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ESR-2379

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DIVISION: 03 00 00—CONCRETE
SECTION: 03 16 00—CONCRETE ANCHORS

REPORT HOLDER:

HILTI, INC.

**7250 DALLAS PARKWAY, SUITE 1000
PLANO, TEXAS 75024**

EVALUATION SUBJECT:

EXTERIOR OR PERIMETER SILL AND INTERIOR PLATE ANCHORAGES



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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors
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EVALUATION SUBJECT:
EXTERIOR OR PERIMETER SILL AND INTERIOR PLATE ANCHORAGES
1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code*® (IBC)
- 2015, 2012 and 2009 *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 exterior or perimeter sill and interior plate anchorages described in this report are used as alternatives to the cast-in-place anchors described in 2015 IBC Section 2308.3.1 (2012 and 2009 IBC Section 2308.6) and IRC Section R403.1.6 for the anchorage of wood sill plates to normalweight concrete foundations. The fasteners may be used under the IRC when an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION
3.1 Fasteners:

The Hilti exterior or perimeter sill and interior plate anchorages are powder-actuated fasteners (PAFs) with premounted steel washers. The X-CF 72 fasteners and premounted washers are manufactured from carbon steel complying with SAE J403 Grade 1060 or modified Grade 1070, with an electro-deposited zinc coating complying

with ASTM B633 SC 1, Type III. The X-CP 72 fasteners and premounted washers are manufactured from carbon steel complying with SAE J403 Grade 1060 or modified Grade 1070, and are mechanically galvanized in accordance with ASTM B695 Type I, minimum Class 55. See Figures 1 and 2 for depictions of the fasteners.

3.2 Concrete:

Normalweight concrete must conform to IBC Chapter 19 or IRC Section R402.2, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in the tables of this report.

3.3 Sill Plates:

The sill plates must be nominally 2-inch-thick lumber that is naturally durable in accordance with 2015 and 2012 IBC Section 202 (2009 IBC Section 2302) and IRC Section R202; or preservative-treated in accordance with 2015 IBC Section 2303.1.9 (2012 and 2009 IBC Section 2303.1.8) or IRC Section R317.1, as applicable.

4.0 DESIGN AND INSTALLATION
4.1 Design:

The Hilti fasteners may be used to attach wood sill plates to concrete for structural walls in Seismic Design Categories A and B. Allowable shear and tension loads for the fasteners are provided in Table 1. Bearing area and thickness of the washers are also given in Table 1. For shear loads, spacing of fasteners must be determined based on the lesser of the allowable shear load from Table 1 and the allowable load based on the fastener/wood sill plate/concrete foundation interaction, determined in accordance with the ANSI/AWC National Design Specification (NDS) for Wood Construction, with a fastener bending yield strength, $F_{yb} = 90,000$ psi (621 MPa) and a concrete dowel bearing strength, $F_e = 7,500$ psi (52 MPa). For tension loads, spacing of fasteners must be determined based on the lesser of the allowable tension load from Table 1 and the pull-through capacity of the fastener with respect to the wood sill plate, determined in accordance with Section 3.10 of the NDS, using the washer bearing area from Table 1.

For fasteners subjected to both tension and shear loads, compliance with the following interaction equation must be verified:

$$(p/P_a) + (v/V_a) \leq 1.0$$

where:

- p = Actual applied tension load on fastener, lbf (N).
- P_a = Allowable tension load on fastener, lbf (N).

v = Actual applied shear load on fastener, lbf (N).

V_a = Allowable shear load on fastener, lbf (N).

Hilti fasteners listed in Table 2 may be used to attach wood sill plates to concrete for interior, nonstructural walls [maximum horizontal transverse load on the walls must not exceed 5 psf (0.24 kN/m²)] in Seismic Design Categories A through F, when installed as described in Table 2.

4.2 Installation:

The fasteners must be installed in accordance with this report and the Hilti, Inc., published installation instructions. A copy of the instructions must be available on the jobsite at all times during installation.

