- Compliance with International Codes
- Compliance to State/Regional Codes

ICC-ES Evaluation Report
ESR-4372

DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

HILTI, INC.

EVALUATION SUBJECT:

HILTI HVU2 ADHESIVE CAPSULE SYSTEM IN CRACKED AND UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

■ 2018, 2015, 2012 and 2009 *International Building Code®* (IBC)

■ 2018, 2015, 2012 and 2009 *International Residential Code®* (IRC)

■ 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in ADIBC.

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see ESR-4372 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

The Hilti HVU2 Adhesive Capsule System is used as anchorage to resist static, wind and earthquake (Seismic Design Categories A through F) tension and shear loads in cracked and uncracked normal-weight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].

The anchor system complies with anchors as described in Section 1901.3 of the 2018 and 2015 IBC, Section 1909 of the 2012 IBC and is an alternative to cast-in-place anchors described in Section 1908 of the 2012 IBC, and Sections 1911 and 1912 of the 2009 IBC. The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 General:

The Hilti HVU2 Adhesive Capsule System is comprised of the following components:

- Hilti HVU2 adhesive capsules

- Equipment for hole cleaning

- Setting tools to mix the adhesive capsules with the threaded rod during installation

The Hilti HVU2 Adhesive Capsule System must be used with continuously threaded rod as depicted in Figure 1. The primary components of the Hilti HVU2 Adhesive Capsule System, including the Hilti HVU2 capsules, setting tools and steel anchoring elements, are shown in Figure 2 of this report.

The manufacturer's printed installation instructions (MPII), as included with each adhesive unit package, are consolidated as Figure 5.

3.2 Materials:

3.2.1 Hilti HVU2 Adhesive Capsule: Hilti HVU2 adhesive is a two-component adhesive (resin and aggregate / hardener) with each component individually contained in a single foil capsule. The two components are mixed when the single capsule is inserted into a drilled hole in the concrete and a threaded rod with a 45-degree setting tip is spun into the capsule with a setting tool as described in Section 3.2.3, mixing the adhesive. Hilti HVU2 capsules are individually sized and labeled by diameter. Each capsule is stamped with the adhesive expiration date, capsule size, and lot number. The shelf life, as indicated by the expiration date, applies to an unused capsule stored in a dry, dark environment and in accordance with Figure 5.

3.2.2 Hole Cleaning Equipment:

3.2.2.1 Standard Equipment: Standard hole cleaning equipment, comprised of steel wire brushes and air nozzles, is described in Figure 5 of this report.

3.2.2.2 Hilti Safe-Set™ System: For the elements described in Section 3.2.4, the Hilti TE-CD or TE-YD hollow carbide drill bit with a carbide drilling head conforming to ANSI B212.15 must be used. When used in conjunction with a Hilti vacuum with a minimum value for the maximum volumetric flow rate of 129 CFM (61 ℓ/s), the Hilti TE-CD or

TE-YD drill bit will remove the drilling dust, automatically cleaning the hole. Available sizes for Hilti TE-CD or TE-YD drill bit are shown in Figure 5.

3.2.3 Setting Tools: Hilti HVU2 adhesive capsules must be set with threaded rods that are connected to electric drill drivers or electropneumatic hammer drills with a Hilti nut setting tool as described in Figure 5 of this report.

3.2.4 Anchor Elements:

3.2.4.1 Hilti HAS Threaded Steel Rods: Threaded steel rods must be clean, continuously threaded rods (all-thread) in diameters as described in Tables 3 and 6 and Figure 1 of this report supplied by Hilti. Steel design information for common grades of threaded rods is provided in Table 2. Carbon steel threaded rods must be furnished with a 0.0002-inch-thick (0.005 mm) zinc electroplated coating complying with ASTM B633 SC 1 or must be hot-dipped galvanized complying with ASTM A153, Class C or D. Stainless steel threaded rods must comply with ASTM F593 or ISO 3506 A4. Threaded steel rods must be straight and free of indentations or other defects along their length. The ends may be stamped with identifying marks. The end of the threaded rod must have a 45-degree setting tip on the embedded end in order to break the capsule and mix the adhesive system as it is spun into the hole.

3.2.4.2 Ductility: In accordance with ACI 318-14 2.3 or ACI 318-11 D.1, as applicable, in order for a steel element to be considered ductile, the tested elongation must be at least 14 percent and reduction of area must be at least 30 percent. Steel elements with a tested elongation of less than 14 percent or a reduction of area of less than 30 percent, or both, are considered brittle. Values for various steel materials are provided in Tables 2, 3, and 6 of this report. Where values are nonconforming or unstated, the steel must be considered brittle.

3.3 Concrete:

Normal-weight concrete must comply with Sections 1903 and 1905 of the IBC, as applicable. The specified compressive strength of the concrete must be from 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa) [minimum 24 MPa required under ADIBC Appendix L, Section 5.1.1].

4.0 DESIGN AND INSTALLATION

4.1 Strength Design of Post-Installed Anchors:

Refer to Table 1 for the design parameters for specific installed elements, and refer to Figure 3 and Section 4.1.4 for a flowchart to determine the applicable design bond strength or pullout strength.

4.1.1 General: The design strength of anchors complying with the 2018 and 2015 IBC, as well as Section R301.1.3 of the 2018 and 2015 IRC must be determined in accordance with ACI 318-14 Chapter 17 and this report.

The design strength of anchors under the 2012 and 2009 IBC, as well as the 2012 and 2009 IRC must be determined in accordance with ACI 318-11 and this report.

A design example according to the 2018 and 2015 IBC based on ACI 318-14 is given in Figure 4 of this report.

Design parameters are based on ACI 318-14 for use with the 2018 and 2015 IBC, and ACI 318-11 for use with the 2012 and 2009 IBC unless noted otherwise in Sections 4.1.1 through 4.1.11 of this report.

The strength design of anchors must comply with ACI 318-14 17.3.1 or ACI 318-11 D.4.1 as applicable, except as required in ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable.

Design parameters are provided in Table 2 through Table 8. Strength reduction factors, ϕ, as given in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, must be used for load combinations calculated in accordance with Section 1605.2 of the IBC or ACI 318-14 5.3 or ACI 318-11 9.2, as applicable. Strength reduction factors, ϕ, as given in ACI 318-11 D.4.4 must be used for load combinations calculated in accordance with ACI 318-11 Appendix C.

4.1.2 Static Steel Strength in Tension: The nominal static steel strength of a single anchor in tension, N_{sa}, in accordance with ACI 318-14 17.4.1.2 or ACI 318-11 Section D.5.1.2, as applicable, and the associated strength reduction factors, ϕ, in accordance with ACI 318-14 17.3.3 or ACI 318-11 Section D.4.3, as applicable, are provided in the tables outlined in Table 1 for the anchor element types included in this report.

4.1.3 Static Concrete Breakout Strength in Tension: The nominal concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, must be calculated in accordance with ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, with the following addition:

The basic concrete breakout strength of a single anchor in tension, N_b, must be calculated in accordance with ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable using the values of $k_{c,cr}$, and $k_{c,uncr}$ as described in this report. Where analysis indicates no cracking in accordance with ACI 318-14 17.4.2.6 or ACI 318-11 D.5.2.6, as applicable, N_b must be calculated using $k_{c,uncr}$ and $\Psi_{c,N}$ = 1.0. See Table 1. For anchors in lightweight concrete, see ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable. The value of f'_c used for calculation must be limited to 8,000 psi (55 MPa) in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable. Additional information for the determination of nominal bond strength in tension is given in Section 4.1.4 of this report.

4.1.4 Static Bond Strength in Tension: The nominal static bond strength of a single adhesive anchor or group of adhesive anchors in tension, N_a or N_{ag}, must be calculated in accordance with ACI 318-14 17.4.5 or ACI 318-11 D.5.5, as applicable. Bond strength values are a function of the concrete compressive strength, whether the concrete is cracked or uncracked, the concrete temperature range, the drilling method, and the installation conditions (dry or water-saturated, etc.). The resulting characteristic bond strength shall be multiplied by the associated strength reduction factor ϕ_{nn} as follows:

DRILLING METHOD	CONCRETE TYPE	PERMISSIBLE INSTALLATION CONDITIONS	BOND STRENGTH	ASSOCIATED STRENGTH REDUCTION FACTOR
Hammer-drill or Hilti TE-CD or TE-YD Hollow Drill Bit or Diamond Core Drilled	Cracked and Uncracked	Dry	$\tau_{k,uncr}$ or $\tau_{k,cr}$	ϕ_d
		Water-saturated	$\tau_{k,uncr}$ or $\tau_{k,cr}$	ϕ_{ws}

Figure 3 of this report presents a bond strength design selection flowchart. Strength reduction factors for determination of the bond strength are outlined in Table 1 of this report. Adjustments to the bond strength may also be made for increased concrete compressive strength as noted in the footnotes to the bond strength tables.

4.1.5 Static Steel Strength in Shear: The nominal static strength of a single anchor in shear as governed by the steel, V_{sa}, in accordance with ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable, and strength reduction

factors, ϕ, in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are given in the tables outlined in Table 1 for the anchor element types included in this report.

4.1.6 Static Concrete Breakout Strength in Shear: The nominal static concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, must be calculated in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, based on information given in the tables outlined in Table 1. The basic concrete breakout strength of a single anchor in shear, V_b, must be calculated in accordance with ACI 318-14 17.5.2.2 or ACI 318-11 D.6.2.2, as applicable, using the values of d given in the tables as outlined in Table 1 for the corresponding anchor steel in lieu of d_a (2018, 2015, 2012 and 2009 IBC). In addition, h_{ef} must be substituted for ℓ_e. In no case must ℓ_e exceed $8d$. The value of f'_c must be limited to a maximum of 8,000 psi (55 MPa) in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable.

