

ICC-ES Evaluation Report

ESR-4561 Issued December 2020

This report is subject to renewal December 2021.

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

REPORT HOLDER:

HILTI, INC.

EVALUATION SUBJECT:

KWIK BOLT TZ2 MASONRY ANCHORS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, and 2012 International Building Code[®] (IBC)
- 2018, 2015, and 2012 International Residential Code[®] (IRC)

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see ESR-4561 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

The Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors are used to resist static, wind, and seismic tension and shear loads in uncracked, fully grouted concrete masonry unit (CMU) construction. The anchor system is an alternative to castin-place anchors described in Section 8.1.3 (2016 and 2013 edition) or Section 2.1.4 (2011 or 2008 editions) of TMS 402/ ACI 530/ ASCE 5, as applicable, as referenced in Section 2107.1 of the IBC. The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 Kwik Bolt TZ2:

KB-TZ2 anchors are torque-controlled, mechanical expansion anchors. KB-TZ2 anchors consist of a stud (anchor body), wedge (expansion elements), nut, and washer. The anchor (carbon steel version) is illustrated in Figure 1. The stud is manufactured from carbon steel or AISI Type 304 or Type 316 stainless steel materials. Carbon steel KB-TZ2 anchors have a 5 μ m (0.0002 inch) zinc-nickel plating. The expansion elements for the carbon steel KB-TZ2 anchors are fabricated from carbon steel. The expansion elements of the stainless steel KB-TZ2 anchors are fabricated from steel KB-TZ2 anchors are fabricated from steel KB-TZ2 anchors are fabricated from steel. The hex nut for the carbon steel KB-TZ2 conforms to ASTM A563-04,

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Grade A, and the hex nut for the stainless steel KB-TZ2 conforms to ASTM F594.

The anchor body is comprised of a high-strength rod threaded at one end and a tapered mandrel at the other end. The tapered mandrel is enclosed by a three-section expansion element that freely moves around the mandrel. The expansion element movement is restrained by the mandrel taper at the bottom and by a collar at the top of the mandrel. 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 is in turn expanded against the wall of the drilled hole.

3.2 Fully Grouted CMU Masonry:

Fully grouted CMU masonry must comply with Chapter 21 of the IBC. The compressive strength of masonry must be at least 1,500 psi (10.3 MPa) at the time of anchor installation. The concrete masonry must be fully grouted and constructed from the following materials:

3.2.1 Concrete Masonry Units (CMUs): Fully grouted concrete masonry walls must be constructed from minimum Type I, Grade N, lightweight, medium-weight or normal-weight concrete masonry units (CMUs) conforming to ASTM C90 (IBC). The minimum allowable nominal size of the CMU is 8 inches (203 mm) wide by 8 inches (203 mm) high by 16 inches (406 mm) long.

3.2.2 Grout: The masonry units must be fully grouted with grout complying with Section 2103.3 of the 2018 and 2015 IBC, or Section 2103.13 of the 2012 IBC, Section R606.2.12 of the 2018 IRC, Section R606.2.11 of the 2015 IRC, or Section R609.1.1 of the 2012 IRC, 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 N, S or M, prepared in accordance with Section 2103.2.1 of the 2018 and 2015 IBC, Section 2103.9 of the 2012 IBC, Section R606.2.8 of the 2018 IRC, Section R606.2.7 of the 2015 IRC, or Section R607.1 of the 2012 IRC, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Design:

Minimum embedment depth, edge distance, and spacing requirements are provided in Tables 1A, 1B, 3, 4, and 5 of this report. Allowable stress design tension and shear loads are provided in Tables 3, 4 and 5. Allowable loads for Kwik Bolt TZ2 anchors subjected to combined shear and tension forces are determined by the following equation:

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$$\left(\frac{P_s}{P_t}\right)^{5/3} + \left(\frac{V_s}{V_t}\right)^{5/3} \le 1.0$$

where:

- Ps = 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 Table 1A, Table 1B, Figure 2 and Figure 4. Anchor locations must comply with this report and plans and specifications approved by the code official. The Hilti KB-TZ2 must be installed in accordance with manufacturer's published instructions and this report. In case of conflict, this report governs. Anchors must be installed in holes drilled into the masonry using carbide-tipped masonry drill bits complying with ANSI B212.15-1994. Nominal drill bit diameters must be equal to the nominal diameter of the anchors, and holes shall be drilled to a depth allowing proper embedment. It is permitted to utilize Hilti Dust Removal System (DRS) attachments to clean the drilling dust from the concrete surface while drilling. Anchors shall be driven into the hole using a hammer until the proper embedment depth is achieved. Nuts and washers shall be tightened against the base material or material to be fastened until the appropriate installation torque value specified in Table 1A or Table 1B of this report is achieved.

