The following excerpt are pages from the North American Product Technical Guide, Volume 2: Anchor Fastening, Edition 21.

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

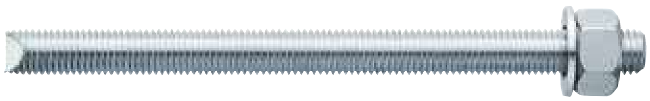
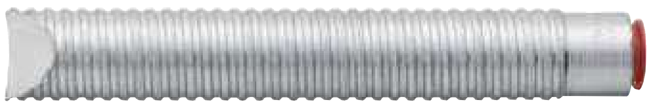
To consult directly with a team member regarding our anchor fastening products, contact Hilti's team of technical support specialists between the hours of 7:00am – 6:00pm CST.
US: 877-749-6337 or HNATechnicalServices@hilti.com
CA: 1-800-363-4458, ext. 6 or CATechnicalServices@hilti.com

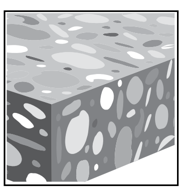
Hilti, Inc.
7250 Dallas Parkway, Suite 1000
Plano, TX 75024

1-800-879-8000
www.hilti.com

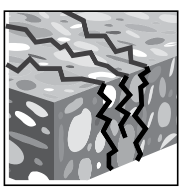
3.2.6 HVU2 CAPSULE ADHESIVE ANCHORING SYSTEM

PRODUCT DESCRIPTION

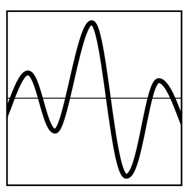
Mortar system		Features and Benefits
	Hilti HVU2 adhesive capsule	• Combines high performance, versatility, and convenience of nearly instant loading • Rapid cure time — as soon as 5 minutes at room temperature • Diamond core drilling applicable, even in cracked concrete and seismic applications
	Hilti HAS threaded rod with setting tip	• Tough, resilient soft foil capsule — little risk of breakage • Suitable for tough jobsite conditions including water-saturated concrete and low installation temperature • SafeSet™ automatic hole cleaning with Hilti hollow drill bit and Hilti vacuum for virtually dust free use and OSHA 1926.1153 Table 1 compliance
	Hilti HIS-N and HIS-RN internally threaded inserts	• Faster and more convenient installation with drill driver, impact driver, or hammer drill



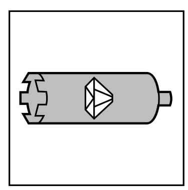
Uncracked concrete



Cracked concrete



Seismic Desing Categories A-F



Diamond core drilling permitted

SAFESET

Hollow Drill Bit

PROFIS Anchor design software

Listings/Approvals	
ICC-ES (International Code Council) **- 2021 International Building Code / International Residential Code**	ESR-4372 in concrete per ACI 318 Ch. 17 / ACI 355.4 / ICC-ES AC308
NSF/ANSI Std 61	Certification for use in potable water
European Technical Approval	ETA-18/0184, ETA-18/0185
City of Los Angeles	2020 LABC Supplement (within ESR-4372)
Florida Building Code	2020 FBC Supplement (within ESR-4372) w/ High Velocity Hurricane Zone
U.S. Green Building Council	LEED® Credit 4.1-Low Emitting Materials

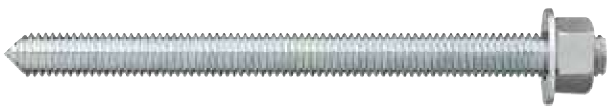
ICC ES | EOTA | LA DBS DEPARTMENT OF BUILDING AND SAFETY | NSF

DESIGN DATA IN CONCRETE PER ACI 318

ACI 318 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-4372 and the equations within ACI 318 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8. Data tables from ESR-4372 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

Hilti HVU2 Adhesive Capsule with Hilti HAS Threaded Rod



Hilti HAS threaded rod with setting tip

Figure 1 — Hilti HAS threaded rod installation conditions

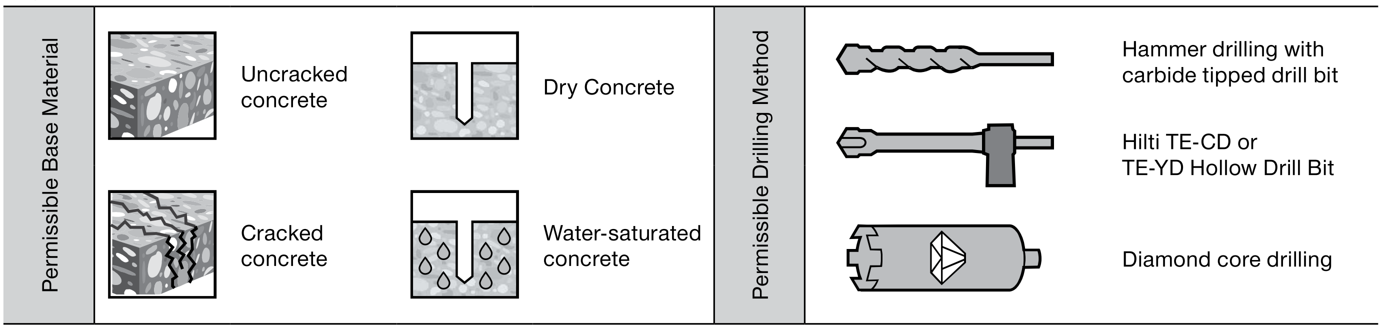
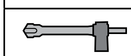
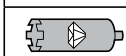


Table 1 — Hilti HAS threaded rod installation specifications [1]

Setting information		Symbol	Units	Nominal rod diameter (in.)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4 [2]
Nominal bit diameter		d_o	-	7/16"	9/16"	11/16"	7/8"	1"	1-1/8"	1-3/8"
		d_o	-	12mm	9/16"	11/16"	7/8"	1"	1-1/8"	1-3/8"
		d_o	-	-	9/16"	11/16"	7/8"	1"	1-1/8"	1-3/8"
Effective embedment		h_{ef}	in. (mm)	3-1/2 (89)	4-1/4 (108)	5 (127)	6-5/8 (168)	6-5/8 (168)	8-1/4 (210)	11 (279)
Diameter of fixture hole		d_f	in.	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
Installation torque		T_{inst}	ft-lb (Nm)	15 (20)	30 (41)	60 (81)	100 (136)	125 (169)	150 (203)	200 (271)
Minimum concrete thickness		h_{min}	in. (mm)	4-3/4 (121)	5-1/2 (140)	6-3/8 (162)	8-3/8 (213)	8-5/8 (219)	10-1/2 (267)	13-3/4 (349)
Minimum edge distance		c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-1/4 (95)	4-3/8 (111)	5 (127)	6-1/4 (159)
Minimum anchor spacing		s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-1/4 (95)	4-3/8 (111)	5 (127)	6-1/4 (159)

1 Material specifications for Hilti HAS threaded rods are listed in section 3.2.7.
2 1-1/4-in. diameter threaded rods to be installed in generally vertical down direction only.

Figure 2 — Hilti HAS threaded rods installed with Hilti HVU2 adhesive capsule

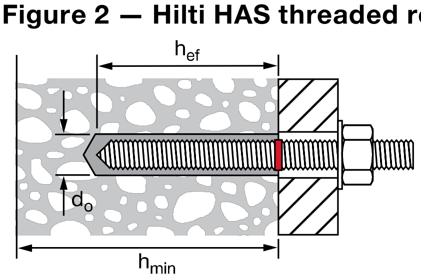
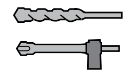


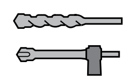
Table 2 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for threaded rod in uncracked concrete [1,2,3,4,5,6,7,8,9]



Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

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)
3/8	3-1/2 (89)	3,955 (17.6)	4,145 (18.4)	4,465 (19.9)	4,965 (22.1)	8,515 (37.9)	8,930 (39.7)	9,620 (42.8)	10,690 (47.6)
1/2	4-1/4 (108)	6,835 (30.4)	7,485 (33.3)	8,645 (38.5)	10,585 (47.1)	14,720 (65.5)	16,125 (71.7)	18,620 (82.8)	22,805 (101.4)
5/8	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)
3/4	6-5/8 (168)	13,300 (59.2)	14,570 (64.8)	16,825 (74.8)	20,605 (91.7)	28,650 (127.4)	31,380 (139.6)	36,235 (161.2)	44,380 (197.4)
7/8	6-5/8 (168)	13,300 (59.2)	14,570 (64.8)	16,825 (74.8)	20,605 (91.7)	28,650 (127.4)	31,380 (139.6)	36,235 (161.2)	44,380 (197.4)
1	8-1/4 (210)	18,485 (82.2)	20,245 (90.1)	23,380 (104.0)	28,635 (127.4)	39,810 (177.1)	43,610 (194.0)	50,355 (224.0)	61,675 (274.3)
1-1/4 [10]	11 (279)	28,455 (126.6)	31,175 (138.7)	35,995 (160.1)	44,085 (196.1)	61,290 (272.6)	67,140 (298.7)	77,530 (344.9)	94,950 (422.4)

Table 3 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for threaded rod in cracked concrete [1,2,3,4,5,6,7,8,9,11]



Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

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)
1/2	4-1/4 (108)	4,580 (20.4)	4,695 (20.9)	4,890 (21.8)	5,175 (23.0)	9,860 (43.9)	10,115 (45.0)	10,530 (46.8)	11,145 (49.6)
5/8	5 (127)	6,175 (27.5)	6,765 (30.1)	7,190 (32.0)	7,610 (33.9)	13,305 (59.2)	14,575 (64.8)	15,485 (68.9)	16,390 (72.9)
3/4	6-5/8 (168)	9,420 (41.9)	10,320 (45.9)	11,430 (50.8)	12,100 (53.8)	20,290 (90.3)	22,230 (98.9)	24,625 (109.5)	26,060 (115.9)
7/8	6-5/8 (168)	9,420 (41.9)	10,320 (45.9)	11,915 (53.0)	14,115 (62.8)	20,290 (90.3)	22,230 (98.9)	25,670 (114.2)	30,405 (135.2)
1	8-1/4 (210)	13,090 (58.2)	14,340 (63.8)	16,560 (73.7)	20,090 (89.4)	28,200 (125.4)	30,890 (137.4)	35,670 (158.7)	43,275 (192.5)
1-1/4 [10]	11 (279)	20,155 (89.7)	22,080 (98.2)	25,495 (113.4)	31,225 (138.9)	43,415 (193.1)	47,560 (211.6)	54,915 (244.3)	67,260 (299.2)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 7 – 10 as necessary to the above values. Compare to the steel values in table 6. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 130°F (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 0.93.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.58.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 For 3/8-in to 1-in dia. threaded rods, tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 1-1/4-in diameter rods to be installed in generally vertically downward direction only.
11 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 for additional information on seismic applications.

