LEGACY REPORT

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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

DIVISION: 04—MASONRY
Section: 040801—Masonry Anchorage

HILTI HIT HY-150 ADHESIVE ANCHOR SYSTEMS

HILTI, INC.
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1.0 SUBJECT

Hilti Hit HY-150 Adhesive Anchor Systems.

2.0 DESCRIPTION

2.1 General

The Hilti HIT HY-150 Adhesive Anchor Systems consist of HY-150 hybrid adhesive mortar used in conjunction with threaded steel rod or deformed steel reinforcement bars. This evaluation report recognizes the use of HIT HY-150 in normal-weight concrete, lightweight concrete and fully grouted, concrete masonry construction. Table 1 provides general application descriptions for use of the Hilti HY-150 adhesive. The anchor system is an alternative 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 HIT HY-150 Adhesive: Hilti HIT HY-150 adhesive is a hybrid adhesive mortar combining urethane methacrylate resin, hardener, portland cement, and water. The resin and cement are kept separate from the hardener and water by means of a dual cartridge that allows for multiple uses. An injection nozzle, equipped with an internal helical mixing element, is attached to the manifold, and the adhesive components are dispensed through the injection nozzle to ensure proper mixing of the separate adhesive components. The injection nozzle may be replaced to permit multiple uses of the refill cartridges. The shelf life of the adhesive is at least nine months when it is stored in a dry, dark environment. Each cartridge is stamped with an adhesive expiration date. Temperatures during short-term (less than 48 hours) storage of the adhesive must be between 23°F and 95°F (-5°C and 35°C). Temperatures during long-term storage of the adhesive must be between 41°F and 70°F (5°C and 25°C). Hilti, Inc., should be contacted regarding suitability of adhesive for which the storage history is unknown.

2.2.2 Threaded Steel Rods: Threaded rods must be manufactured from steel that complies with the mechanical property requirements of ASTM A 36; ASTM A 193, Grade B7; AISI 304-SS, Group 1 CW; or ISO 898-1, Class 5.8, as shown in Table 2. Specification and installation parameters for threaded rods are noted in Table 3.

2.2.3 Reinforcement Bars: Deformed reinforcement bars (rebars) range in size from No. 3 through No. 11. The bars are manufactured from steel conforming to ASTM A 615, A 616, A 617, or A 706; minimum Grade 60.

2.2.4 Normal-weight Concrete: Normal-weight concrete must be normal-weight, stone-aggregate concrete having a minimum 2,000 psi (13.79 MPa) compressive strength at the time of anchor installation.

2.2.5 Structural Lightweight Concrete: Structural lightweight concrete must have a minimum 3,000 psi (19.17 MPa) compressive strength at the time of anchor installation.

2.2.6 Grouted Concrete Masonry Units: Concrete masonry construction must be fully grouted and have a minimum prism strength of 1,500 psi (9.58 MPa) at the time of anchor installation. Concrete masonry units must be Grade N, Type 1, in accordance with UBC Standard 21-4 or ASTM C 90-99 (IBC or IRC). Mortar must be Type N (minimum) in accordance with Section 2103.3 of the UBC, Section 2103.7 of the IBC, or Section R607 of the IRC. Grout shall comply with Section 2103.4 of the UBC, Section 2103.10 of the IBC, or Section R609.1.1 of the IRC.

2.3 Design:

2.3.1 General: Hilti HIT HY-150, in conjunction with threaded steel rod or rebar, is permitted to resist dead loads, live loads, and short-term loads, such as those resulting from wind or earthquake. The allowable tension and shear loads for threaded rod and rebar in concrete and masonry are given in Tables 6 through 13.

The allowable bond or concrete tension and shear values in this report must be adjusted in accordance with Figure 1 for in-service base material temperatures in excess of 100˚F (38˚C).

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

$$(P_s / P_t) + (V_s / V_t) \leq 1$$

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.

For anchors installed at edge distances less than c_{cr}, or anchor spacing less than s_{cr}, or both, the allowable load of the anchor based on the bond/concrete strength must be reduced in accordance with reduction factors found in Table 4 of this report.

2.3.2 Short-term Loading: The allowable short-term seismic or wind shear load with threaded rod is the lower of the steel shear strength calculated in Section 2.3.2.1 or the bond or concrete/masonry shear strength given in Tables 7 through 9, 12 and 13, and may be increased in accordance with Section 1612.3.2 of the UBC or Section 1605.3.2 of the IBC, for wind or earthquake loading conditions.

The allowable short-term seismic or wind tension load with threaded rod (Tables 6, 8, 9, 12 and 13) and the allowable seismic tension and shear load with rebar (Tables 10 and 11) is the lower of the tabulated steel or bond or concrete strength given in the tables, and may be increased by $33^1/_3$ percent in accordance with Section 1612.3.2 of the UBC or Section 1605.3.2 of the IBC, for short-term loading conditions.

