工程名稱

HILTI HIT-HY200-R 化學錨栓工程
品質管理與施工計畫書

材料廠商：喜利得股份有限公司
承攬廠商：

中　華　民　國　　110　年　2　月

目　錄

化學錨栓工程施工說明

一、 說明

本工程之施工要點乃在原有結構之混凝土上鑽孔，注入化學粘著藥劑並旋入螺桿，以達到螺桿與原有結構混凝土結合成一體之目的，增加設計之彈性，已達到錨栓錨定的作用。

二、 品質管理及拉拔試驗

必要的品質管制與測試機制，可使得工程進展順利，更可以維持工程的品質，保障大眾權益，本化學藥劑品質管理及拉拔試驗均依據規範辦理。

（一） 品質管理

A. 本化學錨栓工程使用之化學藥劑為 HILTI HIT-HY 200-R，其使用期限標示於藥劑瓶蓋上。施作前需注意藥劑是否在使用期限之內，並提供藥劑之購買與進口證明予工地工程司查核。

B. 本化學藥劑 HILTI HIT-HY 200-R 依照製造廠商之產品安全資料)儲存方式保管，工地現場需放置於陰涼處所避免陽光直接照射，其產品安全資料需標明誤觸或誤食之處理方式，使用藥劑前施工人員應穿戴護目鏡及手套等防護措施。

C. 本化學藥劑通過美國規範協會 ICC AC308 之認證報告，報告編號為 ICC ESR-3187(詳附件一)，其通過之測試項目詳報告中第 4 及 5 章節所述，內容包含通過潛變試驗(第 5.7 節 long-term loads ； AC308 第 7 項試驗)、潮濕試驗(第 4.1.4 節 water-saturated ; AC308 第 2f 項試驗)、耐震試驗(第 5.8 節 seismic design ; AC308 第 17、18 項試驗)，握裹性測試(第 4.1.4 節 bond strength determination ; AC308 第 1、11、16 項試驗)，本化學藥劑之耐震測試結果

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符合 IBC 或 IRC 規定之地震設計類別(Seismic Design Category：C,D,E 或 F)以及 UBC 規定之地震區域(Seismic Zone：2B,3,4)。

D. 拉拔試驗之試驗單位與儀器依規範辦理，詳細規定如下：油壓千斤頂及手動幫浦，需提供財團法人全國認證基金會(TAF) 或經濟部標準檢驗局認可之實驗單位或經濟部標準檢驗局認證通過之校正期限為一年內之校正報告。

(二) 施工後拉拔試驗

A. 設備：油壓千斤頂、手動幫浦、校正報告等。

B. 試驗以化學錨栓 1 倍設計拉力為測試力量，在工地測試並以所需尺寸的化學錨栓各取 3 支作為測試（藥劑錨錠不可破壞），並紀錄孔深、使用藥劑品牌及型號。

C. 試驗時，確定其樣本周圍表面平坦且與金屬螺桿垂直，以做為千斤頂施力時之反力。

D. 套入千斤頂並鎖上螺母及墊片。測試時可依據實際情形，裝置腳座以方便測試進行。

E. 將手動幫浦油壓管接上千斤頂，並旋緊閥門。

F. 確定油壓錶歸零後由手動幫浦慢慢加壓，直到油壓錶達到試驗拉力所需值。

G. 記錄並拍照存證後打開閥門，解除壓力，試驗完成。

三、 材料

(一)化學黏著藥劑

本化學藥劑為二劑型藥劑(主劑及硬化劑)，並符合規範規定，通過 ICC AC308 規範之握裹性、潛變、耐震及潮濕環境測試，ICC AC308 允收標準報告詳附件一， HILTI HIT-HY 200-R產品型錄詳附件二。

四、　施工步驟

（一）　鑽孔

1. 本藥劑進場經核可後方可使用。
2. 鑽孔應按照預定之順序及位置，使用電鎚鑽，連續鑽孔須達到規定之直徑、深度及角度(請參考下表)。
3. 鑽孔完畢後用吹氣筒或其他空壓設備將孔內灰屑吹出。

HIT-HY 200 + HIT-Z螺桿，混凝土強度3000psi

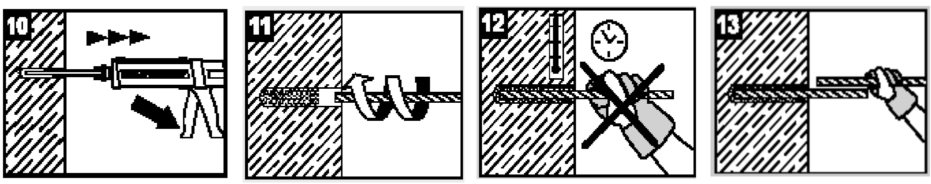
錨栓尺寸		M8	M10	M12	M16	M20
有效埋深	[mm]	70	90	110	145	180
基材厚度	[mm]	130	150	170	245	280

HIT-HY 200 + HAS 5.8級螺桿，混凝土強度3000psi

錨栓尺寸			M8	M10	M12	M16	M20	M24	M27	M30
有效埋深	h_{ef}	[mm]	80	90	110	125	170	210	240	270
基材厚度	h	[mm]	110	120	140	165	220	270	300	340

（二）　化學錨栓安裝

1. 將本化學藥劑裝入注射器中，再將混合器安裝完成。若鑽孔深度超過混合器長度時，可加裝延長管（內附）使用。(使用新的藥劑包需廢棄前 2~3 次扣板機所流出的藥劑，以確保藥劑有充分混合)
2. 注射時深入孔底緩緩將化學藥劑打入孔內，依刻度邊打邊退，直到注入至少六分滿為止，再將準備好之金屬螺桿慢慢旋入孔內，直至底部且可目視藥劑外溢。
3. 化學錨栓施作完成後，應靜置避免擾動，待超過藥劑膠凝時間，即可硬化完成進行負載或施工。
4. 待施工完成後，必須經業主或監造人員檢驗合格，完成記錄備核。



五、 附件說明

（一） HILTI HIT-HY 200-R ICC認證報告

－ 通過ICC AC308允收標準報告：ESR-3187

（二） HILTI HIT-HY 200－R產品型錄與技術資料

（三） 材料廠商公司資料

（四） HILTI HIT-HY 200-R 防腐蝕報告

（五） HILTI HIT-HY 200-R 測試報告
CNS 10142(1994) 接著強度、抗壓強度

附件一 fgjrg>fgrKfw>PNN-R>gaa> œ

-通過 ICC AC308 允收標準報告

ESR-QOVU

ICC EVALUATION SERVICE

ICC-ES Evaluation Report

ESR-3187

Reissued March 2020

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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 HIT-HY 200 ADHESIVE ANCHORS AND POST INSTALLED REINFORCING BAR CONNECTIONS IN 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 the ADIBC.

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see ESR-3187 LABC and LARC Supplement.

For evaluation for compliance with the *National Building Code of Canada®* (NBCC), see listing report ELC-3187.

Property evaluated:

Structural

2.0 USES

Adhesive anchors and reinforcing bars installed using the Hilti HIT-HY 200 Adhesive Anchoring System and Post-Installed Reinforcing Bar System are used 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.

The post-installed reinforcing bar system is an alternative to cast-in-place reinforcing bars governed by ACI 318 and IBC Chapter 19.

3.0 DESCRIPTION

3.1 General:

The Hilti HIT-HY 200 Adhesive Anchoring System and Post-Installed Reinforcing Bar System are comprised of the following components:

- Hilti HIT-HY 200 adhesive packaged in foil packs (either Hilti HIT-HY 200-A or Hilti HIT-HY 200-R)
- Adhesive mixing and dispensing equipment
- Equipment for hole cleaning and adhesive injection

The Hilti HIT-HY 200 Adhesive Anchoring System may be used with continuously threaded rod, Hilti HIT-Z(-R) anchor rods, Hilti HIS-(R)N internally threaded inserts or deformed steel reinforcing bars as depicted in Figure 1. The Hilti HIT-HY 200 Post-Installed Reinforcing Bar System may only be used with deformed steel reinforcing bars as depicted in Figure 2. The primary components of the Hilti Adhesive Anchoring and Post-Installed Reinforcing Bar Systems, including the Hilti HIT-HY 200 Adhesive, HIT-RE-M static mixing nozzle and steel anchoring elements, are shown in Figure 6 of this report.

The manufacturer's printed Installation instructions (MPII), as included with each adhesive unit package, are replicated as Figure 9.

3.2 Materials:

3.2.1 Hilti HIT-HY 200 Adhesive: Hilti HIT-HY 200 Adhesive is an injectable, two-component hybrid adhesive. The two components are separated by means of a dual-cylinder foil pack attached to a manifold. The two components combine and react when dispensed through a static mixing nozzle attached to the manifold. Hilti HIT-HY 200 is available in 11.1-ounce (330 mL) and 16.9-ounce (500 mL) foil packs. The manifold attached to each foil pack is stamped with the adhesive expiration date. The shelf life, as indicated by the expiration date, applies to an unopened foil pack stored in a dry, dark environment and in accordance with Figure 9.

Hilti HIT-HY 200 Adhesive is available in two options, Hilti HIT-HY 200-A and Hilti HIT-HY 200-R. Both options are subject to the same technical data as set forth in this report. Hilti HIT-HY 200-A will have shorter working times and curing times than Hilti HIT-HY 200-R. The packaging for each option employs a different color, which helps the user distinguish between the two adhesives.

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 9 of this report.

3.2.2.2 Hilti Safe-Set™ System: The Hilti Safe-Set™ with Hilti HIT-HY 200 consists of one of the following:

- For the Hilti HIT-Z and HIT-Z-R anchor rods, hole cleaning is not required after drilling the hole, except if the hole is drilled with a diamond core drill bit.
- For the elements described in Sections 3.2.4.2 through 3.2.4.4 and Section 3.2.5, the Hilti TE-CD or TE-YD hollow carbide drill bit with a carbide drilling head conforming to ANSI B212.15. 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.

3.2.3 Hole Preparation Equipment:

3.2.3.1 Hilti Safe-Set™ System: TE-YRT Roughening Tool: For the elements described in Sections 3.2.5.2 through 3.2.5.4 and Tables 12, 13, 16, 17, 21, and 23, the Hilti TE-YRT roughening tool with a carbide roughening head is used for hole preparation in conjunction with holes core drilled with a diamond core bit as illustrated in Figure 4.

3.2.4 Dispensers: Hilti HIT-HY 200 must be dispensed with manual or electric dispensers provided by Hilti.

3.2.5 Anchor Elements:

3.2.5.1 Hilti HIT-Z and HIT-Z-R Anchor Rods: Hilti HIT-Z and HIT-Z-R anchor rods have a conical shape on the embedded section and a threaded section above the concrete surface. Mechanical properties for the Hilti HIT-Z and HIT-Z-R anchor rods are provided in Table 2. The rods are available in diameters as shown in Table 7 and Figure 1. Hilti HIT-Z anchor rods are produced from carbon steel and furnished with a 0.005-millimeter-thick (5 μm) zinc electroplated coating. Hilti HIT-Z-R anchor rods are fabricated from grade 316 stainless steel.

3.2.5.2 Threaded Steel Rods: Threaded steel rods must be clean, continuously threaded rods (all-thread) in diameters as described in Tables 11 and 15 and Figure 1 of this report. Steel design information for common grades of threaded rods is provided in Table 3. Carbon steel threaded rods may 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 and the embedded end may be blunt cut or cut on the bias to a chisel point.

3.2.5.3 Steel Reinforcing Bars for use in Post-Installed Anchor Applications: Steel reinforcing bars are deformed bars as described in Table 4 of this report. Tables 11, 15, and 19 and Figure 1 summarize reinforcing bar size ranges. The embedded portions of reinforcing bars must be straight, and free of mill scale, rust, mud, oil and other coatings (other than zinc) that may impair the bond with the adhesive. Reinforcing bars must not be bent after installation except as set forth in ACI 318-14 26.6.3.1(b) or ACI 318-11 7.3.2, as applicable, with the additional condition that the bars must be bent cold, and heating of reinforcing bars to facilitate field bending is not permitted.

3.2.5.4 Hilti HIS-N and HIS-RN Inserts: Hilti HIS-N and HIS-RN inserts have a profile on the external surface and are internally threaded. Mechanical properties for Hilti HIS-N and HIS-RN inserts are provided in Table 5. The inserts are available in diameters and lengths as shown in Table 22 and Figure 1. Hilti HIS-N inserts are produced from carbon steel and furnished with a 0.005-millimeter-thick (5 μm) zinc electroplated coating complying with ASTM B633 SC 1. The stainless steel Hilti HIS-RN inserts are fabricated from X5CrNiMo17122 K700 steel conforming to DIN 17440. Specifications for common bolt types that may be used in conjunction with Hilti HIS-N and HIS-RN inserts are provided in Table 6. Bolt grade and material type (carbon, stainless) must be matched to the insert. Strength reduction factors, ϕ, corresponding to brittle steel elements must be used for Hilti HIS-N and HIS-RN inserts.

3.2.5.5 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.

3.2.6 Steel Reinforcing Bars for Use in Post-Installed Reinforcing Bar Connections: Steel reinforcing bars used in post-installed reinforcing bar connections are deformed bars (rebar) as depicted in Figures 2 and 3. Tables 25, 26, 27, and Figure 9 summarize reinforcing bar size ranges. The embedded portions of reinforcing bars must be straight, and free of mill scale, rust and other coatings that may impair the bond with the adhesive. Reinforcing bars must not be bent after installation, except as set forth in Section 26.6.3.1(a) of ACI 318-14 or Section 7.3.2 of ACI 318-11, as applicable, with the additional condition that the bars must be bent cold, and heating of reinforcing bars to facilitate field bending is not permitted.

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 of 24 MPa is 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 4 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 under the 2018 and 2015 IBC and 2018 and 2015 IRC must be determined in accordance with ACI 318-14 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 2012 and 2009 IBC based on ACI 318-11 is given in Figure 7 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 7 through Table 24. 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/Static Pullout Strength in Tension:

4.1.4.1 Static Pullout Strength In Tension: Hilti HIT-Z and HIT-Z-R Anchor Rods: The nominal static pullout strength of a single anchor in accordance with ACI 318-14 17.4.3.1 and 17.4.3.2 or ACI 318-11 D.5.3.1 and D.5.3.2, as applicable, in cracked and uncracked concrete, $N_{p,cr}$ and $N_{p,uncr}$, respectively, is given in Table 10. For all design cases $\Psi_{c,P}$ = 1.0.

Pullout strength values are a function of the concrete compressive strength, whether the concrete is cracked or uncracked, the drilling method (hammer drill, including Hilti hollow drill bit, diamond core drill) and installation conditions (dry or water-saturated). The resulting characteristic pullout strength must be multiplied by the associated strength reduction factor ϕ_{nn} as follows:

HILTI HIT-Z AND HIT-Z-R THREADED RODS				
DRILLING METHOD	**CONCRETE TYPE**	**PERMISSIBLE INSTALLATION CONDITIONS**	**PULLOUT STRENGTH**	**ASSOCIATED STRENGTH REDUCTION FACTOR**
Hammer-drill (or Hilti TE-CD or TE-YD Hollow Drill Bit) or Diamond Core Bit	Uncracked	Dry	$N_{p,uncr}$	ϕ_d
		Water saturated	$N_{p,uncr}$	ϕ_{ws}
	Cracked	Dry	$N_{p,cr}$	ϕ_d
		Water saturated	$N_{p,cr}$	ϕ_{ws}

Figure 4 of this report presents a pullout strength design selection flowchart. Strength reduction factors for determination of the bond strength are given in the tables referenced in Table 1 of this report.

4.1.4.2 Static Bond Strength in Tension: Threaded Rod, Steel Reinforcing Bars, and Hilti HIS-N and HIS-RN Inserts: 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, and the installation conditions (dry or water-saturated concrete). 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 Bit with Hilti TE-YRT roughening tool	Uncracked	Dry	$\tau_{k,uncr}$	ϕ_d
		Water saturated	$\tau_{k,uncr}$	ϕ_{ws}
	Cracked	Dry	$\tau_{k,cr}$	ϕ_d
		Water saturated	$\tau_{k,cr}$	ϕ_{ws}

Figure 4 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 38-14 17.2.3 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}:

4.1.9.1 Hilti HIT-Z and HIT-Z-R Anchor Rods: 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 Table 9 of this report must be observed for anchor design and installation. The minimum member thicknesses, h_{min}, given in Table 9 of this report must be observed for anchor design and installation.

4.1.9.2 Threaded Rod, Steel Reinforcing Bars, and Hilti HIS-N and HIS-RN Inserts: 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 c_{min} and s_{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.

For edge distances c_{ai} and anchor spacing s_{ai}, the maximum torque T_{max} shall comply with the following requirements:

REDUCED MAXIMUM INSTALLATION TORQUE $T_{max,red}$ FOR EDGE DISTANCES c_{ai} < (5 x d_a)		
EDGE DISTANCE, c_{ai}	**MINIMUM ANCHOR SPACING, s_{ai}**	**MAXIMUM TORQUE, $T_{max,red}$**
1.75 in. (45 mm) ≤ c_{ai} < 5 x d_a	5 x d_a ≤ s_{ai} < 16 in.	0.3 x T_{max}
	s_{ai} ≥ 16 in. (406 mm)	0.5 x T_{max}

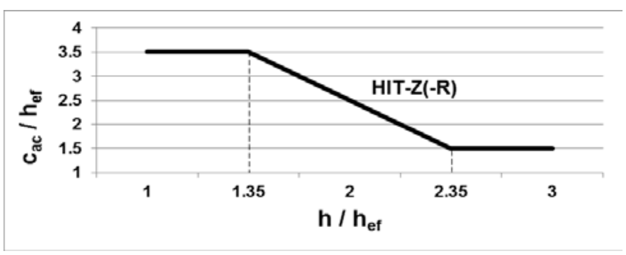
4.1.10 Critical Edge Distance c_{ac} and $\psi_{cp,Na}$:

4.1.10.1 Hilti HIT-Z and HIT-Z-R Anchor Rods: In lieu of ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable, for the calculation of N_{cb} and N_{cbg} in accordance with ACI 318-14 17.4.2.7 or ACI 318-11 D.5.2.7, as applicable and Section 4.1.3 of this report, the critical edge distance, c_{ac}, must be determined as follows:

i. $c_{ac} = 1.5 h_{ef}$ for $h/h_{ef} \geq 2.35$

ii. $c_{ac} = 3.5 h_{ef}$ for $h/h_{ef} \leq 1.35$

For definitions of h and h_{ef}, see Figure 1.



Linear interpolation is permitted to determine the ratio of c_{ac}/h_{ef} for values of h/h_{ef} between 2.35 and 1.35 as illustrated in the graph above.

4.1.10.2 Threaded Rod, Steel Reinforcing Bars, and Hilti HIS-N and HIS-RN Inserts: The modification factor $\psi_{cp,Na}$, must be determined in accordance with ACI 318-14 17.4.5.5 or ACI 318-11 D.5.5.5, as applicable, except as noted below:

For all cases where c_{Na}/c_{ac}<1.0, $\psi_{cp,Na}$ determined from ACI 318-14 Eq. 17.4.5.5b or ACI 318-11 Eq. D-27, as applicable, need not be taken less than c_{Na}/c_{ac}. For all other cases, $\psi_{cp,Na}$ shall be taken as 1.0.

The critical edge distance, c_{ac} must be calculated according to Eq. 17.4.5.5c for ACI 318-14 or Eq. D-27a for ACI 318-11, in lieu of ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable.

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

(Eq. 17.4.5.5c for ACI 318-14 or Eq. D-27a for ACI 318-11)

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, h is the member thickness, and h_{ef} is the embedment depth.

$\tau_{k,uncr}$ need not be taken as greater than:

$$\tau_{k,uncr}=\frac{k_{uncr}\sqrt{h_{ef}f'_c}}{\pi \cdot d} \qquad \text{Eq. (4-1)}$$

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, anchors must be designed in accordance with ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, except as described below:

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 19.5.1.9 shall be omitted. 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 10, 13, 14, 17, 18, 21 and 24.

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 Strength Design of Post-Installed Reinforcing Bars:

4.2.1 General: The design of straight post-installed deformed reinforcing bars must be determined in accordance with ACI 318 rules for cast-in place reinforcing bar development and splices and this report.

Examples of typical applications for the use of post-installed reinforcing bars are illustrated in Figure 3 of this report.

A design example in accordance with the 2012 and 2009 IBC based on ACI 318-11 is given in Figure 8 of this report.

4.2.2 Determination of bar development length l_d: Values of l_d must be determined in accordance with the ACI 318 development and splice length requirements for straight cast-in place reinforcing bars.

Exceptions:

1. For uncoated and zinc-coated (galvanized) post-installed reinforcing bars, the factor Ψ_e shall be taken as 1.0. For all other cases, the requirements in ACI 318-14 25.4.2.4 or ACI 318-1112.2.4 (b) shall apply.

2. When using alternate methods to calculate the development length (e.g., anchor theory), the applicable factors for post-installed anchors generally apply.

4.2.3 Minimum Member Thickness, h_{min}, Minimum Concrete Cover, $c_{c,min}$, Minimum Concrete Edge Distance, $c_{b,min}$, Minimum Spacing, $s_{b,min}$,: For post-installed reinforcing bars, there is no limit on the minimum member thickness. In general, all requirements on concrete cover and spacing applicable to straight cast-in bars designed in accordance with ACI 318 shall be maintained.

For post-installed reinforcing bars installed at embedment depths, h_{ef}, larger than 20d (h_{ef} > 20d), the minimum concrete cover shall be as follows:

REBAR SIZE	MINIMUM CONCRETE COVER, $c_{c,min}$
$d_b \leq$ No. 6 (16mm)	$1^3/_{16}$ in.(30mm)
No. 6 < $d_b \leq$ No.10 (16mm < $d_b \leq$ 32mm)	$1^9/_{16}$ in. (40mm)

The following requirements apply for minimum concrete edge and spacing for h_{ef} > 20d:

Required minimum edge distance for post-installed reinforcing bars (measured from the center of the bar):

$c_{b,min} = d_0/2 + c_{c,min}$

Required minimum center-to-center spacing between post-installed bars:

$s_{b,min} = d_0 + c_{c,min}$

Required minimum center-to-center spacing from existing (parallel) reinforcing:

$s_{b,min} = d_b/2 \text{ (existing reinforcing)} + d_0/2 + c_{c,min}$

4.2.4 Design Strength in Seismic Design Categories C, D, E and F: In structures assigned to Seismic Category C, D, E or F under the IBC or IRC, design of straight post-installed reinforcing bars must take into account the provisions of ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21, as applicable. The value of f'_c to be used in ACI 318-14 25.4.2.2, 25.4.2.3, and 25.4.9.2 or ACI 318-11 Section 12.2.2, 12.2.3, and 12.3.2, as applicable, calculations shall not exceed 2,500 psi for post-installed reinforcing bar applications in SDCs C, D, E, and F.

4.3 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 and post-installed reinforcing bar locations must comply with this report and the plans and specifications approved by the code official. Installation of the Hilti HIT-HY 200 Adhesive Anchor and Post-Installed Reinforcing Bar Systems must conform to the manufacturer's printed installation instructions (MPII) included in each unit package as provided in Figure 9 of this report. The MPII contains additional requirements for combinations of drill hole depth, diameter, drill bit type, and dispensing tools.

4.4 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, Sections 1704.4 and 1704.15 of the 2009 IBC, and this report. The special inspector must be on the jobsite initially during anchor or post-installed reinforcing bar installation to verify anchor or post-installed reinforcing bar type and dimensions, concrete type, concrete compressive strength, adhesive identification and expiration date, hole dimensions, hole cleaning procedures, spacing, edge distances, concrete thickness, anchor or post-installed reinforcing bar 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 or post-installed reinforcing bar by construction personnel on site. Subsequent installations of the same anchor or post-installed reinforcing bar 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 or post-installed reinforcing bar 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 or post-installed reinforcing bar 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 HIT-HY 200 Adhesive Anchor System and Post-Installed Reinforcing Bar 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 HIT-HY 200 Adhesive anchors and post-installed reinforcing bars must be installed in accordance with the manufacturer's printed installation instructions (MPII) as included in the adhesive packaging and provided in Figure 9 of this report.

5.2 The anchors and post-installed reinforcing bars 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) except as noted in Sections 4.2.2 and 4.2.4 of this report.

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

5.5 Anchors and post-installed reinforcing bars must be installed in concrete base materials in holes predrilled in accordance with the instructions in Figure 9, using carbide-tipped masonry drill bits manufactured with the range of maximum and minimum drill-tip dimensions specified in ANSI B212.15-1994. The Hilti HIT-Z(-R) anchor rods may be installed in holes predrilled using diamond core drill bits. Threaded rods, reinforcing bars, and the Hilti HIS-(R)N inserts may be installed in holes predrilled using diamond core bits and roughened with the Hilti TE-YRT roughening tool as detailed in Figure 10.

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

5.7 Hilti HIT-HY 200 adhesive anchors and post-installed reinforcing bars are recognized for use to resist short- and long-term loads, including wind and earthquake, subject to the conditions of this report.

5.8 In structures assigned to Seismic Design Category C, D, E or F under the IBC or IRC, anchor strength must be adjusted in accordance in accordance with Section 4.1.11 of this report, and post-installed reinforcing bars must comply with section 4.2.4 of this report.

5.9 Hilti HIT-HY 200 adhesive anchors and post-installed reinforcing bars 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.

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

5.11 Post-installed reinforcing bar development and splice length is established in accordance with Section 4.2 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 Post-installed reinforcing bar spacing, minimum member thickness, and cover distance must be in accordance with the provisions of ACI 318 for cast-in place bars and section 4.2.3 of this report.

5.14 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.

5.15 Anchors and post-installed reinforcing bars are not permitted to support fire-resistive construction. Where not otherwise prohibited by the code, Hilti HIT-HY 200 adhesive anchors and post-installed reinforcing bars are permitted for installation in fire-resistive construction provided that at least one of the following conditions is fulfilled:

- Anchors and post-installed reinforcing bars are used to resist wind or seismic forces only.
- Anchors and post-installed reinforcing bars 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 and post-installed reinforcing bars are used to support nonstructural elements.

5.16 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of adhesive anchors and post-installed reinforcing bars 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.

5.17 Use of zinc-plated carbon steel threaded rods or steel reinforcing bars is limited to dry, interior locations.

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

5.19 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.

5.20 Periodic special inspection must be provided in accordance with Section 4.4 of this report. Continuous special inspection for anchors and post-installed reinforcing bars installed in horizontal or upwardly inclined orientations to resist sustained tension loads must be provided in accordance with Section 4.4 of this report.

5.21 Installation of anchors and post-installed reinforcing bars 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.

5.22 Hilti HIT-HY 200 adhesive anchors and post-installed reinforcing bars 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) for threaded rods, rebar, and Hilti HIS-(R)N inserts, or between 41°F and 104°F (5°C and 40°C) for Hilti HIT-Z(-R) anchor rods. Overhead installations for hole diameters larger than $^7/_{16}$-inch or 10mm require the use of piston plugs (HIT-SZ, -IP) during injection to the back of the hole. $^7/_{16}$-inch diameter holes may be injected directly to the back of the hole with the use of extension tubing on the end of the nozzle. The anchor or post-installed reinforcing bars 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 impairment of the anchor shear resistance. Installations in concrete temperatures below 32°F require the adhesive to be conditioned to a minimum temperature of 32°F.

5.23 Anchors and post-installed reinforcing bars when installed at temperatures below 40°F 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.

5.24 Hilti HIT-HY 200-A and Hilti HIT-HY 200-R adhesives are manufactured by Hilti GmbH, Kaufering, Germany, under a quality control program with inspections by ICC-ES.

5.25 Hilti HIT-Z and HIT-Z-R rods are manufactured by Hilti AG, Schaan, Liechtenstein, under a quality-control program with inspections by ICC-ES.

5.26 Hilti HIS-N and HIS-RN inserts are manufactured by Hilti (China) Ltd., Guangdong, China, 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 June 2019, revised March 2018, which incorporates requirements in ACI 355.4-11, and Table 3.8 for evaluating post-installed reinforcing bars.

7.0 IDENTIFICATION

7.1 Hilti HIT-HY 200 A and Hilti HIT HY 200 R 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-3187).

7.2 Hilti HIT-Z and HIT-Z-R rods are identified by packaging labeled with the manufacturer's name (Hilti Corp.) and address, anchor name, and evaluation report number (ESR-3187).

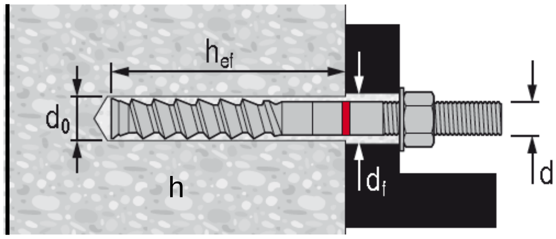
7.3 Hilti HIS-N and HIS-RN inserts are identified by packaging labeled with the manufacturer's name (Hilti Corp.) and address, anchor name and size, and evaluation report number (ESR-3187).

