ICC-ES Evaluation Report

ESR-3056

Reissued October 2015
Revised February 2017
This report is subject to renewal October 2017.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors

REPORT HOLDER:

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

EVALUATION SUBJECT:

HILTI KWIK HUS-EZ (KH-EZ) CARBON STEEL SCREW ANCHORS FOR USE IN MASONRY

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009, and 2006 *International Building Code*® (IBC)
- * 2015, 2012, 2009, ~~and 2006~~ *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.~~

Property evaluated:

Structural

2.0 USES

The Hilti KWIK HUS-EZ (KH-EZ) screw anchors are used to resist static, wind and seismic tension and shear loads in grout-filled concrete masonry units.

The Hilti KWIK HUS-EZ screw anchors are alternatives to cast-in-place anchors described in Section 8.1.3 (2013 edition), or Section 2.1.4 (2011, 2008 or 2005 edition) of TMS 402/ ACI 530/ ASCE 5, as applicable, as referenced in Section 2107 of the IBC.

The Hilti KWIK HUS-EZ screw anchors are permitted to be used in structures regulated by the IRC, provided an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 KWIK HUS-EZ:

Hilti KWIK HUS-EZ (KH-EZ) screw anchors are comprised of a threaded body with hex washer head. The anchor is manufactured from carbon steel and is heat treated. It has a minimum 0.0003-inch (8 µm) zinc coating in accordance with DIN EN ISO 4042. The anchoring system is available in a variety of lengths with diameters of $^1/_4$ inch, $^3/_8$ inch, $^1/_2$ inch, $^5/_8$ inch, and $^3/_4$ inch (6.4 mm, 9.5 mm, 12.7 mm, 15.9 mm and 19.1 mm). The KWIK HUS-EZ (KH-EZ) is illustrated in Figure 1.

The hex head is larger than the anchor diameter and is formed with serrations on the underside. The anchor body is formed with threads running most of the length of the anchor body. The anchor is installed in a predrilled hole with a powered impact wrench or torque wrench. The anchor threads cut into the base material on the sides of the hole and interlock with the base material during installation.

Product information is found in Table 1, installation parameters are found in Table 2 and described in Section 4.2, and the Manufacturers Published Installation Instructions (MPII) are depicted in Figure 4.

3.2 Grout-filled Concrete Masonry:

The compressive strength of masonry, f'_m at 28 days must be a minimum of 1,500 psi (10.3 MPa). Fully grouted masonry walls must be constructed from the following materials:

3.2.1 Concrete Masonry Units (CMUs): CMUs must be minimum Grade N, Type II, lightweight, medium-weight, or normal-weight conforming to ASTM C90. The minimum size of the CMU must be a nominal 8 inches wide by a nominal 8 inches high by a nominal 16 inches long.

3.2.2 Grout: Grout must comply, as applicable, with 2015 IBC Section 2103.3, 2012 IBC Section 2103.13, 2009 and 2006 IBC Section 2103.12, or IRC Section R606.2.11 (2015 IRC) or R609.1.1 (2012, 2009, ~~or 2006~~), as * applicable. Alternatively, the grout must have a minimum compressive strength, when tested in accordance with ASTM C1019, equal to its specified strength but not less than 2,000 psi (13.8 MPa).

3.2.3 Mortar: Mortar must be Type M or S in compliance with Section 2103 of the IBC, or Section R607 of the IRC, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Allowable Stress Design:

4.1.1 General: Anchors described in this report are assigned allowable tension and shear loads for designs based on allowable stress design (ASD).

* Deleted by the City of Los Angeles

4.1.2 Design of Anchors Installed in Uncracked Grout-filled Concrete Masonry: Allowable tension and shear loads for anchors installed in the face of uncracked grout-filled masonry are noted in Tables 3 and 4. The allowable tension and shear loads are for anchors installed in the grouted cells, the center web of concrete masonry units and horizontal mortared bed joints of fully grouted CMU construction. Allowable loads for anchors installed within $1^1/_4$ inches (32 mm) of the vertical (head) joint, as depicted in Figure 2, are beyond the scope of this report. Critical and minimum spacings and edge distances are given in Table 2. Allowable load reduction factors for anchors installed at reduced spacing and reduced edge distances (between critical and minimum) are noted in Table 3 and Table 4.

