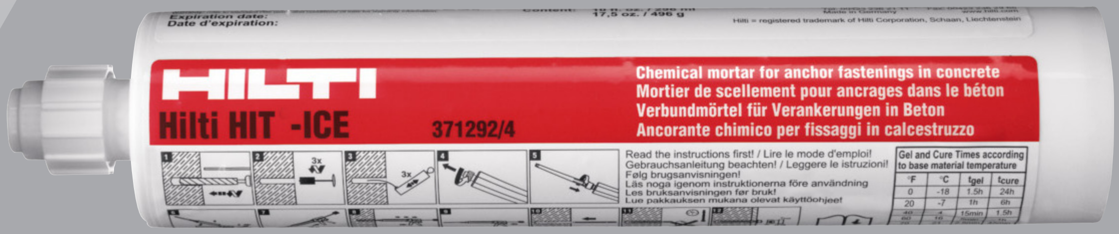
DON'T GET LEFT IN THE COLD

Hilti HIT-ICE
Adhesive Anchor System



DON'T GET LEFT IN THE COLD

Hilti HIT-ICE

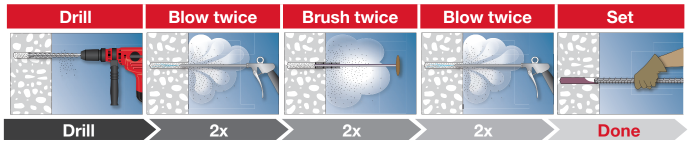
Hilti HIT-ICE is the solution for cold weather adhesive anchoring applications in cracked and uncracked concrete, and grout filled masonry for a wide variety of anchoring applications. The formulation of Hilti HIT-ICE ensures consistent dispensing in challenging cold weather applications as low as -10°F/-23°C. Don't get left in the cold on your next project, choose Hilti HIT-ICE.

SAFESET

THE TRADITIONAL METHOD

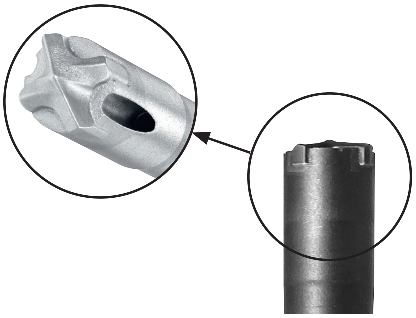
Blow and brush

All Hilti adhesive anchors can be cleaned with the traditional blow-brush-blow method.

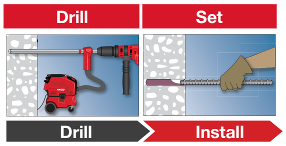


Note: OSHA 1926.1153 Table 1 requires a HEPA rated vacuum filter with this procedure

DUST CONTROL



SAFESET



Note: OSHA 1926.1153 Table 1 - compliant control metnods require a vacuum cleaner with 99% filter efficiency and a filter cleaning mechanism - HEPA not required

HOLES THAT CLEAN THEMSELVES

Hilti TE-CD and TE-YD Hollow Drill Bits, in conjunction with the Hilti VC 150 and VC 300 Series Vacuum and HIT-ICE make subsequent hole cleaning completely unnecessary. Dust is removed by the Hilti VC 150 and VC 300 Series Vacuum system while drilling is in progress which leads to faster drilling and a virtually dustless working environment.

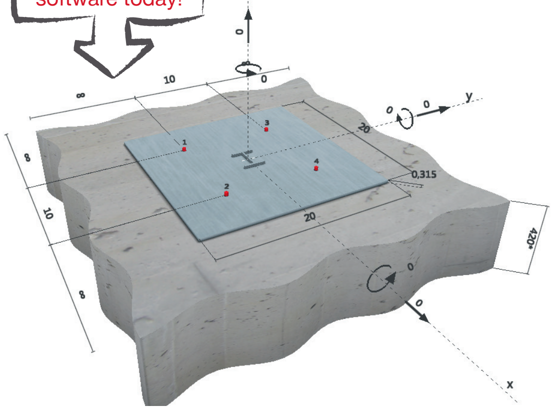
- The Hilti TE-CD/TE-YD hollow drill bits together with a VC 150 and VC 300 series vacuum cleaner is a specified exposure control method per OSHA's silica standard (OSHA 1926.1153)
- Because no separate hole cleaning is needed, a HEPA filter is not required for the hollow drill bit system

PROFIS ANCHOR SOFTWARE

Hilti PROFIS Anchor represents the next generation in anchor design software. PROFIS Anchor performs calculations for cast in place anchors and Hilti post-installed anchors in accordance with the Strength Design provisions of ACI 318, CSA A23.3, and the International Building Code. Ask your Hilti Field Engineer or visit Hilti Online for details.

HIT-ICE and the new, alternative installation methods are now included in PROFIS Anchor. Look for TE-CD / TE-YD Hollow Drill Bit options when designing your next project.

Download your complimentary PROFIS Anchor software today!



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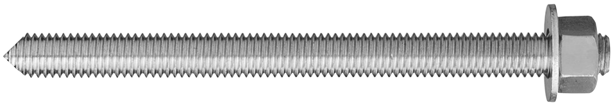
PRODUCT DESCRIPTION

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

Mortar Systems

Hilti HIT-ICE
Cartridge



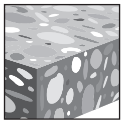
Threaded Rod
HAS
HAS-E
HIT-V

Rebar

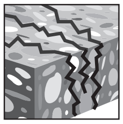
Hilti
HIS-N

Features and Benefits

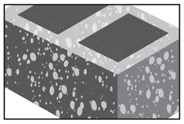
- Winter formulation for base material temperatures down to -10°F (-23°C)
- Two hole cleaning options including the Hilti SafeSet™ System using the TE-CD or TE-YD Hollow Drill Bit in conjunction with a Hilti Vacuum to remove the dust as you drill.
- Small edge distance and anchor spacing allowance
- 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



Uncracked
concrete



Cracked
concrete



Grout-filled
concrete
masonry

SAFESET

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

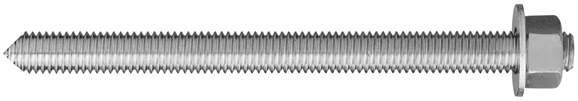
Table 1 - Material properties of cured HIT-ICE adhesive

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.

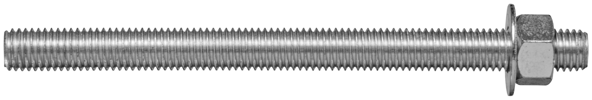
For material specifications for anchor rods and inserts, please refer to section 3.2.8 of the Hilti North American Tech Guide volume 2: Anchor Fastening Technical Guide, Edition 17.

