

# **ICC-ES Evaluation Report**

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# ESR-2892\*

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

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

**REPORT HOLDER:** 

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# **EVALUATION SUBJECT:**

# HILTI X-CW CEILING WIRE ASSEMBLIES

#### **1.0 EVALUATION SCOPE**

# Compliance with the following codes:

- 2012 International Building Code<sup>®</sup> (IBC)
- 2012 International Residential Code<sup>®</sup> (IRC)
- 2009, 2006 <del>and 2003</del> International Building Code<sup>®</sup>\* (IBC)
- 2009, <del>2006 and 2003</del> International Residential Code<sup>®</sup>\* (IRC)

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

#### Property evaluated:

Structural

#### 2.0 USES

Hilti X-CW ceiling wire assemblies are used to fasten steel wire to normal-weight concrete and structural sandlightweight concrete-filled steel deck panels for the purpose of hanging suspended ceiling systems complying with IBC Section 808.1. The ceiling wire assemblies may be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

# 3.0 DESCRIPTION

#### 3.1 General:

The Hilti 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 1. See Table 1 for assembly types and fastener dimensions.

3.2 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 <u>RR25646</u>. 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 <u>RR25675</u>.

This report is subject to renewal October 1, 2014.

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# 3.3 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).

# 3.4 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.

# 3.5 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.

#### 3.6 Lightweight Concrete:

Lightweight concrete must be sand-lightweight complying with IBC Chapter 19. The minimum concrete compressive strength at the time of fastener installation is noted in Table 3.

#### 3.7 Steel Deck Panels:

Steel deck panels must conform to a code-referenced material standard, and have the minimum thickness and minimum yield strength noted in Table 3. See Figure 3 for panel configuration requirements.

# 4.0 DESIGN AND INSTALLATION

#### 4.1 Design:

**4.1.1 Allowable Loads:** The allowable tension and 45-degree-angle loads for X-CW ceiling wire assemblies installed into normal-weight concrete are provided in Table 2. The allowable tension and 45-degree-angle loads for X-CW ceiling wire assemblies installed through steel deck panels into sand-lightweight concrete are provided in Table 3. For installation at angles between 45 degrees and 90 degrees to the supporting slab, the allowable load is the lesser of the allowable tension and 45-degree-angle loads.

#### \*Revised May 2013

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The stress increases and load reductions described in Section 1605.3 of the IBC are not allowed for wind loads acting alone or when combined with gravity loads. No increase is allowed for vertical loads acting alone. Allowable loads apply to the connection of the X-CW Wire Assembly to the base material only. Design of the connection to the suspended material must comply with the applicable requirements of the IBC.

# 4.1.2 Seismic Considerations:

**4.1.2.1 Use with Structural Components:** Resistance to seismic loads is outside the scope of this report. Therefore, the suitability of the Hilti X-CW Wire Assemblies for use with structural components that are subjected to seismic loads is outside the scope of this report.

**4.1.2.2 Use with Nonstructural Components:** Seismic load resistance is outside the scope of this report, except when use is with architectural, mechanical and electrical components described in Section 13.1.4 of ASCE 7 and as follows:

The X-CW Ceiling Wire 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 X-CW Wire Assembly does not exceed the lesser of 90 lbf (400 N) or the published allowable load shown in Table 2 or 3, as applicable.

### 4.2 Installation:

**4.2.1 General:** The X-CW ceiling wire assemblies must be installed in accordance with this report and the Hilti, Inc., published installation instructions, including those shown in Figure 2. A copy of these instructions must be available on the jobsite at all times during installation. Installation must be limited to dry, interior locations.

Fastener placement requires the use of a low-velocity powder-actuated tool in accordance with Hilti, Inc. recommendations. Fastener embedment and standoff distance must be as noted in the tables and as shown in Figure 2. Installers must be certified by Hilti, and have a current, Hilti-issued, operator's license.

**4.2.2 Fastening to Concrete:** Fasteners must be driven into the normal-weight or sand-lightweight concrete after the concrete attains the specified concrete compressive strength. Unless otherwise noted, minimum spacing between fasteners must be 4 inches (102 mm) and minimum edge distance must be 3 inches (76 mm). Unless otherwise noted in this report, 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:** Installation in sand-lightweight concrete-filled steel deck panels must comply with Figure 3. Minimum distance from fastener centerline to rolled deck panel flute edges must be as depicted in Figure 3.

# 5.0 CONDITIONS OF USE

The Hilti 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 ceiling wire assemblies are manufactured and identified in accordance with this report.
- **5.2** Ceiling wire assembly installation complies with this report and the Hilti, Inc., published instructions. In the event of conflict between this report and Hilti, Inc., published instructions, this report governs.

- **5.4** Refer to Section 4.1.2 for seismic considerations.
- **5.5** The use of ceiling wire assemblies is limited to installation in uncracked concrete. Cracking occurs when  $f_t > f_r$  due to service loads or deformations.
- **5.6** Use of ceiling wire assemblies is limited to dry, interior locations.
- **5.7** Installers must be certified by Hilti, Inc. and have a current, Hilti-issued, operator's license.

### 6.0 EVIDENCE SUBMITTED

**6.1** Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements (AC70), dated February 2013.

**6.2** Report of testing of hanger wire connection to fastener, in accordance with the ICC-ES Acceptance Criteria for Suspended Ceiling Framing Systems (AC368), dated February 2012.

