DIVISION: 03 00 00—CONCRETE
Section: 03 15 00—Concrete Accessories
Section: 03 16 00—Concrete Anchors

DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors

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

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:
HILTI, INC.

EVALUATION SUBJECT:
HILTI LOW-VELOCITY X-U AND X-U 15 UNIVERSAL FASTENERS AND X-P CONCRETE FASTENERS

1.0 EVALUATION SCOPE
Compliance with the following codes:
- 2018, 2015, and 2012 International Residential Code® (IRC)

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see ESR-2269 LABC and LARC Supplement.

Property evaluated:
Structural

2.0 USES
2.1 General:
The Hilti X-U and X-P power-actuated fasteners (PAFs) are used to attach wood, light gage steel, and other building elements to base materials of normal-weight concrete, sand-lightweight concrete, steel deck panels with sand-lightweight concrete fill and concrete masonry. The X-U fasteners are also used to attach building elements to steel base materials. The Hilti X-U 15 fasteners are used to attach light gage steel and other building elements to steel base material. The fasteners are alternatives to the cast-in-place anchors described in IBC Section 1901.3 (2012 IBC Section 1908; 2009 IBC Section 1911) for placement in concrete; the embedded anchors described in Section 8.1.3 of TMS 402, referenced in Section 2107 of the IBC (Section 2.1.4 of TMS 402-11 and -08 referenced in Section 2107 of the 2012 and 2009 IBC, respectively), for placement in masonry; and the welds and bolts used to attach materials to steel, described in IBC Sections 2204.1 and 2204.2, respectively. For structures regulated under the IRC, the fasteners may be used where an engineered design is submitted in accordance with IRC Section R301.1.3.

2.2 Horizontal Diaphragms:
The Hilti X-U fasteners may be used as alternates to 10d common nails for fastening wood structural panels to structural steel members in horizontal diaphragms.

3.0 DESCRIPTION
3.1 Fasteners:
3.1.1 X-U: The X-U fasteners are powder-driven fasteners made from hardened steel complying with the manufacturer’s quality documentation, austempered to a Rockwell C nominal hardness of 57.5 and zinc-plated in accordance with ASTM B633 SC 1, Type III. The fasteners have a shank diameter of 0.157 inch (4.0 mm), a head diameter of 0.32 inch (8.2 mm) and a knurled tip, and come in lengths ranging from 0.63 inch to 2.83 inches (16 to 72 mm). See Figure 1 for the fastener configuration.

3.1.2 X-U 15: The X-U 15 fasteners are powder-driven fasteners made from hardened steel complying with the manufacturer’s quality documentation, austempered to a Rockwell C nominal hardness of 59 and zinc plated in accordance with ASTM B633 SC 1, Type III. The fasteners have a shank diameter of 0.145 inch (3.7 mm), a head diameter of 0.32 inch (8.2 mm) and a shank length of 0.63 inch (16 mm). See Figure 2 for the fastener configuration.

3.1.3 X-P: The X-P fasteners are powder-driven fasteners made from hardened steel complying with the manufacturer’s quality documentation, austempered to a Rockwell C nominal hardness of 59 and zinc plated in accordance with ASTM B633 SC 1, Type III. The fasteners have a shank diameter of 0.157 inch (4.0 mm), a head diameter of 0.32 inch (8.2 mm) and come in lengths ranging from 0.87 inch to 1.57 inches (22 to 40 mm). See Figure 3 for the fastener configuration.

3.2 Substrate Materials:
3.2.1 Concrete: Normal-weight and sand-lightweight concrete must comply with IBC Chapter 19 or IRC Section 1908; 2009 IBC Section 1911 for placement in concrete; the embedded anchors described in Section 8.1.3 of TMS 402, referenced in Section 2107 of the IBC (Section 2.1.4 of TMS 402-11 and -08 referenced in Section 2107 of the 2012 and 2009 IBC, respectively), for placement in masonry; and the welds and bolts used to attach materials to steel, described in IBC Sections 2204.1 and 2204.2, respectively. For structures regulated under the IRC, the fasteners may be used where an engineered design is submitted in accordance with IRC Section R301.1.3.
Section R402.2, as applicable. The minimum concrete compressive strength at the time of fastener installation must be as noted in the applicable allowable load table. Hollow core precast concrete slabs must conform to the cross-sectional dimensions shown in Figure 7.