As an alternative, the applied loads may be reduced in accordance with Section 1612.3.1 of the UBC or Section 1605.3.1.1 of the IBC, for wind or earthquake loading.

2.3.2.1 Short-term Seismic or Wind Shear Based on Steel Strength: Allowable short-term shear capacities may be based on steel strength and must be calculated as follows and then compared to the corresponding concrete/masonry or bond value as described in Section 2.3.2:

- For normal-weight concrete:
  - At less than standard embedment, the allowable steel strength is limited to A 36 threaded rod values, regardless of the actual type of steel used.
  - At standard embedment and deeper, the allowable steel shear strengths, given in Table 6, must be reduced as follows:
    - ASTM A 36 rods—No reduction from A 36 rod value.
    - ISO 898 Class 5.8 rods—Allowable load based on steel strength is limited to A 36 threaded rod values.
    - ASTM A 193 B7 rods—Allowable load based on steel strength is 0.71 times the A 193 B7 rod values.
    - AISI 304/316 SS CW rods—Allowable load based on steel strength is 0.79 times the AISI 304/316 stainless steel rod values.
- Structural lightweight concrete and grouted concrete masonry units:
  - The allowable steel shear strength is limited to A 36 threaded rod values, regardless of the actual type of steel used.

2.4 Installation:

Installation of the Hilti HIT HY-150 System must conform to the manufacturer's published installation instructions included in each unit package, and the requirements of this evaluation report. Installation parameters are summarized further in Tables 3, 4, and 5, and the corresponding load data tables. Holes for installation of the threaded rod or reinforcement bar must be drilled using a drill that is set in roto-hammer mode and that has a carbide-tipped bit that complies with ANSI B212.15-1994. Holes must be cleaned of dust and debris, using a wire brush and compressed air as required to remove particulate debris and to achieve a relatively dust-free surface. Holes are permitted to be damp, but all standing water must be removed in accordance with Section 4.12 of this evaluation report.

The dual cartridge is self-opening, and the adhesive is dispensed through an injection nozzle equipped with an internal helical mixing element that is attached to the cartridge manifold to ensure proper mixing of the components. Material from the first two "trigger pulls" must be discarded to ensure that only properly mixed product is used. The injection nozzle may be replaced to permit multiple uses of the cartridge. The injection nozzle must always be equipped with the internal helical mixing element. The injection nozzle must be as manufactured by Hilti for the HIT HY-150 Adhesive Anchor System. Holes are filled approximately two-thirds full with the mixed adhesive, injecting from the bottom of the hole towards the top. The threaded rod or deformed bar is twisted as it is inserted into the hole to the required embedment depth. The anchor position may be adjusted only during the gel time shown in Table 5. Anchors are permitted to be loaded to the design load only after the cure time shown in Table 5 has passed. See Section 4.13 of this evaluation report for limitations on base-material temperature during installation.

2.5 Special Inspection:

Adhesive anchor installations require special inspection in accordance with Section 1701 of the UBC or Section 1704 of the IBC. The special inspector must record product description (including product name), adhesive expiration date, concrete or masonry type and strength, anchor diameter and steel grade, compliance of the drill bit with this report, hole diameter and location, cleanliness of hole and anchor, adhesive application, and anchor embedment. Additionally, the special inspector must state in the report supplied to the building official whether the anchor installation is in accordance with the manufacturer's published instructions and this evaluation report.

2.6 Identification:

The Hilti HY-150 adhesive is identified by labels on or in the packaging that include the manufacturer's name (Hilti), product name, lot number, expiration date, evaluation report number (ER-5193), and installation instructions.

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, including test reports for the following optional tests: axial tension testing of single anchors, establishing minimum edge distance, $c = c_{min}$ (AC58 Test Series 5); axial tension testing of a group of two anchors, establishing minimum spacing distance, $s = s_{min}$ (AC58 Test Series 9); shear testing of single anchors, establishing critical edge distance, $c = c_{cr}$ (AC58 Test Series 13); shear testing of single anchors, establishing minimum edge distance, $c = c_{min}$ (AC58 Test Series 14); creep testing (AC58 Test Series 17); dampness testing (AC58 Test Series 19); freezing and thaw testing (AC58 Test Series 20); and seismic shear and tension testing of threaded rods and rebar (AC58 Test Series 21).

4.0 FINDINGS

That the Hilti HY-150 Adhesive Anchor Systems described in this report comply with the 1997 *Uniform Building Code*™ (UBC), the 2000 *International Building*

***Code*® (IBC), and the 2000 *International Residential Code*® (IRC), subject to the following conditions:**

4.1 The HIT HY-150 Adhesive Anchor Systems with threaded rod are permitted to be used to resist dead loads, live loads and short-term loads, such as those resulting from wind or earthquake forces.