Allowable tension and shear loads for $^1/_2$-inch and $^5/_8$-inch (12.7 mm and 15.9 mm) anchors installed in the top of uncracked fully grouted concrete masonry walls are noted in Table 5. Separate values are given for shear loads towards the edge and parallel to the edge of the masonry wall. Allowable loads for anchors installed within $1^1/_4$ inches (32 mm) of the head joint are beyond the scope of this report.

Allowable loads for anchors installed in uncracked grout-filled masonry subjected to combined tension and shear loads must be determined by the following equations:

$\left(\frac{P_s}{P_t}\right) + \left(\frac{V_s}{V_t}\right) \leq 1.0$ for all diameters installed in the top of the wall

$\left(\frac{P_s}{P_t}\right)^{5/3} + \left(\frac{V_s}{V_t}\right)^{5/3} \leq 1.0$ for all diameters installed in the face of the wall

where:

P_s = Applied service tension load

P_t = Allowable service tension load

V_s = Applied service shear load

V_t = Allowable service shear load

4.2 Installation

Installation parameters are provided in Tables 2, 3, 4 and 5, and Figures 2, 3 and 4. Anchor locations must comply with this report and with plans and specifications approved by the code official. The Hilti KWIK HUS-EZ (KH-EZ) must be installed according to this report and the manufacturer's published instructions (MPII) as depicted in Figure 4. In case of conflict, this report governs. Anchors must be installed into base material perpendicular to the surface using carbide-tipped masonry drill bits complying with ANSI B212.15-1994. The nominal drill bit diameter must be equal to that of the anchor. The minimum drilled hole depth is given in Table 2. Prior to installation, dust and debris must be removed from the drilled hole using a hand pump, compressed air or a vacuum. The anchor must be installed into the predrilled hole using a powered impact wrench or with a torque wrench until the proper nominal embedment depth is obtained. The maximum impact wrench torque and the maximum installation torque for a manually calibrated torque wrench must be in accordance with Table 2.

4.3 Special Inspection:

Anchors must be installed with special inspection. For the IBC and IRC, special inspection must conform to Sections 1704 and 1705 of the IBC.

For fasteners installed with special inspection, the following items, as applicable, must be inspected: fastener type, diameter and length; masonry dimensions and compliance with ASTM C90; grout and mortar compliance with standards listed in Section 3.2, and, where required, masonry prism compressive strength; drill bit diameter and compliance with ANSI B212.12-1994; and fastener embedment, spacing, and edge distance. The special inspector must verify that anchor installation complies with this evaluation report and the manufacturer's published installation instructions.

5.0 CONDITIONS OF USE

The Hilt KWIK HUS-EZ Screw Anchors described in this report are suitable alternatives to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Anchors are identified and installed in accordance with this report and the manufacturer's published installation instructions. In case of conflict, this report governs.

5.2 Anchors resisting static, seismic or wind load in grout-filled concrete masonry must be designed in accordance with Section 4.1 of this report.

5.3 When using the basic load combinations in accordance with IBC Section 1605.3.1, allowable loads are not permitted to be increased for seismic or wind loading. When using the alternative basic load combinations in Section 1605.3.2 of the 2009 and 2006 IBC that include seismic or wind loads, the allowable shear and tension capacities for anchors included in this report may be increased by $33^1/_3$ percent, or the alternative basic load combinations may be multiplied by a factor of 0.75. For the 2015 or 2012 IBC, the allowable loads or load combinations must not be adjusted.

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

5.5 Where not otherwise prohibited by the applicable code, anchors are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:

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

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

5.7 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the building official for approval. The calculations must be prepared by a registered design

professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.8 Special inspection must be provided in accordance with Section 4.3.

5.9 Anchors are limited to dry, interior use.

5.10 Anchors must be installed in holes predrilled in masonry as described in this report, using drill bits in compliance with ANSI B212.15-1994.