3.2.2 Concrete Masonry: Concrete masonry units (CMUs) must be minimum 8-inch-thick (203 mm), and must comply with ASTM C90. Mortar must comply with ASTM C270. Grout must be coarse grout complying with ASTM C476. Concrete masonry walls must have a minimum compressive strength, $f_{cm}$, of 1,500 psi (10.3 MPa). See Table 6 for applicable CMU density and mortar type.

3.2.3 Steel: Structural steel must comply with the minimum strength requirements of ASTM A36, ASTM A572 Grade 50 or ASTM A992, as applicable, and must have minimum yield and tensile strengths and thickness as noted in Table 2.

3.2.4 Steel Deck Panels: Steel deck panel properties and configurations must be as described in Table 5 and Figures 4 through 6, as applicable.

3.3 Wood Structural Panel Horizontal Diaphragms:

3.3.1 Wood Structural Panel: Wood structural panels must have a minimum thickness of 15/32 inch (11.9 mm) and must comply with the requirements of Section 4.2.6 of AWC Special Design Provisions for Wood & Seismic (SDPWS), which is referenced in IBC Section 2305.

3.3.2 Structural Steel Supports: Structural steel framing members supporting the wood structural panel diaphragm must comply with the minimum strength requirements of ASTM A36, ASTM A572 Grade 50 or ASTM A992, and have a thickness greater than or equal to $\frac{5}{16}$ inch (4.8 mm) as shown in Table 2.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Selection of fasteners must take into consideration the applicable base material and the length of the fastener. The minimum fastener length must be determined as follows:

- Unless otherwise noted, for installation into concrete, concrete-filled steel deck panels, concrete masonry and steel base materials, the minimum effective shank length shown in Table 1 must equal or exceed the sum of the thickness of the attached material and the minimum embedment depth (penetration) shown in the applicable tables in this report.

- For installation through steel base materials, the minimum effective shank length shown in Table 1 must equal or exceed the sum of the following: the thickness of the attached material, the thickness of the base material and the required point penetration shown in the applicable tables in this report.

4.1.2 Allowable Loads for Individual Fasteners: The applicable allowable shear and tension load tables for the Hilti X-U, X-U 15 and X-P fasteners driven into different base materials may be determined by referencing Table 1.

   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. For fasteners which are subjected to seismic loads, see Section 4.1.6 for additional information. The stress increases and load reductions described in IBC Section 1605.3 are not allowed.

   Allowable shear and tension loads in this report apply to the connection of the fastener to the base material only. Other limit states applicable to the design of a connection, such as fastener pull-through (pull-over) and lateral bearing on the attached material, which are governed by the properties of attached materials, are outside the scope of this report. Design of the connection to the attached material must comply with the applicable requirements of the IBC. When designing the connection of wood members to the base material, the bending yield strength of the PAFs can be assumed to be the same as that of a nail with the same shank diameter.

4.1.3 Combined Loading: For fasteners subjected to both shear and tension loads, compliance with the following interaction equation must be verified:

\[
(p/P_a) + (v/V_a) \leq 1
\]

where:

- $p = \text{Actual applied tension load on fastener, lbf (N)}$.
- $P_a = \text{Allowable tension load for the fastener, lbf (N)}$.
- $v = \text{Actual applied shear load on fastener, lbf (N)}$.
- $V_a = \text{Allowable shear load for the fastener, lbf (N)}$.

4.1.4 Wood Structural Panel Horizontal Diaphragms: When the X-U fastener is used to fasten wood structural panels to steel members, the fastener is recognized as equivalent to a 10d common nail specified in Table 4.2A of AWC SDPWS. Diaphragm design, including fastener spacing, diaphragm capacity and diaphragm deflection, must comply with Section 4.2.6 of AWC SDPWS, which is referenced in IBC Sections 2305.1 and IBC Section 2306.2.

