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RESEARCH REPORT: RR 25662
(CSI #03150)

BASED UPON ICC ES EVALUATION
REPORT No. ESR-1752

REEVALUATION DUE DATE:
August 1, 2008

GENERAL APPROVAL - Hilti Low-Velocity Power Driven Track Fasteners.

DETAILS

The Power Driven Fasteners are approved when in compliance with the description, identification and conditions of use in Evaluation Report No ESR-1752, dated May 1, 2006, of the ICC Evaluation Service, Incorporated. That report, in its entirety, is attached and made a part of this general approval.

The parts of Report No. ESR-1752 marked by the asterisks are modified by the Los Angeles Building Department from this approval.

The approval is subject to the following conditions:

1. The fasteners are only allowed to anchor non-building components including but not limited to drywall tracks, sprinkler pipes, furniture, cabinets, sheet metal duct work, electrical conduits, cable trays, cables, lighting, wood sill plates, acoustical ceiling, light gauge framing, and non-bearing-non-structural interior partitions.
2. The fasteners shall not be used in cracked concrete or cracked masonry.
3. The allowable values listed in the attached report and tables are for the fasteners only. Connected members shall be checked for their capacity (which may govern).
4. Fasteners are manufactured and identified in accordance with report ESR-1752.
5. The use of fasteners attaching cold-formed-steel tracks to foundations shall comply with the section 4.3 of ESR-1752.

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Hilti, Inc.

RE: Hilti Low-Velocity Power Driven Track Fasteners

6. Fasteners shall be installed in accordance with this report and the manufacturer's published installation instructions. In the event of conflicts between this report and the manufacturer's published installation instructions, this report shall govern.
7. The fasteners shall be limited to dry, interior locations.
8. The allowable tension and shear values shall comply with Section 4.1 of ESR 1752. Calculations demonstrating that the applied loads are less than the allowable loads described in this report shall be submitted to the code official for approval.
9. Fastener shall be limited to nonfire-resistive construction.
10. Placement of fasteners into preservative-treated or fire-retardant-treated wood is outside the scope of this report.

DISCUSSION

The approval is based on tests conforming with AC-70.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

This general approval will remain effective provided the Evaluation Report is maintained valid and unrevised with the issuing organization. Any revisions to the report must be submitted to this Department, with appropriate fee, for review in order to continue the approval of the revised report.

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this Approval have been met in the project in which it is to be used.

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Attachments: ICC ES Evaluation Report No. ESR-1752 (5 Pages).

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ICC Evaluation Service, Inc.www.icc-es.org

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DIVISION: 03—CONCRETE**Section: 03151—Concrete Anchoring****DIVISION: 05—METALS****Section: 05090—Metal Fastenings****REPORT HOLDER:****HILTI, INC.**

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www.us.hilti.com**EVALUATION SUBJECT:****LOW-VELOCITY POWER-DRIVEN TRACK FASTENERS****1.0 EVALUATION SCOPE****Compliance with the following codes:**

- * ■ ~~2003 International Building Code® (IBC)~~
- * ■ ~~2003 International Residential Code® (IRC)~~
- 1997 Uniform Building Code™ (UBC)
- * ■ ~~1999 Standard Building Code® (SBC)~~

Properties evaluated:

Structural

2.0 USES

Hilti low-velocity power-driven track fasteners are used to attach light-gage cold-formed steel framing to concrete, structural lightweight concrete, metal decks with structural lightweight concrete fill, concrete masonry units (CMU) and steel-base materials.

3.0 DESCRIPTION**3.1 General:**

Hilti low-velocity power-driven track fasteners are manufactured from steel conforming to AISI 1060 or 1070 modified, austempered to a Rockwell "C" hardness of 58 ± 1 for X-EGN and 53.5 ± 1 for X-GN fasteners. The X-EGN fastener is for installation into steel and has a tapered smooth shank with a nominal diameter at the base of 0.118 inch (3.0 mm). The X-GN fastener is for installation into concrete and masonry and has a 0.118-inch (3.0 mm) knurled shank diameter. The X-GN lengths include 0.787 inch, 1.063 inches, and 1.260 inches (20, 27, and 32 mm). All fastener head diameters are 0.268 inch (6.8 mm). Both fasteners have a 2-to-8-micron zinc finish, and both fasteners are collated into plastic strips of ten fasteners each. The fasteners are alternatives to cast-in-place anchors described in Sections

