CITY OF LOS ANGELES
CALIFORNIA

DEPARTMENT OF
BUILDING AND SAFETY
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(918) 252-6693

RESEARCH REPORT: RR 25363
(CSI #03150)

BASED UPON ICC EVALUATION
SERVICE LEGACY REPORT NO. 5369

REEVALUATION DUE DATE:
December 1, 2007

GENERAL APPROVAL - Reevaluation/Clerical Modification - Hilti HVA Adhesive Anchor System For Normal Weight Concrete.

DETAILS

The above products are approved when in compliance with the description, use, identification and findings of Legacy Report No. 5369 dated October 1, 2004, of the ICC Evaluation Service, Incorporated. The report, in its entirety, is attached and made part of this general approval.

The parts of Legalcy Report No. 5369 marked by the asterisk are deleted by the Los Angeles Building Department from this approval.

The approval is subject to the following conditions :

1. The values in this report shall not be used in repair, retrofit and new construction of tilt-up wall anchors (in tension) for the connection with horizontal wood diaphragm.

2. A 25% reduction in all allowable loads specified in the research report shall be taken in hold-down devices per Section 91.2315.5.6 of the 2002 Los Angeles City Building Code.

3. The anchors shall be identified by labels on the packaging indicating the manufacturer's name and product designation.

4. Design values and minimum embedment requirements shall be per Tables in ICBOES Report No. 5369.

5. The design values in the tables shall be reduced as specified in Figure 2 when the anchors are installed in locations where concrete temperatures exceed 70ºF.

6. Special inspection in accordance with Section 91.1701 of the 2002 Los Angeles City Building Code shall be provided for anchor installations.

7. The anchors shall be installed as per the attached manufacturer's instructions except as otherwise stated in this report. Copies of the installation instructions shall be available at each job site.

8. The concrete shall have attained their design strength prior to installation of the anchors.

9. The adhesive anchor system shall not be used to support fire-resistive construction.

DISCUSSION

The clerical modification is to change the name and phone number of contact person.

The approval is based on load tests. The allowable loads are limited to Table 19-D values for anchors embedded in concrete or any test values with a factor of safety of four, whichever is less. The anchors have been tested in accordance with ASTM E488 for static loads. Creep tests were done in accordance with ASTM E1512-93 and ICC-ES AC58.

This general approval will remain effective provided the Evaluation Report is maintained valid and unrevised with the issuing organization. Any revisions to the report must be submitted to this Department, with appropriate fee, for review in order to continue the approval of the revised report.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

Hilti, Inc.
RE: Hilti HVA Adhesive Anchor Systems

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this approval have been met in the project in which it is to be used.

YEUAN CHOU, Chief
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GB:elcm
RR25363/wp8.0
R11/30/05
5A1/5B/1912.6/1923

Attachment: ICC ES Legacy Report No. 5369 (5 Pages).

LEGACY REPORT

ER-5369

Reissued October 1, 2004

ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

Legacy report on the 1997 *Uniform Building Code*™, the 2000 *International Building Code*® and the 2000 *International Residential Code*®

DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

HVA ADHESIVE ANCHOR SYSTEM

HILTI, INC.
5400 SOUTH 122ND EAST AVENUE
TULSA, OKLAHOMA 74146

1.0 SUBJECT

HVA Adhesive Anchor System.

2.0 DESCRIPTION

2.1 General:

The Hilti HVA adhesive anchor system is for installation in normal-weight concrete, and consists of a two-component vinyl urethane resin adhesive (HVU) and a Hilti threaded rod (HAS).

The anchor systems are alternatives to cast-in-place anchors described in Sections 1923.1 and 2107.1.5 of the 1997 *Uniform Building Code*™ (UBC), ~~and Sections 1912 and 2107 of the 2000 *International Building Code*® (IBC). The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.2 of the 2000 *International Residential Code*® (IRC).~~

*

2.2 Materials:

2.2.1 Hilti HVA Adhesive: The HVA adhesive is contained in a dual-chambered foil capsule that separates the resin from the hardener. The capsules are supplied in various sizes that correspond to the anchor diameters. The adhesive has a shelf life of one year when stored in the manufacturer's unopened container at temperatures between 40˚F (4˚C) and 75˚F (23˚C).