4.1.5 Steel-to-steel Connections: When the Hilti fasteners listed in Table 2 are used in connections of two steel elements in accordance with Section J5 of AISI S100-16, connection capacity must be determined in accordance with Sections 4.1.5.1 and 4.1.5.2, as applicable.

4.1.5.1 Connection Strength - Tension: To determine tensile connection strength in accordance with Section J5.2 of AISI S100-16, the fastener tension strength, pull-over strength and pull-over strength must be known. These characteristics must be determined as follows:

- **Pull-out Strength**: See Table 2 for available pull-out strength.
- **Pull-over Strength**: The available pull-over strengths must be calculated in accordance with Section J5.2.3 of AISI S100-16.
- **PAF Tensile Strength**: The allowable fastener tension strengths, determined in accordance with Section J5.2.1 of AISI S100-16, must exceed the corresponding allowable pull-over strengths in Table 2.

4.1.5.2 Connection Strength - Shear: To determine shear connection strength in accordance with Section J5.3 of AISI S100-16, the fastener shear strength, bearing and tilting strength, pull-out strength in shear, net section rupture strength and shear strength limited by edge distance must be known. These characteristics must be determined as follows:

- **Bearing and Tilting Strength**: The available bearing and tilting strengths must be calculated in accordance with Section J5.3.2 of AISI S100-16.
- **Pull-out Strength in Shear**: The available pull-out strength in shear must be the applicable allowable shear strength from Table 2, or must be calculated in accordance with Section J5.3.3 of AISI S100-16.
4.2.2 Fastening to Steel: When installing the Hilti X-U or X-U 15 fastener in steel, the minimum spacing between fasteners must be 1 inch (25.4 mm) and the minimum edge distance must be 1/2 inch (12.7 mm).

4.2.3 Fastening to Concrete: Hilti X-U and X-P fasteners must be driven into the concrete after the concrete attains the compressive strength specified in the applicable tables of this report. Minimum spacing between fasteners must be 4 inches (102 mm) and minimum edge distance must be 3 inches (76 mm). Unless noted otherwise in this report, concrete thickness must be a minimum of three times the penetration depth of the fastener.

4.2.4 Fastening to Hollow Core Precast Concrete Slabs: Hilti X-U fasteners must be installed into the top or bottom of the hollow core precast concrete slab at the center of a core as shown in Figure 7, and must not make contact with the prestressing steel. The concrete thickness at these locations must be a minimum of 1 3/8 (35 mm) inches thick. Spacing along the length of the slab must be a minimum of 4 inches (102 mm).

4.2.5 DX-KWIK System: Installation of the Hilti X-U fastener into normal-weight concrete, using the Hilti DX-KWIK system as an alternate procedure, requires the drilling of a pilot hole using a Special DX-KWIK drill bit (TX-C) supplied by Hilti, Inc. prior to the installation of the fastener with the powder-actuated tool.

4.2.6 Fastening to Sand-lightweight Concrete-filled Steel Deck Panels: Installation of Hilti X-U or X-P fasteners in sand-lightweight concrete-filled steel deck panels must comply with Table 6. Minimum distances from fastener centerline to rolled deck panel flute edges must be as depicted in Figures 4 through 6, as applicable.

4.2.7 Fastening to Concrete Masonry: Hilti X-U and X-P fasteners must be driven into the concrete masonry after the mortar and grout materials have attained the specified strength. Fasteners must be located in accordance with Table 6.

4.2.8 Wood Structural Panel Diaphragms: For horizontal diaphragm applications, wood structural panels must be fastened to steel members with Hilti X-U fasteners at the spacing specified in the approved plans. When used, the optional steel strap is placed on top of the panels and the fasteners are driven through the strap and panel into the supporting steel member. The minimum distance from the centerline of the fasteners to the edge of the panel is 3/8 inch (9.5 mm). Fastener penetration and distance to the edge of the supporting steel member must be as described in Section 4.2.2. See Figure 8 for a typical installation detail showing one row of fasteners. The remainder of the diaphragm must be constructed in accordance with the code and the approved plans.