4.2 When anchors are used to resist short-term loads, such as wind or seismic, allowable loads must be calculated in accordance with Section 2.3.2 of this report.

4.3 The anchors are installed in accordance with the manufacturer's instructions and this report.

4.4 The HIT HY-150 Adhesive Anchor Systems are installed in holes predrilled using a carbide-tipped masonry drill bit manufactured within the range of the maximum and minimum dimensions of ANSI B212.15-1994.

4.5 Special inspection in accordance with Section 2.5 of this report is provided for all anchor installations.

4.6 Calculations and details demonstrating compliance with this report must be submitted to the building official for approval.

4.7 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.**

4.8 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 1 describes load reduction factors for elevated temperatures.

4.9 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.

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

4.11 Use of the HIT HY-150 Adhesive Anchor System in conjunction with unprotected carbon steel threaded rods and/or reinforcing bars shall be limited to interior exposure. Installations exposed to severe, moderate and negligible exterior weathering conditions, as defined in Figure 21-1-1 of UBC Standard 21-1 (Table 1 of ASTM C 62-97a), are permitted where stainless steel (AISI 304 or 316 SS) threaded rod anchors are used.

4.12 Standing water must be removed from drilled holes. In applications where the concrete has been exposed to water for extended periods, drilled holes must be blown dry with oil-free compressed air for a minimum of one minute, or otherwise prepared to achieve an equivalent damp surface condition prior to anchor installation.

4.13 HIT HY-150 may be used in base materials having interior temperatures between 23°F (-5°C) and 110°F (43°C) at the time of installation. Installation of HIT HY-150 in base materials having interior temperatures outside this range is beyond the scope of this report. The temperature of the HY-150 adhesive must be between 41°F (5°C) and 95°F (35°C) at the time of installation.

4.14 When anchors are located where the interior base-material temperature may exceed 100°F (38°C), allowable tension and shear loads in this report must be adjusted for in-service temperatures in accordance with Figure 1. The use of HIT HY-150 in base materials having interior temperatures exceeding 248°F (120°C) during their service life is beyond the scope of this report.

4.15 The HIT HY-150 adhesive is manufactured by Hilti GmbH at their facilities in Kaufering, Germany, with quality control inspection by Underwriters Laboratories Inc. (AA-668).

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

TABLE 1—APPLICATION DESCRIPTIONS

BASE MATERIAL	ADHESIVE ANCHOR PRODUCT	INSERT	SPECIFICATION DATA	LOAD DATA
Normal-weight concrete	HIT HY-150	Threaded rod	Tables 3, 4, 5	Tables 6, 7, and 12
		Reinforcing bar	Tables 4, 5, 10 and 11	Table 10 and 11
Structural lightweight concrete	HIT HY-150	Threaded rod	Tables 3, 4, 5	Table 8
Grouted block masonry	HIT HY-150	Threaded rod	Tables 3 and 5	Tables 9 and 13

TABLE 2—STEEL SPECIFICATIONS FOR ROD, NUT AND WASHER

ALL-THREAD ROD				NUT SPECIFICATION	WASHER SPECIFICATION
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
Standard HAS-E Rod	ISO 898, Class 5.8	58.0	72.5	ASTM A 563, Grade DH	ASTM F 436
Super HAS Rod	ASTM A 193 B7	105.0	125.0	ASTM A 563, Grade DH	ASTM F 436
304/316 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
304/316 Stainless HAS Rod ($^3/_4$" - $1^1/_4$")		45.0	85.0		

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.894 kPa.

TABLE 3—SPECIFICATIONS FOR INSTALLATION OF THREADED RODS IN CONCRETE USING HILTI HIT HY-150 ADHESIVE

PROPERTY		THREADED ROD DIAMETER						
		$^3/_8$ inch	**$^1/_2$ inch**	**$^5/_8$ inch**	**$^3/_4$ inch**	**$^7/_8$ inch**	**1 inch**	**$1^1/_4$ inches**
A_{nom} = Nominal area of threaded rod (inch^2)		0.1105	0.1963	0.3068	0.4418	0.6013	0.7854	1.2272
BD = Nominal bit diameter (inches)		$^7/_{16}$	$^9/_{16}$	$^{11}/_{16}$	$^{13}/_{16}$	$^{15}/_{16}$	$1^1/_{16}$	$1^1/_2$
T = Maximum torque (ft.-lbf)	Embedment ≤ Standard	15	20	50	105	125	165	280
	Embedment > Standard	18	30	75	150	175	235	400
Standard embedment depth (inches)		$3^1/_2$	$4^1/_4$	5	$6^5/_8$	$7^1/_2$	$8^1/_4$	12

For **SI:** 1 inch = 25.4 mm, 1 ft.-lb. = 1.4 N-m, 1 inch^2 = 645 mm^2.