4.1.7 Static Concrete Pryout Strength in Shear: The nominal static pryout strength of a single anchor or group of anchors in shear, V_{cp} or V_{cpg}, must be calculated in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable.

4.1.8 Interaction of Tensile and Shear Forces: For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 17.6 or ACI 318-11 D.7, as applicable.

4.1.9 Minimum Member Thickness, h_{min}, Anchor Spacing, s_{min} and Edge Distance, c_{min}: In lieu of ACI 318-14 17.7.1 and 17.7.3 or ACI 318-11 D.8.1 and D.8.3, as applicable, values of s_{min} and c_{min} described in this report must be observed for anchor design and installation. Likewise, in lieu of ACI 318-14 17.7.5 or ACI 318-11 D.8.5, as applicable, the minimum member thicknesses, h_{min}, described in this report must be observed for anchor design and installation. For adhesive anchors that will remain untorqued, ACI 318-14 17.7.4 or ACI 318-11 D.8.4, as applicable, applies.

4.1.10 Critical Edge Distance c_{ac}: In lieu of ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable, c_{ac} must be determined as follows:

$$c_{ac} = h_{ef} \cdot \left(\frac{\tau_{k,uncr}}{1160}\right)^{0.4} \cdot \left[3.1 - 0.7\frac{h}{h_{ef}}\right] \qquad \text{Eq. (4-1)}$$

where $\left[\frac{h}{h_{ef}}\right]$ need not be taken as larger than 2.4: and

$\tau_{k,uncr}$ is the characteristic bond strength in uncracked concrete stated in the tables of this report, whereby $\tau_{k,uncr}$ need not be taken as greater than:

$$\tau_{k,uncr} = \frac{k_{uncr}\sqrt{h_{ef}f'_c}}{\pi \cdot d_a}$$

4.1.11 Design Strength in Seismic Design Categories C, D, E and F: In structures assigned to Seismic Design Category C, D, E or F under the IBC or IRC, the design must be performed according to ACI 318-14 17.2.3 or ACI 318-11 Section D.3.3, as applicable. Modifications to ACI 318-14 17.2.3 shall be applied under Section 1905.1.8 of the 2018 and 2015 IBC. For the 2012 IBC, Section 1905.1.9 shall be omitted. Modifications to ACI 318-08 D.3.3 must be applied under Section 1908.1.9 of the 2009 IBC.

The nominal steel shear strength, V_{sa}, must be adjusted by $\alpha_{V,seis}$ as given in the tables summarized in Table 1 for the anchor element types included in this report. For tension, the nominal pullout strength $N_{p,cr}$ or bond

strength τ_{cr} must be adjusted by $\alpha_{N,seis}$. See Tables 5 and 8.

As an exception to ACI 318-11 D.3.3.4.2: Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 shall be deemed to satisfy ACI 318-11 D.3.3.4.3(d).

Under ACI 318-11 D.3.3.4.3(d), in lieu of requiring the anchor design tensile strength to satisfy the tensile strength requirements of ACI 318-11 D.4.1.1, the anchor design tensile strength shall be calculated from ACI 318-11 D.3.3.4.4.

The following exceptions apply to ACI 318-11 D.3.3.5.2:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or non-bearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with ACI 318-11 D.6.2 and D.6.3 need not be computed and ACI 318-11 D.3.3.5.3 need not apply provided all of the following are satisfied:

   1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AF&PA NDS Table 11E for lateral design values parallel to grain.

   1.2. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).

   1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).

   1.4. Anchor bolts are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

   1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

   1.6. The sill plate is 2-inch or 3-inch nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or non-bearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with ACI 318-11 D.6.2 and D.6.3, need not be computed and ACI 318-11 D.3.3.5.3 need not apply provided all of the following are satisfied:

   2.1. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).

   2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

   2.3. Anchors are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.

   2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

   2.5. The track is 33 to 68 mil designation thickness.

   Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100 Section E3.3.1.

3. In light-frame construction, bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching a sill plate or track to foundation or foundation stem wall need not satisfy ACI 318-11 D.3.3.5.3(a) through (c) when the design strength of the anchors is determined in accordance with ACI 318-11 D.6.2.1(c).

4.2 Installation:

Installation parameters are illustrated in Figure 1. Installation must be in accordance with ACI 318-14 17.8.1 and 17.8.2 or ACI 318-11 D.9.1 and D.9.2, as applicable. Anchor locations must comply with this report and the plans and specifications approved by the code official. Installation of the Hilti HVU2 Adhesive Capsule System must conform to the manufacturer's printed installation instructions (MPII) included in each unit package consolidated as Figure 5 of this report. The MPII contains additional requirements for combinations of drill hole depth, diameter, drill bit type, hole preparation, setting tools and minimum drill machine sizes used for setting anchors.

1$^{1}/_{4}$-in., 27mm, and 30mm diameter threaded rod to be installed in generally vertically downward direction only. Smaller diameters may be installed horizontally and overhead in accordance with the MPII depicted in Figure 5.

4.3 Special Inspection:

Periodic special inspection must be performed where required in accordance with Section 1705.1.1 and Table 1705.3 of the 2018, 2015 and 2012 IBC, or Section 1704.15 and Table 1704.4 of the 2009 IBC, as applicable, and this report. The special inspector must be on the jobsite initially during anchor installation to verify anchor type and dimensions, concrete type, concrete compressive strength, adhesive identification and expiration date, hole dimensions, hole cleaning procedures, spacing, edge distances, concrete thickness, anchor embedment, tightening torque and adherence to the manufacturer's printed installation instructions.

The special inspector must verify the initial installations of each type and size of adhesive anchor by construction personnel on site. Subsequent installations of the same anchor type and size by the same construction personnel are permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or the personnel performing the installation requires an initial inspection. For ongoing installations over an extended period, the special inspector must make regular inspections to confirm correct handling and installation of the product.

Continuous special inspection of adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be performed in accordance with ACI 318-14 17.8.2.4, 26.7.1(h), and 26.13.3.2(c) or ACI 318-11 D.9.2.4, as applicable.

Under the IBC, additional requirements as set forth in Sections 1705, 1706, and 1707 must be observed, where applicable.

5.0 CONDITIONS OF USE

The Hilti HVU2 Adhesive Capsule System described in this report complies with, or is a suitable alternative to what is specified in, the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Hilti HVU2 adhesive anchors must be installed in accordance with the manufacturer's printed installation instructions (MPII) as included in the adhesive packaging and consolidated as Figure 5 of this report.

5.2 The anchors must be installed in cracked and uncracked normal-weight concrete having a specified compressive strength f'_c = 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].

5.3 The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.1 MPa).

5.4 The concrete shall have attained its minimum design strength prior to installation of the Hilti HVU2 adhesive anchors.

5.5 Anchors must be installed in concrete base materials in holes drilled using carbide-tipped drill bits manufactured with the range of maximum and minimum drill-tip dimensions specified in ANSI B212.15-1994, or diamond core drill bits, as detailed in Figure 5.

5.6 Installation setting tools and minimum drill machine sizes used for setting anchors must be in accordance with the (MPII) as included in the adhesive packaging and consolidated as Figure 5 of this report.

5.7 Loads applied to the anchors must be adjusted in accordance with Section 1605.2 of the IBC for strength design.

5.8 Hilti HVU2 adhesive anchors are recognized for use to resist short- and long-term loads, including wind and earthquake, subject to the conditions of this report.

5.9 In structures assigned to Seismic Design Category C, D, E or F under the IBC or IRC, anchor strength must be adjusted in accordance with Section 4.1.11 of this report.

5.10 Hilti HVU2 adhesive anchors are permitted to be installed in concrete that is cracked or that may be expected to crack during the service life of the anchor, subject to the conditions of this report.

5.11 Anchor strength design values must be established in accordance with Section 4.1 of this report.

5.12 Minimum anchor spacing and edge distance as well as minimum member thickness must comply with the values noted in this report.

5.13 Prior to anchor installation, calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.14 Anchors are not permitted to support fire-resistive construction. Where not otherwise prohibited by the code, Hilti HVU2 adhesive anchors are permitted for installation in fire-resistive construction provided that at least one of the following conditions is fulfilled:

- Anchors are used to resist wind or seismic forces only.

- Anchors that support gravity load–bearing structural elements are within a fire-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.

- Anchors are used to support nonstructural elements.

5.15 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 such conditions is beyond the scope of this report.

5.16 Use of zinc-plated carbon steel threaded rods is limited to dry, interior locations.

5.17 Use of hot-dipped galvanized carbon steel and stainless steel rods is permitted for exterior exposure or damp environments.

5.18 Steel anchoring materials in contact with preservative-treated and fire-retardant-treated wood must be of zinc-coated carbon steel or stainless steel. The minimum coating weights for zinc-coated steel must comply with ASTM A153.

5.19 Periodic special inspection must be provided in accordance with Section 4.3 of this report. Continuous special inspection for anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads must be provided in accordance with Section 4.3 of this report.

5.20 Installation of $^3/_8$- through 1-inch diameter and M8 through M24 diameter anchors in horizontal or upwardly inclined orientations to resist sustained tension loads shall be performed by personnel certified by an applicable certification program in accordance with ACI 318-14 17.8.2.2 or 17.8.2.3, or ACI 318-11 D.9.2.2 or D.9.2.3, as applicable. Installation of 1 ¼-inch and M27 and M30 diameter anchors are limited to generally vertically downward direction only.

5.21 Hilti HVU2 adhesive anchors may be used to resist tension and shear forces in floor, wall, and overhead installations only if installation is into concrete with a temperature between 14°F and 104°F (-10°C and 40°C). The anchor must be supported until fully cured (i.e., with Hilti HIT-OHW wedges, or other suitable means). Where temporary restraint devices are used, their use shall not result in imparement of the anchor shear resistance.

