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HILTI® HUS4-H, HUS4-HF, HUS4-C, HUS4-A, AND HUS4-AF SCREW ANCHORS IN CONCRETE

CSI Section:
03 15 19 Cast-In Concrete Anchors
05 05 19 Post-Installed Concrete Anchors

1.0 RECOGNITION

HILTI HUS4-H, HUS4-HF, HUS4-C, HUS4-A, and HUS4-AF screw anchors recognized in this report have been evaluated for use as screw anchors. The structural performance properties of the HILTI HUS4-H, HUS4-HF, HUS4-C, HUS4-A, and HUS4-AF screw anchors comply with the intent of the provisions of the following codes and regulations:

- 2024, 2021, 2018, and 2015 International Building Code® (IBC)
- 2024, 2021, 2018, and 2015 International Residential Code® (IRC)

2.0 LIMITATIONS

Use of the HILTI HUS4-H(F), HUS4-C, and HUS4-A(F) screw anchors recognized in this report is subject to the following limitations:

2.1 The anchors shall be installed in accordance with the IBC or IRC, this report, and the manufacturer's printed installation instructions. Where conflicts occur, the more restrictive governs.

2.2 The anchor sizes, dimensions, and minimum embedment depths shall be as set forth in this report.

2.3 The anchors shall be installed in cracked or uncracked normalweight or lightweight concrete having a specified compressive strength, f'_c, between 17.2 MPa (2,500 psi) and 58.6 MPa (8,500 psi).

2.4 For calculation purposes, the compressive strength value, f'_c, shall not exceed 55.2 MPa (8,000 psi).

2.5 Strength design values shall be determined in accordance with Section 3.2.1 of this report. Loads applied to the anchors shall be adjusted in accordance with Section 1605.1 of the IBC for strength design.

2.6 Allowable stress design values shall be determined in accordance with Section 3.2.2 of this report. Loads applied to the anchors shall be adjusted in accordance with Section 1605.1 of the IBC for allowable stress design.

2.7 Anchor spacing, edge distance, and minimum concrete thickness shall comply with Table 1 of this report.

2.8 Prior to installation, calculations and design details that demonstrate compliance with this report shall be submitted to the code official. The calculations and design details shall be prepared by a licensed design professional where required by the laws and statutes of the jurisdiction in which the construction is to occur.

2.9 Since suitable criteria for evaluating performance is not available, the use of the screw anchors for fatigue or shock loading conditions is beyond the scope of this report.

2.10 Use of the HUS4-H(F), HUS4-C, and HUS4-A(F) zinc-plated carbon steel anchors is limited to dry, interior locations.

2.11 Periodic special inspection shall be provided in accordance with Section 3.4 of this report.

2.12 Where not otherwise prohibited in the applicable code, anchors are permitted for use with fire-resistant-rated construction, provided at least one of the following conditions is satisfied:

- Anchors are used to resist wind or seismic forces only.
- Anchors that support fire-resistance-rated construction or gravity load-bearing structural elements are within a fire-resistance-rated envelope or a fire-resistance-rated membrane, are protected by approved fire-resistance-rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

2.13 The HUS4-H(F), HUS4-C, and HUS4-A(F) screw anchors are manufactured by Hilti AG in Schaan, Liechtenstein.

3.0 PRODUCT USE

3.1 General: The HILTI HUS4-H(F), HUS4-C, and HUS4-A(F) screw anchors are used to resist static, wind, and seismic (Seismic Design Categories A through F under the IBC) tension and shear loads in cracked or uncracked normalweight concrete that has a specified compressive strength, f'_c, between 17.2 MPa (2,500 psi) and 58.6 MPa (8,500 psi). Cracked concrete shall be assumed except for anchors located in a region of the concrete member where analysis indicates no cracking (uncracked) at service loads or restrained shrinkage in accordance with ACI 318-19 17.6.2.5 and 17.7.2.5 or ACI 318-14 17.4.2.6 and 17.5.2.7. Cracked concrete also shall be assumed for anchors in structures assigned to Seismic Design Category C, D, E, or F.

The anchors comply with Section 1901.3 of the IBC. The anchors may be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

Installation instructions and information are set forth in Section 3.3, Tables 1 and 2, and Figures 1 through 5 of this report.

3.2 Design

3.2.1 Strength Design

3.2.1.1 General: The design strength of anchors complying with the 2024 and 2021 IBC, or with Section R301.1.3 of the 2024 and 2021 IRC, shall be determined in accordance with ACI 318-19 Chapter 17 and this report.

