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PROJECT NO Stainless Cable 217-1 SHEET ____ OF ____

PROJECT NAME ____ DESIGNED BY AF DATE ____

SUBJECT fascia mount to 5/16" steel CHECKED BY ____ DATE ____

Conclusion

① Rectangular bracket

(1-1) with 4- screws

Bracket size: 6.25" * 3.5" * 0.39"

use [4- 5/16" ϕ Drill & Tap screws]

(1-2) with 2- screws

Bracket size: 9" * 3.5" * 0.39"

use [2- 5/16 ϕ Drill & Tap screws]

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PROJECT NO. Stainless Cable 217-1 SHEET ____ OF ____
PROJECT NAME ____ DESIGNED BY AF DATE ____
SUBJECT fascia mount to 5/16" steel CHECKED BY ____ DATE ____

② Circular bracket

(2-1) with 4-screws

Bracket size = 7"ϕ × 0.39"

use [4 - 5/16"ϕ Drill & Tap screws]

(2-2) with 2-screws

Bracket size = 9"ϕ × 0.39"

use [2 - 5/16"ϕ Drill & Tap screws]

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PROJECT NO. Stainless Cable 217-1 SHEET ____ OF ____

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(3) Corner bracket

use [2 - 1/2" φ thru-bolt]

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PROJECT NO. Stainless Cable 217-1 SHEET 1 OF

PROJECT NAME DESIGNED BY AF DATE

SUBJECT Fascia mount to 5/16" st CHECKED BY DATE

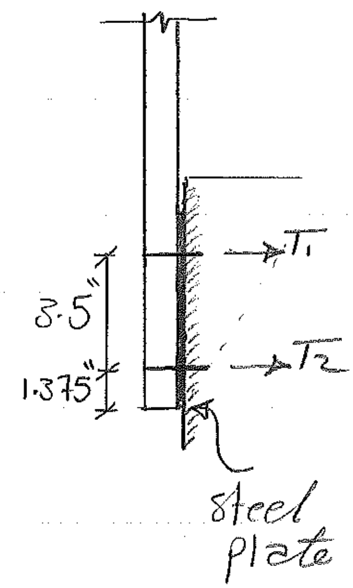
Fascia mount to $\frac{5}{16}$" steel plate

① Rectangular bracket

Moment: $M = 50^{\,lb/ft} * 5^{\,ft} * 48''/12$

$= 1000$ lb·ft

$\frac{T_2}{T_1} = \frac{1.375}{(3.5+1.375)} = 0.28$



$T_1 = 3.54\,T_2$

$T_1 + T_2 = \frac{M}{d} = \frac{1000^{\,lb.ft} * 12^{\,in/ft}}{3.5+1.375}$

$= 2,462$ lb

$T_2 + 3.54\,T_2 = 2,462$ lb

$T_2 = 543$ lb ∴ $T_1 = 1920$ lb use $2000^{\,lb}$

Tensio / 2 bolts = $2000^{\,lb}$

Tension / bolt = $1000^{\,lb}$

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PROJECT NO. Stainless Cable 217-1 SHEET 2 OF

PROJECT NAME DESIGNED BY AF DATE

SUBJECT Fascia mount to $\frac{5}{16}$" steel CHECKED BY DATE

$\frac{1}{4}$" - 20 pull-out capacity = 1206 lb

2 screws capacity = 2 * 1206 = 2412 lb > 2000 lb

∴ use [4 - $\frac{1}{4}$" ϕ screw]

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PROJECT NO. Stainless Cable 217-9 SHEET ____ OF ____

PROJECT NAME ____ DESIGNED BY AF DATE ____

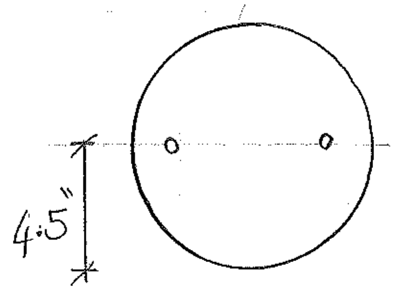
SUBJECT Fascia mount to $\frac{5}{16}$" steel CHECKED BY ____ DATE ____

