☐ Submittal ☐ Substitution Request

To: _____

Firm: _____

Project: _____

Product Specified: _____

Specified Location:_____

Attached information includes product description, installation instructions and technical data needed for review and evaluation of the submittal request.

Submitted By:

Name: _____ Signature: _____

Firm: _____

Address: _____

_____

Phone: _____ Fax: _____

Email: _____ Submittal Date: _____

For Architect / Engineer Use:

Reviewed, Accepted ~ No Exceptions: _____ Make Corrections as Noted: _____

Revise and Resubmit: _____ Rejected: _____

Brief explanation for corrections needed, revisions needed or why rejected:

_____

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3.2.10 HVA Capsule Adhesive Anchoring System

3.2.10.1 Product Description

3.2.10.2 Material Specifications

3.2.10.3 Technical Data

3.2.10.4 Installation Instructions

3.2.10.5 Ordering Information

Listings/Approvals

NSF/ANSI Std 61
certification for use in potable water
European Technical approval
ETA-05/0255
ETA-05/0256
ETA-05/0257

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.

3.2.10.1 Product Description

HVU Adhesive Capsule

HIS Internally Threaded Insert

HAS Anchor Rod Assembly with nut and washer

Rebar (Not supplied by Hilti)

The Hilti HVA system is a heavy duty, two component adhesive anchor consisting of a self-contained adhesive capsule and either a threaded rod with nut and washer or an internally threaded insert.

Product Features

- High loading capacity
- Small edge distance and anchor spacing allowance
- Excellent dynamic load resistance
- Wide range of installation temperatures
- Excellent performance in holes cored using Hilti DD-B or DD-C diamond core bits
- Excellent elevated temperature performance
- Excellent performance in freezing and thawing conditions
- No hole brushing required—just blow out hole with compressed air—makes installation fast and easy

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)

Adhesive anchors shall consist of an all-thread anchor rod, nut, washer and adhesive capsule. Alternatively, adhesive anchors shall consist of a steel insert and an adhesive capsule.

Anchor Rod Shall be provided with 45 degree chisel or cut point to provide proper mixing of the adhesive components. Anchor rod shall be manufactured to meet the following requirements: **1.** ISO 898 Class 5.8; **2.** ASTM A 193 Grade B7; **3.** AISI 304 or AISI 316 stainless steel meeting the mechanical requirements of ASTM F 593 (Condition CW); **4.** Rebar with chisel or cut point.

Special order HAS Rod materials may vary from standard steel rod product.

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

Adhesive Capsule Shall consist of a dual chamber foil capsule. The resin material shall be vinyl urethane methacrylate.

Steel Insert The internally threaded insert shall have a 45 degree (from central axis) chisel pointed end. The insert shall be carbon steel or stainless steel material which meets minimum ultimate tensile strengths of 66.7 and 101.5 ksi, respectively.

The adhesive anchoring system shall be the Hilti HVA anchoring system, consisting of the Hilti HVU adhesive capsule and the Hilti HAS anchor rod or HIS internally threaded insert.

Installation Adhesive anchors to be installed in holes drilled using the specified diameter of Hilti carbide tipped drill bit or matched tolerance Hilti DD-B or DD-C diamond core bit. Anchors shall be installed in strict accordance to section 3.2.10.4. Do not disturb until cure time has elapsed.

3.2.10.2 Material Specifications

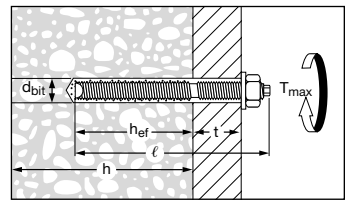
Material	Mechanical Properties			
	f_y ksi (MPa)		min. f_u ksi (MPa)	
Standard HAS-E rod material meets the requirements of ISO 898 Class 5.8	58	(400)	72.5	(500)
High Strength or 'Super HAS' rod material meets the requirements of ASTM A 193, Grade B7	105	(724)	125	(862)
Stainless HAS rod material meets the requirements of ASTM F 593 (304/316) Condition CW 3/8" to 5/8"	65	(448)	100	(689)
Stainless HAS rod material meets the requirements of ASTM F 593 (304/316) Condition CW 3/4" to 1-1/4"	45	(310)	85	(586)
HIS Insert 11SMnPb30+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 Carbon Steel and Stainless Steel Washers meet dimensional requirements of ANSI B18.22.1 Type A Plain				
HAS Super & HAS-E Standard Washers meet the requirements of ASTM F 436				
All HAS-E & HAS Super Rods (except 7/8") & HAS-E Standard, HIS inserts, nuts & washers are zinc plated to ASTM B 633 SC 1				
7/8" Standard HAS-E & HAS Super rods hot-dip galvanized in accordance with ASTM A 153				
HVU Adhesive—Vinyl Urethane Methacrylate Resin with a Dibenzoyl Peroxide hardener				

Note: Special Order steel rod material may vary from standard steel rod materials.

3.2.10.3 Technical Data

HAS Rod Specification Table

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}: nominal bit diameter[1]		in.	15/32	9/16	11/16	7/8	1	1-1/8	1-3/8
h_{ef} = h_{nom} std. depth of embed.[2] = capsule length		in. (mm)	3-1/2 (90)	4-1/4 (110)	5 (125)	6-5/8 (170)	6-5/8 (170)	8-1/4 (210)	12 (305)
t: max. thickness fastened[3]		in. (mm)	1 (25.4)	1-1/2 (38.1)	1-3/4 (44.5)	2 (50.8)	2-1/4 (57.2)	2-1/2 (63.5)	2-3/4 (69.9)
t_{max}: max. tightening torque	All HILTI Rods	ft-lb (Nm)	18 (24)	30 (41)	75 (102)	150 (203)	175 (237)	235 (319)	400 (540)
h: minimum base material thickness[4]	h_{ef} = h_{nom}	in. (mm)	5-1/2 (140)	6-1/4 (160)	7 (180)	8-1/2 (220)	8-1/2 (220)	10-1/2 (270)	15 (380)
	$h_{ef} \neq h_{nom}$	in. (mm)	1.0 hef+ 2 (51)	1.0 hef+ 2 (51)	1.0 hef+ 2 (51)	1.0 hef+ 2 (51)	1.0 hef+ 2 (51)	1.0 hef+ 2-1/4 (57)	1.0 hef+ 3 (76)
Recommended Hilti Rotary Hammer Drill			TE 1...30		TE 1...60	TE 50...60		TE 50...80	



1 Use matched tolerance carbide tipped bits or Hilti matched tolerance DD-B or DD-C diamond core bit.

2 Data available for varying embedments; see Load Tables.

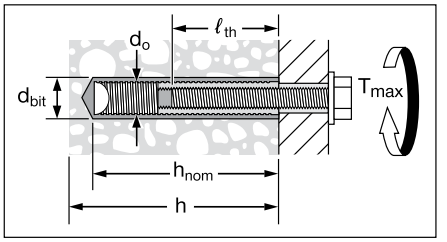
3 When using standard length rods at standard embedment (h_{nom})

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

3.2.10 HVA Capsule Adhesive Anchoring System

HIS Insert Specification Table

Details \ HIS Insert		in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)
HVU capsule required			1/2 x 4-1/4	5/8 x 5	7/8 x 6-5/8	1 x 8-1/4
d_{bit}	bit diameter[1]	in.	11/16	7/8	1-1/8	1-1/4
d_O	outside diameter[1]	in.	0.65	0.81	1	1.09
$h_{ef} = h_{nom}$	std. depth of embed. = capsule length	in. (mm)	4-3/8 (110)	5 (125)	6-5/8 (170)	8-1/4 (210)
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)	30 (41)	75 (102)	150 (203)
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 1...40	TE 1...40	TE 40...60	TE 40...80



1 Hilti matched tolerance carbide tipped drill bits

Rebar Specification Table

Rebar Size			#4	#5	#6	#7	#8
d_{bit}	bit diameter[1,2]	in.	5/8	13/16	1	1-1/8	1-1/4
$h_{ef} = h_{nom}$	std. depth of embed. = capsule length	in.	4-1/4	5	6-5/8	6-5/8	8-1/4
		(mm)	(110)	(125)	(170)	(170)	(210)

1 Rebar diameters may vary; the witnessed test was performed using the above mentioned drill bit diameters. Rebar must have a minimum length 4” greater than embedment to accommodate the setting equipment.