TECHNICAL DATA

Hilti HIT-ICE with HAS/HIT-V Threaded Rod



Hilti HAS threaded rod



Hilti HIT-V threaded rod

Figure 1 - Hilti HAS/HIT-V threaded rod installation conditions

Permissible concrete conditions			Permissible drilling method	
	Uncracked concrete	Dry concrete		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/HIT-V 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. (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)
	maximum	$h_{ef,max}$	in. (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)
Minimum 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]	1-1/2[1]
	preset		in.	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
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)		$h_{ef}+2*d_o$				
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/HIT-V threaded rods

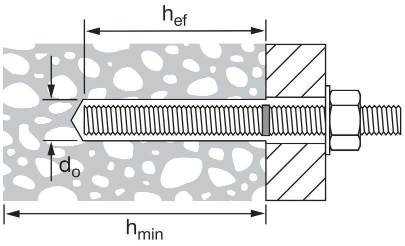
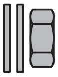


Figure 3 -
Installation with (2) washers



03/2018

ACI 318-14 Chapter 17 design

Load Resistance Factored Design of anchors is described in the provisions of ACI 318-14 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 318-14 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, Edition 17 (PTG Vol. 2).

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

Table 3 - Hilti HIT-ICE design information with HAS/HIT-V threaded rods in holes drilled with a hammer drill and carbide bit (or hollow drill bit) in accordance with ACI 318-14 Ch. 17[1]

Design parameter		Symbol	Units	Nominal rod diameter (in.)							Ref ACI 318-14
				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		$h_{ef,min}$[2]	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		$h_{ef,max}$[2]	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		h_{min}[2]	in (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		hef + $2d_0$[(8)]					
Critical edge distance		c_{ac}	in (mm)	$c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{1160}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr}\sqrt{h_{ef} * f'_c}}{\pi * d_a}$ $\left(c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{8}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)\right.$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\left.\tau_{k,uncr} = \frac{k_{uncr}\sqrt{h_{ef} * f'_c}}{\pi * d_a}\right)$							
Minimum edge distance		c_{min}[3]	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		$k_{c,uncr}$[4]	-	24 (10)							17.4.2.2
Effectiveness factor for cracked concrete		$k_{c,cr}$[4]	-	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)	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]	$\tau_{k,uncr}$	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	
		-	-	0.55	0.65	0.55	0.65	0.65	0.65	0.65	
	Strength reduction factor for tension, bond failure modes, water saturated concrete	-	-	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) ≤ 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 318-14 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)

1 See section 3.1.8 of PTG Vol. 2 (Ed. 17) for explanation on development of load values.
2 See Section 3.1.8.6 of PTG Vol. 2 (Ed. 17) 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 of PTG Vol. 2 (Ed. 17).
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 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)

1 See section 3.1.8 of PTG Vol. 2 (Ed. 17) for explanation on development of load values.

2 See Section 3.1.8.6 of PTG Vol. 2 (Ed. 17) 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 of PTG Vol 2 (Ed. 17).

8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

9 Tabular values are for static loads only. Seismic applications are not permitted.

Table 6 - Steel design strength for Hilti HIT-V and HAS threaded rods[1]

Nominal anchor diameter in.	HIT-V ASTM A307 Grade A[4]		HAS-E ISO 898 Class 5.8[4]		HAS-E B7 ASTM A193 B7[5]		HAS-V / HAS-V HDG ASTM F1554 Gr. 36[4]		HAS-E / HAS-E HDG ASTM F1554 Gr. 55[4]		HAS-B and HAS-B HDG[4] 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[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)	Tensile[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)	Tensile[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)	Tensile[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)	Tensile[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)	Tensile[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)	Tensile[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)	Tensile[2] ϕN_{sa} lb (kN)	Shear[3] ϕV_{sa} lb (kN)
3/8	3,025 (13.5)	1,395 (6.2)	3,655 (16.3)	1,685 (7.5)	7,265 (32.3)	3,150 (14.0)	3,370 (15.0)	1,750 (7.8)	4,360 (19.4)	2,270 (10.1)	7,270 (32.3)	3,780 (16.8)	5,040 (22.4)	2,790 (12.4)	5,040 (22.4)	2,325 (10.3)
1/2	5,535 (24.6)	3,065 (13.6)	6,690 (29.8)	3,705 (16.5)	13,300 (59.2)	6,915 (30.8)	6,175 (27.5)	3,210 (14.3)	7,985 (35.5)	4,150 (18.5)	13,305 (59.2)	6,920 (30.8)	9,225 (41.0)	5,110 (22.7)	9,225 (41.0)	5,110 (22.7)
5/8	8,815 (39.2)	4,880 (21.7)	10,650 (47.4)	5,900 (26.2)	21,190 (94.3)	11,020 (49.0)	9,835 (43.7)	5,110 (22.7)	12,715 (56.6)	6,610 (29.4)	21,190 (94.3)	11,020 (49.0)	14,690 (65.3)	8,135 (36.2)	14,690 (65.3)	8,135 (36.2)
3/4	13,045 (58.0)	7,225 (32.1)	15,765 (70.1)	8,730 (38.8)	31,360 (139.5)	16,305 (72.5)	14,550 (64.7)	7,565 (33.7)	18,820 (83.7)	9,785 (43.5)	31,360 (139.5)	16,310 (72.6)	18,485 (82.2)	10,235 (45.5)	18,480 (82.2)	10,235 (45.5)
7/8	-	-	21,755 (96.8)	12,050 (53.6)	43,285 (192.5)	22,505 (100.1)	20,085 (89.3)	10,445 (46.5)	25,975 (115.5)	13,505 (60.1)	43,285 (192.5)	22,510 (100.1)	25,510 (113.5)	14,125 (62.8)	25,510 (113.5)	14,125 (62.8)
1	23,620 (105.1)	13,085 (58.2)	28,540 (127.0)	15,805 (70.3)	56,785 (252.6)	29,525 (131.3)	26,350 (117.2)	13,700 (60.9)	34,075 (151.6)	17,720 (78.8)	56,785 (252.6)	29,530 (131.4)	33,465 (148.9)	18,535 (82.4)	33,465 (148.9)	18,535 (82.4)
1-1/4	-	-	45,670 (203.1)	25,295 (112.5)	90,850 (404.1)	47,240 (210.1)	42,160 (187.5)	21,920 (97.5)	54,515 (242.5)	28,345 (126.1)	90,855 (404.1)	47,245 (210.2)	41,430 (184.3)	21,545 (95.8)	53,540 (238.2)	29,655 (131.9)

1 See Section 3.1.8.6 of PTG Vol. 2 (Ed. 17) to convert design strength value to ASD value.

2 Tensile = $\Phi A_{se,N} f_{uta}$ as noted in ACI 318 Chapter 17.

3 Shear = $\Phi 0.60 A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17. For 3/8-in diameter threaded rod, shear = $\Phi 0.50 A_{se,V} f_{uta}$

4 HIT-V, HAS, and HAS-R threaded rods are considered brittle steel elements. HIT-V does not comply with % elongation requirements of ASTM A307 Grade A steel. HAS-E does not comply with % elongation requirements of ISO 898-1.