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

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

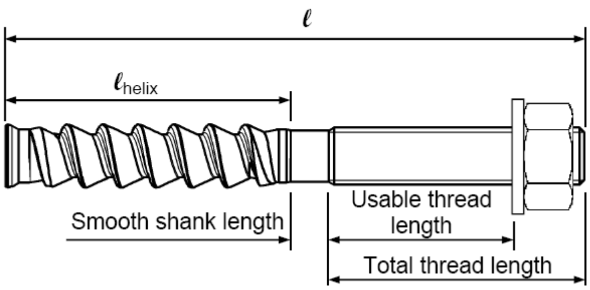
HILTI, INC.
7250 DALLAS PARKWAY, SUITE 1000
PLANO, TEXAS 75024
(800) 879-8000
www.us.hilti.com
HiltiTechEng@us.hilti.com

HILTI HIT-Z AND HIT-Z-R ANCHOR ROD



FRACTIONAL HIT-Z AND HIT-Z-R ANCHOR ROD

Ø d [inch]	Ø d_0 [inch]	h_{ef} [inch]	T_{inst} [ft-lb]		T_{inst} [Nm]	
			HIT-Z	HIT-Z-R	HIT-Z	HIT-Z-R
$^3/_8$	$^7/_{16}$	$2\,^3/_8 \ldots 4\,^1/_2$	15	30	20	40
$^1/_2$	$^9/_{16}$	$2\,^3/_4 \ldots 6$	30	65	40	90
$^5/_8$	$^3/_4$	$3\,^3/_4 \ldots 7\,^1/_2$	60	125	80	170
$^3/_4$	$^7/_8$	$4 \ldots 8\,^1/_2$	110	165	150	220



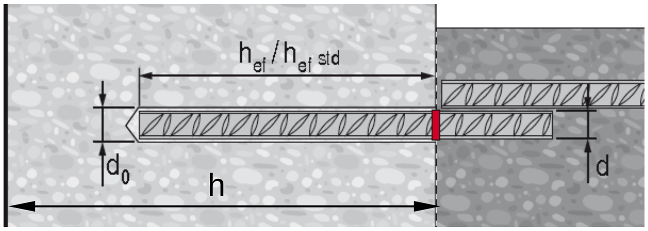
METRIC HIT-Z AND HIT-Z-R ANCHOR ROD

Ø d [mm]	Ø d_0 [mm]	h_{nom} [mm]	T_{inst} [Nm]	
			HIT-Z	HIT-Z-R
M10	12	60…120	25	55
M12	14	70…144	40	75
M16	18	96…192	80	155
M20	22	100…220	150	215

Name and Size	ℓ Anchor Length		ℓ_{helix} Helix Length		Smooth Shank Length		Total Thread Length		Usable Thread Length	
	in	(mm)	in	(mm)	in	(mm)	In	(mm)	in	(mm)
HIT-Z(-R) $^3/_8$"x$3^3/_8$"	$3^3/_8$	(85)	$2^1/_4$	(57)	$^3/_8$	(6)	$^{13}/_{16}$	(21)	$^5/_{16}$	(8)
HIT-Z(-R) $^3/_8$" x $4^3/_8$"	$4^3/_8$	(111)	$2^1/_4$	(57)	$^5/_{16}$	(8)	$1^{13}/_{16}$	(46)	$1^5/_{16}$	(33)
HIT-Z(-R) $^3/_8$" x $5^1/_8$"	$5^1/_8$	(130)	$2^1/_4$	(57)	$^5/_{16}$	(8)	$2^9/_{16}$	(65)	$2^1/_{16}$	(52)
HIT-Z(-R) $^3/_8$" x $6^3/_8$"	$6^3/_8$	(162)	$2^1/_4$	(57)	$^5/_{16}$	(8)	$3^{13}/_{16}$	(97)	$3^5/_{16}$	(84)
HIT-Z(-R) $^1/_2$" x $4^1/_2$"	$4^1/_2$	(114)	$2^1/_2$	(63)	$^5/_{16}$	(8)	$1^{11}/_{16}$	(43)	1	(26)
HIT-Z(-R) $^1/_2$" x $6^1/_2$"	$6^1/_2$	(165)	$2^1/_2$	(63)	$^5/_{16}$	(8)	$3^{11}/_{16}$	(94)	$3^1/_{16}$	(77)
HIT-Z(-R) $^1/_2$" x $7^3/_4$"	$7^3/_4$	(197)	$2^1/_2$	(63)	$^5/_{16}$	(8)	$4^{15}/_{16}$	(126)	$4^5/_{16}$	(109)
HIT-Z(-R) $^5/_8$" x 6"	6	(152)	$3^5/_8$	(92)	$^7/_{16}$	(11)	$1^{15}/_{16}$	(49)	$1^1/_8$	(28)
HIT-Z(-R) $^5/_8$" x 8"	8	(203)	$3^5/_8$	(92)	$^7/_{16}$	(11)	$3^{15}/_{16}$	(100)	$3^1/_8$	(79)
HIT-Z(-R) $^5/_8$" x $9^1/_2$"	$9^1/_2$	(241)	$3^5/_8$	(92)	$1^{15}/_{16}$	(49)	$3^{15}/_{16}$	(100)	$3^1/_8$	(79)
HIT-Z(-R) ¾"x 6½"	6½"	(165)	4	(102)	$^5/_{16}$	(8)	2	(51)	1	(26)
HIT-Z(-R) $^3/_4$" x $8^1/_2$"	$8^1/_2$	(216)	4	(102)	$^7/_{16}$	(12)	4	(102)	$3^1/_{16}$	(77)
HIT-Z(-R) $^3/_4$" x $9^3/_4$"	$9^3/_4$	(248)	4	(102)	$1^{11}/_{16}$	(44)	4	(102)	$3^1/_{16}$	(77)
HIT-Z(-R) M10x95	$3^3/_4$	(95)	$2^3/_8$	(60)	$^5/_{16}$	(8)	$1^1/_8$	(27)	$^9/_{16}$	(14)
HIT-Z(-R) M10x115	$4^1/_2$	(115)	$2^3/_8$	(60)	$^5/_{16}$	(8)	$1^7/_8$	(47)	$1^5/_{16}$	(34)
HIT-Z(-R) M10x135	$5^5/_{16}$	(135)	$2^3/_8$	(60)	$^5/_{16}$	(8)	$2^5/_8$	(67)	$2^1/_8$	(54)
HIT-Z(-R) M10x160	$6^5/_{16}$	(160)	$2^3/_8$	(60)	$^5/_{16}$	(8)	$3^5/_8$	(92)	$3^1/_8$	(79)
HIT-Z(-R) M12x105	$4^1/_8$	(105)	$2^3/_8$	(60)	$^5/_{16}$	(8)	$1^1/_2$	(37)	$^{13}/_{16}$	(21)
HIT-Z(-R) M12x140	$5^1/_2$	(140)	$2^3/_8$	(60)	$^5/_{16}$	(8)	$2^7/_8$	(72)	$2^3/_{16}$	(56)
HIT-Z(-R) M12x155	$6^1/_8$	(155)	$2^3/_8$	(60)	$^5/_{16}$	(8)	$3^3/_8$	(87)	$2^{13}/_{16}$	(71)
HIT-Z(-R) M12x196	$7^3/_4$	(196)	$2^3/_8$	(60)	$^5/_{16}$	(8)	5	(128)	$4^7/_{16}$	(112)
HIT-Z(-R) M16x155	$6^1/_8$	(155)	$3^{11}/_{16}$	(93)	$^7/_{16}$	(11)	2	(51)	$1^3/_{16}$	(30)
HIT-Z(-R) M16x175	$6^7/_8$	(175)	$3^{11}/_{16}$	(93)	$^7/_{16}$	(11)	$2^{13}/_{16}$	(71)	$1^{15}/_{16}$	(50)
HIT-Z(-R) M16x205	$8^1/_{16}$	(205)	$3^{11}/_{16}$	(93)	$^7/_{16}$	(11)	4	(101)	$3^1/_8$	(80)
HIT-Z(-R) M16x240	$9^7/_{16}$	(240)	$3^{11}/_{16}$	(93)	$1^1/_4$	(32)	$4^1/_2$	(115)	$3^{11}/_{16}$	(94)
HIT-Z(-R) M20x215	$8^1/_2$	(215)	$3^{15}/_{16}$	(100)	$^1/_2$	(13)	4	(102)	$3^1/_{16}$	(78)
HIT-Z(-R) M20x250	$9^{13}/_{16}$	(250)	$3^{15}/_{16}$	(100)	$1^7/_8$	(48)	4	(102)	$3^1/_{16}$	(78)

FIGURE 1—INSTALLATION PARAMETERS FOR POST-INSTALLED ADHESIVE ANCHORS

DEFORMED REINFORCMENT



US REBAR

d	Ø d_0 [inch]	$h_{ef\ std}$ [inch]	h_{ef} [inch]
# 3	½	3⅜	2⅜...7½
# 4	⅝	4½	2¾...10
# 5	¾	5⅝	3⅛...12½
# 6	⅞	6¾	3½...15
# 7	1	7⅞	3½...17½
# 8	1⅛	9	4...20
# 9	1⅜	10⅛	4½...22½
# 10	1½	11¼	5...25

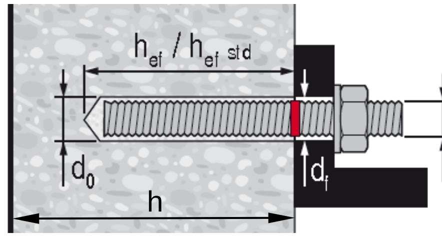
CANADIAN REBAR

d	Ø d_0 [inch]	$h_{ef\ std}$ [mm]	h_{ef} [mm]
10 M	9⁄16	115	70...226
15 M	¾	145	80...320
20 M	1	200	90...390
25 M	1¼	230	101...504
30 M	1½	260	120...598

EUROPEAN REBAR

Ø d [mm]	Ø d_0 [mm]	$h_{ef\ std}$ [mm]	h_{ef} [mm]
10	14	90	60...200
12	16	110	70...240
14	18	125	75...280
16	20	125	80...320
20	25	170	90...400
25	32	210	100...500
28	35	270	112...560
32	40	300	128...640

THREADED ROD



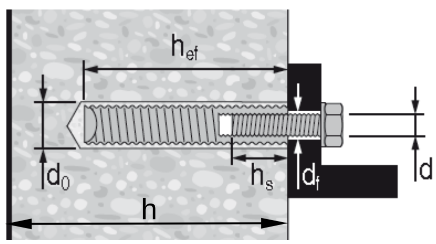
FRACTIONAL THREADED ROD

Ø d [inch]	Ø d_0 [inch]	$h_{ef\ std}$ [inch]	h_{ef} [inch]	T_{max} [ft-lb]	T_{max} [Nm]
⅜	7⁄16	3⅜	2⅜...7½	15	20
½	9⁄16	4½	2¾...10	30	41
⅝	¾	5⅝	3⅛...12½	60	81
¾	⅞	6¾	3½...15	100	136
⅞	1	7⅞	3½...17½	125	169
1	1⅛	9	4...20	150	203
1¼	1⅜	11¼	5...25	200	271

METRIC THREADED ROD

Ø d [mm]	Ø d_0 [mm]	$h_{ef\ std}$ [mm]	h_{ef} [mm]	T_{max} [Nm]
M10	12	90	60...200	20
M12	14	110	70...240	40
M16	18	125	80...320	80
M20	22	170	90...400	150
M24	28	210	96...480	200
M27	30	240	108...540	270
M30	35	270	120...600	300

HILTI HIS-N AND HIS-RN THREADED INSERTS



FRACTIONAL HILTI HIS-N AND HIS-RN THREADED INSERTS

Ø d [inch]	Ø d_0 [inch]	h_{ef} [inch]	Ø d_f [inch]	h_s [inch]	T_{max} [ft-lb]	T_{max} [Nm]
⅜	11⁄16	4⅜	7⁄16	⅜...15⁄16	15	20
½	⅞	5	9⁄16	½...1 3⁄16	30	41
⅝	1⅛	6¾	11⁄16	⅝...1½	60	81
¾	1¼	8⅛	13⁄16	¾...1⅞	100	136

METRIC HILTI HIS-N AND HIS-RN THREADED INSERTS

Ø d [mm]	Ø d_0 [mm]	h_{ef} [mm]	Ø d_f [mm]	h_s [mm]	T_{max} [Nm]
M8	14	90	9	8...20	10
M10	18	110	12	10...25	20
M12	22	125	14	12...30	40
M16	28	170	18	16...40	80
M20	32	205	22	20...50	150

FIGURE 1—INSTALLATION PARAMETERS FOR POST INSTALLED ADHESIVE ANCHORS (Continued)

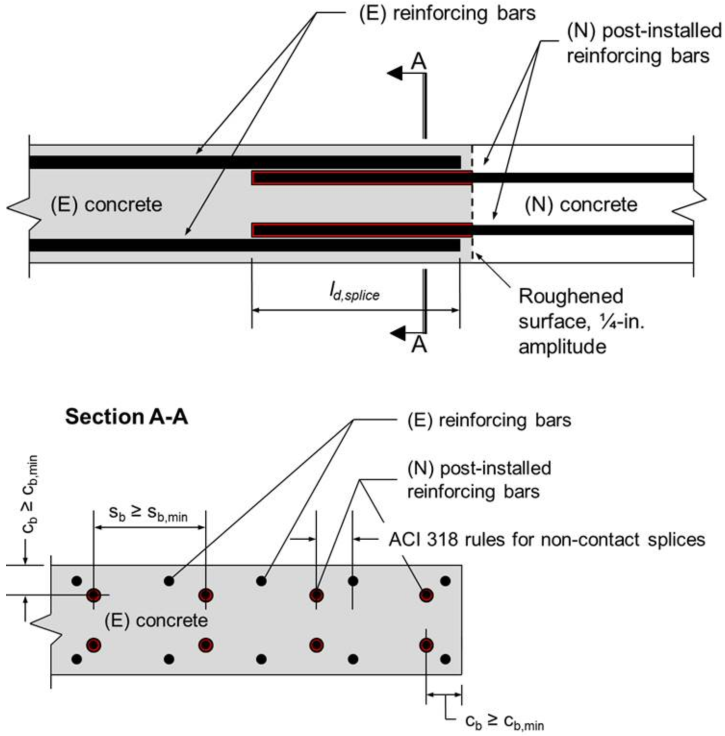


FIGURE 2—INSTALLATION PARAMATERS FOR POST-INSTALLED REINFORCING BARS

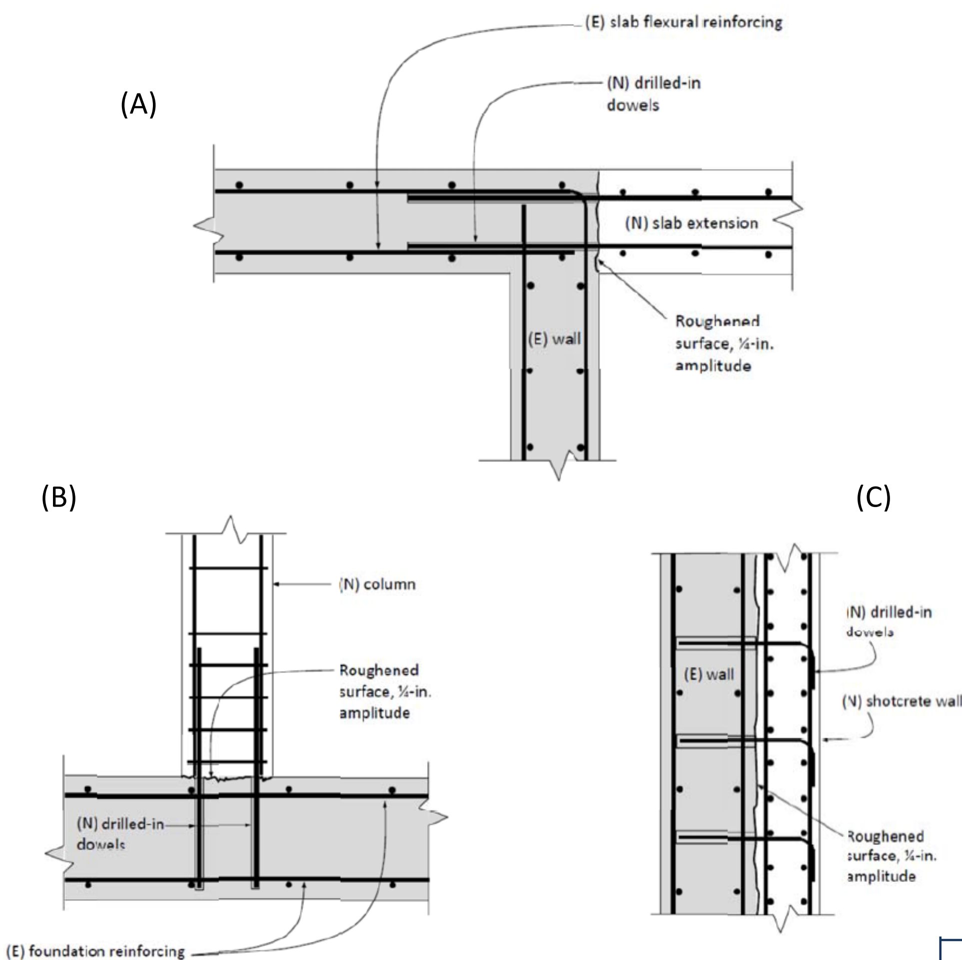


FIGURE 3—APPLICATION EXAMPLES FOR POST-INSTALLED REINFORCING BARS:

(A) TENSION LAP SPLICE WITH EXISTING FLEXURAL REINFORCEMENT; (B) TENSION DEVELOPMENT OF COLUMN DOWELS;

(C) DEVELOPMENT OF SHEAR DOWELS FOR NEWLY THICKENED SHEAR WALL

TABLE 1—DESIGN TABLE INDEX

Design Table		Fractional		Metric	
		Table	Page	Table	Page
Hilti HIT-Z and HIT-Z-R Anchor Rod 	Steel Strength - N_{sa}, V_{sa}	7	14	7	14
	Concrete Breakout - N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	8	15	8	15
	Pullout Strength – N_p	10	19	10	19
Standard Threaded Rod 	Steel Strength - N_{sa}, V_{sa}	11	20	15	25
	Concrete Breakout - N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	12	22	16	26
	Bond Strength - N_a, N_{ag}	14	24	18	28
Hilti HIS-N and HIS-RN Internally Threaded Insert 	Steel Strength - N_{sa}, V_{sa}	22	32	22	32
	Concrete Breakout - N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	23	33	23	33
	Bond Strength - N_a, N_{ag}	24	34	24	34

Design Table		Fractional		EU Metric		Canadian	
		Table	Page	Table	Page	Table	Page
Steel Reinforcing Bars 	Steel Strength - N_{sa}, V_{sa}	11A	21	15	25	19	29
	Concrete Breakout - N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	12	22	16	26	20	30
	Bond Strength - N_a, N_{ag}	13	23	17	27	21	31
	Determination of development length for post-installed reinforcing bar connections	25	35	26	36	27	36

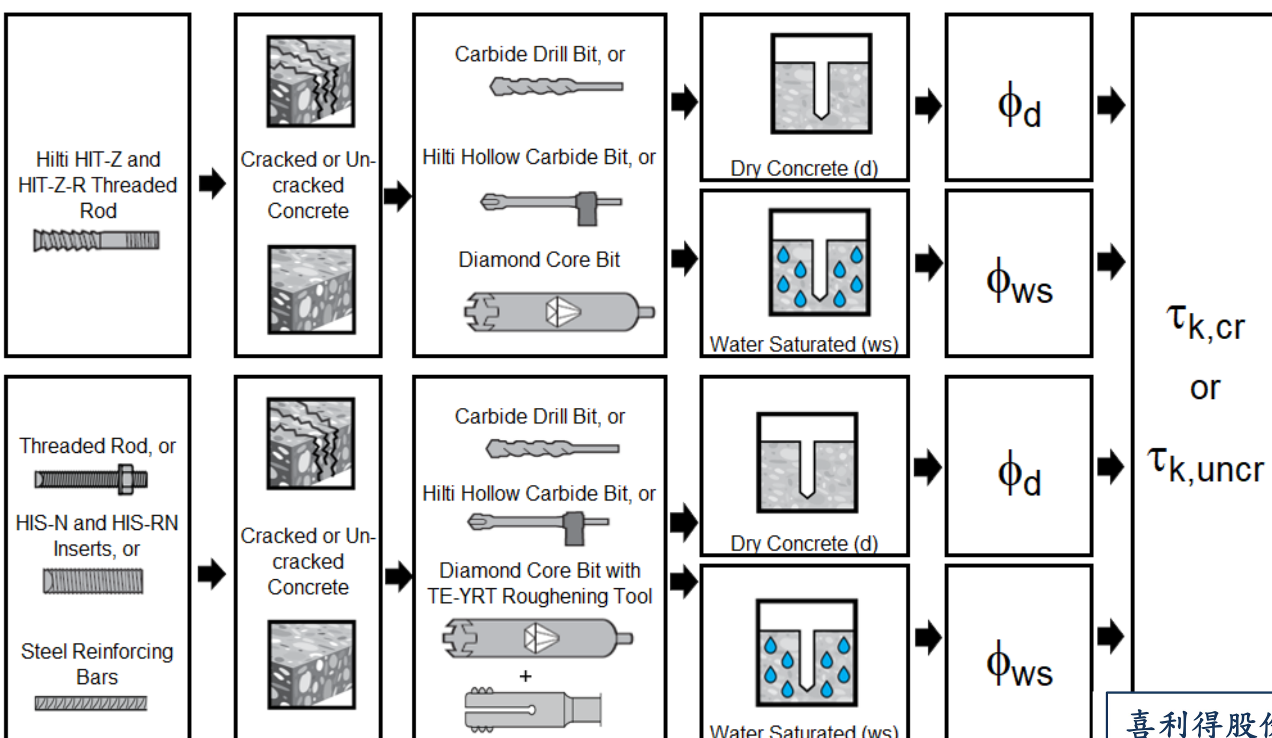


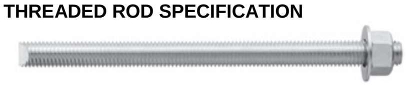
FIGURE 4—FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND OR PULLOUT STRENGTH FOR P ADHESIVE ANCHORS

TABLE 2—SPECIFICATIONS AND PHYSICAL PROPERTIES OF FRACTIONAL AND METRIC HIT-Z AND HIT-Z RODS

HIT-Z AND HIT-Z-R ROD SPECIFICATION 			Minimum specified ultimate strength, f_{uta}	Minimum specified yield strength 0.2 percent offset, f_{ya}	f_{uta}/f_{ya}	Elongation, min. percent	Reduction of Area, min. percent	Specification for nuts[2]
CARBON STEEL	3/8-in. to 5/8-in. and M10 to M12 - AISI 1038 3/4-in. - AISI 1038 or 18MnV5	psi (MPa)	94,200 (650)	75,300 (520)	1.25	8	20	ASTM A563 Grade A
	M16 - AISI 1038	psi (MPa)	88,400 (610)	71,000 (490)				
	M20 - AISI 1038 or 18MnV5	psi (MPa)	86,200 (595)	69,600 (480)				
STAINLESS STEEL	3/8-in. to 3/4-in. and M10 to M12 Grade 316 DIN-EN 10263-5 X5CrNiMo 17-12-2+AT	psi (MPa)	94,200 (650)	75,300 (520)	1.25	8	20	ASTM F594 Type 316
	M16 Grade 316 DIN-EN 10263-5 X5CrNiMo 17-12-2+AT	psi (MPa)	88,400 (610)	71,000 (490)				
	M20 Grade 316 DIN-EN 10263-5 X5CrNiMo 17-12-2+AT	psi (MPa)	86,200 (595)	69,600 (480)				

[1] Steel properties are minimum values and maximum values will vary due to the cold forming of the rod.
[2] 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.

TABLE 3—SPECIFICATIONS 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 percent offset, f_{ya}	f_{uta}/f_{ya}	Elongation, min. percent[7]	Reduction of Area, min. percent	Specification for nuts[8]
CARBON STEEL	ASTM A193[2] Grade B7 ≤ 2 1/2 in. (≤ 64 mm)	psi (MPa)	125,000 (862)	105,000 (724)	1.19	16	50	ASTM A563 Grade DH
	ASTM F568M[3] Class 5.8 M5 (1/4 in.) to M24 (1 in.) (equivalent to ISO 898-1)	psi (MPa)	72,500 (500)	58,000 (400)	1.25	10	35	ASTM A563 Grade DH[9] DIN 934 (8-A2K)
	ASTM F1554, Grade 36[7]	psi (MPa)	58,000 (400)	36,000 (248)	1.61	23	40	ASTM A194 or ASTM A563
	ASTM F1554, Grade 55[7]	psi (MPa)	75,000 (517)	55,000 (379)	1.36	21	30	ASTM A194 or ASTM A563
	ASTM F1554, Grade 105[7]	psi (MPa)	125,000 (862)	105,000 (724)	1.19	15	45	ASTM A194 or ASTM A563
	ISO 898-1[4] Class 5.8	MPa (psi)	500 (72,500)	400 (58,000)	1.25	22	-	DIN 934 Grade 6
	ISO 898-1[4] Class 8.8	MPa (psi)	800 (116,000)	640 (92,800)	1.25	12	52	DIN 934 Grade 8
STAINLESS STEEL	ASTM F593[5] CW1 (316) 1/4-in. to 5/8-in.	psi (MPa)	100,000 (689)	65,000 (448)	1.54	20	-	ASTM F594
	ASTM F593[5] CW2 (316) 3/4-in. to 1 1/2-in.	psi (MPa)	85,000 (586)	45,000 (310)	1.89	25	-	ASTM F594
	ASTM A193 Grade 8(M), Class 1[2] - 1 ¼-in.	psi (MPa)	75,000 (517)	30,000 (207)	2.50	30	50	ASTM F594
	ISO 3506-1[6] A4-70 M8 – M24	MPa (psi)	700 (101,500)	450 (65,250)	1.56	40	-	ISO 4032
	ISO 3506-1[6] A4-50 M27 – M30	MPa (psi)	500 (72,500)	210 (30,450)	2.38	40	-	ISO 4032

[1] Hilti HIT-HY 200 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.
[2] *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*
[3] *Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners*
[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 A 193, 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.
[9] Nuts for fractional rods.

TABLE 4—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON STEEL REINFORCING BARS

REINFORCING BAR SPECIFICATION 		**Minimum specified ultimate strength, f_{uta}**	**Minimum specified yield strength, f_{ya}**
ASTM A615[1] Gr. 60	psi (MPa)	90,000 (620)	60,000 (414)
ASTM A615[1] Gr. 40	psi (MPa)	60,000 (414)	40,000 (276)
ASTM A706[2] Gr. 60	psi (MPa)	80,000 (550)	60,000 (414)
DIN 488[3] BSt 500	MPa (psi)	550 (79,750)	500 (72,500)
CAN/CSA-G30.18[4] Gr. 400	MPa (psi)	540 (78,300)	400 (58,000)

[1] *Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement*
[2] *Standard Specification for Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement*
[3] *Reinforcing steel; reinforcing steel bars; dimensions and masses*
[4] *Billet-Steel Bars for Concrete Reinforcement*

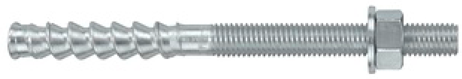
TABLE 5—SPECIFICATIONS AND PHYSICAL PROPERTIES OF FRACTIONAL AND METRIC HIS-N AND HIS-RN INSERTS

HILTI HIS-N AND HIS-RN INSERTS 		**Minimum specified ultimate strength, f_{uta}**	**Minimum specified yield strength, f_{ya}**
Carbon Steel DIN EN 10277-3 11SMnPb30+c or DIN 1561 9SMnPb28K $^3/_8$-in. and M8 to M10	psi (MPa)	71,050 (490)	59,450 (410)
Carbon Steel DIN EN 10277-3 11SMnPb30+c or DIN 1561 9SMnPb28K $^1/_2$ to $^3/_4$-in. and M12 to M20	psi (MPa)	66,700 (460)	54,375 (375)
Stainless Steel EN 10088-3 X5CrNiMo 17-12-2	psi (MPa)	101,500 (700)	50,750 (350)

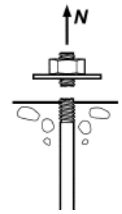
TABLE 6—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON BOLTS, CAP SCREWS AND STUDS FOR USE WITH HIS-N AND HIS-RN INSERTS[1,2]

BOLT, CAP SCREW OR STUD SPECIFICATION 		**Minimum specified ultimate strength f_{uta}**	**Minimum specified yield strength 0.2 percent offset f_{ya}**	**f_{uta}/f_{ya}**	**Elongation, min.**	**Reduction of Area, min.**	**Specification for nuts[6]**
SAE J429[3] Grade 5	psi (MPa)	120,000 (828)	92,000 (634)	1.30	14	35	SAE J995
ASTM A325[4] $^1/_2$ to 1-in.	psi (MPa)	120,000 (828)	92,000 (634)	1.30	14	35	A563 C, C3, D, DH, DH3 Heavy Hex
ASTM A193[5] Grade B8M (AISI 316) for use with HIS-RN	psi (MPa)	110,000 (759)	95,000 (655)	1.16	15	45	ASTM F594[7] Alloy Group 1, 2 or 3
ASTM A193[5] Grade B8T (AISI 321) for use with HIS-RN	psi (MPa)	125,000 (862)	100,000 (690)	1.25	12	35	ASTM F594[7] Alloy Group 1, 2 or 3

[1] Minimum Grade 5 bolts, cap screws or studs must be used with carbon steel HIS inserts.
[2] Only stainless steel bolts, cap screws or studs must be used with HIS-RN inserts.
[3] *Mechanical and Material Requirements for Externally Threaded Fasteners*
[4] *Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength*
[5] *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*
[6] Nuts must have specified minimum proof load stress equal to or greater than the specified minimum full-size tensile strength of the specified stud.
[7] Nuts for stainless steel studs must be of the same alloy group as the specified bolt, cap screw, or stud.



