Attached are page(s) from the 2011 Hilti North American Product Technical Guide. For complete details on this product, including data development, product specifications, general suitability, installation, corrosion, and spacing & edge distance guidelines, please refer to the Technical Guide, or contact Hilti.

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HIT-ICE Adhesive Anchoring System 3.2.8

3.2.8.1 Product Description

HIT-ICE consists of an epoxy acrylate and hardener. It is formulated for fast curing and installation in a wide range of solid base material temperatures. Designed for colder environmental installations, HIT-ICE adhesive is a winter formulation for base material temperatures down to –10°F (–23°C).

The systems consist of adhesive refill packs, a mixing nozzle, a HIT dispenser and either a threaded rod, rebar, HIS internally threaded insert or eyebolts. HIT-ICE is specifically designed for fastening into solid base materials such as concrete, grout, stone or grout filled block.

Product Features of HIT-ICE

- Small edge distance and anchor spacing allowance
- Mixing tube provides proper mixing and accurate dispensing of mixed resin
- Contains no styrene; virtually odorless
- Cures quickly over a large range of base material temperatures
- Excellent weathering resistance; high temperature resistance
- High load capacities

HIT-ICE Cartridge

Independent Code Evaluation

LEED®: Credit 4.1-Low Emitting Materials

The Leadership in Energy and Environmental Design (LEED®) Green Building Rating system™ is the nationally accepted benchmark for the design, construction and operation of high performance green buildings.

3.2.8 HIT-ICE Adhesive Anchoring System

Guide Specifications

Master Format Section:

Previous	**2004 Format**	
03250	**03 16 00**	(Concrete Anchors)

Related Sections:

03200	**03 20 00**	(Concrete Reinforcing)
05050	**05 50 00**	(Metal Fabrications)
05120	**05 10 00**	(Structural Metal Framing)

Injectable adhesive shall be used for installation of all reinforcing steel dowels or threaded anchor rods and inserts into new or existing concrete. Adhesive shall be furnished in containers which keep component A and component B separate. Containers shall be designed to accept static mixing nozzle which thoroughly blends component A and component B and allows injection directly into drilled hole. Only injection tools and static mixing nozzles as recommended by manufacturer shall be used. Manufacturer's instructions shall be followed. Injection adhesive shall be formulated to include resin and hardener to provide optimal curing speed as well as high strength and stiffness. Typical curing time at 68°F shall be 1 hour for HIT-ICE. Injection adhesive shall be HIT-ICE, as furnished by Hilti.

Anchor Rods shall be furnished with chamfered ends so that either end will accept a nut and washer. Alternatively, anchor rods shall be furnished with a 45 degree chisel point on one end to allow for easy insertion into the adhesive-filled hole. Anchor rods shall be manufactured to meet the following requirements: 1. ISO 898 Class 5.8; 2. ASTM A 193, Grade B7 (high strength carbon steel anchor); 3. AISI 304 or AISI 316 stainless steel, meeting the requirements of ASTM F 593 (condition CW).

Special order length HAS Rods may vary from standard product.

Nuts and Washers shall be furnished to meet the requirements of the above anchor rod specifications.

Fastener Components

HIT-ICE Mixer

HIT-ICE Cartridge

HIT-ICE Dispenser

3.2.8.2 Material Specifications

Material Properties for Cured Adhesive	HIT-ICE	
Compressive Strength	72 MPa	10,440 psi
Tensile Strength	12 MPa	1740 psi
Water Absorption DIN 53495	2.4%	2.4%
Electrical Resistance DIN/VDE 0303T3	$2x10^{11}$OHM/in.	$5.1x10^{11}$OHM/in.

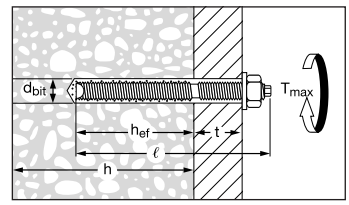
Material	Mechanical Properties			
	f_y ksi (MPa)		min. f_u ksi (MPa)	
Standard HAS-E rod material meets the requirements of ISO 898 Class 5.8	58	(400)	72.5	(500)
High Strength or 'Super HAS' rod material meets the requirements of ASTM A 193, Grade B7	105	(724)	125	(862)
Stainless HAS rod material meets the requirements of ASTM F 593 (AISI 304/316) Condition CW 3/8" to 5/8"	65	(448)	100	(689)
Stainless HAS rod material meets the requirements of ASTM F 593 (AISI 304/316) Condition CW 3/4" to 1-1/4"	45	(310)	85	(586)
HIS Insert 11MnPb30+C Carbon Steel conforming to DIN 10277-3	54.4	(375)	66.7	(460)
HIS-R Insert X5CrNiMo17122 K700 Stainless Steel conforming to DIN EN 10088-3	50.8	(350)	101.5	(700)
HAS Super & HAS-E Standard Nut Material meets the requirements of SAE J995 Grade 5				
HAS Stainless Steel Nut material meets the requirements of ASTM F 594				
HAS Standard and Stainless Steel Washers meet dimensional requirements of ANSI B18.22.1 Type A Plain				
HAS Stainless Steel Washers meet the requirements of AISI 304 or AISI 316 conforming to ASTM A 240				
HAS Super & HAS-E Standard Washers meet the requirements of ASTM F 884, HV				
All HAS Super Rods (except 7/8") & HAS-E Standard, HIS inserts, nuts & washers are zinc plated to ASTM B 633 SC 1				
7/8" HAS Super rods hot-dip galvanized in accordance with ASTM A 153				

Note: Special Order threaded rods may vary from standard materials.

3.2.8.3 Technical Data

HIT-ICE Installation Specification Table for HAS Rods

Details \ HAS Rod Size			in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)	1 (25.4)	1-1/4 (31.8)
d_{bit} bit diameter[1]			in.	7/16	9/16	11/16	13/16	1	1-1/16	1-1/2
$h_{ef} = h_{nom}$ standard depth of embedment[2]			in. (mm)	3-1/2 (90)	4-1/4 (110)	5 (125)	6-5/8 (170)	7-1/2 (190)	8-1/4 (210)	12 (305)
T_{max} max. tightening torque	All HILTI Threaded Rods	$h_{ef} \geq h_{nom}$	ft-lb (Nm)	18 (24)	30 (41)	75 (102)	150 (203)	175 (237)	235 (319)	400 (540)
		$h_{ef} < h_{nom}$	ft-lb (Nm)	15 (20)	20 (27)	50 (68)	105 (142)	125 (169)	165 (224)	280 (375)
h minimum base material thickness[3]		$h_{ef} = h_{nom}$	in. (mm)	5-1/2 (140)	6-1/4 (160)	7 (180)	8-5/8 (220)	9-1/2 (240)	10-1/2 (270)	15 (380)
		$h_{ef} \neq h_{nom}$	in. (mm)	1.0 h_{ef}+ 2 (51)	1.0 h_{ef}+ 2 (51)	1.0 h_{ef}+ 2 (51)	1.0 h_{ef}+ 2 (51)	1.0 h_{ef}+ 2 (51)	1.0 h_{ef}+ 2-1/4 (57)	1.0 h_{ef}+ 3 (76)
Approximate number of fastenings at standard embedment										
HIT-ICE Small Refill Pack				45	28	16	9	7	5	2



1 Use Hilti matched tolerance carbide tipped bits.

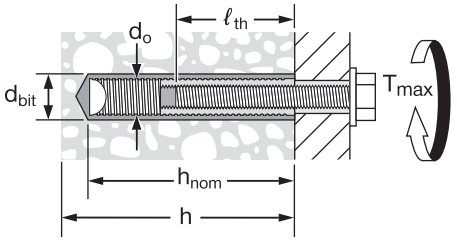
2 Data available for varying embedments; see Load Tables.