The design strength of anchors complying with the 2018 and 2015 IBC, or with Section R301.1.3 of the 2018 and 2015 IRC, shall be determined in accordance with ACI 318-14 Chapter 17 and this report.

The strength design of anchors shall comply with ACI 318-19 17.5.1.2 and 17.5.2 or ACI 318-14 17.3.1 and 17.3.1.1, except as required in ACI 318-19 17.10 or ACI 318-14 17.2.3. Strength reduction factors, ϕ, as given in ACI 318-19 17.5.3 or ACI 318-14 17.3.3 and in Table 3 of this report, shall be used for load combinations calculated in accordance with Section 1605.2 of the IBC and ACI 318 (-19, -14) 5.3. Under the IBC and IRC, anchor group effects shall be considered in accordance with ACI 318 (-19 and -14) 17.2.1.1.

The value of f'_c used in the calculations shall be limited to a maximum of 55 MPa (8,000 psi) in accordance with ACI 318-19 17.3.1 or ACI 318-14 17.2.7. Table 3 of this report provides the mean axial stiffness values, β, for each diameter in normalweight concrete.

3.2.1.2 Requirements for Static Steel Strength in Tension, N_{sa}: The nominal static steel strength of a single anchor in tension, N_{sa}, calculated in accordance with ACI 318-19 17.6.1.2 or ACI 318-14 17.4.1.2, as applicable, is given in Table 2 of this report. The strength reduction factors, ϕ, associated with brittle steel elements listed in Table 2 of this report shall be used.

3.2.1.3 Requirements for Static Concrete Breakout Strength in Tension, N_{cb} or N_{cbg}: The nominal concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, respectively, shall be calculated in accordance with ACI 318-19 17.6.2 or ACI 318-14 17.4.2, with modifications as described in this report. The basic concrete breakout strength in tension, N_b, shall be calculated in accordance with ACI 318-19 17.6.2.2 or ACI 318-14 17.4.2.2, using the values of h_{ef} and k_{cr} as listed in Table 3 of this report. The nominal concrete breakout strength in tension located in regions where analysis indicates no cracking in accordance with ACI 318-19 17.6.2.5.1 or ACI 318-14 17.4.2.6 shall be calculated with the value of k_{uncr} as listed in Table 2 of this report and with $\psi_{c,N} = 1.0$.

3.2.1.4 Requirements for Static Pullout Strength in Tension, N_{pn}: The nominal pullout strength of a single anchor in tension need not be evaluated.

3.2.1.5 Requirements for Static Steel Strength in Shear, V_{sa}: The nominal steel strength of a single anchor in shear, V_{sa}, in accordance with ACI 318-19 17.7.1.2 or ACI 318-14 17.5.1.2 is given in Table 3 of this report and shall be used in lieu of the values derived by calculation from ACI 318-19 Eq. 17.7.1.2b or ACI 318-14 Eq. 17.5.1.2b. The strength reduction factors, ϕ, associated with brittle steel elements listed in Table 2 of this report shall be used.

3.2.1.6 Requirements for Static Concrete Breakout Strength in Shear, V_{cb} or V_{cbg}: The nominal concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, respectively, shall be calculated in accordance with ACI 318-19 17.7.2 or ACI 318-14 17.5, with modifications as described in this report. The basic concrete breakout strength in shear, V_b, shall be calculated in accordance with ACI 318-19 17.7.2.2.1 or ACI 318-14 17.5.2.2 with the values of l_e and d_a given in Table 2 of this report.

3.2.1.7 Requirements for Static Concrete Pryout Strength in Shear, V_{cp} or V_{cpg}: The nominal concrete pryout strength of a single anchor or group of anchors in shear, V_{cp} or V_{cpg}, shall be calculated in accordance with ACI 318-19 17.7.3 or ACI 318-14 17.5.3, modified using the value of k_{cp} provided in Table 2 of this report and the value of N_{cb} or N_{cbg} as calculated in accordance with Section 3.2.1.3 of this report.

3.2.1.8 Requirements for Seismic Design

3.2.1.8.1 General: For load combinations including seismic loads, the design calculations shall be performed in accordance with ACI 318-19 17.10 or ACI 318-14 17.2.3, as applicable. ACI 318-19 17.10 shall be modified by Section 1905.7 of the 2024 and 2021 IBC. ACI 318-14 17.2.3 shall be modified by Section 1905.1.8 of the 2018 and 2015 IBC.