4.2.9 Use with Treated Lumber: The Hilti carbon steel fasteners described in Table 1 may be used in contact with fire-retardant-treated wood in dry (2012 and 2009 IBC Section 2304.9.5.4) and Hilti’s recommendations. Use of fasteners in contact with preservative-treated wood or fire-retardant-treated wood in exterior applications is outside the scope of this report.

5.0 CONDITIONS OF USE

The Hilti X-U, X-U 15 and X-P 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 The fasteners are manufactured and identified in accordance with this report.
5.2 Fastener installation complies with this report and the Hilti, Inc., instructions. In the event of conflict between this report and the Hilti, Inc., published instructions, the more restrictive requirements govern.

5.3 Calculations demonstrating that the actual loads are less than the allowable loads described in this report must be submitted to the code official for approval. The calculations 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 For steel-to-steel connections that meet the applicability requirements of Section J5 of AISI S100-16, calculations demonstrating that the available connection strength has been determined in accordance with Section J5 of AISI S100-16 and Section 4.1.5 of this report, and equals to or exceeds the applied load, must be submitted to the code official. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.5 Refer to Section 4.1.6 for seismic considerations.

5.6 The use of fasteners is limited to installation in uncracked concrete or masonry. Cracking occurs when $f > f_c$ due to service loads or deformations.

5.7 Use of fasteners is limited to dry, interior locations, which include exterior walls which are protected by an exterior wall envelope.

5.8 Installation must comply with Section 4.2.9 regarding fasteners in contact with preservative-treated and fire-retardant-treated wood.

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

5.10 The Hilti products addressed in this report are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fasteners Power-actuated Fasteners Driven into Concrete, Steel and Masonry Elements (AC70), dated February 2016 (editorially revised November 2017), including seismic load test data in accordance with Annex A of AC70.

7.0 IDENTIFICATION

7.1 Each package of fasteners is labeled with the fastener type and size, the manufacturer’s name (Hilti) and the evaluation report number (ESR-2269). An “H”, for Hilti, is imprinted on the head of the fastener as shown in Figures 1, 2 and 3.

7.2 The report holder’s contact information is the following:

HILTI, INC.
7250 DALLAS PARKWAY, SUITE 1000
PLANO, TEXAS 75024
(800) 879-8000
www.us.hilti.com
HNATechnicalServices@hilti.com
### TABLE 1—FASTENER DESCRIPTION AND APPLICATIONS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>FASTENER DESCRIPTION</th>
<th>SHANK TYPE</th>
<th>SHANK DIAMETER [inch (mm)]</th>
<th>HEAD DIAMETER [inch (mm)]</th>
<th>MAXIMUM POINT LENGTH [inch (mm)]</th>
<th>MINIMUM EFFECTIVE SHANK LENGTH [inch (mm)]</th>
<th>FASTENER COATING</th>
<th>APPLICABLE BASE MATERIAL</th>
<th>APPLICABLE LOAD TABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-U ##</td>
<td>Universal Powder Actuated Fastener</td>
<td>Knurled, straight</td>
<td>0.157 (4.0)</td>
<td>0.323 (8.2)</td>
<td>0.433 (11.0)</td>
<td>See Footnote 2</td>
<td>ASTM B633, SC1, Type III</td>
<td>Steel</td>
<td>2, 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Concrete</td>
<td>3, 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>Conc.-filled deck</td>
<td>5</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CMU</td>
<td>6</td>
</tr>
<tr>
<td>X-U 15</td>
<td>Powder Actuated Fastener</td>
<td>Knurled, stepped</td>
<td>0.145 (3.7)</td>
<td>0.323 (8.2)</td>
<td>0.413 (10.5)</td>
<td>0.61 (15.5)</td>
<td>ASTM B633, SC1, Type III</td>
<td>Steel</td>
<td>2</td>
</tr>
<tr>
<td>X-P ##</td>
<td>Powder Actuated Fastener</td>
<td>Smooth straight</td>
<td>0.157 (4.0)</td>
<td>0.323 (8.2)</td>
<td>0.524 (13.3)</td>
<td>See Footnote 3</td>
<td>ASTM B633, SC1, Type III</td>
<td>Concrete</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Conc.-filled deck</td>
<td>5</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CMU</td>
<td>6</td>
</tr>
</tbody>
</table>