TABLE 4—REDUCTION FACTORS FOR REDUCED SPACING AND EDGE DISTANCE IN NORMAL-WEIGHT AND STRUCTURAL LIGHTWEIGHT CONCRETE

SPACING *(s)* AND EDGE DISTANCE *(c)*	TENSION CAPACITY	SHEAR CAPACITY	
	Tension Reduction Factor (f_N)	**Direction of Load**	**Shear Reduction Factor (f_V)**
$s_{min} = 0.25s_{cr}$	0.7	Toward edge	0.7
		Not toward edge	
$c_{min} = 0.33c_{cr}$	0.6	Toward edge	0.2
		Not toward edge	0.6

TABLE 5—HILTI, INC.'S, RECOMMENDED GEL AND CURE TIMES FOR HILTI HIT HY-150 ADHESIVE

MINIMUM BASE-MATERIAL TEMPERATURE	GEL TIME	CURE TIME
23°F	25 minutes	6 hours
32°F	18 minutes	3 hours
41°F	13 minutes	90 minutes
68°F	5 minutes	50 minutes
86°F	4 minutes	40 minutes
104°F	2 minutes	30 minutes

For **SI**: t°C = (t°F - 32)/1.8.

TABLE 6—ALLOWABLE TENSION LOADS FOR THREADED RODS INSTALLED IN 2,000 psi AND 4,000 psi NORMAL-WEIGHT CONCRETE, USING HILTI HY-150 ADHESIVE [1,2,3,4,5]

ANCHOR DIAMETER (inches)	EMBEDMENT DEPTH (inches)	CRITICAL EDGE DISTANCE, C_{cr} (inches)	CRITICAL SPACING, S_{cr} (inches)	ALLOWABLE TENSION LOAD BASED ON BOND OR CONCRETE CAPACITY (pounds)		ALLOWABLE TENSION LOAD BASED ON STEEL STRENGTH (pounds)			
				f'_c = 2,000 psi	f'_c = 4,000 psi	ASTM A 36	ISO 898 Class 5.8	ASTM A 193 Grade B7	AISI 304/316 SS
3/8	1 3/4	2 3/4	3 1/2	675	1,185	2,115	2,640	4,555	3,645
	3 1/2	5 1/4	7	1,780	2,540				
	5 1/4	8	10 1/2	2,470	2,625				
1/2	2 1/8	3 1/4	4 1/4	1,145	1,475	3,775	4,700	8,100	6,480
	4 1/4	6 1/2	8 1/2	2,555	3,690				
	6 3/8	9 1/2	12 3/4	4,035	4,965				
5/8	2 1/2	3 3/4	5	1,520	1,865	5,870	7,340	12,655	10,125
	5	7 1/2	10	4,120	4,920				
	7 1/2	11 1/4	15	5,645	7,715				
3/4	3 3/8	5	6 3/4	2,215	3,680	8,455	10,570	18,225	12,390
	6 5/8	10	13 1/4	4,365	8,330				
	10	15	20	8,920	11,380				
7/8	3 3/4	5 3/4	7 1/2	2,890	4,560	11,510	14,385	24,805	16,865
	7 1/2	11 1/4	15	7,355	10,250				
	11 1/4	17	22 1/2	12,495	15,605				
1	4 1/8	6 1/4	8 1/4	3,230	4,560	15,030	18,790	32,400	22,030
	8 1/4	12 1/2	16 1/2	7,810	10,910				
	12 3/8	18 1/2	24 3/4	14,570	18,305				
1 1/4	6	9	12	4,355	6,565	23,490	29,360	50,620	34,425
	12	18	24	14,520	19,475				
	15	22 1/2	30	18,010	25,140				

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

[1]Allowable load shall be the lesser of tabulated bond or concrete and steel values. Load-reduction factors given in Table 4 for reduced edge distance (*c*) and anchor spacing (*s*) shall be applied to values in the bond or concrete capacity column. Linear interpolation may be used for intermediate spacings, edge distances, embedments and concrete strengths. Load-reduction factors are cumulative for anchors with multiple anchor spacings or base-material edge distances.

[2]The tabulated values are for anchors installed in concrete complying with Section 2.2.4 and having the designated compressive strength (f'_c) or higher at the time of installation.

[3]Allowable loads based on bond or concrete strength have been calculated using a safety factor of 4.0.

[4]Concrete thickness must be equal to or greater than 1.5 times the anchor embedment depth.

[5]When anchors are used to resist short-term loads, allowable loads must be calculated in accordance with Section 2.3.2 of this report.