3 Minimum base material thickness given to minimize backside blowout during drilling process. Ability of base material to withstand loads applied (e.g. bending of concrete slab) should be determined by design engineer.

3.2.8 HIT-ICE Adhesive Anchoring System

HIT-ICE Installation Specification Table for HIS Inserts

Details		HIS Insert	in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)
d_{bit}	bit diameter[1]		in.	11/16	7/8	1-1/8	1-1/4
d_o	outside diameter		in.	0.65	0.81	1	1.09
h_{nom}	std. depth of embed.		in. (mm)	4-3/8 (110)	5 (125)	6-5/8 (170)	8-1/4 (170)
ℓ_{th}	useable thread length		in. (mm)	1 (25)	1-3/16 (30)	1-1/2 (40)	2 (50)
T_{max}	max. tightening torque		ft-lb (Nm)	18 (24)	35 (47)	80 (108)	160 (217)
h	min. base material thickness		in. (mm)	6-3/8 (162)	7-1/2 (191)	10 (254)	12-3/8 (314)
Recommended Hilti Rotary Hammer Drill				TE 6, 16, 25, 35	TE 16, 25, 35, 46	TE 46, 56, 76	



1 Hilti matched tolerance carbide tipped drill bits

HIT-ICE Installation Specification Table for Rebar in Concrete

Details		Rebar Size		No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11
d_{bit}	bit diameter[1,2]		in.	1/2	5/8	3/4	7/8	1	1-1/8	1-3/8	1-1/2	1-9/16

1 Rebar diameters may vary. Use smallest drill bit which will accommodate rebar.

2 Hilti matched tolerance carbide tipped drill bits

HIT-ICE Installation Specification Table for Metric Rebar in Concrete (Canada Only)

Rebar Number		10M	15M	20M	25M	30M	35M
d_{bit}	bit diameter[1,2]	14 mm	3/4"	24mm	1-1/8"	37mm	1-9/16"

1 Rebar diameters may vary. Use smallest drill bit which will accommodate rebar.

2 Hilti matched tolerance carbide tipped drill bits

Combined Shear and Tension Loading

$$\left(\frac{N_d}{N_{rec}}\right)^{5/3} + \left(\frac{V_d}{V_{rec}}\right)^{5/3} \leq 1.0 \text{ (Ref. Section 3.1.8.3)}$$

HIT-ICE Adhesive Anchoring System 3.2.8

HIT-ICE Allowable and Ultimate Bond/Concrete Capacity for HAS Rods in Normal-Weight Concrete[1,2,3]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	HIT-ICE Allowable Bond/Concrete Capacity				HIT-ICE Ultimate Bond/Concrete Capacity			
		Tensile		Shear		Tensile		Shear	
		f'_c = 2000 psi (13.8 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 2000 psi (13.8 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 2000 psi (13.8 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 2000 psi (13.8 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)
3/8 (9.5)	1-3/4 (44)	720 (3.2)	1265 (5.6)	1395 (6.2)	1970 (8.8)	2710 (12.1)	4750 (21.1)	4175 (18.6)	5900 (26.2)
	3-1/2 (89)	1895 (8.4)	2705 (12.0)	3335 (14.8)	4715 (21.0)	7120 (31.7)	10160 (45.2)	10000 (44.5)	14140 (62.9)
	5-1/4 (133)	2635 (11.7)	2800 (12.5)	6120 (27.2)	8655 (38.5)	9880 (44.0)	10510 (46.8)	18360 (81.7)	25960 (115.5)
1/2 (12.7)	2-1/8 (54)	1220 (5.4)	1575 (7.0)	1980 (8.8)	2800 (12.5)	4580 (20.4)	5910 (26.3)	5940 (26.4)	8400 (37.4)
	4-1/4 (108)	2725 (12.1)	3935 (17.5)	5150 (22.9)	7280 (32.4)	10220 (44.5)	14760 (65.7)	15440 (68.7)	21840 (97.1)
	6-3/8 (162)	4300 (19.1)	5295 (23.6)	9455 (42.1)	13375 (59.5)	16140 (71.8)	19860 (88.3)	28360 (126.2)	40120 (178.5)
5/8 (15.9)	2-1/2 (64)	1620 (7.2)	1985 (8.8)	2460 (10.9)	3480 (15.5)	6090 (27.1)	7460 (33.2)	7380 (32.8)	10440 (46.4)
	5 (127)	4395 (19.5)	5250 (23.4)	7350 (32.7)	10390 (46.2)	16480 (73.3)	19690 (87.6)	22040 (98.0)	31160 (138.6)
	7-1/2 (191)	6025 (26.8)	8225 (36.6)	13495 (60.0)	19080 (84.9)	22595 (100.5)	30850 (137.2)	40480 (180.0)	57240 (254.6)
3/4 (19.1)	3-3/8 (86)	2365 (10.5)	3925 (17.5)	5435 (24.2)	7680 (34.2)	8870 (39.5)	14720 (65.5)	16295 (72.5)	23040 (102.5)
	6-5/8 (168)	4655 (20.7)	8885 (39.5)	12270 (54.6)	17355 (77.2)	17460 (77.7)	33330 (148.3)	36800 (163.7)	52060 (231.6)
	10 (254)	9515 (42.3)	12140 (54.0)	22755 (101.2)	32180 (143.1)	35695 (158.8)	45530 (202.5)	68260 (303.6)	96540 (429.4)
7/8 (22.2)	3-3/4 (95)	3080 (13.7)	4800 (21.4)	6705 (29.8)	9480 (42.4)	11555 (51.4)	18000 (80.1)	20105 (89.4)	28430 (126.5)
	7-1/2 (191)	7845 (34.9)	11020 (49.0)	15960 (71.0)	22575 (100.4)	29430 (130.9)	41000 (182.3)	47880 (213.0)	67720 (301.2)
	11-1/4 (286)	13330 (59.3)	16645 (74.0)	29330 (130.5)	41475 (184.5)	49990 (222.4)	62425 (277.7)	87980 (391.4)	124420 (553.4)
1 (25.4)	4-1/8 (105)	3445 (15.3)	4865 (21.6)	8265 (36.8)	11685 (52.0)	12920 (57.5)	18250 (81.2)	24790 (110.3)	35050 (155.9)
	8-1/4 (210)	8330 (37.1)	11635 (51.8)	19690 (87.6)	27840 (123.8)	31250 (139.0)	43640 (194.1)	59060 (262.7)	83520 (371.5)
	12-3/8 (314)	15540 (69.1)	19525 (86.8)	36170 (160.9)	51150 (227.5)	58280 (259.3)	73220 (325.7)	108500 (482.6)	153440 (682.5)
1-1/4 (31.8)	6 (152)	4645 (20.7)	7000 (31.1)	14760 (65.7)	20870 (92.8)	17430 (77.5)	26265 (116.8)	44280 (197.0)	62610 (278.5)
	12 (305)	15490 (68.9)	20770 (92.4)	38615 (171.8)	54610 (242.9)	58085 (258.4)	77900 (346.5)	115840 (515.3)	163820 (728.7)
	15 (381)	19210 (85.5)	26815 (119.3)	53960 (240.0)	76315 (339.5)	72040 (320.5)	100560 (447.3)	161880 (720.1)	228940 (1018.4)

1 Influence factors for spacing and/or edge distance are applied to concrete/bond values above, and then compared to the steel value. The lesser of the values is to be used for the design.

2 For $h_{ef} \geq h_{nom}$ average ultimate concrete shear capacity based on Strength Design method. For $h_{ef} < h_{nom}$ average ultimate concrete shear values based on testing.

3 All values based on holes drilled with carbide bit and cleaned with compressed air and a wire brush per manufacturer's instructions.