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

### Footnotes:

1. ## denotes numbers used in fastener designation to represent nominal fastener length in mm, e.g. X-U 27 has a nominal shank length of 27 mm.
2. For fastener length of 16 mm, the minimum effective shank length is 14.8 mm (0.58 inch). For longer fasteners, the minimum effective shank length can be calculated in terms of the designated length as (##-0.5)/25.4 in inches.
3. The minimum effective shank length can be calculated in terms of the designated length as (##-1)/25.4 in inches.

### TABLE 2—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO STEEL\(^1,2,6\)

<table>
<thead>
<tr>
<th>FASTENER DESCRIPTION</th>
<th>FASTENER DESCRIPTION</th>
<th>SHANK DIAMETER (inch)</th>
<th>ALLOWABLE LOADS (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Thickness (inch):</td>
<td>1/8</td>
<td>1/4</td>
<td>3/8</td>
</tr>
<tr>
<td>Load Direction:</td>
<td>Tension</td>
<td>Shear</td>
<td>Tension</td>
</tr>
<tr>
<td>Universal Knurled Shank</td>
<td>X-U</td>
<td>0.157</td>
<td>500(^7)</td>
</tr>
<tr>
<td>Universal Knurled Shank</td>
<td>X-U 15</td>
<td>0.145</td>
<td>155</td>
</tr>
</tbody>
</table>

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.4 N; 1 ksi = 6.9 MPa.

1. Allowable load capacities are based on base steel with a minimum yield strength \((F_y)\) of 36 ksi and a minimum tensile strength \((F_u)\) of 58 ksi.
2. The fasteners must be driven to where the point of the fastener penetrates through the steel base material, unless otherwise noted.
3. Based upon a minimum point penetration of 1/8 inch.
4. Based upon a minimum point penetration of 3/32 inch.
5. Based upon a minimum point penetration of 1/16 inch.
6. Allowable loads are applicable to static and seismic loads in accordance with Section 4.1.
7. For steel-to-steel connections designed in accordance with Section 4.1.6 for static loads only, the tabulated allowable load may be increased by a factor of 1.25, and the design strength maybe taken as the tabulated allowable load multiplied by a factor of 2.0.
### TABLE 3—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO NORMAL-WEIGHT CONCRETE¹,²,⁴

<table>
<thead>
<tr>
<th>FASTENER DESCRIPTION</th>
<th>FASTENER SHANK DIAMETER (inch)</th>
<th>MINIMUM EMBEDMENT DEPTH (inches)</th>
<th>ALLOWABLE LOADS (lbf)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Concrete Compressive Strength: 2500 psi 4000 psi 6000 psi 8000 psi</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tension Shear Tension Shear Tension Shear Tension Shear</td>
</tr>
<tr>
<td>Universal Knurled Shank</td>
<td>X-U 0.157</td>
<td>³⁄₄</td>
<td>100 125 100 125 105 205 – –</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>165 190 170 225 110³ 280³ – –</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 ⁴⁄₄</td>
<td>240 310 280 310 180 425 – –</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 ¹⁄₂</td>
<td>275 420 325 420 – – – –</td>
</tr>
<tr>
<td>Smooth Shank</td>
<td>X-P 0.157</td>
<td>³⁄₄, ⁵</td>
<td>100 155 100 175 105 205 135 205</td>
</tr>
<tr>
<td></td>
<td></td>
<td>¹</td>
<td>165 220 180 225 150 300 150 215</td>
</tr>
<tr>
<td></td>
<td></td>
<td>¹¹⁄₄</td>
<td>240 310 280 310 180 425 – –</td>
</tr>
<tr>
<td></td>
<td></td>
<td>¹¹⁄₂</td>
<td>310 420 – – – – – –</td>
</tr>
</tbody>
</table>

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

¹Unless otherwise noted, values apply to normal weight cast-in-place concrete. Fasteners must not be driven until the concrete has reached the designated minimum compressive strength.

