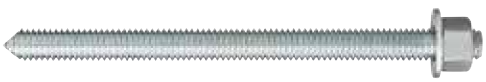
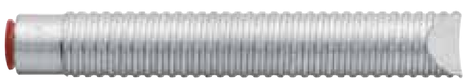
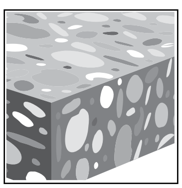
CORE DRILLING SOLUTION FOR CRACKED CONCRETE

Hilti HIT-HY 200 SafeSet system with TE-YRT roughening tool

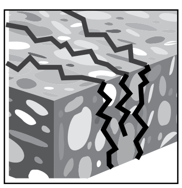
HIT-HY 200 ADHESIVE ANCHORING WITH DIAMOND CORING USING THE TE-YRT ROUGHENING TOOL

Product description

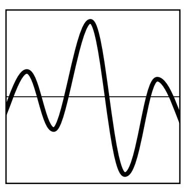
Mortar System		Features and Benefits
	Hilti HIT-HY 200-R Cartridge	• Two great products with equal performance data • User can select product cure time suitability based on temperature of the base material and jobsite time requirements • ICC-ES approved for cracked concrete and seismic service • ICC-ES approved for cracked and uncracked concrete for diamond core drilling with roughening using the the TE-YRT roughening tool
	Hilti HIT-HY 200-A Cartridge	
	Hilti HAS Threaded Rod	
	Rebar	
	Hilti HIS-N	
	TE-YRT Roughening tool	



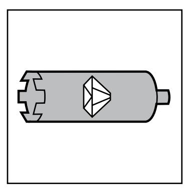
Uncracked concrete



Cracked concrete



Seismic Design Categories A-F



Diamond Cored and roughened using TE-YRT Roughening Tool

Hollow Drill Bit HIT-Z Rod TE-YRT Roughening Tool

PROFIS Anchor design software

Listings/Approvals	
ICC-ES (International Code Council)	ESR-3187
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	Research Report No. 25964, 26077
U.S. Green Building Council	LEED® Credit 4.1-Low Emitting Materials
Department of Transportation	Contact Hilti for various states

This document is a supplement to the Hilti North American Product Technical Guide, Volume 2, Anchor Fastening Technical Guide, Edition 19 (PTG Ed. 19). Please refer to the publication in its entirety available at www.hilti.com for complete details on this product including data development, product specifications, general suitability, installation, corrosion and spacing and edge distance guidelines.

MATERIAL SPECIFICATIONS

Material specifications for Hilti HAS threaded rods and Hilti HIT-Z anchor rods are listed in section 3.2.7 (PTG Ed. 19).

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 of PTG Ed. 19. 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 deformed reinforcing bars (Rebar) with Core Drilling and TE-YRT Roughening Tool

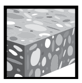
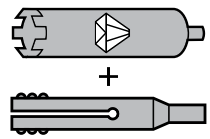
Permissible Base Material					Permissible Drilling Method		
		Uncracked concrete		Dry Concrete			Diamond core drilling with Hilti TE-YRT roughening tool
		Cracked concrete		Water-saturated concrete			

Figure 1 — Rebar installed with Hilti HIT-HY 200 adhesive

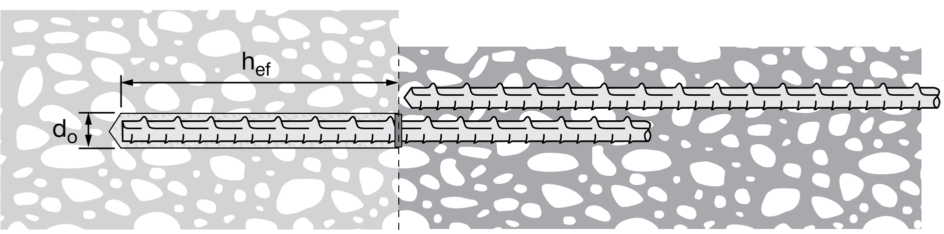


Table 1 — Specifications for rebar installed with Hilti HIT-HY 200 adhesive

Setting information		Symbol	Units	Rebar size					
				5	6	7	8	9	10
Nominal bit diameter		d_o	in.	3/4	7/8	1	1-1/8	1-3/8	1-1/2
Effective embedment	minimum	$h_{ef,min}$	in. (mm)	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)	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)	$h_{ef} + 2d_o$					
Minimum edge distance[1]		c_{min}	in. (mm)	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)	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 (44 mm) is permitted provided the rebar remains un-torqued.

Note: The installation specifications in table 1 above and the data in tables 2 through 16 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 3.1.13 of PTG Ed. 19 for the design method and tables 89 through 93 at the end of section 3.2.2 of PTG Ed. 19.

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Table 2 — Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for US rebar in uncracked concrete for diamond core drilling with roughening [1,2,3,4,5,6,7,8]

Rebar size	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
#5	5-5/8	10,405	11,400	11,740	12,225	22,415	24,550	25,280	26,330
	(143)	(46.3)	(50.7)	(52.2)	(54.4)	(99.7)	(109.2)	(112.5)	(117.1)
	7-1/2	14,930	15,205	15,650	16,300	32,160	32,755	33,710	35,105
	(191)	(66.4)	(67.6)	(69.6)	(72.5)	(143.1)	(145.7)	(149.9)	(156.2)
	12-1/2	24,885	25,345	26,085	27,165	53,605	54,590	56,185	58,510
	(318)	(110.7)	(112.7)	(116.0)	(120.8)	(238.4)	(242.8)	(249.9)	(260.3)
#6	6-3/4	13,680	14,985	16,905	17,600	29,460	32,275	36,405	37,915
	(171)	(60.9)	(66.7)	(75.2)	(78.3)	(131.0)	(143.6)	(161.9)	(168.7)
	9	21,060	21,900	22,535	23,470	45,360	47,165	48,540	50,550
	(229)	(93.7)	(97.4)	(100.2)	(104.4)	(201.8)	(209.8)	(215.9)	(224.9)
	15	35,840	36,495	37,560	39,115	77,190	78,610	80,905	84,250
	(381)	(159.4)	(162.3)	(167.1)	(174.0)	(343.4)	(349.7)	(359.9)	(374.8)
#7	7-7/8	17,235	18,885	21,805	23,960	37,125	40,670	46,960	51,605
	(200)	(76.7)	(84.0)	(97.0)	(106.6)	(165.1)	(180.9)	(208.9)	(229.5)
	10-1/2	26,540	29,070	30,675	31,945	57,160	62,615	66,070	68,805
	(267)	(118.1)	(129.3)	(136.4)	(142.1)	(254.3)	(278.5)	(293.9)	(306.1)
	17-1/2	48,780	49,675	51,125	53,240	105,065	106,995	110,120	114,675
	(445)	(217.0)	(221.0)	(227.4)	(236.8)	(467.4)	(475.9)	(489.8)	(510.1)
#8	9	21,060	23,070	26,640	31,295	45,360	49,690	57,375	67,400
	(229)	(93.7)	(102.6)	(118.5)	(139.2)	(201.8)	(221.0)	(255.2)	(299.8)
	12	32,425	35,520	40,065	41,725	69,835	76,500	86,295	89,870
	(305)	(144.2)	(158.0)	(178.2)	(185.6)	(310.6)	(340.3)	(383.9)	(399.8)
	20	63,710	64,885	66,775	69,540	137,225	139,750	143,830	149,780
	(508)	(283.4)	(288.6)	(297.0)	(309.3)	(610.4)	(621.6)	(639.8)	(666.3)
#9	10-1/8	25,130	27,530	31,785	38,930	54,125	59,290	68,465	83,850
	(257)	(111.8)	(122.5)	(141.4)	(173.2)	(240.8)	(263.7)	(304.5)	(373.0)
	13-1/2	38,690	42,380	48,940	52,805	83,330	91,285	105,405	113,740
	(343)	(172.1)	(188.5)	(217.7)	(234.9)	(370.7)	(406.1)	(468.9)	(505.9)
	22-1/2	80,635	82,120	84,515	88,010	173,675	176,870	182,035	189,565
	(572)	(358.7)	(365.3)	(375.9)	(391.5)	(772.5)	(786.8)	(809.7)	(843.2)
#10	11-1/4	29,430	32,240	37,230	45,595	63,395	69,445	80,185	98,205
	(286)	(130.9)	(143.4)	(165.6)	(202.8)	(282.0)	(308.9)	(356.7)	(436.8)
	15	45,315	49,640	57,320	65,195	97,600	106,915	123,455	140,420
	(381)	(201.6)	(220.8)	(255.0)	(290.0)	(434.1)	(475.6)	(549.2)	(624.6)
	25	97,500	101,380	104,340	108,655	210,000	218,360	224,730	234,030
	(635)	(433.7)	(451.0)	(464.1)	(483.3)	(934.1)	(971.3)	(999.6)	(1041.0)

