



- Compliance with International Codes
- Compliance to State/Regional Codes

ICC-ES Evaluation Report ESR-4367

Reissued September 2021

This report is subject to renewal September 2022.

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:

ELCO CONSTRUCTION PRODUCTS

EVALUATION SUBJECT:

ELCO DRILIT®, BI-FLEX® AND DRIL-FLEX® SELF-DRILLING SCREWS FOR WOOD-TO-STEEL CONNECTIONS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012, and 2009 *International Building Code*® (IBC)
- 2018, 2015, 2012 and 2009 *International Residential Code*® (IRC)

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see [ESR-4367 LABC and LARC Supplement](#).

Properties evaluated:

Structural

2.0 USES

Elco Drilit® self-drilling screws are used to attach wood structural panels to cold-formed steel, as prescribed in the code, and as specified in engineering designs.

Elco Bi-Flex® self-drilling screws and Elco Dril-Flex® self-drilling screws are used to attach wood structural panels to cold-formed steel as specified in engineering designs. They may be used in structures regulated under IRC when an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

The Elco Drilit® self-drilling screws are formed from carbon steel wire conforming to ASTM F2282, Grade 1018-1022,

and case-hardened in accordance with the documented specifications. The screws are coated with a proprietary corrosion-resistant coating identified as Gray Stalgard®. The Elco Bi-Flex® self-drilling tapping screws have a head and shank which are formed from a 300 series stainless steel and fused to a hardened steel drill point and tapping threads. The screws are coated with a proprietary corrosion-resistant coating identified as Stalgard® GB, which is silver in color. The Elco Dril-Flex® self-drilling screws are formed from alloy steel wire complying with the manufacturer's specifications. The screws have a dual heat treatment and are coated with a corrosion-resistant coating identified as Stalgard® SUB, which is silver in color. The drill point and lead threads are heat-treated to a relatively high hardness to facilitate drilling and thread forming. The head and shank are 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.

Between the threads and the drill point, the Elco Drilit® and Elco Bi-Flex® screws have a portion of smooth shank with two projecting wings used to cut a smooth hole in the wood structural panel that is being attached to the steel.

Table 1 provides screw descriptions including screw type, applicable figure, size, threads per inch (TPI), nominal diameter, head style, head diameter, point type, drilling capacity, and minimum required protrusion length.

3.2 Drilit® Screws:

3.2.1 Type 1: These #10 screws have fine threads and a phillips wafer head. These screws comply with the thread design, material specifications and performance requirements of ASTM C1513.

3.2.2 Type 2: These #12 screws have fine threads and a phillips wafer head. These screws comply with the thread design, material specifications and performance requirements of ASTM C1513.

3.2.3 Type 3: These #12 screws have fine threads and a phillips flat head. These screws comply with the thread design, material specifications and performance requirements of ASTM C1513.

3.2.4 Type 4: These 1/4-inch screws have fine threads and a phillips wafer head. Long lengths of these screws are partially threaded. These screws comply with the thread design, material specifications and performance requirements of ASTM C1513.

3.3 Bi-Flex® Screws:

3.3.1 Type 5: These #10 screws have coarse threads and a phillips flat head. These screws comply with the thread design and performance requirements of ASTM C1513.

3.3.2 Type 6: These #12 screws have fine threads and a phillips flat head. These screws comply with the thread design and performance requirements of ASTM C1513.

3.3.3 Type 7: These 1/4-inch screws have fine threads and a phillips flat head. These screws comply with the thread design and performance requirements of ASTM C1513.

3.4 Drill-Flex® Screws:

3.4.1 Type 8: These 1/4-inch screws have fine threads and an indented hex washer head. These screws are partially threaded and comply with the thread design and performance requirements of ASTM C1513.

3.5 Cold-formed Steel:

Connected steel must comply with one of the specifications listed in Section A3.1 of AISI S100 (Section A2.1 of AISI S100 for the 2015, 2012 and 2009 IBC) and must have the minimum base-metal thickness and tensile strength shown in the tables in this report.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Selection of screw length must be based on the thickness of the fastened wood structural panel plus the minimum required protrusion past the back of the supporting steel. See Table 1 for minimum required protrusion lengths.

The screw point number must be selected on the basis of drilling capacity, which is shown in Table 1. The tabulated drilling capacity refers to the thickness of the supporting cold-formed steel member. Evaluation of the ability of the screw to self-drill through the attached wood structural panel is outside the scope of this report.

When tested for corrosion resistance in accordance with ASTM B117, the screws met the minimum requirement listed in ASTM F1941, as required by ASTM C1513, with no white corrosion after three hours and no red rust after 12 hours.