Table 4 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for threaded rod in uncracked concrete [1,2,3,4,5,6,7,8,9]

Diamond core drilling

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)
1/2	4-1/4	6,835	7,485	8,645	9,970	14,720	16,125	18,620	21,475
	(108)	(30.4)	(33.3)	(38.5)	(44.3)	(65.5)	(71.7)	(82.8)	(95.5)
5/8	5	8,720	9,555	11,030	13,510	18,785	20,575	23,760	29,100
	(127)	(38.8)	(42.5)	(49.1)	(60.1)	(83.6)	(91.5)	(105.7)	(129.4)
3/4	6-5/8	13,300	14,570	16,825	20,605	28,650	31,380	36,235	44,380
	(168)	(59.2)	(64.8)	(74.8)	(91.7)	(127.4)	(139.6)	(161.2)	(197.4)
7/8	6-5/8	13,300	14,570	16,825	20,605	28,650	31,380	36,235	44,380
	(168)	(59.2)	(64.8)	(74.8)	(91.7)	(127.4)	(139.6)	(161.2)	(197.4)
1	8-1/4	18,485	20,245	23,380	28,635	39,810	43,610	50,355	61,675
	(210)	(82.2)	(90.1)	(104.0)	(127.4)	(177.1)	(194.0)	(224.0)	(274.3)
1-1/4 [10]	11	28,455	31,175	35,995	44,085	61,290	67,140	77,530	94,950
	(279)	(126.6)	(138.7)	(160.1)	(196.1)	(272.6)	(298.7)	(344.9)	(422.4)

Table 5 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for threaded rod in cracked concrete [1,2,3,4,5,6,7,8,9,11]

Diamond core drilling

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)
1/2	4-1/4	4,665	4,665	4,665	4,665	10,045	10,045	10,045	10,045
	(108)	(20.8)	(20.8)	(20.8)	(20.8)	(44.7)	(44.7)	(44.7)	(44.7)
5/8	5	6,175	6,765	6,860	6,860	13,305	14,575	14,775	14,775
	(127)	(27.5)	(30.1)	(30.5)	(30.5)	(59.2)	(64.8)	(65.7)	(65.7)
3/4	6-5/8	9,420	10,320	10,905	10,905	20,290	22,230	23,495	23,495
	(168)	(41.9)	(45.9)	(48.5)	(48.5)	(90.3)	(98.9)	(104.5)	(104.5)
7/8	6-5/8	9,420	10,320	11,915	12,725	20,290	22,230	25,670	27,410
	(168)	(41.9)	(45.9)	(53.0)	(56.6)	(90.3)	(98.9)	(114.2)	(121.9)
1	8-1/4	13,090	14,340	16,560	18,110	28,200	30,890	35,670	39,005
	(210)	(58.2)	(63.8)	(73.7)	(80.6)	(125.4)	(137.4)	(158.7)	(173.5)
1-1/4 [10]	11	20,155	22,080	25,495	30,185	43,415	47,560	54,915	65,010
	(279)	(89.7)	(98.2)	(113.4)	(134.3)	(193.1)	(211.6)	(244.3)	(289.2)

1 See Section 3.1.8 of for explanation on development of load values.
2 See Section 3.1.8 of to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 7 – 10 as necessary to the above values. Compare to the steel values in table 6. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 130°F (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 0.93.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.58.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 For 1/2-in to 1-in dia. threaded rods, tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 1-1/4-in diameter rods to be installed in generally vertically downward direction only.
11 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 for additional information on seismic applications.

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

Nominal anchor diameter in.	HAS-E-55 / HAS-E-55 HDG ASTM F1554 Gr. 55[4,6]			HAS-B-105 and HAS-B-105 HDG ASTM A193 B7 and ASTM F 1554 Gr.105[4,6]			HAS-R stainless steel ASTM F593 (3/8-in to 1-in)[5] ASTM A193 (1-1/8-in to 2-in)[4]		
	Tensile[1] ΦN_{sa} lb (kN)	Shear[2] ΦV_{sa} lb (kN)	Seismic Shear[3] $\Phi V_{sa,eq}$ lb (kN)	Tensile[1] ΦN_{sa} lb (kN)	Shear[2] ΦV_{sa} lb (kN)	Seismic Shear[3] $\Phi V_{sa,eq}$ lb (kN)	Tensile[1] ΦN_{sa} lb (kN)	Shear[2] ΦV_{sa} lb (kN)	Seismic Shear[3] $\Phi V_{sa,eq}$ lb (kN)
3/8	4,360 (19.4)	2,270 (10.1)	1,590 (7.1)	7,270 (32.3)	3,780 (16.8)	2,645 (11.8)	5,040 (22.4)	2,790 (12.4)	1,955 (8.7)
1/2	7,985 (35.5)	4,150 (18.5)	2,905 (12.9)	13,305 (59.2)	6,920 (30.8)	4,845 (21.6)	9,225 (41.0)	5,110 (22.7)	3,575 (15.9)
5/8	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	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	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	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	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 17.4.1.2
2 Shear = $\phi\ 0.60 A_{se,V} f_{uta}$ as noted in ACI 318 17.5.1.2b.
3 Seismic Shear = $\alpha_{V,seis}\ \phi V_{sa}$: Reduction factor for seismic shear only. See ACI 318 for additional information on seismic applications.
4 HAS-E (3/8-in to 1-1/4-in), HAS-B, and HAS-R (Class 1; 1-1/4-in) threaded rods are considered ductile steel elements (including HDG rods).
5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements.
6 3/8-inch dia. threaded rods are not included in the ASTM F1554 standard. Hilti 3/8-inch dia. HAS-E-55, and HAS-B-105 (incl. HDG) threaded rods meet the chemical composition and mechanical property requirements of ASTM F1554.

Table 7 — Load adjustment factors for 3/8, 1/2, 5/8, and 3/4-in. diameter threaded rods in uncracked concrete [1,2]

3/8, 1/2, 5/8 & 3/4-in. threaded rods 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}			
Thread size, in.		3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4
Embedment h_{ef}	in.	3-1/2	4-1/4	5	6-5/8	3-1/2	4-1/4	5	6-5/8	3-1/2	4-1/4	5	6-5/8	3-1/2	4-1/4	5	6-5/8	3-1/2	4-1/4	5	6-5/8	3-1/2	4-1/4	5	6-5/8
	(mm)	(89)	(108)	(127)	(168)	(89)	(108)	(127)	(168)	(89)	(108)	(127)	(168)	(89)	(108)	(127)	(168)	(89)	(108)	(127)	(168)	(89)	(108)	(127)	(168)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm): 1-7/8	(48)	0.59	n/a	n/a	n/a	0.30	n/a	n/a	n/a	0.53	n/a	n/a	n/a	0.10	n/a	n/a	n/a	0.19	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	(51)	0.60	n/a	n/a	n/a	0.31	n/a	n/a	n/a	0.54	n/a	n/a	n/a	0.11	n/a	n/a	n/a	0.21	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-1/2	(64)	0.62	0.58	n/a	n/a	0.35	0.29	n/a	n/a	0.55	0.54	n/a	n/a	0.15	0.10	n/a	n/a	0.30	0.20	n/a	0.54	n/a	n/a	n/a	n/a
3	(76)	0.64	0.60	n/a	n/a	0.38	0.31	n/a	n/a	0.56	0.54	n/a	n/a	0.19	0.13	n/a	n/a	0.38	0.26	n/a	0.54	n/a	n/a	n/a	n/a
3-1/8	(79)	0.65	0.60	0.58	n/a	0.39	0.32	0.31	n/a	0.56	0.54	0.54	n/a	0.21	0.14	0.12	n/a	0.39	0.28	0.24	0.54	n/a	n/a	n/a	n/a
3-1/4	(83)	0.65	0.61	0.59	0.57	0.40	0.33	0.32	0.29	0.56	0.55	0.54	0.53	0.22	0.15	0.13	0.09	0.40	0.29	0.26	0.18	n/a	n/a	n/a	n/a
4	(102)	0.69	0.63	0.61	0.59	0.46	0.37	0.35	0.31	0.57	0.56	0.55	0.54	0.30	0.20	0.18	0.12	0.46	0.37	0.35	0.25	n/a	n/a	n/a	n/a
4-3/4	(121)	0.73	0.66	0.63	0.61	0.53	0.41	0.39	0.34	0.59	0.57	0.56	0.55	0.39	0.26	0.23	0.16	0.53	0.41	0.39	0.32	0.60	n/a	n/a	n/a
5	(127)	0.74	0.67	0.63	0.61	0.55	0.42	0.40	0.35	0.59	0.57	0.57	0.55	0.42	0.28	0.24	0.17	0.55	0.42	0.40	0.34	0.61	n/a	n/a	n/a
5-1/2	(140)	0.76	0.68	0.65	0.62	0.61	0.45	0.43	0.36	0.60	0.58	0.57	0.56	0.48	0.32	0.28	0.20	0.61	0.45	0.43	0.36	0.64	0.56	n/a	n/a
6	(152)	0.79	0.70	0.66	0.63	0.66	0.48	0.45	0.38	0.61	0.59	0.58	0.56	0.55	0.37	0.32	0.23	0.66	0.48	0.45	0.38	0.67	0.58	n/a	n/a
6-3/8	(162)	0.80	0.71	0.67	0.64	0.70	0.51	0.47	0.40	0.62	0.59	0.58	0.57	0.60	0.40	0.35	0.25	0.70	0.51	0.47	0.40	0.69	0.60	0.58	n/a
7	(178)	0.83	0.73	0.69	0.66	0.77	0.56	0.51	0.42	0.63	0.60	0.59	0.57	0.69	0.46	0.41	0.29	0.77	0.56	0.51	0.42	0.72	0.63	0.60	n/a
8	(203)	0.88	0.77	0.71	0.68	0.88	0.64	0.57	0.46	0.65	0.61	0.60	0.58	0.85	0.57	0.50	0.35	0.88	0.64	0.57	0.46	0.77	0.68	0.65	n/a
8-3/8	(213)	0.90	0.78	0.72	0.69	0.92	0.67	0.60	0.48	0.66	0.62	0.61	0.59	0.91	0.61	0.53	0.37	0.92	0.67	0.60	0.48	0.79	0.69	0.66	0.59
10	(254)	0.98	0.84	0.77	0.72	1.00	0.80	0.71	0.54	0.69	0.64	0.63	0.60	1.00	0.79	0.69	0.49	1.00	0.80	0.71	0.54	0.86	0.75	0.72	0.64
12	(305)	1.00	0.90	0.82	0.77		0.96	0.85	0.65	0.72	0.67	0.66	0.62		1.00	0.91	0.64		0.96	0.85	0.65	0.95	0.83	0.79	0.70
14	(356)		0.97	0.88	0.81		1.00	1.00	0.76	0.76	0.70	0.68	0.64			1.00	0.81		1.00	1.00	0.76	1.00	0.89	0.85	0.76
16	(406)		1.00	0.93	0.86				0.87	0.80	0.73	0.71	0.67				0.99				0.87		0.95	0.91	0.81
18	(457)			0.98	0.90				0.98	0.84	0.76	0.73	0.69				1.00				0.98		1.00	0.97	0.86
24	(610)			1.00	1.00				1.00	0.95	0.84	0.81	0.75								1.00			1.00	1.00
30	(762)									1.00	0.93	0.89	0.81												
36	(914)										1.00	0.97	0.87												
> 48	(1219)											1.00	1.00												

Table 8 — Load adjustment factors for 1/2, 5/8, and 3/4-in. diameter threaded rods in cracked concrete[1,2]