²Unless otherwise noted, concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

³This allowable load value for the X-U fastener also applies to normal weight hollow core concrete slabs with $f'_c$ of 6600 psi and minimum dimensions shown in Figure 7, when installed in accordance with Section 4.2.4.

⁴The fasteners listed in the table above may be used for static load conditions and for the seismic load conditions described in Section 4.1.6, as applicable. The tabulated allowable loads apply to static load conditions. For seismic load conditions, the allowable loads must be limited in accordance with Section 4.1.6, Items 2 and 3, as applicable.

⁵Applies to fastening of cold-formed steel up to 54 mil thick using the X-P 22, X-P 27, X-P 34 and X-P 40 fasteners, respectively, for the ³⁄₄, 1, ¹¹⁄₄ and ¹¹⁄₂ inch embedment depths.

### TABLE 4—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO NORMAL-WEIGHT CONCRETE USING DX-KWIK¹,²,³,⁴

<table>
<thead>
<tr>
<th>FASTENER DESCRIPTION</th>
<th>FASTENER</th>
<th>SHANK DIAMETER (inch)</th>
<th>MINIMUM EMBEDMENT DEPTH (inches)</th>
<th>ALLOWABLE LOADS (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Universal Knurled Shank</td>
<td>X-U 47 P8 w/ DX-KWIK</td>
<td>0.157</td>
<td>¹⁄₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>395</td>
<td>405</td>
</tr>
</tbody>
</table>

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

¹X-U Fastener is installed using the DX-KWIK drilled pilot hole installation procedure described in Section 4.2.5.

²Pilot holes must not be drilled until the concrete has reached the designated minimum compressive strength.

³Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.

⁴Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.
### TABLE 5—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO MINIMUM $f'_c = 3000$ psi STRUCTURAL SAND-LIGHTWEIGHT CONCRETE WITH OR WITHOUT METAL DECK\(^1,6\)

<table>
<thead>
<tr>
<th>FASTENER DESCRIPTION</th>
<th>FASTENER</th>
<th>SHANK DIAMETER (inch)</th>
<th>MINIMUM EMBEDMENT (inch)</th>
<th>ALLOWABLE LOADS (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Installed into Concrete(^4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3-inch deep composite floor deck panel(^2)</td>
</tr>
<tr>
<td>Load Direction:</td>
<td>Tension</td>
<td>Shear</td>
<td>Tension</td>
<td>Shear</td>
</tr>
<tr>
<td>Universal Knurled Shank</td>
<td>X-U</td>
<td>0.157</td>
<td>(\frac{3}{4})</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>205</td>
<td>260</td>
<td>215</td>
</tr>
<tr>
<td></td>
<td>1(\frac{1}{4})</td>
<td>315</td>
<td>435</td>
<td>295</td>
</tr>
<tr>
<td></td>
<td>1(\frac{1}{2})</td>
<td>425</td>
<td>475</td>
<td>400</td>
</tr>
<tr>
<td>Smooth Shank</td>
<td>X-P</td>
<td>0.157</td>
<td>(\frac{3}{4})</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>1(\frac{1}{4})</td>
<td>225</td>
<td>300</td>
<td>215</td>
</tr>
<tr>
<td></td>
<td>1(\frac{1}{2})</td>
<td>325</td>
<td>445</td>
<td>295</td>
</tr>
<tr>
<td></td>
<td>1(\frac{3}{4})</td>
<td>425</td>
<td>480</td>
<td>400</td>
</tr>
</tbody>
</table>