1 See Section 3.1.8 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 5-16 as necessary. Compare to the steel values in table 4. 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 value 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 value 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 (PTG Ed. 19).
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

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

Rebar size	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
#5	5-5/8	7,370	7,970	8,200	8,540	15,875	17,165	17,665	18,395
	(143)	(32.8)	(35.5)	(36.5)	(38.0)	(70.6)	(76.4)	(78.6)	(81.8)
	7-1/2	10,435	10,625	10,935	11,390	22,470	22,885	23,555	24,530
	(191)	(46.4)	(47.3)	(48.6)	(50.7)	(100.0)	(101.8)	(104.8)	(109.1)
	12-1/2	17,390	17,710	18,225	18,980	37,455	38,145	39,255	40,880
	(318)	(77.4)	(78.8)	(81.1)	(84.4)	(166.6)	(169.7)	(174.6)	(181.8)
#6	6-3/4	9,690	10,615	11,810	12,300	20,870	22,860	25,440	26,490
	(171)	(43.1)	(47.2)	(52.5)	(54.7)	(92.8)	(101.7)	(113.2)	(117.8)
	9	14,920	15,300	15,745	16,400	32,130	32,955	33,915	35,320
	(229)	(66.4)	(68.1)	(70.0)	(73.0)	(142.9)	(146.6)	(150.9)	(157.1)
	15	25,040	25,500	26,245	27,330	53,935	54,925	56,530	58,870
	(381)	(111.4)	(113.4)	(116.7)	(121.6)	(239.9)	(244.3)	(251.5)	(261.9)
#7	7-7/8	11,750	11,965	12,315	12,825	25,305	25,770	26,525	27,620
	(200)	(52.3)	(53.2)	(54.8)	(57.0)	(112.6)	(114.6)	(118.0)	(122.9)
	10-1/2	15,665	15,955	16,420	17,100	33,740	34,360	35,365	36,830
	(267)	(69.7)	(71.0)	(73.0)	(76.1)	(150.1)	(152.8)	(157.3)	(163.8)
	17-1/2	26,110	26,590	27,365	28,500	56,235	57,270	58,940	61,380
	(445)	(116.1)	(118.3)	(121.7)	(126.8)	(250.1)	(254.7)	(262.2)	(273.0)
#8	9	14,920	15,720	16,180	16,850	32,130	33,860	34,850	36,295
	(229)	(66.4)	(69.9)	(72.0)	(75.0)	(142.9)	(150.6)	(155.0)	(161.4)
	12	20,585	20,960	21,575	22,465	44,335	45,150	46,470	48,390
	(305)	(91.6)	(93.2)	(96.0)	(99.9)	(197.2)	(200.8)	(206.7)	(215.2)
	20	34,305	34,935	35,955	37,445	73,890	75,250	77,445	80,650
	(508)	(152.6)	(155.4)	(159.9)	(166.6)	(328.7)	(334.7)	(344.5)	(358.7)
#9	10-1/8	17,800	19,500	20,720	21,580	38,340	42,000	44,635	46,480
	(257)	(79.2)	(86.7)	(92.2)	(96.0)	(170.5)	(186.8)	(198.5)	(206.8)
	13-1/2	26,360	26,845	27,630	28,775	56,780	57,825	59,510	61,975
	(343)	(117.3)	(119.4)	(122.9)	(128.0)	(252.6)	(257.2)	(264.7)	(275.7)
	22-1/2	43,935	44,745	46,050	47,955	94,630	96,370	99,185	103,290
	(572)	(195.4)	(199.0)	(204.8)	(213.3)	(420.9)	(428.7)	(441.2)	(459.5)
#10	11-1/4	20,850	22,840	25,585	26,640	44,905	49,190	55,105	57,385
	(286)	(92.7)	(101.6)	(113.8)	(118.5)	(199.7)	(218.8)	(245.1)	(255.3)
	15	32,095	33,145	34,110	35,525	69,135	71,385	73,470	76,510
	(381)	(142.8)	(147.4)	(151.7)	(158.0)	(307.5)	(317.5)	(326.8)	(340.3)
	25	54,240	55,240	56,850	59,205	116,830	118,980	122,450	127,515
	(635)	(241.3)	(245.7)	(252.9)	(263.4)	(519.7)	(529.2)	(544.7)	(567.2)

1 See Section 3.1.8 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 5-16 as necessary. Compare to the steel values in table 4. 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 value 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 value 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 (PTG Ed. 19)
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:
#5 - α_{seis} = 0.53
#6 - α_{seis} =0.58
#7 - α_{seis} =0.61
#8 - α_{seis} = 0.71
#9 - α_{seis} =0.59
#10 - $\alpha_{N,seis}$ = 0.62
See section 3.1.8.7 (PTG Ed. 19) for additional information on seismic applications.

Table 4 — Steel design strength for US rebar [1,2]

Rebar size	ASTM A 615 Grade 40			ASTM A 615 Grade 60			ASTM A 706 Grade 60		
	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)	Tensile[3] ΦN_{sa} lb (kN)	Shear[4] ΦV_{sa} lb (kN)	Seismic Shear[5] $\Phi V_{sa,eq}$ lb (kN)
#5	12,090 (53.8)	6,695 (29.8)	4,685 (20.8)	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 (42.7)
#7	23,400 (104.1)	12,960 (57.6)	9,070 (40.3)	35,100 (156.1)	19,440 (86.5)	13,610 (60.5)	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 (76.8)
#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 (97.1)
#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 (PTG Ed. 19) to convert design strength value to ASD value.
2 ASTM A706 Grade 60 rebar are considered ductile steel elements. ASTM A 615 Grade 40 and 60 rebar are considered brittle steel elements.
3 Tensile = $\Phi\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Chapter 17
4 Shear = Φ 0.60 $A_{se,N}\ f_{uta}$ as noted in ACI 318 Chapter 17
5 Seismic Shear = $\alpha_{V,seis}\ \Phi V_{sa}$: Reduction for seismic shear only. See section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

Table 5 — 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 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	0.39	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	0.44	0.32	0.19	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	0.49	0.36	0.21	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	0.50	0.37	0.22	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	0.55	0.40	0.24	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	0.46	0.27	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	0.51	0.30	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	0.33	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	0.36	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	0.41	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	0.47	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	0.53	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 6 — 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 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 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 ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3 * h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3 * h_{ef}$. If $c \geq 3 * h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3 * h_{ef}$. If $c \geq 3 * h_{ef}$, then $f_{HV} = 1.0$.