1/2, 5/8 & 3/4-in. threaded rods 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}		
Thread size, in.		1/2	5/8	3/4	1/2	5/8	3/4	1/2	5/8	3/4	1/2	5/8	3/4	1/2	5/8	3/4	1/2	5/8	3/4
Embedment h_{ef}	in.	4-1/4	5	6-5/8	4-1/4	5	6-5/8	4-1/4	5	6-5/8	4-1/4	5	6-5/8	4-1/4	5	6-5/8	4-1/4	5	6-5/8
	(mm)	(108)	(127)	(168)	(108)	(127)	(168)	(108)	(127)	(168)	(108)	(127)	(168)	(108)	(127)	(168)	(108)	(127)	(168)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm): 2-1/2	(64)	0.58	n/a	n/a	0.53	n/a	n/a	0.54	n/a	n/a	0.11	n/a	n/a	0.21	n/a	n/a	n/a	n/a	n/a
3	(76)	0.60	n/a	n/a	0.58	n/a	n/a	0.54	n/a	n/a	0.14	n/a	n/a	0.28	n/a	n/a	n/a	n/a	n/a
3-1/8	(79)	0.60	0.58	n/a	0.59	0.53	n/a	0.55	0.54	n/a	0.15	0.12	n/a	0.29	0.24	n/a	n/a	n/a	n/a
3-1/4	(83)	0.61	0.59	0.57	0.60	0.54	0.51	0.55	0.54	0.53	0.16	0.13	0.09	0.31	0.26	0.18	n/a	n/a	n/a
4	(102)	0.63	0.61	0.59	0.66	0.59	0.55	0.56	0.55	0.54	0.21	0.18	0.12	0.43	0.35	0.25	n/a	n/a	n/a
4-3/4	(121)	0.66	0.63	0.61	0.73	0.64	0.59	0.57	0.56	0.55	0.28	0.23	0.16	0.55	0.46	0.32	n/a	n/a	n/a
5	(127)	0.67	0.63	0.61	0.75	0.66	0.60	0.57	0.57	0.55	0.30	0.25	0.17	0.60	0.49	0.35	n/a	n/a	n/a
5-1/2	(140)	0.68	0.65	0.62	0.80	0.70	0.63	0.58	0.57	0.56	0.34	0.28	0.20	0.69	0.57	0.40	0.57	n/a	n/a
6	(152)	0.70	0.66	0.63	0.85	0.73	0.66	0.59	0.58	0.56	0.39	0.32	0.23	0.78	0.65	0.46	0.60	n/a	n/a
6-3/8	(162)	0.71	0.67	0.64	0.89	0.76	0.68	0.59	0.58	0.57	0.43	0.36	0.25	0.86	0.71	0.50	0.62	0.58	n/a
7	(178)	0.73	0.69	0.66	0.95	0.81	0.72	0.60	0.59	0.57	0.49	0.41	0.29	0.95	0.81	0.57	0.65	0.61	n/a
8	(203)	0.77	0.71	0.68	1.00	0.89	0.78	0.62	0.60	0.58	0.60	0.50	0.35	1.00	0.89	0.70	0.69	0.65	n/a
8-3/8	(213)	0.78	0.72	0.69		0.92	0.81	0.62	0.61	0.59	0.65	0.53	0.38		0.92	0.75	0.71	0.66	0.59
10	(254)	0.84	0.77	0.72		1.00	0.92	0.65	0.63	0.60	0.84	0.70	0.49		1.00	0.92	0.77	0.72	0.64
12	(305)	0.90	0.82	0.77			1.00	0.68	0.66	0.62	1.00	0.92	0.65			1.00	0.84	0.79	0.71
14	(356)	0.97	0.88	0.81				0.71	0.68	0.65		1.00	0.81				0.91	0.86	0.76
16	(406)	1.00	0.93	0.86				0.74	0.71	0.67			0.99				0.98	0.92	0.81
18	(457)		0.98	0.90				0.77	0.74	0.69			1.00				1.00	0.97	0.86
24	(610)		1.00	1.00				0.86	0.81	0.75								1.00	1.00
30	(762)							0.95	0.89	0.81									
36	(914)							1.00	0.97	0.87									
> 48	(1219)								1.00	1.00									

1 Linear interpolation not permitted.
2 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance c < 3*h_{ef}. If c ≥ 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 ≥ 3*h_{ef}, then f_{HV} = 1.0.

3.2.6

Table 9 — Load adjustment factors for 7/8, 1, and 1-1/4-in. diameter threaded rods in uncracked concrete[1,2]

7/8, 1 & 1-1/4-in. threaded rods uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[4] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ‖ To edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Thread size, in.		7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4
Embedment h_{ef}	in.	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11
	(mm)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm)																			
4-3/8	(111)	0.58	n/a	n/a	0.35	n/a	n/a	0.55	n/a	n/a	0.14	n/a	n/a	0.28	n/a	n/a	n/a	n/a	n/a
5	(127)	0.60	0.58	n/a	0.37	0.34	n/a	0.55	0.54	n/a	0.17	0.12	n/a	0.34	0.25	n/a	n/a	n/a	n/a
6	(152)	0.61	0.60	n/a	0.41	0.37	n/a	0.56	0.55	n/a	0.23	0.16	n/a	0.41	0.33	n/a	n/a	n/a	n/a
6-1/4	(159)	0.62	0.60	0.58	0.42	0.37	0.34	0.56	0.55	0.54	0.24	0.17	0.11	0.42	0.35	0.22	n/a	n/a	n/a
7	(178)	0.63	0.62	0.59	0.45	0.40	0.35	0.57	0.56	0.54	0.29	0.21	0.13	0.45	0.40	0.27	n/a	n/a	n/a
8	(203)	0.65	0.63	0.61	0.50	0.43	0.37	0.58	0.57	0.55	0.35	0.25	0.16	0.50	0.43	0.33	n/a	n/a	n/a
8-5/8	(219)	0.67	0.64	0.61	0.52	0.45	0.39	0.59	0.57	0.55	0.39	0.28	0.18	0.52	0.45	0.36	0.60	n/a	n/a
9	(229)	0.67	0.65	0.62	0.54	0.46	0.40	0.59	0.57	0.56	0.42	0.30	0.19	0.54	0.46	0.39	0.61	n/a	n/a
10	(254)	0.69	0.67	0.63	0.59	0.50	0.42	0.60	0.58	0.56	0.49	0.35	0.23	0.59	0.50	0.42	0.64	n/a	n/a
10-1/2	(267)	0.70	0.68	0.64	0.62	0.51	0.44	0.61	0.59	0.57	0.52	0.38	0.24	0.62	0.51	0.44	0.66	0.59	n/a
11	(279)	0.71	0.68	0.65	0.64	0.53	0.45	0.61	0.59	0.57	0.56	0.40	0.26	0.64	0.53	0.45	0.67	0.60	n/a
12	(305)	0.73	0.70	0.66	0.70	0.57	0.47	0.62	0.60	0.57	0.64	0.46	0.30	0.70	0.57	0.47	0.70	0.63	n/a
13	(330)	0.75	0.72	0.67	0.76	0.61	0.50	0.63	0.61	0.58	0.72	0.52	0.34	0.76	0.61	0.50	0.73	0.66	n/a
13-3/4	(349)	0.76	0.73	0.68	0.81	0.65	0.52	0.64	0.61	0.59	0.78	0.56	0.37	0.81	0.65	0.52	0.75	0.67	0.58
14	(356)	0.77	0.73	0.68	0.82	0.66	0.53	0.64	0.62	0.59	0.81	0.58	0.38	0.82	0.66	0.53	0.76	0.68	0.59
15	(381)	0.79	0.75	0.70	0.88	0.71	0.55	0.65	0.62	0.59	0.89	0.64	0.42	0.88	0.71	0.55	0.79	0.70	0.61
16	(406)	0.81	0.77	0.71	0.94	0.75	0.58	0.67	0.63	0.60	0.99	0.71	0.46	0.94	0.75	0.58	0.81	0.73	0.63
17	(432)	0.83	0.78	0.72	1.00	0.80	0.62	0.68	0.64	0.61	1.00	0.78	0.50	1.00	0.80	0.62	0.84	0.75	0.65
18	(457)	0.84	0.80	0.74		0.85	0.65	0.69	0.65	0.61		0.85	0.55		0.85	0.65	0.86	0.77	0.67
20	(508)	0.88	0.84	0.76		0.94	0.72	0.71	0.67	0.62		0.99	0.64		0.94	0.72	0.91	0.81	0.70
24	(610)	0.96	0.90	0.82		1.00	0.87	0.75	0.70	0.65		1.00	0.85		1.00	0.87	1.00	0.89	0.77
30	(762)	1.00	1.00	0.90			1.00	0.81	0.75	0.69			1.00			1.00		1.00	0.86
36	(914)			0.97				0.87	0.80	0.72									0.95
> 48	(1219)			1.00				1.00	0.90	0.80									1.00

Table 10 — Load adjustment factors for 7/8, 1, and 1-1/4-in. diameter threaded rods in cracked concrete[1,2]

7/8, 1 & 1-1/4-in. threaded rods cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[4] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ‖ To edge f_{RV}			Concrete thickness factor in shear[5] f_{HV}		
Thread size, in.		7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4	7/8	1	1 1/4
Embedment h_{ef}	in.	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11	6-5/8	8-1/4	11
	(mm)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)	(168)	(210)	(279)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm)																			
4-3/8	(111)	0.58	n/a	n/a	0.53	n/a	n/a	0.55	n/a	n/a	0.14	n/a	n/a	0.28	n/a	n/a	n/a	n/a	n/a
5	(127)	0.60	0.58	n/a	0.56	0.53	n/a	0.55	0.54	n/a	0.17	0.12	n/a	0.35	0.25	n/a	n/a	n/a	n/a
6	(152)	0.61	0.60	n/a	0.61	0.58	n/a	0.56	0.55	n/a	0.23	0.16	n/a	0.46	0.33	n/a	n/a	n/a	n/a
6-1/4	(159)	0.62	0.60	0.58	0.62	0.59	0.53	0.56	0.55	0.54	0.24	0.17	0.11	0.49	0.35	0.23	n/a	n/a	n/a
7	(178)	0.63	0.62	0.59	0.66	0.62	0.56	0.57	0.56	0.54	0.29	0.21	0.13	0.57	0.41	0.27	n/a	n/a	n/a
8	(203)	0.65	0.63	0.61	0.71	0.66	0.59	0.58	0.57	0.55	0.35	0.25	0.16	0.70	0.51	0.33	n/a	n/a	n/a
8-5/8	(219)	0.67	0.64	0.61	0.75	0.69	0.61	0.59	0.57	0.55	0.39	0.28	0.18	0.75	0.57	0.37	0.60	n/a	n/a
9	(229)	0.67	0.65	0.62	0.77	0.71	0.62	0.59	0.57	0.56	0.42	0.30	0.20	0.77	0.60	0.39	0.61	n/a	n/a
10	(254)	0.69	0.67	0.63	0.82	0.75	0.66	0.60	0.58	0.56	0.49	0.35	0.23	0.82	0.71	0.46	0.64	n/a	n/a
10-1/2	(267)	0.70	0.68	0.64	0.85	0.78	0.67	0.61	0.59	0.57	0.53	0.38	0.25	0.85	0.76	0.49	0.66	0.59	n/a
11	(279)	0.71	0.68	0.65	0.88	0.80	0.69	0.61	0.59	0.57	0.57	0.41	0.26	0.88	0.80	0.53	0.68	0.61	n/a
12	(305)	0.73	0.70	0.66	0.94	0.85	0.73	0.62	0.60	0.57	0.65	0.46	0.30	0.94	0.85	0.60	0.71	0.63	n/a
13	(330)	0.75	0.72	0.67	1.00	0.90	0.76	0.63	0.61	0.58	0.73	0.52	0.34	1.00	0.90	0.68	0.73	0.66	n/a
13-3/4	(349)	0.76	0.73	0.68		0.94	0.79	0.64	0.61	0.59	0.79	0.57	0.37		0.94	0.74	0.76	0.68	0.59
14	(356)	0.77	0.73	0.68		0.95	0.80	0.65	0.62	0.59	0.81	0.59	0.38		0.95	0.76	0.76	0.68	0.59
15	(381)	0.79	0.75	0.70		1.00	0.84	0.66	0.62	0.59	0.90	0.65	0.42		1.00	0.84	0.79	0.71	0.61
16	(406)	0.81	0.77	0.71			0.88	0.67	0.63	0.60	0.99	0.71	0.46			0.88	0.81	0.73	0.63
17	(432)	0.83	0.78	0.72			0.92	0.68	0.64	0.61	1.00	0.78	0.51			0.92	0.84	0.75	0.65
18	(457)	0.84	0.80	0.74			0.96	0.69	0.65	0.61		0.85	0.55			0.96	0.86	0.77	0.67
20	(508)	0.88	0.84	0.76			1.00	0.71	0.67	0.62		1.00	0.65			1.00	0.91	0.82	0.71
24	(610)	0.96	0.90	0.82				0.75	0.70	0.65			0.85				1.00	0.89	0.77
30	(762)	1.00	1.00	0.90				0.81	0.75	0.69			1.00					1.00	0.87
36	(914)			0.97				0.87	0.80	0.72									0.95
> 48	(1219)			1.00				1.00	0.90	0.80									1.00