3.2.8 HIT-ICE Adhesive Anchoring System

Allowable Steel Strength for Carbon Steel and Stainless Steel HAS Rods[1]

Rod Diameter in. (mm)	HAS-E Standard ISO 898 Class 5.8		HAS Super ASTM A 193 B7		HAS SS AISI 304/316 SS	
	Tensile lb (kN)	Shear lb (kN)	Tensile lb (kN)	Shear lb (kN)	Tensile lb (kN)	Shear lb (kN)
3/8 (9.5)	2640 (11.7)	1360 (6.0)	4555 (20.3)	2345 (10.4)	3645 (16.2)	1875 (8.3)
1/2 (12.7)	4700 (20.9)	2420 (10.8)	8100 (36.0)	4170 (18.5)	6480 (28.8)	3335 (14.8)
5/8 (15.9)	7340 (32.7)	3780 (16.8)	12655 (56.3)	6520 (29.0)	10125 (45.0)	5215 (23.2)
3/4 (19.1)	10570 (47.0)	5445 (24.2)	18225 (81.1)	9390 (41.8)	12390 (55.1)	6385 (28.4)
7/8 (22.2)	14385 (64.0)	7410 (33.0)	24805 (110.3)	12780 (56.9)	16865 (75.0)	8690 (38.6)
1 (25.4)	18790 (83.6)	9680 (43.0)	32400 (144.1)	16690 (74.2)	22030 (98.0)	11350 (50.5)
1-1/4 (31.8)	29360 (130.6)	15125 (67.3)	50620 (225.2)	26080 (116.0)	34425 (153.1)	17735 (78.9)

1 Steel strength as defined in AISC Manual of Steel Construction (ASD):

Tensile = 0.33 x F_u x Nominal Area
Shear = 0.17 x F_u x Nominal Area

Ultimate Steel Strength for Carbon Steel and Stainless Steel HAS Rods[1]

Rod Diameter in. (mm)	HAS-E Standard ISO 898 Class 5.8			HAS Super ASTM A 193 B7			HAS SS AISI 304/316 SS		
	Yield lb (kN)	Tensile lb (kN)	Shear lb (kN)	Yield lb (kN)	Tensile lb (kN)	Shear lb (kN)	Yield lb (kN)	Tensile lb (kN)	Shear lb (kN)
3/8 (9.5)	4495 (20.0)	6005 (26.7)	3605 (16.0)	8135 (36.2)	10350 (43.4)	6210 (27.6)	5035 (22.4)	8280 (36.8)	4970 (22.1)
1/2 (12.7)	8230 (36.6)	10675 (47.5)	6405 (28.5)	14900 (66.3)	18405 (79.0)	11040 (49.1)	9225 (41.0)	14720 (65.5)	8835 (39.3)
5/8 (15.9)	13110 (58.3)	16680 (74.2)	10010 (44.5)	23730 (105.6)	28760 (125.7)	17260 (76.8)	14690 (65.3)	23010 (102.4)	13805 (61.4)
3/4 (19.1)	19400 (86.3)	24020 (106.9)	14415 (64.1)	35120 (156.2)	41420 (185.7)	24850 (110.5)	15050 (66.9)	28165 (125.3)	16800 (75.2)
7/8 (22.2)	26780 (119.1)	32695 (145.4)	19620 (87.3)	48480 (215.7)	56370 (256.9)	33825 (150.5)	20775 (92.4)	38335 (170.5)	23000 (102.3)
1 (25.4)	35130 (156.3)	42705 (190.0)	25625 (114.0)	63600 (282.9)	73630 (337.0)	44180 (196.5)	27255 (121.2)	50070 (222.7)	30040 (133.6)
1-1/4 (31.8)	56210 (250.0)	66730 (296.8)	40035 (178.1)	101755 (452.6)	115050 (511.8)	69030 (307.1)	43610 (194.0)	78235 (348.0)	46940 (208.8)

1 Steel strength as defined in AISC Manual of Steel Construction 2nd Ed. (LRFD):

Yield = F_y x Tensile Stress Area
Tensile = 0.75 x F_u x Nominal Area
Shear = 0.45 x F_u x Nominal Area

HIT-ICE Adhesive Anchoring System 3.2.8

HIT-ICE Allowable Bond/Concrete Capacity and Steel Strength for HIS Carbon Steel and HIS-R Stainless Steel Internally Threaded Inserts

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	HIT-ICE Allowable Bond/Concrete Capacity		Allowable Bolt Strength[1,2]			
		Tensile $f'_c \geq 2000$ psi (13.8 MPa) lb (kN)	Shear $f'_c \geq 2000$ psi (13.8 MPa) lb (kN)	ASTM A 325 Carbon Steel		ASTM F 593 Stainless Steel	
				Tensile[1] lb (kN)	Shear[1] lb (kN)	Tensile[1] lb (kN)	Shear[1] lb (kN)
3/8 (9.5)	4-3/8 (110)	2750 (12.2)	1605 (7.1)	4370 (19.4)	2250 (10.0)	3645 (16.2)	1875 (8.3)
1/2 (12.7)	5 (127)	4195 (18.7)	3040 (13.5)	7775 (34.6)	4005 (17.8)	6480 (28.8)	3335 (14.8)
5/8 (15.9)	6-5/8 (168)	6700 (29.8)	4575 (20.4)	12150 (54.0)	6260 (27.8)	10125 (45.0)	5215 (23.2)
3/4 (19.1)	8-1/4 (210)	7855 (34.9)	6305 (28.0)	17495 (77.8)	9010 (40.1)	12395 (55.1)	6385 (28.4)

HIT-ICE Ultimate Bond/Concrete Capacity and Steel Strength for HIS Carbon Steel and HIS-R Stainless Steel Internally Threaded Inserts

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	HIT-ICE Ultimate Bond/Concrete Capacity[2]		Ultimate Bolt Strength[1,2]			
		Tensile $f'_c \geq 2000$ psi (13.8 MPa) lb (kN)	Shear $f'_c \geq 2000$ psi (13.8 MPa) lb (kN)	ASTM A 325 Carbon Steel		ASTM F 593 Stainless Steel	
				Tensile[1] lb (kN)	Shear[1] lb (kN)	Tensile[1] lb (kN)	Shear[1] lb (kN)
3/8 (9.5)	4-3/8 (110)	11000 (48.9)	6425 (28.6)	9935 (44.2)	5960 (26.5)	8280 (36.8)	4970 (22.1)
1/2 (12.7)	5 (127)	16790 (74.7)	12170 (54.1)	17665 (78.6)	10600 (47.2)	14720 (65.5)	8835 (39.3)
5/8 (15.9)	6-5/8 (168)	26795 (119.2)	18310 (81.5)	27610 (122.8)	16565 (73.7)	23010 (102.4)	13805 (61.4)
3/4 (19.1)	8-1/4 (210)	31430 (139.8)	25215 (112.2)	39760 (176.9)	23855 (106.1)	28165 (125.3)	16900 (75.1)

1 Steel values in accordance with AISC
ASTM A 325 bolts: F_y = 92 ksi , F_u = 120 ksi
ASTM F 593 (AISI 304/316): F_y = 65 ksi, F_u = 100 ksi for 3/8" thru 5/8"
F_y = 45 ksi, F_u = 85 ksi for 3/4"

Allowable Load Values
Tension = 0.33 x F_u x A_{nom}
Shear = 0.17 x F_u x A_{nom}

Ultimate Load Values
Tension = 0.75 x F_u x A_{nom}
Shear = 0.45 x F_u x A_{nom}

2 Use lower value of either bond/concrete capacity or steel strength.

3.2.8 HIT-ICE Adhesive Anchoring System

HIT-ICE Allowable and Ultimate Bond/Concrete Capacity for HAS Rods Installed in Lightweight Concrete 3000 psi (20.7 MPa)[2]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	Allowable Bond/Concrete Capacity[1] lb (kN)		Ultimate Bond/Concrete Capacity lb (kN)	
		Tensile	Shear	Tensile	Shear
3/8 (9.5)	1-3/4 (44)	745 (3.3)	1285 (5.7)	2980 (13.3)	5150 (22.9)
	3-1/2 (89)	1220 (5.4)	1580 (7.0)	4920 (21.9)	6320 (28.1)
1/2 (12.7)	2-1/8 (54)	975 (4.3)	2130 (9.5)	3900 (17.3)	8520 (37.9)
	4-1/4 (108)	1210 (5.4)	2910 (12.9)	4840 (21.5)	11640 (51.8)
5/8 (15.9)	2-1/2 (63)	1200 (5.3)	2480 (11.0)	4800 (21.4)	9920 (44.1)
3/4 (19.1)	3-3/8 (86)	1760 (7.8)	4000 (17.8)	7040 (31.3)	15985 (71.1)

1 Influence factors for spacing and/or edge distance are applied to allowable concrete/bond values above, and then compared to the allowable steel value. The lesser of these values is to be used for design.