4.1.2 Prescriptive Attachment of Sheathing to Steel: Elco Drilit® self-drilling screws are recognized for use where ASTM C1513 screws of the same size and head style/dimension are prescribed in IRC Sections R505.2.5, R603.2.5, and R804.2.5 (2012 and 2009 IRC Sections R505.2.4, R603.2.4 and R804.2.4) for attachment of wood sheathing panels to cold-formed steel.

4.1.3 Prescriptive Use in Shear Walls and Diaphragms: Elco Drilit® self-drilling screws are recognized for use in shear walls and diaphragms consisting of wood structural panels fastened to cold-formed steel framing, where ASTM C1513 screws of the same size and head style/dimension prescribed in the code. Under the 2018 IBC refer to Sections B5.2.2.3.3 and B5.4 of AISI S240 and Sections E1 and F2 of AISI S400, which are referenced in 2018 IBC Section 2211. Under the 2015, 2012 and 2009 IBC, refer to Sections C2.2.2 and D2.2 of AISI S213, which is referenced in Section 2211 of the 2015 and 2012 IBC, and in Section 2210 of the 2009 IBC.

4.1.4 Engineered Design: For use in engineered design, the available fastener strengths are shown in Table 2 and the available pull-out strengths in common thicknesses of cold-formed steel are shown in Tables 3A and 3B. The available bending moment strengths for #12 and 1/4-inch screws are shown in Tables 4A and 4B. These values in are intended to aid the designer in meeting the requirements of IBC Section 1604.2.

Determination of the suitability of a particular screw recognized in this report for the specific application is the responsibility of the registered design professional and is outside the scope of this report.

The registered design professional is responsible for determining the available strengths for the connection, considering all applicable limit states such as pull-over or pull-through, tilting and bearing, etc., and for considering serviceability issues, such as fastener slip.

The registered design professional is responsible for determining the required spacing, edge distance and end distance for the fasteners, based on the characteristics of the steel base material and the attached wood structural panel. For the supporting cold-formed steel base material, screws must be spaced a minimum of 3 times the nominal diameter of the screw and must be located not less than 1.5 times the diameter of the screw from any end or edge of the cold-formed steel base material. The required edge distance, end distance and spacing for the attached wood structural panel is outside the scope of this report.

4.2 Installation:

Installation of Elco Drilit® self-drilling screws, Elco Bi-Flex® self-drilling screws and Elco Drill-Flex® self-drilling screws 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.

The screws must be installed perpendicular to the work surface using a screw gun incorporating a depth-sensitive or torque-limiting nose piece with a maximum speed of 1800 rpm for 1/4" and #12 screws and a maximum speed of 2500 rpm for #10 screws.

5.0 CONDITIONS OF USE

The Elco screws 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 screws must be installed in accordance with the manufacturer's published installation instructions and this report. In the event of a conflict between this report and the manufacturer's published installation instructions, the more restrictive requirements govern.
- 5.2** The screws have only been evaluated for fastener strength, compliance with ASTM C1513, quality control and pull-out strength. Evaluation of other applicable limit states for connections of building materials to the steel base material is outside the scope of this report.
- 5.3** Design of the connection of the attached wood structural panel to the steel base material, taking into account the properties of the attached material, must comply with the applicable requirements of the IBC, and be justified to the satisfaction of the code official.

5.4 The screws 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 Self-drilling Tapping Screws Used to Attach Miscellaneous Building Materials to Steel Base Material (AC500), dated October 2017 (editorially revised December 2017).

7.0 IDENTIFICATION

7.1 The heads of the Elco Drillit® self-drilling screws and Elco Bi-Flex® self-drilling screws are marked with “☐” as shown in Figures 1 through 7. The Elco Bi-Flex® self-drilling screws are also marked with a “3” for material identification. The Elco Drill-Flex® self-drilling screws are marked with a “⊕” on the top surface of the screw heads, as shown in Figure 8. Each box of the fasteners has a label bearing the

report holder name, product name, part number, size, lot number and the evaluation report number (ESR-4367).

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

ELCO CONSTRUCTION PRODUCTS
701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286
(800) 435-7213
www.ELCOconstruction.com
infoELCO@sbdinc.com

