ICC-ES Evaluation Report

ESR-2302

Reissued December 2024

This report also contains:

- City of LA Supplement

Subject to renewal December 2025

- FL Supplement w/ HVHZ

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 KWIK BOLT 3 (KB3) CONCRETE ANCHORS**	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, and 2012 *International Building Code®* (IBC)
- 2021, 2018, 2015, and 2012 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

The Hilti Kwik Bolt 3 Concrete Anchor (KB3) is used as anchorage to resist static, wind and earthquake (Seismic Design Categories A and B only) tension and shear loads in uncracked normal-weight concrete and uncracked lightweight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

The anchoring system complies with anchors as described in Section 1901.3 of the 2021, 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. The anchors may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 KB3 Anchors:

The KB3 anchors are torque-controlled, mechanical expansion anchors. KB3 anchors consist of a stud (anchor body), expansion element (wedge), nut, and washer. The stud is manufactured from medium carbon steel complying with the manufacturer's quality documentation, or AISI Type 304 or 316 stainless steel materials.

The carbon steel anchors are available in diameters of $^1/_4$ inch through $^3/_4$ inch (6.4 mm through 19.1 mm) and an example is illustrated in Figure 1 of this report. Carbon steel KB3 anchors and components have a minimum 5-micrometer (0.0002 inch) zinc plating. The expansion elements (wedges) for the carbon steel anchors are made from carbon steel, except all $^1/_4$-inch (6.4 mm) anchors and the $^3/_4$-inch-by-12-inch (19.1 mm by 305 mm) anchor have expansion elements made from AISI Type 316 stainless steel.

The $^1/_2$-, $^5/_8$-, and $^3/_4$-inch-diameter (12.7 mm, 15.9 mm, and 19.1 mm) carbon steel KB3 anchors are also available with a hot-dip galvanized coating. The $^1/_2$- and $^3/_4$-inch-diameter (12.7 mm and 19.1 mm) anchors with hot-dip galvanized coating comply with ASTM A153. All hot-dip galvanized anchors use stainless steel expansion elements (wedges).

The stainless steel KB3 anchors are available in diameters of $^{1}/_{4}$ inch through 1 inch (6.4 mm through 25.4 mm) and have an anchor body in conformance with AISI Type 304 or 316. The expansion elements (wedges) of the AISI Type 304 anchors are in conformance with AISI Types 304 or 316 stainless steel. The expansion elements (wedges) of the AISI Type 316 anchors are in conformance with AISI Type 316 stainless steel.

The anchor body is comprised of a rod threaded at one end and with a tapered mandrel at the other end. The tapered mandrel is enclosed by a three-section expansion element which freely moves around the mandrel. The expansion element movement is restrained by the mandrel taper and by a collar. The anchor is installed in a predrilled hole with a hammer. When torque is applied to the nut of the installed anchor, the mandrel is drawn into the expansion element, which engages the wall of the drilled hole. Installation information and dimensions are set forth in Section 4.3 and Table 1 of this report.

3.2 Concrete:

Normal-weight concrete and lightweight concrete must comply with Section 1903 and 1905 of the IBC.

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

4.1.1 General: Design strength of anchors complying with the 2021, 2018 and 2015 IBC, as well as Section R301.1.3 of the 2021, 2018 and 2015 IRC must be determined in accordance with ACI 318 (-19 or -14) Chapter 17 and this report.

Design strength of anchors complying with the 2012 IBC, as well as Section R301.1.3 of the 2012 IRC must be determined in accordance with ACI 318-11 Appendix D and this report.

Design parameters and nomenclature provided in Tables 3, 4 and 5 of this report are based on the 2021 IBC (ACI 318-19), 2018 and 2015 IBC (ACI 318-14) and 2012 IBC (ACI 318-11), unless noted otherwise in Sections 4.1.1 through 4.1.11 of this report.

The strength design of anchors must comply with the requirements in ACI 318-19 17.5.1.2, ACI 318-14 17.3.1 or ACI 318-11 D.4.1, as applicable. Strength reduction factors ϕ as given in ACI 318-19 17.5.3, 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 and Section 5.3 of ACI 318 (-19 or -14) or Section 9.2 of ACI 318-11, 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 Appendix C of ACI 318-11. The value of f'_c used in calculations must be limited to a maximum of 8,000 psi (55.2 MPa), in accordance with ACI 318-19 17.3.1, ACI 318-14 17.2.7 or ACI 318-11 D.3.7.

4.1.2 Requirements for Static Steel Strength in Tension, N_{sa}: The nominal static steel strength of a single anchor in tension, N_{sa}, must be calculated in accordance with ACI 318-19 17.6.1.2, ACI 318-14 17.4.1.2 or ACI 318-11 D.5.1.2, as applicable. The resulting values of N_{sa} are described in Tables 3, 4 and 5 of this report. Strength reduction factors ϕ corresponding to ductile steel elements are appropriate for stainless steel and carbon steel elements.

4.1.3 Requirements for Static Concrete Breakout Strength in Tension, N_{cb} or N_{cbg}: The nominal static concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, respectively, must be calculated in accordance with ACI 318-19 17.6.2, ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, with modifications as described in this section. The values of f'_c must be limited to 8,000 psi (55.2 MPa) in accordance with ACI 318-19 17.3.1, ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable. The nominal concrete breakout strength in tension in regions of concrete where analysis indicates no cracking at service loads, must be calculated in accordance with ACI 318-19 17.6.2.5.1, ACI 318-14 17.4.2.6 or ACI 318-11 D.5.2.6, as applicable, with $\Psi_{c,N}$ = 1.0. The basic concrete breakout strength of a single anchor in tension, N_b, must be calculated in accordance with ACI 318-19 17.6.2.2, ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable, using the values of h_{ef} and k_{uncr} as given in Tables 3, 4 and 5 in lieu of h_{ef} and k_c, respectively.