# 7.0 IDENTIFICATION

The fasteners are imprinted with an "H" on the head. All assemblies are identified on the packaging with the Hilti, Inc., name, the fastener type and size, and the evaluation report number (ESR-2892).

# 8.0 OTHER CODES

### 8.1 Evaluation Scope:

In addition to the 2012 IBC and 2012 IRC, addressed in Sections 2.0 through 7.0, the products in this report were evaluated for compliance with the requirements of the following codes:

- 2009, 2006 and 2003 International Building Code<sup>®</sup> (2009, 2006 and 2003 IBC)
- 2009, 2006 and 2003 International Residential Code<sup>®</sup> (2009, 2006 and 2003 IRC)

# 8.2 Uses:

Hilti X-CW ceiling wire assemblies are used to fasten steel wire to normal-weight concrete and sand-lightweight concrete-filled steel deck panels for the purpose of hanging suspended ceiling systems complying with 2009 IBC Section 808.1 and 2006 and 2003 IBC Section 803.9, as applicable. The Hilti X-CW ceiling wire assemblies may be used where an engineered design is submitted in accordance with 2009, 2006 or 2003 IRC Section R301.1.3, as applicable.

8.3 Description:

See Section 3.0.

8.4 Design and Installation:

8.4.1 Design:

- 8.4.1.1 Allowable Loads: See Section 4.1.1.
- **8.4.1.2 Seismic Considerations:** See Section 4.1.2.
- 8.5 Conditions of use:
- See Section 5.0.
- 8.6 Evidence Submitted:

See Section 6.0.

8.7 Identification:

See Section 7.0.

CEILING WIRE ASSEMBLY TYPE	FASTENER DIAMETER (inch)	FASTENER SHANK LENGTH (inches)	RELEVANT BASE MATERIAL	MINIMUM EMBEDMENT OF FASTENER (inches)
X-CW C27 Class 1 X-CW C27 INT	0.138	1.063		7 <sub>/8</sub>
X-CW C32 Class 1 X-CW C32 INT	0.138	1.260	Normal-weight concrete,	1 <sup>1</sup> / <sub>8</sub>
X-CW U22 Class 1 X-CW U22 INT	0.157	0.866	over steel deck panel	<sup>3</sup> / <sub>4</sub>
X-CW U27 Class 1 X-CW U27 INT	0.157	1.063		7/ <sub>8</sub>

### TABLE 1—X-CW CEILING WIRE ASSEMBLY TYPES

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

# TABLE 2—ALLOWABLE LOADS FOR HILTI X-CW CEILING WIRE ASSEMBLIES INSTALLED IN NORMAL-WEIGHT CONCRETE (Ibf)<sup>1,2</sup>

CEILING WIRE ASSEMBLY	MINIMUM	CONCRETE COMPRESSIVE STRENGTH			
ТҮРЕ	EMBEDMENT (inches)	4000 psi		6000 psi	
		Tension	45-Degree	Tension	45-Degree
X-CW C27 Class 1 X-CW C27 INT	<sup>7</sup> / <sub>8</sub>	210	210		
X-CW C32 Class 1 X-CW C32 INT	1 <sup>1</sup> / <sub>8</sub>	210	210		
X-CW U22 Class 1 X-CW U22 INT	<sup>3</sup> / <sub>4</sub>			100	90
X-CW U27 Class 1 X-CW U27 INT	<sup>7</sup> /8	210	210	130	150

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

<sup>1</sup>Allowable values are for ceiling wire assemblies installed in concrete having the designated compressive strength at the time of installation. <sup>2</sup>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-CW CEILING WIRE ASSEMBLIES INSTALLED IN SAND-LIGHTWEIGHT CONCRETE FILLED COMPOSITE STEEL DECK PANEL (Ibf)<sup>1,2</sup>

CEILING WIRE ASSEMBLY	MINIMUM EMBEDMENT (inches)	3000 psi CONCRETE COMPRESSIVE STRENGTH			
ТҮРЕ		Upper Flute		Lower Flute	
		Tension	45-Degree	Tension	45-Degree
X-CW C27 Class 1 X-CW C27 INT	<sup>7</sup> / <sub>8</sub>	110	210	100	145
X-CW C32 Class 1 X-CW C32 INT	1 <sup>1</sup> / <sub>8</sub>	150	210	100	145
X-CW U27 Class 1 X-CW U27 INT	<sup>7</sup> / <sub>8</sub>	170	210	150	160

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

<sup>1</sup>Allowable values are for ceiling wire assemblies installed in concrete having the designated compressive strength at the time of installation. <sup>2</sup>The composite floor deck panel must have a minimum base-metal thickness of 0.0358 inch and conform to the applicable material standard, with a minimum yield strength ( $F_y$ ) of 38 ksi. Figure 3 shows nominal flute dimensions, ceiling wire assembly locations and load orientations for the deck panel profile. Sand-lightweight concrete fill above top of steel deck panel must be a minimum of 3<sup>1</sup>/<sub>4</sub> inches thick.







Insert X-CW Ceiling Wire Assembly Into the Hilti Powder Actuated Tool

Locate the Fastening, Compress the Hilti Powder-Actuated Tool and Install Fastener

Check Nail Standoff and Adjust the X-CW Ceiling Wire Position as Needed





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

FIGURE 3—HILTI X-CW CEILING WIRE HANGER ASSEMBLY LOCATION IN 3-INCH-DEEP COMPOSITE FLOOR DECK PANEL, NORMAL DECK PANEL PROFILE ORIENTATION