The following excerpt are pages from the North American Product Technical Guide, Volume 2: Anchor Fastening, Edition 19.

Please refer to the publication in its entirety for complete details on this product including data development, product specifications, general suitability, installation, corrosion and spacing and edge distance guidelines.
US&CA: https://submittals.us.hilti.com/PTGVol2/

To consult directly with a team member regarding our anchor fastening products, contact Hilti's team of technical support specialists between the hours of 7:00am – 6:00pm CST.
US: 877-749-6337 or HNATechnicalServices@hilti.com
CA: 1-800-363-4458, ext. 6 or CATechnicalServices@hilti.com

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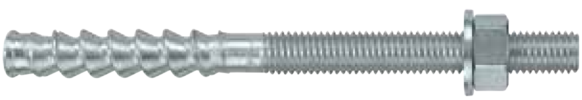
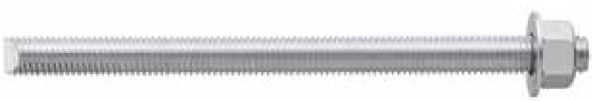
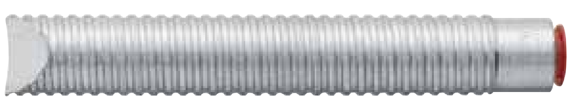
3.2.2 HIT-HY 200 ADHESIVE ANCHORING SYSTEM

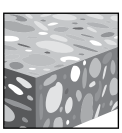
PRODUCT DESCRIPTION

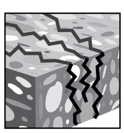
HIT-HY 200 with HIT-Z rods, Threaded Rod, Rebar, and HIS-N/RN Inserts

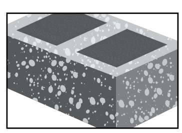
Anchor System	
	Hilti HIT-HY 200-R Cartridge
	Hilti HIT-HY 200-A Cartridge
	Hilti HIT-Z Anchor Rod
	Hilti HAS Threaded Rod
	Rebar
	Hilti HIS-N/RN

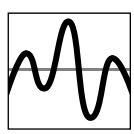
Features and Benefits

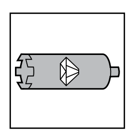
- Two great products with equal performance data
- User can select product gel time suitability based on temperature of the base material and jobsite time requirements
- No hole cleaning requirement when installed SafeSet™ hollow drill bit technology
- No hole cleaning requirement when installing HIT-Z anchor rods in dry conditions with hammer drilled holes
- ICC-ES approved for cracked concrete and seismic service
- May be installed in diamond cored holes with HIT-Z anchor rod only when addition cleaning steps are employed
- ICC-ES approved for grout-filled concrete masonry


Uncracked concrete

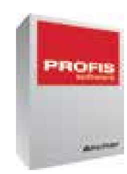

Cracked concrete


Grout-filled concrete masonry


Seismic Design Categories A-F


Diamond cored holes for Cracked and Uncracked Concrete

Hollow Drill Bit



Profis Anchor design software

Approvals/Listings	
ICC-ES (International Code Council)	ESR-3187 in concrete per ACI 318-14 Ch. 17 / ACI 355.2/ ICC-ES AC308 ESR-3963 in grout-filled CMU per ICC-ES AC58 ELC-3187 in concrete per CSA A23.3-14 / ACI 355.2
NSF/ANSI Std 61	Certification for use in potable water
European Technical Approval	ETA-11/0492, ETA-11/0493 ETA-12/0006, ETA-12/0028 ETA-12/0083, ETA-12/0084
City of Los Angeles	City of Los Angeles 2017 LABC Supplement (within ESR-3187 for Concrete) Research Report No. 26077 for Masonry
Florida Building Code	2017 Florida Building Code Supplement (within ESR-3187)
U.S. Green Building Council	LEED® Credit 4.1-Low Emitting Materials
Department of Transportation	Contact Hilti for various states

MATERIAL SPECIFICATIONS

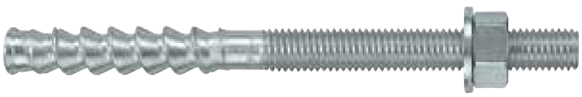
For material specifications for anchor rods and inserts, please refer to section 3.2.8.

DESIGN DATA IN CONCRETE PER ACI 318

ACI 318-14 Chapter 17 design

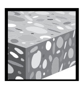
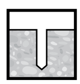
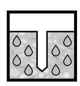
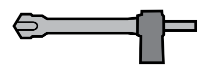
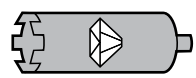
The load values contained in this section are Hilti Simplified Design Tables. The load tables in this section were developed using the Strength Design parameters and variables of ESR-3187 and the equations within ACI 318-14 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8. Data tables from ESR-3187 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

HIT-HY 200 adhesive with HIT-Z and HIT-Z-R anchor rods



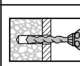
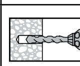
3.2.2

Figure 1 - Hilti HIT-Z and HIT-Z-R installation conditions

Permissible concrete conditions					Permissible drilling method		
		Uncracked concrete		Dry concrete			Hammer drilling with carbide tipped drill bit [1]
		Cracked concrete		Water-saturated concrete			Hilti TE-CD or TE-YD Hollow Drill Bit [2]
							Diamond core drill bit [3]

1 Anchor may be installed in a hole drilled with a carbide-tipped bit without cleaning the drilling dust from the hole. Temperature must be 41° F or higher. Drilling dust must be removed from the hole if the temperature is below 41° F. See Manufacturer's Published Installation Instructions (MPII).
2 When temperatures are below 41° F, TE-CD or TE-YD Hollow Drill Bits used with a Hilti vacuum cleaner are viable methods for removing drilling dust from the hole.
3 Holes drilled by diamond coring require cleaning with a wire brush, a water hose and compressed air. See MPII.

Table 1 - Specifications for Hilti HIT-Z and HIT-Z-R installed with Hilti HIT-HY 200 adhesive

Setting information		Symbol	Units	Nominal anchor diameter			
				3/8	1/2	5/8	3/4
Nominal bit diameter		d_o	in.	7/16	9/16	3/4	7/8
Effective embedment	minimum	$h_{ef,min}$	in. (mm)	2-3/8 (60)	2-3/4 (70)	3-3/4 (95)	4 (102)
	maximum	$h_{ef,max}$	in. (mm)	4-1/2 (114)	6 (152)	7-1/2 (190)	8-1/2 (216)
Diameter of fixture hole	through-set		in.	1/2	5/8	13/16[1]	15/16[1]
	preset		in.	7/16	9/16	11/16	13/16
Installation torque		T_{inst}	ft-lb (Nm)	15 (20)	30 (40)	60 (80)	110 (150)

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

Figure 2 - Hilti HIT-Z and HIT-Z-R specfications

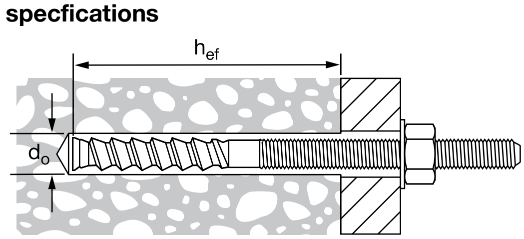


Figure 3 - Installation with (2) washers

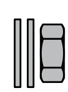


Table 2 - Hilti HIT-Z and HIT-Z-R anchor rod length and thread dimension

Size	ℓ Anchor length		$ℓ_{helix}$ Helix length		Smooth shank length		Total thread length		Usable thread length		HIT-Z Length Code
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	
3/8 x 3-3/8	3-3/8	(111)	2-1/4	(57)	5/16	(8)	1-13/16	(46)	1-5/16	(33)	D
3/8 x 4-3/8	4-3/8	(111)	2-1/4	(57)	5/16	(8)	1-13/16	(46)	1-5/16	(33)	F
3/8 x 5-1/8	5-1/8	(130)	2-1/4	(57)	5/16	(8)	2-9/16	(65)	2-1/16	(52)	H
3/8 x 6-3/8	6-3/8	(162)	2-1/4	(57)	5/16	(8)	3-13/16	(97)	3-5/16	(84)	J
1/2 x 4-1/2	4-1/2	(114)	2-1/2	(63)	5/16	(8)	1-11/16	(43)	1	(26)	F
1/2 x 6-1/2	6-1/2	(165)	2-1/2	(63)	5/16	(8)	3-11/16	(94)	3-1/16	(77)	J
1/2 x 7-3/4	7-3/4	(197)	2-1/2	(63)	5/16	(8)	4-15/16	(126)	4-5/16	(109)	M
5/8 x 6	6	(152)	3-5/8	(92)	7/16	(11)	1-15/16	(49)	1-1/8	(28)	I
5/8 x 8	8	(203)	3-5/8	(92)	7/16	(11)	3-15/16	(100)	3-1/8	(79)	M
5/8 x 9-1/2	9-1/2	(241)	3-5/8	(92)	1-15/16	(49)	3-15/16	(100)	3-1/8	(79)	P
3/4 x 6-1/2	6-1/2	(165)	4	(102)	5/16	(8)	2	(51)	1	(26)	K
3/4 x 8-1/2	8-1/2	(216)	4	(102)	7/16	(12)	4	(102)	3-1/16	(77)	N
3/4 x 9-3/4	9-3/4	(248)	4	(102)	1-11/16	(44)	4	(102)	3-1/16	(77)	Q

Figure 4 - Hilti HIT-Z and HIT-Z-R anchor rod length and thread dimension

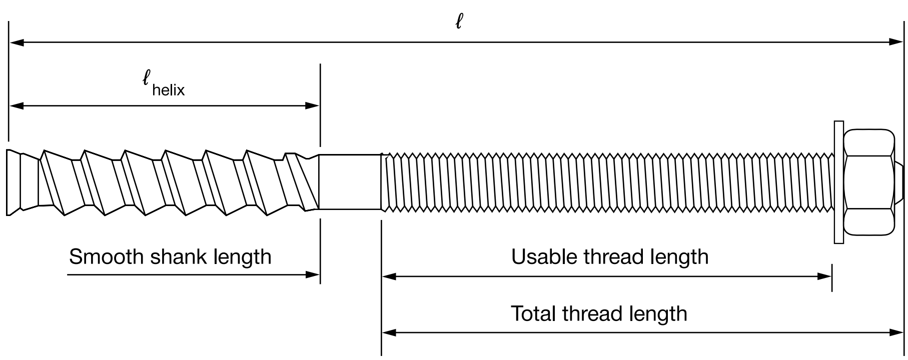


Table 3 - Hilti HIT-HY 200 design strength with concrete/pullout failure for Hilti HIT-Z(-R) rods in uncracked concrete[1,2,3,4,5,6,7,8,9,10]

Nominal anchor diameter in.	Effective embed. 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)	2,855 (12.7)	3,125 (13.9)	3,610 (16.1)	4,425 (19.7)	3,075 (13.7)	3,370 (15.0)	3,890 (17.3)	4,765 (21.2)
	3-3/8 (86)	4,835 (21.5)	5,170 (23.0)	5,170 (23.0)	5,170 (23.0)	10,415 (46.3)	11,410 (50.8)	13,175 (58.6)	16,135 (71.8)
	4-1/2 (114)	5,170 (23.0)	5,170 (23.0)	5,170 (23.0)	5,170 (23.0)	16,035 (71.3)	17,570 (78.2)	20,285 (90.2)	24,845 (110.5)
1/2	2-3/4 (70)	3,555 (15.8)	3,895 (17.3)	4,500 (20.0)	5,510 (24.5)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
	4-1/2 (114)	7,445 (33.1)	7,615 (33.9)	7,615 (33.9)	7,615 (33.9)	16,035 (71.3)	17,570 (78.2)	20,285 (90.2)	24,845 (110.5)
	6 (152)	7,615 (33.9)	7,615 (33.9)	7,615 (33.9)	7,615 (33.9)	24,690 (109.8)	27,045 (120.3)	31,230 (138.9)	38,250 (170.1)
5/8	3-3/4 (95)	5,665 (25.2)	6,205 (27.6)	7,165 (31.9)	8,775 (39.0)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)
	5-5/8 (143)	10,405 (46.3)	11,400 (50.7)	13,165 (58.6)	13,905 (61.9)	22,415 (99.7)	24,550 (109.2)	28,350 (126.1)	34,720 (154.4)
	7-1/2 (191)	13,905 (61.9)	13,905 (61.9)	13,905 (61.9)	13,905 (61.9)	34,505 (153.5)	37,800 (168.1)	43,650 (194.2)	53,455 (237.8)
3/4	4 (102)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
	6-3/4 (171)	13,680 (60.9)	14,985 (66.7)	17,305 (77.0)	18,500 (82.3)	29,460 (131.0)	32,275 (143.6)	37,265 (165.8)	45,645 (203.0)
	8-1/2 (216)	18,500 (82.3)	18,500 (82.3)	18,500 (82.3)	18,500 (82.3)	41,635 (185.2)	45,605 (202.9)	52,660 (234.2)	64,500 (286.9)

3.2.2

Table 4 - Hilti HIT-HY 200 design strength with concrete/pullout failure for Hilti HIT-Z(-R) rods in cracked concrete[1,2,3,4,5,6,7,8,9,10]

Nominal anchor diameter in.	Effective embed. 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)	2,020 (9.0)	2,215 (9.9)	2,560 (11.4)	3,135 (13.9)	2,180 (9.7)	2,385 (10.6)	2,755 (12.3)	3,375 (15.0)
	3-3/8 (86)	3,425 (15.2)	3,755 (16.7)	4,335 (19.3)	5,170 (23.0)	7,380 (32.8)	8,085 (36.0)	9,335 (41.5)	11,430 (50.8)
	4-1/2 (114)	5,170 (23.0)	5,170 (23.0)	5,170 (23.0)	5,170 (23.0)	11,360 (50.5)	12,445 (55.4)	14,370 (63.9)	17,600 (78.3)
1/2	2-3/4 (70)	2,520 (11.2)	2,760 (12.3)	3,185 (14.2)	3,905 (17.4)	5,425 (24.1)	5,945 (26.4)	6,865 (30.5)	8,405 (37.4)
	4-1/2 (114)	5,275 (23.5)	5,780 (25.7)	6,670 (29.7)	7,110 (31.6)	11,360 (50.5)	12,445 (55.4)	14,370 (63.9)	17,600 (78.3)
	6 (152)	7,110 (31.6)	7,110 (31.6)	7,110 (31.6)	7,110 (31.6)	17,490 (77.8)	19,160 (85.2)	22,120 (98.4)	27,095 (120.5)
5/8	3-3/4 (95)	4,010 (17.8)	4,395 (19.5)	5,075 (22.6)	6,215 (27.6)	8,640 (38.4)	9,465 (42.1)	10,930 (48.6)	13,390 (59.6)
	5-5/8 (143)	7,370 (32.8)	8,075 (35.9)	9,325 (41.5)	11,420 (50.8)	15,875 (70.6)	17,390 (77.4)	20,080 (89.3)	24,595 (109.4)
	7-1/2 (191)	11,350 (50.5)	12,430 (55.3)	13,905 (61.9)	13,905 (61.9)	24,440 (108.7)	26,775 (119.1)	30,915 (137.5)	37,865 (168.4)
3/4	4 (102)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
	6-3/4 (171)	9,690 (43.1)	10,615 (47.2)	12,255 (54.5)	15,010 (66.8)	20,870 (92.8)	22,860 (101.7)	26,395 (117.4)	32,330 (143.8)
	8-1/2 (216)	13,690 (60.9)	15,000 (66.7)	17,320 (77.0)	18,155 (80.8)	29,490 (131.2)	32,305 (143.7)	37,300 (165.9)	45,685 (203.2)

1 Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 10 - 17 as necessary to the above values. Compare to the steel values in table 5. 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).
For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C) multiply above values by 1.0.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above values by 0.90.
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 and water saturated concrete conditions.
7 Tabular values are for short-term loads only. For sustained loads, see section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength (factored resistance) by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension only by the following reduction factors:
3/8-in diameter - $\alpha_{N,seis}$ = 0.705
1/2-in to 3/4-in diameter - $\alpha_{N,seis}$ = 0.75
See Section 3.1.8 for additional information on seismic applications.
10 Diamond core drilling with Hilti HIT-Z(-R) rods is permitted with no reduction in published data above.

Table 5 - Steel design strength for Hilti HIT-Z and HIT-Z-R rods [1,2]

Nominal anchor diameter in.	ACI 318-14 Chapter 17 Based Design					
	HIT-Z carbon steel rod			HIT-Z-R stainless steel rod		
	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic Shear[5] $\phi V_{sa,eq}$ lb (kN)	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic Shear[5] $\phi V_{sa,eq}$ lb (kN)
3/8	4,750 (21.1)	1,930 (8.6)	1,930 (8.6)	4,750 (21.1)	2,630 (11.7)	2,630 (11.7)
1/2	8,695 (38.7)	3,530 (15.7)	2,295 (10.2)	8,695 (38.7)	4,815 (21.4)	3,610 (16.1)
5/8	13,850 (61.6)	5,625 (25.0)	3,655 (16.3)	13,850 (61.6)	7,670 (34.1)	4,985 (22.2)
3/4	20,455 (91.0)	8,310 (37.0)	5,400 (24.0)	20,455 (91.0)	11,330 (50.4)	7,365 (32.8)

1 See section 3.1.8 to convert design strength value to ASD value.
2 HIT-Z and HIT-Z-R rods are to be considered brittle steel elements.
3 Tensile = $\phi A_{se,N} f_{uta}$ as noted in ACI 318-14 Chapter 17.
4 Shear values determined by static shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318-14 Chapter 17.
5 Seismic Shear = $\alpha_{V,seis}\ \phi_{Vsa}$: Reduction for seismic shear only. See section 3.1.8 for additional information on seismic applications.

Hilti HIT-Z(-R) rod permissible combinations of edge distance, anchor spacing, and concrete thickness

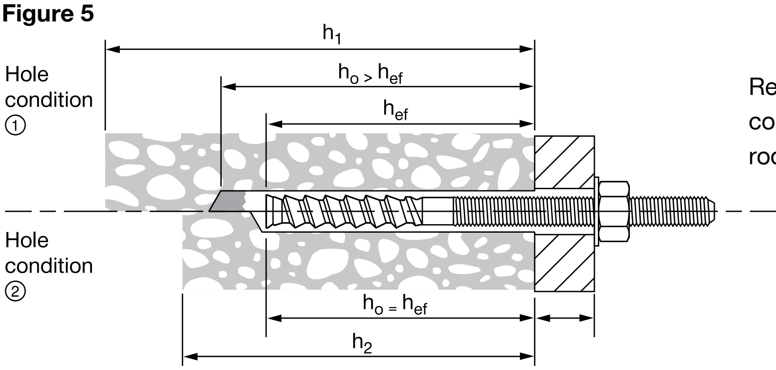
The Hilti HIT-Z and HIT-Z-R anchor rods produce higher expansion forces in the concrete slab when the installation torque is applied. This means that the anchor must be installed with larger edge distances and spacing when compared to standard threaded rod, to minimize the likelihood that the concrete slab will split during installation.

The permissible edge distance is based on the concrete condition (cracked or uncracked), the concrete thickness, and anchor spacing if designing for anchor groups. The permissible concrete thickness is dependent on whether or not the drill dust is removed during the anchor installation process.

Step 1: Check concrete thickness

When using Hilti HIT-Z and HIT-Z-R anchor rods, drilling dust does not need to be removed for optimum capacity when base material temperatures are greater than 41° F (5° C) and a hammer drill with a carbide tipped drill bit is used. However, concrete thickness can be reduced if the drilling dust is removed. The figure below shows both drilled hole conditions. Drilled hole condition 1 illustrates the hole depth and concrete thickness when drilling dust is left in the hole. Drilled hole condition 2 illustrates the corresponding reduction when drill dust is removed by using compressed air, Hilti TE-CD or TE-YD Hollow Drill Bits with a Hilti vacuum.

Figure 5

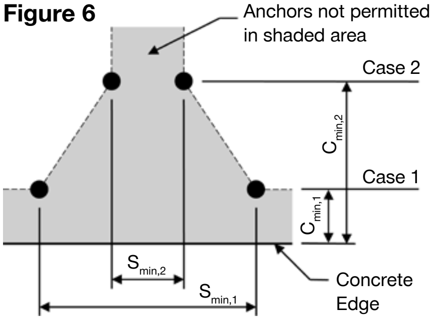


Refer to tables 6 to 9 in this section for the minimum concrete thicknesses associated with the Hilti HIT-Z(-R) rods based on diameter and drilled hole condition.

Step 2: Check edge distance and anchor spacing

Tables 6 to 9 in this section show the minimum edge distance and anchor spacing based on a specific concrete thickness and whether or not the design is for cracked or uncracked concrete. There are two cases of edge distance and anchor spacing combinations for each embedment and concrete condition (cracked or uncracked). **Case 1** is the minimum edge distance needed for one anchor or for two anchors with large anchor spacing. **Case 2** is the minimum anchor spacing that can be used, but the edge distance is increased to help prevent splitting. Linear interpolation can be used between **Case 1** and **Case 2** for any specific concrete thickness and concrete condition. See the following figure and calculation which can be used to determine specific edge distance and anchor spacing combinations.

Figure 6



For a specific edge distance, the permitted spacing is calculated as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}(c - c_{min,2})$$

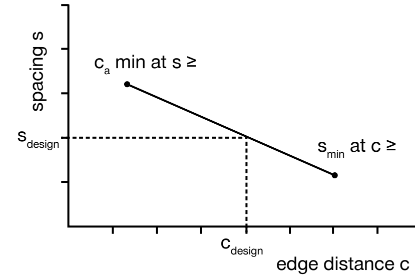


Table 6 - Minimum edge distance, spacing, and concrete thickness for 3/8-in. diameter Hilti HIT-Z and HIT-Z-R rods[1]

Nominal anchor diameter		d	in.	3/8								
Effective embedment		h_{ef}	in. (mm)	2-3/8 (60)			3-3/8 (86)			4-1/2 (114)		
Drilled hole condition		-	-	2[2]	1 or 2		2[2]	1 or 2		2[2]	1 or 2	
Minimum concrete thickness		h	in. (mm)	4 (102)	4-5/8 (117)	5-3/4 (146)	4-5/8 (117)	5-5/8 (143)	6-3/8 (162)	5-3/4 (146)	6-3/4 (171)	7-3/8 (187)
Uncracked concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	3-1/8 (79)	2-3/4 (70)	2-1/4 (57)	2-3/4 (70)	2-1/4 (57)	2 (51)	2-1/4 (57)	1-7/8 (48)	1-7/8 (48)
		$s_{min,1}$	in. (mm)	9-1/8 (232)	7-3/4 (197)	6-1/8 (156)	7-3/4 (197)	6-1/2 (165)	5-5/8 (143)	6-1/8 (156)	5-3/8 (137)	4-1/2 (114)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	5-5/8 (143)	4-3/4 (121)	3-3/4 (95)	4-3/4 (121)	3-7/8 (98)	3-1/4 (83)	3-3/4 (95)	3-1/8 (79)	2-3/4 (70)
		$s_{min,2}$	in. (mm)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)
Cracked concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	2-1/8 (54)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)
		$s_{min,1}$	in. (mm)	6-3/8 (162)	5-1/2 (140)	4-1/4 (108)	5-1/2 (140)	3-1/2 (89)	2-5/8 (67)	3-1/4 (83)	2 (51)	1-7/8 (48)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	3-5/8 (92)	3-1/8 (79)	2-3/8 (60)	3-1/8 (79)	2-1/2 (64)	2-1/8 (54)	2-3/8 (60)	2 (51)	1-7/8 (48)
		$s_{min,2}$	in. (mm)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)	1-7/8 (48)

Table 7 - Minimum edge distance, spacing, and concrete thickness for 1/2-in. diameter Hilti HIT-Z and HIT-Z-R rods[1]

Nominal anchor diameter		d	in.	1/2								
Effective embedment		h_{ef}	in. (mm)	2-3/4 (70)			4-1/2 (114)			6 (152)		
Drilled hole condition		-	-	2[2]	1 or 2		2[2]	1 or 2		2[2]	1 or 2	
Minimum concrete thickness		h	in. (mm)	4 (102)	5 (127)	7-1/8 (181)	5-3/4 (146)	6-3/4 (171)	8-1/4 (210)	7-1/4 (184)	8-1/4 (210)	9-3/4 (248)
Uncracked Concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	5-1/8 (130)	4-1/8 (105)	2-7/8 (73)	3-5/8 (92)	3 (76)	2-1/2 (64)	2-7/8 (73)	2-1/2 (64)	2-1/2 (64)
		$s_{min,1}$	in. (mm)	14-7/8 (378)	11-7/8 (302)	8-5/8 (219)	10-1/4 (260)	9 (229)	7-1/4 (184)	8-1/8 (206)	7-1/4 (184)	5 (127)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	9-1/4 (235)	7-1/4 (184)	4-7/8 (124)	6-1/4 (159)	5-1/4 (133)	4-1/8 (105)	4-3/4 (121)	4-1/8 (105)	3-3/8 (86)
		$s_{min,2}$	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
Cracked Concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	3-5/8 (92)	3 (76)	2-1/2 (64)	2-5/8 (67)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)
		$s_{min,1}$	in. (mm)	10-7/8 (276)	8-1/2 (216)	6 (152)	7-3/8 (187)	5-1/2 (140)	3-1/8 (79)	4-1/2 (114)	3-1/8 (79)	2-1/2 (64)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	6-1/2 (165)	5 (127)	3-1/4 (83)	4-1/4 (108)	3-1/2 (89)	2-3/4 (70)	3-1/4 (83)	2-3/4 (70)	2-1/2 (64)
		$s_{min,2}$	in. (mm)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)	2-1/2 (64)

1 Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2.
Linear interpoloation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$, will determine the permissible spacing s as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}(c - c_{min,2})$$

2 For shaded cells, drilling dust must be removed from drilled hole to justify minimum concrete thickness.

Table 8 - Minimum edge distance, spacing, and concrete thickness for 5/8-in. diameter Hilti HIT-Z and HIT-Z-R rods[1]

Nominal anchor diameter		d	in.	5/8								
Effective embedment		h_{ef}	in. (mm)	3-3/4 (95)			5-5/8 (143)			7-1/2 (191)		
Drilled hole condition		-	-	2 [2]	1 or 2		2 [2]	1 or 2		2 [2]	1 or 2	
Minimum concrete thickness		h	in. (mm)	5-1/2 (140)	7-3/4 (197)	9-3/8 (238)	7-3/8 (187)	9-5/8 (244)	10-1/2 (267)	9-1/4 (235)	11-1/2 (292)	12-1/4 (311)
Uncracked concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	6-1/4 (159)	4-1/2 (114)	3-3/4 (95)	4-5/8 (117)	3-5/8 (92)	3-1/4 (83)	3-3/4 (95)	3-1/8 (79)	3-1/8 (79)
		$s_{min,1}$	in. (mm)	18-3/8 (467)	12-7/8 (327)	10-5/8 (270)	13-7/8 (352)	10-3/8 (264)	9-3/4 (248)	10-7/8 (276)	8-3/8 (213)	7-3/8 (187)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	11-3/8 (289)	7-3/4 (197)	6-1/4 (159)	8-1/4 (210)	6-1/8 (156)	5-1/2 (140)	6-3/8 (162)	4-7/8 (124)	4-5/8 (117)
		$s_{min,2}$	in. (mm)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)
Cracked concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	4-5/8 (117)	3-3/8 (86)	3-1/8 (79)	3-1/2 (89)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)
		$s_{min,1}$	in. (mm)	13-7/8 (352)	9-1/2 (241)	8-3/4 (222)	10-1/8 (257)	6-1/2 (165)	5-3/8 (137)	7-1/8 (181)	3-7/8 (98)	3-1/8 (79)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	8-1/4 (210)	5-1/2 (140)	4-3/8 (111)	5-7/8 (149)	4-1/4 (108)	3-7/8 (98)	4-1/2 (114)	3-3/8 (86)	3-1/8 (79)
		$s_{min,2}$	in. (mm)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)	3-1/8 (79)

Table 9 - Minimum edge distance, spacing, and concrete thickness for 3/4-in. diameter Hilti HIT-Z and HIT-Z-R rods[1]

Nominal anchor diameter		d	in.	3/4								
Effective embedment		h_{ef}	in. (mm)	4 (102)			6-3/4 (171)			8-1/2 (216)		
Drilled hole condition		-	-	2 [2]	1 or 2		2 [2]	1 or 2		2 [2]	1 or 2	
Minimum concrete thickness		h	in. (mm)	5-3/4 (146)	8 (203)	11-1/2 (292)	8-1/2 (216)	10-3/4 (273)	13-1/8 (333)	10-1/4 (260)	12-1/2 (318)	14-1/2 (368)
Uncracked concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	9-3/4 (248)	7 (178)	5 (127)	6-5/8 (168)	5-1/4 (133)	4-1/4 (108)	5-1/2 (140)	4-1/2 (114)	4 (102)
		$s_{min,1}$	in. (mm)	28-3/4 (730)	20-5/8 (524)	14 (356)	19-3/8 (492)	15-1/4 (387)	12-5/8 (321)	16 (406)	13-1/4 (337)	11 (279)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	18-1/8 (460)	12-5/8 (321)	8-1/2 (216)	11-7/8 (302)	9-1/8 (232)	7-1/4 (184)	9-5/8 (244)	7-3/4 (197)	6-1/2 (165)
		$s_{min,2}$	in. (mm)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)
Cracked concrete	Minimum edge and spacing **Case 1**	$c_{min,1}$	in. (mm)	7-1/4 (184)	5-1/4 (133)	4-1/8 (105)	5 (127)	4 (102)	3-3/4 (95)	4-1/8 (105)	3-3/4 (95)	3-3/4 (95)
		$s_{min,1}$	in. (mm)	21-3/4 (552)	15-1/2 (394)	12-1/4 (311)	14-1/2 (368)	11-3/8 (289)	9 (229)	12-1/8 (308)	8-3/4 (222)	6-1/2 (165)
	Minimum edge and spacing **Case 2**	$c_{min,2}$	in. (mm)	13-1/4 (337)	9-1/4 (235)	6 (152)	8-5/8 (219)	6-5/8 (168)	5-1/8 (130)	7 (178)	5-1/2 (140)	4-1/2 (114)
		$s_{min,2}$	in. (mm)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)

1 Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2. Linear interpoloation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$, will determine the permissible spacing s as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})} (c - c_{min,2})$$

2 For shaded cells, drilling dust must be removed from drilled hole to justify minimum concrete thickness.

Table 10 - Load adjustment factors for 3/8-in. diameter Hilti HIT-Z and HIT-Z-R rods in uncracked concrete [1,2]

3/8-in. HIT-Z(-R) uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef}	in. (mm)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-7/8 (48)	0.63	0.59	0.57	n/a	n/a	0.21	0.57	0.53	0.52	n/a	n/a	0.05	n/a	n/a	0.10	n/a	n/a	n/a
	2 (51)	0.64	0.60	0.57	n/a	0.25	0.21	0.57	0.53	0.52	n/a	0.09	0.06	n/a	0.17	0.11	n/a	n/a	n/a
	2-1/4 (57)	0.66	0.61	0.58	0.38	0.26	0.22	0.58	0.54	0.53	0.33	0.10	0.07	0.38	0.21	0.13	n/a	n/a	n/a
	3 (76)	0.71	0.65	0.61	0.46	0.30	0.25	0.61	0.55	0.54	0.51	0.16	0.10	0.51	0.32	0.21	n/a	n/a	n/a
	4 (102)	0.78	0.70	0.65	0.59	0.36	0.29	0.64	0.57	0.55	0.79	0.24	0.16	0.79	0.44	0.29	0.76	n/a	n/a
	4-5/8 (117)	0.82	0.73	0.67	0.69	0.40	0.31	0.66	0.58	0.56	0.98	0.30	0.20	0.98	0.49	0.31	0.81	0.55	n/a
	5 (127)	0.85	0.75	0.69	0.74	0.43	0.33	0.68	0.58	0.56	1.00	0.34	0.22	1.00	0.52	0.33	0.84	0.57	n/a
	5-3/4 (146)	0.90	0.78	0.71	0.86	0.49	0.36	0.70	0.59	0.57	1.00	0.42	0.27	1.00	0.59	0.36	0.91	0.61	0.53
	6 (152)	0.92	0.80	0.72	0.89	0.51	0.38	0.71	0.60	0.57	1.00	0.45	0.29	1.00	0.62	0.38	0.92	0.63	0.54
	7 (178)	0.99	0.85	0.76	1.00	0.60	0.43	0.75	0.61	0.59		0.57	0.37		0.72	0.43	1.00	0.68	0.58
	8 (203)	1.00	0.90	0.80		0.69	0.49	0.79	0.63	0.60		0.69	0.45		0.83	0.49	1.00	0.72	0.63
	9 (229)	1.00	0.94	0.83		0.77	0.55	0.82	0.65	0.61		0.83	0.54		0.93	0.55		0.77	0.66
	10 (254)	1.00	0.99	0.87		0.86	0.61	0.86	0.66	0.62		0.97	0.63		1.00	0.63		0.81	0.70
	11 (279)		1.00	0.91		0.94	0.67	0.89	0.68	0.63		1.00	0.72			0.72		0.85	0.73
	12 (305)			0.94		1.00	0.73	0.93	0.70	0.65			0.83			0.83		0.88	0.77
	14 (356)			1.00			0.85	1.00	0.73	0.67			1.00			1.00		0.96	0.83
	16 (406)						0.98		0.76	0.70								1.00	0.88
	18 (457)						1.00		0.79	0.72									0.94
	24 (610)								0.89	0.79									1.00
	30 (762)								0.99	0.87									
	36 (914)								1.00	0.94									
	> 48 (1219)									1.00									

Table 11 - Load adjustment factors for 3/8-in. diameter Hilti HIT-Z and HIT-Z-R rods in cracked concrete [1,2]

3/8-in. HIT-Z(-R) cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef}	in. (mm)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)	2-3/8 (60)	3-3/8 (86)	4-1/2 (114)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-7/8 (48)	0.63	0.59	0.57	n/a	0.56	0.50	0.57	0.53	0.52	n/a	0.08	0.05	n/a	0.16	0.10	n/a	n/a	n/a
	2 (51)	0.64	0.60	0.57	n/a	0.57	0.51	0.57	0.53	0.52	n/a	0.09	0.06	n/a	0.17	0.11	n/a	n/a	n/a
	2-1/4 (57)	0.66	0.61	0.58	0.73	0.60	0.53	0.58	0.54	0.53	0.34	0.10	0.07	0.67	0.21	0.14	n/a	n/a	n/a
	3 (76)	0.71	0.65	0.61	0.88	0.70	0.60	0.61	0.55	0.54	0.52	0.16	0.10	0.88	0.32	0.21	n/a	n/a	n/a
	4 (102)	0.78	0.70	0.65	1.00	0.84	0.70	0.64	0.57	0.55	0.80	0.25	0.16	1.00	0.49	0.32	0.76	n/a	n/a
	4-5/8 (117)	0.82	0.73	0.67		0.93	0.76	0.67	0.58	0.56	0.99	0.31	0.20		0.61	0.40	0.81	0.55	n/a
	5 (127)	0.85	0.75	0.69		0.99	0.80	0.68	0.58	0.56	1.00	0.34	0.22		0.69	0.45	0.85	0.57	n/a
	5-3/4 (146)	0.90	0.78	0.71		1.00	0.88	0.71	0.59	0.57		0.42	0.28		0.85	0.55	0.91	0.61	0.53
	6 (152)	0.92	0.80	0.72			0.91	0.71	0.60	0.57		0.45	0.29		0.91	0.59	0.93	0.63	0.54
	7 (178)	0.99	0.85	0.76			1.00	0.75	0.61	0.59		0.57	0.37		1.00	0.74	1.00	0.68	0.59
	8 (203)	1.00	0.90	0.80				0.79	0.63	0.60		0.70	0.45			0.91		0.72	0.63
	9 (229)		0.94	0.83				0.82	0.65	0.61		0.83	0.54			1.00		0.77	0.67
	10 (254)		0.99	0.87				0.86	0.66	0.62		0.97	0.63					0.81	0.70
	11 (279)		1.00	0.91				0.89	0.68	0.64		1.00	0.73					0.85	0.74
	12 (305)			0.94				0.93	0.70	0.65			0.83					0.89	0.77
	14 (356)			1.00				1.00	0.73	0.67			1.00					0.96	0.83
	16 (406)								0.76	0.70								1.00	0.89
	18 (457)								0.79	0.72									0.94
	24 (610)								0.89	0.79									1.00
	30 (762)								0.99	0.87									
	36 (914)								1.00	0.94									
	> 48 (1219)									1.00									

1 Linear interpolation not permitted.

2 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 Chapter 17 or CSA A23.3 Annex D.

3 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 $f_{AV} = f_{AN}$.

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

(Shaded box) If a reduction factor value is in a shaded area, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with figure 6 and table 6 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 12 - Load adjustment factors for 1/2-in. diameter Hilti HIT-Z and HIT-Z-R rods in uncracked concrete [1,2]

1/2-in. HIT-Z(-R) uncracked concrete	Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef} in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm): 2-1/2 (64)	0.65	0.59	0.57	n/a	0.23	0.20	0.55	0.53	0.53	n/a	0.09	0.06	n/a	0.18	0.12	n/a	n/a	n/a
2-7/8 (73)	0.67	0.61	0.58	0.35	0.24	0.21	0.56	0.54	0.53	0.22	0.11	0.07	0.35	0.22	0.15	n/a	n/a	n/a
3 (76)	0.68	0.61	0.58	0.36	0.25	0.21	0.56	0.54	0.53	0.23	0.12	0.08	0.36	0.24	0.15	n/a	n/a	n/a
3-1/2 (89)	0.71	0.63	0.60	0.40	0.27	0.22	0.57	0.55	0.54	0.29	0.15	0.10	0.40	0.30	0.19	n/a	n/a	n/a
4 (102)	0.74	0.65	0.61	0.44	0.29	0.24	0.58	0.55	0.54	0.36	0.18	0.12	0.44	0.33	0.24	0.58	n/a	n/a
4-1/2 (114)	0.77	0.67	0.63	0.50	0.31	0.25	0.59	0.56	0.55	0.42	0.22	0.14	0.50	0.35	0.25	0.61	n/a	n/a
5 (127)	0.80	0.69	0.64	0.55	0.33	0.27	0.60	0.57	0.55	0.50	0.26	0.17	0.55	0.38	0.27	0.65	n/a	n/a
5-1/2 (140)	0.83	0.70	0.65	0.61	0.35	0.28	0.62	0.57	0.56	0.57	0.30	0.19	0.61	0.40	0.28	0.68	n/a	n/a
6 (152)	0.86	0.72	0.67	0.66	0.38	0.30	0.63	0.58	0.56	0.65	0.34	0.22	0.66	0.43	0.30	0.71	0.57	n/a
7 (178)	0.92	0.76	0.69	0.77	0.43	0.33	0.65	0.59	0.57	0.82	0.42	0.28	0.82	0.49	0.33	0.77	0.61	n/a
7-1/4 (184)	0.94	0.77	0.70	0.80	0.44	0.34	0.65	0.60	0.57	0.87	0.45	0.29	0.87	0.50	0.34	0.78	0.62	0.54
8 (203)	0.98	0.80	0.72	0.88	0.49	0.36	0.67	0.61	0.58	1.00	0.52	0.34	1.00	0.56	0.36	0.82	0.66	0.57
9 (229)	1.00	0.83	0.75	0.99	0.55	0.40	0.69	0.62	0.59	1.00	0.62	0.40	1.00	0.63	0.40	0.87	0.70	0.60
10 (254)	1.00	0.87	0.78	1.00	0.61	0.44	0.71	0.63	0.60	1.00	0.72	0.47	1.00	0.72	0.47	0.92	0.73	0.64
11 (279)	1.00	0.91	0.81		0.67	0.48	0.73	0.65	0.61		0.84	0.54		0.84	0.54	0.96	0.77	0.67
12 (305)	1.00	0.94	0.83		0.73	0.53	0.75	0.66	0.62		0.95	0.62		0.95	0.62	1.00	0.80	0.70
14 (356)	1.00	1.00	0.89		0.85	0.62	0.79	0.69	0.64		1.00	0.78		1.00	0.78		0.87	0.75
16 (406)	1.00		0.94		0.98	0.70	0.83	0.72	0.66			0.95			0.95		0.93	0.80
18 (457)			1.00		1.00	0.79	0.88	0.74	0.68			1.00			1.00		0.98	0.85
24 (610)						1.00	1.00	0.82	0.74								1.00	0.98
30 (762)								0.90	0.80									1.00
36 (914)								0.98	0.86									
> 48 (1219)								1.00	0.98									

Table 13 - Load adjustment factors for 1/2-in. diameter Hilti HIT-Z and HIT-Z-R rods in Cracked Concrete [1,2]

1/2-in. HIT-Z(-R) cracked concrete	Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef} in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)	2-3/4 (70)	4-1/2 (114)	6 (152)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm): 2-1/2 (64)	0.65	0.59	0.57	0.71	0.56	0.50	0.55	0.53	0.53	0.18	0.09	0.06	0.35	0.18	0.12	n/a	n/a	n/a
2-7/8 (73)	0.67	0.61	0.58	0.77	0.59	0.53	0.56	0.54	0.53	0.22	0.11	0.07	0.44	0.23	0.15	n/a	n/a	n/a
3 (76)	0.68	0.61	0.58	0.79	0.60	0.53	0.56	0.54	0.53	0.23	0.12	0.08	0.47	0.24	0.16	n/a	n/a	n/a
3-1/2 (89)	0.71	0.63	0.60	0.88	0.65	0.57	0.57	0.55	0.54	0.29	0.15	0.10	0.59	0.30	0.20	n/a	n/a	n/a
4 (102)	0.74	0.65	0.61	0.98	0.70	0.60	0.58	0.55	0.54	0.36	0.18	0.12	0.72	0.37	0.24	0.58	n/a	n/a
4-1/2 (114)	0.77	0.67	0.63	1.00	0.75	0.64	0.59	0.56	0.55	0.43	0.22	0.14	0.86	0.44	0.29	0.62	n/a	n/a
5 (127)	0.80	0.69	0.64	1.00	0.80	0.67	0.61	0.57	0.55	0.50	0.26	0.17	1.00	0.52	0.34	0.65	n/a	n/a
5-1/2 (140)	0.83	0.70	0.65	1.00	0.86	0.71	0.62	0.57	0.56	0.58	0.30	0.19	1.00	0.60	0.39	0.68	n/a	n/a
6 (152)	0.86	0.72	0.67	1.00	0.91	0.75	0.63	0.58	0.56	0.66	0.34	0.22	1.00	0.68	0.44	0.71	0.57	n/a
7 (178)	0.92	0.76	0.69	1.00	1.00	0.83	0.65	0.59	0.57	0.83	0.43	0.28	1.00	0.86	0.56	0.77	0.62	n/a
7-1/4 (184)	0.94	0.77	0.70			0.85	0.65	0.60	0.57	0.88	0.45	0.29		0.90	0.59	0.78	0.63	0.54
8 (203)	0.98	0.80	0.72			0.91	0.67	0.61	0.58	1.00	0.52	0.34		1.00	0.68	0.82	0.66	0.57
9 (229)	1.00	0.83	0.75			1.00	0.69	0.62	0.59		0.62	0.41			0.81	0.87	0.70	0.60
10 (254)	1.00	0.87	0.78				0.71	0.64	0.60		0.73	0.47			0.95	0.92	0.74	0.64
11 (279)	1.00	0.91	0.81				0.73	0.65	0.61		0.84	0.55			1.00	0.96	0.77	0.67
12 (305)		0.94	0.83				0.75	0.66	0.62		0.96	0.62				1.00	0.81	0.70
14 (356)		1.00	0.89				0.79	0.69	0.64		1.00	0.79					0.87	0.75
16 (406)			0.94				0.84	0.72	0.66			0.96					0.93	0.81
18 (457)			1.00				0.88	0.74	0.68			1.00					0.99	0.85
24 (610)							1.00	0.82	0.74								1.00	0.99
30 (762)								0.91	0.80									1.00
36 (914)								0.99	0.87									
> 48 (1219)								1.00	0.99									

1 Linear interpolation not permitted.

2 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 Chapter 17 or CSA A23.3 Annex D.

3 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 $f_{AV} = f_{AN}$.