2 All values based on holes drilled with matched tolerance carbide tipped bit and cleaned with a wire brush per manufacturer's instructions.

HIT-ICE Allowable Bond/Concrete Capacity for Sill Plate Applications

Allowable Loads for Attachment of Sill Plates to f'_c = 2000 PSI Normal Weight Concrete with HIT-ICE[1]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	Edge Distance in. (mm)	Tension lb (kN)	Shear lb (kN)	
				Load II to Edge	Load ⊥ to Edge
1/2 (12.7)	4-1/4 (108.0)	1-3/4 (44.5)	1280 (5.3)	1445 (6.4)	400 (1.8)
		2-3/4 (69.9)	1800 (8.1)	2100 (9.5)	845 (3.8)
5/8 (15.9)	5 (127.0)	1-3/4 (44.5)	1700 (7.6)	1445 (6.4)	400 (1.8)
		2-3/4 (69.9)	2725 (12.1)	2455 (10.9)	960 (4.3)

1 Loads are based on concrete failure. Steel strength must be checked separately. Values are based on safety factor of 4.

Allowable Loads for Attachment of Sill Plates to top of grout filled block wall with HIT-ICE[1]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	Edge Distance in. (mm)	Tension lb (kN)	Shear lb (kN)	
				Load II to Edge	Load ⊥ to Edge
1/2 (12.7)	4-1/4 (108.0)	1-3/4 (44.5)	1120 (5.0)	1425 (6.3)	560 (2.5)
		2-3/4 (69.9)	1440 (6.4)	2085 (9.3)	1110 (4.9)
5/8 (15.9)	5 (127.0)	1-3/4 (44.5)	1475 (6.5)	1800 (8.0)	680 (3.0)
		2-3/4 (69.9)	1630 (7.2)	3070 (13.7)	1110 (4.9)

1 Loads are based on masonry failure. Steel strength must be checked separately. Values are based on safety factor of 5.

HIT-ICE Adhesive Anchoring System 3.2.8

HIT-ICE Allowable Loads for Threaded Rods in Grout-Filled Concrete Masonry Units (ASTM C 90 Block)[1, 2, 3, 4]

Anchor Diameter		Embedment Depth		Distance from Edge		Tension[5,6]		Shear lb (kN)[5,6]					
								HAS-E		HAS Super		HAS SS	
in.	(mm)	in.	(mm)	in.	(mm)	lb	(kN)						
3/8	(9.5)	3-1/2	(88.9)	4	(101.6)	1550	(6.9)	1360	(6.0)	2020	(9.0)	1875	(8.3)
				≥12	(304.8)								
1/2	(12.7)	4-1/4	(108)	4	(101.6)	1785	(7.9)	2020	(9.0)	2020	(9.0)	2020	(9.0)
				≥12	(304.8)			2420	(10.8)	4170	(18.5)	3335	(14.8)
5/8	(15.9)	5	(127)	4	(101.6)	2265	(10.1)	2020	(9.0)	2020	(9.0)	2020	(9.0)
				≥12	(304.8)			3780	(16.8)	5625	(25.0)	5215	(23.2)
3/4	(19.1)	6-5/8	(168.3)	4	(101.6)	3740	(16.6)	2020	(9.0)	2020	(9.0)	2020	(9.0)
				≥12	(304.8)			5445	(24.2)	5625	(25.0)	5625	(25.0)

HIT-ICE Ultimate Loads for Threaded Rods in Grout-Filled Concrete Masonry Units (ASTM C 90 Block)[1, 2, 3, 4]

Anchor Diameter		Embedment Depth		Distance from Edge		Tension lb (kN)[5,6]						Shear lb (kN)[5,6]					
						HAS-E		HAS Super		HAS SS (304SS)		HAS-E		HAS Super		HAS SS (304SS)	
in.	(mm)	in.	(mm)	in.	(mm)												
3/8	(9.5)	3-1/2	(88.9)	4	(101.6)	6005	(26.7)	6200	(27.6)	6200	(27.6)	3605	(16.0)	6210	(27.6)	4970	(22.1)
				≥12	(304.8)												
1/2	(12.7)	4-1/4	(108)	4	(101.6)	7140	(31.8)	7140	(31.8)	7140	(31.8)	6405	(28.5)	8075	(35.9)	8075	(35.9)
				≥12	(304.8)									11040	(49.1)	8835	(39.3)
5/8	(15.9)	5	(127)	4	(101.6)	9060	(40.3)	9060	(40.3)	9060	(40.3)	8075	(35.9)	8075	(35.9)	8075	(35.9)
				≥12	(304.8)							10010	(44.2)	17260	(76.8)	13805	(61.4)
3/4	(19.1)	6-5/8	(168.3)	4	(101.6)	14970	(66.6)	14970	(66.6)	14970	(66.6)	8075	(35.9)	8075	(35.9)	8075	(35.9)
				≥12	(304.8)							14415	(64.1)	22500	(100.1)	16800	(75.2)

1 Values are for lightweight, medium weight or normal weight concrete masonry units conforming to ASTM C 90 with 2000 psi grout conforming to ASTM C 476.

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

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

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

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

6 Steel values in accordance with AISC

Allowable Load Values
Tension = $0.33 \times F_u \times A_{nom}$
Shear = $0.17 \times F_u \times A_{nom}$

Ultimate Load Values
Tension = $0.75 \times F_u \times A_{nom}$
Shear = $0.45 \times F_u \times A_{nom}$

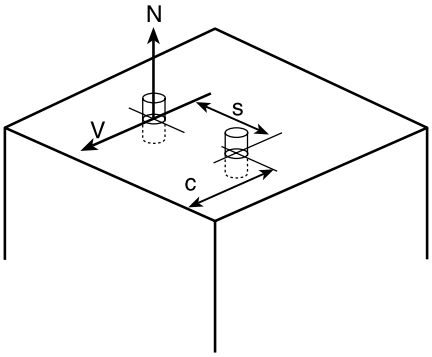
3.2.8 HIT-ICE Adhesive Anchoring System

Anchor Spacing and Edge Distance Guidelines for Grout-Filled Block

Influence of Anchor Spacing and Edge Distance

Anchor Size	in.	3/8	1/2	5/8	3/4
	(mm)	(9.5)	(12.7)	(15.8)	(19.1)
h_{nom}	in.	3-1/2	4-1/4	5	6-5/8
	(mm)	(90)	(110)	(125)	(170)

h_{nom} = standard embedment depth



Edge Distance for Shear and Tension:
Grout Filled, Normal Weight and Lightweight Block

c_{cr} = 12 in. (305 mm) minimum from free edge

c_{min} = 4 in. (102 mm) minimum from free edge

Anchor Spacing for Shear and Tension:
Grout Filled, Normal Weight and Lightweight Block

s_{cr} = s_{min} = One (1) anchor per cell (max), and 8 in. (203mm) (min)