5 HAS-E B7 rods are considered ductile steel elements.

Table 7 - Load adjustment factors for 3/8-in. diameter threaded rods in uncracked concrete[1,2,3]

3/8-in. 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)	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)	7-1/2 (191)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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)			1.00	0.81				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								0.10				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												

Table 8 - Load adjustment factors for 3/8-in. diameter threaded rods in cracked concrete[1,2,3]

3/8-in. 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}							
Embedment h_{ef}		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)	7-1/2 (191)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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		0.93	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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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. 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.	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10
		(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)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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. 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}							
Embedment h_{ef}		in.	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10	2-3/4	4-1/2	6	10
		(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)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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	0.549	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	1.00	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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 11 - Load adjustment factors for 5/8-in. diameter threaded rods in uncracked concrete[1,2,3]

5/8-in. 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	in.		3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2
h_{ef}	(mm)		(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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				0.73			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												

Table 12 - Load adjustment factors for 5/8-in. diameter threaded rods in cracked concrete[1,2,3]

5/8-in. 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}							
Embedment	in.		3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2	3-1/8	5-5/8	7-1/2	12-1/2
h_{ef}	(mm)		(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)	(79)	(143)	(191)	(318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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
	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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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]

3/4-in. 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 ⊥ Toward edge f_{RV}				Edge distance in shear ǁ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)																									
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	0.09	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	0.29	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]

3/4-in. 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 ⊥ Toward edge f_{RV}				Edge distance in shear ǁ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)																									
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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 15 - Load adjustment factors for 7/8-in. diameter threaded rods in uncracked concrete[1,2,3]

7/8-in. 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 ⊥ Toward edge f_{RV}				Edge distance in shear ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in.	(mm)	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)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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

Table 16 - Load adjustment factors for 7/8-in. diameter threaded rods in cracked concrete[1,2,3]

7/8-in. 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 ⊥ Toward edge f_{RV}				Edge distance in shear ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in.	(mm)	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)	3-1/2 (89)	7-7/8 (200)	10-1/2 (267)	17-1/2 (445)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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	0.54	0.75	0.65	0.63	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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 17 - Load adjustment factors for 1-in. diameter threaded rods in uncracked concrete[1,2,3]

1-in. 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.	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20
		(mm)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	n/a	0.38	0.23	0.17	0.10	n/a	n/a	n/a	n/a	0.08	0.03	0.02	0.01	0.15	0.05	0.04	0.02	n/a	n/a	n/a	n/a
	5	(127)	0.62	0.59	0.57	0.542	0.63	0.32	0.24	0.14	0.59	0.54	0.53	0.52	0.37	0.12	0.09	0.05	0.63	0.24	0.18	0.12	n/a	n/a	n/a	n/a
	6	(152)	0.65	0.61	0.58	0.550	0.70	0.36	0.26	0.15	0.60	0.55	0.54	0.53	0.48	0.16	0.12	0.07	0.70	0.31	0.23	0.14	n/a	n/a	n/a	n/a
	6-1/4	(159)	0.65	0.62	0.59	0.552	0.71	0.37	0.27	0.16	0.61	0.55	0.54	0.53	0.51	0.17	0.12	0.08	0.71	0.33	0.25	0.15	0.65	n/a	n/a	n/a
	7	(178)	0.67	0.63	0.60	0.558	0.76	0.39	0.29	0.17	0.62	0.56	0.55	0.53	0.61	0.20	0.15	0.09	0.76	0.39	0.29	0.17	0.69	n/a	n/a	n/a
	8	(203)	0.70	0.65	0.61	0.567	0.83	0.43	0.31	0.18	0.64	0.56	0.55	0.54	0.74	0.24	0.18	0.11	0.84	0.43	0.31	0.19	0.74	n/a	n/a	n/a
	9	(229)	0.72	0.67	0.63	0.575	0.91	0.47	0.34	0.20	0.65	0.57	0.56	0.54	0.89	0.29	0.22	0.13	0.91	0.47	0.34	0.20	0.78	n/a	n/a	n/a
	10	(254)	0.75	0.69	0.64	0.583	0.98	0.50	0.37	0.22	0.67	0.58	0.57	0.55	1.00	0.34	0.25	0.15	0.98	0.50	0.37	0.22	0.83	n/a	n/a	n/a
	11	(279)	0.77	0.70	0.65	0.592	1.00	0.55	0.41	0.24	0.69	0.59	0.57	0.55		0.39	0.29	0.17	1.00	0.55	0.41	0.24	0.87	n/a	n/a	n/a
	11-1/4	(286)	0.78	0.71	0.66	0.594		0.57	0.42	0.24	0.70	0.59	0.58	0.55		0.40	0.30	0.18		0.57	0.42	0.24	0.88	0.60	n/a	n/a
	12	(305)	0.80	0.72	0.67	0.600		0.60	0.44	0.26	0.71	0.60	0.58	0.56		0.44	0.33	0.20		0.60	0.44	0.26	0.91	0.62	n/a	n/a
	13	(330)	0.82	0.74	0.68	0.608		0.65	0.48	0.28	0.72	0.61	0.59	0.56		0.50	0.37	0.22		0.65	0.48	0.28	0.94	0.65	n/a	n/a
	14	(356)	0.84	0.76	0.69	0.617		0.70	0.52	0.30	0.74	0.61	0.59	0.57		0.56	0.42	0.25		0.70	0.52	0.30	0.98	0.67	n/a	n/a
	14-1/4	(362)	0.85	0.76	0.70	0.619		0.72	0.53	0.31	0.74	0.62	0.60	0.57		0.57	0.43	0.26		0.72	0.53	0.31	0.99	0.68	0.62	n/a
	16	(406)	0.90	0.80	0.72	0.633		0.80	0.59	0.35	0.77	0.63	0.61	0.58		0.68	0.51	0.31		0.80	0.59	0.35	1.00	0.72	0.65	n/a
	18	(457)	0.94	0.83	0.75	0.650		0.90	0.66	0.39	0.81	0.65	0.62	0.59		0.81	0.61	0.35		0.90	0.664	0.40		0.76	0.70	n/a
	20	(508)	0.99	0.87	0.78	0.667		1.00	0.74	0.43	0.84	0.66	0.63	0.60		0.95	0.71	0.43		1.00	0.74	0.43		0.80	0.73	n/a
	22	(559)	1.00	0.91	0.81	0.683			0.81	0.48	0.88	0.68	0.65	0.60		1.00	0.82	0.49			0.81	0.48		0.84	0.77	n/a
	22-1/4	(565)		0.91	0.81	0.685			0.82	0.48	0.88	0.68	0.65	0.61			0.84	0.50			0.82	0.48		0.85	0.77	0.65
	24	(610)		0.94	0.83	0.700			0.89	0.52	0.91	0.69	0.66	0.61			0.94	0.56			0.89	0.52		0.88	0.80	0.67
	26	(660)		0.98	0.86	0.717			0.96	0.56	0.94	0.71	0.67	0.62			1.00	0.63			0.96	0.56		0.92	0.83	0.70
	28	(711)		1.00	0.89	0.733			1.00	0.61	0.98	0.73	0.69	0.63				0.71			1.00	0.61		0.95	0.86	0.73
	30	(762)			0.92	0.750				0.65	1.00	0.74	0.70	0.64				0.79				0.65		0.98	0.89	0.75
	36	(914)			1.00	0.800				0.78		0.79	0.74	0.67				1.00				0.78		1.00	0.98	0.83
	> 48	(1219)				0.900				1.00		0.87	0.82	0.73								1.00			1.00	0.95

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 $5d \le s \le$ 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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 $c \ge 3{*}h_{ef}$, then $f_{AV} = f_{AN}$.