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

If a reduction factor value is in a shaded area, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with figure 6 and table 7 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 14 - Load adjustment factors for 5/8-in. diameter Hilti HIT-Z and HIT-Z-R rods in uncracked concrete [1,2]

5/8-in. HIT-Z(-R) uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef}	in. (mm)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	3-1/8 (79)	0.64	0.59	0.57	n/a	n/a	0.20	0.55	0.54	0.53	n/a	n/a	0.07	n/a	n/a	0.13	n/a	n/a	n/a
	3-1/4 (83)	0.64	0.60	0.57	n/a	0.24	0.20	0.55	0.54	0.53	n/a	0.11	0.07	n/a	0.21	0.14	n/a	n/a	n/a
	3-3/4 (95)	0.67	0.61	0.58	0.34	0.25	0.21	0.56	0.54	0.53	0.23	0.13	0.09	0.34	0.27	0.17	n/a	n/a	n/a
	4 (102)	0.68	0.62	0.59	0.36	0.26	0.22	0.57	0.55	0.53	0.25	0.15	0.10	0.36	0.29	0.19	n/a	n/a	n/a
	5 (127)	0.72	0.65	0.61	0.42	0.29	0.24	0.58	0.56	0.54	0.36	0.21	0.13	0.42	0.38	0.24	n/a	n/a	n/a
	5-1/2 (140)	0.74	0.66	0.62	0.45	0.31	0.25	0.59	0.56	0.55	0.41	0.24	0.15	0.45	0.40	0.25	0.61	n/a	n/a
	6 (152)	0.77	0.68	0.63	0.49	0.33	0.26	0.60	0.57	0.55	0.47	0.27	0.18	0.49	0.42	0.26	0.63	n/a	n/a
	7 (178)	0.81	0.71	0.66	0.57	0.36	0.29	0.62	0.58	0.56	0.59	0.34	0.22	0.59	0.47	0.29	0.68	n/a	n/a
	7-3/8 (187)	0.83	0.72	0.66	0.60	0.38	0.30	0.62	0.59	0.56	0.64	0.37	0.24	0.64	0.49	0.30	0.70	0.58	n/a
	8 (203)	0.86	0.74	0.68	0.65	0.40	0.31	0.63	0.59	0.57	0.72	0.41	0.27	0.72	0.52	0.31	0.73	0.61	n/a
	9 (229)	0.90	0.77	0.70	0.73	0.45	0.34	0.65	0.60	0.58	0.86	0.50	0.32	0.86	0.58	0.34	0.78	0.65	n/a
	9-1/4 (235)	0.91	0.77	0.71	0.76	0.46	0.35	0.65	0.61	0.58	0.89	0.52	0.34	0.89	0.59	0.35	0.79	0.65	0.57
	10 (254)	0.94	0.80	0.72	0.82	0.50	0.37	0.67	0.62	0.59	1.00	0.58	0.38	1.00	0.64	0.38	0.82	0.68	0.59
	11 (279)	0.99	0.83	0.74	0.90	0.55	0.39	0.68	0.63	0.60	1.00	0.67	0.43	1.00	0.70	0.43	0.86	0.71	0.62
	12 (305)	1.00	0.86	0.77	0.98	0.60	0.43	0.70	0.64	0.60	1.00	0.76	0.50	1.00	0.77	0.50	0.90	0.75	0.65
	14 (356)	1.00	0.91	0.81	1.00	0.70	0.50	0.73	0.66	0.62		0.96	0.62		0.96	0.62	0.97	0.81	0.70
	16 (406)	1.00	0.97	0.86		0.80	0.57	0.77	0.69	0.64		1.00	0.76		1.00	0.76	1.00	0.86	0.75
	18 (457)	1.00	1.00	0.90		0.89	0.64	0.80	0.71	0.66			0.91			0.91		0.91	0.79
	24 (610)	1.00		1.00		1.00	0.86	0.90	0.78	0.71			1.00			1.00		1.00	0.91
	30 (762)						1.00	1.00	0.85	0.76									1.00
	36 (914)								0.92	0.81									
	> 48 (1219)								1.00	0.92									

Table 15 - Load adjustment factors for 5/8-in. diameter Hilti HIT-Z and HIT-Z-R rods in cracked concrete [1,2]

5/8-in. HIT-Z(-R) cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef}	in. (mm)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)	3-3/4 (95)	5-5/8 (143)	7-1/2 (191)
Spacing (s) / Edge Distance (c_a) / Concrete thickness (h), - in. (mm)	3-1/8 (79)	0.64	0.59	0.57	0.67	0.56	0.50	0.55	0.54	0.53	0.18	0.10	0.07	0.35	0.20	0.13	n/a	n/a	n/a
	3-1/4 (83)	0.64	0.60	0.57	0.69	0.56	0.51	0.55	0.54	0.53	0.19	0.11	0.07	0.38	0.22	0.14	n/a	n/a	n/a
	3-3/4 (95)	0.67	0.61	0.58	0.75	0.60	0.53	0.56	0.54	0.53	0.23	0.13	0.09	0.47	0.27	0.17	n/a	n/a	n/a
	4 (102)	0.68	0.62	0.59	0.78	0.62	0.55	0.57	0.55	0.53	0.26	0.15	0.10	0.51	0.30	0.19	n/a	n/a	n/a
	5 (127)	0.72	0.65	0.61	0.91	0.70	0.60	0.58	0.56	0.54	0.36	0.21	0.13	0.72	0.41	0.27	n/a	n/a	n/a
	5-1/2 (140)	0.74	0.66	0.62	0.98	0.74	0.63	0.59	0.56	0.55	0.41	0.24	0.15	0.83	0.48	0.31	0.61	n/a	n/a
	6 (152)	0.77	0.68	0.63	1.00	0.78	0.66	0.60	0.57	0.55	0.47	0.27	0.18	0.94	0.54	0.35	0.64	n/a	n/a
	7 (178)	0.81	0.71	0.66	1.00	0.87	0.72	0.62	0.58	0.56	0.59	0.34	0.22	1.00	0.68	0.44	0.69	n/a	n/a
	7-3/8 (187)	0.83	0.72	0.66	1.00	0.90	0.74	0.62	0.59	0.56	0.64	0.37	0.24	1.00	0.74	0.48	0.70	0.59	n/a
	8 (203)	0.86	0.74	0.68	1.00	0.96	0.78	0.63	0.59	0.57	0.73	0.42	0.27	1.00	0.84	0.54	0.73	0.61	n/a
	9 (229)	0.90	0.77	0.70	1.00	1.00	0.85	0.65	0.60	0.58	0.87	0.50	0.32	1.00	1.00	0.65	0.78	0.65	n/a
	9-1/4 (235)	0.91	0.77	0.71			0.86	0.66	0.61	0.58	0.90	0.52	0.34			0.68	0.79	0.66	0.57
	10 (254)	0.94	0.80	0.72			0.91	0.67	0.62	0.59	1.00	0.58	0.38			0.76	0.82	0.68	0.59
	11 (279)	0.99	0.83	0.74			0.98	0.69	0.63	0.60		0.67	0.44			0.88	0.86	0.72	0.62
	12 (305)	1.00	0.86	0.77			1.00	0.70	0.64	0.60		0.77	0.50			1.00	0.90	0.75	0.65
	14 (356)	1.00	0.91	0.81				0.74	0.66	0.62		0.97	0.63			1.00	0.97	0.81	0.70
	16 (406)		0.97	0.86				0.77	0.69	0.64		1.00	0.77				1.00	0.86	0.75
	18 (457)		1.00	0.90				0.80	0.71	0.66			0.92					0.92	0.79
	24 (610)			1.00				0.90	0.78	0.71			1.00					1.00	0.92
	30 (762)							1.00	0.85	0.76									1.00
	36 (914)								0.92	0.81									
	> 48 (1219)								1.00	0.92									

1 Linear interpolation not permitted.
2 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 Chapter 17 or CSA A23.3 Annex D.
3 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 $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded area, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with figure 6 and table 8 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

3.2.2

Table 16 - Load adjustment factors for 3/4-in. diameter Hilti HIT-Z and HIT-Z-R rods in uncracked concrete [1,2]

3/4-in. HIT-Z(-R) uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef}	in. (mm)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)																			
3-3/4	(95)	0.66	0.59	0.57	n/a	n/a	n/a	0.56	0.54	0.53	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	(102)	0.67	0.60	0.58	n/a	n/a	0.21	0.57	0.54	0.53	n/a	n/a	0.08	n/a	n/a	0.17	n/a	n/a	n/a
4-1/8	(105)	0.67	0.60	0.58	n/a	n/a	0.21	0.57	0.54	0.53	n/a	n/a	0.09	n/a	n/a	0.18	n/a	n/a	n/a
4-1/4	(108)	0.68	0.60	0.58	n/a	0.24	0.21	0.57	0.54	0.53	n/a	0.13	0.09	n/a	0.26	0.19	n/a	n/a	n/a
5	(127)	0.71	0.62	0.60	0.39	0.26	0.23	0.58	0.55	0.54	0.35	0.17	0.12	0.39	0.32	0.23	n/a	n/a	n/a
5-3/4	(146)	0.74	0.64	0.61	0.44	0.28	0.24	0.59	0.56	0.55	0.43	0.21	0.15	0.44	0.34	0.24	0.61	n/a	n/a
6	(152)	0.75	0.65	0.62	0.45	0.28	0.24	0.60	0.56	0.55	0.45	0.22	0.16	0.45	0.35	0.24	0.63	n/a	n/a
7	(178)	0.79	0.67	0.64	0.53	0.31	0.27	0.61	0.57	0.56	0.57	0.28	0.20	0.57	0.38	0.27	0.68	n/a	n/a
8	(203)	0.83	0.70	0.66	0.60	0.34	0.29	0.63	0.58	0.56	0.70	0.34	0.24	0.70	0.42	0.29	0.72	n/a	n/a
8-1/2	(216)	0.85	0.71	0.67	0.64	0.36	0.30	0.64	0.59	0.57	0.77	0.37	0.26	0.77	0.44	0.30	0.75	0.59	n/a
9	(229)	0.88	0.72	0.68	0.68	0.37	0.31	0.65	0.59	0.57	0.83	0.40	0.29	0.83	0.45	0.31	0.77	0.60	n/a
10	(254)	0.92	0.75	0.70	0.75	0.40	0.33	0.66	0.60	0.58	0.98	0.47	0.33	0.98	0.49	0.33	0.81	0.64	n/a
10-1/4	(260)	0.93	0.75	0.70	0.77	0.41	0.34	0.67	0.60	0.58	1.00	0.49	0.35	1.00	0.50	0.35	0.82	0.64	0.57
11	(279)	0.96	0.77	0.72	0.83	0.44	0.35	0.68	0.61	0.59	1.00	0.55	0.39	1.00	0.55	0.39	0.85	0.67	0.59
12	(305)	1.00	0.80	0.74	0.90	0.48	0.38	0.70	0.62	0.60	1.00	0.62	0.44	1.00	0.62	0.44	0.89	0.70	0.62
14	(356)	1.00	0.85	0.77	1.00	0.56	0.43	0.73	0.64	0.61	1.00	0.78	0.55	1.00	0.78	0.55	0.96	0.75	0.67
16	(406)	1.00	0.90	0.81	1.00	0.64	0.50	0.76	0.66	0.63	1.00	0.96	0.68	1.00	0.96	0.68	1.00	0.80	0.72
18	(457)	1.00	0.94	0.85	1.00	0.72	0.56	0.80	0.68	0.64	1.00	1.00	0.81	1.00	1.00	0.81		0.85	0.76
24	(610)	1.00	1.00	0.97	1.00	0.97	0.75	0.89	0.74	0.69	1.00		1.00	1.00		1.00		0.99	0.88
30	(762)	1.00		1.00		1.00	0.93	0.99	0.80	0.74								1.00	0.98
36	(914)						1.00	1.00	0.86	0.79									1.00
> 48	(1219)								0.99	0.89									

Table 17 - Load adjustment factors for 3/4-in. diameter Hilti HIT-Z and HIT-Z-R rods in cracked concrete [1,2]

3/4-in. HIT-Z(-R) cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[4] f_{HV}		
Embedment h_{ef}	in. (mm)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)	4 (102)	6-3/4 (171)	8-1/2 (216)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)																			
3-3/4	(95)	0.66	0.59	0.57	n/a	0.56	0.51	0.56	0.54	0.53	n/a	0.11	0.08	n/a	0.22	0.16	n/a	n/a	n/a
4	(102)	0.67	0.60	0.58	n/a	0.57	0.52	0.57	0.54	0.53	n/a	0.12	0.09	n/a	0.24	0.17	n/a	n/a	n/a
4-1/8	(105)	0.67	0.60	0.58	0.76	0.58	0.53	0.57	0.54	0.53	0.26	0.13	0.09	0.52	0.25	0.18	n/a	n/a	n/a
4-1/4	(108)	0.68	0.60	0.58	0.78	0.59	0.53	0.57	0.54	0.53	0.27	0.13	0.09	0.55	0.26	0.19	n/a	n/a	n/a
5	(127)	0.71	0.62	0.60	0.87	0.63	0.57	0.58	0.55	0.54	0.35	0.17	0.12	0.70	0.34	0.24	n/a	n/a	n/a
5-3/4	(146)	0.74	0.64	0.61	0.97	0.68	0.61	0.59	0.56	0.55	0.43	0.21	0.15	0.86	0.42	0.29	0.62	n/a	n/a
6	(152)	0.75	0.65	0.62	1.00	0.70	0.62	0.60	0.56	0.55	0.46	0.22	0.16	0.92	0.44	0.31	0.63	n/a	n/a
7	(178)	0.79	0.67	0.64	1.00	0.77	0.67	0.62	0.57	0.56	0.58	0.28	0.20	1.00	0.56	0.40	0.68	n/a	n/a
8	(203)	0.83	0.70	0.66	1.00	0.84	0.72	0.63	0.58	0.56	0.70	0.34	0.24	1.00	0.68	0.48	0.73	n/a	n/a
8-1/2	(216)	0.85	0.71	0.67	1.00	0.88	0.75	0.64	0.59	0.57	0.77	0.37	0.26	1.00	0.75	0.53	0.75	0.59	n/a
9	(229)	0.88	0.72	0.68	1.00	0.91	0.78	0.65	0.59	0.57	0.84	0.41	0.29	1.00	0.82	0.58	0.77	0.61	n/a
10	(254)	0.92	0.75	0.70	1.00	0.99	0.83	0.67	0.60	0.58	0.99	0.48	0.34	1.00	0.95	0.68	0.81	0.64	n/a
10-1/4	(260)	0.93	0.75	0.70	1.00	1.00	0.85	0.67	0.60	0.58	1.00	0.50	0.35	1.00	0.99	0.70	0.82	0.65	0.58
11	(279)	0.96	0.77	0.72	1.00		0.89	0.68	0.61	0.59	1.00	0.55	0.39	1.00	1.00	0.78	0.85	0.67	0.60
12	(305)	1.00	0.80	0.74	1.00		0.95	0.70	0.62	0.60	1.00	0.63	0.44	1.00		0.89	0.89	0.70	0.62
14	(356)	1.00	0.85	0.77	1.00		1.00	0.73	0.64	0.61	1.00	0.79	0.56	1.00		1.00	0.96	0.76	0.67
16	(406)	1.00	0.90	0.81				0.76	0.66	0.63		0.97	0.68				1.00	0.81	0.72
18	(457)	1.00	0.94	0.85				0.80	0.68	0.65		1.00	0.82					0.86	0.76
24	(610)	1.00	1.00	0.97				0.90	0.74	0.69			1.00					0.99	0.88
30	(762)			1.00				1.00	0.81	0.74								1.00	0.98
36	(914)							1.00	0.87	0.79									1.00
>48	(1219)								0.99	0.89									

1 Linear interpolation not permitted.

2 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 Chapter 17 or CSA A23.3 Annex D.

3 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 $f_{AV} = f_{AN}$.

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

(shaded box) If a reduction factor value is in a shaded area, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with figure 6 and table 9 of this section to calculate permissible edge distance, spacing and concrete thickness combinations.

Hilti HIT-HY 200 adhesive with deformed reinforcing bars (rebar)

Figure 7 - Rebar installation conditions

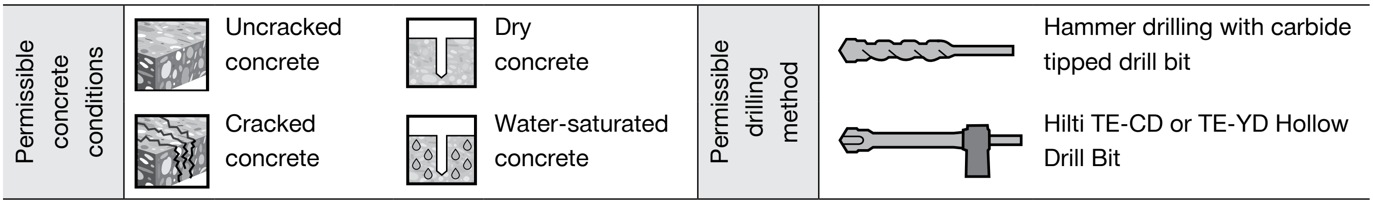


Figure 8 - Rebar installed with Hilti HIT-HY 200 adhesive

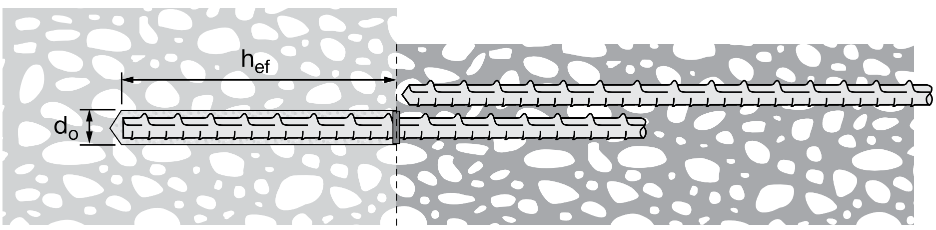


Table 18 - Specifications for rebar installed with Hilti HIT-HY 200 adhesive

Setting information		Symbol	Units	Rebar size							
				3	4	5	6	7	8	9	10
Nominal bit diameter		d_o	in.	1/2	5/8	3/4	7/8	1	1-1/8	1-3/8	1-1/2
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)	4-1/2 (114)	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)	22-1/2 (572)	25 (635)
Minimum concrete member thickness		h_{min}	in. (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$					
Minimum edge distance[1]		c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
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)

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

Note: The installation specifications in table 18 above and the data in tables 19 through 37 pertain to the use of Hilti HIT-HY 200 with rebar designed as a post-installed anchor using the provisions of ACI 318-14 Chapter 17. For the use of Hilti HIT-HY 200 with rebar for typical development calculations according to ACI 318-14 Chapter 25 (formerly ACI 318-11 Chapter 12), refer to section 3.1.14 for the design method and tables 89 through 93 at the end of this section.

Table 19 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for rebar in uncracked concrete [1,2,3,4,5,6,7,8,9]

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)	4,030 (17.9)	4,105 (18.3)	4,225 (18.8)	4,400 (19.6)	8,685 (38.6)	8,845 (39.3)	9,100 (40.5)	9,480 (42.2)
	4-1/2 (114)	5,375 (23.9)	5,475 (24.4)	5,635 (25.1)	5,865 (26.1)	11,580 (51.5)	11,790 (52.4)	12,135 (54.0)	12,640 (56.2)
	7-1/2 (191)	8,960 (39.9)	9,125 (40.6)	9,390 (41.8)	9,780 (43.5)	19,295 (85.8)	19,650 (87.4)	20,225 (90.0)	21,065 (93.7)
#4	4-1/2 (114)	7,170 (31.9)	7,300 (32.5)	7,510 (33.4)	7,825 (34.8)	15,440 (68.7)	15,720 (69.9)	16,180 (72.0)	16,850 (75.0)
	6 (152)	9,555 (42.5)	9,735 (43.3)	10,015 (44.5)	10,430 (46.4)	20,585 (91.6)	20,960 (93.2)	21,575 (96.0)	22,465 (99.9)
	10 (254)	15,930 (70.9)	16,220 (72.1)	16,695 (74.3)	17,385 (77.3)	34,305 (152.6)	34,935 (155.4)	35,955 (159.9)	37,445 (166.6)
#5	5-5/8 (143)	10,405 (46.3)	11,400 (50.7)	11,740 (52.2)	12,225 (54.4)	22,415 (99.7)	24,550 (109.2)	25,280 (112.5)	26,330 (117.1)
	7-1/2 (191)	14,930 (66.4)	15,205 (67.6)	15,650 (69.6)	16,300 (72.5)	32,160 (143.1)	32,755 (145.7)	33,710 (149.9)	35,105 (156.2)
	12-1/2 (318)	24,885 (110.7)	25,345 (112.7)	26,085 (116.0)	27,165 (120.8)	53,605 (238.4)	54,590 (242.8)	56,185 (249.9)	58,510 (260.3)
#6	6-3/4 (171)	13,680 (60.9)	14,985 (66.7)	16,905 (75.2)	17,600 (78.3)	29,460 (131.0)	32,275 (143.6)	36,405 (161.9)	37,915 (168.7)
	9 (229)	21,060 (93.7)	21,900 (97.4)	22,535 (100.2)	23,470 (104.4)	45,360 (201.8)	47,165 (209.8)	48,540 (215.9)	50,550 (224.9)
	15 (381)	35,840 (159.4)	36,495 (162.3)	37,560 (167.1)	39,115 (174.0)	77,190 (343.4)	78,610 (349.7)	80,905 (359.9)	84,250 (374.8)
#7	7-7/8 (200)	17,235 (76.7)	18,885 (84.0)	21,805 (97.0)	23,960 (106.6)	37,125 (165.1)	40,670 (180.9)	46,960 (208.9)	51,605 (229.5)
	10-1/2 (267)	26,540 (118.1)	29,070 (129.3)	30,675 (136.4)	31,945 (142.1)	57,160 (254.3)	62,615 (278.5)	66,070 (293.9)	68,805 (306.1)
	17-1/2 (445)	48,780 (217.0)	49,675 (221.0)	51,125 (227.4)	53,240 (236.8)	105,065 (467.4)	106,995 (475.9)	110,120 (489.8)	114,675 (510.1)
#8	9 (229)	21,060 (93.7)	23,070 (102.6)	26,640 (118.5)	31,295 (139.2)	45,360 (201.8)	49,690 (221.0)	57,375 (255.2)	67,400 (299.8)
	12 (305)	32,425 (144.2)	35,520 (158.0)	40,065 (178.2)	41,725 (185.6)	69,835 (310.6)	76,500 (340.3)	86,295 (383.9)	89,870 (399.8)
	20 (508)	63,710 (283.4)	64,885 (288.6)	66,775 (297.0)	69,540 (309.3)	137,225 (610.4)	139,750 (621.6)	143,830 (639.8)	149,780 (666.3)
#9	10-1/8 (257)	25,130 (111.8)	27,530 (122.5)	31,785 (141.4)	38,930 (173.2)	54,125 (240.8)	59,290 (263.7)	68,465 (304.5)	83,850 (373.0)
	13-1/2 (343)	38,690 (172.1)	42,380 (188.5)	48,940 (217.7)	52,805 (234.9)	83,330 (370.7)	91,285 (406.1)	105,405 (468.9)	113,740 (505.9)
	22-1/2 (572)	80,635 (358.7)	82,120 (365.3)	84,515 (375.9)	88,010 (391.5)	173,675 (772.5)	176,870 (786.8)	182,035 (809.7)	189,565 (843.2)
#10	11-1/4 (286)	29,430 (130.9)	32,240 (143.4)	37,230 (165.6)	45,595 (202.8)	63,395 (282.0)	69,445 (308.9)	80,185 (356.7)	98,205 (436.8)
	15 (381)	45,315 (201.6)	49,640 (220.8)	57,320 (255.0)	65,195 (290.0)	97,600 (434.1)	106,915 (475.6)	123,455 (549.2)	140,420 (624.6)
	25 (635)	97,500 (433.7)	101,380 (451.0)	104,340 (464.1)	108,655 (483.3)	210,000 (934.1)	218,360 (971.3)	224,730 (999.6)	234,030 (1041.0)

1 See section 3.1.8 for explanation on development of load values.
2 See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 22 - 37 as necessary to the above values. Compare to the steel values in table 21. 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).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 110° F (43° C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above values by 0.78.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete, multiply design strength (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 design is not permitted for uncracked concrete.

Table 20 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for rebar in cracked concrete[1,2,3,4,5,6,7,8,9]

Rebar size	Effective embedment in. (mm)	Tension — ϕN_n f'_c = 2,500 psi (17.2 MPa) lb (kN)	Tension — ϕN_n f'_c = 3,000 psi (20.7 MPa) lb (kN)	Tension — ϕN_n f'_c = 4,000 psi (27.6 MPa) lb (kN)	Tension — ϕN_n f'_c = 6,000 psi (41.4 MPa) lb (kN)	Shear — ϕV_n f'_c = 2,500 psi (17.2 MPa) lb (kN)	Shear — ϕV_n f'_c = 3,000 psi (20.7 MPa) lb (kN)	Shear — ϕV_n f'_c = 4,000 psi (27.6 MPa) lb (kN)	Shear — ϕV_n f'_c = 6,000 psi (41.4 MPa) lb (kN)
#3	3-3/8 (86)	2,790 (12.4)	2,845 (12.7)	2,925 (13.0)	3,045 (13.5)	6,010 (26.7)	6,120 (27.2)	6,300 (28.0)	6,560 (29.2)
	4-1/2 (114)	3,720 (16.5)	3,790 (16.9)	3,900 (17.3)	4,060 (18.1)	8,015 (35.7)	8,165 (36.3)	8,400 (37.4)	8,750 (38.9)
	7-1/2 (191)	6,205 (27.6)	6,315 (28.1)	6,500 (28.9)	6,770 (30.1)	13,360 (59.4)	13,605 (60.5)	14,005 (62.3)	14,580 (64.9)
#4	4-1/2 (114)	4,960 (22.1)	5,055 (22.5)	5,200 (23.1)	5,415 (24.1)	10,690 (47.6)	10,885 (48.4)	11,200 (49.8)	11,665 (51.9)
	6 (152)	6,615 (29.4)	6,740 (30.0)	6,935 (30.8)	7,220 (32.1)	14,250 (63.4)	14,510 (64.5)	14,935 (66.4)	15,555 (69.2)
	10 (254)	11,025 (49.0)	11,230 (50.0)	11,560 (51.4)	12,035 (53.5)	23,750 (105.6)	24,185 (107.6)	24,895 (110.7)	25,925 (115.3)
#5	5-5/8 (143)	7,370 (32.8)	7,970 (35.5)	8,200 (36.5)	8,540 (38.0)	15,875 (70.6)	17,165 (76.4)	17,665 (78.6)	18,395 (81.8)
	7-1/2 (191)	10,435 (46.4)	10,625 (47.3)	10,935 (48.6)	11,390 (50.7)	22,470 (100.0)	22,885 (101.8)	23,555 (104.8)	24,530 (109.1)
	12-1/2 (318)	17,390 (77.4)	17,710 (78.8)	18,225 (81.1)	18,980 (84.4)	37,455 (166.6)	38,145 (169.7)	39,255 (174.6)	40,880 (181.8)
#6	6-3/4 (171)	9,690 (43.1)	10,615 (47.2)	11,810 (52.5)	12,300 (54.7)	20,870 (92.8)	22,860 (101.7)	25,440 (113.2)	26,490 (117.8)
	9 (229)	14,920 (66.4)	15,300 (68.1)	15,745 (70.0)	16,400 (73.0)	32,130 (142.9)	32,955 (146.6)	33,915 (150.9)	35,320 (157.1)
	15 (381)	25,040 (111.4)	25,500 (113.4)	26,245 (116.7)	27,330 (121.6)	53,935 (239.9)	54,925 (244.3)	56,530 (251.5)	58,870 (261.9)
#7	7-7/8 (200)	11,750 (52.3)	11,965 (53.2)	12,315 (54.8)	12,825 (57.0)	25,305 (112.6)	25,770 (114.6)	26,525 (118.0)	27,620 (122.9)
	10-1/2 (267)	15,665 (69.7)	15,955 (71.0)	16,420 (73.0)	17,100 (76.1)	33,740 (150.1)	34,360 (152.8)	35,365 (157.3)	36,830 (163.8)
	17-1/2 (445)	26,110 (116.1)	26,590 (118.3)	27,365 (121.7)	28,500 (126.8)	56,235 (250.1)	57,270 (254.7)	58,940 (262.2)	61,380 (273.0)
#8	9 (229)	14,920 (66.4)	15,720 (69.9)	16,180 (72.0)	16,850 (75.0)	32,130 (142.9)	33,860 (150.6)	34,850 (155.0)	36,295 (161.4)
	12 (305)	20,585 (91.6)	20,960 (93.2)	21,575 (96.0)	22,465 (99.9)	44,335 (197.2)	45,150 (200.8)	46,470 (206.7)	48,390 (215.2)
	20 (508)	34,305 (152.6)	34,935 (155.4)	35,955 (159.9)	37,445 (166.6)	73,890 (328.7)	75,250 (334.7)	77,445 (344.5)	80,650 (358.7)
#9	10-1/8 (257)	17,800 (79.2)	19,500 (86.7)	20,720 (92.2)	21,580 (96.0)	38,340 (170.5)	42,000 (186.8)	44,635 (198.5)	46,480 (206.8)
	13-1/2 (343)	26,360 (117.3)	26,845 (119.4)	27,630 (122.9)	28,775 (128.0)	56,780 (252.6)	57,825 (257.2)	59,510 (264.7)	61,975 (275.7)
	22-1/2 (572)	43,935 (195.4)	44,745 (199.0)	46,050 (204.8)	47,955 (213.3)	94,630 (420.9)	96,370 (428.7)	99,185 (441.2)	103,290 (459.5)
#10	11-1/4 (286)	20,850 (92.7)	22,840 (101.6)	25,585 (113.8)	26,640 (118.5)	44,905 (199.7)	49,190 (218.8)	55,105 (245.1)	57,385 (255.3)
	15 (381)	32,095 (142.8)	33,145 (147.4)	34,110 (151.7)	35,525 (158.0)	69,135 (307.5)	71,385 (317.5)	73,470 (326.8)	76,510 (340.3)
	25 (635)	54,240 (241.3)	55,240 (245.7)	56,850 (252.9)	59,205 (263.4)	116,830 (519.7)	118,980 (529.2)	122,450 (544.7)	127,515 (567.2)

1 See section 3.1.8 for explanation on development of load values.
2 See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 22 - 37 as necessary to the above values. Compare to the steel values in table 21. 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).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 110° F (43° C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above values by 0.78.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_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:
#3 to #6 - α_{seis} = 0.60, #7 - α_{seis} = 0.64, #8 - α_{seis} = 0.68, #9 - α_{seis} = 0.71, #10 - α_{seis} = 0.75
See section 3.1.8 for additional information on seismic applications.

Table 21 - 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)	Seismic[5] Shear $\phi V_{sa,eq}$ lb (kN)	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic[5] Shear $\phi V_{sa,eq}$ lb (kN)	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic[5] Shear $\phi V_{sa,eq}$ lb (kN)
#3	4,290 (19.1)	2,375 (10.6)	1,665 (7.4)	6,435 (28.6)	3,565 (15.9)	2,495 (11.1)	6,600 (29.4)	3,430 (15.3)	2,400 (10.7)
#4	7,800 (34.7)	4,320 (19.2)	3,025 (13.4)	11,700 (52.0)	6,480 (28.8)	4,535 (20.2)	12,000 (53.4)	6,240 (27.8)	4,370 (19.5)
#5	12,090 (53.8)	6,695 (29.8)	4,685 (20.9)	18,135 (80.7)	10,045 (44.7)	7,030 (31.3)	18,600 (82.7)	9,670 (43.0)	6,770 (30.1)
#6	17,160 (76.3)	9,505 (42.3)	6,655 (29.6)	25,740 (114.5)	14,255 (63.4)	9,980 (44.4)	26,400 (117.4)	13,730 (61.1)	9,610 (42.8)
#7	23,400 (104.1)	12,960 (57.6)	9,070 (40.3)	35,100 (156.1)	19,440 (86.5)	13,610 (60.6)	36,000 (160.1)	18,720 (83.3)	13,105 (58.3)
#8	30,810 (137.0)	17,065 (75.9)	11,945 (53.1)	46,215 (205.6)	25,595 (113.9)	17,915 (79.7)	47,400 (210.8)	24,650 (109.6)	17,255 (76.7)
#9	39,000 (173.5)	21,600 (96.1)	15,120 (67.3)	58,500 (260.2)	32,400 (144.1)	22,680 (100.9)	60,000 (266.9)	31,200 (138.8)	21,840 (97.2)
#10	49,530 (220.3)	27,430 (122.0)	19,200 (85.4)	74,295 (330.5)	41,150 (183.0)	28,805 (128.1)	76,200 (339.0)	39,625 (176.3)	27,740 (123.4)

1 See Section 3.1.8 to convert design strength value to ASD value.
2 ASTM A706 Grade 60 rebar are considered ductile steel elements. ASTM A615 Grade 40 and 60 rebar are considered brittle steel elements.
3 Tensile = $\phi A_{se,N} f_{uta}$ 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.
5 Seismic Shear = $\alpha_{V,seis} \phi V_{sa}$: Reduction for seismic shear only.
See section 3.1.8 for additional information on seismic applications.

Table 22 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.31	0.23	0.13	n/a	n/a	n/a	0.08	0.06	0.04	0.17	0.13	0.08	n/a	n/a	n/a
1-7/8	(48)	0.59	0.57	0.54	0.32	0.23	0.13	0.53	0.53	0.52	0.09	0.07	0.04	0.19	0.14	0.08	n/a	n/a	n/a
2	(51)	0.60	0.57	0.54	0.33	0.24	0.14	0.54	0.53	0.52	0.10	0.08	0.05	0.21	0.16	0.09	n/a	n/a	n/a
3	(76)	0.65	0.61	0.57	0.41	0.30	0.17	0.56	0.55	0.53	0.19	0.14	0.09	0.38	0.29	0.17	n/a	n/a	n/a
4	(102)	0.70	0.65	0.59	0.49	0.36	0.21	0.57	0.56	0.54	0.29	0.22	0.13	0.50	0.41	0.26	n/a	n/a	n/a
4-5/8	(117)	0.73	0.67	0.60	0.55	0.40	0.23	0.59	0.57	0.55	0.36	0.27	0.16	0.56	0.45	0.33	0.58	n/a	n/a
5	(127)	0.75	0.69	0.61	0.59	0.43	0.25	0.59	0.58	0.55	0.41	0.31	0.18	0.60	0.47	0.34	0.61	n/a	n/a
5-3/4	(146)	0.78	0.71	0.63	0.68	0.50	0.29	0.61	0.59	0.56	0.51	0.38	0.23	0.68	0.52	0.36	0.65	0.59	n/a
6	(152)	0.80	0.72	0.63	0.71	0.52	0.30	0.61	0.59	0.56	0.54	0.40	0.24	0.71	0.53	0.37	0.66	0.60	n/a
7	(178)	0.85	0.76	0.66	0.83	0.61	0.35	0.63	0.61	0.58	0.68	0.51	0.31	0.83	0.61	0.41	0.72	0.65	n/a
8	(203)	0.90	0.80	0.68	0.95	0.69	0.40	0.65	0.62	0.59	0.83	0.62	0.37	0.95	0.69	0.44	0.77	0.70	n/a
8-3/4	(222)	0.93	0.82	0.69	1.00	0.76	0.44	0.66	0.63	0.59	0.95	0.71	0.43	1.00	0.76	0.47	0.80	0.73	0.61
9	(229)	0.94	0.83	0.70		0.78	0.45	0.67	0.64	0.60	0.99	0.74	0.45		0.78	0.48	0.81	0.74	0.62
10	(254)	0.99	0.87	0.72		0.86	0.50	0.68	0.65	0.61	1.00	0.87	0.52		0.86	0.51	0.86	0.78	0.66
11	(279)	1.00	0.91	0.74		0.95	0.55	0.70	0.67	0.62		1.00	0.60		0.95	0.55	0.90	0.82	0.69
12	(305)		0.94	0.77		1.00	0.60	0.72	0.68	0.63			0.69		1.00	0.60	0.94	0.85	0.72
14	(356)		1.00	0.81			0.70	0.76	0.71	0.65			0.86			0.70	1.00	0.92	0.78
16	(406)			0.86			0.80	0.79	0.74	0.67			1.00			0.80		0.99	0.83
18	(457)			0.90			0.90	0.83	0.77	0.69						0.90		1.00	0.88
24	(610)			1.00			1.00	0.94	0.86	0.76						1.00			1.00
30	(762)							1.00	0.96	0.82									
36	(914)								1.00	0.89									
> 48	(1219)									1.00									

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

#3 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.54	0.49	0.43	n/a	n/a	n/a	0.09	0.07	0.04	0.18	0.13	0.08	n/a	n/a	n/a
1-7/8	(48)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.10	0.07	0.04	0.19	0.15	0.09	n/a	n/a	n/a
2	(51)	0.60	0.57	0.54	0.57	0.51	0.44	0.54	0.53	0.52	0.11	0.08	0.05	0.21	0.16	0.10	n/a	n/a	n/a
3	(76)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.53	0.20	0.15	0.09	0.39	0.29	0.18	n/a	n/a	n/a
4	(102)	0.70	0.65	0.59	0.84	0.70	0.55	0.58	0.56	0.54	0.30	0.23	0.14	0.61	0.45	0.27	n/a	n/a	n/a
4-5/8	(117)	0.73	0.67	0.60	0.93	0.76	0.58	0.59	0.57	0.55	0.38	0.28	0.17	0.75	0.56	0.34	0.59	n/a	n/a
5	(127)	0.75	0.69	0.61	0.99	0.80	0.60	0.59	0.58	0.56	0.42	0.32	0.19	0.85	0.63	0.38	0.61	n/a	n/a
5-3/4	(146)	0.78	0.71	0.63	1.00	0.88	0.64	0.61	0.59	0.56	0.52	0.39	0.23	1.00	0.78	0.47	0.66	0.60	n/a
6	(152)	0.80	0.72	0.63		0.91	0.66	0.61	0.59	0.57	0.56	0.42	0.25		0.83	0.50	0.67	0.61	n/a
7	(178)	0.85	0.76	0.66		1.00	0.72	0.63	0.61	0.58	0.70	0.53	0.32		1.00	0.63	0.73	0.66	n/a
8	(203)	0.90	0.80	0.68			0.78	0.65	0.62	0.59	0.86	0.64	0.39			0.77	0.78	0.70	n/a
8-3/4	(222)	0.93	0.82	0.69			0.83	0.66	0.64	0.60	0.98	0.73	0.44			0.83	0.81	0.74	0.62
9	(229)	0.94	0.83	0.70			0.85	0.67	0.64	0.60	1.00	0.77	0.46			0.85	0.82	0.75	0.63
10	(254)	0.99	0.87	0.72			0.91	0.69	0.66	0.61		0.90	0.54			0.91	0.87	0.79	0.66
11	(279)	1.00	0.91	0.74			0.98	0.71	0.67	0.62		1.00	0.62			0.98	0.91	0.83	0.70
12	(305)		0.94	0.77			1.00	0.73	0.69	0.63			0.71			1.00	0.95	0.86	0.73
14	(356)		1.00	0.81				0.76	0.72	0.65			0.89				1.00	0.93	0.79
16	(406)			0.86				0.80	0.75	0.68			1.00					1.00	0.84
18	(457)			0.90				0.84	0.78	0.70									0.89
24	(610)			1.00				0.95	0.87	0.76									1.00
30	(762)							1.00	0.97	0.83									
36	(914)								1.00	0.90									
> 48	(1219)									1.00									

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.
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 $f_{HV} = 1.0$.

3.2.2

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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.27	0.20	0.12	n/a	n/a	n/a	0.06	0.04	0.02	0.11	0.08	0.05	n/a	n/a	n/a
2-1/2	(64)	0.59	0.57	0.54	0.31	0.23	0.13	0.53	0.53	0.52	0.09	0.07	0.04	0.19	0.14	0.08	n/a	n/a	n/a
3	(76)	0.61	0.58	0.55	0.34	0.25	0.14	0.54	0.53	0.52	0.12	0.09	0.06	0.25	0.19	0.11	n/a	n/a	n/a
4	(102)	0.65	0.61	0.57	0.39	0.29	0.17	0.56	0.55	0.53	0.19	0.14	0.09	0.38	0.29	0.17	n/a	n/a	n/a
5	(127)	0.69	0.64	0.58	0.46	0.33	0.20	0.57	0.56	0.54	0.27	0.20	0.12	0.47	0.38	0.24	n/a	n/a	n/a
5-3/4	(146)	0.71	0.66	0.60	0.51	0.37	0.22	0.58	0.57	0.55	0.33	0.25	0.15	0.52	0.42	0.30	0.56	n/a	n/a
6	(152)	0.72	0.67	0.60	0.52	0.38	0.22	0.58	0.57	0.55	0.35	0.26	0.16	0.53	0.43	0.31	0.58	n/a	n/a
7	(178)	0.76	0.69	0.62	0.61	0.44	0.26	0.60	0.58	0.56	0.44	0.33	0.20	0.61	0.47	0.34	0.62	n/a	n/a
7-1/4	(184)	0.77	0.70	0.62	0.63	0.46	0.27	0.60	0.58	0.56	0.46	0.35	0.21	0.63	0.49	0.35	0.63	0.57	n/a
8	(203)	0.80	0.72	0.63	0.69	0.51	0.30	0.61	0.59	0.56	0.54	0.40	0.24	0.69	0.52	0.37	0.66	0.60	n/a
9	(229)	0.83	0.75	0.65	0.78	0.57	0.33	0.62	0.60	0.57	0.64	0.48	0.29	0.78	0.57	0.39	0.70	0.64	n/a
10	(254)	0.87	0.78	0.67	0.86	0.63	0.37	0.64	0.61	0.58	0.75	0.56	0.34	0.86	0.63	0.42	0.74	0.67	n/a
11-1/4	(286)	0.92	0.81	0.69	0.97	0.71	0.42	0.66	0.63	0.59	0.90	0.67	0.40	0.97	0.71	0.45	0.79	0.72	0.60
12	(305)	0.94	0.83	0.70	1.00	0.76	0.45	0.67	0.64	0.60	0.99	0.74	0.45	1.00	0.76	0.47	0.81	0.74	0.62
14	(356)	1.00	0.89	0.73		0.89	0.52	0.69	0.66	0.61	1.00	0.94	0.56		0.89	0.53	0.88	0.80	0.67
16	(406)		0.94	0.77		1.00	0.59	0.72	0.68	0.63		1.00	0.69		1.00	0.59	0.94	0.85	0.72
18	(457)		1.00	0.80			0.67	0.75	0.70	0.65			0.82			0.67	1.00	0.91	0.76
20	(508)			0.83			0.74	0.78	0.73	0.66			0.96			0.74		0.95	0.81
22	(559)			0.87			0.82	0.80	0.75	0.68			1.00			0.82		1.00	0.84
24	(610)			0.90			0.89	0.83	0.77	0.69						0.89			0.88
30	(762)			1.00			1.00	0.91	0.84	0.74						1.00			0.99
36	(914)							1.00	0.91	0.79									1.00
>48	(1219)								1.00	0.89									

Table 25 - Load adjustment factors for #4 rebar in cracked concrete[1,2,3]

#4 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.49	0.45	0.41	n/a	n/a	n/a	0.06	0.04	0.03	0.11	0.09	0.05	n/a	n/a	n/a
2-1/2	(64)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.10	0.07	0.04	0.19	0.15	0.09	n/a	n/a	n/a
3	(76)	0.61	0.58	0.55	0.60	0.53	0.46	0.54	0.53	0.52	0.13	0.10	0.06	0.26	0.19	0.11	n/a	n/a	n/a
4	(102)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.53	0.20	0.15	0.09	0.39	0.29	0.18	n/a	n/a	n/a
5	(127)	0.69	0.64	0.58	0.80	0.67	0.53	0.57	0.56	0.54	0.27	0.21	0.12	0.55	0.41	0.25	n/a	n/a	n/a
5-3/4	(146)	0.71	0.66	0.60	0.88	0.73	0.56	0.58	0.57	0.55	0.34	0.25	0.15	0.68	0.51	0.30	0.57	n/a	n/a
6	(152)	0.72	0.67	0.60	0.91	0.75	0.57	0.58	0.57	0.55	0.36	0.27	0.16	0.72	0.54	0.32	0.58	n/a	n/a
7	(178)	0.76	0.69	0.62	1.00	0.83	0.62	0.60	0.58	0.56	0.46	0.34	0.20	0.91	0.68	0.41	0.63	n/a	n/a
7-1/4	(184)	0.77	0.70	0.62		0.85	0.63	0.60	0.58	0.56	0.48	0.36	0.22	0.96	0.72	0.43	0.64	0.58	n/a
8	(203)	0.80	0.72	0.63		0.91	0.66	0.61	0.59	0.57	0.56	0.42	0.25	1.00	0.83	0.50	0.67	0.61	n/a
9	(229)	0.83	0.75	0.65		1.00	0.70	0.63	0.60	0.57	0.66	0.50	0.30		1.00	0.60	0.71	0.65	n/a
10	(254)	0.87	0.78	0.67			0.75	0.64	0.62	0.58	0.78	0.58	0.35			0.70	0.75	0.68	n/a
11-1/4	(286)	0.92	0.81	0.69			0.81	0.66	0.63	0.59	0.93	0.70	0.42			0.81	0.80	0.72	0.61
12	(305)	0.94	0.83	0.70			0.85	0.67	0.64	0.60	1.00	0.77	0.46			0.85	0.82	0.75	0.63
14	(356)	1.00	0.89	0.73			0.95	0.70	0.66	0.62		0.97	0.58			0.95	0.89	0.81	0.68
16	(406)		0.94	0.77			1.00	0.73	0.69	0.63		1.00	0.71			1.00	0.95	0.86	0.73
18	(457)		1.00	0.80				0.75	0.71	0.65			0.84				1.00	0.91	0.77
20	(508)			0.83				0.78	0.73	0.67			0.99					0.96	0.81
22	(559)			0.87				0.81	0.76	0.68			1.00					1.00	0.85
24	(610)			0.90				0.84	0.78	0.70									0.89
30	(762)			1.00				0.92	0.85	0.75									1.00
36	(914)							1.00	0.92	0.80									
>48	(1219)								1.00	0.90									

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.
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 26 - 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 ⊥ Toward edge f_{RV}			Edge distance in shear ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef}	in. (mm)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm): 1-3/4	(44)	n/a	n/a	n/a	0.25	0.18	0.11	n/a	n/a	n/a	0.04	0.03	0.02	0.08	0.06	0.04	n/a	n/a	n/a
3-1/8	(79)	0.59	0.57	0.54	0.31	0.23	0.13	0.54	0.53	0.52	0.10	0.07	0.04	0.20	0.14	0.08	n/a	n/a	n/a
4	(102)	0.62	0.59	0.55	0.35	0.25	0.15	0.55	0.54	0.53	0.15	0.10	0.06	0.29	0.20	0.12	n/a	n/a	n/a
5	(127)	0.65	0.61	0.57	0.39	0.29	0.17	0.56	0.55	0.53	0.21	0.14	0.09	0.41	0.29	0.17	n/a	n/a	n/a
6	(152)	0.68	0.63	0.58	0.44	0.32	0.19	0.57	0.55	0.54	0.27	0.19	0.11	0.45	0.38	0.23	n/a	n/a	n/a
7	(178)	0.71	0.66	0.59	0.49	0.36	0.21	0.58	0.56	0.55	0.34	0.24	0.14	0.50	0.41	0.28	n/a	n/a	n/a
7-1/8	(181)	0.71	0.66	0.60	0.50	0.37	0.22	0.58	0.56	0.55	0.35	0.24	0.15	0.51	0.41	0.29	0.57	n/a	n/a
8	(203)	0.74	0.68	0.61	0.55	0.40	0.24	0.59	0.57	0.55	0.41	0.29	0.17	0.56	0.44	0.33	0.61	n/a	n/a
9	(229)	0.77	0.70	0.62	0.62	0.46	0.27	0.60	0.58	0.56	0.50	0.35	0.21	0.62	0.48	0.35	0.65	0.57	n/a
10	(254)	0.80	0.72	0.63	0.69	0.51	0.30	0.62	0.59	0.56	0.58	0.40	0.24	0.69	0.52	0.37	0.68	0.60	n/a
11	(279)	0.83	0.74	0.65	0.76	0.56	0.33	0.63	0.60	0.57	0.67	0.47	0.28	0.76	0.56	0.39	0.71	0.63	n/a
12	(305)	0.86	0.77	0.66	0.83	0.61	0.36	0.64	0.61	0.58	0.76	0.53	0.32	0.83	0.61	0.41	0.75	0.66	n/a
14	(356)	0.91	0.81	0.69	0.96	0.71	0.41	0.66	0.63	0.59	0.96	0.67	0.40	0.96	0.71	0.45	0.81	0.71	0.60
16	(406)	0.97	0.86	0.71	1.00	0.81	0.47	0.69	0.65	0.60	1.00	0.82	0.49	1.00	0.81	0.49	0.86	0.76	0.64
18	(457)	1.00	0.90	0.74		0.91	0.53	0.71	0.66	0.62		0.98	0.59		0.91	0.54	0.91	0.81	0.68
20	(508)		0.94	0.77		1.00	0.59	0.73	0.68	0.63		1.00	0.69		1.00	0.59	0.96	0.85	0.72
22	(559)		0.99	0.79			0.65	0.75	0.70	0.64			0.79			0.65	1.00	0.90	0.76
24	(610)		1.00	0.82			0.71	0.78	0.72	0.66			0.90			0.71		0.94	0.79
26	(660)			0.85			0.77	0.80	0.74	0.67			1.00			0.77		0.97	0.82
28	(711)			0.87			0.83	0.82	0.76	0.68						0.83		1.00	0.85
30	(762)			0.90			0.89	0.85	0.77	0.69						0.89			0.88
36	(914)			0.98			1.00	0.92	0.83	0.73						1.00			0.97
> 48	(1219)			1.00				1.00	0.94	0.81									1.00

Table 27 - Load adjustment factors for #5 rebar in cracked concrete[1,2,3]

#5 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef}	in. (mm)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm): 1-3/4	(44)	n/a	n/a	n/a	0.46	0.43	0.40	n/a	n/a	n/a	0.04	0.03	0.02	0.09	0.06	0.04	n/a	n/a	n/a
3-1/8	(79)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.10	0.07	0.04	0.20	0.14	0.09	n/a	n/a	n/a
4	(102)	0.62	0.59	0.55	0.62	0.55	0.46	0.55	0.54	0.53	0.15	0.10	0.06	0.30	0.21	0.13	n/a	n/a	n/a
5	(127)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.53	0.21	0.15	0.09	0.41	0.29	0.18	n/a	n/a	n/a
6	(152)	0.68	0.63	0.58	0.78	0.66	0.53	0.57	0.56	0.54	0.27	0.19	0.12	0.54	0.38	0.23	n/a	n/a	n/a
7	(178)	0.71	0.66	0.59	0.87	0.72	0.56	0.58	0.56	0.55	0.34	0.24	0.15	0.68	0.48	0.29	n/a	n/a	n/a
7-1/8	(181)	0.71	0.66	0.60	0.88	0.73	0.56	0.58	0.57	0.55	0.35	0.25	0.15	0.70	0.50	0.30	0.58	n/a	n/a
8	(203)	0.74	0.68	0.61	0.96	0.78	0.59	0.59	0.57	0.55	0.42	0.30	0.18	0.84	0.59	0.35	0.61	n/a	n/a
9	(229)	0.77	0.70	0.62	1.00	0.85	0.62	0.60	0.58	0.56	0.50	0.35	0.21	1.00	0.71	0.42	0.65	0.58	n/a
10	(254)	0.80	0.72	0.63		0.91	0.66	0.62	0.59	0.57	0.58	0.41	0.25		0.83	0.50	0.68	0.61	n/a
11	(279)	0.83	0.74	0.65		0.98	0.69	0.63	0.60	0.57	0.67	0.48	0.29		0.95	0.57	0.72	0.64	n/a
12	(305)	0.86	0.77	0.66		1.00	0.73	0.64	0.61	0.58	0.77	0.54	0.33		1.00	0.65	0.75	0.67	n/a
14	(356)	0.91	0.81	0.69			0.81	0.66	0.63	0.59	0.97	0.68	0.41			0.81	0.81	0.72	0.61
16	(406)	0.97	0.86	0.71			0.89	0.69	0.65	0.61	1.00	0.84	0.50			0.89	0.86	0.77	0.65
18	(457)	1.00	0.90	0.74			0.97	0.71	0.67	0.62		1.00	0.60			0.97	0.92	0.82	0.69
20	(508)		0.94	0.77			1.00	0.73	0.68	0.63			0.70			1.00	0.97	0.86	0.73
22	(559)		0.99	0.79				0.76	0.70	0.64			0.81				1.00	0.90	0.76
24	(610)		1.00	0.82				0.78	0.72	0.66			0.92					0.94	0.79
26	(660)			0.85				0.80	0.74	0.67			1.00					0.98	0.83
28	(711)			0.87				0.83	0.76	0.68								1.00	0.86
30	(762)			0.90				0.85	0.78	0.70									0.89
36	(914)			0.98				0.92	0.83	0.74									0.97
> 48	(1219)			1.00				1.00	0.94	0.82									1.00

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.
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 $f_{HV} = 1.0$.