5.11 The KWIK HUS-EZ screw anchors are manufactured by Hilti AG, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry (AC106), dated November 2015; including tests for seismic qualification, edge distance and spacing, and installations for top of fully grouted CMU masonry wall construction.

6.2 Quality control documentation.

7.0 IDENTIFICATION

The HILTI KWIK HUS-EZ (KH-EZ) anchors are identified by packaging with the manufacturer's name (Hilti, Inc.) and contact information, anchor name, anchor size, and evaluation report number (ESR-3056). The anchors have KH-EZ, HILTI, and the anchor diameter and anchor length embossed on the anchor head. Identifications are visible after installation, for verification.

FIGURE 1—HILTI KWIK HUS-EZ SCREW ANCHOR

TABLE 1—KWIK HUS-EZ (KH EZ) PRODUCT INFORMATION

DESCRIPTION	NAME AND SIZE	DIAMETER	TOTAL LENGTH UNDER THE ANCHOR HEAD
Screw Anchor with Hex-Head	KH-EZ 1/4"x1 7/8"	1/4"	1 7/8"
	KH-EZ 1/4"x2 5/8"	1/4"	2 5/8"
	KH-EZ 1/4"x3"	1/4"	3"
	KH-EZ 1/4"x3 1/2"	1/4"	3 1/2"
	KH-EZ 1/4"x4"	1/4"	4"
	KH-EZ 3/8"x1 7/8"	3/8"	1 7/8"
	KH-EZ 3/8"x2 1/8"	3/8"	2 1/8"
	KH-EZ 3/8"x3"	3/8"	3"
	KH-EZ 3/8"x3 1/2"	3/8"	3 1/2"
	KH-EZ 3/8"x4"	3/8"	4"
	KH-EZ 3/8"x5"	3/8"	5"
	KH-EZ 1/2"x2 1/2"	1/2"	2 1/2"
	KH-EZ 1/2"x3"	1/2"	3"
	KH-EZ 1/2"x3 1/2"	1/2"	3 1/2"
	KH-EZ 1/2"x4"	1/2"	4"
	KH-EZ 1/2"x4 1/2"	1/2"	4 1/2"
	KH-EZ 1/2"x5"	1/2"	5"
	KH-EZ 1/2"x6"	1/2"	6"
	KH-EZ 5/8"x3 1/2"	5/8"	3 1/2"
	KH-EZ 5/8"x4"	5/8"	4"
	KH-EZ 5/8"x5 1/2"	5/8"	5 1/2"
	KH-EZ 5/8"x6 1/2"	5/8"	6 1/2"
	KH-EZ 5/8"x8"	5/8"	8"
	KH-EZ 3/4"x4 1/2"	3/4"	4 1/2"
	KH-EZ 3/4"x5 1/2"	3/4"	5 1/2"
	KH-EZ 3/4"x7"	3/4"	7"
	KH-EZ 3/4"x8"	3/4"	8"
	KH-EZ 3/4"x9"	3/4"	9"

TABLE 2—KWIK HUS-EZ (KH-EZ) INSTALLATION INFORMATION AND ANCHOR SPECIFICATION[1,2,3,4]

INSTALLATION DETAIL	UNITS	NOMINAL ANCHOR DIAMETERS (INCHES)									
		1/4		3/8		1/2		5/8		3/4	
Drill Bit Diameter	in.	1/4		3/8		1/2		5/8		3/4	
Minimum Baseplate Clearance Hole Diameter	in.	3/8		1/2		5/8		3/4		7/8	
Maximum Installation Torque[5]	ft-lbf	21		22		34		38		70	
Maximum Impact Wrench Torque Rating[6]	ft-lbf	114	114	114	332	332	332	332	332	332	332
Minimum Nominal Embedment Depth	in.	1 5/8	2 1/2	1 5/8	3 1/4	2 1/4	4 1/2	3 1/4	5	4	6 1/4
Minimum Hole Depth	in.	2	2 7/8	1 7/8	3 1/2	2 5/8	4 5/8	3 5/8	5 3/8	4 3/8	6 5/8
Critical Edge Distance	in.	4		6		8		10		12	
Minimum Edge Distance	in.	4									
Critical Spacing Distance	in.	4		6		8		10		12	
Minimum Spacing Distance	in.	4									
Wrench Socket Size	in.	7/16		9/16		3/4		15/16		1 1/8	