1923.1 and 2107.1.5 of the UBC, ~~Sections 1912 and 2107 of the IBC, and Sections 1914 and 2103.1 of the SBC. The fasteners may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.~~ *

3.2 Materials:

3.2.1 Normal-weight Concrete: Normal-weight concrete shall be stone-aggregate and comply with ~~Section 1905 of the IBC, Section 402.2 of the IRC, Section 1905 of the SBC or Section 1903 of the UBC, as applicable.~~ *

3.2.2 Lightweight Concrete: Structural lightweight concrete shall be sand- lightweight and shall comply with ~~Section 1905 of the IBC, Section 402.2 of the IRC, Section 1905 of the SBC or Section 1903 of the UBC, as applicable.~~ *

3.2.3 Concrete Masonry Units: Concrete masonry units shall be nominally 8 inches (203 mm) thick and comply as Grade N, Type 1, in accordance with ~~ASTM C 90-99 (IBC, IRC or SBC) or UBC Standard 21-4. Mortar shall be Type N (minimum) in accordance with Section 2103.7 of the IBC, Section R607 of the IRC, or either Table 2104.7A or Table 2104.7B of the SBC, or Section 2103.3 of the UBC. Grouted concrete-masonry construction shall be fully grouted and shall have minimum prism strength of 1,500 psi (10.3 MPa) at the time of fastener installation. Grout shall comply with Section 2103.10 of the IBC, Section R609.1.1 of the IRC, Table 2104.7C of the SBC, or Section 2103.4 of the UBC.~~ *

3.2.4 Steel: Structural steel used in supports shall comply with the applicable referenced standard and shall have a minimum yield strength of 36 ksi (248 MPa) and a thickness as noted in Tables 1 and 2, as applicable.

3.2.5 Steel Deck: Where fasteners are placed through a steel deck into structural lightweight concrete in accordance with Table 4 and Figures 1 and 2, the steel deck shall comply with the applicable reference standard and shall have a minimum yield strength of 38 ksi (262 MPa). The deck shall have No. 20 gage to No.16 gage thickness [0.0359 inch (0.091 mm) to 0.060 inch (0.152 mm) base-steel thickness] and a depth of either $1\frac{1}{2}$ inches (38 mm) or 3 inches (76 mm).

4.0 DESIGN AND INSTALLATION**4.1 Design:**

The allowable tension and shear loads, along with the fastener description and shank diameters for low-velocity power-driven fasteners installed into $F_y = 36$ ksi (248 MPa) and 50 ksi (345 MPa) carbon-steel-base materials, are shown in Tables 1 and 2, respectively. The allowable tension and shear loads with required embedment depths, along with fastener description and shank diameters for fasteners installed in normal-weight and structural lightweight concrete base materials, are shown in Tables 3 and 4, respectively. The allowable tension and shear loads with required embedment depths, along with fastener description and

shank diameters, for fasteners installed in hollow and grouted concrete-masonry construction, are shown in Table 5.

Allowable loads for fasteners subjected to combined shear and tension forces are determined by the following formula:

$$(P_s/P_t) + (V_s/V_t) \leq 1$$

where:

P_s = Applied service tension load, pounds (kg).

P_t = Allowable tension load, pounds (kg).

V_s = Applied service shear load, pounds (kg).

V_t = Allowable shear load, pounds (kg).

4.2 Installation:

Fastener installation requires a Hilti low-velocity power-actuated tool used in accordance with the manufacturer's published installation instructions.

When installation is in steel, minimum spacing between fasteners is 1 inch (25 mm) on center, and minimum edge distance is $1/2$ inch (12.7 mm). Unless otherwise noted, when installation is in normal-weight and structural lightweight concrete, minimum spacing between fasteners is 4 inches (102 mm) on center and minimum edge distance is 3 inches (76 mm). Unless otherwise noted, concrete thickness shall be a minimum of three times the embedment depth of the fastener. For concrete masonry units, the minimum fastener spacing is $7\frac{3}{4}$ inches (197 mm), and the minimum edge (boundary) distance is 8 inches (203 mm), with no more than one power-driven fastener installed per individual CMU cell.

For fasteners installed into concrete or masonry, the fasteners shall not be driven until the concrete or masonry has reached the designated strength.