Fractional and Metric HIT-Z and HIT-Z-R Anchor Rod



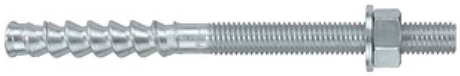
Steel Strength

TABLE 7—STEEL DESIGN INFORMATION FOR FRACTIONAL AND METRIC HIT-Z AND HIT-Z-R ANCHOR RODS

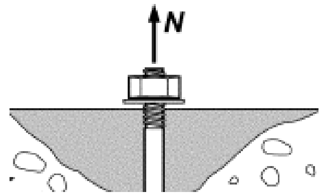
DESIGN INFORMATION		Symbol	Units	Nominal Rod Dia. (in.) Fractional				Units	Nominal Rod Dia. (mm) Metric			
				3/8	1/2	5/8	3/4		10	12	16	20
Rod O.D.		d	in.	0.375	0.5	0.625	0.75	mm	10	12	16	20
			(mm)	(9.5)	(12.7)	(15.9)	(19.1)	(in.)	(0.39)	(0.47)	(0.63)	(0.79)
Rod effective cross-sectional area		A_{se}	in.^{2}	0.0775	0.1419	0.2260	0.3340	mm^2	58.0	84.3	157.0	245.0
			(mm^2)	(50)	(92)	(146)	(216)	(in.^{2})	(0.090)	(0.131)	(0.243)	(0.380)
CARBON STEEL	Nominal strength as governed by steel strength[1]	N_{sa}	lb	7,306	13,377	21,306	31,472	kN	37.7	54.8	95.8	145.8
			(kN)	(32.5)	(59.5)	(94.8)	(140.0)	(lb)	(8,475)	(12,318)	(21,529)	(32,770)
		V_{sa}	lb	3,215	5,886	9,375	13,848	kN	16.6	24.1	42.2	64.2
			(kN)	(14.3)	(26.2)	(41.7)	(61.6)	(lb)	(3,729)	(5,420)	(9,476)	(14,421)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	1.0	0.65			-	1.0	0.65		
	Strength reduction factor for tension[2]	ϕ	-	0.65				-	0.65			
	Strength reduction factor for shear[2]	ϕ	-	0.60				-	0.60			
STAINLESS STEEL	Nominal strength as governed by steel strength[1]	N_{sa}	lb	7,306	13,377	21,306	31,472	kN	37.7	54.8	95.8	145.8
			(kN)	(32.5)	(59.5)	(94.8)	(140.0)	(lb)	(8,475)	(12,318)	(21,529)	(32,770)
		V_{sa}	lb	4,384	8,026	12,783	18,883	kN	22.6	32.9	57.5	87.5
			(kN)	(19.5)	(35.7)	(56.9)	(84.0)	(lb)	(5,085)	(7,391)	(12,922)	(19,666)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	1.0	0.75	0.65		-	1.0	0.75	0.65	
	Strength reduction factor for tension[2]	ϕ	-	0.65				-	0.65			
	Strength reduction factor for shear[2]	ϕ	-	0.60				-	0.60			

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

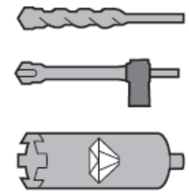
[1] Steel properties are minimum values and maximum values will vary due to the cold forming of the rod.
[2] For use with the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3.



Fractional and Metric HIT-Z and HIT-Z-R Anchor Rod



Concrete Breakout Strength



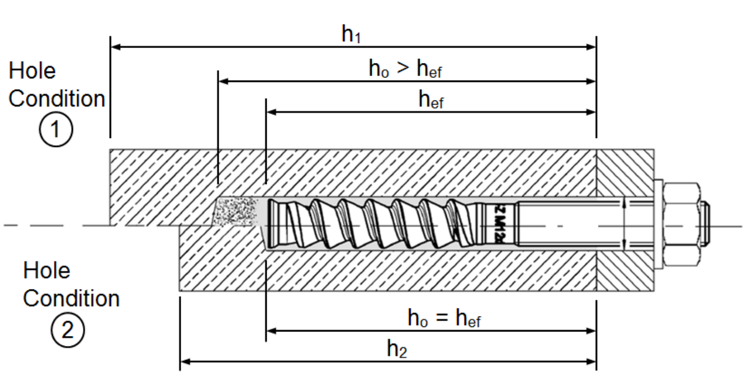
Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit

TABLE 8—CONCRETE BREAKOUT DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT HIT-Z AND HIT-Z-R ANCHOR ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR A CORE DRILL[1]

DESIGN INFORMATION	Symbol	Units	Nominal Rod Dia. (in.) Fractional				Units	Nominal Rod Dia. (mm) Metric			
			$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$		10	12	16	20
Effectiveness factor for cracked concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)				SI (in-lb)	7.1 (17)			
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	in-lb (SI)	24 (10)				SI (in-lb)	10 (24)			
Minimum embedment depth[3]	$h_{ef,min}$	in. (mm)	$2^3/_8$ (60)	$2^3/_4$ (70)	$3^3/_4$ (95)	4 (102)	mm (in.)	60 (2.4)	70 (2.8)	96 (3.8)	100 (3.9)
Maximum embedment depth[3]	$h_{ef,max}$	in. (mm)	$4^1/_2$ (114)	6 (152)	$7^1/_2$ (190)	$8^1/_2$ (216)	mm (in.)	120 (4.7)	144 (5.7)	192 (7.6)	220 (8.7)
Min. anchor spacing	s_{min}	-	See Section 4.1.9.1 of this report. Pre-calculated combinations of anchor spacing and edge distance are given in Table 9 of this report.				-	See Section 4.1.9.1 of this report. Pre-calculated combinations of anchor spacing and edge distance are given in Table 9 of this report.			
Min. edge distance	c_{min}	-					-				
Minimum concrete thickness Hole condition 1[3]	$h_{min,1}$	in. (mm)	$h_{ef} + 2^1/_4$ (h_{ef} + 57)		h_{ef} + 4 (h_{ef} + 102)		mm (in.)	h_{ef} + 60 (h_{ef} + 2.4)		h_{ef} + 100 (h_{ef} + 3.9)	
Minimum concrete thickness Hole condition 2[3]	$h_{min,2}$	in. (mm)	$h_{ef} + 1^1/_4 \geq 4$ ($h_{ef} + 32 \geq 100$)		$h_{ef} + 1^3/_4$ (h_{ef} + 45)		mm (in.)	$h_{ef} + 30 \geq 100$ ($h_{ef} + 1.25 \geq 3.9$)		h_{ef} + 45 (h_{ef} + 1.8)	
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	See Section 4.1.10.1 of this report				-	See Section 4.1.10.1 of this report			
Strength reduction factor for tension, concrete failure modes, Condition B[2]	ϕ	-	0.65				-	0.65			
Strength reduction factor for shear, concrete failure modes, Condition B[2]	ϕ	-	0.70				-	0.70			

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Additional setting information is described in Figure 9, 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.
[3] Borehole condition is described in Figure 5 below.



Hole Condition ① → non-cleaned hole

Hole Condition ② → drilling dust is completely removed

FIGURE 5—BOREHOLE SETTING CONDITIONS FOR HILTI HIT-Z AND HIT-Z-R ANCHOR RODS

TABLE 9—PRE-CALCULATED EDGE DISTANCE AND SPACING COMBINATIONS FOR HILTI HIT-Z AND HIT-Z-R RODS

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (in.) – Fractional								
Rod O.D.		d	in. (mm)	3/8 (9.5)								
Effective embedment		h_{ef}	in. (mm)	2 3/8 (60)			3 3/8 (86)			4 1/2 (114)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	in. (mm)	4 (102)	4 5/8 (117)	5 3/4 (146)	4 5/8 (117)	5 5/8 (143)	6 3/8 (162)	5 3/4 (146)	6 3/4 (171)	7 3/8 (187)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	3 1/8 (79)	2 3/4 (70)	2 1/4 (57)	2 3/4 (70)	2 1/4 (57)	2 (51)	2 1/4 (57)	1 7/8 (48)	1 7/8 (48)
		$s_{min,1}$	in. (mm)	9 1/8 (232)	7 3/4 (197)	6 1/8 (156)	7 3/4 (197)	6 1/2 (165)	5 5/8 (143)	6 1/8 (156)	5 3/8 (137)	4 1/2 (114)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	5 5/8 (143)	4 3/4 (121)	3 3/4 (95)	4 3/4 (121)	3 7/8 (98)	3 1/4 (83)	3 3/4 (95)	3 1/8 (79)	2 3/4 (70)
		$s_{min,2}$	in. (mm)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	2 1/8 (54)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)
		$s_{min,1}$	in. (mm)	6 3/8 (162)	5 1/2 (140)	4 1/4 (108)	5 1/2 (140)	3 1/2 (89)	2 5/8 (67)	3 1/4 (83)	2 (51)	1 7/8 (48)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	3 5/8 (92)	3 1/8 (79)	2 3/8 (60)	3 1/8 (79)	2 1/2 (64)	2 1/8 (54)	2 3/8 (60)	2 (51)	1 7/8 (48)
		$s_{min,2}$	in. (mm)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)	1 7/8 (48)

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (in.) – Fractional								
Rod O.D.		d	in. (mm)	1/2 (12.7)								
Effective embedment		h_{ef}	in. (mm)	2-3/4 (70)			4 1/2 (114)			6 (152)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	in. (mm)	4 (102)	5 (127)	7 1/8 (181)	5 3/4 (146)	6 3/4 (171)	8 1/4 (210)	7 1/4 (184)	8 1/4 (210)	9 3/4 (248)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	5 1/8 (130)	4 1/8 (105)	2 7/8 (73)	3 5/8 (92)	3 (76)	2 1/2 (64)	2 7/8 (73)	2 1/2 (64)	2 1/2 (64)
		$s_{min,1}$	in. (mm)	14 7/8 (378)	11 7/8 (302)	8 5/8 (219)	10 1/4 (260)	9 (229)	7 1/4 (184)	8 1/8 (206)	7 1/4 (184)	5 (127)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	9 1/4 (235)	7 1/4 (184)	4 7/8 (124)	6 1/4 (159)	5 1/4 (133)	4 1/8 (105)	4 3/4 (121)	4 1/8 (105)	3 3/8 (86)
		$s_{min,2}$	in. (mm)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	3 5/8 (92)	3 (76)	2 1/2 (64)	2 5/8 (67)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)
		$s_{min,1}$	in. (mm)	10 7/8 (276)	8 1/2 (216)	6 (152)	7 3/8 (187)	5 1/2 (140)	3 1/8 (79)	4 1/2 (114)	3 1/8 (79)	2 1/2 (64)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	6 1/2 (165)	5 (127)	3 1/4 (83)	4 1/4 (108)	3 1/2 (89)	2 3/4 (70)	3 1/4 (83)	2 3/4 (70)	2 1/2 (64)
		$s_{min,2}$	in. (mm)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)	2 1/2 (64)

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (in.) – Fractional								
Rod O.D.		d	in. (mm)	5/8 (15.9)								
Effective embedment		h_{ef}	in. (mm)	3 3/4 (95)			5 5/8 (143)			7 1/2 (191)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	in. (mm)	5 1/2 (140)	7 3/4 (197)	9 3/8 (238)	7 3/8 (187)	9 5/8 (244)	10 1/2 (267)	9 1/4 (235)	11 1/2 (292)	12 1/4 (311)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	6 1/4 (159)	4 1/2 (114)	3 3/4 (95)	4 5/8 (117)	3 5/8 (92)	3 1/4 (83)	3 3/4 (95)	3 1/8 (79)	3 1/8 (79)
		$s_{min,1}$	in. (mm)	18 3/8 (467)	12 7/8 (327)	10 5/8 (270)	13 7/8 (352)	10 3/8 (264)	9 3/4 (248)	10 7/8 (276)	8 3/8 (213)	7 3/8 (187)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	11 3/8 (289)	7 3/4 (197)	6 1/4 (159)	8 1/4 (210)	6 1/8 (156)	5 1/2 (140)	6 3/8 (162)	4 7/8 (124)	4 5/8 (117)
		$s_{min,2}$	in. (mm)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	4 5/8 (117)	3 3/8 (86)	3 1/8 (79)	3 1/2 (89)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)
		$s_{min,1}$	in. (mm)	13 7/8 (352)	9 1/2 (241)	8 3/4 (222)	10 1/8 (257)	6 1/2 (165)	5 3/8 (137)	7 1/8 (181)	3 7/8 (98)	3 1/8 (79)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	8 1/4 (210)	5 1/2 (140)	4 3/8 (111)	5 7/8 (149)	4 1/4 (108)	3 7/8 (98)	4 1/2 (114)	3 3/8 (86)	3 1/8 (79)
		$s_{min,2}$	in. (mm)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)	3 1/8 (79)

For **SI**: 1 inch ≡ 25.4 mm

[1] See Figure 5 for description of drilled hole condition.

[2] Linear interpolation is permitted to establish an edge distance and spacing combination between case 1 and case 2.
Linear interpolation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$, will determine the permissible spacing, s, as follows:

$$s \geq s_{min,2} + \frac{\left(s_{min,1} - s_{min,2}\right)}{\left(c_{min,1} - c_{min,2}\right)}\left(c - c_{min,2}\right)$$

TABLE 9—PRE-CALCULATED EDGE DISTANCE AND SPACING COMBINATIONS FOR HILTI HIT-Z AND HIT-Z-R RODS (Continued)

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (in.) – Fractional								
Rod O.D.		d	in. (mm)	3/4 (19.1)								
Effective embedment		h_{ef}	in. (mm)	4 (102)			6-3/4 (171)			8-1/2 (216)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	in. (mm)	5-3/4 (146)	8 (203)	11-1/2 (292)	8-1/2 (216)	10-3/4 (273)	13-1/8 (333)	10-1/4 (260)	12-1/2 (318)	14-1/2 (368)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	9-3/4 (248)	7 (178)	5 (127)	6-5/8 (168)	5-1/4 (133)	4-1/4 (108)	5-1/2 (140)	4-1/2 (114)	4 (102)
		$s_{min,1}$	in. (mm)	28-3/4 (730)	20-5/8 (524)	14 (356)	19-3/8 (492)	15-1/4 (387)	12-5/8 (321)	16 (406)	13-1/4 (337)	11 (279)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	18-1/8 (460)	12-5/8 (321)	8-1/2 (216)	11-7/8 (302)	9-1/8 (232)	7-1/4 (184)	9-5/8 (244)	7-3/4 (197)	6-1/2 (165)
		$s_{min,2}$	in. (mm)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	in. (mm)	7-1/4 (184)	5-1/4 (133)	4-1/8 (105)	5 (127)	4 (102)	3-3/4 (95)	4-1/8 (105)	3-3/4 (95)	3-3/4 (95)
		$s_{min,1}$	in. (mm)	21-3/4 (552)	15-1/2 (394)	12-1/4 (311)	14-1/2 (368)	11-3/8 (289)	9 (229)	12-1/8 (308)	8-3/4 (222)	6-1/2 (165)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	in. (mm)	13-1/4 (337)	9-1/4 (235)	6 (152)	8-5/8 (219)	6-5/8 (168)	5-1/8 (130)	7 (178)	5-1/2 (140)	4-1/2 (114)
		$s_{min,2}$	in. (mm)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)	3-3/4 (95)

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (mm) – Metric								
Rod O.D.		d	mm (in.)	10 (0.39)								
Effective embedment		h_{ef}	mm (in.)	60 (2.36)			90 (3.54)			120 (4.72)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	mm (in.)	100 (3.94)	120 (4.72)	156 (6.14)	120 (4.72)	150 (5.91)	176 (6.91)	150 (5.91)	180 (7.09)	197 (7.74)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	99 (3.90)	83 (3.27)	64 (2.52)	83 (3.27)	66 (2.60)	57 (2.24)	66 (2.60)	55 (2.17)	51 (2.01)
		$s_{min,1}$	mm (in.)	295 (11.61)	244 (9.61)	187 (7.36)	244 (9.61)	197 (7.76)	166 (6.54)	197 (7.76)	164 (6.46)	148 (5.83)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	181 (7.13)	148 (5.83)	110 (4.33)	148 (5.83)	115 (4.53)	96 (3.78)	115 (4.53)	93 (3.66)	84 (3.31)
		$s_{min,2}$	mm (in.)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	71 (2.80)	59 (2.32)	52 (2.05)	59 (2.32)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)
		$s_{min,1}$	mm (in.)	209 (8.23)	174 (6.85)	150 (5.91)	174 (6.85)	131 (5.16)	106 (4.17)	131 (5.16)	84 (3.31)	66 (2.60)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	124 (4.88)	101 (3.98)	74 (2.91)	101 (3.98)	77 (3.03)	64 (2.52)	77 (3.03)	62 (2.44)	55 (2.17)
		$s_{min,2}$	mm (in.)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (mm) – Metric								
Rod O.D.		d	mm (in.)	12 (0.47)								
Effective embedment		h_{ef}	mm (in.)	70 (2.76)			108 (4.25)			144 (5.67)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	mm (in.)	100 (3.94)	130 (5.12)	184 (7.24)	138 (5.43)	168 (6.61)	209 (8.21)	174 (6.85)	204 (8.03)	234 (9.21)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	139 (5.47)	107 (4.21)	76 (2.99)	101 (3.98)	83 (3.27)	67 (2.64)	80 (3.15)	68 (2.68)	60 (2.36)
		$s_{min,1}$	mm (in.)	416 (16.38)	320 (12.60)	225 (8.86)	300 (11.81)	247 (9.72)	199 (7.83)	239 (9.41)	204 (8.03)	176 (6.93)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	258 (10.16)	194 (7.64)	131 (5.16)	181 (7.13)	146 (5.75)	114 (4.49)	140 (5.51)	116 (4.57)	99 (3.90)
		$s_{min,2}$	mm (in.)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	101 (3.98)	78 (3.07)	62 (2.44)	74 (2.91)	61 (2.40)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)
		$s_{min,1}$	mm (in.)	303 (11.93)	232 (9.13)	186 (7.32)	217 (8.54)	178 (7.01)	126 (4.96)	168 (6.61)	117 (4.61)	79 (3.11)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	182 (7.17)	136 (5.35)	90 (3.54)	127 (5.00)	101 (3.98)	77 (3.03)	96 (3.78)	79 (3.11)	67 (2.64)
		$s_{min,2}$	mm (in.)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)	60 (2.36)

For **SI**: 1 inch ≡ 25.4 mm

[1] See Figure 5 for description of drilled hole condition.

[2] Linear interpolation is permitted to establish an edge distance and spacing combination between case 1 and case 2.

Linear interpolation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$, will determine the permissible spacing, s, as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}(c - c_{min,2})$$

TABLE 9—PRE-CALCULATED EDGE DISTANCE AND SPACING COMBINATIONS FOR HILTI HIT-Z AND HIT-Z-R RODS (Continued)

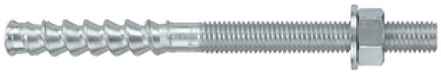
DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (mm) – Metric								
Rod O.D.		d	mm (in.)	16 (0.63)								
Effective embedment		h_{ef}	mm (in.)	96 (3.78)			144 (5.67)			192 (7.56)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	mm (in.)	141 (5.55)	196 (7.72)	237 (9.33)	189 (7.44)	244 (9.61)	269 (10.57)	237 (9.33)	292 (11.50)	312 (12.28)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	158 (6.22)	114 (4.49)	94 (3.70)	118 (4.65)	92 (3.62)	83 (3.27)	94 (3.70)	80 (3.15)	80 (3.15)
		$s_{min,1}$	mm (in.)	473 (18.62)	339 (13.35)	281 (11.06)	352 (13.86)	271 (10.67)	248 (9.76)	281 (11.06)	217 (8.54)	188 (7.40)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	289 (11.38)	201 (7.91)	161 (6.34)	209 (8.23)	156 (6.14)	139 (5.47)	161 (6.34)	126 (4.96)	116 (4.57)
		$s_{min,2}$	mm (in.)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	116 (4.57)	83 (3.27)	80 (3.15)	86 (3.39)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)
		$s_{min,1}$	mm (in.)	343 (13.50)	248 (9.76)	211 (8.31)	258 (10.16)	160 (6.30)	129 (5.08)	171 (6.73)	94 (3.70)	81 (3.19)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	204 (8.03)	139 (5.47)	111 (4.37)	146 (5.75)	107 (4.21)	95 (3.74)	111 (4.37)	85 (3.35)	80 (3.15)
		$s_{min,2}$	mm (in.)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter (mm) – Metric								
Rod O.D.		d	mm (in.)	20 (0.79)								
Effective embedment		h_{ef}	mm (in.)	100 (3.94)			180 (7.09)			220 (8.66)		
Drilled hole condition[1]		-	-	2	1 or 2		2	1 or 2		2	1 or 2	
Minimum concrete thickness		h	mm (in.)	145 (5.71)	200 (7.87)	282 (11.08)	225 (8.86)	280 (11.02)	335 (13.17)	265 (10.43)	320 (12.60)	370 (14.57)
UNCRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	235 (9.25)	170 (6.69)	121 (4.76)	152 (5.98)	122 (4.80)	103 (4.06)	129 (5.08)	107 (4.21)	100 (3.94)
		$s_{min,1}$	mm (in.)	702 (27.64)	511 (20.12)	362 (14.25)	451 (17.76)	363 (14.29)	301 (11.85)	383 (15.08)	317 (12.48)	252 (9.92)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	436 (17.17)	307 (12.09)	209 (8.23)	269 (10.59)	210 (8.27)	170 (6.69)	224 (8.82)	180 (7.09)	151 (5.94)
		$s_{min,2}$	mm (in.)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)
CRACKED CONCRETE	Minimum edge and spacing Case 1 [2]	$c_{min,1}$	mm (in.)	176 (6.93)	128 (5.04)	102 (4.02)	114 (4.49)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)
		$s_{min,1}$	mm (in.)	526 (20.71)	380 (14.96)	298 (11.73)	337 (13.27)	246 (9.69)	163 (6.42)	277 (10.91)	178 (7.01)	113 (4.45)
	Minimum edge and spacing Case 2 [2]	$c_{min,2}$	mm (in.)	318 (12.52)	222 (8.74)	148 (5.83)	193 (7.60)	149 (5.87)	119 (4.69)	159 (6.26)	126 (4.96)	105 (4.13)
		$s_{min,2}$	mm (in.)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)

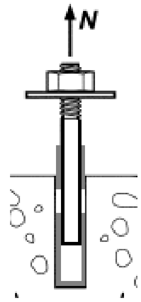
For **SI**: 1 inch ≡ 25.4 mm

[1] See Figure 5 for description of drilled hole condition.
[2] Linear interpolation is permitted to establish an edge distance and spacing combination between case 1 and case 2.
Linear interpolation for a specific edge distance *c*, where $c_{min,1} < c < c_{min,2}$, will determine the permissible spacing, *s*, as follows:

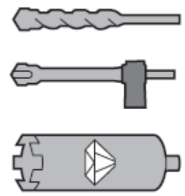
$$s \geq s_{min2} + \frac{(s_{min1} - s_{min2})}{(c_{min1} - c_{min2})}(c - c_{min2})$$



Fractional and Metric HIT-Z and HIT-Z-R Anchor Rod



Pullout Strength



Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit

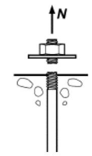
TABLE 10—PULLOUT STRENGTH DESIGN INFORMATION FOR FRACTIONAL AND METRIC HILTI HIT-Z AND HIT-Z-R RODS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR A CORE DRILL[1]

DESIGN INFORMATION		Symbol	Units	Nominal Rod Dia. (in.) Fractional				Units	Nominal Rod Dia. (mm) Metric			
				$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$		10	12	16	20
Minimum embedment depth		$h_{ef,min}$	in. (mm)	$2^3/_8$ (60)	$2^3/_4$ (70)	$3^3/_4$ (95)	4 (102)	mm (in.)	60 (2.4)	70 (2.8)	96 (3.8)	100 (3.9)
Maximum embedment depth		$h_{ef,max}$	in. (mm)	$4^1/_2$ (114)	6 (152)	$7^1/_2$ (190)	$8^1/_2$ (216)	mm (in.)	120 (4.7)	144 (5.7)	192 (7.6)	220 (8.7)
Temperature range A[2]	Pullout strength in cracked concrete	$N_{p,cr}$	lb (kN)	7,952 (35.4)	10,936 (48.6)	21,391 (95.1)	27,930 (124.2)	kN (lb)	39.1 (8,790)	43.8 (9,847)	98.0 (22,032)	127.9 (28,754)
	Pullout strength in uncracked concrete	$N_{p,uncr}$	lb (kN)	7,952 (35.4)	11,719 (52.1)	21,391 (95.1)	28,460 (126.6)	kN (lb)	39.1 (8,790)	46.9 (10,545)	98.0 (22,028)	130.3 (29,293)
Temperature range B[2]	Pullout strength in cracked concrete	$N_{p,cr}$	lb (kN)	7,952 (35.4)	10,936 (48.6)	21,391 (95.1)	27,930 (124.2)	kN (lb)	39.1 (8,790)	43.8 (9,847)	98.0 (22,032)	127.9 (28,754)
	Pullout strength in uncracked concrete	$N_{p,uncr}$	lb (kN)	7,952 (35.4)	11,719 (52.1)	21,391 (95.1)	28,460 (126.6)	kN (lb)	39.1 (8,790)	46.9 (10,545)	98.0 (22,028)	130.3 (29,293)
Temperature range C[2]	Pullout strength in cracked concrete	$N_{p,cr}$	lb (kN)	7,182 (31.9)	9,877 (43.9)	19,321 (85.9)	25,227 (112.2)	kN (lb)	35.3 (7,936)	39.5 (8,880)	88.5 (19,897)	115.5 (25,967)
	Pullout strength in uncracked concrete	$N_{p,uncr}$	lb (kN)	7,182 (31.9)	10,585 (47.1)	19,321 (85.9)	25,705 (114.3)	kN (lb)	35.3 (7,936)	42.4 (9,532)	88.5 (19,897)	117.7 (26,461)
Permissible installation conditions	Dry concrete, water saturated concrete	Anchor Category	-	1				-	1			
		ϕ_d, ϕ_{ws}	-	0.65				-	0.65			
Reduction for seismic tension		$\alpha_{N,seis}$	-	0.94	1.0			-	1.0	0.89	1.0	

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] 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.

Fractional Threaded Rod



Steel Strength

TABLE 11—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 O.D.		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)
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 ϕ for tension[2]	ϕ	-	0.65						
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60						
ASTM A193 B7	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	9,685 (43.1)	17,735 (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)	5,810 (25.9)	10,640 (47.3)	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 ϕ for tension[3]	ϕ	-	0.75						
	Strength reduction factor ϕ for shear[3]	ϕ	-	0.65						
ASTM F1554 Gr. 36	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	- -	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lb (kN)	- -	4,940 (22.0)	7,865 (35.0)	11,640 (51.8)	16,070 (71.5)	21,080 (93.8)	33,725 (150.0)
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	0.6						
	Strength reduction factor ϕ for tension [3]	ϕ	-	0.75						
	Strength reduction factor ϕ for shear [3]	ϕ	-	0.65						
ASTM F1554 Gr. 55	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	- -	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)	- -	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 factor, seismic shear	$\alpha_{v,seis}$	-	0.7						
	Strength reduction factor ϕ for tension [3]	ϕ	-	0.75						
	Strength reduction factor ϕ for shear [3]	ϕ	-	0.65						
ASTM F1554 Gr. 105	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	- -	17,740 (78.9)	28,250 (125.7)	41,815 (186.0)	57,715 (256.7)	75,715 (336.8)	121,135 (538.8)
		V_{sa}	lb (kN)	- -	10,645 (47.4)	16,950 (75.4)	25,090 (111.6)	34,630 (154.0)	45,430 (202.1)	72,680 (323.3)
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	0.7						
	Strength reduction factor ϕ for tension [3]	ϕ	-	0.75						
	Strength reduction factor ϕ for shear [3]	ϕ	-	0.65						
ASTM F593, CW Stainless	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 factor, seismic shear	$\alpha_{v,seis}$	-	0.7						-
	Strength reduction factor ϕ for tension [2]	ϕ	-	0.65						-
	Strength reduction factor ϕ for shear [2]	ϕ	-	0.60						-
ASTM A193, Gr. 8(M), Class 1 Stainless	Nominal strength as governed by steel strength	N_{sa}	lb	-						55,240
			(kN)	-						(245.7)
		V_{sa}	lb	-						33,145
			(kN)	-						(147.4)
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	-						0.6
	Strength reduction factor ϕ for tension [2]	ϕ	-	-						0.75
	Strength reduction factor ϕ for shear [2]	ϕ	-	-						0.65

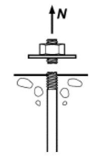
For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf

[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). 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 set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3. 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.

[3] For use with the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 9.2, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3. 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.

Fractional Reinforcing Bars



Steel Strength

TABLE 11A—STEEL DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS

DESIGN INFORMATION		Symbol	Units	Nominal Reinforcing bar size (Rebar)							
				#3	#4	#5	#6	#7	#8	#9	#10
Nominal bar diameter		d	in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)	1 (25.4)	1 1/8 (28.6)	1 1/4 (31.8)
Bar effective cross-sectional area		A_{se}	in.^{2} (mm^2)	0.11 (71)	0.2 (129)	0.31 (200)	0.44 (284)	0.6 (387)	0.79 (510)	1.0 (645)	1.27 (819)
ASTM A615 Grade 40	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.9)	60,000 (266.9)	76,200 (339.0)
		V_{sa}	lb (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)	21,600 (96.1)	28,440 (126.5)	36,000 (160.1)	45,720 (203.4)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70							
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60							
ASTM A615 Grade 60	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.2)	54,000 (240.2)	71,100 (316.3)	90,000 (400.4)	114,300 (508.5)
		V_{sa}	lb (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.1)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70							
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60							
ASTM A706 Grade 60	Nominal strength as governed by steel strength	N_{sa}	lb (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lb (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction for seismic shear	$\alpha_{V,seis}$		0.70							
	Strength reduction factor ϕ for tension[3]	ϕ		0.75							
	Strength reduction factor ϕ for shear[3]	ϕ		0.65							

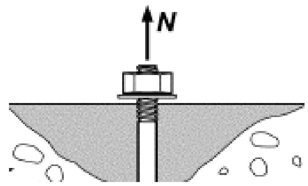
For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf

[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). Nuts and washers must be appropriate for the rod.

