	0.41	n/a	n/a	n/a	n/a	0.15	0.10	0.08	0.05	0.30	0.20	0.15	0.09	n/a	n/a	n/a	n/a	
2-1/2 (64)	0.62	0.59	0.57	0.54	0.61	0.56	0.50	0.44	0.57	0.55	0.54	0.53	0.26	0.17	0.13	0.08	0.52	0.34	0.26	0.15	n/a	n/a	n/a	n/a	
3 (76)	0.64	0.61	0.58	0.55	0.67	0.60	0.53	0.46	0.58	0.56	0.55	0.54	0.34	0.22	0.17	0.10	0.67	0.45	0.34	0.20	n/a	n/a	n/a	n/a	
4 (102)	0.68	0.65	0.61	0.57	0.80	0.70	0.60	0.49	0.61	0.58	0.57	0.54	0.52	0.35	0.26	0.16	0.80	0.69	0.52	0.31	0.66	n/a	n/a	n/a	
5 (127)	0.73	0.69	0.64	0.58	0.93	0.80	0.67	0.53	0.64	0.60	0.59	0.56	0.73	0.48	0.36	0.22	0.93	0.80	0.67	0.43	0.736	n/a	n/a	n/a	
5-3/4 (146)	0.76	0.71	0.66	0.60	1.00	0.89	0.73	0.56	0.66	0.62	0.60	0.57	0.90	0.60	0.45	0.27	1.00	0.89	0.73	0.54	0.79	0.69	n/a	n/a	
6 (152)	0.78	0.72	0.67	0.60		0.91	0.75	0.57	0.66	0.62	0.60	0.57	0.96	0.63	0.48	0.29		0.91	0.75	0.57	0.81	0.70	n/a	n/a	
7 (178)	0.82	0.76	0.69	0.62		1.00	0.83	0.62	0.69	0.64	0.62	0.58	1.00	0.80	0.60	0.36		1.00	0.83	0.62	0.87	0.76	n/a	n/a	
7-1/4 (184)	0.83	0.77	0.70	0.62			0.85	0.63	0.70	0.65	0.62	0.59		0.84	0.63	0.38			0.85	0.63	0.89	0.77	0.70	n/a	
8 (203)	0.87	0.80	0.72	0.63			0.91	0.66	0.72	0.66	0.64	0.60		0.98	0.73	0.44			0.91	0.66	0.93	0.81	0.74	n/a	
9 (229)	0.91	0.83	0.75	0.65			1.00	0.70	0.74	0.69	0.65	0.61		1.00	0.87	0.52			1.00	0.70	0.99	0.86	0.78	n/a	
10 (254)	0.96	0.87	0.78	0.67				0.75	0.77	0.71	0.67	0.62			1.00	0.61				0.75	1.00	0.91	0.82	n/a	
11-1/4 (286)	1.00	0.92	0.81	0.69				0.81	0.81	0.73	0.69	0.64				0.73				0.81		0.96	0.87	0.74	
12 (305)		0.94	0.83	0.70				0.85	0.83	0.75	0.70	0.64				0.81				0.85		0.99	0.90	0.76	
14 (356)		1.00	0.89	0.73				0.95	0.88	0.79	0.74	0.67				1.00				0.95		1.00	0.97	0.82	
16 (406)			0.94	0.77				1.00	0.93	0.83	0.77	0.69								1.00			1.00	0.88	
18 (457)			1.00	0.80					0.99	0.87	0.81	0.72												0.93	
20 (508)				0.83					1.00	0.91	0.84	0.74												0.98	
22 (559)				0.87						0.95	0.87	0.77												1.00	
24 (610)				0.90						0.99	0.91	0.79													
30 (762)				1.00						1.00	0.91	0.86													
36 (914)											0.93														
>48 (1219)											1.00														

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.

4 Spacing factor reduction in shear applicable when c < 3*h_{ef}. f_{AV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{AV} = f_{AN}.

5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{HV} = 1.0.

Table 11 – Load adjustment factors for 5/8-in. diameter threaded rods in uncracked concrete^{1,2,3}

5/8-in. threaded rods uncracked concrete	Spacing factor in tension				Edge distance factor in tension				Spacing factor in shear ⁴				Edge distance in shear								Concrete thickness factor in shear ⁵					
	f_{AN}				f_{RN}				f_{AV}				f_{RV} ⊥ Toward edge				f_{RV} ∥ To edge				f_{HV}					
Embedment h_{ef} in. (mm)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)		
1-3/4 (44)	n/a	n/a	n/a	n/a	0.39	0.26	0.19	0.11	n/a	n/a	n/a	n/a	0.09	0.05	0.04	0.02	0.187	0.10	0.08	0.05	n/a	n/a	n/a	n/a		
3-1/8 (79)	0.62	0.60	0.57	0.54	0.52	0.32	0.23	0.14	0.56	0.54	0.53	0.52	0.22	0.12	0.09	0.06	0.45	0.25	0.19	0.11	n/a	n/a	n/a	n/a		
4 (102)	0.65	0.62	0.59	0.55	0.62	0.36	0.27	0.16	0.58	0.55	0.54	0.53	0.32	0.18	0.14	0.08	0.62	0.36	0.27	0.16	n/a	n/a	n/a	n/a		
4-5/8 (117)	0.67	0.64	0.60	0.56	0.69	0.40	0.29	0.17	0.59	0.56	0.55	0.54	0.40	0.22	0.17	0.10	0.69	0.40	0.29	0.17	0.60	n/a	n/a	n/a		
5 (127)	0.68	0.648	0.61	0.57	0.74	0.42	0.31	0.18	0.60	0.57	0.56	0.54	0.45	0.25	0.19	0.11	0.74	0.42	0.31	0.18	0.63	n/a	n/a	n/a		
6 (152)	0.72	0.68	0.63	0.58	0.891	0.47	0.35	0.20	0.62	0.58	0.57	0.55	0.59	0.33	0.25	0.15	0.89	0.47	0.35	0.20	0.69	n/a	n/a	n/a		
7 (178)	0.76	0.71	0.66	0.59	1.00	0.54	0.40	0.23	0.64	0.59	0.58	0.55	0.75	0.42	0.31	0.19	1.00	0.54	0.40	0.23	0.74	n/a	n/a	n/a		
7-1/8 (181)	0.76	0.71	0.66	0.60		0.55	0.40	0.24	0.64	0.59	0.58	0.56	0.77	0.43	0.32	0.19		0.55	0.40	0.24	0.75	0.62	n/a	n/a		
8 (203)	0.80	0.74	0.68	0.61		0.62	0.45	0.27	0.66	0.61	0.59	0.56	0.91	0.51	0.38	0.23		0.62	0.45	0.27	0.79	0.65	n/a	n/a		
9 (229)	0.83	0.77	0.70	0.62		0.69	0.51	0.30	0.68	0.62	0.60	0.57	1.00	0.61	0.45	0.27		0.69	0.51	0.30	0.84	0.69	0.63	n/a		
10 (254)	0.87	0.80	0.72	0.63		0.77	0.57	0.33	0.70	0.63	0.61	0.58		0.71	0.53	0.32		0.77	0.57	0.33	0.89	0.73	0.6	n/a		
11 (279)	0.91	0.83	0.74	0.65		0.85	0.62	0.36	0.72	0.65	0.62	0.59		0.82	0.61	0.37		0.85	0.62	0.36	0.93	0.76	0.694	n/a		
12 (305)	0.94	0.86	0.77	0.66		0.92	0.68	0.40	0.74	0.66	0.63	0.59		0.93	0.70	0.42		0.92	0.68	0.40	0.97	0.80	0.73	n/a		
14 (356)		1.00	0.92	0.81	0.69		1.00	0.79	0.46	0.77	0.69	0.65	0.61		1.00	0.88	0.53		1.00	0.79	0.46	1.00	0.86	0.78	0.66	
16 (406)			0.97	0.86	0.71			0.90	0.53	0.81	0.71	0.68	0.63			1.00	0.65			0.90	0.53		0.92	0.84	0.71	
18 (457)		1.00	0.90	0.74				1.00	0.60	0.85	0.74	0.70	0.64				0.77				1.00	0.60		0.98	0.89	0.75
20 (508)			0.94	0.77					0.66	0.89	0.77	0.72	0.66			0.90				0.66			1.00	0.94	0.79	
22 (559)			0.99	0.79					0.73	0.93	0.80	0.74	0.67				1.00				0.66			0.98	0.83	
24 (610)			1.00	0.82					0.79	0.97	0.82	0.76	0.69								0.79			1.00	0.86	
26 (660)				0.85					0.86	1.00	0.85	0.79	0.70								0.86				0.90	
28 (711)				0.87					0.93		0.87	0.81	0.72								0.93				0.93	
30 (762)				0.90					0.99		0.90	0.83	0.73								0.99				0.97	
36 (914)				0.98					1.00		0.98	0.89	0.78								1.00				1.00	
> 48 (1219)				1.00						1.00	1.00	0.87														

3.2.5

Table 12 – Load adjustment factors for 5/8-in. diameter threaded rods in cracked concrete^{1,2,3}

5/8-in. threaded rods cracked concrete	Spacing factor in tension				Edge distance factor in tension				Spacing factor in shear ⁴				Edge distance in shear								Concrete thickness factor in shear ⁵			
	f_{AN}				f_{RN}				f_{AV}				f_{RV} ⊥ Toward edge				f_{RV} ∥ To edge				f_{HV}			
Embedment h_{ef} in. (mm)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
1-3/4 (44)	n/a	n/a	n/a	n/a	0.49	0.46	0.43	0.40	n/a	n/a	n/a	n/a	0.14	0.09	0.06	0.04	0.28	0.17	0.13	0.08	n/a	n/a	n/a	n/a
3-1/8 (79)	0.62	0.59	0.57	0.54	0.61	0.56	0.50	0.44	0.58	0.56	0.55	0.53	0.33	0.20	0.15	0.09	0.61	0.40	0.30	0.18	n/a	n/a	n/a	n/a
4 (102)	0.65	0.62	0.59	0.55	0.70	0.62	0.55	0.46	0.602	0.57	0.56	0.54	0.48	0.29	0.22	0.13	0.70	0.58	0.44	0.26	n/a	n/a	n/a	n/a
4-5/8 (117)	0.67	0.64	0.60	0.56	0.76	0.67	0.58	0.48	0.62	0.59	0.57	0.55	0.60	0.36	0.27	0.16	0.76	0.67	0.55	0.33	0.69	n/a	n/a	n/a
5 (127)	0.68	0.65	0.61	0.57	0.80	0.70	0.60	0.49	0.63	0.59	0.58	0.55	0.67	0.41	0.31	0.18	0.80	0.70	0.60	0.37	0.71	n/a	n/a	n/a
6 (152)	0.72	0.68	0.63	0.58	0.91	0.78	0.66	0.53	0.65	0.61	0.59	0.57	0.88	0.54	0.40	0.24	0.91	0.78	0.66	0.48	0.78	n/a	n/a	n/a
7 (178)	0.76	0.71	0.66	0.59	1.00	0.87	0.72	0.56	0.68	0.63	0.61	0.58	1.00	0.68	0.51	0.30	1.00	0.87	0.72	0.56	0.85	n/a	n/a	n/a
7-1/8 (181)	0.76	0.71	0.66	0.60		0.88	0.73	0.56	0.68	0.63	0.61	0.58		0.69	0.52	0.31		0.88	0.73	0.56	0.85	0.72	n/a	n/a
8 (203)	0.80	0.74	0.68	0.61		0.96	0.78	0.60	0.70	0.65	0.62	0.59		0.83	0.62	0.37		0.96	0.78	0.59	0.90	0.77	n/a	n/a
9 (229)	0.83	0.77	0.70	0.62		1.00	0.85	0.63	0.73	0.67	0.64	0.60		0.99	0.74	0.44		1.00	0.85	0.63	0.96	0.81	0.74	n/a
10 (254)	0.87	0.80	0.72	0.63			0.91	0.66	0.76	0.68	0.65	0.61		1.00	0.87	0.52			0.91	0.66	1.00	0.86	0.78	n/a
11 (279)	0.91	0.83	0.74	0.65			0.98	0.70	0.78	0.70	0.67	0.62			1.00	0.60			0.98	0.70	0.90	0.82	n/a	n/a
12 (305)	0.94	0.86	0.77	0.66			1.00	0.73	0.81	0.72	0.68	0.63				0.68			1.00	0.73		0.94	0.85	n/a
14 (356)		1.00	0.92	0.81	0.69			0.81	0.86	0.76	0.71	0.65				0.86				0.81		1.00	0.92	0.78
16 (406)			0.97	0.86	0.71			0.89	0.91	0.79	0.74	0.67					1.00			0.89			0.98	0.83
18 (457)		1.00	0.90	0.74				0.97	0.96	0.83	0.77	0.69								0.97			1.00	0.88
20 (508)			0.94	0.77				1.00	1.00	0.87	0.80	0.72								1.00				0.93
22 (559)			0.99	0.79						0.90	0.83	0.74												0.97
24 (610)			1.00	0.82						0.94	0.86	0.76												1.00
26 (660)				0.85						0.98	0.89	0.78												
28 (711)				0.87						1.00	0.92	0.80												
30 (762)				0.90							0.95	0.82												
36 (914)				0.98							1.00	0.89												
> 48 (1219)				1.00								1.00												

1 Linear interpolation not permitted
 2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
 3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
 4 Spacing factor reduction in shear applicable when c < 3*h_{ef}. f_{AV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{AV} = f_{AN}.
 5 Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{HV} = 1.0.

Table 13 — Load adjustment factors for 3/4-in. diameter threaded rods in uncracked concrete^{1,2,3}

Embedment h_{ef}	in. (mm)	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear ⁴ f_{AV}				Edge distance in shear								Concrete thickness factor in shear ⁵ f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
		3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15
1-3/4	(44)	n/a	n/a	n/a	n/a	0.39	0.24	0.18	0.10	n/a	n/a	n/a	n/a	0.09	0.04	0.03	0.02	0.17	0.09	0.06	0.04	n/a	n/a	n/a	n/a
3-3/4	(95)	0.62	0.59	0.57	0.54	0.57	0.32	0.24	0.14	0.57	0.54	0.54	0.53	0.27	0.13	0.10	0.06	0.53	0.27	0.20	0.12	n/a	n/a	n/a	n/a
4	(102)	0.63	0.60	0.57	0.54	0.60	0.33	0.25	0.14	0.57	0.55	0.54	0.53	0.29	0.15	0.11	0.07	0.59	0.30	0.22	0.13	n/a	n/a	n/a	n/a
5	(127)	0.66	0.62	0.59	0.56	0.70	0.38	0.28	0.16	0.59	0.56	0.55	0.53	0.41	0.21	0.15	0.10	0.70	0.38	0.28	0.16	n/a	n/a	n/a	n/a
5-1/4	(133)	0.67	0.63	0.60	0.56	0.73	0.39	0.29	0.17	0.60	0.56	0.55	0.54	0.44	0.22	0.17	0.10	0.73	0.39	0.29	0.17	0.62	n/a	n/a	n/a
6	(152)	0.69	0.65	0.61	0.57	0.83	0.43	0.31	0.18	0.61	0.57	0.56	0.54	0.54	0.27	0.20	0.12	0.83	0.41	0.31	0.18	0.67	n/a	n/a	n/a
7	(178)	0.73	0.67	0.63	0.58	0.92	0.48	0.35	0.21	0.63	0.58	0.57	0.55	0.68	0.34	0.26	0.15	0.92	0.48	0.35	0.21	0.72	n/a	n/a	n/a
8	(203)	0.76	0.70	0.65	0.59	1.00	0.53	0.39	0.23	0.65	0.59	0.58	0.56	0.83	0.42	0.31	0.19	1.00	0.53	0.39	0.23	0.77	n/a	n/a	n/a
8-1/2	(216)	0.77	0.71	0.66	0.59		0.57	0.42	0.24	0.66	0.60	0.58	0.56	0.91	0.46	0.34	0.21		0.57	0.42	0.24	0.79	0.63	n/a	n/a
9	(229)	0.79	0.72	0.67	0.60		0.60	0.44	0.26	0.67	0.61	0.59	0.56	0.99	0.50	0.37	0.22		0.60	0.44	0.26	0.81	0.65	n/a	n/a
10	(254)	0.82	0.75	0.69	0.61		0.67	0.49	0.27	0.68	0.62	0.60	0.57	1.00	0.58	0.44	0.26		0.67	0.49	0.27	0.86	0.68	n/a	n/a
10-3/4	(273)	0.85	0.77	0.70	0.62		0.72	0.53	0.31	0.70	0.63	0.60	0.57		0.65	0.49	0.29		0.72	0.53	0.31	0.89	0.71	0.64	n/a
12	(305)	0.89	0.80	0.72	0.63		0.80	0.59	0.34	0.72	0.64	0.62	0.58		0.77	0.57	0.35		0.80	0.59	0.34	0.94	0.75	0.68	n/a
14	(356)	0.95	0.85	0.76	0.66		0.93	0.69	0.40	0.76	0.66	0.63	0.60		0.97	0.72	0.43		0.931	0.68	0.40	1.00	0.81	0.73	n/a
16	(406)	1.00	0.90	0.80	0.68		1.00	0.79	0.46	0.80	0.69	0.65	0.61		1.00	0.89	0.53		1.00	0.78	0.46		0.86	0.78	n/a
16-3/4	(425)		0.91	0.81	0.69			0.82	0.48	0.81	0.70	0.66	0.61			0.95	0.57			0.82	0.48		0.88	0.80	0.68
18	(457)		0.94	0.83	0.70			0.88	0.52	0.83	0.71	0.67	0.62			1.00	0.63			0.88	0.52		0.92	0.83	0.70
20	(508)		0.99	0.87	0.72			0.98	0.57	0.87	0.73	0.69	0.64				0.74			0.98	0.57		0.96	0.88	0.74
22	(559)		1.00	0.91	0.74			1.00	0.63	0.91	0.76	0.71	0.65				0.86			1.00	0.63		1.00	0.92	0.78
24	(610)			0.94	0.77				0.69	0.94	0.78	0.73	0.66				0.98				0.69			0.96	0.81
26	(660)			0.98	0.79				0.74	0.98	0.80	0.75	0.68				1.00				0.74			1.00	0.84
28	(711)				1.00	0.81			0.80	1.00	0.83	0.77	0.69									0.80			0.87
30	(762)				0.83				0.86		0.85	0.79	0.71									0.86			0.91
36	(914)				0.90				1.00		0.92	0.85	0.75									1.00			0.99
> 48	(1219)				1.00						1.00	0.96	0.83												1.00

Table 14 — Load adjustment factors for 3/4-in. diameter threaded rods in cracked concrete^{1,2,3}