5.22 Anchors shall not be used for applications where the concrete temperature can rise from 40°F or less to 80°F or higher within a 12-hour period. Such applications may include but are not limited to anchorage of building façade systems and other applications subject to direct sun exposure.

5.23 Hilti HVU2 adhesives are manufactured by Hilti GmbH, Kaufering, Germany, under a quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Post-installed Adhesive Anchors in Concrete (AC308), dated October 2017 (Editorially revised March 2018), which incorporates requirements in ACI 355.4-11, including but not limited to tests under freeze/thaw conditions (Table 3.2, test series 6).

7.0 IDENTIFICATION

7.1 Hilti HVU2 adhesive is identified by packaging labeled with the manufacturer's name (Hilti Corp.) and address, product name, lot number, expiration date, and evaluation report number (ESR-4372).

7.2 Threaded rods, nuts, washers, bolts, cap screws, and deformed reinforcing bars are standard elements and must conform to applicable national or international specifications.

7.3 The report holder's contact information is the following:

HILTI, INC.
7250 DALLAS PARKWAY, SUITE 1000
PLANO, TEXAS 75024
(800) 879-8000
www.hilti.com
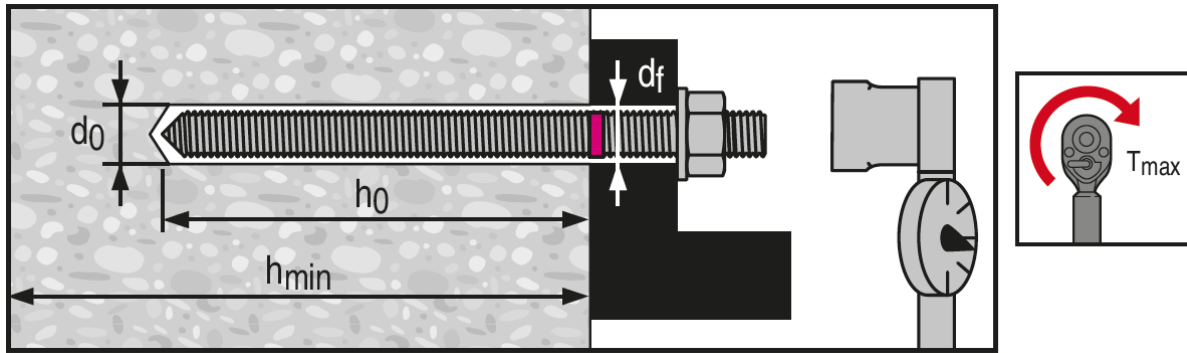
Anchor Size	HVU2	d_0			h_0 (exact)	d_f	h_{min}	T_{max}	HIT-RB
3/8"	3/8"x 3 1/2"	7/16"	12 mm	–	3 1/2"	7/16"	4 3/4"	15 ft-lb 20 Nm	–
1/2"	1/2"x 4 1/4"	9/16"	9/16"	9/16"	4 1/4"	9/16"	5 1/2"	30 ft-lb 41 Nm	9/16"
5/8"	5/8"x 5"	11/16"	11/16"	11/16"	5"	11/16"	6 3/8"	60 ft-lb 81 Nm	11/16"
3/4"	3/4"x 6 5/8"	7/8"	7/8"	7/8"	6 5/8"	13/16"	8 3/8"	100 ft-lb 136 Nm	7/8"
7/8"	7/8"x 6 5/8"	1"	1"	1"	6 5/8"	15/16"	8 5/8"	125 ft-lb 169 Nm	1"
1"	1"x 8 1/4"	1 1/8"	1 1/8"	1 1/8"	8 1/4"	1 1/8"	10 1/2"	150 ft-lb 203 Nm	1 1/8"
1 1/4"	1 1/4"x 11"	1 3/8"	1 3/8"	1 3/8"	11"	1 3/8"	13 3/4"	200 ft-lb 271 Nm	1 3/8"

Anchor Size	HVU2	d_0 [mm]			h_0 (exact) [mm]	d_f [mm]	h_{min} [mm]	T_{max} [Nm]	HIT-RB
M8	M8x80	10	–	–	80	9	110	10	10
M10	M10x90	12	–	12	90	12	120	20	12
M12	M12x110	14	14	14	110	14	140	40	14
M16	M16x125	18	18	18	125	18	160	80	18
M20	M20x170	22	22	22	170	22	220	150	22
M24	M24x210	28	28	28	210	26	270	200	28
M27	M27x240	30	–	30	240	30	300	270	30
M30	M30x270	35	35	35	270	33	340	300	35

FIGURE 1—INSTALLATION PARAMETERS FOR HVU2 WITH THREADED ROD

HILTI TE-CD OR TE-YD HOLLOW CARBIDE DRILL BIT AND VACUUM

HILTI HVU2 ADHESIVE CAPSULE

IMPACT DRIVER

OR

DRILL DRIVER

OR

HAMMER DRILL

THREADED ROD WITH SETTING TIP, DOUBLE NUT, SOCKET, DRILL ADAPTERS, AND SETTING DRILLS

FIGURE 2—HILTI HVU2 ANCHORING SYSTEM

TABLE 1—DESIGN TABLE INDEX

Anchor element	Design table	Fractional		Metric	
		Table	Page	Table	Page
Standard Threaded Rod	Steel strength – N_{sa}, V_{sa}	3	9	6	12
	Concrete breakout – $N_{cb(g)}$, $V_{cb(g)}$, $V_{cp(g)}$	4	10	7	13
	Bond strength, Diamond core drill – $N_{a(g)}$	5	11	8	14

Threaded rod with setting tip → Uncracked concrete or Cracked concrete → Carbide drill bit or Hilti TE-CD or TE-YD hollow drill bit or Diamond core drill bit → dry concrete (d) or Water-saturated (ws) → ϕ_d / ϕ_{ws} → $\tau_{k,cr}$ or $\tau_{k,uncr}$
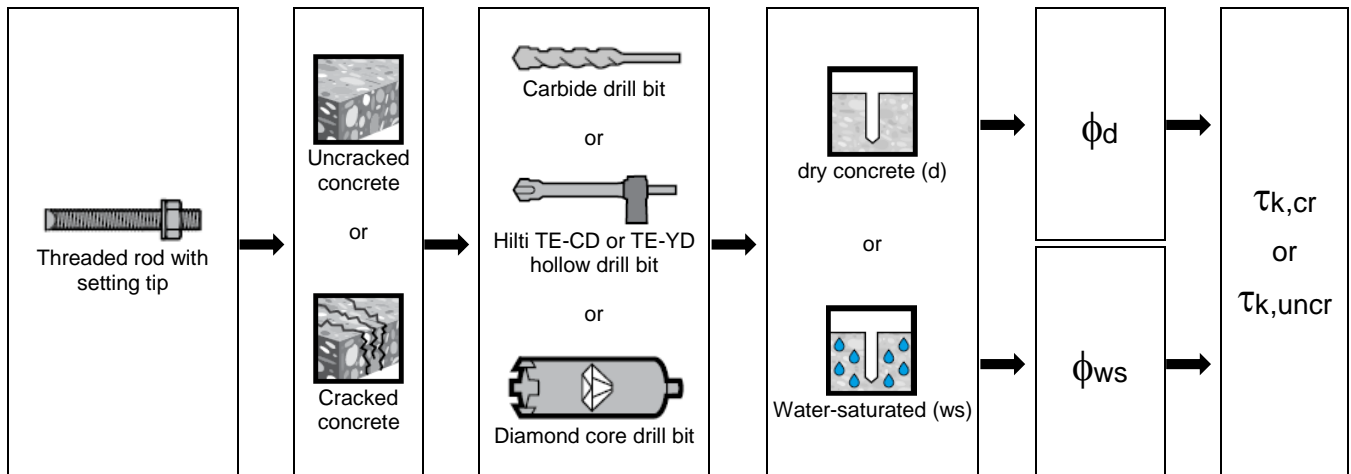
FIGURE 3—FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH

TABLE 2—SPECIFICATION AND PHYSICAL PROPERTIES OF COMMON CARBON AND STAINLESS STEEL THREADED ROD MATERIALS [1]

Threaded rod specification			Minimum specified ultimate strength f_{uta}	Minimum specified yield strength 0.2% offset f_{ya}	f_{uta} / f_{ya}	Elongation, min. percent [7]	Reduction of area, min. percent	Specification for nuts [8]
CARBON STEEL	ASTM F1554, Grade 55 [2]	psi	75,000	55,000	1.36	21	30	ASTM A194 or ASTM A563
		(MPa)	(517)	(379)				
	ASTM F1554, Grade 105 [2]	psi	125,000	105,000	1.19	15	45	ASTM A194 or ASTM A563
		(MPa)	(862)	(724)				
	ASTM A193 Grade B7 [3] ≤ 2¹/₂ in. (≤ 64 mm)	psi	125,000	105,000	1.19	16	50	ASTM A193
		(MPa)	(862)	(724)				
	ISO 898-1 Class 5.8 [4]	MPa	500	400	1.25	22	-	DIN 934 Grade 6
		(psi)	(72,500)	(58,000)				
	ISO 898-1 Class 8.8 [4]	MPa	800	640	1.25	12	52	DIN 934 Grade 8
		(psi)	(116,000)	(92,800)				
STAINLESS STEEL	ASTM F593 CW1 (316) [5] ¹/₄-in. to ⁵/₈-in.	psi	100,000	65,000	1.54	20	-	ASTM F594
		(MPa)	(690)	(448)				
	ASTM F593 CW2 (316) [5] ³/₄-in. to 1-in.	psi	85,000	45,000	1.89	25	-	ASTM F594
		(MPa)	(586)	(310)				
	ASTM A193 Grade 8(M) [3] Class 1: 1¼-in.	psi	75,000	30,000	2.50	30	50	ASTM F594
		(MPa)	(517)	(207)				
	ISO 3506-1 A4-70 [6] M8 – M24	MPa	700	450	1.56	20	-	ISO 4032
		(psi)	(101,500)	(65,250)				
	ISO 3506-1 A4-50 [6] M27 – M30	MPa	500	210	2.38	30	-	ISO 4032
		(psi)	(72,500)	(30,450)				

For **SI**: 1 psi = 0.006897 MPa.
For **pound-inch** units: 1 MPa = 145 psi.

