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ESR-2184

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SECTION: 05 05 23—METAL FASTENINGS

DIVISION: 09 00 00—FINISHES

SECTION: 09 22 16.23—FASTENERS

REPORT HOLDER:

HILTI, INC.

5400 SOUTH 122ND EAST AVENUE
TULSA, OKLAHOMA 74146

EVALUATION SUBJECT:

HILTI LOW-VELOCITY POWDER-ACTUATED X-CC CEILING CLIP ASSEMBLIES AND X-CW CEILING WIRE ASSEMBLIES

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ESR-2184

Reissued June 2015

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 23—Metal Fastenings

DIVISION: 09 00 00—FINISHES
Section: 09 22 16.23—Fasteners

REPORT HOLDER:

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EVALUATION SUBJECT:

HILTI LOW-VELOCITY POWDER-ACTUATED X-CC CEILING CLIP ASSEMBLIES AND X-CW CEILING WIRE ASSEMBLIES

1.0 EVALUATION SCOPE

Compliance with the following codes:

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

Hilti low-velocity powder-actuated X-CC Ceiling Clip Assemblies and X-CW Ceiling Wire Assemblies are used as alternatives to cast-in-place anchors described in IBC Section 1908 (2009 and 2006 IBC Section 1911) and the welds and bolts used to attach materials to steel described in IBC Sections 2204.1 and 2204.2, respectively. The assemblies may also be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 X-CC Ceiling Clip Assemblies:

3.1.1 General: Each X-CC Ceiling Clip Assembly consists of a steel angle (ceiling clip) premounted on a powder-driven fastener. A typical assembly is illustrated in Figure 1. See Table 1 for assembly types and fastener dimensions.

3.1.2 Powder-actuated Fasteners: The powder-actuated fasteners are Hilti X-C and X-AL-H fasteners recognized in ESR-1663 or Hilti X-U fasteners recognized in ESR-2269.

3.1.3 Ceiling Clip: The ceiling clip is manufactured from carbon steel conforming to ASTM A653M grade SS275, with a minimum Z180 coating; or DIN EN 10346 S320GD with Z200-N-A-C coating. The clip measures $^{3}/_{4}$ inch wide (18 mm) and 0.0728 inch thick (1.85 mm). The $1^{1}/_{8}$-inch-long (29 mm) leg has a hole with a diameter of 0.22 inch (5.6 mm) through which the powder-actuated fasteners are installed. The 1-inch-long (26.5 mm) leg has a hole with a diameter of 0.43 inch (11 mm) through which the ceiling wire is attached.

3.2 X-CW Ceiling Wire Assemblies:

3.2.1 General: Each X-CW Ceiling Wire Assembly consists of a steel wire clamped to a powder-actuated fastener with a premounted clamping washer, as shown in Figure 3. See Table 1 for assembly types and fastener dimensions.

3.2.2 Powder-actuated Fastener: The powder-actuated fasteners used in the X-CW C27 and X-CW C32 ceiling wire assemblies are the Hilti X-C 27 and X-C 32, respectively, recognized in ESR-1663. The powder-actuated fasteners used in the X-CW U22 and X-CW U27 ceiling wire assemblies are the Hilti X-U 22 and X-U 27 fasteners, respectively, recognized in ESR-2269.

3.2.3 Clamping Washer: The premounted clamping washer is formed from galvanized steel complying with ASTM A653M SS, Grade 255, with a Z120 coating designation. The steel has a base-metal thickness of 0.06 inch (1.5 mm).

3.2.4 Wire: For assemblies designated as Class 1, the ceiling wire is No. 12 gage diameter [0.106 inch (2.7 mm)], zinc-coated carbon steel wire complying with ASTM A641, soft temper, with a Class 1 zinc coating designation. For assemblies designated as INT, the ceiling wire is No. 12 gage diameter [0.106 inch (2.7 mm)], zinc-coated carbon steel wire complying with ASTM A641, with a tensile strength of 50 to 85 ksi and a regular coating.