Table 7 — 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 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	0.39	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	0.43	0.32	0.19	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	0.48	0.35	0.20	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	0.50	0.37	0.21	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	0.52	0.38	0.22	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	0.42	0.25	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	0.45	0.27	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	0.51	0.30	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	0.35	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	0.39	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	0.41	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	0.44	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	0.49	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	0.54	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 8 — 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 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 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 ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3*h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{HV} = 1.0$.

Table 9 — 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 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	0.39	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	0.43	0.31	0.18	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	0.46	0.34	0.20	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	0.49	0.36	0.21	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	0.50	0.37	0.22	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	0.54	0.40	0.23	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	0.43	0.25	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	0.45	0.26	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	0.50	0.30	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	0.34	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	0.38	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	0.41	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	0.42	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	0.46	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	0.51	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

Table 10 — 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 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					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 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 ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3*h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{HV} = 1.0$.

Table 11 — 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 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	0.39	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	0.42	0.31	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	0.45	0.33	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	0.48	0.36	0.21	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	0.49	0.36	0.21	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	0.52	0.38	0.22	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	0.41	0.24	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	0.44	0.26	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	0.45	0.26	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	0.50	0.30	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	0.33	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	0.37	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	0.41	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	1.00	0.66	0.34	0.95	0.70	0.41	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	0.44	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	0.48	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	0.52	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 12 — 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 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 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 ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3*h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{HV} = 1.0$.

Table 13 — 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 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	0.40	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	0.42	0.31	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	0.45	0.33	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	0.48	0.35	0.20	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	0.51	0.37	0.22	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	0.51	0.37	0.22	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	0.54	0.39	0.23	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	0.45	0.26	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	0.46	0.27	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	0.51	0.30	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	0.33	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	0.36	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	0.40	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	0.42	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	0.43	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	0.46	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	0.49	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 14 — 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 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 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 ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3*h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{HV} = 1.0$.

Table 15 — Load adjustment factors for #10 rebar in uncracked concrete [1,2,3]

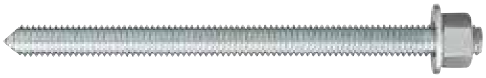
#10 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [4] f_{AV}			Edge distance in shear – ⊥ Toward edge f_{RV}			Edge distance in shear – ∥ To edge f_{RV}			Concrete thickness factor in shear [5] f_{HV}		
Embedment h_{ef} in (mm)		11-1/4	15	25	11-1/4	15	25	11-1/4	15	25	11-1/4	15	25	11-1/4	15	25	11-1/4	15	25
		(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(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	0.40	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	0.43	0.31	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	0.45	0.32	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	0.48	0.34	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	0.51	0.36	0.21	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	0.51	0.37	0.22	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	0.54	0.38	0.22	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	0.40	0.24	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	0.43	0.25	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	0.46	0.27	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	0.51	0.30	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	0.33	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	0.36	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	0.39	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	0.41	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	0.44	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	0.53	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 16— 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 edge f_{RV}			Concrete thickness factor in shear [5] f_{HV}		
Embedment h_{ef} in (mm)		11-1/4	15	25	11-1/4	15	25	11-1/4	15	25	11-1/4	15	25	11-1/4	15	25	11-1/4	15	25
		(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(635)	(286)	(381)	(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 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 ACI 318 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3*h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{HV} = 1.0$.

HIT-HY 200 adhesive with Hilti HAS Threaded Rod with Core Drilling and TE-YRT Roughening Tool



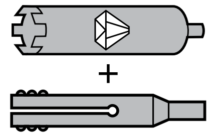
Permissible Base Material		Permissible Drilling Method	
Uncracked concrete	Dry Concrete		Diamond core drilling with Hilti TE-YRT roughening tool
Cracked concrete	Water-saturated concrete		

Table 17 — Hilti HAS threaded rod specifications

Setting information		Symbol	Units	Nominal rod diameter (in.)				
				5/8	3/4	7/8	1	1-1/4
Nominal bit diameter		d_o	in.	3/4	7/8	1	1-1/8	1-3/8
Effective embedment	minimum	$h_{ef,min}$	in. (mm)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
	maximum	$h_{ef,max}$	in. (mm)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)
Minimum diameter of fixture hole	through-set		in.	13/16[1]	15/16[1]	1-1/8[1]	1-1/4[1]	1-1/2[1]
	preset		in.	11/16	13/16	15/16	1-1/8	1-3/8
Installation torque		T_{inst}	ft-lb (Nm)	60 (80)	100 (136)	125 (169)	150 (203)	200 (271)
Minimum concrete member thickness		h_{min}	in. (mm)	$h_{ef} + 2d_o$				
Minimum edge distance[1]		c_{min}	in. (mm)	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)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	6-1/4 (159)

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

Figure 2 — Hilti HAS threaded rods installed with Hilti HIT-HY 200 adhesive

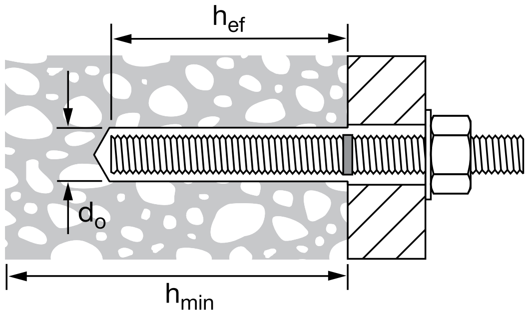


Figure 3 — Installation with (2) washers

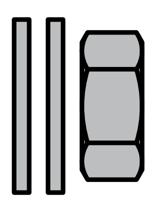


Table 18 — Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for threaded rod in uncracked concrete for diamond core drilling with roughening [1,2,3,4,5,6,7,8]

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
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 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 21– 30 as necessary. Compare to the steel values in table 20. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 104°F (40°C), max. long term temperature = 75°F (24°C).
For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 122°F (50°C) multiply above value by 0.80.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.70.
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.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8 (PTG Ed. 19).
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