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

Table 18 - Load adjustment factors for 1-1/4-in. diameter threaded rods in uncracked concrete[1,2,3]

1-1/4-in. 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 and away from edge f_{RV}							
Embedment h_{ef}		in.	5	11-1/4	15	25	5	11-1/4	15	25	5	11-1/4	15	25	5	11-1/4	15	25	5	11-1/4	15	25	5	11-1/4	11-1/4	25
		(mm)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(286)	(635)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	n/a	0.37	0.22	0.16	0.09	n/a	n/a	n/a	n/a	0.05	0.02	0.01	0.01	0.11	0.03	0.02	0.02	n/a	n/a	n/a	n/a
	6-1/4	(159)	0.62	0.59	0.57	0.542	0.64	0.32	0.24	0.14	0.59	0.54	0.53	0.52	0.37	0.11	0.08	0.05	0.64	0.22	0.16	0.10	n/a	n/a	n/a	n/a
	7	(178)	0.64	0.60	0.58	0.547	0.68	0.34	0.25	0.15	0.60	0.54	0.54	0.53	0.44	0.13	0.10	0.06	0.68	0.26	0.19	0.12	n/a	n/a	n/a	n/a
	8	(203)	0.66	0.62	0.59	0.553	0.73	0.37	0.27	0.16	0.61	0.55	0.54	0.53	0.53	0.16	0.12	0.07	0.73	0.32	0.24	0.15	0.66	n/a	n/a	n/a
	9	(229)	0.68	0.63	0.60	0.560	0.79	0.40	0.29	0.17	0.62	0.56	0.55	0.53	0.63	0.19	0.14	0.09	0.79	0.38	0.28	0.17	0.70	n/a	n/a	n/a
	10	(254)	0.70	0.65	0.61	0.567	0.84	0.43	0.32	0.19	0.64	0.561	0.55	0.54	0.74	0.22	0.17	0.10	0.84	0.43	0.32	0.19	0.74	n/a	n/a	n/a
	11	(279)	0.72	0.66	0.62	0.573	0.90	0.46	0.34	0.20	0.65	0.57	0.56	0.54	0.86	0.26	0.19	0.12	0.90	0.46	0.34	0.20	0.78	n/a	n/a	n/a
	12	(305)	0.74	0.68	0.63	0.580	0.96	0.49	0.36	0.21	0.66	0.57	0.56	0.54	0.98	0.29	0.22	0.13	0.96	0.49	0.36	0.21	0.81	n/a	n/a	n/a
	13	(330)	0.76	0.69	0.64	0.587	1.00	0.53	0.39	0.23	0.68	0.58	0.57	0.55	1.00	0.33	0.25	0.15	1.00	0.53	0.39	0.23	0.84	n/a	n/a	n/a
	14	(356)	0.78	0.71	0.66	0.593		0.57	0.42	0.25	0.70	0.59	0.57	0.55		0.37	0.28	0.17		0.57	0.42	0.25	0.88	0.58	n/a	n/a
	14-1/4	(362)	0.78	0.71	0.66	0.595		0.58	0.43	0.25	0.70	0.59	0.57	0.55		0.38	0.28	0.17		0.58	0.43	0.25	0.88	0.58	n/a	n/a
	15	(381)	0.80	0.72	0.67	0.600		0.61	0.45	0.26	0.71	0.59	0.58	0.55		0.41	0.31	0.18		0.61	0.45	0.26	0.91	0.61	n/a	n/a
	16	(406)	0.82	0.74	0.68	0.607		0.65	0.48	0.28	0.72	0.60	0.58	0.56		0.45	0.34	0.20		0.65	0.48	0.28	0.94	0.62	n/a	n/a
	17	(432)	0.84	0.75	0.69	0.613		0.69	0.51	0.30	0.73	0.60	0.59	0.56		0.49	0.37	0.22		0.69	0.51	0.30	0.96	0.64	n/a	n/a
	18	(457)	0.86	0.77	0.70	0.620		0.73	0.54	0.32	0.75	0.61	0.59	0.56		0.53	0.40	0.24		0.73	0.54	0.32	0.99	0.66	0.60	n/a
	20	(508)	0.90	0.80	0.72	0.633		0.81	0.60	0.35	0.77	0.62	0.60	0.57		0.63	0.47	0.28		0.81	0.60	0.35	1.00	0.70	0.63	n/a
	22	(559)	0.94	0.83	0.74	0.647		0.89	0.66	0.39	0.80	0.63	0.61	0.58		0.72	0.54	0.33		0.89	0.66	0.39		0.73	0.67	n/a
	24	(610)	0.98	0.86	0.77	0.660		0.97	0.72	0.42	0.83	0.65	0.62	0.58		0.82	0.62	0.37		0.97	0.72	0.42		0.77	0.70	n/a
	26	(660)	1.00	0.89	0.79	0.673		1.00	0.78	0.46	0.86	0.66	0.63	0.59		0.93	0.70	0.42		1.00	0.78	0.46		0.80	0.72	n/a
	28	(711)		0.92	0.81	0.687			0.84	0.49	0.88	0.67	0.64	0.60		1.00	0.78	0.47			0.84	0.49		0.81	0.75	0.63
	30	(762)		0.94	0.83	0.700			0.90	0.53	0.91	0.68	0.65	0.61			0.86	0.52			0.90	0.53		0.86	0.78	0.66
	36	(914)		1.00	0.90	0.740			1.00	0.63	0.99	0.72	0.68	0.63			1.00	0.68			1.00	0.63		0.94	0.85	0.72
	> 48	(1219)			1.00	0.820				0.84	1.00	0.79	0.74	0.67				1.00				0.84		1.00	0.98	0.83

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 $5d \le s \le$ 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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 $c \ge 3{*}h_{ef}$, then $f_{AV} = f_{AN}$.