3.3 Substrate Materials:

3.3.1 Normal-weight Concrete: Normal-weight concrete must be stone-aggregate and comply with IBC Chapter 19 or IRC Section R402.2, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in Table 2.

minimum concrete compressive strength at the time of fastener installation is noted in Table 3.

3.3.3 Steel Deck Panels: Steel deck panels must conform to a code-referenced material standard, with the minimum thickness and minimum yield strength noted in Table 3. See Figures 4 and 5 for panel configuration requirements.

3.3.4 Steel: Structural steel supports must comply with the minimum strength requirements of ASTM A36, ASTM A572 Grade 50 or ASTM A992, and must have the minimum thickness, yield strength and tensile strength as shown in Table 4.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 Allowable Loads: The most critical applied loads, excluding seismic load effects, resulting from the load combinations in IBC Section 1605.3.1 or 1605.3.2 must not exceed the allowable loads given in this section. For fasteners which are subjected to seismic loads, see Section 4.1.2 for additional requirements. The allowable tension, shear and 45-degree-angle loads for assemblies installed in normal-weight concrete are provided in Table 2. The allowable shear, tension and 45-degree-angle loads for assemblies installed through steel deck panels into sand-lightweight concrete are provided in Table 3. The allowable tension, shear and 45-degree-angle loads for assemblies installed in structural steel are provided in Table 4. The stress increases and load reductions described in IBC Section 1605.3 are not allowed for wind loads acting alone or when combined with gravity loads. No adjustment is allowed for vertical loads acting alone. Allowable loads apply to the connection of the X-CC Ceiling Clip Assembly or the X-CW Ceiling Wire Assembly to the base material only. Design of the connection of the attached material to the clip angle or ceiling wire must comply with the applicable requirements of the IBC.

4.1.2 Seismic Considerations: The X-CC Ceiling Clip and X-CW Ceiling Wire Assemblies are recognized for use when subjected to seismic loads as follows:

1. The assemblies may be used with nonstructural components listed in Section 13.1.4 of ASCE 7, which are exempt from the requirements of ASCE 7.
2. The assemblies fastened to concrete may be used to support acoustical tile or lay-in panel suspended ceiling systems, distributed systems and distribution systems where the service load on any individual assembly does not exceed the lesser of 90 lbf (400 N) or the allowable load shown in Table 2 or 3, as applicable.
3. The assemblies fastened to steel may be used where the service load on any individual assembly does not exceed the lesser of 250 lbf (1112 N) or the allowable load shown in Table 4.

4.2 Installation:

4.2.1 General: The X-CC Ceiling Clip Assemblies and X-CW Ceiling Wire Assemblies must be installed in accordance with this report and the Hilti, Inc. published installation instructions. A copy of these instructions must be available on the jobsite at all times during installation. Installation must be limited to dry, interior locations.

Installation requires the use of a low-velocity powder-actuated tool in accordance with the Hilti, Inc. recommendations. The X-CW Ceiling Wire Assembly fastener standoff distance must be as shown in Figure 2.

4.2.2 Fastening to Concrete: Fasteners must not be driven until the concrete has reached the specified concrete strength noted in Table 2. Unless otherwise noted, minimum spacing between embedded fasteners must be 4 inches (102 mm), and minimum edge distance must be 3 inches (76 mm). Unless otherwise noted, concrete thickness must be a minimum of three times the embedment depth of the fastener.

4.2.3 Fastening to Sand-lightweight Concrete-filled Steel Deck Panels: Fasteners must not be driven until the concrete has reached the specified concrete strength noted in Table 3. Installation of the X-CC Ceiling Clip Assemblies and the X-CW Ceiling Wire Assemblies must comply with Figures 4 and 5, respectively. Minimum distances from fastener centerline to rolled deck panel flute edges must be as depicted in Figure 4 or 5, as applicable.