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

1Fasteners must not be driven until the concrete has reached the designated minimum compressive strength.
2The steel deck profile for the 3-inch deep composite floor deck panel has a minimum thickness of 0.0359 inch (0.91 mm) and a minimum tensile strength of 65 ksi. Lower and upper flute width must be a minimum of 3\(\frac{1}{8}\) inches. Figure 4 shows the nominal flute dimensions, fastener locations, and load orientations for the deck panel profile. Sand-lightweight concrete fill above top of steel deck panel must be minimum 3\(\frac{1}{4}\) inches thick.
3The steel deck profile for the 1\(\frac{1}{2}\)-inch deep composite floor deck panel has a minimum thickness of 0.0359 inch (0.91 mm) and a minimum tensile strength of 45 ksi. Lower flute and upper flute widths must be a minimum of 1\(\frac{1}{8}\) inch and 3\(\frac{1}{2}\) inch, respectively. This deck panel may also be inverted as shown in Figure 6. Figures 5 and 6 show the nominal flute dimensions, fastener locations, and load orientations for the deck panel profile. Sand-lightweight concrete fill above top of steel deck panel must be minimum 2\(\frac{1}{2}\) inches thick.
4Concrete thickness must be a minimum of 3 times the embedment depth of the fastener.
5Minimum allowable spacing parallel to the deck flutes is 5.1 inches.
6The tabulated allowable load values are for fasteners installed in masonry conforming to the requirements of Section 3.2.2 of this report. CMUs must be normal weight. Mortar must be Type S.
7No more than one low-velocity fastener may be installed in an individual concrete masonry unit cell. The fastener must be installed a minimum of 4 inches from the top, bottom and edges of the wall.
8Fastener must be located a minimum of 1 inch from the mortar joints.
9Fasteners must not be installed in the head joints. Fasteners installed in the bed joints must be installed a minimum of 8 inches from the end of the wall. Multiple fasteners in a bed joint must be spaced a minimum of 8 inches.
10Shear load can be in any direction.
11The fasteners listed in the table above may be used for static load conditions and for the seismic load condition described in Item 1 of Section 4.1.6.

### TABLE 6—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO CONCRETE MASONRY\(^3,10\)

<table>
<thead>
<tr>
<th>FASTENER DESCRIPTION</th>
<th>FASTENER</th>
<th>SHANK DIAMETER (inch)</th>
<th>MINIMUM EMBEDMENT DEPTH (inch)</th>
<th>ALLOWABLE LOADS (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Face Shell(^a)</td>
</tr>
<tr>
<td>Load Direction:</td>
<td>Tension</td>
<td>Shear</td>
<td>Tension</td>
<td>Shear(^d)</td>
</tr>
<tr>
<td>Universal Knurled Shank</td>
<td>X-U</td>
<td>0.157</td>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td>Smooth Shank</td>
<td>X-P</td>
<td>0.157</td>
<td>1</td>
<td>70</td>
</tr>
</tbody>
</table>

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

1The tabulated allowable load values are for fasteners installed in masonry conforming to the requirements of Section 3.2.2 of this report. CMUs must be normal weight. Mortar must be Type S.
2The tabulated allowable load values are for fasteners installed in masonry conforming to the requirements of Section 3.2.2 of this report. CMUs must be medium weight. Mortar must be Type S.
3No more than one low-velocity fastener may be installed in an individual concrete masonry unit cell. The fastener must be installed a minimum of 4 inches from the top, bottom and edges of the wall.
4Fastener must be located a minimum of 1 inch from the mortar joints.
5Fasteners must not be installed in the head joints. Fasteners installed in the bed joints must be installed a minimum of 8 inches from the end of the wall. Multiple fasteners in a bed joint must be spaced a minimum of 8 inches.
6Shear load can be in any direction.
7The fasteners listed in the table above may be used for static load conditions and for the seismic load condition described in Item 1 of Section 4.1.6.
FIGURE 1—HILTI X-U FASTENER