4.1.4 Requirements for Static Pullout Strength in Tension, N_p: The nominal static pullout strength, $N_{p,uncr}$ of a single anchor installed in uncracked concrete (regions where analysis indicates no cracking in accordance with ACI 318-19 17.6.3.3, ACI 318-14 17.4.3.6 or ACI 318-11 D.5.3.6), where applicable, is given in Tables 3, 4 and 5 of this report. The nominal pullout strength in tension may be adjusted for concrete compressive strengths other than 2,500 psi according to the following equation:

$$N_{p,f'c} = N_{p,uncr}\sqrt{\frac{f'_c}{2,500}} \qquad \text{(lb, psi)} \qquad \text{(Eq-1)}$$

$$N_{p,f'c} = N_{p,uncr}\sqrt{\frac{f'_c}{17.2}} \qquad \text{(N, MPa)}$$

Where values for $N_{p,uncr}$ are not provided in Table 3, 4, or 5 of this report, the pullout strength in tension need not be evaluated.

4.1.5 Requirements for Static Steel Strength in Shear, V_{sa}: In lieu of the value of V_{sa} as given in ACI 318-19 17.7.1.2, ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable, the nominal static steel strength in shear of a single anchor given in Tables 3, 4 and 5 of this report must be used. Strength reduction factors ϕ corresponding to ductile steel elements are appropriate for stainless steel and carbon steel elements.

4.1.6 Requirements for Static Concrete Breakout Strength in Shear, V_{cb} or V_{cbg}: The nominal static concrete breakout strength of a single anchor or group of anchors, V_{cb} or V_{cbg}, respectively, must be calculated in accordance with ACI 318-19 17.7.2, ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, based on the values provided in Tables 3, 4 and 5 of this report. The basic concrete breakout strength of a single anchor in uncracked concrete, V_b, must be calculated in accordance with ACI 318-19 17.7.2.2.1, ACI 318-14 17.5.2.2 or ACI 318-11 D.6.2.2, as applicable, using the values given in Tables 3, 4 and 5. The value of l_e used in ACI 318-19 17.7.2.2.1, ACI 318-14 17.5.2.2 or ACI 318-11 D.6.2.2, as applicable, must be no greater than the lesser of h_{ef} or $8d_a$.

4.1.7 Requirements for Static Concrete Pryout Strength in Shear, V_{cp} or V_{cpg}: The nominal static concrete pryout strength of a single anchor or group of anchors, V_{cp} or V_{cpg}, respectively must be calculated in accordance with ACI 318-19 17.7.3, ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable, based on the values given in Tables 3, 4 and 5 of this report; the value of N_{cb} or N_{cbg} is as calculated in Section 4.1.3 of this report.

4.1.8 Requirements for Interaction of Tensile and Shear Forces: For anchors or groups of anchors that are subject to the effects of combined tensile and shear forces, the design must be determined in accordance with ACI 318-19 17.8, ACI 318-14 17.6 or ACI 318-11 D.7, as applicable.

4.1.9 Requirements for Critical Edge Distance: In applications where $c < c_{ac}$ 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, ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, must be further multiplied by the factor $\psi_{cp,N}$ given by the following equation:

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

where the factor $\psi_{cp,N}$ need not be taken as less than $\frac{1.5h_{ef}}{c_{ac}}$. For all other cases, $\psi_{cp,N} = 1.0$. In lieu of ACI 318-19 17.9.5, ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable, values of c_{ac} provided in Table 3 of this report must be used.

4.1.10 Requirements for Minimum Member Thickness, Minimum Anchor Spacing and Minimum Edge Distance: In lieu of ACI 318-19 17.9.2, ACI 318-14 17.7.1 and 17.7.3 or ACI 318-11 D.8.1 and D.8.3, respectively, as applicable, values of s_{min} and c_{min} as given in Tables 3, 4 and 5 of this report must be used. In lieu of ACI 318-19 17.9.4, ACI 318-14 17.7.5 or ACI 318-11 D.8.5, as applicable, minimum member thicknesses h_{min} as given in Tables 3, 4 and 5 of this report must be used. Additional combinations for minimum edge distance c_{min} and spacing s_{min} may be derived by linear interpolation between the given boundary values. (See Figure 5)

4.1.11 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 $\sqrt{f'_c}$ affecting N_n and V_n.

For ACI 318-19 (2021 IBC), ACI 318-14 (2018 and 2015 IBC) and ACI 318-11 (2012 IBC), λ shall be determined in accordance with the corresponding version of ACI 318.

4.2 Allowable Stress Design:

4.2.1 Design values for use with allowable stress design load combinations calculated in accordance with Section 1605.3 of the IBC, must be established using the equations below:

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

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

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 in accordance with ACI 318 (-19 and -14) Chapter 17 and 2021, 2018 and 2015 IBC Section 1905.1.8, ACI 318-11 Appendix D and Section 4.1 of this report, as applicable (lbf or N).

ϕVn = *Lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318 (-19 and -14) Chapter 17 and 2021, 2018 and 2015 IBC Section 1905.1.8, ACI 318-11 Appendix D, and Section 4.1 of this report, as applicable (lbf or N).*

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

The requirements for member thickness, edge distance and spacing, described in this report, must apply. An example of allowable stress design values for illustrative purposes is shown in Table 6.