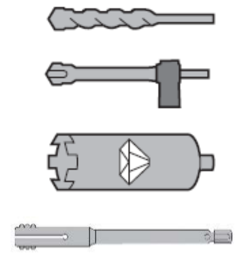
[2] For use with the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 9.2, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values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

[3] For use with the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 9.2, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3. 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.

Fractional Threaded Rod and Reinforcing Bars



Concrete Breakout Strength



Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit + Roughening Tool

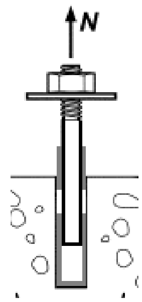
TABLE 12—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL THREADED ROD AND REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (in.) / Reinforcing bar size							
			$^3/_8$ or #3	$^1/_2$ or #4	$^5/_8$ or #5	$^3/_4$ or #6	$^7/_8$ or #7	1 or #8	#9	$1^1/_4$ or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	in-lb (SI)	24 (10)							
Minimum Embedment	$h_{ef,min}$	in. (mm)	$2^3/_8$ (60)	$2^3/_4$ (70)	$3^1/_8$ (79)	$3^1/_2$ (89)	$3^1/_2$ (89)	4 (102)	$4^1/_2$ (114)	5 (127)
Maximum Embedment	$h_{ef,max}$	in. (mm)	$7^1/_2$ (191)	10 (254)	$12^1/_2$ (318)	15 (381)	$17^1/_2$ (445)	20 (508)	$22^1/_2$ (572)	25 (635)
Min. anchor spacing[3]	s_{min}	in. (mm)	$1^7/_8$ (48)	$2^1/_2$ (64)	$3^1/_8$ (79)	$3^3/_4$ (95)	$4^3/_8$ (111)	5 (127)	$5^5/_8$ (143)	$6^1/_4$ (159)
Min. edge distance (Threaded rods)	c_{min}	in. (mm)	1¾ (45)	1¾ (45)	2 [(3)] (50) [(3)]	$2^1/_8$ [(3)] (55) [(3)]	2¼ [(3)] (60) [(3)]	2¾ [(3)] (70) [(3)]	n/a	$3^1/_8$ [(3)] (80) [(3)]
Min. edge distance (Reinforcing bars)[3]	c_{min}	-	5d; or see Section 4.1.9.2 of this report for design with reduced minimum edge distances							
Minimum concrete thickness	h_{min}	in. (mm)	$h_{ef} + 1^1/_4$ (h_{ef} + 30)		$h_{ef} + 2d_0$[(4)]					
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	See Section 4.1.10.2 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							

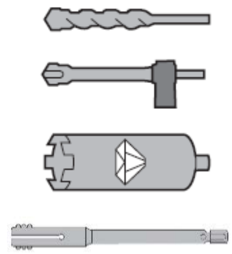
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Additional setting information is described in Figure 9, 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.
[3] For installations with $1^3/_4$-inch edge distance, refer to Section 4.1.9.2 for spacing and maximum torque requirements.
[4] d_0 = hole diameter.

Fractional Reinforcing Bars

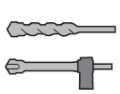
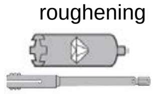


Bond Strength



Carbide Bit or
Hilti Hollow Carbide Bit or
Diamond Core Bit + Roughening Tool

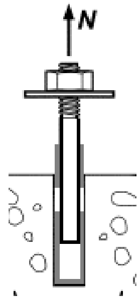
TABLE 13—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION		Symbol	Units	Nominal reinforcing bar size							
				#3	#4	#5	#6	#7	#8	#9	#10
Minimum Embedment		$h_{ef,min}$	in. (mm)	2 3/8 (60)	2 3/4 (70)	3 1/8 (79)	3 1/2 (89)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 (127)
Maximum Embedment		$h_{ef,max}$	in. (mm)	7 1/2 (191)	10 (254)	12 1/2 (318)	15 (381)	17 1/2 (445)	20 (508)	22 1/2 (572)	25 (635)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	1,080 (7.4)	1,080 (7.4)	1,090 (7.5)	1,090 (7.5)	835 (5.7)	840 (5.8)	850 (5.9)	850 (5.9)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)	1,560 (10.8)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	990 (6.8)	995 (6.9)	1000 (6.9)	1005 (6.9)	770 (5.3)	775 (5.3)	780 (5.4)	780 (5.4)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)	1,435 (9.9)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	845 (5.8)	850 (5.9)	855 (5.9)	855 (5.9)	660 (4.5)	665 (4.6)	665 (4.6)	670 (4.6)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)	1,230 (8.5)
Permissible installation conditions	Dry concrete	Anchor Category	-	1							
		ϕ_d	-	0.65							
	Water saturated concrete	Anchor Category	-	2							
		ϕ_{ws}	-	0.55							
Reduction for seismic tension	Hammer drilled 	$\alpha_{N,seis}$	-	0.80				0.85	0.90	0.95	1.0
	Core drilled + roughening 	$\alpha_{N,seis}$	-	N/A		0.71	0.77	0.82	0.95	0.79	0.83

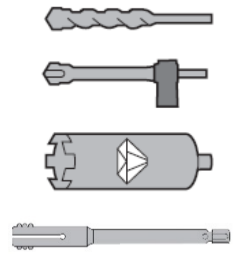
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[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) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1], the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.1}$ [For SI: $(f'_c / 17.2)^{0.1}$]. 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.

Fractional Threaded Rod

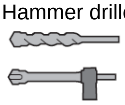
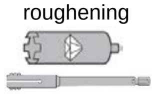


Bond Strength



Carbide Bit or
Hilti Hollow Carbide Bit or
Diamond Core Bit + Roughening Tool

TABLE 14—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 CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

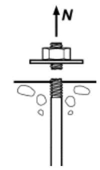
DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.)						
				$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$
Minimum Embedment		$h_{ef,min}$	in. (mm)	$2^3/_8$ (60)	$2^3/_4$ (70)	$3^1/_8$ (79)	$3^1/_2$ (89)	$3^1/_2$ (89)	4 (102)	5 (127)
Maximum Embedment		$h_{ef,max}$	in. (mm)	$7^1/_2$ (191)	10 (254)	$12^1/_2$ (318)	15 (381)	$17^1/_2$ (445)	20 (508)	25 (635)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	1,045 (7.2)	1,135 (7.8)	1,170 (8.1)	1,260 (8.7)	1,290 (8.9)	1,325 (9.1)	1,380 (9.5)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	1,045 (7.2)	1,135 (7.8)	1,170 (8.1)	1,260 (8.7)	1,290 (8.9)	1,325 (9.1)	1,380 (9.5)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)	2,220 (15.3)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	855 (5.9)	930 (6.4)	960 (6.6)	1,035 (7.1)	1,055 (7.3)	1,085 (7.5)	1,130 (7.8)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)	1,820 (12.6)
Permissible installation conditions	Dry and water saturated concrete	Anchor Category	-	1						
		ϕ_d, ϕ_{ws}	-	0.65						
Reduction for seismic tension	Hammer drilled 	$\alpha_{N,seis}$	-	0.88	0.99	0.99	1.0	1.0	0.95	0.99
	Core drilled + roughening 	$\alpha_{N,seis}$	-	N/A		0.88	0.96	0.96	1.0	0.82

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 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) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1], the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.1}$ [For SI: $(f'_c / 17.2)^{0.1}$]. 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.

Metric Threaded Rod and EU Metric Reinforcing Bars



Steel Strength

TABLE 15—STEEL DESIGN INFORMATION FOR METRIC THREADED ROD AND EU METRIC REINFORCING BARS

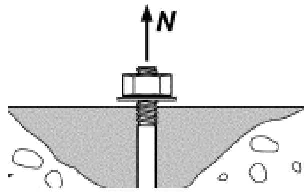
DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (mm)[1]						
				10	12	16	20	24	27	30
Rod Outside Diameter		d	mm	10	12	16	20	24	27	30
			(in.)	(0.39)	(0.47)	(0.63)	(0.79)	(0.94)	(1.06)	(1.18)
Rod effective cross-sectional area		A_{se}	mm^2	58.0	84.3	157	245	353	459	561
			(in.^{2})	(0.090)	(0.131)	(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	29.0	42.0	78.5	122.5	176.5	229.5	280.5
			(lb)	(6,519)	(9,476)	(17,647)	(27,539)	(39,679)	(51,594)	(63,059)
		V_{sa}	kN	14.5	25.5	47.0	73.5	106.0	137.5	168.5
			(lb)	(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	46.5	67.5	125.5	196.0	282.5	367.0	449.0
			(lb)	(10,431)	(15,161)	(28,236)	(44,063)	(63,486)	(82,550)	(100,894)
		V_{sa}	kN	23.0	40.5	75.5	117.5	169.5	220.5	269.5
			(lb)	(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[3]	Nominal strength as governed by steel strength	N_{sa}	kN	40.6	59.0	109.9	171.5	247.1	183.1	223.8
			(lb)	(9,127)	(13,266)	(24,706)	(38,555)	(55,550)	(41,172)	(50,321)
		V_{sa}	kN	20.3	35.4	65.9	102.9	148.3	109.9	134.3
			(lb)	(4,564)	(7,960)	(14,824)	(23,133)	(33,330)	(24,703)	(30,192)
	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						

DESIGN INFORMATION		Symbol	Units	Reinforcing bar size							
				10	12	14	16	20	25	28	32
Nominal bar diameter		d	mm	10.0	12.0	14.0	16.0	20.0	25.0	28.0	32.0
			(in.)	(0.394)	(0.472)	(0.551)	(0.630)	(0.787)	(0.984)	(1.102)	(1.260)
Bar effective cross-sectional area		A_{se}	mm^2	78.5	113.1	153.9	201.1	314.2	490.9	615.8	804.2
			(in.^{2})	(0.122)	(0.175)	(0.239)	(0.312)	(0.487)	(0.761)	(0.954)	(1.247)
DIN 488 BSt 550/500	Nominal strength as governed by steel strength	N_{sa}	kN	43.0	62.0	84.5	110.5	173.0	270.0	338.5	442.5
			(lb)	(9,711)	(13,984)	(19,034)	(24,860)	(38,844)	(60,694)	(76,135)	(99,441)
		V_{sa}	kN	26.0	37.5	51.0	66.5	103.0	162.0	203.0	265.5
			(lb)	(5,827)	(8,390)	(11,420)	(14,916)	(23,307)	(36,416)	(45,681)	(59,665)
	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							

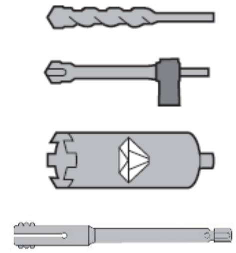
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Values provided for common rod material types are based on specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29). 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 set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3. 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.
[3] A4-70 Stainless (M8- M24); A4-502 Stainless (M27- M30)

Metric Threaded Rod and EU Metric Reinforcing Bars



Concrete Breakout Strength



Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit + Roughening Tool

TABLE 16—CONCRETE BREAKOUT DESIGN INFORMATION FOR METRIC THREADED ROD AND EU METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

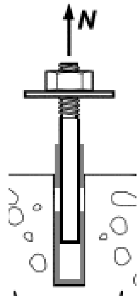
DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (mm)						
			10	12	16	20	24	27	30
Minimum Embedment	$h_{ef,min}$	mm (in.)	60 (2.4)	70 (2.8)	80 (3.1)	90 (3.5)	96 (3.8)	108 (4.3)	120 (4.7)
Maximum Embedment	$h_{ef,max}$	mm (in.)	200 (7.9)	240 (9.4)	320 (12.6)	400 (15.7)	480 (18.9)	540 (21.3)	600 (23.6)
Min. anchor spacing[3]	s_{min}	mm (in.)	50 (2.0)	60 (2.4)	80 (3.2)	100 (3.9)	120 (4.7)	135 (5.3)	150 (5.9)
Min. edge distance[3]	c_{min}	-	5d; or see Section 4.1.9.2 of this report for design with reduced minimum edge distances						
Minimum concrete thickness	h_{min}	mm (in.)	h_{ef} + 30 (h_{ef} + $1^1/_4$)	$h_{ef} + 2d_o^{(4)}$					

DESIGN INFORMATION	Symbol	Units	Reinforcing bar size							
			10	12	14	16	20	25	28	32
Minimum Embedment	$h_{ef,min}$	mm (in.)	60 (2.4)	70 (2.8)	75 (3.0)	80 (3.1)	90 (3.5)	100 (3.9)	112 (4.4)	128 (5.0)
Maximum Embedment	$h_{ef,max}$	mm (in.)	200 (7.9)	240 (9.4)	280 (11.0)	320 (12.6)	400 (15.7)	500 (19.7)	560 (22.0)	640 (25.2)
Min. anchor spacing[3]	s_{min}	mm (in.)	50 (2.0)	60 (2.4)	80 (3.2)	100 (3.9)	120 (4.7)	135 (5.3)	140 (5.5)	160 (6.3)
Min. edge distance[3]	c_{min}	-	5d; or see Section 4.1.9 of this report for design with reduced minimum edge distances							
Minimum concrete thickness	h_{min}	mm (in.)	h_{ef} + 30 (h_{ef} + $1^1/_4$)	$h_{ef} + 2d_o^{(4)}$						
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	See Section 4.1.10.2 of this report.							
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI (in-lb)	7.1 (17)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI (in-lb)	10 (24)							
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							

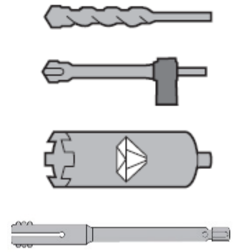
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Additional setting information is described in Figure 9, Manufacturers Printed Installation Instructions (MPII).
[2] Values provided for post-installed anchors installed under Condition B without supplementary reinforcement as defined in ACI 318-14 17.3.3 or ACI 318-11 D.4.3.
[3] For installations with $1^3/_4$-inch edge distance, refer to Section 4.1.9.2 for spacing and maximum torque requirements.
[4] d_0 = hole diameter.

EU Metric Reinforcing Bars

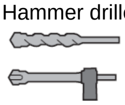
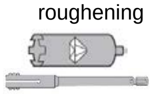


Bond Strength



Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit + Roughening Tool

TABLE 17—BOND STRENGTH DESIGN INFORMATION FOR EU METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

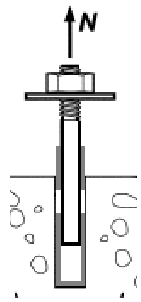
DESIGN INFORMATION		Symbol	Units	Reinforcing bar size							
				10	12	14	16	20	25	28	32
Minimum Embedment		$h_{ef,min}$	mm (in.)	60 (2.4)	70 (2.8)	75 (3.0)	80 (3.1)	90 (3.5)	100 (3.9)	112 (4.4)	128 (5.0)
Maximum Embedment		$h_{ef,max}$	mm (in.)	200 (7.9)	240 (9.4)	280 (11.0)	320 (12.6)	400 (15.7)	500 (19.7)	560 (22.0)	640 (25.2)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa (psi)	7.4 (1,075)	7.5 (1,080)	7.5 (1,085)	7.5 (1,090)	7.5 (1,095)	5.8 (840)	5.8 (845)	5.9 (850)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa (psi)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa (psi)	6.8 (990)	6.9 (995)	6.9 (995)	6.9 (1000)	6.9 (1005)	5.3 (770)	5.4 (775)	5.4 (785)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa (psi)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa (psi)	5.8 (845)	5.9 (850)	5.9 (850)	5.9 (855)	5.9 (860)	4.6 (660)	4.6 (665)	4.6 (670)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa (psi)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)
Permissible Installation Conditions	Dry concrete	Anchor Category	-	1							
		ϕ_d	-	0.65							
	Water saturated concrete	Anchor Category	-	2							
		ϕ_{ws}	-	0.55							
Reduction for seismic tension	Hammer drilled 	$\alpha_{N,seis}$	-	0.80					0.85	0.90	1.00
	Core drilled + roughening 	$\alpha_{N,seis}$	-	N/A			0.71	0.77	0.86	0.78	0.86

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

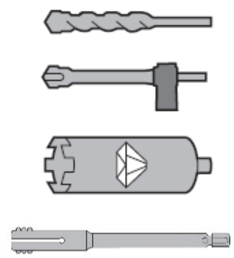
[1] Bond strength values correspond to concrete compressive strength f'_c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'_c, between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1], the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.1}$ [For SI: $(f'_c / 17.2)^{0.1}$]. 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.

Metric Threaded Rod

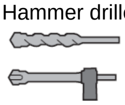
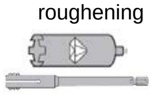


Bond Strength



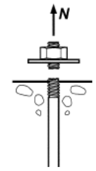
Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit + Roughening Tool

TABLE 18—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (mm)						
				10	12	16	20	24	27	30
Minimum Embedment		$h_{ef,min}$	mm	60	70	80	90	96	108	120
			(in.)	(2.4)	(2.8)	(3.1)	(3.5)	(3.8)	(4.3)	(4.7)
Maximum Embedment		$h_{ef,max}$	mm	200	240	320	400	480	540	600
			(in.)	(7.9)	(9.4)	(12.6)	(15.7)	(18.9)	(21.3)	(23.6)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	7.3	7.6	8.1	8.8	9.0	9.2	9.4
			(psi)	(1,055)	(1,105)	(1,170)	(1,270)	(1,305)	(1,340)	(1,365)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	15.3	15.3	15.3	15.3	15.3	15.3	15.3
			(psi)	(2,220)	(2,220)	(2,220)	(2,220)	(2,220)	(2,220)	(2,220)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	7.3	7.6	8.1	8.8	9.0	9.2	9.4
			(psi)	(1,055)	(1,105)	(1,170)	(1,270)	(1,305)	(1,340)	(1,365)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	15.3	15.3	15.3	15.3	15.3	15.3	15.3
			(psi)	(2,220)	(2,220)	(2,220)	(2,220)	(2,220)	(2,220)	(2,220)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.0	6.3	6.6	7.2	7.4	7.6	7.7
			(psi)	(865)	(905)	(960)	(1,040)	(1,070)	(1,095)	(1,120)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.6	12.6	12.6	12.6	12.6	12.6	12.6
			(psi)	(1,820)	(1,820)	(1,820)	(1,820)	(1,820)	(1,820)	(1,820)
Permissible Installation Conditions	Dry and water saturated concrete	Anchor Category	-	1						
		ϕ_d, ϕ_{ws}	-	0.65						
Reduction for seismic tension	Hammer drilled 	$\alpha_{N,seis}$	-	0.88	0.88	0.99	1.0	0.95	0.95	0.95
	Core drilled + roughening 	$\alpha_{N,seis}$	-	N/A		0.88	0.96	0.96	0.82	0.82

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 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) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1], the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.1}$ [For SI: $(f'_c / 17.2)^{0.1}$]. 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.



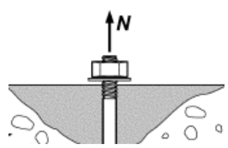
Canadian Reinforcing Bars **Steel Strength**

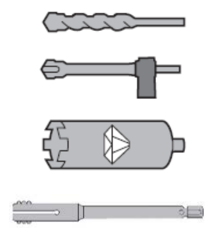
TABLE 19—STEEL DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS

DESIGN INFORMATION		Symbol	Units	Bar size 10 M	15 M	20 M	25 M	30 M
Nominal bar diameter		*d*	mm (in.)	11.3 (0.445)	16.0 (0.630)	19.5 (0.768)	25.2 (0.992)	29.9 (1.177)
Bar effective cross-sectional area		A_{se}	mm² (in.²)	100.3 (0.155)	201.1 (0.312)	298.6 (0.463)	498.8 (0.773)	702.2 (1.088)
CSA G30	Nominal strength as governed by steel strength	N_{sa}	kN (lb)	54.0 (12,175)	108.5 (24,408)	161.5 (36,255)	270.0 (60,548)	380.0 (85,239)
		V_{sa}	kN (lb)	32.5 (7,305)	65.0 (14,645)	97.0 (21,753)	161.5 (36,329)	227.5 (51,144)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70				
	Strength reduction factor for tension[1]	ϕ	-	0.65				
	Strength reduction factor for shear[1]	ϕ	-	0.60				

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] For use with the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3. Values correspond to a brittle steel element.





Canadian Reinforcing Bars **Concrete Breakout Strength** **Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit + Roughening Tool**

TABLE 20—CONCRETE BREAKOUT DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

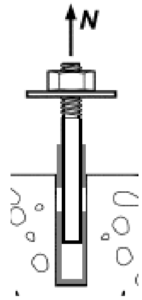
DESIGN INFORMATION	Symbol	Units	Bar size 10 M	15 M	20 M	25 M	30 M
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI (in-lb)	7.1 (17)				
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI (in-lb)	10 (24)				
Minimum Embedment	$h_{ef,min}$	mm (in.)	70 (2.8)	80 (3.1)	90 (3.5)	101 (4.0)	120 (4.7)
Maximum Embedment	$h_{ef,max}$	mm (in.)	226 (8.9)	320 (12.6)	390 (15.4)	504 (19.8)	598 (23.5)
Min. bar spacing[3]	s_{min}	mm (in.)	57 (2.2)	80 (3.1)	98 (3.8)	126 (5.0)	150 (5.9)
Min. edge distance[3]	c_{min}	mm (in.)	5d; or see Section 4.1.9.2 of this report for design with reduced minimum edge distances				
Minimum concrete thickness	h_{min}	mm (in.)	h_{ef} + 30 (h_{ef} + 1¼)	$h_{ef} + 2d_o$[(4)]			
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	See Section 4.1.10.2 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, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

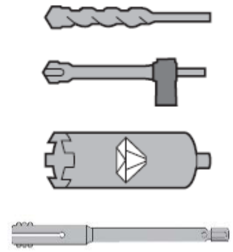
[1] Additional setting information is described in Figure 9, Manufacturers Printed Installation Instructions (MPII).
[2] Values provided for post-installed anchors installed under Condition B without supplementary reinforcement.

[3] For installations with $1^3/_4$-inch edge distance, refer to Section 4.1.9.2 for spacing and maximum torque requirements.
[4] d_0 = hole diameter.

Canadian Reinforcing Bars

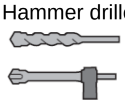
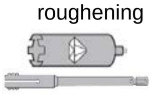


Bond Strength



Carbide Bit or
Hilti Hollow Carbide Bit or
Diamond Core Bit + Roughening Tool

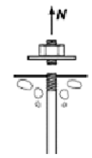
TABLE 21—BOND STRENGTH DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION		Symbol	Units	Bar size				
				10 M	15 M	20 M	25 M	30 M
Minimum Embedment		$h_{ef,min}$	mm (in.)	70 (2.8)	80 (3.1)	90 (3.5)	101 (4.0)	120 (4.7)
Maximum Embedment		$h_{ef,max}$	mm (in.)	226 (8.9)	320 (12.6)	390 (15.4)	504 (19.8)	598 (23.5)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa (psi)	7.4 (1,075)	7.5 (1,085)	7.5 (1,095)	5.8 (840)	5.9 (850)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa (psi)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)	10.8 (1,560)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa (psi)	6.8 (990)	6.9 (995)	6.9 (1005)	5.3 (775)	5.4 (780)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa (psi)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)	9.9 (1,435)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa (psi)	5.8 (845)	5.9 (850)	5.9 (860)	4.6 (660)	4.6 (670)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa (psi)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)	8.5 (1,230)
Permissible installation conditions	Dry concrete	Anchor Category	-	1				
		ϕ_d	-	0.65				
	Water saturated concrete	Anchor Category	-	2				
		ϕ_{ws}	-	0.55				
Reduction for seismic tension	Hammer drilled 	$\alpha_{N,seis}$	-	0.80			0.85	0.97
	Core drilled + roughening 	$\alpha_{N,seis}$	-	N/A	0.71	0.77	N/A	

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 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) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1], the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.1}$ [For SI: $(f'_c / 17.2)^{0.1}$]. 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.

Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert



Steel Strength

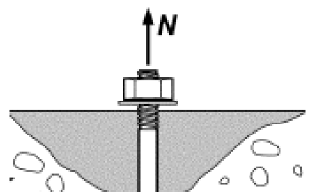
TABLE 22—STEEL DESIGN INFORMATION FOR FRACTIONAL AND METRIC HIS-N AND HIS-RN THREADED INSERTS[1]

DESIGN INFORMATION		Symbol	Units	Nominal Bolt/Cap Screw Diameter (in.) Fractional				Units	Nominal Bolt/Cap Screw Diameter (mm) Metric				
				3/8	1/2	5/8	3/4		8	10	12	16	20
HIS Insert O.D.		D	in. (mm)	0.65 (16.5)	0.81 (20.5)	1.00 (25.4)	1.09 (27.6)	mm (in.)	12.5 (0.49)	16.5 (0.65)	20.5 (0.81)	25.4 (1.00)	27.6 (1.09)
HIS insert length		L	in. (mm)	4.33 (110)	4.92 (125)	6.69 (170)	8.07 (205)	mm (in.)	90 (3.54)	110 (4.33)	125 (4.92)	170 (6.69)	205 (8.07)
Bolt effective cross-sectional area		A_{se}	in.^{2} (mm^2)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	mm^2 (in.^{2})	36.6 (0.057)	58 (0.090)	84.3 (0.131)	157 (0.243)	245 (0.380)
HIS insert effective cross-sectional area		A_{insert}	in.^{2} (mm^2)	0.178 (115)	0.243 (157)	0.404 (260)	0.410 (265)	mm^2 (in.^{2})	51.5 (0.080)	108 (0.167)	169.1 (0.262)	256.1 (0.397)	237.6 (0.368)
ASTM A193 B7	Nominal steel strength – ASTM A193 B7[3] bolt/cap screw	N_{sa}	lb (kN)	9,690 (43.1)	17,740 (78.9)	28,250 (125.7)	41,815 (186.0)	kN (lb)	-	-	-	-	-
ASTM A193 B7	Nominal steel strength – ASTM A193 B7[3] bolt/cap screw	V_{sa}	lb (kN)	5,815 (25.9)	10,645 (47.3)	16,950 (75.4)	25,090 (111.6)	kN (lb)	-	-	-	-	-
ASTM A193 B7	Nominal steel strength – HIS-N insert	N_{sa}	lb (kN)	12,650 (56.3)	16,195 (72.0)	26,925 (119.8)	27,360 (121.7)	kN (lb)	-	-	-	-	-
ASTM A193 Grade B8M SS	Nominal steel strength – ASTM A193 Grade B8M SS bolt/cap screw	N_{sa}	lb (kN)	8,525 (37.9)	15,610 (69.4)	24,860 (110.6)	36,795 (163.7)	kN (lb)	-	-	-	-	-
ASTM A193 Grade B8M SS	Nominal steel strength – ASTM A193 Grade B8M SS bolt/cap screw	V_{sa}	lb (kN)	5,115 (22.8)	9,365 (41.7)	14,915 (66.3)	22,075 (98.2)	kN (lb)	-	-	-	-	-
ASTM A193 Grade B8M SS	Nominal steel strength – HIS-RN insert	N_{sa}	lb (kN)	17,165 (76.3)	23,430 (104.2)	38,955 (173.3)	39,535 (175.9)	kN (lb)	-	-	-	-	-
ISO 898-1 Class 8.8	Nominal steel strength – ISO 898-1 Class 8.8 bolt/cap screw	N_{sa}	lb (kN)	-	-	-	-	kN (lb)	29.5 (6,582)	46.5 (10,431)	67.5 (15,161)	125.5 (28,236)	196.0 (44,063)
ISO 898-1 Class 8.8	Nominal steel strength – ISO 898-1 Class 8.8 bolt/cap screw	V_{sa}	lb (kN)	-	-	-	-	kN (lb)	17.5 (3,949)	28.0 (6,259)	40.5 (9,097)	75.5 (16,942)	117.5 (26,438)
ISO 898-1 Class 8.8	Nominal steel strength – HIS-N insert	N_{sa}	lb (kN)	-	-	-	-	kN (lb)	25.0 (5,669)	53.0 (11,894)	78.0 (17,488)	118.0 (26,483)	110.0 (24,573)
ISO 3506-1 Class A4-70 Stainless	Nominal steel strength – ISO 3506-1 Class A4-70 Stainless bolt/cap screw	N_{sa}	lb (kN)	-	-	-	-	kN (lb)	25.5 (5,760)	40.5 (9,127)	59.0 (13,266)	110.0 (24,706)	171.5 (38,555)
ISO 3506-1 Class A4-70 Stainless	Nominal steel strength – ISO 3506-1 Class A4-70 Stainless bolt/cap screw	V_{sa}	lb (kN)	-	-	-	-	kN (lb)	15.5 (3,456)	24.5 (5,476)	35.5 (7,960)	66.0 (14,824)	103.0 (23,133)
ISO 3506-1 Class A4-70 Stainless	Nominal steel strength – HIS-RN insert	N_{sa}	lb (kN)	-	-	-	-	kN (lb)	36.0 (8,099)	75.5 (16,991)	118.5 (26,612)	179.5 (40,300)	166.5 (37,394)
Reduction for seismic shear		$\alpha_{V,seis}$	-	0.70				-	0.70				
Strength reduction factor for tension[2]		ϕ	-	0.65				-	0.65				
Strength reduction factor for shear[2]		ϕ	-	0.60				-	0.60				

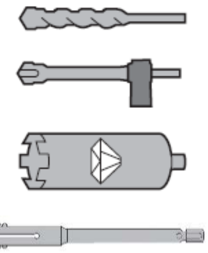
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Values provided for common rod material types based on specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29). Nuts and washers must be appropriate for the rod.
[2] For use with the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3. Values correspond to a brittle steel element for the HIS insert.
[3] For the calculation of the design steel strength in tension and shear for the bolt or screw, the ϕ factor for ductile steel failure according to ACI 318-14 17.3.3 or ACI 318-11 D.4.3 can be used.

Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert



Concrete Breakout Strength



Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit + Roughening Tool

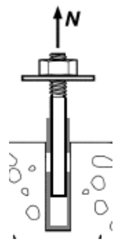
TABLE 23—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL AND METRIC HILTI HIS-N AND HIS-RN INSERTS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT) OR CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION	Symbol	Units	Nominal Bolt/Cap Screw Diameter (in.) Fractional				Units	Nominal Bolt/Cap Screw Diameter (mm) Metric				
			$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$		8	10	12	16	20
Effectiveness factor for cracked concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)				SI (in-lb)	7.1 (17)				
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	in-lb (SI)	24 (10)				SI (in-lb)	10 (24)				
Effective embedment depth	h_{ef}	in. (mm)	$4^3/_8$ (110)	5 (125)	$6^3/_4$ (170)	$8^1/_8$ (205)	mm (in.)	90 (3.5)	110 (4.3)	125 (4.9)	170 (6.7)	205 (8.1)
Min. anchor spacing[3]	s_{min}	in. (mm)	$3^1/_4$ (83)	4 (102)	5 (127)	$5^1/_2$ (140)	mm (in.)	63 (2.5)	83 (3.25)	102 (4.0)	127 (5.0)	140 (5.5)
Min. edge distance[3]	c_{min}	in. (mm)	$3^1/_4$ (83)	4 (102)	5 (127)	$5^1/_2$ (140)	mm (in.)	63 (2.5)	83 (3.25)	102 (4.0)	127 (5.0)	140 (5.5)
Minimum concrete thickness	h_{min}	in. (mm)	5.9 (150)	6.7 (170)	9.1 (230)	10.6 (270)	mm (in.)	120 (4.7)	150 (5.9)	170 (6.7)	230 (9.1)	270 (10.6)
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	See Section 4.1.10.2 of this report				-	See Section 4.1.10.2 of this report				
Strength reduction factor for tension, concrete failure modes, Condition B[2]	ϕ	-	0.65				-	0.65				
Strength reduction factor for shear, concrete failure modes, Condition B[2]	ϕ	-	0.70				-	0.70				

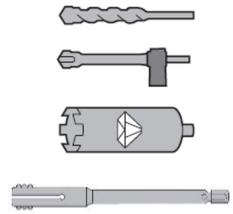
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Additional setting information is described in Figure 9, Manufacturers Printed Installation Instructions (MPII).
[2] Values provided for post-installed anchors installed under Condition B without supplementary reinforcement as defined in ACI 318-14 17.3.3 or ACI 318-11 D.4.3.
[3] For installations with $1^3/_4$-inch edge distance, refer to Section 4.1.9.2 for spacing and maximum torque requirements.

Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert

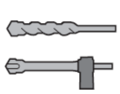
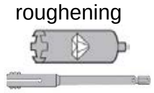


Bond Strength



Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit + Roughening Tool

TABLE 24—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL AND METRIC HILTI HIS-N AND HIS-RN INSERTS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

DESIGN INFORMATION		Symbol	Units	Nominal Bolt/Cap Screw Diameter (in.) Fractional				Units	Nominal Bolt/Cap Screw Diameter (mm) Metric				
				$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$		8	10	12	16	20
Effective embedment depth		h_{ef}	in. (mm)	$4^3/_8$ (110)	5 (125)	$6^3/_4$ (170)	$8^1/_8$ (205)	mm (in.)	90 (3.5)	110 (4.3)	125 (4.9)	170 (6.7)	205 (8.1)
HIS Insert O.D.		D	in. (mm)	0.65 (16.5)	0.81 (20.5)	1.00 (25.4)	1.09 (27.6)	mm (in.)	12.5 (0.49)	16.5 (0.65)	20.5 (0.81)	25.4 (1.00)	27.6 (1.09)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	870 (6.0)	890 (6.1)	910 (6.3)	920 (6.3)	MPa (psi)	5.9 (850)	6.0 (870)	6.1 (890)	6.3 (910)	6.3 (920)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	1,950 (13.5)	1,950 (13.5)	1,950 (13.5)	1,950 (13.5)	MPa (psi)	13.5 (1,950)	13.5 (1,950)	13.5 (1,950)	13.5 (1,950)	13.5 (1,950)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	870 (6.0)	890 (6.1)	910 (6.3)	920 (6.3)	MPa (psi)	5.9 (850)	6.0 (870)	6.1 (890)	6.3 (910)	6.3 (920)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	1,950 (13.5)	1,950 (13.5)	1,950 (13.5)	1,950 (13.5)	MPa (psi)	13.5 (1,950)	13.5 (1,950)	13.5 (1,950)	13.5 (1,950)	13.5 (1,950)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi (MPa)	715 (4.9)	730 (5.0)	750 (5.2)	755 (5.2)	MPa (psi)	4.8 (695)	4.9 (715)	5.0 (730)	5.2 (750)	5.2 (755)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi (MPa)	1,600 (11.0)	1,600 (11.0)	1,600 (11.0)	1,600 (11.0)	MPa (psi)	11.0 (1,600)	11.0 (1,600)	11.0 (1,600)	11.0 (1,600)	11.0 (1,600)
Permissible installation conditions	Dry and water saturated concrete	Anchor Category	-	1				-	1				
		ϕ_d	-	0.65				-	0.65				
Reduction for seismic tension	Hammer drilled 	$\alpha_{N,seis}$	-	0.92				-	0.92				
	Core drilled + roughening 	$\alpha_{N,seis}$	-	0.81	0.88	0.92	0.76	-	N/A	0.81	0.88	0.92	0.76

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 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) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1], the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.1}$ for uncracked concrete, [For SI: $(f'_c / 17.2)^{0.1}$] and $(f'_c / 2{,}500)^{0.3}$ for cracked concrete, [For SI: $(f'_c / 17.2)^{0.3}$]. 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.

HILTI HIT-HY 200 FOIL PACK AND MIXING NOZZLE

HILTI DISPENSER

ANCHORING ELEMENTS

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

HILTI TE-YRT ROUGHENING TOOL

FIGURE 6—HILTI HIT-HY 200 ANCHORING SYSTEM

TABLE 25—DEVELOPMENT LENGTH FOR U.S. CUSTOMARY UNIT REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT OR HILTI HOLLOW CARBIDE BIT[1, 2, 4]

DESIGN INFORMATION	Symbol	Criteria Section of Reference Standard	Units	Bar size							
				#3	#4	#5	#6	#7	#8	#9	#10
Nominal reinforcing bar diameter	d_b	ASTM A615/A706	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)
Nominal bar area	A_b	ASTM A615/A706	in^2 (mm^2)	0.11 (71.3)	0.20 (126.7)	0.31 (197.9)	0.44 (285.0)	0.60 (387.9)	0.79 (506.7)	1.00 (644.7)	1.27 (817.3)
Development length for f_y = 60 ksi and f'_c = 2,500 psi (normal weight concrete)[3]	l_d	ACI 318-11 12.2.3	in. (mm)	12.0 (304.8)	14.4 (365.8)	18.0 (457.2)	21.6 (548.6)	31.5 (800.1)	36.0 (914.4)	40.5 (1028.7)	45.0 (1143)
Development length for f_y = 60 ksi and f'_c = 4,000 psi (normal weight concrete)[3]	l_d	ACI 318-11 12.2.3	in. (mm)	12.0 (304.8)	12.0 (304.8)	14.2 (361.4)	17.1 (433.7)	24.9 (632.5)	28.5 (722.9)	32.0 (812.8)	35.6 (904.2)

For **SI:** 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Development lengths valid for static, wind, and earthquake loads (SDC A and B).
[2] Development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21 and section 4.2.4 of this report. The value of f'_c used to calculate development lengths shall not exceed 2,500 psi for post-installed reinforcing bar applications in SDCs C, D, E, and F.
[3] For sand-lightweight concrete, increase development length by 33%, unless the provisions of ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4 (d) are met to permit $\lambda > 0.75$.
[4] $\left(\frac{c_b + K_{tr}}{d_b}\right) = 2.5$, $\psi_t = 1.0$, $\psi_e = 1.0$, $\psi_s = 0.8$ for $d_b \le$ #6, 1.0 for $d_b >$ #6.

TABLE 26—DEVELOPMENT LENGTH FOR EU METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT OR HILTI HOLLOW CARBIDE BIT [1, 2, 4]

DESIGN INFORMATION	Symbol	Criteria Section of Reference Standard	Units	Bar size						
				8	10	12	16	20	25	32
Nominal reinforcing bar diameter	d_b	BS 4449: 2005	mm (in.)	8 (0.315)	10 (0.394)	12 (0.472)	16 (0.630)	20 (0.787)	25 (0.984)	32 (1.260)
Nominal bar area	A_b	BS 4449: 2005	mm² (in²)	50.3 (0.08)	78.5 (0.12)	113.1 (0.18)	201.1 (0.31)	314.2 (0.49)	490.9 (0.76)	804.2 (1.25)
Development length for f_y = 72.5 ksi and f'_c = 2,500 psi (normal weight concrete) [3]	l_d	ACI 318-11 12.2.3	mm (in.)	305 (12.0)	348 (13.7)	417 (16.4)	556 (21.9)	871 (34.3)	1087 (42.8)	1392 (54.8)
Development length for f_y = 72.5 ksi and f'_c = 4,000 psi (normal weight concrete) [3]	l_d	ACI 318-11 12.2.3	mm (in.)	305 (12.0)	305 (12.0)	330 (13.0)	439 (17.3)	688 (27.1)	859 (33.8)	1100 (43.3)

For **SI:** 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1]Development lengths valid for static, wind, and earthquake loads (SDC A and B).
[2] Development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21 and section 4.2.4 of this report. The value of f'_c used to calculate development lengths shall not exceed 2,500 psi for post-installed reinforcing bar applications in SDCs C, D, E, and F.
[3] For sand-lightweight concrete, increase development length by 33%, unless the provisions of ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4 (d) are met to permit $\lambda > 0.75$.
[4] $\left(\frac{c_b + K_{tr}}{d_b}\right) = 2.5$, ψ_t = 1.0, ψ_e = 1.0, ψ_s = 0.8 for d_b < 20mm, 1.0 for $d_b \geq$ 20mm.

TABLE 27—DEVELOPMENT LENGTH FOR CANADIAN METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT OR HILTI HOLLOW CARBIDE BIT [1, 2, 4]

DESIGN INFORMATION	Symbol	Criteria Section of Reference Standard	Units	Bar size				
				10M	15M	20M	25M	30M
Nominal reinforcing bar diameter	d_b	CAN/CSA-G30.18 Gr. 400	mm (in.)	11.3 (0.445)	16.0 (0.630)	19.5 (0.768)	25.2 (0.992)	29.9 (1.177)
Nominal bar area	A_b	CAN/CSA-G30.18 Gr. 400	mm² (in²)	100.3 (0.16)	201.1 (0.31)	298.6 (0.46)	498.8 (0.77)	702.2 (1.09)
Development length for f_y = 58 ksi and f'_c = 2,500 psi (normal weight concrete) [3]	l_d	ACI 318-11 12.2.3	mm (in.)	315 (12.4)	445 (17.5)	678 (26.7)	876 (34.5)	1041 (41.0)
Development length for f_y = 58 ksi and f'_c = 4,000 psi (normal weight concrete) [3]	l_d	ACI 318-11 12.2.3	mm (in.)	305 (12.0)	353 (13.9)	536 (21.1)	693 (27.3)	823 (32.4)

For **SI:** 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

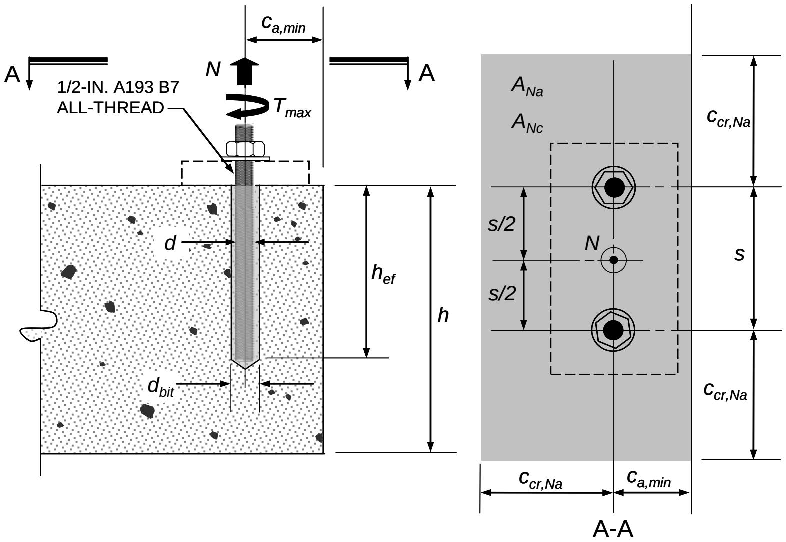
[1] Development lengths valid for static, wind, and earthquake loads (SDC A and B).
[2] Development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21 and section 4.2.4 of this report. The value of f'_c used to calculate development lengths shall not exceed 2,500 psi for post-installed reinforcing bar applications in SDCs C, D, E, and F.
[3] For sand-lightweight concrete, increase development length by 33%, unless the provisions of ACi 318-14 25.4.2.4 or ACI 318-11 12.2.4 (d) are met to permit $\lambda > 0.75$.
[4] $\left(\frac{c_b + K_{tr}}{d_b}\right) = 2.5$, ψ_t = 1.0, ψ_e = 1.0, ψ_s = 0.8 for d_b < 20M, 1.0 for $d_b \geq$20M.

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 318-11 D.1 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}	= 9.0 in.
s	= 4.0 in.
$c_{a,min}$	= 2.5 in.
h	= 12.0 in.
d	= 1/2 in.



Calculation for the 2012 and 2009 IBC in accordance with ACI 318-11 Appendix D and this report	***ACI 318-11 Code Ref.***	***Report Ref.***
***Step 1**. Check minimum edge distance, anchor spacing and member thickness:* c_{min} = 2.5 in. ≤ $c_{a,min}$ = 2.5 in. ∴ OK s_{min} = 2.5 in. ≤ s = 4.0 in. ∴ OK h_{min} = h_{ef} + 1.25 in. = 9.0 + 1.25 = 10.25 in. ≤ h = 12.0 ∴ OK $h_{ef,min}$ ≤ h_{ef} ≤ $h_{ef,max}$ = 2.75 in. ≤ 9 in. ≤ 10 in. ∴ OK	-	***Table 12 Table 14***
***Step 2**. Check steel strength in tension:* Single Anchor: $N_{sa} = A_{se} \cdot f_{uta}$ = 0.1419 in² • 125,000 psi = 17,738 lb. Anchor Group: $\phi N_{sa} = \phi \cdot n \cdot A_{se} \cdot f_{uta}$ = 0.75 • 2 • 17,738 lb. = 26,606 lb. Or using Table 11: ϕN_{sa} = 0.75 • 2 • 17,735 lb. = **26,603 lb.**	***D.5.1.2 Eq. (D-2)***	***Table 3 Table 11***
***Step 3**. Check concrete breakout strength in tension:* $N_{cbg} = \frac{A_{Nc}}{A_{Nc0}} \cdot \psi_{ec,N} \cdot \psi_{ed,N} \cdot \psi_{c,N} \cdot \psi_{cp,N} \cdot N_b$	***D.5.2.1 Eq. (D-4)***	-
$A_{Nc} = (3 \cdot h_{ef} + s)(1.5 \cdot h_{ef} + c_{a,min})$ = (3 • 9 + 4)(13.5 + 2.5) = **496 in²**	-	-
$A_{Nc0} = 9 \cdot h_{ef}^2$ = **729 in²**	***D.5.2.1 and Eq. (D-5)***	-
$\psi_{ec,N}$ = **1.0** no eccentricity of tension load with respect to tension-loaded anchors	***D.5.2.4***	-
$\psi_{ed,N} = 0.7 + 0.3 \cdot \frac{c_{a,min}}{1.5 h_{ef}} = 0.7 + 0.3 \cdot \frac{2.5}{1.5 \cdot 9} = \mathbf{0.76}$	***D.5.2.5 and Eq. (D-10)***	-
$\psi_{c,N}$ = **1.0** uncracked concrete assumed ($k_{c,uncr}$ = 24)	***D.5.2.6***	***Table 12***
Determine c_{ac}: From Table 14: τ_{uncr} = 1,670 psi $\tau_{uncr} = \frac{k_{c,uncr}}{\pi \cdot d}\sqrt{h_{ef} \cdot f'_c} = \frac{24}{\pi \cdot 0.5}\sqrt{9.0 \cdot 4{,}000}$ = 2,899 psi > 1,670 psi ∴ use 1,670 psi $c_{ac} = h_{ef} \cdot \left(\frac{\tau_{uncr}}{1{,}160}\right)^{0.4} \cdot \left[3.1 - 0.7 \cdot \frac{h}{h_{ef}}\right] = 9 \cdot \left(\frac{1{,}670}{1{,}160}\right)^{0.4} \cdot \left[3.1 - 0.7 \cdot \frac{12}{9}\right]$ = **22.6 in.**	-	***Section 4.1.10 Table 14***
For $c_{a,min} < c_{ac}$ $\psi_{cp,N} = \frac{\max\lvert c_{a,min}; 1.5 \cdot h_{ef}\rvert}{c_{ac}} = \frac{\max\lvert 2.5; 1.5 \cdot 9\rvert}{22.6} = \mathbf{0.60}$	***D.5.2.7 and Eq. (D-12)***	-
$N_b = k_{c,uncr} \cdot \lambda \cdot \sqrt{f'_c} \cdot h_{ef}^{1.5} = 24 \cdot 1.0 \cdot \sqrt{4{,}000} \cdot 9^{1.5}$ = **40,983 lb.**	***D.5.2.2 and Eq. (D-6)***	***Table 12***
$N_{cbg} = \frac{496}{729} \cdot 1.0 \cdot 0.76 \cdot 1.0 \cdot 0.60 \cdot 40{,}983$ = **12,715 lb.**	-	-
ϕN_{cbg} = 0.65 • 12,715 = **8,265 lb.**	***D.4.3(c)***	***Table 12***

FIGURE 7—SAMPLE CALCULATION [POST-INSTALLED ANCHORS]

***Step 4**. Check bond strength in tension:* $N_{ag} = \frac{A_{Na}}{A_{Na0}} \cdot \psi_{ec,Na} \cdot \psi_{ed,Na} \cdot \psi_{cp,Na} \cdot N_{ba}$	***D.5.5.1 Eq. (D-19)***	-
$A_{Na} = (2c_{Na} + s)(c_{Na} + c_{a,min})$ $c_{Na} = 10d_a\sqrt{\frac{\tau_{uncr}}{1,100}} = 10 \cdot 0.5 \cdot \sqrt{\frac{1,670}{1,100}}$ = ***6.16 in.*** $A_{Na} = (2 \cdot 6.16 + 4)(6.16 + 2.5)$ = ***141.3 in²***	***D.5.5.1 Eq. (D-21)***	***Table 14***
$A_{Na0} = (2c_{Na})^2 = (2 \cdot 6.16)^2$ = ***151.8 in²***	***D.5.5.1 and Eq. (D-20)***	-
$\psi_{ec,Na}$ = ***1.0*** *no eccentricity – loading is concentric*	***D.5.5.3***	-
$\psi_{ed,Na} = \left(0.7 + 0.3 \cdot \frac{c_{a,\min}}{c_{Na}}\right) = \left(0.7 + 0.3 \cdot \frac{2.5}{6.16}\right)$ = ***0.82***	***D5.5.4***	-
$\psi_{cp,Na} = \frac{\max\lvert c_{a,\min}; c_{Na}\rvert}{c_{ac}} = \frac{\max\lvert 2.5; 6.16\rvert}{22.6}$ = ***0.27***	***D.5.5.5***	-
$N_{ba} = \lambda \cdot \tau_{uncr} \cdot \pi \cdot d \cdot h_{ef} = 1.0 \cdot 1,670 \cdot \pi \cdot 0.5 \cdot 9.0$ = ***23,609 lb.***	***D.5.5.2 and Eq. (D-22)***	***Table 14***
$N_{ag} = \frac{141.3}{151.8} \cdot 1.0 \cdot 0.82 \cdot 0.27 \cdot 23,609$ = ***4,865 lb.***	-	-
$\phi N_{ag} = 0.65 \cdot 4,865$ = ***3,163 lb.***	***D.4.3(c)***	***Table 14***
Step 5.** Determine controlling strength:* *Steel Strength* ϕN_{sa} = *26,603 lb.* *Concrete Breakout Strength* ϕN_{cbg} = *8,265 lb.* *Bond Strength* ϕN_{ag} = ***3,163 lb. CONTROLS	***D.4.1***	-

FIGURE 7—SAMPLE CALCULATION [POST-INSTALLED ANCHORS] (Continued)

Specifications / Assumptions:

Development length for column starter bars

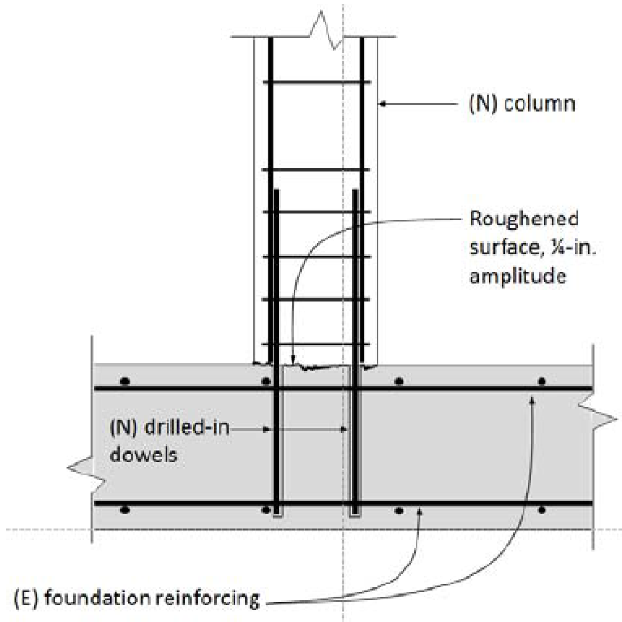
Existing construction (E):

Foundation grade beam 24 wide x 36-in deep., 4 ksi normal weight concrete, ASTM A615 Gr. 60 reinforcement

New construction (N):

18 x 18-in. column as shown, centered on 24-in wide grade beam, 4 ksi normal weight concrete, ASTM A615 Gr. 60 reinforcement, 4 - #7 column bars

The column must resist moment and shear arising from wind loading.



Dimensional Parameters:

d_b = 0.875 in.

$\left(\frac{c_b + K_{tr}}{d_b}\right)$ = 2.5

ψ_t = 1.0

ψ_e = 1.0

ψ_s = 1.0

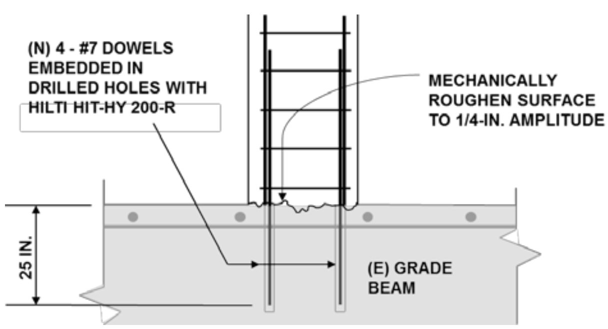
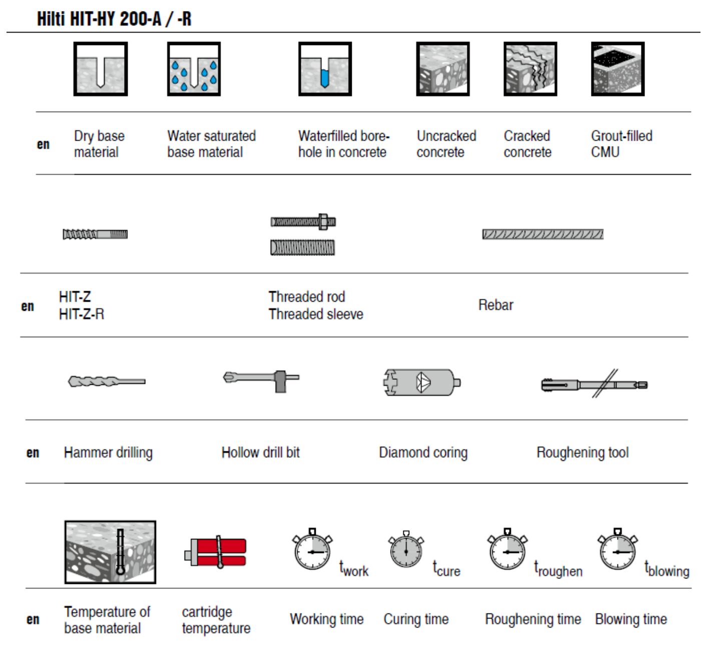
Calculation in accordance with ACI 318-11	***ACI 318-11 Code Ref.***
***Step 1**. Determination of development length for the column bars:* $$l_d = \left[\frac{3}{40}\cdot\frac{f_y}{\lambda\cdot\sqrt{f'_c}}\cdot\frac{\psi_t\psi_e\psi_s}{\frac{c_b+K_{tr}}{d_b}}\right]\cdot d_b = \left[\frac{3}{40}\cdot\frac{60000}{1.0\cdot\sqrt{4000}}\cdot\frac{(1.0)(1.0)(1.0)}{2.5}\right]\cdot 0.875 = 25 in.$$ *Note that the confinement term K_{tr} is taken equal to the maximum value 2.5 given the edge distance and confinement condition*	***Eq. (12-1)***
***Step 2** Detailing (not to scale)* 	

FIGURE 8—SAMPLE CALCULATION [POST-INSTALLED REINFORCING BARS]



Hilti HIT-HY 200-A / -R

Ø	HAS HIT-V	HIS-N	Rebar	HIT-Z	HIT-RB	HIT-SZ	HIT-DL	HIT-OHC	TE-YRT
d_0 [inch]	d [inch]				[inch]	[inch]	[inch]	Art. No.	[inch]
7/16	3/8	–	–	3/8	7/16	–	–	387551	–
1/2	–	–	#3	–	1/2	1/2	1/2		–
9/16	1/2	–	10M	1/2	9/16	9/16	9/16		–
5/8	–	–	#4	–	5/8	5/8	9/16		–
11/16	–	3/8	–	–	11/16	11/16	11/16		–
3/4	5/8	–	15M #5	5/8	3/4	3/4	3/4		3/4
7/8	3/4	1/2	#6	3/4	7/8	7/8	7/8	387552	7/8
1	7/8	–	20M #6 #7	–	1	1	1		1
1 1/8	1	5/8	#7 #8	–	1 1/8	1 1/8	1		1 1/8
1 1/4	–	3/4	25M #8	–	1 1/4	1 1/4	1		–
1 3/8	1 1/4	–	#9	–	1 3/8	1 3/8	1 3/8		1 3/8
1 1/2	–	–	30M #10	–	1 1/2	1 1/2	1 3/8		–

HIT-DL: h_{ef} > 10" HIT-RB: h_{ef} > 20d

Hilti VC 150/300	HIT-RE-M Art. No.		HIT-OHW Art. No.
min. 61 l/s	337111	HDM 330 HDM 500 HDE 500-A18	387550

Ø d_0 [inch]	h_{ef} [inch]	Art. No. 381215	
7/16"...1 1/8"	2 3/8"...20"	✔	≥ 6 bar/90 psi @ 6 m³/h
1 1/4"...1 1/2"	4"...25"	–	≥ 140 m³/h / ≥ 82 CFM

Hilti HIT-HY 200-A / -R

Ø	TE-CD TE-YD	HIT-V HAS	HIS-N	Rebar	HIT-Z	HIT-RB	HIT-SZ	HIT-DL	HIT-OHC	TE-YRT
d_0 [mm]		d [mm]				[mm]	[mm]		Art. No.	[mm]
10	–	8		–	8	10	–	–	387551	–
12	12	10	–	8	10	12	12	12		–
14	14	12	8	10	12	14	14	14		–
16	16	–	–	12	–	16	16	16		–
18	18	16	10	14	16	18	18	18		18
20	20	–	–	16	–	20	20	20		20
22	22	20	12	18	20	22	22	20	387552	22
25	25	–	–	20	–	25	25	25		25
28	28	24	16	22	–	28	28	25		28
30	30	27	–	–	–	30	30	25		30
32	32	–	20	24/25	–	32	32	32		32
35	35	30	–	26/28	–	35	35	32		35
37	–	–	–	30	–	37	37	32		–
40	–	–	–	32	–	40	40	32		–

HIT-DL: h_{ef} > 250 mm HIT-RB: h_{ef} > 20d

Hilti VC 150/300	HIT-RE-M Art. No.		HIT-OHW Art. No.
min. 61 l/s	337111	HDM 330 / 500 HDE 500-A18	387550

Ø d_0 [mm]	h_{ef} [mm]	Art. No. 381215	
10...32	60...500	✔	≥ 6 bar/90 psi
35...40	100...640	–	≥ 140 m³/h

FIGURE 9—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII)