Table 19 — Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for threaded rod in cracked concrete for diamond core drilling with roughening [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 = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
5/8	3-1/8	3,050	3,345	3,860	4,730	6,575	7,200	8,315	10,185
	(79)	(13.6)	(14.9)	(17.2)	(21.0)	(29.2)	(32.0)	(37.0)	(45.3)
	5-5/8	7,370	8,075	8,805	9,170	15,875	17,390	18,960	19,745
	(143)	(32.8)	(35.9)	(39.2)	(40.8)	(70.6)	(77.4)	(84.3)	(87.8)
	7-1/2	11,200	11,405	11,740	12,225	24,120	24,565	25,280	26,330
	(191)	(49.8)	(50.7)	(52.2)	(54.4)	(107.3)	(109.3)	(112.5)	(117.1)
	12-1/2	18,665	19,010	19,565	20,375	40,205	40,940	42,135	43,880
	(318)	(83.0)	(84.6)	(87.0)	(90.6)	(178.8)	(182.1)	(187.4)	(195.2)
3/4	3-1/2	3,620	3,965	4,575	5,605	7,790	8,535	9,855	12,070
	(89)	(16.1)	(17.6)	(20.4)	(24.9)	(34.7)	(38.0)	(43.8)	(53.7)
	6-3/4	9,690	10,615	12,255	14,215	20,870	22,860	26,395	30,620
	(171)	(43.1)	(47.2)	(54.5)	(63.2)	(92.8)	(101.7)	(117.4)	(136.2)
	9	14,920	16,340	18,205	18,955	32,130	35,195	39,205	40,830
	(229)	(66.4)	(72.7)	(81.0)	(84.3)	(142.9)	(156.6)	(174.4)	(181.6)
	15	28,945	29,480	30,340	31,595	62,345	63,490	65,345	68,050
	(381)	(128.8)	(131.1)	(135.0)	(140.5)	(277.3)	(282.4)	(290.7)	(302.7)
7/8	3-1/2	3,620	3,965	4,575	5,605	7,790	8,535	9,855	12,070
	(89)	(16.1)	(17.6)	(20.4)	(24.9)	(34.7)	(38.0)	(43.8)	(53.7)
	7-7/8	12,210	13,375	15,445	18,915	26,300	28,810	33,265	40,740
	(200)	(54.3)	(59.5)	(68.7)	(84.1)	(117.0)	(128.2)	(148.0)	(181.2)
	10-1/2	18,800	20,590	23,780	26,415	40,490	44,355	51,215	56,895
	(267)	(83.6)	(91.6)	(105.8)	(117.5)	(180.1)	(197.3)	(227.8)	(253.1)
	17-1/2	40,335	41,080	42,280	44,025	86,880	88,475	91,060	94,830
	(445)	(179.4)	(182.7)	(188.1)	(195.8)	(386.5)	(393.6)	(405.1)	(421.8)
1	4	4,420	4,840	5,590	6,845	9,520	10,430	12,040	14,750
	(102)	(19.7)	(21.5)	(24.9)	(30.4)	(42.3)	(46.4)	(53.6)	(65.6)
	9	14,920	16,340	18,870	23,110	32,130	35,195	40,640	49,775
	(229)	(66.4)	(72.7)	(83.9)	(102.8)	(142.9)	(156.6)	(180.8)	(221.4)
	12	22,965	25,160	29,050	35,440	49,465	54,190	62,570	76,330
	(305)	(102.2)	(111.9)	(129.2)	(157.6)	(220.0)	(241.0)	(278.3)	(339.5)
	20	49,415	54,135	56,720	59,065	106,435	116,595	122,160	127,215
	(508)	(219.8)	(240.8)	(252.3)	(262.7)	(473.4)	(518.6)	(543.4)	(565.9)
1-1/4	5	6,175	6,765	7,815	9,570	13,305	14,575	16,830	20,610
	(127)	(27.5)	(30.1)	(34.8)	(42.6)	(59.2)	(64.8)	(74.9)	(91.7)
	11-1/4	20,850	22,840	26,370	32,295	44,905	49,190	56,800	69,565
	(286)	(92.7)	(101.6)	(117.3)	(143.7)	(199.7)	(218.8)	(252.7)	(309.4)
	15	32,095	35,160	40,600	49,725	69,135	75,730	87,445	107,100
	(381)	(142.8)	(156.4)	(180.6)	(221.2)	(307.5)	(336.9)	(389.0)	(476.4)
	25	69,060	75,655	87,360	96,120	148,750	162,945	188,155	207,030
	(635)	(307.2)	(336.5)	(388.6)	(427.6)	(661.7)	(724.8)	(837.0)	(920.9)

1 See Section 3.1.8 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 21– 30 as necessary. Compare to the steel values in table 20. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 104°F (40°C), max. long term temperature = 75°F (24°C).
For temperature range B: Max. short term temperature = 176°F (80°C), max. long term temperature = 122°F (50°C) multiply above value by 0.80.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.70.
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.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8 (PTG Ed. 19).
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:
5/8-in diameter - α_{seis} = 0.66
3/4-in to 7/8-in diameter α_{seis} = 0.72
1-in - α_{seis} = 0.75
1-1/4-in diameter - α_{seis} = 0.66
See section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

Table 20 — 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. 36 [4]			HAS-E-55 / HAS-E-55 HDG ASTM F1554 Gr. 55 [4,5]			HAS-B-105 / 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)
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 (included HDG rods).
5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements (including HDG rods).

Table 21 — 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 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 22 — 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 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	0.54	0.53	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	0.15	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	0.14	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	0.36	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	0.23	0.14	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	0.28	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	0.28	0.17	0.89	0.84	0.55	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	0.33	0.20	0.98	0.98	0.66	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	0.77	0.46	0.89	0.68	0.59	n/a
	11 (279)	0.80	0.80	0.74	0.65		1.00	0.98	0.69	0.72	0.63	0.60	0.57		0.67	0.44	0.27			0.89	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	0.61	0.58		0.77	0.51	0.30			1.00	0.61	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	0.64	0.38				0.77	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	0.78	0.47				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			0.93	0.56				0.97		0.92	0.80	0.67
	20 (508)	1.00	1.00	0.94	0.77				1.00	0.89	0.73	0.68	0.63			1.00	0.65				1.00		0.97	0.84	0.71
	22 (559)			0.99	0.79					0.93	0.76	0.69	0.64				0.75						1.00	0.88	0.74
	24 (610)			1.00	0.82					0.97	0.78	0.71	0.65				0.86							0.92	0.78
	26 (660)				0.85					1.00	0.80	0.73	0.66				0.97							0.96	0.81
	28 (711)				0.87						0.83	0.75	0.68				1.00							0.99	0.84
	30 (762)				0.90						0.85	0.76	0.69											1.00	0.87
	36 (914)				0.98						0.92	0.82	0.73												0.95
	> 48 (1219)				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 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 23 — 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 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				0.94

Table 24 — 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 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	0.07	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	0.52	0.41	0.17	0.11	0.06	0.60	0.34	0.22	0.11	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	0.12	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	0.07	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	0.53	0.69	0.28	0.18	0.09	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	0.11	0.79	0.68	0.44	0.23	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	0.25	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	0.54	1.00	0.41	0.26	0.14	0.85	0.82	0.53	0.27	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	0.16	0.92	0.92	0.62	0.32	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	0.36	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	0.21	1.00	1.00	0.82	0.42	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	0.26			1.00	0.53	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	0.32				0.65		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	0.35				0.69		0.83	0.72	0.57
18 (457)	0.90	0.90	0.83	0.70				0.85	0.83	0.68	0.64	0.59			0.75	0.39				0.77		0.86	0.74	0.59
20 (508)	0.95	0.95	0.87	0.72				0.91	0.87	0.70	0.65	0.60			0.88	0.45				0.90		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	0.52				0.98		0.95	0.82	0.66
24 (610)	1.00	1.00	0.94	0.77				1.00	0.94	0.74	0.68	0.62				0.59				1.00		0.99	0.86	0.69
26 (660)			0.98	0.79					0.98	0.76	0.70	0.63				0.67						1.00	0.89	0.71
28 (711)			1.00	0.81					1.00	0.79	0.71	0.64				0.75							0.92	0.74
30 (762)				0.83						0.81	0.73	0.65				0.83							0.96	0.77
36 (914)				0.90						0.87	0.77	0.68				1.00							1.00	0.84
> 48 (1219)				1.00						0.99	0.87	0.74												0.97