② Circular bracket option 1, 2 screws

$$\text{Tension}/2\text{ bolts} = \frac{M}{d}$$

$$= \frac{1000 * 12}{4.5"}$$

$$= 2{,}667 \text{ lb}$$



$\frac{5}{16}$" ϕ screw pull-out capacity = 1424 lb

2 - screws capacity = 2 * 1424 = 2,848 lb > Tension in bolts

use [2 - $\frac{5}{16}$" ϕ screw w/ 9" ϕ plate * 0.039" thick]

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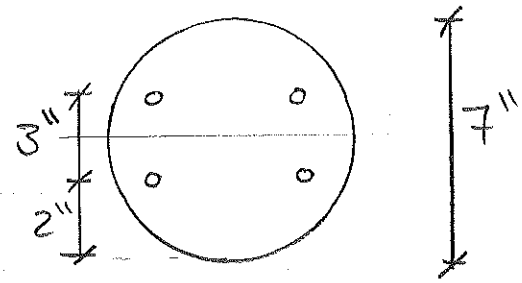
PROJECT NO. Stainless Cable 217-1 SHEET ____ OF ____

PROJECT NAME ____ DESIGNED BY AF DATE ____

SUBJECT fascia mount to 5/16" steel CHECKED BY ____ DATE ____

(2-1) Circular bracket option - 2

4 - screws



Tension $= \frac{M}{d}$

$= \frac{1000 * 12}{5.0"} = 2,400$ lb / 2 bolts

$\frac{5}{16}"$ ϕ screw capacity = 1428 lb

∴ 2 screws capacity = 2 * 1428 = 2,826 lb > applied load

use [4 - $\frac{5}{16}"$ ϕ screws w/ 7" ϕ plate * 0.039" thick]

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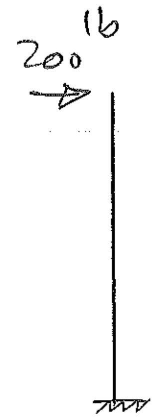
PROJECT NO Stainless Cable 217-1 SHEET ____ OF ____
PROJECT NAME ____ DESIGNED BY AF DATE ____
SUBJECT fascia mount to $\frac{5}{16}$" steel CHECKED BY ____ DATE ____

③ Corner fascia mount bracket

Applied load = 200 lb



$M = 200^{lb} * 4' = 800 \text{ lb-ft}$

$\text{Tension / bolt} = \frac{M}{d}$

$= \frac{800^{lb\text{-}ft} * 12}{4"} = 2{,}400^{lb}$

$\frac{1}{2}"\ \phi$ thru-bolt capacity "Tension" $= 45^{ksi} * \frac{\pi}{4} * (0.5)^2$

$= 8.55$ Kip

> applied load

use [2 - $\frac{1}{2}"\ \phi$ thru-bolt]

ICC-ES Report

ESR-3332

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

Reissued 09/2016
This report is subject to renewal 09/2017.

DIVISION: 05 00 00—METALS
SECTION: 05 05 23—METAL FASTENINGS

REPORT HOLDER:

INFASTECH DECORAH LLC ELCO CONSTRUCTION PRODUCTS

1302 KERR DRIVE
DECORAH, IOWA 52101

EVALUATION SUBJECT:

DRIL-FLEX® SELF-DRILLING STRUCTURAL FASTENERS

ICC-ES Evaluation Report

ESR-3332

Reissued September 2016

This report is subject to renewal September 2017.

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

REPORT HOLDER:

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EVALUATION SUBJECT:

DRIL-FLEX® SELF-DRILLING STRUCTURAL FASTENERS

ADDITIONAL LISTEE:

HILTI, INC.
5400 SOUTH 122ND EAST AVENUE
TULSA, OKLAHOMA 74146
(800) 879-8000
www.us.hilti.com
PRODUCT NAME: KWIK-FLEX® SELF DRILLING SCREWS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012, 2009 and 2006 *International Building Code®* (IBC)
- 2012 and 2009 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

Elco Dril-Flex® and Hilti Kwik-Flex® Self-Drilling Structural Fasteners are used in engineered connections of cold-formed steel members. The fasteners may be used under the IRC when an engineered design is submitted for review in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

Elco Dril-Flex® and Hilti Kwik-Flex® Self-Drilling Structural Fasteners are proprietary, self-drilling tapping screws that have a dual heat treatment and that are coated with a corrosion-preventive coating identified as Silver Stalgard®. The drill point and lead threads of the screws are heat-treated to a relatively high hardness to facilitate drilling and thread forming. The balance of the fastener is treated to a lower hardness complying with the hardness limits for SAE J429 Grade 5 screws and the hardness limits for ASTM A449-10 Type 1 screws. The threaded portion of the screw with the lower hardness is considered the load-bearing area, used to transfer loads between connected elements. See Figures 10, 11 and 12. Table 1 provides screw descriptions (size, tpi, length), nominal diameters, head styles, head diameters, point styles, drilling capacities and length of load-bearing area.