4.3 Special Inspection:

Special inspection under the IBC and IRC must be provided in accordance with Sections 1704 and 1705 of the IBC. Under the IBC, additional requirements as set forth in Sections 1705 and 1706 must be observed, where applicable. The code official must receive a report, from an approved special inspector, that includes the following details:

- 1. Anchor description, including the anchor product name, nominal anchor and bolt diameters, and anchor length.
- 2. Hole description, including verification of drill bit compliance with ANSI B212.15-1994.
- Installation description, including verification of masonry compressive strength and verification of anchor installation and location (spacing and edge distance) in accordance with Hilti's published installation instructions and this report.

5.0 CONDITIONS OF USE

The Kwik Bolt TZ2 Masonry 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** Anchor sizes, dimensions, and installation must comply with this report and Hilti's printed installation instructions (MPII). In case of conflict, this report governs.
- **5.2** Allowable tension and shear loads must be as noted in Tables 3, 4 and 5 of this report.
- **5.3** Calculations and details demonstrating compliance with this report must be submitted to the code official for approval.
- **5.4** The use of anchors must be limited to installation in uncracked fully grouted CMU masonry. Cracking

- **5.5** Design of Kwik Bolt TZ2 Masonry Anchors installed in fully grouted CMU masonry to resist dead, live, wind and seismic load applications must be in accordance with Section 4.1 of this report.
- **5.6** Where not otherwise prohibited in 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.
- **5.7** Use of carbon steel Kwik Bolt TZ2 anchors must be limited to dry, interior locations.
- **5.8** Use of stainless steel Kwik Bolt TZ2 anchors as specified in this report are permitted for exterior exposure and damp environments.
- **5.9** Special inspection must be provided in accordance with Section 4.3 of this report.
- 5.10 Anchors are manufactured by Hilti, Inc., under a quality control program with inspections conducted by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Expansion Anchors in Masonry Elements (AC01), approved March 2018, including seismic tests, reduced spacing tests and reduced edge distance tests.

7.0 IDENTIFICATION

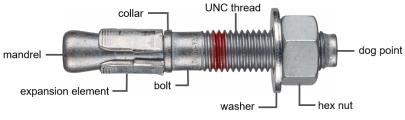
- **7.1** The anchors are identified by packaging labeled with the manufacturer's name (Hilti, Inc.) and contact information, anchor name, anchor size, and evaluation report number (ESR-4561). The anchors have the letters KB-TZ2 embossed on the on the anchor stud and a notch or multiple notches embossed into the anchor head. The letters are visible after installation for verification as depicted in Figure 3 of this report. The number of notches indicate the steel type as described in Figure 3. The letter system indicating length embossed on the head of the anchor is described in Table 2.
- **7.2** The report holder's contact information is the following:

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

Design	Symbol	Unito			No	minal anc	hor diamet	er (in.)			
information	Symbol	Units	¹ / ₄	3	/ ₈	1	/ ₂	5	/ ₈	³ / ₄	
Nominal bit diameter	d _{bit}	in.	¹ / ₄	³ / ₈		1	/ ₂	5	/ ₈	³ / ₄	
Effective min. embedment	h _{ef}	in. (mm)	1 ¹ / ₂ (38)	1 ¹ / ₂ (38)	2 ¹ / ₂ (64)	2 (51)	3 ¹ / ₄ (83)	2 ³ / ₄ (70)	4 (102)	3 ¹ / ₄ (83)	4 ³ / ₄ (121)
Nominal embedment	h _{nom}	in. (mm)	1 ³ / ₄ (44)	1 ⁷ / ₈ (48)	3 (76)	2 ¹ / ₂ (64)	3 ³ / ₄ (95)	3 ¹ / ₄ (83)	4 ¹ / ₂ (114)	4 (102)	5 ¹ / ₂ (140)
Min. hole depth	h₀	in. (mm)	2 (51)	2 (51)	3 ¹ / ₄ (83)	2 ³ / ₄ (70)	4 ¹ / ₄ (108)	3 ³ / ₄ (95)	4 ³ / ₄ (121)	4 ¹ / ₄ (108)	5 ³ / ₄ (146)
Installation torque Carbon Steel	Tinst	ft-lb (Nm)	4 (5.4)	15 (20.3)		25 (33.9)		30 (40.7)		50 (67.8)	
Installation torque Stainless Steel	Tinst	ft-lb (Nm)	6 (8.1)	15 (20.3)		25 (33.9)		35 (47.5)		50 (67.8)	
Min. dia. of hole in fastened part	d _h	in. (mm)	⁵ / ₁₆ (7.9)		16 . 1)		(₁₆ 1.3)		/ ₁₆ 7.5)		/ ₁₆).6)