[1] Hilti HVU2 adhesive may be used in conjunction with all grades of continuously threaded carbon or stainless steel rod (all-thread) that comply with the code reference standards and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M M Profile Metric Thread Series. Values for threaded rod types and associated nuts supplied by Hilti are provided here. Rods used with HVU2 capsules must have a 45° setting tip to properly mix adhesive during installation. See Figure 5 for MPII.

[2] *Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength*

[3] *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*

[4] *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs*

[5] *Standard Steel Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs*

[6] *Mechanical properties of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs*

[7] Based on 2-in. (50 mm) gauge length except for A193, which are based on a gauge length of 4d and ISO 898, which is based on 5d.

[8] Nuts of other grades and styles having specified proof load stresses greater than the specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod

Fractional Threaded Rod   **Steel Strength**

TABLE 3—STEEL DESIGN INFORMATION FOR FRACTIONAL THREADED ROD

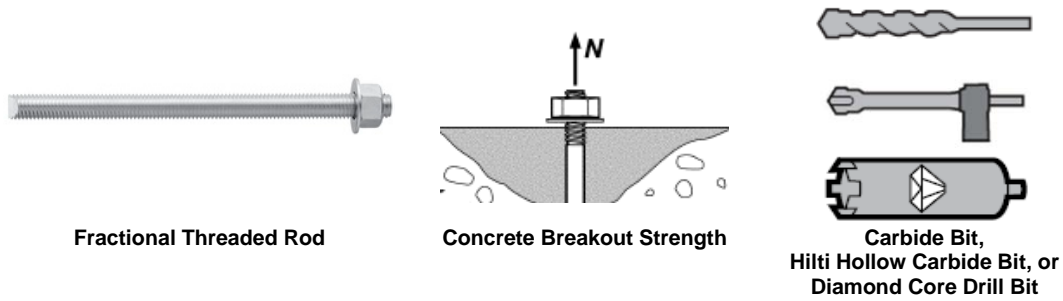| DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.) [1]						
				$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$
Rod outside diameter		d	in. (mm)	0.375 (9.5)	0.5 (12.7)	0.625 (15.9)	0.75 (19.1)	0.875 (22.2)	1 (25.4)	1.25 (31.8)
Rod effective cross-sectional area		A_{se}	in.² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM F1554 Gr. 55	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	5,815 (25.9)	10,645 (47.4)	16,950 (75.4)	25,090 (111.6)	34,630 (154.0)	45,430 (202.1)	72,685 (323.3)
		V_{sa}	lb (kN)	3,490 (15.5)	6,385 (28.4)	10,170 (45.2)	15,055 (67.0)	20,780 (92.4)	27,260 (121.3)	43,610 (194.0)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70						
	Strength reduction factor for tension [2]	ϕ	-	0.75						
	Strength reduction factor for shear [2]	ϕ	-	0.65						
ASTM F1554 Gr. 105 or ASTM A193 B7	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	9,690 (43.1)	17,740 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lb (kN)	5,815 (25.9)	10,645 (47.4)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70						
	Strength reduction factor for tension [2]	ϕ	-	0.75						
	Strength reduction factor for shear [2]	ϕ	-	0.65						
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33,470 (148.9)	43,910 (195.3)	70,260 (312.5)
		V_{sa}	lb (kN)	3,370 (15.0)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,345 (117.2)	42,155 (187.5)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70						
	Strength reduction factor for tension [3]	ϕ	-	0.65						
	Strength reduction factor for shear [3]	ϕ	-	0.60						
ASTM F593, CW Stainless steel	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,435 (126.5)	39,245 (174.6)	51,485 (229.0)	- -
		V_{sa}	lb (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	- -
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70						
	Strength reduction factor for tension [3]	ϕ	-	0.65						
	Strength reduction factor for shear [3]	ϕ	-	0.60						
ASTM A193, Gr. 8(M), Class 1 Stainless steel	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	- -	- -	- -	- -	- -	- -	55,240 (245.7)
		V_{sa}	lb (kN)	- -	- -	- -	- -	- -	- -	33,145 (147.4)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70						
	Strength reduction factor for tension [2]	ϕ	-	0.75						
	Strength reduction factor for shear [2]	ϕ	-	0.65						

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N.

For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

[1] Values provided for common rod material types are based on specified strengths and calculated in accordance with ACI 318-14 Eq (17.4.1.2) and Eq. (17.5.1.2b); or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable. Nuts and washers must be appropriate for the rod.

[2] For use with the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a ductile steel element.

[3] For use with the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a brittle steel element.

Fractional Threaded Rod

Concrete Breakout Strength

**Carbide Bit,
Hilti Hollow Carbide Bit, or
Diamond Core Drill Bit**

TABLE 4—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL THREADED ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE BIT), OR DIAMOND CORE DRILL BIT [1]
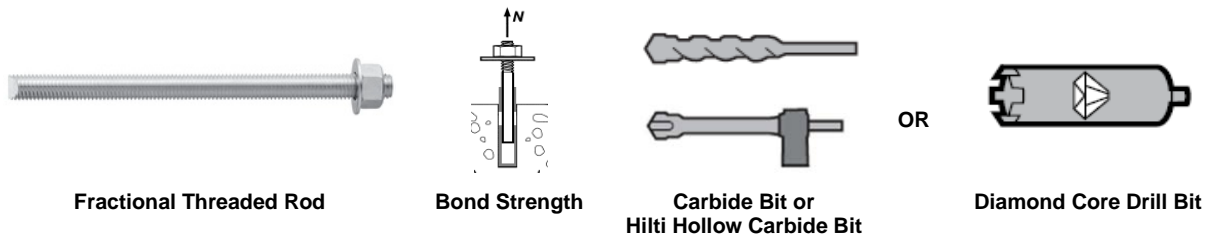
DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (in.)						
			$3/8$	$1/2$	$5/8$	$3/4$	$7/8$	1	$1\frac{1}{4}$
Effectiveness factor for cracked concrete	$k_{c,cr}$	in-lb	17						
		(SI)	(7.1)						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	in-lb	24						
		(SI)	(10.0)						
Effective embedment	h_{ef}	in.	$3\frac{1}{2}$	$4\frac{1}{4}$	5	$6\frac{5}{8}$	$6\frac{5}{8}$	$8\frac{1}{4}$	11
		(mm)	(89)	(108)	(127)	(168)	(168)	(210)	(279)
Minimum anchor spacing	s_{min}	in.	$1\frac{7}{8}$	$2\frac{1}{2}$	$3\frac{1}{8}$	$3\frac{1}{4}$	$4\frac{3}{8}$	5	$6\frac{1}{4}$
		(mm)	(48)	(64)	(79)	(95)	(111)	(127)	(159)
Minimum edge distance	c_{min}	in.	$1\frac{7}{8}$	$2\frac{1}{2}$	$3\frac{1}{8}$	$3\frac{1}{4}$	$4\frac{3}{8}$	5	$6\frac{1}{4}$
		(mm)	(48)	(64)	(79)	(95)	(111)	(127)	(159)
Minimum concrete thickness	h_{min}	in.	$4\frac{3}{4}$	$5\frac{1}{2}$	$6\frac{3}{8}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$10\frac{1}{2}$	$13\frac{3}{4}$
		(mm)	(121)	(140)	(162)	(213)	(219)	(267)	(349)
Critical edge distance for splitting (uncracked concrete)	c_{ac}	-	See Section 4.1.10 of this report.						
Strength reduction factor for tension, concrete failure modes, Condition B [2]	ϕ	-	0.65						
Strength reduction factor for shear, concrete failure modes, Condition B [2]	ϕ	-	0.70						

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

[1] Additional setting information is described in Figure 5, Manufacturers Printed Installation Instructions (MPII).
[2] Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable.