TABLE 7—ALLOWABLE SHEAR LOADS FOR THREADED RODS INSTALLED IN NORMAL-WEIGHT CONCRETE USING HILTI HY-150 ADHESIVE (pounds) [1,2,3,4,5]

ANCHOR DIAMETER (inches)	EMBEDMENT DEPTH (inches)	CRITICAL EDGE DISTANCE, C_{cr} (inches)	CRITICAL SPACING, S_{cr} (inches)	ALLOWABLE SHEAR LOAD BASED ON BOND OR CONCRETE CAPACITY (pounds)		ALLOWABLE SHEAR LOAD BASED ON STEEL STRENGTH (pounds)			
				f'_c = 2,000 psi	f'_c = 4,000 psi	ASTM A 36	ISO 898 Class 5.8	ASTM A 193 Grade B7	AISI 304/316 SS
3/8	1 3/4	2 3/4	3 1/2	1,010	1,010	1,090	1,360	2,345	1,875
	3 1/2	5 1/4	7	1,675	2,365				
	5 1/4	8	10 1/2	3,335	4,715				
1/2	2 1/8	3 1/4	4 1/4	1,900	1,900	1,935	2,420	4,170	3,335
	4 1/4	6 1/2	8 1/2	2,540	3,590				
	6 3/8	9 1/2	12 3/4	5,060	7,150				
5/8	2 1/2	3 3/4	5	2,985	2,985	3,025	3,780	6,520	5,215
	5	7 1/2	10	3,575	5,060				
	7 1/2	11 1/4	15	7,125	10,080				
3/4	3 3/8	5	6 3/4	4,380	4,380	4,355	5,445	9,390	6,385
	6 5/8	10	13 1/4	6,095	8,620				
	10	15	20	12,275	17,360				
7/8	3 3/4	5 3/4	7 1/2	5,700	5,700	5,930	7,410	12,780	8,690
	7 1/2	11 1/4	15	7,885	11,150				
	11 1/4	17	22 1/2	15,705	22,215				
1	4 1/8	6 1/4	8 1/4	7,005	7,005	7745	9,680	16,690	11,350
	8 1/4	12 1/2	16 1/2	9,650	13,645				
	12 3/8	18 1/2	24 3/4	19,225	27,190				
1 1/4	6	9	12	11,790	11,790	12,100	15,125	26,080	17,735
	12	18	24	19,510	27,590				
	15	22 1/2	30	28,510	40,315				

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

[1]Allowable load shall be the lesser of tabulated bond or concrete and steel values. Load-reduction factors given in Table 4 for reduced edge distance (*c*) and anchor spacing (*s*) shall be applied to values in the concrete capacity column. Linear interpolation may be used for intermediate spacings, edge distances, embedments and concrete strengths. Load-reduction factors are cumulative for anchors with multiple anchor spacings or base material edge distances.

[2]The tabulated values are for anchors installed in concrete complying with Section 2.2.4 and having the designated compressive strength (f'_c) or higher at the time of installation.

[3]Allowable loads based on bond or concrete strength have been calculated using a safety factor of 4.0.

[4]Concrete thickness must be equal to or greater than 1.5 times the anchor embedment depth.

[5]When anchors resist short-term loads, allowable shear loads must be calculated in accordance with Section 2.3.2 of this report.

TABLE 8—ALLOWABLE TENSION AND SHEAR VALUES FOR THREADED ROD INSTALLED USING HILTI HIT HY-150 ADHESIVE IN 3,000 psi STRUCTURAL LIGHTWEIGHT CONCRETE[1,2,3,4,5]

ANCHOR DIAMETER (inch)	EMBEDMENT DEPTH (inches)	EDGE DISTANCE, C_{cr} (inches)	ANCHOR SPACING, S_{cr} (inches)	ALLOWABLE LOADS BASED ON BOND OR CONCRETE CAPACITY (pounds)	
				Tension	Shear[6]
3/8	1 3/4	4	3 1/2	745	1,285
	3 1/2	8	7	1,000	1,580
1/2	2 1/8	4 3/4	4 1/4	975	2,130
	4 1/4	9 1/2	8 1/2	1,210	2,910
5/8	2 1/2	5 1/2	5	1,200	2,480
	3 3/8	7 1/2	6 3/4	1,760	3,995

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

[1]Load-reduction factors given in Table 4 for reduced edge distance (*c*) and anchor spacing (*s*) shall be applied to values in the bond or concrete capacity column. Linear interpolation may be used for intermediate spacings, edge distances, and embedments. Load-reduction factors are cumulative for anchors with multiple anchor spacings and/or base material edge distances.
[2]The tabulated values are for anchors installed in structural lightweight concrete complying with Section 2.2.5 and having the designated compressive strength (f'_c) or higher at the time of installation.
[3]Allowable loads based on bond or concrete strength have been calculated using a safety factor of 4.0.
[4]Concrete thickness must be equal to or greater than 1.5 times the anchor embedment depth.
[5]When anchors are used to resist short-term loads, allowable loads must be calculated in accordance with Section 2.3.2 of this report.
[6]Allowable shear loads shall be the lesser of adjusted bond/concrete values above and the steel values give in Table 7.