3.1.1 EDX445 (Type 1): The EDX445 screw is a #10, coarse threaded screw with a phillips pan head. See Figure 1.

3.1.2 EAF430, EAF460, EAF470, EAF480 (Type 2): These screws are #10, coarse threaded screws with an indented hex washer head. See Figure 2.

3.1.3 EAF621, EAF641, EAF681, EAF690, EAF715 (Types 3 and 4): These screws are #12, coarse threaded screws with an indented hex washer head. See Figure 3.

3.1.4 EAF755 (Type 5): The EAF755 screw is a #12, fine threaded screw with an indented hex washer head. See Figure 4.

3.1.5 EAF816, EAF841, EAF846 (Type 6): These screws are $^1/_4$-inch-diameter, coarse threaded screws with an indented hex washer head. See Figure 5.

3.1.6 EAF865, EAF876, EAF886, EAF890 (Type 7): These screws are $^1/_4$-inch-diameter, fine threaded screws with an indented hex washer head. See Figure 6.

3.1.7 EAF888 (Type 8): The EAF888 screw is a $^1/_4$-inch-diameter, fine threaded screw with an indented hex washer head. The lead threads have a design identified by the manufacturer as Round Body Taptite®. See Figure 7.

3.1.8 EAF900, EAF910 (Types 9 and 10): These screws are $^1/_4$-inch-diameter, partially threaded, fine threaded screws with an indented hex washer head.

3.1.9 EAF940 (Type 11): The EAF940 screw is a $^5/_{16}$-inch-diameter, fine threaded screw with an indented hex washer head. The lead threads have a design identified by the manufacturer as Round Body Taptite®. See Figure 8.

3.1.10 EAF960, EAF970 (Type 12): These screws are $^5/_{16}$-inch-diameter, fine threaded screws with an indented hex washer head. At the lead end of the screw, the shank of the screw is notched to form a shank slot. See Figure 9.

3.2 Screw Material:

The screws are formed from alloy steel wire complying with ASTM F2282 Grade IFI-4037. The screws are heat-treated to a through-hardness of 28 to 34 HRC. The drilling point and lead threads are heat-treated to a minimum of 52 HRC.

3.3 Connected Material:

The connected steel materials must comply with one of the standards listed in Section A2 of AISI S100 (AISI NAS for the 2006 IBC) and have the minimum thickness, yield strength and tensile strength shown in the tables in this report.

4.0 DESIGN AND INSTALLATION

4.1 Design:

Elco Dril-Flex® and Hilti Kwik-Flex® Self-Drilling Structural Fasteners are recognized for use in engineered connections of cold-formed steel construction. Design of the connections must comply with Section E4 of AISI S100 (AISI-NAS for the 2006 IBC). Nominal and available fastener tension and shear strengths for the screws are shown in Table 2. Available connection shear, pull-over and pull-out capacities are given in Tables 3, 4 and 5, respectively. For tension connections, the lowest of the available fastener tension strength, pull-over strength and pull-out strength, in accordance with Tables 2, 4 and 5, respectively, must be used for design. For shear connections, the lower of the available fastener shear strength and the shear (bearing) strength, in accordance with Tables 2 and 3, respectively, must be used for design. Connections subject to combined tension and shear loading must be designed in accordance with Section E4.5 of AISI S100 (AISI-NAS for the 2006 IBC). Connected members must be checked for rupture in accordance with Section E5 of AISI S100.

The values in the tables are based on a minimum spacing between the centers of fasteners of three times the nominal diameter of the screw, and a minimum distance from the center of a fastener to the edge of any connected part of 1.5 times the nominal diameter of the screw. See Table 6. When the direction to the end of the connected part is parallel to the line of the applied force, the allowable connection shear strength determined in accordance with Section E4.3.2 of Appendix A of AISI S100 (AISI-NAS for the 2006 IBC) must be considered.