4.2.4 Fastening to Steel: Minimum spacing between fasteners must be 1 inch (25.4 mm) on center, and minimum edge distance must be $^1/_2$ inch (12.7 mm).

5.0 CONDITIONS OF USE

The Hilti X-CC Ceiling Clip Assemblies and X-CW Ceiling Wire Assemblies 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 assemblies are manufactured and identified in accordance with this report.

5.2 Assembly installation complies with this report and the Hilti, Inc. published installation instructions. In the event of a conflict between this report and the Hilti, Inc. published installation instructions, this report governs.

5.3 Calculations demonstrating that the actual loads are less than the allowable loads described in Section 4.1 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.

5.4 Refer to Section 4.1.2 for seismic considerations.

5.5 The use of ceiling clip and ceiling wire assemblies is limited to dry, interior locations, which include exterior walls which are protected by an exterior wall envelope.

5.6 The use of ceiling clip and ceiling wire assemblies is limited to installation in uncracked concrete. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

5.7 Installers must be certified by Hilti, Inc., and have a current, Hilti-issued, operator's license.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements (AC70) dated June 2014.

7.0 IDENTIFICATION

The word "Hilti" and the designation "CC-27" are stamped on the X-CC ceiling clips. All fasteners are imprinted with an "H" on the top of the head. The packaging for all assemblies is labeled with the fastener type and size, the report holder's name (Hilti, Inc.) and the evaluation report number (ESR-2184).

TABLE 1—X-CC CEILING CLIP AND X-CW CEILING WIRE ASSEMBLY TYPES

CEILING CLIP ASSEMBLY	FASTENER DIAMETER (inch)	FASTENER SHANK LENGTH (inches)	APPLICABLE BASE MATERIAL			MINIMUM EMBEDMENT OF FASTENER IN CONCRETE (inches)	RELEVANT ALLOWABLE LOAD TABLE
			Steel	Normal-Weight Concrete	Lightweight Concrete Filled Steel Deck		
X-CC27 C27	0.138	1.063		X	X	1	2, 3
X-CC27 C32	0.138	1.260		X	X	$1^1/_8$	2, 3
X-CC27 U22	0.157	0.866	X	X		$^3/_4$	2, 4
X-CC27 U27	0.157	1.063		X	X	1	2, 3
X-CC27 ALH22	0.157	0.866		X		$^3/_4$	2
X-CC27 ALH27	0.177	1.063		X	X	1	2, 3
X-CW C27 Class 1	0.138	1.063		X	X	$^7/_8$	2, 3
X-CW C27 INT							
X-CW C32 Class 1	0.138	1.260		X	X	$1^1/_8$	2, 3
X-CW C32 INT							
X-CW U22 Class 1	0.157	0.866		X		$^3/_4$	2
X-CW U22 INT							
X-CW U27 Class 1	0.157	1.063		X	X	$^7/_8$	2, 3
X-CW U27 INT							

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

TABLE 2—ALLOWABLE LOADS FOR HILTI X-CC CEILING CLIP AND X-CW CEILING WIRE ASSEMBLIES INSTALLED IN NORMAL-WEIGHT CONCRETE (lbf)[1,2,3]

CEILING CLIP ASSEMBLY	CONCRETE COMPRESSIVE STRENGTH					
	4,000 psi			6,000 psi		
	Tension	Shear	45-Degree	Tension	Shear	45-Degree
X-CC27 C27	160	205	210	—	—	—
X-CC27 C32	220	270	260	—	—	—
X-CC27 U22	—	—	—	80	175	90
X-CC27 U27	160	205	210	125	205	150
X-CC27 ALH22	—	—	—	80	175	70
X-CC27 ALH27	150	205	145	125	205	130
X-CW C27 Class 1, X-CW C27 INT	210	—	210	—	—	—
X-CW C32 Class 1, X-CW C32 INT	210	—	210	—	—	—
X-CW U22 Class 1, X-CW U22 INT	—	—	—	100	—	90
X-CW U27 Class 1, X-CW U27 INT	210	—	210	130	—	150

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.4 N; 1 psi = 6895 Pa.