The anchors shall be designed in accordance with ACI 318-19 17.10.4, 17.10.5, 17.10.6, or 17.10.7 or ACI 318-14 17.2.3.4, 17.2.3.5, 17.2.3.6, or 17.2.3.7, as applicable. Strength reduction factors, ϕ, are listed in Table 2 of this report.

All anchors listed in this report may be installed in structures assigned to IBC Seismic Design Categories A to F.

3.2.1.8.2 Seismic Tension: The nominal steel strength and nominal concrete breakout strength of anchors in tension shall be calculated in accordance with ACI 318-19 17.6.1 and 17.6.2 or ACI 318-14 17.4.1 and 17.4.2, as described in Sections 3.2.1.2 and 3.2.1.3 of this report. In accordance with ACI 318-19 17.6.3.2.1 or ACI 318-14 17.4.3.2, the appropriate value for pullout strength in tension for seismic loads, $N_{p,eq}$, as listed in Table 2 of this report, shall be used in lieu of $N_{p,cr}$. $N_{p,eq}$ may be adjusted by calculations in accordance with Eq-1 of this report.

$$\boldsymbol{N_{p,eq,f'c} = N_{p,eq}\left(\frac{f'_c}{2{,}500}\right)^{0.5}} \quad \text{(lb, psi)} \quad \text{Eq-1}$$

$$\boldsymbol{N_{p,eq,f'c} = N_{p,eq}\left(\frac{f'_c}{17.2}\right)^{0.5}} \quad \text{(N, MPa)}$$

Where values for $N_{p,eq}$ are not listed in Table 2 of this report, the pullout strength in tension need not be evaluated.

3.2.1.8.3 Seismic Shear: The nominal concrete breakout strength and concrete pryout strength of anchors in shear shall be calculated in accordance with ACI 318-19 17.7.2 and 17.7.3 or ACI 318-14 17.5.2 and 17.5.3, as described in Sections 3.2.1.6 and 3.2.1.7 of this report. In accordance with ACI 318-19 17.7.1.2 or ACI 318-14 17.5.1.2, the appropriate value for nominal steel strength in shear for seismic loads, $V_{sa,eq}$, as listed in Table 2 of this report, shall be used in lieu of V_{sa}.

3.2.1.9 Requirements for Interaction of Tensile and Shear Forces: Anchors or groups of anchors that resist both tension and shear forces shall be designed in accordance with ACI 318-19 17.8 or ACI 318-14 17.6.

3.2.1.10 Requirements for Critical Edge Distance: In applications where the design edge distance, c, is less than the critical edge distance, c_{ac}, and supplemental reinforcement to control splitting of the concrete is not present, the concrete breakout strength in tension for uncracked concrete, calculated according to ACI 318-19 17.6.2 or ACI 318-14 17.4.2, shall be further multiplied by the factor $\psi_{cp,N}$ given by Eq-2 of this report:

$$\psi_{cp,N} = \frac{c}{c_{ac}} \quad \text{Eq-2}$$

where the factor $\psi_{cp,N}$ need not be taken as less than $\frac{1.5h_{ef}}{c_{ac}}$, where c_{ac} and h_{ef} shall be as listed in Table 2 of this report. For all other cases, $\psi_{cp,N} = 1.0$.

3.2.1.11 Requirements for Minimum Member Thickness, Minimum Anchor Spacing, and Minimum Edge Distance: In lieu of ACI 318-19 17.9.2 and 17.9.4 or ACI 318-14 17.7.1, 17.7.3, and 17.7.5, values of c_{min}, s_{min}, and h_{min} shall comply with Table 1 of this report.

3.2.1.12 Requirements for Lightweight Concrete: For the use of anchors in lightweight concrete, the modification factor λ_a equal to 0.8λ is applied to all values of $(f'_c)^{0.5}$ affecting N_n and V_n.

For ACI 318-19 (2024 and 2021 IBC or IRC) or ACI 318-14 (2018 and 2015 IBC or IRC), λ shall be determined in accordance with the corresponding version of ACI 318.