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance c < 3*h_{ef}. If c ≥ 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 ≥ 3*h_{ef}, then f_{HV} = 1.0.

Hilti HVU2 with Hilti HIS-N Inserts

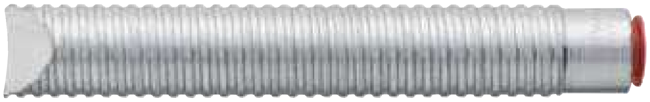


Figure 3 — Hilti HIS-N and HIS-RN internally threaded insert installation conditions

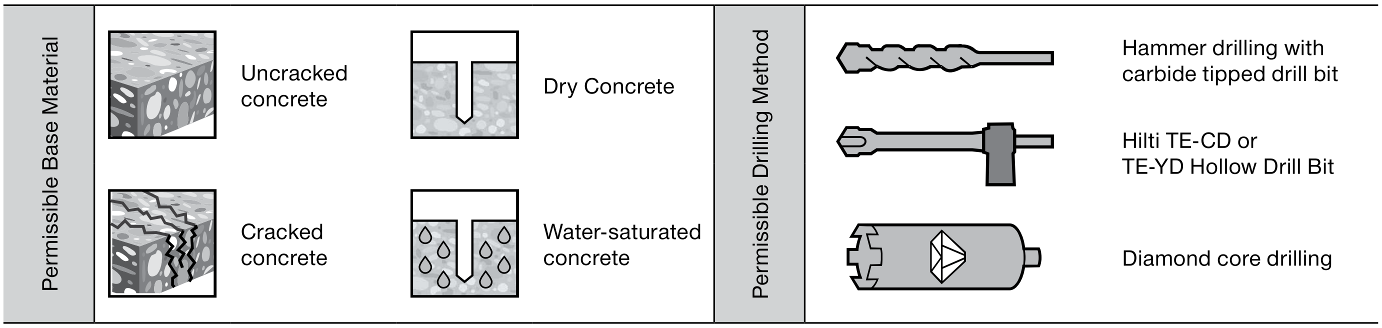
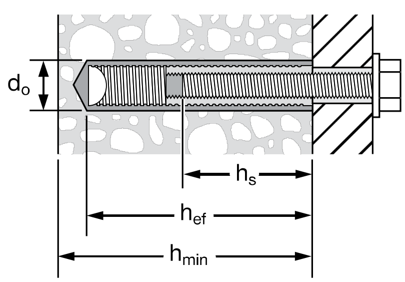


Table 11 — Hilti HIS-N and HIS-RN internally threaded insert installation specifications

Setting information		Symbol	Units	Thread Size			
				3/8-16 UNC	1/2-13 UNC	5/8-11 UNC	3/4-10 UNC
Outside diameter of insert			in.	0.65	0.81	1.00	1.09
Nominal bit diameter (all drilling methods)		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)	(170)	(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)	(41)	(81)	(136)
Minimum Concrete Thickness		h_{min}	in.	5-7/8	6-3/4	9	10-5/8
			(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)

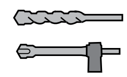
Figure 4 — Hilti HIS-N and HIS-RN internally threaded inserts installed with Hilti HVU2 adhesive capsules



DESIGN OF HILTI HVU2 ADHESIVE CAPSULES WITH HIS-N AND HIS-RN INSERTS PER ACI 318 CHAPTER 17

Hilti HVU2 adhesive capsule testing for ICC-ES ESR-4372 did not include the Hilti HIS-N and HIS-RN inserts. Additional testing was performed with the HIS-N and HIS-RN inserts and the results evaluated per ACI 355.4 and ICC-ES AC308 and published in the following tables. The tables include the design parameters per ACI 318 Ch. 17 and the parameters are calculated using
ACI 318 Ch. 17 to develop the Hilti Simplified Design Tables. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8.

Table 12 — HVU2 adhesive capsule design information with Hilti HIS-N and HIS-RN internally threaded inserts per ACI 318 Chapter 17 [1]



Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

	Setting information	Symbol	Units	Nominal bolt/cap screw diameter (in) 3/8	1/2	5/8	3/4
	HIS insert outside diameter	d_a	in. (mm)	0.65 (16.5)	0.81 (20.5)	1.00 (25.4)	1.09 (27.6)
	Effective embedment [2]	h_{ef}	in. (mm)	4-1/4 (110)	5 (125)	6-3/4 (170)	8-1/8 (205)
	Minimum concrete thickness [2]	h_{min}	in. (mm)	5-7/8 (150)	6-3/4 (170)	9 (230)	10-5/8 (270)
	Critical edge distance	c_{ac}	-	See footnote 8 below			
	Minimum edge distance	c_{min}	in. (mm)	3-1/4 (83)	4 (102)	5 (127)	5-1/2 (140)
	Minimum anchor spacing	s_{min}	in. (mm)	3-1/4 (83)	4 (102)	5 (127)	5-1/2 (140)
	Effectiveness factor for uncracked concrete [3]	$k_{c,uncr}$	in-lb (SI)	24 (10.0)			
	Effectiveness factor for cracked concrete [3]	$k_{c,cr}$	in-lb (SI)	17 (7.1)			
	Strength reduction factor for concrete failure in tension [4]	$\Phi_{c,N}$	-	0.65			
	Strength reduction factor for concrete failure in shear [4]	$\Phi_{c,V}$	-	0.70			
Temp. range A [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	725 (4.99)	725 (4.99)	725 (4.99)	725 (4.99)
	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	1,490 (10.26)	1,490 (10.26)	1,490 (10.26)	1,490 (10.26)
Temp. range B [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	670 (4.63)	670 (4.63)	670 (4.63)	670 (4.63)
	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	1,380 (9.53)	1,380 (9.53)	1,380 (9.53)	1,380 (9.53)
Temp. range C [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	420 (2.90)	420 (2.90)	420 (2.90)	420 (2.90)
	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	865 (5.97)	865 (5.97)	865 (5.97)	865 (5.97)
	Reduction for seismic tension	$\alpha_{N,seis}$	-	1.0			
Permissible installation conditions	Strength reduction factor for bond failure, dry concrete	Anchor category	-	1			
		Φ_d	-	0.65			
	Strength reduction factor for bond failure, water-saturated concrete	Anchor category	-	1			
		Φ_{ws}	-	0.65			

1 Design information in this table is based on testing in accordance with ACI 355.4.
2 See Figure 4.
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 Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318 17.3.3.
For cases where the presence of supplementary reinforcement can be verified, the reduction factors associated with Condition A may be used.
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 $(f'_c/2{,}500)^n$ [for SI: $(f'_c/17.2)^n$], where n is as follows:
n = 0 for uncracked concrete, all drilling methods
n = 0.26 for cracked concrete, carbide bit or Hilti hollow drill bit
7 Characteristic bond strengths are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.
8 $c_{ac} = h_{ef} \cdot \left(\frac{\tau_{k,uncr}}{1{,}160}\right)^{0.4} \cdot \left[3.1 - 0.7 \cdot \frac{h}{h_{ef}}\right]$, where
$\frac{h}{h_{ef}}$ need not be greater than 2.4, and
$\tau_{k,uncr}$ need not be greater than $\tau_{k,uncr} = \frac{\tau_{k,uncr}\sqrt{h_{ef} \cdot f'_c}}{\pi \cdot d_a}$ (use imperial units in all equations)

Table 13 — HVU2 adhesive capsule design information with Hilti HIS-N and HIS-RN internally threaded inserts per ACI 318 Chapter 17 [1,2]

Diamond core drilling

Setting information		Symbol	Units	Nominal bolt/cap screw diameter (in)			
				3/8	1/2	5/8	3/4
Temp. range A [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	505 (3.49)	505 (3.49)	505 (3.49)	505 (3.49)
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	1,415 (9.77)	1,415 (9.77)	1,415 (9.77)	1,415 (9.77)
Temp. range B [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	475 (3.28)	475 (3.28)	475 (3.28)	475 (3.28)
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	1,330 (9.17)	1,330 (9.17)	1,330 (9.17)	1,330 (9.17)
Temp. range C [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	305 (2.11)	305 (2.11)	305 (2.11)	305 (2.11)
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	855 (5.89)	855 (5.89)	855 (5.89)	855 (5.89)
Reduction for seismic tension		$\alpha_{N,seis}$	-	1.0			

1 Design information in this table is based on testing in accordance with ACI 355.4.
2 Items from Table 12 (d_a, h_{ef}, h_{min}, c_{ac}, c_{min}, s_{min}, $k_{c,uncr}$, $k_{c,cr}$, and Φ factors) are applicable to this table for diamond core drilling.
3 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.
4 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 $(f'_c/2{,}500)^n$ [for SI: $(f'_c / 17.2)^n$], where n is as follows:
n = 0 for uncracked concrete, all drilling methods
n = 0.18 for cracked concrete, diamond core drill bit
5 Characteristic bond strengths are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.