3.2.2

Table 28 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.03	0.02	0.01	0.07	0.05	0.03	n/a	n/a	n/a
	3-3/4 (95)	0.59	0.57	0.54	0.31	0.23	0.13	0.54	0.53	0.52	0.11	0.07	0.04	0.22	0.14	0.08	n/a	n/a	n/a
	4 (102)	0.60	0.57	0.54	0.32	0.23	0.14	0.54	0.53	0.52	0.12	0.08	0.05	0.24	0.16	0.09	n/a	n/a	n/a
	5 (127)	0.62	0.59	0.56	0.35	0.26	0.15	0.55	0.54	0.53	0.17	0.11	0.06	0.33	0.22	0.13	n/a	n/a	n/a
	6 (152)	0.65	0.61	0.57	0.39	0.29	0.17	0.56	0.55	0.53	0.22	0.14	0.08	0.41	0.29	0.17	n/a	n/a	n/a
	7 (178)	0.67	0.63	0.58	0.43	0.32	0.19	0.57	0.55	0.54	0.28	0.18	0.11	0.45	0.36	0.21	n/a	n/a	n/a
	8 (203)	0.70	0.65	0.59	0.48	0.35	0.20	0.58	0.56	0.54	0.34	0.22	0.13	0.49	0.40	0.26	n/a	n/a	n/a
	8-1/2 (216)	0.71	0.66	0.59	0.50	0.37	0.21	0.59	0.56	0.55	0.37	0.24	0.14	0.51	0.41	0.28	0.59	n/a	n/a
	9 (229)	0.72	0.67	0.60	0.52	0.38	0.22	0.59	0.57	0.55	0.40	0.26	0.15	0.53	0.43	0.31	0.60	n/a	n/a
	10 (254)	0.75	0.69	0.61	0.57	0.42	0.25	0.60	0.58	0.55	0.47	0.31	0.18	0.57	0.46	0.33	0.64	n/a	n/a
	10-3/4 (273)	0.77	0.70	0.62	0.62	0.45	0.27	0.61	0.58	0.56	0.53	0.34	0.20	0.62	0.48	0.35	0.66	0.57	n/a
	12 (305)	0.80	0.72	0.63	0.69	0.51	0.30	0.62	0.59	0.56	0.62	0.40	0.24	0.69	0.52	0.37	0.70	0.60	n/a
	14 (356)	0.85	0.76	0.66	0.80	0.59	0.35	0.64	0.61	0.57	0.78	0.51	0.30	0.80	0.59	0.40	0.75	0.65	n/a
	16 (406)	0.90	0.80	0.68	0.92	0.67	0.39	0.66	0.62	0.59	0.96	0.62	0.37	0.92	0.67	0.43	0.80	0.70	n/a
	16-3/4 (425)	0.91	0.81	0.69	0.96	0.71	0.41	0.67	0.63	0.59	1.00	0.67	0.39	0.96	0.71	0.45	0.82	0.71	0.60
	18 (457)	0.94	0.83	0.70	1.00	0.76	0.44	0.68	0.64	0.60		0.74	0.44	1.00	0.76	0.47	0.85	0.74	0.62
	20 (508)	0.99	0.87	0.72		0.84	0.49	0.70	0.65	0.61		0.87	0.51		0.84	0.51	0.90	0.78	0.65
	22 (559)	1.00	0.91	0.74		0.93	0.54	0.72	0.67	0.62		1.00	0.59		0.93	0.55	0.94	0.82	0.68
	24 (610)		0.94	0.77		1.00	0.59	0.74	0.68	0.63			0.67		1.00	0.59	0.99	0.85	0.72
	26 (660)		0.98	0.79			0.64	0.76	0.70	0.64			0.76			0.64	1.00	0.89	0.74
	28 (711)		1.00	0.81			0.69	0.78	0.71	0.65			0.85			0.69		0.92	0.77
	30 (762)			0.83			0.74	0.80	0.73	0.66			0.94			0.74		0.95	0.80
	36 (914)			0.90			0.89	0.86	0.77	0.69			1.00			0.89		1.00	0.88
	> 48 (1219)			1.00			1.00	0.99	0.86	0.76						1.00			1.00

Table 29 - Load adjustment factors for #6 rebar in cracked concrete[1,2,3]

#6 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.44	0.42	0.39	n/a	n/a	n/a	0.03	0.02	0.01	0.07	0.05	0.03	n/a	n/a	n/a
	3-3/4 (95)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.11	0.07	0.04	0.22	0.14	0.08	n/a	n/a	n/a
	4 (102)	0.60	0.57	0.54	0.57	0.51	0.44	0.54	0.53	0.52	0.12	0.08	0.05	0.24	0.16	0.09	n/a	n/a	n/a
	5 (127)	0.62	0.59	0.56	0.63	0.56	0.47	0.55	0.54	0.53	0.17	0.11	0.07	0.34	0.22	0.13	n/a	n/a	n/a
	6 (152)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.53	0.22	0.14	0.09	0.44	0.29	0.17	n/a	n/a	n/a
	7 (178)	0.67	0.63	0.58	0.77	0.65	0.52	0.57	0.55	0.54	0.28	0.18	0.11	0.56	0.36	0.22	n/a	n/a	n/a
	8 (203)	0.70	0.65	0.59	0.84	0.70	0.55	0.58	0.56	0.54	0.34	0.22	0.13	0.68	0.44	0.26	n/a	n/a	n/a
	8-1/2 (216)	0.71	0.66	0.59	0.88	0.72	0.56	0.59	0.56	0.55	0.37	0.24	0.14	0.75	0.49	0.29	0.59	n/a	n/a
	9 (229)	0.72	0.67	0.60	0.91	0.75	0.57	0.59	0.57	0.55	0.41	0.26	0.16	0.82	0.53	0.32	0.61	n/a	n/a
	10 (254)	0.75	0.69	0.61	0.99	0.80	0.60	0.60	0.58	0.55	0.48	0.31	0.18	0.95	0.62	0.37	0.64	n/a	n/a
	10-3/4 (273)	0.77	0.70	0.62	1.00	0.84	0.62	0.61	0.58	0.56	0.53	0.35	0.21	1.00	0.69	0.41	0.66	0.57	n/a
	12 (305)	0.80	0.72	0.63		0.91	0.66	0.62	0.59	0.56	0.63	0.41	0.24		0.82	0.49	0.70	0.61	n/a
	14 (356)	0.85	0.76	0.66		1.00	0.72	0.64	0.61	0.58	0.79	0.51	0.31		1.00	0.61	0.76	0.65	n/a
	16 (406)	0.90	0.80	0.68			0.78	0.66	0.62	0.59	0.97	0.63	0.37			0.75	0.81	0.70	n/a
	16-3/4 (425)	0.91	0.81	0.69			0.81	0.67	0.63	0.59	1.00	0.67	0.40			0.80	0.83	0.72	0.60
	18 (457)	0.94	0.83	0.70			0.85	0.68	0.64	0.60		0.75	0.45			0.85	0.86	0.74	0.62
	20 (508)	0.99	0.87	0.72			0.91	0.70	0.65	0.61		0.88	0.52			0.91	0.90	0.78	0.66
	22 (559)	1.00	0.91	0.74			0.98	0.72	0.67	0.62		1.00	0.60			0.98	0.95	0.82	0.69
	24 (610)		0.94	0.77			1.00	0.74	0.68	0.63			0.69			1.00	0.99	0.86	0.72
	26 (660)		0.98	0.79				0.76	0.70	0.64			0.77				1.00	0.89	0.75
	28 (711)		1.00	0.81				0.79	0.71	0.65			0.87					0.92	0.78
	30 (762)			0.83				0.81	0.73	0.66			0.96					0.96	0.81
	36 (914)			0.90				0.87	0.77	0.69			1.00					1.00	0.88
	> 48 (1219)			1.00				0.99	0.87	0.76									1.00

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.
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 30 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.02	0.01	0.05	0.04	0.02	n/a	n/a	n/a
	4-3/8 (111)	0.59	0.57	0.54	0.31	0.23	0.13	0.54	0.53	0.52	0.11	0.07	0.04	0.22	0.14	0.08	n/a	n/a	n/a
	5 (127)	0.61	0.58	0.55	0.33	0.24	0.14	0.54	0.53	0.52	0.13	0.09	0.05	0.27	0.17	0.09	n/a	n/a	n/a
	6 (152)	0.63	0.60	0.56	0.36	0.26	0.15	0.55	0.54	0.53	0.17	0.11	0.06	0.35	0.23	0.12	n/a	n/a	n/a
	7 (178)	0.65	0.61	0.57	0.39	0.29	0.17	0.56	0.55	0.53	0.22	0.14	0.08	0.40	0.29	0.16	n/a	n/a	n/a
	8 (203)	0.67	0.63	0.58	0.43	0.31	0.18	0.57	0.55	0.53	0.27	0.17	0.09	0.44	0.35	0.19	n/a	n/a	n/a
	9 (229)	0.69	0.64	0.59	0.46	0.34	0.20	0.58	0.56	0.54	0.32	0.21	0.11	0.47	0.39	0.23	n/a	n/a	n/a
	9-7/8 (251)	0.71	0.66	0.59	0.49	0.36	0.21	0.59	0.56	0.54	0.37	0.24	0.13	0.51	0.41	0.26	0.59	n/a	n/a
	10 (254)	0.71	0.66	0.60	0.50	0.37	0.22	0.59	0.57	0.54	0.38	0.24	0.13	0.51	0.41	0.27	0.59	n/a	n/a
	11 (279)	0.73	0.67	0.60	0.54	0.40	0.23	0.60	0.57	0.55	0.43	0.28	0.15	0.55	0.44	0.31	0.62	n/a	n/a
	12 (305)	0.75	0.69	0.61	0.59	0.43	0.25	0.60	0.58	0.55	0.49	0.32	0.17	0.59	0.46	0.34	0.65	n/a	n/a
	12-1/2 (318)	0.76	0.70	0.62	0.61	0.45	0.26	0.61	0.58	0.55	0.52	0.34	0.19	0.61	0.48	0.35	0.66	0.57	n/a
	14 (356)	0.80	0.72	0.63	0.69	0.50	0.30	0.62	0.59	0.56	0.62	0.40	0.22	0.69	0.52	0.37	0.70	0.60	n/a
	16 (406)	0.84	0.75	0.65	0.78	0.58	0.34	0.64	0.60	0.57	0.76	0.49	0.27	0.78	0.58	0.39	0.75	0.65	n/a
	18 (457)	0.88	0.79	0.67	0.88	0.65	0.38	0.66	0.62	0.58	0.91	0.59	0.32	0.88	0.65	0.42	0.79	0.68	n/a
	19-1/2 (495)	0.91	0.81	0.69	0.96	0.70	0.41	0.67	0.63	0.58	1.00	0.66	0.36	0.96	0.70	0.45	0.82	0.71	0.58
	20 (508)	0.92	0.82	0.69	0.98	0.72	0.42	0.67	0.63	0.59		0.69	0.38	0.98	0.72	0.45	0.83	0.72	0.59
	22 (559)	0.97	0.85	0.71	1.00	0.79	0.46	0.69	0.64	0.60		0.80	0.43	1.00	0.79	0.48	0.87	0.76	0.62
	24 (610)	1.00	0.88	0.73		0.87	0.51	0.71	0.66	0.60		0.91	0.49		0.87	0.52	0.91	0.79	0.65
	26 (660)		0.91	0.75		0.94	0.55	0.73	0.67	0.61		1.00	0.56		0.94	0.55	0.95	0.82	0.67
	28 (711)		0.94	0.77		1.00	0.59	0.74	0.68	0.62			0.62		1.00	0.59	0.99	0.85	0.70
	30 (762)		0.98	0.79			0.63	0.76	0.70	0.63			0.69			0.63	1.00	0.88	0.72
	36 (914)		1.00	0.84			0.76	0.81	0.73	0.66			0.91			0.76		0.97	0.79
	> 48 (1219)			0.96			1.00	0.92	0.81	0.71			1.00			1.00		1.00	0.91

3.2.2

Table 31 - Load adjustment factors for #7 rebar in cracked concrete[1,2,3]

#7 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.43	0.41	0.38	n/a	n/a	n/a	0.03	0.02	0.01	0.06	0.04	0.03	n/a	n/a	n/a
	4-3/8 (111)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.11	0.09	0.05	0.23	0.17	0.10	n/a	n/a	n/a
	5 (127)	0.61	0.58	0.55	0.59	0.52	0.45	0.54	0.54	0.53	0.14	0.10	0.06	0.28	0.21	0.13	n/a	n/a	n/a
	6 (152)	0.63	0.60	0.56	0.64	0.56	0.47	0.55	0.54	0.53	0.18	0.14	0.08	0.37	0.27	0.16	n/a	n/a	n/a
	7 (178)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.54	0.23	0.17	0.10	0.46	0.35	0.21	n/a	n/a	n/a
	8 (203)	0.67	0.63	0.58	0.76	0.64	0.52	0.57	0.56	0.54	0.28	0.21	0.13	0.56	0.42	0.25	n/a	n/a	n/a
	9 (229)	0.69	0.64	0.59	0.82	0.68	0.54	0.58	0.57	0.55	0.34	0.25	0.15	0.67	0.50	0.30	n/a	n/a	n/a
	9-7/8 (251)	0.71	0.66	0.59	0.87	0.72	0.56	0.59	0.57	0.55	0.39	0.29	0.17	0.77	0.58	0.35	0.59	n/a	n/a
	10 (254)	0.71	0.66	0.60	0.88	0.73	0.56	0.59	0.57	0.55	0.39	0.30	0.18	0.79	0.59	0.35	0.60	n/a	n/a
	11 (279)	0.73	0.67	0.60	0.95	0.77	0.59	0.60	0.58	0.56	0.45	0.34	0.20	0.91	0.68	0.41	0.63	n/a	n/a
	12 (305)	0.75	0.69	0.61	1.00	0.82	0.61	0.61	0.59	0.56	0.52	0.39	0.23	1.00	0.78	0.47	0.66	n/a	n/a
	12-1/2 (318)	0.76	0.70	0.62		0.84	0.62	0.61	0.59	0.57	0.55	0.41	0.25		0.83	0.50	0.67	0.61	n/a
	14 (356)	0.80	0.72	0.63		0.91	0.66	0.63	0.60	0.57	0.65	0.49	0.29		0.91	0.59	0.71	0.64	n/a
	16 (406)	0.84	0.75	0.65		1.00	0.71	0.64	0.62	0.58	0.80	0.60	0.36		1.00	0.71	0.76	0.69	n/a
	18 (457)	0.88	0.79	0.67			0.76	0.66	0.63	0.59	0.95	0.71	0.43			0.76	0.80	0.73	n/a
	19-1/2 (495)	0.91	0.81	0.69			0.80	0.67	0.64	0.60	1.00	0.80	0.48			0.80	0.84	0.76	0.64
	20 (508)	0.92	0.82	0.69			0.82	0.68	0.65	0.61		0.84	0.50			0.82	0.85	0.77	0.65
	22 (559)	0.97	0.85	0.71			0.87	0.70	0.66	0.62		0.96	0.58			0.87	0.89	0.81	0.68
	24 (610)	1.00	0.88	0.73			0.93	0.71	0.68	0.63		1.00	0.66			0.93	0.93	0.84	0.71
	26 (660)		0.91	0.75			0.99	0.73	0.69	0.64			0.74			0.99	0.96	0.88	0.74
	28 (711)		0.94	0.77			1.00	0.75	0.71	0.65			0.83			1.00	1.00	0.91	0.77
	30 (762)		0.98	0.79				0.77	0.72	0.66			0.92				1.00	0.94	0.79
	36 (914)		1.00	0.84				0.82	0.77	0.69			1.00					1.00	0.87
	> 48 (1219)			0.96				0.93	0.85	0.75									1.00

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.
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 32 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.02	0.01	0.01	0.05	0.03	0.01	n/a	n/a	n/a
5	(127)	0.59	0.57	0.54	0.31	0.23	0.13	0.54	0.53	0.52	0.11	0.07	0.04	0.22	0.14	0.07	n/a	n/a	n/a
6	(152)	0.61	0.58	0.55	0.33	0.25	0.14	0.55	0.53	0.52	0.14	0.09	0.05	0.29	0.19	0.09	n/a	n/a	n/a
7	(178)	0.63	0.60	0.56	0.36	0.27	0.16	0.55	0.54	0.53	0.18	0.12	0.06	0.36	0.23	0.12	n/a	n/a	n/a
8	(203)	0.65	0.61	0.57	0.39	0.29	0.17	0.56	0.55	0.53	0.22	0.14	0.07	0.40	0.29	0.15	n/a	n/a	n/a
9	(229)	0.67	0.63	0.58	0.42	0.31	0.18	0.57	0.55	0.53	0.26	0.17	0.09	0.43	0.34	0.17	n/a	n/a	n/a
10	(254)	0.69	0.64	0.58	0.45	0.33	0.20	0.58	0.56	0.54	0.31	0.20	0.10	0.46	0.38	0.20	n/a	n/a	n/a
11	(279)	0.70	0.65	0.59	0.48	0.36	0.21	0.58	0.56	0.54	0.35	0.23	0.12	0.50	0.40	0.23	n/a	n/a	n/a
11-1/4	(286)	0.71	0.66	0.59	0.49	0.36	0.21	0.59	0.56	0.54	0.37	0.24	0.12	0.50	0.41	0.24	0.58	n/a	n/a
12	(305)	0.72	0.67	0.60	0.52	0.38	0.22	0.59	0.57	0.54	0.40	0.26	0.13	0.53	0.43	0.27	0.60	n/a	n/a
13	(330)	0.74	0.68	0.61	0.56	0.41	0.24	0.60	0.57	0.55	0.46	0.30	0.15	0.56	0.45	0.30	0.63	n/a	n/a
14	(356)	0.76	0.69	0.62	0.60	0.44	0.26	0.61	0.58	0.55	0.51	0.33	0.17	0.60	0.47	0.34	0.65	n/a	n/a
14-1/4	(362)	0.76	0.70	0.62	0.61	0.45	0.26	0.61	0.58	0.55	0.52	0.34	0.17	0.61	0.48	0.34	0.66	0.57	n/a
16	(406)	0.80	0.72	0.63	0.69	0.50	0.30	0.62	0.59	0.56	0.62	0.40	0.21	0.69	0.52	0.37	0.70	0.60	n/a
18	(457)	0.83	0.75	0.65	0.77	0.57	0.33	0.64	0.60	0.57	0.74	0.48	0.25	0.77	0.57	0.39	0.74	0.64	n/a
20	(508)	0.87	0.78	0.67	0.86	0.63	0.37	0.65	0.61	0.57	0.87	0.56	0.29	0.86	0.63	0.42	0.78	0.67	n/a
22	(559)	0.91	0.81	0.68	0.94	0.69	0.41	0.67	0.63	0.58	1.00	0.65	0.33	0.94	0.69	0.44	0.82	0.71	n/a
22-1/4	(565)	0.91	0.81	0.69	0.95	0.70	0.41	0.67	0.63	0.58		0.66	0.34	0.95	0.70	0.45	0.82	0.71	0.57
24	(610)	0.94	0.83	0.70	1.00	0.76	0.44	0.68	0.64	0.59		0.74	0.38	1.00	0.76	0.47	0.85	0.74	0.59
26	(660)	0.98	0.86	0.72		0.82	0.48	0.70	0.65	0.59		0.84	0.43		0.82	0.50	0.89	0.77	0.61
28	(711)	1.00	0.89	0.73		0.88	0.52	0.71	0.66	0.60		0.94	0.48		0.88	0.53	0.92	0.80	0.64
30	(762)		0.92	0.75		0.95	0.55	0.73	0.67	0.61		1.00	0.53		0.95	0.55	0.95	0.83	0.66
36	(914)		1.00	0.80		1.00	0.67	0.77	0.70	0.63			0.69		1.00	0.67	1.00	0.91	0.72
> 48	(1219)			0.90			0.89	0.86	0.77	0.67			1.00			0.89		1.00	0.83

Table 33 - Load adjustment factors for #8 rebar in cracked concrete[1,2,3]

#8 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.42	0.40	0.38	n/a	n/a	n/a	0.02	0.02	0.01	0.05	0.03	0.02	n/a	n/a	n/a
5	(127)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.11	0.08	0.05	0.22	0.16	0.10	n/a	n/a	n/a
6	(152)	0.61	0.58	0.55	0.60	0.53	0.46	0.55	0.54	0.53	0.14	0.10	0.06	0.29	0.21	0.13	n/a	n/a	n/a
7	(178)	0.63	0.60	0.56	0.65	0.57	0.47	0.55	0.54	0.53	0.18	0.13	0.08	0.36	0.26	0.16	n/a	n/a	n/a
8	(203)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.54	0.22	0.16	0.10	0.44	0.32	0.19	n/a	n/a	n/a
9	(229)	0.67	0.63	0.58	0.75	0.64	0.51	0.57	0.56	0.54	0.26	0.19	0.12	0.53	0.38	0.23	n/a	n/a	n/a
10	(254)	0.69	0.64	0.58	0.80	0.67	0.53	0.58	0.56	0.54	0.31	0.22	0.13	0.62	0.45	0.27	n/a	n/a	n/a
11	(279)	0.70	0.65	0.59	0.86	0.71	0.55	0.58	0.57	0.55	0.36	0.26	0.16	0.72	0.52	0.31	n/a	n/a	n/a
11-1/4	(286)	0.71	0.66	0.59	0.87	0.72	0.56	0.59	0.57	0.55	0.37	0.27	0.16	0.74	0.54	0.32	0.59	n/a	n/a
12	(305)	0.72	0.67	0.60	0.91	0.75	0.57	0.59	0.57	0.55	0.41	0.30	0.18	0.82	0.59	0.35	0.61	n/a	n/a
13	(330)	0.74	0.68	0.61	0.97	0.79	0.59	0.60	0.58	0.56	0.46	0.33	0.20	0.92	0.67	0.40	0.63	n/a	n/a
14	(356)	0.76	0.69	0.62	1.00	0.83	0.62	0.61	0.59	0.56	0.51	0.37	0.22	1.00	0.74	0.45	0.65	n/a	n/a
14-1/4	(362)	0.76	0.70	0.62		0.84	0.62	0.61	0.59	0.56	0.53	0.38	0.23		0.76	0.46	0.66	0.59	n/a
16	(406)	0.80	0.72	0.63		0.91	0.66	0.62	0.60	0.57	0.63	0.45	0.27		0.91	0.55	0.70	0.63	n/a
18	(457)	0.83	0.75	0.65		1.00	0.70	0.64	0.61	0.58	0.75	0.54	0.33		1.00	0.65	0.74	0.67	n/a
20	(508)	0.87	0.78	0.67			0.75	0.65	0.62	0.59	0.88	0.64	0.38			0.75	0.78	0.70	n/a
22	(559)	0.91	0.81	0.68			0.80	0.67	0.64	0.60	1.00	0.73	0.44			0.80	0.82	0.74	n/a
22-1/4	(565)	0.91	0.81	0.69			0.80	0.67	0.64	0.60		0.75	0.45			0.80	0.82	0.74	0.62
24	(610)	0.94	0.83	0.70			0.85	0.68	0.65	0.61		0.84	0.50			0.85	0.86	0.77	0.65
26	(660)	0.98	0.86	0.72			0.90	0.70	0.66	0.61		0.94	0.57			0.90	0.89	0.80	0.68
28	(711)	1.00	0.89	0.73			0.95	0.71	0.67	0.62		1.00	0.63			0.95	0.92	0.83	0.70
30	(762)		0.92	0.75			1.00	0.73	0.68	0.63			0.70			1.00	0.96	0.86	0.73
36	(914)		1.00	0.80				0.77	0.72	0.66			0.92				1.00	0.94	0.79
> 48	(1219)			0.90				0.87	0.80	0.71			1.00					1.00	0.92

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.
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 34 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.01	0.01	0.04	0.02	0.01	n/a	n/a	n/a
5-5/8	(143)	0.59	0.57	0.54	0.31	0.23	0.13	0.54	0.53	0.52	0.11	0.07	0.03	0.22	0.14	0.07	n/a	n/a	n/a
6	(152)	0.60	0.57	0.54	0.32	0.23	0.14	0.54	0.53	0.52	0.12	0.08	0.04	0.24	0.16	0.07	n/a	n/a	n/a
7	(178)	0.62	0.59	0.55	0.34	0.25	0.15	0.55	0.54	0.52	0.15	0.10	0.05	0.30	0.20	0.09	n/a	n/a	n/a
8	(203)	0.63	0.60	0.56	0.37	0.27	0.16	0.55	0.54	0.52	0.18	0.12	0.06	0.37	0.24	0.11	n/a	n/a	n/a
9	(229)	0.65	0.61	0.57	0.40	0.29	0.17	0.56	0.55	0.53	0.22	0.14	0.07	0.41	0.29	0.14	n/a	n/a	n/a
10	(254)	0.66	0.62	0.57	0.42	0.31	0.18	0.57	0.55	0.53	0.26	0.17	0.08	0.44	0.33	0.16	n/a	n/a	n/a
11	(279)	0.68	0.64	0.58	0.45	0.33	0.19	0.57	0.56	0.53	0.30	0.19	0.09	0.46	0.38	0.19	n/a	n/a	n/a
12	(305)	0.70	0.65	0.59	0.48	0.35	0.20	0.58	0.56	0.54	0.34	0.22	0.11	0.49	0.40	0.21	n/a	n/a	n/a
12-7/8	(327)	0.71	0.66	0.60	0.51	0.37	0.22	0.59	0.57	0.54	0.38	0.24	0.12	0.52	0.42	0.23	0.59	n/a	n/a
13	(330)	0.71	0.66	0.60	0.51	0.37	0.22	0.59	0.57	0.54	0.38	0.25	0.12	0.52	0.42	0.24	0.59	n/a	n/a
14	(356)	0.73	0.67	0.60	0.54	0.39	0.23	0.59	0.57	0.54	0.43	0.28	0.13	0.55	0.44	0.27	0.61	n/a	n/a
16	(406)	0.76	0.70	0.62	0.62	0.45	0.26	0.61	0.58	0.55	0.52	0.34	0.16	0.62	0.48	0.33	0.66	n/a	n/a
16-1/4	(413)	0.77	0.70	0.62	0.63	0.46	0.27	0.61	0.58	0.55	0.53	0.35	0.17	0.63	0.48	0.33	0.66	0.57	n/a
18	(457)	0.80	0.72	0.63	0.69	0.51	0.30	0.62	0.59	0.56	0.62	0.40	0.19	0.69	0.52	0.37	0.70	0.60	n/a
20	(508)	0.83	0.75	0.65	0.77	0.56	0.33	0.63	0.60	0.56	0.73	0.47	0.23	0.77	0.56	0.39	0.73	0.64	n/a
22	(559)	0.86	0.77	0.66	0.85	0.62	0.36	0.65	0.61	0.57	0.84	0.55	0.26	0.85	0.62	0.41	0.77	0.67	n/a
24	(610)	0.90	0.80	0.68	0.93	0.68	0.40	0.66	0.62	0.57	0.96	0.62	0.30	0.93	0.68	0.43	0.80	0.70	n/a
25-1/4	(641)	0.92	0.81	0.69	0.97	0.71	0.42	0.67	0.63	0.58	1.00	0.67	0.32	0.97	0.71	0.45	0.83	0.71	0.56
26	(660)	0.93	0.82	0.69	1.00	0.73	0.43	0.68	0.63	0.58		0.70	0.34	1.00	0.73	0.46	0.84	0.73	0.57
28	(711)	0.96	0.85	0.71		0.79	0.46	0.69	0.64	0.59		0.78	0.38		0.79	0.48	0.87	0.75	0.59
30	(762)	0.99	0.87	0.72		0.84	0.49	0.70	0.65	0.59		0.87	0.42		0.84	0.51	0.90	0.78	0.61
36	(914)	1.00	0.94	0.77		1.00	0.59	0.74	0.68	0.61		1.00	0.55		1.00	0.59	0.99	0.85	0.67
> 48	(1219)		1.00	0.86			0.79	0.82	0.74	0.65			0.84			0.79	1.00	0.99	0.77

Table 35 - Load adjustment factors for #9 rebar in cracked concrete[1,2,3]

#9 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.41	0.39	0.38	n/a	n/a	n/a	0.02	0.01	0.01	0.04	0.03	0.02	n/a	n/a	n/a
5-5/8	(143)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.11	0.07	0.04	0.22	0.15	0.09	n/a	n/a	n/a
6	(152)	0.60	0.57	0.54	0.57	0.51	0.44	0.54	0.53	0.52	0.12	0.08	0.05	0.24	0.16	0.10	n/a	n/a	n/a
7	(178)	0.62	0.59	0.55	0.61	0.54	0.46	0.55	0.54	0.53	0.15	0.10	0.06	0.30	0.21	0.12	n/a	n/a	n/a
8	(203)	0.63	0.60	0.56	0.65	0.57	0.48	0.55	0.54	0.53	0.19	0.13	0.08	0.37	0.25	0.15	n/a	n/a	n/a
9	(229)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.53	0.22	0.15	0.09	0.44	0.30	0.18	n/a	n/a	n/a
10	(254)	0.66	0.62	0.57	0.74	0.63	0.51	0.57	0.55	0.54	0.26	0.18	0.11	0.52	0.35	0.21	n/a	n/a	n/a
11	(279)	0.68	0.64	0.58	0.79	0.67	0.53	0.57	0.56	0.54	0.30	0.20	0.12	0.60	0.40	0.24	n/a	n/a	n/a
12	(305)	0.70	0.65	0.59	0.84	0.70	0.55	0.58	0.56	0.54	0.34	0.23	0.14	0.68	0.46	0.28	n/a	n/a	n/a
12-7/8	(327)	0.71	0.66	0.60	0.88	0.73	0.56	0.59	0.57	0.55	0.38	0.26	0.15	0.76	0.51	0.31	0.59	n/a	n/a
13	(330)	0.71	0.66	0.60	0.89	0.73	0.56	0.59	0.57	0.55	0.39	0.26	0.16	0.77	0.52	0.31	0.59	n/a	n/a
14	(356)	0.73	0.67	0.60	0.94	0.77	0.58	0.60	0.57	0.55	0.43	0.29	0.17	0.86	0.58	0.35	0.62	n/a	n/a
16	(406)	0.76	0.70	0.62	1.00	0.84	0.62	0.61	0.58	0.56	0.53	0.36	0.21	1.00	0.71	0.43	0.66	n/a	n/a
16-1/4	(413)	0.77	0.70	0.62		0.85	0.63	0.61	0.58	0.56	0.54	0.36	0.22		0.73	0.44	0.66	0.58	n/a
18	(457)	0.80	0.72	0.63		0.91	0.66	0.62	0.59	0.57	0.63	0.42	0.25		0.85	0.51	0.70	0.61	n/a
20	(508)	0.83	0.75	0.65		0.99	0.70	0.64	0.60	0.57	0.73	0.50	0.30		0.99	0.60	0.74	0.65	n/a
22	(559)	0.86	0.77	0.66		1.00	0.74	0.65	0.61	0.58	0.85	0.57	0.34		1.00	0.69	0.77	0.68	n/a
24	(610)	0.90	0.80	0.68			0.78	0.66	0.63	0.59	0.97	0.65	0.39			0.78	0.81	0.71	n/a
25-1/4	(641)	0.92	0.81	0.69			0.81	0.67	0.63	0.59	1.00	0.70	0.42			0.81	0.83	0.73	0.61
26	(660)	0.93	0.82	0.69			0.82	0.68	0.64	0.60		0.74	0.44			0.82	0.84	0.74	0.62
28	(711)	0.96	0.85	0.71			0.87	0.69	0.65	0.60		0.82	0.49			0.87	0.87	0.76	0.65
30	(762)	0.99	0.87	0.72			0.91	0.70	0.66	0.61		0.91	0.55			0.91	0.90	0.79	0.67
36	(914)	1.00	0.94	0.77			1.00	0.74	0.69	0.63		1.00	0.72			1.00	0.99	0.87	0.73
> 48	(1219)		1.00	0.86				0.83	0.75	0.68			1.00				1.00	1.00	0.84

1 Linear interpolation not permitted.

2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.

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

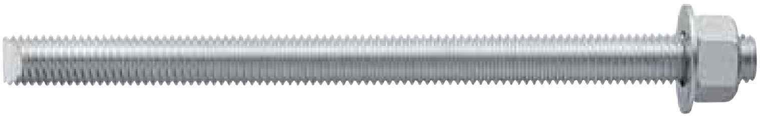
#10 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[4] f_{AV}			Edge distance in shear: ⊥ Toward edge f_{RV}			Edge distance in shear: ∥ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef} 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	0.00	0.03	0.02	0.01	n/a	n/a	n/a
6-1/4	(159)	0.59	0.57	0.54	0.32	0.23	0.13	0.54	0.53	0.52	0.11	0.07	0.03	0.22	0.14	0.07	n/a	n/a	n/a
7	(178)	0.60	0.58	0.55	0.33	0.24	0.14	0.54	0.53	0.52	0.13	0.08	0.04	0.26	0.17	0.08	n/a	n/a	n/a
8	(203)	0.62	0.59	0.55	0.36	0.25	0.15	0.55	0.54	0.52	0.16	0.10	0.05	0.31	0.20	0.10	n/a	n/a	n/a
9	(229)	0.63	0.60	0.56	0.38	0.27	0.16	0.55	0.54	0.52	0.19	0.12	0.06	0.38	0.24	0.11	n/a	n/a	n/a
10	(254)	0.65	0.61	0.57	0.40	0.29	0.17	0.56	0.55	0.53	0.22	0.14	0.07	0.42	0.29	0.13	n/a	n/a	n/a
11	(279)	0.66	0.62	0.57	0.43	0.31	0.18	0.57	0.55	0.53	0.25	0.16	0.08	0.44	0.33	0.15	n/a	n/a	n/a
12	(305)	0.68	0.63	0.58	0.45	0.32	0.19	0.57	0.55	0.53	0.29	0.19	0.09	0.47	0.38	0.17	n/a	n/a	n/a
13	(330)	0.69	0.64	0.59	0.48	0.34	0.20	0.58	0.56	0.54	0.33	0.21	0.10	0.49	0.39	0.20	n/a	n/a	n/a
14	(356)	0.71	0.66	0.59	0.51	0.36	0.21	0.59	0.56	0.54	0.36	0.24	0.11	0.52	0.41	0.22	n/a	n/a	n/a
14-1/4	(362)	0.71	0.66	0.60	0.51	0.37	0.22	0.59	0.56	0.54	0.37	0.24	0.11	0.53	0.41	0.23	0.59	n/a	n/a
15	(381)	0.72	0.67	0.60	0.54	0.38	0.22	0.59	0.57	0.54	0.40	0.26	0.12	0.55	0.43	0.24	0.60	n/a	n/a
16	(406)	0.74	0.68	0.61	0.57	0.40	0.24	0.60	0.57	0.54	0.45	0.29	0.13	0.57	0.44	0.27	0.62	n/a	n/a
17	(432)	0.75	0.69	0.61	0.60	0.43	0.25	0.60	0.58	0.55	0.49	0.32	0.15	0.60	0.46	0.29	0.64	n/a	n/a
18	(457)	0.77	0.70	0.62	0.64	0.46	0.27	0.61	0.58	0.55	0.53	0.35	0.16	0.64	0.48	0.32	0.66	0.57	n/a
20	(508)	0.80	0.72	0.63	0.71	0.51	0.30	0.62	0.59	0.55	0.62	0.40	0.19	0.71	0.52	0.37	0.70	0.60	n/a
22	(559)	0.83	0.74	0.65	0.78	0.56	0.33	0.63	0.60	0.56	0.72	0.47	0.22	0.78	0.56	0.39	0.73	0.63	n/a
24	(610)	0.86	0.77	0.66	0.85	0.61	0.36	0.65	0.61	0.57	0.82	0.53	0.25	0.85	0.61	0.41	0.76	0.66	n/a
26	(660)	0.89	0.79	0.67	0.92	0.66	0.39	0.66	0.62	0.57	0.92	0.60	0.28	0.92	0.66	0.43	0.79	0.69	n/a
28	(711)	0.91	0.81	0.69	0.99	0.71	0.41	0.67	0.63	0.58	1.00	0.67	0.31	0.99	0.71	0.45	0.82	0.71	0.55
30	(762)	0.94	0.83	0.70	1.00	0.76	0.44	0.68	0.64	0.58		0.74	0.35	1.00	0.76	0.47	0.85	0.74	0.57
36	(914)	1.00	0.90	0.74		0.91	0.53	0.72	0.66	0.60		0.98	0.45		0.91	0.54	0.94	0.81	0.63
> 48	(1219)		1.00	0.82		1.00	0.71	0.79	0.72	0.63		1.00	0.70		1.00	0.71	1.00	0.94	0.72

Table 37 - Load adjustment factors for #10 rebar in cracked concrete [1,2,3]

#10 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.40	0.39	0.37	n/a	n/a	n/a	0.02	0.01	0.01	0.03	0.02	0.01	n/a	n/a	n/a
6-1/4	(159)	0.59	0.57	0.54	0.56	0.50	0.44	0.54	0.53	0.52	0.11	0.07	0.04	0.22	0.14	0.08	n/a	n/a	n/a
7	(178)	0.60	0.58	0.55	0.58	0.52	0.45	0.54	0.53	0.52	0.13	0.08	0.05	0.26	0.17	0.10	n/a	n/a	n/a
8	(203)	0.62	0.59	0.55	0.62	0.55	0.46	0.55	0.54	0.53	0.16	0.10	0.06	0.32	0.21	0.12	n/a	n/a	n/a
9	(229)	0.63	0.60	0.56	0.66	0.57	0.48	0.55	0.54	0.53	0.19	0.12	0.07	0.38	0.25	0.15	n/a	n/a	n/a
10	(254)	0.65	0.61	0.57	0.70	0.60	0.49	0.56	0.55	0.53	0.22	0.14	0.09	0.44	0.29	0.17	n/a	n/a	n/a
11	(279)	0.66	0.62	0.57	0.74	0.63	0.51	0.57	0.55	0.54	0.26	0.17	0.10	0.51	0.33	0.20	n/a	n/a	n/a
12	(305)	0.68	0.63	0.58	0.78	0.66	0.53	0.57	0.55	0.54	0.29	0.19	0.11	0.58	0.38	0.22	n/a	n/a	n/a
13	(330)	0.69	0.64	0.59	0.82	0.69	0.54	0.58	0.56	0.54	0.33	0.21	0.13	0.66	0.43	0.25	n/a	n/a	n/a
14	(356)	0.71	0.66	0.59	0.87	0.72	0.56	0.59	0.56	0.55	0.37	0.24	0.14	0.73	0.48	0.28	n/a	n/a	n/a
14-1/4	(362)	0.71	0.66	0.60	0.88	0.73	0.56	0.59	0.57	0.55	0.38	0.25	0.15	0.75	0.49	0.29	0.59	n/a	n/a
15	(381)	0.72	0.67	0.60	0.91	0.75	0.57	0.59	0.57	0.55	0.41	0.26	0.16	0.82	0.53	0.31	0.61	n/a	n/a
16	(406)	0.74	0.68	0.61	0.96	0.78	0.59	0.60	0.57	0.55	0.45	0.29	0.17	0.90	0.58	0.35	0.63	n/a	n/a
17	(432)	0.75	0.69	0.61	1.00	0.81	0.61	0.60	0.58	0.55	0.49	0.32	0.19	0.98	0.64	0.38	0.64	n/a	n/a
18	(457)	0.77	0.70	0.62		0.85	0.62	0.61	0.58	0.56	0.54	0.35	0.21	1.00	0.70	0.41	0.66	0.57	n/a
20	(508)	0.80	0.72	0.63		0.91	0.66	0.62	0.59	0.56	0.63	0.41	0.24		0.82	0.48	0.70	0.61	n/a
22	(559)	0.83	0.74	0.65		0.98	0.69	0.63	0.60	0.57	0.72	0.47	0.28		0.94	0.56	0.73	0.63	n/a
24	(610)	0.86	0.77	0.66		1.00	0.73	0.65	0.61	0.58	0.82	0.54	0.32		1.00	0.63	0.77	0.66	n/a
26	(660)	0.89	0.79	0.67			0.77	0.66	0.62	0.58	0.93	0.60	0.36			0.71	0.80	0.69	n/a
28	(711)	0.91	0.81	0.69			0.81	0.67	0.63	0.59	1.00	0.68	0.40			0.80	0.83	0.72	0.60
30	(762)	0.94	0.83	0.70			0.85	0.68	0.64	0.60		0.75	0.44			0.85	0.86	0.74	0.62
36	(914)	1.00	0.90	0.74			0.97	0.72	0.66	0.62		0.98	0.58			0.97	0.94	0.81	0.68
> 48	(1219)		1.00	0.82			1.00	0.79	0.72	0.65		1.00	0.90			1.00	1.00	0.94	0.79

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided rebar has no installation torque.
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-HY 200 Adhesive with HAS Threaded Rod



Hilti HAS threaded rod

Figure 9 - Hilti HAS threaded rod installation conditions

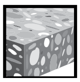
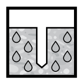
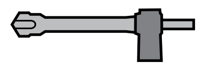
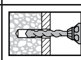
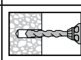
Permissible concrete conditions		Uncracked concrete		Dry concrete	Permissible drilling method		Hammer drilling with carbide tipped drill bit
		Cracked concrete		Water saturated concrete			Hilti TE-CD or TE-YD Hollow Drill Bit

Table 38 - Hilti HAS threaded rod specifications

Setting information		Symbol	Units	Nominal rod diameter, d						
				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)
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]
Diameter of fixture hole	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)		$h_{ef}+2d_o$				
Minimum edge distance		c_{min}	in. (mm)	1-3/4 (45)	1-3/4 (45)	2[2] (50)[2]	2-1/8[2] (55)[2]	2-1/4[2] (60)[2]	2-3/4[2] (70)[2]	3-1/8[2] (80)[2]
Minimum anchor spacing		s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/4 (111)	5 (127)	6-1/4 (159)

1 Install using (2) washers. See Figure 11.
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 0.5 T_{inst} for s > 16-in.