4.2.2 Interaction of Tensile and Shear Forces: The interaction of tension and shear loads must be consistent with ACI 318-19 17.8, ACI 318-14 17.6 or ACI 318-11 D.7, as follows:

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

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

For all other cases:

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

4.3 Installation:

Installation parameters are provided in Table 1 and Figure 2. Anchor locations must comply with this report, and the plans and specifications approved by the code official. Anchors must be installed in accordance with the manufacturer's published installation instructions and this report. In case of conflict, this report governs. Embedment, spacing, edge distance, and concrete thickness are provided in Tables 3, 4 and 5 of this report. Holes must be drilled using carbide-tipped masonry drill bits complying with ANSI B212.15-1994 or using the Hilti SafeSet System™ with Hilti TE-YD or TE-CD Hollow Drill Bits complying with ANSI B212.15-1994 with a Hilti vacuum with a minimum value for the maximum volumetric flow rate of 129 CFM (61 ℓ/s). The nominal drill bit diameter must be equal to that of the anchor. The Hollow Drill Bits are not permitted for use with the $^1/_4$", $^3/_8$", or 1" KB3 anchors. The minimum drilled hole depth, h_0, is given in Table 1. When drilling dust is not removed after hole drilling, make sure to drill deep enough to achieve h_{nom}, taking into account the depth of debris remaining in the hole. If dust and debris is removed from the drilled hole with the Hilti TE-YD or TE-CD Hollow Drill Bits or compressed air or a manual pump, h_{nom}, is achieved at the specified value of h_0 noted in Table 1. The anchor must be hammered into the predrilled hole until at least four threads are below the fixture surface. The nut must be tightened against the washer until the torque value, T_{inst}, specified in Table 1, is achieved. The $^3/_8$-inch, $^1/_2$-inch, and $^5/_8$-inch-diameter KB3 carbon steel and stainless-steel anchors may be installed using the Hilti Safe-Set™ System consisting of the appropriate combination of Hilti Impact Wrench used together with the corresponding Hilti Adaptive Torque Module (See Figure 4) in accordance with the manufacturer's published installation instructions as shown in Figure 3.

4.4 Special Inspection:

Periodic special inspection is required in accordance with Section 1705.1.1 and Table 1705.3 of the 2021, 2018, 2015 and 2012 IBC, as applicable. The special inspector must make periodic inspections during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, drill bit type, hole dimensions, hole cleaning procedure, concrete member thickness, anchor embedment, anchor spacing, edge distances, anchor embedment, tightening torque and adherence to the manufacturer's printed installation instructions. The special inspector must be present as often as required in accordance with the "statement of special inspection." 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 Kwik Bolt 3 (KB3) anchors described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 KB3 anchor sizes, dimensions, minimum embedment depths, and other installation parameters are as set forth in this report.

5.2 The KB3 anchors must be installed in accordance with the manufacturer's (Hilti) published instructions and this report in uncracked normal-weight concrete and uncracked lightweight concrete having a specified compressive strength f'_c = 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa). In case of conflict between the manufacturer's instructions and this report, this report governs.

5.3 The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.2 MPa).

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

5.5 Strength design values are established in accordance with Section 4.1 of this report.

5.6 Allowable stress design values are established in accordance with Section 4.2 of this report.

5.7 Anchor spacing, edge distance and minimum member thickness must comply with Tables 3, 4 and 5 of this report.

5.8 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the code official for approval. 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.

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

5.10 Use of carbon steel anchors and hot-dipped 5/8-inch (15.9 mm) galvanized KB3 anchors is limited to dry, interior locations.

5.11 Use of KB3 anchors in structures assigned to Seismic Design Category C, D, E or F (IBC) is beyond the scope of this report. Anchors may be used to resist short-term loading due to wind forces, subject to the conditions of this report.

5.12 Special inspection must be provided in accordance with Section 4.4 of this report.

5.13 Where not otherwise prohibited in the code, KB3 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 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.

5.14 The anchors are manufactured by Hilti AG with quality-control inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC193), dated October 2017 (editorially revised December 2020), which incorporates requirements in ACI 355.2-19 and ACI 355.2-07, for use in cracked and uncracked concrete; and quality-control documentation.

7.0 IDENTIFICATION

7.1 The concrete anchors are identified in the field by their dimensional characteristics, size, and the length code stamped on the anchor, as indicated in Table 2. Packages are identified with the manufacturer's name (Hilti, Inc.) and address, anchor name, anchor size, and evaluation report number (ESR-2302).

7.2 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

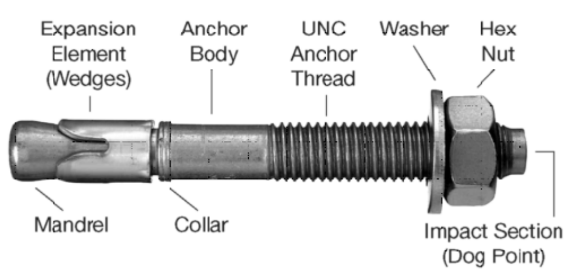


FIGURE 1—HILTI CARBON STEEL KWIK BOLT 3 (KB3)

