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ICC-ES Evaluation Report

ESR-2184

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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 CEILING CLIP ASSEMBLIES

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009 *International Building Code*® (2009 IBC)
- 2009 *International Residential Code*® (2009 IRC)
- 2006 *International Building Code*® (2006 IBC)*
- 2006 *International Residential Code*® (2006 IRC)*
- 2003 *International Building Code*® (2003 IBC)*
- 2003 *International Residential Code*® (2003 IRC)*
- 2000 *International Building Code*® (2000 IBC)*
- 2000 *International Residential Code*® (2000 IRC)*

*Codes indicated with an asterisk are addressed in Section 8.0.

Property evaluated:

Structural

2.0 USES

Hilti low-velocity powder-actuated ceiling clip assemblies are used as alternatives to cast-in-place anchors described in IBC Sections 1911 and 1912 and the bolts used to attach materials to steel described in IBC Section 2204.1. The ceiling clip 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:

Each ceiling clip assembly consists of a steel angle (ceiling clip) premounted on a powder-driven fastener. A typical assembly is illustrated in Figure 1.

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. The ceiling clip is manufactured from carbon steel conforming to ASTM A 653M grade SS275, with a minimum G60 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 $1^{1}/_{8}$-inches 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 long (11 mm) through which the ceiling wire is attached.

3.2 Substrate Materials:

3.2.1 Normal-weight Concrete: Normal-weight concrete must be stone-aggregate and comply with IBC Section 1905 or IRC Section 402.2, as applicable. The minimum concrete compressive strength at the time of fastener installation is noted in Table 2.

3.2.2 Structural Lightweight Concrete: Structural lightweight concrete must be sand-lightweight complying with IBC Section 1905. The minimum concrete compressive strength at the time of fastener installation is noted in Table 3.

3.2.3 Steel Deck Panels: Steel deck panels must have a minimum 0.0358-inch (0.912 mm) base-metal thickness and conform to the applicable material standard, with a minimum yield strength of 38 ksi (262 MPa). See Figure 2 for panel configuration requirements.

3.2.4 Steel: Structural steel supports must comply with the minimum requirements of ASTM A 36, ASTM A 572 Grade 50 or ASTM A 992, including tensile strength, and must have thicknesses as shown in Table 4.

4.0 INSTALLATION

4.1 Design:

The allowable tension, shear and 45-degree-angle loads for ceiling clip assemblies installed in normal-weight concrete are provided in Table 2. The allowable shear, tension and 45-degree-angle loads for ceiling clip assemblies installed through steel deck panels into structural sand-lightweight concrete are provided in Table 3. The allowable tension, shear and 45-degree-angle loads for ceiling clip 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. Except for ceiling clip assemblies used with architectural, electrical, and mechanical components described in Section 13.1.4 of ASCE/SEI 7 as exempt from seismic design requirements, use of ceiling clip assemblies to resist earthquake loads is outside the scope of this report.

4.2 Installation:

Installation procedures must be in accordance with this report and Hilti's 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 Hilti recommendations. Installers must be certified by Hilti and have a current Hilti-issued operator's license.

Unless otherwise noted, where installation is in normal-weight or structural sand-lightweight concrete, minimum spacing between embedded fasteners shall be 4 inches (102 mm), and minimum edge distance shall be 3 inches (76 mm). Normal-weight concrete flat slab and structural sand-lightweight concrete over steel deck panel slab thicknesses must be a minimum of $1^1/_2$ inches (38 mm) greater than the fastener embedment at the point of penetration. Minimum distances from fastener centerline to rolled deck panel flute edges shall be as depicted in Figure 2. Installation in structural sand-lightweight concrete and composite deck panel must comply with Figure 2.

Fasteners must not be driven until the concrete has reached the specified concrete strength as noted in Tables 2 and 3.

When installation is in 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 Low-Velocity Powder-Actuated Ceiling Clip 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 ceiling clip assemblies are manufactured and identified in accordance with this report.

5.2 Fastener 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 Allowable tension, shear and 45-degree-angle loads must comply with Section 4.1 of this report. 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 increase is allowed for vertical loads acting alone.