Figure 10 - Hilti HAS threaded rods

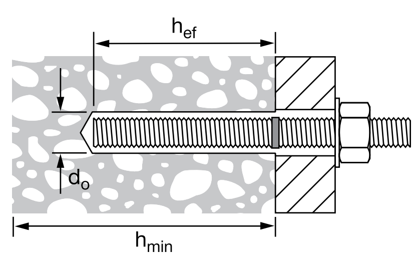


Figure 11 - Installation with (2) washers

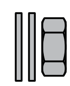


Table 39 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for threaded rod in uncracked concrete [1,2,3,4,5,6,7,8,9]

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)	2,855 (12.7)	3,125 (13.9)	3,610 (16.1)	4,405 (19.6)	3,075 (13.7)	3,370 (15.0)	3,890 (17.3)	4,745 (21.1)
	3-3/8 (86)	4,835 (21.5)	5,300 (23.6)	6,015 (26.8)	6,260 (27.8)	10,415 (46.3)	11,410 (50.8)	12,950 (57.6)	13,490 (60.0)
	4-1/2 (114)	7,445 (33.1)	7,790 (34.7)	8,020 (35.7)	8,350 (37.1)	16,035 (71.3)	16,780 (74.6)	17,270 (76.8)	17,985 (80.0)
	7-1/2 (191)	12,750 (56.7)	12,985 (57.8)	13,365 (59.5)	13,915 (61.9)	27,460 (122.1)	27,965 (124.4)	28,785 (128.0)	29,975 (133.3)
1/2	2-3/4 (70)	3,555 (15.8)	3,895 (17.3)	4,500 (20.0)	5,510 (24.5)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
	4-1/2 (114)	7,445 (33.1)	8,155 (36.3)	9,420 (41.9)	11,135 (49.5)	16,035 (71.3)	17,570 (78.2)	20,285 (90.2)	23,980 (106.7)
	6 (152)	11,465 (51.0)	12,560 (55.9)	14,255 (63.4)	14,845 (66.0)	24,690 (109.8)	27,045 (120.3)	30,700 (136.6)	31,970 (142.2)
	10 (254)	22,665 (100.8)	23,085 (102.7)	23,755 (105.7)	24,740 (110.0)	48,820 (217.2)	49,720 (221.2)	51,170 (227.6)	53,285 (237.0)
5/8	3-1/8 (79)	4,310 (19.2)	4,720 (21.0)	5,450 (24.2)	6,675 (29.7)	9,280 (41.3)	10,165 (45.2)	11,740 (52.2)	14,380 (64.0)
	5-5/8 (143)	10,405 (46.3)	11,400 (50.7)	13,165 (58.6)	16,120 (71.7)	22,415 (99.7)	24,550 (109.2)	28,350 (126.1)	34,720 (154.4)
	7-1/2 (191)	16,020 (71.3)	17,550 (78.1)	20,265 (90.1)	23,195 (103.2)	34,505 (153.5)	37,800 (168.1)	43,650 (194.2)	49,955 (222.2)
	12-1/2 (318)	34,470 (153.3)	36,070 (160.4)	37,120 (165.1)	38,655 (171.9)	74,245 (330.3)	77,685 (345.6)	79,955 (355.7)	83,260 (370.4)
3/4	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,460 (28.7)	7,910 (35.2)	11,000 (48.9)	12,050 (53.6)	13,915 (61.9)	17,040 (75.8)
	6-3/4 (171)	13,680 (60.9)	14,985 (66.7)	17,305 (77.0)	21,190 (94.3)	29,460 (131.0)	32,275 (143.6)	37,265 (165.8)	45,645 (203.0)
	9 (229)	21,060 (93.7)	23,070 (102.6)	26,640 (118.5)	32,625 (145.1)	45,360 (201.8)	49,690 (221.0)	57,375 (255.2)	70,270 (312.6)
	15 (381)	45,315 (201.6)	49,640 (220.8)	53,455 (237.8)	55,665 (247.6)	97,600 (434.1)	106,915 (475.6)	115,130 (512.1)	119,895 (533.3)
7/8	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,460 (28.7)	7,910 (35.2)	11,000 (48.9)	12,050 (53.6)	13,915 (61.9)	17,040 (75.8)
	7-7/8 (200)	17,235 (76.7)	18,885 (84.0)	21,805 (97.0)	26,705 (118.8)	37,125 (165.1)	40,670 (180.9)	46,960 (208.9)	57,515 (255.8)
	10-1/2 (267)	26,540 (118.1)	29,070 (129.3)	33,570 (149.3)	41,115 (182.9)	57,160 (254.3)	62,615 (278.5)	72,300 (321.6)	88,550 (393.9)
	17-1/2 (445)	57,100 (254.0)	62,550 (278.2)	72,230 (321.3)	75,770 (337.0)	122,990 (547.1)	134,730 (599.3)	155,570 (692.0)	163,190 (725.9)
1	4 (102)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
	9 (229)	21,060 (93.7)	23,070 (102.6)	26,640 (118.5)	32,625 (145.1)	45,360 (201.8)	49,690 (221.0)	57,375 (255.2)	70,270 (312.6)
	12 (305)	32,425 (144.2)	35,520 (158.0)	41,015 (182.4)	50,230 (223.4)	69,835 (310.6)	76,500 (340.3)	88,335 (392.9)	108,190 (481.3)
	20 (508)	69,765 (310.3)	76,425 (340.0)	88,245 (392.5)	98,960 (440.2)	150,265 (668.4)	164,605 (732.2)	190,070 (845.5)	213,150 (948.1)
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)	29,430 (130.9)	32,240 (143.4)	37,230 (165.6)	45,595 (202.8)	63,395 (282.0)	69,445 (308.9)	80,185 (356.7)	98,205 (436.8)
	15 (381)	45,315 (201.6)	49,640 (220.8)	57,320 (255.0)	70,200 (312.3)	97,600 (434.1)	106,915 (475.6)	123,455 (549.2)	151,200 (672.6)
	25 (635)	97,500 (433.7)	106,805 (475.1)	123,330 (548.6)	151,045 (671.9)	210,000 (934.1)	230,045 (1023.3)	265,630 (1181.6)	325,330 (1447.1)

1 See section 3.1.8 for explanation on development of load values.
2 See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 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).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 110° F (43° C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above values by 0.78.
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 and water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_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 design is not permitted for uncracked concrete.

Table 40 - Hilti HIT-HY 200 adhesive design strength 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 — 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)	1,900 (8.5)	1,935 (8.6)	1,990 (8.9)	2,075 (9.2)	2,045 (9.1)	2,085 (9.3)	2,145 (9.5)	2,235 (9.9)
	3-3/8 (86)	2,700 (12.0)	2,750 (12.2)	2,830 (12.6)	2,950 (13.1)	5,815 (25.9)	5,925 (26.4)	6,095 (27.1)	6,350 (28.2)
	4-1/2 (114)	3,600 (16.0)	3,665 (16.3)	3,775 (16.8)	3,930 (17.5)	7,755 (34.5)	7,900 (35.1)	8,130 (36.2)	8,465 (37.7)
	7-1/2 (191)	6,000 (26.7)	6,110 (27.2)	6,290 (28.0)	6,550 (29.1)	12,925 (57.5)	13,165 (58.6)	13,550 (60.3)	14,110 (62.8)
1/2	2-3/4 (70)	2,520 (11.2)	2,760 (12.3)	3,185 (14.2)	3,480 (15.5)	5,425 (24.1)	5,945 (26.4)	6,865 (30.5)	7,490 (33.3)
	4-1/2 (114)	5,215 (23.2)	5,310 (23.6)	5,465 (24.3)	5,690 (25.3)	11,230 (50.0)	11,440 (50.9)	11,770 (52.4)	12,260 (54.5)
	6 (152)	6,955 (30.9)	7,080 (31.5)	7,290 (32.4)	7,590 (33.8)	14,975 (66.6)	15,250 (67.8)	15,695 (69.8)	16,345 (72.7)
	10 (254)	11,590 (51.6)	11,800 (52.5)	12,145 (54.0)	12,650 (56.3)	24,960 (111.0)	25,420 (113.1)	26,160 (116.4)	27,245 (121.2)
5/8	3-1/8 (79)	3,050 (13.6)	3,345 (14.9)	3,860 (17.2)	4,730 (21.0)	6,575 (29.2)	7,200 (32.0)	8,315 (37.0)	10,185 (45.3)
	5-5/8 (143)	7,370 (32.8)	8,075 (35.9)	8,805 (39.2)	9,170 (40.8)	15,875 (70.6)	17,390 (77.4)	18,960 (84.3)	19,745 (87.8)
	7-1/2 (191)	11,200 (49.8)	11,405 (50.7)	11,740 (52.2)	12,225 (54.4)	24,120 (107.3)	24,565 (109.3)	25,280 (112.5)	26,330 (117.1)
	12-1/2 (318)	18,665 (83.0)	19,010 (84.6)	19,565 (87.0)	20,375 (90.6)	40,205 (178.8)	40,940 (182.1)	42,135 (187.4)	43,880 (195.2)
3/4	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	6-3/4 (171)	9,690 (43.1)	10,615 (47.2)	12,255 (54.5)	14,215 (63.2)	20,870 (92.8)	22,860 (101.7)	26,395 (117.4)	30,620 (136.2)
	9 (229)	14,920 (66.4)	16,340 (72.7)	18,205 (81.0)	18,955 (84.3)	32,130 (142.9)	35,195 (156.6)	39,205 (174.4)	40,830 (181.6)
	15 (381)	28,945 (128.8)	29,480 (131.1)	30,340 (135.0)	31,595 (140.5)	62,345 (277.3)	63,490 (282.4)	65,345 (290.7)	68,050 (302.7)
7/8	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	7-7/8 (200)	12,210 (54.3)	13,375 (59.5)	15,445 (68.7)	18,915 (84.1)	26,300 (117.0)	28,810 (128.2)	33,265 (148.0)	40,740 (181.2)
	10-1/2 (267)	18,800 (83.6)	20,590 (91.6)	23,780 (105.8)	26,415 (117.5)	40,490 (180.1)	44,355 (197.3)	51,215 (227.8)	56,895 (253.1)
	17-1/2 (445)	40,335 (179.4)	41,080 (182.7)	42,280 (188.1)	44,025 (195.8)	86,880 (386.5)	88,475 (393.6)	91,060 (405.1)	94,830 (421.8)
1	4 (102)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
	9 (229)	14,920 (66.4)	16,340 (72.7)	18,870 (83.9)	23,110 (102.8)	32,130 (142.9)	35,195 (156.6)	40,640 (180.8)	49,775 (221.4)
	12 (305)	22,965 (102.2)	25,160 (111.9)	29,050 (129.2)	35,440 (157.6)	49,465 (220.0)	54,190 (241.0)	62,570 (278.3)	76,330 (339.5)
	20 (508)	49,415 (219.8)	54,135 (240.8)	56,720 (252.3)	59,065 (262.7)	106,435 (473.4)	116,595 (518.6)	122,160 (543.4)	127,215 (565.9)
1-1/4	5 (127)	6,175 (27.5)	6,765 (30.1)	7,815 (34.8)	9,570 (42.6)	13,305 (59.2)	14,575 (64.8)	16,830 (74.9)	20,610 (91.7)
	11-1/4 (286)	20,850 (92.7)	22,840 (101.6)	26,370 (117.3)	32,295 (143.7)	44,905 (199.7)	49,190 (218.8)	56,800 (252.7)	69,565 (309.4)
	15 (381)	32,095 (142.8)	35,160 (156.4)	40,600 (180.6)	49,725 (221.2)	69,135 (307.5)	75,730 (336.9)	87,445 (389.0)	107,100 (476.4)
	25 (635)	69,060 (307.2)	75,655 (336.5)	87,360 (388.6)	96,120 (427.6)	148,750 (661.7)	162,945 (724.8)	188,155 (837.0)	207,030 (920.9)

1 See section 3.1.8 for explanation on development of load values.
2 See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 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).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 110° F (43° C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above values by 0.78.
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 and water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_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:
3/8-in diameter - α_{seis} = 0.66; 1/2-in, 5/8-in, and 1-1/4-in diameter - α_{seis} =0.74
3/4-in and 7/8-in diameter - α_{seis} = 0.75; 1-in diameter - α_{seis} = 0.71
See section 3.1.8 for additional information on seismic applications.

3.2.2

Table 41 - Steel design strength for Hilti HAS threaded rods for use with ACI 318-14 Chapter 17

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

1 Tensile = $\phi A_{se,N} f_{uta}$ as noted in ACI 318-14 17.4.1.2
2 Shear = $\phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318-14 17.5.1.2b.
3 Seismic Shear = $\alpha_{V,seis}\ \phi\ V_{sa}$: Reduction factor for seismic shear only. See ACI 318 for additional information on seismic applications.
4 HAS-V, HAS-E (3/8-in to 1-1/4-in), HAS-B, and HAS-R (Class 1; 1-1/4-in) threaded rods are considered ductile steel elements (including HDG rods).
5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements.
6 3/8-inch dia. threaded rods are not included in the ASTM F1554 standard. Hilti 3/8-inch dia. HAS-V, HAS-E, and HAS-E-B (incl. HDG) threaded rods meet the chemical composition and mechanical property requirements of ASTM F1554.

Table 42 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
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	0.35	0.28	0.22	0.13	n/a	n/a	n/a	n/a	0.23	0.07	0.05	0.03	0.35	0.14	0.09	0.05	n/a	n/a	n/a	n/a
	1-7/8 (48)	0.58	0.58	0.57	0.54	0.36	0.29	0.22	0.13	0.57	0.53	0.52	0.52	0.25	0.08	0.05	0.03	0.36	0.16	0.10	0.06	n/a	n/a	n/a	n/a
	2 (51)	0.59	0.59	0.57	0.54	0.37	0.30	0.23	0.13	0.57	0.53	0.52	0.52	0.28	0.09	0.06	0.03	0.37	0.17	0.11	0.07	n/a	n/a	n/a	n/a
	3 (76)	0.63	0.63	0.61	0.57	0.48	0.36	0.28	0.16	0.61	0.55	0.54	0.53	0.51	0.16	0.10	0.06	0.48	0.32	0.21	0.12	n/a	n/a	n/a	n/a
	3-5/8 (92)	0.66	0.66	0.63	0.58	0.56	0.41	0.31	0.18	0.63	0.56	0.54	0.53	0.68	0.21	0.14	0.08	0.56	0.41	0.27	0.16	0.72	n/a	n/a	n/a
	4 (102)	0.68	0.68	0.65	0.59	0.62	0.44	0.33	0.19	0.64	0.57	0.55	0.53	0.79	0.24	0.16	0.09	0.62	0.44	0.32	0.19	0.75	n/a	n/a	n/a
	4-5/8 (117)	0.71	0.71	0.67	0.60	0.71	0.49	0.36	0.21	0.66	0.58	0.56	0.54	0.98	0.30	0.20	0.12	0.71	0.49	0.36	0.21	0.81	0.55	n/a	n/a
	5 (127)	0.72	0.72	0.69	0.61	0.77	0.52	0.38	0.22	0.68	0.58	0.56	0.54	1.00	0.34	0.22	0.13	0.77	0.52	0.38	0.22	0.84	0.57	n/a	n/a
	5-3/4 (146)	0.76	0.76	0.71	0.63	0.89	0.59	0.43	0.25	0.70	0.59	0.57	0.55		0.42	0.27	0.16	0.89	0.59	0.43	0.25	0.91	0.61	0.53	n/a
	6 (152)	0.77	0.77	0.72	0.63	0.93	0.62	0.45	0.26	0.71	0.60	0.57	0.55		0.45	0.29	0.17	0.93	0.62	0.45	0.26	0.92	0.63	0.54	n/a
	7 (178)	0.81	0.81	0.76	0.66	1.00	0.72	0.53	0.30	0.75	0.61	0.59	0.56		0.57	0.37	0.21	1.00	0.72	0.53	0.30	1.00	0.68	0.58	n/a
	8 (203)	0.86	0.86	0.80	0.68		0.82	0.60	0.35	0.79	0.63	0.60	0.57		0.69	0.45	0.26		0.82	0.60	0.35		0.72	0.63	n/a
	8-3/4 (222)	0.89	0.89	0.82	0.69		0.90	0.66	0.38	0.81	0.64	0.61	0.57		0.79	0.51	0.30		0.90	0.66	0.38		0.76	0.65	0.55
	9 (229)	0.90	0.90	0.83	0.70		0.93	0.68	0.39	0.82	0.65	0.61	0.58		0.83	0.54	0.31		0.93	0.68	0.39		0.77	0.66	0.55
	10 (254)	0.95	0.95	0.87	0.72		1.00	0.75	0.43	0.86	0.66	0.62	0.59		0.97	0.63	0.37		1.00	0.75	0.43		0.81	0.70	0.58
	11 (279)	0.99	0.99	0.91	0.74			0.83	0.48	0.89	0.68	0.63	0.59		1.00	0.72	0.42			0.83	0.48		0.85	0.73	0.61
	12 (305)	1.00	1.00	0.94	0.77			0.90	0.52	0.93	0.70	0.65	0.60			0.83	0.48			0.90	0.52		0.88	0.77	0.64
	14 (356)		1.00	1.00	0.81			1.00	0.61	1.00	0.73	0.67	0.62			1.00	0.61			1.00	0.61		0.96	0.83	0.69
	16 (406)				0.86				0.70		0.76	0.70	0.64				0.74				0.70		1.00	0.88	0.74
	18 (457)				0.90				0.78		0.79	0.72	0.65				0.89				0.78			0.94	0.78
	24 (610)				1.00				1.00		0.89	0.79	0.70				1.00				1.00			1.00	0.91
	30 (762)										0.99	0.87	0.76												1.00
	36 (914)										1.00	0.94	0.81												
	>48 (1219)											1.00	0.91												

3.2.2

Table 43 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
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	0.52	0.52	0.49	0.43	n/a	n/a	n/a	n/a	0.25	0.09	0.07	0.04	0.49	0.18	0.14	0.08	n/a	n/a	n/a	n/a
	1-7/8 (48)	0.58	0.58	0.57	0.54	0.54	0.54	0.50	0.44	0.57	0.54	0.53	0.52	0.27	0.10	0.08	0.05	0.54	0.20	0.15	0.09	n/a	n/a	n/a	n/a
	2 (51)	0.59	0.59	0.57	0.54	0.55	0.55	0.51	0.44	0.57	0.54	0.53	0.52	0.30	0.11	0.08	0.05	0.55	0.22	0.17	0.10	n/a	n/a	n/a	n/a
	3 (76)	0.63	0.63	0.61	0.57	0.66	0.66	0.60	0.49	0.61	0.56	0.55	0.53	0.55	0.20	0.15	0.09	0.66	0.41	0.30	0.18	n/a	n/a	n/a	n/a
	3-5/8 (92)	0.66	0.66	0.63	0.58	0.74	0.74	0.66	0.53	0.64	0.57	0.56	0.54	0.73	0.27	0.20	0.12	0.74	0.54	0.40	0.24	0.74	n/a	n/a	n/a
	4 (102)	0.68	0.68	0.65	0.59	0.79	0.79	0.70	0.55	0.65	0.58	0.56	0.55	0.85	0.31	0.23	0.14	0.79	0.63	0.47	0.28	0.77	n/a	n/a	n/a
	4-5/8 (117)	0.71	0.71	0.67	0.60	0.87	0.87	0.76	0.58	0.67	0.59	0.57	0.55	1.00	0.39	0.29	0.17	0.87	0.78	0.58	0.35	0.83	0.60	n/a	n/a
	5 (127)	0.72	0.72	0.69	0.61	0.92	0.92	0.80	0.60	0.69	0.60	0.58	0.56		0.44	0.33	0.20	0.92	0.87	0.66	0.39	0.86	0.62	n/a	n/a
	5-3/4 (146)	0.76	0.76	0.71	0.63	1.00	1.00	0.88	0.64	0.71	0.61	0.59	0.56		0.54	0.40	0.24	1.00	1.00	0.81	0.49	0.93	0.66	0.60	n/a
	6 (152)	0.77	0.77	0.72	0.63			0.91	0.66	0.72	0.62	0.60	0.57		0.57	0.43	0.26			0.86	0.52	0.95	0.68	0.62	n/a
	7 (178)	0.81	0.81	0.76	0.66			1.00	0.72	0.76	0.63	0.61	0.58		0.72	0.54	0.33			1.00	0.65	1.00	0.73	0.67	n/a
	8 (203)	0.86	0.86	0.80	0.68				0.78	0.80	0.65	0.63	0.59		0.88	0.66	0.40				0.78		0.78	0.71	n/a
	8-3/4 (222)	0.89	0.89	0.82	0.69				0.83	0.83	0.67	0.64	0.60		1.00	0.76	0.46				0.83		0.82	0.74	0.63
	9 (229)	0.90	0.90	0.83	0.70				0.85	0.84	0.67	0.64	0.60			0.79	0.47				0.85		0.83	0.76	0.64
	10 (254)	0.95	0.95	0.87	0.72				0.91	0.87	0.69	0.66	0.61			0.93	0.56				0.91		0.88	0.80	0.67
	11 (279)	0.99	0.99	0.91	0.74				0.98	0.91	0.71	0.67	0.62			1.00	0.64				0.98		0.92	0.84	0.70
	12 (305)	1.00	1.00	0.94	0.77				1.00	0.95	0.73	0.69	0.64				0.73				1.00		0.96	0.87	0.74
	14 (356)			1.00	0.81					1.00	0.77	0.72	0.66				0.92						1.00	0.94	0.79
	16 (406)				0.86						0.81	0.75	0.68				1.00							1.00	0.85
	18 (457)				0.90						0.85	0.79	0.70												0.90
	24 (610)				1.00						0.96	0.88	0.77												1.00
	30 (762)										1.00	0.98	0.84												
	36 (914)											1.00	0.91												
	>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 ≥ 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.

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Table 44 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	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	n/a	0.34	0.25	0.19	0.11	n/a	n/a	n/a	n/a	0.10	0.05	0.03	0.02	0.21	0.11	0.07	0.03	n/a	n/a	n/a	n/a
2-1/2	(64)	0.58	0.58	0.57	0.54	0.41	0.28	0.22	0.13	0.55	0.53	0.53	0.52	0.18	0.09	0.06	0.03	0.35	0.18	0.12	0.06	n/a	n/a	n/a	n/a
3	(76)	0.60	0.60	0.58	0.55	0.46	0.30	0.24	0.14	0.56	0.54	0.53	0.52	0.23	0.12	0.08	0.04	0.46	0.24	0.15	0.08	n/a	n/a	n/a	n/a
4	(102)	0.63	0.63	0.61	0.57	0.57	0.35	0.27	0.16	0.58	0.55	0.54	0.53	0.36	0.18	0.12	0.06	0.57	0.35	0.24	0.12	0.58	n/a	n/a	n/a
5	(127)	0.67	0.67	0.64	0.58	0.71	0.41	0.31	0.18	0.60	0.57	0.55	0.53	0.50	0.26	0.17	0.08	0.71	0.41	0.31	0.17	0.65	n/a	n/a	n/a
5-3/4	(146)	0.69	0.69	0.66	0.60	0.81	0.45	0.34	0.20	0.62	0.58	0.56	0.54	0.61	0.32	0.21	0.10	0.81	0.45	0.34	0.20	0.69	0.56	n/a	n/a
6	(152)	0.70	0.70	0.67	0.60	0.85	0.46	0.35	0.20	0.63	0.58	0.56	0.54	0.65	0.34	0.22	0.11	0.85	0.46	0.35	0.20	0.71	0.57	n/a	n/a
7	(178)	0.74	0.74	0.69	0.62	0.96	0.53	0.39	0.23	0.65	0.59	0.57	0.54	0.82	0.42	0.28	0.14	0.96	0.53	0.39	0.23	0.77	0.61	n/a	n/a
7-1/4	(184)	0.74	0.74	0.70	0.62	0.98	0.54	0.40	0.23	0.65	0.60	0.57	0.55	0.87	0.45	0.29	0.15	0.98	0.54	0.40	0.23	0.78	0.62	0.54	n/a
8	(203)	0.77	0.77	0.72	0.63	1.00	0.60	0.44	0.26	0.67	0.61	0.58	0.55	1.00	0.52	0.34	0.17	1.00	0.60	0.44	0.26	0.82	0.66	0.57	n/a
9	(229)	0.80	0.80	0.75	0.65		0.68	0.50	0.29	0.69	0.62	0.59	0.56		0.62	0.40	0.20		0.68	0.50	0.29	0.87	0.70	0.60	n/a
10	(254)	0.84	0.84	0.78	0.67		0.75	0.55	0.32	0.71	0.63	0.60	0.56		0.72	0.47	0.24		0.75	0.55	0.32	0.92	0.73	0.64	n/a
11-1/4	(286)	0.88	0.88	0.81	0.69		0.84	0.62	0.36	0.74	0.65	0.61	0.57		0.86	0.56	0.28		0.84	0.62	0.36	0.97	0.78	0.67	0.54
12	(305)	0.90	0.90	0.83	0.70		0.90	0.66	0.39	0.75	0.66	0.62	0.58		0.95	0.62	0.31		0.90	0.66	0.39	1.00	0.80	0.70	0.55
14	(356)	0.97	0.97	0.89	0.73		1.00	0.77	0.45	0.79	0.69	0.64	0.59		1.00	0.78	0.39		1.00	0.77	0.45		0.87	0.75	0.60
16	(406)	1.00	1.00	0.94	0.77			0.88	0.52	0.83	0.72	0.66	0.60			0.95	0.48			0.88	0.52		0.93	0.80	0.64
18	(457)			1.00	0.80			0.99	0.58	0.88	0.74	0.68	0.62			1.00	0.58			0.99	0.58		0.98	0.85	0.68
20	(508)				0.83			1.00	0.64	0.92	0.77	0.70	0.63				0.67			1.00	0.64		1.00	0.90	0.72
22	(559)				0.87				0.71	0.96	0.80	0.72	0.64				0.78				0.71			0.94	0.75
24	(610)				0.90				0.77	1.00	0.82	0.74	0.65				0.89				0.77			0.98	0.78
30	(762)				1.00				0.97		0.90	0.80	0.69				1.00				0.97			1.00	0.88
36	(914)								1.00		0.98	0.86	0.73								1.00				0.96
>48	(1219)										1.00	0.98	0.81												1.00

Table 45 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	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	n/a	0.48	0.48	0.45	0.41	n/a	n/a	n/a	n/a	0.10	0.05	0.04	0.02	0.21	0.11	0.08	0.05	n/a	n/a	n/a	n/a
2-1/2	(64)	0.58	0.58	0.57	0.54	0.54	0.54	0.50	0.44	0.55	0.53	0.53	0.52	0.18	0.09	0.07	0.04	0.35	0.19	0.14	0.08	n/a	n/a	n/a	n/a
3	(76)	0.60	0.60	0.58	0.55	0.58	0.58	0.53	0.46	0.56	0.54	0.53	0.52	0.23	0.12	0.09	0.06	0.47	0.25	0.18	0.11	n/a	n/a	n/a	n/a
4	(102)	0.63	0.63	0.61	0.57	0.66	0.66	0.60	0.49	0.58	0.55	0.55	0.53	0.36	0.19	0.14	0.09	0.66	0.38	0.28	0.17	0.58	n/a	n/a	n/a
5	(127)	0.67	0.67	0.64	0.58	0.76	0.76	0.67	0.53	0.61	0.57	0.56	0.54	0.50	0.26	0.20	0.12	0.76	0.53	0.40	0.24	0.65	n/a	n/a	n/a
5-3/4	(146)	0.69	0.69	0.66	0.60	0.83	0.83	0.73	0.56	0.62	0.58	0.57	0.55	0.62	0.33	0.24	0.15	0.83	0.65	0.49	0.29	0.70	0.56	n/a	n/a
6	(152)	0.70	0.70	0.67	0.60	0.85	0.85	0.75	0.57	0.63	0.58	0.57	0.55	0.66	0.35	0.26	0.16	0.85	0.70	0.52	0.31	0.71	0.57	n/a	n/a
7	(178)	0.74	0.74	0.69	0.62	0.96	0.96	0.83	0.62	0.65	0.60	0.58	0.56	0.83	0.44	0.33	0.20	0.96	0.88	0.66	0.39	0.77	0.62	n/a	n/a
7-1/4	(184)	0.74	0.74	0.70	0.62	0.98	0.98	0.85	0.63	0.65	0.60	0.58	0.56	0.88	0.46	0.35	0.21	0.98	0.92	0.69	0.42	0.78	0.63	0.57	n/a
8	(203)	0.77	0.77	0.72	0.63	1.00	1.00	0.91	0.66	0.67	0.61	0.59	0.56	1.00	0.54	0.40	0.24	1.00	1.00	0.80	0.48	0.82	0.66	0.60	n/a
9	(229)	0.80	0.80	0.75	0.65			1.00	0.70	0.69	0.62	0.60	0.57		0.64	0.48	0.29			0.96	0.58	0.87	0.70	0.64	n/a
10	(254)	0.84	0.84	0.78	0.67				0.75	0.71	0.64	0.61	0.58		0.75	0.56	0.34			1.00	0.67	0.92	0.74	0.67	n/a
11-1/4	(286)	0.88	0.88	0.81	0.69				0.81	0.74	0.65	0.63	0.59		0.89	0.67	0.40				0.80	0.97	0.79	0.71	0.60
12	(305)	0.90	0.90	0.83	0.70				0.85	0.75	0.66	0.64	0.60		0.98	0.74	0.44				0.85	1.00	0.81	0.74	0.62
14	(356)	0.97	0.97	0.89	0.73				0.95	0.79	0.69	0.66	0.61		1.00	0.93	0.56				0.95		0.88	0.80	0.67
16	(406)	1.00	1.00	0.94	0.77				1.00	0.84	0.72	0.68	0.63			1.00	0.68				1.00		0.94	0.85	0.72
18	(457)			1.00	0.80					0.88	0.75	0.70	0.65				0.81						0.99	0.90	0.76
20	(508)				0.83					0.92	0.77	0.73	0.66				0.95						1.00	0.95	0.80
22	(559)				0.87					0.96	0.80	0.75	0.68				1.00							1.00	0.84
24	(610)				0.90					1.00	0.83	0.77	0.69												0.88
30	(762)				1.00						0.91	0.84	0.74												0.98
36	(914)										0.99	0.91	0.79												1.00
>48	(1219)										1.00	1.00	0.89												

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 46 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ‖ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)		3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	n/a	0.35	0.24	0.18	0.11	n/a	n/a	n/a	n/a	0.09	0.04	0.03	0.01	0.19	0.08	0.06	0.03	n/a	n/a	n/a	n/a
	2	(51)	n/a	n/a	n/a	n/a	0.37	0.25	0.19	0.11	n/a	n/a	n/a	n/a	0.11	0.05	0.03	0.02	0.23	0.10	0.07	0.03	n/a	n/a	n/a	n/a
	3-1/8	(79)	0.58	0.58	0.57	0.54	0.47	0.29	0.22	0.13	0.56	0.54	0.53	0.52	0.22	0.10	0.07	0.03	0.45	0.20	0.13	0.06	n/a	n/a	n/a	n/a
	4	(102)	0.61	0.61	0.59	0.55	0.56	0.32	0.24	0.14	0.58	0.55	0.53	0.52	0.32	0.15	0.10	0.04	0.56	0.29	0.19	0.09	n/a	n/a	n/a	n/a
	4-5/8	(117)	0.62	0.62	0.60	0.56	0.62	0.35	0.26	0.15	0.59	0.55	0.54	0.52	0.40	0.18	0.12	0.06	0.62	0.35	0.24	0.11	0.60	n/a	n/a	n/a
	5	(127)	0.63	0.63	0.61	0.57	0.66	0.36	0.27	0.16	0.60	0.56	0.54	0.53	0.45	0.21	0.13	0.06	0.66	0.36	0.27	0.12	0.63	n/a	n/a	n/a
	6	(152)	0.66	0.66	0.63	0.58	0.74	0.41	0.30	0.18	0.62	0.57	0.55	0.53	0.59	0.27	0.18	0.08	0.74	0.41	0.30	0.16	0.69	n/a	n/a	n/a
	7	(178)	0.69	0.69	0.66	0.59	0.81	0.45	0.33	0.19	0.64	0.58	0.56	0.54	0.75	0.34	0.22	0.10	0.81	0.45	0.33	0.19	0.74	n/a	n/a	n/a
	7-1/8	(181)	0.69	0.69	0.66	0.60	0.82	0.46	0.34	0.20	0.64	0.58	0.56	0.54	0.77	0.35	0.23	0.11	0.82	0.46	0.34	0.20	0.75	0.57	n/a	n/a
	8	(203)	0.72	0.72	0.68	0.61	0.89	0.50	0.36	0.21	0.66	0.59	0.57	0.54	0.91	0.41	0.27	0.13	0.89	0.50	0.36	0.21	0.79	0.61	n/a	n/a
	9	(229)	0.74	0.74	0.70	0.62	0.98	0.56	0.40	0.23	0.68	0.60	0.58	0.55	1.00	0.50	0.32	0.15	0.98	0.56	0.40	0.23	0.84	0.65	0.56	n/a
	10	(254)	0.77	0.77	0.72	0.63	1.00	0.62	0.44	0.26	0.70	0.62	0.59	0.55		0.58	0.38	0.18	1.00	0.62	0.44	0.26	0.89	0.68	0.59	n/a
	11	(279)	0.80	0.80	0.74	0.65		0.68	0.48	0.28	0.72	0.63	0.60	0.56		0.67	0.43	0.20		0.68	0.48	0.28	0.93	0.71	0.62	n/a
	12	(305)	0.82	0.82	0.77	0.66		0.74	0.53	0.31	0.74	0.64	0.60	0.56		0.76	0.50	0.23		0.74	0.53	0.31	0.97	0.75	0.65	n/a
	14	(356)	0.88	0.88	0.81	0.69		0.86	0.62	0.36	0.77	0.66	0.62	0.57		0.96	0.62	0.29		0.86	0.62	0.36	1.00	0.81	0.70	0.54
	16	(406)	0.93	0.93	0.86	0.71		0.99	0.70	0.41	0.81	0.69	0.64	0.58		1.00	0.76	0.35		0.99	0.70	0.41		0.86	0.75	0.58
	18	(457)	0.99	0.99	0.90	0.74		1.00	0.79	0.46	0.85	0.71	0.66	0.59			0.91	0.42		1.00	0.79	0.46		0.91	0.79	0.61
	20	(508)	1.00	1.00	0.94	0.77			0.88	0.51	0.89	0.73	0.67	0.60			1.00	0.50			0.88	0.51		0.96	0.83	0.65
	22	(559)			0.99	0.79			0.97	0.57	0.93	0.75	0.69	0.61				0.57			0.97	0.57		1.00	0.87	0.68
	24	(610)			1.00	0.82			1.00	0.62	0.97	0.78	0.71	0.63				0.65			1.00	0.62			0.91	0.71
	26	(660)				0.85				0.67	1.00	0.80	0.73	0.64				0.73				0.67			0.95	0.74
	28	(711)				0.87				0.72		0.82	0.74	0.65				0.82				0.72			0.99	0.76
	30	(762)				0.90				0.77		0.85	0.76	0.66				0.91				0.77			1.00	0.79
	36	(914)				0.98				0.93		0.92	0.81	0.69				1.00				0.93				0.87
	> 48	(1219)				1.00				1.00		1.00	0.92	0.75								1.00				1.00

Table 47 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ‖ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)		3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4	(44)	n/a	n/a	n/a	n/a	0.45	0.45	0.43	0.40	n/a	n/a	n/a	n/a	0.09	0.04	0.03	0.02	0.19	0.09	0.06	0.03	n/a	n/a	n/a	n/a
	2	(51)	n/a	n/a	n/a	n/a	0.46	0.46	0.44	0.41	n/a	n/a	n/a	n/a	0.11	0.05	0.03	0.02	0.23	0.10	0.07	0.04	n/a	n/a	n/a	n/a
	3-1/8	(79)	0.58	0.58	0.57	0.54	0.54	0.54	0.50	0.44	0.56	0.54	0.53	0.52	0.22	0.10	0.07	0.04	0.45	0.20	0.13	0.08	n/a	n/a	n/a	n/a
	4	(102)	0.61	0.61	0.59	0.55	0.59	0.59	0.55	0.46	0.58	0.55	0.53	0.52	0.33	0.15	0.10	0.06	0.59	0.30	0.19	0.12	n/a	n/a	n/a	n/a
	4-5/8	(117)	0.62	0.62	0.60	0.56	0.64	0.64	0.58	0.48	0.59	0.55	0.54	0.53	0.40	0.18	0.12	0.07	0.64	0.37	0.24	0.14	0.60	n/a	n/a	n/a
	5	(127)	0.63	0.63	0.61	0.57	0.66	0.66	0.60	0.49	0.60	0.56	0.54	0.53	0.45	0.21	0.13	0.08	0.66	0.41	0.27	0.16	0.63	n/a	n/a	n/a
	6	(152)	0.66	0.66	0.63	0.58	0.74	0.74	0.66	0.53	0.62	0.57	0.55	0.54	0.60	0.27	0.18	0.11	0.74	0.54	0.35	0.21	0.69	n/a	n/a	n/a
	7	(178)	0.69	0.69	0.66	0.59	0.81	0.81	0.72	0.56	0.64	0.58	0.56	0.54	0.75	0.34	0.22	0.13	0.81	0.68	0.45	0.27	0.74	n/a	n/a	n/a
	7-1/8	(181)	0.69	0.69	0.66	0.60	0.82	0.82	0.73	0.56	0.64	0.58	0.56	0.54	0.77	0.35	0.23	0.14	0.82	0.70	0.46	0.27	0.75	0.58	n/a	n/a
	8	(203)	0.72	0.72	0.68	0.61	0.89	0.89	0.78	0.59	0.66	0.59	0.57	0.55	0.92	0.42	0.27	0.16	0.89	0.84	0.54	0.33	0.79	0.61	n/a	n/a
	9	(229)	0.74	0.74	0.70	0.62	0.98	0.98	0.85	0.62	0.68	0.60	0.58	0.56	1.00	0.50	0.32	0.19	0.98	0.98	0.65	0.39	0.84	0.65	0.56	n/a
	10	(254)	0.77	0.77	0.72	0.63	1.00	1.00	0.91	0.66	0.70	0.62	0.59	0.56		0.58	0.38	0.23	1.00	1.00	0.76	0.46	0.89	0.68	0.59	n/a
	11	(279)	0.80	0.80	0.74	0.65			0.98	0.69	0.72	0.63	0.60	0.57		0.67	0.44	0.26			0.88	0.53	0.93	0.72	0.62	n/a
	12	(305)	0.82	0.82	0.77	0.66			1.00	0.73	0.74	0.64	0.60	0.57		0.77	0.50	0.30			1.00	0.60	0.97	0.75	0.65	n/a
	14	(356)	0.88	0.88	0.81	0.69				0.81	0.78	0.66	0.62	0.59		0.97	0.63	0.38				0.76	1.00	0.81	0.70	0.59
	16	(406)	0.93	0.93	0.86	0.71				0.89	0.82	0.69	0.64	0.60		1.00	0.77	0.46				0.89		0.86	0.75	0.63
	18	(457)	0.99	0.99	0.90	0.74				0.97	0.85	0.71	0.66	0.61			0.92	0.55				0.97		0.92	0.79	0.67
	20	(508)	1.00	1.00	0.94	0.77				1.00	0.89	0.73	0.67	0.62			1.00	0.64				1.00		0.97	0.84	0.71
	22	(559)	1.00		0.99	0.79					0.93	0.76	0.69	0.64				0.74						1.00	0.88	0.74
	24	(610)	1.00		1.00	0.82					0.97	0.78	0.71	0.65				0.85							0.92	0.77
	26	(660)	1.00			0.85					1.00	0.80	0.73	0.66				0.96							0.95	0.80
	28	(711)	1.00			0.87						0.83	0.74	0.67				1.00							0.99	0.83
	30	(762)	1.00			0.90						0.85	0.76	0.69											1.00	0.86
	36	(914)	1.00			0.98						0.92	0.81	0.72											1.00	0.95
	> 48	(1219)	1.00			1.00						1.00	0.92	0.80												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 48 - 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 ∥ To and away from 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	0.35	0.24	0.18	0.10	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.17	0.07	0.05	0.02	n/a	n/a	n/a	n/a
2-1/8	(54)	n/a	n/a	n/a	n/a	0.38	0.25	0.19	0.11	n/a	n/a	n/a	n/a	0.11	0.05	0.03	0.01	0.23	0.09	0.06	0.03	n/a	n/a	n/a	n/a
3-3/4	(95)	0.58	0.58	0.57	0.54	0.52	0.30	0.22	0.13	0.57	0.54	0.53	0.52	0.27	0.11	0.07	0.03	0.52	0.22	0.14	0.07	n/a	n/a	n/a	n/a
4	(102)	0.59	0.59	0.57	0.54	0.54	0.31	0.23	0.13	0.57	0.54	0.53	0.52	0.29	0.12	0.08	0.04	0.54	0.24	0.16	0.07	n/a	n/a	n/a	n/a
5	(127)	0.61	0.61	0.59	0.56	0.60	0.34	0.25	0.14	0.59	0.55	0.54	0.52	0.41	0.17	0.11	0.05	0.60	0.33	0.22	0.10	n/a	n/a	n/a	n/a
5-1/4	(133)	0.62	0.62	0.60	0.56	0.62	0.35	0.25	0.15	0.60	0.55	0.54	0.52	0.44	0.18	0.12	0.05	0.62	0.35	0.23	0.11	0.62	n/a	n/a	n/a
6	(152)	0.63	0.63	0.61	0.57	0.66	0.38	0.27	0.16	0.61	0.56	0.55	0.53	0.54	0.22	0.14	0.07	0.66	0.38	0.27	0.13	0.66	n/a	n/a	n/a
7	(178)	0.66	0.66	0.63	0.58	0.72	0.41	0.30	0.17	0.63	0.57	0.55	0.53	0.68	0.28	0.18	0.08	0.72	0.41	0.30	0.17	0.72	n/a	n/a	n/a
8	(203)	0.68	0.68	0.65	0.59	0.79	0.45	0.32	0.19	0.65	0.58	0.56	0.54	0.83	0.34	0.22	0.10	0.79	0.45	0.32	0.19	0.77	n/a	n/a	n/a
8-1/2	(216)	0.69	0.69	0.66	0.59	0.82	0.47	0.34	0.20	0.66	0.59	0.56	0.54	0.91	0.37	0.24	0.11	0.82	0.47	0.34	0.20	0.79	0.59	n/a	n/a
9	(229)	0.70	0.70	0.67	0.60	0.85	0.49	0.35	0.20	0.67	0.59	0.57	0.54	0.99	0.40	0.26	0.12	0.85	0.49	0.35	0.20	0.81	0.60	n/a	n/a
10	(254)	0.72	0.72	0.69	0.61	0.92	0.53	0.38	0.22	0.68	0.60	0.58	0.55	1.00	0.47	0.31	0.14	0.92	0.53	0.38	0.22	0.86	0.64	n/a	n/a
10-3/4	(273)	0.74	0.74	0.70	0.62	0.97	0.57	0.40	0.23	0.70	0.61	0.58	0.55		0.53	0.34	0.16	0.97	0.57	0.40	0.23	0.89	0.66	0.57	n/a
12	(305)	0.77	0.77	0.72	0.63	1.00	0.64	0.44	0.26	0.72	0.62	0.59	0.55		0.62	0.40	0.19	1.00	0.64	0.44	0.26	0.94	0.70	0.60	n/a
14	(356)	0.81	0.81	0.76	0.66		0.74	0.52	0.30	0.76	0.64	0.61	0.56		0.78	0.51	0.24		0.74	0.52	0.30	1.00	0.75	0.65	n/a
16	(406)	0.86	0.86	0.80	0.68		0.85	0.59	0.34	0.79	0.66	0.62	0.57		0.96	0.62	0.29		0.85	0.59	0.34		0.80	0.70	n/a
16-3/4	(425)	0.88	0.88	0.81	0.69		0.89	0.62	0.36	0.81	0.67	0.63	0.58		1.00	0.67	0.31		0.89	0.62	0.36		0.82	0.71	0.55
18	(457)	0.90	0.90	0.83	0.70		0.96	0.66	0.39	0.83	0.68	0.64	0.58			0.74	0.35		0.96	0.66	0.39		0.85	0.74	0.57
20	(508)	0.95	0.95	0.87	0.72		1.00	0.74	0.43	0.87	0.70	0.65	0.59			0.87	0.40		1.00	0.74	0.43		0.90	0.78	0.60
22	(559)	0.99	0.99	0.91	0.74			0.81	0.47	0.91	0.72	0.67	0.60			1.00	0.47			0.81	0.47		0.94	0.82	0.63
24	(610)	1.00	1.00	0.94	0.77			0.89	0.51	0.94	0.74	0.68	0.61				0.53			0.89	0.51		0.99	0.85	0.66
26	(660)			0.98	0.79			0.96	0.56	0.98	0.76	0.70	0.62				0.60			0.96	0.56		1.00	0.89	0.69
28	(711)			1.00	0.81			1.00	0.60	1.00	0.78	0.71	0.63				0.67			1.00	0.60			0.92	0.71
30	(762)				0.83				0.64		0.80	0.73	0.64				0.74				0.64			0.95	0.74
36	(914)				0.90				0.77		0.86	0.77	0.66				0.98				0.77			1.00	0.81
> 48	(1219)				1.00				1.00		0.99	0.86	0.72				1.00				1.00			1.00	0.94