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

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

Figure 4 - Rebar installation conditions

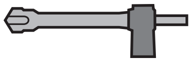
Permissible concrete conditions	Uncracked concrete	Dry concrete	Permissible drilling method		Hammer drilling with carbide tipped drill bit
	Cracked concrete	Water-saturated concrete			Hilti TE-CD or TE-YD Hollow Drill Bit

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

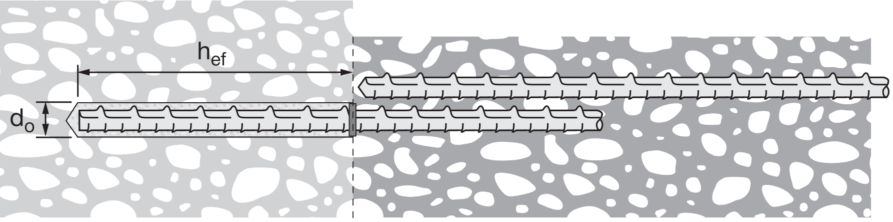


Table 20 - Hilti HIT-ICE design information with Rebar holes drilled with a hammer drill and carbide bit (or hollow drill bit) in accordance with ACI 318-14 Ch. 17[1]

Design parameter		Symbol	Units	Nominal rod diameter (in.)									Ref
				#3	#4	#5	#6	#7	#8	#9	#10	#11	ACI 318-14
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)	hef + $2d_0$[(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		$k_{c,uncr}$[4]	-	24 (10)									17.4.2.2
Effectiveness factor for cracked concrete		$k_{c,cr}$[4]	-	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 318-14 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)

1 See section 3.1.8 of PTG (Ed. 17) for explanation on development of load values.

2 See section 3.1.8.6 of PTG (Ed. 17) 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 of PTG (Ed. 17).

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, λ_a = 0.51. For all-lightweight, λ_a = 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)	6,435 (28.6)	3,565 (15.9)	6,600 (29.4)	3,430 (15.3)
#4	7,800 (34.7)	4,320 (19.2)	11,700 (52.0)	6,480 (28.8)	12,000 (53.4)	6,240 (27.8)
#5	12,090 (53.8)	6,695 (29.8)	18,135 (80.7)	10,045 (44.7)	18,600 (82.7)	9,670 (43.0)
#6	17,160 (76.3)	9,505 (42.3)	25,740 (114.5)	14,255 (63.4)	26,400 (117.4)	13,730 (61.1)
#7	23,400 (104.1)	12,960 (57.6)	35,100 (156.1)	19,440 (86.5)	36,000 (160.1)	18,720 (83.3)
#8	30,810 (137.0)	17,065 (75.9)	46,215 (205.6)	25,595 (113.9)	47,400 (210.8)	24,650 (109.6)
#9	39,000 (173.5)	21,600 (96.1)	58,500 (260.2)	32,400 (144.1)	60,000 (266.9)	31,200 (138.8)
#10	49,530 (220.3)	27,430 (122.0)	74,295 (330.5)	41,150 (183.0)	76,200 (339.0)	39,625 (176.3)

1 See Section 3.1.8.6 of PTG (Ed. 17) 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 = $\phi A_{se,N} f_{uta}$ as noted in ACI 318-14 Chapter 17.

4 Shear = $\phi\, 0.60\, A_{se,N} f_{uta}$ as noted in ACI 318-14 Chapter 17.

Table 23 - Load adjustment factors for #3 rebar in uncracked concrete[1,2,3]

#3 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}			ǁ To edge f_{RV}					
Embedment h_{ef}	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)	7-1/2 (191)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - 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)																		

Table 24 - Load adjustment factors for #4 rebar in uncracked concrete[1,2,3]

#4 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}			ǁ To edge f_{RV}					
Embedment h_{ef}	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)	10 (254)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - 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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 25 - Load adjustment factors for #5 rebar in uncracked concrete[1,2,3]

	#5 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)	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)	10 (254)
Spacing (s) / Edge distance (c_a) / 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 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)	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)	15 (381)
Spacing (s) / Edge distance (c_a) / 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 ≤ 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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 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)	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)	17-1/2 (445)
Spacing (s) / Edge distance (c_a) / 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		0.97	0.82
	30	(762)		0.98	0.79			0.77	0.81	0.75	0.68						0.77		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

Table 28 - Load adjustment factors for #8 rebar in uncracked concrete[1,2,3]

#8 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)	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)	20 (508)
Spacing (s) / Edge distance (c_a) / 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	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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 29 - Load adjustment factors for #9 rebar in uncracked concrete[1,2,3]

#9 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)	10-1/8 (257)	13-1/2 (343)	22-1/2 (572)	10-1/8 (257)	13-1/2 (343)	22-1/2 (572)	10-1/8 (257)	13-1/2 (343)	22-1/2 (572)	10-1/8 (257)	13-1/2 (343)	22-1/2 (572)	10-1/8 (257)	13-1/2 (343)	22-1/2 (572)	10-1/8 (257)	13-1/2 (343)	22-1/2 (572)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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	0.71			1.00			0.97		1.00	0.92

Table 30 - Load adjustment factors for #10 rebar in uncracked concrete[1,2,3]

#10 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)	11-1/4 (286)	15 (381)	25 (635)	11-1/4 (286)	15 (381)	25 (635)	11-1/4 (286)	15 (381)	25 (635)	11-1/4 (286)	15 (381)	25 (635)	11-1/4 (286)	15 (381)	25 (635)	11-1/4 (286)	15 (381)	25 (635)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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	0.68			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 ≤ 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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 $f_{HV} = 1.0$.

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

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	minimum	h_s	in.	3/8	1/2	5/8	3/4
	maximum		in.	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

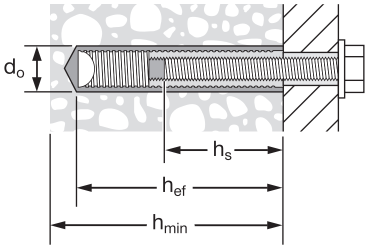


Table 32 - Hilti HIT-ICE design information with Hilti HIS-R and HIS-RN holes drilled with a hammer drill and carbide bit (or hollow drill bit) accordance with ACI 318-14 Ch. 17[1]

Design parameter		Symbol	Units	Nominal rod diameter (in.)				Ref
				3/8	1/2	5/8	3/4	ACI 318-14
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)	$c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{1160}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr}\sqrt{h_{ef} * f'_c}}{\pi * d_a}$ $\left(c_{ac} = h_{ef} * \left(\frac{\tau_{k,uncr}}{8}\right)^{0.4} * \left[3.1 - 0.7 * \frac{h}{h_{ef}}\right]; \left(\frac{h}{h_{ef}}\right)\right.$ need not be larger than 2.4 $\tau_{k,uncr}$ need not be taken as greater than: $\left.\tau_{k,uncr} = \frac{k_{uncr}\sqrt{h_{ef} * f'_c}}{\pi * d_a}\right)$				
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		$k_{c,uncr}$[4]	-	24 (10)				17.4.2.2
Effectiveness factor for cracked concrete		$k_{c,cr}$[4]	-	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	350 (2.4)	300 (2.1)	n/a	n/a	17.4.5
	Characteristic bond stress in uncracked concrete[7]	$\tau_{k,uncr}$	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 $0.5T_{ins}$t 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 318-14 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 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 of PTG (Ed. 17) for explanation on development of load values.
2 See section 3.1.8.6 of PTG (Ed. 17) 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 of PTG (Ed. 17).
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.8 of PTG (Ed. 17).
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, λ_a = 0.51. For all-lightweight, λ_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 318-14 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 3.1.8.6 of PTG (Ed. 17) 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 = $\phi A_{se,N} f_{uta}$ as noted in ACI 318-14 Chapter 17.
5 Shear = ϕ 0.60 $A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17. For 3/8-in diameter insert shear = ϕ 0.50 $A_{se,V} f_{uta}$