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

Table 25 — Load adjustment factors for 7/8-in. diameter threaded rods in uncracked concrete [1,2,3]

7/8-in. uncracked concrete	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear [5] f_{HV}			
Embedment h_{ef} in	3.50	7.88	10.50	17.50	3.50	7.88	10.50	17.50	3.50	7.88	10.50	17.50	3.50	7.88	10.50	17.50	3.50	7.88	10.50	17.50	3.50	7.88	10.50	17.50
(mm)	88.90	200.03	266.70	444.50	88.90	200.03	266.70	444.50	88.90	200.03	266.70	444.50	88.90	200.03	266.70	444.50	88.90	200.03	266.70	444.50	88.90	200.03	266.70	444.50
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		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		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		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		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 26 — Load adjustment factors for 7/8-in. diameter threaded rods in cracked concrete [1,2,3]

7/8-in. cracked concrete	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear [5] f_{HV}			
Embedment h_{ef} in	3-1/2	7-7/8	10-1/2	17-1/2	3-1/2	7-7/8	10-1/2	17-1/2	3-1/2	7-7/8	10-1/2	17-1/2	3-1/2	7-7/8	10-1/2	17-1/2	3-1/2	7-7/8	10-1/2	17-1/2	3-1/2	7-7/8	10-1/2	17-1/2
(mm)	(89)	(200)	(267)	(445)	(89)	(200)	(267)	(445)	(89)	(200)	(267)	(445)	(89)	(200)	(267)	(445)	(89)	(200)	(267)	(445)	(89)	(200)	(267)	(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	0.02	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	0.09	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	0.05	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	0.66	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	0.13	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	0.08	0.72	0.54	0.35	0.16	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	0.11	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	0.11	0.82	0.76	0.49	0.23	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	0.13	0.88	0.87	0.57	0.26	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	0.15	0.94	0.94	0.65	0.30	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	0.16	0.97	0.97	0.69	0.32	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	0.19	1.00	1.00	0.82	0.38	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	0.23			1.00	0.46		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	0.28				0.55		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	0.31				0.62		0.82	0.71	0.55
20 (508)	0.89	0.89	0.82	0.69				0.82	0.88	0.67	0.63	0.58			0.70	0.32				0.65		0.84	0.72	0.56
22 (559)	0.92	0.92	0.85	0.71				0.87	0.92	0.69	0.64	0.59			0.80	0.37				0.75		0.88	0.76	0.59
24 (610)	0.96	0.96	0.88	0.73				0.93	0.96	0.71	0.66	0.59			0.91	0.43				0.85		0.92	0.79	0.61
26 (660)	1.00	1.00	0.91	0.75				0.99	1.00	0.73	0.67	0.60			1.00	0.48				0.96		0.95	0.82	0.64
28 (711)			0.94	0.77				1.00		0.74	0.68	0.61				0.54				1.00		0.99	0.86	0.66
30 (762)			0.98	0.79						0.76	0.70	0.62				0.60						1.00	0.89	0.69
36 (914)			1.00	0.84						0.81	0.74	0.64				0.78							0.97	0.75
> 48 (1219)				0.96						0.92	0.81	0.69				1.00							1.00	0.87

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 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3*h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3*h_{ef}$. If $c \geq 3*h_{ef}$, then f_{HV} = 1.0.

Table 27 — Load adjustment factors for 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 edge f_{RV}				Concrete thickness factor in shear [5] f_{HV}			
Embedment h_{ef}	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20
in (mm)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm)																								
1-3/4 (44)	n/a	n/a	n/a	n/a	0.38	0.24	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 28 — 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 edge f_{RV}				Concrete thickness factor in shear [5] f_{HV}			
Embedment h_{ef}	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20	4	9	12	20
in (mm)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)	(102)	(229)	(305)	(508)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm)																								
1-3/4 (44)	n/a	n/a	n/a	n/a	0.41	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 Chapter 17.
4 Spacing factor reduction in shear applicable when $c < 3 \cdot h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then f_{HV} = 1.0.

Table 29 — Load adjustment factors for 1-1/4-in. diameter threaded rods in uncracked concrete [1,2,3]

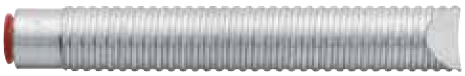
1-1/4-in. uncracked concrete	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear [5] f_{HV}			
Embedment h_{ef} 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	15	25
(mm)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(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 30 — 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 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	15	25
(mm)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(635)	(127)	(286)	(381)	(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 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 Hilti HIS-N Inserts with Core Drilling and TE-YRT Roughening Tool



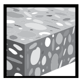
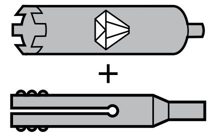
Permissible Base Material					Permissible Drilling Method		
		Uncracked concrete		Dry Concrete			Diamond core drilling with Hilti TE-YRT roughening tool
		Cracked concrete		Water-saturated concrete			

Table 31 — 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.	4-3/8	5	6-3/4	8-1/8
			(mm)	(110)	(125)	(171)	(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	15	30	60	100
			(Nm)	(20)	(40)	(81)	(136)
Minimum Concrete Thickness		h_{min}	in.	5.9	6.7	9.1	10.6
			(mm)	(150)	(170)	(230)	(270)
Minimum edge distance		c_{min}	in.	3-1/4	4	5	5-1/2
			(mm)	(83)	(102)	(127)	(140)
Minimum spacing		s_{min}	in.	3-1/4	4	5	5-1/2
			(mm)	(83)	(102)	(127)	(140)

Figure 4 — Hilti HIS-N and HIS-RN specifications

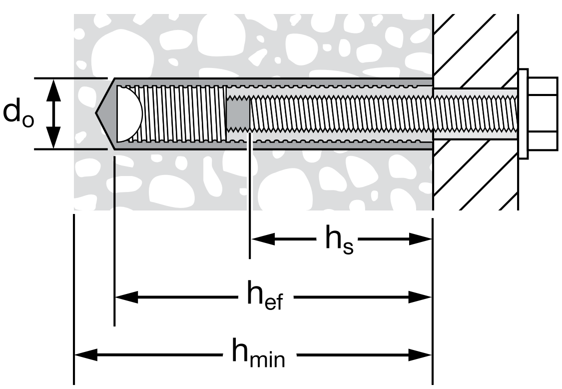


Table 32 — Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete for diamond core drilling with roughening [1,2,3,4,5,6,7,8]

Thread size	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 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 33 — Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for Hilti HIS-N and HIS-RN internally threaded inserts in cracked concrete for diamond core drilling with roughening [1,2,3,4,5,6,7,8,9]