FIGURE 2—X-U 15 FASTENER

FIGURE 3—X-P FASTENER

FIGURE 4—HILTI FASTENER LOCATION IN 3-INCH-DEEP COMPOSITE FLOOR DECK PANEL, NORMAL DECK PANEL PROFILE ORIENTATION
FIGURE 5—HILTI FASTENER LOCATION IN 1½-INCH-DEEP COMPOSITE FLOOR DECK PANEL, NORMAL DECK PANEL PROFILE ORIENTATION

FIGURE 6—HILTI FASTENER LOCATION IN 1½-INCH-DEEP COMPOSITE FLOOR DECK PANEL, INVERTED DECK PANEL PROFILE ORIENTATION

FIGURE 7—HILTI X-U FASTENER LOCATION IN HOLLOW-CORE CONCRETE SLABS
FIGURE 8—WOOD STRUCTURAL PANEL DECK ATTACHMENT TO STEEL LEDGER WITH HILTI X-U UNIVERSAL POWDER DRIVEN FASTENER
1.0 REPORT PURPOSE AND SCOPE

Purpose: The purpose of this evaluation report supplement is to indicate that Hilti Low-Velocity X-U and X-U 15 Universal Fasteners and X-P Concrete Fasteners, described in ICC-ES evaluation report ESR-2269, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:
- 2020 City of Los Angeles Building Code (LABC)
- 2020 City of Los Angeles Residential Code (LARC)

2.0 CONCLUSIONS

The Hilti Low-Velocity X-U and X-U 15 Universal Fasteners and X-P Concrete Fasteners, described in Sections 2.0 through 7.0 of the evaluation report ESR-2269, comply with the LABC Chapter 19, 21, 22, 23 and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Hilti Low-Velocity X-U and X-U 15 Universal Fasteners and X-P Concrete Fasteners described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-2269.
- The design, installation, conditions of use and identification of the fasteners are in accordance with the 2018 International Building Code® (2018 IBC) provisions noted in the evaluation report ESR-2269.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.
• The allowable strength values listed in the evaluation report are for the connection of the fasteners to normalweight concrete, lightweight concrete with or without metal deck, steel, and masonry. The connection between the fasteners and the connected members must be checked for capacity (which may govern).

This supplement expires concurrently with the evaluation report, reissued February 2019 and revised January 2020.
DIVISION: 03 00 00—CONCRETE  
Section: 03 15 00—Concrete Accessories  
Section: 03 16 00—Concrete Anchors  

DIVISION: 04 00 00—MASONRY  
Section: 04 05 19.16—Masonry Anchors  

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

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES  
Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:  
HILTI, INC.

EVALUATION SUBJECT:  
HILTI LOW-VELOCITY X-U AND X-U 15 UNIVERSAL FASTENERS AND X-P CONCRETE FASTENERS

1.0 REPORT PURPOSE AND SCOPE  

Purpose:  
The purpose of this evaluation report supplement is to indicate that the Hilti Low-Velocity X-U and X-U 15 Universal and X-P Concrete Powder Driven Fasteners, recognized in ICC-ES master report ESR-2269, have also been evaluated for compliance with the codes noted below.

Applicable code editions:  
- 2017 Florida Building Code—Building  
- 2017 Florida Building Code—Residential

2.0 CONCLUSIONS  
The Hilti Low-Velocity X-U and X-U 15 Universal and X-P Concrete Powder Driven Fasteners, described in Sections 2.0 through 7.0 of the master report ESR-2269, comply with the Florida Building Code—Building and the Florida Building Code—Residential, provided the design and installation are in accordance with the 2015 International Building Code® provisions noted in the master report.

Use of the Hilti Low-Velocity X-U and X-U 15 Universal and X-P Concrete Powder Driven Fasteners has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the Florida Building Code—Building and the Florida Building Code—Residential under the following conditions.

- The use of the Hilti Low-Velocity X-U and X-U 15 Universal and X-P Concrete Powder Driven Fasteners as a means of attachment for wood blocking, as defined in Section 2330.1.10 of the Florida Building Code—Building, is prohibited. Attachment of wood structural panel diaphragms to supporting steel framing members, as recognized in the master report, is acceptable.
- 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 February 2019 and revised January 2020.