TABLE 1—ELCO SELF-DRILLING SCREWS

SCREW TYPE	SIZE	TPI	NOMINAL SCREW DIAMETER (inches)	HEAD STYLE ¹	NOMINAL HEAD DIAMETER (inch)	POINT TYPE	DRILLING CAPACITY ² (inch)		MINIMUM REQUIRED PROTRUSION LENGTH (inch)	FIGURE NO.
							Min.	Max.		
DRILIT® SCREWS										
1	10	24	0.190	PWH	0.470	#3	0.036	0.187	0.625	1
2	12	24	0.216	PWH	0.540	#4	0.060	0.312	0.937	2
3	12	24	0.216	PFH	0.480	#4	0.060	0.312	0.937	3
4	1/4	20	0.250	PFH	0.487	#4	0.060	0.312	1.000	4
BI-FLEX® SCREWS										
5	10	16	0.190	PFH	0.367	#3	0.036	0.187	0.687	5
6	12	24	0.216	PFH	0.415	#5	0.060	0.375	1.250	6
7	1/4	20	0.250	PFH	0.478	#5	0.060	0.375	1.250	7
DRIL-FLEX® SCREWS										
8	1/4	20	0.250	IHWH	0.500	#4	0.110	0.312	0.750	8

For SI: 1 inch = 25.4 mm.

¹Head styles: PWH = Phillips Wafer Head; PFH = Phillips Flat Head; IHWH= Indented Hex Washer Head

²The drilling capacity of a fastener refers to the minimum and maximum thickness of the steel that the fastener is designed to drill through.

TABLE 2—ELCO SELF-DRILLING SCREWS SHEAR (lbf), TENSION (lbf) AND BENDING MOMENT (in-lb) FASTENER STRENGTH^{1,2,3,4}

SCREW TYPE	SIZE	TPI	NOMINAL FASTENER STRENGTH			ALLOWABLE FASTENER STRENGTH (ASD)			DESIGN FASTENER STRENGTH (LRFD)		
			Shear: P _s	Tension: P _t	Bending Moment: M	Shear: P _s /Ω	Tension: P _t /Ω	Bending Moment: M/ Ω	Shear: ΦP _s	Tension: ΦP _t	Bending Moment: ΦM
DRILIT® SCREWS											
1	10	24	1574	2635	—	525	878	—	787	1318	—
2,3	12	24	1993	3972	167	664	1324	69	997	1986	111
4	1/4	20	3379	4947	213	1126	1649	89	1690	2474	142
BI-FLEX® SCREWS											
5	10	16	1409	1759	—	470	586	—	704	880	—
6	12	24	1840	2393	112	613	798	47	920	1197	75
7	1/4	20	2554	3409	188	851	1136	78	1277	1705	125
DRIL-FLEX® SCREWS											
8	1/4	20	2659	4729	—	886	1576	—	1330	2364	—

For SI: 1 inch = 25.4 mm.

¹For tension connections, the lower of the pull-out and fastener tension strength must be used for design.

²Nominal strengths average (ultimate) values based on laboratory tests.

³The tabulated allowable strength (ASD) and design strength (LRFD) values for shear and tension are based on a safety factor, Ω = 3.0 and a resistance factor, Φ = 0.5, respectively.

⁴The tabulated allowable strength (ASD) and design strength (LRFD) values for bending moment are based on a safety factor, Ω = 2.4 and a resistance factor, Φ = 0.67, respectively.

TABLE 3A—ALLOWABLE (ASD) TENSION PULL-OUT CAPACITY OF SCREW CONNECTIONS (lbf)^{1, 2, 3, 4, 5}

SCREW TYPE	SIZE	TPI	THICKNESS OF STEEL NOT IN CONTACT WITH SCREW HEAD (inch):						
			0.060	0.075	0.105	1/8	3/16	1/4	5/16
DRILIT® SCREWS									
1	10	24	168 ⁶	—	—	407 ⁷	—	—	—
2,3	12	24	134 ⁶	—	—	435 ⁷	—	442	—
4	1/4	20	168 ⁶	—	—	453 ⁷	—	985	—
BI-FLEX® SCREWS									
5	10	16	108	—	—	501 ⁶	—	—	—
6	12	24	89	—	—	379 ⁶	—	563	—
7	1/4	20	56	—	—	386 ⁶	—	779	—
DRIL-FLEX® SCREWS									
8	1/4	20	204 ⁶	260 ⁶	423 ⁶	524 ⁷	914 ⁷	1044	1206

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

¹⁻⁷See notes following Table 3B.

TABLE 3B—DESIGN (LRFD) TENSION PULL-OUT CAPACITY OF SCREW CONNECTIONS (lbf)^{1, 2, 3, 4, 5}

SCREW TYPE	SIZE	TPI	THICKNESS OF STEEL NOT IN CONTACT WITH SCREW HEAD (inch):						
			0.060	0.075	0.105	1/8	3/16	1/4	5/16
DRILIT® SCREWS									
1	10	24	269 ⁶	—	—	651 ⁷	—	—	—
2,3	12	24	214 ⁶	—	—	696 ⁷	—	707	—
4	1/4	20	268 ⁶	—	—	726 ⁷	—	1576	—
BI-FLEX® SCREWS									
5	10	16	173	—	—	801 ⁶	—	—	—
6	12	24	142	—	—	606 ⁶	—	901	—
7	1/4	20	90	—	—	617 ⁶	—	1246	—
DRIL-FLEX® SCREWS									
8	1/4	20	326 ⁶	416 ⁶	677 ⁶	838 ⁷	1462 ⁷	1670	1930

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

¹For tension connections, the lower of the pull-out and fastener tension strength must be used for design.