TABLE 9—ALLOWABLE TENSION AND SHEAR VALUES FOR THREADED ROD INSTALLED USING HILTI HIT HY-150 ADHESIVE IN GROUT-FILLED CONCRETE MASONRY CONSTRUCTION (pounds)[1,2,3,4,5,8,9]

PARAMETER	VALUES							
Anchor diameter (inches)	3/8		1/2		5/8		3/4	
Embedment (inches)[5]	3 1/2		4 1/4		5		6 5/8	
Minimum anchor spacing, s_{min} (inches)	7		8 1/2		10		13 1/4	
Load direction	Tension	Shear[7]	Tension	Shear[7]	Tension	Shear[7]	Tension	Shear[7]
4-inch edge distance, c_{min}[6]	1,240	1,610	1,430	1,610	1,810	1,610	2,995	1,610
Edge distance ≥ 12 inches[6]		1,875		3,335		4,495		4,495

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.48 N.

[1]Anchors are limited to one per masonry cell.
[2]Anchors may be installed at any location in the face of the masonry wall (cell, web, head joint, bed joint, etc.).
[3]Allowable load values are for use in any masonry construction complying with Section 2.2.6 of this report.
[4]When anchors are used to resist short-term loads, allowable loads must be calculated in accordance with Section 2.3.2 of this report.
[5]Embedment depth is measured from the outside face of the masonry.
[6]Edge distances of less than 4 inches are beyond the scope of this report. Linear interpolation for edge distances between 4 inches and 12 inches is allowed.
[7]Allowable shear loads should be the lesser of the adjusted masonry or bond tabulated values and the steel values given in Table 7.
[8]The tabulated allowable loads have been calculated based on safety factor of 5.0. These values may be increased by 25% (safety factor of 4) under the UBC only.
[9]Masonry thickness must be equal to or greater than 1.5 times the anchor embedment depth.

EXCEPTION: The 3/4-inch-diameter anchors may be installed in minimum nominal 8-inch-thick masonry.

TABLE 10—ALLOWABLE TENSION LOADS FOR GRADE 60 REINFORCING BAR INSTALLED USING HILTI HIT HY-150 ADHESIVE IN NORMAL-WEIGHT CONCRETE (pounds)[1,2,3,4,5,6]

REBAR SIZE	DRILL BIT DIAMETER (inches)	EMBEDMENT DEPTH (inches)	CRITICAL EDGE DISTANCE, c_{cr} (inches)	CRITICAL SPACING, s_{cr} (inches)	ALLOWABLE TENSION LOAD BASED ON BOND OR CONCRETE STRENGTH (pounds)		ALLOWABLE TENSION LOAD BASED ON STEEL STRENGTH (pounds)
					f'_c = 2,000 psi	f'_c = 4,000 psi	Grade 60
No. 3	1/2	1 1/2	2 1/4	3	625	960	2,650
		3 1/2	5 1/4	7	1,735	2,040	
		7	10 1/2	14	3,900	3,860	
No. 4	5/8	2	3	4	1,070	1,500	4,710
		4	6	8	2,375	3,950	
		8	12	16	4,510	4,810	
No. 5	3/4	2 1/2	3 3/4	5	1,405	1,735	7,365
		5	7 1/2	10	3,115	5,210	
		10	15	20	8,085	9,770	
No. 6	7/8	3 1/2	5 1/4	7	2,550	3,200	10,605
		7	10 1/2	14	5,305	9,120	
		14	21	28	12,575	13,515	
No. 7	1	3 3/4	5 3/4	7 1/2	2,690	3,955	14,430
		7 1/2	11 1/4	15	6,610	8,570	
		13 1/4	20	26 1/2	17,655	16,955	
No. 8	1 1/8	4	6	8	3,520	4,525	18,850
		8	12	16	8,885	11,330	
		16	24	32	15,440	22,000	
No. 9	1 3/8	5	7 1/2	10	4,190	6,565	23,850
		10	15	20	12,180	15,880	
		18	27	36	25,315	21,345	
No. 10	1 1/2	6	9	12	5,820	8,105	29,450
		12	18	24	13,180	20,375	
		20	30	40	29,290	31,540	
No. 11	1 5/8	7	10 1/2	14	8,010	10,335	35,635
		14	21	28	22,910	24,660	
		20	30	40	29,290	35,260	

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

[1]Load-reduction factors given in Table 4 for reduced edge distance (*c*) and anchor spacing (*s*) shall be applied to values in the bond or concrete capacity column. Linear interpolation may be used for intermediate spacings, edge distances, embedments, or concrete strengths. Load-reduction factors are cumulative for anchors with multiple anchor spacings or base-material edge distances.