When tested for corrosion resistance in accordance with ASTM B117, the screws meet the minimum requirement listed in ASTM F1941, as required by ASTM C1513, with no white corrosion after three hours and no red rust after twelve hours.

4.2 Installation:

Installation of Elco Dril-Flex® and Hilti Kwik-Flex® Self-Drilling Structural Fasteners must be in accordance with the manufacturer's published installation instructions and this report. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

Screw length and point style must be selected by considering, respectively, the length of load-bearing area and the drilling capacities shown in Table 1. The fasteners must be installed without predrilling holes in the receiving member of the connection. The drilling function of the fastener must be completed prior to the lead threads of the fastener engaging the metal. When the total connection thickness exceeds the maximum drilling capacity shown in Table 1, clearance holes must be provided in the attached material to reduce the thickness to be drilled by the screw. Clearance holes must be $^{13}/_{64}$, $^{15}/_{64}$, $^{17}/_{64}$ and $^{21}/_{64}$ inch (5.2, 5.9, 6.7 and 8.3 mm) in diameter for #10, #12, $^{1}/_{4}$-inch-diameter and $^{5}/_{16}$-inch-diameter (4.7, 5.3, 6.4 and 7.9 mm) fasteners, respectively. The screw must be installed perpendicular to the work surface using a 1,200 to 2,500 rpm screw gun incorporating a depth-sensitive or torque-limiting nose piece. The screw must penetrate through the supporting metal with a minimum of three threads protruding past the back side of the supporting metal.

5.0 CONDITIONS OF USE

The Elco Dril-Flex® and Hilti Kwik-Flex® Self-Drilling Structural 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 must be installed in accordance with the manufacturer's published installation instructions and this report. If there is a conflict between the manufacturer's published installation instructions and this report, the more severe requirements govern.

5.2 The allowable connection capacities specified in Section 4.1 are not to be increased when the fasteners are used to resist short-duration loads, such as wind or seismic forces.

5.3 The utilization of the nominal connection capacities contained in this evaluation report, for the design of cold-formed steel diaphragms, is outside the scope of this report.

5.4 Drawings and calculations verifying compliance with this report and the applicable code must be submitted to the code official for approval. The drawings and calculations are to be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Tapping Screw Fasteners (AC118), dated June 2012.

7.0 IDENTIFICATION

The Elco Dril-Flex® and Hilti Kwik-Flex® self-drilling tapping screws are marked with a “ ” on the top surface of the screw heads, as shown in Figures 1 through 9. Packages of self-drilling tapping screws are labeled with the report holder or listee name (Elco Construction Products or Hilti, Inc.) and address, product brand name (Dril-Flex® or Kwik-Flex®), product number or item number, size and length, point style and the evaluation report number (ESR-3332).