Table 49 - 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 ∥ To and away from 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	0.43	0.43	0.42	0.39	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.17	0.07	0.05	0.02	n/a	n/a	n/a	n/a
2-1/8	(54)	n/a	n/a	n/a	n/a	0.45	0.45	0.43	0.40	n/a	n/a	n/a	n/a	0.11	0.05	0.03	0.02	0.23	0.09	0.06	0.03	n/a	n/a	n/a	n/a
3-3/4	(95)	0.58	0.58	0.57	0.54	0.54	0.54	0.50	0.44	0.57	0.54	0.53	0.52	0.27	0.11	0.07	0.04	0.54	0.22	0.14	0.08	n/a	n/a	n/a	n/a
4	(102)	0.59	0.59	0.57	0.54	0.55	0.55	0.51	0.44	0.57	0.54	0.53	0.52	0.30	0.12	0.08	0.04	0.55	0.24	0.16	0.08	n/a	n/a	n/a	n/a
5	(127)	0.61	0.61	0.59	0.56	0.60	0.60	0.56	0.47	0.59	0.55	0.54	0.53	0.41	0.17	0.11	0.06	0.60	0.34	0.22	0.12	n/a	n/a	n/a	n/a
5-1/4	(133)	0.62	0.62	0.60	0.56	0.62	0.62	0.57	0.47	0.60	0.55	0.54	0.53	0.45	0.18	0.12	0.06	0.62	0.36	0.24	0.13	0.62	n/a	n/a	n/a
6	(152)	0.63	0.63	0.61	0.57	0.66	0.66	0.60	0.49	0.61	0.56	0.55	0.53	0.54	0.22	0.14	0.08	0.66	0.44	0.29	0.15	0.67	n/a	n/a	n/a
7	(178)	0.66	0.66	0.63	0.58	0.72	0.72	0.65	0.52	0.63	0.57	0.55	0.54	0.69	0.28	0.18	0.10	0.72	0.56	0.36	0.19	0.72	n/a	n/a	n/a
8	(203)	0.68	0.68	0.65	0.59	0.79	0.79	0.70	0.55	0.65	0.58	0.56	0.54	0.84	0.34	0.22	0.12	0.79	0.68	0.44	0.24	0.77	n/a	n/a	n/a
8-1/2	(216)	0.69	0.69	0.66	0.59	0.82	0.82	0.72	0.56	0.66	0.59	0.56	0.54	0.92	0.37	0.24	0.13	0.82	0.75	0.49	0.26	0.79	0.59	n/a	n/a
9	(229)	0.70	0.70	0.67	0.60	0.85	0.85	0.75	0.57	0.67	0.59	0.57	0.55	1.00	0.41	0.26	0.14	0.85	0.82	0.53	0.28	0.82	0.61	n/a	n/a
10	(254)	0.72	0.72	0.69	0.61	0.92	0.92	0.80	0.60	0.69	0.60	0.58	0.55		0.48	0.31	0.17	0.92	0.92	0.62	0.33	0.86	0.64	n/a	n/a
10-3/4	(273)	0.74	0.74	0.70	0.62	0.97	0.97	0.84	0.62	0.70	0.61	0.58	0.55		0.53	0.35	0.18	0.97	0.97	0.69	0.37	0.89	0.66	0.57	n/a
12	(305)	0.77	0.77	0.72	0.63	1.00	1.00	0.91	0.66	0.72	0.62	0.59	0.56		0.63	0.41	0.22	1.00	1.00	0.82	0.44	0.94	0.70	0.61	n/a
14	(356)	0.81	0.81	0.76	0.66			1.00	0.72	0.76	0.64	0.61	0.57		0.79	0.51	0.27		1.00	1.00	0.55	1.00	0.76	0.65	n/a
16	(406)	0.86	0.86	0.80	0.68				0.78	0.80	0.66	0.62	0.58		0.97	0.63	0.34				0.67		0.81	0.70	n/a
16-3/4	(425)	0.88	0.88	0.81	0.69				0.81	0.81	0.67	0.63	0.58		1.00	0.67	0.36				0.72		0.83	0.72	0.58
18	(457)	0.90	0.90	0.83	0.70				0.85	0.83	0.68	0.64	0.59			0.75	0.40				0.80		0.86	0.74	0.60
20	(508)	0.95	0.95	0.87	0.72				0.91	0.87	0.70	0.65	0.60			0.88	0.47				0.91		0.90	0.78	0.63
22	(559)	0.99	0.99	0.91	0.74				0.98	0.91	0.72	0.67	0.61			1.00	0.54				0.98		0.95	0.82	0.67
24	(610)	1.00	1.00	0.94	0.77				1.00	0.94	0.74	0.68	0.62				0.62				1.00		0.99	0.86	0.69
26	(660)			0.98	0.79					0.98	0.76	0.70	0.63				0.69						1.00	0.89	0.72
28	(711)			1.00	0.81					1.00	0.79	0.71	0.64				0.78							0.92	0.75
30	(762)				0.83						0.81	0.73	0.65				0.86							0.96	0.78
36	(914)				0.90						0.87	0.77	0.68				1.00							1.00	0.85
> 48	(1219)				1.00						0.99	0.87	0.74												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 ≥ 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 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 and away from 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	0.39	0.24	0.18	0.10	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.18	0.05	0.04	0.02	n/a	n/a	n/a	n/a
2-1/4	(57)	n/a	n/a	n/a	n/a	0.43	0.25	0.19	0.11	n/a	n/a	n/a	n/a	0.13	0.04	0.03	0.01	0.26	0.08	0.05	0.02	n/a	n/a	n/a	n/a
4-3/8	(111)	0.58	0.58	0.57	0.54	0.54	0.31	0.23	0.13	0.58	0.54	0.53	0.52	0.35	0.11	0.07	0.03	0.54	0.22	0.14	0.07	n/a	n/a	n/a	n/a
5	(127)	0.60	0.60	0.58	0.55	0.56	0.33	0.24	0.13	0.59	0.54	0.53	0.52	0.43	0.13	0.09	0.04	0.56	0.27	0.17	0.08	n/a	n/a	n/a	n/a
5-1/2	(140)	0.61	0.61	0.59	0.55	0.59	0.34	0.25	0.14	0.60	0.55	0.54	0.52	0.50	0.15	0.10	0.05	0.59	0.31	0.20	0.09	0.65	n/a	n/a	n/a
6	(152)	0.62	0.62	0.60	0.56	0.61	0.36	0.26	0.15	0.61	0.55	0.54	0.52	0.57	0.17	0.11	0.05	0.61	0.35	0.23	0.11	0.68	n/a	n/a	n/a
7	(178)	0.63	0.63	0.61	0.57	0.66	0.39	0.28	0.16	0.63	0.56	0.55	0.53	0.71	0.22	0.14	0.07	0.66	0.39	0.28	0.13	0.73	n/a	n/a	n/a
8	(203)	0.65	0.65	0.63	0.58	0.72	0.42	0.30	0.17	0.65	0.57	0.55	0.53	0.87	0.27	0.17	0.08	0.72	0.42	0.30	0.16	0.78	n/a	n/a	n/a
9	(229)	0.67	0.67	0.64	0.59	0.77	0.45	0.33	0.18	0.67	0.58	0.56	0.54	1.00	0.32	0.21	0.10	0.77	0.45	0.33	0.18	0.83	n/a	n/a	n/a
9-7/8	(251)	0.69	0.69	0.66	0.59	0.82	0.48	0.35	0.19	0.69	0.59	0.56	0.54		0.37	0.24	0.11	0.82	0.48	0.35	0.19	0.87	0.59	n/a	n/a
10	(254)	0.69	0.69	0.66	0.60	0.82	0.49	0.35	0.20	0.69	0.59	0.57	0.54		0.38	0.24	0.11	0.82	0.49	0.35	0.20	0.87	0.59	n/a	n/a
11	(279)	0.71	0.71	0.67	0.60	0.88	0.52	0.37	0.21	0.71	0.60	0.57	0.54		0.43	0.28	0.13	0.88	0.52	0.37	0.21	0.91	0.62	n/a	n/a
12	(305)	0.73	0.73	0.69	0.61	0.94	0.56	0.40	0.22	0.73	0.60	0.58	0.55		0.49	0.32	0.15	0.94	0.56	0.40	0.22	0.95	0.65	n/a	n/a
12-1/2	(318)	0.74	0.74	0.70	0.62	0.97	0.59	0.41	0.23	0.74	0.61	0.58	0.55		0.52	0.34	0.16	0.97	0.59	0.41	0.23	0.97	0.66	0.57	n/a
14	(356)	0.77	0.77	0.72	0.63	1.00	0.66	0.46	0.26	0.77	0.62	0.59	0.55		0.62	0.40	0.19	1.00	0.66	0.46	0.26	1.00	0.70	0.60	n/a
16	(406)	0.81	0.81	0.75	0.65		0.75	0.52	0.29	0.80	0.64	0.60	0.56		0.76	0.49	0.23	1.00	0.75	0.52	0.29		0.75	0.65	n/a
18	(457)	0.85	0.85	0.79	0.67		0.84	0.59	0.33	0.84	0.66	0.62	0.57		0.91	0.59	0.27	1.00	0.84	0.59	0.33		0.79	0.68	n/a
19-1/2	(495)	0.88	0.88	0.81	0.69		0.92	0.64	0.36	0.87	0.67	0.63	0.58		1.00	0.66	0.31	1.00	0.92	0.64	0.36		0.82	0.71	0.55
20	(508)	0.89	0.89	0.82	0.69		0.94	0.65	0.37	0.88	0.67	0.63	0.58			0.69	0.32	1.00	0.94	0.65	0.37		0.83	0.72	0.56
22	(559)	0.92	0.92	0.85	0.71		1.00	0.72	0.40	0.92	0.69	0.64	0.59			0.80	0.37		1.00	0.72	0.40		0.87	0.76	0.59
24	(610)	0.96	0.96	0.88	0.73			0.78	0.44	0.96	0.71	0.66	0.59			0.91	0.42			0.78	0.44		0.91	0.79	0.61
26	(660)	1.00	1.00	0.91	0.75			0.85	0.48	0.99	0.73	0.67	0.60			1.00	0.48			0.85	0.48		0.95	0.82	0.64
28	(711)			0.94	0.77			0.91	0.51	1.00	0.74	0.68	0.61				0.53			0.91	0.51		0.99	0.85	0.66
30	(762)			0.98	0.79			0.98	0.55		0.76	0.70	0.62				0.59			0.98	0.55		1.00	0.88	0.68
36	(914)			1.00	0.84			1.00	0.66		0.81	0.73	0.64				0.77			1.00	0.66			0.97	0.75
> 48	(1219)				0.96				0.88		0.92	0.81	0.69				1.00				0.88			1.00	0.87

Table 51 - 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 and away from 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	0.42	0.42	0.41	0.38	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.18	0.06	0.04	0.02	n/a	n/a	n/a	n/a
2-1/4	(57)	n/a	n/a	n/a	n/a	0.44	0.44	0.42	0.39	n/a	n/a	n/a	n/a	0.13	0.04	0.03	0.01	0.26	0.08	0.05	0.03	n/a	n/a	n/a	n/a
4-3/8	(111)	0.58	0.58	0.57	0.54	0.54	0.54	0.50	0.44	0.58	0.54	0.53	0.52	0.36	0.11	0.07	0.03	0.54	0.22	0.14	0.07	n/a	n/a	n/a	n/a
5	(127)	0.60	0.60	0.58	0.55	0.56	0.56	0.52	0.45	0.60	0.54	0.53	0.52	0.43	0.13	0.09	0.04	0.56	0.27	0.17	0.08	n/a	n/a	n/a	n/a
5-1/2	(140)	0.61	0.61	0.59	0.55	0.59	0.59	0.54	0.46	0.61	0.55	0.54	0.52	0.50	0.15	0.10	0.05	0.59	0.31	0.20	0.10	0.65	n/a	n/a	n/a
6	(152)	0.62	0.62	0.60	0.56	0.61	0.61	0.56	0.47	0.61	0.55	0.54	0.52	0.57	0.18	0.11	0.06	0.61	0.35	0.23	0.11	0.68	n/a	n/a	n/a
7	(178)	0.63	0.63	0.61	0.57	0.66	0.66	0.60	0.49	0.63	0.56	0.55	0.53	0.72	0.22	0.14	0.07	0.66	0.44	0.29	0.14	0.73	n/a	n/a	n/a
8	(203)	0.65	0.65	0.63	0.58	0.72	0.72	0.64	0.52	0.65	0.57	0.55	0.53	0.88	0.27	0.18	0.09	0.72	0.54	0.35	0.17	0.78	n/a	n/a	n/a
9	(229)	0.67	0.67	0.64	0.59	0.77	0.77	0.68	0.54	0.67	0.58	0.56	0.54	1.00	0.32	0.21	0.10	0.77	0.65	0.42	0.20	0.83	n/a	n/a	n/a
9-7/8	(251)	0.69	0.69	0.66	0.59	0.82	0.82	0.72	0.56	0.69	0.59	0.56	0.54		0.37	0.24	0.12	0.82	0.74	0.48	0.23	0.87	0.59	n/a	n/a
10	(254)	0.69	0.69	0.66	0.60	0.82	0.82	0.73	0.56	0.69	0.59	0.57	0.54		0.38	0.25	0.12	0.82	0.76	0.49	0.24	0.87	0.59	n/a	n/a
11	(279)	0.71	0.71	0.67	0.60	0.88	0.88	0.77	0.59	0.71	0.60	0.57	0.54		0.44	0.28	0.14	0.88	0.87	0.57	0.28	0.92	0.62	n/a	n/a
12	(305)	0.73	0.73	0.69	0.61	0.94	0.94	0.82	0.61	0.73	0.60	0.58	0.55		0.50	0.32	0.16	0.94	0.94	0.65	0.31	0.96	0.65	n/a	n/a
12-1/2	(318)	0.74	0.74	0.70	0.62	0.97	0.97	0.84	0.62	0.74	0.61	0.58	0.55		0.53	0.34	0.17	0.97	0.97	0.69	0.33	0.98	0.66	0.57	n/a
14	(356)	0.77	0.77	0.72	0.63	1.00	1.00	0.91	0.66	0.77	0.62	0.59	0.56		0.63	0.41	0.20	1.00	1.00	0.82	0.40	1.00	0.70	0.61	n/a
16	(406)	0.81	0.81	0.75	0.65			1.00	0.71	0.81	0.64	0.60	0.56		0.77	0.50	0.24			1.00	0.48		0.75	0.65	n/a
18	(457)	0.85	0.85	0.79	0.67				0.76	0.84	0.66	0.62	0.57		0.91	0.59	0.29				0.58		0.79	0.69	n/a
19-1/2	(495)	0.88	0.88	0.81	0.69				0.80	0.87	0.67	0.63	0.58		1.00	0.67	0.32				0.65		0.82	0.71	0.56
20	(508)	0.89	0.89	0.82	0.69				0.82	0.88	0.67	0.63	0.58			0.70	0.34				0.67		0.84	0.72	0.57
22	(559)	0.92	0.92	0.85	0.71				0.87	0.92	0.69	0.64	0.59			0.80	0.39				0.78		0.88	0.76	0.60
24	(610)	0.96	0.96	0.88	0.73				0.93	0.96	0.71	0.66	0.60			0.91	0.44				0.89		0.92	0.79	0.62
26	(660)	1.00	1.00	0.91	0.75				0.99	1.00	0.73	0.67	0.61			1.00	0.50				0.99		0.95	0.82	0.65
28	(711)			0.94	0.77				1.00		0.74	0.68	0.61				0.56				1.00		0.99	0.86	0.67
30	(762)			0.98	0.79						0.76	0.70	0.62				0.62						1.00	0.89	0.70
36	(914)			1.00	0.84						0.81	0.74	0.65				0.81							0.97	0.76
> 48	(1219)				0.96						0.92	0.81	0.69				1.00							1.00	0.88

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 52 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ‖ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	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	n/a	0.38	0.24	0.18	0.10	n/a	n/a	n/a	n/a	0.08	0.02	0.01	0.01	0.15	0.05	0.03	0.01	n/a	n/a	n/a	n/a
2-3/4	(70)	n/a	n/a	n/a	n/a	0.45	0.26	0.19	0.11	n/a	n/a	n/a	n/a	0.15	0.04	0.03	0.01	0.30	0.09	0.06	0.03	n/a	n/a	n/a	n/a
5	(127)	0.58	0.58	0.57	0.54	0.54	0.32	0.23	0.13	0.59	0.54	0.53	0.52	0.37	0.11	0.07	0.03	0.54	0.22	0.14	0.07	n/a	n/a	n/a	n/a
6	(152)	0.60	0.60	0.58	0.55	0.58	0.34	0.25	0.14	0.60	0.55	0.53	0.52	0.48	0.14	0.09	0.04	0.58	0.29	0.19	0.09	n/a	n/a	n/a	n/a
6-1/4	(159)	0.61	0.61	0.59	0.55	0.59	0.35	0.25	0.14	0.61	0.55	0.54	0.52	0.51	0.15	0.10	0.05	0.59	0.30	0.20	0.09	0.65	n/a	n/a	n/a
7	(178)	0.62	0.62	0.60	0.56	0.62	0.37	0.27	0.15	0.62	0.55	0.54	0.52	0.61	0.18	0.12	0.05	0.62	0.36	0.23	0.11	0.69	n/a	n/a	n/a
8	(203)	0.63	0.63	0.61	0.57	0.66	0.40	0.29	0.16	0.64	0.56	0.55	0.53	0.74	0.22	0.14	0.07	0.66	0.40	0.29	0.13	0.74	n/a	n/a	n/a
9	(229)	0.65	0.65	0.63	0.58	0.71	0.43	0.31	0.17	0.65	0.57	0.55	0.53	0.89	0.26	0.17	0.08	0.71	0.43	0.31	0.16	0.78	n/a	n/a	n/a
10	(254)	0.67	0.67	0.64	0.58	0.76	0.46	0.33	0.18	0.67	0.58	0.56	0.53	1.00	0.31	0.20	0.09	0.76	0.46	0.33	0.18	0.83	n/a	n/a	n/a
11	(279)	0.69	0.69	0.65	0.59	0.80	0.49	0.35	0.19	0.69	0.58	0.56	0.54		0.35	0.23	0.11	0.80	0.49	0.35	0.19	0.87	n/a	n/a	n/a
11-1/4	(286)	0.69	0.69	0.66	0.59	0.82	0.50	0.35	0.19	0.69	0.59	0.56	0.54		0.37	0.24	0.11	0.82	0.50	0.35	0.19	0.88	0.58	n/a	n/a
12	(305)	0.70	0.70	0.67	0.60	0.85	0.52	0.37	0.20	0.70	0.59	0.57	0.54		0.40	0.26	0.12	0.85	0.52	0.37	0.20	0.91	0.60	n/a	n/a
13	(330)	0.72	0.72	0.68	0.61	0.90	0.55	0.39	0.22	0.72	0.60	0.57	0.54		0.46	0.30	0.14	0.90	0.55	0.39	0.22	0.94	0.63	n/a	n/a
14	(356)	0.74	0.74	0.69	0.62	0.96	0.59	0.41	0.23	0.74	0.61	0.58	0.55		0.51	0.33	0.15	0.96	0.59	0.41	0.23	0.98	0.65	n/a	n/a
14-1/4	(362)	0.74	0.74	0.70	0.62	0.97	0.60	0.42	0.23	0.74	0.61	0.58	0.55		0.52	0.34	0.16	0.97	0.60	0.42	0.23	0.99	0.66	0.57	n/a
16	(406)	0.77	0.77	0.72	0.63	1.00	0.67	0.47	0.26	0.77	0.62	0.59	0.55		0.62	0.40	0.19	1.00	0.67	0.47	0.26	1.00	0.70	0.60	n/a
18	(457)	0.80	0.80	0.75	0.65		0.76	0.53	0.29	0.81	0.64	0.60	0.56		0.74	0.48	0.22		0.76	0.53	0.29		0.74	0.64	n/a
20	(508)	0.84	0.84	0.78	0.67		0.84	0.58	0.32	0.84	0.65	0.61	0.57		0.87	0.56	0.26		0.84	0.58	0.32		0.78	0.67	n/a
22	(559)	0.87	0.87	0.81	0.68		0.93	0.64	0.35	0.88	0.67	0.63	0.58		1.00	0.65	0.30		0.93	0.64	0.35		0.82	0.71	n/a
22-1/4	(565)	0.87	0.87	0.81	0.69		0.94	0.65	0.36	0.88	0.67	0.63	0.58			0.66	0.31		0.94	0.65	0.36		0.82	0.71	0.55
24	(610)	0.90	0.90	0.83	0.70		1.00	0.70	0.39	0.91	0.68	0.64	0.58			0.74	0.35		1.00	0.70	0.39		0.85	0.74	0.57
26	(660)	0.94	0.94	0.86	0.72			0.76	0.42	0.94	0.70	0.65	0.59			0.84	0.39			0.76	0.42		0.89	0.77	0.60
28	(711)	0.97	0.97	0.89	0.73			0.82	0.45	0.98	0.71	0.66	0.60			0.94	0.43			0.82	0.45		0.92	0.80	0.62
30	(762)	1.00	1.00	0.92	0.75			0.88	0.48	1.00	0.73	0.67	0.60			1.00	0.48			0.88	0.48		0.95	0.83	0.64
36	(914)			1.00	0.80			1.00	0.58		0.77	0.70	0.62				0.63			1.00	0.58		1.00	0.91	0.70
> 48	(1219)				0.90				0.77		0.86	0.77	0.66				0.98				0.77			1.00	0.81

Table 53 - Load adjustment factors for 1-in. diameter threaded rods in cracked concrete[1,2,3]

1-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 and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	9 (229)	12 (305)	20 (508)	4 (102)	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	n/a	0.41	0.41	0.40	0.38	n/a	n/a	n/a	n/a	0.08	0.02	0.01	0.01	0.15	0.05	0.03	0.01	n/a	n/a	n/a	n/a
2-3/4	(70)	n/a	n/a	n/a	n/a	0.45	0.45	0.43	0.40	n/a	n/a	n/a	n/a	0.15	0.04	0.03	0.01	0.30	0.09	0.06	0.03	n/a	n/a	n/a	n/a
5	(127)	0.58	0.58	0.57	0.54	0.54	0.54	0.50	0.44	0.59	0.54	0.53	0.52	0.37	0.11	0.07	0.03	0.54	0.22	0.14	0.07	n/a	n/a	n/a	n/a
6	(152)	0.60	0.60	0.58	0.55	0.58	0.58	0.53	0.46	0.60	0.55	0.53	0.52	0.49	0.14	0.09	0.04	0.58	0.29	0.19	0.09	n/a	n/a	n/a	n/a
6-1/4	(159)	0.61	0.61	0.59	0.55	0.59	0.59	0.54	0.46	0.61	0.55	0.54	0.52	0.52	0.15	0.10	0.05	0.59	0.31	0.20	0.09	0.66	n/a	n/a	n/a
7	(178)	0.62	0.62	0.60	0.56	0.62	0.62	0.57	0.47	0.62	0.55	0.54	0.52	0.61	0.18	0.12	0.05	0.62	0.36	0.24	0.11	0.69	n/a	n/a	n/a
8	(203)	0.63	0.63	0.61	0.57	0.66	0.66	0.60	0.49	0.64	0.56	0.55	0.53	0.75	0.22	0.14	0.07	0.66	0.44	0.29	0.13	0.74	n/a	n/a	n/a
9	(229)	0.65	0.65	0.63	0.58	0.71	0.71	0.64	0.51	0.65	0.57	0.55	0.53	0.89	0.26	0.17	0.08	0.71	0.53	0.34	0.16	0.79	n/a	n/a	n/a
10	(254)	0.67	0.67	0.64	0.58	0.76	0.76	0.67	0.53	0.67	0.58	0.56	0.53	1.00	0.31	0.20	0.09	0.76	0.62	0.40	0.19	0.83	n/a	n/a	n/a
11	(279)	0.69	0.69	0.65	0.59	0.80	0.80	0.71	0.55	0.69	0.58	0.56	0.54		0.36	0.23	0.11	0.80	0.72	0.46	0.22	0.87	n/a	n/a	n/a
11-1/4	(286)	0.69	0.69	0.66	0.59	0.82	0.82	0.72	0.56	0.69	0.59	0.56	0.54		0.37	0.24	0.11	0.82	0.74	0.48	0.22	0.88	0.59	n/a	n/a
12	(305)	0.70	0.70	0.67	0.60	0.85	0.85	0.75	0.57	0.71	0.59	0.57	0.54		0.41	0.26	0.12	0.85	0.82	0.53	0.25	0.91	0.61	n/a	n/a
13	(330)	0.72	0.72	0.68	0.61	0.90	0.90	0.79	0.59	0.72	0.60	0.57	0.54		0.46	0.30	0.14	0.90	0.90	0.60	0.28	0.95	0.63	n/a	n/a
14	(356)	0.74	0.74	0.69	0.62	0.96	0.96	0.83	0.62	0.74	0.61	0.58	0.55		0.51	0.33	0.16	0.96	0.96	0.67	0.31	0.98	0.65	n/a	n/a
14-1/4	(362)	0.74	0.74	0.70	0.62	0.97	0.97	0.84	0.62	0.74	0.61	0.58	0.55		0.53	0.34	0.16	0.97	0.97	0.69	0.32	0.99	0.66	0.57	n/a
16	(406)	0.77	0.77	0.72	0.63	1.00	1.00	0.91	0.66	0.77	0.62	0.59	0.55		0.63	0.41	0.19	1.00	1.00	0.82	0.38	1.00	0.70	0.61	n/a
18	(457)	0.80	0.80	0.75	0.65			1.00	0.70	0.81	0.64	0.60	0.56		0.75	0.49	0.23			0.97	0.45		0.74	0.64	n/a
20	(508)	0.84	0.84	0.78	0.67				0.75	0.84	0.65	0.61	0.57		0.88	0.57	0.26			1.00	0.53		0.78	0.68	n/a
22	(559)	0.87	0.87	0.81	0.68				0.80	0.88	0.67	0.63	0.58		1.00	0.66	0.31				0.61		0.82	0.71	n/a
22-1/4	(565)	0.87	0.87	0.81	0.69				0.80	0.88	0.67	0.63	0.58			0.67	0.31				0.62		0.82	0.71	0.55
24	(610)	0.90	0.90	0.83	0.70				0.85	0.91	0.68	0.64	0.58			0.75	0.35				0.70		0.86	0.74	0.57
26	(660)	0.94	0.94	0.86	0.72				0.90	0.95	0.70	0.65	0.59			0.84	0.39				0.78		0.89	0.77	0.60
28	(711)	0.97	0.97	0.89	0.73				0.95	0.98	0.71	0.66	0.60			0.94	0.44				0.88		0.92	0.80	0.62
30	(762)	1.00	1.00	0.92	0.75				1.00	1.00	0.73	0.67	0.60			1.00	0.49				0.97		0.96	0.83	0.64
36	(914)			1.00	0.80						0.77	0.71	0.62				0.64				1.00		1.00	0.91	0.70
> 48	(1219)				0.90						0.87	0.77	0.66				0.98							1.00	0.81

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 54 - 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: ⊥ Toward edge f_{RV}				Edge distance in shear: ‖ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
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	0.24	0.18	0.10	n/a	n/a	n/a	n/a	0.05	0.02	0.01	0.00	0.11	0.03	0.02	0.01	n/a	n/a	n/a	n/a
3-1/8	(79)	n/a	n/a	n/a	n/a	0.44	0.27	0.20	0.11	n/a	n/a	n/a	n/a	0.13	0.04	0.02	0.01	0.26	0.08	0.05	0.02	n/a	n/a	n/a	n/a
6-1/4	(159)	0.58	0.58	0.57	0.54	0.54	0.33	0.24	0.13	0.59	0.54	0.53	0.52	0.37	0.11	0.07	0.03	0.54	0.22	0.14	0.07	n/a	n/a	n/a	n/a
7	(178)	0.59	0.59	0.58	0.55	0.56	0.35	0.25	0.13	0.60	0.54	0.53	0.52	0.43	0.13	0.08	0.04	0.56	0.26	0.17	0.08	n/a	n/a	n/a	n/a
8	(203)	0.61	0.61	0.59	0.55	0.59	0.37	0.27	0.14	0.61	0.55	0.54	0.52	0.53	0.16	0.10	0.05	0.59	0.31	0.20	0.10	0.66	n/a	n/a	n/a
9	(229)	0.62	0.62	0.60	0.56	0.63	0.39	0.28	0.15	0.62	0.55	0.54	0.52	0.63	0.19	0.12	0.06	0.63	0.38	0.24	0.11	0.70	n/a	n/a	n/a
10	(254)	0.63	0.63	0.61	0.57	0.66	0.41	0.30	0.16	0.64	0.56	0.55	0.53	0.74	0.22	0.14	0.07	0.66	0.41	0.29	0.13	0.74	n/a	n/a	n/a
11	(279)	0.65	0.65	0.62	0.57	0.70	0.44	0.32	0.17	0.65	0.57	0.55	0.53	0.86	0.25	0.16	0.08	0.70	0.44	0.32	0.15	0.78	n/a	n/a	n/a
12	(305)	0.66	0.66	0.63	0.58	0.74	0.46	0.33	0.18	0.66	0.57	0.55	0.53	0.98	0.29	0.19	0.09	0.74	0.46	0.33	0.17	0.81	n/a	n/a	n/a
13	(330)	0.68	0.68	0.64	0.59	0.77	0.49	0.35	0.19	0.68	0.58	0.56	0.54	1.00	0.33	0.21	0.10	0.77	0.49	0.35	0.19	0.84	n/a	n/a	n/a
14	(356)	0.69	0.69	0.66	0.59	0.81	0.52	0.37	0.20	0.69	0.59	0.56	0.54		0.36	0.24	0.11	0.81	0.52	0.37	0.20	0.87	0.58	n/a	n/a
14-1/4	(362)	0.69	0.69	0.66	0.60	0.82	0.52	0.37	0.20	0.69	0.59	0.56	0.54		0.37	0.24	0.11	0.82	0.52	0.37	0.20	0.88	0.59	n/a	n/a
15	(381)	0.70	0.70	0.67	0.60	0.85	0.54	0.39	0.20	0.70	0.59	0.57	0.54		0.40	0.26	0.12	0.85	0.54	0.39	0.20	0.91	0.60	n/a	n/a
16	(406)	0.72	0.72	0.68	0.61	0.89	0.57	0.40	0.21	0.72	0.60	0.57	0.54		0.45	0.29	0.13	0.89	0.57	0.40	0.21	0.94	0.62	n/a	n/a
17	(432)	0.73	0.73	0.69	0.61	0.93	0.60	0.42	0.22	0.73	0.60	0.58	0.55		0.49	0.32	0.15	0.93	0.60	0.42	0.22	0.96	0.64	n/a	n/a
18	(457)	0.74	0.74	0.70	0.62	0.98	0.63	0.44	0.23	0.75	0.61	0.58	0.55		0.53	0.35	0.16	0.98	0.63	0.44	0.23	0.99	0.66	0.57	n/a
20	(508)	0.77	0.77	0.72	0.63	1.00	0.70	0.49	0.26	0.77	0.62	0.59	0.55		0.62	0.40	0.19	1.00	0.70	0.49	0.26	1.00	0.70	0.60	n/a
22	(559)	0.80	0.80	0.74	0.65		0.77	0.54	0.28	0.80	0.63	0.60	0.56		0.72	0.47	0.22		0.77	0.54	0.28		0.73	0.63	n/a
24	(610)	0.82	0.82	0.77	0.66		0.84	0.59	0.31	0.83	0.65	0.61	0.57		0.82	0.53	0.25		0.84	0.59	0.31		0.76	0.66	n/a
26	(660)	0.85	0.85	0.79	0.67		0.91	0.64	0.34	0.86	0.66	0.62	0.57		0.92	0.60	0.28		0.91	0.64	0.34		0.79	0.69	n/a
28	(711)	0.88	0.88	0.81	0.69		0.98	0.68	0.36	0.88	0.67	0.63	0.58		1.00	0.67	0.31		0.98	0.68	0.36		0.82	0.71	0.55
30	(762)	0.90	0.90	0.83	0.70		1.00	0.73	0.39	0.91	0.68	0.64	0.58			0.74	0.35		1.00	0.73	0.39		0.85	0.74	0.57
36	(914)	0.99	0.99	0.90	0.74			0.88	0.47	0.99	0.72	0.66	0.60			0.98	0.45			0.88	0.47		0.94	0.81	0.63
> 48	(1219)	1.00	1.00	1.00	0.82			1.00	0.62	1.00	0.79	0.72	0.63			1.00	0.70			1.00	0.62		1.00	0.94	0.72

Table 55 - Load adjustment factors for 1-1/4-in. diameter threaded rods in cracked concrete[1,2,3]

1-1/4-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: ‖ To and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
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	0.40	0.40	0.39	0.37	n/a	n/a	n/a	n/a	0.05	0.02	0.01	0.00	0.11	0.03	0.02	0.01	n/a	n/a	n/a	n/a
3-1/8	(79)	n/a	n/a	n/a	n/a	0.44	0.44	0.42	0.39	n/a	n/a	n/a	n/a	0.13	0.04	0.03	0.01	0.26	0.08	0.05	0.02	n/a	n/a	n/a	n/a
6-1/4	(159)	0.58	0.58	0.57	0.54	0.54	0.54	0.50	0.44	0.59	0.54	0.53	0.52	0.37	0.11	0.07	0.03	0.54	0.22	0.14	0.07	n/a	n/a	n/a	n/a
7	(178)	0.59	0.59	0.58	0.55	0.56	0.56	0.52	0.45	0.60	0.54	0.53	0.52	0.44	0.13	0.08	0.04	0.56	0.26	0.17	0.08	n/a	n/a	n/a	n/a
8	(203)	0.61	0.61	0.59	0.55	0.59	0.59	0.55	0.46	0.61	0.55	0.54	0.52	0.54	0.16	0.10	0.05	0.59	0.32	0.21	0.10	0.66	n/a	n/a	n/a
9	(229)	0.62	0.62	0.60	0.56	0.63	0.63	0.57	0.48	0.62	0.55	0.54	0.52	0.64	0.19	0.12	0.06	0.63	0.38	0.25	0.11	0.70	n/a	n/a	n/a
10	(254)	0.63	0.63	0.61	0.57	0.66	0.66	0.60	0.49	0.64	0.56	0.55	0.53	0.75	0.22	0.14	0.07	0.66	0.44	0.29	0.13	0.74	n/a	n/a	n/a
11	(279)	0.65	0.65	0.62	0.57	0.70	0.70	0.63	0.51	0.65	0.57	0.55	0.53	0.86	0.26	0.17	0.08	0.70	0.51	0.33	0.15	0.78	n/a	n/a	n/a
12	(305)	0.66	0.66	0.63	0.58	0.74	0.74	0.66	0.53	0.66	0.57	0.55	0.53	0.98	0.29	0.19	0.09	0.74	0.58	0.38	0.18	0.81	n/a	n/a	n/a
13	(330)	0.68	0.68	0.64	0.59	0.77	0.77	0.69	0.54	0.68	0.58	0.56	0.54	1.00	0.33	0.21	0.10	0.77	0.66	0.43	0.20	0.85	n/a	n/a	n/a
14	(356)	0.69	0.69	0.66	0.59	0.81	0.81	0.72	0.56	0.69	0.59	0.56	0.54		0.37	0.24	0.11	0.81	0.73	0.48	0.22	0.88	0.58	n/a	n/a
14-1/4	(362)	0.69	0.69	0.66	0.60	0.82	0.82	0.73	0.56	0.70	0.59	0.57	0.54		0.38	0.25	0.11	0.82	0.75	0.49	0.23	0.89	0.59	n/a	n/a
15	(381)	0.70	0.70	0.67	0.60	0.85	0.85	0.75	0.57	0.71	0.59	0.57	0.54		0.41	0.26	0.12	0.85	0.82	0.53	0.25	0.91	0.61	n/a	n/a
16	(406)	0.72	0.72	0.68	0.61	0.89	0.89	0.78	0.59	0.72	0.60	0.57	0.54		0.45	0.29	0.14	0.89	0.89	0.58	0.27	0.94	0.63	n/a	n/a
17	(432)	0.73	0.73	0.69	0.61	0.93	0.93	0.81	0.61	0.73	0.60	0.58	0.55		0.49	0.32	0.15	0.93	0.93	0.64	0.30	0.97	0.64	n/a	n/a
18	(457)	0.74	0.74	0.70	0.62	0.98	0.98	0.85	0.62	0.75	0.61	0.58	0.55		0.54	0.35	0.16	0.98	0.98	0.70	0.32	0.99	0.66	0.57	n/a
20	(508)	0.77	0.77	0.72	0.63	1.00	1.00	0.91	0.66	0.77	0.62	0.59	0.55		0.63	0.41	0.19	1.00	1.00	0.82	0.38	1.00	0.70	0.61	n/a
22	(559)	0.80	0.80	0.74	0.65			0.98	0.69	0.80	0.63	0.60	0.56		0.72	0.47	0.22			0.94	0.44		0.73	0.63	n/a
24	(610)	0.82	0.82	0.77	0.66			1.00	0.73	0.83	0.65	0.61	0.57		0.82	0.54	0.25			1.00	0.50		0.77	0.66	n/a
26	(660)	0.85	0.85	0.79	0.67				0.77	0.86	0.66	0.62	0.57		0.93	0.60	0.28				0.56		0.80	0.69	n/a
28	(711)	0.88	0.88	0.81	0.69				0.81	0.88	0.67	0.63	0.58		1.00	0.68	0.31				0.63		0.83	0.72	0.55
30	(762)	0.90	0.90	0.83	0.70				0.85	0.91	0.68	0.64	0.58			0.75	0.35				0.70		0.86	0.74	0.57
36	(914)	0.99	0.99	0.90	0.74				0.97	0.99	0.72	0.66	0.60			0.98	0.46				0.91		0.94	0.81	0.63
> 48	(1219)	1.00	1.00	1.00	0.82				1.00	1.00	0.79	0.72	0.63			1.00	0.70				1.00		1.00	0.94	0.73

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.

HIT-HY 200 with HIS-N Inserts

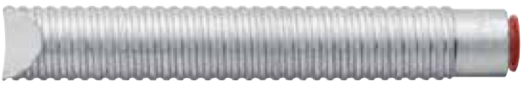


Figure 12 - Hilti HIS-N and HIS-RN internally threaded insert installation conditions

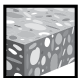
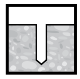
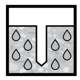
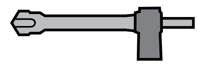
Permissible concrete conditions					Permissible Drilling Method		
		Uncracked concrete		Dry concrete			Hammer drilling with carbide tipped drill bit
		Cracked concrete		Water saturated concrete			Hilti TE-CD or TE-YD Hollow Drill Bit

Table 56 - Hilti HIS-N and HIS-RN 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)	6-3/4 (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)
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)

Figure 13 - Hilti HIS-N and HIS-RN specifications

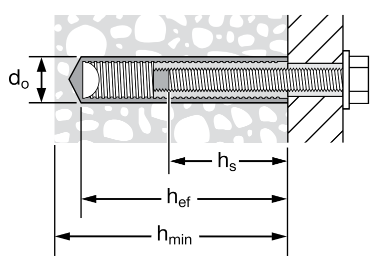


Table 57 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete [1,2,3,4,5,6,7,8,9]

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)	7,140 (31.8)	7,820 (34.8)	9,030 (40.2)	11,060 (49.2)	15,375 (68.4)	16,840 (74.9)	19,445 (86.5)	23,815 (105.9)
1/2-13 UNC	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)
5/8-11 UNC	6-3/4 (171)	13,680 (60.9)	14,985 (66.7)	17,305 (77.0)	21,190 (94.3)	29,460 (131.0)	32,275 (143.6)	37,265 (165.8)	45,645 (203.0)
3/4-10 UNC	8-1/8 (206)	18,065 (80.4)	19,790 (88.0)	22,850 (101.6)	27,985 (124.5)	38,910 (173.1)	42,620 (189.6)	49,215 (218.9)	60,275 (268.1)

Table 58 - Hilti HIT-HY 200 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)	5,050 (22.5)	5,335 (23.7)	5,815 (25.9)	6,570 (29.2)	10,880 (48.4)	11,495 (51.1)	12,530 (55.7)	14,150 (62.9)
1/2-13 UNC	5 (127)	6,175 (27.5)	6,765 (30.1)	7,815 (34.8)	9,570 (42.6)	13,305 (59.2)	14,575 (64.8)	16,830 (74.9)	20,610 (91.7)
5/8-11 UNC	6-3/4 (171)	9,690 (43.1)	10,615 (47.2)	12,255 (54.5)	15,010 (66.8)	20,870 (92.8)	22,860 (101.7)	26,395 (117.4)	32,330 (143.8)
3/4-10 UNC	8-1/8 (206)	12,795 (56.9)	14,015 (62.3)	16,185 (72.0)	19,825 (88.2)	27,560 (122.6)	30,190 (134.3)	34,860 (155.1)	42,695 (189.9)

3.2.2

1 See section 3.1.8 for explanation on development of load values.
2 See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 60 - 61 as necessary to the above values. Compare to the steel values in table 59. 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).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 110° F (43° C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above values by 0.78.
Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength (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 design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.69.
See section 3.1.8 for additional information on seismic applications.

Table 59 - Steel design strength for steel bolt and 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)	Seismic Shear[6] $\phi V_{sa,eq}$ lb (kN)	Tensile[4] ϕN_{sa} lb (kN)	Shear[5] ϕV_{sa} lb (kN)	Seismic Shear[6] $\phi V_{sa,eq}$ lb (kN)
3/8-16 UNC	6,300 (28.0)	3,490 (15.5)	2,445 (10.9)	5,540 (24.6)	3,070 (13.7)	2,150 (9.6)
1/2-13 UNC	11,530 (51.3)	6,385 (28.4)	4,470 (19.9)	10,145 (45.1)	5,620 (25.0)	3,935 (17.5)
5/8-11 UNC	18,365 (81.7)	10,170 (45.2)	7,120 (31.6)	16,160 (71.9)	8,950 (39.8)	6,265 (27.9)
3/4-10 UNC	27,180 (120.9)	15,055 (67.0)	10,540 (46.9)	23,915 (106.4)	13,245 (58.9)	9,270 (41.2)

1 See section 3.1.8 to convert design strength (factored resistance) 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 values determined by static shear tests with $\phi V_{sa} \leq \phi$ 0.60 $A_{se,V} f_{uta}$ as noted in ACI 318-14 Chapter 17.
6 Seismic Shear = $\alpha_{V,seis}\ \phi_{Vsa}$: Reduction for seismic shear only. See section 3.1.8 for additional information on seismic applications.

Table 60 - Load adjustment Factors for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete[1,2,3]

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 and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Thread Size	in.	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4
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)	0.59	n/a	n/a	n/a	0.36	n/a	n/a	n/a	0.55	n/a	n/a	n/a	0.15	n/a	n/a	n/a	0.31	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	(102)	0.61	0.59	n/a	n/a	0.41	0.40	n/a	n/a	0.56	0.55	n/a	n/a	0.21	0.19	n/a	n/a	0.41	0.38	n/a	n/a	n/a	n/a	n/a	n/a
5	(127)	0.64	0.61	0.59	n/a	0.47	0.45	0.39	n/a	0.57	0.57	0.55	n/a	0.29	0.26	0.17	n/a	0.47	0.45	0.33	n/a	n/a	n/a	n/a	n/a
5-1/2	(140)	0.65	0.62	0.60	0.59	0.50	0.48	0.41	0.37	0.58	0.58	0.56	0.55	0.34	0.30	0.19	0.15	0.50	0.48	0.39	0.29	n/a	n/a	n/a	n/a
6	(152)	0.67	0.63	0.61	0.60	0.53	0.51	0.43	0.39	0.59	0.58	0.56	0.55	0.39	0.35	0.22	0.17	0.53	0.51	0.43	0.33	0.60	n/a	n/a	n/a
7	(178)	0.69	0.66	0.63	0.62	0.61	0.57	0.48	0.42	0.60	0.60	0.57	0.56	0.49	0.43	0.28	0.21	0.61	0.57	0.48	0.42	0.64	0.62	n/a	n/a
8	(203)	0.72	0.68	0.64	0.63	0.70	0.65	0.52	0.45	0.62	0.61	0.58	0.57	0.60	0.53	0.34	0.26	0.70	0.65	0.52	0.45	0.69	0.66	n/a	n/a
9	(229)	0.75	0.70	0.66	0.65	0.78	0.73	0.57	0.49	0.63	0.62	0.59	0.58	0.71	0.63	0.40	0.31	0.78	0.73	0.57	0.49	0.73	0.70	n/a	n/a
10	(254)	0.78	0.72	0.68	0.66	0.87	0.81	0.62	0.53	0.65	0.64	0.60	0.58	0.83	0.74	0.47	0.36	0.87	0.81	0.62	0.53	0.77	0.74	0.64	n/a
11	(279)	0.80	0.74	0.70	0.68	0.96	0.89	0.68	0.56	0.66	0.65	0.61	0.59	0.96	0.86	0.55	0.41	0.96	0.89	0.68	0.56	0.81	0.78	0.67	0.61
12	(305)	0.83	0.77	0.72	0.70	1.00	0.97	0.74	0.60	0.68	0.66	0.62	0.60	1.00	0.98	0.62	0.47	1.00	0.97	0.74	0.60	0.84	0.81	0.70	0.64
14	(356)	0.89	0.81	0.75	0.73		1.00	0.86	0.70	0.71	0.69	0.64	0.62		1.00	0.78	0.59		1.00	0.86	0.70	0.91	0.87	0.75	0.69
16	(406)	0.94	0.86	0.79	0.76			0.98	0.80	0.74	0.72	0.66	0.63			0.96	0.73			0.98	0.80	0.97	0.94	0.80	0.73
18	(457)	1.00	0.90	0.82	0.80			1.00	0.90	0.77	0.75	0.68	0.65			1.00	0.87			1.00	0.90	1.00	0.99	0.85	0.78
24	(610)		1.00	0.93	0.90				1.00	0.85	0.83	0.74	0.70				1.00				1.00		1.00	0.99	0.90
30	(762)			1.00	0.99					0.94	0.91	0.80	0.75											1.00	1.00
36	(914)				1.00					1.00	0.99	0.86	0.80												1.00
> 48	(1219)										1.00	0.99	0.90												

Table 61 - Load adjustment factors for Hilti HIS-N and HIS-RN internally threaded inserts in cracked concrete[1,2,3]

HIS-N and HIS-RN all diameters 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 and away from edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Thread Size	in.	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4
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)	0.59	n/a	n/a	n/a	0.55	n/a	n/a	n/a	0.55	n/a	n/a	n/a	0.16	n/a	n/a	n/a	0.31	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	(102)	0.61	0.59	n/a	n/a	0.60	0.55	n/a	n/a	0.56	0.55	n/a	n/a	0.21	0.19	n/a	n/a	0.43	0.38	n/a	n/a	n/a	n/a	n/a	n/a
5	(127)	0.64	0.61	0.59	n/a	0.67	0.60	0.55	n/a	0.57	0.57	0.55	n/a	0.30	0.26	0.17	n/a	0.59	0.53	0.34	n/a	n/a	n/a	n/a	n/a
5-1/2	(140)	0.65	0.62	0.60	0.59	0.71	0.63	0.57	0.55	0.58	0.58	0.56	0.55	0.34	0.31	0.19	0.15	0.69	0.61	0.39	0.29	n/a	n/a	n/a	n/a
6	(152)	0.67	0.63	0.61	0.60	0.75	0.66	0.59	0.57	0.59	0.58	0.56	0.55	0.39	0.35	0.22	0.17	0.75	0.66	0.44	0.34	0.60	n/a	n/a	n/a
7	(178)	0.69	0.66	0.63	0.62	0.83	0.72	0.64	0.61	0.60	0.60	0.57	0.56	0.49	0.44	0.28	0.21	0.83	0.72	0.56	0.42	0.64	0.62	n/a	n/a
8	(203)	0.72	0.68	0.64	0.63	0.91	0.78	0.69	0.66	0.62	0.61	0.58	0.57	0.60	0.54	0.34	0.26	0.91	0.78	0.68	0.52	0.69	0.66	n/a	n/a
9	(229)	0.75	0.70	0.66	0.65	1.00	0.85	0.74	0.70	0.63	0.62	0.59	0.58	0.72	0.64	0.41	0.31	1.00	0.85	0.74	0.62	0.73	0.70	n/a	n/a
10	(254)	0.78	0.72	0.68	0.66		0.91	0.79	0.75	0.65	0.64	0.60	0.58	0.84	0.75	0.48	0.36		0.91	0.79	0.72	0.77	0.74	0.64	n/a
11	(279)	0.80	0.74	0.70	0.68		0.98	0.84	0.79	0.66	0.65	0.61	0.59	0.97	0.86	0.55	0.42		0.98	0.84	0.79	0.81	0.78	0.67	0.61
12	(305)	0.83	0.77	0.72	0.70		1.00	0.89	0.84	0.68	0.66	0.62	0.60	1.00	0.98	0.63	0.48		1.00	0.89	0.84	0.84	0.81	0.70	0.64
14	(356)	0.89	0.81	0.75	0.73			1.00	0.94	0.71	0.69	0.64	0.62		1.00	0.79	0.60			1.00	0.94	0.91	0.88	0.76	0.69
16	(406)	0.94	0.86	0.79	0.76				1.00	0.74	0.72	0.66	0.64			0.97	0.73				1.00	0.97	0.94	0.81	0.74
18	(457)	1.00	0.90	0.82	0.80					0.77	0.75	0.68	0.65			1.00	0.87					1.00	0.99	0.86	0.78
24	(610)		1.00	0.93	0.90					0.86	0.83	0.74	0.70				1.00						1.00	0.99	0.90
30	(762)			1.00	0.99					0.95	0.91	0.81	0.75											1.00	1.00
36	(914)				1.00					1.00	0.99	0.87	0.80												
> 48	(1219)										1.00	0.99	0.91												

1 Linear interpolation not permitted
2 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.
3 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 $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{HV} = 1.0$.

DESIGN DATA IN CONCRETE PER CSA A23.

CSA A23.3-14 Annex D 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 the published loads in ICC Evaluation Services ESR-3187 and ELC-3187. 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. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.com.

Table 62 - Steel factored resistance for Hilti HIT-Z and HIT-Z-R anchor rods[1]

Nominal anchor diameter in.	HIT-Z Carbon Steel Rod[2]			HIT-Z-R Stainless Steel Rod[2]		
	Tensile N_{sar} [3] lb (kN)	Shear V_{sar} [4] lb (kN)	Seismic shear $V_{sar,eq}$ [5] lb (kN)	Tensile N_{sar} [3] lb (kN)	Shear V_{sar} [4] lb (kN)	Seismic shear $V_{sar,eq}$ [5] lb (kN)
3/8	4,345 (19.3)	1,775 (7.9)	1,775 (7.9)	4,345 (19.3)	2,420 (10.8)	2,420 (10.8)
1/2	7,960 (35.4)	3,250 (14.5)	2,115 (9.4)	7,960 (35.4)	4,435 (19.7)	3,325 (14.8)
5/8	12,675 (56.4)	5,180 (23.0)	3,365 (15.0)	12,675 (56.4)	7,065 (31.4)	4,590 (20.4)
3/4	18,725 (83.3)	7,650 (34.0)	4,975 (22.1)	18,725 (83.3)	10,435 (46.4)	6,785 (30.2)

1 See section 3.1.8 to convert design strength value to ASD value.
2 HIT-Z and HIT-Z-R anchor rods are considered brittle steel elements.
3 Tensile = $A_{se,N}\ \phi_s\ f_{uta}$ R as noted in CSA A23.3-14 Annex D.
4 Shear values determined by static shear tests with $V_{sar} \leq A_{se,V}\ \phi_s\ 0.60\ f_{uta}$ R as noted in CSA A23.3-14 Annex D.
5 Seismic Shear = $\alpha_{V,seis}\ V_{sar}$: Reduction factor for seismic shear only. See section 3.1.8 for additional information on seismic applications.