Embedment h_{ef}	in. (mm)	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear ⁴ f_{AV}				Edge distance in shear								Concrete thickness factor in shear ⁵ f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
		3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15	3-1/2	6-3/4	9	15
1-3/4	(44)	n/a	n/a	n/a	n/a	0.47	0.44	0.42	0.39	n/a	n/a	n/a	n/a	0.14	0.08	0.06	0.04	0.28	0.16	0.12	0.07	n/a	n/a	n/a	n/a
3-3/4	(95)	0.62	0.59	0.57	0.54	0.63	0.56	0.50	0.44	0.60	0.57	0.55	0.54	0.43	0.25	0.18	0.11	0.63	0.49	0.37	0.22	n/a	n/a	n/a	n/a
4	(102)	0.63	0.60	0.57	0.54	0.65	0.57	0.51	0.44	0.60	0.57	0.56	0.54	0.48	0.27	0.20	0.12	0.65	0.56	0.40	0.24	n/a	n/a	n/a	n/a
5	(127)	0.66	0.62	0.59	0.56	0.74	0.63	0.56	0.47	0.63	0.59	0.57	0.55	0.67	0.38	0.28	0.17	0.74	0.63	0.56	0.34	n/a	n/a	n/a	n/a
5-1/4	(133)	0.67	0.63	0.60	0.56	0.76	0.65	0.57	0.48	0.63	0.59	0.58	0.55	0.72	0.41	0.30	0.18	0.76	0.65	0.57	0.37	0.73	n/a	n/a	n/a
6	(152)	0.70	0.65	0.61	0.57	0.83	0.70	0.60	0.49	0.65	0.60	0.59	0.56	0.88	0.50	0.37	0.22	0.83	0.70	0.61	0.45	0.78	n/a	n/a	n/a
7	(178)	0.73	0.67	0.63	0.58	0.92	0.77	0.65	0.52	0.68	0.62	0.60	0.57	1.00	0.62	0.47	0.28	0.92	0.77	0.65	0.52	0.84	n/a	n/a	n/a
8	(203)	0.76	0.70	0.65	0.59	1.00	0.84	0.70	0.55	0.70	0.64	0.62	0.58		0.76	0.57	0.34	1.00	0.84	0.70	0.55	0.90	n/a	n/a	n/a
8-1/2	(216)	0.78	0.71	0.66	0.59		0.88	0.72	0.56	0.72	0.65	0.62	0.59		0.84	0.63	0.38		0.88	0.72	0.56	0.93	0.77	n/a	n/a
9	(229)	0.80	0.72	0.67	0.60		0.91	0.75	0.57	0.73	0.66	0.63	0.59		0.91	0.68	0.41		0.91	0.75	0.57	0.96	0.79	n/a	n/a
10	(254)	0.82	0.75	0.69	0.61		0.99	0.80	0.60	0.75	0.67	0.64	0.60		1.00	0.80	0.48		0.99	0.80	0.60	1.00	0.83	n/a	n/a
10-3/4	(273)	0.85	0.77	0.70	0.62		1.00	0.84	0.62	0.77	0.69	0.65	0.61			0.90	0.53		1.00	0.84	0.62		0.87	0.79	n/a
12	(305)	0.89	0.80	0.72	0.63			0.91	0.66	0.81	0.71	0.67	0.62			1.00	0.63			0.91	0.66		0.91	0.83	n/a
14	(356)	0.95	0.85	0.76	0.66			1.00	0.72	0.86	0.74	0.70	0.64				0.79			1.00	0.72		0.99	0.90	n/a
16	(406)	1.00	0.90	0.80	0.68				0.78	0.91	0.78	0.73	0.66				0.97				0.78		1.00	0.96	n/a
16-3/4	(425)		0.91	0.81	0.69				0.81	0.93	0.79	0.74	0.67				1.00				0.81			0.98	0.83
18	(457)		0.94	0.83	0.70				0.85	0.96	0.81	0.76	0.68								0.85			1.00	0.86
20	(508)		0.99	0.87	0.72				0.91	1.00	0.85	0.79	0.70								0.91				0.90
22	(559)		1.00	0.91	0.74				0.98		0.88	0.82	0.73								0.98				0.95
24	(610)			0.94	0.77				1.00		0.92	0.84	0.75								1.00				0.99
26	(660)			0.98	0.79						0.95	0.87	0.77												1.00
28	(711)				1.00	0.81					0.99	0.90	0.79												
30	(762)				0.83						1.00	0.93	0.81												
36	(914)				0.90							1.00	0.87												
> 48	(1219)				1.00								0.99												

1 Linear interpolation not permitted
2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when c < 3*h_{ef}. f_{AV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{AV} = f_{AN}.
5 Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{HV} = 1.0.

Table 15 – Load adjustment factors for 7/8-in. diameter threaded rods in uncracked concrete^{1,2,3}

7/8-in. threaded rods uncracked concrete	Embedment h_{ef} in. (mm)	Spacing factor in tension				Edge distance factor in tension				Spacing factor in shear ⁴				Edge distance in shear				Concrete thickness factor in shear ⁵						
		f_{AN}				f_{RN}				f_{AV}				⊥ Toward edge		 To edge		f_{HV}						
		3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)			
1-3/4 (44)	n/a	n/a	n/a	n/a	0.40	0.23	0.17	0.10	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.18	0.06	0.05	0.03	n/a	n/a	n/a	n/a
4-3/8 (111)	0.62	0.59	0.57	0.54	0.63	0.33	0.24	0.14	0.58	0.54	0.54	0.53	0.35	0.13	0.09	0.06	0.63	0.25	0.19	0.11	n/a	n/a	n/a	n/a
5 (127)	0.64	0.61	0.58	0.55	0.68	0.35	0.26	0.15	0.60	0.55	0.54	0.53	0.43	0.15	0.12	0.07	0.68	0.31	0.23	0.14	n/a	n/a	n/a	n/a
5-1/2 (140)	0.65	0.62	0.59	0.55	0.71	0.37	0.27	0.16	0.60	0.55	0.54	0.53	0.50	0.18	0.13	0.08	0.71	0.35	0.27	0.16	0.65	n/a	n/a	n/a
6 (152)	0.67	0.63	0.60	0.56	0.75	0.39	0.28	0.17	0.61	0.56	0.55	0.54	0.57	0.20	0.15	0.09	0.75	0.39	0.28	0.17	0.68	n/a	n/a	n/a
7 (178)	0.70	0.65	0.61	0.57	0.83	0.43	0.31	0.18	0.63	0.57	0.56	0.54	0.71	0.25	0.19	0.11	0.83	0.43	0.31	0.18	0.73	n/a	n/a	n/a
8 (203)	0.72	0.67	0.63	0.58	0.92	0.47	0.35	0.20	0.65	0.58	0.56	0.55	0.87	0.31	0.23	0.14	0.92	0.47	0.35	0.20	0.78	n/a	n/a	n/a
9 (229)	0.75	0.69	0.64	0.59	1.00	0.52	0.38	0.22	0.67	0.59	0.57	0.55	1.00	0.37	0.28	0.17	1.00	0.52	0.38	0.22	0.83	n/a	n/a	n/a
9-7/8 (251)	0.78	0.71	0.66	0.59		0.57	0.42	0.24	0.69	0.59	0.58	0.56		0.43	0.32	0.19		0.57	0.42	0.24	0.87	0.61	n/a	n/a
10 (254)	0.78	0.71	0.66	0.60		0.57	0.42	0.25	0.69	0.60	0.58	0.56		0.43	0.33	0.20		0.57	0.42	0.25	0.87	0.62	n/a	n/a
11 (279)	0.81	0.73	0.68	0.61		0.63	0.46	0.27	0.71	0.61	0.59	0.56		0.50	0.38	0.23		0.63	0.46	0.27	0.91	0.65	n/a	n/a
12 (305)	0.84	0.75	0.69	0.62		0.69	0.51	0.30	0.73	0.62	0.60	0.57		0.57	0.43	0.26		0.69	0.51	0.30	0.96	0.68	n/a	n/a
12-1/2 (318)	0.85	0.77	0.70	0.62		0.72	0.53	0.31	0.74	0.62	0.60	0.57		0.61	0.46	0.27		0.72	0.53	0.31	0.98	0.69	0.63	n/a
14 (356)	0.89	0.80	0.72	0.63		0.80	0.59	0.35	0.77	0.63	0.61	0.58		0.72	0.54	0.32		0.80	0.59	0.35	1.00	0.73	0.67	n/a
16 (406)	0.95	0.84	0.75	0.65		0.92	0.67	0.40	0.80	0.65	0.63	0.59		0.88	0.66	0.40		0.92	0.67	0.40		0.78	0.71	n/a
18 (457)	1.00	0.88	0.79	0.67		1.00	0.76	0.44	0.84	0.67	0.64	0.60		1.00	0.79	0.47		1.00	0.76	0.44		0.83	0.75	n/a
19-1/2 (495)		0.91	0.81	0.69			0.82	0.48	0.87	0.69	0.65	0.61			0.89	0.53			0.82	0.48		0.86	0.78	0.66
20 (508)		0.92	0.82	0.69			0.84	0.49	0.88	0.69	0.66	0.61			0.92	0.55			0.84	0.49		0.87	0.79	0.67
22 (559)		0.97	0.85	0.71			0.93	0.54	0.92	0.71	0.67	0.63			1.00	0.64			0.93	0.54		0.92	0.83	0.70
24 (610)		1.00	0.88	0.73			1.00	0.59	0.96	0.73	0.69	0.64				0.73			1.00	0.59		0.96	0.87	0.73
26 (660)			0.91	0.75				0.64	0.99	0.75	0.71	0.65				0.82			0.64			1.00	0.91	0.76
28 (711)			0.94	0.77				0.69	1.00	0.77	0.72	0.66				0.92			0.69				0.94	0.79
30 (762)			0.98	0.79				0.74		0.79	0.74	0.67				1.00			0.74				0.97	0.82
36 (914)			1.00	0.84				0.89		0.84	0.78	0.70							0.89				1.00	0.90
> 48 (1219)				0.96				1.00		0.96	0.88	0.77							1.00					1.00

3.2.5

Table 16 – Load adjustment factors for 7/8-in. diameter threaded rods in cracked concrete^{1,2,3}

7/8-in. threaded rods cracked concrete	Embedment h_{ef} in. (mm)	Spacing factor in tension				Edge distance factor in tension				Spacing factor in shear ⁴				Edge distance in shear				Concrete thickness factor in shear ⁵							
		f_{AN}				f_{RN}				f_{AV}				⊥ Toward edge		 To edge		f_{HV}							
		3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)				
1-3/4 (44)	n/a	n/a	n/a	n/a	0.46	0.43	0.41	0.38	n/a	n/a	n/a	n/a	0.16	0.07	0.06	0.03	0.32	0.15	0.11	0.07	n/a	n/a	n/a	n/a	
4-3/8 (111)	0.62	0.59	0.57	0.54	0.63	0.56	0.50	0.44	0.62	0.57	0.56	0.54	0.63	0.29	0.22	0.13	0.63	0.56	0.44	0.26	n/a	n/a	n/a	n/a	
5 (127)	0.64	0.61	0.58	0.55	0.68	0.59	0.52	0.45	0.64	0.58	0.57	0.55	0.77	0.36	0.27	0.16	0.68	0.59	0.52	0.32	n/a	n/a	n/a	n/a	
5-1/2 (140)	0.65	0.62	0.59	0.55	0.71	0.62	0.54	0.46	0.65	0.59	0.58	0.55	0.89	0.41	0.31	0.19	0.71	0.62	0.54	0.37	0.79	n/a	n/a	n/a	
6 (152)	0.67	0.63	0.60	0.56	0.75	0.64	0.56	0.47	0.67	0.60	0.58	0.56	1.00	0.47	0.35	0.21	0.75	0.64	0.56	0.42	0.82	n/a	n/a	n/a	
7 (178)	0.70	0.648	0.61	0.57	0.83	0.70	0.60	0.49	0.70	0.62	0.60	0.57		0.59	0.44	0.27	0.83	0.70	0.60	0.49	0.89	n/a	n/a	n/a	
8 (203)	0.72	0.67	0.63	0.58	0.92	0.76	0.64	0.52	0.72	0.63	0.61	0.58		0.72	0.54	0.33	0.92	0.76	0.64	0.52	0.95	n/a	n/a	n/a	
9 (229)	0.75	0.69	0.64	0.59	1.00	0.82	0.69	0.59	0.86	0.75	0.65	0.59		0.86	0.65	0.39	1.00	0.82	0.69	0.54	1.00	n/a	n/a	n/a	
9-7/8 (251)	0.78	0.71	0.66	0.59		0.88	0.72	0.56	0.78	0.67	0.64	0.60		0.99	0.74	0.45		0.87	0.72	0.56		0.81	n/a	n/a	
10 (254)	0.78	0.71	0.66	0.60		0.88	0.73	0.56	0.78	0.67	0.64	0.60		1.00	0.76	0.46		0.88	0.73	0.56		0.82	n/a	n/a	
11 (279)	0.81	0.73	0.68	0.61		0.95	0.77	0.59	0.81	0.69	0.65	0.61			0.88	0.53		0.95	0.77	0.59		0.86	n/a	n/a	
12 (305)	0.84	0.75	0.69	0.61		1.00	0.82	0.61	0.84	0.70	0.67	0.62			1.00	0.60		1.00	0.82	0.61		0.90	n/a	n/a	
12-1/2 (318)	0.85	0.77	0.70	0.62			0.84	0.62	0.85	0.71	0.67	0.62				0.64			0.84	0.62		0.92	0.83	n/a	
14 (356)	0.90	0.80	0.72	0.63			0.92	0.66	0.89	0.74	0.69	0.64				0.75			0.91	0.66		0.97	0.88	n/a	
16 (406)	0.95	0.84	0.75	0.65			1.00	0.71	0.95	0.77	0.72	0.66				0.92			1.00	0.71		1.00	0.94	n/a	
18 (457)	1.00	0.88	0.79	0.67				0.76	1.00	0.80	0.75	0.68					1.00		0.76				1.00	n/a	
19-1/2 (495)		0.91	0.81	0.69				0.80		0.83	0.77	0.69								0.80					0.88
20 (508)		0.92	0.82	0.69				0.82		0.84	0.78	0.70								0.82					0.89
22 (559)		0.97	0.85	0.71				0.87		0.87	0.81	0.72								0.87					0.93
24 (610)		1.00	0.88	0.73				0.93		0.90	0.83	0.74								0.93					0.97
26 (660)			0.91	0.75				0.99		0.94	0.86	0.76								0.99					1.00
28 (711)			0.94	0.77				1.00		0.97	0.89	0.78								1.00					
30 (762)			0.98	0.79						1.00	0.92	0.80													
36 (914)			1.00	0.85							1.00	0.86													
> 48 (1219)				0.96								0.97													

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.

4 Spacing factor reduction in shear applicable when c < 3h_{ef}. f_{AV} is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{AV} = f_{AN}.

5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{HV} = 1.0.



Table 17 — Load adjustment factors for 1-in. diameter threaded rods in uncracked concrete^{1,2,3}

Table with columns for Embedment, Spacing factor in tension (f_AN), Edge distance factor in tension (f_RN), Spacing factor in shear (f_AV), Edge distance in shear (perpendicular and parallel), and Concrete thickness factor in shear (f_HV). Rows list various embedment and spacing values.

- 1 Linear interpolation not permitted
2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_max for 5d <= s <= 16-in. and to 0.5 T_max for s > 16-in.
3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative.
4 Spacing factor reduction in shear applicable when c < 3*h_eff.
5 Concrete thickness reduction factor in shear, f_HV is applicable when edge distance, c < 3*h_eff.

Table 18 — Load adjustment factors for 1-1/4-in. diameter threaded rods in uncracked concrete^{1,2,3}

Table with columns for Embedment, Spacing factor in tension (f_AN), Edge distance factor in tension (f_RN), Spacing factor in shear (f_AV), Edge distance in shear (perpendicular and parallel), and Concrete thickness factor in shear (f_HV). Rows list various embedment and spacing values.

- 1 Linear interpolation not permitted
2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_max for 5d <= s <= 16-in. and to 0.5 T_max for s > 16-in.
3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative.
4 Spacing factor reduction in shear applicable when c < 3*h_eff.
5 Concrete thickness reduction factor in shear, f_HV is applicable when edge distance, c < 3*h_eff.

Hilti HIT-ICE adhesive with deformed reinforcing bars (rebar)



Figure 4 — Rebar installation conditions

Permissible concrete conditions	Uncracked concrete	Dry concrete	Permissible drilling method	Hammer drilling with carbide tipped drill bit
	Water-saturated concrete	Water-saturated concrete		Hilti TE-CD or TE-YD Hollow Drill Bit

3.2.5

Table 19 — Rebar installation specifications with Hilti HIT-ICE adhesive system

Setting information		Symbol	Units	Rebar size								
				#3	#4	#5	#6	#7	#8	#9	#10	#11
Nominal bit diameter		d_o	in.	1/2	5/8	3/4	7/8	1	1-1/8	1-3/8	1-1/2	1-3/4
Effective embedment	minimum	$h_{ef,min}$	in. (mm)	2-3/8 (60)	2-3/8 (60)	3 (76)	3 (76)	3-3/8 (85)	4 (102)	4-1/2 (114)	5 (127)	5-1/2 (140)
	maximum	$h_{ef,max}$	in. (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	27-1/2 (699)
Minimum concrete thickness		h_{min}	in. (mm)	$h_{ef} + 1-1/4$ ($h_{ef} + 30$)			$(h_{ef} + 2d_o)$					
Minimum edge distance ¹		c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	7 (178)
Minimum anchor spacing		s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	7 (178)

¹ Edge distance of 1-3/4-inch (44mm) is permitted provided the rebar remains un-torqued.

Figure 5 — Rebar installed with HIT-ICE adhesive

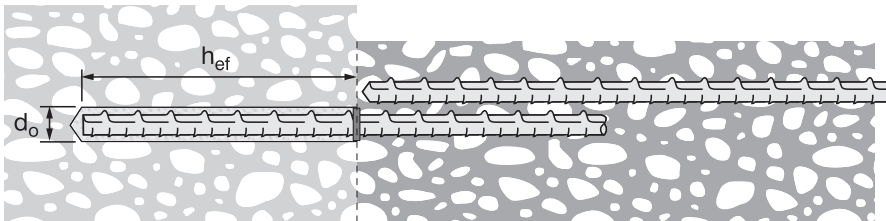


Table 20 — Hilti HIT-ICE design information with Rebar holes drilled with a hammer drill and carbide bit (or hollow drill bit) in accordance with ACI 318 Ch. 17¹

Design parameter	Symbol	Units	Nominal rod diameter (in.)									Ref ACI 318	
			#3	#4	#5	#6	#7	#8	#9	#10	#11		
Nominal anchor diameter	d_a	in (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)	1.00 (25.4)	1-1/8 (28.6)	1-1/4 (31.8)	1-3/8 (34.9)		
Effective minimum embedment ²	$h_{ef,min}$	in (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5-1/2 (114)		
Effective maximum embedment ²	$h_{ef,max}$	in (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	27-1/2 (699)		
Minimum concrete thickness ²	h_{min}	in (mm)	$h_{ef} + 1-1/4$ ($h_{ef} + 30$)		$h_{ef} + 2d_0^{(8)}$								
Critical edge distance	in (mm)	-	$C_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{1160}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$ $C_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{8}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$										
Minimum edge distance	c_{min}	in (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	7 (178)		
Minimum anchor spacing	s_{min}	in (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	7 (178)		
Effectiveness factor for uncracked concrete ⁴	$k_{c,uncr}$	-	24 (10)									17.4.2.2	
Effectiveness factor for cracked concrete ⁴	$k_{c,cr}$	-	17 (7.1)									17.4.2.2	
Strength reduction factor for tension, concrete failure modes ⁵	$\Phi_{c,N}$	-	0.65									17.3.3	
Strength reduction factor for shear, concrete failure modes ⁵	$\Phi_{c,V}$	-	0.70									17.3.3	
Temperature range A ⁶	Characteristic bond stress in cracked concrete ⁷	$\tau_{k,cr}$	psi MPa	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	17.4.5
	Characteristic bond stress in uncracked concrete ⁷	$\tau_{k,uncr}$	psi (MPa)	1,015 (7.0)	1,005 (6.9)	990 (6.8)	975 (6.7)	965 (6.7)	950 (6.6)	935 (6.4)	920 (6.3)	905 (6.2)	17.4.5
Permissible installation conditions	Strength reduction factor for tension, bond failure modes, dry concrete	Anchor category	-	1	1	1	2	2	2	2	2	2	
		$\Phi_{b,dry}$	-	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.55	0.55	
	Strength reduction factor for tension, bond failure modes, water saturated concrete	Anchor category	-	1	1	1	2	2	2	2	2	2	
		$\Phi_{b,ws}$	-	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.55	0.55	

1 Design information in this table is based on testing in accordance with ACI 355.4.

2 See figure 4 of this section.

3 Minimum edge distance may be reduced to 1-3/4" (44mm) provided the rebar remains untorqued.

4 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.