TABLE 1—SETTING INFORMATION

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.36 Nm



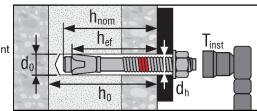


FIGURE 1—HILTI CARBON STEEL KWIK BOLT TZ (KB-TZ2)

FIGURE 2—HILTI KB-TZ2 INSTALLED

TABLE 2—LENGTH IDENTIFICATION SYSTEM (CARBON STEEL AND STAINLESS STEEL ANCHORS)

Stamp	on anchor	Α	в	С	D	Е	F	G	Н	I	J	к	L	М	Ν	0	Ρ	Q	R	S	т	U	۷	w
Length of	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	12	13	14	15
anchor (inches)	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	13	14	15	16

For **SI:** 1 inch = 25.4 mm.

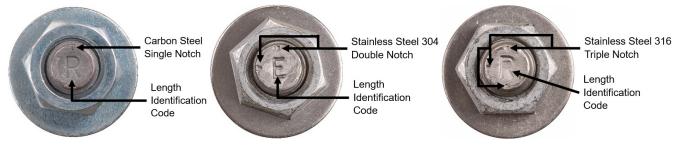


FIGURE 3—ANCHOR HEAD WITH LENGTH IDENTIFICATION CODE AND KB-TZ2 HEAD NOTCH EMBOSSMENT

TABLE 3—ALLOWABLE TENSILE LOADS FOR CARBON STEEL AND STAINLESS STEEL KB-TZ2 ANCHORS IN THE FACE OF GROUT-FILLED CONCRETE MASONRY WALLS ^{1,3,4,5,6}

			Allowable				Spac	ing			Edge Distance					
Nominal Anchor Diameter	Nominal Embedment		Tensile Capacity at S _{cr} and C _{cr}		Critical Spacing, S _{cr}		Minimum spacing, S _{min} ²		Load Multiplier at S _{min}	Critical Edge Distance, C _{cr}		Minimum Edge Distance, <i>C_{min}</i>		Load Multiplier at <i>C_{min}</i>		
	in.	(mm)	lb	(kN)	in	(mm)	in	(mm)		in	(mm)	in (mm)				
¹ / ₄	1 ³ / ₄	(44)	145	(0.6)	6	(152)	3	(76)	0.62	12	(305)			0.87		
³ / ₈	1 ⁷ / ₈	(48)	405	(1.8)	6	(152)			0.49					0.80		
-7 ₈	3	(76)	590	(2.6)	10	(254)			0.58					0.93		
¹ / ₂	2 ¹ / ₂	(64)	500	(2.2)	8	(203)	4		0.59					0.94		
12	3 ³ / ₄	(95)	640	(2.8)	13	(330)	4	(102)	0.78			4	(102)	1.00		
⁵ /8	31/4	(83)	890	(4.0)	11	(279)	Б	(127)	0.66	20				0.96		
/8	4 ¹ / ₂	(114)	940	(4.2)	16	(406)	5	5 (127) -	0.61		(508)			0.96		
³ / ₄	4	(102)	1,245	(5.5)	13	(330)	6	(152)	0.49		(508)			0.75		
3/4	5 ¹ / ₂	(140)	1,385	(6.2)	19	(483)	0		0.45					0.82		

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.45 N.

TABLE 4—ALLOWABLE SHEAR LOADS FOR CARBON STEEL AND STAINLESS STEEL KB-TZ2 ANCHORS IN THE FACE OF GROUT-FILLED CONCRETE MASONRY WALLS 1,3,4,5,6