HIT-HY 200 Adhesive with Hilti HIT-Z anchor rods

Table 63 - Hilti HIT-HY 200 design information with Hilti HIT-Z and HIT-R-Z anchor rods in hammer drilled holes or diamond core drilled holes in accordance with CSA A23.3-14[1]

	Design parameter	Symbol	Units	Nominal rod diameter (in.)				Ref
				3/8	1/2	5/8	3/4	A23.3-14
	Nominal anchor diameter	d_a	mm	9.5	12.7	15.9	19.1	
	Effective minimum embedment[2]	h_{ef}	mm	60	70	95	102	
	Effective maximum embedment[2]	h_{ef}	mm	114	152	190	216	
	Minimum concrete thickness[3]	h_{min}	mm	See tables 6 to 9 of this section or table 8 of ESR-3187				
	Critical edge distance	c_{ac}	–	See section 4.1.10.1 of ESR-3187				
	Minimum edge distance[4]	c_{ac}	–	See tables 6 to 9 of this section or table 8 of ESR-3187				
	Minimum anchor spacing[4]	s_{min}	–					
	Coeff. for factored concrete breakout resistance, uncracked concrete	$k_{c,uncr}$[5]	–	10				D.6.2.2
	Coeff. for factored concrete breakout resistance, cracked concrete	$k_{c,cr}$[5]	–	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[7]	Characteristic pullout resistance in cracked concrete	$N_{p,cr}$	lb (kN)	7,952 (35.4)	10,936 (48.6)	21,391 (95.2)	27,930 (124.2)	D.6.3.1
Temp range A[7]	Characteristic pullout resistance in uncracked concrete	$N_{p,uncr}$	lb (kN)	7,952 (35.4)	11,719 (52.1)	21,391 (95.2)	28,460 (126.6)	D.6.3.1
Temp range B[7]	Characteristic pullout resistance in cracked concrete	$N_{p,cr}$	lb (kN)	7,952 (35.4)	10,936 (48.6)	21,391 (95.2)	27,930 (124.2)	D.6.3.1
Temp range B[7]	Characteristic pullout resistance in uncracked concrete	$N_{p,uncr}$	lb (kN)	7,952 (35.4)	11,719 (52.1)	21,391 (95.2)	28,460 (126.6)	D.6.3.1
Temp range C[7]	Characteristic pullout resistance in cracked concrete	$N_{p,cr}$	lb (kN)	7,182 (31.9)	9,877 (43.9)	19,321 (85.9)	25,277 (112.4)	D.6.3.1
Temp range C[7]	Characteristic pullout resistance in uncracked concrete	$N_{p,uncr}$	lb (kN)	7,182 (31.9)	10,585 (47.1)	19,321 (85.9)	25,705 (114.3)	D.6.3.1
	Reduction for seismic tension	$\alpha_{N,seis}$	–	0.94	1.0			
Permissible installation conditions	Resistance modification factor tension and shear, pullout failure dry concrete	Anchor category	–	1				D.5.3 (c)
Permissible installation conditions		R_{dry}	–	1.00				
Permissible installation conditions	Resistance modification factor tension and shear, pullout failure water-saturated concrete	Anchor category	–	1				D.5.3 (c)
Permissible installation conditions		R_{ws}	–	1.00				

1 Design information in this table is taken from ICC-ES ESR-3187, dated April 2019, tables 8 and 10, and converted for use with CSA A23.3-14 Annex D.
2 See figure 2 of this section.
3 See figure 5 of this section.
4 See figure 6 of this section.
5 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.
6 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.
7 Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°C).
Temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C).
Temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°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.

Table 64 - Hilti HIT-HY 200 adhesive factored resistance with concrete/pullout failure for Hilti HIT-Z and HIT-Z-R anchor rods in uncracked concrete[1,2,3,4,5,6,7,8,9,10]

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)	3,060 (13.6)	3,425 (15.2)	3,750 (16.7)	4,330 (19.3)	3,060 (13.6)	3,425 (15.2)	3,750 (16.7)	4,330 (19.3)
	3-3/8 (86)	5,175 (23.0)	5,175 (23.0)	5,175 (23.0)	5,175 (23.0)	10,375 (46.1)	11,600 (51.6)	12,705 (56.5)	14,670 (65.3)
	4-1/2 (114)	5,175 (23.0)	5,175 (23.0)	5,175 (23.0)	5,175 (23.0)	15,970 (71.0)	17,855 (79.4)	19,560 (87.0)	22,585 (100.5)
1/2	2-3/4 (70)	3,815 (17.0)	4,265 (19.0)	4,670 (20.8)	5,395 (24.0)	7,630 (33.9)	8,530 (37.9)	9,345 (41.6)	10,790 (48.0)
	4-1/2 (114)	7,615 (33.9)	7,615 (33.9)	7,615 (33.9)	7,615 (33.9)	15,970 (71.0)	17,855 (79.4)	19,560 (87.0)	22,585 (100.5)
	6 (152)	7,615 (33.9)	7,615 (33.9)	7,615 (33.9)	7,615 (33.9)	24,590 (109.4)	27,490 (122.3)	30,115 (134.0)	34,775 (154.7)
5/8	3-3/4 (95)	6,075 (27.0)	6,790 (30.2)	7,440 (33.1)	8,590 (38.2)	12,150 (54.0)	13,585 (60.4)	14,880 (66.2)	17,185 (76.4)
	5-5/8 (143)	11,160 (49.6)	12,480 (55.5)	13,670 (60.8)	13,895 (61.8)	22,320 (99.3)	24,955 (111.0)	27,335 (121.6)	31,565 (140.4)
	7-1/2 (191)	13,895 (61.8)	13,895 (61.8)	13,895 (61.8)	13,895 (61.8)	34,365 (152.9)	38,420 (170.9)	42,090 (187.2)	48,600 (216.2)
3/4	4 (102)	6,690 (29.8)	7,480 (33.3)	8,195 (36.5)	9,465 (42.1)	13,385 (59.5)	14,965 (66.6)	16,395 (72.9)	18,930 (84.2)
	6-3/4 (171)	14,670 (65.3)	16,400 (73.0)	17,970 (79.9)	18,500 (82.3)	29,340 (130.5)	32,805 (145.9)	35,935 (159.8)	41,495 (184.6)
	8-1/2 (216)	18,500 (82.3)	18,500 (82.3)	18,500 (82.3)	18,500 (82.3)	41,460 (184.4)	46,355 (206.2)	50,780 (225.9)	58,635 (260.8)

Table 65 - Hilti HIT-HY 200 adhesive factored resistance with concrete/pullout failure for Hilti HIT-Z and HIT-Z-R anchor rods in cracked concrete[1,2,3,4,5,6,7,8,9,10]

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)	2,145 (9.5)	2,395 (10.7)	2,625 (11.7)	3,030 (13.5)	2,145 (9.5)	2,395 (10.7)	2,625 (11.7)	3,030 (13.5)
	3-3/8 (86)	3,630 (16.2)	4,060 (18.1)	4,445 (19.8)	5,135 (22.8)	7,260 (32.3)	8,120 (36.1)	8,895 (39.6)	10,270 (45.7)
	4-1/2 (114)	5,175 (23.0)	5,175 (23.0)	5,175 (23.0)	5,175 (23.0)	11,180 (49.7)	12,500 (55.6)	13,695 (60.9)	15,810 (70.3)
1/2	2-3/4 (70)	2,670 (11.9)	2,985 (13.3)	3,270 (14.5)	3,775 (16.8)	5,340 (23.8)	5,970 (26.6)	6,540 (29.1)	7,555 (33.6)
	4-1/2 (114)	5,590 (24.9)	6,250 (27.8)	6,845 (30.5)	7,100 (31.6)	11,180 (49.7)	12,500 (55.6)	13,695 (60.9)	15,810 (70.3)
	6 (152)	7,100 (31.6)	7,100 (31.6)	7,100 (31.6)	7,100 (31.6)	17,215 (76.6)	19,245 (85.6)	21,080 (93.8)	24,340 (108.3)
5/8	3-3/4 (95)	4,250 (18.9)	4,755 (21.1)	5,210 (23.2)	6,015 (26.8)	8,505 (37.8)	9,510 (42.3)	10,415 (46.3)	12,030 (53.5)
	5-5/8 (143)	7,810 (34.8)	8,735 (38.9)	9,570 (42.6)	11,050 (49.1)	15,625 (69.5)	17,470 (77.7)	19,135 (85.1)	22,095 (98.3)
	7-1/2 (191)	12,030 (53.5)	13,445 (59.8)	13,895 (61.8)	13,895 (61.8)	24,055 (107.0)	26,895 (119.6)	29,460 (131.1)	34,020 (151.3)
3/4	4 (102)	4,685 (20.8)	5,240 (23.3)	5,740 (25.5)	6,625 (29.5)	9,370 (41.7)	10,475 (46.6)	11,475 (51.0)	13,250 (58.9)
	6-3/4 (171)	10,270 (45.7)	11,480 (51.1)	12,575 (55.9)	14,525 (64.6)	20,540 (91.4)	22,965 (102.1)	25,155 (111.9)	29,045 (129.2)
	8-1/2 (216)	14,510 (64.6)	16,225 (72.2)	17,775 (79.1)	18,150 (80.7)	29,025 (129.1)	32,450 (144.3)	35,545 (158.1)	41,045 (182.6)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 10 - 17 as necessary to the above values. Compare to the steel values in table 62. 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). For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C) multiply above values by 1.00. For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above values by 0.90. 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 and water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength (factored resistance) by 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 design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension only by the following reduction factors:
3/8-in diameter - $\alpha_{N,seis}$ = 0.705   1/2-in to 3/4-in diameter - $\alpha_{N,seis}$ = 0.75
See section 3.1.8 for additional information on seismic applications.
10 Hilti HIT-Z(-R) rods may be installed in diamond cored holes with no reduction in published data above.

HIT-HY 200 Adhesive with Deformed Reinforcing Bars (Rebar)

Table 66 - Steel factored resistance for CA rebar[1]

Rebar size	CSA-G30.18 Grade 400[2]		
	Tensile N_{sar} [3] lb (kN)	Shear V_{sar} [4] lb (kN)	Seismic shear $V_{sar,eq}$ [5] lb (kN)
10M	7,245 (32.2)	4,035 (17.9)	2,825 (12.6)
15M	14,525 (64.6)	8,090 (36.0)	5,665 (25.2)
20M	21,570 (95.9)	12,020 (53.5)	8,415 (37.4)
25M	36,025 (160.2)	20,070 (89.3)	14,050 (62.5)
30M	50,715 (225.6)	28,255 (125.7)	19,780 (88.0)

1 See section 3.1.8 to convert design strength value to ASD value.
2 CSA-G30.18 Grade 400 rebar are considered ductile steel elements.
3 Tensile = $A_{se,N}\ \phi_s\ f_{uta}$ 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.
5 Seismic Shear = $\alpha_{V,seis}\ V_{sar}$: Reduction factor for seismic shear only. See CSA A23.3-14 Annex D for additional information on seismic applications.

Table 67 - Specifications for CA rebar installed with Hilti HIT-HY 200 adhesive

Setting information		Symbol	Units	Rebar size				
				10M	15M	20M	25M	30M
Nominal bit size		d_o	in.	9/16	3/4	1	1-1/4	1-1/2
Effective embedment	minimum	$h_{ef,min}$	mm	70	80	90	101	120
	maximum	$h_{ef,max}$	mm	226	320	390	504	598
Minimum concrete member thickness		h_{min}	mm	h_{ef} + 30	$h_{ef} + 2d_o$			

Note: The installation specifications in table 67 above and the data in tables 66 through 80 pertain to the use of Hilti HIT-HY 200 with rebar designed as a post-installed anchor using the provisions of CSA A23.3-14 Annex D. For the use of Hilti HIT-HY 200 with rebar for typical development calculations according to CSA A23.3-14 Chapter 12, refer to section 3.1.8 for the design method and tables 94 through 98 at the end of this section.

Table 68 - Hilti HIT-HY 200 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 10M	15M	20M	25M	30M	Ref A23.3-14
Rebar diameter		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}	–	$2h_{ef}$					
Minimum edge distance		c_{min}[3]	mm	57	80	98	126	150	
Minimum rebar spacing		s_{min}	mm	57	80	98	126	150	
Coeff. for factored conc. breakout resistance, uncracked concrete		$k_{c,uncr}$[4]	–	10					D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete		$k_{c,cr}$[4]	–	7					D.6.2.2
Concrete material resistance factor		$A_{se,N}$	–	0.65					8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B[5]		ϕ_s	–	1.00					D.5.3(c)
Temp range A[6]	Characteristic bond stress in cracked concrete[7]	τ_{cr}	psi (MPa)	1,075 (7.4)	1,085 (7.5)	1,095 (7.6)	840 (5.8)	850 (5.9)	D.6.5.2
	Characteristic bond stress in uncracked concrete[7]	τ_{uncr}	psi (MPa)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	D.6.5.2
Temp range B[6]	Characteristic bond stress in cracked concrete[7]	τ_{cr}	psi (MPa)	990 (6.8)	995 (6.9)	1,005 (6.9)	775 (5.3)	780 (5.4)	D.6.5.2
	Characteristic bond stress in uncracked concrete[7]	τ_{uncr}	psi (MPa)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	D.6.5.2
Temp range C[6]	Characteristic bond stress in cracked concrete[7]	τ_{cr}	psi (MPa)	845 (5.8)	850 (5.9)	860 (5.9)	660 (4.6)	670 (4.6)	D.6.5.2
	Characteristic bond stress in uncracked concrete[7]	τ_{uncr}	psi (MPa)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	D.6.5.2
Reduction for seismic tension		$\alpha_{N,seis}$	–	0.80			0.85	0.97	
Permissible installation conditions[5]	Resistance modification factor tension & shear, bond failure dry concrete	Anchor category	–	1					D.5.3 (c)
		R_{dry}	–	1.00					
	Resistance modification factor tension & shear, bond failure water-saturated concrete	Anchor category	–	2					D.5.3 (c)
		R_{dry}	–	0.85					

1 Design information in this table is taken from ELC-3187, dated April 2019, tables 16 and 17, for use with CSA A23.3-14 Annex D.
2 See figure 8 of this section.
3 Minimum edge distance may be reduced to 45mm provided rebar remains untorqued. See ELC-3187 Installation Torque Subject to Edge Distance section.
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).
Temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C).
Temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°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: $(f'_c / 17.2)^{0.1}$].

3.2.2

Table 69 - Hilti HIT-HY 200 adhesive factored resistance with concrete/bond failure for CA rebar in uncracked concrete[1,2,3,4,5,6,7,8,9]

Rebar size	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)
10M	4-1/2 (115)	6,515 (29.0)	6,665 (29.6)	6,785 (30.2)	6,985 (31.1)	13,030 (58.0)	13,325 (59.3)	13,570 (60.4)	13,965 (62.1)
	7-1/16 (180)	10,200 (45.4)	10,430 (46.4)	10,620 (47.2)	10,930 (48.6)	20,395 (90.7)	20,855 (92.8)	21,240 (94.5)	21,860 (97.2)
	8-7/8 (226)	12,805 (57.0)	13,095 (58.2)	13,335 (59.3)	13,725 (61.0)	25,610 (113.9)	26,185 (116.5)	26,670 (118.6)	27,450 (122.1)
15M	5-11/16 (145)	11,410 (50.8)	11,895 (52.9)	12,115 (53.9)	12,465 (55.5)	22,820 (101.5)	23,790 (105.8)	24,230 (107.8)	24,935 (110.9)
	9-13/16 (250)	20,055 (89.2)	20,510 (91.2)	20,885 (92.9)	21,495 (95.6)	40,110 (178.4)	41,015 (182.5)	41,770 (185.8)	42,990 (191.2)
	12-5/8 (320)	25,670 (114.2)	26,250 (116.8)	26,735 (118.9)	27,515 (122.4)	51,345 (228.4)	52,500 (233.5)	53,470 (237.8)	55,030 (244.8)
20M	7-7/8 (200)	18,485 (82.2)	19,995 (88.9)	20,365 (90.6)	20,960 (93.2)	36,965 (164.4)	39,990 (177.9)	40,730 (181.2)	41,915 (186.5)
	14 (355)	34,710 (154.4)	35,495 (157.9)	36,145 (160.8)	37,200 (165.5)	69,420 (308.8)	70,985 (315.8)	72,290 (321.6)	74,400 (331.0)
	15-3/8 (390)	38,130 (169.6)	38,990 (173.4)	39,710 (176.6)	40,870 (181.8)	76,265 (339.2)	77,985 (346.9)	79,420 (353.3)	81,735 (363.6)
25M	9-1/16 (230)	22,795 (101.4)	25,485 (113.4)	27,920 (124.2)	31,145 (138.5)	45,590 (202.8)	50,970 (226.7)	55,835 (248.4)	62,295 (277.1)
	15-15/16 (405)	51,175 (227.6)	52,330 (232.8)	53,290 (237.0)	54,845 (244.0)	102,345 (455.3)	104,655 (465.5)	106,580 (474.1)	109,690 (487.9)
	19-13/16 (504)	63,680 (283.3)	65,120 (289.7)	66,315 (295.0)	68,255 (303.6)	127,365 (566.5)	130,240 (579.3)	132,635 (590.0)	136,505 (607.2)
30M	10-1/4 (260)	27,395 (121.9)	30,630 (136.3)	33,555 (149.3)	38,745 (172.3)	54,795 (243.7)	61,260 (272.5)	67,110 (298.5)	77,490 (344.7)
	17-15/16 (455)	63,425 (282.1)	69,750 (310.3)	71,035 (316.0)	73,110 (325.2)	126,850 (564.3)	139,505 (620.5)	142,070 (632.0)	146,220 (650.4)
	23-9/16 (598)	89,650 (398.8)	91,675 (407.8)	93,360 (415.3)	96,085 (427.4)	179,305 (797.6)	183,350 (815.6)	186,725 (830.6)	192,170 (854.8)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 71 - 80 as necessary to the above values. Compare to the steel values in table 66. 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). For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C) multiply above values by 0.92. For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above values by 0.78. Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.

Table 70 - Hilti HIT-HY 200 adhesive factored resistance with concrete/bond failure for CA rebar in cracked concrete[1,2,3,4,5,6,7,8,9]

Rebar size	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)
10M	4-1/2 (115)	4,490 (20.0)	4,590 (20.4)	4,675 (20.8)	4,810 (21.4)	8,980 (39.9)	9,185 (40.8)	9,350 (41.6)	9,625 (42.8)
	7-1/16 (180)	7,030 (31.3)	7,185 (32.0)	7,320 (32.6)	7,530 (33.5)	14,055 (62.5)	14,375 (63.9)	14,635 (65.1)	15,065 (67.0)
	8-7/8 (226)	8,825 (39.3)	9,025 (40.1)	9,190 (40.9)	9,455 (42.1)	17,650 (78.5)	18,045 (80.3)	18,380 (81.7)	18,915 (84.1)
15M	5-11/16 (145)	7,985 (35.5)	8,275 (36.8)	8,425 (37.5)	8,670 (38.6)	15,975 (71.1)	16,545 (73.6)	16,850 (75.0)	17,345 (77.1)
	9-13/16 (250)	13,950 (62.0)	14,265 (63.4)	14,525 (64.6)	14,950 (66.5)	27,900 (124.1)	28,530 (126.9)	29,055 (129.2)	29,900 (133.0)
	12-5/8 (320)	17,855 (79.4)	18,260 (81.2)	18,595 (82.7)	19,135 (85.1)	35,710 (158.8)	36,515 (162.4)	37,190 (165.4)	38,275 (170.2)
20M	7-7/8 (200)	12,940 (57.6)	14,035 (62.4)	14,295 (63.6)	14,710 (65.4)	25,875 (115.1)	28,070 (124.9)	28,590 (127.2)	29,420 (130.9)
	14 (355)	24,365 (108.4)	24,915 (110.8)	25,370 (112.9)	26,110 (116.2)	48,725 (216.7)	49,825 (221.6)	50,745 (225.7)	52,225 (232.3)
	15-3/8 (390)	26,765 (119.1)	27,370 (121.7)	27,875 (124.0)	28,685 (127.6)	53,530 (238.1)	54,740 (243.5)	55,745 (248.0)	57,375 (255.2)
25M	9-1/16 (230)	15,650 (69.6)	16,000 (71.2)	16,295 (72.5)	16,770 (74.6)	31,295 (139.2)	32,005 (142.4)	32,590 (145.0)	33,545 (149.2)
	15-15/16 (405)	27,555 (122.6)	28,175 (125.3)	28,695 (127.6)	29,530 (131.4)	55,110 (245.1)	56,355 (250.7)	57,390 (255.3)	59,065 (262.7)
	19-13/16 (504)	34,290 (152.5)	35,065 (156.0)	35,710 (158.8)	36,750 (163.5)	68,580 (305.1)	70,130 (311.9)	71,420 (317.7)	73,505 (327.0)
30M	10-1/4 (260)	19,180 (85.3)	21,440 (95.4)	22,115 (98.4)	22,765 (101.3)	38,355 (170.6)	42,885 (190.8)	44,235 (196.8)	45,525 (202.5)
	17-15/16 (455)	37,165 (165.3)	38,005 (169.1)	38,705 (172.2)	39,835 (177.2)	74,335 (330.7)	76,010 (338.1)	77,410 (344.3)	79,670 (354.4)
	23-9/16 (598)	48,850 (217.3)	49,950 (222.2)	50,870 (226.3)	52,355 (232.9)	97,695 (434.6)	99,900 (444.4)	101,740 (452.6)	104,710 (465.8)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 71 - 80 as necessary to the above values. Compare to the steel values in table 66. 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). For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C) multiply above values by 0.92. For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above values by 0.78. Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, 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: 10M to 20M - α_{seis} = 0.60, 25M - α_{seis} = 0.64, 30M - α_{seis} = 0.73
See section 3.1.8 for additional information on seismic applications.

Table 71 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.25	0.15	0.12	n/a	n/a	n/a	0.06	0.04	0.03	0.12	0.08	0.06	n/a	n/a	n/a
2-3/16	(55)	0.58	0.55	0.54	0.27	0.17	0.13	0.53	0.52	0.52	0.09	0.05	0.04	0.17	0.11	0.09	n/a	n/a	n/a
3	(76)	0.61	0.57	0.56	0.31	0.20	0.15	0.54	0.53	0.53	0.14	0.09	0.07	0.28	0.18	0.14	n/a	n/a	n/a
4	(102)	0.65	0.59	0.57	0.37	0.23	0.18	0.56	0.54	0.54	0.22	0.14	0.11	0.40	0.28	0.22	n/a	n/a	n/a
5	(127)	0.68	0.62	0.59	0.44	0.27	0.21	0.57	0.56	0.55	0.30	0.19	0.15	0.46	0.35	0.31	n/a	n/a	n/a
5-11/16	(145)	0.71	0.63	0.61	0.49	0.30	0.24	0.59	0.56	0.55	0.37	0.23	0.19	0.51	0.37	0.33	0.58	n/a	n/a
6	(152)	0.72	0.64	0.61	0.51	0.32	0.25	0.59	0.57	0.56	0.40	0.25	0.20	0.53	0.38	0.34	0.60	n/a	n/a
7	(178)	0.76	0.66	0.63	0.60	0.37	0.29	0.60	0.58	0.57	0.50	0.32	0.25	0.60	0.42	0.36	0.65	n/a	n/a
8	(203)	0.79	0.69	0.65	0.68	0.42	0.33	0.62	0.59	0.58	0.61	0.39	0.31	0.68	0.46	0.39	0.69	n/a	n/a
8-1/4	(210)	0.80	0.69	0.65	0.71	0.44	0.35	0.62	0.59	0.58	0.64	0.41	0.33	0.71	0.47	0.40	0.70	0.61	n/a
9	(229)	0.83	0.71	0.67	0.77	0.48	0.38	0.63	0.60	0.59	0.73	0.47	0.37	0.77	0.50	0.42	0.73	0.63	n/a
10-1/16	(256)	0.87	0.74	0.69	0.86	0.53	0.42	0.65	0.61	0.60	0.86	0.55	0.44	0.86	0.54	0.45	0.78	0.67	0.62
11	(279)	0.90	0.76	0.71	0.94	0.58	0.46	0.66	0.62	0.61	0.98	0.63	0.50	0.94	0.58	0.48	0.81	0.70	0.65
12	(305)	0.94	0.78	0.72	1.00	0.64	0.50	0.68	0.63	0.61	1.00	0.72	0.57	1.00	0.64	0.51	0.85	0.73	0.68
14	(356)	1.00	0.83	0.76		0.74	0.59	0.71	0.66	0.63		0.90	0.72		0.74	0.59	0.92	0.79	0.73
16	(406)		0.88	0.80		0.85	0.67	0.74	0.68	0.65		1.00	0.88		0.85	0.67	0.98	0.84	0.78
18	(457)		0.92	0.84		0.96	0.75	0.77	0.70	0.67			1.00		0.96	0.75	1.00	0.89	0.83
24	(610)		1.00	0.95		1.00	1.00	0.86	0.77	0.73					1.00	1.00		1.00	0.96
30	(762)			1.00				0.95	0.83	0.79									1.00
36	(914)							1.00	0.90	0.84									
> 48	(1219)								1.00	0.96									

Table 72 - Load adjustment factors for 10M rebar in cracked concrete[1,2,3]

10M 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.49	0.44	0.42	n/a	n/a	n/a	0.06	0.04	0.03	0.13	0.08	0.07	n/a	n/a	n/a
2-3/16	(55)	0.58	0.55	0.54	0.52	0.46	0.43	0.53	0.52	0.52	0.09	0.06	0.05	0.18	0.11	0.09	n/a	n/a	n/a
3	(76)	0.61	0.57	0.56	0.60	0.50	0.47	0.55	0.53	0.53	0.15	0.09	0.07	0.29	0.19	0.15	n/a	n/a	n/a
4	(102)	0.65	0.59	0.57	0.70	0.56	0.51	0.56	0.55	0.54	0.22	0.14	0.11	0.45	0.29	0.23	n/a	n/a	n/a
5	(127)	0.68	0.62	0.59	0.80	0.62	0.56	0.58	0.56	0.55	0.31	0.20	0.16	0.62	0.40	0.32	n/a	n/a	n/a
5-11/16	(145)	0.71	0.63	0.61	0.88	0.66	0.59	0.59	0.56	0.56	0.38	0.24	0.19	0.76	0.49	0.39	0.59	n/a	n/a
6	(152)	0.72	0.64	0.61	0.91	0.68	0.61	0.59	0.57	0.56	0.41	0.26	0.21	0.82	0.52	0.42	0.61	n/a	n/a
7	(178)	0.76	0.66	0.63	1.00	0.74	0.65	0.61	0.58	0.57	0.52	0.33	0.26	1.00	0.66	0.53	0.66	n/a	n/a
8	(203)	0.79	0.69	0.65		0.81	0.70	0.62	0.59	0.58	0.63	0.40	0.32		0.81	0.64	0.70	n/a	n/a
8-1/4	(210)	0.80	0.69	0.65		0.83	0.72	0.63	0.59	0.58	0.66	0.42	0.34		0.83	0.68	0.71	0.61	n/a
9	(229)	0.83	0.71	0.67		0.88	0.76	0.64	0.60	0.59	0.75	0.48	0.38		0.88	0.76	0.74	0.64	n/a
10-1/16	(256)	0.87	0.74	0.69		0.96	0.81	0.65	0.61	0.60	0.89	0.57	0.46		0.96	0.81	0.79	0.68	0.63
11	(279)	0.90	0.76	0.71		1.00	0.86	0.67	0.63	0.61	1.00	0.65	0.52		1.00	0.86	0.82	0.71	0.66
12	(305)	0.94	0.78	0.72			0.92	0.68	0.64	0.62		0.74	0.59			0.92	0.86	0.74	0.69
14	(356)	1.00	0.83	0.76			1.00	0.71	0.66	0.64		0.94	0.74			1.00	0.93	0.80	0.74
16	(406)		0.88	0.80				0.75	0.68	0.66		1.00	0.91				0.99	0.85	0.79
18	(457)		0.92	0.84				0.78	0.70	0.68			1.00				1.00	0.91	0.84
24	(610)		1.00	0.95				0.87	0.77	0.73								1.00	0.97
30	(762)			1.00				0.96	0.84	0.79									1.00
36	(914)							1.00	0.91	0.85									
> 48	(1219)								1.00	0.97									

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided the rebar has no installation torque.
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 CSA A23.3-14 Annex D.
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 73 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ∥ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.04	0.02	0.02	0.08	0.05	0.04	n/a	n/a	n/a
3-1/8	(80)	0.59	0.55	0.54	0.31	0.17	0.13	0.54	0.53	0.52	0.10	0.06	0.05	0.20	0.12	0.09	n/a	n/a	n/a
4	(102)	0.62	0.57	0.55	0.35	0.19	0.15	0.55	0.53	0.53	0.14	0.08	0.07	0.29	0.17	0.13	n/a	n/a	n/a
5	(127)	0.65	0.58	0.57	0.39	0.22	0.17	0.56	0.54	0.53	0.20	0.12	0.09	0.40	0.23	0.18	n/a	n/a	n/a
6	(152)	0.68	0.60	0.58	0.44	0.25	0.19	0.57	0.55	0.54	0.27	0.15	0.12	0.45	0.31	0.24	n/a	n/a	n/a
7	(178)	0.70	0.62	0.59	0.49	0.27	0.21	0.58	0.56	0.55	0.33	0.19	0.15	0.50	0.35	0.30	n/a	n/a	n/a
7-1/4	(184)	0.71	0.62	0.60	0.50	0.28	0.22	0.58	0.56	0.55	0.35	0.20	0.16	0.51	0.35	0.31	0.58	n/a	n/a
8	(203)	0.73	0.64	0.61	0.54	0.30	0.24	0.59	0.56	0.55	0.41	0.24	0.18	0.55	0.37	0.33	0.61	n/a	n/a
9	(229)	0.76	0.65	0.62	0.61	0.34	0.26	0.60	0.57	0.56	0.49	0.28	0.22	0.61	0.40	0.35	0.64	n/a	n/a
10	(254)	0.79	0.67	0.63	0.68	0.38	0.29	0.61	0.58	0.57	0.57	0.33	0.26	0.68	0.43	0.37	0.68	n/a	n/a
11-3/8	(289)	0.83	0.69	0.65	0.77	0.43	0.33	0.63	0.59	0.58	0.69	0.40	0.31	0.77	0.46	0.39	0.72	0.60	n/a
12	(305)	0.85	0.70	0.66	0.81	0.46	0.35	0.64	0.60	0.58	0.75	0.43	0.34	0.81	0.48	0.40	0.74	0.62	n/a
14-1/8	(359)	0.91	0.74	0.69	0.96	0.54	0.42	0.66	0.61	0.60	0.96	0.55	0.43	0.96	0.54	0.45	0.81	0.67	0.62
16	(406)	0.97	0.77	0.71	1.00	0.61	0.47	0.68	0.63	0.61	1.00	0.67	0.52	1.00	0.61	0.49	0.86	0.71	0.66
18	(457)	1.00	0.80	0.74		0.68	0.53	0.71	0.64	0.62		0.80	0.62		0.68	0.54	0.91	0.76	0.70
20	(508)		0.84	0.76		0.76	0.59	0.73	0.66	0.63		0.93	0.73		0.76	0.59	0.96	0.80	0.73
22	(559)		0.87	0.79		0.84	0.65	0.75	0.67	0.65		1.00	0.84		0.84	0.65	1.00	0.84	0.77
24	(610)		0.91	0.82		0.91	0.71	0.78	0.69	0.66			0.96		0.91	0.71		0.87	0.80
30	(762)		1.00	0.90		1.00	0.88	0.84	0.74	0.70			1.00		1.00	0.88		0.98	0.90
36	(914)			0.98			1.00	0.91	0.79	0.74						1.00		1.00	0.99
> 48	(1219)			1.00				1.00	0.88	0.82									1.00

3.2.2

Table 74 - Load adjustment factors for 15M rebar in cracked concrete[1,2,3]

15M 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
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	0.46	0.41	0.40	n/a	n/a	n/a	0.04	0.02	0.02	0.09	0.05	0.04	n/a	n/a	n/a
3-1/8	(80)	0.59	0.55	0.54	0.55	0.46	0.44	0.54	0.53	0.52	0.10	0.06	0.05	0.21	0.12	0.09	n/a	n/a	n/a
4	(102)	0.62	0.57	0.55	0.62	0.50	0.46	0.55	0.53	0.53	0.15	0.09	0.07	0.30	0.17	0.13	n/a	n/a	n/a
5	(127)	0.65	0.58	0.57	0.69	0.54	0.49	0.56	0.54	0.53	0.21	0.12	0.09	0.41	0.24	0.19	n/a	n/a	n/a
6	(152)	0.68	0.60	0.58	0.77	0.58	0.52	0.57	0.55	0.54	0.27	0.16	0.12	0.54	0.31	0.25	n/a	n/a	n/a
7	(178)	0.70	0.62	0.59	0.86	0.62	0.56	0.58	0.56	0.55	0.34	0.20	0.15	0.68	0.40	0.31	n/a	n/a	n/a
7-1/4	(184)	0.71	0.62	0.60	0.88	0.63	0.56	0.58	0.56	0.55	0.36	0.21	0.16	0.72	0.42	0.33	0.58	n/a	n/a
8	(203)	0.73	0.64	0.61	0.95	0.66	0.59	0.59	0.56	0.55	0.42	0.24	0.19	0.84	0.48	0.38	0.61	n/a	n/a
9	(229)	0.76	0.65	0.62	1.00	0.71	0.62	0.60	0.57	0.56	0.50	0.29	0.23	1.00	0.58	0.45	0.65	n/a	n/a
10	(254)	0.79	0.67	0.63		0.76	0.66	0.62	0.58	0.57	0.58	0.34	0.26		0.68	0.53	0.68	n/a	n/a
11-3/8	(289)	0.83	0.69	0.65		0.82	0.71	0.63	0.59	0.58	0.71	0.41	0.32		0.82	0.64	0.73	0.61	n/a
12	(305)	0.85	0.70	0.66		0.86	0.73	0.64	0.60	0.58	0.77	0.44	0.35		0.86	0.70	0.75	0.62	n/a
14-1/8	(359)	0.91	0.74	0.69		0.97	0.81	0.66	0.61	0.60	0.98	0.57	0.44		0.97	0.81	0.81	0.68	0.62
16	(406)	0.97	0.77	0.71		1.00	0.88	0.69	0.63	0.61	1.00	0.69	0.54		1.00	0.88	0.86	0.72	0.66
18	(457)	1.00	0.80	0.74			0.96	0.71	0.65	0.62		0.82	0.64			0.96	0.92	0.76	0.70
20	(508)		0.84	0.76			1.00	0.73	0.66	0.64		0.96	0.75			1.00	0.96	0.80	0.74
22	(559)		0.87	0.79				0.76	0.68	0.65		1.00	0.86				1.00	0.84	0.78
24	(610)		0.91	0.82				0.78	0.69	0.66			0.98					0.88	0.81
30	(762)		1.00	0.90				0.85	0.74	0.71			1.00					0.99	0.91
36	(914)			0.98				0.92	0.79	0.75								1.00	0.99
> 48	(1219)			1.00				1.00	0.89	0.83									1.00

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided the rebar has no installation torque.
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 CSA A23.3-14 Annex D.
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 75 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ∥ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef}		7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in. (mm): in.	(mm)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)
1-3/4	(44)	n/a	n/a	n/a	0.21	0.11	0.10	n/a	n/a	n/a	0.03	0.01	0.01	0.06	0.03	0.03	n/a	n/a	n/a
3-7/8	(98)	0.58	0.55	0.54	0.27	0.15	0.13	0.53	0.52	0.52	0.09	0.05	0.04	0.18	0.10	0.09	n/a	n/a	n/a
4	(102)	0.58	0.55	0.54	0.27	0.15	0.13	0.53	0.52	0.52	0.10	0.05	0.05	0.19	0.10	0.09	n/a	n/a	n/a
5	(127)	0.61	0.56	0.55	0.30	0.17	0.15	0.54	0.53	0.53	0.13	0.07	0.07	0.27	0.14	0.13	n/a	n/a	n/a
6	(152)	0.63	0.57	0.57	0.34	0.18	0.17	0.55	0.53	0.53	0.17	0.09	0.09	0.35	0.19	0.17	n/a	n/a	n/a
7	(178)	0.65	0.58	0.58	0.37	0.20	0.18	0.56	0.54	0.54	0.22	0.12	0.11	0.41	0.24	0.22	n/a	n/a	n/a
8	(203)	0.67	0.60	0.59	0.41	0.22	0.20	0.57	0.55	0.54	0.27	0.15	0.13	0.44	0.29	0.26	n/a	n/a	n/a
9	(229)	0.69	0.61	0.60	0.45	0.24	0.22	0.58	0.55	0.55	0.32	0.17	0.16	0.47	0.33	0.32	n/a	n/a	n/a
10	(254)	0.71	0.62	0.61	0.49	0.27	0.24	0.59	0.56	0.55	0.38	0.20	0.18	0.51	0.35	0.33	0.59	n/a	n/a
11	(279)	0.73	0.63	0.62	0.54	0.29	0.27	0.60	0.56	0.56	0.43	0.23	0.21	0.55	0.37	0.35	0.62	n/a	n/a
12	(305)	0.75	0.64	0.63	0.59	0.32	0.29	0.60	0.57	0.56	0.49	0.27	0.24	0.59	0.38	0.36	0.65	n/a	n/a
14	(356)	0.80	0.67	0.65	0.69	0.37	0.34	0.62	0.58	0.58	0.62	0.34	0.31	0.69	0.42	0.40	0.70	n/a	n/a
16	(406)	0.84	0.69	0.67	0.78	0.43	0.39	0.64	0.59	0.59	0.76	0.41	0.37	0.78	0.46	0.43	0.74	0.61	n/a
18	(457)	0.88	0.71	0.70	0.88	0.48	0.44	0.66	0.60	0.60	0.91	0.49	0.45	0.88	0.50	0.46	0.79	0.64	0.62
20	(508)	0.92	0.74	0.72	0.98	0.53	0.48	0.67	0.62	0.61	1.00	0.57	0.52	0.98	0.54	0.50	0.83	0.68	0.66
22	(559)	0.97	0.76	0.74	1.00	0.59	0.53	0.69	0.63	0.62		0.66	0.60	1.00	0.59	0.54	0.87	0.71	0.69
24	(610)	1.00	0.79	0.76		0.64	0.58	0.71	0.64	0.63		0.76	0.69		0.64	0.58	0.91	0.74	0.72
26	(660)		0.81	0.78		0.69	0.63	0.73	0.65	0.64		0.85	0.78		0.69	0.63	0.95	0.77	0.75
28	(711)		0.83	0.80		0.75	0.68	0.74	0.66	0.65		0.95	0.87		0.75	0.68	0.99	0.80	0.78
30	(762)		0.86	0.83		0.80	0.73	0.76	0.67	0.66		1.00	0.96		0.80	0.73	1.00	0.83	0.81
36	(914)		0.93	0.89		0.96	0.87	0.81	0.71	0.69			1.00		0.96	0.87		0.91	0.88
> 48	(1219)		1.00	1.00		1.00	1.00	0.92	0.78	0.76					1.00	1.00		1.00	1.00

Table 76 - Load adjustment factors for 20M rebar in cracked concrete[1,2,3]

20M 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef}		7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8	7-7/8	14	15-3/8
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in. (mm): in.	(mm)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)	(200)	(355)	(390)
1-3/4	(44)	n/a	n/a	n/a	0.43	0.39	0.39	n/a	n/a	n/a	0.03	0.02	0.01	0.06	0.03	0.03	n/a	n/a	n/a
3-7/8	(98)	0.58	0.55	0.54	0.53	0.45	0.44	0.53	0.52	0.52	0.09	0.05	0.05	0.18	0.10	0.09	n/a	n/a	n/a
4	(102)	0.58	0.55	0.54	0.54	0.45	0.44	0.54	0.52	0.52	0.10	0.05	0.05	0.19	0.10	0.10	n/a	n/a	n/a
5	(127)	0.61	0.56	0.55	0.59	0.48	0.47	0.54	0.53	0.53	0.14	0.07	0.07	0.27	0.15	0.13	n/a	n/a	n/a
6	(152)	0.63	0.57	0.57	0.64	0.51	0.49	0.55	0.53	0.53	0.18	0.10	0.09	0.36	0.19	0.17	n/a	n/a	n/a
7	(178)	0.65	0.58	0.58	0.70	0.53	0.52	0.56	0.54	0.54	0.22	0.12	0.11	0.45	0.24	0.22	n/a	n/a	n/a
8	(203)	0.67	0.60	0.59	0.76	0.56	0.54	0.57	0.55	0.54	0.27	0.15	0.13	0.55	0.30	0.27	n/a	n/a	n/a
9	(229)	0.69	0.61	0.60	0.82	0.59	0.57	0.58	0.55	0.55	0.33	0.18	0.16	0.65	0.35	0.32	n/a	n/a	n/a
10	(254)	0.71	0.62	0.61	0.88	0.62	0.60	0.59	0.56	0.55	0.38	0.21	0.19	0.77	0.41	0.38	0.59	n/a	n/a
11	(279)	0.73	0.63	0.62	0.95	0.65	0.62	0.60	0.56	0.56	0.44	0.24	0.22	0.88	0.48	0.43	0.62	n/a	n/a
12	(305)	0.75	0.64	0.63	1.00	0.69	0.65	0.61	0.57	0.57	0.50	0.27	0.25	1.00	0.54	0.49	0.65	n/a	n/a
14	(356)	0.80	0.67	0.65		0.75	0.71	0.62	0.58	0.58	0.64	0.34	0.31		0.68	0.62	0.70	n/a	n/a
16	(406)	0.84	0.69	0.67		0.82	0.77	0.64	0.59	0.59	0.77	0.42	0.38		0.82	0.76	0.75	0.61	n/a
18	(457)	0.88	0.71	0.70		0.89	0.83	0.66	0.60	0.60	0.93	0.50	0.45		0.89	0.83	0.80	0.65	0.63
20	(508)	0.92	0.74	0.72		0.96	0.90	0.68	0.62	0.61	1.00	0.58	0.53		0.96	0.90	0.84	0.68	0.66
22	(559)	0.97	0.76	0.74		1.00	0.96	0.69	0.63	0.62		0.67	0.61		1.00	0.96	0.88	0.72	0.69
24	(610)	1.00	0.79	0.76			1.00	0.71	0.64	0.63		0.77	0.70			1.00	0.92	0.75	0.72
26	(660)		0.81	0.78				0.73	0.65	0.64		0.87	0.79				0.96	0.78	0.75
28	(711)		0.83	0.80				0.75	0.66	0.65		0.97	0.88				0.99	0.81	0.78
30	(762)		0.86	0.83				0.76	0.67	0.66		1.00	0.98				1.00	0.84	0.81
36	(914)		0.93	0.89				0.82	0.71	0.70			1.00					0.92	0.89
> 48	(1219)		1.00	1.00				0.92	0.78	0.76								1.00	1.00

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided the rebar has no installation torque.
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 CSA A23.3-14 Annex D.
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 77 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ∥ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef}		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
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in.	(mm)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)
1-3/4	(44)	n/a	n/a	n/a	0.22	0.12	0.10	n/a	n/a	n/a	0.02	0.01	0.01	0.04	0.02	0.02	n/a	n/a	n/a
5	(127)	0.59	0.55	0.54	0.30	0.17	0.13	0.54	0.52	0.52	0.11	0.05	0.04	0.22	0.10	0.08	n/a	n/a	n/a
6	(152)	0.61	0.56	0.55	0.33	0.18	0.14	0.55	0.53	0.52	0.14	0.06	0.05	0.28	0.13	0.10	n/a	n/a	n/a
7	(178)	0.63	0.57	0.56	0.36	0.20	0.16	0.55	0.53	0.53	0.18	0.08	0.06	0.36	0.16	0.13	n/a	n/a	n/a
8	(203)	0.65	0.58	0.57	0.39	0.21	0.17	0.56	0.54	0.53	0.22	0.10	0.08	0.41	0.20	0.16	n/a	n/a	n/a
9	(229)	0.67	0.59	0.58	0.42	0.23	0.18	0.57	0.54	0.53	0.26	0.12	0.09	0.44	0.24	0.19	n/a	n/a	n/a
10	(254)	0.68	0.60	0.58	0.45	0.25	0.20	0.58	0.54	0.54	0.30	0.14	0.11	0.47	0.28	0.22	n/a	n/a	n/a
11-9/16	(294)	0.71	0.62	0.60	0.50	0.28	0.22	0.59	0.55	0.54	0.38	0.17	0.14	0.52	0.34	0.28	0.59	n/a	n/a
12	(305)	0.72	0.63	0.60	0.52	0.28	0.23	0.59	0.55	0.55	0.40	0.18	0.15	0.53	0.36	0.29	0.60	n/a	n/a
14	(356)	0.76	0.65	0.62	0.60	0.33	0.26	0.61	0.56	0.55	0.50	0.23	0.18	0.60	0.39	0.34	0.65	n/a	n/a
16	(406)	0.79	0.67	0.63	0.69	0.38	0.30	0.62	0.57	0.56	0.62	0.28	0.22	0.69	0.42	0.37	0.69	n/a	n/a
18	(457)	0.83	0.69	0.65	0.77	0.42	0.34	0.64	0.58	0.57	0.74	0.33	0.27	0.77	0.46	0.39	0.74	n/a	n/a
18-7/16	(469)	0.84	0.69	0.66	0.79	0.43	0.35	0.64	0.58	0.57	0.76	0.35	0.28	0.79	0.46	0.40	0.75	0.57	n/a
20	(508)	0.87	0.71	0.67	0.86	0.47	0.37	0.65	0.59	0.58	0.86	0.39	0.31	0.86	0.49	0.42	0.78	0.60	n/a
22-3/8	(568)	0.91	0.73	0.69	0.96	0.53	0.42	0.67	0.60	0.59	1.00	0.46	0.37	0.96	0.53	0.45	0.82	0.63	0.59
24	(610)	0.94	0.75	0.70	1.00	0.56	0.45	0.68	0.61	0.59		0.51	0.41	1.00	0.56	0.47	0.85	0.65	0.61
26	(660)	0.98	0.77	0.72		0.61	0.49	0.70	0.62	0.60		0.58	0.46		0.61	0.50	0.89	0.68	0.63
28	(711)	1.00	0.79	0.74		0.66	0.52	0.71	0.62	0.61		0.65	0.52		0.66	0.53	0.92	0.71	0.66
30	(762)		0.81	0.75		0.71	0.56	0.73	0.63	0.62		0.72	0.58		0.71	0.56	0.95	0.73	0.68
36	(914)		0.88	0.80		0.85	0.67	0.77	0.66	0.64		0.94	0.76		0.85	0.67	1.00	0.80	0.74
> 48	(1219)		1.00	0.90		1.00	0.90	0.86	0.71	0.68		1.00	1.00		1.00	0.90		0.92	0.86

3.2.2

Table 78 - Load adjustment factors for 25M rebar in cracked concrete[1,2,3]