5 Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318 17.3.3.

For cases where the presence of supplementary reinforcement can be verified, the reduction factors associated with Condition A may be used.

6 Temperature range A: Max. short term temperature = 130°F (54°C), max. long term temperature = 110°F (43°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.

7 Bond strength values corresponding to concrete compressive strength $f'_c = 2500$ psi (17.2 Mpa). For concrete compressive strength, f'_c , between 2,500 psi (17.2 Mpa) and 8,000 psi (55.2 Mpa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2,500)^{0.1}$ [for SI: $(f'_c/17.2)^{0.1}$].

8 d_0 = drilled hole diameter

Table 21 — Hilti HIT-ICE adhesive design strength with concrete / bond failure for US rebar in uncracked concrete^{1,2,3,4,5,6,7,8}

Rebar size	Effective embedment in. (mm)	Tension — ϕN_n				Shear — ϕV_n			
		$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)
#3	3-3/8 (86)	2,625 (11.7)	2,670 (11.9)	2,750 (12.2)	2,865 (12.7)	5,650 (25.1)	5,755 (25.6)	5,920 (26.3)	6,165 (27.4)
	4-1/2 (114)	3,500 (15.6)	3,560 (15.8)	3,665 (16.3)	3,820 (17.0)	7,535 (33.5)	7,670 (34.1)	7,895 (35.1)	8,225 (36.6)
	7-1/2 (191)	5,830 (25.9)	5,935 (26.4)	6,110 (27.2)	6,365 (28.3)	12,555 (55.8)	12,785 (56.9)	13,160 (58.5)	13,705 (61.0)
#4	4-1/2 (114)	4,620 (20.6)	4,705 (20.9)	4,840 (21.5)	5,040 (22.4)	9,945 (44.2)	10,130 (45.1)	10,425 (46.4)	10,855 (48.3)
	6 (152)	6,155 (27.4)	6,270 (27.9)	6,455 (28.7)	6,720 (29.9)	13,260 (59.0)	13,505 (60.1)	13,900 (61.8)	14,475 (64.4)
	10 (254)	10,260 (45.6)	10,450 (46.5)	10,755 (47.8)	11,200 (49.8)	22,100 (98.3)	22,510 (100.1)	23,165 (103.0)	24,125 (107.3)
#5	5-5/8 (143)	7,105 (31.6)	7,240 (32.2)	7,450 (33.1)	7,760 (34.5)	15,310 (68.1)	15,590 (69.3)	16,045 (71.4)	16,710 (74.3)
	7-1/2 (191)	9,475 (42.1)	9,650 (42.9)	9,930 (44.2)	10,345 (46.0)	20,410 (90.8)	20,785 (92.5)	21,395 (95.2)	22,280 (99.1)
	12-1/2 (318)	15,795 (70.3)	16,085 (71.5)	16,555 (73.6)	17,240 (76.7)	34,020 (151.3)	34,645 (154.1)	35,655 (158.6)	37,130 (165.2)
#6	6-3/4 (171)	8,530 (37.9)	8,685 (38.6)	8,940 (39.8)	9,310 (41.4)	21,710 (96.6)	22,110 (98.3)	22,755 (101.2)	23,695 (105.4)
	9 (229)	11,370 (50.6)	11,580 (51.5)	11,920 (53.0)	12,410 (55.2)	28,945 (128.8)	29,480 (131.1)	30,340 (135.0)	31,595 (140.5)
	15 (381)	18,955 (84.3)	19,300 (85.9)	19,865 (88.4)	20,685 (92.0)	48,245 (214.6)	49,130 (218.5)	50,565 (224.9)	52,655 (234.2)
#7	7-7/8 (200)	11,490 (51.1)	11,700 (52.0)	12,040 (53.6)	12,540 (55.8)	29,245 (130.1)	29,785 (132.5)	30,655 (136.4)	31,920 (142.0)
	10-1/2 (267)	15,320 (68.1)	15,600 (69.4)	16,055 (71.4)	16,720 (74.4)	38,995 (173.5)	39,710 (176.6)	40,870 (181.8)	42,560 (189.3)
	17-1/2 (445)	25,530 (113.6)	26,000 (115.7)	26,760 (119.0)	27,870 (124.0)	64,990 (289.1)	66,185 (294.4)	68,120 (303.0)	70,935 (315.5)
#8	9 (229)	14,775 (65.7)	15,045 (66.9)	15,485 (68.9)	16,125 (71.7)	37,605 (167.3)	38,295 (170.3)	39,415 (175.3)	41,045 (182.6)
	12 (305)	19,700 (87.6)	20,060 (89.2)	20,645 (91.8)	21,500 (95.6)	50,140 (223.0)	51,060 (227.1)	52,555 (233.8)	54,725 (243.4)
	20 (508)	32,830 (146.0)	33,435 (148.7)	34,410 (153.1)	35,835 (159.4)	83,565 (371.7)	85,105 (378.6)	87,590 (389.6)	91,210 (405.7)
#9	10-1/8 (257)	18,400 (81.8)	18,740 (83.4)	19,290 (85.8)	20,085 (89.3)	46,840 (208.4)	47,705 (212.2)	49,095 (218.4)	51,130 (227.4)
	13-1/2 (343)	24,535 (109.1)	24,990 (111.2)	25,715 (114.4)	26,780 (119.1)	62,455 (277.8)	63,605 (282.9)	65,460 (291.2)	68,170 (303.2)
	22-1/2 (572)	40,895 (181.9)	41,645 (185.2)	42,860 (190.6)	44,635 (198.5)	104,095 (463.0)	106,010 (471.6)	109,105 (485.3)	113,620 (505.4)
#10	11-1/4 (286)	22,355 (99.4)	22,765 (101.3)	23,430 (104.2)	24,400 (108.5)	56,900 (253.1)	57,950 (257.8)	59,640 (265.3)	62,110 (276.3)
	15 (381)	29,805 (132.6)	30,355 (135.0)	31,240 (139.0)	32,535 (144.7)	75,870 (337.5)	77,265 (343.7)	79,520 (353.7)	82,810 (368.4)
	25 (635)	49,675 (221.0)	50,590 (225.0)	52,065 (231.6)	54,220 (241.2)	126,450 (562.5)	128,775 (572.8)	132,535 (589.5)	138,020 (613.9)

3.2.5

1 See section 3.1.8 for explanation on development of load values.
 2 See section 3.1.8 to convert design strength value to ASD value.
 3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
 4 Apply spacing, edge distance, and concrete thickness factors in tables 23-30 as necessary to the above values. Compare to the steel values in table 22. The lesser of the values is to be used for the design.
 5 Data is for temperature range A: Max. short term temperature = 130° F (55° C), max. long term temperature = 110° F (43° 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.
 6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength by 0.85.
 7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.
 8 Tabular values are for normal-weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_n as follows: For sand-lightweight, $\lambda_n = 0.51$. For all-lightweight, $\lambda_n = 0.45$.

Table 22 — Steel design strength for US rebar^{1,2}

Rebar size	ASTM A615 Grade 40 ⁴		ASTM A615 Grade 60 ⁴		ASTM A706 Grade 60 ⁴	
	Tensile ³ ϕN_{sa} lb (kN)	Shear ⁴ ϕV_{sa} lb (kN)	Tensile ³ ϕN_{sa} lb (kN)	Shear ⁴ ϕV_{sa} lb (kN)	Tensile ³ ϕN_{sa} lb (kN)	Shear ⁴ ϕV_{sa} lb (kN)
#3	4,290 (19.1)	2,375 (10.6)	5,720 (25.4)	3,170 (14.1)	6,600 (29.4)	3,430 (15.3)
#4	7,800 (34.7)	4,320 (19.2)	10,400 (46.3)	5,760 (25.6)	12,000 (53.4)	6,240 (27.8)
#5	12,090 (53.8)	6,695 (29.8)	16,120 (71.7)	8,930 (39.7)	18,600 (82.7)	9,670 (43.0)
#6	17,160 (76.3)	9,505 (42.3)	22,880 (101.8)	12,670 (56.4)	26,400 (117.4)	13,730 (61.1)
#7	23,400 (104.1)	12,960 (57.6)	31,200 (138.8)	17,280 (76.9)	36,000 (160.1)	18,720 (83.3)
#8	30,810 (137.0)	17,065 (75.9)	41,080 (182.7)	22,750 (101.2)	47,400 (210.8)	24,650 (109.6)
#9	39,000 (173.5)	21,600 (96.1)	52,000 (231.3)	28,800 (128.1)	60,000 (266.9)	31,200 (138.8)
#10	49,530 (220.3)	27,430 (122.0)	66,040 (293.8)	36,575 (162.7)	76,200 (339.0)	39,625 (176.3)

1 See Section 3.1.8 to convert design strength value to ASD value.

2 ASTM A706 Grade 60 rebar are considered ductile steel elements. ASTM A615 Grade 40 and 60 rebar are considered brittle steel elements.

3 Tensile = $\phi A_{se,N} f_{uts}$ as noted in ACI 318 Chapter 17.

4 Shear = $\phi 0.60 A_{se,N} f_{uts}$ as noted in ACI 318 Chapter 17.

Table 23 – Load adjustment factors for #3 rebar in uncracked concrete^{1,2,3}

Embedment h_{ef}	#3 Rebar uncracked concrete	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵		
		f_{AN}			f_{RN}			f_{AV}			⊥ Toward edge			∥ To edge			f_{HV}		
		in. (mm)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	3-3/8 (86)	4-1/2 (114)	7-1/2 (191)	3-3/8 (86)	4-1/2 (114)
Spacing (s) / Edge distance (c _e) / Concrete thickness (h _c) - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	0.33	0.24	0.14	n/a	n/a	n/a	0.13	0.10	0.06	0.26	0.20	0.12	n/a	n/a	n/a
	1-7/8 (48)	0.59	0.57	0.54	0.34	0.25	0.14	0.55	0.54	0.53	0.14	0.11	0.07	0.29	0.22	0.13	n/a	n/a	n/a
	2 (51)	0.60	0.57	0.54	0.35	0.25	0.15	0.55	0.54	0.53	0.16	0.12	0.07	0.32	0.24	0.14	n/a	n/a	n/a
	3 (76)	0.65	0.61	0.57	0.45	0.33	0.19	0.57	0.56	0.54	0.29	0.22	0.13	0.45	0.33	0.19	n/a	n/a	n/a
	4 (102)	0.70	0.65	0.59	0.56	0.41	0.24	0.60	0.58	0.56	0.45	0.34	0.20	0.56	0.41	0.24	n/a	n/a	n/a
	4-5/8 (117)	0.73	0.67	0.60	0.65	0.47	0.28	0.61	0.59	0.57	0.56	0.42	0.25	0.65	0.47	0.28	0.67	n/a	n/a
	5 (127)	0.75	0.69	0.61	0.71	0.51	0.30	0.62	0.60	0.57	0.63	0.47	0.28	0.71	0.51	0.30	0.70	n/a	n/a
	5-3/4 (146)	0.78	0.71	0.63	0.81	0.59	0.34	0.64	0.62	0.58	0.78	0.58	0.35	0.81	0.59	0.34	0.75	0.68	n/a
	6 (152)	0.80	0.72	0.63	0.85	0.62	0.36	0.65	0.62	0.59	0.83	0.62	0.37	0.85	0.62	0.36	0.77	0.70	n/a
	7 (178)	0.85	0.76	0.66	0.99	0.72	0.42	0.67	0.64	0.60	1.00	0.78	0.47	0.99	0.72	0.42	0.83	0.75	n/a
	8 (203)	0.90	0.80	0.68	1.00	0.82	0.48	0.70	0.66	0.62		0.96	0.57	1.00	0.82	0.48	0.89	0.80	n/a
	8-3/4 (222)	0.93	0.82	0.69		0.90	0.52	0.71	0.68	0.63		1.00	0.66		0.90	0.52	0.93	0.84	0.71
	9 (229)	0.94	0.83	0.70		0.92	0.54	0.72	0.68	0.63			0.68		0.92	0.54	0.94	0.85	0.72
	10 (254)	0.99	0.87	0.72		1.00	0.59	0.74	0.70	0.64			0.80		1.00	0.59	0.99	0.90	0.76
	11 (279)	1.00	0.91	0.74			0.65	0.77	0.72	0.66			0.93			0.65	1.00	0.94	0.80
	12 (305)		0.94	0.77			0.71	0.79	0.74	0.67			1.00			0.71		0.99	0.83
	14 (356)		1.00	0.81			0.83	0.84	0.78	0.70						0.83		1.00	0.90
	16 (406)			0.86			0.95	0.89	0.82	0.73						0.95			0.96
	18 (457)			0.90			1.00	0.94	0.86	0.76						1.00			1.00
	24 (610)			1.00				1.00	0.99	0.85									
30 (762)								1.00	0.93										
36 (914)									1.00										
> 48 (1219)																			

3.2.5

Table 24 – Load adjustment factors for #4 rebar in uncracked concrete^{1,2,3}

Embedment h_{ef}	#4 Rebar uncracked concrete	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵		
		f_{AN}			f_{RN}			f_{AV}			⊥ Toward edge			∥ To edge			f_{HV}		
		in. (mm)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)
Spacing (s) / Edge distance (c _e) / Concrete thickness (h _c) - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	0.28	0.21	0.12	n/a	n/a	n/a	0.09	0.06	0.04	0.17	0.13	0.08	n/a	n/a	n/a
	2-1/2 (64)	0.59	0.57	0.54	0.33	0.24	0.14	0.55	0.54	0.53	0.15	0.11	0.07	0.29	0.22	0.13	n/a	n/a	n/a
	3 (76)	0.61	0.58	0.55	0.36	0.27	0.16	0.56	0.55	0.53	0.19	0.14	0.09	0.36	0.27	0.16	n/a	n/a	n/a
	4 (102)	0.65	0.61	0.57	0.44	0.32	0.19	0.57	0.56	0.54	0.30	0.22	0.13	0.44	0.32	0.19	n/a	n/a	n/a
	5 (127)	0.69	0.64	0.58	0.52	0.38	0.22	0.59	0.58	0.55	0.41	0.31	0.19	0.52	0.38	0.22	n/a	n/a	n/a
	5-3/4 (146)	0.71	0.66	0.60	0.59	0.43	0.25	0.61	0.59	0.56	0.51	0.38	0.23	0.59	0.43	0.25	0.65	n/a	n/a
	6 (152)	0.72	0.67	0.60	0.62	0.45	0.27	0.61	0.59	0.57	0.54	0.41	0.24	0.62	0.45	0.27	0.67	n/a	n/a
	7 (178)	0.76	0.69	0.62	0.72	0.53	0.31	0.63	0.61	0.58	0.68	0.51	0.31	0.72	0.53	0.31	0.72	n/a	n/a
	7-1/4 (184)	0.77	0.70	0.62	0.75	0.55	0.32	0.63	0.61	0.58	0.72	0.54	0.32	0.75	0.55	0.32	0.73	0.67	n/a
	8 (203)	0.80	0.72	0.63	0.82	0.60	0.35	0.65	0.62	0.59	0.84	0.63	0.38	0.82	0.60	0.35	0.77	0.70	n/a
	9 (229)	0.83	0.75	0.65	0.93	0.68	0.40	0.67	0.64	0.60	1.00	0.75	0.45	0.93	0.68	0.40	0.82	0.74	n/a
	10 (254)	0.87	0.78	0.67	1.00	0.76	0.44	0.68	0.65	0.61		0.88	0.53	1.00	0.76	0.44	0.86	0.78	n/a
	11-1/4 (286)	0.92	0.81	0.69		0.85	0.50	0.71	0.67	0.62		1.00	0.63		0.85	0.50	0.91	0.83	0.70
	12 (305)	0.94	0.83	0.70		0.91	0.53	0.72	0.68	0.63			0.69		0.91	0.53	0.94	0.86	0.72
	14 (356)	1.00	0.89	0.73		1.00	0.62	0.76	0.71	0.65			0.87		1.00	0.62	1.00	0.92	0.78
	16 (406)		0.94	0.77			0.71	0.80	0.74	0.67			1.00			0.71		0.99	0.83
	18 (457)		1.00	0.80			0.80	0.83	0.77	0.70						0.80		1.00	0.88
	20 (508)			0.83			0.88	0.87	0.81	0.72						0.88			0.93
	22 (559)			0.87			0.97	0.91	0.84	0.74						0.97			0.98
	24 (610)			0.90			1.00	0.94	0.87	0.76						1.00			1.00
30 (762)			1.00				1.00	0.96	0.83										
36 (914)								1.00	0.89										
> 48 (1219)									1.00										

1 Linear interpolation not permitted
 2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
 3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
 4 Spacing factor reduction in shear applicable when c < 3*h_{ef}. f_{AV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{AV} = f_{AN}.
 5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then f_{HV} = 1.0.