2 Hilti matched tolerance carbide tipped drill bits

Metric Rebar Specification Table (Canada Only)

Rebar Size			10M	15M	20M	25M
d_{bit}	bit diameter[1,2]	in. or mm	9/16	13/16	1	32mm
$h_{ef} = h_{nom}$	std. depth of embed. = capsule length	mm	90	125	170	210
		in.	(3-1/2)	(5)	(6-5/8)	(8-1/4)

1 Rebar diameters may vary; the witnessed test was performed using the above mentioned drill bit diameters. Rebar must have a minimum length 4” greater than embedment to accommodate the setting equipment.

2 Hilti matched tolerance carbide tipped drill bits

Combined Shear and Tension Loading

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

HVA Capsule Adhesive Anchoring System 3.2.10

HVA Allowable and Ultimate Bond/Concrete Capacity for HAS Rods in Normal Weight Concrete[1, 2]

Rod Diameter in (mm)	Embed. Depth[3] in (mm)	Adhesive Capsule(s) Required	HVU Allowable Bond/Concrete Capacity				HVU 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)	3-1/2 (90)	(1) 3/8 x 3-1/2	2085 (9.3)	2595 (11.5)	3335 (14.8)	4710 (21.0)	8345 (37.1)	10380 (46.2)	10000 (44.5)	14120 (62.8)
	5-1/4 (133)	(2) 3/8 x 3-1/2	2325 (10.3)	4185 (18.6)	6120 (27.2)	8655 (38.5)	9295 (41.3)	16730 (74.4)	18360 (81.7)	25960 (115.5)
	7 (178)	(2) 3/8 x 3-1/2	4405 (19.6)	4895 (21.8)	9420 (41.9)	13330 (59.3)	17630 (78.4)	19590 (87.1)	28260 (125.7)	39980 (177.8)
1/2 (12.7)	4-1/4 (110)	(1) 1/2 x 4-1/4	3250 (14.5)	4735 (21.1)	5450 (24.2)	7280 (32.4)	12990 (57.8)	18940 (84.2)	15440 (68.7)	21840 (97.1)
	6-3/8 (162)	(1) 1/2 x 4-1/4 & (1) 3/8 x 3-1/2	4890 (21.8)	5455 (24.3)	9455 (42.1)	13375 (59.5)	19565 (87.0)	21815 (97.0)	28360 (126.2)	40120 (178.5)
	8-1/2 (216)	(2) 1/2 x 4-1/4	6700 (29.8)	7545 (33.6)	14560 (64.8)	20590 (91.6)	26810 (119.3)	30190 (134.3)	43680 (194.3)	61760 (274.7)
5/8 (15.9)	5 (125)	(1) 5/8 x 5	3970 (17.7)	5245 (23.3)	7350 (32.7)	10390 (46.2)	15890 (70.7)	20970 (93.3)	22040 (98.0)	31160 (138.6)
	7-1/2 (184)	(1) 5/8 x 5 & (1) 1/2 x 4-1/4	5770 (25.7)	10465 (46.6)	13495 (60.0)	19080 (84.9)	23080 (102.7)	41865 (186.2)	40480 (180.1)	57240 (254.6)
	10 (254)	(2) 5/8 x 5	11700 (52.0)	12835 (57.1)	20775 (92.4)	29375 (130.7)	46795 (208.2)	51340 (228.4)	62320 (277.2)	88120 (392.0)
3/4 (19.1)	6-5/8 (170)	(1) 3/4 x 6-5/8	6080 (27.0)	8615 (38.3)	12270 (54.6)	17355 (77.2)	24330 (108.2)	34470 (153.3)	36800 (163.7)	52060 (231.6)
	10 (254)	(1) 3/4 x 6-5/8 & (1) 1/2 x 4-1/4	9110 (40.5)	14835 (66.0)	22755 (101.2)	32180 (143.1)	36445 (162.1)	59350 (264.0)	68260 (303.6)	96540 (429.4)
	13-1/4 (337)	(2) 3/4 x 6-5/8	15220 (67.7)	15310 (68.1)	34700 (154.4)	49080 (218.3)	60875 (270.8)	61230 (272.4)	104100 (463.1)	147240 (655.0)
7/8 (22.2)	6-5/8 (170)	(1) 7/8 x 6-5/8	7145 (31.8)	9130 (40.6)	13110 (58.3)	18535 (82.4)	28580 (127.1)	36525 (162.5)	39320 (174.9)	55600 (247.3)
	10 (254)	(2) 3/4 x 6-5/8	10475 (46.6)	18970 (84.4)	24575 (109.3)	34755 (154.6)	41905 (186.4)	75870 (337.5)	73720 (327.9)	104260 (463.8)
	13-1/4 (337)	(2) 7/8 x 6-5/8	16475 (73.3)	23055 (102.6)	34780 (154.7)	53010 (235.8)	65895 (293.1)	92220 (410.2)	112440 (500.2)	159020 (707.4)
1 (25.4)	8 1/4 (210)	(1) 1 x 8-1/4	8640 (38.4)	13425 (59.7)	19690 (87.6)	27840 (123.8)	34560 (153.7)	53695 (238.8)	59060 (262.7)	83520 (371.5)
	12-3/8 (314)	(2) 7/8 x 6-5/8	14665 (65.2)	23450 (104.3)	36170 (160.9)	51150 (227.5)	58665 (261.0)	93800 (417.2)	108500 (482.6)	153440 (682.5)
	16-1/2 (419)	(2) 1 x 8-1/4	26645 (118.5)	30805 (137.0)	55690 (247.7)	78750 (350.3)	106580 (474.1)	123220 (548.1)	167060 (743.1)	236240 (1050.8)
1-1/4 (31.8)	12 (305)	(1) 1-1/4 x 12	19175 (85.3)	23920 (106.4)	38615 (171.8)	54610 (242.9)	76740 (341.4)	95680 (425.6)	115840 (515.3)	163820 (728.7)
	15 (381)	(1) 1-1/4 x 12 & (1) 1 x 8-1/4	24750 (110.1)	26855 (119.5)	53960 (240.0)	76315 (339.5)	99000 (440.4)	107420 (477.8)	161880 (720.1)	228940 (1018.4)
	18 (457)	(1) 1-1/4 x 12 & (2) 1 x 8-1/4	29535 (131.4)	37920 (168.7)	70935 (315.5)	100320 (446.2)	118140 (525.5)	151680 (674.7)	212800 (946.6)	300960 (1338.7)

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 Average ultimate concrete shear capacity based on Strength Design method.

3 Contact Hilti for the use of alternate embedment other than those tested and listed above.

3.2.10 HVA Capsule 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

HVA Capsule Adhesive Anchoring System 3.2.10

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

Anchor Dia. in (mm)	Embed. Depth in (mm)	Adhesive Capsule(s) Required	HVU Allowable Bond/Concrete Capacity[2]	Steel Bolt Strength[1,2]			
			Tensile $f'_c \geq 2000$ psi (13.8 MPa) lb (kN)	ASTM A 325 Carbon Steel		ASTM F 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)	(1) 1/2 x 4-1/4	3180 (14.1)	4370 (19.4)	2250 (10.0)	3645 (16.2)	1875 (8.3)
1/2 (12.7)	5 (127)	(1) 5/8 x 5	4570 (20.3)	7775 (34.6)	4005 (17.8)	6480 (28.8)	3335 (14.8)
5/8 (15.9)	6-5/8 (168)	(1) 7/8 x 6-5/8	7460 (33.2)	12150 (54.0)	6260 (27.8)	10125 (45.0)	5215 (23.2)
3/4 (19.1)	8-1/4 (210)	(1) 1 x 8-1/4	9165 (40.8)	17495 (77.8)	9010 (40.1)	12395 (55.1)	6385 (28.4)

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

Anchor Dia. in (mm)	Embed. Depth in (mm)	Adhesive Capsule(s) Required	HVU Ultimate Bond/Concrete Capacity[2]	Steel Bolt Strength[1,2]			
			Tensile $f'_c \geq 2000$ 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)	(1) 1/2 x 4-1/4	12715 (56.6)	9935 (44.2)	5960 (26.5)	8280 (36.8)	4970 (22.1)
1/2 (12.7)	5 (127)	(1) 5/8 x 5	18275 (81.3)	17665 (78.6)	10600 (47.2)	14720 (65.5)	8835 (39.3)
5/8 (15.9)	6-5/8 (168)	(1) 7/8 x 6-5/8	29840 (132.7)	27610 (122.8)	16565 (73.7)	23010 (102.4)	13805 (61.4)
3/4 (19.1)	8-1/4 (210)	(1) 1 x 8-1/4	36660 (163.1)	39760 (176.9)	23855 (106.1)	28165 (125.3)	16900 (75.1)

1 Steel values in accordance with AISC

ASTM A 325 bolts: Fy = 92 ksi , Fu = 120 ksi

ASTM F 593 (AISI 304/316): Fy = 65 ksi, Fu = 100 ksi for 3/8” thru 5/8”

Fy = 45 ksi, Fu = 85 ksi for 3/4”

Allowable Load Values	Ultimate Load Values
Tension = 0.33 x F_u x A_{nom}	Tension = 0.75 x F_u x A_{nom}
Shear = 0.17 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.