Table 14 — Steel design strength for steel bolt and cap screw for Hilti HIS-N and HIS-RN internally threaded inserts[1,2,3]

Thread size	ASTM A193 B7			ASTM A193 Grade B8M stainless steel		
	Tensile[4] ϕN_{sa} lb (kN)	Shear[5] ϕV_{sa} lb (kN)	Seismic Shear[6] $\phi V_{sa,eq}$ lb (kN)	Tensile[4] ϕN_{sa} lb (kN)	Shear[5] ϕV_{sa} lb (kN)	Seismic Shear[6] $\phi V_{sa,eq}$ lb (kN)
3/8-16 UNC	6,300 (28.0)	3,490 (15.5)	2,445 (10.9)	5,540 (24.6)	3,070 (13.7)	2,150 (9.6)
1/2-13 UNC	11,530 (51.3)	6,385 (28.4)	4,470 (19.9)	10,145 (45.1)	5,620 (25.0)	3,935 (17.5)
5/8-11 UNC	18,365 (81.7)	10,170 (45.2)	7,120 (31.6)	16,160 (71.9)	8,950 (39.8)	6,265 (27.9)
3/4-10 UNC	27,180 (120.9)	15,055 (67.0)	10,540 (46.9)	23,915 (106.4)	13,245 (58.9)	9,270 (41.2)

1 See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
2 Hilti HIS-N and HIS-RN inserts with steel bolts are to be considered brittle steel elements.
3 Table values are the lesser of steel failure in the HIS-N insert or inserted steel bolt.
4 Tensile = $\phi A_{se,N} f_{uta}$ as noted in ACI 318 Chapter 17.
5 Shear values determined by static shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17.
6 Seismic Shear = $\alpha_{V,seis}\ \phi_{Vsa}$: Reduction for seismic shear only. See section 3.1.8 for additional information on seismic applications.

Table 15 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in uncracked concrete [1,2,3,4,5,6,7,8,9]

Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

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 (110)	7,140 (31.8)	7,820 (34.8)	8,650 (38.5)	8,650 (38.5)	15,375 (68.4)	16,840 (74.9)	18,635 (82.9)	18,635 (82.9)
1/2-13 UNC	5 (125)	8,720 (38.8)	9,555 (42.5)	11,030 (49.1)	12,325 (54.8)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	26,540 (118.1)
5/8-11 UNC	6-3/4 (170)	13,680 (60.9)	14,985 (66.7)	17,305 (77.0)	20,540 (91.4)	29,460 (131.0)	32,275 (143.6)	37,265 (165.8)	44,235 (196.8)
3/4-10 UNC	8-1/8 (205)	18,065 (80.4)	19,790 (88.0)	22,850 (101.6)	26,945 (119.9)	38,910 (173.1)	42,620 (189.6)	49,215 (218.9)	58,040 (258.2)

Table 16 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in cracked concrete [1,2,3,4,5,6,7,8,9,10]

Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

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 (110)	4,210 (18.7)	4,415 (19.6)	4,755 (21.2)	5,285 (23.5)	9,070 (40.3)	9,510 (42.3)	10,245 (45.6)	11,385 (50.6)
1/2-13 UNC	5 (125)	5,995 (26.7)	6,285 (28.0)	6,775 (30.1)	7,530 (33.5)	12,915 (57.4)	13,540 (60.2)	14,595 (64.9)	16,215 (72.1)
5/8-11 UNC	6-3/4 (170)	9,690 (43.1)	10,480 (46.6)	11,290 (50.2)	12,550 (55.8)	20,870 (92.8)	22,570 (100.4)	24,320 (108.2)	27,025 (120.2)
3/4-10 UNC	8-1/8 (205)	12,795 (56.9)	13,750 (61.2)	14,815 (65.9)	16,465 (73.2)	27,560 (122.6)	29,610 (131.7)	31,910 (141.9)	35,460 (157.7)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 19 – 20 as necessary to the above values. Compare to the steel values in table 14. 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 0.93.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.58.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 for additional information on seismic applications.

Table 17 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in uncracked concrete [1,2,3,4,5,6,7,8,9]

Diamond core drilling

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)	8,215 (36.5)	8,215 (36.5)	15,375 (68.4)	16,840 (74.9)	17,700 (78.7)	17,700 (78.7)
1/2-13 UNC	5 (127)	8,720 (38.8)	9,555 (42.5)	11,030 (49.1)	11,700 (52.0)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	25,205 (112.1)
5/8-11 UNC	6-3/4 (171)	13,680 (60.9)	14,985 (66.7)	17,305 (77.0)	19,505 (86.8)	29,460 (131.0)	32,275 (143.6)	37,265 (165.8)	42,010 (186.9)
3/4-10 UNC	8-1/8 (206)	18,065 (80.4)	19,790 (88.0)	22,850 (101.6)	25,590 (113.8)	38,910 (173.1)	42,620 (189.6)	49,215 (218.9)	55,115 (245.2)

Table 18 — Hilti HVU2 adhesive design strength with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in cracked concrete [1,2,3,4,5,6,7,8,9,10]

Diamond core drilling

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)	2,935 (13.1)	3,030 (13.5)	3,190 (14.2)	3,435 (15.3)	6,315 (28.1)	6,525 (29.0)	6,875 (30.6)	7,395 (32.9)
1/2-13 UNC	5 (127)	4,175 (18.6)	4,315 (19.2)	4,545 (20.2)	4,890 (21.8)	8,995 (40.0)	9,295 (41.3)	9,790 (43.5)	10,530 (46.8)
5/8-11 UNC	6-3/4 (171)	6,960 (31.0)	7,195 (32.0)	7,575 (33.7)	8,150 (36.3)	14,990 (66.7)	15,495 (68.9)	16,315 (72.6)	17,550 (78.1)
3/4-10 UNC	8-1/8 (206)	9,135 (40.6)	9,440 (42.0)	9,940 (44.2)	10,690 (47.6)	19,670 (87.5)	20,325 (90.4)	21,405 (95.2)	23,030 (102.4)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 19 – 20 as necessary to the above values. Compare to the steel values in table 14. 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 0.94.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.60.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 for additional information on seismic applications.

Table 19 — 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 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}			
Thread size, in.		3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4
Embedment h_{ef}	in.	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8
	(mm)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm): 3-1/4	(83)	0.61	n/a	n/a	n/a	0.40	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)	0.63	0.61	n/a	n/a	0.45	0.42	n/a	n/a	0.56	0.55	n/a	n/a	0.21	0.19	n/a	n/a	0.42	0.38	n/a	n/a	n/a	n/a	n/a	n/a
5	(127)	0.67	0.63	0.61	n/a	0.51	0.47	0.40	n/a	0.57	0.57	0.55	n/a	0.29	0.26	0.17	n/a	0.51	0.47	0.33	n/a	n/a	n/a	n/a	n/a
5-1/2	(140)	0.68	0.65	0.62	0.61	0.55	0.50	0.42	0.38	0.58	0.58	0.56	0.55	0.34	0.30	0.19	0.15	0.55	0.50	0.39	0.29	n/a	n/a	n/a	n/a
6	(152)	0.70	0.66	0.63	0.62	0.59	0.53	0.44	0.39	0.59	0.58	0.56	0.55	0.39	0.35	0.22	0.17	0.59	0.53	0.44	0.33	0.60	n/a	n/a	n/a
7	(178)	0.73	0.69	0.65	0.64	0.67	0.60	0.48	0.43	0.60	0.60	0.57	0.56	0.49	0.43	0.28	0.21	0.67	0.60	0.48	0.42	0.64	0.62	n/a	n/a
8	(203)	0.76	0.71	0.67	0.66	0.77	0.67	0.53	0.46	0.62	0.61	0.58	0.57	0.60	0.53	0.34	0.26	0.77	0.67	0.53	0.46	0.69	0.66	n/a	n/a
9	(229)	0.80	0.74	0.69	0.68	0.86	0.76	0.57	0.50	0.63	0.62	0.59	0.58	0.71	0.63	0.40	0.31	0.86	0.76	0.57	0.50	0.73	0.70	0.60	n/a
10	(254)	0.83	0.77	0.71	0.70	0.96	0.84	0.62	0.53	0.65	0.64	0.60	0.58	0.83	0.74	0.47	0.36	0.96	0.84	0.62	0.53	0.77	0.74	0.64	n/a
11	(279)	0.86	0.79	0.74	0.72	1.00	0.92	0.68	0.57	0.66	0.65	0.61	0.59	0.96	0.86	0.55	0.41	1.00	0.92	0.68	0.57	0.81	0.78	0.67	0.61
12	(305)	0.90	0.82	0.76	0.74		1.00	0.74	0.61	0.68	0.66	0.62	0.60	1.00	0.98	0.62	0.47		1.00	0.74	0.61	0.84	0.81	0.70	0.64
14	(356)	0.96	0.87	0.80	0.78			0.87	0.71	0.71	0.69	0.64	0.62		1.00	0.78	0.59			0.87	0.71	0.91	0.87	0.75	0.69
16	(406)	1.00	0.92	0.84	0.82			0.99	0.82	0.74	0.72	0.66	0.63			0.96	0.73			0.99	0.82	0.97	0.94	0.80	0.73
18	(457)		0.98	0.89	0.85			1.00	0.92	0.77	0.75	0.68	0.65			1.00	0.87			1.00	0.92	1.00	0.99	0.85	0.78
24	(610)		1.00	1.00	0.97				1.00	0.85	0.83	0.74	0.70				1.00				1.00		1.00	0.99	0.90
30	(762)				1.00					0.94	0.91	0.80	0.75											1.00	1.00
36	(914)									1.00	0.99	0.86	0.80												
> 48	(1219)										1.00	0.99	0.90												