TABLE 1—ELCO DRIL-FLEX SELF-DRILLING STRUCTURAL FASTENERS

SCREW TYPE	ELCO PRODUCT NUMBER	HILTI ITEM NUMBER	DESCRIPTION (nom. size-tpi x length)	NOMINAL DIAMETER (in.)	HEAD STYLE[1]	HEAD DIAMETER (in.)	POINT STYLE	DRILLING CAPACITY (in.)		LENGTH OF LOAD BEARING AREA[2] (in.)
								Min.	Max.	
1	EDX445	03409732	#10-16x$^{3}/_{4}$	0.190	PPH	0.365	2	0.11	0.110	0.38
2	EAF430	00408123	#10-16x$^{3}/_{4}$	0.190	IHWH	0.399	3	0.11	0.150	0.38
	EAF460	03489672	#10-16x1$^{1}/_{2}$	0.190	IHWH	0.399	3	0.11	0.150	1.00
	EAF470	03458234	#10-16x2	0.190	IHWH	0.415	3	0.11	0.150	1.50
	EAF480	03492651	#10-16x2$^{1}/_{2}$	0.190	IHWH	0.399	3	0.11	0.150	1.83
3	EAF621	00087572	#12-14x$^{7}/_{8}$	0.216	IHWH	0.415	3	0.11	0.187	0.38
	EAF641	00087646	#12-14x1	0.216	IHWH	0.415	3	0.11	0.187	0.50
	EAF681	00087647	#12-14x1$^{1}/_{2}$	0.216	IHWH	0.415	3	0.11	0.187	1.00
	EAF690	00008595	#12-14x2	0.216	IHWH	0.415	3	0.11	0.187	1.50
4	EAF715	03011177	#12-14x3	0.216	IHWH	0.500	2	0.11	0.110	2.35
5	EAF755	03458235	#12-24x1$^{3}/_{4}$	0.216	IHWH	0.415	5	0.11	0.500	0.80
6	EAF816	00087648	$^{1}/_{4}$-14x1	0.250	IHWH	0.500	3	0.11	0.210	0.45
	EAF841	00087649	$^{1}/_{4}$-14x1$^{1}/_{2}$	0.250	IHWH	0.500	3	0.11	0.210	0.95
	EAF846	00008598	$^{1}/_{4}$-14x2	0.250	IHWH	0.500	3	0.11	0.210	1.45
7	EAF865	03011203	$^{1}/_{4}$-20x1$^{1}/_{8}$	0.250	IHWH	0.500	4	0.11	0.312	0.50
	EAF876	00000451	$^{1}/_{4}$-20x1$^{1}/_{2}$	0.250	IHWH	0.500	4	0.11	0.312	0.83
	EAF886	00000452	$^{1}/_{4}$-20x2	0.250	IHWH	0.500	4	0.11	0.312	1.33
	EAF890	00010436	$^{1}/_{4}$-20x2$^{1}/_{2}$	0.250	IHWH	0.500	4	0.11	0.312	1.83
8	EAF888	03458236	$^{1}/_{4}$-20x1$^{3}/_{4}$	0.250	IHWH	0.500	5	0.11	0.500	0.80
9	EAF900	03414194	$^{1}/_{4}$-20x3$^{3}/_{8}$	0.250	IHWH	0.500	3	0.11	0.210	2.70
10	EAF910	03463594	$^{1}/_{4}$-20x4	0.250	IHWH	0.500	4	0.11	0.312	3.50
11	EAF940	03011230	$^{5}/_{16}$-18x1$^{1}/_{2}$	0.313	IHWH	0.600	3	0.11	0.312	0.80
12	EAF960	03006009	$^{5}/_{16}$-24x1$^{1}/_{2}$	0.313	IHWH	0.600	4	0.11	0.312	0.80
	EAF970	03432628	$^{5}/_{16}$-24x2	0.313	IHWH	0.600	4	0.11	0.312	1.25

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

[1]Head styles: IHWH = Indented Hex Washer Head; PPH = Phillips Pan Head.
[2]The Length of Load Bearing Area is based on the length of the threaded portion of the screw that is heat treated to HRC 28-34, and represents the limit of the total thickness of the connected elements. See Sections 3.1 and 4.2 and Figures 10 through 12 for further clarification.

TABLE 2—FASTENER SHEAR AND TENSION STRENGTH, pounds-force[1,2,3]

SCREW TYPE	SCREW SIZE	NOMINAL STRENGTH (TESTED)		ALLOWABLE STRENGTH (ASD) Ω=3		DESIGN STRENGTH (LRFD) Φ=0.5	
		Shear, P_{ss}	Tension, P_{ts}	Shear, P_{ss}/Ω	Tension, P_{ts}/Ω	Shear, ΦP_{ss}	Tension, ΦP_{ts}
1	#10-16	1526	2273	509	758	763	1136
2	#10-16	1463	2276	488	759	732	1138
3, 4	#12-14	1992	3216	664	1072	996	1608
5	#12-24	2503	4177	834	1392	1252	2088
6	$^{1}/_{4}$-14	2692	4363	897	1454	1346	2182
7, 9, 10	$^{1}/_{4}$-20	2659	4729	886	1576	1330	2364
8	$^{1}/_{4}$-20	2617	4619	872	1540	1308	2309
11	$^{5}/_{16}$-18	4568	8070	1523	2690	2284	4035
12	$^{5}/_{16}$-24	5471	8757	1824	2919	2736	4379

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

[1]For tension connections, the lower of the available fastener tension strength, pullover strength, and pull-out strength found in Tables 2, 4 and 5, respectively, must be used for design.
[2]For shear connections, the lower of the available fastener shear strength and the allowable shear (bearing) capacity found in Tables 2 and 3, respectively, must be used for design.
[3]Nominal strengths are based on laboratory tests.