3.2.10 HVA Capsule Adhesive Anchoring System

HVA Ultimate Bond Capacity and Steel Strength for Rebar in Concrete

Rebar Size	Embed. Depth in (mm)	Adhesive Capsule(s) Required	HVU Ultimate Bond Concrete Strength[1]				Grade 60 Rebar[1]	
			f'_c = 2000 psi (13.8 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)	Yield Strength lb (kN)	Tensile Strength lb (kN)
#4	4-1/4 (108)	(1) 1/2 X 4-1/4	9680 (43.1)	10980 (48.8)	12270 (54.6)	14850 (66.1)	12000 (53.4)	18000 (80.1)
	6-3/8 (162)	(1) 1/2 X 4-1/4 & (1) 3/8 X 3-1/2	14520 (64.6)	16460 (73.2)	18400 (81.9)	22280 (99.1)		
	8-1/2 (216)	(2) 1/2 x 4-1/4	19360 (86.1)	21950 (97.6)	24530 (109.1)	29710 (132.2)		
#5	5 (127)	(1) 5/8 X 5	15000 (66.7)	16920 (75.3)	18830 (83.8)	22650 (100.8)	18600 (82.7)	27900 (124.1)
	7-1/2 (184)	(1) 5/8 X 5 & (1) 1/2 X 4-1/4	22490 (100.4)	25370 (112.9)	28240 (125.6)	33980 (151.1)		
	10 (254)	(2) 5/8 X 5	29990 (133.4)	33820 (150.4)	37650 (167.5)	45310 (201.5)		
#6	6-5/8 (168)	(1) 7/8 X 6-5/8	21020 (93.5)	24250 (107.9)	27470 (122.2)	33930 (150.9)	26400 (117.4)	39600 (176.1)
	10 (254)	(2) 3/4 X 6-5/8	31530 (140.3)	36370 (161.8)	41210 (183.3)	50890 (226.4)		
	13-1/4 (337)	(2) 7/8 X 6-5/8	42040 (187.0)	48500 (215.7)	54950 (244.4)	67850 (301.8)		
#7	6-5/8 (168)	(1) 1 X 8-1/4	23650 (105.2)	27280 (121.3)	30910 (137.5)	38170 (169.8)	36000 (160.1)	54000 (240.2)
	10 (254)	(2) 3/4 X 6-5/8	35470 (157.8)	40920 (182.0)	46360 (206.2)	57250 (254.7)		
	13-1/4 (337)	(2) 1 X 8-1/4	47300 (210.4)	54560 (242.7)	61810 (274.9)	76330 (339.5)		
#8	8-1/4 (210)	(1) 1 X 8-1/4 & (1) 5/8 X 5	35640 (158.5)	40500 (180.2)	45360 (201.8)	55080 (245.0)	47400 (210.8)	71100 (316.3)
	12/3/8 (314)	(1) 7/8 X 6-5/8 & (1) 1 X 8-1/4	53460 (237.8)	60750 (270.2)	68040 (302.7)	82610 (367.5)		
	16/1/2 (419)	(2) 1 X 8-1/4 & (1) 3/4 X 6-5/8	71270 (317.0)	80990 (360.3)	90710 (403.5)	110150 (490.0)		

1 Use lower of either bond/concrete or steel strength.

HVA Capsule Adhesive Anchoring System 3.2.10

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

Rebar Size	Embed. Depth mm (in)	Adhesive Capsule(s) Required	HVU Allowable Tensile Concrete/Bond Strength[1]				Strength Properties of Metric Rebar f_y = 400 MPa	
			14 MPa (2000 psi) kN (lb)	20 MPa (3000 psi) kN (lb)	28 MPa (4000 psi) kN (lb)	40 MPa (6000 psi) kN (lb)	Yield Strength kN (lb)	Tensile Strength kN (lb)
15M	125 (5)	(1) M16	16.7 (3750)	18.8 (4230)	21.0 (4705)	25.2 (5660)	80 (17985)	120 (26975)
	185 (7-1/2)	(1) M16 & (1) M12	25.1 (5620)	28.2 (6340)	31.4 (7060)	37.8 (8495)		
	255 (10)	(2) M16	33.4 (7495)	37.6 (8455)	41.9 (9410)	50.4 (11325)		
20M	170 (6-5/8)	(1) M20	23.4 (5255)	27.0 (6060)	30.6 (6865)	37.7 (8480)	120 (26975)	180 (40465)
	255 (10)	(2) 3/4 x 6-5/8	35.1 (7880)	40.5 (9090)	45.8 (10300)	56.6 (12720)		
	340 (13-1/4)	(2) M20	46.8 (10510)	53.9 (12125)	61.1 (13735)	75.4 (16960)		
25M	210 (8-1/4)	(1) M24	39.6 (8910)	45.0 (10125)	50.4 (11340)	61.3 (13770)	200 (44960)	300 (67440)
	315 (12-3/8)	(1) M24 & (1) 3/4 x 6-5/8	59.4 (13365)	67.6 (15185)	75.7 (17010)	91.9 (20650)		
	420 (16-1/2)	(2) M24	79.2 (17815)	90.1 (20245)	100.9 (22675)	122.5 (27535)		

1 Allowable bond/concrete strength based on a safety factor of 4.0.

2 For anchor spacing and edge distance guidelines, refer to the following pages of this HVA Adhesive Anchor System section.

3 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 = $0.45 \times F_u \times A_{nom}$

3.2.10 HVA Capsule Adhesive Anchoring System

HVA Ultimate Bond Capacity and Steel Strength for Metric Rebar in Concrete (Canada Only)[1,2]

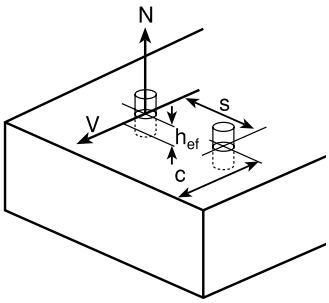
Rebar Size	Embed. Depth mm (in)	Adhesive Capsule(s) Required	HVU Ultimate Tensile Concrete/Bond Strength[1]				Strength Properties of Metric Rebar f_y = 400 MPa	
			14 MPa (2000 psi) kN (lb)	20 MPa (3000 psi) kN (lb)	28 MPa (4000 psi) kN (lb)	40 MPa (6000 psi) kN (lb)	Yield Strength kN (lb)	Tensile Strength kN (lb)
15M	125 (5)	(1) M16	66.7 (15000)	75.3 (16920)	83.3 (18830)	100.8 (22650)	80 (17985)	120 (26975)
	185 (7-1/2)	(1) M16 & (1) M12	100.4 (22490)	112.9 (25370)	125.6 (28240)	151.1 (33980)		
	255 (10)	(2) M16	133.4 (29990)	150.4 (33820)	167.5 (37650)	201.5 (45310)		
20M	170 (6-5/8)	(1) M20	93.5 (21020)	107.9 (24250)	122.2 (27470)	150.9 (33930)	120 (26975)	180 (40465)
	255 (10)	(2) 3/4 x 6-5/8	140.3 (31530)	161.8 (36370)	183.3 (41210)	226.4 (50890)		
	340 (13-1/4)	(2) M20	187.0 (42040)	215.7 (48500)	244.4 (54950)	301.8 (67850)		
25M	210 (8-1/4)	(1) M24	158.5 (35640)	180.2 (40500)	201.8 (45360)	245.0 (55080)	200 (44960)	300 (67440)
	315 (12-3/8)	(1) M24 & (1) 3/4 x 6-5/8	237.8 (53460)	270.2 (60750)	302.7 (68040)	367.5 (82610)		
	420 (16-1/2)	(2) M24	317.0 (71270)	360.3 (80990)	403.5 (90710)	490.0 (110150)		

1 Actual tensile bond test data developed for imperial-sized rebar. Yield and ultimate rebar strengths are for metric sizes.