Fractional Threaded Rod   **Bond Strength**   **Carbide Bit or Hilti Hollow Carbide Bit**   **OR**   **Diamond Core Drill Bit**

TABLE 5—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL THREADED ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT), OR DIAMOND CORE DRILL BIT[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.)						
				$3/8$	$1/2$	$5/8$	$3/4$	$7/8$	1	$1 1/4$ [4]
Effective embedment		h_{ef}	in.	$3 1/2$	$4 1/4$	5	$6 5/8$	$6 5/8$	$8 1/4$	11
			(mm)	(89)	(108)	(127)	(168)	(168)	(210)	(279)
Carbide Bit				**or Hilti Hollow Carbide Bit**						
Temp. Range A [2] 130°F / 110°F (55°C / 43°C)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	psi	-	1,055	1,055	1,055	1,055	1,055	1,055
			(MPa)	-	(7.3)	(7.3)	(7.3)	(7.3)	(7.3)	(7.3)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	psi	1,475	1,950	1,950	1,950	1,950	1,950	2,015
			(MPa)	(10.2)	(13.5)	(13.5)	(13.5)	(13.5)	(13.5)	(13.9)
Temp. Range B [2] 176°F / 110°F (80°C / 43°C)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	psi	-	980	980	980	980	980	980
			(MPa)	-	(6.8)	(6.8)	(6.8)	(6.8)	(6.8)	(6.8)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	psi	1,370	1,815	1,815	1,815	1,815	1,815	1,870
			(MPa)	(9.5)	(12.5)	(12.5)	(12.5)	(12.5)	(12.5)	(12.9)
Temp. Range C [2] 248°F / 162°F (120°C / 72°C)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	psi	-	615	615	615	615	615	615
			(MPa)	-	(4.2)	(4.2)	(4.2)	(4.2)	(4.2)	(4.2)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	psi	860	1,135	1,135	1,135	1,135	1,135	1,170
			(MPa)	(5.9)	(7.8)	(7.8)	(7.8)	(7.8)	(7.8)	(8.1)
Reduction for seismic tension		$\alpha_{N,seis}$	-	-	1.00					
Diamond Core Drill Bit										
Temp. Range A [2] 130°F / 110°F (55°C / 43°C)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	psi	-	1,075	1,075	1,075	1,075	1,075	1,075
			(MPa)	-	(7.4)	(7.4)	(7.4)	(7.4)	(7.4)	(7.4)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	psi	-	1,830	1,830	1,830	1,830	1,830	1,885
			(MPa)	-	(12.6)	(12.6)	(12.6)	(12.6)	(12.6)	(13.0)
Temp. Range B [2] 176°F / 110°F (80°C / 43°C)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	psi	-	1,010	1,010	1,010	1,010	1,010	1,010
			(MPa)	-	(7.0)	(7.0)	(7.0)	(7.0)	(7.0)	(7.0)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	psi	-	1,720	1,720	1,720	1,720	1,720	1,770
			(MPa)	-	(11.9)	(11.9)	(11.9)	(11.9)	(11.9)	(12.2)
Temp. Range C [2] 248°F / 162°F (120°C / 72°C)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	psi	-	650	650	650	650	650	650
			(MPa)	-	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	psi	-	1,105	1,105	1,105	1,105	1,105	1,135
			(MPa)	-	(7.6)	(7.6)	(7.6)	(7.6)	(7.6)	(7.8)
Reduction for seismic tension		$\alpha_{N,seis}$	-	-	1.00					
Carbide Bit, Hilti Hollow Carbide Bit, or Diamond Core Drill Bit										
Dry concrete	Anchor category	-	-	1						
	Strength reduction factor	ϕ_d	-	0.65						
Water-saturated	Anchor category	-	-	1						
	Strength reduction factor	ϕ_{ws}	-	0.65						

For **SI**: 1 inch = 25.4 mm, 1 psi = 0.006897 MPa.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 MPa = 145 psi.

[1] Bond strength values correspond to concrete compressive strength f'_c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'_c, between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2,500)^n$ [For SI: $(f'_c / 17.2)^n$], where n is as follows:
 n = 0.26 for uncracked concrete, all drilling methods
 n = 0.14 for cracked concrete, carbide bit or Hilti hollow drill bit
 n = 0 for cracked concrete, diamond core drill bit
 See Section 4.1.4 of this report for bond strength determination.
[2] Temperature range A: Maximum short term temperature = 130°F (55°C), Maximum long term temperature = 110°F (43°C).
 Temperature range B: Maximum short term temperature = 176°F (80°C), Maximum long term temperature = 110°F (43°C).
 Temperature range C: Maximum short term temperature = 248°F (120°C), Maximum long term temperature = 162°F (72°C).
 Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.
[3] Characteristic bond strengths for $3/8$-in. to 1-in. rods are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.
[4] $1 1/4$-in. rods to be installed in generally vertically downward direction only.

Metric Threaded Rod   **Steel Strength**

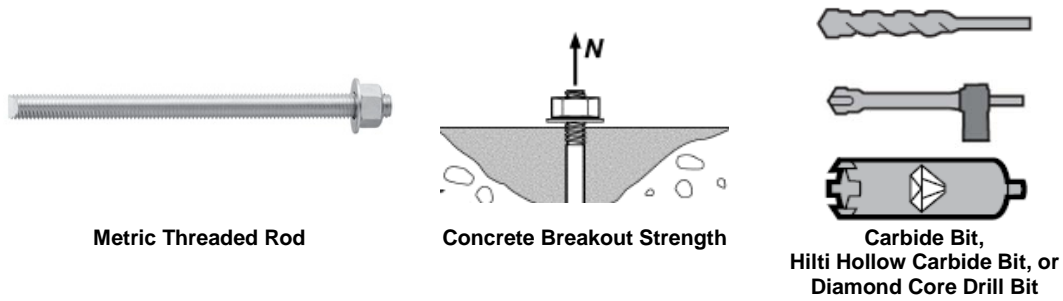**TABLE 6—STEEL DESIGN INFORMATION FOR METRIC THREADED ROD**

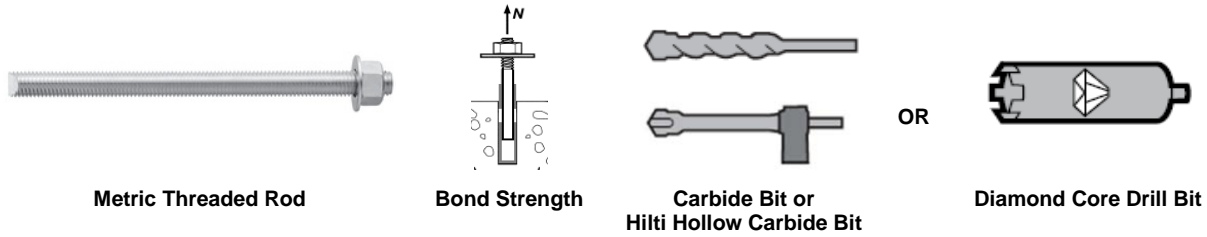| DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (mm) [1]							
				8	10	12	16	20	24	27	30
Rod outside diameter		d	mm	8	10	12	16	20	24	27	30
			(in.)	(0.31)	(0.39)	(0.47)	(0.63)	(0.79)	(0.94)	(1.06)	(1.18)
Rod effective cross-sectional area		A_{se}	mm^2	36.6	58.0	84.3	157	245	353	459	561
			(in.^{2})	(0.057)	(0.090)	(0.131)	(0.243)	(0.380)	(0.547)	(0.711)	(0.870)
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength	N_{sa}	kN	18.5	29.0	42.0	78.5	122.5	176.5	229.5	280.5
			(lb)	(4,114)	(6,519)	(9,476)	(17,647)	(27,539)	(39,679)	(51,594)	(63,059)
		V_{sa}	kN	11.0	14.5	25.5	47.0	73.5	106.0	137.5	168.5
			(lb)	(2,648)	(3,260)	(5,685)	(10,588)	(16,523)	(23,807)	(30,956)	(37,835)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70							
	Strength reduction factor for tension [2]	ϕ	-	0.65							
	Strength reduction factor for shear [2]	ϕ	-	0.60							
ISO 898-1 Class 8.8	Nominal strength as governed by steel strength	N_{sa}	kN	29.3	46.5	67.5	125.5	196.0	282.5	367.0	449.0
			(lb)	(6,582)	(10,431)	(15,161)	(28,236)	(44,063)	(63,486)	(82,550)	(100,894)
		V_{sa}	kN	17.6	23.0	40.5	75.5	117.5	169.5	220.5	269.5
			(lb)	(3,949)	(5,216)	(9,097)	(16,942)	(26,438)	(38,092)	(49,530)	(60,537)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70							
	Strength reduction factor for tension [2]	ϕ	-	0.65							
	Strength reduction factor for shear [2]	ϕ	-	0.60							
ISO 3506-1 Class A4 Stainless steel	Nominal strength as governed by steel strength	N_{sa}	kN	25.6	40.6	59.0	109.9	171.5	247.1	229.5	280.5
			(lb)	(5,760)	(9,127)	(13,266)	(24,706)	(38,555)	(55,550)	(51,594)	(63,059)
		V_{sa}	kN	15.4	20.3	35.4	65.9	102.9	148.3	137.7	168.3
			(lb)	(3,456)	(4,564)	(7,960)	(14,824)	(23,133)	(33,330)	(30,956)	(37,835)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70							
	Strength reduction factor for tension [2]	ϕ	-	0.65							
	Strength reduction factor for shear [2]	ϕ	-	0.60							

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

[1] Values provided for common rod material types are based on specified strengths and calculated in accordance with ACI 318-14 Eq (17.4.1.2) and Eq. (17.5.1.2b); or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable. Nuts and washers must be appropriate for the rod.
[2] For use with the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a brittle steel element.

Metric Threaded Rod   **Concrete Breakout Strength**   **Carbide Bit,**
Hilti Hollow Carbide Bit, or
Diamond Core Drill Bit

**TABLE 7—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL THREADED ROD IN HOLES DRILLED WITH A
HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE BIT), OR DIAMOND CORE DRILL BIT [1]**

DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (in.)							
			8	10	12	16	20	24	27	30
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI	7.1							
		(in-lb)	(17)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI	10.0							
		(in-lb)	(24)							
Effective embedment	h_{ef}	mm	80	90	110	125	170	210	240	270
		(in.)	(3.1)	(3.5)	(4.3)	(4.9)	(6.7)	(8.3)	(9.4)	(10.6)
Minimum anchor spacing	s_{min}	mm	40	50	60	80	100	120	135	150
		(in.)	(1.6)	(2.0)	(2.4)	(3.2)	(3.9)	(4.7)	(5.3)	(5.9)
Minimum edge distance	c_{min}	mm	40	50	60	80	100	120	135	150
		(in.)	(1.6)	(2.0)	(2.4)	(3.2)	(3.9)	(4.7)	(5.3)	(5.9)
Minimum concrete thickness	h_{min}	mm	110	120	140	160	220	270	300	340
		(in.)	(4.3)	(4.7)	(5.5)	(6.3)	(8.7)	(10.6)	(11.8)	(13.4)
Critical edge distance for splitting (uncracked concrete)	c_{ac}	-	See Section 4.1.10 of this report.							
Strength reduction factor for tension, concrete failure modes, Condition B [2]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B [2]	ϕ	-	0.70							

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

[1] Additional setting information is described in Figure 5, Manufacturers Printed Installation Instructions (MPII).
[2] Values provided for post-installed anchors under Condition B without supplementary reinforcement as defined in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable.