	Nominal Embedment		Allowable Shear capacity at S _{cr} and C _{cr}				Spac	ing		Edge Distance							
Nominal Anchor Diameter					Critical spacing, S _{cr}		Minimum spacing, S _{min} ²		Load multiplier at S _{min}		al edge nce, C _{cr}	Minimum edge distance, <i>C_{min}</i>		Perpen- dicular load direction factor at	Parallel load direction factor at		
	in.	(mm)	lb	(kN)	in	(mm)	in	(mm)		in	(mm)	in	(mm)	C _{min}	C _{min}		
¹ / ₄	1 ³ / ₄	(44)	320	(1.4)	6	(152)								1.00	1.00		
³ /8	1 ⁷ /8	(48)	585	(2.6)	6	(152)	3	(76)				4	(102)	0.76	0.99		
/8	3	(76)	695	(3.1)	10	(254)				12	(305)			0.70	0.99		
¹ / ₂	2 ¹ / ₂	(64)	1,045	(47)	8	(203)	4	(102)						0.50	0.83		
12	3 ³ / ₄	(95)	1,045	(4.7)	13	(330)	4		0.73						0.03		
⁵ /8	3 ¹ / ₄	(83)	1,735	(7.7)	11	(279)	5	(107)						0.36	0.75		
-78	4 ¹ / ₂	(114)	2050	(9.1)	16	(406)	5	(127)		20	(509)			0.35	0.85		
3/	4	(102)	1,735	(7.7)	13	(330)	6	(152)		20	(508)			0.36	0.75		
³ / ₄	5 ¹ / ₂	(140)	2050	(9.1)	19	(483)	6							0.35	0.85		

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.45 N.

Footnotes for Table 3 and Table 4:

¹Values valid for anchors installed in face shells of Type 1, Grade N, lightweight, medium-weight, or normal-weight concrete masonry units conforming to ASTM C90. The masonry units must be fully grouted with coarse grout conforming to 2018 and 2015 IBC Section 2103.3, or 2012 IBC Section 2103.13. Mortar must comply with 2018 and 2015 IBC Section 2103.2.1, or 2012 IBC Section 2103.9. Masonry compressive strength must be at least 1,500 psi at the time of anchor installation.

²Loads tabulated are applicable to anchors spaced a critical distance of 4 times the effective embedment. The anchors maybe placed at a minimum spacing, s_{min}, provided that reductions are applied to the tabulated values.

³Anchors must be installed a minimum of 1³/₈ inches from any vertical mortar joint in accordance with Figure 4.

⁴Embedment depth must be measured from the outside face of the concrete masonry unit.

⁵For intermediate edge distances, allowable loads may be determined by linearly interpolating between the allowable loads at the two tabulated edge distances.

⁶ The tabulated allowable loads have been calculated based on a safety factor of 5.0.

TABLE 5—ALLOWABLE TENSILE AND SHEAR LOADS FOR CARBON AND STAINLESSSTEELKB-TZ2 ANCHORS IN THE TOP OF GROUT-FILLED CONCRETE MASONRY WALLS 1,3,4,5,6

	Nominal embedment		Minimum edge distance from edge of wall, C _{min}		Min	imum	Minim	um end		wable	Allowable shear capacity				
Nominal anchor diameter						ng, s _{min}		nce C _{end}		sile acity	Parallel to edge of masonry wall		Perpendicular to edge of masonry wall		
	in.	(mm)	in	(mm)	in	(mm)	in	(mm)	lb	(kN)	lb	(kN)	lb	(kN)	
³ /8	1 ⁷ / ₈	(48)			6	(152)	12	(305)	300	(1.3)	325	(1.4)	175	(0.8)	
78	3	(76)	1 ³ / ₄	(44)	10	(254)	12	(305)	395	(1.8)	475	(2.1)	220	(1.0)	
¹ / ₂	2 ¹ / ₂	(64)		(44)	8	(203)	12	(305)	385	(1.7)	500	(2.2)	195	(0.9)	
72	3 ³ / ₄	(95)			13	(330)	12	(305)	485	(2.2)	610	(2.7)	240	(1.1)	
⁵ /8	31/4	(83)	2 ³ /4	(70)	11	(279)	12	(305)	620	(2.8)	930	(4.1)	410	(1.8)	
-7 ₈	4 ¹ / ₂	(114)	∠%/4	(70)	16	(406)	12	(305)	865	(3.8)	1240	(5.5)	465	(2.1)	

For **SI:** 1 inch = 25.4 mm, 1 lb = 4.45 N

¹ Values valid for anchors installed in face shells of Type 1, Grade N, lightweight, medium-weight, or normal-weight concrete masonry units conforming to ASTM C90. The masonry units must be fully grouted with coarse grout conforming to 2018 and 2015 IBC Section 2103.3, or 2012 IBC Section 2103.13. Mortar must comply with 2018 and 2015 IBC Section 2103.2.1, or 2012 IBC Section 2103.9. Masonry compressive strength must be at least 1,500 psi at the time of anchor installation.