2.2.2 Hilti HAS Threaded Rod: Three HAS rods are available: Standard HAS rod, Super HAS (high-strength) rod, and HAS stainless steel rod. HAS rods are threaded and have a beveled end. The rods, with washer and nut, are available in three grades of steel as follows:

ALL-THREAD ROD				NUT SPECIFI-CATION	WASHER SPECIFI-CATION
Description	Specification	f_y (ksi)	f_u (ksi)		
Standard HAS Rod	ASTM A 36	36.0	58.0	ASTM A 563, Grade A	ANSI B18.22.1, Type A, plain
Super HAS Rod	ASTM A 193, B7	105.0	125.0	ASTM A 563, Grade DH	ASTM F 436
Stainless HAS Rod $^3/_8$" - $^5/_8$"	ASTM F 593, CW	65.0	100.0	ASTM F 594, Alloy Group 1	ANSI B18.22.1, Type A, plain
Stainless HAS Rod $^3/_4$" - $1^1/_4$"		45.0	85.0		

For **SI:** 1 inch = 25.4 mm.

The Standard HAS Rod and the Super HAS Rod are furnished with a 5-µm zinc electroplate coating in accordance with ASTM B 633 SC 1.

2.2.3 Concrete Substrate: Concrete must be normal-weight, stone-aggregate concrete having a minimum 28-day compressive strength in accordance with Table 4 at the time of anchor installation.

2.3 Design:

Allowable tension and shear loads for HAS threaded rod installed in accordance with this report are shown in Table 4. Anchors are permitted to resist live loads, dead loads, wind loads and earthquake loads. For allowable short-term shear loads resulting from wind or earthquake based on steel strength, the steel shear values must be calculated as follows:

- For Standard HAS rods (ASTM A 36 rods), the allowable load based on steel strength is 1.33 times the A 36 value for static loads given in Table 4.
- For Stainless HAS rods (ASTM F 593 CW rods), the allowable load based on steel strength is 1.33 times the A 36 value for static loads given in Table 4.
- For Super HAS rods (ASTM A 193 B7 rods), the allowable load based on steel strength is 0.94 times the A 193 B7 value for static loads given in Table 4.

* deleted by City of Los Angeles

Tension loads in Table 4 are permitted to be increased by $33^1/_3$ percent for short-term loads, such as those resulting from wind or earthquake.

For anchors installed at edge distances less than c_{cr}, or at a spacing of less than s_{cr}, or both, the bond- or concrete-strength anchor values given in Table 4 must be reduced in accordance with the reduction factors given in Table 3. The reduced bond- or concrete-strength anchor values must be compared with the corresponding allowable steel strength, and the lesser value must be used to establish allowable anchor capacity.

The allowable load values in Table 4 must be adjusted in accordance with Figure 2 for in-service base-material temperatures in excess of 70˚F (21˚C).

Allowable loads for anchors subjected to combined shear and tension forces are determined using the following equation:

$$\frac{P_s}{P_t} + \frac{V_s}{V_t} \leq 1$$

where:

P_s = Applied service tension load.

P_t = Allowable service tension load.

V_s = Applied service shear load.

V_t = Allowable service shear load.

2.4 Installation:

The anchor is installed into a predrilled hole in concrete. The hole must be drilled to the diameter and embedment depth specified in Table 2 of this report, and must be cleaned of debris and standing water. The hole for the HAS rod is drilled using a rotary hammer drill with an adapter or setting tool. During anchor installation, the hole and surrounding location are permitted to be damp. No standing water is permitted in the hole.

The HVA capsule is inserted into the hole. The beveled end of the HAS rod is placed on top of the resin capsule, and the rod is driven into the hole using the rotary hammer drill. The combined rotation and hammering action shreds the capsule and mixes the resin with the hardener. After the HAS threaded rod is driven to the specified embedment depth, the drilling should immediately stop and the adapter/setting tool withdrawn. See Figure 1 for additional installation instructions.

The anchor must not be disturbed during its cure time. The curing times and temperatures for the HVA system are noted in Table 1.

2.5 Special Inspection:

Special inspection in accordance with Section 1701 of the UBC or Section 1704 of the IBC must be provided for all anchor installations. The special inspector must record compliance of the drill bit with ANSI B212.15-1994; the hole depth and cleanliness; the product description, including product name, rod diameter and length; the adhesive expiration date; and verification of anchor installation in accordance with this report and the manufacturer's published installation instructions.

2.6 Identification:

The adhesive material is identified in the field by packaging labels bearing the manufacturer's name (Hilti, Inc.), the evaluation report number (ER-5369), the product name and the anchor diameter. The head of the Hilti HAS rod is identified by the mark HA36, H193, H304, or H316.

3.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Adhesive Anchors in Concrete and Masonry Elements (AC58), dated November 2001.