HIT-HY 200-A

[°C]	[°F]	HIT-V, HAS / HIS-N / Rebar t_{work}	HIT-V, HAS / HIS-N / Rebar t_{cure}	HIT-Z t_{work}	HIT-Z t_{cure}
-10…-5	14…23	1,5 h	7 h	–	–
-4…0	24…32	50 min	4 h	–	–
1…5	33…41	25 min	2 h	–	–
6…10	42…50	15 min	75 min	15 min	75 min
11…20	51…68	7 min	45 min	7 min	45 min
21…30	69…86	4 min	30 min	4 min	30 min
31…40	87…104	3 min	30 min	3 min	30 min

HIT-HY 200-R

[°C]	[°F]	HIT-V, HAS / HIS-N / Rebar t_{work}	HIT-V, HAS / HIS-N / Rebar t_{cure}	HIT-Z t_{work}	HIT-Z t_{cure}
-10…-5	14…23	3 h	20 h	–	–
-4…0	24…32	2 h	8 h	–	–
1…5	33…41	1 h	4 h	–	–
6…10	42…50	40 min	2,5 h	40 min	2,5 h
11…20	51…68	15 min	1,5 h	15 min	1,5 h
21…30	69…86	9 min	1 h	9 min	1 h
31…40	87…104	6 min	1 h	6 min	1 h

h_{ef} [mm]	$t_{roughen}$	$t_{blowing\ min}$
0 … 100	10 sec	30 sec
101 … 200	20 sec	40 sec
201 … 300	30 sec	50 sec
301 … 400	40 sec	60 sec
401 … 500	50 sec	70 sec
501 … 600	60 sec	80 sec

$t_{roughen}$ [sec] = h_{ef} [mm] / 10

Rebar $h_{ef} \geq 20d$

			h_{ef}		
HIT-HY 200-A HIT-HY 200-R	HDM, HDE	≤ US #5 ≤ EU 16mm ≤ CAN 15M	12 1/2 … 37 1/2 [inch] 320 … 960 [mm] 320 … 960 [mm]	14°F…104°F -10°C…40°C	50°F…86°F 10°C…30°C
HIT-HY 200-A HIT-HY 200-R	HDE	≤ US #5 ≤ EU 16mm ≤ CAN 15M	12 1/2 … 37 1/2 [inch] 320 … 960 [mm] 320 … 960 [mm]	14°F…104°F -10°C…40°C	32°F…86°F 0°C…30°C
HIT-HY 200-R	HDE	≤ US #8 ≤ EU 25mm ≤ CAN 25M	20 … 60 [inch] 500 … 1500 [mm] 504 … 1512 [mm]	32°F…104°F 0°C…40°C	32°F…86°F 0°C…30°C
HIT-HY 200-R	HDE	≤ US #10 ≤ EU 32mm ≤ CAN 30M	25 … 75 [inch] 640 … 1920 [mm] 598 … 1794 [mm]	50°F…86°F 10°C…30°C	50°F…68°F 10°C…20°C

			h_{ef}		
HIT-HY 200-A HIT-HY 200-R	HDM, HDE	≤ US #5 ≤ EU 16mm ≤ CAN 15M	12 1/2 … 37 1/2 [inch] 320 … 960 [mm] 320 … 960 [mm]	14°F…104°F -10°C…40°C	50°F…86°F 10°C…30°C
HIT-HY 200-A HIT-HY 200-R	HDE	≤ US #5 ≤ EU 16mm ≤ CAN 15M	12 1/2 … 37 1/2 [inch] 320 … 960 [mm] 320 … 960 [mm]	14°F…104°F -10°C…40°C	32°F…86°F 0°C…30°C
HIT-HY 200-R	HDE	≤ US #8 ≤ EU 25mm ≤ CAN 25M	20 … 39 3/8 [inch] 500 … 1000 [mm] 504 … 1000 [mm]	32°F…104°F 0°C…40°C	32°F…86°F 0°C…30°C

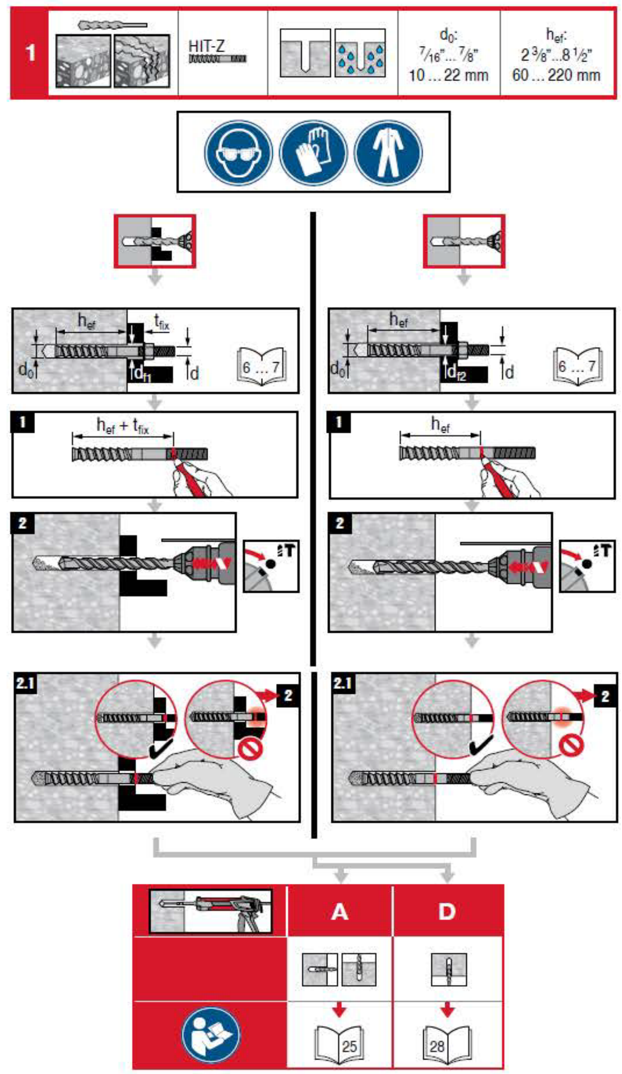


FIGURE 9—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)

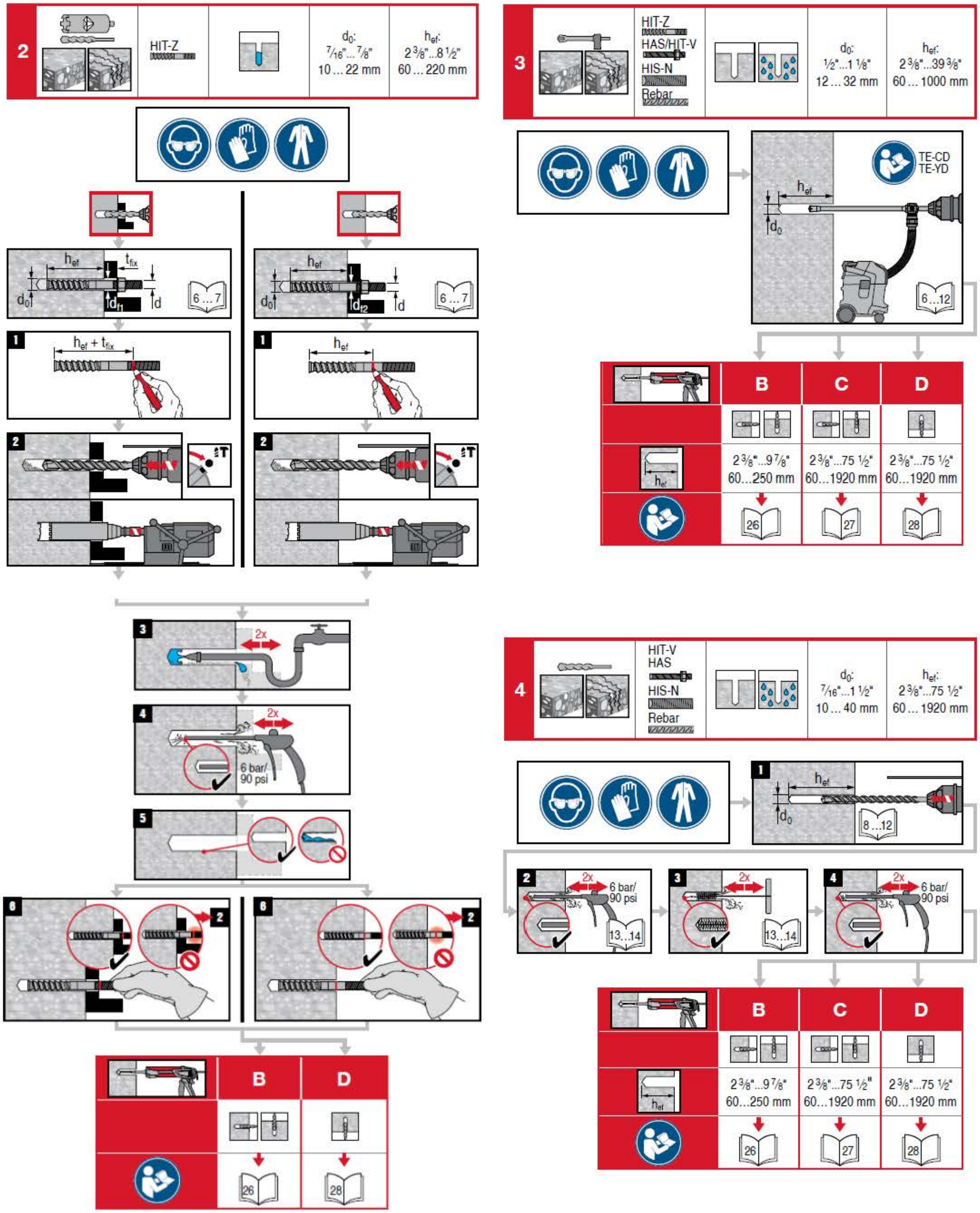


FIGURE 9—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continu

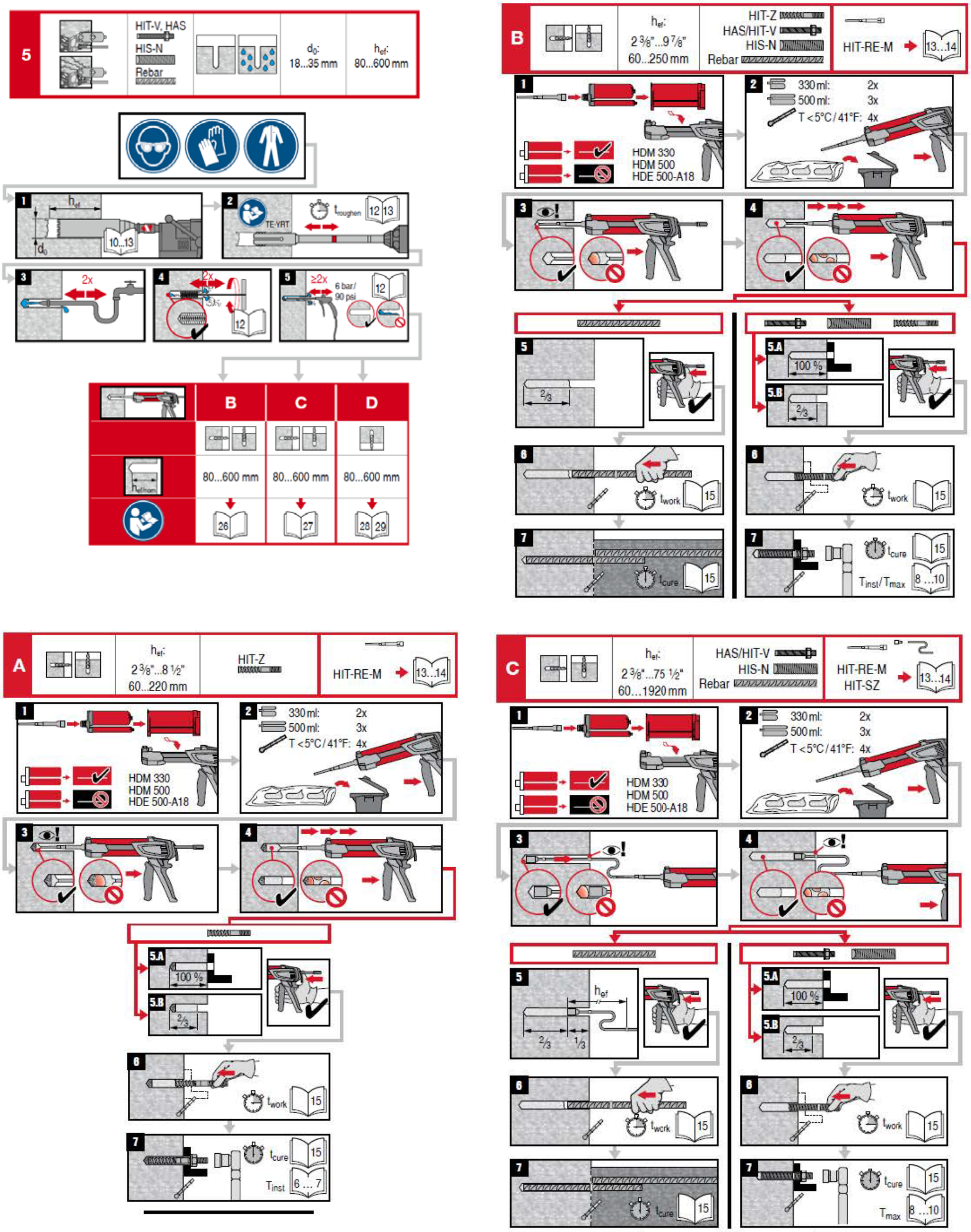
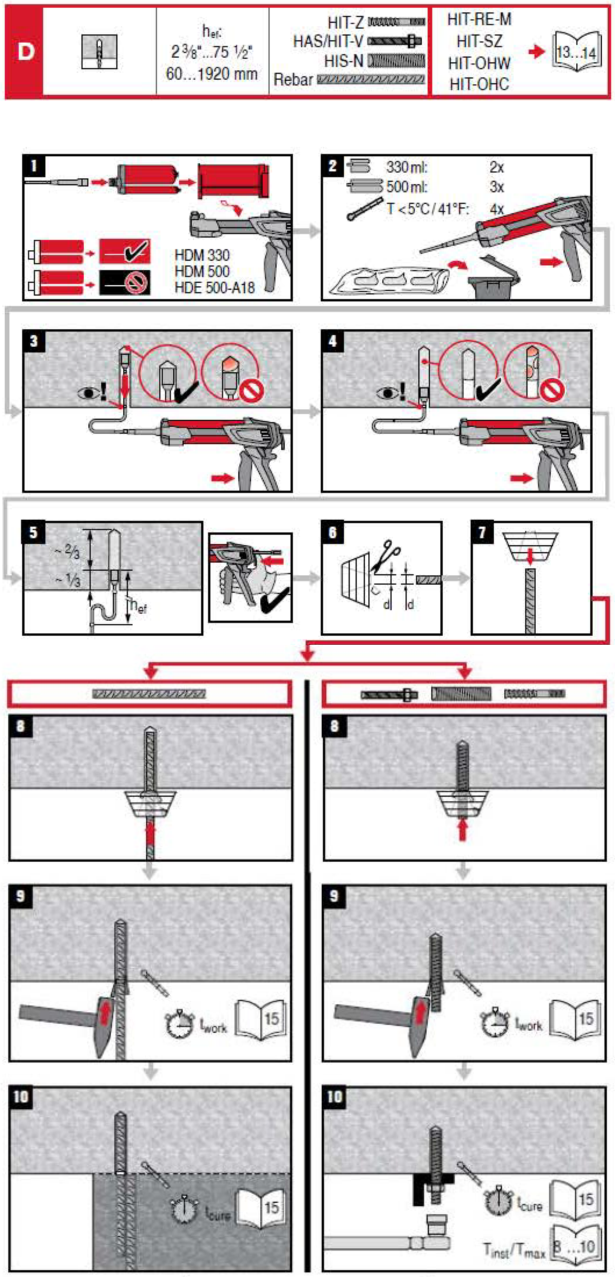


FIGURE 9—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)



Hilti HIT-HY 200-A / -R

Adhesive anchoring system for rebar and anchor fastenings in concrete.

Hilti HIT-HY 200-A
Contains: Hydroxypropylmethacrylat (A), Dibenzoylperoxid (B)

Warning

H317	May cause an allergic skin reaction. (A, B)
H319	Causes serious eye irritation. (B)
H400	Very toxic to aquatic life. (B)
P262	Do not get in eyes, on skin or on clothing.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P333+313	If skin irritation or rash occurs: Get medical advice/attention.
P337+313	If eye irritation persists: Get medical advice/attention.

Disposal considerations

Empty packs:

► Leave the mixer attached and dispose of via the local Green Dot recovery system

► or EAK waste material code: 150102 plastic packaging

Full or partially emptied packs:

► Must be disposed of as special waste in accordance with official regulations.
- EAK waste material code: 08 04 09* waste adhesives and sealants containing organic solvents or other dangerous substances.
- or EAK waste material code: 20 01 27* paint, inks, adhesives and resins containing dangerous substances.

Content: 330 ml / 11.1 fl.oz. 500 ml / 16.9 fl. oz **Weight:** 590 g / 20.8 oz 890 g / 31.4 oz

Failure to observe these installation instructions, use of non-Hilti anchors, poor or questionable base material conditions, or unique applications may affect the reliability or performance of the fastenings.

Hilti HIT-HY 200-A / -R

Product information
- Always keep these instructions together with the product even when given to other persons.
- **Material Safety Data Sheet:** Review the MSDS before use.
- **Check expiration date:** See imprint on foil pack manifold (month/year). Do not use expired product.
- **Foil pack temperature during usage:** 0 °C to 40 °C / 32 °F to 104 °F.
- **Base material temperature at time of installation:**
  HAS/HIT-V, HIS, Rebar: between -10 °C and 40 °C / 14 °F and 104 °F.
  HIT-Z: between +5°C and 40°C / 41°F and 104°F.
- **Conditions for transport and storage:** Keep in a cool, dry and dark place between 5 °C and 25 °C / 41 °F and 77 °F.
- For any application not covered by this document / beyond values specified, please contact Hilti.
- **Partly used foil packs must remain in the cassette** and has to be used within **4 weeks**. Leave the mixer attached on the foil pack manifold and store within the cassette under the recommended storage conditions. If reused, attach a new mixer and discard the initial quantity of anchor adhesive.

⚠ NOTICE

⚠ The surface of the HIT-Z anchor rod must not be altered in any way.

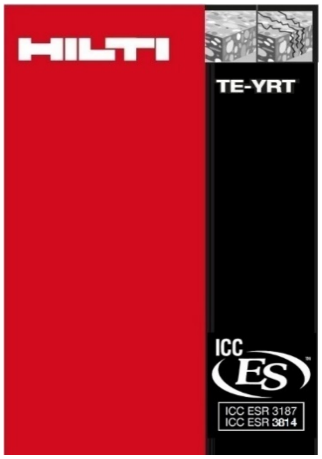
⚠ Improper handling may cause mortar splashes.
- Always wear safety glasses, gloves and protective clothes during installation.
- Never start dispensing without a mixer properly screwed on.
- Attach a new mixer prior to dispensing a new foil pack (ensure snug fit).
- Use only the type of mixer (HIT-RE-M) supplied with the adhesive. Do not modify the mixer in any way.
- Never use damaged foil packs and/or damaged or unclean foil pack holders (cassettes).

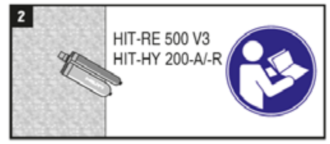
⚠ Poor load values / potential failure of fastening points due to inadequate borehole cleaning.
- The boreholes must be free of debris, dust, water, ice, oil, grease and other contaminants prior to adhesive injection.
- For blowing out the borehole – blow out with oil free air until return air stream is free of noticeable dust.
- For flushing the borehole – flush with water line pressure until water runs clear.
- For brushing the borehole – only use specified wire brush. The brush must resist insertion into the borehole – if not the brush is too small and must be replaced.

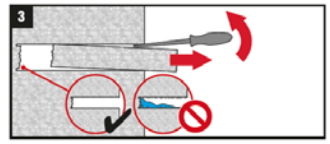
⚠ Ensure that boreholes are filled from the back of the borehole without forming air voids.
- If necessary use the accessories / extensions to reach the back of the borehole.
- For overhead applications use the overhead accessories HIT-SZ and take special care when inserting the fastening element. Excess adhesive may be forced out of the borehole. Make sure that no mortar drips onto the installer.

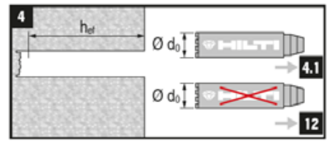
⚠ Not adhering to these setting instructions can result in failure of fastening points!

FIGURE 9—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)



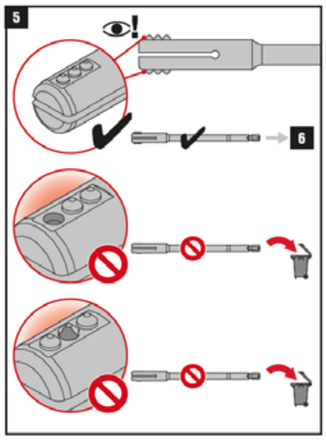






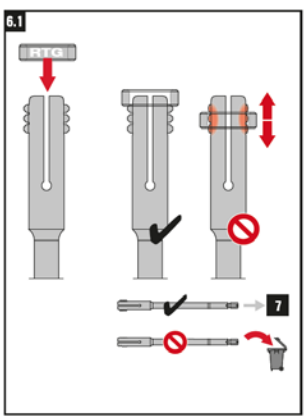
4.1

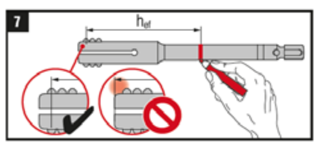
Ø d0 [mm]	TE-YRT
18	TE-YRT 18/320
20	TE-YRT 20/320
22	TE-YRT 22/400
25	TE-YRT 25/400
28	TE-YRT 28/480
30	TE-YRT 30/540
32	TE-YRT 32/500
35	TE-YRT 35/600
Ø d0 [inch]	TE-YRT
3/4"	TE-YRT 3/4" / 12 1/2"
7/8"	TE-YRT 7/8" / 15"
1"	TE-YRT 1" / 17 1/2"
1 1/8"	TE-YRT 1 1/8" / 20"
1 3/8"	TE-YRT 1 3/8" / 25"

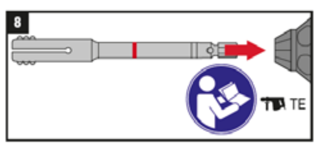


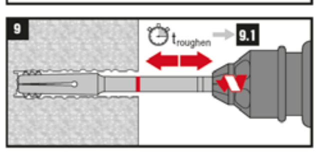
6

TE-YRT	RTG
TE-YRT 18/320	RTG 18
TE-YRT 20/320	RTG 20
TE-YRT 22/400	RTG 22
TE-YRT 25/400	RTG 25
TE-YRT 28/480	RTG 28
TE-YRT 30/540	RTG 30
TE-YRT 32/500	RTG 32
TE-YRT 35/600	RTG 35
TE-YRT	RTG
TE-YRT 3/4" / 12 1/2"	RTG 3/4"
TE-YRT 7/8" / 15"	RTG 7/8"
TE-YRT 1" / 17 1/2"	RTG 1"
TE-YRT 1 1/8" / 20"	RTG 1 1/8"
TE-YRT 1 3/8" / 25"	RTG 1 3/8"



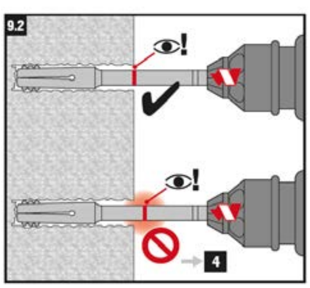


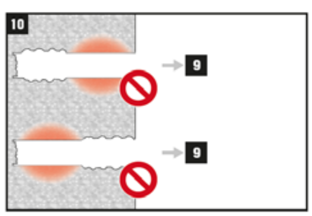




9.1

h_{ef} [mm]	$t_{roughen}$ (= h_{ef} / 10)
0 ... 100	10 sec
101 ... 200	20 sec
201 ... 300	30 sec
301 ... 400	40 sec
401 ... 500	50 sec
501 ... 600	60 sec
h_{ef} [inch]	$t_{roughen}$ (= h_{ef} · 2.5)
0 ... 4	10 sec
4.01 ... 8	20 sec
8.01 ... 12	30 sec
12.01 ... 16	40 sec
16.01 ... 20	50 sec
20.01 ... 25	60 sec





12

Ø d0 [mm]	TE-YRT
17,9 ... 18,2	TE-YRT 18/320
19,9 ... 20,2	TE-YRT 20/320
21,9 ... 22,2	TE-YRT 22/400
24,9 ... 25,2	TE-YRT 25/400
27,9 ... 28,2	TE-YRT 28/480
29,9 ... 30,2	TE-YRT 30/540
31,9 ... 32,2	TE-YRT 32/500
34,9 ... 35,2	TE-YRT 35/600
Ø d0 [inch]	TE-YRT
0.764 ... 0.776	TE-YRT 3/4" / 12 1/2"
0.862 ... 0.874	TE-YRT 7/8" / 15"
1.008 ... 1.020	TE-YRT 1" / 17 1/2"
1.146 ... 1.157	[illegible]
1.374 ... 1.386	[illegible]

FIGURE 9—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Conti

ICC EVALUATION SERVICE

ICC-ES Evaluation Report

ESR-3187 LABC and LARC Supplement

Reissued March 2020
Revised April 2020
This report is subject to renewal March 2022.

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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 HIT-HY 200 ADHESIVE ANCHORS AND POST INSTALLED REINFORCING BAR CONNECTIONS IN CONCRETE

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Hilti HIT HY 200 Adhesive Anchoring System and Post-Installed Reinforcing Bar System for cracked and uncracked concrete, described in ICC-ES evaluation report ESR-3187, has 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 HIT-HY 200 Adhesive Anchoring System and Post-Installed Reinforcing Bar System for cracked and uncracked concrete, described in Sections 2.0 through 7.0 of the evaluation report ESR-3187, complies with LABC Chapter 19, and LARC, and is subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Hilti HIT HY 200 Adhesive Anchoring System and Post-Installed Reinforcing Bar System described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-3187.
- The design, installation, conditions of use and labeling of the Hilti HIT-HY 200 Adhesive Anchoring System and Post-Installed Reinforcing Bar System are in accordance with the 2018 *International Building Code*® (2018 IBC) provisions noted in the evaluation report ESR-3187.
- 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 allowable and strength design values listed in the evaluation report and tables are for the connection of the adhesive anchors and post-installed reinforcing bars to the concrete. The connection between the adhesive anchors or post-installed reinforcing bars 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 March 2020 and revised April 2020.

ICC-ES Evaluation Report

ESR-3187 FBC Supplement

Reissued March 2020

Revised April 2020

This report is subject to renewal March 2022.

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DIVISION: 03 00 00—CONCRETE
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HILTI, INC.

EVALUATION SUBJECT:

HILTI HIT-HY 200 ADHESIVE ANCHORS AND POST INSTALLED REINFORCING BAR CONNECTIONS IN CONCRETE

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Hilti HIT-HY 200 Adhesive Anchors and Post-Installed Reinforcing Bar System in Concrete, recognized in ICC-ES evaluation evaluation report ESR-3187, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2017 *Florida Building Code—Building*
- 2017 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Hilti HIT-HY 200 Adhesive Anchor System and Post-Installed Reinforcing Bar System**,** described in Sections 2.0 through 7.0 of the evaluation report ESR-3187, comply with the 2017 *Florida Building Code—Building* and the 2017 *Florida Building Code—Residential*, provided the design and installation are in accordance with the *International Building Code*® provisions noted in the evaluation report, and under the following conditions:

Use of the Hilti HIT-HY 200 Adhesive Anchor System and Post-Installed Reinforcing Bar System with stainless steel threaded rod materials and reinforcing bars, stainless steel Hilti HIT-Z-R anchor rods, and stainless steel Hilti HIS-RN inserts has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the 2017 *Florida Building Code—Building* and the 2017 *Florida Building Code—Residential*, when the following condition is met:

The design wind loads for use of the anchors in a High-Velocity Hurricane Zone are based on Section 1620 of the *Florida Building Code—Building*.

Use of the Hilti HIT-HY 200 Adhesive Anchor System and Post-Installed Reinforcing Bar System with carbon steel threaded rod materials and reinforcing bars, carbon steel Hilti HIT-Z anchor rods and carbon steel Hilti HIS-N inserts for compliance with the High-velocity Hurricane Zone provisions of the 2017 *Florida Building Code—Building* and the 2017 *Florida Building Code—Residential* has not been evaluated and is outside the scope of this supplemental report.

For products falling under Florida Rule 9N-3, 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 March 2020 and revised April 2020.