Table 25 — Load adjustment factors for #5 rebar in uncracked concrete^{1,2,3}

#5 Rebar uncracked concrete	Embedment h_{ef}	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵		
		f_{AN}			f_{RN}			f_{AV}			⊥ Toward edge f_{RV}			∥ To edge f_{RV}			f_{HV}		
		in. (mm)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)	10 (254)	4-1/2 (114)	6 (152)
Spacing (s) / Edge distance (c_e) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	0.26	0.19	0.11	n/a	n/a	n/a	0.06	0.05	0.03	0.12	0.09	0.06	n/a	n/a	n/a
	3-1/8 (79)	0.59	0.57	0.54	0.33	0.24	0.14	0.55	0.54	0.53	0.15	0.11	0.07	0.30	0.22	0.13	n/a	n/a	n/a
	4 (102)	0.62	0.59	0.55	0.38	0.28	0.16	0.56	0.55	0.54	0.21	0.16	0.10	0.38	0.28	0.16	n/a	n/a	n/a
	5 (127)	0.65	0.61	0.57	0.44	0.32	0.19	0.57	0.56	0.54	0.30	0.23	0.14	0.44	0.32	0.19	n/a	n/a	n/a
	6 (152)	0.68	0.63	0.58	0.50	0.37	0.21	0.59	0.57	0.55	0.39	0.30	0.18	0.50	0.37	0.21	n/a	n/a	n/a
	7 (178)	0.71	0.66	0.59	0.58	0.42	0.25	0.60	0.59	0.56	0.50	0.37	0.22	0.58	0.42	0.25	n/a	n/a	n/a
	7-1/8 (181)	0.71	0.66	0.60	0.59	0.43	0.25	0.61	0.59	0.56	0.51	0.38	0.23	0.59	0.43	0.25	0.65	n/a	n/a
	8 (203)	0.74	0.68	0.61	0.66	0.49	0.28	0.62	0.60	0.57	0.61	0.46	0.27	0.66	0.49	0.28	0.69	n/a	n/a
	9 (229)	0.77	0.70	0.62	0.74	0.55	0.32	0.63	0.61	0.58	0.72	0.54	0.33	0.74	0.55	0.32	0.73	0.67	n/a
	10 (254)	0.80	0.72	0.63	0.83	0.61	0.36	0.65	0.62	0.59	0.85	0.64	0.38	0.83	0.61	0.36	0.77	0.70	n/a
	11 (279)	0.83	0.74	0.65	0.91	0.67	0.39	0.66	0.64	0.60	0.98	0.73	0.44	0.91	0.67	0.39	0.81	0.74	n/a
	12 (305)	0.86	0.77	0.66	0.99	0.73	0.43	0.68	0.65	0.61	1.00	0.84	0.50	0.99	0.73	0.43	0.85	0.77	n/a
	14 (356)	0.91	0.81	0.69	1.00	0.85	0.50	0.71	0.67	0.62		1.00	0.63	1.00	0.85	0.50	0.91	0.83	0.70
	16 (406)	0.97	0.86	0.71		0.97	0.57	0.74	0.70	0.64			0.77		0.97	0.57	0.98	0.89	0.75
	18 (457)	1.00	0.90	0.74		1.00	0.64	0.77	0.72	0.66			0.92		1.00	0.64	1.00	0.94	0.79
	20 (508)		0.94	0.77			0.71	0.80	0.75	0.68			1.00			0.71		0.99	0.84
	22 (559)		0.99	0.79			0.78	0.83	0.77	0.69						0.78		1.00	0.88
	24 (610)		1.00	0.82			0.85	0.86	0.80	0.71						0.85			0.92
	26 (660)			0.85			0.92	0.89	0.82	0.73						0.92			0.96
	28 (711)			0.87			1.00	0.92	0.85	0.75						1.00			0.99
30 (762)			0.90				0.95	0.87	0.76									1.00	
36 (914)			0.98				1.00	0.94	0.82										
> 48 (1219)			1.00					1.00	0.92										

Table 26 — Load adjustment factors for #6 rebar in uncracked concrete^{1,2,3}

#6 Rebar uncracked concrete	Embedment h_{ef}	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵		
		f_{AN}			f_{RN}			f_{AV}			⊥ Toward edge f_{RV}			∥ To edge f_{RV}			f_{HV}		
		in. (mm)	6-3/4 (171)	9 (229)	15 (381)	6-3/4 (171)	9 (229)	15 (381)	6-3/4 (171)	9 (229)	15 (381)	6-3/4 (171)	9 (229)	15 (381)	6-3/4 (171)	9 (229)	15 (381)	6-3/4 (171)	9 (229)
Spacing (s) / Edge distance (c_e) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	0.24	0.18	0.10	n/a	n/a	n/a	0.05	0.04	0.02	0.09	0.07	0.04	n/a	n/a	n/a
	3-3/4 (95)	0.59	0.57	0.54	0.33	0.24	0.14	0.55	0.54	0.53	0.15	0.11	0.07	0.30	0.22	0.13	n/a	n/a	n/a
	4 (102)	0.60	0.57	0.54	0.34	0.25	0.15	0.55	0.54	0.53	0.16	0.12	0.07	0.33	0.24	0.15	n/a	n/a	n/a
	5 (127)	0.62	0.59	0.56	0.39	0.28	0.17	0.56	0.55	0.54	0.23	0.17	0.10	0.39	0.28	0.17	n/a	n/a	n/a
	6 (152)	0.65	0.61	0.57	0.44	0.32	0.19	0.57	0.56	0.54	0.30	0.22	0.13	0.44	0.32	0.19	n/a	n/a	n/a
	7 (178)	0.67	0.63	0.58	0.49	0.36	0.21	0.59	0.57	0.55	0.38	0.28	0.17	0.49	0.36	0.21	n/a	n/a	n/a
	8 (203)	0.70	0.65	0.59	0.55	0.41	0.24	0.60	0.58	0.56	0.46	0.34	0.21	0.55	0.41	0.24	n/a	n/a	n/a
	8-1/2 (216)	0.71	0.66	0.59	0.59	0.43	0.25	0.61	0.59	0.56	0.50	0.38	0.23	0.59	0.43	0.25	0.65	n/a	n/a
	9 (229)	0.72	0.67	0.60	0.62	0.46	0.27	0.61	0.59	0.57	0.55	0.41	0.25	0.62	0.46	0.27	0.67	n/a	n/a
	10 (254)	0.75	0.69	0.61	0.69	0.51	0.30	0.62	0.60	0.57	0.64	0.48	0.29	0.69	0.51	0.30	0.70	n/a	n/a
	10-3/4 (273)	0.77	0.70	0.62	0.74	0.55	0.32	0.63	0.61	0.58	0.72	0.54	0.32	0.74	0.55	0.32	0.73	0.66	n/a
	12 (305)	0.80	0.72	0.63	0.83	0.61	0.36	0.65	0.62	0.59	0.84	0.63	0.38	0.83	0.61	0.36	0.77	0.70	n/a
	14 (356)	0.85	0.76	0.66	0.97	0.71	0.42	0.67	0.64	0.60	1.00	0.80	0.48	0.97	0.71	0.42	0.83	0.76	n/a
	16 (406)	0.90	0.80	0.68	1.00	0.81	0.48	0.70	0.66	0.62		0.98	0.59	1.00	0.81	0.48	0.89	0.81	n/a
	16-3/4 (425)	0.91	0.81	0.69		0.85	0.50	0.71	0.67	0.62		1.00	0.63		0.85	0.50	0.91	0.83	0.70
	18 (457)	0.94	0.83	0.70		0.91	0.54	0.72	0.68	0.63			0.70		0.91	0.54	0.95	0.86	0.72
	20 (508)	0.99	0.87	0.72		1.00	0.60	0.75	0.70	0.65			0.82		1.00	0.60	1.00	0.91	0.76
	22 (559)	1.00	0.91	0.74			0.65	0.77	0.73	0.66			0.94			0.65		0.95	0.80
	24 (610)		0.94	0.77			0.71	0.80	0.75	0.67			1.00			0.71		0.99	0.84
	26 (660)		0.98	0.79			0.77	0.82	0.77	0.69						0.77		1.00	0.87
28 (711)		1.00	0.81			0.83	0.85	0.79	0.70						0.83			0.90	
30 (762)			0.83			0.89	0.87	0.81	0.72						0.89			0.94	
36 (914)			0.90			1.00	0.95	0.87	0.76						1.00			1.00	
> 48 (1219)			1.00				1.00	0.99	0.85										

1 Linear interpolation not permitted
2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for $5d \leq s \leq 16$ -in. and to 0.5 T_{max} for $s > 16$ -in.
3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3^*h_{ef}$. f_{AV} is applicable when edge distance, $c < 3^*h_{ef}$. If $c \geq 3^*h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, $c < 3^*h_{ef}$. If $c \geq 3^*h_{ef}$, then $f_{HV} = 1.0$.

Table 27 – Load adjustment factors for #7 rebar in uncracked concrete^{1,2,3}

#7 Rebar uncracked Concrete	Embedment h_{ef}	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵		
		f_{AN}			f_{RN}			f_{AV}			⊥ Toward edge			∥ To edge			f_{HV}		
		in. (mm)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)	7-7/8 (200)	10-1/2 (267)
Spacing (s) / Edge distance (c) / Concrete thickness (h) - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	0.23	0.17	0.10	n/a	n/a	n/a	0.03	0.03	0.02	0.07	0.05	0.03	n/a	n/a	n/a
	4-3/8 (111)	0.59	0.57	0.54	0.33	0.24	0.14	0.54	0.54	0.53	0.14	0.10	0.06	0.28	0.21	0.12	n/a	n/a	n/a
	5 (127)	0.61	0.58	0.55	0.35	0.26	0.15	0.55	0.54	0.53	0.17	0.13	0.08	0.34	0.25	0.15	n/a	n/a	n/a
	6 (152)	0.63	0.60	0.56	0.39	0.29	0.17	0.56	0.55	0.54	0.22	0.17	0.10	0.39	0.29	0.17	n/a	n/a	n/a
	7 (178)	0.65	0.61	0.57	0.44	0.32	0.19	0.57	0.56	0.54	0.28	0.21	0.13	0.44	0.32	0.19	n/a	n/a	n/a
	8 (203)	0.67	0.63	0.58	0.48	0.35	0.21	0.58	0.57	0.55	0.34	0.26	0.15	0.48	0.35	0.21	n/a	n/a	n/a
	9 (229)	0.69	0.64	0.59	0.53	0.39	0.23	0.59	0.58	0.55	0.41	0.31	0.18	0.53	0.39	0.23	n/a	n/a	n/a
	9-7/8 (251)	0.71	0.66	0.59	0.59	0.43	0.25	0.60	0.58	0.56	0.47	0.35	0.21	0.59	0.43	0.25	0.63	n/a	n/a
	10 (254)	0.71	0.66	0.60	0.59	0.44	0.26	0.60	0.58	0.56	0.48	0.36	0.21	0.59	0.44	0.26	0.64	n/a	n/a
	11 (279)	0.73	0.67	0.60	0.65	0.48	0.28	0.61	0.59	0.57	0.55	0.41	0.25	0.65	0.48	0.28	0.67	n/a	n/a
	12 (305)	0.75	0.69	0.61	0.71	0.52	0.31	0.62	0.60	0.57	0.63	0.47	0.28	0.71	0.52	0.31	0.70	n/a	n/a
	12-1/2 (318)	0.76	0.70	0.62	0.74	0.55	0.32	0.63	0.60	0.57	0.67	0.50	0.30	0.74	0.55	0.32	0.71	0.65	n/a
	14 (356)	0.80	0.72	0.63	0.83	0.61	0.36	0.64	0.62	0.58	0.79	0.59	0.36	0.83	0.61	0.36	0.75	0.69	n/a
	16 (406)	0.84	0.75	0.65	0.95	0.70	0.41	0.66	0.63	0.60	0.97	0.72	0.43	0.95	0.70	0.41	0.81	0.73	n/a
	18 (457)	0.88	0.79	0.67	1.00	0.79	0.46	0.68	0.65	0.61	1.00	0.86	0.52	1.00	0.79	0.46	0.86	0.78	n/a
	19-1/2 (495)	0.91	0.81	0.69		0.85	0.50	0.70	0.66	0.62		0.97	0.58		0.85	0.50	0.89	0.81	0.68
	20 (508)	0.92	0.82	0.69		0.87	0.51	0.70	0.67	0.62		1.00	0.61		0.87	0.51	0.90	0.82	0.69
	22 (559)	0.97	0.85	0.71		0.96	0.56	0.72	0.68	0.63			0.70		0.96	0.56	0.95	0.86	0.73
	24 (610)	1.00	0.88	0.73		1.00	0.61	0.74	0.70	0.64			0.80		1.00	0.61	0.99	0.90	0.76
	26 (660)		0.91	0.75			0.67	0.76	0.72	0.66			0.90			0.67	1.00	0.93	0.79
	28 (711)		0.94	0.77			0.72	0.78	0.74	0.67			1.00			0.72	1.00	0.97	0.82
	30 (762)		0.98	0.79			0.77	0.81	0.75	0.68						0.77	1.00	1.00	0.85
	36 (914)		1.00	0.84			0.92	0.87	0.80	0.72						0.92			0.93
> 48 (1219)			0.96			1.00	0.99	0.90	0.79						1.00			1.00	

3.2.5

Table 28 – Load adjustment factors for #8 rebar in uncracked concrete^{1,2,3}

#8 Rebar uncracked concrete	Embedment h_{ef}	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵		
		f_{AN}			f_{RN}			f_{AV}			⊥ Toward edge			∥ To edge			f_{HV}		
		in. (mm)	9 (229)	12 (305)	20 (508)	9 (229)	12 (305)	20 (508)	9 (229)	12 (305)	20 (508)	9 (229)	12 (305)	20 (508)	9 (229)	12 (305)	20 (508)	9 (229)	12 (305)
Spacing (s) / Edge distance (c) / Concrete thickness (h) - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	0.23	0.17	0.10	n/a	n/a	n/a	0.03	0.02	0.01	0.05	0.04	0.02	n/a	n/a	n/a
	5 (127)	0.59	0.57	0.54	0.33	0.24	0.14	0.54	0.54	0.53	0.13	0.10	0.06	0.26	0.20	0.12	n/a	n/a	n/a
	6 (152)	0.61	0.58	0.55	0.36	0.27	0.16	0.55	0.54	0.53	0.17	0.13	0.08	0.34	0.26	0.16	n/a	n/a	n/a
	7 (178)	0.63	0.60	0.56	0.40	0.29	0.17	0.56	0.55	0.54	0.22	0.16	0.10	0.40	0.29	0.17	n/a	n/a	n/a
	8 (203)	0.65	0.61	0.57	0.44	0.32	0.19	0.57	0.56	0.54	0.27	0.20	0.12	0.44	0.32	0.19	n/a	n/a	n/a
	9 (229)	0.67	0.63	0.58	0.48	0.35	0.21	0.58	0.56	0.55	0.32	0.24	0.14	0.48	0.35	0.21	n/a	n/a	n/a
	10 (254)	0.69	0.64	0.58	0.52	0.38	0.23	0.59	0.57	0.55	0.37	0.28	0.17	0.52	0.38	0.23	n/a	n/a	n/a
	11 (279)	0.70	0.65	0.59	0.57	0.42	0.25	0.59	0.58	0.56	0.43	0.32	0.19	0.57	0.42	0.25	n/a	n/a	n/a
	11-1/4 (286)	0.71	0.66	0.59	0.59	0.43	0.25	0.60	0.58	0.56	0.44	0.33	0.20	0.59	0.43	0.25	0.62	n/a	n/a
	12 (305)	0.72	0.67	0.60	0.63	0.46	0.27	0.60	0.59	0.56	0.49	0.37	0.22	0.63	0.46	0.27	0.64	n/a	n/a
	13 (330)	0.74	0.68	0.61	0.68	0.50	0.29	0.61	0.59	0.57	0.55	0.41	0.25	0.68	0.50	0.29	0.67	n/a	n/a
	14 (356)	0.76	0.69	0.62	0.73	0.54	0.32	0.62	0.60	0.57	0.61	0.46	0.28	0.73	0.54	0.32	0.69	n/a	n/a
	14-1/4 (362)	0.76	0.70	0.62	0.74	0.55	0.32	0.62	0.60	0.57	0.63	0.47	0.28	0.74	0.55	0.32	0.70	0.64	n/a
	16 (406)	0.80	0.72	0.63	0.84	0.61	0.36	0.64	0.61	0.58	0.75	0.56	0.34	0.84	0.61	0.36	0.74	0.67	n/a
	18 (457)	0.83	0.75	0.65	0.94	0.69	0.41	0.65	0.63	0.59	0.90	0.67	0.40	0.94	0.69	0.41	0.79	0.72	n/a
	20 (508)	0.87	0.78	0.67	1.00	0.77	0.45	0.67	0.64	0.60	1.00	0.79	0.47	1.00	0.77	0.45	0.83	0.75	n/a
	22 (559)	0.91	0.81	0.68		0.85	0.50	0.69	0.66	0.61		0.91	0.54		0.85	0.50	0.87	0.79	n/a
	22-1/4 (565)	0.91	0.81	0.69		0.85	0.50	0.69	0.66	0.61		0.92	0.55		0.85	0.50	0.88	0.80	0.67
	24 (610)	0.94	0.83	0.70		0.92	0.54	0.71	0.67	0.62		1.00	0.62		0.92	0.54	0.91	0.83	0.70
	26 (660)	0.98	0.86	0.72		1.00	0.59	0.72	0.68	0.63			0.70		1.00	0.59	0.95	0.86	0.72
	28 (711)	1.00	0.89	0.73			0.63	0.74	0.70	0.64			0.78			0.63	0.98	0.89	0.75
	30 (762)		0.92	0.75			0.68	0.76	0.71	0.65			0.87			0.68	1.00	0.92	0.78
	36 (914)		1.00	0.80			0.81	0.81	0.76	0.68			1.00			0.81	1.00	1.00	0.85
> 48 (1219)			0.90			1.00	0.91	0.84	0.74						1.00			0.98	

1 Linear interpolation not permitted
 2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
 3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
 4 Spacing factor reduction in shear applicable when c < 3h_{ef}; f_{AV} is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{AV} = f_{AN}.
 5 Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{HV} = 1.0.

Table 29 — Load adjustment factors for #9 rebar in uncracked concrete^{1,2,3}

#9 Rebar uncracked concrete	Embedment h_{ef}	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵			
		f_{AN}			f_{RN}			f_{AV}			┌ Toward edge			┐ To edge			f_{HV}			
		10-1/8	13-1/2	22-1/2	10-1/8	13-1/2	22-1/2	10-1/8	13-1/2	22-1/2	┌	┐	┐	┌	┐	┐	10-1/8	13-1/2	22-1/2	
	in. (mm)	(257)	(343)	(572)	(257)	(343)	(572)	(257)	(343)	(572)	(257)	(343)	(572)	(257)	(343)	(572)	(257)	(343)	(572)	
	1-3/4 (44)	n/a	n/a	n/a	0.22	0.16	0.10	n/a	n/a	n/a	0.02	0.02	0.01	0.04	0.03	0.02	n/a	n/a	n/a	
	5-5/8 (143)	0.59	0.57	0.54	0.33	0.24	0.14	0.54	0.53	0.52	0.13	0.09	0.06	0.25	0.19	0.11	n/a	n/a	n/a	
	6 (152)	0.60	0.57	0.54	0.34	0.25	0.15	0.54	0.54	0.53	0.14	0.10	0.06	0.28	0.21	0.12	n/a	n/a	n/a	
	7 (178)	0.62	0.59	0.55	0.38	0.28	0.16	0.55	0.54	0.53	0.17	0.13	0.08	0.35	0.26	0.16	n/a	n/a	n/a	
	8 (203)	0.63	0.60	0.56	0.41	0.30	0.18	0.56	0.55	0.53	0.21	0.16	0.10	0.41	0.30	0.18	n/a	n/a	n/a	
	9 (229)	0.65	0.61	0.57	0.44	0.33	0.19	0.57	0.56	0.54	0.25	0.19	0.11	0.44	0.33	0.19	n/a	n/a	n/a	
	10 (254)	0.66	0.62	0.57	0.48	0.35	0.21	0.57	0.56	0.54	0.30	0.22	0.13	0.48	0.35	0.21	n/a	n/a	n/a	
	11 (279)	0.68	0.64	0.58	0.52	0.38	0.22	0.58	0.57	0.55	0.34	0.26	0.15	0.52	0.38	0.22	n/a	n/a	n/a	
	12 (305)	0.70	0.65	0.59	0.56	0.41	0.24	0.59	0.57	0.55	0.39	0.29	0.18	0.56	0.41	0.24	n/a	n/a	n/a	
	12-7/8 (327)	0.71	0.66	0.60	0.61	0.44	0.26	0.60	0.58	0.56	0.43	0.33	0.20	0.61	0.44	0.26	0.62	n/a	n/a	
	13 (330)	0.71	0.66	0.60	0.61	0.45	0.26	0.60	0.58	0.56	0.44	0.33	0.20	0.61	0.45	0.26	0.62	n/a	n/a	
	14 (356)	0.73	0.67	0.60	0.66	0.48	0.28	0.60	0.59	0.56	0.49	0.37	0.22	0.66	0.48	0.28	0.65	n/a	n/a	
	16 (406)	0.76	0.70	0.62	0.75	0.55	0.32	0.62	0.60	0.57	0.60	0.45	0.27	0.75	0.55	0.32	0.69	n/a	n/a	
	16-1/4 (413)	0.77	0.70	0.62	0.76	0.56	0.33	0.62	0.60	0.57	0.62	0.46	0.28	0.76	0.56	0.33	0.69	0.63	n/a	
	18 (457)	0.80	0.72	0.63	0.85	0.62	0.36	0.63	0.61	0.58	0.72	0.54	0.32	0.85	0.62	0.36	0.73	0.66	n/a	
	20 (508)	0.83	0.75	0.65	0.94	0.69	0.40	0.65	0.62	0.59	0.84	0.63	0.38	0.94	0.69	0.40	0.77	0.70	n/a	
	22 (559)	0.86	0.77	0.66	1.00	0.76	0.44	0.66	0.63	0.60	0.97	0.73	0.44	1.00	0.76	0.44	0.81	0.73	n/a	
	24 (610)	0.90	0.80	0.68		0.83	0.49	0.68	0.65	0.60	1.00	0.83	0.50		0.83	0.49	0.84	0.77	n/a	
	25-1/4 (641)	0.92	0.81	0.69		0.87	0.51	0.69	0.65	0.61		0.90	0.54		0.87	0.51	0.87	0.79	0.66	
	26 (660)	0.93	0.82	0.69		0.90	0.53	0.69	0.66	0.61		0.94	0.56		0.90	0.53	0.88	0.80	0.67	
	28 (711)	0.96	0.85	0.71		0.97	0.57	0.71	0.67	0.62		1.00	0.63		0.97	0.57	0.91	0.83	0.70	
	30 (762)	0.99	0.87	0.72		1.00	0.61	0.72	0.68	0.63			0.70		1.00	0.61	0.94	0.86	0.72	
	36 (914)	1.00	0.94	0.77			0.73	0.77	0.72	0.66			0.92			0.73	1.00	0.94	0.79	
	> 48 (1219)		1.00	0.86				0.97	0.86	0.79			1.00				0.97		1.00	0.92