3.2.2 Allowable Stress Design

3.2.2.1 General: Design values for use with allowable stress design load combinations calculated in accordance with Section 1605.1 of the 2024 and 2021 IBC or Section 1605.3 of the 2018 and 2015 IBC, shall be established using Eq-3 and Eq-4 of this report:

$$T_{allowable,ASD} = \frac{\phi N_n}{\alpha} \quad \text{Eq-3}$$

$$V_{allowable,ASD} = \frac{\phi V_n}{\alpha} \quad \text{Eq-4}$$

where:

$T_{allowable,ASD}$ = Allowable tension load (lbf or kN)
$V_{allowable,ASD}$ = Allowable shear load (lbf or kN)

ϕN_n = Lowest design strength of an anchor or anchor group in tension as determined with ACI 318(-19 and -14) Chapter 17 and 2024 IBC Section 1905.7, 2021, 2018, and 2015 IBC Section 1905.1.8, and Section 3.2 of this report, as applicable (lbf or kN)

ϕV_n = Lowest design strength of an anchor or anchor group in shear as determined with ACI 318(-19 and -14) Chapter 17 and 2024 IBC Section 1905.7, 2021, 2018 or 2015 IBC Section 1905.1.8, and Section 3.2 of this report, as applicable (lbf or kN)

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, α shall include all applicable factors to account for non-ductile failure modes and required over-strength.

The requirements for member thickness, edge distance, and spacing, described in this report, shall apply.

3.2.2.2 Interaction of Tensile and Shear Forces: Anchors or groups of anchors that resist both tension and shear forces shall be designed in accordance with ACI 318-19 17.8 or ACI 318-14 17.6, as follows:

For tension loads, $T_{applied} \leq 0.2T_{allowable,ASD}$, the full allowable load in shear shall be permitted.

For shear loads, $V_{applied} \leq 0.2V_{allowable,ASD}$, the full allowable load in tension shall be permitted.

For all other cases, Eq-5 of this report shall be satisfied:

$$\frac{T_{applied}}{T_{allowable,ASD}} + \frac{V_{applied}}{V_{allowable,ASD}} \leq 1.2 \qquad \text{Eq-5}$$

3.3 Installation: Installation parameters and instructions are provided in Table 1 and Figures 4 and 5 of this report. Anchor locations shall comply with this report and the plans and specifications approved by the building official. The HUS4-H(F), HUS4-C, and HUS4-A(F) screw anchors shall be installed in accordance with the manufacturer's printed installation instructions and this report. Anchors shall be installed in holes drilled into the concrete perpendicular to the surface using carbide-tipped drill bits that comply with ANSI B212.15-1994 or using the Hilti TE-CD with a Hilti vacuum with a minimum value for the maximum volumetric flow rate of 193 CFM (61 l/s). The Hollow Drill Bits are not permitted for use with the M8 and M10 diameter screw anchors. The nominal drill bit diameter shall be equal to that of the anchor and listed in Table 1 of this report. The minimum drilled hole depth, h_1, is listed in Table 1 of this report. When drilling dust is not removed after hole drilling, make sure to drill deep, $h_{1,NC}$, enough to achieve h_{nom}, taking into account the depth of debris remaining in the hole. If dust and debris are removed from the drilled hole with the TE-CD Hollow Drill Bits or compressed air, vacuum, or a manual pump, h_{nom} is achieved at the specified drilled hole depth value of $h_{1,C}$. The maximum manual torque wrench, $T_{inst,max}$, for the HUS4-A(F) shall be in accordance with Table 1 of this report.

3.4 Special Inspection: Periodic special inspection is required in accordance with Section 1705.1.1 and Table 1705.3 of the IBC. The special inspector shall make periodic inspections during anchor installation to verify anchor type, anchor dimensions, concrete specifications, concrete compressive strength, concrete member thickness, anchor spacing, anchor edge distance, drill bit type, drill bit size, hole dimensions, the hole cleaning method, installation torque procedure, and verification and of conformance with the manufacturer's printed installation instructions. The special inspector shall be present as often as required in accordance with the "statement of special inspection".

4.0 PRODUCT DESCRIPTION

4.1 Product Information: The HUS4-H(F) screw anchors are comprised of a body with a hex washer head. The hex head is larger than the diameter of the anchor and is formed with serration on the underside. The anchor body is formed with threads running most of the length of the anchor body. The anchor threads cut into the concrete on the sides of the hole and interlock with the base material during installation. The anchor is available in M8, M10, M12, and M14. The HUS4-H(F) is illustrated in Figure 1 of this report.

The HUS4-C screw anchors are comprised of the same thread profile as the hex head but with a countersunk head. The anchor is available in M8 and M10 diameters. The HUS4-C is illustrated in Figure 2 of this report.

The HUS4-A(F) screw anchor is comprised of the same thread profile as the hex head but with a long externally threads head. The anchor is available in M10 and M14 diameters. The HUS4-A(F) is illustrated in Figure 3 of this report.