Table 20 — 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}			
Thread size, in.		3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4	3/8	1/2	5/8	3/4
Embedment h_{ef}	in.	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8	4-3/8	5	6-3/4	8-1/8
	(mm)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)	(111)	(127)	(171)	(206)
Spacing (s) / edge distance (c_a) / concrete thickness (h), - in (mm): 3-1/4	(83)	0.61	n/a	n/a	n/a	0.59	n/a	n/a	n/a	0.55	n/a	n/a	n/a	0.19	n/a	n/a	n/a	0.37	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	(102)	0.63	0.61	n/a	n/a	0.66	0.59	n/a	n/a	0.57	0.56	n/a	n/a	0.26	0.20	n/a	n/a	0.51	0.39	n/a	n/a	n/a	n/a	n/a	n/a
5	(127)	0.67	0.63	0.61	n/a	0.75	0.66	0.59	n/a	0.58	0.57	0.55	n/a	0.36	0.27	0.17	n/a	0.71	0.55	0.34	n/a	n/a	n/a	n/a	n/a
5-1/2	(140)	0.68	0.65	0.62	0.61	0.79	0.69	0.62	0.59	0.59	0.58	0.56	0.55	0.41	0.31	0.19	0.15	0.79	0.63	0.39	0.29	n/a	n/a	n/a	n/a
6	(152)	0.70	0.66	0.63	0.62	0.84	0.73	0.65	0.62	0.60	0.58	0.56	0.55	0.47	0.36	0.22	0.17	0.84	0.72	0.44	0.34	0.63	n/a	n/a	n/a
7	(178)	0.73	0.69	0.65	0.64	0.94	0.80	0.70	0.67	0.62	0.60	0.57	0.56	0.59	0.45	0.28	0.21	0.94	0.80	0.56	0.42	0.69	0.63	n/a	n/a
8	(203)	0.76	0.71	0.67	0.66	1.00	0.88	0.76	0.72	0.63	0.61	0.58	0.57	0.72	0.55	0.34	0.26	1.00	0.88	0.68	0.52	0.73	0.67	n/a	n/a
9	(229)	0.80	0.74	0.69	0.68		0.96	0.83	0.78	0.65	0.63	0.59	0.58	0.86	0.66	0.41	0.31		0.96	0.82	0.62	0.78	0.71	0.61	n/a
10	(254)	0.83	0.77	0.71	0.70		1.00	0.89	0.84	0.67	0.64	0.60	0.58	1.00	0.77	0.48	0.36		1.00	0.89	0.72	0.82	0.75	0.64	n/a
11	(279)	0.86	0.79	0.74	0.72			0.96	0.90	0.68	0.65	0.61	0.59		0.89	0.55	0.42			0.96	0.83	0.86	0.79	0.67	0.61
12	(305)	0.90	0.82	0.76	0.74			1.00	0.96	0.70	0.67	0.62	0.60		1.00	0.63	0.48			1.00	0.95	0.90	0.82	0.70	0.64
14	(356)	0.96	0.87	0.80	0.78				1.00	0.73	0.70	0.64	0.62			0.79	0.60				1.00	0.97	0.89	0.76	0.69
16	(406)	1.00	0.92	0.84	0.82					0.77	0.72	0.66	0.64			0.97	0.73					1.00	0.95	0.81	0.74
18	(457)		0.98	0.89	0.85					0.80	0.75	0.68	0.65			1.00	0.87						1.00	0.86	0.78
24	(610)		1.00	1.00	0.97					0.90	0.84	0.74	0.70				1.00							0.99	0.90
30	(762)				1.00					1.00	0.92	0.81	0.75											1.00	1.00
36	(914)										1.00	0.87	0.80												
> 48	(1219)											0.99	0.91												

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

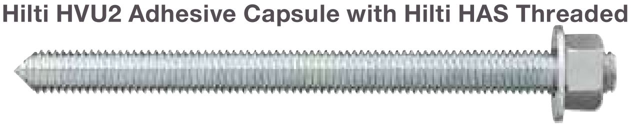
DESIGN DATA IN CONCRETE PER CSA A23.3

CSA A23.3 Annex D design

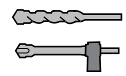
This section contains the Limit State Design tables with un-factored characteristic loads and pre-calculated factored resistance tables based on the published loads in ICC Evaluation Services ESR-4372 and testing per ACI 355.4.

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

Hilti HVU2 Adhesive Capsule with Hilti HAS Threaded Rod



Hilti HAS threaded rod with setting tip — See Table 1 and Figures 1 and 2 of this document for installation parameters



Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

Table 21 — Hilti HVU2 adhesive capsule design information with HAS threaded rods per CSA A23.3 Annex D [1]

Setting information		Symbol	Units	Nominal rod diameter (in.)							Ref A23.3-14
				3/8	1/2	5/8	3/4	7/8	1	1-1/4 [8]	
Nominal anchor diameter		d_a	mm	9.5	12.7	15.9	19.1	22.2	25.4	31.8	
Effective embedment [2]		h_{ef}	mm	89	108	127	168	168	210	279	
Min. concrete thickness [2]		h_{min}	mm	121	140	162	213	219	267	349	
Critical edge distance		c_{ac}	-	See footnote 9 below							
Minimum edge distance		c_{min}	mm	48	64	79	95	111	127	159	
Minimum anchor spacing		s_{min}	mm	48	64	79	95	111	127	159	
Coeff. for factored conc. breakout resistance, uncracked concrete[3]		$k_{c,uncr}$	-	10							D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete[3]		$k_{c,cr}$	-	7							D.6.2.2
Concrete material resistance factor		Φ_c	-	0.65							8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B [4]		R_{conc}	-	1.00							D.5.3 (c)
Temp. range A [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	- -	1,055 (7.3)	1,055 (7.3)	1,055 (7.3)	1,055 (7.3)	1,055 (7.3)	1,055 (7.3)	D.6.5.2
Temp. range A [5]	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	1,475 (10.2)	1,950 (13.5)	1,950 (13.5)	1,950 (13.5)	1,950 (13.5)	1,950 (13.5)	2,015 (13.9)	D.6.5.2
Temp. range B [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	- -	980 (6.8)	980 (6.8)	980 (6.8)	980 (6.8)	980 (6.8)	980 (6.8)	D.6.5.2
Temp. range B [5]	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	1,370 (9.5)	1,815 (12.5)	1,815 (12.5)	1,815 (12.5)	1,815 (12.5)	1,815 (12.5)	1,870 (12.9)	D.6.5.2
Temp. range C [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	- -	615 (4.2)	615 (4.2)	615 (4.2)	615 (4.2)	615 (4.2)	615 (4.2)	D.6.5.2
Temp. range C [5]	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	860 (5.9)	1,135 (7.8)	1,135 (7.8)	1,135 (7.8)	1,135 (7.8)	1,135 (7.8)	1,170 (8.1)	D.6.5.2
Reduction for seismic tension		$\alpha_{N,seis}$	-	-	1.0						
Permissible installation conditions	Strength reduction factor for bond failure, dry concrete	Anchor category	-	1							D.5.3 (c)
		R_{dry}	-	1.00							
Permissible installation conditions	Strength reduction factor for bond failure, water-saturated concrete	Anchor category	-	1							D.5.3 (c)
		R_{ws}	-	1.00							

1 Design information in this table is taken from ICC-ES ESR-4372, dated May, 2019, Tables 4 and 5, and converted for use with CSA A23.3 Annex D.

2 See Figure 2.

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 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.

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 $(f'_c/2{,}500)^n$ [for SI: $(f'_c / 17.2)^n$].
where n is as follows:
n = 0.26 for uncracked concrete
n = 0.14 for cracked concrete

7 For 3/8-in. to 1-in. rods, characteristic bond strengths are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.

8 1-1/4-in. diameter rods to be installed in generally vertically downward direction only.

9 $c_{ac} = h_{ef} \cdot \left(\frac{\tau_{k,uncr}}{1{,}160}\right)^{0.4} \cdot \left[3.1 - 0.7 \cdot \frac{h}{h_{ef}}\right]$, where

$\frac{h}{h_{ef}}$ need not be greater than 2.4, and

$\tau_{k,uncr}$ need not be greater than $\tau_{k,uncr} = \frac{\tau_{k,uncr}\sqrt{h_{ef} \cdot f'_c}}{\pi \cdot d_a}$ (use imperial units in all equations)

Table 22 — Hilti HVU2 design information with HAS threaded rods per CSA A23.3 Annex D [1,2]

Diamond core drilling

	Design parameter	Symbol	Units	Nominal rod diameter (in.)						Ref A23.3-14
				1/2	5/8	3/4	7/8	1	1-1/4 [6]	
Temp. range A [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	1,075 (7.4)	1,075 (7.4)	1,075 (7.4)	1,075 (7.4)	1,075 (7.4)	1,075 (7.4)	D.6.5.2
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	1,830 (12.6)	1,830 (12.6)	1,830 (12.6)	1,830 (12.6)	1,830 (12.6)	1,885 (13.0)	D.6.5.2
Temp. range B [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	1,010 (7.0)	1,010 (7.0)	1,010 (7.0)	1,010 (7.0)	1,010 (7.0)	1,010 (7.0)	D.6.5.2
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	1,720 (11.9)	1,720 (11.9)	1,720 (11.9)	1,720 (11.9)	1,720 (11.9)	1,770 (12.2)	D.6.5.2
Temp. range C [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	650 (4.5)	650 (4.5)	650 (4.5)	650 (4.5)	650 (4.5)	650 (4.5)	D.6.5.2
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	1,105 (7.6)	1,105 (7.6)	1,105 (7.6)	1,105 (7.6)	1,105 (7.6)	1,135 (7.8)	D.6.5.2
Reduction for seismic tension		$\alpha_{N,seis}$	-	1.0						

1 Design information in this table is taken from ICC-ES ESR-4372, dated May, 2019, Tables 4 and 5, and converted for use with CSA A23.3Annex D.
2 Items from Table 21 (d_a, h_{ef}, h_{min}, c_{ac}, c_{min}, s_{min}, $k_{c,uncr}$, $k_{c,cr}$, and Φ factors) are applicable to this table for diamond core drilling.
3 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.
4 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 $(f'_c/2,500)^n$ [for SI: $(f'_c / 17.2)^n$].
where n is as follows:
n = 0.26 for uncracked concrete
n = 0 for cracked concrete
5 For 1/2-in. to 1-in. rods, characteristic bond strengths are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.
6 1-1/4-in. diameter rods to be installed in generally vertically downward direction only.

3.2.6

Table 23 — Steel factored resistance for Hilti HAS threaded rods for use with CSA A23.3 Annex D

Nominal anchor diameter in.	HAS-E-55 / HAS-E-55 HDG ASTM F1554 Gr. 55[4,6]			HAS-B-105 / HAS-B-105 HDG ASTM A193 B7 and ASTM F 1554 Gr.105[4,6]			HAS-R stainless steel ASTM F593 (3/8-in to 1-in)[5] ASTM A193 (1-1/8-in to 2-in)[4]		
	Tensile[1] ϕN_{sar} lb (kN)	Shear[2] ϕV_{sar} lb (kN)	Seismic Shear[3] $\phi V_{sar,eq}$ lb (kN)	Tensile[1] ϕN_{sar} lb (kN)	Shear[2] ϕV_{sar} lb (kN)	Seismic Shear[3] $\phi V_{sar,eq}$ lb (kN)	Tensile[1] ϕN_{sar} lb (kN)	Shear[2] ϕV_{sar} lb (kN)	Seismic Shear[3] $\phi V_{sar,eq}$ lb (kN)
3/8	3,955 (17.6)	2,225 (9.9)	1,560 (6.9)	6,570 (29.2)	3,695 (16.4)	2,585 (11.5)	4,610 (20.5)	2,570 (11.4)	1,800 (8.0)
1/2	7,240 (32.2)	4,070 (18.1)	2,850 (12.7)	12,035 (53.5)	6,765 (30.1)	4,735 (21.1)	8,445 (37.6)	4,705 (20.9)	3,295 (14.7)
5/8	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	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	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	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	49,425 (219.9)	27,800 (123.7)	19,460 (86.6)	82,175 (365.5)	46,220 (205.6)	32,355 (143.9)	37,565 (167.1)	21,130 (94.0)	12,680 (56.4)

1 Tensile = $A_{se,N}$ ϕ f_{uta} R as noted in CSA A23.3Eq. D.2.
2 Shear = $A_{se,V}$ ϕ 0.60 f_{uta} R as noted in CSA A23.3 Eq. D.31.
3 Seismic Shear = $\alpha_{V,seis}$ V_{sar} : Reduction factor for seismic shear only. See CSA A23.3 Annex D for additional information on seismic applications. Seismic shear for HIT-RE 500 V3
4 HAS-E (3/8-in to 1-1/4-in), HAS-B, and HAS-R (Class 1; 1-1/4-in) threaded rods are considered ductile steel elements (including HDG rods).
5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements.
6 3/8-inch dia. threaded rods are not included in the ASTM F1554 standard. Hilti 3/8-inch dia. HAS-E-55, and HAS-B-105 (incl. HDG) threaded rods meet the chemical composition and mechanical property requirements of ASTM F1554.