Installation of the X-CF 72 and X-CP 72 fasteners is limited to dry, interior locations. The X-CP 72 fasteners may be installed in preservative-treated lumber complying with 2015 IBC Section 2303.1.9 (2012 and 2009 IBC Section 2303.1.8) or IRC Section R317, as applicable. The X-CF 72 fasteners may be used to attach naturally durable wood to concrete or to attach fire-retardant-treated wood to concrete in accordance with 2015 IBC Section 2304.10.5.4 (2012 and 2009 IBC Section 2304.9.5.4) and Hilti's recommendations. Fastener placement requires the use of a low-velocity, powder-actuated tool in accordance with the manufacturer's recommendations.

The concrete must attain a minimum compressive strength of 2,000 psi (13.8 MPa) prior to installation of the fasteners. The fasteners must be installed through the sill plate. Minimum concrete edge distance is 1³/₄ inches (44 mm). Concrete thickness must be a minimum of 4¹/₂ inches (114 mm).

5.0 CONDITIONS OF USE

The exterior or perimeter sill and interior plate anchorages 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 The fasteners are manufactured and identified in accordance with this report.
- 5.2 Fastener installation complies with this report and the Hilti, Inc., instructions. In the event of a conflict between this report and the Hilti, Inc., published instructions, this report governs.
- 5.3 Calculations demonstrating that the applied loads are less than the allowable loads described in Section 4.1

must be submitted to the code official for approval. These calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is constructed. **Exception:** Fasteners used in nonstructural walls in accordance with Table 2.

- 5.4 The fasteners may be used to attach wood sill plates to concrete for structural walls in Seismic Design Categories A and B. The fasteners may be used to attach wood sill plates to concrete for interior, nonstructural walls in Seismic Design Categories A through F.
- 5.5 The use of fasteners is limited to installation in uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 5.6 The minimum concrete thickness must be 4¹/₂ inches (114 mm).
- 5.7 Installation is limited to dry, interior locations, which include exterior walls which are protected by an exterior wall envelope.
- 5.8 Installation must comply with Section 4.2 regarding fasteners in contact with preservative-treated and fire-retardant-treated wood.
- 5.9 The fasteners must be installed by personnel certified by Hilti, Inc., and having a current, Hilti-issued operator's license.
- 5.10 The Hilti products addressed in this report are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements (AC70), dated February 2016.

7.0 IDENTIFICATION

Each package of fasteners is identified with the manufacturer's name (Hilti), the fastener type and size, and the evaluation report number (ESR-2379). Additionally, an "H" is imprinted on the fastener heads, as shown in Figures 1 and 2. Furthermore, each fastener type has a unique alphanumeric code as well as the name "HILTI" stamped on the premounted washer. Refer to Figures 3 and 4 for depictions of the premounted washers.

TABLE 1—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO MINIMUM 2,000 psi NORMALWEIGHT CONCRETE^{1,2}

FASTENER TYPE	SHANK LENGTH (inches)	SHANK DIAMETER (inch)	WASHER THICKNESS (inch)	WASHER BEARING AREA (in ²)	EMBEDMENT	CONCRETE EDGE DISTANCE (inches)	TENSION (lbf)	SHEAR (lbf)
X-CF 72	2 ⁷ / ₈	0.145	0.059	0.543	Washer bearing on sill plate	≥ 3	130	210
						1 ³ / ₄	130	165
X-CP 72	2 ⁷ / ₈	0.145	0.059	0.527	Washer bearing on sill plate	≥ 3	175	250
						1 ³ / ₄	150	105

For **SI**: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lbf = 4.4 N.

¹Wood members connected to the substrate must be investigated for compliance with the applicable code in accordance with referenced design criteria, for both lateral resistance and fastener pull-through.

²The concrete base material must have a minimum compressive strength of 2,000 psi (13.8 MPa) at the time of fastener installation. Concrete must have a minimum compressive strength at 28 days (*f_c*) of 2,500 psi (17.2 MPa) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].