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 ⊥ Toward edge f_{RV}				Edge distance in shear ‖ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
	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 h_{ef}	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 distanc (c_a) / Concrete thickness (h), - in. (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	0.97	0.84	0.79												1.00
	36	(914)										1.00	0.91	0.84												
	> 48	(1219)											1.00	0.96												

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 $5d \le s \le 16$-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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 $c \ge 3*h_{ef}$, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \ge 3*h_{ef}$, 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 ⊥ Toward edge f_{RV}		Edge distance in shear ‖ To edge f_{RV}		Concrete thickness factor in shear[5] f_{HV}	
	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)
	Embedment h_{ef}	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)
Spacing (s) / Edge distanc (c_a) / Concrete thickness (h), - in. (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
	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
	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
	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
	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
	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
	8	(203)	0.80	0.77		1.00	0.72	0.70				1.00	0.93	0.90
	9	(229)	0.84	0.80			0.75	0.73					0.99	0.95
	10	(254)	0.88	0.83			0.77	0.75					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)												

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 $5d \le s \le 16$-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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 $c \ge 3*h_{ef}$, then $f_{AV} = f_{AN}$.

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

CANADIAN LIMIT STATE DESIGN

Limit State Design of anchors is described in the provisions of CSA A23.3-14 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 318-14 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 A23.3-14 Annex D, refer to Section 3.1.8 of the Hilti North American Product Technical Guide, Volume 2: Anchor Fastening Technical Guide, Edition 17. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.ca.

Table 38 - Hilti HIT-ICE design information with HAS/HIT-V threaded rods in hammer drilled holes in accordance with CSA A23.3-14 Annex D[1]

	Design parameter	Symbol	Units	Nominal rod diameter (in.)							Ref
				3/8	1/2	5/8	3/4	7/8	1	1-1/4	A23.3-14
	Nominal anchor O.D.	d_a	mm	9.5	12.7	15.9	19.1	22.2	25.4	31.8	
	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	c_{min}[3]	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	$k_{c,uncr}$[4]	–	10							D.6.2.2
	Coeff. for factored concrete breakout resistance, cracked concrete	$k_{c,cr}$[4]	–	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 318-14 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: $(f'_c / 17.2)^{0.1}$].

8 d_0 = drilled hole diameter.

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_r				Shear - V_r			
		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)	9,335 (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 of PTG (Ed. 17) for explanation on development of load values.
2 See Section 3.1.8.6 of PTG (Ed. 17) 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 of PTG (Ed. 17).
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 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_r				Shear - V_r			
		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)

1 See Section 3.1.8 of PTG (Ed. 17) for explanation on development of load values.
2 See Section 3.1.8.6 of PTG (Ed. 17) 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 41. 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).
Seismic applicaitons 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.
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 of PTG (Ed. 17).
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45
9 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 applicaitons are not permitted.

Table 41 - Steel factored resistance for Hilti HIT-V and HAS threaded rods[1,2]

	HIT-V ASTM A307 Grade A[2]		HAS-E ISO 898 Class 5.8[2]		HAS-E B7 ASTM A193 B7[3]		HAS-V / HAS-V HDG ASTM F1554 Gr. 36[2]		HAS-E / HAS-E HDG ASTM F1554 Gr. 55[2]		HAS-B and HAS-B HDG[2] ASTM A193 B7 and ASTM F 1554 Gr. 105		HAS-R Stainless Steel[2] ASTM F593 (3/8-in to 1-in)[5] ASTM A193 (1-1/8-in to 1-1/4-in)		HAS-R stainless steel ASTM F 593 - AISI 304/316 SS[2]	
Nominal anchor diameter in.	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	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	2,765 (12.3)	1,285 (5.7)	3,345 (14.9)	1,555 (6.9)	6,585 (29.3)	3,090 (13.7)	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	5,065 (22.5)	2,825 (12.6)	6,125 (27.2)	3,410 (15.2)	12,060 (53.6)	6,785 (30.2)	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	8,070 (35.9)	4,495 (20.0)	9,750 (43.4)	5,430 (24.2)	19,210 (85.4)	10,805 (48.1)	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	11,940 (53.1)	6,650 (29.6)	14,430 (64.2)	8,040 (35.8)	28,430 (126.5)	15,990 (71.1)	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	-	-	19,915 (88.6)	11,095 (49.4)	39,245 (174.6)	22,075 (98.2)	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	21,620 (96.2)	12,045 (53.6)	26,125 (116.2)	14,555 (64.7)	51,485 (229.0)	28,960 (128.8)	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	-	-	41,805 (186.0)	23,290 (103.6)	82,370 (366.4)	46,335 (206.1)	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)

1 See Section 3.1.8.6 of PTG (Ed. 17) to convert design strength value to ASD value.

2 HIT-V, HAS, and HAS-R threaded rods are considered brittle steel elements. HIT-V does not comply with % elongation requirements of ASTM A307 Grade A steel. HAS does not comply with % elongation requirements of ISO 898-1.

3 HAS-E B7 rods are considered ductile steel elements.

4 Tensile = $A_{se,N}$ Φ_s f_{uta} R as noted in CSA A23.3-14 Annex D

5 Shear = $A_{se,V}$ Φ_s 0.60 f_{uta} R as noted in CSA A23.3-14 Annex D. For 3/8-in diameter threaded rod, shear = $A_{se,V}$ Φ_s 0.50 f_{uta} R.

Table 42 - Hilti HIT-ICE adhesive design information with CA rebar in hammer drilled holes in accordance with CSA A23.3-14 Annex D[1]

Design parameter		Symbol	Units	Rebar size					Ref
				10M	15M	20M	25M	30M	A23.3-14
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		c_{min}[3]	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		$k_{c,uncr}$[4]	–	10					D.6.2.2
Coeff. for factored concrete breakout resistance, cracked concrete		$k_{c,cr}$[4]	–	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)	n/a	n/a	n/a	n/a	n/a	D.6.5.2
	Characteristic bond stress in uncracked concrete[7]	τ_{uncr}	psi (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	

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 A23.3-14 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3-14 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 system

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	$h_{ef} + 30$	$h_{ef} + 2d_o$			

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

1 See Section 3.1.8 of PTG (Ed. 17) for explanation on development of load values.

2 See Section 3.1.8.6 of PTG (Ed. 17) 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 of PTG (Ed. 17).

8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

Table 45 - Steel factored resistance for CA rebar[1]

Rebar size	ASTM A615 Grade 40 [4] Tensile[3] N_{sa} lb (kN)	ASTM A615 Grade 40 [4] 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 3.1.8.6 of PTG (Ed. 17) to convert design strength value to ASD value.
2 CSA-G30.18 Grade 400 rebar are considered ductile steel elements.
3 Tensile = $A_{se,N}\ \Phi_s\ f_{uta}$ R as noted in CSA A23.3-14 Annex D
4 Shear = $A_{se,V}\ \Phi_s$ 0.60 f_{uta} R as noted in CSA A23.3-14 Annex D.