[2]The allowable tension load must be the lesser of the tabulated concrete or bond strength and the allowable steel tension strength. Tabulated steel tension strengths are for Grade 60 only. For Grade 40 or 50, the allowable steel strength is computed as the product of the nominal cross-sectional area of the rebar times the tensile stress described in Section 1926.3.2 of the UBC or Section A3.2 of ACI 318-99 (IBC).

[3]Allowable loads based on bond or concrete strength have been calculated using a safety factor of 4.0.

[4]Concrete thickness must be equal to or greater than 1.5 times the anchor embedment depth.

[5]The tabulated values are for anchors installed in concrete complying with Section 2.2.4 having the designated compressive strength (f'_c) at time of installation.

[6]When anchors are used to resist short-term loads, allowable tension loads should be calculated in accordance with Section 2.3.2 of this report.

TABLE 11—ALLOWABLE SHEAR LOADS FOR GRADE 60 REINFORCING BAR INSTALLED USING HILTI HIT HY-150 ADHESIVE IN ≥ 2,000 psi NORMAL-WEIGHT CONCRETE (pounds)[1,2,3,4,5,6]

REBAR SIZE	DRILL BIT DIAMETER (inches)	EMBEDMENT DEPTH (inches)	CRITICAL EDGE DISTANCE, c_{cr} (inches)	CRITICAL SPACING, s_{cr} (inches)	ALLOWABLE SHEAR LOAD BASED ON BOND OR CONCRETE CAPACITY (pounds)	ALLOWABLE SHEAR LOAD BASED ON STEEL STRENGTH GRADE 60 (pounds)
					f'_c ≥ 2,000 psi	ASTM A 615 Grade 60
No. 3	1/2	3 1/2	5 1/4	7	1,560	1,680
No. 4	5/8	4	6	8	2,615	3,060
No. 5	3/4	5	7 1/2	10	4,125	4,740
No. 6	7/8	7	10 1/2	14	6,200	6,730
No. 7	1	7 1/2	11 1/4	15	8,260	9,180
No. 8	1 1/8	8	12	16	8,375	12,085
No. 9	1 3/8	10	15	20	11,855	15,300
No. 10	1 1/2	12	18	24	17,430	19,430

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

[1]Load-reduction factors given in Table 3 for reduced edge (*c*) and anchor spacing (*s*) shall be applied to values in the bond or concrete capacity column. Linear interpolation may be used for intermediate spacings, edge distances, embedments, or concrete strengths. Load-reduction factors are cumulative for anchors with multiple anchor spacings or base-material edge distances.
[2]The allowable shear load must be the lesser of the tabulated bond or concrete strength and the allowable steel strength. Tabulated steel shear strengths are for Grade 60 only. For Grade 40 or 50, allowable steel strengths is obtained using the following formula: 0.17 × F_t × nominal area.
[3]Allowable loads based on bond or concrete strength have been calculated using a safety factor of 4.0.
[4]Concrete thickness must be equal to or greater than 1.5 times the anchor embedment depth.
[5]The tabulated values are for anchors installed in concrete complying with Section 2.2.4 having the designated compressive strength (f'_c) at the time of installation.
[6]When anchors are used to resist short-term loads, allowable shear loads should be calculated in accordance with Section 2.3.2 of this report.

TABLE 12—ALLOWABLE TENSION AND SHEAR LOADS FOR SILL PLATES AND OTHER ATTACHMENTS TO MINIMUM 2,000 psi NORMAL-WEIGHT CONCRETE AT MINIMUM EDGE DISTANCES AND USING HILTI HY-150 ADHESIVE (pounds)[1,2,3,4,5,6]

ANCHOR DIAMETER (inch)	EMBEDMENT DEPTH (inches)	EDGE DISTANCE (inches)	TENSION (pounds)	SHEAR (pounds)	
				Load Applied Perpendicular to Edge	Load Applied Parallel to Edge
1/2	4 1/4	1 3/4	1,200	400	1,445
		2 3/4	1,890	775	2,130
5/8	5	1 3/4	1,610	400	1,445
		2 3/4	2,550	1,010	2,445
7/8	10	1 3/4	4,680	—	—
	15	1 3/4	8,190	—	—