附件二 HILTI HIT-HY 200-R
原廠型錄與技術資料

HIT-HY 200化學錨栓系統技術資料

HIT-HY 200 + HIT-Z螺桿，混凝土強度3000psi

錨栓尺寸		M8	M10	M12	M16	M20
有效埋深	[mm]	70	90	110	145	180
基材厚度	[mm]	130	150	170	245	280

特徵抗力值

錨栓尺寸		M8	M10	M12	M16	M20
未開裂混凝土						
拉力	N_{RK} [kN]	24.0	38.0	54.3	88.2	122.0
剪力	V_{RK} [kN]	12.0	19.0	27.0	48.0	73.0
開裂混凝土						
拉力	N_{RK} [kN]	21.1	30.7	41.5	62.9	86.9
剪力	V_{RK} [kN]	12.0	19.0	27.0	48.0	73.0

設計抗力值

錨栓尺寸		M8	M10	M12	M16	M20
未開裂混凝土						
拉力	N_{Rd} [kN]	16.0	25.3	36.2	58.8	81.3
剪力	V_{Rd} [kN]	9.6	15.2	21.6	38.4	58.4
開裂混凝土						
拉力	N_{Rd} [kN]	14.1	20.5	27.7	41.9	58.0
剪力	V_{Rd} [kN]	9.6	15.2	21.6	38.4	58.4

HIT-HY 200 + HAS 5.8級螺桿，混凝土強度3000psi

錨栓尺寸		M8	M10	M12	M16	M20	M24	M27	M30
有效埋深	h_{ef} [mm]	80	90	110	125	170	210	240	270
基材厚度	h [mm]	110	120	140	165	220	270	300	340

特徵抗力值

錨栓尺寸		M8	M10	M12	M16	M20	M24	M27	M30
未開裂混凝土									
拉力	N_{RK} [kN]	18.0	29.0	42.0	70.6	111.9	153.7	187.8	224.0
剪力	V_{RK} [kN]	9.0	15.0	21.0	39.0	61.0	88.0	115.0	140.0
開裂混凝土									
拉力	N_{RK} [kN]	12.1	17.0	33.2	50.3	79.8	109.6	133.9	159.7
剪力	V_{RK} [kN]	9.0	15.0	21.0	39.0	61.0	88.0	115.0	140.0

設計抗力值

錨栓尺寸		M8	M10	M12	M16	M20	M24	M27	M30
未開裂混凝土									
拉力	N_{Rd} [kN]	12.0	19.3	28.0	39.2	62.2	85.4	104.3	124.5
剪力	V_{Rd} [kN]	7.2	12.0	16.8	31.2	48.8	70.4	92.0	112.0
開裂混凝土									
拉力	N_{Rd} [kN]	6.7	9.4	18.4	27.9	44.3	60.9	74.4	88.7
剪力	V_{Rd} [kN]	7.2	12.0	16.8	31.2	48.8	70.4	92.0	112.0

HIT-HY 200植筋技術資料　達到各尺寸鋼筋降伏所需埋深

鋼筋尺寸		#3	#4	#5	#6
降伏強度	(kgf)	1988	3556	5572	
鋼筋強度	f'c (kg/cm^2)	D10	D13	D16	D19
SD280(W)	≧210	120	160	200	
降伏強度	(kgf)	2982	5334	8358	12054
鋼筋強度	f'c (kg/cm^2)	D10	D13	D16	D19
SD420(W)	≧210	180	240	305	360

喜利得
HIT-HY 200
化學錨栓系統

HIT HY 200-R 化學藥劑

品名	包裝數量	品號
HIT-HY 200-R 330ml （含一支HIT-HY 200、混和嘴、延長管）	1	2045036


HIT-HY 200-R

注射器

品名	包裝數量	品號
HDM 330 in cardboard box	1	2005640


HDM 330

套筒

品名	包裝數量	品號
HIT-CR 330	1	2007058


HIT-CR 330

HIT-Z螺桿

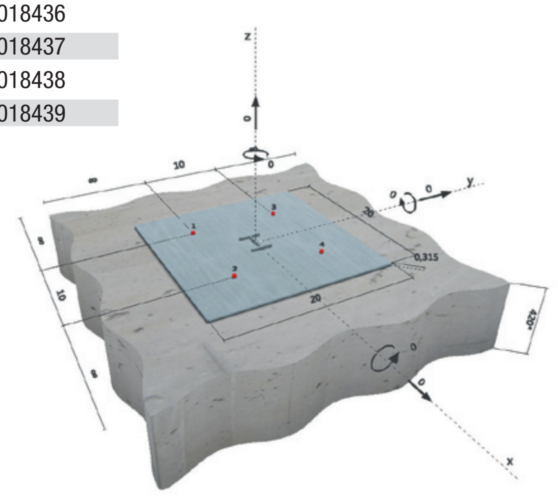

HIT-Z

品名	包裝數量	品號	品名	包裝數量	品號
HIT-Z M8x80	40	2018364	HIT-Z-R M8x80	40	2018422
HIT-Z M8x100	40	2018365	HIT-Z-R M8x100	40	2018423
HIT-Z M8x120	40	2018366	HIT-Z-R M8x120	40	2018424
HIT-Z M10x95	40	2018367	HIT-Z-R M10x95	40	2018425
HIT-Z M10x115	40	2018368	HIT-Z-R M10x115	40	2018426
HIT-Z M10x135	40	2018369	HIT-Z-R M10x135	40	2018427
HIT-Z M10x160	40	2018410	HIT-Z-R M10x160	40	2018428
HIT-Z M12x105	20	2018411	HIT-Z-R M12x105	20	2018429
HIT-Z M12x140	20	2018412	HIT-Z-R M12x140	20	2018430
HIT-Z M12x155	20	2018413	HIT-Z-R M12x155	20	2018431
HIT-Z M12x196	20	2018415	HIT-Z-R M12x196	20	2018433
HIT-Z M16x155	12	2018416	HIT-Z-R M16x155	12	2018434
HIT-Z M16x175	12	2018417	HIT-Z-R M16x175	12	2018435
HIT-Z M16x205	12	2018418	HIT-Z-R M16x205	12	2018436
HIT-Z M16x240	12	2018419	HIT-Z-R M16x240	12	2018437
HIT-Z M20x215	6	2018420	HIT-Z-R M20x215	6	2018438
HIT-Z M20x250	6	2018421	HIT-Z-R M20x250	6	2018439

喜利得PROFIS軟體

完美設計，一步到位

PROFIS software



喜利得PROFIS錨栓設計軟體免費提供。

歡迎洽詢喜利得工程部：0800-221036

喜利得股份有限公司

免費服務專線：0800-221036

總公司：台北市中正區10060仁愛路二段2號4樓　傳真：02-2397-3730　網址：www.hilti.com.tw

喜利得
HIT-HY 200
化學錨栓系統

HILTI

喜利得
HIT-HY 200
化學錨栓系統

產品應用

可廣泛運用於非開裂或是開裂混凝土基材上的固定，應用範圍如：

- 建築石材、金屬帷幕、鋼構、扶手與護欄
- 交通號誌，如紅綠燈、路燈、指示牌、警告標誌、軌道圍籬
- 重型機具設備、軌道、管架、輕鋼架固定
- 需要快乾效能的植筋應用

創新的喜利得SAFEset™ 科技

- 喜利得SAFEset™ 科技的應用，使得HIT-HY 200搭配HIT-Z螺桿或是HIT-HY 200搭配HDB空心鑽頭（即將上市），可省去安裝過程中清孔的步驟；除了可以節省工時，也能夠確保安裝的可靠性，使業主或設計單位對於施工品質與未來的安全性放心。

產品優勢

- 喜利得HIT-HY 200是最新一代，產品性能優越的化學錨栓藥劑。
- 具備極佳的黏著強度
- 搭配螺桿可應用於開裂與非開裂混凝土，性能具最新的國際認證。
- 在應用於高溫環境下，性能比其他化學錨栓藥劑更為優異。

這是對於工程技術發展的一小步，也是對您設計的一大步

不正確的清孔會大大降低傳統化學錨栓的性能。喜利得新一代不需清孔化學錨栓系統，解除了這一個風險。現在，您可以更有信心也更安心地將化學錨栓加入設計方案中。

SAFEset 系統產品

歐盟技術認證報告

歐盟認證產品標章

美國混凝土協會(AC308)認證報告

可使用於開裂混凝土

可用於地震帶

防火認證報告

美國綠建築協會認證

美國全國衛生基金會認證

可使用喜利得錨栓設計軟體

喜利得 SAFEset 科技介紹

不需清孔

搭配HIT-Z螺桿

最新的喜利得HIT-Z螺桿透過特殊圓錐螺紋設計，在埋入部分產生類似金屬錨栓的膨脹效果，搭配HIT-HY 200化學藥劑，除了可安裝在一般非開裂混凝土基材外，更可以應用在開裂混凝土與張力區基材，即使在未經清孔處理的乾孔、濕孔或是鑽石洗孔條件下，皆可以保持優異性能。除了可減少安裝程序節約工時外，更是可以讓設計者與業主放心，可靠的新一代化學錨栓系統。

HIT-HY 200-R 硬化時間表

基材溫度(℃)	工作時間	硬化時間
-5℃	3小時	20小時
0℃	2小時	7小時
5℃	1小時	3小時
10℃	40分鐘	2小時
20℃	15分鐘	1小時
30℃	9分鐘	1小時
40℃	6分鐘	1小時

本公司保留技術變更之權利

即將上市

自動清孔

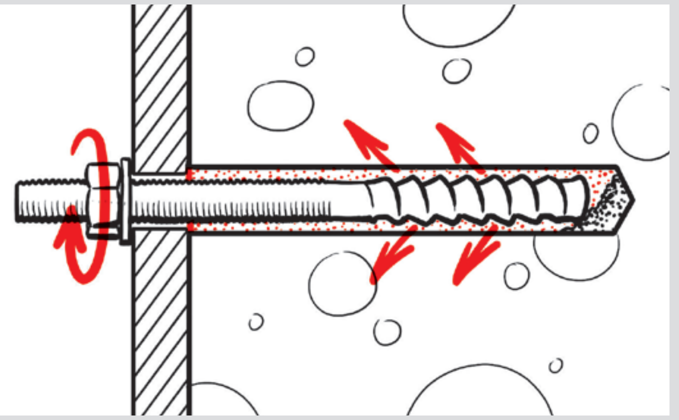
喜利得空心鑽頭

喜利得TE-CD與TE-YD空心鑽頭，結合HIT-HY 200，可完全省略安裝過程中的清孔步驟。

鑽孔過程中的粉塵碎屑將通過空心鑽頭被吸入喜利得乾濕兩用吸塵系統，不需清孔使工程更可靠，同時也能避免粉塵對空氣的汙染及人體的危害。

不需清孔，最可靠的 SAFEset 化學錨栓系統!

最新的喜利得HIT-Z螺桿透過特殊圓錐螺紋設計，在埋入部分產生類似金屬錨栓的膨脹效果，因此在安裝過程中無須清孔；此外，無論安裝在乾燥或濕潤孔洞內，可以維持優異效能。如此高可靠度與強度的化學錨栓系統，可以讓設計單位無後顧之憂地將此化學錨栓系統導入工程專案的各種應用之中。



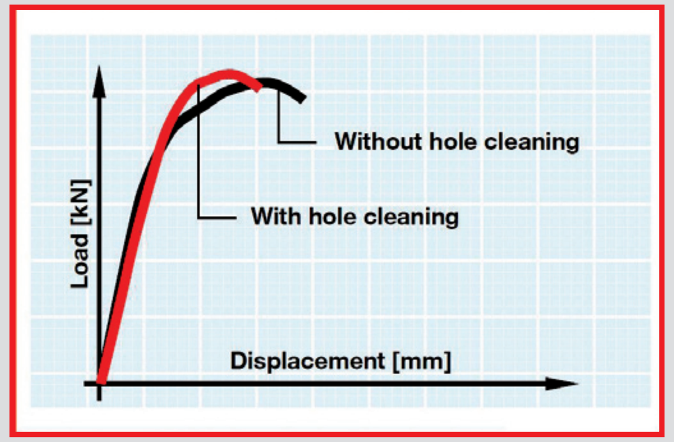
螺桿直徑	M8 to M20
材質	鍍鋅鋼材（鍍鋅厚度至少5μm），316不銹鋼
彈性的埋深	60mm到220mm
混凝土強度	C20/25 (3000psi) 以上

本公司保留技術變更之權利

SAFEset

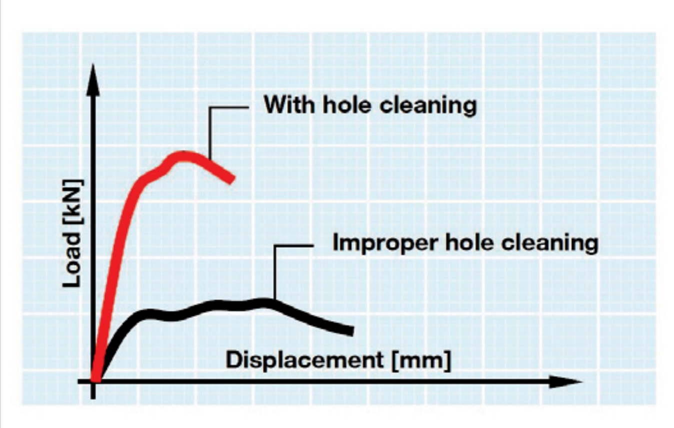
HIT-Z螺桿的膨脹性能，同樣能夠應用在開裂混凝土、張力區或是鑽石洗孔，並保持優異性能。HIT-Z螺桿搭配HIT-HY 200是第一種具膨脹效能，不需清孔的化學錨栓系統，可全面使用在傳統一般螺桿的化錨應用。

HIT-Z螺桿搭配 HIT-HY 200注射型混和黏著劑



SAFEset™ 系統中HIT-Z螺桿所產生的膨脹效能搭配HIT-HY 200的優異黏著效果，使得此化學錨栓系統無論在清孔或不清孔，乾孔或濕空的開裂／非開裂混凝土中皆維持高強度的表現。

一般螺桿搭配化學藥劑



傳統螺桿搭配一般化學藥劑，在未清孔狀態下，性能表現大打折扣，遠低於清孔條件下的效能。

4.3 HIT-HY 200-R 兩劑混合注射式化學錨栓系統

a. 產品說明

Hilti HIT-HY 200-R 為兩劑混合注射式黏著劑。兩劑鋁箔包裝的環氧樹脂經由混合嘴混合並產生化學作用。

Hilti HIT-HY 200-R 黏著劑可應用於三種清孔方法：

- 傳統清孔：使用鋼絲刷及壓縮空機清孔
- 空心鑽頭清孔：使用 Hilti TE-CD 或 TE-YD 中空鑽頭搭配 Hilti 真空吸塵器清除鑽孔產生的粉塵，可立即安裝錨栓。
- 無需清孔：使用電鎚鑽搭配 Hilti HIT-Z 及 HIT-Z-R 螺桿，則無需清孔。HIT-Z 使用環境之基材溫度需大於攝氏五度以上。如採用鑽石鑽孔，則需搭配水洗並以高壓氣槍吹乾孔內。

適合此系統使用的元件包括螺桿、Hilti HIS-（R）N 內牙套筒螺桿、鋼筋及 Hilti HIT-Z 和 HIT-Z-R 螺桿。

產品特性

- 若使用 SafeSet™ 中空鑽頭技術，則無需清孔
- 使用電鎚鑽在乾燥與水飽和混凝土情況下搭配 HIT-Z 螺桿，則無需清孔
- 通過嚴格的 ICC-ES 開裂混凝土與耐震應用認證
- 採用鑽石鑽孔，只需搭配水洗並以高壓氣槍吹乾孔內，無需使用毛刷清孔，即可使用 HIT-Z 螺桿

注射式黏著劑為搭配鋼筋或螺桿安裝至混凝土中。黏著劑為 A 劑和 B 劑，並保持並排分離。藥劑包並排的設計可減少注射時藥劑的浪費。混合嘴可確保充分混合 A 劑與 B 劑，且能直接注射於鑽孔的孔洞。僅限使用製造商提供的注射工具與混合嘴。

HIT-HY 200-R

列名/認證

ICC-ES（國際規範委員會）
ESR-3187
NSF/ANSI Std 61
飲用水應用認證
歐洲技術認證
ETA-11/0492、
ETA-05/0493、ETA-05/0006、
ETA-05/0028
ETA-12/0083、ETA-12/0084
洛杉磯市
研究報告號碼 25964

獨立規範評估

IBC®/IRC® 2015
(ICC-ES AC308/ACI 355.4）
IBC®/IRC® 2012
(ICC-ES AC308/ACI 355.4)
IBC®/IRC® 2009
(ICC-ES AC308)
IBC®/IRC® 2006
(ICC-ES AC308)
2013 年 Abu Dhabi International Building Code（ADIBC）

LEED® Credit 4.1-低排放材料
能源與環境設計先鋒 (LEED®) 綠建築評比系統 TM 是全國性高效能綠建築的設計、建設與運作基準。

b. 材料規格

如需有關 HIT-HY 200-R 的材料規格資訊，請洽詢喜利得工程師。

c. 技術資料

以下文件為 2018 台灣喜利得安卡固定技術手冊的增補文件。此文件將在特定章節提及前述文件。

請參閱該等文件的全部內容，以通盤瞭解產品細節，包括測試數據、產品規格、一般適用性、安裝、腐蝕、間距與邊距指引。

如需直接聯絡團隊成員瞭解本公司的安卡固定產品，請透過電子信箱地址 www.hilti.com.tw 聯絡喜利得技術支援專家團隊。

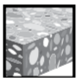
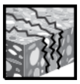
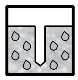
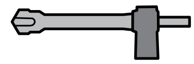
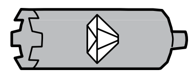
ACI 318-14 第 17 章設計

此節的負載資料取自喜利得簡易設計表，負載表係使用強度設計參數、ESR-3187 的變數和 ACI 318-14 第 17 章的方程式作為訂定依據。ESR-3187 的資料表未納入此節，但可上 www.icc-es.org 或 www.hilti.com.tw 查詢。

4.3 HIT-HY 200-R 兩劑混合注射式化學錨栓系統

HIT-HY 200-R 黏著劑與 HIT-Z 和 HIT-Z-R 螺桿

圖 1 - HIT-Z 與 HIT-Z-R 安裝條件

允許的混凝土條件					允許的鑽孔方法		
		非開裂混凝土		乾式混凝土			電鎚鑽頭與鎢鋼鑽頭 1
		開裂混凝土		水飽和混凝土			Hilti TE-CD 或 TE-YD 中空鑽頭 2
							鑽石鑽頭 3

1 錨栓可安裝在鎢鋼鑽頭鑽鑿的鑽孔內，無需從鑽孔清除粉塵。基材溫度須在 5°C 以上。

2 其他清孔方式請參閱 MPII。

表 1 - HIT-Z 與 HIT-Z-R 的規格 - 用 HIT-HY 200-R 黏著劑安裝

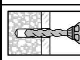
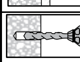
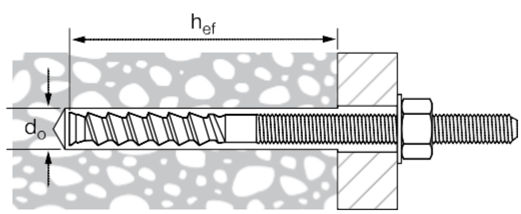
設定資訊		符號	單位	標稱螺桿直徑			
				10	12	16	20
標稱鑽頭直徑		d_0	mm	12	14	18	22
有效埋入深度	最小	$h_{ef,min}$	mm	60	70	96	100
	最大	$h_{ef,max}$	mm	120	144	192	220
固定物孔徑	穿透式		mm	14	16	20[1]	24[1]
	預置式		mm	12	14	18	22
安裝扭矩		T_{inst}	Nm	25	40	80	150

圖 2 - HIT-Z 與 HIT-Z-R 規格

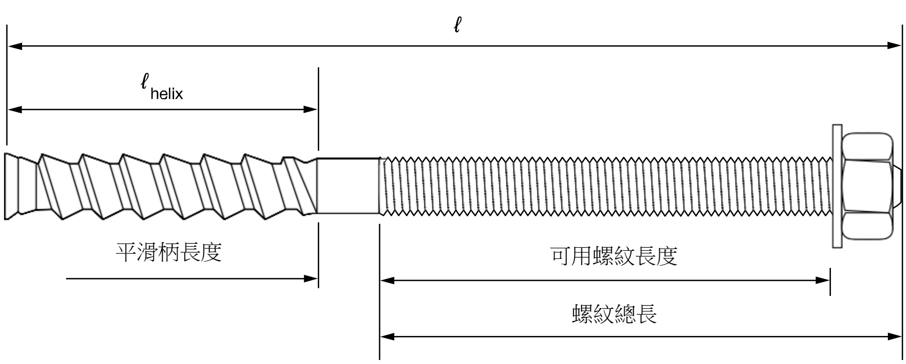


4.3 HIT-HY 200-R 兩劑混合注射式化學錨栓系統

表 2 - HIT-Z 及 HIT-Z-R 螺桿的長度與螺紋尺寸

尺寸	ℓ 螺桿長度 mm	ℓ_{helix} 螺旋長度 mm	平滑柄長度 mm	螺紋總長 mm	可用螺紋長度 mm	HIT-Z 長度碼
HIT-Z(-R) M10x95	95	60	8	27	14	E
HIT-Z(-R) M10x115	115	60	8	47	34	G
HIT-Z(-R) M10x135	135	60	8	67	54	H
HIT-Z(-R) M10x160	160	60	8	92	79	J
HIT-Z(-R) M12x105	105	60	8	37	21	F
HIT-Z(-R) M12x140	140	60	8	72	56	I
HIT-Z(-R) M12x155	155	60	8	87	71	J
HIT-Z(-R) M12x196	196	60	8	128	112	M
HIT-Z(-R) M16x155	155	93	11	51	30	J
HIT-Z(-R) M16x175	175	93	11	71	50	K
HIT-Z(-R) M16x205	205	93	11	101	80	N
HIT-Z(-R) M16x240	240	93	32	115	94	P
HIT-Z(-R) M20x215	215	100	13	102	78	N
HIT-Z(-R) M20x250	250	100	48	102	78	Q

圖 3 - HIT-Z 及 HIT-Z-R 螺桿的長度與螺紋尺寸



4.3 HIT-HY 200-R 兩劑混合注射式化學錨栓系統

表 **3** 表 **4** 之數值需與表 **5** 的鋼材數值比較。設計強度以數值較小者為主。

表 **3 -** 在非開裂混凝土中搭配 **HIT-Z(-R)** 螺桿之 **HIT-HY 200-R** 設計強度與混凝土／握裏破壞 [1,2,3,4,5,6,7,8]

標稱錨栓直徑 mm	有效埋入深度 mm	抗拉 — ΦN_n				抗剪 — ΦV_n			
		f'_c= 20 MPa (204 kg/cm²) kN	f'_c = 30 MPa (306 kg/cm²) kN	f'_c = 40 MPa (408 kg/cm²) kN	f'_c = 50 MPa (510 kg/cm²) kN	f'_c = 20 MPa (204 kg/cm²) kN	f'_c = 30 MPa (306 kg/cm²) kN	f'_c = 40 MPa (408 kg/cm²) kN	f'_c = 50 MPa (510 kg/cm²) kN
10	60	13.6	16.5	19.1	21.4	14.7	17.8	20.6	23.0
	90	24.9	25.4	25.4	25.4	53.7	65.5	75.6	84.5
	120	25.4	25.4	25.4	25.4	82.7	100.8	116.4	130.1
12	70	17.1	20.9	24.1	26.9	36.8	44.9	51.9	58.0
	108	30.5	30.5	30.5	30.5	70.6	86.1	99.4	111.1
	144	30.5	30.5	30.5	30.5	108.7	132.5	153.0	171.1
16	96	27.5	33.5	38.7	43.2	59.1	72.1	83.3	93.1
	144	50.5	61.5	63.7	63.7	108.7	132.5	153.0	171.1
	192	63.7	63.7	63.7	63.7	167.3	204.0	235.6	263.4
20	100	29.2	35.6	41.1	46.0	62.9	76.7	88.5	99.0
	180	70.5	84.7	84.7	84.7	151.9	185.2	213.8	239.1
	220	84.7	84.7	84.7	84.7	205.2	250.2	288.9	323.0

表 **4 -** 在開裂混凝土中搭配 **HIT-Z(-R)** 螺桿之 **HIT-HY 200-R** 設計強度與混凝土／握裏破壞 [1,2,3,4,5,6,7,8]

標稱錨栓直徑 mm	有效埋入深度 mm	抗拉 — ΦN_n				抗剪 — ΦV_n			
		f'_c= 20 MPa (204 kg/cm²) kN	f'_c = 30 MPa (306 kg/cm²) kN	f'_c = 40 MPa (408 kg/cm²) kN	f'_c = 50 MPa (510 kg/cm²) kN	f'_c = 20 MPa (204 kg/cm²) kN	f'_c = 30 MPa (306 kg/cm²) kN	f'_c = 40 MPa (408 kg/cm²) kN	f'_c = 50 MPa (510 kg/cm²) kN
10	60	9.6	11.7	13.6	15.2	10.4	12.7	14.6	16.3
	90	17.7	21.6	24.9	25.4	38.0	46.5	53.7	60.0
	120	25.4	25.4	25.4	25.4	58.6	71.6	82.6	92.4
12	70	12.1	14.8	17.1	19.1	26.1	31.9	36.8	41.2
	108	23.2	28.4	28.5	28.5	50.0	61.1	70.6	78.9
	144	28.5	28.5	28.5	28.5	77.0	94.1	108.6	121.5
16	96	19.5	23.8	27.5	30.7	41.9	51.2	59.1	66.1
	144	35.7	43.7	50.4	56.4	77.0	94.1	108.6	121.5
	192	55.0	63.7	63.7	63.7	118.5	144.8	167.3	187.0
20	100	20.7	25.3	29.2	32.6	44.5	54.4	62.9	70.3
	180	49.9	61.0	70.5	78.8	107.6	131.5	151.8	169.7
	220	67.5	82.5	83.1	83.1	145.3	177.7	205.1	229.4

表 **5 - Hilti HIT-Z** 與 **HIT-Z-R** 螺桿的鋼材設計強度

標稱錨栓直徑 mm	HIT-Z 碳鋼螺桿		HIT-Z-R 不鏽鋼螺桿	
	抗拉 ϕN kN	抗剪 ϕV kN	抗拉 ϕN kN	抗剪 ϕV kN
10	24.5	10.0	24.5	13.6
12	35.6	14.5	35.6	19.7
16	62.3	25.3	62.3	34.5
20	94.8	38.5	94.8	52.5

1. 不允許在埋入深度與混凝土的抗壓強度之間進行線性計算。若有不同設計條件，請使用喜利得錨栓設計軟體 PROFIS Anchor。
2. 表中數值為單根錨栓數值，且未折減邊距、錨栓間距或混凝土厚度。表 3 表 4 需與表 5 的鋼材數值比較。以數值較小者為準。如遇較複雜的錨栓設計，請使用喜利得錨栓設計軟體 PROFIS Anchor。
3. 資料適用於溫度範圍 A：最大短期溫度 = 55°C，最大長期溫度 = 43°C。
4. 表中數值適用於乾或水飽和混凝土條件。如需用於其他條件，請洽詢喜利得工程師。
5. 表中的數值僅適用於標準配比的混凝土。如需用於輕型混凝土，請洽詢喜利得工程師。
6. 表中數值適用於使用鎢鋼電鎚鑽頭鑽鑿的混凝土鑽孔。有關開裂混凝土條件下的礦石鑽孔，請洽詢喜利得工程師。
7. 如需耐震負載資訊，請洽詢喜利得工程師。
8. 允許礦石鑽孔搭配 Hilti HIT-Z(R) 螺桿，此應用不影響上述資料。

4.3 HIT-HY 200-R 兩劑混合注射式化學錨栓系統

Hilti HIT-HY 200-R 黏著劑搭配

Hilti HAS-T & HAS-T-R2 螺桿

圖 4 - HAS-T & HAS-T-R2 螺桿安裝條件

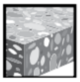
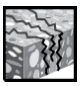
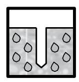
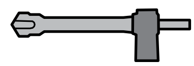
允許的混凝土條件		非開裂混凝土		乾式混凝土	允許的鑽孔方法		電鎚鑽頭與鎢鋼鑽頭
		開裂混凝土		水飽和混凝土			Hilti TE-CD 或 TE-YD 空心鑽頭

圖 5 - HAS-T & HAS-T-R2 螺桿規格

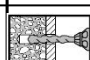
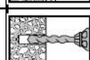
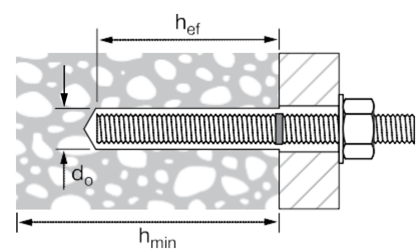
設定資訊		符號	單位	標稱螺桿直徑，d				
				10	12	16	20	24
標稱鑽頭直徑		d_o	mm	12	14	18	22	28
有效埋入深度		h_{ef}	mm	90	110	125	170	210
固定物孔徑	穿透式		mm	14	16	20[1]	24[1]	30[1]
	預置式		mm	12	14	18	22	26
安裝扭矩		T_{inst}	Nm	20	40	80	150	200
最小混凝土厚度		h_{min}	mm	120	h_{ef} +2d_o			
最小邊距 [2]		c_{min}	mm	50	60	80	100	120
最小錨栓間距		s_{min}	mm	50	60	80	100	120

圖 6 -
HAS-T & HAS-T-R2 螺桿規格



4.3 HIT-HY 200-R 兩劑混合注射式化學錨栓系統

表 **7** 表 **8** 之數值需與表 **9** 的鋼材數值比較。設計強度以數值較小者為主。

表 **7 –** 在非開裂混凝土中搭配螺桿之喜利得 **HIT-HY 200-R** 黏著劑設計強度與混凝土／握裹破壞 [1,2,3,4,5,6,7]

標稱錨栓直徑 mm	有效埋入深度 mm	抗拉 — ϕN_n				抗剪 — ϕV_n			
		f'_c= 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN	f'_c = 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN
10	90	24.8	29.7	30.6	31.3	53.5	64.0	65.9	67.4
12	110	33.5	41.1	44.9	45.9	72.2	88.5	96.6	98.8
16	125	40.6	49.8	57.5	64.2	87.5	107.2	123.7	138.3
20	170	64.4	78.9	91.1	101.9	138.8	170.0	196.3	219.4
24	210	88.5	108.3	125.1	139.9	190.5	233.4	269.5	301.3