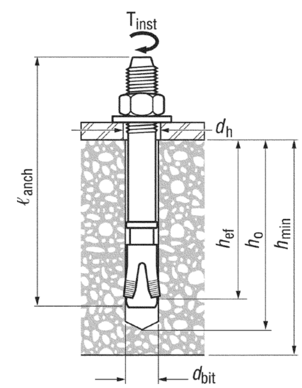
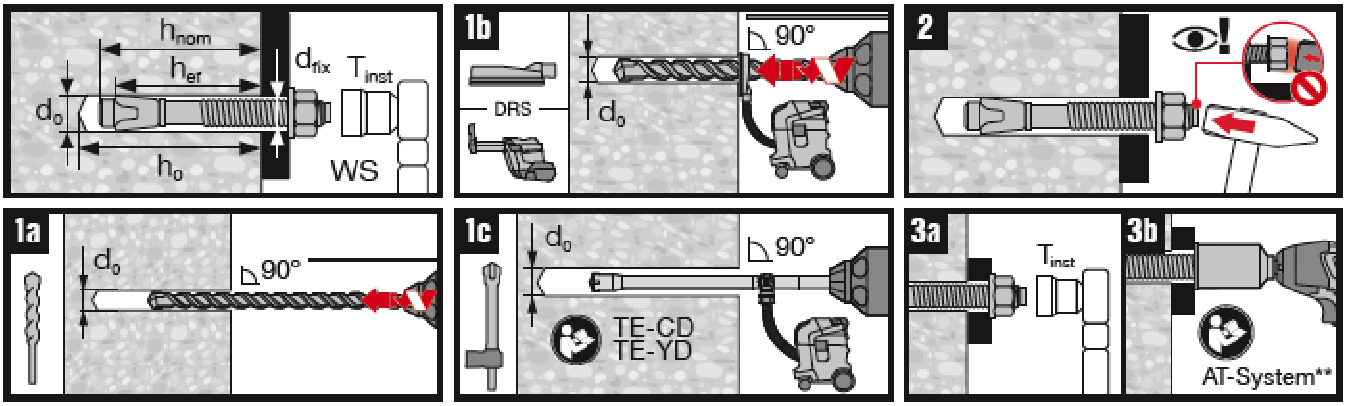


FIGURE 2—KB3 INSTALLED



Symbol	Symbol Description	Units	Anchor Diameter [inch]					
			¼	⅜	½	⅝	¾	1
HDB	Hollow Drill Bit	–	–	–	✔	✔	✔	–
DRS	Dust Removal Systems	–	✔	✔	✔	✔	✔	–
AT-System	SIW 6AT-A22 + SI AT-A22	–	–	✔	✔	✔	–	–
	SIW 4AT-22 + SI-AT-22	–	–	✔	✔	✔	–	–

FIGURE 3—INSTALLATION OF KB3 WITH HAND TORQUE WRENCH OR HILTI AT TOOL SYSTEM

Hilti SafeSet™ System with Hollow Drill Bit	 Hilti TE-CD or TE-YD Hollow Carbide Drill Bit with a Hilti Vacuum (per section 4.3)	
Hilti SafeSet™ System with the Adaptive Torque Tool	 Hilti SIW 4AT-22/SIW-6AT-A22 Impact Wrench with the Hilti SI-AT-22/SI-AT-A22 Adaptive Torque Module	
Hilti Dust Removal Systems	 **Hilti Rotary Hammer Drill with DRS (Dust Removal System) Module**	 **Hilti TE DRS-D Dust Removal System with Hilti Vacuum**

FIGURE 4—HILTI SYSTEM COMPONENTS

TABLE 1—INSTALLATION INFORMATION

Setting Information	Symbol		Nominal anchor diameter									
			1/4	3/8	1/2		5/8		3/4		1	
Anchor O.D.	d_o	in.	0.250	0.375	0.500		0.625		0.750		1.000	
		(mm)	(6.4)	(9.5)	(12.7)		(15.9)		(19.1)		(25.4)	
ANSI drill bit dia	d_{bit}	in.	1/4	3/8	1/2		5/8		3/4		1	
		(mm)	(6.4)	(9.5)	(12.7)		(15.9)		(19.1)		(25.4)	
Effective min. embedment	h_{ef}	in.	1 1/2	2	2	3 1/4	3 1/8	4	3 3/4	5	4	5 3/4
		(mm)	(38)	(51)	(51)	(83)	(79)	(102)	(95)	(127)	(102)	(146)
Min. hole depth	h_{hole}	in.	2	2 5/8	2 5/8	4	3 7/8	4 3/4	4 1/2	5 3/4	5	6 3/4
		(mm)	(51)	(67)	(67)	(102)	(98)	(121)	(114)	(146)	(127)	(171)
Installation torque	T_{inst}	ft-lb	4	20	40		60		110		150	
		(Nm)	(5)	(27)	(54)		(81)		(149)		(203)	
Expansion element clearance hole	d_h	in.	5/16	7/16	9/16		11/16		13/16		1 1/8	
		(mm)	(7.9)	(11.1)	(14.3)		(17.5)		(20.6)		(28.6)	

TABLE 2—LENGTH IDENTIFICATION SYSTEM

Length marking on the bolt head		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Length of anchor (in.)	From	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	11
	Up to but not including	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	11	12