The HUS4-H, HUS4-C, and HUS4-A screw anchors are manufactured from galvanized carbon steel with zinc electroplating according to ISO 4042:2018. The HUS4-HF and HUS4-AF screw anchors are manufactured from the same zinc-plated carbon steel but additionally feature a multilayer coating that enhances corrosion resistance.

4.2 Material Information: Normalweight and lightweight concrete shall comply with Sections 1903 and 1905 of the IBC.

5.0 IDENTIFICATION

HILTI HUS4-H(F), HUS4-C, and HUS4-A(F) screw anchors are identified by dimensional characteristics and packaging. The packaging label lists the name and address of Hilti Inc., the manufacturing location, the anchor size, and type; the IAPMO UES evaluation report number (IAPMO UES ER-969), and the IAPMO UES Mark of Conformity. The anchors with hex washer heads and countersunk heads have HUS4, HILTI, anchor size, and anchor length embossed on the anchor head. These identification embossments are visible after installation for verification.

The IAPMO Uniform Evaluation Service Mark of Conformity may also be used as shown below:

IAPMO UES ER-969

6.0 SUBSTANTIATING DATA

Testing and analytical data for cracked and uncracked concrete in accordance with ICC-ES Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC193), published April 2025, and ACI 355.2-19, Qualification of Post-Installed Mechanical Anchors in Concrete, including testing for seismic tension and seismic shear. Test reports are from laboratories accredited to ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on HILTI HUS4-H(F), HUS4-C, and HUS4-A(F) screw anchors to assess conformance to the codes shown in Section 1.0 of this report and serves as documentation of the product certification. Products are manufactured at the location noted in Section 2.13 of this report under a quality control program with periodic inspection under the supervision of IAPMO UES.

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org

TABLE 1 - HILTI HUS4-H(F), HUS4-C, AND HUS4-A(F) SCREW ANCHOR INSTALLATION PARAMETERS

Setting information	Symbol	Units	Nominal anchor diameter (mm)			
			M8	M10	M12	M14
Head Style	-	-	H(F), C	H(F), C, A(F)	H(F)	H(F), A(F)
Nominal drill bit diameter	d_o	mm	8	10	12	14
Effective embedment depth	h_{ef}	mm	56.1	68	79.9	91.8
Nominal embedment depth	h_{nom}	mm	70	85	100	115
Minimum edge distance	c_{min}	mm	35	40	50	60
Minimum anchor spacing	s_{min}	mm	35	40	50	60
Minimum hole depth in concrete for non-cleaned hole [1]	$h_{1, NC}$	mm	95	115	135	155
Minimum hole depth in concrete for cleaned hole [2]	$h_{1, C}$	mm	80	95	110	125
Minimum concrete thickness for non-cleaned hole [1]	$h_{min, NC}$	mm	126	145	164	183
Minimum concrete thickness for cleaned hole [2]	$h_{min, C}$	mm	110	125	140	155
Minimum fixture hole diameter	$d_{f, min}$	mm	11	13	16	18
Maximum fixture hole diameter	$d_{f, min}$	mm	12	14		
Wrench size (H, HF-type)	S	mm	13	15	17	21
Wrench size (A-type)	$s1$	mm	-	8	-	12
Wrench size for nut (A-type)	$s2$	mm	-	19	-	24
Maximum installation torque (A-type)	$T_{inst,max}$	Nm	-	40	-	80
Torx size (C-type)	TX	mm	45	50	-	-
Diameter of countersunk head	d_h	mm	18	21	-	-

For pound-inch units: 1 mm = 0.03937 inch, 1 Nm = 8.8507 in-lbs

[1] Figure 4 Steps 3b and 4b for the HUS4-H(F) and HUS4-C, and Figure 5 Step 1c for the HUS4-A(F), provide drilling and dust removal instructions for non-cleaned hole conditions.
[2] Figure 4 Steps 3a and 4a for the HUS4-H(F) and HUS4-C, and Figure 5 Step 1a for the HUS4-A(F), provide drilling and dust removal instructions for cleaned hole conditions.