表 **8 –** 在開裂混凝土中搭配螺桿之喜利得 **HIT-HY 200-R** 黏著劑設計強度與混凝土／握裹破壞 [1,2,3,4,5,6,7]

標稱錨栓直徑 mm	有效埋入深度 mm	抗拉 — ϕN_n				抗剪 — ϕV_n			
		f'_c= 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN	f'_c = 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN
10	90	13.6	14.2	14.6	14.9	29.3	30.5	31.4	32.2
12	110	20.8	21.7	22.3	22.8	44.8	46.6	48.0	49.1
16	125	28.8	35.3	36.4	37.3	62.1	76.1	78.5	80.3
20	170	45.7	56.0	63.5	64.9	98.5	120.7	136.7	139.8
24	210	62.8	76.9	88.8	98.5	135.3	165.7	191.3	212.1

表 **9 - Hilti HAS-T& HAS-T-R2** 螺桿的鋼材設計強度

標稱錨栓直徑 mm	HAS-T 碳鋼螺桿 (5.8 級)		HAS-T-R2 不銹鋼螺桿	
	抗拉 ϕN kN	抗剪 ϕV kN	抗拉 ϕN kN	抗剪 ϕV kN
10	18.9	8.7	22.4	12.2
12	27.3	15.3	41.0	22.7
16	51.0	28.2	65.3	36.2
20	79.6	44.1	82.2	45.5
24	114.7	63.6	113.5	62.8

1. 不允許在埋入深度與混凝土的抗壓強度之間進行線性計算。若有不同設計條件，請使用喜利得錨栓設計軟體 PROFIS Anchor。
2. 表中數值為單根錨栓數值，且未折減邊距、錨栓間距或混凝土厚度。表 7 表 8 需與表 9 的鋼材數值比較。以數值較小者為準。如遇較複雜的錨栓設計，請使用喜利得錨栓設計軟體 PROFIS Anchor。
3. 資料適用於溫度範圍 A：最大短期溫度 = 55°C，最大長期溫度 = 43°C。
4. 表中數值適用於乾或水飽和混凝土條件。如需用於其他條件，請洽詢喜利得工程師。
5. 表中的數值僅適用於標準配比的混凝土。如需用於輕型混凝土，請洽詢喜利得工程師。
6. 表中數值適用於使用鎢鋼電鎚鑽頭鑽鑿的混凝土鑽孔。有關開裂混凝土條件下的礦石鑽孔，請洽詢喜利得工程師。
7.如需耐震負載資訊，請洽詢喜利得工程師。

HIT-HY 200-R 搭配 HIS-N 螺桿

圖 7 - HIS-N 與 HIS-RN 內牙螺桿的安裝條件

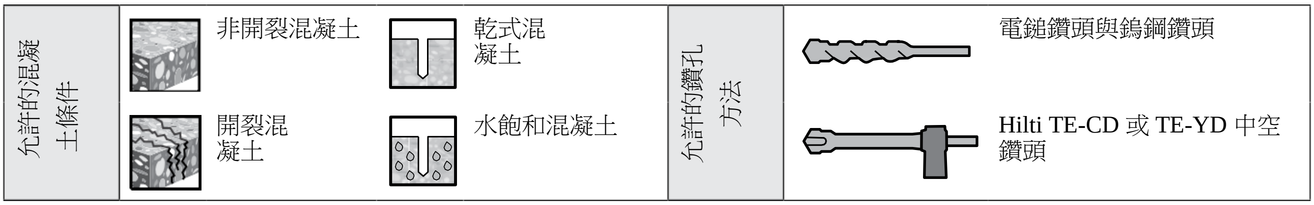
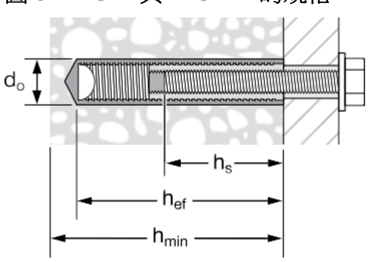


表 10 - HIS-N 與 HIS-RN 螺桿

設定資訊		符號	單位	標稱螺栓／螺帽直徑				
				8	10	12	16	20
螺桿直徑			mm	12.5	16.5	20.5	25.4	27.6
標稱鑽頭直徑		d_0	mm	14	18	22	28	32
有效埋入深度		h_{ef}	mm	90	110	125	170	205
螺紋囓合	最小	h_s	mm	8	10	12	16	20
	最大		mm	20	25	30	40	50
安裝扭矩		T_{inst}	Nm	10	20	40	80	150
混凝土構件最小厚度		h_{min}	mm	120	150	170	230	270
最小邊距		c_{min}	mm	63	83	102	127	140
最小錨栓間距		s_{min}	mm	63	83	102	127	140

圖 8 - HIS-N 與 HIS-RN 的規格



4.3 HIT-HY 200-R 兩劑混合注射式化學錨栓系統

表 11 表 12 之數值需與**表 13** 的鋼材數值比較。設計強度以數值較小者為主。

表 11 – 在非開裂混凝土中搭配 **HIS-N** 與 **HIS-RN** 內牙螺桿之喜利得 **HIT-HY 200-R** 黏著劑設計強度與混凝土／握裹破壞 [1,2,3,4,5,6,7,8]

內螺紋直徑 mm	有效埋入深度 mm	抗拉 - ϕN_n or N_r				抗剪 - ϕV_n or V_r			
		f'_c= 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN	f'_c= 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN
8	90	24.8	30.4	33.7	34.5	53.5	65.5	72.7	74.3
10	110	33.5	41.1	47.4	53.0	72.2	88.5	102.2	114.2
12	125	40.6	49.8	57.5	64.2	87.5	107.2	123.7	138.3
16	170	64.4	78.9	91.1	101.9	138.8	170.0	196.3	219.4
20	205	85.3	104.5	120.7	134.9	183.8	225.1	259.9	290.6

表 12 - 開裂混凝土喜利得 **HIS-N** 與 **HIS-RN** 內牙螺桿之喜利得 **HIT-HY 200-R** 黏著劑設計強度與混凝土／握裹破壞 [1,2,3,4,5,6,7,8]

內螺紋直徑 mm	有效埋入深度 mm	抗拉 - ϕN_n or N_r				抗剪 - ϕV_n or V_r			
		f'_c= 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN	f'_c= 20 MPa (204 kg/cm^2) kN	f'_c = 30 MPa (306 kg/cm^2) kN	f'_c = 40 MPa (408 kg/cm^2) kN	f'_c = 50 MPa (510 kg/cm^2) kN
8	90	13.8	14.3	14.7	15.1	29.6	30.9	31.8	32.5
10	110	22.6	23.5	24.2	24.7	48.6	50.6	52.1	53.3
12	125	28.8	33.7	34.7	35.5	62.1	72.7	74.8	76.5
16	170	45.7	56.0	60.4	61.8	98.5	120.7	130.2	133.1
20	205	60.6	74.2	79.2	81.0	130.5	159.8	170.6	174.4

表 13 - 喜利得 **HIS-N** 與 **HIS-RN** 內牙螺桿的鋼材設計強度

內螺紋直徑 mm	ISO 898-1 8.8 級		ISO 3056-1 A4-70 級不鏽鋼	
	抗拉 ϕN kN	抗剪 ϕV kN	抗拉 ϕN kN	抗剪 ϕV kN
8	19.2	10.5	16.6	9.3
10	30.2	16.8	26.3	14.7
12	43.9	24.3	38.4	21.3
16	81.6	45.3	71.5	39.6
20	125.5	70.5	111.5	61.8

1. 不允許在埋入深度與混凝土的抗壓強度之間進行線性計算。若有不同設計條件，請使用喜利得錨栓設計軟體 PROFIS Anchor。
2. 表中數值為單根錨栓數值，且未折減邊距、錨栓間距或混凝土厚度。表 11 表 12 需與表 13 的鋼材數值比較。以數值較小者為準。如遇較複雜的錨栓設計，請使用喜利得錨栓設計軟體 PROFIS Anchor。
3. 資料適用於溫度範圍 A：最大短期溫度 = 55°C，最大長期溫度 = 43°C。
4. 表中數值適用於乾混凝土及水飽和混凝土條件。
5. 表中的數值僅適用於標準配比的混凝土。如需用於輕型混凝土，請洽詢喜利得工程師。
6. 表中數值適用於使用鎢鋼電鎚鑽頭鑽鑿的混凝土鑽孔。
7. 如使用礦石鑽頭，請洽詢喜利得工程師。
8. 如需耐震負載資訊，請洽詢喜利得工程師。

d. 安裝說明

安裝使用說明書（IFU）已附於產品包裝內，您亦可至 www.us.hilti.com（美國）線上檢閱和下載。由於內容可能修訂，使用時請務必確認下載的是最新版 IFU。

正確的安裝對發揮完整效能至關重要。可依客戶要求提供訓練。如需瞭解 IFU 未提及的應用與條件，請聯絡 Hilti 技術服務部門。

圖 9 - HIT-HY 200-R 黏著劑固化時間與作用時間（近似值）

HIT-HY 200-R					
		HAS / HIS-N / Rebar		HIT-Z[1]	
[°C]	[°F]	t_{work}	t_{cure}	t_{work}	t_{cure}
-10 ~ -5	14 ~ 23	3 小時	20 小時	-	-
-4 ~ 0	24 ~ 32	2 小時	8 小時	-	-
1 ~ 5	33 ~ 41	1 小時	4 小時	-	-
6 ~ 10	42 ~ 50	40 分鐘	2.5 小時	40 分鐘	2.5 小時
11 ~ 20	51 ~ 68	15 分鐘	1.5 小時	15 分鐘	1.5 小時
21 ~30	69 ~ 86	9 分鐘	1 小時	9 分鐘	1 小時
31 ~ 40	87 ~ 104	6 分鐘	1 小時	6 分鐘	1 小時

1. 允許在 HIT-Z 螺桿的溫度降至 14° F（-10° C）的條件下安裝喜利得 HIT-HY 200-R，但須徹底清除鑽孔內的鑽塵。可用喜利得 TE-CD 或 TE-YD 中空鑽頭或使用標準螺桿的清潔程序達到清除鑽塵的目的。

表 14 - 喜利得 HIT-HY 200-R 固化後的化學耐受性

化學藥劑		反應
乙酸	10%	+
丙酮		▲
氨	5%	+
苯甲醇		–
鹽酸	10%	▲
氯化石灰	10%	+
檸檬酸	10%	+
混凝土增塑劑		+
防凍鹽（氯化鈣）		+
軟化水		+
柴油		+
鑽塵懸浮液 pH 13.2		+
乙醇	96%	
乙酸乙酯		–
甲酸	10%	+
膜板油		+
汽油		+
乙二醇		▲
過氧化氫	10%	▲
乳酸	10%	+
機油		+
甲基乙基酮		▲
硝酸	10%	▲
磷酸	10%	+
氫氧化鉀 pH 13.2		+
海水		+
下水道汙泥		+
碳酸鈉 10%	10%	+
次氯酸鈉 2%	2%	+
硫酸	10%	+
	30%	+
甲苯		▲
二甲苯		▲

解說： – 不耐受
+ 耐受
▲有限耐受

將 HIT-HY 200-R 黏著劑樣品浸沒於各種化合物長達一年，並在試驗期結束時分析樣品。無明顯損傷且握裹（固定）強度衰減率低於 25% 的樣品歸類為「耐受」。些微損傷（例如龜裂、屑片等等）或彎曲強度衰減率達到 25% 或以上的樣品 歸類為「有限耐受」（亦即暴露達 48 小時或以下，直到徹底清除化學藥劑）。嚴重受損或毀壞的樣品歸類為「不耐受」。

註：實際使用時，大部分黏著劑皆包覆在基材內，僅非常少的表面暴露於外。

附件三 材料廠商公司資料

經濟部商工登記公示資料查詢服務

公司基本資料

統一編號	22348814
公司狀況	核准設立
股權狀況	僑外資
公司名稱	喜利得股份有限公司
章程所訂外文公司名稱	Hilti Taiwan Company Ltd.
資本總額(元)	170,000,000
實收資本額(元)	110,000,000
每股金額(元)	100
已發行股份總數(股)	1,100,000
代表人姓名	Laurent Camille Gimenez
公司所在地	新北市板橋區新站路16號24樓 電子地圖
登記機關	新北市政府
核准設立日期	075年12月31日
最後核准變更日期	109年07月17日
複數表決權特別股	無
對於特定事項具否決權特別股	無
特別股股東被選為董事、監察人之禁止或限制或當選一定名額之權利	無
所營事業資料	F106010 五金批發業 F107170 工業助劑批發業 F107990 其他化學製品批發業 F113010 機械批發業 F113020 電器批發業 F113030 精密儀器批發業 F113060 度量衡器批發業 F120010 耐火材料批發業 F206010 五金零售業 F207170 工業助劑零售業 F207990 其他化學製品零售業 F213080 機械器具零售業 F213010 電器零售業 F213040 精密儀器零售業 F213050 度量衡器零售業 F220010 耐火材料零售業 F401010 國際貿易業 F401021 電信管制射頻器材輸入業 E903010 防蝕、防銹工程業 EZ99990 其他工程業 JA02010 電器及電子產品修理業 JE01010 租賃業 I301010 資訊軟體服務業 I301030 電子資訊供應服務業 ZZ99999 除許可業務外，得經營法令非禁止或限制之業務

喜利得股份有限公司 紀明智

喜利得股份有限公司
送審專用
FOR REVIEW

正本

郵掛
2

新北市政府　　函

機關地址：22001新北市板橋區中山路1段161號3樓
承辦人：林梅蓁（603）
電　話：(02)29603456轉5289
傳　真：(02)29568030
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105
臺北市松山區敦化北路168號15樓
受文者：喜利得股份有限公司代理人：馬靜如律師

發文日期：中華民國109年07月17日
發文字號：新北府經司字第1098050134號
速別：普通件
密等及解密條件：普通
附件：規費收據暨變更登記表1份

主旨：貴公司（統一編號：22348814）申請法人股東改派代表人為董事、補選Laurent Camille Gimenez為董事長、委任盧俊文為經理人、經理人解任變更登記，經核符合規定，准予登記。

說明：

一、依公司法辦理兼復貴公司109年07月15日補正（收文日）申請書。

二、處分相對人名稱：喜利得股份有限公司（代表人姓名：Laurent Camille Gimenez、身分證照號碼：13BC8****）、公司所在地：新北市板橋區新站路16號24樓。

三、檢附規費收據暨變更登記表1份，請查收。

四、依公司法第22條-1規定，除外商公司、公開發行股票公司及國營事業外，公司應檢視本次變更若有董事、監察人、經理人及持有已發行股份總數或資本總額超過百分之十之股東等申報資料如有變動，公司應於變動後15日內前往「公司負責人及主要股東資訊申報平臺」(網址：https://ctp.tdcc.com.tw)執行變動申報。未依規定完成申報或申報不實之公司，經限期通知改正仍未改正者，可處新臺幣5~500萬元罰鍰，最重將可廢止公司登記。申報方式及相關規定可前往申報平臺瀏覽或電洽412-1166。

五、如涉及稅籍登記部分，請於開始營業前檢送負責人身分證明文件、公司章程、許可業務之核准文件等影本洽營業所在地稽徵機關辦理；詳細文件請逕洽各地區國稅局。

六、對本行政處分如有不服，請依訴願法第14條及第58條規定，自行政處分書到達之次日起30日內，繕具訴願書，向本府遞送（以實際收受訴願書之日期為準，而非投郵日），並將副本抄送經濟部（地址：臺北市中正區福州街15號）。

※有關全民健康保險部分，請檢送相關表件自行向衛生福利部中央健康保險署各分區業務組，辦理有關投保單位變更事宜，相關規定請至該署全球資訊網(https://www.nhi.gov.tw)參閱。

※如需查詢公司登記公示資料可至本部「商工登記公示資料查詢服務」(網址為https://findbiz.nat.gov.tw)輸入統一編號或公司名稱即可查

喜利得股份有限公司
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喜利得股份有限公司　紀明智

統一編號：22348814

詢，公示資料查得之資料與本部公司登記資料一致，敬請多加利用。

正本：喜利得股份有限公司代理人：馬靜如律師
副本：喜利得股份有限公司　負責人：Laurent Camille Gimenez（無附件）

市長 侯友宜

本案依分層負責規定授權業務主管決行

裝

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喜利得股份有限公司
紀明智

喜利得股份有限公司
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Certificate

Site certificate of main certificate Reg. no. H12455

SQS certifies herewith that the organisation mentioned below has at its disposal a management system which complies with the requirements of the normative directive listed.

Hilti Taiwan Co., Ltd.
24F., No. 16, Xinzhan Rd.,
Banqiao Dist., New Taipei City 220,
10060 Taipei Taiwan

Scope of certification

Sales

Normative base

ISO 9001:2015 Quality Management System

喜利得股份有限公司 紀明智

喜利得股份有限公司
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Reg. no. S39941

Validity 01.07.2019–30.06.2022
Issue 01.07.2019

A. Grisard, President SQS

F. Müller, CEO SQS

Swiss Association for Quality and Management Systems (SQS)
Bernstrasse 103, 3052 Zollikofen, Switzerland

Swiss Made

Partner of IQNet

sqs.ch

4040_2/June 2019/Version 2.0

附件四 HILTI HY200-R 防腐蝕報告

喜利得股份有限公司
仁愛路二段二號四樓
台北市中正區 10060

電話 0800-221 036 I 傳真 02-2397 3730
www.hilti.com.tw

Date:	20.04.2017	Page	1 of 1	**Memo**
From:	Hilti Taiwan Co., Ltd 喜利得股份有限公司	喜利得股份有限公司	伯樂	**T 0800- 221 036** **F 02-2397 3683** **E**
Subject:	Corrosion resistance of rebar with HIT-HY 200R			

References: AC308 Table 3.8, ICC-ESR 3187

To whom it may concern:

The verification for corrosion resistance of rebar is now being covered by the AC308 ACCEPTANCE CRITERIA FOR POSTINSTALLED ADHESIVE ANCHORS IN CONCRETE ELEMENTS as per Table 3.8 (see below).

Referring to AC308 Table 3.8 and the procedures it defines in Test ref 9.4.7, we hereby confirm the corrosion resistance of rebar of Hilti HIT-HY200R adhesive anchoring system with the ICC-ESR No. 3187, as proof.

Table 3.8– Test program for evaluating deformed reinforcing bars for use in post-installed reinforcing bar connections

Testing				Bar size	Assessment			Bar embedment	Minimum sample size
Test no.	Test ref.	Purpose	Test parameters	US/M§,‖	α_{req}	Load & displ.	f_c*	ℓ_b	n_{min}
1d	9.4.3.1	Bond resistance§§	Tension, confined, single reinforcing bar†	$d_{b,max}$	–	10.25.2 10.25.3	high	$7d_b$	Five
1e††	9.4.3.1	Bond resistance§§	Tension, confined, single reinforcing bar†	#4/12	–	10.25.2 10.25.3	high	$7d_b$	Five
2	9.4.3.2	Bond/splitting behavior	Tension, confined, reinforcing bars in corner condition	#8/25	–	10.25.6	low	$35d_b$	Six‡
Reliability tests									
3	9.4.4.1	Sensitivity to hole cleaning, dry substrate#,**	Tension, confined, single reinforcing bar†	$d_{b,max}$	≥ 0.8	10.25.7	low	$7d_b$	Five
4	9.4.4.2	Sensitivity to hole cleaning, saturated concrete#,**	Tension, confined, single reinforcing bar†	$d_{b,max}$	≥ 0.8	10.25.7	low	$7d_b$	Five
5	9.4.4.3	Sensitivity to freezing/thawing conditions#	Tension, confined, single reinforcing bar†	#4/12	≥ 0.9	10.25.7	high	$7d_b$	Five
6	9.4.4.4	Sensitivity to sustained load at maximum long-term temperature#	Tension, confined, single reinforcing bar†	#4/12	≥ 0.9	10.25.7	low	$7d_b$	Five
7	9.4.4.5	Decreased installation temperature#	Tension, confined, single reinforcing bar†	#4/12	≥ 0.9	10.25.7	low	$7d_b$	Five
8	9.4.4.6	Sensitivity to installation direction#	Tension, confined, single reinforcing bar†	$d_{b,max}$	≥ 0.9	10.25.7	low	$7d_b$	Five
Installation procedure verification									
9	9.4.5.1	Installation at deep embedment	Bar installation in injected hole, horizontal	$d_{b,max}$	–	10.25.8	–	$60d_b$	Three
10	9.4.5.2	Injection verification	Injection in clear tube	$d_{b,max}$	–	10.25.8	–	$60d_b$	Three
Durabiltiy									
11a	9.4.6.1.1	Resistance to alkalinity#	Slice test	#4/12	–	10.25.10	low	-	Ten
11b	9.4.6.1.2	Resistance to sulfur#	Slice test	#4/12	–	10.25.10	low	-	Ten
12	9.4.7	Corrosion resistance	Current and potential test	#4/12	–	10.25.9	low	$2^3/_4$"	Three
Special conditions									
13	9.4.8	Seismic qualification for reinforcing bar connections##	Cyclic tension, confined, single reinforcing bar	$d_{b,max}$	–	10.25.11	low	$7d_b$	Five
14	9.4.8	Seismic qualification for reinforcing bar connections§§	Cyclic tension, confined, single reinforcing bar	$d_{b,max}$	–	10.25.11	high	$7d_b$	Five

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喜利得股份有限公司
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PROPOSED REVISIONS TO ACCEPTANCE CRITERIA FOR POST-INSTALLED ADHESIVE ANCHORS IN CONCRETE ELEMENTS

AC308

Proposed April 2016

Compliance date June 15, 2016

Previously approved January 2016, June 2015, February 2015, September 2014, May 2014, December 2013, June 2013, February 2013, February 2012, June 2011, November 2009, June 2009, October 2008, August 2008, May 2008, February 2008, January 2008, October 2007, June 2007, February 2007, June 2006

(Previously editorially revised April 2014, October 2013, August 2013)

PREFACE

Evaluation reports issued by ICC Evaluation Service, LLC (ICC-ES), are based upon performance features of the International family of codes. (Some reports may also reference older code families such as the BOCA National Codes, the Standard Codes, and the Uniform Codes.) Section 104.11 of the *International Building Code*® reads as follows:

> **The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.**

ICC-ES may consider alternate criteria for report approval, provided the report applicant submits data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. ICC-ES retains the right to refuse to issue or renew any evaluation report, if the applicable product, material, or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause injury or unreasonable damage.

NOTE: The Preface for ICC-ES acceptance criteria was revised in July 2011 to reflect changes in policy.

Acceptance criteria are developed for use solely by ICC-ES for purposes of issuing ICC-ES evaluation reports.

ANNEX 1

Annex 1 summarizes amendments to ACI 355.4. These amendments supersede applicable portions in ACI 355.4. For the purpose of satisfying this acceptance criteria, Annex 1 shall be used with ACI 355.4. The revisions herein reflect the difference in content from ACI 355.4. Sections, tables, and figures of ACI 355.4 that are modified by this Annex are presented here in their modified form. The numbering system within Annex 1 uses the number that corresponds to the location in ACI 355.4 where that change would be located. Added sections, tables, and figures are noted as such.

Keywords: anchors, concrete; cracked concrete; adhesive anchors; torque-controlled adhesive anchors, post-installed anchors

1.1 – Introduction

This criteria prescribes testing and evaluation requirements for adhesive anchors, torque-controlled adhesive anchors, and post-installed reinforcing bar systems intended for use in concrete under the provisions of ACI 318. Criteria are prescribed separately to determine the suitability of adhesive anchors and torque-controlled adhesive anchors. Included are assessments of the adhesive anchor and torque-controlled adhesive anchor systems for bond strength, reliability, service conditions, and quality control. Criteria are also provided for post-installed reinforcing bar systems as either supplemental to recognition under the criteria for adhesive anchors or as stand-alone requirements. Special inspection (13.3) is required during anchor installation as noted in 10.22. Table 1.1 provides an overview of the scope.

1.2 – Scope

This criteria applies to post-installed adhesive anchors, post-installed torque-controlled adhesive anchors, and post-installed reinforcing bars as defined herein.

Table 1.1 – Overview of anchor systems

Anchor type	Embedded part	Assessment criteria	
Adhesive anchor	Threaded rods, deformed reinforcing bars, or internally threaded steel sleeves with external deformations	Uncracked concrete	Table 3.1*
		Cracked and uncracked concrete	Table 3.2* or Table 3.3*
Torque-controlled adhesive anchor	Proprietary threaded and deformed steel element	Cracked and uncracked concrete	Table 3.6 or Table 3.7
Post-installed reinforcing bar	Deformed reinforcing bars, see Table 1.2	Cracked and uncracked concrete	Table 3.8

For multiple anchor element types, see Table 3.4. For alternate drilling methods, see Table 3.5.

Table 3.8– Test program for evaluating deformed reinforcing bars for use in post-installed reinforcing bar connections

Testing				Bar size	Assessment			Bar embedment	Minimum sample size
Test no.	Test ref.	Purpose	Test parameters	US/M§,‖	α_{req}	Load & displ.	f'_c *	ℓ_b	n_{min}
1d	9.4.3.1	Bond resistance§§	Tension, confined, single reinforcing bar†	$d_{b,max}$	–	10.25.2 10.25.3	high	$7d_b$	Five
1e††	9.4.3.1	Bond resistance§§	Tension, confined, single reinforcing bar†	#4/12	–	10.25.2 10.25.3	high	$7d_b$	Five
2	9.4.3.2	Bond/splitting behavior	Tension, confined, reinforcing bars in corner condition	#8/25	–	10.25.6	low	$35d_b$	Six‡
Reliability tests									
3	9.4.4.1	Sensitivity to hole cleaning, dry substrate#,**	Tension, confined, single reinforcing bar†	$d_{b,max}$	≥ 0.8	10.25.7	low	$7d_b$	Five
4	9.4.4.2	Sensitivity to hole cleaning, saturated concrete#,**	Tension, confined, single reinforcing bar†	$d_{b,max}$	≥ 0.8	10.25.7	low	$7d_b$	Five
5	9.4.4.3	Sensitivity to freezing/thawing conditions#	Tension, confined, single reinforcing bar†	#4/12	≥ 0.9	10.25.7	high	$7d_b$	Five
6	9.4.4.4	Sensitivity to sustained load at maximum long-term temperature#	Tension, confined, single reinforcing bar†	#4/12	≥ 0.9	10.25.7	low	$7d_b$	Five
7	9.4.4.5	Decreased installation temperature#	Tension, confined, single reinforcing bar†	#4/12	≥ 0.9	10.25.7	low	$7d_b$	Five
8	9.4.4.6	Sensitivity to installation direction#	Tension, confined, single reinforcing bar†	$d_{b,max}$	≥ 0.9	10.25.7	low	$7d_b$	Five
Installation procedure verification									
9	9.4.5.1	Installation at deep embedment	Bar installation in injected hole, horizontal	$d_{b,max}$	–	10.25.8	–	$60d_b$	Three
10	9.4.5.2	Injection verification	Injection in clear tube	$d_{b,max}$	–	10.25.8	–	$60d_b$	Three
Durabiltiy									
11a	9.4.6.1.1	Resistance to alkalinity#	Slice test	#4/12	–	10.25.10	low	-	Ten
11b	9.4.6.1.2	Resistance to sulfur#	Slice test	#4/12	–	10.25.10	low	-	Ten
12	9.4.7	Corrosion resistance	Current and potential test	#4/12	–	10.25.9	low	2 3/4"	Three
Special conditions									
13	9.4.8	Seismic qualification for reinforcing bar connections##	Cyclic tension, confined, single reinforcing bar	$d_{b,max}$	–	10.25.11	low	$7d_b$	Five
14	9.4.8	Seismic qualification for reinforcing bar connections§§	Cyclic tension, confined, single reinforcing bar	$d_{b,max}$	–	10.25.11	high	$7d_b$	Five

*For definition of high- and low-strength concrete, refer to 4.3.4.

†Tests performed in test specimens in accordance with Fig. 4.5 and having minimum length/thickness of ℓ_b + 2 in. (ℓ_b + 50 mm).

§Sizes are U.S. customary and European metric. $d_{b,max}$ is maximum size sought for recognition.

‖Perform tests with deformed reinforcing bars conforming to the mechanical requirements of 9.4.3.2.1.

#Tests are not required if corresponding test has been performed in accordance with Table 3.1, 3.2 or 3.3.

‡Test bars in three test specimens for a total of six tests with cast-in bars and six tests with post-installed bars.

**Tests shall be required if hole cleaning equipment and technique varies from that used for tests in accordance with Table 3.1, 3.2 or 3.3.

附件五 HILTI HIT-HY 200-R 測試報告
CNS 10142(1994) 接著強度、抗壓強度

試 驗 報 告

報告編號： PO-20-01008C
報告日期： 2020 年 10 月 30 日
頁　　次： 第 1 頁；共 1 頁

* 工程名稱：自行測試
* 業　　主：NA
* 監造單位：NA
* 承 包 商：NA
* 供 料 商：喜利得股份有限公司
* 樣品名稱：HIT-HY 200-R 化學黏著劑
* 取樣地點：NA
* 取樣人員：NA
送驗人員：喜利得股份有限公司(劉祥宇)
會驗人員：NA
* 委託單位：喜利得股份有限公司
* 聯絡資訊：NA
* 取樣日期：NA
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會驗日期：NA
試驗日期：2020 年 10 月 08 日~2020 年 10 月 28 日
※本報告中"*"為客戶提供之資訊

試驗結果：

序號	試驗項目	單位	試驗結果	試驗方法
1	接著強度	kgf/cm^2	57.6	CNS 10142(1994)
2	抗壓強度	kgf/cm^2	687	

註：1.TAF 認可範圍：2。
　　2.非 TAF 認可範圍：1。

------ END ------

喜利得股份有限公司
送審專用
FOR REVIEW

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