2 For anchor spacing and edge distance guidelines, refer to the following pages of this HVA Adhesive Anchor System section.

HVA Capsule Adhesive Anchoring System 3.2.10

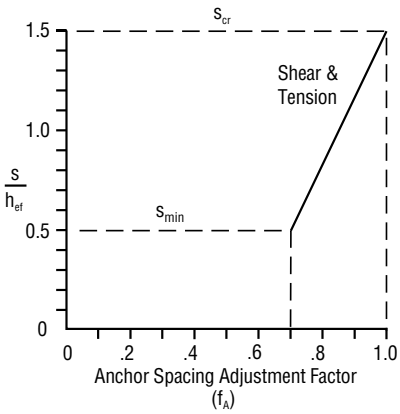
Anchor Spacing and Edge Distance Guidelines in Concrete



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

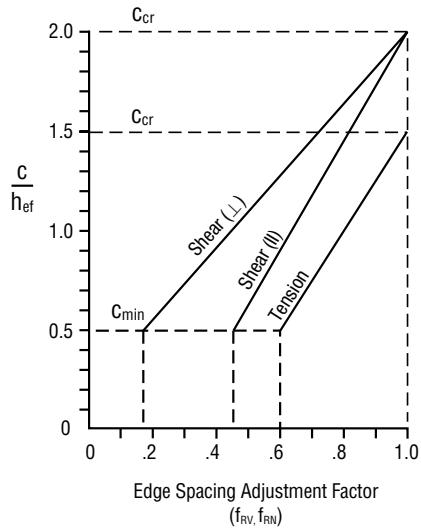
Anchor Spacing Adjustment Factors

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



Edge Distance Adjustment Factors

c = Actual edge distance
h_{ef} = Actual embedment
c_{min} = 0.5 h_{ef} Tension and shear
c_{cr} = 1.5 h_{ef} Tension
= 2.0 h_{ef} Shear
⊥ = Perpendicular to edge
II = Parallel to edge



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		3-1/2	5-1/4	7	3-1/2	5-1/4	7	3-1/2	5-1/4	7	3-1/2	5-1/4	7
Spacing (s)/Edge Distance (c), in.	1-3/4	0.70			0.60			0.18			0.46		
	2	0.72			0.63			0.22			0.49		
	2-5/8	0.78	0.70		0.70	0.60		0.32	0.18		0.55	0.46	
	3	0.81	0.72		0.74	0.63		0.37	0.22		0.59	0.49	
	3-1/2	0.85	0.75	0.70	0.80	0.67	0.60	0.45	0.27	0.18	0.64	0.52	0.46
	4	0.89	0.78	0.72	0.86	0.70	0.63	0.53	0.32	0.22	0.69	0.55	0.49
	4-1/2	0.94	0.81	0.74	0.91	0.74	0.66	0.60	0.37	0.26	0.74	0.59	0.51
	5-1/4	1.00	0.85	0.78	1.00	0.80	0.70	0.72	0.45	0.32	0.82	0.64	0.55
	6		0.89	0.81		0.86	0.74	0.84	0.53	0.37	0.90	0.69	0.59
	7		0.95	0.85		0.93	0.80	1.00	0.63	0.45	1.00	0.76	0.64
	7-7/8		1.00	0.89		1.00	0.85		0.72	0.52		0.82	0.69
	8-1/2			0.89			0.86		0.78	0.57		0.86	0.72
	9			0.91			0.89		0.84	0.60		0.90	0.74
	10			0.94			0.91		0.94	0.68		0.97	0.79
	10-1/2			0.96			0.94		1.00	0.72		1.00	0.82
	12			0.98			0.97			0.84			0.90
	13			1.00			1.00			0.91			0.95
	14									1.00			1.00

3.2.10 HVA Capsule 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		4-1/4	6-3/8	8-1/2	4-1/4	6-3/8	8-1/2	4-1/4	6-3/8	8-1/2	4-1/4	6-3/8	8-1/2
Spacing (s)/Edge Distance (c), in.	2-1/8	0.70			0.60			0.18			0.46		
	3	0.76			0.68			0.29			0.53		
	3-3/16	0.78	0.70		0.70	0.60		0.32	0.18		0.55	0.46	
	3-1/2	0.80	0.71		0.73	0.62		0.35	0.21		0.58	0.48	
	4	0.83	0.74		0.78	0.65		0.42	0.25		0.62	0.51	
	4-1/4	0.85	0.75	0.70	0.80	0.67	0.60	0.45	0.27	0.18	0.64	0.52	0.46
	5	0.90	0.79	0.73	0.87	0.71	0.64	0.55	0.33	0.23	0.70	0.56	0.49
	5-1/2	0.94	0.81	0.74	0.92	0.75	0.66	0.61	0.38	0.26	0.75	0.59	0.51
	6	0.97	0.83	0.76	0.96	0.78	0.68	0.67	0.42	0.29	0.79	0.62	0.53
	6-3/8	1.00	0.85	0.78	1.00	0.80	0.70	0.72	0.45	0.32	0.82	0.64	0.55
	7		0.88	0.80		0.84	0.73	0.80	0.50	0.35	0.87	0.68	0.58
	8		0.93	0.83		0.90	0.78	0.93	0.59	0.42	0.96	0.73	0.62
	8-1/2		0.95	0.85		0.93	0.80	1.00	0.63	0.45	1.00	0.76	0.64
	9		0.97	0.87		0.96	0.82		0.67	0.48		0.79	0.66
	9-9/16		1.00	0.89		1.00	0.85		0.72	0.52		0.82	0.69
	10			0.90			0.87		0.76	0.55		0.84	0.70
	10-1/2			0.92			0.89		0.80	0.58		0.87	0.72
	12			0.97			0.96		0.93	0.67		0.96	0.79
	12-3/4			1.00			1.00		1.00	0.72		1.00	0.82
	14									0.80			0.87
	16									0.93			0.96
	17									1.00			1.00

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		5	7-1/2	10	5	7-1/2	10	5	7-1/2	10	5	7-1/2	10	6-5/8	10	13-1/4	6-5/8	10	13-1/4	6-5/8	10	13-1/4	6-5/8	10	13-1/4
Spacing (s)/Edge Distance (c), in.	2-1/2	0.70			0.60			0.18			0.46														
	3-5/16	0.75			0.67			0.27			0.52			0.70			0.60			0.18			0.46		
	3-3/4	0.78	0.70		0.70	0.60		0.32	0.18		0.55	0.46		0.72			0.63			0.22			0.48		
	4	0.79	0.71		0.72	0.61		0.34	0.20		0.57	0.47		0.73			0.64			0.24			0.50		
	4-1/2	0.82	0.73		0.76	0.64		0.40	0.23		0.60	0.50		0.75			0.67			0.28			0.52		
	5	0.85	0.75	0.70	0.80	0.67	0.60	0.45	0.27	0.18	0.64	0.52	0.46	0.78	0.70		0.70	0.60		0.32	0.18		0.55	0.46	
	5-1/2	0.88	0.77	0.72	0.84	0.69	0.62	0.50	0.31	0.21	0.68	0.54	0.48	0.80	0.72		0.73	0.62		0.36	0.21		0.58	0.48	
	6	0.91	0.79	0.73	0.88	0.72	0.64	0.56	0.34	0.23	0.71	0.57	0.50	0.82	0.73		0.76	0.64		0.40	0.23		0.61	0.50	
	6-5/8	0.95	0.82	0.75	0.93	0.75	0.67	0.63	0.39	0.27	0.76	0.60	0.52	0.85	0.75	0.70	0.80	0.67	0.60	0.45	0.27	0.18	0.64	0.52	0.46
	7	0.97	0.83	0.76	0.96	0.77	0.68	0.67	0.41	0.29	0.78	0.62	0.53	0.87	0.76	0.71	0.82	0.68	0.61	0.48	0.29	0.20	0.66	0.53	0.47
	7-1/2	1.00	0.85	0.78	1.00	0.80	0.70	0.72	0.45	0.32	0.82	0.64	0.55	0.89	0.78	0.72	0.85	0.70	0.63	0.52	0.32	0.22	0.69	0.55	0.48
	8		0.87	0.79		0.83	0.72	0.77	0.49	0.34	0.86	0.66	0.57	0.91	0.79	0.73	0.88	0.72	0.64	0.56	0.34	0.24	0.71	0.57	0.50
	9		0.91	0.82		0.88	0.76	0.88	0.56	0.40	0.93	0.71	0.60	0.96	0.82	0.75	0.94	0.76	0.67	0.64	0.40	0.28	0.77	0.60	0.52
	9-15/16		0.95	0.85		0.93	0.80	0.98	0.63	0.45	1.00	0.76	0.64	1.00	0.85	0.78	1.00	0.80	0.70	0.72	0.45	0.32	0.82	0.64	0.55
	10		0.95	0.85		0.93	0.80	1.00	0.63	0.45		0.76	0.64		0.85	0.78		0.80	0.70	0.73	0.45	0.32	0.82	0.64	0.55
	11-1/4		1.00	0.89		1.00	0.85		0.72	0.52		0.82	0.69		0.89	0.80		0.85	0.74	0.83	0.52	0.37	0.89	0.69	0.59
	12			0.91			0.88		0.77	0.56		0.86	0.71		0.91	0.82		0.88	0.76	0.89	0.56	0.40	0.93	0.71	0.61
	13			0.94			0.92		0.85	0.61		0.90	0.75		0.94	0.84		0.92	0.79	0.97	0.61	0.44	0.99	0.75	0.63
	13-1/4			0.95			0.93		0.86	0.63		0.92	0.76		0.95	0.85		0.93	0.80	1.00	0.63	0.45	1.00	0.76	0.64
	15			1.00			1.00		1.00	0.72		1.00	0.82		1.00	0.89		1.00	0.85		0.72	0.52		0.82	0.69
	18									0.88			0.93			0.96			0.94		0.88	0.64		0.93	0.77
	20									1.00			1.00			1.00			1.00		1.00	0.73		1.00	0.82
	22																					0.81			0.88
	24																					0.89			0.93
	26-1/2																					1.00			1.00