Table 46 - Load adjustment factors for 10M rebar in uncracked concrete[1,2,3]

10M 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)	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)	8-7/8 (226)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - 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
	5-11/16	(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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 47 - Load adjustment factors for 15M rebar in uncracked concrete[1,2,3]

15M 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)	12-5/8 (320)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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									

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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 48 - Load adjustment factors for 20M rebar in uncracked concrete[1,2,3]

20M 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)	15-3/8 (390)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	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			1.00
	> 48	(1219)		1.00	1.00				1.00	0.92	0.90									

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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 49 - Load adjustment factors for 25M rebar in uncracked concrete[1,2,3]

25M 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.	9-1/16	15-15/16	19-13/16	9-1/16	15-15/16	19-13/16	9-1/16	15-15/16	19-13/16	9-1/16	15-15/16	19-13/16	9-1/16	15-15/16	19-13/16	9-1/16	15-15/16	19-13/16
		(mm)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	0.22	0.12	0.10	n/a	n/a	n/a	0.03	0.02	0.02	0.07	0.04	0.03	n/a	n/a	n/a
	5	(127)	0.59	0.55	0.54	0.33	0.18	0.14	0.55	0.53	0.53	0.17	0.09	0.08	0.33	0.18	0.14	n/a	n/a	n/a
	6	(152)	0.61	0.56	0.55	0.36	0.20	0.16	0.56	0.54	0.54	0.22	0.12	0.10	0.36	0.20	0.16	n/a	n/a	n/a
	7	(178)	0.63	0.57	0.56	0.40	0.22	0.17	0.57	0.55	0.54	0.27	0.16	0.13	0.40	0.22	0.17	n/a	n/a	n/a
	8	(203)	0.65	0.58	0.57	0.44	0.24	0.19	0.58	0.56	0.55	0.34	0.19	0.15	0.44	0.24	0.19	n/a	n/a	n/a
	9	(229)	0.67	0.59	0.58	0.48	0.26	0.21	0.59	0.56	0.55	0.40	0.23	0.18	0.48	0.26	0.21	n/a	n/a	n/a
	10	(254)	0.68	0.60	0.58	0.52	0.29	0.23	0.60	0.57	0.56	0.47	0.27	0.21	0.52	0.29	0.23	n/a	n/a	n/a
	11-9/16	(294)	0.71	0.62	0.60	0.61	0.33	0.26	0.62	0.58	0.57	0.58	0.33	0.27	0.61	0.33	0.26	0.68	n/a	n/a
	12	(305)	0.72	0.63	0.60	0.63	0.34	0.27	0.62	0.58	0.57	0.62	0.35	0.28	0.63	0.34	0.27	0.69	n/a	n/a
	14	(356)	0.76	0.65	0.62	0.73	0.40	0.32	0.64	0.60	0.58	0.78	0.44	0.35	0.73	0.40	0.32	0.75	n/a	n/a
	16	(406)	0.79	0.67	0.63	0.84	0.46	0.37	0.66	0.61	0.60	0.95	0.54	0.43	0.84	0.46	0.37	0.80	n/a	n/a
	18	(457)	0.83	0.69	0.65	0.94	0.52	0.41	0.68	0.62	0.61	1.00	0.64	0.52	0.94	0.52	0.41	0.85	n/a	n/a
	18-7/16	(469)	0.84	0.69	0.66	0.97	0.53	0.42	0.69	0.63	0.61		0.67	0.54	0.97	0.53	0.42	0.86	0.71	n/a
	20	(508)	0.87	0.71	0.67	1.00	0.57	0.46	0.70	0.64	0.62		0.75	0.60	1.00	0.57	0.46	0.90	0.74	n/a
	22-3/8	(568)	0.91	0.73	0.69		0.64	0.51	0.72	0.65	0.63		0.89	0.72		0.64	0.51	0.95	0.79	0.73
	24	(610)	0.94	0.75	0.70		0.69	0.55	0.74	0.67	0.64		0.99	0.80		0.69	0.55	0.98	0.81	0.76
	26	(660)	0.98	0.77	0.72		0.75	0.59	0.76	0.68	0.65		1.00	0.90		0.75	0.59	1.00	0.85	0.79
	28	(711)	1.00	0.79	0.74		0.80	0.64	0.78	0.69	0.67			1.00		0.80	0.64		0.88	0.82
	30	(762)		0.81	0.75		0.86	0.68	0.80	0.71	0.68					0.86	0.68		0.91	0.85
	36	(914)		0.88	0.80		1.00	0.82	0.86	0.75	0.71					1.00	0.82		1.00	0.93
	> 48	(1219)		1.00	0.90			1.00	0.98	0.83	0.79						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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 50 - Load adjustment factors for 30M rebar in uncracked concrete[1,2,3]