HIT-ICE Adhesive Anchoring System 3.2.8

HIT-ICE Ultimate Bond Capacity and Steel Strength for Rebar in Concrete

Nominal Rebar Size	Embedment Depth in. (mm)	Concrete Compressive Strength						Grade 60 Rebar	
		f'_c = 2000 psi (13.8 MPa)			f'_c = 4000 psi (27.6 MPa)				
		Ultimate Bond Strength lb (kN)	Embed. to Develop Yield Strength[1] in. (mm)	Embed. to Develop Tensile Strength[1] in. (mm)	Ultimate Bond Strength lb (kN)	Embed. to Develop Yield Strength[1] in. (mm)	Embed. to Develop Tensile Strength[1] in. (mm)	Yield Strength lb (kN)	Tensile Strength lb (kN)
#3	1-1/2 (38)	2500 (11.1)	3-3/4 (95.3)	5-1/2 (139.7)	3800 (16.9)	2-3/4 (69.9)	4-1/4 (108.0)	6600 (29.4)	9900 (44.0)
	3-1/2 (89)	6300 (28.0)			8200 (36.5)				
	7 (178)	12600 (56.0)			16500 (73.4)				
#4	2 (51)	4200 (18.7)	5-1/2 (139.7)	8 (203.2)	6000 (26.7)	4-1/4 (108.0)	6-1/4 (158.8)	12000 (53.4)	18000 (80.1)
	4 (102)	9000 (40.0)			11800 (52.5)				
	8 (203)	18000 (80.1)			23600 (105.0)				
#5	2-1/2 (64)	5600 (24.9)	7 (177.8)	10-1/4 (260.4)	6900 (30.7)	5-1/4 (133.4)	8 (203.2)	18600 (82.7)	27900 (124.1)
	5 (127)	13500 (60.1)			17700 (78.7)				
	10 (254)	27000 (120.1)			35300 (157.0)				
#6	3-1/2 (90)	10200 (45.4)	8-1/2 (215.9)	12-3/4 (323.9)	12800 (56.9)	6-1/2 (165.1)	9-3/4 (247.7)	26400 (117.4)	39600 (176.2)
	7 (178)	22100 (98.3)			28900 (128.6)				
	14 (356)	44200 (196.6)			57700 (256.7)				
#7	3-3/4 (95)	10700 (47.6)	10 (254.0)	15 (381)	15800 (70.3)	7-3/4 (196.9)	11-1/2 (292.1)	36000 (160.1)	54000 (240.2)
	7-1/2 (190)	27100 (120.6)			35300 (157.0)				
	15 (380)	54200 (241.1)			70700 (314.5)				
#8	4 (102)	14100 (62.7)	11-3/4 (298.5)	17-1/2 (444.5)	18100 (80.5)	9 (228.6)	13-1/2 (342.9)	47450 (211.1)	71100 (316.3)
	8 (204)	32500 (144.6)			42400 (188.6)				
	16 (408)	65000 (289.1)			84800 (377.2)				
#9	5 (127)	16700 (74.3)	12-3/4 (323.9)	19 (482.6)	21800 (97.0)	10 (254.0)	15-3/4 (400.1)	60000 (266.9)	90000 (400.4)
	10 (254)	47400 (210.9)			61800 (274.9)				
	18 (457)	85300 (379.4)			111300 (495.1)				
#10	6 (152)	23300 (103.6)	15-1/2 (393.7)	23 (584.2)	32400 (144.1)	12 (304.8)	17-3/4 (450.9)	76200 (339.0)	114300 (508.5)
	12 (304)	59600 (265.1)			77700 (345.6)				
	20 (508)	99300 (441.7)			129600 (576.5)				
#11	7 (178)	32000 (142.3)	17-1/4 (438.2)	26 (660.4)	41300 (183.7)	13-1/2 (342.9)	20 (508.0)	93600 (416.4)	140400 (624.6)
	14 (356)	75800 (337.2)			99000 (440.4)				
	20 (508)	108400 (482.2)			141400 (629.0)				

1 Based on comparison of average ultimate adhesive bond test values versus minimum yield and ultimate tensile strength of rebar; for more information, contact Hilti.

3.2.8 HIT-ICE Adhesive Anchoring System

HIT-ICE Bond Capacity and Steel Strength for Metric Rebar in Concrete (Canada Only)[1,2,3]

Rebar Size	HIT-ICE Tensile Bond Strength[2,3,4]					Strength Properties of Metric Rebar[2,3]	
	Embedment Depth (mm)	f'_c = 14 MPa		f'_c = 28 MPa		f_y = 400 MPa	
		Ultimate Bond (kN)	Allowable Bond (kN)	Ultimate Bond (kN)	Allowable Bond (kN)	Yield Strength (kN)	Tensile Strength (kN)
10M (#3)	40	11.1	2.8	16.9	4.2	40	60
	90	28.0	7.0	36.5	9.1		
	180	56.0	14.0	73.4	18.3		
15M (#5)	65	24.9	6.2	30.7	7.7	80	120
	130	60.1	15.0	78.7	19.7		
	250	120	30.0	157	39.2		
20M (#6)	90	45.4	11.3	56.9	14.2	120	180
	180	98.3	24.6	129	32.2		
	355	197	49.2	257	64.2		
25M (#8)	100	62.7	15.7	80.5	20.1	200	300
	200	145	36.2	189	47.2		
	405	289	72.2	377	94.2		
30M (#9)	125	74.3	18.6	97.0	24.2	280	420
	250	211	52.8	275	68.8		
	455	379	94.8	495	124		
35M (#11)	180	142	35.5	184	46.0	400	600
	355	337	84.2	440	110		
	510	482	120	629	157		

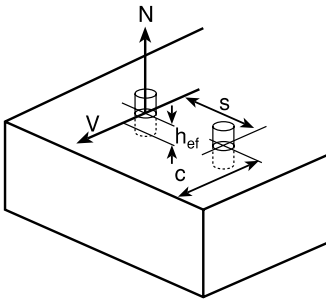
1 Use lesser value of bond strength or rebar's steel strength for tensile capacity.

2 Test data developed for hammer-drilled holes. For diamond cored holes, contact Hilti Engineering.

3 For anchoring spacing and edge distance guidelines, please refer to the following pages of this HIT-ICE Injection Adhesive Anchor section.

HIT-ICE Adhesive Anchoring System 3.2.8

Anchor Spacing and Edge Distance Guidelines in Concrete for HIT-ICE

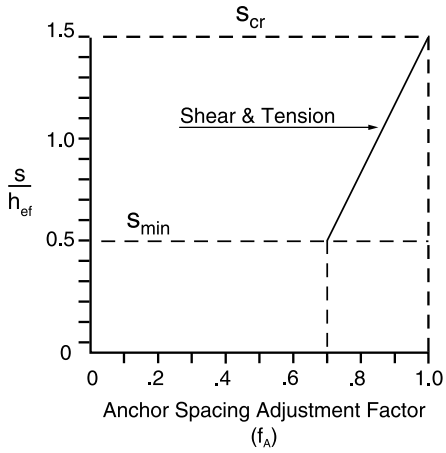


Note: Tables apply for listed embedment depths. Reduction factors for other embedment depths must be calculated using equations below.