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

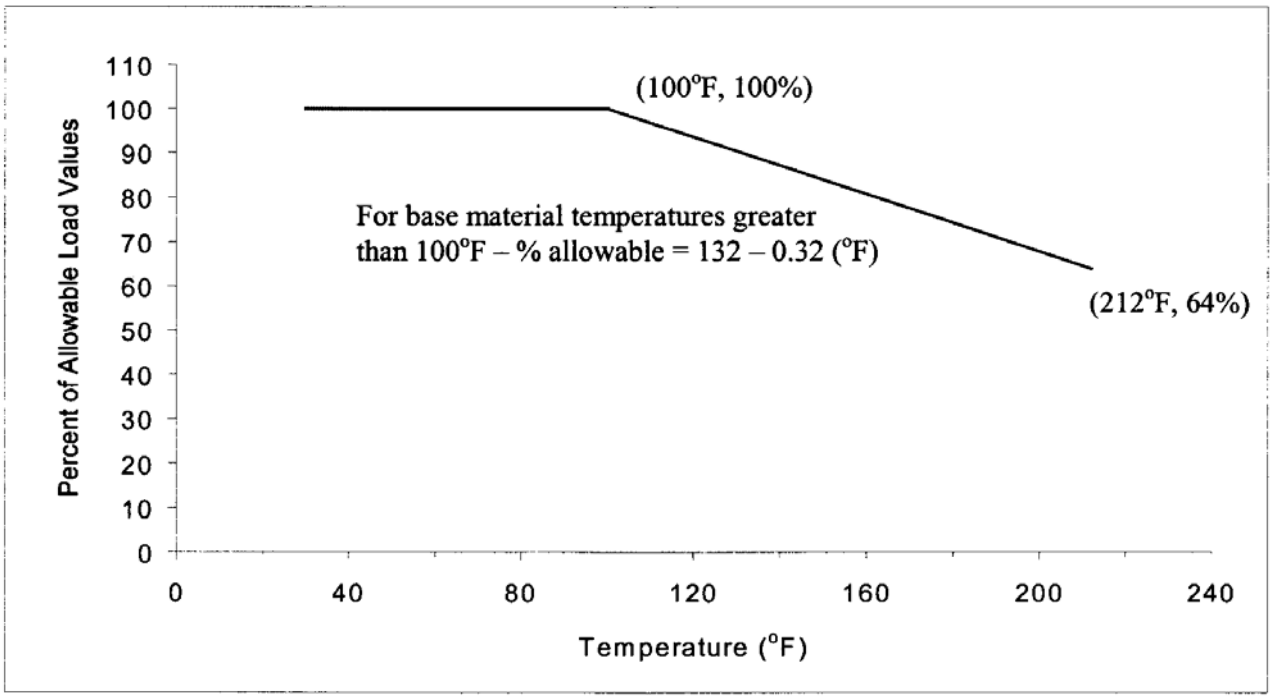
[1]Loads in this table are for threaded rod complying with Section 2.2.2 and installed in the concrete at the edge distance listed in this table. No reductions for edge distance are required when anchors are installed with the minimum edge distance specified in the table. Capacity of attached sill plate or other material to resist loads in this table must comply with the applicable code.
[2]Edge distances are given in this table. Anchor spacing shall conform to the dimensions given in Tables 6 and 7.
[3]When anchors are used to resist short-term loads, allowable loads should be calculated in accordance with Section 2.3.2 of this report.
[4]Allowable loads have been calculated using a safety factor of 4.0.
[5]Concrete thickness must be equal to or greater than 1.5 times the anchor embedment depth.
[6]The tabulated values are for anchors installed in concrete complying with Section 2.2.4 and having the designated compressive strength (f'_c) at the time of installation.

TABLE 13—ALLOWABLE LOADS FOR SILL PLATES AND OTHER ITEMS ATTACHED TO TOPS OF GROUT-FILLED MASONRY WALLS AT MINIMUM EDGE DISTANCES AND USING HILTI HY-150 ADHESIVE[1,2,3]

ANCHOR DIAMETER (inch)	EMBEDMENT DEPTH (inches)	EDGE DISTANCE (inches)	TENSION (pounds)	SHEAR (pounds)	
				Load Applied Perpendicular to Edge	Load Applied Parallel to Edge
$^1/_2$	$4^1/_4$	$1^3/_4$	1,395	560	1,425
		$2^3/_4$	1,795	1,110	2,085
$^5/_8$	5	$1^3/_4$	1,840	705	1,800
		$2^3/_4$	2,035	1,110	3,070

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

[1]Loads in this table are for threaded rod complying with Section 2.2.2 installed in the masonry at the edge distance listed in this table. No reductions for edge distance are required when anchors are installed with the minimum edge distance specified in the table. Capacity of attached sill plate or other material to resist loads in this table must comply with the applicable code.
[2]Edge distances are given in this table. Anchor spacing shall conform to the dimensions given in Table 9.
[3]When anchors are used to resist short-term loads, allowable loads should be calculated in accordance with Section 2.3.2 of this report.
[4]Masonry thickness must be equal to or greater than 1.5 times the embedment depth.
[5]The tabulated values are for anchors installed in any masonry complying with Section 2.2.6 of this report.



For **SI:** t˚C = (t˚F – 32)/1.8.

FIGURE 1—INFLUENCE OF BASE-MATERIAL TEMPERATURE ON THE TENSION OR SHEAR BOND CAPACITY OF THE HILTI HY-150 ADHESIVE ANCHOR FOR INSTALLATIONS IN BASE MATERIAL AT 23°F OR GREATER