30M 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.	17-15/16	23-9/16	10-1/4	17-15/16	23-9/16	10-1/4	17-15/16	23-9/16	10-1/4	17-15/16	23-9/16	10-1/4	17-15/16	23-9/16	10-1/4	17-15/16	23-9/16	23-9/16
		(mm)	(455)	(598)	(260)	(455)	(598)	(260)	(455)	(598)	(260)	(455)	(598)	(260)	(455)	(598)	(260)	(455)	(598)	(598)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	0.23	0.13	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
	5-7/8	(150)	0.60	0.55	0.54	0.35	0.19	0.14	0.54	0.53	0.53	0.14	0.08	0.06	0.28	0.16	0.12	n/a	n/a	n/a
	6	(152)	0.60	0.56	0.54	0.35	0.19	0.14	0.55	0.53	0.53	0.14	0.08	0.06	0.28	0.16	0.12	n/a	n/a	n/a
	7	(178)	0.61	0.57	0.55	0.38	0.21	0.16	0.55	0.54	0.53	0.18	0.10	0.08	0.36	0.20	0.15	n/a	n/a	n/a
	8	(203)	0.63	0.57	0.56	0.41	0.23	0.17	0.56	0.54	0.53	0.22	0.12	0.09	0.41	0.23	0.17	n/a	n/a	n/a
	9	(229)	0.65	0.58	0.56	0.45	0.25	0.18	0.57	0.55	0.54	0.26	0.15	0.11	0.45	0.25	0.18	n/a	n/a	n/a
	10	(254)	0.66	0.59	0.57	0.48	0.27	0.20	0.58	0.55	0.54	0.30	0.17	0.13	0.48	0.27	0.20	n/a	n/a	n/a
	11	(279)	0.68	0.60	0.58	0.52	0.29	0.21	0.58	0.56	0.55	0.35	0.20	0.15	0.52	0.29	0.21	n/a	n/a	n/a
	12	(305)	0.70	0.61	0.58	0.56	0.31	0.23	0.59	0.56	0.55	0.40	0.23	0.17	0.56	0.31	0.23	n/a	n/a	n/a
	13-1/4	(337)	0.72	0.62	0.59	0.62	0.34	0.26	0.60	0.57	0.56	0.46	0.26	0.20	0.62	0.34	0.26	0.63	n/a	n/a
	14	(356)	0.73	0.63	0.60	0.66	0.36	0.27	0.61	0.57	0.56	0.50	0.29	0.22	0.66	0.36	0.27	0.65	n/a	n/a
	16	(406)	0.76	0.65	0.61	0.75	0.41	0.31	0.62	0.58	0.57	0.61	0.35	0.27	0.75	0.41	0.31	0.69	n/a	n/a
	18	(457)	0.79	0.67	0.63	0.85	0.46	0.35	0.64	0.59	0.58	0.73	0.42	0.32	0.85	0.46	0.35	0.74	n/a	n/a
	20	(508)	0.83	0.69	0.64	0.94	0.52	0.39	0.65	0.60	0.59	0.86	0.49	0.37	0.94	0.52	0.39	0.78	n/a	n/a
	20-7/8	(531)	0.84	0.69	0.65	0.98	0.54	0.41	0.66	0.61	0.59	0.92	0.52	0.40	0.98	0.54	0.41	0.79	n/a	n/a
	22	(559)	0.86	0.70	0.66	1.00	0.57	0.43	0.67	0.61	0.60	0.99	0.57	0.43	1.00	0.57	0.43	0.81	0.68	n/a
	24	(610)	0.89	0.72	0.67		0.62	0.47	0.68	0.62	0.60	1.00	0.64	0.49		0.62	0.47	0.85	0.71	n/a
	26-9/16	(675)	0.93	0.75	0.69		0.69	0.52	0.70	0.64	0.61		0.75	0.57		0.69	0.52	0.89	0.74	0.68
	28	(711)	0.96	0.76	0.70		0.72	0.54	0.71	0.65	0.62		0.81	0.62		0.72	0.54	0.92	0.76	0.70
	30	(762)	0.99	0.78	0.71		0.77	0.58	0.73	0.66	0.63		0.90	0.69		0.77	0.58	0.95	0.79	0.72
	36	(914)	1.00	0.83	0.75		0.93	0.70	0.77	0.69	0.66		1.00	0.90		0.93	0.70	1.00	0.86	0.79
	> 48	(1219)		0.95	0.84		1.00	0.93	0.86	0.75	0.71			1.00		1.00	0.93		1.00	0.91

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 Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318-14 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 51 - Hilti HIT-ICE design information with Hilti HIS-N and HIS-RN internally threaded inserts in hammer drilled holes in accordance with CSA A23.3-14 Annex D[1]

	Design parameter	Symbol	Units	Nominal bolt/cap screw diameter (in.)				Ref
				3/8	1/2	5/8	3/4	A23.3-14
	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	$k_{c,uncr}$[3]	–	10				D.6.2.2
	Coeff. for factored concrete breakout resistance, cracked concrete	$k_{c,cr}$[3]	–	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]	τ_{cr}	psi (MPa)	350 (2.4)	30 (0.2)	n/a	n/a	D.6.5.2
	Characteristic bond stress in uncracked concrete[6]	τ_{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_{inst} 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 318-14 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: $(f'_c / 17.2)^{0.1}$].

8 d_0 = drilled hole diameter.

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]

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

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]

		Tension N_r				Shear V_r			
Thread size	Effective embedment in. (mm)	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	1,735	1,775	1,810	1,860	3,475	3,550	3,615	3,720
	(110)	(7.7)	(7.9)	(8.0)	(8.3)	(15.4)	(15.8)	(16.1)	(16.6)
1/2-13 UNC	5	2,480	2,535	2,580	2,660	4,960	5,070	5,165	5,315
	(125)	(11.0)	(11.3)	(11.5)	(11.8)	(22.1)	(22.6)	(23.0)	(23.6)

1 See Section 3.1.8 of PTG (Ed. 17) for explanation on development of load values.

2 See Section 3.1.8.6 of PTG (Ed. 17) 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 of PTG (Ed. 17).

8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by la as follows: For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_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]

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

1 See section 3.1.8.6 of PTG (Ed. 17) 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 A23.3-14 Annex D

5 Shear = $A_{se,V} \Phi_s 0.60 f_{uta} R$ as noted in CSA A23.3-14 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

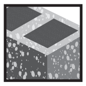
Permissible masonty conditions			Permissible drilling method		
		Grout-filed concrete masonry			Rotary only drilling with carbide tip

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)	lb	(kN)	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)	lb	(kN)	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.

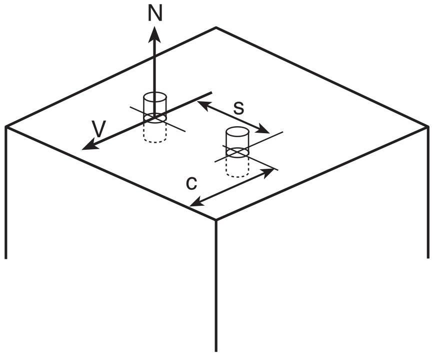
5 Loads are based on the lesser of bond strength, steel strength or base material strength.

6 Steel values in accordance with AISC

Allowable load values
Tension = 0.33 x F_u x A_{nom}
Shear = 0.17 x F_u x A_{nom}

Ultimate load values
Tension = 0.75 x F_u x A_{nom}
Shear = 0.45 x F_u x 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

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 II 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)

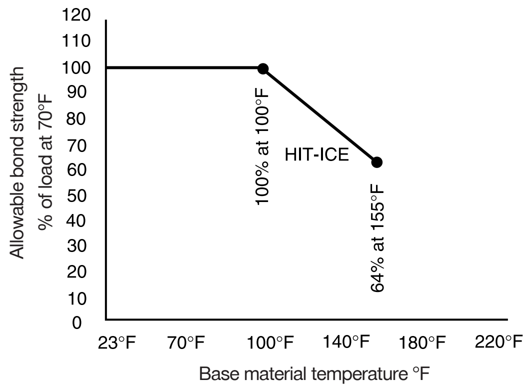
[1] Allowable loads calculated using a factor of safety of 5.

[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 bond strength[1,2]



1 Test procedure involves the concrete being held at the elevated temperature for 24 hours them 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 h
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 of PTG (Ed. 17).

HIT-ICE Mixer

HIT-ICE Cartridge

HIT-ICE Dispenser

Hilti, Inc. (U.S.) 1-800-879-8000
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Hilti (Canada) Corporation 1-800-363-4458
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