

ICC-ES Evaluation Report

ESR-1385

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

REPORT HOLDER:

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EVALUATION SUBJECT:

KWIK BOLT 3 MASONRY ANCHORS

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 Kwik Bolt 3 (KB3) Masonry Anchor is used to resist static, wind, and earthquake tension and shear loads in uncracked, fully grouted concrete masonry unit (CMU) construction.

The anchor system is an alternative to cast-in-place anchors described in Section 8.1.3 (2013 edition), or Section 2.1.4 (2011, 2008, 2005 edition) of TMS 402/ ACI 530/ ASCE 5, as applicable, as referenced in Section 2107 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 3:

The Kwik Bolt 3 expansion anchors consist of a stud, wedge, nut, and washer. The stud is manufactured from carbon material. The carbon steel Kwik Bolt 3 anchors have a 5 µm (0.0002 inch) zinc plating. The anchor is illustrated in Figure 1 of this report.

The wedges for the carbon steel anchors are made from carbon steel, except for all 1/4-inch (6.4 mm) lengths, which have AISI 316 stainless steel wedges. All carbon steel components are zinc-plated. The stud consists of a high-strength rod threaded at one end. The standard Kwik Bolt 3 has a thread length equal to or less than three bolt diameters, while the Long Thread Kwik Bolt 3 has a thread length greater than three bolt diameters. The tapered mandrel has an increasing diameter toward the anchor base, and is enclosed by a three-section wedge that freely moves around the mandrel. In the vertical direction, the wedge movement is restrained by the mandrel taper at the bottom and by a collar at the top of the mandrel. When the anchor nut is tightened, the wedge is forced against the wall of the predrilled hole to provide anchorage.

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 2015 IBC, Section 2103.13 of the 2012 IBC, Section 2103.12 of the 2009 and 2006 IBC, or Section R606.2.11 of the 2015 IRC, or R609.1.1 of the 2012, 2009 and 2006 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 of the IBC, or Section R606.2.7 of the 2015 IRC, or R607.1 of the 2012, 2009 and 2006 IRC, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Design:

Minimum embedment depth, edge distance, and spacing requirements are set forth in Table 2. Allowable stress design tension and shear loads are as noted in Tables 2 and 3. Allowable loads for Kwik Bolt 3 anchors subjected to

combined shear and tension forces are determined by the following equation:

$$(P_s/P_t)^{5/3} + (V_s/V_t)^{5/3} \leq 1$$

where:

- P_s = Applied service tension load (lbf or N).
- P_t = Allowable service tension load (lbf or N).
- V_s = Applied service shear load (lbf or N).
- V_t = Allowable service shear load (lbf or N).

4.2 Installation Requirements:

Kwik Bolt 3 must be installed in holes drilled into the base material 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 drilled hole must exceed the depth of anchor embedment by at least one anchor diameter to permit over-driving of anchors and to provide a dust collection area. The anchor must be hammered into the predrilled hole until at least six threads are below the fixture surface. The nut must be tightened against the washer until the torque values specified in Table 1 are attained.

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.
3. 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 3 Masonry Anchors described in this report 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 Anchor sizes, dimensions, and installation must comply with this report and Hilti's published installation instructions.
- 5.2 Allowable tension and shear loads must be as noted in Tables 2 and 3 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 occurs when $f_t > f_r$ due to service loads or deformations.

5.5 Design of Kwik Bolt 3 Masonry Anchors installed in fully grouted CMU masonry to resist dead, live, wind and earthquake load applications must be in accordance with Section 4.1.

5.6 When using the basic load combinations in accordance with IBC Section 1605.3.1, allowable loads are not permitted to be increased for wind or earthquake loading. When using the alternative basic load combinations in 2009 and 2006 IBC Section 1605.3.2 that include wind or seismic loads, the allowable shear and tension loads for anchors are permitted to be increased by 33¹/₃ percent. Alternatively, the basic load combinations may be reduced by a factor of 0.75 when using 2009 and 2006 IBC Section 1605.3.2. For the 2015 and 2012 IBC, the allowable loads or load combinations may not be adjusted.

5.7 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.

5.8 Use of carbon steel Kwik Bolt 3 anchors must be limited to dry, interior locations.

5.9 Special inspection must be provided in accordance with Section 4.3 of this report.

5.10 Anchors are manufactured by Hilti, Inc., Feldkircherstrasse 100, Schaan, Liechtenstein; and Hilti Operaciones de Mexico S.A., Matamoros, Tamaulipas, Mexico, 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 November 2015, including seismic tests, reduced spacing tests and reduced edge distance tests.