[1]Allowable load values are for assemblies installed in concrete having the designated compressive strength at the time of installation [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].
[2]For X-CC Ceiling Clip Assemblies, the concrete thickness at the point of penetration must be the fastener embedment depth plus $1^1/_2$ inches, minimum.
[3]For X-CW Ceiling Wire Assemblies, the concrete thickness at the point of penetration must be a minimum of three times the fastener embedment depth.

TABLE 3—ALLOWABLE LOADS FOR HILTI X-CC CEILING CLIP AND X-CW CEILING WIRE ASSEMBLIES INSTALLED IN STRUCTURAL SAND-LIGHTWEIGHT CONCRETE FILLED COMPOSITE STEEL DECK PANEL (lbf)[1,2,3,4]

CEILING CLIP ASSEMBLY	3,000 psi CONCRETE COMPRESSIVE STRENGTH					
	Lower Flute			Upper Flute		
	Tension	Shear	45-Degree	Tension	Shear	45-Degree
X-CC27 C27	50	275	120	105	285	240
X-CC27 C32	65	325	130	130	325	265
X-CC27 U27	150	275	160	170	285	240
X-CC27 ALH27	70	240	145	160	240	240
X-CW C27 Class 1, X-CW C27 INT	110	—	210	100	—	145
X-CW C32 Class 1, X-CW C32 INT	150	—	210	100	—	145
X-CW U27 Class 1, X-CW U27 INT	170	—	210	150	—	160

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.4 N; 1 psi = 6895 Pa.

[1]Allowable load values are for assemblies installed in concrete having the designated compressive strength at the time of installation [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].
[2]For X-CC Ceiling Clip Assemblies, the concrete thickness at the point of penetration must be the fastener embedment depth plus $1^1/_2$ inches, minimum.
[3]For X-CW Ceiling Wire Assemblies, the concrete thickness at the point of penetration must be a minimum of three times the fastener embedment depth.
[4]Deck panel must be 3-inch deep composite floor deck and have a minimum 0.0358 inch base-metal thickness and a minimum yield strength of 38,000 psi. See Figures 4 and 5 for deck configuration.

TABLE 4—ALLOWABLE LOADS FOR HILTI CEILING CLIP ASSEMBLIES INSTALLED IN STEEL (lbf)[1,2]

CEILING CLIP ASSEMBLY	STEEL THICKNESS (in.)								
	$^1/_4$			$^3/_8$			$^1/_2$		
	Tension	Shear	45-Degree	Tension	Shear	45-Degree	Tension	Shear	45-Degree
X-CC27 U22	375	410	375	375	410	375	375	410	375

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

[1]The fasteners must be driven to where the point of the fastener penetrates through the steel base material.
[2]Steel must comply with Section 3.3.4 of this report.
[3]Allowable load capacities are based on base steel with minimum yield strength (F_y) of 36 ksi and minimum tensile strength (F_u) of 58 ksi.