25M 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef}		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
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in.	(mm)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)	(230)	(405)	(504)
1-3/4	(44)	n/a	n/a	n/a	0.42	0.39	0.38	n/a	n/a	n/a	0.02	0.01	0.01	0.05	0.03	0.02	n/a	n/a	n/a
5	(127)	0.59	0.55	0.54	0.55	0.46	0.44	0.54	0.53	0.52	0.11	0.06	0.05	0.23	0.13	0.10	n/a	n/a	n/a
6	(152)	0.61	0.56	0.55	0.60	0.48	0.46	0.55	0.53	0.53	0.15	0.08	0.07	0.30	0.17	0.14	n/a	n/a	n/a
7	(178)	0.63	0.57	0.56	0.65	0.51	0.48	0.55	0.54	0.53	0.19	0.11	0.09	0.38	0.21	0.17	n/a	n/a	n/a
8	(203)	0.65	0.58	0.57	0.70	0.53	0.50	0.56	0.54	0.54	0.23	0.13	0.11	0.46	0.26	0.21	n/a	n/a	n/a
9	(229)	0.67	0.59	0.58	0.75	0.56	0.51	0.57	0.55	0.54	0.27	0.16	0.13	0.55	0.31	0.25	n/a	n/a	n/a
10	(254)	0.68	0.60	0.58	0.80	0.59	0.53	0.58	0.55	0.55	0.32	0.18	0.15	0.64	0.37	0.29	n/a	n/a	n/a
11-9/16	(294)	0.71	0.62	0.60	0.89	0.63	0.57	0.59	0.56	0.55	0.40	0.23	0.18	0.80	0.46	0.37	0.60	n/a	n/a
12	(305)	0.72	0.63	0.60	0.91	0.64	0.58	0.59	0.56	0.56	0.42	0.24	0.19	0.85	0.48	0.39	0.61	n/a	n/a
14	(356)	0.76	0.65	0.62	1.00	0.69	0.62	0.61	0.58	0.56	0.53	0.30	0.24	1.00	0.61	0.49	0.66	n/a	n/a
16	(406)	0.79	0.67	0.63		0.75	0.66	0.63	0.59	0.57	0.65	0.37	0.30		0.74	0.59	0.71	n/a	n/a
18	(457)	0.83	0.69	0.65		0.81	0.71	0.64	0.60	0.58	0.78	0.44	0.35		0.81	0.71	0.75	n/a	n/a
18-7/16	(469)	0.84	0.69	0.66		0.83	0.72	0.64	0.60	0.59	0.81	0.46	0.37		0.83	0.72	0.76	0.63	n/a
20	(508)	0.87	0.71	0.67		0.87	0.75	0.66	0.61	0.59	0.91	0.52	0.42		0.87	0.75	0.79	0.66	n/a
22-3/8	(568)	0.91	0.73	0.69		0.95	0.81	0.68	0.62	0.60	1.00	0.61	0.49		0.95	0.81	0.84	0.69	0.64
24	(610)	0.94	0.75	0.70		1.00	0.85	0.69	0.63	0.61		0.68	0.55		1.00	0.85	0.87	0.72	0.67
26	(660)	0.98	0.77	0.72			0.90	0.70	0.64	0.62		0.77	0.62			0.90	0.90	0.75	0.69
28	(711)	1.00	0.79	0.74			0.95	0.72	0.65	0.63		0.86	0.69			0.95	0.94	0.78	0.72
30	(762)		0.81	0.75			1.00	0.73	0.66	0.64		0.95	0.76			1.00	0.97	0.80	0.75
36	(914)		0.88	0.80				0.78	0.69	0.67		1.00	1.00				1.00	0.88	0.82
> 48	(1219)		1.00	0.90				0.88	0.76	0.72								1.00	0.94

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided the rebar has no installation torque.
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 CSA A23.3-14 Annex D.
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 79 - 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: ⊥ Toward edge f_{RV}			Edge distance in shear: ‖ To and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef} in.	(mm)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (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	0.02	0.01	n/a	n/a	n/a
5-7/8	(150)	0.60	0.55	0.54	0.33	0.18	0.13	0.54	0.52	0.52	0.12	0.05	0.04	0.23	0.10	0.07	n/a	n/a	n/a
6	(152)	0.60	0.56	0.54	0.33	0.18	0.13	0.54	0.52	0.52	0.12	0.05	0.04	0.24	0.10	0.07	n/a	n/a	n/a
7	(178)	0.61	0.57	0.55	0.36	0.19	0.14	0.55	0.53	0.52	0.15	0.06	0.05	0.30	0.13	0.09	n/a	n/a	n/a
8	(203)	0.63	0.57	0.56	0.38	0.20	0.15	0.55	0.53	0.52	0.18	0.08	0.06	0.36	0.16	0.11	n/a	n/a	n/a
9	(229)	0.65	0.58	0.56	0.41	0.22	0.16	0.56	0.53	0.53	0.22	0.09	0.07	0.42	0.19	0.13	n/a	n/a	n/a
10	(254)	0.66	0.59	0.57	0.44	0.23	0.18	0.57	0.54	0.53	0.25	0.11	0.08	0.45	0.22	0.16	n/a	n/a	n/a
11	(279)	0.68	0.60	0.58	0.46	0.25	0.19	0.57	0.54	0.53	0.29	0.13	0.09	0.47	0.25	0.18	n/a	n/a	n/a
12	(305)	0.70	0.61	0.58	0.49	0.26	0.20	0.58	0.55	0.54	0.33	0.14	0.10	0.50	0.29	0.21	n/a	n/a	n/a
13-1/4	(337)	0.72	0.62	0.59	0.53	0.28	0.21	0.59	0.55	0.54	0.39	0.17	0.12	0.54	0.33	0.24	0.60	n/a	n/a
14	(356)	0.73	0.63	0.60	0.55	0.30	0.22	0.59	0.55	0.54	0.42	0.18	0.13	0.56	0.36	0.26	0.61	n/a	n/a
16	(406)	0.76	0.65	0.61	0.63	0.34	0.25	0.61	0.56	0.55	0.51	0.22	0.16	0.63	0.40	0.32	0.65	n/a	n/a
18	(457)	0.79	0.67	0.63	0.71	0.38	0.28	0.62	0.57	0.56	0.61	0.26	0.19	0.71	0.42	0.36	0.69	n/a	n/a
20	(508)	0.83	0.69	0.64	0.79	0.42	0.32	0.63	0.58	0.56	0.72	0.31	0.22	0.79	0.45	0.38	0.73	n/a	n/a
20-7/8	(531)	0.84	0.69	0.65	0.82	0.44	0.33	0.64	0.58	0.56	0.77	0.33	0.24	0.82	0.47	0.39	0.75	n/a	n/a
22	(559)	0.86	0.70	0.66	0.87	0.46	0.35	0.65	0.58	0.57	0.83	0.36	0.26	0.87	0.49	0.40	0.77	0.58	n/a
24	(610)	0.89	0.72	0.67	0.94	0.50	0.38	0.66	0.59	0.57	0.94	0.41	0.29	0.94	0.52	0.42	0.80	0.61	n/a
26-9/16	(675)	0.93	0.75	0.69	1.00	0.56	0.42	0.68	0.60	0.58	1.00	0.47	0.34	1.00	0.56	0.45	0.84	0.64	0.57
28	(711)	0.96	0.76	0.70		0.59	0.44	0.69	0.61	0.59		0.51	0.37		0.59	0.47	0.86	0.65	0.59
30	(762)	0.99	0.78	0.71		0.63	0.47	0.70	0.61	0.59		0.57	0.41		0.63	0.49	0.89	0.68	0.61
36	(914)	1.00	0.83	0.75		0.76	0.57	0.74	0.64	0.61		0.75	0.54		0.76	0.57	0.98	0.74	0.66
> 48	(1219)		0.95	0.84		1.00	0.76	0.82	0.68	0.65		1.00	0.83		1.00	0.76	1.00	0.86	0.77

Table 80 - Load adjustment factors for 30M rebar in cracked concrete[1,2,3]

30M 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 and away from edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Embedment h_{ef} in.	(mm)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)	10-1/4 (260)	17-15/16 (455)	23-9/16 (598)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in. (mm)																			
1-3/4	(44)	n/a	n/a	n/a	0.41	0.38	0.38	n/a	n/a	n/a	0.02	0.01	0.01	0.04	0.02	0.02	n/a	n/a	n/a
5-7/8	(150)	0.60	0.55	0.54	0.56	0.47	0.44	0.54	0.53	0.52	0.12	0.06	0.05	0.23	0.12	0.09	n/a	n/a	n/a
6	(152)	0.60	0.56	0.54	0.57	0.47	0.44	0.54	0.53	0.52	0.12	0.06	0.05	0.24	0.13	0.10	n/a	n/a	n/a
7	(178)	0.61	0.57	0.55	0.61	0.49	0.46	0.55	0.53	0.53	0.15	0.08	0.06	0.30	0.16	0.12	n/a	n/a	n/a
8	(203)	0.63	0.57	0.56	0.65	0.51	0.47	0.55	0.54	0.53	0.19	0.10	0.07	0.37	0.19	0.15	n/a	n/a	n/a
9	(229)	0.65	0.58	0.56	0.69	0.53	0.49	0.56	0.54	0.53	0.22	0.12	0.09	0.44	0.23	0.18	n/a	n/a	n/a
10	(254)	0.66	0.59	0.57	0.74	0.56	0.50	0.57	0.54	0.54	0.26	0.14	0.10	0.52	0.27	0.21	n/a	n/a	n/a
11	(279)	0.68	0.60	0.58	0.79	0.58	0.52	0.57	0.55	0.54	0.30	0.16	0.12	0.60	0.31	0.24	n/a	n/a	n/a
12	(305)	0.70	0.61	0.58	0.83	0.60	0.54	0.58	0.55	0.54	0.34	0.18	0.14	0.68	0.36	0.27	n/a	n/a	n/a
13-1/4	(337)	0.72	0.62	0.59	0.89	0.63	0.56	0.59	0.56	0.55	0.40	0.21	0.16	0.79	0.41	0.32	0.60	n/a	n/a
14	(356)	0.73	0.63	0.60	0.93	0.65	0.57	0.59	0.56	0.55	0.43	0.22	0.17	0.86	0.45	0.34	0.62	n/a	n/a
16	(406)	0.76	0.65	0.61	1.00	0.70	0.61	0.61	0.57	0.56	0.52	0.27	0.21	1.00	0.55	0.42	0.66	n/a	n/a
18	(457)	0.79	0.67	0.63		0.75	0.64	0.62	0.58	0.57	0.62	0.33	0.25		0.65	0.50	0.70	n/a	n/a
20	(508)	0.83	0.69	0.64		0.81	0.68	0.64	0.59	0.57	0.73	0.38	0.29		0.77	0.58	0.74	n/a	n/a
20-7/8	(531)	0.84	0.69	0.65		0.83	0.70	0.64	0.59	0.58	0.78	0.41	0.31		0.82	0.62	0.75	n/a	n/a
22	(559)	0.86	0.70	0.66		0.86	0.72	0.65	0.60	0.58	0.84	0.44	0.34		0.86	0.67	0.77	0.62	n/a
24	(610)	0.89	0.72	0.67		0.92	0.76	0.66	0.61	0.59	0.96	0.50	0.38		0.92	0.76	0.81	0.65	n/a
26-9/16	(675)	0.93	0.75	0.69		0.99	0.81	0.68	0.62	0.60	1.00	0.59	0.45		0.99	0.81	0.85	0.68	0.62
28	(711)	0.96	0.76	0.70		1.00	0.84	0.69	0.62	0.60		0.63	0.48		1.00	0.84	0.87	0.70	0.64
30	(762)	0.99	0.78	0.71			0.88	0.70	0.63	0.61		0.70	0.54			0.88	0.90	0.73	0.66
36	(914)	1.00	0.83	0.75			1.00	0.74	0.66	0.63		0.93	0.70			1.00	0.99	0.80	0.73
> 48	(1219)		0.95	0.84				0.82	0.71	0.68		1.00	1.00				1.00	0.92	0.84

1 Linear interpolation not permitted.
2 Shaded area with reduced edge distance is permitted provided the rebar has no installation torque.
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 CSA A23.3-14 Annex D.
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-HY 200 Adhesive with Hilti HAS Threaded Rod

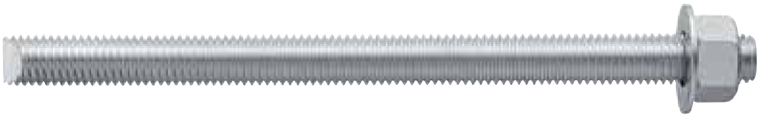


Table 81 - Steel factored resistance for Hilti HAS threaded rods for use with CSA A23.3-14 Annex D

Nominal anchor diameter in.	HAS-V-36 / HAS-V-36 HDG ASTM F1554 Gr.36[4,6]			HAS-E-55 / HAS-E-55 HDG ASTM F1554 Gr. 55[4,5,6]			HAS-B-105 / HAS-B-105 HDG ASTM A193 B7 and ASTM F 1554 Gr.105[4,6]			HAS-R stainless steel ASTM F593 (3/8-in to 1-in)[5] ASTM A193 (1-1/8-in to 2-in)[4]		
	Tensile[1] ΦN_{sar} lb (kN)	Shear[2] ΦV_{sar} lb (kN)	Seismic Shear[3] $\Phi V_{sar,eq}$ lb (kN)	Tensile[1] ΦN_{sar} lb (kN)	Shear[2] ΦV_{sar} lb (kN)	Seismic Shear[3] $\Phi V_{sar,eq}$ lb (kN)	Tensile[1] ΦN_{sar} lb (kN)	Shear[2] ΦV_{sar} lb (kN)	Seismic Shear[3] $\Phi V_{sar,eq}$ lb (kN)	Tensile[1] ΦN_{sar} lb (kN)	Shear[2] ΦV_{sar} lb (kN)	Seismic Shear[3] $\Phi V_{sar,eq}$ lb (kN)
3/8	3,055 (13.6)	1,720 (7.7)	1,030 (4.6)	3,955 (17.6)	2,225 (9.9)	1,560 (6.9)	6,570 (29.2)	3,695 (16.4)	2,585 (11.5)	4,610 (20.5)	2,570 (11.4)	1,800 (8.0)
1/2	5,595 (24.9)	3,150 (14.0)	1,890 (8.4)	7,240 (32.2)	4,070 (18.1)	2,850 (12.7)	12,035 (53.5)	6,765 (30.1)	4,735 (21.1)	8,445 (37.6)	4,705 (20.9)	3,295 (14.7)
5/8	8,915 (39.7)	5,015 (22.3)	3,010 (13.4)	11,525 (51.3)	6,485 (28.8)	4,540 (20.2)	19,160 (85.2)	10,780 (48.0)	7,545 (33.6)	13,445 (59.8)	7,490 (33.3)	5,245 (23.3)
3/4	13,190 (58.7)	7,420 (33.0)	4,450 (19.8)	17,060 (75.9)	9,600 (42.7)	6,720 (29.9)	28,365 (126.2)	15,955 (71.0)	11,170 (49.7)	16,920 (75.3)	9,425 (41.9)	6,600 (29.4)
7/8	18,210 (81.0)	10,245 (45.6)	6,145 (27.3)	23,550 (104.8)	13,245 (58.9)	9,270 (41.2)	39,150 (174.1)	22,020 (97.9)	15,415 (68.6)	23,350 (103.9)	13,010 (57.9)	9,105 (40.5)
1	23,890 (106.3)	13,440 (59.8)	8,065 (35.9)	30,890 (137.4)	17,380 (77.3)	12,165 (54.1)	51,360 (228.5)	28,890 (128.5)	20,225 (90.0)	30,635 (136.3)	17,065 (75.9)	11,945 (53.1)
1-1/4	38,225 (170.0)	21,500 (95.6)	12,900 (57.4)	49,425 (219.9)	27,800 (123.7)	19,460 (86.6)	82,175 (365.5)	46,220 (205.6)	32,355 (143.9)	37,565 (167.1)	21,130 (94.0)	12,680 (56.4)

1 Tensile = $A_{se,N}$ ϕ f_{uta} R as noted in CSA A23.3-14 Eq. D.2.
2 Shear = $A_{se,V}$ ϕ 0.60 f_{uta} R as noted in CSA A23.3-14 Eq. D.31.
3 Seismic Shear = $\alpha_{V,seis}$ V_{sar} : Reduction factor for seismic shear only. See CSA A23.3 Annex D for additional information on seismic applications. Seismic shear for HIT-RE 500 V3
4 HAS-V, HAS-E (3/8-in to 1-1/4-in), HAS-B, and HAS-R (Class 1; 1-1/4-in) threaded rods are considered ductile steel elements (including HDG rods).
5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements.
6 6 3/8-inch dia. threaded rods are not included in the ASTM F1554 standard. Hilti 3/8-inch dia. HAS-V, HAS-E, and HAS-E-B (incl. HDG) threaded rods meet the chemical composition and mechanical property requirements of ASTM F1554.

Table 82 - Hilti HIT-HY 200 design information with Hilti HAS 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 Diameter		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} + $2d_0$					
Critical edge distance		c_{ac}		$2h_{ef}$							
Minimum edge distance		c_{min}	mm	45	45	50[3]	55[3]	60[3]	70[3]	80[3]	
Minimum anchor spacing		s_{min}	mm	48	64	79	95	111	127	159	
Coeff. for factored conc. breakout resistance, uncracked concrete		$k_{c,uncr}$[4]	–	10							D.6.2.2
Coeff. for factored conc. 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							
Temp. range A[6]	Characteristic bond stress in cracked concrete[7]	τ_{cr}	psi (MPa)	1,045 (7.2)	1,135 (7.7)	1,170 (8.2)	1,260 (8.4)	1,290 (8.6)	1,325 (8.7)	1,380 (9.1)	D.6.5.2
	Characteristic bond stress in uncracked concrete[7]	τ_{uncr}	psi (MPa)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	D.6.5.2
Temp. range B[6]	Characteristic bond stress in cracked concrete[7]	τ_{cr}	psi (MPa)	1,045 (7.2)	1,135 (7.7)	1,170 (8.2)	1,260 (8.4)	1,290 (8.6)	1,325 (8.7)	1,380 (9.1)	D.6.5.2
	Characteristic bond stress in uncracked concrete[7]	τ_{uncr}	psi (MPa)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	D.6.5.2
Temp. range C[6]	Characteristic bond stress in cracked concrete[7]	τ_{cr}	psi (MPa)	885 (6.1)	930 (6.3)	960 (6.7)	1,035 (6.9)	1,055 (7.3)	1,085 (7.1)	1,130 (7.4)	D.6.5.2
	Characteristic bond stress in uncracked concrete[7]	τ_{uncr}	psi (MPa)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	D.6.5.2
Reduction for seismic tension		$\alpha_{N,seis}$	–	0.88	0.99		1.0		0.95	0.99	
Permissible installation conditions	Resistance modification factor tension & shear, bond failure dry concrete	Anchor category	–	1							D.5.3 (c)
		R_{dry}	–	1.00							
	Resistance modification factor tension & shear, bond failure water-saturated concrete	Anchor category	–	1							D.5.3 (c)
		R_{ws}	–	1.00							

1 Design information in this table is taken from ELC-3187, dated April 2019, tables 8 and 10 for use with CSA A23.3-14 Annex D.
2 See figure 10 of this section.
3 Minimum edge distance may be reduced to 45mm ≤ c_{ai} < 5d provided T_{inst} is reduced. See ELC-3187 Installation Torque Subject to Edge Distance section.
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).
Temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C).
Temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°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 83 - Hilti HIT-HY 200 adhesive factored resistance with concrete/bond failure for threaded rod in uncracked 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)	3,060 (13.6)	3,425 (15.2)	3,750 (16.7)	4,330 (19.3)	3,060 (13.6)	3,425 (15.2)	3,750 (16.7)	4,330 (19.3)
	3-3/8 (86)	5,185 (23.1)	5,800 (25.8)	6,065 (27.0)	6,245 (27.8)	10,375 (46.1)	11,600 (51.6)	12,135 (54.0)	12,490 (55.6)
	4-1/2 (114)	7,770 (34.6)	7,945 (35.3)	8,090 (36.0)	8,325 (37.0)	15,535 (69.1)	15,885 (70.7)	16,180 (72.0)	16,650 (74.1)
	7-1/2 (191)	12,945 (57.6)	13,240 (58.9)	13,485 (60.0)	13,875 (61.7)	25,895 (115.2)	26,480 (117.8)	26,965 (119.9)	27,755 (123.5)
1/2	2-3/4 (70)	3,815 (17.0)	4,265 (19.0)	4,670 (20.8)	5,395 (24.0)	7,630 (33.9)	8,530 (37.9)	9,345 (41.6)	10,790 (48.0)
	4-1/2 (114)	7,985 (35.5)	8,930 (39.7)	9,780 (43.5)	11,100 (49.4)	15,970 (71.0)	17,855 (79.4)	19,560 (87.0)	22,200 (98.8)
	6 (152)	12,295 (54.7)	13,745 (61.1)	14,380 (64.0)	14,800 (65.8)	24,590 (109.4)	27,490 (122.3)	28,765 (127.9)	29,605 (131.7)
	10 (254)	23,015 (102.4)	23,535 (104.7)	23,970 (106.6)	24,670 (109.7)	46,035 (204.8)	47,075 (209.4)	47,940 (213.2)	49,340 (219.5)
5/8	3-1/8 (79)	4,620 (20.6)	5,165 (23.0)	5,660 (25.2)	6,535 (29.1)	9,245 (41.1)	10,335 (46.0)	11,320 (50.4)	13,070 (58.1)
	5-5/8 (143)	11,160 (49.6)	12,480 (55.5)	13,670 (60.8)	15,785 (70.2)	22,320 (99.3)	24,955 (111.0)	27,335 (121.6)	31,565 (140.4)
	7-1/2 (191)	17,185 (76.4)	19,210 (85.5)	21,045 (93.6)	23,125 (102.9)	34,365 (152.9)	38,420 (170.9)	42,090 (187.2)	46,255 (205.8)
	12-1/2 (318)	35,965 (160.0)	36,775 (163.6)	37,450 (166.6)	38,545 (171.5)	71,930 (320.0)	73,550 (327.2)	74,905 (333.2)	77,090 (342.9)
3/4	3-1/2 (89)	5,480 (24.4)	6,125 (27.2)	6,710 (29.8)	7,745 (34.5)	10,955 (48.7)	12,250 (54.5)	13,420 (59.7)	15,495 (68.9)
	6-3/4 (171)	14,670 (65.3)	16,400 (73.0)	17,970 (79.9)	20,745 (92.3)	29,340 (130.5)	32,805 (145.9)	35,935 (159.8)	41,495 (184.6)
	9 (229)	22,585 (100.5)	25,255 (112.3)	27,665 (123.1)	31,945 (142.1)	45,175 (200.9)	50,505 (224.7)	55,325 (246.1)	63,885 (284.2)
	15 (381)	48,600 (216.2)	52,955 (235.6)	53,930 (239.9)	55,505 (246.9)	97,200 (432.4)	105,915 (471.1)	107,865 (479.8)	111,010 (493.8)
7/8	3-1/2 (89)	5,480 (24.4)	6,125 (27.2)	6,710 (29.8)	7,745 (34.5)	10,955 (48.7)	12,250 (54.5)	13,420 (59.7)	15,495 (68.9)
	7-7/8 (200)	18,485 (82.2)	20,670 (91.9)	22,640 (100.7)	26,145 (116.3)	36,975 (164.5)	41,340 (183.9)	45,285 (201.4)	52,290 (232.6)
	10-1/2 (267)	28,465 (126.6)	31,820 (141.6)	34,860 (155.1)	40,255 (179.1)	56,925 (253.2)	63,645 (283.1)	69,720 (310.1)	80,505 (358.1)
	17-1/2 (445)	61,240 (272.4)	68,470 (304.6)	73,405 (326.5)	75,550 (336.1)	122,485 (544.8)	136,940 (609.1)	146,815 (653.1)	151,100 (672.1)
1	4 (102)	6,690 (29.8)	7,480 (33.3)	8,195 (36.5)	9,465 (42.1)	13,385 (59.5)	14,965 (66.6)	16,395 (72.9)	18,930 (84.2)
	9 (229)	22,585 (100.5)	25,255 (112.3)	27,665 (123.1)	31,945 (142.1)	45,175 (200.9)	50,505 (224.7)	55,325 (246.1)	63,885 (284.2)
	12 (305)	34,775 (154.7)	38,880 (172.9)	42,590 (189.5)	49,180 (218.8)	69,550 (309.4)	77,760 (345.9)	85,180 (378.9)	98,360 (437.5)
	20 (508)	74,825 (332.8)	83,655 (372.1)	91,640 (407.6)	98,675 (438.9)	149,650 (665.7)	167,310 (744.2)	183,280 (815.3)	197,355 (877.9)
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)	31,565 (140.4)	35,290 (157.0)	38,660 (172.0)	44,640 (198.6)	63,135 (280.8)	70,585 (314.0)	77,320 (343.9)	89,285 (397.1)
	15 (381)	48,600 (216.2)	54,335 (241.7)	59,520 (264.8)	68,730 (305.7)	97,200 (432.4)	108,670 (483.4)	119,045 (529.5)	137,460 (611.4)
	25 (635)	104,570 (465.1)	116,910 (520.0)	128,070 (569.7)	147,885 (657.8)	209,140 (930.3)	233,825 (1040.1)	256,140 (1139.4)	295,765 (1315.6)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 as necessary to the above values. Compare to the steel values in table 81. 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).
For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above values by 0.78.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51.
For all-lightweight, λ_a = 0.45
9 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete.

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Table 84 - Hilti HIT-HY 200 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 (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 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 = 20 MPa (5,800 psi) lb (kN)
3/8	2-3/8 (60)	1,930 (8.6)	1,975 (8.8)	2,010 (8.9)	2,070 (9.2)	1,930 (8.6)	1,975 (8.8)	2,010 (8.9)	2,070 (9.2)
	3-3/8 (86)	2,745 (12.2)	2,805 (12.5)	2,855 (12.7)	2,940 (13.1)	5,485 (24.4)	5,610 (24.9)	5,710 (25.4)	5,880 (26.1)
	4-1/2 (114)	3,655 (16.3)	3,740 (16.6)	3,810 (16.9)	3,920 (17.4)	7,315 (32.5)	7,480 (33.3)	7,615 (33.9)	7,840 (34.9)
	7-1/2 (191)	6,095 (27.1)	6,230 (27.7)	6,345 (28.2)	6,530 (29.1)	12,190 (54.2)	12,465 (55.4)	12,695 (56.5)	13,065 (58.1)
1/2	2-3/4 (70)	2,670 (11.9)	2,985 (13.3)	3,270 (14.5)	3,470 (15.4)	5,340 (23.8)	5,970 (26.6)	6,540 (29.1)	6,935 (30.9)
	4-1/2 (114)	5,295 (23.6)	5,415 (24.1)	5,515 (24.5)	5,675 (25.2)	10,590 (47.1)	10,830 (48.2)	11,030 (49.1)	11,350 (50.5)
	6 (152)	7,060 (31.4)	7,220 (32.1)	7,355 (32.7)	7,565 (33.7)	14,120 (62.8)	14,440 (64.2)	14,705 (65.4)	15,135 (67.3)
	10 (254)	11,770 (52.3)	12,035 (53.5)	12,255 (54.5)	12,610 (56.1)	23,535 (104.7)	24,065 (107.1)	24,510 (109.0)	25,225 (112.2)
5/8	3-1/8 (79)	3,235 (14.4)	3,615 (16.1)	3,960 (17.6)	4,575 (20.4)	6,470 (28.8)	7,235 (32.2)	7,925 (35.2)	9,150 (40.7)
	5-5/8 (143)	7,810 (34.8)	8,720 (38.8)	8,880 (39.5)	9,140 (40.7)	15,625 (69.5)	17,445 (77.6)	17,765 (79.0)	18,285 (81.3)
	7-1/2 (191)	11,370 (50.6)	11,630 (51.7)	11,845 (52.7)	12,190 (54.2)	22,745 (101.2)	23,260 (103.5)	23,685 (105.4)	24,375 (108.4)
	12-1/2 (318)	18,955 (84.3)	19,380 (86.2)	19,740 (87.8)	20,315 (90.4)	37,910 (168.6)	38,765 (172.4)	39,475 (175.6)	40,630 (180.7)
3/4	3-1/2 (89)	3,835 (17.1)	4,285 (19.1)	4,695 (20.9)	5,425 (24.1)	7,670 (34.1)	8,575 (38.1)	9,390 (41.8)	10,845 (48.2)
	6-3/4 (171)	10,270 (45.7)	11,480 (51.1)	12,575 (55.9)	14,175 (63.1)	20,540 (91.4)	22,965 (102.1)	25,155 (111.9)	28,355 (126.1)
	9 (229)	15,810 (70.3)	17,675 (78.6)	18,365 (81.7)	18,900 (84.1)	31,620 (140.7)	35,355 (157.3)	36,730 (163.4)	37,805 (168.2)
	15 (381)	29,395 (130.7)	30,055 (133.7)	30,610 (136.2)	31,505 (140.1)	58,785 (261.5)	60,115 (267.4)	61,220 (272.3)	63,005 (280.3)
7/8	3-1/2 (89)	3,835 (17.1)	4,285 (19.1)	4,695 (20.9)	5,425 (24.1)	7,670 (34.1)	8,575 (38.1)	9,390 (41.8)	10,845 (48.2)
	7-7/8 (200)	12,940 (57.6)	14,470 (64.4)	15,850 (70.5)	18,300 (81.4)	25,880 (115.1)	28,935 (128.7)	31,700 (141.0)	36,605 (162.8)
	10-1/2 (267)	19,925 (88.6)	22,275 (99.1)	24,400 (108.5)	26,340 (117.2)	39,850 (177.3)	44,550 (198.2)	48,805 (217.1)	52,680 (234.3)
	17-1/2 (445)	40,960 (182.2)	41,885 (186.3)	42,655 (189.7)	43,900 (195.3)	81,920 (364.4)	83,770 (372.6)	85,310 (379.5)	87,800 (390.6)
1	4 (102)	4,685 (20.8)	5,240 (23.3)	5,740 (25.5)	6,625 (29.5)	9,370 (41.7)	10,475 (46.6)	11,475 (51.0)	13,250 (58.9)
	9 (229)	15,810 (70.3)	17,675 (78.6)	19,365 (86.1)	22,360 (99.5)	31,620 (140.7)	35,355 (157.3)	38,730 (172.3)	44,720 (198.9)
	12 (305)	24,340 (108.3)	27,215 (121.1)	29,815 (132.6)	34,425 (153.1)	48,685 (216.6)	54,430 (242.1)	59,625 (265.2)	68,850 (306.3)
	20 (508)	52,375 (233.0)	56,190 (249.9)	57,225 (254.5)	58,895 (262.0)	104,755 (466.0)	112,380 (499.9)	114,450 (509.1)	117,790 (524.0)
1-1/4	5 (127)	6,545 (29.1)	7,320 (32.6)	8,020 (35.7)	9,260 (41.2)	13,095 (58.2)	14,640 (65.1)	16,035 (71.3)	18,520 (82.4)
	11-1/4 (286)	22,095 (98.3)	24,705 (109.9)	27,060 (120.4)	31,250 (139.0)	44,195 (196.6)	49,410 (219.8)	54,125 (240.8)	62,500 (278.0)
	15 (381)	34,020 (151.3)	38,035 (169.2)	41,665 (185.3)	48,110 (214.0)	68,040 (302.7)	76,070 (338.4)	83,330 (370.7)	96,220 (428.0)
	25 (635)	73,200 (325.6)	81,840 (364.0)	89,650 (398.8)	95,845 (426.3)	146,395 (651.2)	163,675 (728.1)	179,300 (797.6)	191,685 (852.7)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 as necessary to the above values. Compare to the steel values in table 81. 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).
For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above values by 0.78.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by 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. For seismic loads, multiply cracked concrete tabular values in tension and shear by the following reduction factors:
3/8-in diameter - α_{seis} = 0.66, 1/2-in, 5/8-in, and 1-1/4-in diameter - α_{seis} = 0.74, 3/4-in and 7/8-in diameter - α_{seis} = 0.75
See section 3.1.8 for additional information on seismic applications.

HIT-HY 200 Adhesive with Hilti HIS-N and HIS-RN internally threaded inserts

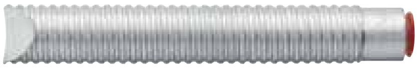


Table 85 - Steel factored resistance for steel bolt/cap screw for Hilti HIS-N and HIS-RN internally threaded inserts[1,2,3]

Thread size	ASTM A193 B7			ASTM A193 Grade B8M Stainless Steel		
	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Seismic Shear[6] $V_{sar,eq}$ lb (kN)	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Seismic Shear[6] $V_{sar,eq}$ lb (kN)
3/8-16 UNC	5,765 (25.6)	3,215 (14.3)	2,250 (10.0)	5,070 (22.6)	2,825 (12.6)	1,975 (8.8)
1/2-13 UNC	9,635 (42.9)	5,880 (26.2)	4,115 (18.3)	9,290 (41.3)	5,175 (23.0)	3,620 (16.1)
5/8-11 UNC	16,020 (71.3)	9,365 (41.7)	6,555 (29.2)	14,790 (65.8)	8,240 (36.7)	5,770 (25.7)
3/4-10 UNC	16,280 (72.4)	13,860 (61.7)	9,700 (43.1)	21,895 (97.4)	12,195 (54.2)	8,535 (38.0)

1 See Section 3.1.8 to convert design strength value to ASD value.
2 Hilti HIS-N and HIS-RN inserts with steel bolts are considered brittle steel elements.
3 Table values are the lesser of steel failure in the HIS-N insert or inserted steel bolt.
4 Tensile = $A_{se,N}\ \phi_s\ f_{uta}$ R as noted in CSA A23.3-14 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.
6 Seismic Shear = $\alpha_{V,seis}\ V_{sar}$: Reduction factor for seismic shear only. See section 3.1.8 for additional information on seismic applications.

Table 86 - Hilti HIT-HY 200 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_{ac}	–	$2h_{ef}$				
	Minimum edge distance	c_{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 pullout resistance in cracked concrete[6]	τ_{cr}	psi (MPa)	870 (6.0)	890 (6.1)	910 (6.3)	920 (6.3)	D.6.5.2
	Characteristic pullout resistance in uncracked concrete[6]	τ_{uncr}	psi (MPa)	1,950 (13.4)	1,950 (13.4)	1,950 (13.4)	1,950 (13.4)	D.6.5.2
Temp range B[5]	Characteristic pullout resistance in cracked concrete[6]	τ_{cr}	psi (MPa)	870 (6.0)	890 (6.1)	910 (6.3)	92 (0.6)	D.6.5.2
	Characteristic pullout resistance in uncracked concrete[6]	τ_{uncr}	psi (MPa)	1,950 (13.4)	1,950 (13.4)	1,950 (13.4)	1,950 (13.4)	D.6.5.2
Temp range C[5]	Characteristic pullout resistance in cracked concrete[6]	τ_{cr}	psi (MPa)	715 (4.9)	730 (5.0)	750 (5.2)	755 (5.2)	D.6.5.2
	Characteristic pullout resistance in uncracked concrete[6]	τ_{uncr}	psi (MPa)	1,600 (11.0)	1,600 (11.0)	1,600 (11.0)	1,600 (11.0)	D.6.5.2
	Reduction for seismic tension	$\alpha_{N,seis}$	–	0.92				
Permissible installation conditions	Resistance modification factor tension and shear, pullout failure dry concrete	Anch cat	–	1				D.5.3 (c)
		R_{dry}	–	1.00				
	Resistance modification factor tension and shear, pullout failure water-saturated concrete	Anch cat	–	1				D.5.3 (c)
		R_{ws}	–	1.0				

1 Design information in this table is taken from ELC-3187, dated April 2019, tables 19 and 20, for use with CSA A23.3-14 Annex D.
2 See figure 13 of this section.
3 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.
4 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.
5 Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°C).
Temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C).
Temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°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 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 87 - Hilti HIT-HY 200 adhesive factored resistance with concrete/bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete[1,2,3,4,5,6,7,8,9]

Thread size	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)
3/8-16 UNC	4-3/8 (110)	7,540 (33.5)	8,430 (37.5)	9,235 (41.1)	10,660 (47.4)	15,080 (67.1)	16,860 (75.0)	18,470 (82.1)	21,325 (94.9)
1/2-13 UNC	5 (125)	9,135 (40.6)	10,210 (45.4)	11,185 (49.8)	12,915 (57.5)	18,265 (81.3)	20,420 (90.8)	22,370 (99.5)	25,830 (114.9)
5/8-11 UNC	6-3/4 (170)	14,485 (64.4)	16,195 (72.0)	17,740 (78.9)	20,485 (91.1)	28,970 (128.9)	32,390 (144.1)	35,480 (157.8)	40,970 (182.2)
3/4-10 UNC	8-1/8 (205)	19,180 (85.3)	21,445 (95.4)	23,490 (104.5)	27,125 (120.7)	38,360 (170.6)	42,890 (190.8)	46,985 (209.0)	54,255 (241.3)

Table 88 - Hilti HIT-HY 200 adhesive factored resistance with concrete/bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in cracked concrete[1,2,3,4,5,6,7,8,9]

Thread size	Effective embedment in. (mm)	Tension - N_r				Shear - V_r			
		f'_c = 20 MPa (2,900psi) 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)
3/8-16 UNC	4-3/8 (110)	5,235 (23.3)	5,595 (24.9)	5,910 (26.3)	6,445 (28.7)	10,470 (46.6)	11,190 (49.8)	11,820 (52.6)	12,885 (57.3)
1/2-13 UNC	5 (125)	6,395 (28.4)	7,150 (31.8)	7,830 (34.8)	9,040 (40.2)	12,785 (56.9)	14,295 (63.6)	15,660 (69.7)	18,080 (80.4)
5/8-11 UNC	6-3/4 (170)	10,140 (45.1)	11,335 (50.4)	12,420 (55.2)	14,340 (63.8)	20,280 (90.2)	22,675 (100.9)	24,835 (110.5)	28,680 (127.6)
3/4-10 UNC	8-1/8 (205)	13,425 (59.7)	15,010 (66.8)	16,445 (73.1)	18,990 (84.5)	26,855 (119.5)	30,025 (133.5)	32,890 (146.3)	37,975 (168.9)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 60 - 61 as necessary to the above values. Compare to the steel values in table 85. 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).
For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 110°F (43°C) multiply above values by 0.92.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above values by 0.78.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength value by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by the following reduction factors:
For all insert diameters - α_{seis} = 0.69
See section 3.1.8 for additional information on seismic applications.

POST-INSTALLED REBAR DESIGN IN CONCRETE PER ACI 318

Development and splicing of post-installed reinforcement

Calculations for post-installed rebar for typical development lengths may be done according to ACI 318-14 Chapter 25 (formerly ACI 318-11 Chapter 12) and CSA A23.3-14 Chapter 12 for adhesive anchors tested and approved in accordance with AC 308. This section contains tables for the data provided in ICC Evaluation Services ESR-3187. Refer to section 3.1.14 and the Hilti North America Post-Installed Reinforcing Bar Guide for the design method.

Table 89 - Calculated tension development and Class B splice lengths for Grade 60 bars in walls, slabs, columns, and footings per ACI 318-14 Chapter 25 for Hilti HIT-HY 200 - SDC A and B only[3,4,5,6,7]

Rebar size	System		$\frac{c_b + K_{tr}}{d_b}$	Minimum edge dist. in.[1]	Minimum spacing in.[2]	f'_c = 2,500 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi	
	HIT-HY 200-A	HIT-HY 200-R				ℓ_d in.	Class B splice in.	ℓ_d in.	Class B splice in.	ℓ_d in.	Class B splice in.	ℓ_d in.	Class B splice in.
#3	◐	◐	2.5	2-1/4	2	12	14	12	13	12	12	12	12
#4	◐	◐		2-3/4	2-1/2	14	19	13	17	12	15	12	12
#5	◐	◐		3	3-1/4	18	23	16	21	14	18	12	15
#6	■	◐		3-3/4	3-3/4	22	28	20	26	17	22	14	18
#7	■	◐		4-1/2	4-1/2	32	41	29	37	25	32	20	26
#8	■	◐		5	5	36	47	33	43	28	37	23	30
#9	■	◐		5-1/4	5-3/4	41	53	37	48	32	42	26	34
#10	■	◐		5-3/4	6-1/2	46	59	42	54	36	47	30	38

◐ Applicable for use with special installation provisions and installation temperature restrictions to account for short gel time with deep embedment depth. See the Instruction For Use (IFU), packaged with the product for special installation parameters.

■ Not recommended due to limited gel time of adhesive.

1 Edge distances are determined using the minimum cover specified by ESR-3187 with an additional 6% of the development length per suggestions for drilling without an aid per Hilti Post-Installed Reinforcing Bar Guide Section 3.3. Smaller edge distances may be possible, for which development and splice lengths may need to be recalculated. For further information on required cover see ACI 318-14, Sec. 20.6.1.3; see Sec. 2.2 for determination of c_b.

2 Spacing values represent those producing $c_b = 5\ d_b$ rounded up to the nearest 1/4 in. Smaller spacing values may be possible, for which development and splice lengths may need to be recalculated. For further information on required spacing see ACI 318-14 Sec. 25.2; see Sec. 2.2 for determination of c_b.

3 ψ_t = 1.0 See ACI 318-14, Sec. 25.4.2.4.

4 ψ_e = 1.0 for non-epoxy coated bars. See ACI 318-14, Sec. 25.4.2.4.

5 ψ_s = 0.8 for #6 bars and smaller bars, 1.0 for #7 and larger bars. See ACI 318-14, Sec. 25.4.2.4.

6 Values are for normal weight concrete. For sand-lightweight concrete, multiply development and splice lengths by 1.18, for all-lightweight concrete multiply development and splice lengths by 1.33. See ACI 318-14 Sec. 19.2.4.

7 Development and splice length values are for static design. Seismic design development and splice lengths can be found in ACI 318-14 18.8.5 for special moment frames and ACI 318-14 18.10.2.3 for special structural walls. For further information about reinforcement in seismic design, see ACI 318-14 Ch. 18.

8 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples.

Table 90 - Suggested embedment, edge distance, and spacing (see figure below) to develop 125% of f_y in Grade 60 bars based on ACI 318-14 Chapter 17 - SDC A and B only[1,2,3,4,5,6,7]

Rebar size	f'_c = 2,500 psi				f'_c = 3,000 psi				f'_c = 4,000 psi				f'_c = 6,000 psi			
	Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II	Min. spacing s_{min} in.	Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II	Min. spacing s_{min} in.	Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II	Min. spacing s_{min} in.	Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II	Min. spacing s_{min} in.
#3	7	18	8	15	7	18	7	14	7	18	7	13	7	17	6	11
#4	10	25	11	22	10	25	11	21	9	24	10	19	9	24	9	17
#5	12	31	15	29	12	31	14	28	12	30	13	25	11	29	11	22
#6	14	37	19	37	14	36	18	35	14	36	16	32	13	35	14	28
#7	17	43	23	45	16	42	22	43	16	41	20	39	15	40	17	34
#8	**19**	49	27	54	19	49	26	51	18	48	23	47	18	47	21	41
#9	**21**	55	32	63	**21**	54	30	60	20	54	27	54	20	52	24	48
#10	**25**	65	37	74	**24**	62	35	70	23	60	32	64	22	59	28	56

1 For additional information see May-June 2013 issue of the ACI Structural Journal, "Recommended Procedures for Development and Splicing of Post-Installed Bonded Reinforcing Bars in Concrete Structures" by Charney, Pal and Silva.
2 h_{ef} is the calculated bar embedment based on uncracked bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Additional reductions per ACI 318-14, 17.3.1.2 for sustained loading conditions are not included and as such these suggested embedments are not intended for sustained tension load applications. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the unbolded and bolded tabulated hef values by 0.80 and 0.86, respectively. Reduction factors for non-sustained loading and no bar overstrength may be combined.
3 c_a and s are the minimum edge distance and bar spacing (from bar centerline) associated with the tabulated embedments. Refer to sec. 3.1.14 for applicability of edge distance "Condition I" and "Condition II."
4 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.
5 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187 Tables 12 and 13 assuming dry, uncracked concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.
6 Values are for normal weight concrete. For lightweight concrete contact Hilti.
7 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

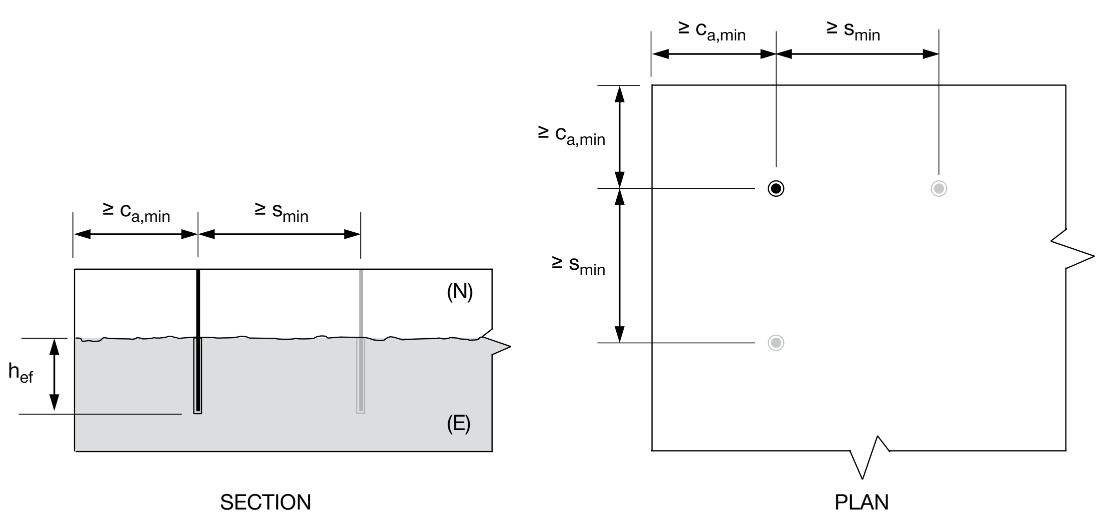


Illustration of Table 90 dimensions

Table 91 - Suggested embedment and edge distance (see figure below) based on ACI 318-14 Chapter 17 to develop 125% of f_y in Grade 60 wall/column starter bars in a linear array with bar spacing = 24 inches - SDC A and B only[1,2,3,4,5,6]

Rebar size	Linear spacing s in.	f'_c = 2,500 psi			f'_c = 3,000 psi			f'_c = 4,000 psi			f'_c = 6,000 psi		
		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.	
			Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II
#3	24	7	18	8	7	18	7	7	18	7	7	17	6
#4		10	25	12	10	25	11	9	24	10	9	24	9
#5		13	33	19	12	31	17	12	30	15	11	29	12
#6		21	55	32	19	49	28	15	40	23	13	35	18
#7		32	83	47	28	75	42	23	62	35	18	48	26

1 h_{ef} is the calculated bar embedment based on uncracked bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Shaded embedment values exceed 20 bar diameters. For non-tabulated rebar sizes, design per development length provisions is recommended. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the tabulated h_{ef} values by 0.86.

2 c_a is the minimum edge distance (from bar centerline) associated with the tabulated embedments and s = 24 in. Refer to sec. 3.1.14 for applicability of edge distance "Condition I" and "Condition II."

3 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.

4 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187 Tables 12 and 13 assuming dry concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.