Thread size	Effective embedment in. (mm)	Tension — ΦN_n				Shear — ΦV_n			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 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)

1 See Section 3.1.8 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 35-36 as necessary. Compare to the steel values in table 34. 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 value 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 value 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 (PTG Ed. 19).
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 only by the following reduction factors:
For 3/8-in diameters - α_{seis} = 0.61
For 1/2-in diameters - α_{seis} = 0.66
For 5/8-in diameters - α_{seis} = 0.69
For 3/4-in diameter - α_{seis} = 0.57
See section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

Table 34 — Steel design strength for steel bolt / cap screw for Hilti HIS-N and HIS-RN internally threaded inserts [1,2,3]

Thread size	ASTM A 193 B7			ASTM A 193 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	9,835 (43.7)	5,110 (22.7)	3,065 (13.6)	14,690 (65.3)	8,135 (36.2)	5,695 (25.3)
1/2-13 UNC	14,550 (64.7)	7,565 (33.7)	4,540 (20.2)	18,485 (82.2)	10,235 (45.5)	7,165 (31.9)
5/8-11 UNC	26,350 (117.2)	13,700 (60.9)	8,220 (36.6)	33,465 (148.9)	18,535 (82.4)	12,975 (57.7)
3/4-10 UNC	42,160 (187.5)	21,920 (97.5)	13,150 (58.5)	41,430 (184.3)	21,545 (95.8)	12,925 (57.5)

1 See Section 3.1.8 (PTG Ed. 19) 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 = $\Phi A_{se,N} f_{uta}$ as noted in ACI 318 Chapter 17
5 Shear = $\Phi 0.60 A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17. For 3/8-in diameter insert shear = $\Phi 0.50 A_{se,V} f_{uta}$
6 Seismic Shear = $\alpha_{V,seis} \Phi V_{sa}$: Reduction for seismic shear only. See section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

Table 35 — Load adjustment factors for Hilti HIS-N and HIS-RN internally threaded inserts in uncracked concrete [1,2]

HIS-N and HIS-RN all diameters uncracked concrete	Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [3] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear [4] f_{HV}			
Internal Diameter in (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)
Embedment h_{ef} in (mm)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)
Spacing (s) / edge distance (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	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	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												
> 48 (1219)									1.00	1.00	0.99	0.90												

Table 36 — Load adjustment factors for Hilti HIS-N and HIS-RN internally threaded inserts in cracked concrete [1,2]

HIS-N and HIS-RN all diameters 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 edge f_{RV}				Concrete thickness factor in shear [4] f_{HV}			
Internal Diameter in (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)
Embedment h_{ef} in (mm)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)	4-3/8 (111)	5 (127)	6-3/4 (171)	8-1/8 (206)
Spacing (s) / edge distance (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 veryconservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 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 $f_{HV} = 1.0$. 1 Linear interpolation not permitted

DESIGN DATA IN CONCRETE PER CSA A23.3

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 (PTG Ed. 19). Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.com.

HIT-HY 200 adhesive with deformed reinforcing bars (Rebar) with Core Drilling and TE-YRT Roughening Tool

Table 37 — Specifications for CA rebar installed with HIT-HY 200 adhesive

Setting information		Symbol	Units	Rebar size	
				15M	20M
Nominal bit diameter		d_o	in.	3/4	1
Effective embedment	minimum	$h_{ef,min}$	mm	80	90
	maximum	$h_{ef,max}$	mm	320	390
Minimum concrete member thickness		h_{min}	mm	$h_{ef} + 2d_o$	

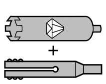
Note: The installation specifications in table 37 above and the data in tables 38 through 45 pertain to the use of Hilti HIT-HY 200 with rebar designed as a post-installed anchor using the provisions of CSA A23.3-14 Annex D. For the use of Hilti HIT-HY 200 with rebar for typical development calculations according to CSA A23.3-14 Chapter 12, refer to section 3.1.8 (PTG Ed. 19) for the design method and tables 94 through 98 at the section 3.2.2 of PTG Ed. 19.

Table 38 — Steel factored resistance for CA rebar [1]

Rebar size	CSA-G30.18 Grade 400 [2]		
	Tensile[3] ΦN_{sar} lb (kN)	Shear[4] ΦV_{sar} lb (kN)	Seismic Shear[5] $\Phi V_{sar,eq}$ lb (kN)
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)

1 See Section 3.1.8 (PTG Ed. 19) 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 section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

Table 39 — Hilti HIT-HY 200 adhesive design information with CA rebar in diamond core drilled holes with roughening in accordance with CSA A23.3-14 Annex D [1]

	Design parameter	Symbol	Units	Nominal rod diameter (mm)		Ref A23.3-14
				15M	20M	
	Anchor O.D.	d_a	mm	16.0	19.5	
	Effective minimum embedment [2]	$h_{ef,min}$	mm	80	90	
	Effective maximum embedment [2]	$h_{ef,max}$	mm	320	390	
	Min. concrete thickness [2]	h_{min}	mm	$h_{ef} + 2d_0$		
	Critical edge distance	c_{ac}	-	$2h_{ef}$		
	Minimum edge distance	c_{min} [3]	mm	80	98	
	Minimum anchor spacing	s_{min}	mm	80	98	
	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]	-	7.1		D.6.2.2
	Concrete material resistance factor	Φ_c	-	0.65		8.4.2
	Resistance modification factor for tension and shear, concrete failure modes, Condition B [5]	R_{conc}	-	1.00		D.5.3 (c)
Temp. range A [6]	Characteristic bond stress in cracked concrete [7]	τ_{cr}	psi (MPa)	1,085 (7.5)	1,095 (7.6)	D.6.5.2
	Characteristic bond stress in uncracked concrete [7]	τ_{uncr}	psi (MPa)	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)	995 (6.9)	1,005 (6.9)	D.6.5.2
	Characteristic bond stress in uncracked concrete [7]	τ_{uncr}	psi (MPa)	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)	850 (5.9)	860 (5.9)	D.6.5.2
	Characteristic bond stress in uncracked concrete [7]	τ_{uncr}	psi (MPa)	1,230 (8.5)	1,230 (8.5)	D.6.5.2
Reduceduction for seismic tension	Core drilled + roughening 	$\alpha_{N,seis}$	-	0.71	0.58	
Permissible installation conditions	Resistance modification factor tension and shear, bond failure dry concrete	Anchor category	-	1		D.5.3 (c)
		R_{dry}	-	1.00		
	Resistance modification factor tension and shear, bond failure water-saturated concrete	Anchor category	-	2		D.5.3 (c)
		R_{ws}	-	0.85		

1 Design information in this table is taken from ICC-ES ELC 3187, dated May 2018, 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 section 4.1.9.2.
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 40 — Hilti HIT-HY 200 adhesive factored resistance with concrete / bond failure for CA rebar in uncracked concrete for diamond core drilling with roughening [1,2,3,4,5,6,7,8]