Metric Threaded Rod   Bond Strength   Carbide Bit or Hilti Hollow Carbide Bit   OR   Diamond Core Drill Bit

TABLE 8—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT(OR HILTI HOLLOW CARBIDE BIT), OR DIAMOND CORE DRILL BIT [1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.)							
				8	10	12	16	20	24	27 [4]	30 [4]
Effective embedment		h_{ef}	in.	80	90	110	125	170	210	240	270
			(mm)	(3.1)	(3.5)	(4.3)	(4.9)	(6.7)	(8.3)	(9.4)	(10.6)
Carbide Bit				**or Hilti Hollow Carbide Bit**							
Temp. Range A [2] 55°C / 43°C (130°F / 110°F)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	MPa	-	7.3	7.3	7.3	7.3	7.3	7.3	7.3
			(psi)	-	(1,055)	(1,055)	(1,055)	(1,055)	(1,055)	(1,055)	(1,055)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	MPa	10.2	13.5	13.5	13.5	13.5	13.5	13.9	13.9
			(psi)	(1,475)	(1,950)	(1,950)	(1,950)	(1,950)	(1,950)	(2,015)	(2,015)
Temp. Range B [2] 80°C / 43°C (176°F / 110°F)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	MPa	-	6.8	6.8	6.8	6.8	6.8	6.8	6.8
			(psi)	-	(980)	(980)	(980)	(980)	(980)	(980)	(980)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	MPa	9.5	12.5	12.5	12.5	12.5	12.5	12.9	12.9
			(psi)	(1,370)	(1,815)	(1,815)	(1,815)	(1,815)	(1,815)	(1,870)	(1,870)
Temp. Range C [2] 120°C / 72°C (248°F / 162°F)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	MPa	-	4.2	4.2	4.2	4.2	4.2	4.2	4.2
			(psi)	-	(615)	(615)	(615)	(615)	(615)	(615)	(615)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	MPa	5.9	7.8	7.8	7.8	7.8	7.8	8.1	8.1
			(psi)	(860)	(1,135)	(1,135)	(1,135)	(1,135)	(1,135)	(1,170)	(1,170)
Reduction for seismic tension		$\alpha_{N,seis}$	-	-				1.00			
Diamond Core Drill Bit											
Temp. Range A [2] 55°C / 43°C (130°F / 110°F)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	MPa	-	7.4	7.4	7.4	7.4	7.4	7.4	7.4
			(psi)	-	(1,075)	(1,075)	(1,075)	(1,075)	(1,075)	(1,075)	(1,075)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	MPa	-	12.6	12.6	12.6	12.6	12.6	13.0	13.0
			(psi)	-	(1,830)	(1,830)	(1,830)	(1,830)	(1,830)	(1,885)	(1,885)
Temp. Range B [2] 80°C / 43°C (176°F / 110°F)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	MPa	-	7.0	7.0	7.0	7.0	7.0	7.0	7.0
			(psi)	-	(1,010)	(1,010)	(1,010)	(1,010)	(1,010)	(1,010)	(1,010)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	MPa	-	11.9	11.9	11.9	11.9	11.9	12.2	12.2
			(psi)	-	(1,720)	(1,720)	(1,720)	(1,720)	(1,720)	(1,770)	(1,770)
Temp. Range C [2] 120°C / 72°C (248°F / 162°F)	Characteristic bond strength cracked concrete [3]	$\tau_{k,cr}$	MPa	-	4.5	4.5	4.5	4.5	4.5	4.5	4.5
			(psi)	-	(650)	(650)	(650)	(650)	(650)	(650)	(650)
	Characteristic bond strength uncracked concrete [3]	$\tau_{k,uncr}$	MPa	-	7.6	7.6	7.6	7.6	7.6	7.8	7.8
			(psi)	-	(1,105)	(1,105)	(1,105)	(1,105)	(1,105)	(1,135)	(1,135)
Reduction for seismic tension		$\alpha_{N,seis}$	-	-				1.00			
Carbide Bit, Hilti Hollow Carbide Bit, or Diamond Core Drill Bit											
Dry concrete	Anchor category	-	-	1							
	Strength reduction factor	ϕ_d	-	0.65							
Water-saturated	Anchor category	-	-	1							
	Strength reduction factor	ϕ_{ws}	-	0.65							

For **SI**: 1 inch = 25.4 mm, 1 psi = 0.006897 MPa.

For **pound-inch** units: 1 mm = 0.03937 inches, 1 MPa = 145 psi.

[1] Bond strength values correspond to concrete compressive strength f'_c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'_c, between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2,500)^n$ [For SI: $(f'_c / 17.2)^n$], where n is as follows:
n = 0.26 for uncracked concrete, all drilling methods
n = 0.14 for cracked concrete, carbide bit or Hilti hollow drill bit
n = 0 for cracked concrete, diamond core drill bit
See Section 4.1.4 of this report for bond strength determination.

[2] Temperature range A: Maximum short term temperature = 130°F (55°C), Maximum long term temperature = 110°F (43°C).
Temperature range B: Maximum short term temperature = 176°F (80°C), Maximum long term temperature = 110°F (43°C).
Temperature range C: Maximum short term temperature = 248°F (120°C), Maximum long term temperature = 162°F (72°C).
Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.

[3] Characteristic bond strengths for 8mm to 24mm rods are for horizontal and vertical downward direction only. For overhead (vertical up) installation, bond strengths must be multiplied by 0.70.
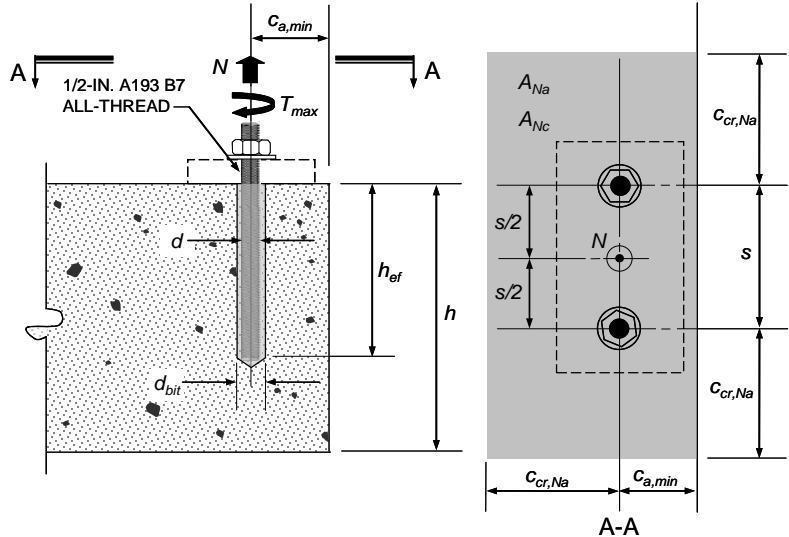
[4] 27mm and 30mm rods to be installed in generally vertically downward direction only.

Specifications / Assumptions:

ASTM A193 Grade B7 threaded rod
Normal weight concrete, f'c = 4,000 psi
Seismic Design Category (SDC) B
No supplementary reinforcing in accordance
with ACI 318-14 2.3 will be provided.
Assume maximum short term (diurnal) base
material temperature ≤ 130° F.
Assume maximum long term base material
temperature ≤ 110° F.
Assume installation in dry concrete and
hammer-drilled holes.
Assume concrete will remain uncracked for
service life of anchorage.

Dimensional Parameters:

h_{ef}	= 4.25 in.
s	= 4.0 in.
$c_{a,min}$	= 2.5 in.
h	= 12.0 in.
d	= 1/2 in.