[1]Values in this table are to be used in conjunction with load values contained in Tables 3, 4, and 5, and the appropriate figures in this report, with the exception of the minimum spacing, edge, and end distances for anchors installed in the top of grout filled concrete masonry, which are listed in Table 5.
[2]Critical spacings and edge distances are the anchor spacing and edge distances for which no reduction in load capacity is required.
[3]Minimum spacings and minimum edge distances in this report are the smallest values for which anchor installation is allowed.
[4]Anchors may be installed anywhere in the fully grouted masonry wall except within 1 1/4 inch of a vertical joint (see Figure 2).
[5]Maximum Installation Torque applies to installations using a calibrated torque wrench.
[6]Because of the variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over-torquing can damage the anchor and/or reduce its holding capacity.

TABLE 3—ALLOWABLE TENSION LOADS FOR KWIK HUS-EZ IN THE FACE OF GROUT-FILLED MASONRY WALLS (POUNDS)[1,3,6]

ANCHOR DIAMETER (INCHES)	MINIMUM EMBEDMENT (INCHES)[2]	ALLOWABLE TENSION LOADS FOR IBC/IRC[5]	EDGE DISTANCE			SPACING		
			CRITICAL C_{CR} (INCHES)	MINIMUM C_{MIN} (INCHES)	LOAD REDUCTION FACTOR[4]	CRITICAL S_{CR} (INCHES)	MINIMUM S_{MIN} (INCHES)	LOAD REDUCTION FACTOR[4]
1/4	1 5/8	424[7]	4	4	1.00	4	4	1.00
	2 1/2	728[8]						
3/8	1 5/8	428[8]	6	4	1.00	6	4	0.80
	3 1/4	968						
1/2	2 1/4	556	8	4	1.00	8	4	0.60
	4 1/4	1,212						
5/8	3 1/4	924	10	4	1.00	10	4	0.57
	5	1,388						
3/4	4	1,156	12	4	1.00	12	4	0.53
	6 1/4	1,628						

[1]Anchors shall be installed in base materials in compliance with Section 3.2 of this report.
[2]Embedment depth is measured from the outside surface of the concrete masonry unit.
[3]Refer to Section 5.3 of this report for modifying allowable loads in this table for anchors resisting short-term loads.
[4]Allowable loads are based on installation at critical spacing and edge distance. Load reduction factors are applicable at the minimum spacing and edge distance. Linear interpolation of reduction factors is allowed for spacings and edge distances between critical and minimum.
[5]Tabulated allowable loads for the IBC/IRC are based on a safety factor of 5.0.
[6]Special inspection must be provided in accordance with Section 4.3 of this report.
[7]Load values for installations within 1 1/4 inch of bed joint for 1/4" diameter at 1 5/8 inch embedment shall be reduced by 21%.
[8]Load values for installations within 1 1/4 inch of bed joint for 1/4 inch diameter at 2 1/2 inch embedment and 3/8 inch diameter at 1 5/8 inch embedment shall be reduced by 13%.

TABLE 4—ALLOWABLE SHEAR LOADS FOR KWIK HUS-EZ INSTALLED IN THE FACE OF GROUT-FILLED MASONRY WALLS (POUNDS)[1,3,6]