HVA Capsule Adhesive Anchoring System 3.2.10

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 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		6-5/8	10	13-1/4	6-5/8	10	13 1/4	6-5/8	10	13-1/4	6-5/8	10	13-1/4
Spacing (s)/Edge Distance (c), in.	3-5/16	0.70			0.60			0.18			0.46		
	4	0.73			0.64			0.24			0.50		
	4-1/2	0.75			0.67			0.28			0.52		
	5	0.78	0.70		0.70	0.60		0.32	0.18		0.55	0.46	
	6	0.82	0.73		0.76	0.64		0.40	0.23		0.61	0.50	
	6-5/8	0.85	0.75	0.70	0.80	0.67	0.60	0.45	0.27	0.18	0.64	0.52	0.46
	7	0.87	0.76	0.71	0.82	0.68	0.61	0.48	0.29	0.20	0.66	0.53	0.47
	8	0.91	0.79	0.73	0.88	0.72	0.64	0.56	0.34	0.24	0.71	0.57	0.50
	9	0.96	0.82	0.75	0.94	0.76	0.67	0.64	0.40	0.28	0.77	0.60	0.52
	9-15/16	1.00	0.85	0.78	1.00	0.80	0.70	0.72	0.45	0.32	0.82	0.64	0.55
	10		0.85	0.78		0.80	0.70	0.73	0.45	0.32	0.82	0.64	0.55
	11		0.88	0.80		0.84	0.73	0.81	0.50	0.36	0.88	0.68	0.58
	12		0.91	0.82		0.88	0.76	0.89	0.56	0.40	0.93	0.71	0.61
	13		0.94	0.84		0.92	0.79	0.97	0.61	0.44	0.99	0.75	0.63
	13-1/4		0.95	0.85		0.93	0.80	1.00	0.63	0.45	1.00	0.76	0.64
	14		0.97	0.87		0.96	0.82		0.67	0.48		0.78	0.66
	15		1.00	0.89		1.00	0.85		0.72	0.52		0.82	0.69
	16			0.91			0.88		0.77	0.56		0.86	0.71
	18			0.96			0.94		0.88	0.64		0.93	0.77
	20			1.00			1.00		1.00	0.73		1.00	0.82
	22									0.81			0.88
	24									0.89			0.93
	26-1/2									1.00			1.00

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		8-1/4	12-3/8	16-1/2	8-1/4	12-3/8	16-1/2	8-1/4	12-3/8	16-1/2	8-1/4	12-3/8	16-1/2	12	15	18	12	15	18	12	15	18	12	15	18
Spacing (s)/Edge Distance (c), in.	4-1/8	0.70			0.60			0.18			0.46														
	4-1/2	0.71			0.62			0.20			0.48														
	5	0.73			0.64			0.24			0.50														
	6	0.77			0.69			0.30			0.54			0.70			0.60			0.18			0.46		
	6-3/16	0.78	0.70		0.70	0.60		0.32	0.18		0.55	0.46		0.70			0.61			0.19			0.47		
	7	0.80	0.72		0.74	0.63		0.37	0.22		0.59	0.48		0.73			0.63			0.23			0.49		
	7-1/2	0.82	0.73		0.76	0.64		0.40	0.24		0.61	0.50		0.74	0.70		0.65	0.60		0.25	0.18		0.51	0.46	
	8-1/4	0.85	0.75	0.70	0.80	0.67	0.60	0.45	0.27	0.18	0.64	0.52	0.46	0.76	0.72		0.68	0.62		0.28	0.21		0.53	0.48	
	9	0.88	0.77	0.71	0.84	0.69	0.62	0.50	0.30	0.20	0.67	0.54	0.48	0.78	0.73	0.70	0.70	0.64	0.60	0.32	0.23	0.18	0.55	0.50	0.46
	10	0.91	0.79	0.73	0.88	0.72	0.64	0.56	0.35	0.24	0.72	0.57	0.50	0.80	0.75	0.72	0.73	0.67	0.62	0.36	0.27	0.21	0.58	0.52	0.48
	11	0.95	0.82	0.75	0.93	0.76	0.67	0.63	0.39	0.27	0.76	0.60	0.52	0.83	0.77	0.73	0.77	0.69	0.64	0.41	0.31	0.24	0.61	0.54	0.50
	12-3/8	1.00	0.85	0.78	1.00	0.80	0.70	0.72	0.45	0.32	0.82	0.64	0.55	0.86	0.80	0.76	0.81	0.73	0.68	0.47	0.36	0.28	0.65	0.58	0.53
	13		0.87	0.79		0.82	0.72	0.76	0.48	0.34	0.85	0.66	0.56	0.88	0.81	0.77	0.83	0.75	0.69	0.50	0.38	0.30	0.67	0.59	0.54
	14		0.89	0.80		0.85	0.74	0.83	0.52	0.37	0.89	0.69	0.59	0.90	0.83	0.78	0.87	0.77	0.71	0.54	0.41	0.33	0.70	0.62	0.56
	16		0.94	0.84		0.92	0.79	0.96	0.61	0.43	0.98	0.75	0.63	0.95	0.87	0.82	0.93	0.83	0.76	0.63	0.49	0.39	0.76	0.66	0.60
	16-1/2		0.95	0.85		0.93	0.80	1.00	0.63	0.45	1.00	0.76	0.64	0.96	0.88	0.83	0.95	0.84	0.77	0.65	0.50	0.41	0.78	0.68	0.61
	18		0.99	0.88		0.98	0.84		0.70	0.50		0.80	0.67	1.00	0.91	0.85	1.00	0.88	0.80	0.72	0.56	0.45	0.82	0.71	0.64
	18-9/16		1.00	0.89		1.00	0.85		0.72	0.52		0.82	0.69		0.92	0.86		0.90	0.81	0.75	0.58	0.47	0.84	0.73	0.65
	22-1/2			0.96			0.95		0.89	0.65		0.93	0.77		1.00	0.93		1.00	0.90	0.92	0.72	0.59	0.96	0.82	0.73
	24			0.99			0.98		0.96	0.70		0.98	0.80			0.95			0.93	1.00	0.77	0.63	1.00	0.86	0.76
	24-3/4			1.00			1.00		1.00	0.72		1.00	0.82			0.96			0.95		0.80	0.65		0.87	0.78
	27									0.79			0.87			1.00			1.00		0.88	0.72		0.93	0.82
	30									0.89			0.93								1.00	0.81		1.00	0.88
	33									1.00			1.00									0.90			0.94
	36																					1.00			1.00