Table 24 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for threaded rod in uncracked concrete [1,2,3,4,5,6,7,8,9]

Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

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	3-1/2	4,110	4,360	4,570	4,925	8,225	8,715	9,140	9,850
	(89)	(18.3)	(19.4)	(20.3)	(21.9)	(36.6)	(38.8)	(40.7)	(43.8)
1/2	4-1/4	7,330	8,195	8,975	10,365	14,660	16,390	17,955	20,730
	(108)	(32.6)	(36.5)	(39.9)	(46.1)	(65.2)	(72.9)	(79.9)	(92.2)
5/8	5	9,355	10,455	11,455	13,225	18,705	20,915	22,910	26,455
	(127)	(41.6)	(46.5)	(51.0)	(58.8)	(83.2)	(93.0)	(101.9)	(117.7)
3/4	6-5/8	14,265	15,950	17,470	20,175	28,530	31,900	34,940	40,350
	(168)	(63.5)	(70.9)	(77.7)	(89.7)	(126.9)	(141.9)	(155.4)	(179.5)
7/8	6-5/8	14,265	15,950	17,470	20,175	28,530	31,900	34,940	40,350
	(168)	(63.5)	(70.9)	(77.7)	(89.7)	(126.9)	(141.9)	(155.4)	(179.5)
1	8-1/4	19,825	22,165	24,280	28,035	39,645	44,325	48,555	56,070
	(210)	(88.2)	(98.6)	(108.0)	(124.7)	(176.4)	(197.2)	(216.0)	(249.4)
1-1/4 [10]	11	30,520	34,120	37,380	43,160	61,040	68,245	74,760	86,325
	(279)	(135.8)	(151.8)	(166.3)	(192.0)	(271.5)	(303.6)	(332.5)	(384.0)

Table 25 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for threaded rod in cracked concrete [1,2,3,4,5,6,7,8,9,11]

Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

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)
1/2	4-1/4	4,675	4,825	4,950	5,155	9,355	9,650	9,900	10,305
	(108)	(20.8)	(21.5)	(22.0)	(22.9)	(41.6)	(42.9)	(44.0)	(45.8)
5/8	5	6,545	7,095	7,280	7,580	13,095	14,190	14,560	15,155
	(127)	(29.1)	(31.6)	(32.4)	(33.7)	(58.2)	(63.1)	(64.8)	(67.4)
3/4	6-5/8	9,985	11,165	11,575	12,050	19,970	22,330	23,150	24,100
	(168)	(44.4)	(49.7)	(51.5)	(53.6)	(88.8)	(99.3)	(103.0)	(107.2)
7/8	6-5/8	9,985	11,165	12,230	14,060	19,970	22,330	24,460	28,115
	(168)	(44.4)	(49.7)	(54.4)	(62.5)	(88.8)	(99.3)	(108.8)	(125.1)
1	8-1/4	13,875	15,515	16,995	19,625	27,755	31,030	33,990	39,250
	(210)	(61.7)	(69.0)	(75.6)	(87.3)	(123.4)	(138.0)	(151.2)	(174.6)
1-1/4 [10]	11	21,365	23,885	26,165	30,215	42,730	47,770	52,330	60,425
	(279)	(95.0)	(106.2)	(116.4)	(134.4)	(190.1)	(212.5)	(232.8)	(268.8)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 7 – 10 as necessary. Compare to the steel values in table 23. 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 0.93.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.58.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 For 3/8-in to 1-in dia. threaded rods, tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 1-1/4-in diameter rods to be installed in generally vertically downward direction only.
11 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 for additional information on seismic applications.

Table 26 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for threaded rod in uncracked concrete [1,2,3,4,5,6,7,8]

Diamond core drilling

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)
1/2	4-1/4	7,330	8,195	8,975	9,890	14,660	16,390	17,955	19,785
	(108)	(32.6)	(36.5)	(39.9)	(44.0)	(65.2)	(72.9)	(79.9)	(88.0)
5/8	5	9,355	10,455	11,455	13,225	18,705	20,915	22,910	26,455
	(127)	(41.6)	(46.5)	(51.0)	(58.8)	(83.2)	(93.0)	(101.9)	(117.7)
3/4	6-5/8	14,265	15,950	17,470	20,175	28,530	31,900	34,940	40,350
	(168)	(63.5)	(70.9)	(77.7)	(89.7)	(126.9)	(141.9)	(155.4)	(179.5)
7/8	6-5/8	14,265	15,950	17,470	20,175	28,530	31,900	34,940	40,350
	(168)	(63.5)	(70.9)	(77.7)	(89.7)	(126.9)	(141.9)	(155.4)	(179.5)
1	8-1/4	19,825	22,165	24,280	28,035	39,645	44,325	48,555	56,070
	(210)	(88.2)	(98.6)	(108.0)	(124.7)	(176.4)	(197.2)	(216.0)	(249.4)
1-1/4 [10]	11	30,520	34,120	37,380	43,160	61,040	68,245	74,760	86,325
	(279)	(135.8)	(151.8)	(166.3)	(192.0)	(271.5)	(303.6)	(332.5)	(384.0)

3.2.6

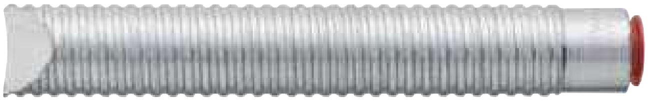
Table 27 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for threaded rod in cracked concrete [1,2,3,4,5,6,7,8,9]

Diamond core drilling

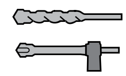
Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — N_r				Shear — V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/2	4-1/4	4,665	4,665	4,665	4,665	9,330	9,330	9,330	9,330
	(108)	(20.8)	(20.8)	(20.8)	(20.8)	(41.5)	(41.5)	(41.5)	(41.5)
5/8	5	6,545	6,860	6,860	6,860	13,095	13,725	13,725	13,725
	(127)	(29.1)	(30.5)	(30.5)	(30.5)	(58.2)	(61.0)	(61.0)	(61.0)
3/4	6-5/8	9,985	10,910	10,910	10,910	19,970	21,820	21,820	21,820
	(168)	(44.4)	(48.5)	(48.5)	(48.5)	(88.8)	(97.1)	(97.1)	(97.1)
7/8	6-5/8	9,985	11,165	12,230	12,730	19,970	22,330	24,460	25,455
	(168)	(44.4)	(49.7)	(54.4)	(56.6)	(88.8)	(99.3)	(108.8)	(113.2)
1	8-1/4	13,875	15,515	16,995	18,115	27,755	31,030	33,990	36,230
	(210)	(61.7)	(69.0)	(75.6)	(80.6)	(123.4)	(138.0)	(151.2)	(161.2)
1-1/4 [10]	11	21,365	23,885	26,165	30,190	42,730	47,770	52,330	60,385
	(279)	(95.0)	(106.2)	(116.4)	(134.3)	(190.1)	(212.5)	(232.8)	(268.6)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 7 – 10 as necessary. Compare to the steel values in table 23. 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 0.93.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.58.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 For 1/2-in to 1-in dia. threaded rods, tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 1-1/4-in diameter rods to be installed in generally vertically downward direction only.
11 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 for additional information on seismic applications.

Hilti HVU2 with Hilti HIS-N Inserts



Hilti HIS-N and HIS-RN internally threaded insert – See Table 11 and Figures 3 and 4 for installation parameters



Hammer drilling with carbide tipped drill bit, orHilti TE-CD or TE-YD Hollow Drill Bit

Table 28 — HVU2 adhesive capsule design information with Hilti HIS-N and HIS-RN internally threaded inserts per CSA A23.3 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 embedment [2]	h_{ef}	mm	110	125	170	205	
	Min. concrete thickness [2]	h_{min}	mm	150	170	230	270	
	Critical edge distance	c_{ac}	-	See footnote 8 below				
	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 [3]	$k_{c,uncr}$	-	10				D.6.2.2
	Coeff. for factored conc. breakout resistance, cracked concrete [3]	$k_{c,cr}$	-	7				D.6.2.2
	Concrete material resistance factor	Φ_c	-	0.65				8.4.2
	Resistance modification factor for tension and shear, concrete failure modes, Condition B [4]	R_{conc}	-	1.00				D.5.3 (c)
Temp. range A [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	725 (4.99)	725 (4.99)	725 (4.99)	725 (4.99)	D.6.5.2
Temp. range A [5]	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	1,490 (10.26)	1,490 (10.26)	1,490 (10.26)	1,490 (10.26)	D.6.5.2
Temp. range B [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	670 (4.63)	670 (4.63)	670 (4.63)	670 (4.63)	D.6.5.2
Temp. range B [5]	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	1,380 (9.53)	1,380 (9.53)	1,380 (9.53)	1,380 (9.53)	D.6.5.2
Temp. range C [5]	Characteristic bond stress in cracked concrete [6,7]	τ_{cr}	psi (MPa)	420 (2.90)	420 (2.90)	420 (2.90)	420 (2.90)	D.6.5.2
Temp. range C [5]	Characteristic bond stress in uncracked concrete [6,7]	τ_{uncr}	psi (MPa)	865 (5.97)	865 (5.97)	865 (5.97)	865 (5.97)	D.6.5.2
	Reduction for seismic tension	$\alpha_{N,seis}$	-	1.0				
Permissible installation conditions	Strength reduction factor for bond failure, dry concrete	Anchor category	-	1				D.5.3 (c)
Permissible installation conditions	Strength reduction factor for bond failure, dry concrete	R_{dry}	-	1.00				D.5.3 (c)
Permissible installation conditions	Strength reduction factor for bond failure, water-saturated concrete	Anchor category	-	1				D.5.3 (c)
Permissible installation conditions	Strength reduction factor for bond failure, water-saturated concrete	R_{ws}	-	1.00				D.5.3 (c)

1 Design information in this table is based on testing in accordance with ACI 355.4.
2 See Figure 4.
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 Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in CSA A23.3 Section D.5.3. For cases where the presence of supplementary reinforcement can be verified, the reduction 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 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., 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
7 Characteristic bond strengths are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.
8 $c_{ac} = h_{ef} \cdot \left(\frac{\tau_{k,uncr}}{1,160}\right)^{0.4} \cdot \left[3.1 - 0.7 \cdot \frac{h}{h_{ef}}\right]$, where

$\frac{h}{h_{ef}}$ need not be greater than 2.4, and

$\tau_{k,uncr}$ need not be greater than $\tau_{k,uncr} = \frac{\tau_{k,uncr} \sqrt{h_{ef} \cdot f'_c}}{\pi \cdot d_a}$ (use metric units in all equations)

Table 29 — HVU2 adhesive capsule design information with Hilti HIS-N and HIS-RN internally threaded inserts per CSA A23.3 Annex D [1,2]

Diamond core drilling

Design parameter		Symbol	Units	Nominal rod diameter (in.)				Ref A23.3-14
				3/8	1/2	5/8	3/4	
Temp. range A [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	505 (3.49)	505 (3.49)	505 (3.49)	505 (3.49)	D.6.5.2
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	1,415 (9.77)	1,415 (9.77)	1,415 (9.77)	1,415 (9.77)	D.6.5.2
Temp. range B [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	475 (3.28)	475 (3.28)	475 (3.28)	475 (3.28)	D.6.5.2
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	1,330 (9.17)	1,330 (9.17)	1,330 (9.17)	1,330 (9.17)	D.6.5.2
Temp. range C [3]	Characteristic bond stress in cracked concrete [4,5]	τ_{cr}	psi (MPa)	305 (2.11)	305 (2.11)	305 (2.11)	305 (2.11)	D.6.5.2
	Characteristic bond stress in uncracked concrete [4,5]	τ_{uncr}	psi (MPa)	855 (5.89)	855 (5.89)	855 (5.89)	855 (5.89)	D.6.5.2
Reduction for seismic tension		$\alpha_{N,seis}$	-	1.0				

1 Design information in this table is based on testing in accordance with ACI 355.4.
2 Items from Table 28 (d_a, h_{ef}, h_{min}, c_{ac}, c_{min}, s_{min}, $k_{c,uncr}$, $k_{c,cr}$, R and Φ factors) are applicable to this table for diamond core drilling.
3 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.
4 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 $(f'_c/2{,}500)^n$ [for SI: $(f'_c / 17.2)^n$], where n is as follows:
n = 0 for uncracked concrete, all drilling methods
n = 0.18 for cracked concrete, diamond core drill bit
5 Characteristic bond strengths are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.