5 Values are for normal weight concrete. For lightweight concrete contact Hilti.

6 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for detailed explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

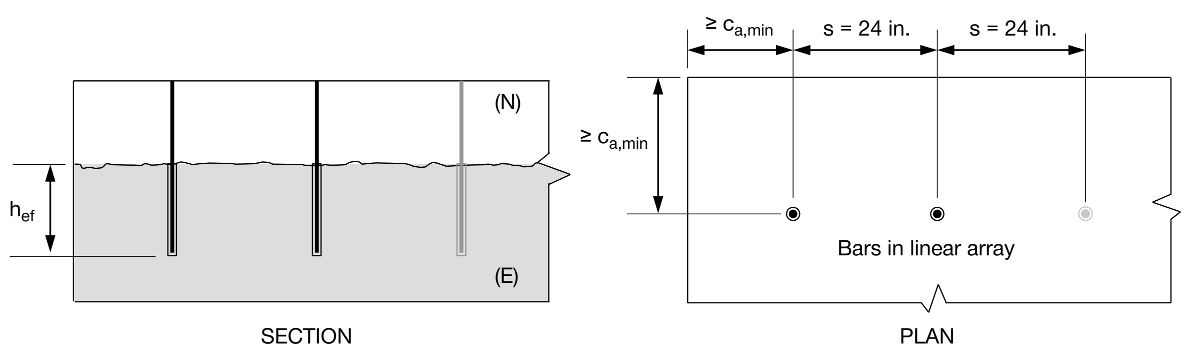


Illustration of Table 91 dimensions

Table 92 - Suggested embedment and edge distance (see figure below) based on ACI 318-14 Chapter 17 to develop 125% of f_y in Grade 60 wall/column starter bars in a linear array with bar spacing = 18 inches - SDC A and B only[1,2,3,4,5,6]

Rebar size	Linear spacing s in.	f'_c = 2,500 psi			f'_c = 3,000 psi			f'_c = 4,000 psi			f'_c = 6,000 psi		
		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II	Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II	Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II	Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in. Cond. I	Minimum edge dist $c_{a,min}$ in. Cond. II
#3	18	7	18	8	7	18	7	7	18	7	7	17	6
#4		10	25	14	10	25	13	9	24	12	9	24	10
#5		18	47	27	16	41	24	13	34	19	11	29	15

1 h_{ef} is the calculated bar embedment based on uncracked bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Shaded embedment values exceed 20 bar diameters. For non-tabulated rebar sizes, design per development length provisions is recommended. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the tabulated h_{ef} values by 0.86.
2 c_a is the minimum edge distance (from bar centerline) associated with the tabulated embedments and s = 18 in. Refer to sec. 3.1.14 for applicability of edge distance "Condition I" and "Condition II."
3 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.
4 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187, Tables 12 and 13 assuming dry, uncracked concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.
5 Values are for normal weight concrete. For lightweight concrete contact Hilti.
6 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for detailed explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

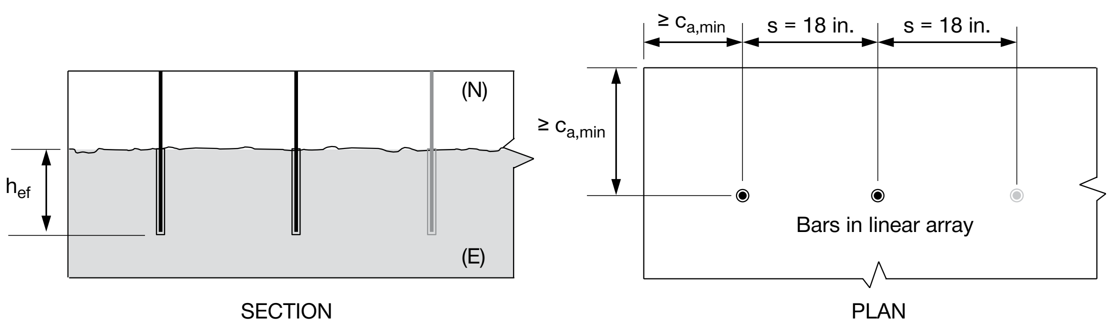


Illustration of Table 92 dimensions

Table 93 - Suggested embedment and edge distance (see figure below) based on ACI 318-14 Chapter 17 to develop 125% of f_y in Grade 60 wall/column starter bars in a linear array with bar spacing = 12 inches - SDC A and B only[1,2,3,4,5,6]

Rebar size	Linear spacing s in.	f'_c = 2,500 psi			f'_c = 3,000 psi			f'_c = 4,000 psi			f'_c = 6,000 psi		
		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.		Effective embed. h_{ef} in.	Minimum edge dist $c_{a,min}$ in.	
			Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II
#3	12	7	18	10	7	18	9	7	18	8	7	17	7
#4		–	–	–	13	35	20	11	29	16	9	24	13

1 h_{ef} is the calculated bar embedment based on uncracked bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Shaded embedment values exceed 20 bar diameters. For non-tabulated rebar sizes, design per development length provisions is recommended. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the tabulated h_{ef} values by 0.86.

2 c_a is the minimum edge distance (from bar centerline) associated with the tabulated embedments and s = 12 in. Refer to sec. 3.1.14 for applicability of edge distance “Condition I” and “Condition II.”

3 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.

4 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187, Tables 12 and 13 assuming dry, uncracked concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.

5 Values are for normal weight concrete. For lightweight concrete contact Hilti.

6 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

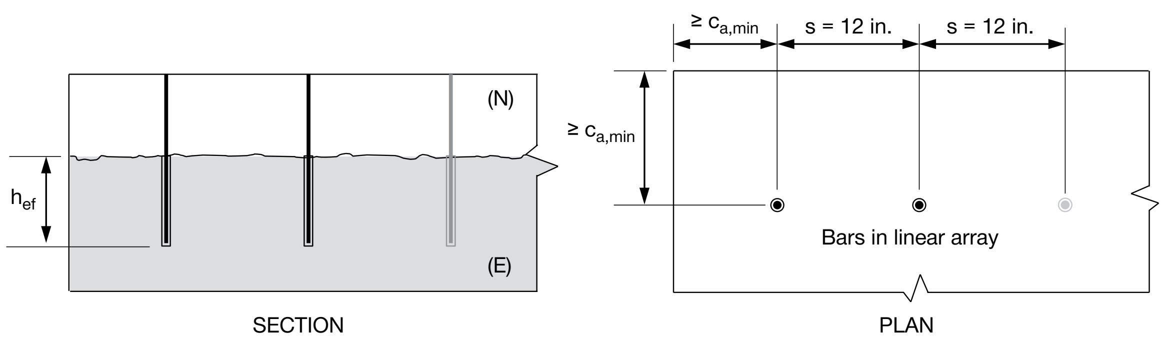


Illustration of Table 93 dimensions

Table 94 - Calculated tension development and splice lengths for Canadian 400 MPa bars in walls, slabs, columns, and footings per CSA A23.3-14 for Hilti HIT-HY 200 - non-seismic design only[3,4,5,6,7,8]

Rebar size	System		$d_{cs} + K_{tr}$	Minimum edge dist. mm[1]	Minimum spacing mm[2]	f'_c = 20 MPa		f'_c = 25 MPa		f'_c = 30 MPa		f'_c = 40 MPa	
	HIT-HY 200-A	HIT-HY 200-R				ℓ_d mm	Class B splice mm	ℓ_d mm	Class B splice mm	ℓ_d mm	Class B splice mm	ℓ_d mm	Class B splice mm
10M	◐	◐	$2.5d_b$	60	50	300	380	300	340	300	310	300	300
15M	◐	◐		70	75	410	540	370	480	340	440	300	380
20M	◐	◐		80	100	510	660	450	590	410	540	360	460
25M	■	◐		120	125	820	1,060	730	950	670	870	580	750
30M	■	◐		130	150	960	1,250	860	1,120	790	1,020	680	890

◐ Applicable for use with special installation provisions and installation temperature restrictions to account for short gel time with deep embedment depth. See Instructions for Use (IFU) for special installation parameters.

■ Not recommended due to limited gel time of adhesive.

1 Edge distances are determined using the minimum cover specified by ESR-3187 with an additional 6% of the development length per suggestions for drilling without an aid per Hilti Post-Installed Reinforcing Bar Guide Section 3.3. Smaller edge distances may be possible, for which development and splice lengths may need to be recalculated. For further information on required cover see CSA A23.1-14 Table 17; see Sec. 3.2 for determination of d_{cs}.

2 Spacing values represent those producing c_b $5d_b$. Smaller spacing values may be possible, for which development and splice lengths may need to be recalculated. For further information on required spacing see CSA A23.1 Sec. 6.6.5.2; see Sec. 3.2 for determination of d_{cs}.

3 k_1 and k_2 as defined by CSA A23.3-14 12.2.4 (a) and (b), are taken as 1.0 for post-installed reinforcing bars. For additional information see May-June 2013 issue of the ACI Structural Journal, “Recommended Procedures for Development and Splicing of Post-Installed Bonded Reinforcing Bars in Concrete Structures” by Charney, Pal and Silva.

4 k_4 = 0.8 for 20M bars and smaller bars, 1.0 for 25M and larger bars. See CSA A23.3-14 12.2.4 (d).

5 K_{tr} is assumed to equal zero.

6 Values are for normal weight concrete. For lightweight concrete, multiply development and splice lengths by 1.3.

7 Development and splice length values are for static design. For tension development and splice lengths of bars in joints, see CSA A23.3-14 21.3.3.5. For further information about reinforcement in seismic design, see CSA A23.3-14 Ch. 21.

8 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples.

Table 95 - Suggested embedment, edge distance, and spacing (see figure below) to develop 125% of f_y in Canadian 400 MPa bars based on CSA A23.3-14 Annex D - non-seismic design only[1,2,3,4,5,6,7]

Rebar size	f'_c = 20 MPa				f'_c = 25 MPa				f'_c = 30 MPa				f'_c = 40 MPa			
	Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Min. spacing s_{min} mm	Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Min. spacing s_{min} mm	Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Min. spacing s_{min} mm	Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Min. spacing s_{min} mm
		Cond. I	Cond. II			Cond. I	Cond. II			Cond. I	Cond. II			Cond. I	Cond. II	
10M	200	520	220	440	200	510	200	400	200	510	190	380	190	500	180	350
15M	280	740	350	690	280	730	320	640	270	720	300	600	270	710	280	550
20M	350	910	450	900	340	890	420	840	330	880	400	790	320	870	360	720
25M	**450**	1,170	630	1,260	440	1,150	590	1,170	430	1,140	560	1,110	420	1,120	500	1,000
30M	**530**	1,390	790	1,580	**520**	1,360	740	1,470	510	1,350	690	1,380	490	1,320	630	1,260

1 For additional information see May-June 2013 issue of the ACI Structural Journal, “Recommended Procedures for Development and Splicing of Post-Installed Bonded Reinforcing Bars in Concrete Structures” by Charney, Pal and Silva.

2 h_{ef} is the calculated bar embedment uncracked based on bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Additional reductions per ACI 318-14 17.3.1.2 for sustained loading conditions are not included and as such these suggested embedments are not intended for sustained tension load applications. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the unbolded and bolded tabulated h_{ef} values by 0.80 and 0.86, respectively.

3 c_a and s are the minimum edge distance and bar spacing (from bar centerline) associated with the tabulated embedments. Refer to sec. 3.1.14 for applicability of edge distance “Condition I” and “Condition II.”

4 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.

5 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187 Tables 20 and 21 assuming dry, uncracked concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.

6 Values are for normal weight concrete. For lightweight concrete contact Hilti.

7 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

3.2.2

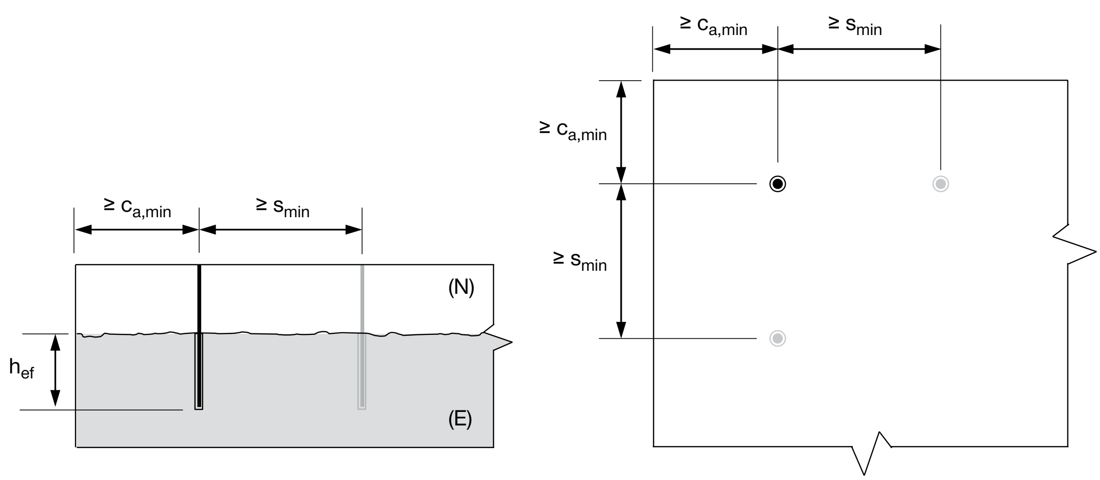


Illustration of Table 95 dimensions

Table 96 - Suggested embedment and edge distance (see figure below) based on CSA A23.3-14 Annex D to develop 125% of f_y in Canadian 400 MPa wall/column starter bars in a linear array with bar spacing = 600 millimeters - non-seismic design only[1,2,3,4,5,6]

Rebar size	Linear spacing s mm	f'_c = 20 MPa			f'_c = 25 MPa			f'_c = 30 MPa			f'_c = 40 MPa		
		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm	
			Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II
10M	600	200	520	220	200	510	200	200	510	190	190	500	180
15M		280	740	420	280	730	350	270	720	300	270	710	280
20M		510	1,340	760	430	1,150	650	380	1,010	570	320	870	460

1 h_{ef} is the calculated bar embedment based on uncracked bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Shaded embedment values exceed 20 bar diameters. For non-tabulated rebar sizes, design per development length provisions is recommended. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the tabulated h_{ef} values by 0.86.

2 c_a is the minimum edge distance (from bar centerline) associated with the tabulated embedments and s = 600 mm. Refer to sec. 3.1.14 for applicability of edge distance “Condition I” and “Condition II.”

3 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.

4 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187, Tables 12 and 13 assuming dry, uncracked concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.

5 Values are for normal weight concrete. For lightweight concrete contact Hilti.

6 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

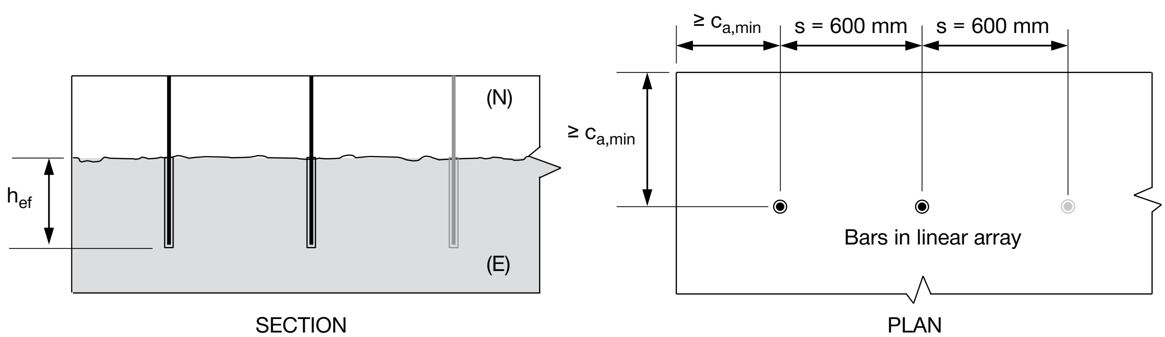


Illustration of Table 96 dimensions

Table 97 - Suggested embedment and edge distance (see figure below) based on CSA A23.3-14 Annex D to develop 125% of f_y in Canadian 400 MPa wall/column starter bars in a linear array with bar spacing = 450 millimeters - non-seismic design only[1,2,3,4,5,6]

Rebar size	Linear spacing s mm	f'_c = 20 MPa			f'_c = 25 MPa			f'_c = 30 MPa			f'_c = 40 MPa		
		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm Cond. I	Cond. II	Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm Cond. I	Cond. II	Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm Cond. I	Cond. II	Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm Cond. I	Cond. II
10M	450	200	520	220	200	510	200	200	510	190	190	500	180
15M		390	1,040	590	340	890	500	300	790	440	270	710	360

1 h_{ef} is the calculated bar embedment based on uncracked bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Shaded embedment values exceed 20 bar diameters. For non-tabulated rebar sizes, design per development length provisions is recommended. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the tabulated h_{ef} values by 0.86.

2 c_a is the minimum edge distance (from bar centerline) associated with the tabulated embedments and s = 450 mm. Refer to sec. 3.1.14 for applicability of edge distance "Condition I" and "Condition II."

3 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.

4 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187 Tables 12 and 13 assuming dry, uncracked concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.

5 Values are for normal weight concrete. For lightweight concrete contact Hilti.

6 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

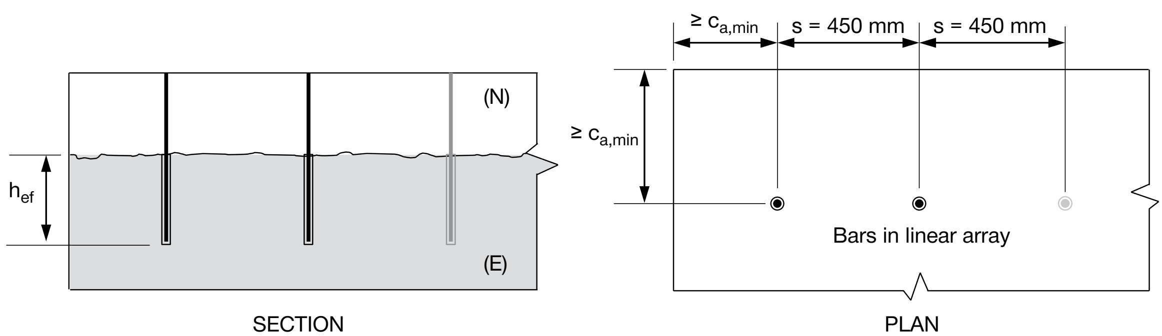


Illustration of Table 97 dimensions

Table 98 - Suggested embedment and edge distance (see figure below) based on CSA A23.3-14 Annex D to develop 125% of f_y in Canadian 400 MPa wall/column starter bars in a linear array with bar spacing = 300 millimeters - non-seismic design only[1,2,3,4,5,6]

Rebar size	Linear spacing s mm	f'_c = 20 MPa			f'_c = 25 MPa			f'_c = 30 MPa			f'_c = 40 MPa		
		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm		Effective embed. h_{ef} mm	Minimum edge dist $c_{a,min}$ mm	
			Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II		Cond. I	Cond. II
10M	300	240	610	350	200	520	300	200	510	260	190	500	210

1 h_{ef} is the calculated bar embedment based on uncracked bond and concrete breakout strengths using equations in section 3.1.14 to develop 125% of nominal bar yield. Shaded embedment values exceed 20 bar diameters. For non-tabulated rebar sizes, design per development length provisions is recommended. The particular assumptions used for the application of anchor theory to bar development (e.g., bar yield and bond strength values) are a matter of engineering judgment and will in part depend on the specific circumstances of the design. For embedments corresponding to nominal yield (i.e., no overstrength) multiply the tabulated hef values by 0.86.
2 c_a is the minimum edge distance (from bar centerline) associated with the tabulated embedments and s = 300 mm. Refer to sec. 3.1.14 for applicability of edge distance "Condition I" and "Condition II."
3 Applicable for hammer-drilled holes. For rock-drilled and core-drilled holes, contact Hilti.
4 Values determined with bond stresses, k-factors and strength reduction factors taken from ESR-3187 Tables 12 and 13 assuming dry, uncracked concrete conditions where concrete temperatures will not exceed a maximum short-term temperature of 130°F (55°C) and long-term temperature of 110°F (43°C). Bond stresses are for static (non-seismic) loading conditions.
5 Values are for normal weight concrete. For lightweight concrete contact Hilti.
6 Refer to the Hilti North America Post-Installed Reinforcing Bar Guide for further explanation, background information, and design examples. See Hilti Instructions for Use (IFU) for specific installation requirements.

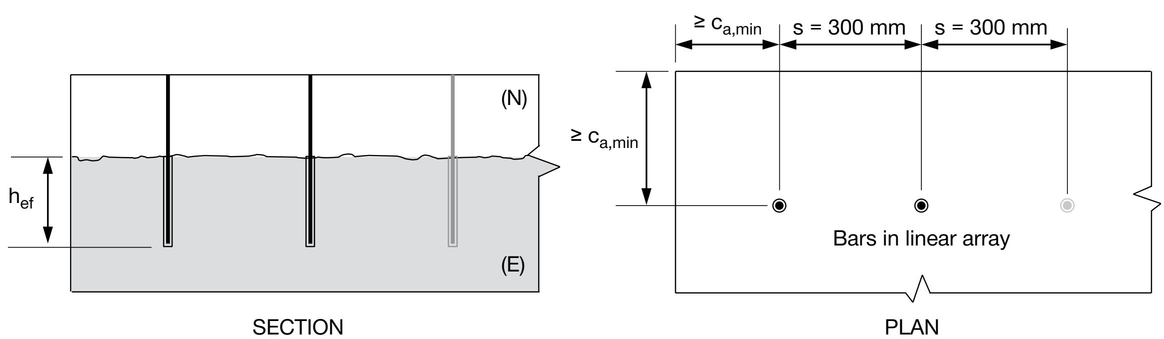
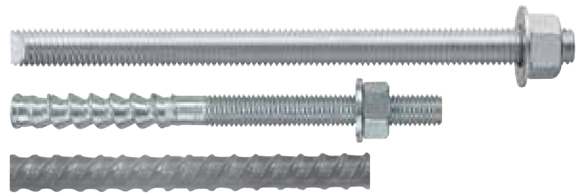


Illustration of Table 98 dimensions



DESIGN DATA IN MASONRY

Hilti HIT-HY 200 adhesive in grout-filled CMU with Hilti HAS threaded rod , Deformed Reinforcing Bar (Rebar), and Hilti HIT-Z(-R) anchor rods

Figure 9 - Hilti HAS threaded rod installation conditions

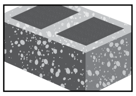
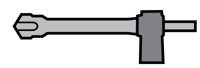
Permissible Base Materials		Grout-filled concrete masonry	Permissible drilling method	 	Hammer drilling with carbide tipped drill bit Hilti TE-CD or TE-YD Hollow Drill Bit

Table 99 - Hilti HIT-HY 200 allowable adhesive bond tension loads for threaded rods, HIT-Z(-R) anchor rods, and reinforcing bars in the face of grout-filled concrete masonry walls[1,2,3,4,5,6,7,8]

Nominal anchor diameter in.	Rebar Size	Effective embedment in. (mm)[11]	Tension lb (kN)	Spacing[9]			Edge distance[10]		
				Critical s_{cr} in. (mm)	Minimum s_{min} in. (mm)	Load Reduction Factor @ s_{min} [6,12]	Critical c_{cr} in. (mm)	Minimum c_{min} in. (mm)	Load Reduction Factor @ c_{min} [12]
3/8	No. 3	3 3/8 (86)	960 (4.3)	13.5 (343)	4 (102)	0.60	12 (305)	4 (102)	0.58
1/2	No. 4	4 1/2 (114)	1,520 (6.8)	18 (457)		0.60	20 (508)		0.70
5/8	No. 5	5 5/8 (143)	1,810 (8.1)	22.5 (572)		0.50	20 (508)		0.82
3/4	No. 6	6 3/4 (171)	2,215 (9.9)	27 (686)		0.50	20 (508)		0.68

Table 100 - Hilti HIT-HY 200 allowable adhesive bond shear loads for threaded rods, HIT-Z(-R) anchor rods, and reinforcing bars in the face of grout-filled concrete masonry walls[1,2,3,4,5,6,7,8]

Nominal anchor diameter in.	Rebar Size	Effective embedment in. (mm)[11]	Shear lb (kN)	Spacing[9]			Edge distance[10]			
				Critical s_{cr} in. (mm)	Minimum s_{min} in. (mm)	Load Reduction Factor @ s_{min} [6,12]	Critical c_{cr} in. (mm)	Minimum c_{min} in. (mm)	Load Reduction Factor @ c_{min} [12]	
									Load ⊥ to edge	Load ll edge
3/8	No. 3	3 3/8 (86)	825 (3.7)	13.5 (343)	4 (102)	0.56	12 (305)	4 (102)	0.60	0.72
1/2	No. 4	4 1/2 (114)	1,240 (5.5)	18 (457)		0.50	12 (305)		0.44	0.85
5/8	No. 5	5 5/8 (143)	2,120 (9.4)	22.5 (572)		0.50	20 (508)		0.22	0.71
3/4	No. 6	6 3/4 (171)	2,480 (11.0)	27 (686)		0.50	20 (508)		0.19	0.71

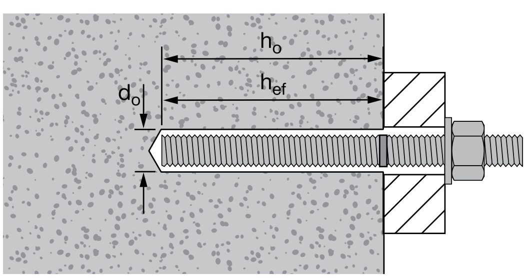
1 All values are for anchors installed in fully grouted concrete masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units shall be lightweight, medium-weight or heavy-weight conforming to ASTM C90. Allowable loads are calculated using a safety factor of 5.
2 Anchors may be installed in any location in the face of the masonry wall including cell, web, and mortar joints. Anchors are limited to one per masonry cell.
3 Linear interpolation of load values between minimum spacing (s_{min}) and critical spacing (s_{cr}) and between minimum edge distance (c_{min}) and critical edge distance (c_{cr}) is permitted.
4 Concrete masonry thickness must be equal to or greater than 1.5 times the anchor embedment depth. EXCEPTION: the 5/8-inch- and the 3/4-inch diameter anchors (No. 5 and No. 6 bars) may be installed in minimum nominally 8-inch thick concrete masonry.
5 When using the basic load combinations in accordance with IBC Section 1605.3.1, tabulated allowable loads must not be increased for seismic or wind loading When using the alternative basic load combinations in IBC Section 1605.3.2 that include seismic or wind loads, tabulated allowable loads may be increased by 33-1/3 percent, or the alternative basic load combinations may be reduced by a factor of 0.75.
6 Allowable loads must be the lesser of the adjusted masonry or bond tabulated values and the steel values given in tables 102 and 103.
7 Tabulated allowable loads shall be adjusted for increased base material temperatures in accordance with figure 14.
8 For combined loading: $(T_{applied} / T_{allowable}) + (V_{applied} / V_{allowable}) \leq 1$
9 The critical spacing, s_{cr}, is the anchor spacing where full load values may be used. The minimum spacing, s_{min}, is the minimum anchor spacing for which values are available and installation is recommended. Spacing is measured from the center of one anchor to the center of an adjacent anchor.
10 The critical edge distance, c_{cr}, is the edge distance where full load values may be used. The minimum edge distance, c_{min}, is the minimum edge distance for which values are available and installation is recommended. Edge distance is measured from the center of the anchor to the closest edge.
11 Embedment depth is measured from the outside face of the concrete masonry unit.
12 Load reduction factors are multiplicative, both spacing and edge distance load reduction factors must be considered. Load values for anchors installed at less than s_{cr} and c_{cr} must be multiplied by the appropriate load reduction factor based on actual edge distance (c) and spacing (s).

Table 101 - Hilti HIT-HY 200 allowable adhesive bond loads for threaded rods and reinforcing bars in the top of grout-filled concrete masonry walls[1,2,3,4,5,6]

Nominal anchor diameter or rebar size	Effective embedment in. (mm)	Edge distance in. (mm)[7,8]	Minimum end distance in. (mm)	Tension lb (kN)	Shear load lb (kN)[9]	
					Load parallel to edge of masonry wall	Load perpendicular to edge of masonry wall
1/2"	4 -1/2 (114)	1 3/4 (44)	8 (203)	685 (3.0)	775 (3.4)	285 (1.3)
		4 (102)		880 (3.9)	1,156 (5.1)	480 (2.1)
5/8"	5 -5/8 (143)	1 3/4 (44)		830 (3.7)	890 (4.0)	315 (1.4)
		4 (102)		980 (4.4)	1,315 (5.8)	625 (2.8)
#4	4 -1/2 (114)	1 3/4 (44)		770 (3.4)	605 (2.7)	235 (1.0)
#5	5 -5/8 (143)			795 (3.5)	720 (3.2)	295 (1.3)

1 All values are for anchors installed in fully grouted concrete masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units shall be lightweight, medium-weight or heavy-weight conforming to ASTM C90. Allowable loads are calculated using a safety factor of 5.
2 When using the basic load combinations in accordance with IBC Section 1605.3.1 or the alternative basic load combinations in IBC Section 1605.3.2. Tabulated allowable loads must not be increased for seismic or wind loading.
3 One anchor shall be permitted to be installed in each concrete block.
4 Anchors are not permitted to be installed in a head joint, flange or web of the concrete masonry unit.
5 Allowable loads must be the lesser of the adjusted masonry or bond tabulated values and the steel values given in tables 102 and 103.
6 Tabulated allowable loads shall be adjusted for increased base material temperatures in accordance with figure 14.
7 For combined loading: $(T_{applied} / T_{allowable}) + (V_{applied} / V_{allowable}) \leq 1$
8 The tabulated edge distance is measured from the anchor centerline to the edge of the concrete block. See figure below.
9 Linear interpolation of load values between the two tabulated edge distances is permitted.

Hilti HIT-HY 200 specifications for HAS threaded rod in grout-filled masonry walls



Edge and end distances for threaded rods and reinforcing bars installed in the top of grout-filled CMU

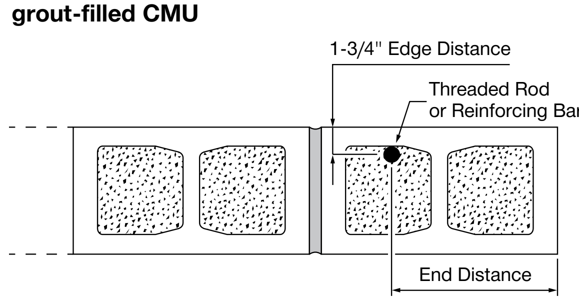


Table 102 - Hilti HIT-HY 200 allowable tension and shear values for threaded rods based on steel strength[1,2,3]

Anchor diameter in.	Tension lb (kN)						Shear lb (kN)					
	ISO 898 class 5.8	ASTM A36	ASTM A307	ASTM A193 B7	ASTM F593 CW (316/304)	HIT-(Z(-R)	ISO 898 class 5.8	ASTM A36	ASTM A307	ASTM A193 B7	ASTM F593 CW (316/304)	HIT-(Z(-R)
3/8	2,640 (11.7)	2,115 (9.4)	2,185 (9.7)	4,555 (20.3)	3,645 (16.2)	3,430 (15.3)	1,360 (6.0)	1,090 (4.8)	1,125 (5.0)	2,345 (10.4)	1,875 (8.3)	1,770 (7.9)
1/2	4,700 (20.9)	3,755 (16.7)	3,885 (17.3)	8,100 (36.0)	6,480 (28.8)	6,100 (27.1)	2,420 (10.8)	1,935 (8.6)	2,000 (8.9)	4,170 (18.5)	3,335 (14.8)	3,145 (14.0)
5/8	7,340 (32.6)	5,870 (26.1)	6,075 (27.0)	12,655 (56.3)	10,125 (45.0)	9,535 (42.4)	3,780 (16.8)	3,025 (13.5)	3,130 (13.9)	6,520 (29.0)	5,215 (23.2)	4,915 (21.9)
3/4	10,570 (47.0)	8,455 (37.6)	8,750 (38.9)	18,225 (81.1)	12,390 (55.1)	13,735 (61.1)	5,445 (24.2)	4,355 (19.4)	4,505 (20.0)	9,390 (41.8)	6,385 (28.4)	7,075 (31.5)

Table 103 - Hilti HIT-HY 200 allowable tension and shear values for reinforcing bars based on steel strength[1,2,3]

3.2.2

Rebar size	Tension lb (kN)	Shear lb (kN)
	ASTM A615, GRADE 60	ASTM A615, GRADE 60
#3	3,270 (14.5)	1,685 (7.5)
#4	5,940 (26.4)	3,060 (13.6)
#5	9,205 (40.9)	4,745 (21.1)
#6	13,070 (58.1)	6,730 (29.9)

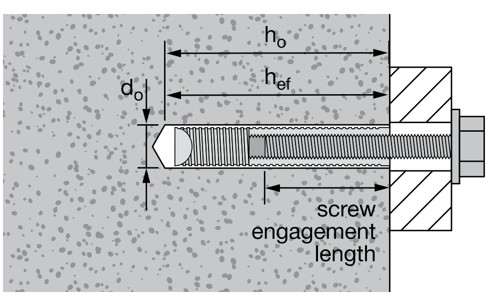
1 Allowable load used in the design must be the lesser of bond values and tabulated steel values.
2 The allowable tension and shear values for threaded rods to resist short term loads, such as wind or seismic, must be calculated in accordance with the appropriate IBC Sections.
2 Allowable steel loads are based on tension and shear stresses equal to 0.33 x Fu and 0.17 x Fu , respectively.

Table 104 - Hilti HIT-HY 200 allowable adhesive bond tension loads for HIS-N inserts in the face of grout-filled concrete masonry walls[1,2,3,4,5,6,7,8]

Thread size in.	Effective embedment in. (mm)[11]	Tension lb (kN)	Spacing[9]			Edge Distance[10]		
			Critical s_{cr} in. (mm)	Minimum s_{min} in. (mm)	Load Reduction Factor @ s_{min}[6,12]	Critical c_{cr} in. (mm)	Minimum c_{min} in. (mm)	Load Reduction Factor @ c_{min}[12]
3/8-16 UNC	4 3/8 (111)	1,355 (6.0)	17 (432)	4 (102)	0.68	12 (305)	4 (102)	0.81
1/2-13 UNC	5 (127)	1,640 (7.3)	20 (508)		0.68	20 (508)		0.74

1 All values are for anchors installed in fully grouted concrete masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units shall be lightweight, medium-weight or heavy-weight conforming to ASTM C90. Allowable loads are calculated using a safety factor of 5.
2 Anchors may be installed in any location in the face of the masonry wall including cell, web, and mortar joints. Anchors are limited to one per masonry cell.
3 Linear interpolation of load values between minimum spacing (s_{min}) and critical spacing (s_{cr}) and between minimum edge distance (c_{min}) and critical edge distance (c_{cr}) is permitted.
4 Concrete masonry thickness must be equal to or greater than 1.5 times the anchor embedment depth.
5 When using the basic load combinations in accordance with IBC Section 1605.3.1, tabulated allowable loads must not be increased for seismic or wind loading When using the alternative basic load combinations in IBC Section 1605.3.2 that include seismic or wind loads, tabulated allowable loads may be increased by 33-1/3 percent, or the alternative basic load combinations may be reduced by a factor of 0.75.
6 Allowable loads must be the lesser of the adjusted masonry or bond tabulated values and the steel values given in tables 102 and 103.
7 Tabulated allowable loads shall be adjusted for increased base material temperatures in accordance with figure 14.
8 For combined loading: $(T_{applied} / T_{allowable}) + (V_{applied} / V_{allowable}) \leq 1$
9 The critical spacing, s_{cr}, is the anchor spacing where full load values may be used. The minimum spacing, s_{min}, is the minimum anchor spacing for which values are available and installation is recommended. Spacing is measured from the center of one anchor to the center of an adjacent anchor.
10 The critical edge distance, c_{cr}, is the edge distance where full load values may be used. The minimum edge distance, c_{min}, is the minimum edge distance for which values are available and installation is recommended. Edge distance is measured from the center of the anchor to the closest edge.
11 Embedment depth is measured from the outside face of the concrete masonry unit.
12 Load reduction factors are multiplicative, both spacing and edge distance load reduction factors must be considered. Load values for anchors installed at less than s_{cr} and c_{cr} must be multiplied by the appropriate load reduction factor based on actual edge distance (c) and spacing (s).

Hilti HIT-HY 200 specifications for HIS-N inserts in grout-filled masonry walls



Allowable anchor installation locations in the face of grout-filled concrete block

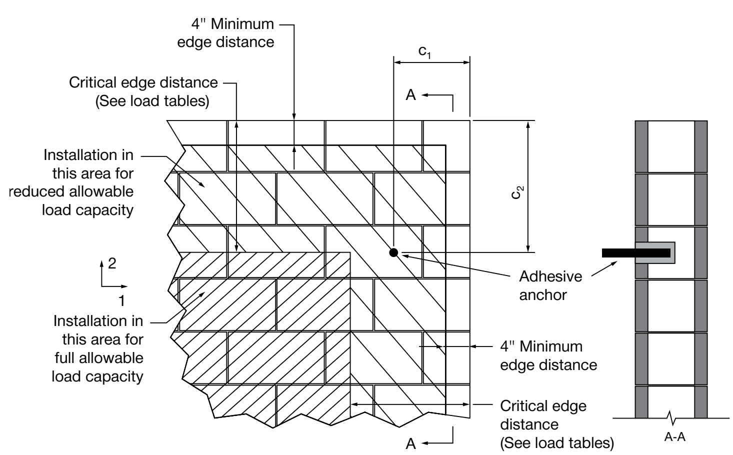


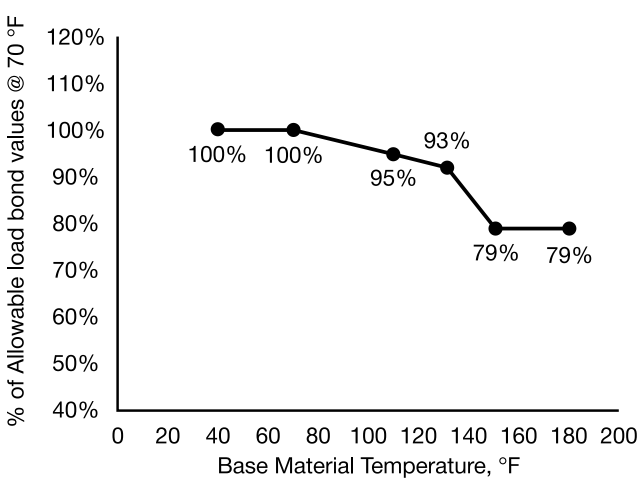
Table 105 - Hilti HIT-HY 200 allowable adhesive bond shear loads for HIS-N inserts in the face of grout-filled concrete masonry walls[1,2,3,4,5,6,7,8]

Thread size in.	Effective embedment in. (mm)[11]	Shear lb (kN)	Spacing[9]			Edge Distance[10]			
			Critical s_{cr} in. (mm)	Minimum s_{min} in. (mm)	Load Reduction Factor @ s_{min}[6,12]	Critical c_{cr} in. (mm)	Minimum c_{min} in. (mm)	Load Reduction Factor @ c_{min}[12] Load perpendicular to edge	Load Reduction Factor @ c_{min}[12] Load parallel to edge
3/8-16 UNC	4 3/8 (111)	1,045 (4.6)	17.0 (432)	4 (102)	0.56	12 (305)	4 (102)	0.65	1.00
1/2-13 UNC	5 (127)	1,730 (7.7)	20 (508)	4 (102)	0.50	20 (508)	4 (102)	0.36	0.91

1 All values are for anchors installed in fully grouted concrete masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units shall be lightweight, medium-weight or heavy-weight conforming to ASTM C90. Allowable loads are calculated using a safety factor of 5.
2 Anchors may be installed in any location in the face of the masonry wall including cell, web, and mortar joints. Anchors are limited to one per masonry cell.
3 Linear interpolation of load values between minimum spacing (s_{min}) and critical spacing (s_{cr}) and between minimum edge distance (c_{min}) and critical edge distance (c_{cr}) is permitted.
4 Concrete masonry thickness must be equal to or greater than 1.5 times the anchor embedment depth.
5 When using the basic load combinations in accordance with IBC Section 1605.3.1, tabulated allowable loads must not be increased for seismic or wind loading When using the alternative basic load combinations in IBC Section 1605.3.2 that include seismic or wind loads, tabulated allowable loads may be increased by 33-1/3 percent, or the alternative basic load combinations may be reduced by a factor of 0.75.
6 Allowable loads must be the lesser of the adjusted masonry or bond tabulated values and the steel values given in tables 102 and 103.
7 Tabulated allowable loads shall be adjusted for increased base material temperatures in accordance with figure 14.
8 For combined loading: $(T_{applied} / T_{allowable}) + (V_{applied} / V_{allowable}) \leq 1$
9 The critical spacing, s_{cr}, is the anchor spacing where full load values may be used. The minimum spacing, s_{min}, is the minimum anchor spacing for which values are available and installation is recommended. Spacing is measured from the center of one anchor to the center of an adjacent anchor.
10 The critical edge distance, c_{cr}, is the edge distance where full load values may be used. The minimum edge distance, c_{min}, is the minimum edge distance for which values are available and installation is recommended. Edge distance is measured from the center of the anchor to the closest edge.
11 Embedment depth is measured from the outside face of the concrete masonry unit.
12 Load reduction factors are multiplicative, both spacing and edge distance load reduction factors must be considered. Load values for anchors installed at less than s_{cr} and c_{cr} must be multiplied by the appropriate load reduction factor based on actual edge distance (c) and spacing (s).

3.2.2

Figure 14 – Influence of in-service temperature on bond strength[1]



1 Test procedure involves the concrete being held at the elevated temperature for 24 hours then removing it from the controlled environment and testing to failure.

HILTI

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. 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.

MATERIAL SPECIFICATIONS

Figure 15 - Hilti HIT-HY 200 adhesive cure time and working time (approx.)

HIT-HY 200-A					
		HAS HIS-N Rebar		HIT-Z [1]	
[°C]	[°F]	t_{work}	t_{cure}	t_{work}	t_{cure}
-10...-5	14...23	1.5 h	7 h	–	–
-4...0	24...32	50 min	4 h	–	–
1...5	33...41	25 min	2 h	–	–
6...10	42...50	15 min	1.25 h	15 min	1.25 h
11...20	51...68	7 min	45 min	7 min	45 min
21...30	69...86	4 min	30 min	4 min	30 min
31...40	87...104	3 min	30 min	3 min	30 min

HIT-HY 200-R					
		HAS HIS-N Rebar		HIT-Z [1]	
[°C]	[°F]	t_{work}	t_{cure}	t_{work}	t_{cure}
-10...-5	14...23	3 h	20 h	–	–
-4...0	24...32	2 h	8 h	–	–
1...5	33...41	1 h	4 h	–	–
6...10	42...50	40 min	2.5 h	40 min	2.5 h
11...20	51...68	15 min	1.5 h	15 min	1.5 h
21...30	69...86	9 min	1 h	9 min	1 h
31...40	87...104	6 min	1 h	6 min	1 h

1 It is permitted to install Hilti HIT-HY 200 with HIT-Z anchor rod down to 14° F (-10° C) provided the drilled hole has the drilling dust fully removed. This can be done with Hilti TE-CD or TE-YD hollow drill bit or with cleaning procedures used with standard threaded rod.

Resistance of cured Hilti HIT-HY 200 to chemicals

Chemical		Behavior
Acetic acid	10%	+
Acetone		●
Ammonia	5%	+
Benzyl alcohol		–
Hydrochloric acid	10%	●
Chlorinated lime	10%	+
Citric acid	10%	+
Concrete plasticizer		+
De-icing salt (Calcium chloride)		+
Demineralized water		+
Diesel fuel		+
Drilling dust suspension pH 13.2		+
Ethanol	96%	–
Ethylacetate		–
Formic acid	10%	+
Formwork oil		+
Gasoline		+
Glycole		●
Hydrogen peroxide	10%	●
Lactic acid	10%	+
Maschinery oil		+
Methylethylketon		●
Nitric acid	10%	●
Phosphoric acid	10%	+
Potassium Hydroxide pH 13.2		+
Sea water		+
Sewage sludge		+
Sodium carbonate 10%	10%	+
Sodium hypochlorite 2%	2%	+
Sulphuric acid	10%	+
	30%	+
Toluene		●
Xylene		●

Key: – non-resistant
\+ resistant
● limited resistance

Samples of the HIT-HY 200 adhesive were immersed in the various chemical compounds for up to one year. At the end of the test period, the samples were analyzed. Any samples showing no visible damage and having less than a 25% reduction in bending (flexural) strength were classified as "Resistant." Samples that had slight damage, such as small cracks, chips, etc. or reduction in bending strength of 25% or more were classified as "Limited Resistance" (i.e. exposed for 48 hours or less until chemical is cleaned up). Samples that were heavily damaged or destroyed were classified as "Non-Resistant."

Note: In actual use, the majority of the adhesive is encased in the base material, leaving very little surface area exposed.

ORDERING INFORMATION

HIT-Z anchor rod

Description	Bit dia. (in.)	Min. embed. (in.)	Qty
HIT-Z 3/8 x 3-3/8	7/16	2-3/8	40
HIT-Z 3/8 x 4 3/8	7/16	2-3/8	40
HIT-Z 3/8 x 5 1/8	7/16	2-3/8	40
HIT-Z 3/8 x 6 3/8	7/16	2-3/8	40
HIT-Z 1/2 x 4 1/2	9/16	2-3/4	20
HIT-Z 1/2 x 6 ½	9/16	2-3/4	20
HIT-Z 1/2 x 8	9/16	2-3/4	20
HIT-Z 5/8 x 6	3/4	3-3/4	12
HIT-Z 5/8 x 8	3/4	3-3/4	12
HIT-Z 5/8 x 9 1/2	3/4	3-3/4	12
HIT-Z 3/4 x 6-1/2	7/8	4	6
HIT-Z 3/4 x 8 1/2	7/8	4	6
HIT-Z 3/4 x 9 ¾	7/8	4	6

HIT-HY 200-A

HIT-HY 200-R

HIT-HY 200-A (accelerated working time)

Description	Package contents	Qty
HIT-HY 200-A (11.1 fl oz/330 ml)	Includes (1) foil pack with (1) mixer and 3/8 filler tube per pack	1
HIT-HY 200-A Master Carton (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack	25
HIT-HY 200-A Combo (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 Manual Dispenser	25
HIT-HY 200-A Master Carton (16.9 fl oz/500 ml)	Includes (1) master carton containing (20) foil packs with (1) mixer and 3/8 filler tube per pack	20
HIT-HY 200-A Combo (16.9 fl oz/500 ml)	Includes (2) master cartons containing (20) foil packs each with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 Manual Dispenser	40
HIT-RE-M Static Mixer	For use with HIT-HY 200-A cartridges	1

HIT-HY 200-R (regular working time)

Description	Package contents	Qty
HIT-HY 200-R (11.1 fl oz/330 ml)	Includes (1) foil pack with (1) mixer and 3/8 filler tube per pack	1
HIT-HY 200-R Master Carton (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack	25
HIT-HY 200-R Combo (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 manual dispenser	25
HIT-HY 200-R Master Carton (16.9 fl oz/500 ml)	Includes (1) master carton containing (20) foil packs with (1) mixer and 3/8 filler tube per pack	20
HIT-HY 200-R Combo (16.9 fl oz/500 ml)	Includes (2) master cartons containing (20) foil packs each with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 manual dispenser	40
HIT-RE-M Static Mixer	For use with HIT-HY 200-R cartridges	1

TE-CD Hollow Drill Bits

Order Description	Working length (in.)
Hollow Drill Bit TE-CD 1/2-13	8
Hollow Drill Bit TE-CD 9/16-14	9-1/2
Hollow Drill Bit TE-CD 5/8-14	9-1/2
Hollow Drill Bit TE-CD 3/4-14	9-1/2
Hollow Drill Bit TE-CD 16-A (Replacement collar)	

TE-YD Hollow Drill Bits

Order Description	Working Length (in.)
Hollow Drill Bit TE-YD 3/4-24	15-1/2
Hollow Drill Bit TE-YD 7/8-24	15-1/2
Hollow Drill Bit TE-YD 1-24	15-1/2
Hollow Drill Bit TE-YD 1 1/8-24	15-1/2
Hollow Drill Bit TE-YD 25-A (Replacement collar)	

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