Rebar size	Effective embedment in. (mm)	Tension — N_r				Shear — V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
15M	5-11/16	11,410	11,895	12,115	12,465	22,820	23,790	24,230	24,935
	(145)	(50.8)	(52.9)	(53.9)	(55.5)	(101.5)	(105.8)	(107.8)	(110.9)
	9-13/16	20,055	20,510	20,885	21,495	40,110	41,015	41,770	42,990
	(250)	(89.2)	(91.2)	(92.9)	(95.6)	(178.4)	(182.5)	(185.8)	(191.2)
	12-5/8	25,670	26,250	26,735	27,515	51,345	52,500	53,470	55,030
	(320)	(114.2)	(116.8)	(118.9)	(122.4)	(228.4)	(233.5)	(237.8)	(244.8)
20M	7-7/8	18,485	19,995	20,365	20,960	36,965	39,990	40,730	41,915
	(200)	(82.2)	(88.9)	(90.6)	(93.2)	(164.4)	(177.9)	(181.2)	(186.5)
	14	34,710	35,495	36,145	37,200	69,420	70,985	72,290	74,400
	(355)	(154.4)	(157.9)	(160.8)	(165.5)	(308.8)	(315.8)	(321.6)	(331.0)
	15-3/8	38,130	38,990	39,710	40,870	76,265	77,985	79,420	81,735
	(390)	(169.6)	(173.4)	(176.6)	(181.8)	(339.2)	(346.9)	(353.3)	(363.6)

1 See Section 3.1.8 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 42-45 as necessary. Compare to the steel values in table 38. 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 value 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 value 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 (PTG Ed. 19).
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

Table 41 — Hilti HIT-HY 200 adhesive factored resistance with concrete / bond failure for CA rebar in cracked concrete for diamond core drilling with roughening [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 (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
15M	5-11/16	7,985	8,275	8,425	8,670	15,975	16,545	16,850	17,345
	(145)	(35.5)	(36.8)	(37.5)	(38.6)	(71.1)	(73.6)	(75.0)	(77.1)
	9-13/16	13,950	14,265	14,525	14,950	27,900	28,530	29,055	29,900
	(250)	(62.0)	(63.4)	(64.6)	(66.5)	(124.1)	(126.9)	(129.2)	(133.0)
	12-5/8	17,855	18,260	18,595	19,135	35,710	36,515	37,190	38,275
	(320)	(79.4)	(81.2)	(82.7)	(85.1)	(158.8)	(162.4)	(165.4)	(170.2)
20M	7-7/8	12,940	14,035	14,295	14,710	25,875	28,070	28,590	29,420
	(200)	(57.6)	(62.4)	(63.6)	(65.4)	(115.1)	(124.9)	(127.2)	(130.9)
	14	24,365	24,915	25,370	26,110	48,725	49,825	50,745	52,225
	(355)	(108.4)	(110.8)	(112.9)	(116.2)	(216.7)	(221.6)	(225.7)	(232.3)
	15-3/8	26,765	27,370	27,875	28,685	53,530	54,740	55,745	57,375
	(390)	(119.1)	(121.7)	(124.0)	(127.6)	(238.1)	(243.5)	(248.0)	(255.2)

1 See Section 3.1.8 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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. 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 value 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 value 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 (PTG Ed. 19).
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 the following reduction factors:
15M - α_{seis} = 0.53
20M - α_{seis} = 0.58
See section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

Table 42 — 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 edge f_{RV}			Concrete thickness factor in shear [5] f_{HV}		
Embedment h_{ef}	in	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8
	(mm)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(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	0.39	0.22	0.17	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	0.44	0.25	0.19	n/a	n/a	n/a
7	(178)	0.70	0.62	0.59	0.49	0.28	0.21	0.58	0.56	0.55	0.33	0.19	0.15	0.49	0.28	0.21	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	0.50	0.28	0.22	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	0.54	0.30	0.24	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	0.34	0.26	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	0.38	0.29	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	0.43	0.33	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	0.46	0.35	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	0.42	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	0.47	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	0.53	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

Table 43 — 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 edge f_{RV}			Concrete thickness factor in shear [5] f_{HV}		
Embedment h_{ef}	in	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8	5-11/16	9-13/16	12-5/8
	(mm)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(320)	(145)	(250)	(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 44 — 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 edge f_{RV}			Concrete thickness factor in shear [5] f_{HV}		
Embedment h_{ef} in (mm)		7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm)																			
1-3/4	(44)	n/a	n/a	n/a	0.21	0.11	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	0.14	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	0.31	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	0.34	0.18	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	0.37	0.20	0.18	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	0.41	0.22	0.20	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	0.45	0.24	0.22	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	0.49	0.27	0.24	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	0.54	0.29	0.27	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	0.32	0.29	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	0.37	0.34	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	0.43	0.39	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	0.48	0.44	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	0.53	0.48	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	0.53	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 45 — 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 edge f_{RV}			Concrete thickness factor in shear [5] f_{HV}		
Embedment h_{ef} in (mm)		7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)	7-7/8 (200)	14 (355)	15-3/8 (390)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm)																			
1-3/4	(44)	n/a	n/a	n/a	0.43	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	1.00					0.92	0.89
> 48	(1219)		1.00	1.00				0.92	0.78	0.76		1.00	1.00					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 $c < 3 \cdot h_{ef}$. f_{AV}, is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{AV} = f_{AN}$.
5 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance, $c < 3 \cdot h_{ef}$. If $c \geq 3 \cdot h_{ef}$, then $f_{HV} = 1.0$.

HIT-HY 200 adhesive with Hilti HAS Threaded Rod with Core Drilling and TE-YRT Roughening Tool

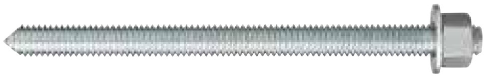
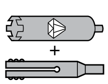


Table 46 — Hilti HIT-HY 200 design information with HAS/HIT-V threaded rods in diamond core drilled holes with roughening in accordance with CSA A23.3-14 Annex D [1]

	Design parameter	Symbol	Units	Nominal rod diameter (in.) 5/8	3/4	7/8	1	1-1/4	Ref A23.3-14
	Nominal anchor diameter	d_a	mm	15.9	19.1	22.2	25.4	31.8	
	Effective minimum embedment [2]	$h_{ef,min}$	mm	79	89	89	102	127	
	Effective maximum embedment [2]	$h_{ef,max}$	mm	318	381	445	508	635	
	Min. concrete thickness [2]	h_{min}	mm	$h_{ef} + 2d_0$					
	Critical edge distance	c_{ac}	-	$2h_{ef}$					
	Minimum edge distance	c_{min} [3]	mm	50	55	60	70	80	
	Minimum anchor spacing	s_{min}	mm	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]	-	7.1					D.6.2.2
	Concrete material resistance factor	Φ_c	-	0.65					8.4.2
	Resistance modification factor for tension and shear, concrete failure modes, Condition B [5]	R_{conc}	-	1.00					D.5.3 (c)
Temp. range A [6]	Characteristic bond stress in cracked concrete [7]	τ_{cr}	psi (MPa)	1,170 (8.1)	1,260 (8.7)	1,290 (8.9)	1,325 (9.1)	1,380 (9.5)	D.6.5.2
Temp. range A [6]	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)	D.6.5.2
Temp. range B [6]	Characteristic bond stress in cracked concrete [7]	τ_{cr}	psi (MPa)	1,170 (8.1)	1,260 (8.7)	1,290 (8.9)	1,325 (9.1)	1,380 (9.5)	D.6.5.2
Temp. range B [6]	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)	D.6.5.2
Temp. range C [6]	Characteristic bond stress in cracked concrete [7]	τ_{cr}	psi (MPa)	960 (6.6)	1,035 (7.1)	1,055 (7.3)	1,085 (7.5)	1,130 (7.8)	D.6.5.2
Temp. range C [6]	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)	D.6.5.2
Reduceduction for seismic tension	Core drilled + roughening 	$\alpha_{N,seis}$	-	0.88	0.96	0.96	1.00	0.82	
Permissible installation conditions	Resistance modification factor tension and shear, bond 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, bond 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 ELC 3187, dated May 2018, 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 ≤ $c_a i \le 5_d$ provided T_{inst} is reduced. See ESR-3187 section 4.1.9.2.
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 47 — Hilti HIT-HY 200 adhesive factored resistance with concrete / bond failure for threaded rod in uncracked concrete for diamond core drilling with roughening [1,2,3,4,5,6,7,8]