Table 30 — Load adjustment factors for #10 rebar in uncracked concrete^{1,2,3}

#10 Rebar uncracked concrete	Embedment h_{ef}	Spacing factor in tension			Edge distance factor in tension			Spacing factor in shear ⁴			Edge distance in shear						Concrete thickness factor in shear ⁵			
		f_{AN}			f_{RN}			f_{AV}			┌ Toward edge			┐ To edge			f_{HV}			
		11-1/4	15	25	11-1/4	15	25	11-1/4	15	25	┌	┐	┐	┌	┐	┐	11-1/4	15	25	
	in. (mm)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	
	1-3/4 (44)	n/a	n/a	n/a	0.22	0.16	0.09	n/a	n/a	n/a	0.02	0.01	0.01	0.04	0.03	0.02	n/a	n/a	n/a	
	6-1/4 (159)	0.59	0.57	0.54	0.33	0.24	0.14	0.54	0.53	0.52	0.12	0.09	0.05	0.24	0.18	0.11	n/a	n/a	n/a	
	7 (178)	0.60	0.58	0.55	0.35	0.26	0.15	0.55	0.54	0.53	0.14	0.11	0.06	0.29	0.22	0.13	n/a	n/a	n/a	
	8 (203)	0.62	0.59	0.55	0.38	0.28	0.16	0.55	0.54	0.53	0.18	0.13	0.08	0.35	0.26	0.16	n/a	n/a	n/a	
	9 (229)	0.63	0.60	0.56	0.41	0.30	0.18	0.56	0.55	0.53	0.21	0.16	0.09	0.41	0.30	0.18	n/a	n/a	n/a	
	10 (254)	0.65	0.61	0.57	0.44	0.33	0.19	0.57	0.55	0.54	0.25	0.18	0.11	0.44	0.33	0.19	n/a	n/a	n/a	
	11 (279)	0.66	0.62	0.57	0.48	0.35	0.20	0.57	0.56	0.54	0.28	0.21	0.13	0.48	0.35	0.20	n/a	n/a	n/a	
	12 (305)	0.68	0.63	0.58	0.51	0.38	0.22	0.58	0.56	0.55	0.32	0.24	0.14	0.51	0.38	0.22	n/a	n/a	n/a	
	13 (330)	0.69	0.64	0.59	0.55	0.41	0.24	0.58	0.57	0.55	0.36	0.27	0.16	0.55	0.41	0.24	n/a	n/a	n/a	
	14 (356)	0.71	0.66	0.59	0.60	0.44	0.26	0.59	0.58	0.55	0.41	0.30	0.18	0.60	0.44	0.26	n/a	n/a	n/a	
	14-1/4 (362)	0.71	0.66	0.60	0.61	0.45	0.26	0.59	0.58	0.55	0.42	0.31	0.19	0.61	0.45	0.26	0.61	n/a	n/a	
	15 (381)	0.72	0.67	0.60	0.64	0.47	0.27	0.60	0.58	0.56	0.45	0.34	0.20	0.64	0.47	0.27	0.63	n/a	n/a	
	16 (406)	0.74	0.68	0.61	0.68	0.50	0.29	0.60	0.59	0.56	0.50	0.37	0.22	0.68	0.50	0.29	0.65	n/a	n/a	
	17 (432)	0.75	0.69	0.61	0.72	0.53	0.31	0.61	0.59	0.57	0.54	0.41	0.24	0.72	0.53	0.31	0.67	n/a	n/a	
	18 (457)	0.77	0.70	0.62	0.77	0.56	0.33	0.62	0.60	0.57	0.59	0.44	0.27	0.77	0.56	0.33	0.69	0.62	n/a	
	20 (508)	0.80	0.72	0.63	0.85	0.63	0.37	0.63	0.61	0.58	0.69	0.52	0.31	0.85	0.63	0.37	0.72	0.66	n/a	
	22 (559)	0.83	0.74	0.65	0.94	0.69	0.40	0.64	0.62	0.58	0.80	0.60	0.36	0.94	0.69	0.40	0.76	0.69	n/a	
	24 (610)	0.86	0.77	0.66	1.00	0.75	0.44	0.66	0.63	0.59	0.91	0.68	0.41	1.00	0.75	0.44	0.79	0.72	n/a	
	26 (660)	0.89	0.79	0.67		0.81	0.48	0.67	0.64	0.60	1.00	0.77	0.46		0.81	0.48	0.82	0.75	n/a	
	28 (711)	0.91	0.81	0.69		0.88	0.51	0.68	0.65	0.61		0.86	0.52		0.88	0.51	0.86	0.78	0.66	
	30 (762)	0.94	0.83	0.70		0.94	0.55	0.70	0.66	0.61		0.96	0.57		0.94	0.55	0.89	0.80	0.68	
	36 (914)	1.00	0.90	0.74		1.00	0.66	0.73	0.69	0.64		1.00	0.75		1.00	0.66	0.97	0.88	0.74	
	> 48 (1219)		1.00	0.82				0.88	0.81	0.76			1.00				0.88	1.00	1.00	0.86

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for $5d \leq s \leq 16$ -in. and to 0.5 T_{max} for $s > 16$ -in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.







4 Spacing factor reduction in shear applicable when $c < 3 \cdot h_{ef}$. f_{AV} is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{HV} = 1.0$.

HIT-ICE with HIS-N Inserts



Figure 6 - Hilti HIS-N and HIS-RN internally threaded insert installation conditions

Permissible concrete conditions		Uncracked concrete		Dry concrete	Permissible Drilling Method		Hammer drilling with carbide tipped drill bit
		Cracked concrete		Water saturated concrete			Hilti TE-CD or TE-YD Hollow Drill Bit

3.2.5

Table 31 – Hilti HIS-N and HIS-RN installation specifications

Setting information	Symbol	Units	Thread size			
			3/8-16 UNC	1/2-13 UNC	5/8-11 UNC	3/4-10 UNC
Outside diameter of insert		in.	0.65	0.81	1.00	1.09
Nominal bit diameter	d_o	in.	11/16	7/8	1-1/8	1-1/4
Effective embedment	h_{ef}	in. (mm)	4-3/8 (110)	5 (125)	6-3/8 (170)	8-1/8 (205)
Thread engagement	h_s	minimum	3/8	1/2	5/8	3/4
		maximum	15/16	1-3/16	1-1/2	1-7/8
Installation torque	T_{inst}	ft-lb (Nm)	15 (20)	30 (40)	60 (81)	100 (136)
Minimum concrete thickness	h_{min}	in. (mm)	5.9 (150)	6.7 (170)	9.1 (230)	10.6 (270)

Figure 7 – HIS-N and HIS-RN specifications

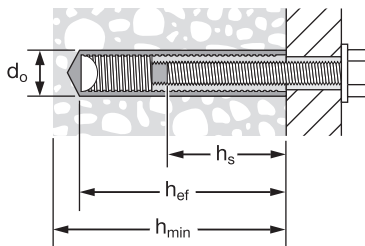


Table 32 — Hilti HIT-ICE design information with Hilti HIS-R and HIS-RN holes drilled with a hammer drill and carbide bit (or hollow drill bit) accordance with ACI 318 Ch. 17¹

Design parameter	Symbol	Units	Nominal rod diameter (in.)				Ref ACI 318	
			3/8	1/2	5/8	3/4		
Nominal anchor diameter	d_a	in (mm)	0.65 (16.5)	0.81 (20.5)	1.00 (25.4)	1.09 (27.6)		
Effective embedment ²	h_{ef}	in (mm)	4 3/8 (110)	5 (125)	6 3/4 (170)	8 1/8 (205)		
Minimum concrete thickness ²	h_{min}	in (mm)	5.9 (150)	6.7 (170)	9.1 (230)	10.6 (270)		
Critical edge distance	c_{ac}	in (mm)	$c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{1160} \right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}} \right]; \left(\frac{h}{h_{ef}} \right) \text{ need not be larger than } 2.4$ $\tau_{k,uncr} \text{ need not be taken as greater than: } \tau_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$ $\left(c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{8} \right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}} \right]; \left(\frac{h}{h_{ef}} \right) \text{ need not be larger than } 2.4 \right)$ $\tau_{k,uncr} \text{ need not be taken as greater than: } \tau_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$					
Minimum edge distance	c_{min}	in (mm)	3 1/4 (83)	4 (102)	5 (127)	5 1/2 (140)		
Minimum anchor spacing	s_{min}	in (mm)	3 1/4 (83)	4 (102)	5 (127)	5 1/2 (140)		
Effectiveness factor for uncracked concrete ⁴	$k_{c,uncr}$	-	24 (10)				17.4.2.2	
Effectiveness factor for cracked concrete ⁴	$k_{c,cr}$	-	17 (7.1)				17.4.2.2	
Strength reduction factor for tension, concrete failure modes ⁵	$\Phi_{c,N}$	-	0.65				17.3.3	
Strength reduction factor for shear, concrete failure modes ⁵	$\Phi_{c,V}$	-	0.70				17.3.3	
Temperature range A ⁶	Characteristic bond stress in cracked concrete ⁷	$T_{k,cr}$	psi MPa	350 (2.4)	300 (2.1)	n/a	n/a	17.4.5
	Characteristic bond stress in uncracked concrete ⁷	$T_{k,uncr}$	psi (MPa)	830 (5.7)	855 (5.9)	840 (5.8)	830 (5.7)	17.4.5
Reduction for seismic tension	$\alpha_{N,seis}$	-	n/a					
Permissible installation conditions	Strength reduction factor for tension, bond failure modes, dry concrete	Anchor category	-	2	1	1	1	
		$\Phi_{b,dry}$	-	0.55	0.65	0.65	0.65	
	Strength reduction factor for tension, bond failure modes, water saturated concrete	Anchor category	-	2	1	1	1	
		$\Phi_{b,ws}$	-	0.55	0.65	0.65	0.65	

1 Design information in this table is based on testing in accordance with ACI 355.4.

2 See figure 7 of this section.

3 Minimum edge distance may be reduced to 1-3/4" (44mm) < c_{min} < 5d provided T_{inst} is reduced to 0.30 T_{inst} for 5d < s < 16-in. and to 0.5 T_{inst} for s > 16-in.

4 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.

5 Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318 17.3.3.

For cases where the presence of supplementary reinforcement can be verified, the reduction factors associated with Condition A may be used.

6 Temperature range A: Max. short term temperature = 130°F (54°C), max. long term temperature = 110°F (43°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.

7 Bond strength values corresponding to concrete compressive strength $f'_c = 2500$ psi (17.2 Mpa). For concrete compressive strength, f'_c , between 2,500 psi (17.2 Mpa) and 8,000 psi (55.2 Mpa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2,500)^{0.1}$ [for SI: $(f'_c / 17.2)^{0.1}$].

8 d_o = drilled hole diameter.

Table 33 — Hilti HIT-ICE adhesive design strength with concrete / bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete^{1,2,3,4,5,6,7,8}

Thread size	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)
3/8-16 UNC	4-3/8 (111)	4,080 (18.1)	4,155 (18.5)	4,275 (19.0)	4,450 (19.8)	10,380 (46.2)	10,570 (47.0)	10,880 (48.4)	11,330 (50.4)
1/2-13 UNC	5 (127)	7,070 (31.4)	7,200 (32.0)	7,410 (33.0)	7,720 (34.3)	15,230 (67.7)	15,510 (69.0)	15,965 (71.0)	16,625 (74.0)
5/8-11 UNC	6-3/4 (171)	11,580 (51.5)	11,790 (52.4)	12,135 (54.0)	12,640 (56.2)	24,940 (110.9)	25,395 (113.0)	26,140 (116.3)	27,220 (121.1)
3/4-10 UNC	8-1/8 (206)	15,010 (66.8)	15,285 (68.0)	15,735 (70.0)	16,385 (72.9)	32,330 (143.8)	32,925 (146.5)	33,885 (150.7)	35,290 (157.0)

Table 34 — Hilti HIT-ICE adhesive design strength with concrete / bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in cracked concrete^{1,2,3,4,5,6,7,8,9}

Thread size	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)
3/8-16 UNC	4-3/8 (111)	1,720 (7.7)	1,750 (7.8)	1,805 (8.0)	1,875 (8.3)	4,380 (19.5)	4,460 (19.8)	4,590 (20.4)	4,780 (21.3)
1/2-13 UNC	5 (127)	2,480 (11.0)	2,525 (11.2)	2,600 (11.6)	2,710 (12.1)	5,345 (23.8)	5,440 (24.2)	5,600 (24.9)	5,835 (26.0)

- 1 See section 3.1.8 for explanation on development of load values.
- 2 See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
- 3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- 4 Apply spacing, edge distance, and concrete thickness factors in tables 36-37 as necessary to the above values. Compare to the steel values in table 35. The lesser of the values is to be used for the design.
- 5 Data is for temperature range A: Max. short term temperature = 130° F (55° C), max. long term temperature = 110° F (43° 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.
- 6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
- 7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.8.
- 8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength (factored resistance) by λ_a as follows: For sand-lightweight, $\lambda_a = 0.51$. For all-lightweight, $\lambda_a = 0.45$.
- 9 Tabular values are for static loads only. Seismic applications are not permitted.

Table 35 — Steel design strength for steel bolt / cap screw for Hilti HIS-N and HIS-RN internally threaded inserts^{1,2,3}

Thread size	ACI 318 Chapter 17 Based Design			
	ASTM A193 B7		ASTM A193 Grade B8M stainless steel	
	Tensile ⁴ ΦN_{sa} lb (kN)	Shear ⁵ ΦV_{sa} lb (kN)	Tensile ⁴ ΦN_{sa} lb (kN)	Shear ⁵ ΦV_{sa} lb (kN)
3/8-16 UNC	6,300 (28.0)	3,490 (15.5)	5,540 (24.6)	3,070 (13.7)
1/2-13 UNC	10,525 (46.8)	6,385 (28.4)	10,145 (45.1)	5,620 (25.0)
5/8-11 UNC	17,500 (77.8)	10,170 (45.2)	16,160 (71.9)	8,950 (39.8)
3/4-10 UNC	17,785 (79.1)	15,055 (67.0)	23,915 (106.4)	13,245 (58.9)

- 1 See section 3.1.8 to convert design strength value to ASD value.
- 2 Hilti HIS-N and HIS-RN inserts with steel bolts are to be considered brittle steel elements.
- 3 Table values are the lesser of steel failure in the HIS-N insert or inserted steel bolt.
- 4 Tensile = $\Phi A_{se,N} f_{uts}$ as noted in ACI 318 Chapter 17.
- 5 Shear = $\Phi 0.60 A_{se,V} f_{uts}$ as noted in ACI 318 Chapter 17. For 3/8-in diameter insert shear = $\Phi 0.50 A_{se,V} f_{uts}$

Table 36 — Load adjustment factors for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete^{1,2}

HIS-N and HIS-RN all diameters uncracked concrete	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear ⁴ f_{AV}				Edge distance in shear								Concrete thickness factor in shear ⁵ f_{HV}				
													⊥ Toward edge f_{RV}				∥ To edge f_{RV}								
													3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4					3/8
Internal diameter	in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)
Embedment	in. (mm)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)
Spacing (s) / Edge distance (c _g) / Concrete thickness (h _c) - in. (mm)	h _{ef} (mm)																								
	3-1/4 (83)	0.62	n/a	n/a	n/a	0.46	n/a	n/a	n/a	0.56	n/a	n/a	n/a	0.23	n/a	n/a	n/a	0.46	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	4 (102)	0.65	0.63	n/a	n/a	0.52	0.50	n/a	n/a	0.58	0.56	n/a	n/a	0.31	0.23	n/a	n/a	0.52	0.46	n/a	n/a	n/a	n/a	n/a	n/a
	5 (127)	0.69	0.67	0.62	n/a	0.61	0.57	0.46	n/a	0.60	0.58	0.56	n/a	0.44	0.32	0.20	n/a	0.61	0.57	0.40	n/a	n/a	n/a	n/a	n/a
	5-1/2 (140)	0.71	0.68	0.64	0.61	0.65	0.60	0.49	0.41	0.61	0.59	0.56	0.55	0.50	0.37	0.23	0.18	0.65	0.60	0.46	0.35	n/a	n/a	n/a	n/a
	6 (152)	0.73	0.70	0.65	0.62	0.70	0.64	0.51	0.44	0.62	0.59	0.57	0.56	0.57	0.43	0.26	0.20	0.70	0.64	0.51	0.40	0.68	n/a	n/a	n/a
	7 (178)	0.77	0.73	0.67	0.64	0.82	0.72	0.57	0.48	0.63	0.61	0.58	0.57	0.72	0.54	0.33	0.25	0.82	0.72	0.57	0.48	0.73	0.66	n/a	n/a
	8 (203)	0.80	0.77	0.70	0.66	0.94	0.81	0.62	0.52	0.65	0.63	0.59	0.58	0.88	0.66	0.40	0.31	0.94	0.81	0.62	0.52	0.78	0.71	n/a	n/a
	9 (229)	0.84	0.80	0.72	0.68	1.00	0.91	0.68	0.57	0.67	0.64	0.60	0.59	1.00	0.78	0.48	0.37	1.00	0.91	0.68	0.57	0.83	0.75	n/a	n/a
	10 (254)	0.88	0.83	0.75	0.71		1.00	0.75	0.62	0.69	0.66	0.61	0.60		0.92	0.56	0.43		1.00	0.75	0.62	0.88	0.79	0.67	n/a
	11 (279)	0.92	0.87	0.77	0.73			0.83	0.68	0.71	0.67	0.62	0.60		1.00	0.65	0.50			0.83	0.68	0.92	0.83	0.71	0.65
	12 (305)	0.96	0.90	0.80	0.75			0.91	0.75	0.73	0.69	0.64	0.61			0.74	0.57			0.91	0.75	0.96	0.87	0.74	0.68
	14 (356)	1.00	0.97	0.85	0.79			1.00	0.87	0.77	0.72	0.66	0.63			0.93	0.71			1.00	0.87	1.00	0.94	0.80	0.73
	16 (406)		1.00	0.90	0.83				0.99	0.81	0.75	0.68	0.65			1.00	0.87				0.99	1.00	0.85	0.78	
	18 (457)			0.94	0.87				1.00	0.85	0.78	0.70	0.67				1.00				1.00		0.90	0.83	
	24 (610)			1.00	0.99					0.96	0.88	0.77	0.73										1.00	0.96	
	30 (762)				1.00						1.00	0.84	0.79												1.00
36 (914)										1.00	0.91	0.84													
> 48 (1219)										1.00	0.96														

- Linear interpolation not permitted
- Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
- When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
- Spacing factor reduction in shear applicable when c < 3h_{ef}. f_{AV} is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{AV} = f_{AN}.
- Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{HV} = 1.0.