TABLE 3—DESIGN INFORMATION CARBON STEEL KB3

DESIGN INFORMATION	Symbol	Units	Nominal anchor diameter												
			1/4	3/8		1/2				5/8			3/4		
Anchor O.D.	d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)		0.500 (12.7)				0.625 (15.9)			0.750 (19.1)		
Effective min. embedment[1]	h_{ef}	in. (mm)	1 1/2 (38)	2 (51)		2 (51)		3 1/4 (83)		3 1/8 (79)	4 (102)		3 3/4 (95)		5 (127)
Min. member thickness	h_{min}	in. (mm)	4 (102)	4 (102)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	6 (152)	8 (203)	8 (203)
Critical edge distance	c_{ac}	in. (mm)	2 3/4 (70)	4 1/2 (114)	3 7/8 (98)	4 7/8 (124)	3 5/8 (92)	6 3/4 (171)	5 5/8 (143)	7 1/2 (191)	9 1/2 (241)	7 1/2 (191)	9 3/4 (248)	7 1/2 (191)	9 1/2 (241)
Min. edge distance	c_{min}	in. (mm)	1 3/8 (35)	2 (51)	1 1/2 (38)	2 1/8 (54)	2 (51)	1 5/8 (41)	1 5/8 (41)	2 1/4 (57)	1 3/4 (44)	1 3/4 (44)	2 3/4 (70)	2 5/8 (67)	2 1/2 (64)
	for s ≥	in. (mm)	1 3/4 (44)	2 7/8 (73)	3 1/2 (89)	4 7/8 (124)	4 3/4 (121)	4 1/4 (108)	4 (102)	5 1/4 (133)	4 3/4 (121)	4 (102)	6 7/8 (175)	6 1/2 (165)	6 3/8 (162)
Min. anchor spacing	s_{min}	in. (mm)	1 1/4 (32)	1 3/4 (44)	1 3/4 (44)	2 1/2 (64)	2 1/4 (57)	2 (51)	1 7/8 (48)	2 3/8 (60)	2 1/8 (54)	2 1/8 (54)	3 3/4 (95)	3 3/8 (86)	3 1/4 (83)
	for c ≥	in. (mm)	1 5/8 (41)	2 3/8 (60)	2 3/8 (60)	2 5/8 (67)	2 3/8 (60)	2 1/4 (57)	2 (51)	3 1/8 (79)	2 3/8 (60)	2 1/4 (57)	3 3/4 (95)	3 3/8 (86)	3 3/8 (86)
Min. hole depth in concrete	h_{hole}	in. (mm)	2 (51)	2 5/8 (67)		2 5/8 (67)		4 (102)		3 7/8 (98)	4 3/4 (121)		4 1/2 (114)		5 3/4 (146)
Min. specified yield strength	f_{ya}	psi (N/mm^2)	84,800 (585)	84,800 (585)		84,800 (585)				84,800 (585)			84,800 (585)		
Min. specified ult. Strength	f_{uta}	psi (N/mm^2)	106,000 (731)	106,000 (731)		106,000 (731)				106,000 (731)			106,000 (731)		
Effective tensile stress area	A_{se}	in^2 (mm^2)	0.02 (12.9)	0.06 (38.7)		0.11 (71.0)				0.17 (109.7)			0.24 (154.8)		
Steel strength in tension	N_{sa}	lb (kN)	2,120 (9.4)	6,360 (28.3)		11,660 (51.9)				18,020 (80.2)			25,440 (113.2)		
Steel strength in shear	V_{sa}	lb (kN)	1,640 (7.3)	4,470 (19.9)		6,635 (29.5)		6,750 (30.0)		12,230 (54.4)			15,660 (69.7)		16,594 (73.8)
Pullout strength uncracked concrete[2]	$N_{p,uncr}$	lb (kN)	1,575 (7.0)	NA		NA		6,800 (30.2)		NA			NA		10,585 (47.1)
Anchor category[3]	*1,2 or 3*	-	1												
Effectiveness factor k_{uncr} uncracked concrete[4]	k_{uncr}	-	24												
Modification factor for uncracked concrete	$\Psi_{c,N}$	-	1.0												
Coefficient for pryout	k_{cp}	-	1.0					2.0							
Installation torque	T_{inst}	ft*lb (Nm)	4 (5)	20 (27)		40 (54)				60 (81)			110 (149)		
Axial stiffness in service load range	β_{uncr}	(lb/in)	116,150	162,850		203,500		191,100		222,150	170,700		207,400		164,000
COV β_{uncr}		%	60	42		29		29		25	21		19		24
Strength reduction factor ϕ for tension, steel failure modes[5]			0.75												
Strength reduction factor ϕ for shear, steel failure modes[5]			0.65												
Strength reduction factor ϕ for tension, concrete failure modes, Condition B[6]			0.65												
Strength reduction factor ϕ for shear, concrete failure modes, Condition B[6]			0.70												

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.45 N, 1 psi = 0.006895 Mpa. For **pound-in** units: 1 mm = 0.03937 inches.

[1]See Fig. 2

[2]See Section 4.1.4 of this report, NA (not applicable) denotes that this value does not govern for design.

[3]See ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable.

[4]See ACI 318-19 17.6.2.2, ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable.

[5]The carbon Steel KB3 is a ductile steel element as defined by ACI 318 (-19 or -14) 2.3 or ACI 318-11 D.1, as applicable.

[6]For use with the load combinations of ACI 318 (-19, -14) Section 5.3, ACI 318-11 Section 9.2 or IBC Section 1605.2, as applicable. Condition B applies where supplementary reinforcement in conformance with ACI 318-19 17.5.3, ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, is not provided, or where pull-out or pry out strength governs. For cases where the presence of supplementary reinforcement can be verified, the strength reduction factors associated with Condition A may be used.