TABLE 3—SHEAR (BEARING) CAPACITY OF SCREW CONNECTIONS, pounds-force[1,2,3,4,5]

SCREW TYPE	SCREW DESIGNATION	NOMINAL DIAMETER (in.)	DESIGN THICKNESS (in.)[6]						
			0.048-0.048	0.048-0.075	0.060-0.060	0.075-0.075	1/8"-3/16"	3/16"-1/4"	1/4"-0.105"
ALLOWABLE STRENGTH (ASD)									
1	#10-16	0.190	289	289	404	-	-	-	-
2	#10-16	0.190	369	395	453	-	-	-	-
3, 4	#12-14	0.216	356	573	513	497	-	-	-
6	1/4-14	0.250	377	626	520	661	638	-	-
7, 8	1/4-20	0.250	386[7,8]	526[7,8]	533[8]	670[8]	595[9]	624[9]	554[9]
11	5/16-18	0.313	408	622	561	891	-	-	-
12	5/16-24	0.313	-	-	-	-	1347	984	887
DESIGN STRENGTH (LRFD)									
1	#10-16	0.190	433	433	605	-	-	-	-
2	#10-16	0.190	590	631	724	-	-	-	-
3, 4	#12-14	0.216	569	917	820	795	-	-	-
6	1/4-14	0.250	603	1001	833	1058	1021		
7, 8	1/4-20	0.250	617[7,8]	842[7,8]	852[8]	1072[8]	952[9]	999[9]	886[9]
11	5/16-18	0.313	653	996	897	1425	-	-	-
12	5/16-24	0.313	-	-	-	-	2155	1575	1419

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 Mpa.

[1]Available strengths are based on laboratory tests, with safety factors/resistance factors calculated in accordance with AISI S100.
[2]For shear connections, the lower of the available fastener shear strength and the available shear (bearing) capacity must be used for design.
[3]Values are based on steel members with a minimum yield strength of F_y = 33 ksi and a minimum tensile strength of F_u = 45 ksi.
[4]Available capacity for other member thickness may be determined by interpolating within the table.
[5]Unless otherwise noted, when both steel sheets have a minimum specified tensile strength $F_u \geq 58$ ksi, multiply tabulated values by 1.29 and when both steel sheets have a minimum tensile strength $F_u \geq 65$ ksi steel, multiply tabulated values by 1.44.
[6]The first number is the thickness of the steel sheet in in contact with the screw head (top sheet). The second number is the thickness of the steel sheet not in contact with the screw head (bottom sheet).
[7]When both steel sheets have a minimum specified tensile strength of $F_u \geq 55$ ksi (e.g. ASTM A653 SS Grade 40), multiply tabulated values by 1.22.
[8]When both steel sheets have a minimum specified tensile strength of $F_u \geq 52$ ksi (e.g. ASTM A653 SS Grade 37), multiply tabulated values by 1.15.
[9]When both steel sheets have a minimum specified tensile strength of $F_u \geq 58$ ksi (e.g. ASTM A36), multiply tabulated values by 1.29.

TABLE 4—TENSILE PULL-OVER CAPACITY OF SCREW CONNECTIONS, pounds-force[1,3,4,5,6]