Table 37 — Load adjustment factors for Hilti HIS-N and HIS-RN internally threaded inserts in cracked concrete^{1,2}

HIS-N and HIS-RN all diameters uncracked concrete	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear ⁴ f_{AV}				Edge distance in shear				Concrete thickness factor in shear ⁵ f_{HV}	
													⊥ Toward edge f_{RV}		∥ To edge f_{RV}			
													3/8	1/2	3/8	1/2		
Internal diameter	in. (mm)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)	1/2 (12.7)			
Embedment	in. (mm)	4-3/8 (111)	5 (127)	4-3/8 (111)	5 (127)	4-3/8 (111)	5 (127)	4-3/8 (111)	5 (127)	4-3/8 (111)	5 (127)	4-3/8 (111)	5 (127)	4-3/8 (111)	5 (127)			
Spacing (s) / Edge distance (c _g) / Concrete thickness (h _c) - in. (mm)	h _{ef} (mm)																	
	3-1/4 (83)	0.62	n/a	0.63	n/a	0.59	n/a	0.39	n/a	0.63	n/a	n/a	n/a	n/a	n/a			
	4 (102)	0.65	0.63	0.71	0.66	0.61	0.60	0.53	0.47	0.71	0.66	n/a	n/a	n/a	n/a			
	5 (127)	0.69	0.67	0.82	0.75	0.64	0.63	0.74	0.66	0.82	0.75	n/a	n/a	n/a	n/a			
	5-1/2 (140)	0.71	0.68	0.87	0.80	0.65	0.64	0.85	0.76	0.87	0.80	n/a	n/a	n/a	n/a			
	6 (152)	0.73	0.70	0.93	0.85	0.66	0.65	0.97	0.87	0.93	0.85	0.81	n/a	n/a	n/a			
	7 (178)	0.77	0.73	1.00	0.95	0.69	0.68	1.00	1.00	1.00	0.95	0.87	0.84	0.87	0.84			
	8 (203)	0.80	0.77		1.00	0.72	0.70				1.00	0.93	0.90	0.93	0.90			
	9 (229)	0.84	0.80			0.75	0.73					0.99	0.95	0.99	0.95			
	10 (254)	0.88	0.83			0.77	0.75					1.00	1.00	1.00	1.00			
	11 (279)	0.92	0.87			0.80	0.78											
	12 (305)	0.96	0.90			0.83	0.80											
	14 (356)	1.00	0.97			0.88	0.85											
	16 (406)		1.00			0.94	0.90											
	18 (457)					0.99	0.95											
	24 (610)					1.00	1.00											
	30 (762)																	
36 (914)																		
> 48 (1219)																		

- Linear interpolation not permitted
- Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
- When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
- Spacing factor reduction in shear applicable when c < 3h_{ef}. f_{AV} is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{AV} = f_{AN}.
- Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, c < 3h_{ef}. If c ≥ 3h_{ef}, then f_{HV} = 1.0.

DESIGN DATA IN CONCRETE PER CSA A23.3

Limit State Design of anchors is described in the provisions of CSA A23.3 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Limit State Design tables with unfactored characteristic loads that are based on testing in accordance with ACI 355.4. These tables are followed by factored resistance tables. The factored resistance tables have characteristic design loads that are prefactored by the applicable reduction factors for a single anchor with no anchor-to-anchor spacing or edge distance adjustments for the convenience of the user of this document. All the figures in the previous ACI 318 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3 Annex D, refer to Section 3.1.8 Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.ca.

3.2.5

Table 38 — Hilti HIT-ICE design information with HAS threaded rods in hammer drilled holes in accordance with CSA A23.3 Annex D¹



Design parameter	Symbol	Units	Nominal rod diameter (in.)							Ref	
			3/8	1/2	5/8	3/4	7/8	1	1-1/4		
Nominal anchor O.D.	d_a	mm	9.5	12.7	15.9	19.1	22.2	25.4	31.8	A23.3-14	
Effective minimum embedment ²	$h_{ef,min}$	mm	60	70	79	89	89	102	127		
Effective maximum embedment ²	$h_{ef,max}$	mm	191	254	318	381	445	508	635		
Minimum concrete thickness ²	h_{min}	mm	$h_{ef} + 30$		$h_{ef} + 2d_o$						
Critical edge distance	c_{ac}	mm	$c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{8}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$								
Minimum edge distance ³	c_{min}	mm	48	64	79	95	111	127	159		
Minimum anchor spacing	s_{min}	mm	48	64	79	95	111	127	159		
Coeff. for factored concrete breakout resistance, uncracked concrete ⁴	$k_{c,uncr}$	-	10							D.6.2.2	
Coeff. for factored concrete breakout resistance, cracked concrete ⁴	$k_{c,cr}$	-	7							D.6.2.2	
Concrete material resistance factor	Φ_c	-	0.65							8.4.2	
Resistance modification factor for tension and shear, concrete failure modes, Condition B ⁵	R_{conc}	-	1.00							D.5.3(c)	
Temp. range A ⁶	Characteristic bond stress in cracked concrete ⁷	τ_{cr} psi (MPa)	715 (4.9)	615 (4.2)	520 (3.6)	420 (2.9)	325 (2.2)	n/a	n/a	D.6.5.2	
	Characteristic bond stress in uncracked concrete ⁷	τ_{uncr} psi (MPa)	1,215 (8.4)	1,200 (8.3)	1,185 (8.2)	1,075 (7.4)	1,060 (7.3)	1,050 (7.2)	1,020 (7.0)	D.6.5.2	
Reduction for seismic tension		$\alpha_{N,seis}$	n/a								
Permissible installation conditions	Resistance modification factor tension & shear, bond failure dry concrete	Anchor category	-	2	1	2	1	1	1	1	D.5.3(c)
		R_{dry}	-	0.85	1.00	0.85	1.00	1.00	1.00	1.00	
	Resistance modification factor tension & shear, bond failure water-saturated concrete	Anchor category	-	2	1	2	1	1	1	1	D.5.3(c)
		R_{ws}	-	0.85	1.00	0.85	1.00	1.00	1.00	1.00	

1 Design information in this table is based on testing in accordance with ACI 355.4.
 2 See figure 2 and 3 of this section.
 3 Minimum edge distance may be reduced to $44mm < c_{min} < 5d$ provided T_{inst} is reduced to $0.30 T_{inst}$ for $5d < s < 16$ -in. and to $0.5T_{inst}$ for $s > 16$ -in.
 4 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
 5 Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318 17.3.3. For cases where the presence of supplementary reinforcement can be verified, the reduction factors associated with Condition A may be used.
 6 Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°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.
 7 Bond strength values corresponding to concrete compressive strength $f'_c = 2500$ psi (17.2 Mpa). For concrete compressive strength, f'_c , between 2,500 psi (17.2 Mpa) and 8,000 psi (55.2 Mpa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2,500)^{0.1}$ [for SI: $(f'_c / 17.2)^{0.1}$].

**Table 39 — Hilti HIT-ICE adhesive factored resistance with concrete / bond failure for threaded rod
in uncracked concrete^{1,2,3,4,5,6,7,8}**

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension - N_t				Shear - V_s			
		$f'_c = 20$ MPa (2,900psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)
3/8	2-3/8 (60)	1,905 (8.5)	1,950 (8.7)	1,985 (8.8)	2,045 (9.1)	1,905 (8.5)	1,950 (8.7)	1,985 (8.8)	2,045 (9.1)
	3-3/8 (86)	2,710 (12.1)	2,770 (12.3)	2,825 (12.6)	2,905 (12.9)	5,420 (24.1)	5,545 (24.7)	5,645 (25.1)	5,810 (25.8)
	4-1/2 (114)	3,615 (16.1)	3,695 (16.4)	3,765 (16.7)	3,875 (17.2)	7,230 (32.2)	7,390 (32.9)	7,525 (33.5)	7,745 (34.5)
	7-1/2 (191)	6,025 (26.8)	6,160 (27.4)	6,270 (27.9)	6,455 (28.7)	12,045 (53.6)	12,320 (54.8)	12,545 (55.8)	12,910 (57.4)
1/2	2-3/4 (70)	3,420 (15.2)	3,500 (15.6)	3,565 (15.8)	3,665 (16.3)	6,845 (30.4)	6,995 (31.1)	7,125 (31.7)	7,335 (32.6)
	4-1/2 (114)	5,600 (24.9)	5,725 (25.5)	5,830 (25.9)	6,000 (26.7)	11,200 (49.8)	11,450 (50.9)	11,660 (51.9)	12,000 (53.4)
	6 (152)	7,465 (33.2)	7,635 (34.0)	7,775 (34.6)	8,000 (35.6)	14,930 (66.4)	15,265 (67.9)	15,550 (69.2)	16,000 (71.2)
	10 (254)	12,440 (55.3)	12,720 (56.6)	12,955 (57.6)	13,335 (59.3)	24,885 (110.7)	25,445 (113.2)	25,915 (115.3)	26,670 (118.6)
5/8	3-1/8 (79)	4,080 (18.1)	4,170 (18.6)	4,250 (18.9)	4,370 (19.4)	8,160 (36.3)	8,345 (37.1)	8,495 (37.8)	8,745 (38.9)
	5-5/8 (143)	7,345 (32.7)	7,510 (33.4)	7,645 (34.0)	7,870 (35.0)	14,685 (65.3)	15,015 (66.8)	15,295 (68.0)	15,740 (70.0)
	7-1/2 (191)	9,790 (43.6)	10,010 (44.5)	10,195 (45.4)	10,495 (46.7)	19,580 (87.1)	20,025 (89.1)	20,390 (90.7)	20,985 (93.4)
	12-1/2 (318)	16,320 (72.6)	16,685 (74.2)	16,995 (75.6)	17,490 (77.8)	32,635 (145.2)	33,370 (148.4)	33,985 (151.2)	34,975 (155.6)
3/4	3-1/2 (89)	5,480 (24.4)	5,985 (26.6)	6,095 (27.1)	6,270 (27.9)	10,955 (48.7)	11,965 (53.2)	12,185 (54.2)	12,545 (55.8)
	6-3/4 (171)	11,285 (50.2)	11,540 (51.3)	11,750 (52.3)	12,095 (53.8)	22,570 (100.4)	23,080 (102.7)	23,505 (104.6)	24,190 (107.6)
	9 (229)	15,045 (66.9)	15,385 (68.4)	15,670 (69.7)	16,125 (71.7)	30,095 (133.9)	30,770 (136.9)	31,340 (139.4)	32,255 (143.5)
	15 (381)	25,080 (111.6)	25,645 (114.1)	26,115 (116.2)	26,880 (119.6)	50,155 (223.1)	51,285 (228.1)	52,230 (232.3)	53,755 (239.1)
7/8	3-1/2 (89)	5,480 (24.4)	6,125 (27.2)	6,710 (29.8)	7,215 (32.1)	10,955 (48.7)	12,250 (54.5)	13,420 (59.7)	14,430 (64.2)
	7-7/8 (200)	15,145 (67.4)	15,490 (68.9)	15,775 (70.2)	16,235 (72.2)	30,290 (134.7)	30,975 (137.8)	31,545 (140.3)	32,465 (144.4)
	10-1/2 (267)	20,195 (89.8)	20,650 (91.9)	21,030 (93.5)	21,645 (96.3)	40,390 (179.7)	41,300 (183.7)	42,060 (187.1)	43,290 (192.6)
	17-1/2 (445)	33,655 (149.7)	34,415 (153.1)	35,050 (155.9)	36,075 (160.5)	67,315 (299.4)	68,835 (306.2)	70,100 (311.8)	72,145 (320.9)
1	4 (102)	6,690 (29.8)	7,480 (33.3)	8,195 (36.5)	8,935 (41.5)	13,385 (59.5)	14,965 (66.6)	16,395 (72.9)	18,670 (83.0)
	9 (229)	19,595 (87.2)	20,040 (89.1)	20,405 (90.8)	21,000 (93.4)	39,190 (174.3)	40,075 (178.3)	40,815 (181.5)	42,005 (186.8)
	12 (305)	26,130 (116.2)	26,715 (118.8)	27,210 (121.0)	28,005 (124.6)	52,255 (232.4)	53,435 (237.7)	54,415 (242.1)	56,005 (249.1)
	20 (508)	43,545 (193.7)	44,530 (198.1)	45,350 (201.7)	46,670 (207.6)	87,090 (387.4)	89,055 (396.1)	90,695 (403.4)	93,345 (415.2)
1-1/4	5 (127)	9,355 (41.6)	10,455 (46.5)	11,455 (51.0)	13,225 (58.8)	18,705 (83.2)	20,915 (93.0)	22,910 (101.9)	26,455 (117.7)
	11-1/4 (286)	29,745 (132.3)	30,415 (135.3)	30,975 (137.8)	31,880 (141.8)	59,485 (264.6)	60,830 (270.6)	61,950 (275.6)	63,755 (283.6)
	15 (381)	39,660 (176.4)	40,555 (180.4)	41,300 (183.7)	42,505 (189.1)	79,315 (352.8)	81,105 (360.8)	82,600 (367.4)	85,010 (378.1)
	25 (635)	66,095 (294.0)	67,590 (300.6)	68,830 (306.2)	70,840 (315.1)	132,195 (588.0)	135,175 (601.3)	137,665 (612.4)	141,680 (630.2)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 10-21 as necessary to the above values. Compare to the steel values in table 43. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°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.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_s as follows:
For sand-lightweight, $\lambda_s = 0.51$. For all-lightweight, $\lambda_s = 0.45$



Table 40 — Hilti HIT-ICE adhesive factored resistance with concrete / bond failure for threaded rod in cracked concrete ^{1,2,3,4,5,6,7,8,9}

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension - N_t				Shear - V_s			
		$f'_c = 20$ MPa (2,900psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)
3/8	2-3/8 (60)	1,120 (5.0)	1,150 (5.1)	1,170 (5.2)	1,205 (5.4)	1,120 (5.0)	1,150 (5.1)	1,170 (5.2)	1,205 (5.4)
	3-3/8 (86)	1,595 (7.1)	1,630 (7.3)	1,660 (7.4)	1,710 (7.6)	3,190 (14.2)	3,260 (14.5)	3,320 (14.8)	3,420 (15.2)
	4-1/2 (114)	2,125 (9.5)	2,175 (9.7)	2,215 (9.9)	2,280 (10.1)	4,255 (18.9)	4,350 (19.3)	4,430 (19.7)	4,560 (20.3)
	7-1/2 (191)	3,545 (15.8)	3,625 (16.1)	3,690 (16.4)	3,800 (16.9)	7,090 (31.5)	7,250 (32.2)	7,380 (32.8)	7,600 (33.8)
1/2	2-3/4 (70)	1,755 (7.8)	1,795 (8.0)	1,825 (8.1)	1,880 (8.4)	3,505 (15.6)	3,585 (16.0)	3,650 (16.2)	3,760 (16.7)
	4-1/2 (114)	2,870 (12.8)	2,935 (13.1)	2,990 (13.3)	3,075 (13.7)	5,740 (25.5)	5,870 (26.1)	5,975 (26.6)	6,150 (27.4)
	6 (152)	3,825 (17.0)	3,910 (17.4)	3,985 (17.7)	4,100 (18.2)	7,650 (34.0)	7,825 (34.8)	7,970 (35.4)	8,200 (36.5)
	10 (254)	6,375 (28.4)	6,520 (29.0)	6,640 (29.5)	6,835 (30.4)	12,755 (56.7)	13,040 (58.0)	13,280 (59.1)	13,670 (60.8)
5/8	3-1/8 (79)	1,790 (8.0)	1,830 (8.1)	1,865 (8.3)	1,920 (8.5)	3,580 (15.9)	3,660 (16.3)	3,730 (16.6)	3,835 (17.1)
	5-5/8 (143)	3,220 (14.3)	3,295 (14.7)	3,355 (14.9)	3,455 (15.4)	6,445 (28.7)	6,590 (29.3)	6,710 (29.9)	6,905 (30.7)
	7-1/2 (191)	4,295 (19.1)	4,395 (19.5)	4,475 (19.9)	4,605 (20.5)	8,595 (38.2)	8,785 (39.1)	8,950 (39.8)	9,210 (41.0)
	12-1/2 (318)	7,160 (31.9)	7,320 (32.6)	7,455 (33.2)	7,675 (34.1)	14,320 (63.7)	14,645 (65.1)	14,915 (66.3)	15,350 (68.3)
3/4	3-1/2 (89)	2,285 (10.2)	2,340 (10.4)	2,380 (10.6)	2,450 (10.9)	4,570 (20.3)	4,675 (20.8)	4,760 (21.2)	4,900 (21.8)
	6-3/4 (171)	4,410 (19.6)	4,510 (20.1)	4,590 (20.4)	4,725 (21.0)	8,820 (39.2)	9,015 (40.1)	9,185 (40.8)	9,450 (42.0)
	9 (229)	5,880 (26.1)	6,010 (26.7)	6,120 (27.2)	6,300 (28.0)	11,755 (52.3)	12,025 (53.5)	12,245 (54.5)	12,600 (56.1)
	15 (381)	9,800 (43.6)	10,020 (44.6)	10,205 (45.4)	10,500 (46.7)	19,595 (87.2)	20,040 (89.1)	20,405 (90.8)	21,000 (93.4)
7/8	3-1/2 (89)	2,065 (9.2)	2,110 (9.4)	2,150 (9.6)	2,210 (9.8)	4,130 (18.4)	4,220 (18.8)	4,300 (19.1)	4,425 (19.7)
	7-7/8 (200)	4,645 (20.7)	4,750 (21.1)	4,835 (21.5)	4,975 (22.1)	9,290 (41.3)	9,495 (42.2)	9,670 (43.0)	9,955 (44.3)
	10-1/2 (267)	6,190 (27.5)	6,330 (28.2)	6,450 (28.7)	6,635 (29.5)	12,385 (55.1)	12,665 (56.3)	12,895 (57.4)	13,270 (59.0)
	17-1/2 (445)	10,320 (45.9)	10,550 (46.9)	10,745 (47.8)	11,060 (49.2)	20,640 (91.8)	21,105 (93.9)	21,495 (95.6)	22,120 (98.4)

3.2.5

- See Section 3.1.8 for explanation on development of load values.
- See Section 3.1.8 to convert design strength value to ASD value.
- Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- Apply spacing, edge distance, and concrete thickness factors in tables 7-18 as necessary to the above values. Compare to the steel values in table 41. The lesser of the values is to be used for the design.
- Data is for temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°C). Seismic applications are not permitted. 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.
- Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
- Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
- Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_s as follows: For sand-lightweight, $\lambda_s = 0.51$. For all-lightweight, $\lambda_s = 0.45$
- Tabular values are for static loads only. For seismic loads, multiply cracked concrete tabular values in tension and shear by the following reduction factors: Seismic applications are not permitted.