TABLE 4—DESIGN INFORMATION STAINLESS STEEL KB3

DESIGN INFORMATION	Symbol	Units	Nominal anchor diameter														
			1/4	**3/8**		**1/2**				**5/8**			**3/4**			**1**	
Anchor O.D.	d_a	in.	0.25	0.375		0.500				0.625			0.750			1.000	
		(mm)	(6.4)	(9.5)		(12.7)				(15.9)			(19.1)			(25.4)	
Effective min. embedment[1]	h_{ef}	in.	1 1/2	2		2		3 1/4		3 1/8	4		3 3/4		5	4	5 3/4
		(mm)	(38)	(51)		(51)		(83)		(79)	(102)		(95)		(127)	(102)	(146)
Minimum member thickness	h_{min}	in.	4	4	5	4	6	6	8	5	6	8	6	8	8	8	10
		(mm)	(102)	(102)	(127)	(102)	(152)	(152)	(203)	(127)	(152)	(203)	(152)	(203)	(203)	(203)	(254)
Critical edge distance	c_{ac}	in.	3	4 3/8	3 7/8	4 7/8	4	6 3/4	5 3/4	7 3/8	9 1/2	7 1/2	10 1/2	9 1/4	9 3/4	10	11
		(mm)	(76)	(111)	(98)	(124)	(102)	(171)	(146)	(187)	(241)	(191)	(267)	(235)	(248)	(254)	(279)
Min. edge distance	c_{min}	in.	1 3/8	2	1 5/8	2 1/2	1 7/8	1 5/8	1 5/8	3 1/4	2 1/2	2 1/2	3 1/4	3	2 7/8	3 1/2	3
		(mm)	(35)	(51)	(41)	(64)	(48)	(41)	(41)	(83)	(64)	(64)	(83)	(76)	(73)	(89)	(76)
	for s ≥	in.	1 3/4	4	3 5/8	5	4 5/8	4 1/2	4 1/4	5 5/8	5 1/4	5	7	6 7/8	6 5/8	6 3/4	6 3/4
		(mm)	(44)	(102)	(92)	(127)	(117)	(114)	(108)	(143)	(133)	(127)	(178)	(175)	(168)	(172)	(172)
Min. anchor spacing	s_{min}	in.	1 1/4	2	1 3/4	2 1/2	2 1/4	2 1/8	1 7/8	3 1/8	2 1/8	2 1/8	4	3 1/2	3 1/2	5	4 3/4
		(mm)	(32)	(51)	(44)	(64)	(57)	(54)	(48)	(79)	(54)	(54)	(102)	(89)	(89)	(127)	(121)
	for c ≥	in.	1 5/8	3 1/4	2 1/2	2 7/8	2 3/8	2 3/8	2 1/8	3 7/8	3	2 3/4	4 1/8	3 3/4	3 3/4	4 1/4	3 3/4
		(mm)	(41)	(83)	(64)	(73)	(60)	(60)	(54)	(98)	(76)	(70)	(105)	(95)	(95)	(108)	(95)
Min. hole depth in concrete	h_{hole}	in.	2	2 5/8		2 5/8		4		3 7/8	4 3/4		4 1/2		5 3/4	5	6 3/4
		(mm)	(51)	(67)		(67)		(102)		(98)	(121)		(114)		(146)	(127)	(171)
Min. specified yield strength	f_{ya}	psi	92,000	92,000		92,000				92,000			76,000			76,000	
		(N/mm²)	(634)	(634)		(634)				(634)			(524)			(524)	
Min. specified ult. strength	f_{uta}	psi	115,000	115,000		115,000				115,000			90,000			90,000	
		(N/mm²)	(793)	(793)		(793)				(793)			(621)			(621)	
Effective tensile stress area	A_{se}	in²	0.02	0.06		0.11				0.17			0.24			0.47	
		(mm²)	(12.9)	(38.7)		(71.0)				(109.7)			(154.8)			(303.2)	
Steel strength in tension	N_{sa}	lb	2,300	6,900		12,650				19,550			21,600			42,311	
		(kN)	(10.2)	(30.7)		(56.3)				(87.0)			(96.1)			(188.2)	
Steel strength in shear	V_{sa}	lb	1,680	4,980		4,195		6,940		8,955	14,300		11,900		23,545	12,510	27,345
		(kN)	(7.5)	(22.2)		(18.7)		(30.9)		(39.8)	(63.6)		(52.9)		(104.7)	(55.6)	(121.6)
Pullout strength uncracked concrete[2]	$N_{p,uncr}$	lb	1,325	2,965		3,310		6,030		6,230	7,830		8,555		10,830	NA	15,550
		(kN)	(5.9)	(13.2)		(14.7)		(26.8)		(27.7)	(34.8)		(38.1)		(48.2)		(69.2)
Anchor category[3]	1,2 or 3	-	2	1													
Effectiveness factor for uncracked concrete[4]	k_{uncr}	-	24														
Modification factor for uncracked concrete	$\Psi_{c,N}$	-	1.0														
Coefficient for pryout	k_{cp}	-	1.0					2.0									
Installation torque	T_{inst}	ft*lb	4	20		40				60			110			150	
		(Nm)	(5)	(27)		(54)				(81)			(149)			(203)	
Axial stiffness in service load range	β_{uncr}	(lb/in)	57,400	158,300		154,150		77,625		227,600	189,200		275,600		187,000	126,400	174,800
COV β_{uncr}		%	40	34		36		17		31	22		35		21	38	22
Strength reduction factor ϕ for tension, steel failure modes[5]			0.75														
Strength reduction factor ϕ for shear, steel failure modes[5]			0.65														
Strength reduction factor ϕ for tension, concrete failure modes, Condition B[6]			0.55	0.65													
Strength reduction factor ϕ for shear, concrete failure modes, Condition B[6]			0.70														

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.45 N, 1 psi = 0.006895 MPa. For **pound-in** units: 1 mm = 0.03937 inches.

[1]See Fig. 2
[2]See Section 4.1.3 of this report, NA (not applicable) denotes that this value does not govern for design.
[3]See ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable.
[4]See ACI 318-19 17.6.2.2, ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable.
[5]The Stainless Steel KB3 is a ductile steel element as defined by ACI 318 (-19 or -14) 2.3 or ACI 318-11 D.1, as applicable.
[6]For use with the load combinations of ACI 318 (-19 or -14) Section 5.3, ACI 318-11 Section 9.2 or IBC Section 1605.2, as applicable. Condition B applies where supplementary reinforcement in conformance with ACI 318-19 17.5.3, ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, is not provided, or where pull-out or pry out strength governs. For cases where the presence of supplementary reinforcement can be verified, the strength reduction factors associated with Condition A may be used.