3.2.10 HVA Capsule Adhesive Anchoring System

Chemical Resistance Table

Chemical/Liquid	% by Weight	Not Resistant	Partially Resistant	Resistant
Acetic acid	conc. 10%		•	•
Acetone		•		
Ammonia	25% 5%	•	•	
Ammonium nitrate Ammonium sulphate	10% 10%			• •
Carbolic acid solution (Phenol)	10%	•		
Carbon tetrachloride	conc.			•
Caustic soda Sodium hydroxide	40% 20%			• •
Chlorinated lime solution	conc.			•
Citric acid	10%			•
Common salt solution	10%			•
Communal waste water				•
Diesel oil				•
Ethanol	96%		•	
Ethylene glycol	conc.			•
Formic acid	10%			•
Hydrochloric acid	20%		•	
Hydrogen peroxide	30% 5%		•	•
Lactic acid	50% 10%			• •
Machine oil				•
Methanol	conc.	•		
Methyl isobutyl ketone	conc.			•
Mixture of amines	Vol%[1]			•
Mixture of aromatic hydrocarbons	Vol%[2]			•
Nitric acid	40% 20%	•	•	
Petrol/Gasoline				•
Phosphoric acid	40% 20%			• •
2-Propanol	conc.			•
Propylene glycol	conc.			•
Sodium carbonate	10%			•
Sodium Silicate (pH=14)	50%			•
Sulphuric acid	40% 20%			• •
Xylene	conc.			•

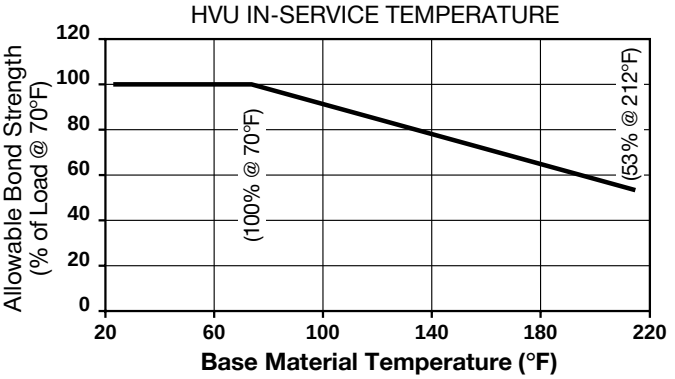
1 35 Vol% Triethanolamine, 30 Vol% n-Butylamine and 35 Vol% N,N-Dimethylaniline

2 60 Vol% Toluene, 30 Vol% Xylene and 10 Vol% Methylnaphthalene

Samples of the HVU Resin were immersed in the various chemical compounds for up to one year. At the end of the test period, the samples were analyzed. Any samples showing no visible damage and having less than a 25% reduction in bending (flexural) strength were classified as ***Resistant.*** Samples that had slight damage, such as small cracks, chips, etc. or reduction in bending strength of 25% or more, were classified as ***Partially Resistant.*** Samples that were heavily damaged or destroyed were classified as ***Not Resistant.***

Note: In actual use, the majority of the resin is encased in the concrete, leaving very little surface area exposed. In some cases, this would allow the HVA system to be used where it would be exposed to the **"Partially Resistant"** chemical compounds.

Influence of Temperature on Bond Strength



Note: Test procedure involves the concrete being held at the temperature for 24 hours then 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.

HVU Capsule Volume

Size	Vol (in^3)
HVU 3/8" (M10)	0.37
HVU 1/2" (M12)	0.61
HVU 5/8" (M16)	1.04
HVU 3/4"	2.07
HVU 7/8" (M20)	2.62
HVU 1" (M24)	4.21
HVU 1-1/4" (M32)	9.46

Curing Time Table (Approximate)

Base Material Temperature		Approx. Full Cure Time
°F	°C	
23	–5	5 hr
32	0	1 hr
50	10	30 min
above 68	20	20 mn

Influence of High Energy Radiation

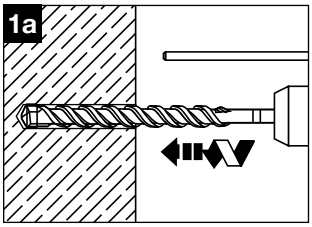
Radiation Exposure[1,2]	Detrimental Effect	Recommendation for Use
< 10 Mrad	Insignificant	Full Use
10 – 100 Mrad	Moderate	Restricted Use $F_{rec.} = 0.5\ F_{perm.}$
> 100 Mrad	Medium to strong	No recommendation for use

1 Mrad = Megarad

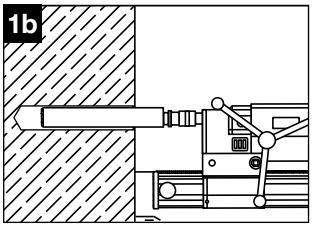
2 Dosage over life span.

3.2.10.4 Installation Instructions

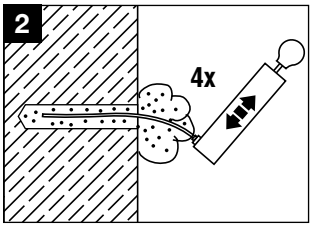
HAS Rod, Rebar and Insert Installation Instructions



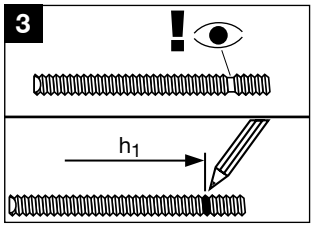
1a. Drilling the hole - Rotary hammer drill: Set the depth gauge to the correct drilling depth.



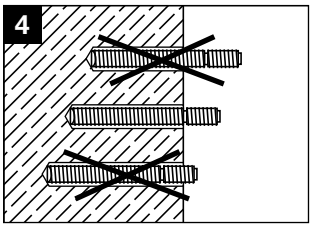
1b. Drilling the hole - Diamond coring: Mark the correct drilling depth on the height adjustment mechanism.



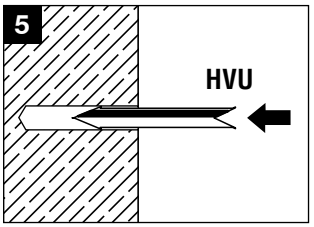
2. Clean the hole immediately before setting the anchor. Remove drilling dust and standing water from the base of the hole by blowing out well with at least 4 strokes of the blow-out pump, or using compressed air or an industrial vacuum cleaner. The anchor holes must be free of dust, water, ice, oil, bitumen, chemicals or any other foreign matter or contaminants. **Poorly-cleaned holes = poor hold.**



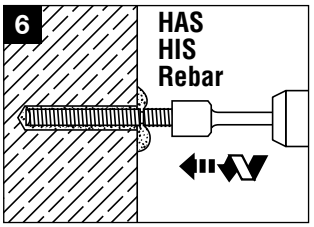
3. Ensure that the specified setting depth is marked on the anchor rod. If not, add an embedment mark, for example with tape or marker.



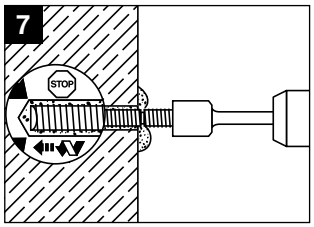
4. Caution! Check that the hole is drilled to the correct depth before setting the anchor. Hole depth is correct when the anchor rod contacts the base of the hole and the setting depth mark coincides with the concrete surface.



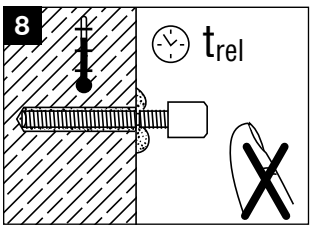
5. Push the anchor capsule into the drilled hole.



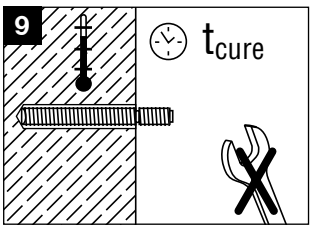
6. Use the setting tool at a speed of 250–1000 r.p.m. to drive the anchor rod into the hole, applying moderate pressure and with the hammering action switched on.



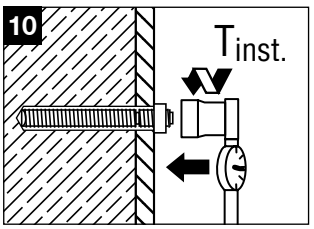
7. Switch off the rotary hammer drill immediately when the specified setting depth is reached (refer to mark on the anchor rod). After setting, adhesive mortar must fill the annular gap completely, right up to the concrete surface. Caution! Prolonged rotary action may cause mortar to be forced out of the hole, resulting in reduced anchor loading capacity.