Table 41 — Steel factored resistance for Hilti HIT-V and HAS threaded rods

Nominal anchor diameter in.	HAS-V / HAS-V HDG ASTM F1554 Gr. 36 ^{3,5}		HAS-E / HAS-E HDG ASTM F1554 Gr. 55 ^{3,5}		HAS-B and HAS-B HDG ^{3,5} ASTM A193 B7 and ASTM F 1554 Gr. 105		HAS-R Stainless Steel ⁴ ASTM F593 (3/8-in to 1-in) ASTM A193 (1-1/8-in to 1-1/4-in)		HAS-R stainless steel ASTM F 593 - AISI 304/316 SS ⁴	
	Tensile ¹ N _{sa} lb (kN)	Shear ² V _{sa} lb (kN)	Tensile ¹ N _{sa} lb (kN)	Shear ² V _{sa} lb (kN)	Tensile ¹ N _{sa} lb (kN)	Shear ² V _{sa} lb (kN)	Tensile ¹ N _{sa} lb (kN)	Shear ² V _{sa} lb (kN)	Tensile ¹ N _{sa} lb (kN)	Shear ² V _{sa} lb (kN)
3/8	3,055 (13.6)	1,720 (7.7)	3,955 (17.6)	2,225 (9.9)	6,590 (29.3)	3,705 (16.5)	4,610 (20.5)	2,570 (11.4)	4,610 (20.5)	2,140 (9.5)
1/2	5,595 (24.9)	3,150 (14.0)	7,240 (32.2)	4,070 (18.1)	12,065 (53.7)	6,785 (30.2)	8,445 (37.6)	4,705 (20.9)	8,445 (37.6)	4,705 (20.9)
5/8	8,915 (39.7)	5,015 (22.3)	11,525 (51.3)	6,485 (28.8)	19,210 (85.4)	10,805 (48.1)	13,445 (59.8)	7,490 (33.3)	13,445 (59.8)	7,490 (33.3)
3/4	13,190 (58.7)	7,420 (33.0)	17,060 (75.9)	9,600 (42.7)	28,435 (126.5)	15,995 (71.1)	16,920 (75.3)	9,425 (41.9)	16,915 (75.2)	9,425 (41.9)
7/8	18,210 (81.0)	10,245 (45.6)	23,550 (104.8)	13,245 (58.9)	39,245 (174.6)	22,075 (98.2)	23,350 (103.9)	13,010 (57.9)	23,350 (103.9)	13,010 (57.9)
1	23,890 (106.3)	13,440 (59.8)	30,890 (137.4)	17,380 (77.3)	51,485 (229.0)	28,960 (128.8)	30,635 (136.3)	17,065 (75.9)	30,635 (136.3)	17,065 (75.9)
1-1/4	38,225 (170.0)	21,500 (95.6)	49,425 (219.9)	27,800 (123.7)	82,375 (366.4)	46,335 (206.1)	37,565 (167.1)	21,130 (94.0)	49,010 (218.0)	27,305 (121.5)

Δ84



Table 42 – Hilti HIT-ICE adhesive design information with CA rebar in hammer drilled holes in accordance with CSA A23.3 Annex D¹

Design parameter	Symbol	Units	Rebar size					Ref A23.3-14	
			10M	15M	20M	25M	30M		
Anchor O.D.	d_a	mm	11.3	16.0	19.5	25.2	29.9		
Effective minimum embedment ²	$h_{ef,min}$	mm	70	80	90	101	120		
Effective maximum embedment ²	$h_{ef,max}$	mm	226	320	390	504	598		
Minimum concrete thickness ²	h_{min}	mm	$h_{ef} + 30$	$h_{ef} + 2d_o$					
Critical edge distance	c_{ac}	mm	$c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{8}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right] * \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$						
Minimum edge distance ³	c_{min}	mm	57	80	98	126	150		
Minimum anchor spacing	s_{min}	mm	57	80	98	126	150		
Coeff. for factored concrete breakout resistance, uncracked concrete ⁴	$k_{c,uncr}$	-	10					D.6.2.2	
Coeff. for factored concrete breakout resistance, cracked concrete ⁴	$k_{c,cr}$	-	7					D.6.2.2	
Concrete material resistance factor	ϕ_c	-	0.65					8.4.2	
Resistance modification factor for tension and shear, concrete failure modes, Condition B ⁵	R_{conc}	-	1.00					D.5.3(c)	
Temp. range A ⁶	Characteristic bond stress in cracked concrete ⁷	τ_{cr} (MPa)	n/a	n/a	n/a	n/a	n/a	D.6.5.2	
	Characteristic bond stress in uncracked concrete ⁷	τ_{uncr} (MPa)	1,010 (7.0)	990 (6.8)	975 (6.7)	950 (6.6)	930 (6.4)	D.6.5.2	
Reduction for seismic tension	$\alpha_{N,seis}$	-	n/a						
Permissible installation conditions	Resistance modification factor tension & shear, bond failure dry concrete	Anchor category	-	1	1	2	2	1	D.5.3(c)
		R_{dry}	-	1.00	1.00	0.85	0.85	1.00	
	Resistance modification factor tension & shear, bond failure water-saturated concrete	Anchor category	-	1	1	2	2	1	D.5.3(c)
		R_{ws}	-	1.00	1.00	0.85	0.85	1.00	

3.2.5

1 Design information in this table is based on testing in accordance with ACI 355.4.
 2 See figure 5 of this section.
 3 Minimum edge distance may be reduced to 45mm provided rebar remains untorqued.
 4 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
 5 For use with the load combinations of CSA A23.3 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
 6 Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°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.
 7 Bond strength values corresponding to concrete compressive strength $f'_c = 2,500$ psi (17.2 MPa). For concrete compressive strength, f'_c , between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2,500)^{0.1}$ [for SI: $(f'_c / 17.2)^{0.1}$].

Table 43 – CA rebar installation specifications with Hilti HIT-ICE adhesive anchor system¹



Setting information	Symbol	Units	Rebar size					
			10M	15M	20M	25M	30M	
Nominal bit diameter	d_o	in.	9/16	3/4	1	1-1/4	1-3/8	
Effective embedment	minimum	$h_{ef,min}$	mm	60	80	90	100	120
	maximum	$h_{ef,max}$	mm	226	320	390	504	598
Minimum concrete thickness	h_{min}	mm	$h_{ef} + 30$	$h_{ef} + 2d_o$				

1 See figure 5 of this section.

**Table 44 — Hilti HIT-ICE adhesive factored resistance with concrete / bond failure for CA rebar
in uncracked concrete^{1,2,3,4,5,6,7,8}**

Rebar size	Effective embedment in. (mm)	Tension N_r				Shear V_r			
		$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)
10M	4-1/2 (115)	4,220 (18.8)	4,315 (19.2)	4,395 (19.5)	4,520 (20.1)	8,435 (37.5)	8,625 (38.4)	8,785 (39.1)	9,045 (40.2)
	7-1/16 (180)	6,605 (29.4)	6,750 (30.0)	6,875 (30.6)	7,075 (31.5)	13,205 (58.7)	13,505 (60.1)	13,750 (61.2)	14,155 (63.0)
	8-7/8 (226)	8,290 (36.9)	8,475 (37.7)	8,635 (38.4)	8,885 (39.5)	16,580 (73.8)	16,955 (75.4)	17,265 (76.8)	17,770 (79.0)
15M	5-11/16 (145)	7,380 (32.8)	7,550 (33.6)	7,690 (34.2)	7,910 (35.2)	14,765 (65.7)	15,100 (67.2)	15,375 (68.4)	15,825 (70.4)
	9-13/16 (250)	12,730 (56.6)	13,015 (57.9)	13,255 (59.0)	13,640 (60.7)	25,455 (113.2)	26,030 (115.8)	26,510 (117.9)	27,285 (121.4)
	12-5/8 (320)	16,290 (72.5)	16,660 (74.1)	16,965 (75.5)	17,460 (77.7)	32,585 (144.9)	33,320 (148.2)	33,930 (150.9)	34,920 (155.3)
20M	7-7/8 (200)	10,390 (46.2)	10,625 (47.3)	10,820 (48.1)	11,135 (49.5)	20,775 (92.4)	21,245 (94.5)	21,635 (96.2)	22,270 (99.1)
	14 (355)	18,440 (82.0)	18,855 (83.9)	19,200 (85.4)	19,765 (87.9)	36,880 (164.0)	37,710 (167.7)	38,405 (170.8)	39,525 (175.8)
	15-3/8 (390)	20,255 (90.1)	20,715 (92.1)	21,095 (93.8)	21,710 (96.6)	40,515 (180.2)	41,430 (184.3)	42,190 (187.7)	43,425 (193.2)
25M	9-1/16 (230)	15,045 (66.9)	15,380 (68.4)	15,665 (69.7)	16,125 (71.7)	30,085 (133.8)	30,765 (136.8)	31,330 (139.4)	32,245 (143.4)
	15-15/16 (405)	26,490 (117.8)	27,085 (120.5)	27,585 (122.7)	28,390 (126.3)	52,975 (235.7)	54,175 (241.0)	55,170 (245.4)	56,780 (252.6)
	19-13/16 (504)	32,965 (146.6)	33,705 (149.9)	34,330 (152.7)	35,330 (157.2)	65,925 (293.3)	67,415 (299.9)	68,655 (305.4)	70,660 (314.3)
30M	10-1/4 (260)	23,235 (103.4)	23,760 (105.7)	24,200 (107.6)	24,905 (110.8)	46,475 (206.7)	47,525 (211.4)	48,400 (215.3)	49,810 (221.6)
	17-15/16 (455)	40,665 (180.9)	41,585 (185.0)	42,350 (188.4)	43,585 (193.9)	81,330 (361.8)	83,165 (369.9)	84,695 (376.7)	87,170 (387.7)
	23-9/16 (598)	53,445 (237.7)	54,650 (243.1)	55,660 (247.6)	57,280 (254.8)	106,890 (475.5)	109,305 (486.2)	111,315 (495.2)	114,565 (509.6)

- 1 See Section 3.1.8 for explanation on development of load values.
- 2 See Section 3.1.8 to convert design strength value to ASD value.
- 3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- 4 Apply spacing, edge distance, and concrete thickness factors in tables 46-50 as necessary. Compare to the steel values in table 45. The lesser of the values is to be used for the design.
- 5 Data is for temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°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.
- 6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
- 7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
- 8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, $\lambda_a = 0.51$. For all-lightweight, $\lambda_a = 0.45$.

Table 45 – Steel factored resistance for CA rebar¹ 

Rebar size	CSA-G30.18 Grade 400 ²	
	Tensile ³ N _{sa} lb (kN)	Shear ⁴ V _{sa} lb (kN)
10M	7,245 (32.2)	4,035 (17.9)
15M	14,525 (64.6)	8,090 (36.0)
20M	21,570 (95.9)	12,020 (53.5)
25M	36,025 (160.2)	20,070 (89.3)
30M	50,715 (225.6)	28,255 (125.7)

1 See Section 3.1.8 to convert design strength value to ASD value.
 2 CSA-G30.18 Grade 400 rebar are considered ductile steel elements.
 3 Tensile = $A_{sa,N} \Phi_s f_{uta} R$ as noted in CSA A23.3 Annex D
 4 Shear = $A_{sa,V} \Phi_s 0.60 f_{uda} R$ as noted in CSA A23.3 Annex D.

Table 46 – Load adjustment factors for 10M rebar in uncracked concrete^{1,2,3} 

10M Rebar uncracked concrete	Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear ⁴ f_{RV}			Edge distance in shear						Concrete thickness factor in shear ⁵ f_{HV}			
										⊥ Toward edge f_{RV}			∥ To edge f_{RV}						
	Embedment h_{ef}	in. (mm)	4-1/2 (115)	7-1/16 (180)	8-7/8 (226)	4-1/2 (115)	7-1/16 (180)	8-7/8 (226)	4-1/2 (115)	7-1/16 (180)	8-8/9 (226)	4-1/2 (115)	7-1/16 (180)	8-7/8 (226)	4-1/2 (115)	7-1/16 (180)	8-7/8 (226)	4-1/2 (115)	7-1/16 (180)
Spacing (s) / Edge distance (c) / Concrete thickness (h _c) - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	0.26	0.16	0.13	n/a	n/a	n/a	0.10	0.06	0.05	0.19	0.12	0.10	n/a	n/a	n/a
	2-3/16 (55)	0.58	0.55	0.54	0.28	0.18	0.14	0.54	0.53	0.53	0.13	0.08	0.07	0.26	0.17	0.13	n/a	n/a	n/a
	3 (76)	0.61	0.57	0.56	0.34	0.21	0.17	0.56	0.54	0.54	0.22	0.14	0.11	0.34	0.21	0.17	n/a	n/a	n/a
	4 (102)	0.65	0.59	0.57	0.42	0.26	0.20	0.58	0.56	0.55	0.33	0.21	0.17	0.42	0.26	0.20	n/a	n/a	n/a
	5 (127)	0.68	0.62	0.59	0.51	0.32	0.25	0.60	0.57	0.56	0.47	0.30	0.24	0.51	0.32	0.25	n/a	n/a	n/a
	5-1/16 (145)	0.71	0.63	0.61	0.58	0.36	0.28	0.61	0.58	0.57	0.57	0.36	0.29	0.58	0.36	0.28	0.68	n/a	n/a
	6 (152)	0.72	0.64	0.61	0.61	0.38	0.30	0.62	0.59	0.58	0.61	0.39	0.31	0.61	0.38	0.30	0.69	n/a	n/a
	7 (178)	0.76	0.66	0.63	0.71	0.44	0.35	0.64	0.60	0.59	0.77	0.49	0.39	0.71	0.44	0.35	0.75	n/a	n/a
	8 (203)	0.79	0.69	0.65	0.81	0.51	0.40	0.66	0.62	0.60	0.94	0.60	0.48	0.81	0.51	0.40	0.80	n/a	n/a
	8-1/4 (210)	0.80	0.69	0.65	0.84	0.52	0.41	0.67	0.62	0.61	0.99	0.63	0.50	0.84	0.52	0.41	0.81	0.70	n/a
	9 (229)	0.83	0.71	0.67	0.92	0.57	0.45	0.68	0.63	0.61	1.00	0.72	0.57	0.92	0.57	0.45	0.85	0.73	n/a
	10-1/16 (256)	0.87	0.74	0.69	1.00	0.64	0.50	0.70	0.65	0.63		0.85	0.68	1.00	0.64	0.50	0.90	0.77	0.72
	11 (279)	0.90	0.76	0.71		0.69	0.55	0.72	0.66	0.64		0.97	0.77		0.69	0.55	0.94	0.81	0.75
	12 (305)	0.94	0.78	0.72		0.76	0.60	0.74	0.68	0.65		1.00	0.88		0.76	0.60	0.98	0.84	0.78
	14 (356)	1.00	0.83	0.76		0.88	0.70	0.78	0.71	0.68			1.00		0.88	0.70	1.00	0.91	0.85
	16 (406)		0.88	0.80		1.00	0.80	0.82	0.74	0.70					1.00	0.80		0.98	0.90
	18 (457)		0.92	0.84			0.90	0.86	0.77	0.73						0.90		1.00	0.96
	24 (610)		1.00	0.95			1.00	0.98	0.86	0.81						1.00			1.00
	30 (762)			1.00				1.00	0.95	0.88									
	36 (914)								1.00	0.96									
> 48 (1219)									1.00										

1 Linear interpolation not permitted
 2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.
 3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
 4 Spacing factor reduction in shear applicable when c < 3*h_{ef}. f_{RV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then $f_{RV} = f_{AN}$.
 5 Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, c < 3*h_{ef}. If c ≥ 3*h_{ef}, then $f_{HV} = 1.0$.



Table 47 — Load adjustment factors for 15M rebar in uncracked concrete^{1,2,3}

15M Rebar uncracked concrete	Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear ⁴ f_{AV}			Edge distance in shear						Concrete thickness factor in shear ⁵ f_{HV}		
										⊥ Toward edge f_{RV}			∥ To edge f_{RV}					
	Embedment h_{ef} in. (mm)	5-11/16 (145)	9-13/16 (250)	12-5/8 (320)	5-11/16 (145)	9-13/16 (250)	12-5/8 (320)	5-11/16 (145)	9-13/16 (250)	12-5/8 (320)	5-11/16 (145)	9-13/16 (250)	12-5/8 (320)	5-11/16 (145)	9-13/16 (250)	12-5/8 (320)	5-11/16 (145)	9-13/16 (250)
1-3/4 (44)	n/a	n/a	n/a	0.25	0.14	0.11	n/a	n/a	n/a	0.07	0.04	0.03	0.13	0.08	0.06	n/a	n/a	n/a
3-1/8 (80)	0.59	0.55	0.54	0.33	0.18	0.14	0.55	0.53	0.53	0.16	0.09	0.07	0.32	0.18	0.14	n/a	n/a	n/a
4 (102)	0.62	0.57	0.55	0.37	0.21	0.16	0.56	0.54	0.54	0.23	0.13	0.10	0.37	0.21	0.16	n/a	n/a	n/a
5 (127)	0.65	0.58	0.57	0.43	0.24	0.19	0.58	0.55	0.55	0.32	0.18	0.14	0.43	0.24	0.19	n/a	n/a	n/a
6 (152)	0.68	0.60	0.58	0.49	0.28	0.21	0.59	0.56	0.55	0.42	0.24	0.19	0.49	0.28	0.21	n/a	n/a	n/a
7 (178)	0.70	0.62	0.59	0.57	0.32	0.25	0.61	0.58	0.56	0.52	0.30	0.24	0.57	0.32	0.25	n/a	n/a	n/a
7-1/4 (184)	0.71	0.62	0.60	0.59	0.33	0.26	0.61	0.58	0.57	0.55	0.32	0.25	0.59	0.33	0.26	0.67	n/a	n/a
8 (203)	0.73	0.64	0.61	0.65	0.37	0.28	0.62	0.59	0.57	0.64	0.37	0.29	0.65	0.37	0.28	0.70	n/a	n/a
9 (229)	0.76	0.65	0.62	0.73	0.41	0.32	0.64	0.60	0.58	0.76	0.44	0.35	0.73	0.41	0.32	0.75	n/a	n/a
10 (254)	0.79	0.67	0.63	0.81	0.46	0.35	0.65	0.61	0.59	0.90	0.52	0.41	0.81	0.46	0.35	0.79	n/a	n/a
11-3/8 (289)	0.83	0.69	0.65	0.93	0.52	0.40	0.68	0.62	0.60	1.00	0.63	0.49	0.93	0.52	0.40	0.84	0.70	n/a
12 (305)	0.85	0.70	0.66	0.98	0.55	0.42	0.69	0.63	0.61		0.68	0.53	0.98	0.55	0.42	0.86	0.72	n/a
14-1/8 (359)	0.91	0.74	0.69	1.00	0.65	0.50	0.72	0.65	0.63		0.87	0.68	1.00	0.65	0.50	0.94	0.78	0.72
16 (406)	0.97	0.77	0.71		0.73	0.56	0.75	0.67	0.65		1.00	0.82		0.73	0.56	1.00	0.83	0.76
18 (457)	1.00	0.80	0.74		0.82	0.64	0.78	0.69	0.66			0.98		0.82	0.64		0.88	0.81
20 (508)		0.84	0.76		0.91	0.71	0.81	0.72	0.68			1.00		0.91	0.71		0.93	0.85
22 (559)		0.87	0.79		1.00	0.78	0.84	0.74	0.70					1.00	0.78		0.97	0.90
24 (610)		0.91	0.82			0.85	0.87	0.76	0.72						0.85		1.00	0.94
30 (762)		1.00	0.90			1.00	0.96	0.82	0.77						1.00			1.00
36 (914)			0.98				1.00	0.89	0.83									
> 48 (1219)			1.00					1.00	0.94									

- Linear interpolation not permitted
- Shaded area with reduced edge distance is permitted provided the installation torque is reduced to $0.30 T_{max}$ for $5d \leq s \leq 16$ -in. and to $0.5 T_{max}$ for $s > 16$ -in.
- When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
- Spacing factor reduction in shear applicable when $c < 3 \cdot h_{ef}$. f_{AV} is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{AV} = f_{AN}$.
- Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{HV} = 1.0$.