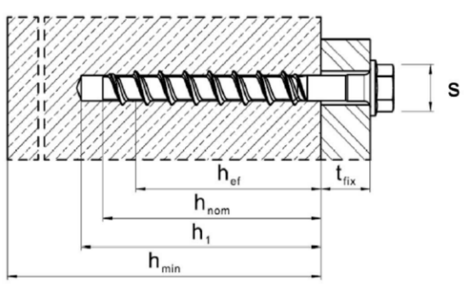

FIGURE 1 - HILTI HUS4-H(F) SCREW ANCHOR

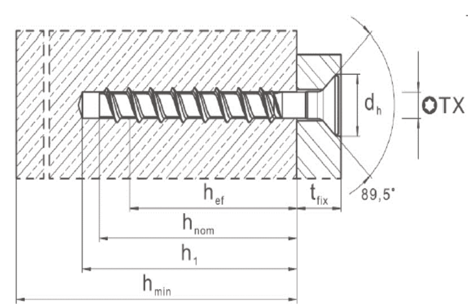

FIGURE 2 – HILTI HUS4-C SCREW ANCHOR

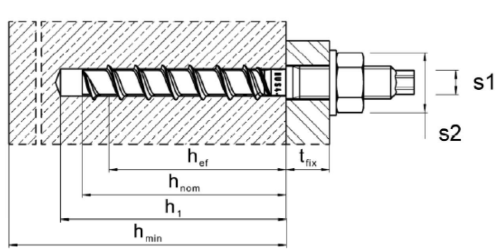

FIGURE 3 - HILTI HUS4-A(F) SCREW ANCHOR

TABLE 2 - HILTI HUS4-H(F), HUS4-C, AND HUS4-A(F) DESIGN INFORMATION

Design parameter	Symbol	Units	Nominal anchor diameter (mm)			
			M8	M10	M12	M14
Anchor O.D.	d_a	mm	8	10	12	14
Effective embedment depth[1]	h_{ef}	mm	56.1	68.0	79.9	91.8
Tension, steel failure modes						
Strength reduction factor for steel in tension[2]	$\phi_{sa,N}$	-	0.65	0.65	0.65	0.65
Min. specified yield strength	f_{ya}	N/mm^2	606	639	613	582
Min. specified ultimate strength	f_{uta}	N/mm^2	758	799	767	728
Effective cross-sectional steel area in tension	A_{se}	mm^2	47.5	68.9	103.1	139.5
Nominal steel strength in tension	N_{sa}	kN	36.0	55.0	79.0	101.5
Tension, concrete failure modes						
Anchor category	-	-	1	2	1	1
Strength reduction factor for concrete failure in tension, Condition B[3]	$\phi_{c,N}$	-	0.65	0.55	0.65	0.65
Effectiveness factor for uncracked concrete	k_{uncr}	-	10.0	11.3	11.3	11.3
Effectiveness factor for cracked concrete	k_{cr}	-	7.1	8.8	8.8	8.8
Modification factor for anchor resistance, tension, uncracked concrete [4]	$\psi_{c,N}$	-	1.0	1.0	1.0	1.0
Critical edge distance	c_{ac}	mm	84.1	272.0	319.6	367.2
Pullout strength in uncracked concrete[6]	$N_{p,uncr}$	kN	NA	NA	NA	NA
Pullout strength in cracked concrete[6]	$N_{p,cr}$	kN	NA	NA	NA	NA
Pullout strength in cracked concrete, seismic[5,6]	$N_{p,eq}$	kN	NA	NA	NA	28.3
Tension, axial stiffness						
Axial stiffness for uncracked concrete	β_{uncr}	kN/mm	375	126	111	182
Axial stiffness for cracked concrete	β_{cr}	kN/mm	50	54	65	56
Shear, steel failure modes						
Strength reduction factor for steel in shear[2]	$\phi_{sa,V}$	-	0.60	0.60	0.60	0.60
Nominal steel strength in shear	V_{sa}	kN	14.6	31.9	42.9	48.4
Nominal steel strength in shear, seismic	$V_{sa,eq}$	kN	11.4	23.8	32.6	26.6
Shear, concrete failure modes						
Strength reduction factor for concrete breakout failure in shear, Condition B[3]	$\phi_{c,V}$	-	0.7	0.7	0.7	0.7
Load-bearing length of anchor in shear	ℓ_e	mm	56.1	68.0	79.9	91.8
Effectiveness factor for pryout	k_{cp}	-	1.0	2.0	2.0	2.0

For pound-inch units: 1 mm = 0.03937 in., 1 mm^2 = 0.00155 $in.^2$, 1 kN = 224.8089 lbs., 1 N/mm^2 = 145.0377 psi, 1 kN/mm = 5710.1472 lbs/in.