4.3 Connections of Drywall Tracks to Foundation:

Attachment of cold-formed steel tracks to the perimeter of concrete slabs is allowed under the following conditions:

1. No cold joint shall exist between the slab and foundation below the plate.
2. No track shall be installed on slabs supported by concrete block foundation walls.

5.0 CONDITIONS OF USE

The Hilti low-velocity power-driven track fasteners 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 Fasteners are manufactured and identified in accordance with this report.

- 5.2 Fasteners shall be installed in accordance with this report and the manufacturer's published installation instructions. In the event of conflicts between this report and the manufacturer's published installation instructions, this report shall govern.

- 5.3 The allowable tension and shear values shall comply with Section 4.1 of this report. Calculations demonstrating that the applied loads are less than the allowable loads described in this report shall be submitted to the code official for approval.

- 5.4 Use of fasteners in resisting earthquake loads is beyond the scope of this report.

Exception: Fasteners used with architectural, electrical and mechanical components ~~as described in the exceptions to Section 9.6.1 of ASCE/SEI 7 (IBC and IRC).~~ SEE CONDITIONS OF APPROVAL ON APPROVAL LETTER **

- 5.5 The use of fasteners attaching cold-formed-steel tracks to foundations shall comply with Section 4.3 of this report.

- 5.6 The fasteners shall be limited to dry, interior locations.

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

- 5.8 Fasteners shall be limited to nonfire-resistive construction (UBC) ~~or nonfire-resistance-rated construction (IBC, IRC, or SBC), unless appropriate data is submitted to the code official to demonstrate that anchor performance is maintained in fire resistive or fire resistance-rated situations.~~ *

- 5.9 Placement of fasteners into preservative-treated or fire-retardant-treated wood is outside the scope of this report.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Power-driven Fasteners in Concrete, Steel, and Masonry Elements (AC70), dated October 2004.
- 6.2 A quality control manual.

7.0 IDENTIFICATION

Hilti low-velocity power-driven track fasteners shall be identified by an "H" imprinted on the fastener head. All fasteners shall be packaged in containers that bear the fastener type and size, the manufacturer's name (Hilti, Inc.), and the evaluation report number (ESR-1752 or ER-6196).

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**TABLE 1—ALLOWABLE WORKING LOADS FOR
HILTI TRACK FASTENERS INSTALLED IN $F_y = 36$ ksi ($F_u = 58$ ksi) STEEL^{1,2,3}**

FASTENER	SHANK DIAMETER (inch)	STEEL THICKNESS (inch)							
		$\frac{1}{8}$		$\frac{3}{16}$		$\frac{1}{4}$		$\frac{3}{8}$ ⁴	
		Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
X-EGN	0.118	140	230	220	245	225	290	280	330

For **SI**: 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1ksi = 6.89 MPa.

¹The tabulated allowable load values are for the fastener only. Steel members connected to the steel receiving elements shall be designed in accordance with accepted design criteria.

²Values are based on the average ultimate load capacities obtained by testing, and an applied factor of safety that is greater than or equal to 5 calculated in accordance with ICC-ES AC70.

³Fasteners shall be driven to obtain the minimum embedment with the point of the fastener penetrating through the steel base material, except as otherwise noted in footnote 4.

⁴For steel base-material thickness greater than or equal to $\frac{3}{8}$ inch, fastener point penetration through the steel is not necessary, provided a minimum embedment of 0.320 inch is achieved.

**TABLE 2—ALLOWABLE WORKING LOADS FOR
HILTI TRACK FASTENERS INSTALLED IN $F_y = 50$ ksi ($F_u = 65$ ksi) STEEL^{1,2,3}**

FASTENER	SHANK DIAMETER (inch)	STEEL THICKNESS (inch)					
		$\frac{3}{16}$		$\frac{1}{4}$		$\frac{3}{8}$ ⁴	
		Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear (lbf)
X-EGN	0.118	220	295	260	355	280	385

For **SI**: 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1ksi = 6.89 MPa.

¹The tabulated allowable load values are for the fastener only. Steel members connected to the steel receiving elements shall be designed in accordance with the applicable code and accepted design criteria.

²Values are based on the average ultimate load capacities obtained by testing, and an applied factor of safety that is greater than or equal to 5 calculated in accordance with ICC-ES AC70.