ANCHOR DIAMETER (INCHES)	MINIMUM EMBEDMENT (INCHES)[2]	SHEAR LOADS at C_{CR} AND S_{CR}[5]	SPACING			EDGE DISTANCE			
		ALLOWABLE SHEAR LOADS FOR IBC/IRC	CRITICAL S_{CR} (INCHES)	MINIMUM S_{MIN} (INCHES)	LOAD REDUCTION FACTOR[4]	CRITICAL C_{CR} (INCHES)	MINIMUM C_{MIN} (INCHES)	LOAD DIRECTION PERPENDICULAR TO EDGE	LOAD DIRECTION PARALLEL TO EDGE
1/4	1 5/8	532	4	4	1.00	4	4	1.00	1.00
	2 1/2	650						1.00	
3/8	1 5/8	912	6	4	0.94	6	4	0.61	1.00
	3 1/4	952						0.70	
1/2	2 1/4	1476	8	4	0.88	8	4	0.50	1.00
	4 1/4	1959						0.40	
5/8	3 1/4	2432	10	4	0.62	10	4	0.36	1.00
	5	2731						0.34	
3/4	4	2432	12	4	0.36	12	4	0.36	1.00
	6 1/4	2731						0.34	

[1]Anchors shall be installed in base materials in compliance with Section 3.2 of this report.
[2]Embedment depth is measured from the outside surface of the concrete masonry unit.
[3]Refer to Section 5.3 of this report for modifying allowable loads in this table for anchors resisting short-term loads.
[4]Allowable loads are based on installation at critical spacing and edge distance. Load reduction factors are applicable at the minimum spacing and edge distance. Linear interpolation of reduction factors is allowed for spacings and edge distances between critical and minimum.
[5]Tabulated allowable loads for the IBC/IRC are based on a safety factor of 5.0.
[6]Special inspection must be provided in accordance with Section 4.3 of this report.

TABLE 5—ALLOWABLE TENSION AND SHEAR LOADS FOR KWIK HUS-EZ INSTALLED IN THE TOP OF GROUT-FILLED CONCRETE MASONRY CONSTRUCTION[1,3,4,5,6]

ANCHOR DIAMETER (INCHES)	MINIMUM EMBEDMENT DEPTH (INCHES)[2]	EDGE DISTANCE (INCHES)	MINIMUM SPACING (INCHES)	MINIMUM END DISTANCE (INCHES)	TENSION (POUNDS)	SHEAR (POUNDS)	
						LOAD DIRECTION	
						PARALLEL TO EDGE OF MASONRY WALL	PERPENDICULAR TO EDGE OF MASONRY WALL
1/2	4 1/4	1 3/4	8	8	540	885	245
5/8	5	1 3/4	10	10	1045	930	245

[1]Anchors shall be installed in base materials in compliance with Section 3.2 of this report.
[2]Embedment depth is measured from the outside surface of the concrete masonry unit.
[3]Refer to Section 5.3 of this report for modifying allowable loads in this table for anchors resisting short-term loads.
[4]See Figure 3 for details of anchor location in top of CMU wall. Additionally, anchors shall be installed with a minimum 4-inch distance to the head joint.
[5]Tabulated allowable loads for the IBC/IRC are based on a safety factor of 5.0.
[6]Special Inspection must be provided in accordance with Section 4.3 of this report.