7.0 IDENTIFICATION

The anchors must be identified in the field by dimensional characteristics and packaging. The packaging label indicates the manufacturer's name (Hilti, Inc.) and address, the size and type of anchor, and the ICC-ES report number (ESR-1385). A length identification code letter is stamped on the threaded end of the bolt. The length identification system is described in Table 4.

TABLE 1—INSTALLATION SPECIFICATIONS¹

| SETTING DETAILS | | ANCHOR SIZE | | | | | | | | | |
|--|------------------------------|---|-------|----------|-------|----------|-------|----------|----|----------|----|
| | | 1/4 inch | | 3/8 inch | | 1/2 inch | | 5/8 inch | | 3/4 inch | |
| Drill bit size = anchor diameter (inches) | | 1/4 | | 3/8 | | 1/2 | | 5/8 | | 3/4 | |
| Wedge clearance hole (inches) | | 5/16 | | 7/16 | | 9/16 | | 11/16 | | 13/16 | |
| Anchor length (min./max.) (inches) | | 1 1/4 | 4 1/2 | 2 1/8 | 7 | 2 3/4 | 7 | 3 1/2 | 10 | 6 | 12 |
| Thread length std./long thread length (inches) | | 3/4 | 3 | 7/8 | 5 5/8 | 1 1/4 | 4 3/4 | 1 1/2 | 7 | 1 1/2 | 6 |
| Installation: Torque guide values (ft-lb) in concrete masonry | Carbon steel: Min. Embedment | 4 | | 15 | | 25 | | 65 | | 120 | |
| | Carbon steel: Std. Embedment | 4 | | 15 | | 25 | | 65 | | 120 | |
| Min. base material thickness (inches) | | 3 inches or 1.5 × embedment depth, whichever is greater | | | | | | | | | |

For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

¹Installation torques are applicable for all anchors installations unless noted otherwise in this report.

TABLE 2—ALLOWABLE TENSION AND SHEAR VALUES FOR HILTI KWIK BOLT 3 CARBON STEEL ANCHORS INSTALLED IN THE FACE SHELLS OF FULLY GROUTED CMU MASONRY WALLS (in pounds)^{1,2,3,4}

| ANCHOR DIAMETER (inch) | EMBEDMENT DEPTH ⁵ (inches) | MINIMUM DISTANCE FROM EDGE OF WALL ⁶ (inches) | TENSION | SHEAR |
|------------------------|---------------------------------------|--|---------|---------|
| | | | IBC/IRC | IBC/IRC |
| 1/4 | 1 1/8 | 4 | 121 | 304 |
| | | 12 | 121 | 304 |
| | 2 | 4 | 432 | 342 |
| | | 12 | 432 | 342 |
| 3/8 | 1 5/8 | 4 | 257 | 589 |
| | | 12 | 273 | 751 |
| | 2 1/2 | 4 | 626 | 764 |
| | | 12 | 626 | 1,054 |
| 1/2 | 2 1/4 | 4 | 502 | 664 |
| | | 12 | 533 | 1,171 |
| | 3 1/2 | 4 | 724 | 840 |
| | | 12 | 724 | 1,853 |
| 5/8 | 2 3/4 | 4 | 651 | 710 |
| | | 12 | 692 | 1,732 |
| | 4 | 4 | 994 | 743 |
| | | 12 | 1,035 | 2,123 |
| 3/4 | 3 1/4 | 4 | 829 | 627 |
| | | 12 | 829 | 2,508 |
| | 4 3/8 | 4 | 1,316 | 657 |
| | | 12 | 1,368 | 2,627 |

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

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 2103.3 of the 2015 IBC, or 2012 IBC Section 2103.13, or 2009 and 2006 IBC Section 2103.12, as applicable. Mortar must comply with Section 2103 of the IBC. Masonry compressive strength must be at least 1,500 psi at the time of anchor installation.

²Anchors must be installed a minimum of 1 3/8 inches from any vertical mortar joint in accordance with Figure 2.

³Anchor locations are limited to one per masonry cell with a minimum spacing of 8 inches on center.

⁴Allowable loads or applied loads may be modified in accordance with Section 5.6 of this report for the 2009 and 2006 IBC, due to short-term wind or seismic loads.

⁵Embedment depth must be measured from the outside face of the concrete masonry unit.