³Fasteners shall be driven to obtain the minimum embedment with the point of the fastener penetrating through the steel-base material, except as otherwise noted in this report.

⁴For steel base-material thickness greater than or equal to $\frac{3}{8}$ inch, fastener point penetration through the steel is not necessary, provided a minimum embedment of 0.320 inch is achieved.

**TABLE 3—ALLOWABLE WORKING LOADS FOR
HILTI TRACK FASTENERS INSTALLED IN NORMAL-WEIGHT CONCRETE^{1,2}**

FASTENER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	CONCRETE COMPRESSIVE STRENGTH 2,000 psi $\leq f'_c \leq$ 4,000 psi	
			Tension (lbf)	Shear (lbf)
X-GN	0.118	$\frac{3}{4}$	95	120
X-GN	0.118	1	115	220

For **SI**: 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

¹The tabulated allowable load values are for the fasteners only. Steel members connected to the concrete shall be designed in accordance with accepted design criteria.

²Values are based on the average ultimate load capacities obtained by testing, and an applied factor of safety that is greater than or equal to 5 calculated in accordance with ICC-ES AC70.

**** 3.- Edge distance must be greater or equal than 3" and spacing must be greater or equal than 4".**

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**TABLE 4—ALLOWABLE WORKING LOADS FOR HILTI TRACK FASTENERS
INSTALLED IN MINIMUM 3,000 psi STRUCTURAL LIGHTWEIGHT CONCRETE^{1,2}**

FASTENER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT ⁴ (inch)	INSTALLED INTO CONCRETE		INSTALLED THROUGH METAL DECK INTO CONCRETE ^{3,4}			
			Tension (lbf)	Shear (lbf)	Tension (lbf)		Shear (lbf)	
					Upper Flute	Lower Flute	Upper Flute	Lower Flute
X-GN	0.118	$\frac{3}{4}$	115	140	75	85	175	215
X-GN	0.118	1	170	220	155	160	255	315

For SI: 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

¹The tabulated allowable load values are for the fasteners only. Steel members connected to the concrete receiving elements shall be designed in accordance with the applicable code and accepted design criteria.

²Values represent the average ultimate load capacities obtained by testing, and an applied factor of safety that is greater than or equal to 5 calculated in accordance with ICC-ES AC70.

³Steel deck profiles include 3-inch-deep, composite floor deck and 1½-inch-deep, Type B deck with thicknesses of 20 gage (0.0359-inch-thick base steel thickness) and minimum yield strengths of 38,000 psi.

⁴Structural lightweight concrete fill above top of metal deck profiles shall be 2½ inches thick for the ¾-inch fastener embedment and 3¼ inches for the 1-inch fastener embedment. Figures 1 and 2 show nominal flute dimensions, fastener locations, and load orientations for both floor deck profiles.

★ ★ 5.- End distance must be greater or equal than 3" and spacing must be greater or equal than 4".

★ ★ **TABLE 5—ALLOWABLE WORKING LOADS FOR
HILTI TRACK FASTENERS INSTALLED IN CONCRETE MASONRY UNITS (CMU)^{1,2,3,4,5}**

FASTENER	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	HOLLOW CMU				GROUT-FILLED CMU					
			Face Shell ⁶		Mortar Joint		Face Shell ⁶		Mortar Joint		Top of Grouted Cell ⁸	
			Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear ⁷ (lbf)	Tension (lbf)	Shear (lbf)	Tension (lbf)	Shear ⁷ (lbf)	Tension (lbf)	Shear ⁹ (lbf)
X-GN	0.118	$\frac{3}{4}$	90	115	65	55 50	95	120	70	85	65	90
X-GN	0.118	1	115	130	70 65	65	130	140 135	85	120	75	95

For SI: 1 lbf = 4.448 N, 1 inch = 25.4 mm.

¹The tabulated allowable load values are for the fastener only, utilizing a minimum factor of safety of 8. Steel members connected to the masonry receiving elements shall be designed in accordance with the applicable code and accepted design criteria.

²The tabulated allowable load values are for fasteners installed in concrete masonry units conforming to UBC Standard 21-4 or ASTM C 90 as Grade N, Type 1.