Calculation for the 2018 IBC in accordance with ACI 318-14 Chapter 17 and this report	ACI 318-14 Code Ref.	Report Ref.
Step 1. Check minimum edge distance, anchor spacing and member thickness: $c_{min} = 2.5$ in. $\leq c_{a,min} = 2.5$ in. ∴ OK $s_{min} = 2.5$ in. $\leq s = 4.0$ in. ∴ OK $h_{min} = h_{ef} + 1.25$ in. $= 4.25 + 1.25 = 5.5$ in. $\leq h = 12.0$ ∴ OK	-	**Table 4**
Step 2. Check steel strength in tension: Single Anchor: $N_{sa} = A_{se} \cdot f_{uta} = 0.1419$ in^2 • 125,000 psi = 17,738 lb. Anchor Group: $\phi N_{sa} = \phi \cdot n \cdot A_{se} \cdot f_{uta} = 0.75 \cdot 2 \cdot 17,738$ lb. = 26,606 lb. Or using Table 3: $\phi N_{sa} = 0.75 \cdot 2 \cdot 17,735$ lb. = **26,603 lb.**	**17.4.1.2** **Eq. (17.4.1.2)**	**Table 2** **Table 3**
Step 3. Check concrete breakout strength in tension: $N_{cbg} = \dfrac{A_{Nc}}{A_{Nc0}} \cdot \psi_{ec,N} \cdot \psi_{ed,N} \cdot \psi_{c,N} \cdot \psi_{cp,N} \cdot N_b$	**17.4.2.1** **Eq. (17.4.2.1b)**	-
$A_{Nc} = (3 \cdot h_{ef} + s)(1.5 \cdot h_{ef} + c_{a,min}) = (3 \cdot 4.25 + 4)(1.5 \cdot 4.25 + 2.5) = $ **149 in^2**	-	-
$A_{Nc0} = 9 \cdot h_{ef}^2 = 9 \cdot 4.25^2 = $ **163 in^2**	**17.4.2.1** **Eq. (17.4.2.1c)**	-
$\psi_{ec,N} = $ **1.0** no eccentricity of tension load with respect to tension-loaded anchors	**17.4.2.4**	-
$\psi_{ed,N} = 0.7 + 0.3 \cdot \dfrac{c_{a,min}}{1.5 h_{ef}} = 0.7 + 0.3 \cdot \dfrac{2.5}{1.5 \cdot 4.25} = $ **0.82**	**17.4.2.5** **Eq. (17.4.2.5b)**	-
$\psi_{c,N} = $ **1.0** uncracked concrete assumed ($k_{c,uncr} = 24$)	**17.4.2.6**	**Table 4**
Determine c_{ac}: From Table 5 incl. footnote 1: $\tau_{uncr} = 1,950$ psi $\cdot (4,000 / 2,500)^{0.26} = 2,203$ psi $\tau_{uncr} = \dfrac{k_{c,uncr}}{\pi \cdot d} \sqrt{h_{ef} \cdot f'_c} = \dfrac{24}{\pi \cdot 0.5} \sqrt{4.25 \cdot 4,000} = $ 1,992 psi < 2,203 psi ∴ use 1,992 psi $\left[\dfrac{h}{h_{ef}}\right] = \left[\dfrac{12}{4.25}\right] = 2.82 > 2.4 \therefore \left[\dfrac{h}{h_{ef}}\right] = 2.4$ $c_{ac} = h_{ef} \cdot \left(\dfrac{\tau_{uncr}}{1,160}\right)^{0.4} \cdot \left[3.1 - 0.7 \cdot \dfrac{h}{h_{ef}}\right] = 4.25 \cdot \left(\dfrac{1,992}{1,160}\right)^{0.4} \cdot [3.1 - 0.7 \cdot 2.4] = 7.49$ in	-	**Section 4.1.10** **Table 5**
For $c_{a,min} < c_{ac}$ $\psi_{cp,N} = \dfrac{max|c_{a,min};1.5 \cdot h_{ef}|}{c_{ac}} = \dfrac{max|2.5;1.5 \cdot 4.25|}{7.49} = $ **0.85**	**17.4.2.7** **Eq. (17.4.2.7b)**	-
$N_b = k_{c,uncr} \cdot \lambda \cdot \sqrt{f'_c} \cdot h_{ef}^{1.5} = 24 \cdot 1.0 \cdot \sqrt{4,000} \cdot 4.25^{1.5} = $ **13,299 lb.**	**17.4.2.2** **Eq. (17.4.2.2a)**	**Table 5**
$N_{cbg} = \dfrac{149}{163} \cdot 1.0 \cdot 0.82 \cdot 1.0 \cdot 0.85 \cdot 13,299 = $ **8,473 lb.**	**17.4.2.1** **Eq. (17.4.2.1b)**	-
$\phi N_{cbg} = 0.65 \cdot 8,473 = $ **5,507 lb.**	**17.3.3(c)**	**Table 5**

**FIGURE 4—HILTI HVU2 SAMPLE CALCULATION**

Step 4. Check bond strength in tension: $N_{ag} = \dfrac{A_{Na}}{A_{Na0}} \cdot \psi_{ec,Na} \cdot \psi_{ed,Na} \cdot \psi_{cp,Na} \cdot N_{ba}$	**17.4.5.1** **Eq. (17.4.5.1b)**	**-**
$A_{Na} = (2c_{Na} + s)(c_{Na} + c_{a,min})$ $c_{Na} = 10d_a\sqrt{\dfrac{\tau_{uncr}}{1,100}} = 10 \cdot 0.5\sqrt{\dfrac{2,203}{1,100}} = \mathbf{7.08\ in}$ $A_{Na} = (2 \cdot 7.08 + 4)(7.08 + 2.5) = \mathbf{174\ in^2}$	**17.4.5.1** **Eq. (17.4.5.1d)**	**Table 5**
$A_{Na0} = (2c_{Na})^2 = (2 \cdot 7.08)^2 = \mathbf{201\ in^2}$	**17.4.5.1** **Eq. (17.4.5.1c)**	**-**
$\psi_{ec,Na} = \mathbf{1.0}$ no eccentricity – loading is concentric	**17.4.5.3**	**-**
$\psi_{ed,Na} = \left(0.7 + 0.3 \cdot \dfrac{c_{a,min}}{c_{Na}}\right) = \left(0.7 + 0.3 \cdot \dfrac{2.5}{7.08}\right) = \mathbf{0.81}$	**17.4.5.4**	**-**
For $c_{a,min} < c_{Na}$ $\psi_{cp,Na} = \dfrac{max\lvert c_{a,min}; c_{Na}\rvert}{c_{ac}} = \dfrac{max\lvert 2.5; 7.08\rvert}{7.49} = \mathbf{0.95}$	**17.4.5.5**	**-**
$N_{ba} = \lambda \cdot \tau_{uncr} \cdot \pi \cdot d \cdot h_{ef} = 1.0 \cdot 2,203 \cdot \pi \cdot 0.5 \cdot 4.25 = \mathbf{14,707\ lb.}$	**17.4.5.2** **Eq. (17.4.5.2)**	**Table 5**
$N_{ag} = \dfrac{174}{201} \cdot 1.00 \cdot 0.81 \cdot 0.95 \cdot 14,707 = \mathbf{9,797\ lb.}$	**17.4.5.1** **Eq. (17.4.5.1b)**	**-**
$\phi N_{abg} = 0.65 \cdot 9,797 = \mathbf{6,368\ lb.}$	**17.3.3(c)**	**Table 5**
Step 5. Determine controlling strength: Steel Strength $\qquad\qquad \phi N_{sa} = \quad$ 26,603 lb. Concrete Breakout Strength $\quad \phi N_{cbg} = \quad$ **5,507 lb. CONTROLS** Bond Strength $\qquad\qquad \phi N_{ag} = \quad$ **6,368** lb.	**17.3.1**	**-**

FIGURE 4—HILTI HVU2 SAMPLE CALCULATION (CONTINUED)

	en	fr	es	pt
Hammer drilling	Hammer drilling	Perçage avec percussion	Taladrado con martillo	Perfurar de martelo
Hollow drill bit	Hollow drill bit	Foret creux	Taladro con broca hueca y aspiración	Broca de coroa oca
Diamond coring	Diamond coring	Forage au diamant	Taladrado con diamante	Perfurar com equipamento diamantado

	Uncracked concrete	Cracked concrete	Temperature of concrete	Curing time	Dry concrete	Water saturated concrete
en	Uncracked concrete	Cracked concrete	Temperature of concrete	Curing time	Dry concrete	Water saturated concrete
fr	Hormigón no fisurado	Hormigón fisurado	Température du béton	Temps de durcissement	Béton sec	Béton saturé d'eau
es	Béton non lézardé	Béton lézardé	Temperatura del hormigón	Tiempo de fraguado	Hormigón seco	Hormigón saturado de agua
pt	Betão não fissurado	Betão fissurado	Temperatura do betão	Tempo de cura total	Betão seco	Betão saturado de água
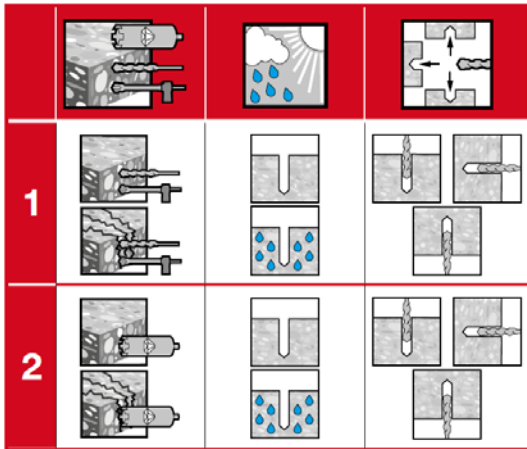
[°C]	[°F]	t_{cure}
-10…-6	14…22	5 h
-5…-1	23…31	3 h
0…4	32…40	40 min
5…9	41…49	20 min
10…19	50…67	10 min
20…40	68…104	5 min