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — N_r				Shear — V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
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 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 21-30 as necessary. Compare to the steel values in table 49. 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 value 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 value 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 (PTG Ed. 19).
8 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

Table 48 — Hilti HIT-HY 200 adhesive factored resistance with concrete / bond failure for threaded rod in cracked concrete for diamond core drilling with roughening [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 = 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)
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 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 21-30 as necessary. Compare to the steel values in table 49. 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 value 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 value 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 (PTG Ed. 19).
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:
5/8-in diameter - α_{seis} = 0.66
3/4-in to 7/8-in diameter α_{seis} = 0.72
1-in diameter α_{seis} = 0.75
1-1/4-in diameter - α_{seis} = 0.62
See section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

Table 49 — 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]			HAS-E-55 / HAS-E-55 HDG ASTM F1554 Gr. 55 [4,5]			HAS-B-105 / 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_{sar} lb (kN)	Shear[2] ΦV_{sa} lb (krN)	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)
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 = $\Phi A_{se,N} f_{uta}$ as noted in CSA A23.3-14 Eq. D.2.
2 Shear = $\alpha_{se,V} \Phi_s 0.60 f_{uta} R$ 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.
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 (included HDG rods).
5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements (including HDG rods).

HIT-HY 200 adhesive with Hilti HIS-N Inserts with Core Drilling and TE-YRT Roughening Tool

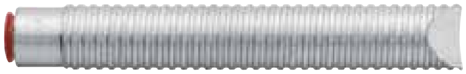
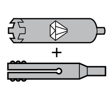


Table 50 — Hilti HIT-HY 200 design information with Hilti HIS-N and HIS-RN internally threaded inserts in diamond core drilled holes with roughening in accordance with CSA A23.3-14 Annex D [1]

	Design parameter	Symbol	Units	Nominal bolt/cap screw diameter (in.)				Ref A23.3-14
				3/8	1/2	5/8	3/4	
	HIS insert outside diameter	d_a	mm	16.5	20.5	25.4	27.6	
	Effective minimum embedment [2]	$h_{ef,min}$	mm	110	125	170	205	
	Min. 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 conc. breakout resistance, uncracked concrete	$k_{c,uncr}$ [3]	-	10				D.6.2.2
	Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$ [3]	-	7				D.6.2.2
	Concrete material resistance factor	Φ_c	-	0.65				8.4.2
	Resistance modification factor for tension and shear, concrete failure modes, Condition B [4]	R_{conc}	-	1.00				D.5.3 (c)
Temp. range A [5]	Characteristic bond stress in cracked concrete [6]	τ_{cr}	psi (MPa)	870 (6.0)	890 (6.1)	910 (6.3)	920 (6.3)	D.6.5.2
Temp. range A [5]	Characteristic bond stress 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 bond stress in cracked concrete [6]	τ_{cr}	psi (MPa)	870 (6.0)	890 (6.1)	910 (6.3)	92 (0.6)	D.6.5.2
Temp. range B [5]	Characteristic bond stress 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 bond stress in cracked concrete [7]	τ_{cr}	psi (MPa)	715 (4.9)	730 (5.0)	750 (5.2)	755 (5.2)	D.6.5.2
Temp. range C [5]	Characteristic bond stress 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
Reduceduction for seismic tension	Core drilled + roughening 	$\alpha_{N,seis}$	-	0.81	0.88	0.92	0.76	
Permissible installation conditions	Resistance modification factor tension and shear, bond 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, bond 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 ELC-3187, dated May 2018, tables 19 and 20, and converted 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] for uncracked concrete and (f'_c/2,500)0.3 [for SI: (f'_c / 17.2)0.3] for cracked concrete.

Table 51 — 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]

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 = 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 52 — 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]

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 = 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 (PTG Ed. 19) for explanation on development of load values.
2 See Section 3.1.8 (PTG Ed. 19) 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 35-36 as necessary. Compare to the steel values in table 53. 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 value 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 value 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 (PTG Ed. 19)
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:
3/8-in diameter - α_{seis}=0.61
1/2-in diameter - α_{seis}=0.66
5/8-in diameter - α_{seis}=0.69
3/4-in diameter - α_{seis}=0.57
See section 3.1.8 for additional information on seismic applications.

Table 53 — Steel factored resistance for steel bolt / cap screw for Hilti HIS-N and HIS-RN internally threaded inserts [1,2,3]

Thread size	ASTM A 193 B7			ASTM A 193 Grade B8M Stainless Steel		
	Tensile[4] ΦN_{sar} lb (kN)	Shear[5] ΦV_{sar} lb (kN)	Seismic Shear[6] $\Phi V_{sar,eq}$ lb (kN)	Tensile[4] ΦN_{sar} lb (kN)	Shear[5] ΦV_{sar} lb (kN)	Seismic Shear[6] $\Phi V_{sar,eq}$ 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 (PTG Ed. 19) 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 = $\alpha_{se,N}\ \Phi_s\ f_{uta}$ R as noted in CSA A23.3-14 Annex D
5 Shear = $\alpha_{se,V}\ \Phi_s\ 0.60\ f_{uta}$ R as noted in CSA A23.3-14 Annex D. For 3/8-in diameter insert, shear = $\alpha_{se,V}\ \Phi_s\ 0.50\ f_{uta}$ R.
6 Seismic Shear = $\alpha_{V,seis}\ V_{sar}$: Reduction factor for seismic shear only. See section 3.1.8 (PTG Ed. 19) for additional information on seismic applications.

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 5 — Hilti HIT-HY 200 adhesive cure time and working time (approx.)

HIT-HY 200-A					
		HIT-V, 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					
		HIT-V, 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) porvided 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.

ORDERING INFORMATION

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-YRT Roughening Tool

Description	Package Contents	Length
TE-YRT 7/8” x 15”	Roughening tool for use with 3/4” diameter threaded rod in core drilled holes	15”
TE-YRT 1-1/8” x 20”	Roughening tool for use with 1” diameter threaded rod in core drilled holes	20”
TE-YRT 1-3/8” x 25”	Roughening tool for use with 1-1/4” diameter threaded rod in core drilled holes	25”
RTG 7/8”	Roughening tool guage for TE-YRT 7/8”	
RTG 1-1/8”	Roughening tool guage for TE-YRT 1-1/8”	
RTG 1-3/8”	Roughening tool guage for TE-YRT 1-3/8”	

For ordering information on anchor rods and inserts, dispensers, hole cleaning equipment and other accessories, see section 3.2.9 (PTG Ed. 19).

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