²Available strengths are based on laboratory tests, with safety factors/resistance factors calculated in accordance with AISI S100.

³Capacity for other member thickness may be determined by interpolating within the table.

⁴Values are based on steel members with a minimum yield strength of $F_y = 33$ ksi and tensile strength $F_u = 45$ ksi.

⁵Unless otherwise noted, when the steel not in contact with the screw head has $F_u \geq 52$ ksi, the capacities in the table may be multiplied by 1.15; When the steel not in contact with the screw head has $F_u \geq 58$ ksi, the capacities in the table may be multiplied by 1.29; When the steel not in contact with the screw head has $F_u \geq 65$ ksi, the capacities in the table may be multiplied by 1.44.

⁶When the steel not in contact with the screw head has $F_u \geq 52$ ksi, the capacities in the table may be multiplied by 1.15.

⁷When the steel not in contact with the screw head has $F_u \geq 58$ ksi, the capacities in the table may be multiplied by 1.29.

DRILIT® SCREWS

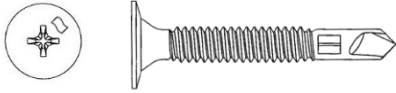


FIGURE 1—#10-24 PHILLIPS WAFER HEAD TYPE 1 SCREW

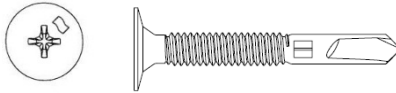


FIGURE 2—#12-24 PHILLIPS WAFER HEAD TYPE 2 SCREW



FIGURE 3—#12-24 PHILLIPS FLAT HEAD TYPE 3 SCREW



FIGURE 4—1/4-20 PHILLIPS FLAT HEAD TYPE 4 SCREW

BI-FLEX® SCREWS

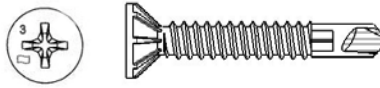


FIGURE 5—#10-24 PHILLIPS WAFER HEAD TYPE 5 SCREW



FIGURE 6—#12-24 PHILLIPS WAFER HEAD TYPE 6 SCREW

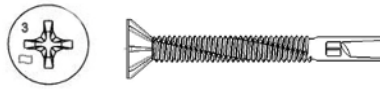


FIGURE 7—1/4-20 PHILLIPS FLAT HEAD TYPE 7 SCREW

DRIL-FLEX® SCREWS



FIGURE 8—1/4-20 INDENTED HEX WASHER HEAD TYPE 8 SCREW

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ELCO CONSTRUCTION PRODUCTS

EVALUATION SUBJECT:

ELCO DRILIT®, BI-FLEX® AND DRIL-FLEX® SELF-DRILLING SCREWS FOR WOOD-TO-STEEL CONNECTIONS

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that Elco Drilit®, Bi-Flex® and Dril-Flex® self-drilling screws, described in ICC-ES evaluation report [ESR-4367](#), 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:

- 2017 *City of Los Angeles Building Code* (LABC)
- 2017 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Elco Drilit®, Bi-Flex® and Dril-Flex® self-drilling screws, described in Sections 2.0 through 7.0 of the evaluation report [ESR-4367](#), comply with the LABC Chapter 22, and the LARC Sections R505, R603, R804, and are subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Elco Drilit®, Bi-Flex® and Dril-Flex® self-drilling screws, described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report [ESR-4367](#).
- The design, installation, conditions of use and identification are in accordance with the 2015 *International Building Code*® (2015 IBC) provisions noted in the evaluation report [ESR-4367](#).
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineering design in accordance with LARC Section R301.1.3 must be submitted.

This supplement expires concurrently with the evaluation report, reissued September 2021.

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Applicable code editions:

- 2017 *Florida Building Code—Building*
- 2017 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Elco Drilit®, Bi-Flex® and Dril-Flex® self-drilling screws, described in Sections 2.0 through 7.0 of the evaluation report ESR-4367, comply with the *Florida Building Code—Building and Florida Building Code—Residential*, provided the design and installation are in accordance with the 2015 *International Building Code*® provisions noted in the evaluation report.

Use of the Elco Drilit®, Bi-Flex® and Dril-Flex® self-drilling screws has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building and Florida Building Code—Residential*.

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).

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