²Loads tabulated are applicable to anchors spaced a critical distance of 4 times the effective embedment. The anchors may be placed at a minimum spacing, s_{min}, provided that reductions are applied to the tabulated values.

³ Anchors must be installed a minimum of 1³/₈ inches from any head joint in accordance with Figure 5.

⁴ Embedment depth must be measured from the outside face of the concrete masonry unit.

⁵ For intermediate edge and spacing distances, allowable loads may be determined by linearly interpolating between the allowable loads at the two tabulated edge or spacing distances.

⁶ The tabulated allowable loads have been calculated based on a safety factor of 5.0.

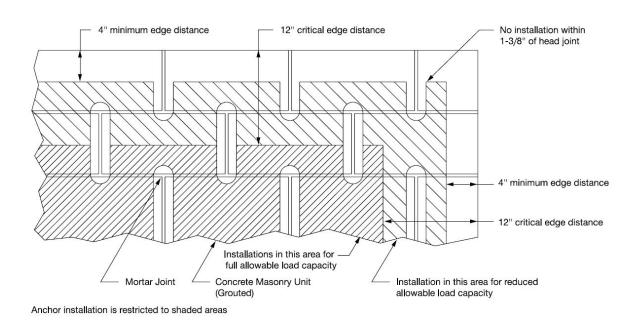


FIGURE 4—ACCEPTABLE INSTALATION LOCATIONS (SHADED AREAS) FOR KB-TZ2 ANCHORS IN GROUT-FILLED CONCRETE MASONRY CONSTRUCTION

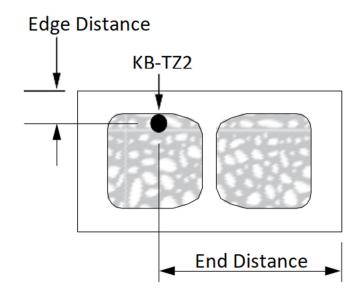


FIGURE 5—EDGE AND END DISTANCES FOR THE HILTI KB-TZ2 ANCHOR INSTALLED IN THE TOP OF CMU MASONRY WALL CONSTRUCTION

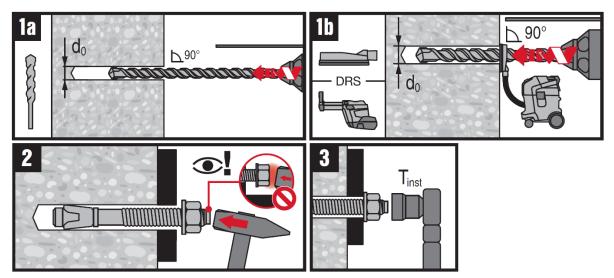


FIGURE 6-MANUFACTURERS PRINTED INSTALLATION INSTRUCTIONS



ICC-ES Evaluation Report

ESR-4561 LABC and LARC Supplement

Issued December 2020 This report is subject to renewal December 2021.

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HILTI, INC.

EVALUATION SUBJECT:

KWIK BOLT TZ2 MASONRY ANCHORS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in ICC-ES evaluation report <u>ESR-4561</u>, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2020 City of Los Angeles Building Code (LABC)
- 2020 City of Los Angeles Residential Code (LARC)

2.0 CONCLUSIONS

The Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in Sections 2.0 through 7.0 of the evaluation report <u>ESR-4561</u>, comply with LABC Chapter 21, and LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report <u>ESR-4561</u>.
- The design, installation, conditions of use and labeling of the Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors are in accordance with the 2018 *International Building Code*[®] (2018 IBC) provisions noted in the evaluation report <u>ESR-4561</u>.
- 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 design values listed in the evaluation report and tables are for the connection of the anchors to fully grouted masonry. The connection between the anchors and the connected members shall be checked for capacity (which may govern).
- For use in wall anchorage assemblies to flexible diaphragm applications, 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, issued December 2020.





ICC-ES Evaluation Report

ESR-4561 FBC Supplement

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Purpose:

The purpose of this evaluation report supplement is to indicate that the Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in ICC-ES evaluation report ESR-4561, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 and 2017 Florida Building Code—Building
- 2020 and 2017 Florida Building Code—Residential

2.0 CONCLUSIONS

The Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-4561, 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 the ICC-ES evaluation report ESR-4561 for the 2018 and 2015 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code® Code—Residential*, as applicable.

Use of the Kwik Bolt TZ2 (KB-TZ2) carbon steel and stainless steel masonry anchors 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 condition:

a) Design and installation must meet the requirements of Section 2122.7 of the Florida Building Code—Building.

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, issued December 2020.

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