Spacing Tension/Shear $s_{min} = 0.5\ h_{ef}$, $s_{cr} = 1.5\ h_{ef}$ $f_A = 0.3(s/h_{ef}) + 0.55$ for $s_{cr} > s > s_{min}$
Edge Distance Tension $c_{min} = 0.5\ h_{ef}$, $c_{cr} = 1.5\ h_{ef}$ $f_{RN} = 0.4(c/h_{ef}) + 0.40$ for $c_{cr} > c > c_{min}$
Edge Distance Shear (⊥ toward edge) $c_{min} = 0.5\ h_{ef}$, $c_{cr} = 2.0\ h_{ef}$ $f_{RV1} = 0.54(c/h_{ef}) - 0.09$ for $c_{cr} > c > c_{min}$
Edge Distance Shear (II to or away from edge) $c_{min} = 0.5\ h_{ef}$, $c_{cr} = 2.0\ h_{ef}$ $f_{RV2} = 0.36(c/h_{ef}) + 0.28$ for $c_{cr} > c > c_{min}$

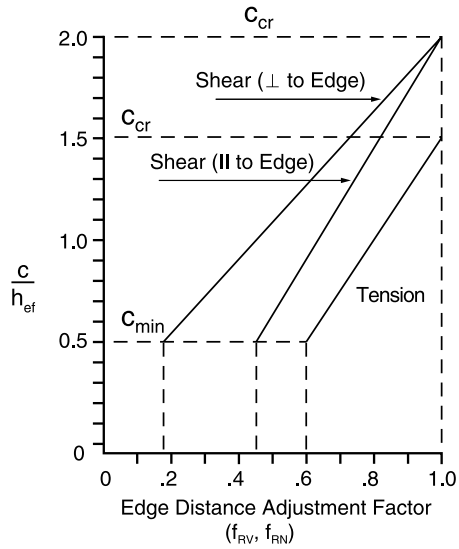
Anchor Spacing Adjustment Factors

s = Actual spacing
s_{min} = $0.5\ h_{ef}$
s_{cr} = $1.5\ h_{ef}$
h_{ef} = Actual embedment



Edge Distance Adjustment Factors

c = Actual edge distance
c_{min} = $0.5\ h_{ef}$
c_{cr} = $1.5\ h_{ef}$ Tension
= $2.0\ h_{ef}$ for Shear
h_{ef} = Actual embedment



Load Adjustment Factors for 3/8" Diameter Anchors													
Anchor Diameter		3/8" diameter											
Adjustment Factor		Spacing Tension/Shear f_A			Edge Distance Tension f_{RN}			Edge Distance Shear (⊥ toward edge) f_{RV1}			Edge Distance Shear (II to or away from edge) f_{RV2}		
Embedment Depth, in		1-3/4	3-1/2	5-1/4	1-3/4	3-1/2	5-1/4	1-3/4	3-1/2	5-1/4	1-3/4	3-1/2	5-1/4
Spacing (s)/Edge Distance (c), in.	7/8	0.70			0.60			0.18			0.46		
	1-1/4	0.76			0.69			0.30			0.54		
	1-3/4	0.85	0.70		0.80	0.60		0.45	0.18		0.64	0.46	
	2	0.89	0.72		0.86	0.63		0.53	0.22		0.69	0.49	
	2-5/8	1.00	0.78	0.70	1.00	0.70	0.60	0.72	0.32	0.18	0.82	0.55	0.46
	3		0.81	0.72		0.74	0.63	0.84	0.37	0.22	0.90	0.59	0.49
	3-1/2		0.85	0.75		0.80	0.67	1.00	0.45	0.27	1.00	0.64	0.52
	4		0.89	0.78		0.86	0.70		0.53	0.32		0.69	0.55
	4-1/2		0.94	0.81		0.91	0.74		0.60	0.37		0.74	0.59
	5-1/4		1.00	0.85		1.00	0.80		0.72	0.45		0.82	0.64
	6-1/2			0.92			0.90		0.91	0.58		0.95	0.73
	7			0.95			0.93		1.00	0.63		1.00	0.76
	7-7/8			1.00			1.00			0.72			0.82
	9									0.84			0.90
	10-1/2									1.00			1.00

3.2.8 HIT-ICE Adhesive Anchoring System

Load Adjustment Factors for 1/2" Diameter Anchors													
Anchor Diameter		1/2" diameter											
Adjustment Factor		Spacing Tension/Shear f_A			Edge Distance Tension f_{RN}			Edge Distance Shear (⊥ toward edge) f_{RV1}			Edge Distance Shear (II to or away from edge) f_{RV2}		
Embedment Depth, in		2-1/8	4-1/4	6-3/8	2-1/8	4-1/4	6-3/8	2-1/8	4-1/4	6-3/8	2-1/8	4-1/4	6-3/8
Spacing (s)/Edge Distance (c), in.	1-1/16	0.70			0.60			0.18			0.46		
	1-1/2	0.76			0.68			0.29			0.53		
	2	0.83			0.78			0.42			0.62		
	2-1/8	0.85	0.70		0.80	0.60		0.45	0.18		0.64	0.46	
	2-3/4	0.94	0.74		0.92	0.66		0.61	0.26		0.75	0.51	
	3	0.97	0.76		0.96	0.68		0.67	0.29		0.79	0.53	
	3-3/16	1.00	0.78	0.70	1.00	0.70	0.60	0.72	0.32	0.18	0.82	0.55	0.46
	4		0.83	0.74		0.78	0.65	0.93	0.42	0.25	0.96	0.62	0.51
	4-1/4		0.85	0.75		0.80	0.67	1.00	0.45	0.27	1.00	0.64	0.52
	5		0.90	0.79		0.87	0.71		0.55	0.33		0.70	0.56
	6		0.97	0.83		0.96	0.78		0.67	0.42		0.79	0.62
	6-3/8		1.00	0.85		1.00	0.80		0.72	0.45		0.82	0.64
	7			0.88			0.84		0.80	0.50		0.87	0.68
	7-1/2			0.90			0.87		0.86	0.55		0.92	0.70
	8-1/2			0.95			0.93		1.00	0.63		1.00	0.76
	9			0.97			0.96			0.67			0.79
	9-9/16			1.00			1.00			0.72			0.82
	10									0.76			0.84
	11									0.84			0.90
	12-3/4									1.00			1.00

Note: Tables apply for listed embedment depths. Reduction factors for other embedment depths must be calculated using equations below.

Spacing Tension/Shear

$s_{min} = 0.5\ h_{ef}$, $s_{cr} = 1.5\ h_{ef}$

$f_A = 0.3(s/h_{ef}) + 0.55$

for $s_{cr} > s > s_{min}$

Edge Distance Tension

$c_{min} = 0.5\ h_{ef}$, $c_{cr} = 1.5\ h_{ef}$

$f_{RN} = 0.4(c/h_{ef}) + 0.40$

for $c_{cr} > c > c_{min}$

Edge Distance Shear (⊥ toward edge)

$c_{min} = 0.5\ h_{ef}$, $c_{cr} = 2.0\ h_{ef}$

$f_{RV1} = 0.54(c/h_{ef}) - 0.09$

for $c_{cr} > c > c_{min}$

Edge Distance Shear (II to or away from edge)