[1] The dimensions are illustrated in Figures 1, 2, and 3 of this report.
[2] The HUS4 is considered a brittle steel element
[3] For use with the load combinations of ACI 318(-19 and -14) 5.3, and 2024 and 2021 IBC Section 1605.1 or 2018 and 2015 IBC Section 1605.2. Condition B applies where supplementary reinforcement in conformance with ACI 318-19 17.5.3 or ACI 318-14 17.3.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
[4] For all design cases, $\psi_{c,N}$ = 1.0. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) shall be used.
[5] For all design cases, $\psi_{c,P}$ = 1.0. The tabular value for pullout strength is for a concrete compressive strength of 17.2 MPa. Pullout strength for concrete compressive strength greater than 17.2 MPa may be increased by multiplying the tabular pullout strength by $(f'_c / 17.2)^{0.39}$.
[6] NA (not applicable) denotes that pullout strength does not need to be considered for design.

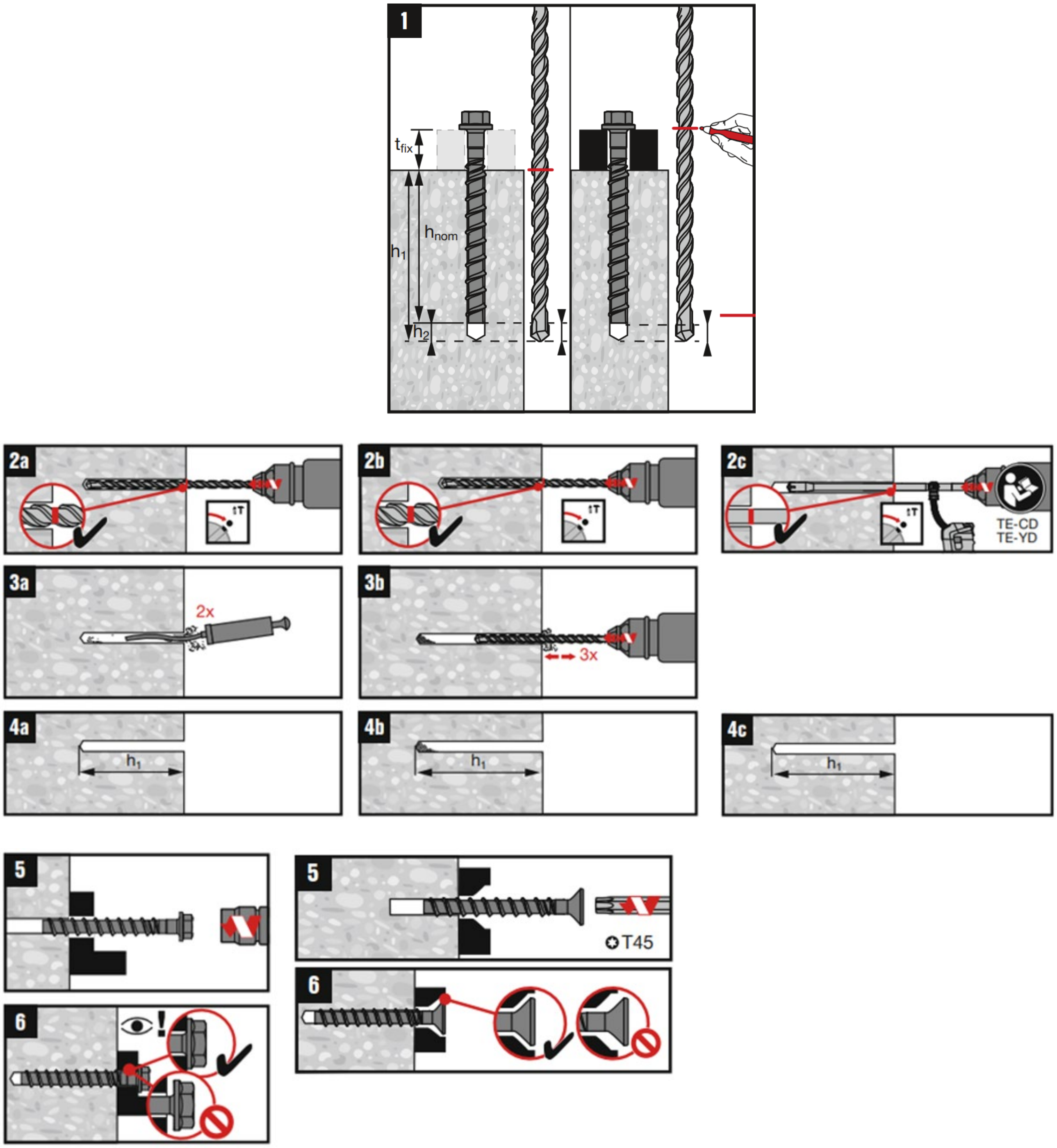

FIGURE 4 - HILTI HUS4-H(F) AND HUS4-C INSTALLATION PARAMETERS AND GEOMETRY

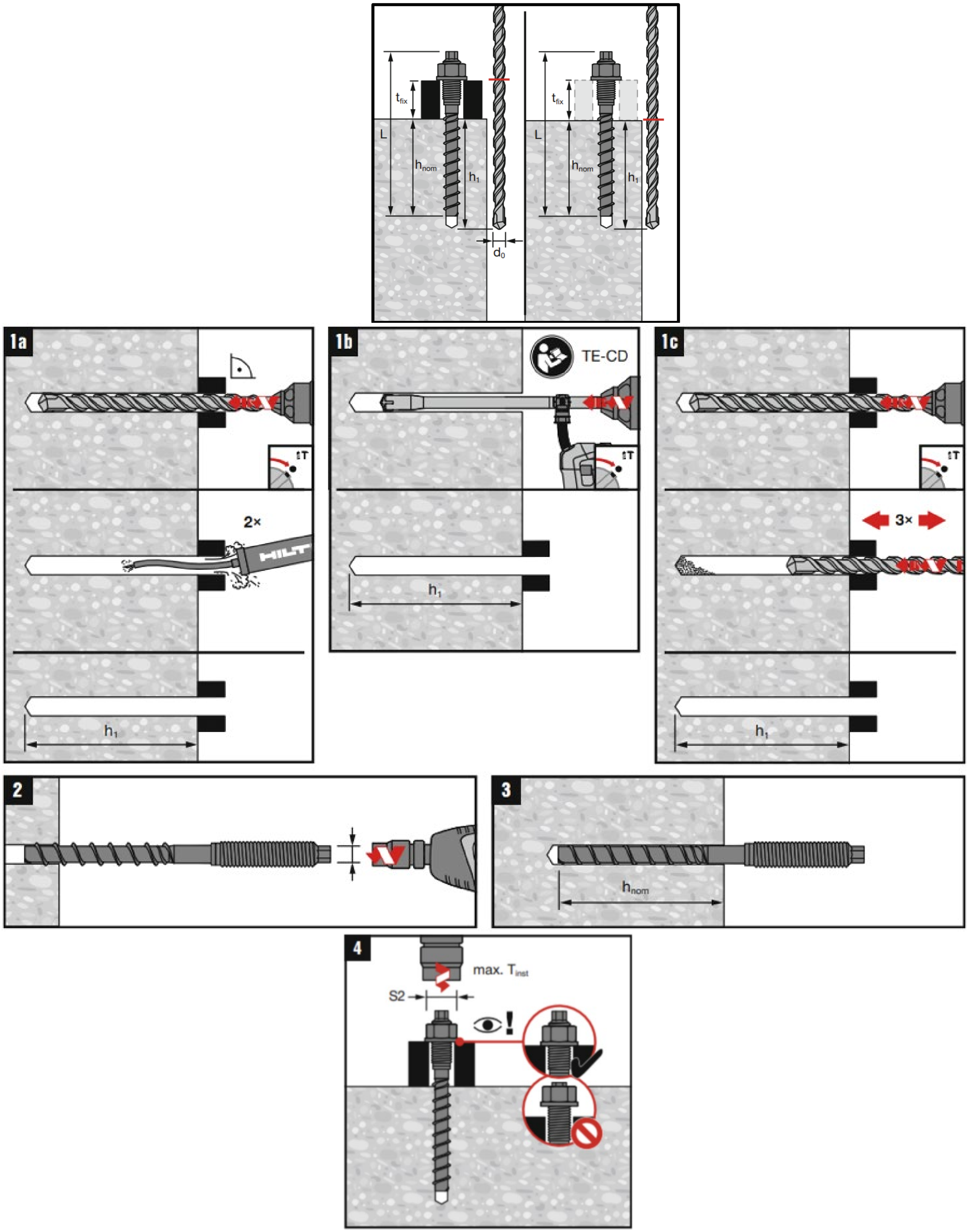

FIGURE 5 - HILTI HUS4-A(F) INSTALLATION PARAMETERS AND GEOMETRY