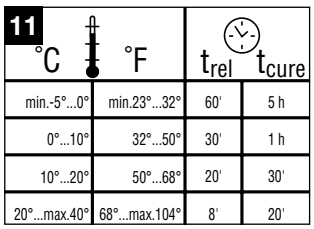
8. The working time “t rel”, which depends on base material temperature, must be observed (see fig. 11). The screwed-on setting tool may be removed only after the time “t rel” has elapsed.



9. After reaching the end of the working time “t rel”, do not manipulate or disturb the anchor rod in any way until the curing time “t cure” has elapsed.



10. A load may be applied to the anchor only after the curing time “t cure” has elapsed.



°C	°F	t_{rel}	t_{cure}
min.-5°...0°	min.23°...32°	60'	5 h
0°...10°	32°...50°	30'	1 h
10°...20°	50°...68°	20'	30'
20°...max.40°	68°...max.104°	8'	20'

11. The working time “t rel” and curing time “t cure”, which depend on base material temperature, must be observed!

3.2.10 HVA Capsule Adhesive Anchoring System

3.2.10.5 Ordering Information

HVU Adhesive Capsule

Gel/Full Cure Time Table (Approximate)

Base Material Temperature			
° F	° C	t_{gel}	t_{cure}
23	-5	60 min	5 hrs
32	0	30 min	1 hrs
50	10	20 min	30 min
68	20	8 min	20 min

Features and Applications

High loading capacity

- Small edge distance and anchor spacing allowance
- Excellent dynamic load resistance
- Excellent performance in diamond cored holes
- Excellent performance in freezing and thawing conditions
- No hole brushing required — just blow out the hole with compressed air — makes installation fast and eas
- Fast curing for high productivity

Technical Data	HVU
Product	Urethane Methacrylate
Base material temperature	23º F to 104º F (-5º C to 40º C)
Diameter range	3/8" to 1-1/4"

Listings/Approvals
- NSF/ANSI Standard 61 Certification for use in potable water

HVU Adhesive Capsules

HVU Anchor System with Threaded Rods		Setting Nuts[2,3]			
Capsule Size	Qty	Description	Qty	Hole Dia	Std Embed
HVU 3/8" x 3-1/2"	10	**3/8"**	10	7/16"	3-1/2"
HVU 1/2" x 4-1/4"	10	**1/2"**	10	9/16"	4-1/4"
HVU 5/8 x 5"	10	**5/8"**	5	11/16"	5"
HVU 3/4" x 6-5/8"	5	**3/4"**	5	7/8"	6-5/8"
HVU 7/8" x 6-5/8"	5	**7/8"**	5	1"	6-5/8"
HVU 1" x 8-1/4"	5	**1"**	5	1-1/8"	8-1/4"
HVU 1-1/4" x 12"	4	**1-1/4"**	5	1-3/8"	12"


HAS-E-Rod


HAS Setting Tool

HVU Anchor System with Internal Threaded Inserts		HIS-S Setting Tool[1]			
Capsule Size	Qty	Description	Drive Socket	Hole Dia	Std Embed
HVU 1/2" x 4-1/4"	10	**3/8"**	9/16"	11/16"	4-1/4"
HVU 5/8" x 5"	10	**1/2"**	3/4"	7/8"	5"
HVU 7/8" x 6-5/8"	5	**5/8"**	15/16"	1-1/8"	6-5/8"
HVU 1" x 8-1/4"	5	**3/4"**	1-1/8"	1-1/4"	8-1/4"


HIS Insert


HIS Setting Tool

	HVU Anchor System with Rebar		Rebar Setting Tool TE-Y		
Rebar Size	Capsule Size	Qty	Description	Hole Dia	Std Embed
#4	**HVU 1/2" x 4-1/4"**	10	**Rebar Adapter #4**	5/8"	4-1/4"
#5	**HVU 5/8" x 5"**	10	**Rebar Adapter #5**	13/16"	5"
#6	**HVU 7/8" x 6-5/8"**	5	**Rebar Adapter #6**	1"	6-5/8"
#7	**HVU 1" x 8-1/4"**	5	**Rebar Adapter #7**	1-1/8"	6-5/8"
#8	**HVU 5/8" x 5" and HVU 1" x 8-1/4"** (both capsules needed)	10 5	**Rebar Adapter #8**	1-1/4"	8-1/4"


Rebar


Rebar Setting Tool

1 To be used with appropriate drive socket and drive shaft from selector chart at left. Setting nuts not required with HIS setting tools
2 Setting nuts are required for proper fit of drive socket
3 Setting nuts have a black finished coating except 7/8" which are HDG


Drive Shaft & Socket
(Use when setting HAS rods and HIS inserts)

Setting Tools

	Square Drive Shaft 1/2"	Square Drive Shaft 3/4"	Square Drive Shaft 1"
HAS Rod Diameter	Drive Socket	Drive Socket	Drive Socket
3/8"	**9/16" x 1/2"**	**-**	**-**
1/2"	**3/4" x 1/2"**	**3/4" x 3/4"**	**-**
5/8"	**15/16" x 1/2"**	**15/16" x 3/4"**	**-**
3/4"	**-**	**1-1/8" x 3/4"**	**-**
7/8"	**-**	**1-7/16" x 3/4"**	**-**
1"	**-**	**1-1/2" x 3/4"**	**-**
1-1/4"	**-**	-	**1-7/8" x 1"**

HVA Capsule Adhesive Anchoring System 3.2.10

Threaded Anchors for Hilti Chemical Anchor Systems

HAS-E Rods 5.8 Steel			HAS-E B High Strength Steel		HAS-R 304 Stainless Steel		HAS-R 316 Stainless Steel	
Description	Qty	Master Carton Qty	Description	Qty	Description	Qty	Description	Qty
3/8" x 3"	10	360	**-**	-	**-**	-	**-**	-
3/8" x 4-3/8"	10	240	**-**	-	**-**	-	**-**	-
3/8"x 5-1/8"	20	200	**3/8" x 5-1/8"**	10	**3/8" x 5-1/8"**	20	**3/8" x 5-1/8"**	10
3/8" x 8"	10	160	**-**	-	**3/8" x 8"**	10	**-**	-
3/8" x 12"	10	90	**-**	-	**-**	-	**3/8" x 8"**	10
1/2" x 3-1/8"	10	240	**-**	-	**-**	-	**-**	-
1/2" x 4-1/2"	10	160	**-**	-	**-**	-	**-**	-
1/2" x 6-1/2"	20	160	**1/2" x 6-1/2"**	10	**1/2" x 6-1/2"**	20	**1/2" x 6-1/2"**	10
1/2"x 8"	10	120	**-**	-	**1/2" x 8"**	10	**1/2" x 8"**	10
1/2" x 10"	10	120	**-**	-	**1/2" x 10"**	10	**-**	-
-	-	-	**-**	-	**-**	-	**1/2" x 11" ***	10
1/2" x 12"	10	80	**-**	-	**-**	-	**1/2" x 12"**	10
5/8" x 8"	20	80	**5/8" x 7-5/8"**	10	**5/8" x 7-5/8"**	20	**5/8" x 7-5/8"**	10
-	-	-	**-**	-	**5/8" x 10"**	10	**-**	-
5/8" x 9"	10	60	**-**	-	**-**	-	**5/8" x 9"**	10
5/8" x 12"	10	60	**-**	-	**-**	-	**5/8" x 12"**	10
5/8" x 17"	10	40	**-**	-	**-**	-	**-**	-
3/4" x 10"	10	40	**3/4" x 9-5/8"**	5	**3/4" x 9-5/8"**	10	**3/4" x 9-5/8" ***	5
3/4" x 11"	10	30	**-**	-	**-**	-	**3/4" x 10"**	5
3/4" x 12"	10	30	**-**	-	**3/4" x 12"**	10	**-**	-
3/4" x 14"	10	30	**3/4" x 14" ***	5	**3/4" x 14"**	10	**3/4" x 16"**	5
-	-	-	**-**	-	**3/4" x 16"**	10	**-**	-
3/4" x 17"	10	20	**-**	-	**-**	-	**7/8" x 10"**	5
3/4" x 19"	10	20	**-**	-	**-**	-	**-**	-
3/4" x 21"	10	20	**-**	-	**-**	-	**-**	-
3/4" x 25"	10	20	**-**	-	**-**	-	**7/8" x 16"**	5
7/8" x 10"	10	20	**7/8" x 10" (HDG)**	5	**7/8" x 10"**	10	**-**	-
-	-	-	**7/8" x 12" (HDG) ***	5	**-**	-	**-**	-
7/8" x 13"	10	20	**7/8" x 16" (HDG)**	5	**-**	-	**-**	-
1" x 12"	4	16	**1" x 12"**	5	**1" x 12"**	4	**1" x 12" ***	4
1" x 14"	2	16	**1" x 14" ***	5	**-**	-	**-**	-
1" x 16"	2	12	**1" x 16" ***	5	**-**	-	**1" x 16" ***	4
1" x 20"	2	12	**1" x 21" ***	5	**-**	-	**1" x 20" ***	4
1-1/4" x 16"	4	8	**1-1/4" x 16"**	4	**-**	-	**-**	-
1-1/4" x 22"	4	8	**-**	-	**-**	-	**-**	-
-	-	-	**1-1/4" x 23" ***	4	**-**	-	**-**	-