$c_{min} = 0.5\ h_{ef}$, $c_{cr} = 2.0\ h_{ef}$

$f_{RV2} = 0.36(c/h_{ef}) + 0.28$

for $c_{cr} > c > c_{min}$

Load Adjustment Factors for 5/8" and 3/4" Diameter Anchors																									
Anchor Diameter		5/8" diameter												3/4" diameter											
Adjustment Factor		Spacing Tension/Shear f_A			Edge Distance Tension f_{RN}			Edge Distance Shear (⊥ toward edge) f_{RV1}			Edge Distance Shear (II to or away from edge) f_{RV2}			Spacing Tension/Shear f_A			Edge Distance Tension f_{RN}			Edge Distance Shear (⊥ toward edge) f_{RV1}			Edge Distance Shear (II to or away from edge) f_{RV2}		
Embedment Depth, in		2-1/2	5	7-1/2	2-1/2	5	7-1/2	2-1/2	5	7-1/2	2-1/2	5	7-1/2	3-3/8	6-5/8	10	3-3/8	6-5/8	10	3-3/8	6-5/8	10	3-3/8	6-5/8	10
Spacing (s)/Edge Distance (c), in.	1-1/4	0.70			0.60			0.18			0.46														
	1-11/16	0.75			0.67			0.27			0.52			0.70			0.60			0.18			0.46		
	2	0.79			0.72			0.34			0.57			0.73			0.64			0.23			0.49		
	2-1/2	0.85	0.70		0.80	0.60		0.45	0.18		0.64	0.46		0.77			0.70			0.31			0.55		
	3	0.91	0.73		0.88	0.64		0.56	0.23		0.71	0.50		0.82			0.76			0.39			0.60		
	3-5/16	0.95	0.75		0.93	0.67		0.63	0.27		0.76	0.52		0.84	0.70		0.79	0.60		0.44	0.18		0.63	0.46	
	3-3/4	1.00	0.78	0.70	1.00	0.70	0.60	0.72	0.32	0.18	0.82	0.55	0.46	0.88	0.72		0.84	0.63		0.51	0.22		0.68	0.48	
	4		0.79	0.71		0.72	0.61	0.77	0.34	0.20	0.86	0.57	0.47	0.91	0.73		0.87	0.64		0.55	0.24		0.71	0.50	
	4-1/2		0.82	0.73		0.76	0.64	0.88	0.40	0.23	0.93	0.60	0.50	0.95	0.75		0.93	0.67		0.63	0.28		0.76	0.52	
	5		0.85	0.75		0.80	0.67	1.00	0.45	0.27	1.00	0.64	0.52	0.99	0.78	0.70	0.99	0.70	0.60	0.71	0.32	0.18	0.81	0.55	0.46
	5-1/16		0.85	0.75		0.81	0.67		0.46	0.27		0.64	0.52	1.00	0.78	0.70	1.00	0.71	0.60	0.72	0.32	0.18	0.82	0.56	0.46
	5-1/2		0.88	0.77		0.84	0.69		0.50	0.31		0.68	0.54		0.80	0.72		0.73	0.62	0.79	0.36	0.21	0.87	0.58	0.48
	6		0.91	0.79		0.88	0.72		0.56	0.34		0.71	0.57		0.82	0.73		0.76	0.64	0.87	0.40	0.23	0.92	0.61	0.50
	6-3/4		0.96	0.82		0.94	0.76		0.64	0.40		0.77	0.60		0.86	0.75		0.81	0.67	1.00	0.46	0.27	1.00	0.65	0.52
	7-1/2		1.00	0.85		1.00	0.80		0.72	0.45		0.82	0.64		0.89	0.78		0.85	0.70		0.52	0.32		0.69	0.55
	8			0.87			0.83		0.77	0.49		0.86	0.66		0.91	0.79		0.88	0.72		0.56	0.34		0.71	0.57
	8-1/2			0.89			0.85		0.83	0.52		0.89	0.69		0.93	0.81		0.91	0.74		0.60	0.37		0.74	0.59
	9			0.91			0.88		0.88	0.56		0.93	0.71		0.96	0.82		0.94	0.76		0.64	0.40		0.77	0.60
	9-15/16			0.95			0.93		0.98	0.63		1.00	0.76		1.00	0.85		1.00	0.80		0.72	0.45		0.82	0.64
	10			0.95			0.93		1.00	0.63			0.76			0.85			0.80		0.73	0.45		0.82	0.64
	11-1/4			1.00			1.00			0.72			0.82			0.89			0.85		0.83	0.52		0.89	0.69
	12									0.77			0.86			0.91			0.88		0.89	0.56		0.93	0.71
	13-1/4									0.86			0.92			0.95			0.93		1.00	0.63		1.00	0.76
	14									0.92			0.95			0.97			0.96			0.67			0.78
	15									1.00			1.00			1.00			1.00			0.72			0.82
	16																					0.77			0.86
	18																					0.88			0.93
	20																					1.00			1.00

HIT-ICE Adhesive Anchoring System 3.2.8

Load Adjustment Factors for 7/8" Diameter Anchors													
Anchor Diameter		7/8" diameter											
Adjustment Factor		Spacing Tension/Shear f_A			Edge Distance Tension f_{RN}			Edge Distance Shear (⊥ toward edge) f_{RV1}			Edge Distance Shear (II to or away from edge) f_{RV2}		
Embedment Depth, in		3-3/4	7-1/2	11-1/4	3-3/4	7-1/2	11-1/4	3-3/4	7-1/2	11-1/4	3-3/4	7-1/2	11-1/4
Spacing (s)/Edge Distance (c), in.	1-7/8	0.70			0.60			0.18			0.46		
	2-1/2	0.75			0.67			0.27			0.52		
	3	0.79			0.72			0.34			0.57		
	3-3/4	0.85	0.70		0.80	0.60		0.45	0.18		0.64	0.46	
	4	0.87	0.71		0.83	0.61		0.49	0.20		0.66	0.47	
	4-1/2	0.91	0.73		0.88	0.64		0.56	0.23		0.71	0.50	
	5	0.95	0.75		0.93	0.67		0.63	0.27		0.76	0.52	
	5-5/8	1.00	0.78	0.70	1.00	0.70	0.60	0.72	0.32	0.18	0.82	0.55	0.46
	6		0.79	0.71		0.72	0.61	0.77	0.34	0.20	0.86	0.57	0.47
	6-1/2		0.81	0.72		0.75	0.63	0.85	0.38	0.22	0.90	0.59	0.49
	7		0.83	0.74		0.77	0.65	0.92	0.41	0.25	0.95	0.62	0.50
	7-1/2		0.85	0.75		0.80	0.67	1.00	0.45	0.27	1.00	0.64	0.52
	8		0.87	0.76		0.83	0.68		0.49	0.29		0.66	0.54
	8-1/2		0.89	0.78		0.85	0.70		0.52	0.32		0.69	0.55
	9		0.91	0.79		0.88	0.72		0.56	0.34		0.71	0.57
	9-15/16		0.95	0.82		0.93	0.75		0.63	0.39		0.76	0.60
	10		0.95	0.82		0.93	0.76		0.63	0.39		0.76	0.60
	11-1/4		1.00	0.85		1.00	0.80		0.72	0.45		0.82	0.64
	12			0.87			0.83		0.77	0.49		0.86	0.66
	14			0.92			0.90		0.92	0.58		0.95	0.73
	15			0.95			0.93		1.00	0.63		1.00	0.76
	16-7/8			1.00			1.00			0.72			0.82
	18									0.77			0.86
	20									0.87			0.92
	22-1/2									1.00			1.00

Note: Tables apply for listed embedment depths. Reduction factors for other embedment depths must be calculated using equations below.

Spacing Tension/Shear

$s_{min} = 0.5\ h_{ef}$, $s_{cr} = 1.5\ h_{ef}$

$f_A = 0.3(s/h_{ef}) + 0.55$

for $s_{cr} > s > s_{min}$

Edge Distance Tension

$c_{min} = 0.5\ h_{ef}$, $c_{cr} = 1.5\ h_{ef}$

$f_{RN} = 0.4(c/h_{ef}) + 0.40$

for $c_{cr} > c > c_{min}$

Edge Distance Shear (⊥ toward edge)

$c_{min} = 0.5\ h_{ef}$, $c_{cr} = 2.0\ h_{ef}$

$f_{RV1} = 0.54(c/h_{ef}) - 0.09$

for $c_{cr} > c > c_{min}$

Edge Distance Shear (II to or away from edge)