4.0 FINDINGS

That the Hilti HVA Adhesive Anchor System described in this report complies with the 1997 *Uniform Building Code*™, the 2000 *International Building Code*®, and the 2000 *International Residential Code*®, subject to the following conditions:

4.1 The anchors are manufactured, identified and installed in accordance with the manufacturer's instructions and this report.

4.2 Anchors are installed in holes predrilled with a carbide-tipped masonry drill bit manufactured within the range of the maximum and minimum drill-tip dimensions of ANSI B212.15-1994.

4.3 Special inspection in accordance with Section 2.5 is provided for all anchor installations.

4.4 Calculations and details showing compliance with this report are submitted to the local building official for approval.

4.5 Anchors are permitted to be used for long-term and short-term allowable shear and tension loads as noted in Section 2.3.

4.6 Anchors are not permitted for use in conjunction with fire-resistive construction. Exceptions are:

- **Anchors resist wind or seismic loading only.**
- **For other than wind or seismic loading, special consideration is given to fire exposure conditions.**

4.7 Adhesive anchors may be used to resist tension and shear forces in overhead or wall installations only if consideration is given to the effects of elevated temperature conditions on anchor performance. Figure 2 shows load reduction factors for elevated temperatures.

4.8 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of adhesive anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under these conditions is beyond the scope of this report.

4.9 Since an ICC-ES acceptance criteria for evaluating the performance of adhesive anchors in cracked concrete is unavailable at this time, the use of anchors is limited to installation in uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

4.10 The anchors are limited to interior use, except that installation in severe, moderate or negligible exterior weathering locations, in accordance with Figure 21-1-1 of UBC Standard 21-1 or Figure 1 in ASTM C 62 (IBC and IRC), is permitted when stainless steel threaded rods are installed.

4.11 During anchor installation, the hole and surrounding location are permitted to be damp. No standing water is permitted in the hole.

4.12 The adhesive is manufactured by Hilti, Inc., in Kaufering, Germany, with quality control inspections by Underwriters Laboratories Inc. (AA-637).

This report is subject to re-examination in two years.

TABLE 1—MANUFACTURER'S RECOMMENDED CURING TIME FOR HVA ADHESIVE[1]

BASE MATERIAL TEMPERATURE	MINIMUM CURING TIME
from 23˚F to 32˚F	5 hours
from 32˚F to 50˚F	1 hour
from 50˚F to 68˚F	30 minutes
68˚F or above	20 minutes

For **SI:** t˚C = $^5/_9$ (t˚F - 32).

[1]The anchor must not be disturbed during its cure time.

TABLE 2—SPECIFICATIONS FOR HVA ADHESIVE ANCHORS

DETAILS	DIAMETER OF HAS THREADED ROD						
	$^3/_8$ inch	$^1/_2$ inch	$^5/_8$ inch	$^3/_4$ inch	$^7/_8$ inch	1 inch	$1^1/_4$ inches
d_{bit}: Bit diameter (inches)	$^{15}/_{32}$	$^9/_{16}$	$^{11}/_{16}$	$^7/_8$	1	$1^1/_8$	$1^3/_8$
h_{nom}: Min. depth of embedment (inches)	$3^1/_2$	$4^1/_4$	5	$6^5/_8$	$6^5/_8$	$8^1/_4$	12
t: Max. thickness fastened (inches)	1	$1^1/_2$	$1^3/_4$	2	$2^1/_4$	$2^1/_2$	$2^3/_4$
T_{inst}: Max. tightening torque (foot-pounds)	18	30	75	150	175	235	400
h: Min. base material thickness (inches)	$5^1/_4$	$6^3/_8$	$7^1/_2$	10	10	$12^3/_8$	18

For **SI:** 1 inch = 25.4 mm, 1 foot-pound = 1.36 N-m.

TABLE 3—ANCHOR SPACING AND EDGE DISTANCES FOR ANCHORS INSTALLED IN CONCRETE[1,2]

ANCHOR SPACING FACTOR, TENSION AND SHEAR			EDGE DISTANCE FACTOR, SHEAR ONLY				EDGE DISTANCE FACTOR, TENSION ONLY		
s_{cr}	s_{min}	f_A	c_{cr}	c_{min}	f_{RV}		c_{cr}	c_{min}	f_{RN}
1.5 × h_{ef}	0.5 × h_{ef}	0.7	1.5 × h_{ef}	0.5 × h_{ef}	0.25 applied load acting perpendicular to edge	0.65 applied load acting parallel to edge	1.5 × h_{ef}	0.5 × h_{ef}	0.6

hef	=	Actual embedment depth.
s	=	The measure between anchors, centerline-to-centerline distance.
s_{cr}	=	The minimum anchor spacing distance at which the allowable load capacity of an anchor is obtained without influence of neighboring anchors.
s_{min}	=	The anchor spacing at which the anchors are tested for recognition.
c	=	The measure between the anchor centerline and the free edge of the concrete member.
c_{cr}	=	The least edge distance at which the allowable load capacity of an anchor is applicable without reductions.
c_{min}	=	The least edge distance at which the anchors are tested for recognition.
f_A, f_{RV}, f_{RN}	=	Load reduction factors applied to the allowable working loads when: $s_{min} \le s < s_{cr}$ or $c_{min} \le c < c_{cr}$