TABLE 5—DESIGN INFORMATION HOT-DIP GALVANIZED KB3

DESIGN INFORMATION	Symbol	Units	Nominal anchor diameter									
			$^{1}/_{2}$				$^{5}/_{8}$			$^{3}/_{4}$		
Anchor O.D.	d_a	in. (mm)	0.500 (12.7)				0.625 (15.9)			0.750 (19.1)		
Effective min. embedment[1]	h_{ef}	in. (mm)	2 (51)		$3^{1}/_{4}$ (83)		$3^{1}/_{8}$ (79)	4 (102)		$3^{3}/_{4}$ (95)		5 (127)
Min. member thickness	h_{min}	in. (mm)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	6 (152)	8 (203)	8 (203)
Critical edge distance	c_{cr}	in. (mm)	$4^{7}/_{8}$ (124)	$3^{5}/_{8}$ (92)	$7^{1}/_{2}$ (191)	$5^{3}/_{4}$ (146)	$7^{5}/_{8}$ (194)	$9^{1}/_{2}$ (241)	$7^{3}/_{4}$ (197)	$9^{3}/_{4}$ (248)	$7^{1}/_{2}$ (191)	$9^{1}/_{2}$ (241)
Min. edge distance	c_{min}	in. (mm)	$3^{1}/_{4}$ (83)	$2^{5}/_{8}$ (67)	2 (51)		$2^{1}/_{4}$ (57)	2 (51)	$1^{7}/_{8}$ (48)	$3^{1}/_{2}$ (89)		$3^{5}/_{8}$ (92)
	for $s \geq$	in. (mm)	$6^{1}/_{4}$ (159)	$5^{1}/_{2}$ (140)	$4^{7}/_{8}$ (124)		$5^{1}/_{4}$ (133)	5 (127)	$4^{3}/_{4}$ (121)	$7^{1}/_{2}$ (191)		$7^{3}/_{8}$ (187)
Min. anchor spacing	s_{min}	in. (mm)	$3^{1}/_{8}$ (79)	$2^{3}/_{4}$ (70)	$2^{3}/_{8}$ (60)	$2^{1}/_{8}$ (54)	$2^{1}/_{2}$ (64)	$2^{1}/_{8}$ (54)	$2^{1}/_{8}$ (54)	4 (102)		$3^{7}/_{8}$ (98)
	for $c \geq$	in. (mm)	$3^{3}/_{4}$ (95)	$2^{3}/_{4}$ (70)	$2^{5}/_{8}$ (67)	$2^{1}/_{4}$ (57)	$3^{1}/_{2}$ (89)	$2^{1}/_{2}$ (64)	$2^{1}/_{4}$ (57)	$6^{1}/_{2}$ (165)		$4^{3}/_{4}$ (121)
Min. hole depth in concrete	h_{hole}	in. (mm)	$2\,^{5}/_{8}$ (67)		4 (102)		$3^{7}/_{8}$ (98)	$4^{3}/_{4}$ (121)		$4^{1}/_{2}$ (114)		$5^{3}/_{4}$ (146)
Min. specified yield strength	f_{ya}	psi (N/mm^2)	84,800 (585)				84,800 (585)			84,800 (585)		
Min. specified ult. strength	f_{uta}	psi (N/mm^2)	106,000 (731)				106,000 (731)			106,000 (731)		
Effective tensile stress area	A_{se}	in^2 (mm^2)	0.11 (71.0)				0.17 (109.7)			0.24 (154.8)		
Steel strength in tension	N_{sa}	lb (kN)	11,660 (51.9)				18,020 (80.2)			25,440 (113.2)		
Steel strength in shear	V_{sa}	lb (kN)	4,500 (20.0)		5,870 (26.1)		11,635 (51.8)			17,000 (75.6)		
Pullout strength uncracked concrete[2]	$N_{p,uncr}$	lb (kN)	NA		6,540 (29.1)		6,465 (28.8)	9,017 (40.1)		NA		10,175 (45.3)
Anchor category[5]	1,2 or 3	-	1									
Effectiveness factor k_{uncr} uncracked concrete[4]	k_{uncr}	-	24									
Modification factor for uncracked concrete	$\Psi_{c,N}$	-	1.0									
Coefficient for pryout	k_{cp}	-	1.0		2.0							
Installation torque	T_{inst}	ft*lb (Nm)	40 (54)				60 (81)			110 (149)		
Axial stiffness in service load range	β_{uncr}	(Nm)	177,000		332,850		347,750	190,130		364,725		314,650
COV β_{uncr}		%	42		18		37	36		27		21
Strength reduction factor ϕ for tension, steel failure modes[5]			0.75									
Strength reduction factor ϕ for shear, steel failure modes[5]			0.65									
Strength reduction factor ϕ for tension, concrete failure modes, Condition B[8]			0.65									
Strength reduction factor ϕ for shear, concrete failure modes, Condition B[8]			0.70									

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.45 N, 1 psi = 0.006895 MPa. For **pound-in** units: 1 mm = 0.03937 inches.

[1]See Fig. 2

[2]See Section 4.1.4 of this report, NA (not applicable) denotes that this value does not govern for design.

[3]See ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable.

[4]See ACI 318-19 17.6.2.2, ACI 318-11 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable.