$c_{min} = 0.5\ h_{ef}$, $c_{cr} = 2.0\ h_{ef}$

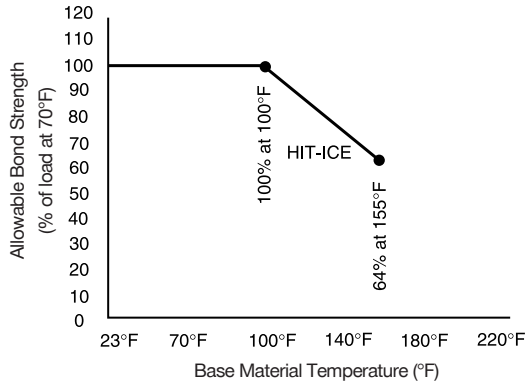
$f_{RV2} = 0.36(c/h_{ef}) + 0.28$

for $c_{cr} > c > c_{min}$

Load Adjustment Factors for 1" and 1 1/4"" Diameter Anchors																									
Anchor Diameter		1" diameter												1 1/4" diameter											
Adjustment Factor		Spacing Tension/Shear f_A			Edge Distance Tension f_{RN}			Edge Distance Shear (⊥ toward edge) f_{RV1}			Edge Distance Shear (II to or away from edge) f_{RV2}			Spacing Tension/Shear f_A			Edge Distance Tension f_{RN}			Edge Distance Shear (⊥ toward edge) f_{RV1}			Edge Distance Shear (II to or away from edge) f_{RV2}		
Embedment Depth, in		4-1/8	8-1/4	12-3/8	4-1/8	8-1/4	12-3/8	4-1/8	8-1/4	12-3/8	4-1/8	8-1/4	12-3/8	6	12	15	6	12	15	6	12	15	6	12	15
Spacing (s)/Edge Distance (c), in.	2-1/16	0.70			0.60			0.18			0.46														
	3	0.77			0.69			0.30			0.54			0.70			0.60			0.18			0.46		
	3-1/2	0.80			0.74			0.37			0.59			0.73			0.63			0.23			0.49		
	4-1/8	0.85	0.70		0.80	0.60		0.45	0.18		0.64	0.46		0.76			0.68			0.28			0.53		
	5	0.91	0.73		0.88	0.64		0.56	0.24		0.72	0.50		0.80			0.73			0.36			0.58		
	5-1/2	0.95	0.75		0.93	0.67		0.63	0.27		0.76	0.52		0.83			0.77			0.41			0.61		
	6	0.99	0.77		0.98	0.69		0.70	0.30		0.80	0.54		0.85	0.70		0.80	0.60		0.45	0.18		0.64	0.46	
	6-3/16	1.00	0.78	0.70	1.00	0.70	0.60	0.72	0.32	0.18	0.82	0.55	0.46	0.86	0.70		0.81	0.61		0.47	0.19		0.65	0.47	
	7-1/2		0.82	0.73		0.76	0.64	0.89	0.40	0.24	0.93	0.61	0.50	0.93	0.74	0.70	0.90	0.65	0.60	0.59	0.25	0.18	0.73	0.51	0.46
	8-1/4		0.85	0.75		0.80	0.67	1.00	0.45	0.27	1.00	0.64	0.52	0.96	0.76	0.72	0.95	0.68	0.62	0.65	0.28	0.21	0.78	0.53	0.48
	9		0.88	0.77		0.84	0.69		0.50	0.30		0.67	0.54	1.00	0.78	0.73	1.00	0.70	0.64	0.72	0.32	0.23	0.82	0.55	0.50
	9-1/2		0.90	0.78		0.86	0.71		0.53	0.32		0.69	0.56		0.79	0.74		0.72	0.65	0.77	0.34	0.25	0.85	0.57	0.51
	10		0.91	0.79		0.88	0.72		0.56	0.35		0.72	0.57		0.80	0.75		0.73	0.67	0.81	0.36	0.27	0.88	0.58	0.52
	10-1/2		0.93	0.80		0.91	0.74		0.60	0.37		0.74	0.59		0.81	0.76		0.75	0.68	0.86	0.38	0.29	0.91	0.60	0.53
	12		0.99	0.84		0.98	0.79		0.70	0.43		0.80	0.63		0.85	0.79		0.80	0.72	1.00	0.45	0.34	1.00	0.64	0.57
	12-3/8		1.00	0.85		1.00	0.80		0.72	0.45		0.82	0.64		0.86	0.80		0.81	0.73		0.47	0.36		0.65	0.58
	14			0.89			0.85		0.83	0.52		0.89	0.69		0.90	0.83		0.87	0.77		0.54	0.41		0.70	0.62
	16-1/2			0.95			0.93		1.00	0.63		1.00	0.76		0.96	0.88		0.95	0.84		0.65	0.50		0.78	0.68
	18			0.99			0.98			0.70			0.80		1.00	0.91		1.00	0.88		0.72	0.56		0.82	0.71
	18-9/16			1.00			1.00			0.72			0.82			0.92			0.90		0.75	0.58		0.84	0.73
	20									0.78			0.86			0.95			0.93		0.81	0.63		0.88	0.76
	22-1/2									0.89			0.93			1.00			1.00		0.92	0.72		0.96	0.82
	24									0.96			0.98								1.00	0.77		1.00	0.86
	24-3/4									1.00			1.00									0.80			0.87
	26																					0.85			0.90
	28																					0.92			0.95
	30																					1.00			1.00

3.2.8 HIT-ICE Adhesive Anchoring System

Influence of Temperature on Bond Strength



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

Long term creep test in accordance with AC58 is available; please contact Hilti Technical Services.

Open Gel Time Table (Approximate)[1]

Base Material Temperature		HIT-ICE
°F	°C	
–10	–23	1.5 hrs
0	–18	1.5 hrs
23	–5	40 min
32	0	26 min
41	5	11 min
68	20	4 min
86	30	1.5 min

Final Cure Time Table (Approximate)[1]

Base Material Temperature		HIT-ICE
°F	°C	
–10	–23	36 hrs
0	–18	24 hrs
23	–5	6 hrs
32	0	4 hrs
41	5	2 hrs
68	20	1 hrs
86	30	30 min

1 Product temperatures must be maintained above 0°F (–18°C) prior to installation.

3.3.1.4 Installation Instructions

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded on-line at www.us.hilti.com (US) and www.hilti.ca (Canada) -- "Service/Technical Info >> Technical Downloads >> Anchoring Systems". 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.

3.2.8 HIT-ICE Adhesive Anchoring System

HIT HIT-ICE Volume Charts

Threaded Rod Installation

Rod Diameter (in.)	Drill Bit Diameter (in.)	Adhesive Volume Required per Inch of embedment (in^3)
1/4	5/16	0.055
3/8	7/16	0.095
1/2	9/16	0.133
5/8	11/16	0.184
3/4	13/16	0.232
7/8	24mm	0.272
1	1-1/16	0.366
1-1/4	1-1/2	0.918

Example: Determine approximate fastenings for 5/8" rod embedded 10" deep.

10 x 0.184 = 1.84 in^3 of adhesive per anchor

- HIT-ICE cartridge:
  18.0 ÷ 1.84 ≈ 10 fastenings

Rebar Installation

Rod Diameter (in.)	Drill Bit[1] Diameter (in.)	Adhesive Volume Required per Inch of embedment (in^3)
#3 or 3/8	1/2	0.110
#4 or 1/2	5/8	0.146
#5 or 5/8	3/4	0.176
#6 or 3/4	7/8	0.218
#7 or 7/8	1	0.252
#8 or 1	1-1/8	0.299
#9 or 1-1/8	1-3/8	0.601
#10 or 1-1/4	1-1/2	0.659
#11 or 1-3/8	1-9/16	0.547

Note: Useable volume of

- HIT-ICE is 18 in^3 (297 ml)

Metric Rebar Installation (Canada Only)

Bar Diameter	Drill Bit[1] Diameter	Adhesive Volume Required per Inch of embedment ($in.^3$)
10M	14 mm	0.101
15M	3/4"	0.176
20M	24 mm	0.268
25M	1-1/8"	0.309
30M	37 mm	0.644
35M	1-9/16"	0.480

1 Rebar diameter may vary. Use smallest drill bit which will accommodate rebar. Use Hilti matched tolerance carbide tipped drill bits.

3.2.8.5 Ordering Information

HIT Adhesives

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

HIT-ICE Cartridge

HIT Dispensers

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

MD 1000 Dispenser

Mixers & Filler Tubes

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

HIT-ICE Mixer

HIT Filler Tube

Refer to Section 3.2.6.5 for ordering information of HAS threaded rods and HIS inserts.