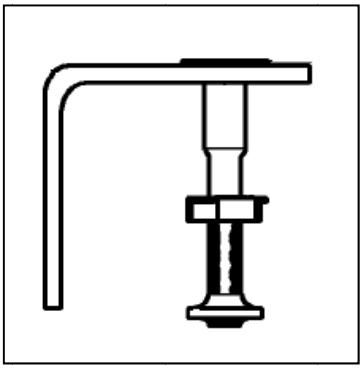


FIGURE 1—HILTI X-CC CEILING CLIP ASSEMBLY

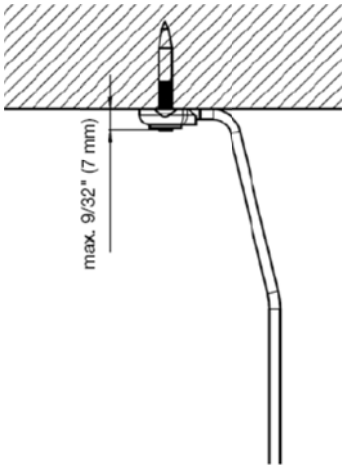


FIGURE 2—HILTI X-CW CEILING WIRE ASSEMBLY STAND-OFF DIMENSION

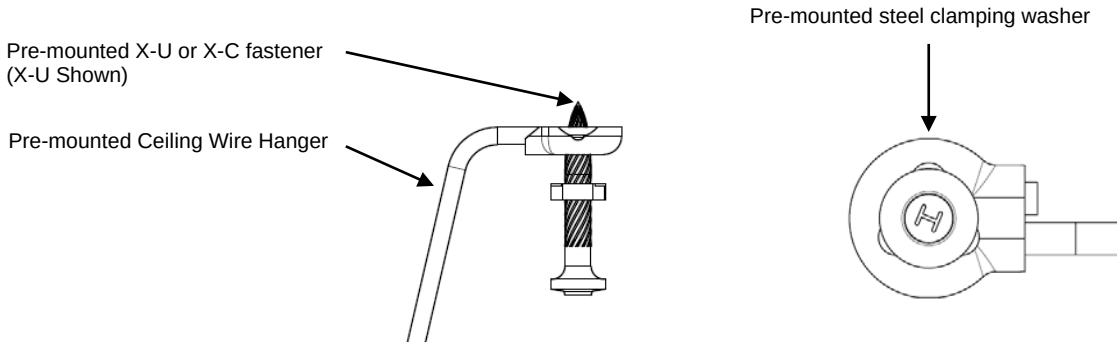
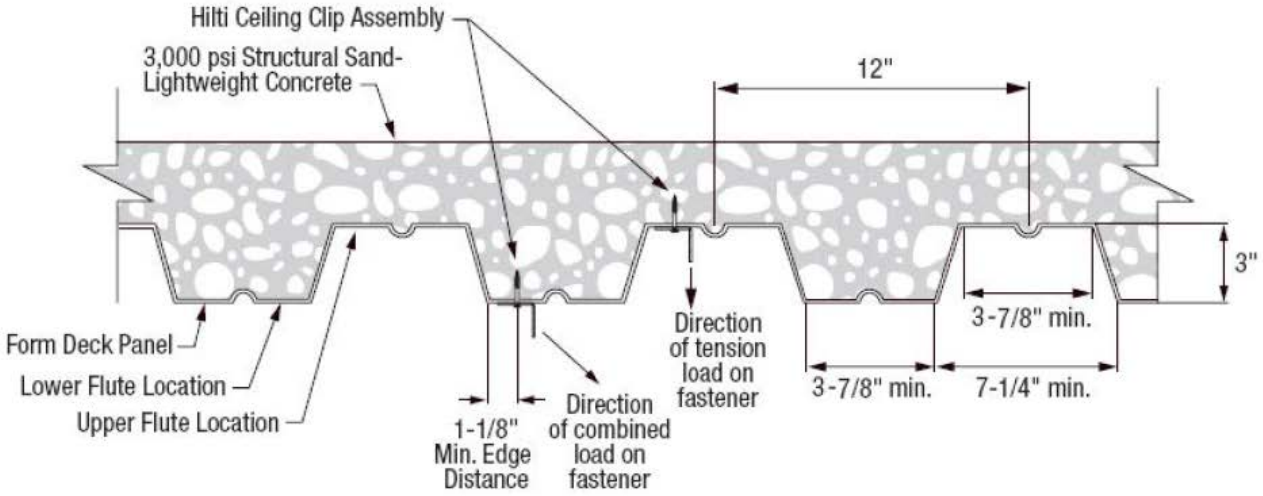


FIGURE 3—HILTI X-CW CEILING WIRE ASSEMBLY



Note: Minimum concrete thickness at the point of penetration must be the embedment depth plus $1^1/_2$ inches.