[1]For an anchor affected by multiple anchor spacings and/or edge distances, the allowable adjusted load is the product of the following factors:

$$F = f_{s1} \times f_{s2} \text{ ..... } f_{sn} \times f_{c1} \times f_{c2} \text{ ..... } f_{cn}.$$

[2]Load adjustment factors for spacing or edge distance are applied to the allowable bond or concrete strength for tension or shear. The lesser of this value and the steel value must be used for the design.

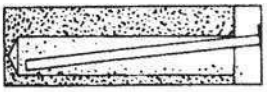
[3]Linear interpolation may be used to determine the allowable load reduction factor for anchor spacings between s_{cr} and s_{min} and edge distances between c_{cr} and c_{min}.

TABLE 4—ALLOWABLE TENSION AND SHEAR VALUES IN NORMAL-WEIGHT CONCRETE FOR THREADED RODS WITH HILTI HVA ADHESIVE[1,2,3,4,5,6,7] (pounds)

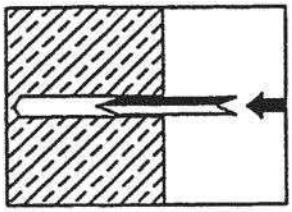
ANCHOR DIAMETER (inches)	EMBEDMENT DEPTH (inches)	TENSION					SHEAR				
		Based on Bond or Concrete Strength		Based on HAS Rod Steel Strength			Based on Concrete Strength		Based on HAS Rod Steel Strength		
		f'_c = 2,000 psi	f'_c = 4,000 psi	ASTM A 36	ASTM A 193 Grade B7	AISI 304SS Condition CW	f'_c = 2,000 psi	f'_c = 4,000 psi	ASTM A 36	ASTM A 193 Grade B7	AISI 304SS Condition CW
3/8	3 1/2	2,085	2,595	2,115	4,555	3,645	1,675	2,365	1,090	2,345	1,875
	5 1/4	2,325	4,185				3,335	4,715			
	7	4,405	4,895				5,440	7,690			
1/2	4 1/4	3,250	4,735	3,755	8,100	6,480	2,540	3,590	1,935	4,170	3,335
	6 3/8	4,890	5,455				5,060	7,150			
	8 1/2	6,700	7,545				8,245	11,660			
5/8	5	3,970	5,245	5,870	12,655	10,125	3,575	5,060	3,025	6,520	5,215
	7 1/2	5,770	10,465				7,125	10,080			
	10	11,700	12,835				11,620	16,435			
3/4	6 5/8	6,080	8,615	8,455	18,225	12,390	6,095	8,620	4,355	9,390	6,385
	10	9,110	14,835				12,275	17,360			
	13 1/4	15,220	15,310				19,805	28,010			
7/8	6 5/8	7,145	9,130	11,510	24,805	16,865	6,385	9,030	5,930	12,780	8,690
	10	10,475	18,970				12,855	18,180			
	13 1/4	16,475	23,055				20,745	29,335			
1	8 1/4	8,640	13,425	15,030	32,400	22,030	9,650	13,645	7,745	16,690	11,350
	12 3/8	14,665	23,450				19,225	27,190			
	16 1/2	26,645	30,805				31,350	44,340			
1 1/4	12	19,175	23,920	23,490	50,620	34,425	19,510	27,590	12,100	26,080	17,735
	15	24,750	26,855				28,510	40,315			
	18	29,535	37,920				38,865	54,965			

For **SI:** 1 inch = 25.4 mm, 1 pound = 4.45 N, 1 psi = 6.89 kPa.

[1]The tabulated tensile and shear values are for anchors installed in normal-weight concrete having the minimum designated ultimate compressive strength ($f'c$) at the time of installation.
[2]The Hilti HVU adhesive experiences a reduction in tensile and shear capacity with increased concrete temperature. Factors noted in Figure 2 must be applied to the allowable values based on bond or concrete strength noted in the table when the anchors are installed in locations where the concrete temperature may exceed 70˚F (21˚C).
[3]For allowable loads for wind and seismic forces, see Section 2.3.
[4]Spacing and edge distance requirements must be in accordance with Table 3.
[5]Special inspection in accordance with Section 1701 of the UBC or Section 1704 of the IBC must be provided for all anchor installations.
[6]Allowable tensile and shear load is the lesser of bond and steel strength.
[7]Allowable tensile and shear load for adhesive bond is based on a safety factor of 4.0.