SCREW TYPE	SCREW DESIGNATION	NOMINAL DIAMETER (in.)	MINIMUM EFFECTIVE PULL-OVER DIAMETER (in.)	DESIGN THICKNESS OF MEMBER IN CONTACT WITH SCREW HEAD (in.)							
				0.048	0.060	0.075	0.105	1/8"	3/16"	1/4"	5/16"
ALLOWABLE STRENGTH (ASD)											
1	#10-16	0.190	0.357	386	481[2]	481[2]	481[2]	481[2]	-	-	-
2	#10-16	0.190	0.384	415	481[2]	481[2]	481[2]	481[2]	-	-	-
3, 4	#12-14	0.216	0.398	430	537	672	734[2]	734[2]	734[2]	-	-
5	#12-24	0.216	0.398	430	537	672	734[2]	734[2]	734[2]	734[2]	734[2]
6	1/4-14	0.250	0.480	518	648	810	1126[2]	1126[2]	1126[2]	-	-
7, 8	1/4-20	0.250	0.480	-	648	810	1126[2]	1126[2]	1126[2]	1126[2]	1126[2]
11	5/16-18	0.313	n/a[2]	-	-	-	1169[2]	1169[2]	-	-	-
12	5/16-24	0.313	n/a[2]	-	-	-	1326[2]	1326[2]	1326[2]	1326[2]	1326[2]
DESIGN STRENGTH (LRFD)											
1	#10-16	0.190	0.357	578	723	781[2]	781[2]	781[2]	-	-	-
2	#10-16	0.190	0.384	622	778	781[2]	781[2]	781[2]	-	-	-
3, 4	#12-14	0.216	0.398	645	806	1007	1192[2]	1192[2]	1192[2]	-	-
5	#12-24	0.216	0.398	645	806	1007	1192[2]	1192[2]	1192[2]	1192[2]	1192[2]
6	1/4-14	0.250	0.480	778	972	1215	1701	1830[2]	1830[2]	-	-
7, 8	1/4-20	0.250	0.480	-	972	1215	1701	1830[2]	1830[2]	1830[2]	1830[2]
11	5/16-18	0.313	n/a[2]	-	-	-	1871[2]	1871[2]	-	-	-
12	5/16-24	0.313	n/a[2]	-	-	-	2121[2]	2121[2]	2121[2]	2121[2]	2121[2]

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 Mpa.

[1]Available strengths are based on calculations in accordance with AISI S100, unless otherwise noted.
[2]Available strengths are based on laboratory tests, with safety factors/resistance factors calculated in accordance with AISI S100, or on the shear strength of the integral washer. Increasing values for higher steel tensile strength per Note 6 is not allowed.
[3]For tension connections, the lowest of the available pull-out, pull-over, and fastener tension strength must be used for design.
[4]Values are based on steel members with a minimum yield strength of F_y = 33 ksi and a minimum tensile strength of F_u = 45 ksi.
[5]Available capacity for other member thickness may be determined by interpolating within the table.
[6]For steel with a minimum tensile strength $F_u \geq 58$ ksi, multiply tabulated values by 1.29 and for steel with a minimum tensile strength $F_u \geq 65$ ksi steel, multiply tabulated values by 1.44.

TABLE 5—TENSILE PULL-OUT CAPACITY OF SCREW CONNECTIONS, pounds-force[1,2,3,4,5]

SCREW TYPE	SCREW DESIGNATION	NOMINAL DIAMETER (in.)	DESIGN THICKNESS OF MEMBER NOT IN CONTACT WITH SCREW HEAD (in.)							
			0.048	0.060	0.075	0.105	1/8"	3/16"	1/4"	5/16"
ALLOWABLE STRENGTH (ASD)										
1	#10-16	0.190	136	193	236	307	297	-	-	-
2	#10-16	0.190	136	193	236	307	297	-	-	-
3, 4	#12-14	0.216	132	205	264	328	510	665	-	-
6	1/4-14	0.250	131	207	255	342	561	899	-	-
7, 8, 9, 10	1/4-20	0.250	-	204[6]	260[6]	423[6]	524[7]	914[7]	1044	1206
11	5/16-18	0.313	-	-	-	520	707	-	-	-
12	5/16-24	0.313	-	-	-	459	637	724	1189	1424
DESIGN STRENGTH (LRFD)										
1	#10-16	0.190	217	309	378	492	476	-	-	-
2	#10-16	0.190	217	309	378	492	476	-	-	-
3, 4	#12-14	0.216	211	328	423	525	816	1064	-	-
6	1/4-14	0.250	210	331	409	548	897	1439	-	-
7, 8, 9, 10	1/4-20	0.250	-	326[6]	416[6]	677[6]	838[7]	1462[7]	1670	1930
11	5/16-18	0.313	-	-	-	832	1131	-	-	-
12	5/16-24	0.313	-	-	-	735	1019	1159	1903	2279

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 Mpa.

[1]Available strengths are based on laboratory tests, with safety factors/resistance factors calculated in accordance with AISI S100.
[2]For tension connections, the lowest of the available pull-out, pull-over, and fastener tension strength must be used for design.
[3]Values are based on steel members with a minimum yield strength of F_y = 33 ksi and a minimum tensile strength of F_u = 45 ksi.
[4]Available capacity for other member thickness may be determined by interpolating within the table.
[5]Unless otherwise noted, for steel with a minimum tensile strength $F_u \geq 58$ ksi, multiply tabulated values by 1.29 and for steel with a minimum tensile strength $F_u \geq 65$ ksi steel, multiply tabulated values by 1.44.
[6]When both steel sheets have a minimum specified tensile strength of $F_u \geq 52$ ksi (e.g. ASTM A653 SS Grade 37), multiply tabulated values by 1.15.
[7]When both steel sheets have a minimum specified tensile strength of $F_u \geq 58$ ksi (e.g. ASTM A36), multiply tabulated values by 1.29.