FIGURE 4—INSTALLATION LOCATIONS FOR HILTI X-CC CEILING CLIPS IN 3-INCH-DEEP COMPOSITE STEEL DECK PANEL

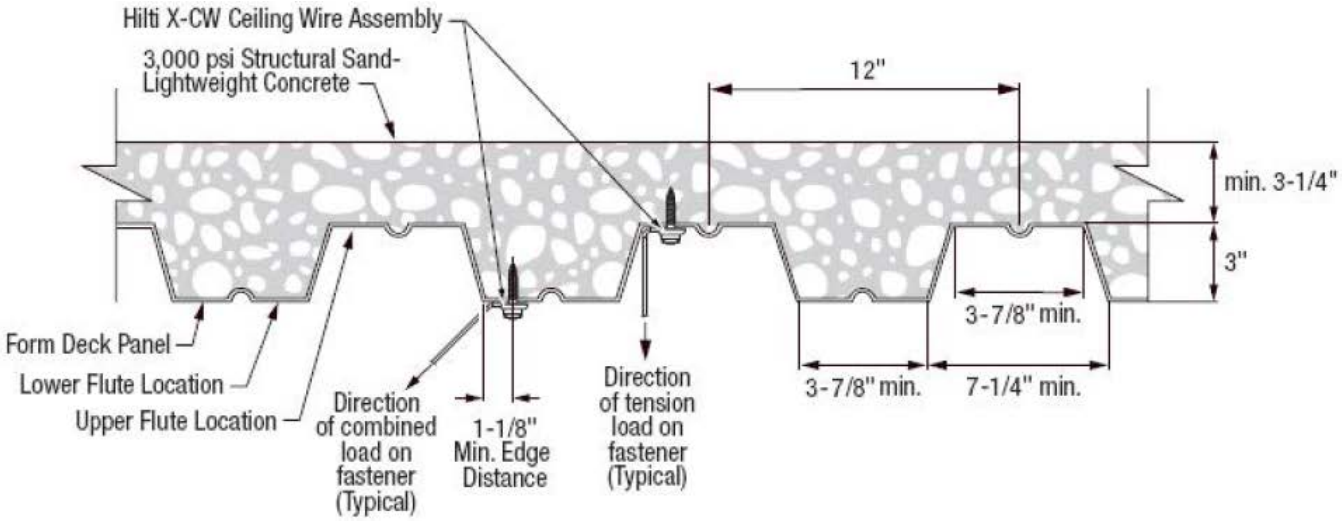


FIGURE 5—INSTALLATION LOCATIONS FOR HILTI X-CW CEILING WIRE HANGER ASSEMBLIES IN 3-INCH-DEEP COMPOSITE STEEL DECK PANEL

ICC-ES Evaluation Report

ESR-2184 FBC Supplement

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1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Hilti X-CC Ceiling Clip Assemblies and X-CW Ceiling Wire Assemblies, recognized in ICC-ES master report ESR-2184, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2010 *Florida Building Code—Building*
- 2010 *Florida Building Code—Residential*

2.0 CONCLUSIONS:

The Hilti X-CC Ceiling Clip Assemblies and X-CW Ceiling Wire Assemblies described in Sections 2.0 through 7.0 of the master report comply with the 2010 *Florida Building Code—Building* and the 2010 *Florida Building Code—Residential*, provided the design and installation are in accordance with the *International Building Code®* provisions noted in the master report.

Use of the Hilti X-CC Ceiling Clip Assemblies and X-CW Ceiling Wire Assemblies has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the 2010 *Florida Building Code—Building* and the 2010 *Florida Building Code—Residential* under the following condition: 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 June 2015.