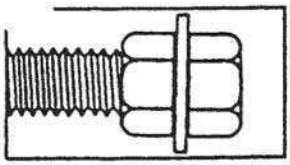
1. Set the drill depth gauge and drill a hole to the required hole depth.
Important: Clean out dust and debris. Use compressed air or vacuum at bottom of the hole. When using a Hilti matched tolerance diamond core bit, immediately remove standing water.



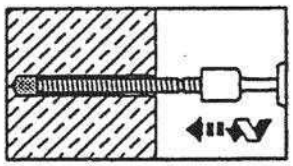
2. Insert appropriate diameter HVU adhesive capsule* into pre-drilled dry hole in base material.

NOTE: The best method for setting multiple capsules is to crush the first capsule(s) into the hole and then insert the next capsule. DO NOT cut off capsules partially protruding from the hole.

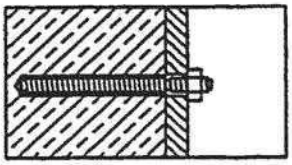
*Capsule length is longer than standard embed. depth and will protrude from the hole.



3. Thread a nut on the HAS rod. Place a washer on top of the first nut and then thread a second nut down on top of the washer. Tighten the two nuts together "locking" the washer between them. The top nut should be flush with the top of the rod.



4. Insert a square drive shaft into the hammer drill and attach the proper impact socket. At the rotary hammer drill setting, engage the top nut of the HAS rod assembly with the socket and drive the rod down through the capsule(s). **Stop drill rotation immediately upon reaching bottom of hole.**



5. The set anchor rod may not be disturbed or loaded before the specified curing time elapses.

FIGURE 1—THE HILTI HVA ADHESIVE ANCHORING SYSTEM—INSTALLATION INSTRUCTIONS FOR HAS RODS

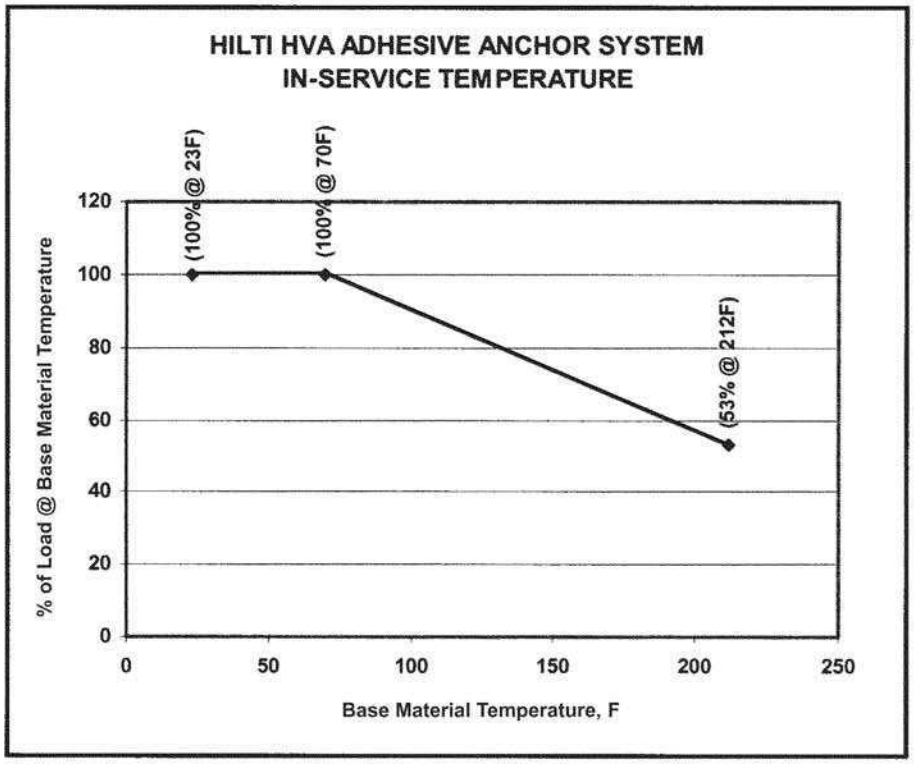


FIGURE 2—IN-SERVICE TEMPERATURE REDUCTION FACTOR