5.4 Calculations demonstrating that the applied loads are less than the allowable loads described in this report are submitted to the code official for approval. The calculations and details must be prepared by a registered design professional where required by the statues of the jurisdiction in which the project is to be constructed.

5.5 Except for ceiling clip assemblies used with architectural, electrical, and mechanical components described in Section 13.1.4 of ASCE/SEI 7 as exempt from seismic design requirements, use of ceiling clip assemblies to resist earthquake loads is outside the scope of this report.

5.6 The use of ceiling clip assemblies is limited to dry, interior locations.

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

5.8 Installers must be certified by Hilti 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 February 2011.

7.0 IDENTIFICATION

Fasteners are imprinted with an "H" on the head and the clips are imprinted with "Hilti" and "CC27" on the horizontal leg. The packaging is labeled with the fastener type, size, manufacturer's name (Hilti, Inc.) and evaluation report number (ESR-2184).

8.0 OTHER CODES

8.1 Evaluation Scope:

In addition to the codes referenced in Section 1.0, the products described in this report were evaluated for compliance with the requirements of the following codes:

- 2006 *International Building Code*® (2006 IBC)
- 2006 *International Residential Code*® (2006 IRC)
- 2003 *International Building Code*® (2003 IBC)
- 2003 *International Residential Code*® (2003 IRC)
- 2000 *International Building Code*® (2000 IBC)
- 2000 *International Residential Code*® (2000 IRC)

8.2 Uses:

Hilti low-velocity powder-actuated ceiling clip assemblies are used as alternatives to cast-in-place anchors described in Sections 1911 and 1912 of the 2006 IBC or Section 1913 of the 2003 and 2000 IBC, and the bolts used to attach materials to steel, described in 2006 and 2003 IBC Section 2204.2 or 2000 IBC Section 2209, as applicable. The ceiling clip assemblies may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the 2006 and 2003 IRC or Section R301.1.2 of the 2000 IRC, as applicable.

8.3 Description:

8.3.1 Ceiling Clip Assemblies: See Section 3.1.

8.3.2 Substrate Materials: See Section 3.2.

8.4 Design and Installation:

8.4.1 Design: See Section 4.1. Under the 2006, 2003 and 2000 IBC and IRC, use of ceiling clip assemblies to resist earthquake loads is outside the scope of this report, except for ceiling clip assemblies used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7-05 (2006 IBC and IRC), Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC) or Section 9.6.1 of ASCE/SEI 7-98 (2000 IBC and IRC), as applicable.

8.4.2 Installation: See Section 4.2.

8.5 Conditions of Use:

See Section 5.0 and the following:

- Allowable tension, shear and 45-degree-angle loads are as noted in Section 4.1. The stress increases and load reductions described in Section 1605.3 of the 2006, 2003 and 2000 IBC are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone.

- Except for ceiling clip assemblies used with architectural, electrical and mechanical components as described in Section 13.1.4 of ASCE/SEI 7-05 (2006 IBC and IRC), Section 9.6.1 of ASCE/SEI 7-02 (2003 IBC and IRC) or Section 9.6.1 of ASCE/SEI 7-98 (2000 IBC and IRC), as applicable, use of ceiling clip assemblies to resist earthquake loads is outside the scope of this report.

8.6 Evidence Submitted:

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements (AC70), dated October 2006.

8.7 Identification:

See Section 7.0.

TABLE 1—X-CC CEILING CLIP 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

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

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

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

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

[1]Fasteners must not be driven until the concrete has reached the specified compressive strength.
[2]Concrete thickness at the point of penetration must be the embedment depth plus $1^1/_2$ inches, minimum.

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

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

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

[1]Fasteners must not be driven until the concrete has reached the specified compressive strength.
[2]Concrete thickness at the point of penetration must be the embedment depth plus $1^1/_2$ inches, minimum.
[3]Deck panel must have a minimum 0.0358 inch base-metal thickness and conform to the applicable material standard with a minimum yield strength of 38,000 psi.

