ICC-ES Evaluation Report

ESR-2184

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This report is subject to re-examination in one year.

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DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

DIVISION: 05—METALS
Section: 05090—Metal Fastenings

DIVISION: 09—FINISHES
Section: 09051—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)*
- 1997 *Uniform Building Code*™ (UBC)*

*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 Section 1912. 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 Ceiling Clip Assemblies:

The ceiling clip assemblies consist of fasteners and steel angles (ceiling clips) having a hole diameter of 5.6 mm (0.22 inch) for the premounted powder-actuated fastener, and a hole diameter of 8 mm (0.31 inch) in the vertical leg for wire attachment. The fasteners are manufactured from modified AISI 1070 carbon steel and are zinc-plated in compliance with ASTM B 633, SC 1, Type III.

Measuring $^{3}/_{4}$ inch wide (19.1 mm) with 1- and $1^{3}/_{16}$-inch-long (25 and 30.1 mm) legs, the 0.0787-inch-thick (2 mm) ceiling clip is manufactured from carbon steel conforming to ASTM A 109, Temper 4, Finish 2, and is plated in accordance with ASTM B 633, SC 1, Type III. Fastener descriptions are in Table 1. The assembly is illustrated in Figure 1.

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 0.0359-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 3 for panel configuration requirements.

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 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 as described in Section 13.1.4 of ASCE/SEI 7, use of ceiling clip assemblies to resist earthquake loads is outside the scope of this report.

4.2 Installation:

4.2.1 Ceiling Clip Assemblies: 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 3. Installation in structural sand-lightweight concrete and composite deck panel must comply with Figure 3.

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

4.2.2 DX KWIK System: As an alternative to the method described in Section 4.2.1, the ceiling clip assembly may be installed with the Hilti DX KWIK system. A small pilot hole is drilled in the concrete base material, using a special drill bit supplied by Hilti, Inc., prior to the installation of the fastener using the powder-actuated tool. DX KWIK installation procedures are shown in Figure 2.

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 as described in Section 13.1.4 of ASCE/SEI 7, 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 October 2006.

7.0 IDENTIFICATION

The word "Hilti" and the designation "CC-27" are stamped on the ceiling clip. Fasteners are imprinted with an "H" on top of the heads. 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)
- 1997 *Uniform Building Code*™ (UBC)

8.2 Uses:

Hilti low-velocity powder-actuated ceiling clip assemblies are used as alternatives to cast-in-place anchors described in Section 1912 of the 2006 IBC or Section 1913 of the 2003 and 2000 IBC or Section 1923.1 of the UBC, 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 Normal-weight Concrete: See Section 3.2.1. Under the UBC, concrete must conform to UBC Section 1903.

8.3.3 Structural Sand-lightweight Concrete: See Section 3.2.2. Under the UBC, sand-lightweight concrete must conform to UBC Section 1903.

8.3.4 Steel Deck Panels: See Section 3.2.3.

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.

The stress increases described in UBC Section 1612.3.2 are not allowed for wind loads acting alone or when combined with gravity loads. Under the UBC, use of ceiling clip assemblies to resist earthquake loads is outside the scope of this report.

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, and the stress increases described in Section 1612.3.2 of the UBC, as applicable, 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:

See Section 6.0.

8.7 Identification:

See Section 7.0.

TABLE 1—DESCRIPTION OF HILTI CEILING CLIP ASSEMBLIES

CEILING CLIP ASSEMBLY	FASTENER DIAMETER (inch)	FASTENER SHANK LENGTH (inches)	MINIMUM EMBEDMENT OF FASTENER (inches)
CC27ZF27	0.138	1.063	1.000
CC27ZF32	0.138	1.260	1.125
CC27ZF37	0.138	1.457	1.375
CC27ALH22	0.177	0.866	0.750
CC27ALH27	0.177	1.063	1.000
CC27ALH32	0.177	1.260	1.125
CC27ALH37	0.177	1.457	1.375
CC27ALH32 w/ DX KWIK	0.177	1.260	1.250
CC27ALH42 w/ DX KWIK	0.177	1.654	1.500

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

TABLE 2—ALLOWABLE LOADS FOR HILTI 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
CC27ZF27	185	205	240	—	—	—
CC27ZF32	220	270	260	—	—	—
CC27ZF37	270	430	260	—	—	—
CC27ALH22	—	—	—	95	175	70
CC27ALH27	150	215	145	145	205	130
CC27ALH32	180	285	305	195	240	190
CC27ALH37	210	325	310	250	275	250
CC27ALH32 w/ DX KWIK[3]	240	350	375	—	—	—-
CC27ALH42 w/ DX KWIK[3]	300	470	330	—	—	—

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]Ceiling clip assemblies with DX KWIK must be installed in holes predrilled with specific Hilti drill bits.