³The tabulated allowable load values are for fasteners installed in concrete masonry units with mortar conforming to UBC Standard 21-15 or ASTM C 270. Mortar shall be proportioned in accordance with Table 21-15-B of the UBC, ~~Table 2103.7(1) of the IBC, Table R607.1 of the IRC or either Table 2104.7A or Table 2104.7B of the SBC, as Type N.~~

★ ~~Table 2104.7A or Table 2104.7B of the SBC, as Type N.~~

⁴The tabulated allowable load values are for fasteners installed in concrete masonry units with grout conforming to UBC Standard 21-19 or ASTM C 476. Grout shall be proportioned in accordance with Table 21-B of the UBC, ~~Table 2103.10 of the IBC, Table R609.1.1 of the IRC, or Table 2104.7C of the SBC, as coarse grout.~~

★ ~~2104.7C of the SBC, as coarse grout.~~

⁵No more than one fastener may be installed in an individual concrete masonry unit cell.

⁶Fastener can be located anywhere on the face shell.

⁷Shear direction can be horizontal or vertical (bed joint or head joint) along the CMU wall plane.

⁸Fastener located in center of grouted cell installed vertically.

⁹Shear can be in any direction.

★ ★ 10.- Edge distance must be greater or equal than 8" and spacing must be greater or equal than 7-3/4".

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COMPOSITE FLOOR DECK

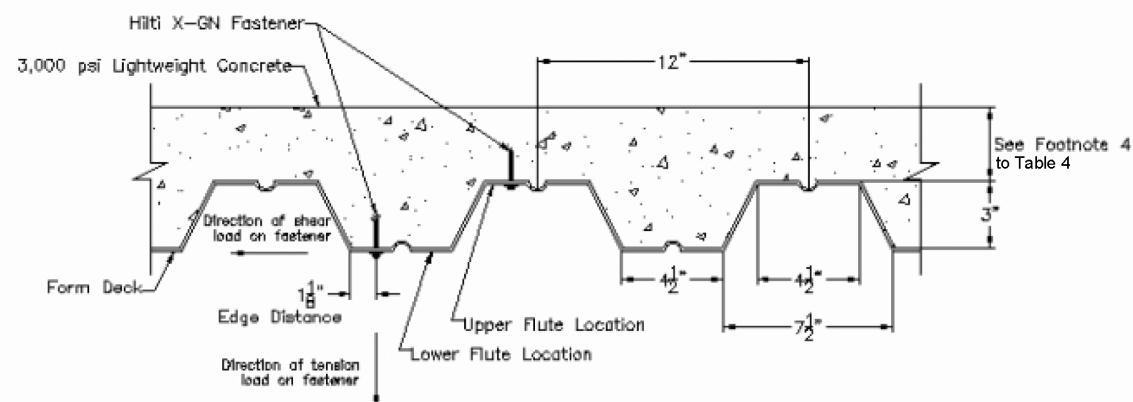


FIGURE 1—HILTI FASTENER INSTALLATION LOCATION IN 3-INCH-DEEP COMPOSITE FLOOR DECK

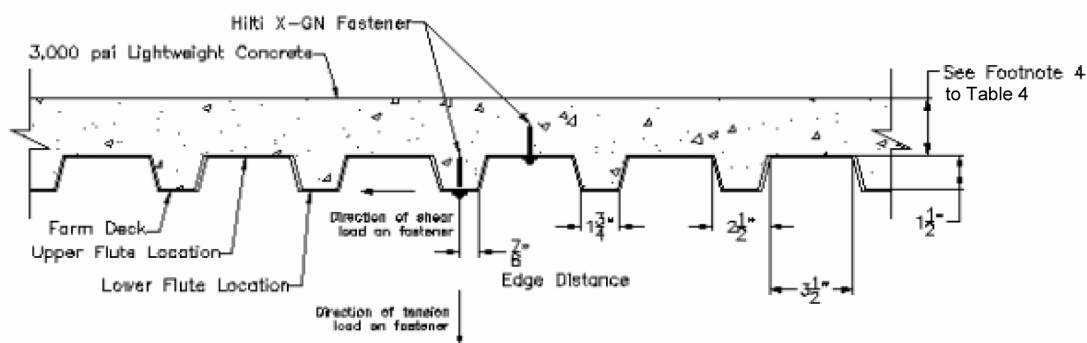


FIGURE 2—HILTI FASTENER INSTALLATION LOCATION IN 1 1/2-INCH-DEEP COMPOSITE FLOOR DECK

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