TABLE 2—FASTENER SPACING FOR WOOD SILL PLATE ANCHORAGE OF INTERIOR NONSTRUCTURAL WALLS^{1,2,3,4,5,6,7}

FASTENER TYPE	SHANK LENGTH (inches)	SHANK DIAMETER (inch)	EMBEDMENT	CONCRETE EDGE DISTANCE (inches)	MAXIMUM FASTENER SPACING (ft.)	MAXIMUM WALL HEIGHT (ft.)
X-CF 72	2 ⁷ / ₈	0.145	Washer bearing on sill plate	≥ 3	3	14
				1 ³ / ₄	3	14
X-CP 72	2 ⁷ / ₈	0.145	Washer bearing on sill plate	≥ 3	3	14
				1 ³ / ₄	2	14

For **SI**: 1 inch = 25.4 mm, 1 foot = 305 mm.

¹Spacings noted above apply to normalweight concrete having a minimum compressive strength of 2,000 psi (13.8 MPa) at the time of fastener installation. Concrete must have a minimum compressive strength at 28 days (*f_c*) of 2,500 psi (17.2 MPa) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].

²Interior nonstructural walls are limited to locations where bearing walls, shear walls or braced walls are not required by the approved plans. Maximum horizontal transverse load on the walls must not exceed 5 psf (0.24 kN/m²).

³Fasteners must be driven into the center of the sill plate with a minimum concrete edge distance as shown in the table.

⁴Walls must have fasteners placed at 6 inches from ends of sill plates with maximum spacing between, as shown in this table.

⁵Walls must be laterally supported at the top and the bottom.

⁶Sill or bottom plates must comply with IBC Section 2304.1 and be of lumber with a specific gravity of 0.50 or greater.

⁷Minimum fastener spacing must be 4 inches on center or shall comply with Section 12.1.6 of the 2015 NDS (Section 11.1.6 of NDS-12 for the 2012 IBC, Section 11.1.5 of NDS-05 for the 2009 IBC) to prevent splitting of the wood.



FIGURE 1—HILTI X-CF SILL PLATE FASTENER



FIGURE 2—HILTI X-CP SILL PLATE FASTENER



FIGURE 3—HILTI X-CF WASHER



FIGURE 4—HILTI X-CP WASHER

ICC-ES Evaluation Report**ESR-2379 FBC Supplement**

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Section: 03 16 00—Concrete Anchors**REPORT HOLDER:****HILTI, INC.**
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www.us.hilti.com
HNATechnicalServices@hilti.com**EVALUATION SUBJECT:****EXTERIOR OR PERIMETER SILL AND INTERIOR PLATE ANCHORAGES****1.0 REPORT PURPOSE AND SCOPE****Purpose:**

The purpose of this evaluation report supplement is to indicate that the Hilti Exterior or Perimeter Sill and Interior Plate Anchorages, recognized in ICC-ES master report ESR-2379, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2014 *Florida Building Code—Building*
- 2014 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Exterior or Perimeter Sill and Interior Plate Anchorages described in Sections 2.0 through 7.0 of the master report ESR-2379, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design and installation are in accordance with the 2012 *International Building Code*® provisions noted in the master evaluation report, and the following additional conditions apply:

- Design wind loads must be based on Section 1609 of the *Florida Building Code—Building* or Section R301.2.1 of the *Florida Building Code—Residential*, as applicable.
- Load combinations must be in accordance with Section 1605.2 or Section 1605.3 of the *Florida Building Code—Building*, as applicable.

Use of the Hilti fasteners has 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* under the following conditions:

- Design wind loads must be based on Section 1620 of the *Florida Building Code—Building*, as applicable.
- The fasteners have not been evaluated for use as cast-in-place anchors for compliance with the High-velocity Hurricane Zone provisions and this use is outside the scope of this evaluation report.

For products falling under Florida Rule 9N-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 master report, reissued August 2016.