Hilti VC 150/300

min. 129 CFM
min. 61 l/s

		HIT-OHC	
d_0 [mm]	d_0 [inch]	HIT-…	Art. No.
10…20	7/16"…11/16"	OHC 1	387551
22…28	7/8"…1 1/8"	OHC 2	387552
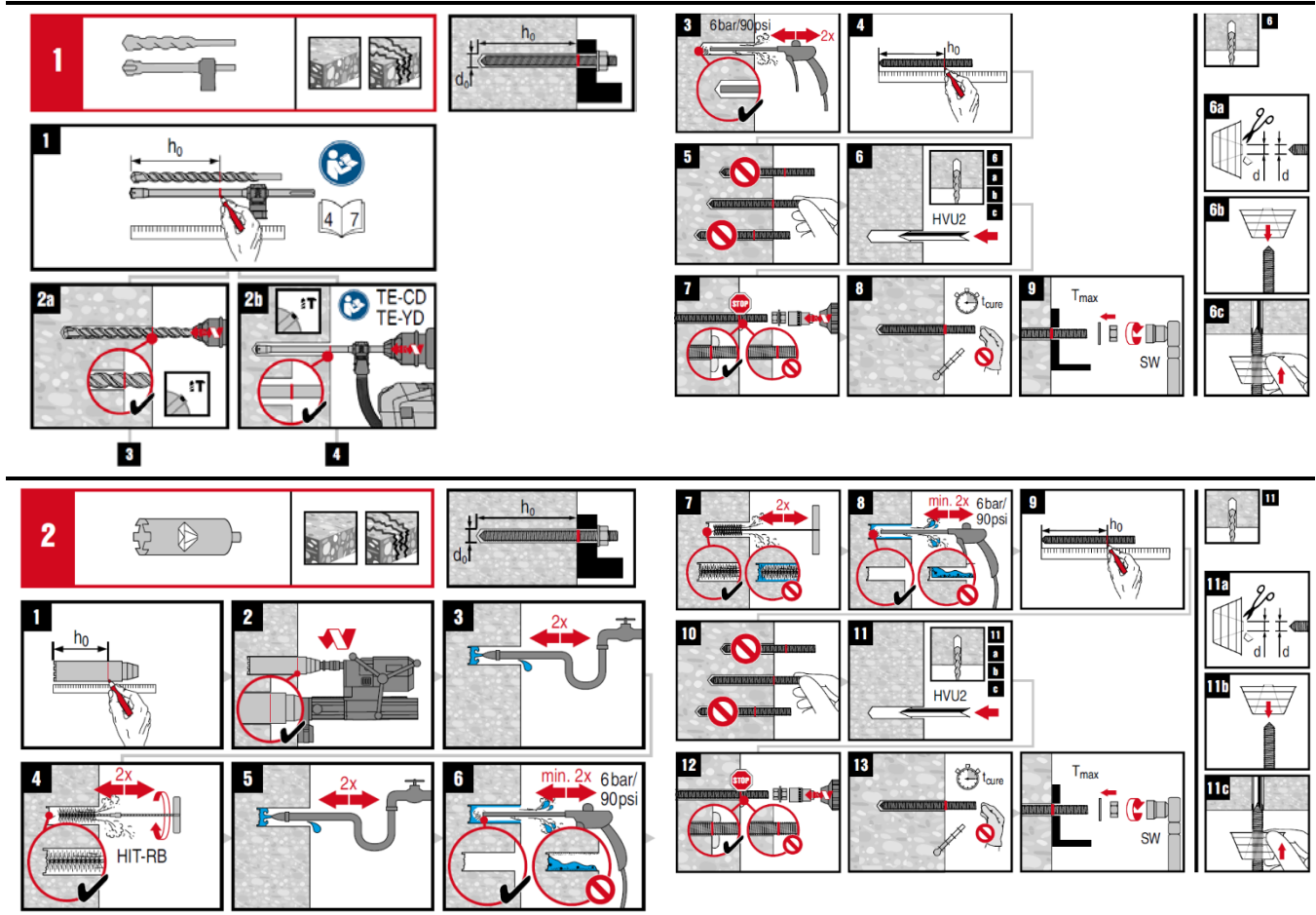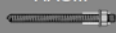
FIGURE 5—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII)

HAS...	TE (A) ↕T	SID 4-A22 ↕T	SIW 22T-A 1/2" ↕T	SF(H) ↕T or ↕	RPM
M8	1...7	+	+	2, 6, 8, 10, 14, 22	450...1300
3/8" / M10	1...7	+	+	6, 8, 10, 14, 22	450...1300
1/2" / M12	1...40	+	+	6, 8, 10, 14, 22	450...1300
5/8" / M16	1...40	+	-	6, 8, 10, 14, 22	450...1300
3/4"	50...60	-	-	-	-
M20	50...60	-	-	-	-
-	40...80	-	-	-	-
7/8"	50...80	-	-	-	-
1" / M24	50...80	-	-	-	-
-	40...80	-	-	-	-
M27	60...80	-	-	-	-
M30	60...80	-	-	-	-
1 1/4"	70...80	-	-	-	-

			TE (A) 1...40	TE 50...80	SF (H)	SID 4-A22
TE-C 1/2"		# 32220	+	-	-	-
TE-Y 3/4"		# 32221	-	+	-	-
SI-SA 1/4" - 1/2"		#2077174	-	-	+	+
SI-SA 7/16"		#2134075	-	-	+	-

Hilti HVU2 adhesive anchor capsule for anchor fastening in concrete
▶ Prior to use of product, follow the instructions for use and the legally obligated safety precautions.Read the Safety data sheet for this product.Selection of appropriate protective equipment is in the responsibility of the user.

Hilti HVU2

Disposal considerations: Unusable foil capsules e.g. if expiry date has been exceeded, should be disposed of as hazardous waste material under observance of the official regulations. EAK code no.: 20 01 27 or 08 04 09*

Product Information:
– Always keep this Instruction for Use together with the product.
– Ensure that the Instruction for Use is with the product when it is given to other persons
– Check expiration date: See expiration date printed on the sales packaging (box) and capsule. **Do not use expired product.**
– Do not use knife to open bulk packaging. Check if capsule is damaged. **Use only undamaged capsules!**
– Installation temperature (base material, capsule, anchor rod): −10 °C to 40 °C / 14°F to 104°F

Transport and storage instructions:
– Store in a cool, dry and dark place only in the original packaging.
– Transport temperature: −20 °C to 30 °C / −4°F to 86°F
– Transport temperature (max. 5 days): −20 °C to 40 °C / −4°F to 104°F
– Storage temperature: −20 °C to 25 °C / −4°F to 77°F

Suitable for anchor fastenings in concrete with a minimum compressive strength of 15 N/mm² (2000 psi).
ICC-ES ESR-4372 must be observed!
For any application not covered by this document, contact Hilti.

⚠ **WARNING**

⚠ **Poor load values / potential failure of fastening due to oversetting. Stop rotation of anchor rod immediately when the embedment depth is reached.**
– Ensure the correct marking of the embedment depth on the drill bit and threaded rod.
– 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.
– Use the setting machine at a speed of 450–1300 RPM to drive the anchor rod into the hole, applying moderate pressure. Switch off the setting machine immediately when the 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 poor load values / potential failure of fastening.
– Ensure that the specified anchor rod is used.

⚠ **Poor load values / potential failure of fastening due to inadequate borehole cleaning**
– Hilti hollow drill bits TE-CD, TE-YD must be used in conjunction with a properly maintained Hilti vacuum cleaner with model and suction capacity (volumetric flow rate) as specified in the accessory table.
– Borehole must be free of dust, water, ice, oil, bitumen, chemicals or any other foreign matter or contaminants.
– Clean the borehole right 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 Hilti blow pump, or using oil-free compressed air.

⚠ **Not adhering to these setting instructions can result in failure of fastening points!**

For diamond cored holes:
– Only use specified wire brush for cleaning the borehole. Wear-out of brushes will lead to reduction in cleaning quality and may lead to poor load values. Please replace the brushes.
– For requirements at application temperature below 0°C, contact Hilti.

For overhead application: Use HIT-OHC as a drip guard.
Overhead and wall application is limited to HVU2 3/8" to 1" (M8 to M24).
Loading or manipulation of anchor rod is not allowed within the curing time «t cure».
Warranty: Refer to standard Hilti terms and conditions of sale for warranty information.

> Failure to observe these installation instructions, use of non-Hilti anchor rods, poor or questionable concrete conditions, or unique applications may affect the reliability or performance of the fastenings.

FIGURE 5—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) - CONTINUED

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

HILTI, INC.

EVALUATION SUBJECT:

HILTI HVU2 ADHESIVE CAPSULE SYSTEM IN CRACKED AND UNCRACKED CONCRETE

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Hilti HVU2 Adhesive Capsule System adhesive anchors in cracked and uncracked concrete, described in ICC-ES evaluation report ESR-4372, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2020 *City of Los Angeles Building Code* (LABC)

- 2020 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Hilti HVU2 Adhesive Capsule System adhesive anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-4372, comply with LABC Chapter 19, and LARC, and are subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Hilti HVU2 Adhesive Capsule System adhesive anchors described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-4372.

- The design, installation, conditions of use and identification of the anchors are in accordance with the 2018 *International Building Code*® (2018 IBC) provisions noted in the evaluation report ESR-4372.

- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.

- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

- The strength design values listed in the evaluation report and tables are for the connection of the anchors to the concrete. The connection between the anchors and the connected members shall be checked for capacity (which may govern).

- For use in wall anchorage assemblies to flexible diaphragm, anchors shall be designed per the requirements of City of Los Angeles Information Bulletin P/BC 2020-071.

This supplement expires concurrently with the evaluation report, reissued June 2021 and revised September 2021.

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-installed Concrete Anchors

REPORT HOLDER:

   HILTI, INC.

EVALUATION SUBJECT:

   HILTI HVU2 ADHESIVE CAPSULE SYSTEM IN CRACKED AND UNCRACKED CONCRETE

1.0 REPORT PURPOSE AND SCOPE

   Purpose:

   The purpose of this evaluation report supplement is to indicate that the Hilti HVU2 Adhesive Capsule System adhesive anchors, recognized in ICC-ES evaluation report ESR-4372, has also been evaluated for compliance with the codes noted below.

   Applicable code editions:

   ■ 2020 *Florida Building Code—Building*

   ■ 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Hilti HVU2 Adhesive Capsule System adhesive anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-4372, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design requirements are determined in accordance with the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-4372 for the 2018 *International Building Code®* meet the requirements of the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable.

   Use of the Hilti HVU2 Adhesive Capsule System adhesive anchors has also been found to be in compliance with the High-Velocity Hurricane Zone Provisions of the *Florida Building Code—Building* and *Florida Building Code—Residential,* with the following condition:

   a) For anchorage to wood members, the connection subject to uplift must be designed for no less than 700 pounds (3114 N).

   For products falling under Florida Rule61G20, verification that the report holder's quality-assurance program is audited by a quality-assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued June 2021 and revised September 2021.