⁶For intermediate edge distances, allowable loads may be determined by linearly interpolating between the allowable loads at the two tabulated edge distances.

TABLE 3—ALLOWABLE TENSION AND SHEAR VALUES FOR HILTI KWIK BOLT 3 CARBON STEEL ANCHORS INSTALLED IN TOP OF FULLY GROUTED CMU MASONRY WALLS (in pounds)^{1,2,3,4}

| ANCHOR DIAMETER (inch) | EMBEDMENT DEPTH ⁵ (inches) | TENSION | SHEAR | |
|------------------------|---------------------------------------|---------|-----------------------|------------------|
| | | | Perpendicular to Wall | Parallel to Wall |
| | | IBC/IRC | IBC/IRC | IBC/IRC |
| 1/2 | 3 | 517 | 249 | 491 |
| 5/8 | 3 1/2 | 682 | 249 | 491 |

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

¹Values valid for anchors installed into top cells 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 2103.3 of the 2015 IBC, or 2012 IBC Section 2103.13, or 2009 and 2006 IBC Section 2103.12, as applicable. Mortar must comply with Section 2103 of the IBC. Masonry compressive strength must be at least 1,500 psi at the time of anchor installation.

²Anchors must be installed a minimum of 1 3/4 inches from edge of the block.

³Anchor locations must be limited to one per masonry cell with a minimum spacing of 8 inches on center.

⁴Allowable loads or applied loads may be modified in accordance with Section 5.6 of this report for the 2009 and 2006 IBC, due to short-term wind or seismic loads.

⁵Embedment depth is measured from the top edge of the concrete masonry unit.

TABLE 4—LENGTH IDENTIFICATION CODES

| STAMP ON ANCHOR | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
|---------------------------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|----|----|----|----|----|----|----|----|
| Length of Anchor (inches) | 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 | 16 | 17 | 18 |
| 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 | 17 | 18 | 18 |

For SI: 1 inch = 25.4 mm.

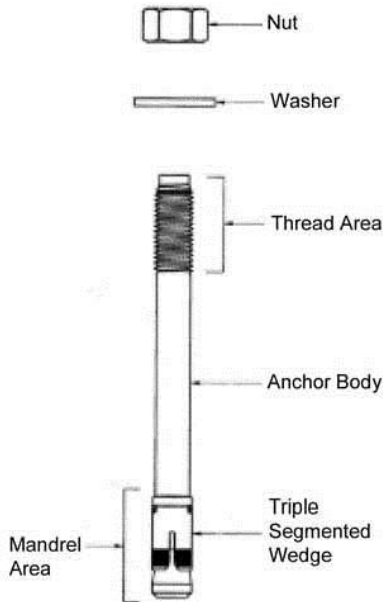


FIGURE 1—KWIK BOLT 3

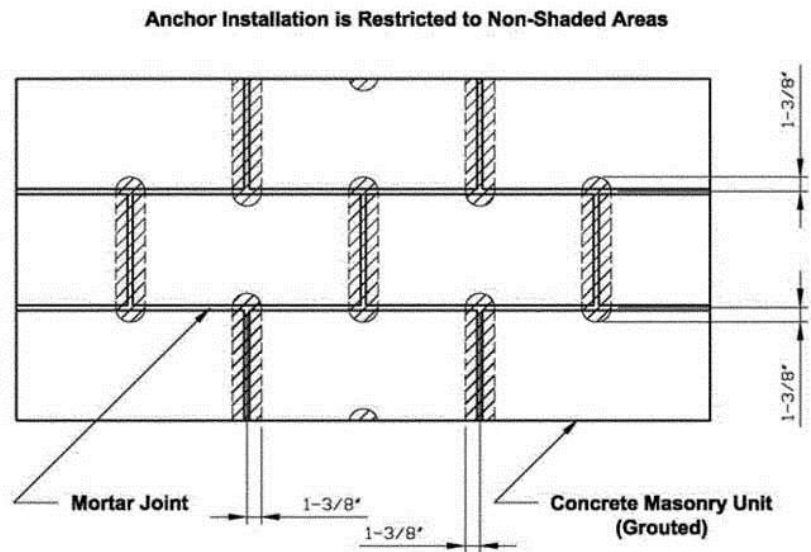


FIGURE 2—ACCEPTANCE LOCATIONS (NON-SHADED AREAS) FOR HILTI KWIK BOLT 3 ANCHORS IN GROUT-FILLED CONCRETE MASONRY ANCHORS