TABLE 3—ALLOWABLE LOADS FOR HILTI CEILING CLIP ASSEMBLIES INSTALLED IN STRUCTURAL SAND-LIGHTWEIGHT CONCRETE AND 3-INCH-DEEP COMPOSITE STEEL DECK PANEL (pounds)[1,2,4]

CEILING CLIP ASSEMBLY	3,000 psi CONCRETE COMPRESSIVE STRENGTH					
	Lower Flute			Upper Flute		
	Tension	Shear	45-Degree	Tension	Shear	45-Degree
CC27ZF27	50	295	120	105	295	290
CC27ZF32	65	325	130	130	325	315
CC27ZF37	80	355	145	155	355	350
CC27ALH27	70	240	145	160	240	240
CC27ALH32	130	295	245	240	295	325
CC27ALH37	195	350	345	325	350	405
CC27ALH42 w/ DX KWIK[3]	200	570	210	250	570	395

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]Ceiling clip assemblies with DX KWIK must be installed in holes predrilled with specific Hilti drill bits.
[4]Deck panel must have a minimum 0.0359 inch base-metal thickness and conform to the applicable material standard with a minimum yield strength of 38,000 psi.

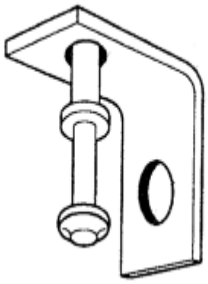
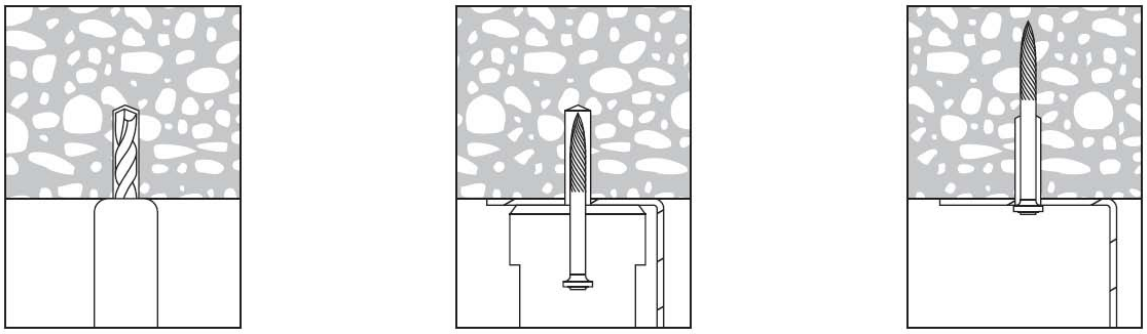


FIGURE 1—HILTI LOW-VELOCITY POWDER-ACTUATED CEILING CLIP ASSEMBLY

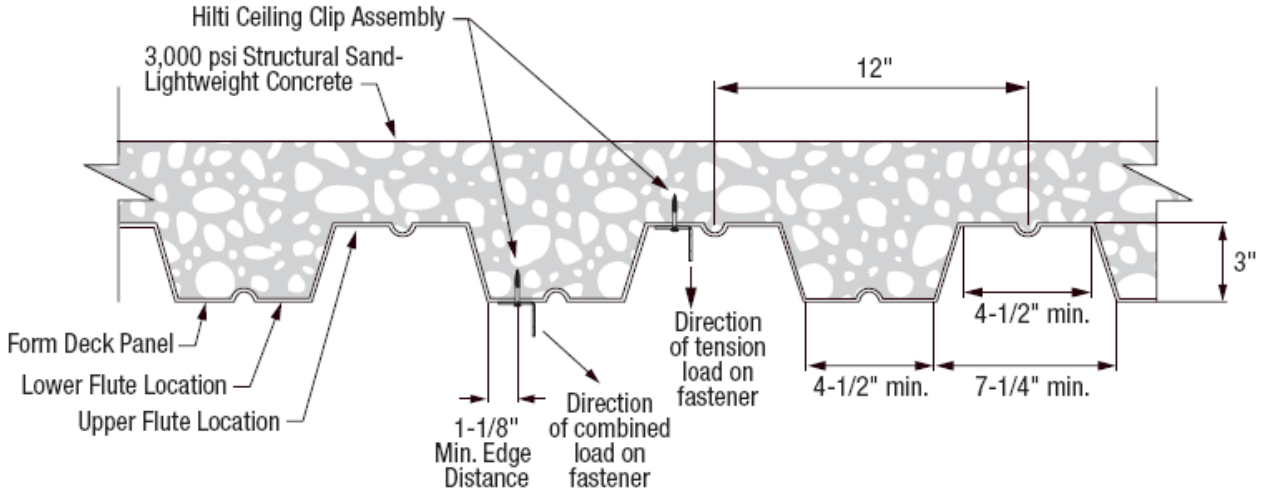


Drill small pilot hole using Hilti drill bit

Insert tip of fastener in predrilled hole and drive with Hilti powder-actuated tool

Correctly installed DX Kwik Ceiling Clip

FIGURE 2—DX KWIK INSTALLATION PROCEDURES



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

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ESR-2184 Supplement

Reissued January 1, 2010

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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 9B-72, 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 issued January 1, 2010.