Table 48 — Load adjustment factors for 20M rebar in uncracked concrete^{1,2,3}



20M Rebar uncracked concrete	Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear ⁴ f_{AV}			Edge distance in shear						Concrete thickness factor in shear ⁵ f_{HV}		
										⊥ Toward edge f_{RV}			∥ To edge f_{RV}					
	Embedment h_{ef} in. (mm)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)
1-3/4 (44)	n/a	n/a	n/a	0.21	0.12	0.10	n/a	n/a	n/a	0.05	0.03	0.03	0.10	0.06	0.05	n/a	n/a	n/a
3-7/8 (98)	0.58	0.55	0.54	0.29	0.16	0.14	0.55	0.53	0.53	0.16	0.09	0.08	0.29	0.16	0.14	n/a	n/a	n/a
4 (102)	0.58	0.55	0.54	0.29	0.16	0.14	0.55	0.54	0.53	0.17	0.10	0.09	0.29	0.16	0.14	n/a	n/a	n/a
5 (127)	0.61	0.56	0.55	0.33	0.18	0.16	0.56	0.54	0.54	0.24	0.14	0.12	0.33	0.18	0.16	n/a	n/a	n/a
6 (152)	0.63	0.57	0.57	0.38	0.20	0.19	0.58	0.55	0.55	0.32	0.18	0.16	0.38	0.20	0.19	n/a	n/a	n/a
7 (178)	0.65	0.58	0.58	0.42	0.23	0.21	0.59	0.56	0.56	0.40	0.22	0.20	0.42	0.23	0.21	n/a	n/a	n/a
8 (203)	0.67	0.60	0.59	0.47	0.26	0.23	0.60	0.57	0.57	0.49	0.27	0.25	0.47	0.26	0.23	n/a	n/a	n/a
9 (229)	0.69	0.61	0.60	0.53	0.29	0.26	0.62	0.58	0.57	0.58	0.33	0.30	0.53	0.29	0.26	n/a	n/a	n/a
10 (254)	0.71	0.62	0.61	0.59	0.32	0.29	0.63	0.59	0.58	0.68	0.38	0.35	0.59	0.32	0.29	0.72	n/a	n/a
11 (279)	0.73	0.63	0.62	0.65	0.35	0.32	0.64	0.60	0.59	0.78	0.44	0.40	0.65	0.35	0.32	0.75	n/a	n/a
12 (305)	0.75	0.64	0.63	0.71	0.39	0.35	0.65	0.61	0.60	0.89	0.50	0.46	0.71	0.39	0.35	0.79	n/a	n/a
14 (356)	0.80	0.67	0.65	0.83	0.45	0.41	0.68	0.62	0.62	1.00	0.63	0.58	0.83	0.45	0.41	0.85	n/a	n/a
16 (406)	0.84	0.69	0.67	0.95	0.52	0.47	0.71	0.64	0.63		0.77	0.70	0.95	0.52	0.47	0.91	0.75	n/a
18 (457)	0.88	0.71	0.70	1.00	0.58	0.53	0.73	0.66	0.65		0.92	0.84	1.00	0.58	0.53	0.96	0.80	0.77
20 (508)	0.92	0.74	0.72		0.64	0.58	0.76	0.68	0.66		1.00	0.98		0.64	0.58	1.00	0.84	0.81
22 (559)	0.97	0.76	0.74		0.71	0.64	0.78	0.69	0.68			1.00		0.71	0.64		0.88	0.85
24 (610)	1.00	0.79	0.76		0.77	0.70	0.81	0.71	0.70					0.77	0.70		0.92	0.89
26 (660)		0.81	0.78		0.84	0.76	0.83	0.73	0.71					0.84	0.76		0.96	0.93
28 (711)		0.83	0.80		0.90	0.82	0.86	0.75	0.73					0.90	0.82		0.99	0.96
30 (762)		0.86	0.83		0.97	0.88	0.89	0.76	0.75					0.97	0.88		1.00	0.99
36 (914)		0.93	0.89		1.00	1.00	0.96	0.82	0.80					1.00	1.00			
> 48 (1219)		1.00	1.00				1.00	0.92	0.90									

- Linear interpolation not permitted
- Shaded area with reduced edge distance is permitted provided the installation torque is reduced to $0.30 T_{max}$ for $5d \leq s \leq 16$ -in. and to $0.5 T_{max}$ for $s > 16$ -in.
- When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
- Spacing factor reduction in shear applicable when $c < 3 \cdot h_{ef}$. f_{AV} is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{AV} = f_{AN}$.
- Concrete thickness reduction factor in shear, f_{HV} is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{HV} = 1.0$.

Table 51 — Hilti HIT-ICE design information with Hilti HIS-N and HIS-RN internally threaded inserts in hammer drilled holes in accordance with CSA A23.3 Annex D¹

Design parameter	Symbol	Units	Nominal bolt/cap screw diameter (in.)				Ref A23.3-14	
			3/8	1/2	5/8	3/4		
HIS insert outside diameter	D	mm	16.5	20.5	25.4	27.6		
Effective embedment ²	h_{ef}	mm	110	125	170	205		
Minimum concrete thickness ²	h_{min}	mm	150	170	230	270		
Critical edge distance	c_{min}	mm	$c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{8}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \sqrt{h_{ef} * f'_c}}{\pi * d_a}$					
Minimum edge distance	s_{min}	mm	83	102	127	140		
Minimum anchor spacing	s_{min}	mm	83	102	127	140		
Coeff. for factored concrete breakout resistance, uncracked concrete ³	$k_{c,uncr}$	-	10				D.6.2.2	
Coeff. for factored concrete breakout resistance, cracked concrete ³	$k_{c,cr}$	-	7				D.6.2.2	
Concrete material resistance factor	Φ_c	-	0.65				8.4.2	
Resistance modification factor for tension and shear, concrete failure modes, Condition B ⁴	R_{conc}	-	1.00				D.5.3(c)	
Temp. range A ⁵	Characteristic bond stress in cracked concrete ⁶	T_{cr}	psi (MPa)	350 (2.4)	30 (0.2)	n/a	n/a	D.6.5.2
	Characteristic bond stress in uncracked concrete ⁶	T_{uncr}	psi (MPa)	830 (5.7)	855 (5.9)	840 (5.8)	830 (5.7)	D.6.5.2
Reduction for seismic tension	$\alpha_{N,seis}$	-	n/a					
Permissible installation conditions	Resistance modification factor tension & shear, bond failure dry concrete	Anchor category	-	2	1	1	1	D.5.3(c)
		R_{dry}	-	0.85	1.00	1.00	1.00	
	Resistance modification factor tension & shear, bond failure water-saturated concrete	Anchor category	-	2	1	1	1	D.5.3(c)
		R_{ws}	-	0.85	1.00	1.00	1.00	

1 Design information in this table is based on testing in accordance with ACI 355.4.

2 See figure 7 of this section.

3 Minimum edge distance may be reduced to 44mm < c_{min} < 5d provided T_{min} is reduced.

4 For all design cases, $\psi_{c,N} = 1.0$. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.

5 Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318 17.3.3. For cases where the presence of supplementary reinforcement can be verified, the reduction factors associated with Condition A may be used.

6 Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°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.

7 Bond strength values corresponding to concrete compressive strength $f'_c = 2,500$ psi (17.2 MPa). For concrete compressive strength, f'_c , between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2,500)^{0.1}$ [for SI: $(f'_c / 17.2)^{0.1}$].

Table 52 — Hilti HIT-ICE adhesive factored resistance with concrete / bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete^{1,2,3,4,5,6,7,8}

Thread size	Effective embedment in. (mm)	Tension N_r				Shear V_r			
		$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)
3/8-16 UNC	4-3/8 (110)	4,120 (18.3)	4,210 (18.7)	4,290 (19.1)	4,415 (19.6)	8,235 (36.6)	8,420 (37.5)	8,575 (38.2)	8,825 (39.3)
1/2-13 UNC	5 (125)	7,065 (31.4)	7,225 (32.1)	7,360 (32.7)	7,575 (33.7)	14,135 (62.9)	14,455 (64.3)	14,720 (65.5)	15,150 (67.4)
5/8-11 UNC	6-3/4 (170)	11,660 (51.9)	11,920 (53.0)	12,140 (54.0)	12,495 (55.6)	23,315 (103.7)	23,840 (106.1)	24,280 (108.0)	24,990 (111.2)
3/4-10 UNC	8-1/8 (205)	15,140 (67.3)	15,485 (68.9)	15,765 (70.1)	16,230 (72.2)	30,280 (134.7)	30,965 (137.7)	31,535 (140.3)	32,455 (144.4)

3.2.5

Table 53 — Hilti HIT-ICE adhesive factored resistance with concrete / bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in cracked concrete^{1,2,3,4,5,6,7,8,9}

Thread size	Effective embedment in. (mm)	Tension N_r				Shear V_r			
		$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)	$f'_c = 20$ MPa (2,900 psi) lb (kN)	$f'_c = 25$ MPa (3,625 psi) lb (kN)	$f'_c = 30$ MPa (4,350 psi) lb (kN)	$f'_c = 40$ MPa (5,800 psi) lb (kN)
3/8-16 UNC	4-3/8 (110)	1,735 (7.7)	1,775 (7.9)	1,810 (8.0)	1,860 (8.3)	3,475 (15.4)	3,550 (15.8)	3,615 (16.1)	3,720 (16.6)
1/2-13 UNC	5 (125)	2,480 (11.0)	2,535 (11.3)	2,580 (11.5)	2,660 (11.8)	4,960 (22.1)	5,070 (22.6)	5,165 (23.0)	5,315 (23.6)

- 1 See Section 3.1.8 for explanation on development of load values.
- 2 See Section 3.1.8 to convert design strength value to ASD value.
- 3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- 4 Apply spacing, edge distance, and concrete thickness factors in tables 36-37 as necessary. Compare to the steel values in table 54. The lesser of the values is to be used for the design.
- 5 Data is for temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°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.
- 6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength value by 0.85.
- 7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
- 8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by I_a as follows: For sand-lightweight, $I_a = 0.51$. For all-lightweight, $I_a = 0.45$.
- 9 Tabular values are for static loads only. Seismic applications are not permitted.

Table 54 — Steel factored resistance for steel bolt / cap screw for Hilti HIS-N and HIS-RN internally threaded inserts^{1,2,3}

Thread size	ASTM A193 B7		ASTM A193 Grade B8M stainless steel	
	Tensile ⁴ N_{sar} lb (kN)	Shear ⁵ V_{sar} lb (kN)	Tensile ⁴ N_{sar} lb (kN)	Shear ⁵ V_{sar} lb (kN)
3/8-16 UNC	5,765 (25.6)	3,215 (14.3)	5,070 (22.6)	2,825 (12.6)
1/2-13 UNC	9,635 (42.9)	5,880 (26.2)	9,290 (41.3)	5,175 (23.0)
5/8-11 UNC	16,020 (71.3)	9,365 (41.7)	14,790 (65.8)	8,240 (36.7)
3/4-10 UNC	16,280 (72.4)	13,860 (61.7)	21,895 (97.4)	12,195 (54.2)

- 1 See section 3.1.8 to convert design strength value to ASD value.
- 2 Hilti HIS-N and HIS-RN inserts with steel bolts are considered brittle steel elements.
- 3 Table values are the lesser of steel failure in the HIS-N insert or inserted steel bolt.
- 4 Tensile = $A_{se,N} \Phi_s f_{uta} R$ as noted in CSA A23.3 Annex D
- 5 Shear = $A_{se,V} \Phi_s 0.60 f_{uta} R$ as noted in CSA A23.3 Annex D. For 3/8-in diameter insert, shear = $A_{se,V} \Phi_s 0.50 f_{uta} R$.

MASONRY CONSTRUCTION

Figure 8 — HIT-ICE installation conditions for masonry construction



Permissible masonry conditions	 Grout-filled concrete masonry	Permissible drilling method	 Hammer drilling with carbide tip
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Table 55 — Hilti HIT-ICE allowable loads for threaded rods in grout-filled concrete masonry units^{1, 2, 3, 4}

Nominal anchor diameter in.	Effective embedment in. (mm)	Distance from edge		Tension ^{5,6}		Shear lb (kN) ^{5,6}					
		in.	(mm)			HAS-E ISO 898 Class 5.5		HAS-E B7 ASTM A193 Grade B7		HAS-R AISI 304 / 316	
3/8	3-1/2 (89)	4	(102)	1,550	(6.9)	1360	(6.0)	2020	(9.0)	1875	(8.3)
		≥12	(305)								
1/2	4-1/4 (108)	4	(102)	1,785	(7.9)	2,020	(9.0)	2,020	(9.0)	2,020	(9.0)
		≥12	(305)			2,420	(10.8)	4,170	(18.5)	3,335	(14.8)
5/8	5 (127)	4	(102)	2,265	(10.1)	2,020	(9.0)	2,020	(9.0)	2,020	(9.0)
		≥12	(305)			3,780	(16.8)	5,625	(25.0)	5,215	(23.2)
3/4	6-5/8 (168)	4	(102)	3,740	(16.6)	2,020	(9.0)	2,020	(9.0)	2,020	(9.0)
		≥12	(305)			5,445	(24.2)	5,625	(25.0)	5,625	(25.0)

Table 56 — Hilti HIT-ICE ultimate loads for threaded rods in grout-filled concrete masonry units^{1, 2, 3, 4}

Nominal anchor diameter in.	Effective embedment in. (mm)	Distance from edge		Tension lb (kN) ^{5,6}		Shear lb (kN) ^{5,6}					
		in.	(mm)			HAS-E ISO 898 Class 5.5		HAS-E B7 ASTM A193 Grade B7		HAS-R AISI 304 / 316	
3/8	3-1/2 (90)	4	(102)	6,005	(26.7)	3,605	(16.0)	6,210	(27.6)	4,970	(22.1)
		≥12	(305)								
1/2	4-1/4 (108)	4	(102)	7,140	(31.8)	6,405	(28.5)	8,075	(35.9)	8,075	(35.9)
		≥12	(305)					11,040	(49.1)	8,835	(39.3)
5/8	5 (127)	4	(102)	9,060	(40.3)	8,075	(35.9)	8,075	(35.9)	8,075	(35.9)
		≥12	(305)			10,010	(44.2)	17,260	(76.8)	13,805	(61.4)
3/4	6-5/8 (168)	4	(102)	14,970	(66.6)	8,075	(35.9)	8,075	(35.9)	8,075	(35.9)
		≥12	(305)			14,415	(64.1)	22,500	(100.1)	16,800	(75.2)

1 Values are for lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C90 with 2,000 psi grout conforming to ASTM C476.

2 Embedment depth is measured from the outside face of the concrete masonry unit.

3 Values are for anchors located in the grouted cell, head joint, bed joint, T-joint, cross web or any combination of the above.

4 Values for edge distances between 4 inches and 12 inches can be calculated by linear interpolation.

5 Loads are based on the lesser of bond strength, steel strength or base material strength.

6 Steel values in accordance with AISC

Allowable load values

$$\text{Tension} = 0.33 \times F_u \times A_{nom}$$

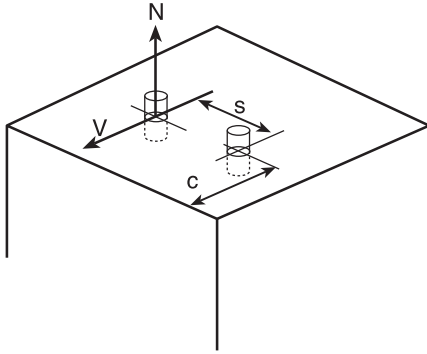
$$\text{Shear} = 0.17 \times F_u \times A_{nom}$$

Ultimate load values

$$\text{Tension} = 0.75 \times F_u \times A_{nom}$$

$$\text{Shear} = 0.45 \times F_u \times A_{nom}$$

Figure 9 — Anchor spacing and edge distance



Edge distance for shear and tension:

Grout-filled, normal-weight and lightweight block

c_{cr} = 12 in. minimum from free edge

c_{min} = 4 in. minimum from free edge

Anchor spacing for shear and tension:

Grout-filled, normal-weight and lightweight block

s_{cr} = s_{min} = maximum (1) anchor per cell and minimum 8 inches center-to-center spacing between anchors

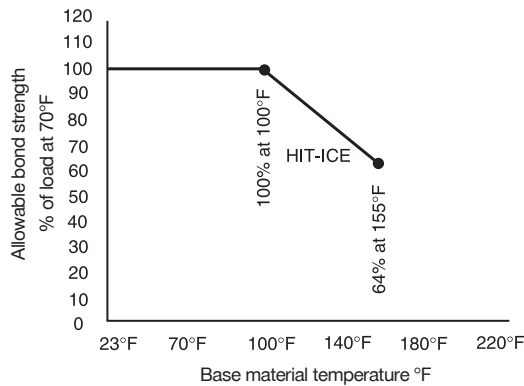
3.2.5

Table 57 — Allowable loads for anchorage to the top of grout-filled block walls with Hilti HIT-ICE^{1,2,3,4}

Nominal anchor diameter in.	Effective embedment in. (mm)	Edge distance		Tension		Shear lb (kN)			
		in.	(mm)	lb	(kN)	Load to edge		Load ⊥ to edge	
1/2	4-1/4 (108)	1-3/4	(45)	1,120	(5.0)	1,425	(6.3)	560	(2.5)
		2-3/4	(70)	1,440	(6.4)	2,085	(9.3)	1,110	(4.9)
5/8	5 (127)	1-3/4	(45)	1,475	(6.5)	1,800	(8.0)	680	(3.0)
		2-3/4	(70)	1,630	(7.2)	3,070	(13.7)	1,110	(4.9)

1 Allowable loads calculated using a factor of safety of 4.
 2 Allowable loads are based on masonry capacity. The steel strength must be checked.
 3 Minimum edge distance is 1-3/4 inches.
 4 Minimum masonry prism strength is 1,500 psi.

Figure 10 — Influence of temperature on masonry bond strength^{1,2}



- 1 Test procedure involves the concrete being held at the elevated temperature for 24 hours then removing it from the controlled environment and testing to failure.
- 2 Long term creep test in accordance with ICC-ES Acceptance Criteria AC58.

Table 58 -Gel time^{1,2}

Base material temperature		HIT-ICE
°F	°C	
-10	-23	1.5 h
0	-18	1.5 h
20	-7	1 h
40	4	15
60	16	5 min
70	21	2.5 min
90	32	1 min

Table 59 - Full cure time^{1,2}

Base material temperature		HIT-ICE
°F	°C	
-10	-23	36 h
0	-18	24 h
20	-7	6 h
40	4	1.5 h
60	16	1 h
70	21	45 min
90	32	35 min

- 1 Product temperatures must be maintained above 0°F (-18°C) prior to installation.
- 2 Gel times and full cure times are approximate.

INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.hilti.com (US), or www.hilti.ca (Canada). Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

ORDERING INFORMATION

Description	Contents
HIT-ICE Cartridge 10 oz (297 ml)	24 Cartridges, 24 Mixers



HIT-ICE Cartridge

Description	Notes	Qty/Pkg
MD 1000 Dispenser	For use with HIT-ICE cartridges	1



MD 1000 Dispenser

Description	Notes	Qty/Pkg
HIT-M2 Mixer for HIT-ICE only	For use with HIT-ICE cartridges	1



HIT-ICE Mixer



HIT Filler Tube

For ordering information on anchor rods and inserts, dispensers, hole cleaning equipment and other accessories, see section 3.2.9.