Anchor Installation is Restricted to Shaded Areas

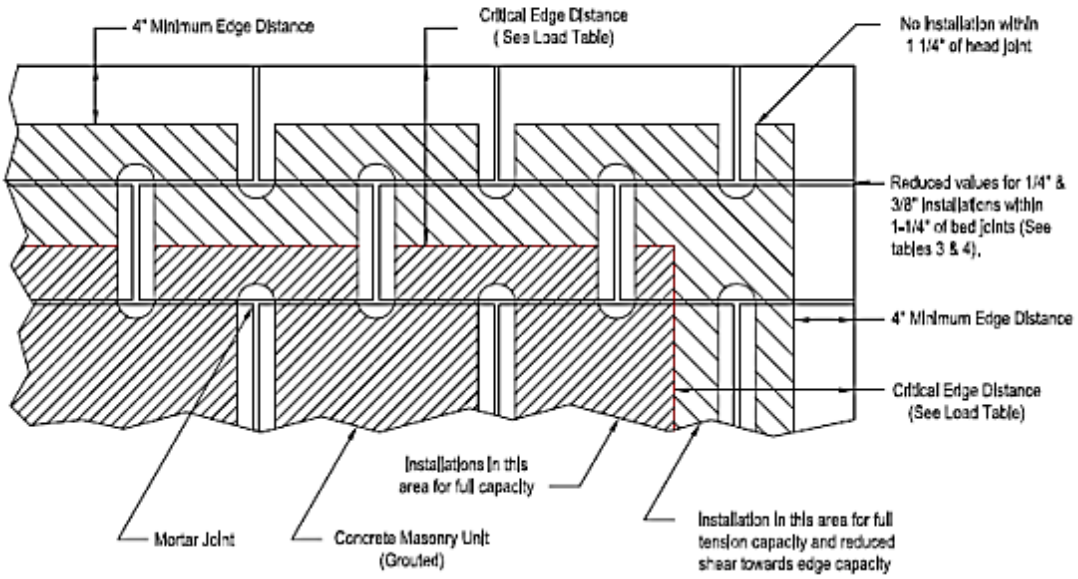

FIGURE 2—ACCEPTABLE LOCATIONS (SHADED AREAS) FOR HILTI KWIK HUS-EZ ANCHORS IN GROUT-FILLED CONCRETE MASONRY

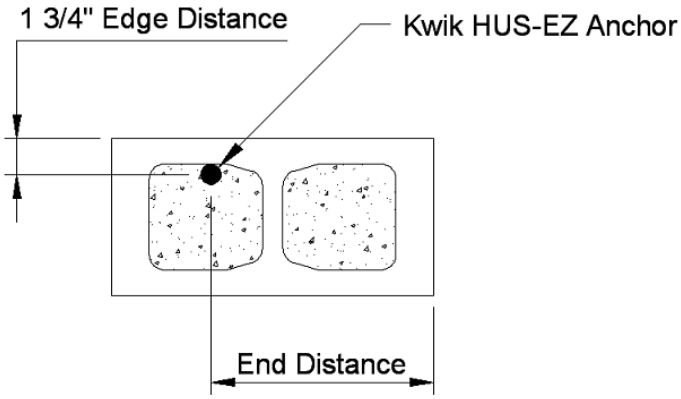

FIGURE 3—EDGE AND END DISTANCES FOR THE KWIK HUS-EZ ANCHORS INSTALLED IN THE TOP OF CMU MASONRY WALL CONSTRUCTION

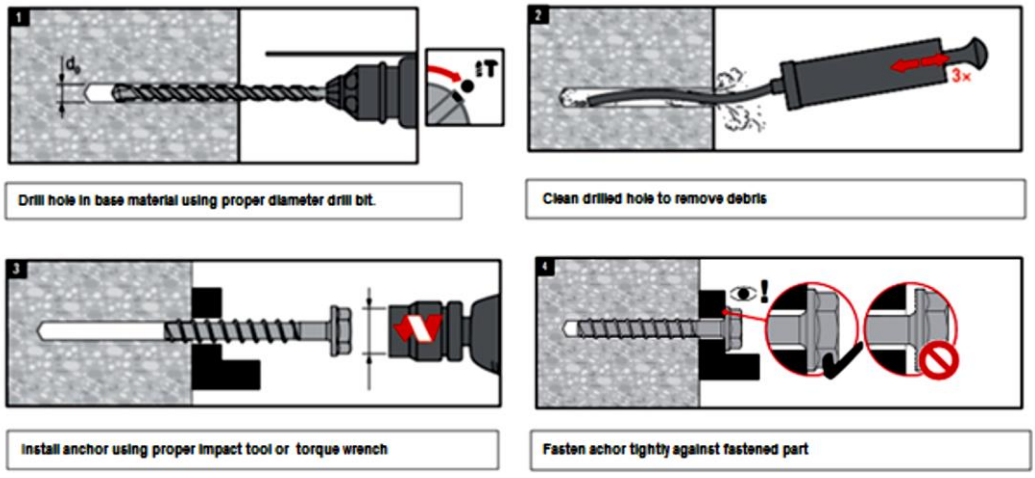

FIGURE 4—INSTALLATION INSTRUCTIONS – HILTI KWIK HUS-EZ (KH-EZ)