[5]The carbon Steel KB3 is a ductile steel element as defined by ACI 318 (-19 or -14) 2.3 or ACI 318-11 D.1, as applicable.

[6]For use with the load combinations of ACI 318 (-19 or -14) Section 5.3, ACI 318-11 Section 9.2 or IBC Section 1605.2, as applicable. Condition B applies where supplementary reinforcement in conformance with ACI 318-19 17.5.3, ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, is not provided, or where pull-out or pry out strength governs. For cases where the presence of supplementary reinforcement can be verified, the strength reduction factors associated with Condition A may be used.

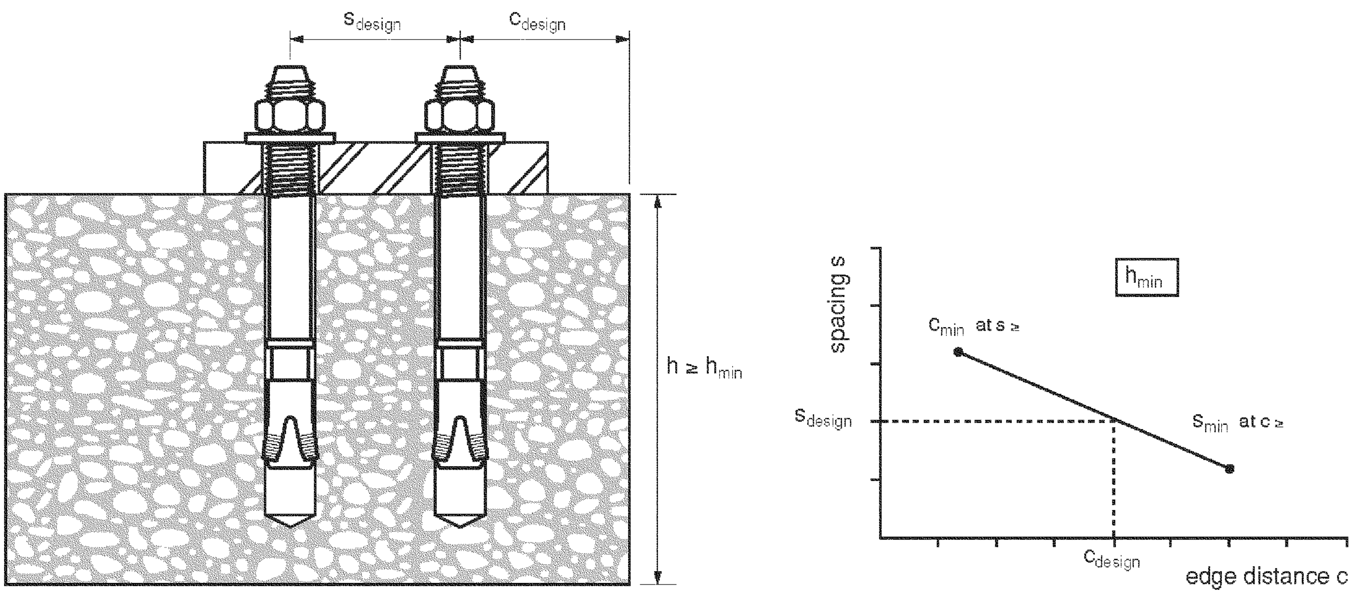


FIGURE 5—INTERPOLATION OF MINIMUM EDGE DISTANCE AND ANCHOR SPACING (SEE TABLES 3, 4 AND 5)

ICC-ES Evaluation Report

ESR-2302 City of LA Supplement

Reissued December 2024

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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 KWIK BOLT 3 (KB3) CONCRETE ANCHORS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Hilti KWIK BOLT 3 (KB3) concrete anchors, described in ICC-ES evaluation report ESR-2302, have also been evaluated for compliance with the codes noted below as adopted by Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2023 *City of Los Angeles Building Code* (LABC)
- 2023 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Hilti KWIK BOLT 3 (KB3) concrete anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-2302, comply with LABC Chapter 19, and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Hilti KWIK BOLT 3 (KB3) concrete anchors described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-2302.
- The design, installation, conditions of use and identification of the anchors are in accordance with the 2021 *International Building Code®* (IBC) provisions noted in the evaluation report ESR-2302.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, and City of Los Angeles Information Bulletin P/BC 2020-092, 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 anchors to the concrete. The connection between the anchors and the connected members shall be checked for capacity (which may govern).
- For the design of wall anchorage assemblies to flexible diaphragms, the anchor 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 December 2024.

ICC-ES Evaluation Report

ESR-2302 FL Supplement w/ HVHZ

Reissued December 2024

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DIVISION: 03 00 00—CONCRETE
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DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

HILTI, INC.

EVALUATION SUBJECT:

HILTI KWIK BOLT 3 (KB3) CONCRETE ANCHORS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Hilti Kwik Bolt 3 Concrete Anchor (KB3), decsribed in ICC-ES evaluation report ESR-2302, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2023 *Florida Building Code—Building*
- 2023 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Hilti Kwik Bolt 3 Concrete Anchors (KB3), described in Sections 2.0 through 7.0 of the evaluation report ESR-2302, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design requirements are determined in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2302 for the 2021 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable.

Use of the Hilti Kwik Bolt 3 Concrete Anchors (KB3) have also been found to be in compliance with the High-velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* with the following conditions:

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

b) For connection to aluminum members, all expansion anchors must be installed no less than 3 inches (76.2 mm) from the edge of concrete slab and/or footings. All expansion anchors shall develop an ultimate withdrawal resisting force equal to four times the imposed load, with no stress increase for duration of load.

For products falling under Florida Rule 61G20-3, 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 December 2024.