TABLE 6—MINIMUM FASTENER SPACING AND EDGE DISTANCE

BASIC SCREW DIAMETER (inch)	FASTENED MATERIAL	MINIMUM SPACING (3d)	MINIMUM EDGE DISTANCE (1.5d)	MINIMUM EDGE DISTANCE FOR FRAMING MEMBERS (3d)
0.190 (#10)	Steel	9/16"	5/16"	9/16"
0.216 (#12)	Steel	11/16"	3/8"	11/16"
1/4	Steel	3/4"	3/8"	3/4"
5/16	Steel	15/16"	1/2"	15/16"

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

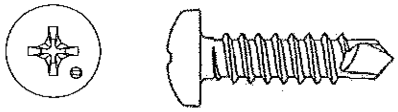

FIGURE 1—#10-16 PHILLIPS PAN HEAD
TYPE 1 SCREW

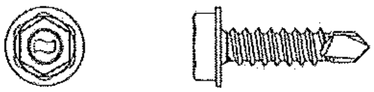

FIGURE 2—#10-16 INDENTED HEX WASHER HEAD
TYPE 2 SCREW

FIGURE 3—#12-14 INDENTED HEX WASHER HEAD
TYPE 3 AND 4 SCREW

FIGURE 4—#12-24 INDENTED HEX WASHER HEAD
TYPE 5 SCREW

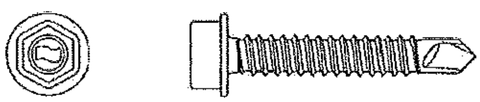

FIGURE 5—$^{1}/_{4}$-14 INDENTED HEX WASHER HEAD
TYPE 6 SCREW

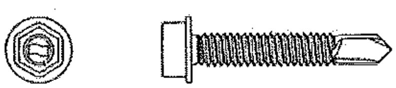

FIGURE 6—$^{1}/_{4}$-20 INDENTED HEX WASHER HEAD
TYPE 7 SCREW

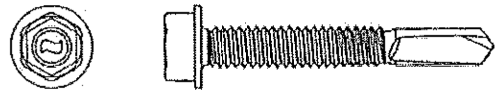

FIGURE 7—$^{1}/_{4}$-20 INDENTED HEX WASHER HEAD
ROUND BODY TAPTITE
TYPE 8 SCREW

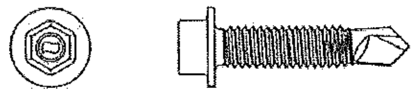

FIGURE 8—$^{5}/_{16}$-18 INDENTED HEX WASHER HEAD
ROUND BODY TAPTITE
TYPE 11 SCREW

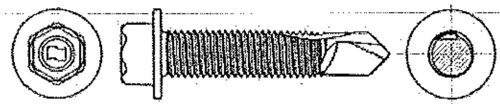

FIGURE 9—$^{5}/_{16}$-24 INDENTED HEX WASHER HEAD
WITH SHANK SLOT
TYPE 12 SCREW

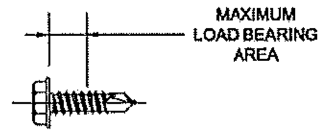

FIGURE 10—PHILLIPS PAN HEAD AND INDENTED
HEX WASHER HEAD LOAD BEARING AREA

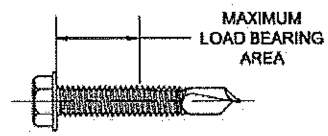

FIGURE 11—INDENTED HEX WASHER HEAD WITH
SHANK SLOT LOAD BEARING AREA

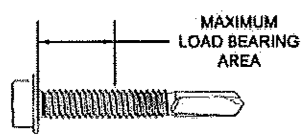

FIGURE 12—INDENTED HEX WASHER HEAD ROUND BODY
TAPTITE LOAD BEARING AREA