*Item not returnable

HIS Carbon Steel and HIS-R 316 Stainless Steel Internally Threaded Inserts

Description	Useable Thread Length (in)	Qty	Qty
3/8" x 4-1/4"	1"	10	10
1/2" x 5"	1-3/16"	5	5
5/8" x 6-5/8"	1-1/2"	5	5
3/4" x 8-1/4"	2"	5	5

Hilti Rods are now stamped on the end to show grade of steel and overall anchor length!

E = ISO 898 Class 5.8 Steel

B = ASTM A 193, Grade B7 Steel

R1 = AISI 304 Stainless Steel

R2 = AISI 316 Stainless Steel

Notes

MATERIAL SAFETY DATA SHEET

Product name: **HVU Adhesive Capsules**

Description: 2-part adhesive anchoring system enclosed in a sealed foil pouch / capsule

Supplier: Hilti, Inc., P.O. Box 21148, Tulsa, OK 74121; Ph: 1 800 879 6000

Emergency # (Chem-Trec.): 1 800 424 9300 (USA, PR, Virgin Islands, Canada); 001 703 527 3887 (other countries)

INGREDIENTS AND EXPOSURE LIMITS

Ingredients:	CAS Number:	TLV: (mg/m^3)	PEL: (mg/m^3)	STEL:
Part A:				
Silicon dioxide (quartz sand)	14808-60-7	0.05 (R)	$\frac{10\ mg/m^3}{\%SiO_2 + 2}$ (R)	NE
Urethane methacrylate resin	19136100-5001 (NJ TSRN)	NE	NE	NE
Methacrylate ester	19136100-5005 (NJ TSRN)	NE	NE	NE
Hydroxypropyl methacrylate	27813-02-1	NE	NE	NE
Silica filled polydimethylsiloxane	67762-90-7	2 mg/m^3	NE	NE
Part B:				
Dicyclohexyl phthalate	00084-61-7	NE	NE	NE
Dibenzoyl peroxide	00094-36-0	5	5	NE

Abbreviations: **NJ TSRN** = New Jersey Trade Secret Registry Number. **PEL** = OSHA Permissible Exposure Limit. **TLV** = ACGIH Threshold Limit Value. **STEL** = Short Term Exposure Limit. **NE** = None Established. **NA** = Not Applicable. **(R)** indicates "as respirable fraction". NOTE: Since this product is an encapsulated paste, these exposure limits are for dust are not relevant.

PHYSICAL DATA

Appearance:	Yellowish paste	**Odor:**	Ester-like odor
Vapor Density: (air = 1)	Not determined	**Vapor Pressure:**	Not applicable
Boiling Point:	Not determined	**VOC Content:**	78.5 g/l
Evaporation Rate:	Not determined	**Solubility in Water:**	Insoluble
Specific Gravity:	1.1 – 1.3	**pH:**	Not determined

FIRE AND EXPLOSION HAZARD DATA

Flash Point:	> 200° F	**Flammable Limits:**	Not applicable
Extinguishing Media:	Water fog, CO_2, dry chemical, foam		
Special Fire Fighting Procedures:	None known.		
Unusual Fire and Explosion Hazards:	None known.		

REACTIVITY DATA

Stability:	When stored at temperatures greater than 30º C, dibenzoyl peroxide can begin to release carbon dioxide. This will cause the foil pouches to begin to well.
Hazardous Polymerization:	Will not occur. Dibenzoyl peroxide decomposes at temperatures > 50º C.
Incompatibility:	Strong oxidizers, peroxides, acids
Decomposition Products:	When heated to decomposition, can yield CO_X and NO_X.
Conditions to Avoid:	Excessive heat for extended periods of time will shorten product shelf-life.

HEALTH HAZARD DATA

Known Hazards:	No effects expected during normal use. Direct contact with the resin or hardener may cause eye and skin irritation; sensitization is possible.
Signs and Symptoms of Exposure:	**Eyes:** Can cause temporary discomfort (itching, dryness, redness, etc.). **Skin:** Can irritate the skin and possibly cause sensitization in susceptible individuals. **Inhalation:** No effects expected. **Ingestion:** Not considered a route of exposure.
Routes of Exposure:	Dermal.
Medical Conditions Aggravated by Exposure:	Eye and skin conditions.

Carcinogenicity:	IARC classifies crystalline silica (quartz sand) as a Gp I carcinogen based upon evidence among workers in industries where there has been long-term and chronic exposure (via inhalation) to silica dust; e.g. mining, quarry, stone crushing, refractory brick and pottery workers. This product does not pose a dust hazard; therefore, this classification is not relevant.

EMERGENCY AND FIRST AID PROCEDURES

Eyes:	Immediately flush with plenty of water. Contact a physician if symptoms persist.
Skin:	Wipe off material and wash with soap and water. Launder contaminated clothing before reuse.
Inhalation:	Move victim to fresh air. Call a physician if symptoms persist.
Ingestion:	If ingested, call a physician immediately. Do not induce vomiting unless directed by a physician.
Other:	Referral to a physician is recommended if there is any question about the seriousness of the injury/exposure.

CONTROL MEASURES AND PERSONAL PROTECTIVE EQUIPMENT

Ventilation:	General (natural or mechanically induced fresh air movements).
Eye Protection:	Safety glasses or goggles are recommended.
Skin Protection:	Impermeable (neoprene or rubber) gloves recommended.
Respiratory Protection:	None normally required. Where ventilation is inadequate to control vapors, use a NIOSH-approved respirator with organic vapor cartridges.

PRECAUTIONS FOR SAFE HANDLING AND USE

Handling and Storing Precautions:	Observe good hygiene practices; i.e. do not eat, drink or smoke while using. Wash hands after using and before meals. Store in a dry place between 41 and 77º F. Keep from freezing. For industrial use only. Keep out of reach of children.
Spill Procedures:	Wipe up spilled material and place in a closed container for disposal.

REGULATORY INFORMATION

Hazard Communication:	This MSDS has been prepared in accordance with the federal OSHA Hazard Communication Standard. 29 CFR 1910.1200.
HMIS Codes:	Health 1, Flammability 0, Reactivity 1, PPE A
DOT Shipping Name:	Not regulated.
IATA / ICAO Shipping Name:	Not regulated.
IMDG Shipping Name:	Not regulated.
TSCA Inventory Status:	Chemical components listed on TSCA inventory.
SARA Title III, Section 313:	This product contains 1 - 5% dibenzoyl peroxide (CAS 94-36-0) which is subject to reporting under Section 313 of SARA Title III (40 CFR Part 372).
EPA Waste Code(s):	Not regulated by EPA as a hazardous waste
Waste Disposal Methods:	Consult with regulatory agencies or your corporate personnel for disposal methods that comply with local, state, and federal safety, health and environmental regulations.

CONTACTS

Customer Service:	1 800 879 8000	**Technical Service:**	1 800 879 8000
Health / Safety:	1 800 879 6000 Jerry Metcalf (x6704)		
Emergency # (Chem-Trec):	1 800 424 9300 (USA, PR, Virgin Islands, Canada); 703 527 3887 (Other countries)		

The information and recommendations contained herein are based upon data believed to be correct; however, no guarantee or warranty of any kind expressed or implied is made with respect to the information provided.