Table 30 — Steel factored resistance for steel bolt/cap screw for Hilti HIS-N and HIS-RN internally threaded inserts [1,2,3]

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

1 See Section 3.1.8 to convert design strength value to ASD value.
2 Hilti HIS-N and HIS-RN inserts with steel bolts are considered brittle steel elements.
3 Table values are the lesser of steel failure in the HIS-N insert or inserted steel bolt.
4 Tensile = $A_{se,N}\ \phi_s\ f_{uta}$ R as noted in CSA A23.3 Annex D.
5 Shear = $A_{se,V}\ \phi_s$ 0.60 f_{uta} R as noted in CSA A23.3 Annex D. For 3/8-in diameter insert, shear = $A_{se,V}\ \phi_s$ 0.50 f_{uta} R.
6 Seismic Shear = $\alpha_{V,seis}\ V_{sar}$: Reduction factor for seismic shear only. See section 3.1.8 for additional information on seismic applications.

Table 31 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in uncracked concrete [1,2,3,4,5,6,7,8,9]

Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

Thread size	Effective embedment in. (mm)	Tension — N_r				Shear — V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8-16 UNC	4-3/8	7,540	8,430	8,555	8,555	15,080	16,860	17,110	17,110
	(110)	(33.5)	(37.5)	(38.0)	(38.0)	(67.1)	(75.0)	(76.1)	(76.1)
1/2-13 UNC	5	9,135	10,210	11,185	12,115	18,265	20,420	22,370	24,225
	(125)	(40.6)	(45.4)	(49.8)	(53.9)	(81.3)	(90.8)	(99.5)	(107.8)
5/8-11 UNC	6-3/4	14,485	16,195	17,740	20,340	28,970	32,390	35,480	40,675
	(170)	(64.4)	(72.0)	(78.9)	(90.5)	(128.9)	(144.1)	(157.8)	(180.9)
3/4-10 UNC	8-1/8	19,180	21,445	23,490	26,735	38,360	42,890	46,985	53,465
	(205)	(85.3)	(95.4)	(104.5)	(118.9)	(170.6)	(190.8)	(209.0)	(237.8)

Table 32 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in cracked concrete [1,2,3,4,5,6,7,8,9,10]

Hammer drilling with carbide tipped drill bit, or Hilti TE-CD or TE-YD Hollow Drill Bit

Thread size	Effective embedment in. (mm)	Tension — N_r				Shear — V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8-16 UNC	4-3/8	4,325	4,585	4,810	5,180	8,655	9,170	9,615	10,360
	(110)	(19.2)	(20.4)	(21.4)	(23.0)	(38.5)	(40.8)	(42.8)	(46.1)
1/2-13 UNC	5	6,125	6,495	6,810	7,335	12,255	12,985	13,615	14,675
	(125)	(27.3)	(28.9)	(30.3)	(32.6)	(54.5)	(57.8)	(60.6)	(65.3)
5/8-11 UNC	6-3/4	10,140	10,900	11,430	12,320	20,280	21,805	22,860	24,635
	(170)	(45.1)	(48.5)	(50.8)	(54.8)	(90.2)	(97.0)	(101.7)	(109.6)
3/4-10 UNC	8-1/8	13,425	14,330	15,025	16,190	26,855	28,660	30,050	32,385
	(205)	(59.7)	(63.7)	(66.8)	(72.0)	(119.5)	(127.5)	(133.7)	(144.0)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 19 – 20 as necessary to the above values. Compare to the steel values in table 30. 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 0.93.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.58.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 for additional information on seismic applications.

Table 33 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in uncracked concrete [1,2,3,4,5,6,7,8,9]

Diamond core drilling

Thread size	Effective embedment in. (mm)	Tension — N_r				Shear — V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8-16 UNC	4-3/8	7,540	8,145	8,145	8,145	15,080	16,290	16,290	16,290
	(110)	(33.5)	(36.2)	(36.2)	(36.2)	(67.1)	(72.5)	(72.5)	(72.5)
1/2-13 UNC	5	9,135	10,210	11,185	11,535	18,265	20,420	22,370	23,070
	(125)	(40.6)	(45.4)	(49.8)	(51.3)	(81.3)	(90.8)	(99.5)	(102.6)
5/8-11 UNC	6-3/4	14,485	16,195	17,740	19,365	28,970	32,390	35,480	38,735
	(170)	(64.4)	(72.0)	(78.9)	(86.1)	(128.9)	(144.1)	(157.8)	(172.3)
3/4-10 UNC	8-1/8	19,180	21,445	23,490	25,455	38,360	42,890	46,985	50,910
	(205)	(85.3)	(95.4)	(104.5)	(113.2)	(170.6)	(190.8)	(209.0)	(226.5)

Table 34 — Hilti HVU2 adhesive factored resistance with lesser of concrete or bond failure for HIS-N and HIS-RN internally threaded inserts in cracked concrete [1,2,3,4,5,6,7,8,9,10]

Diamond core drilling

Thread size	Effective embedment in. (mm)	Tension — N_r				Shear — V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8-16 UNC	4-3/8	2,990	3,110	3,215	3,385	5,980	6,225	6,430	6,775
	(110)	(13.3)	(13.8)	(14.3)	(15.1)	(26.6)	(27.7)	(28.6)	(30.1)
1/2-13 UNC	5	4,235	4,405	4,555	4,795	8,465	8,815	9,110	9,595
	(125)	(18.8)	(19.6)	(20.3)	(21.3)	(37.7)	(39.2)	(40.5)	(42.7)
5/8-11 UNC	6-3/4	7,110	7,400	7,645	8,055	14,215	14,800	15,295	16,105
	(170)	(31.6)	(32.9)	(34.0)	(35.8)	(63.2)	(65.8)	(68.0)	(71.6)
3/4-10 UNC	8-1/8	9,345	9,725	10,050	10,585	18,685	19,455	20,100	21,170
	(205)	(41.6)	(43.3)	(44.7)	(47.1)	(83.1)	(86.5)	(89.4)	(94.2)

1 See Section 3.1.8 for explanation on development of load values.
2 See Section 3.1.8 to convert design strength value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 19 – 20 as necessary to the above values. Compare to the steel values in table 30. 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 0.94.
For temperature range C: Max. short term temperature = 248°F (120°C), max. long term temperature = 162°F (72°C) multiply above value by 0.60.
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 or water saturated concrete conditions.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see Section 3.1.8.
8 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for horizontal and vertical downward direction only. For overhead (vertical up) installation, tabular values must be multiplied by 0.70.
10 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic loads, multiply cracked concrete tabular values in tension and shear by α_{seis} = 0.75.
See section 3.1.8 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 and www.hilti.ca. 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 HVU2 adhesive cure time (approx.)

[°C]	[°F]	t_{cure}
-10...-6	14...22	5 h
-5...-1	23...31	3 h
0...4	32...40	40 min
5...9	41...49	20 min
10...19	50...67	10 min
20...40	68...104	5 min

Table 35 — Material properties of fully cured Hilti HVU2 adhesive

Compressive strength @ 73°F (23°C) / 50% humidity	11,200 psi	77.30 N/mm²
Tensile strength	1,241 psi	8.56 N/mm²
Water absorption after 24h	0.26%	

Key for Table 36 Behavior:

- non-resistant
+ resistant

Samples of cured HVU2 adhesive were immersed in the various chemical compounds at room temperature (77°F / 25°C) for 90 days. Samples that showed weight increase less than 4% were evaluated as Resistant" and samples that showed a weight increase greater than 6% were evaluated as Non-resistant".

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

Table 36 — Resistance of fully cured Hilti HVU2 adhesive to chemicals

Chemical substance	Components	Content [Vol. %]	Behavior
Diesel-Fuel	Test mixture A 20/NP 2 Biodiesel	95.0 5.0	+
Alcohol	Methanol	100.0	-
Aliphatic halogenated hydrocarbons	Dichlormethane (Methylene chloride)	100.0	-
Aqueous organic surfactants/Tensides	Texapon N 28 Marlipal O 13/8 Water	3.0 2.0 95.0	+
Organic esters and ketones	Ethylacetate Methylisobutylketone	50.0 50.0	+
Aqueous organic acids	Acqueous acetic acid (10%)	100.0	+
Organic acids	Acetic acid Propionic acid	50.0 50.0	-
Inorganic acids	Sulfuric acid (20%)	100.0	+
Aliphatic Aldehydes	n-Butyraldehyde (Butanal) n-Heptaldehyde (Heptanal)	50.0 50.0	+
Cyclic and acyclic ether	Tetrahydrofuran (THF)	100.0	-
Hydrocarbons	Toluene Xylene Methylnaphthalene	60.0 30.0 10.0	+
Benzene and benzene mixtures	Benzene Toluene Xylene Methylnaphthalene	30.0 30.0 30.0 10.0	+
Inorganic bases	Sodium hydroxide (20%)	100.0	+
Amine	Triethanolamine n-Butylamine N,N-Dimethylaniline	35.0 30.0 35.0	-

ORDERING INFORMATION

Order information
Description
Adhesive capsule HVU2 3/8" x 3 1/2"
Adhesive capsule HVU2 1/2" x 4 1/4"
Adhesive capsule HVU2 5/8" x 5"
Adhesive capsule HVU2 3/4" x 6 5/8"
Adhesive capsule HVU2 7/8" x 6 5/8"
Adhesive capsule HVU2 1" x 8 1/4"
Adhesive capsule HVU2 1 1/4" x 11"

Accessories

① HAS anchor rods with setting tip

② HIS-N / HIS-RN internally threaded inserts

③ SF 6H-A22 cordless drill driver

④ SID 4-122 cordless impact driver

⑤ Hamer drill / combihammer

⑥ Tool shaft / sockets