TABLE 4—ALLOWABLE LOADS FOR HILTI CEILING CLIP ASSEMBLIES INSTALLED IN STEEL(pounds)[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 3.2.4 of this report.

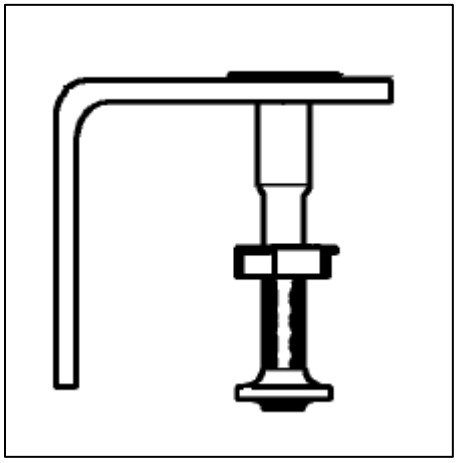
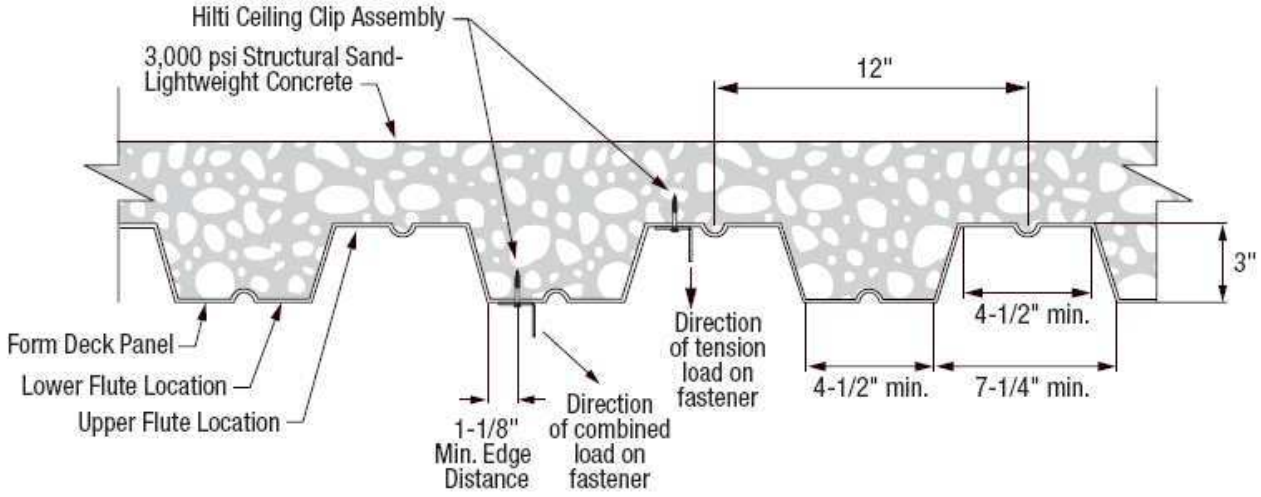


FIGURE 1—HILTI X-CC CEILING CLIP ASSEMBLY



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

For **SI:** 1 inch = 25.4 mm, 1 psi = 6895 Pa.

FIGURE 2—INSTALLATION LOCATIONS FOR HILTI X-CC CEILING CLIPS IN 3-INCH-DEEP COMPOSITE STEEL DECK PANEL

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ESR-2184 Supplement

Reissued June 1, 2011

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EVALUATION SUBJECT:

HILTI LOW-VELOCITY POWDER-ACTUATED CEILING CLIP ASSEMBLIES

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2007 *Florida Building Code—Building*
- 2007 *Florida Building Code—Residential*

Property Evaluated:

Structural

2.0 PURPOSE OF THIS SUPPLEMENT

This supplement is issued to indicate that the Hilti Low-Velocity Powder-Actuated Ceiling Clip Assemblies described in Sections 2.0 through 7.0 of the master report comply with the 2007 *Florida Building Code—Building* and the 2007 *Florida Building Code—Residential*, when designed and installed in accordance with the master evaluation report under the following additional condition.

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 1, 2011.