ICC-ES Evaluation Report

ESR-4367

Reissued September 2023

Subject to renewal September 2024

This report also contains:

- FBC Supplement

- LABC Supplement

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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:** **DEWALT** **ADDITIONAL LISTEE:** **ELCO CONSTRUCTION PRODUCTS** **HILTI**	**EVALUATION SUBJECT:** **DRILIT®, BI-FLEX® AND DRIL-FLEX® SELF-DRILLING STRUCTURAL SCREWS (DEWALT)**	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015 and 2012 *International Building Code®* (IBC)
- 2021, 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-4367 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

Drilit® self-drilling tapping screws with reaming wings are used to attach wood structural panels to cold-formed steel, as prescribed in the code, and as specified in engineering designs. They are also intended to attach miscellaneous building materials to steel base material as specified in engineering designs.

Bi-Flex® self-drilling tapping screws with reaming wings are used to attach wood structural panels to cold-formed steel as specified in engineering designs. They are also intended to attach miscellaneous building materials to steel base material 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.

Dril-Flex® fasteners are self-drilling tapping screws used to attach miscellaneous building materials to steel base material as specified in engineering designs. They may be used in structures regulated under the IRC when an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

The evaluated screws are self-drilling, self-tapping screws with various head styles. See Table 1 for detailed product descriptions including screw size, nominal diameter, head style, head diameter, point number, drilling

capacities in steel and minimum required protrusion lengths. See Figures 1 through 9 for depictions of the screws. Product names for the report holder and the additional listees are presented in the following table:

Company Name	Product Name		
DEWALT	Drilit®	Bi-Flex®	Dril-Flex®
Elco Construction Products	Drilit®	Bi-Flex®	Dril-Flex®
Hilti	–	Bi-Metal Kwik-Flex	Kwik-Flex

3.1.1 Drilit® Screws: The Drilit® 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 Stalgard®, which is gray in color. Between the threads and the drill point, the Drilit® screws have a portion of smooth shank with two projecting wings used to cut a smooth hole in the wood structural panel or other material that is being attached to the steel. These screws comply with the thread design, material specifications and performance requirements of ASTM C1513.

3.1.2 Bi-Flex® Screws: The Bi-Flex® screws have a head and shank which are formed from a 300 series stainless steel and fused to a hardened carbon 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. Between the threads and the drill point, the Bi-Flex® screws have a portion of smooth shank with two projecting wings used to cut a smooth hole in the wood structural panel or other material that is being attached to the steel. These screws comply with the thread design and performance requirements of ASTM C1513.

3.1.3 Dril-Flex® Screws: The Dril-Flex® screws are formed from alloy steel wire complying with the manufacturer's specifications. The screws have a dual heat treatment. 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. Hex washer head parts are coated with a corrosion-resistant coating identified as Stalgard® SUB, which is silver in color. Phillips undercut flat head parts are coated with a corrosion-resistant coating identified as Stalgard®, which is silver in color. These screws are partially threaded and comply with the thread design and performance requirements of ASTM C1513.

3.2 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 and 2012 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 or other miscellaneous building material 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: Drilit® self-drilling screws may be used 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 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: Drilit® self-drilling screws may be used 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 2021 IBC, refer to Sections B5.2.2.3.3 and B5.4.2 of AISI S240 and Sections E1 and F2 of AISI S400, which are referenced in 2021 IBC Section 2211. 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 and 2012 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.

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 addressed 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 or other miscellaneous building material. 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 or other miscellaneous building material is outside the scope of this report.

4.2 Installation:

Installation of Drilit®, Bi-Flex® and Dril-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 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 or other miscellaneous building material 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 January 2021).

7.0 IDENTIFICATION

7.1 The heads of the Drilit® self-drilling screws and Bi-Flex® self-drilling screws are marked with a flag" ⚑ " as shown in Figures 1 through 7. The Bi-Flex® self-drilling screws are also marked with a "3" above the flag for material identification. The Dril-Flex® self-drilling screws are marked with a " ⚑ " on the top surface of the screw heads, as shown in Figures 8 and 9. 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:

DEWALT
701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286
(800) 425-7213
www.DEWALT.com
anchors@DEWALT.com

7.3 The Additional Listees' contact information is the following:

ELCO CONSTRUCTION PRODUCTS
701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286
(800) 524-3244
www.ELCOconstruction.com

HILTI, INC.
7250 DALLAS PARKWAY, SUITE 1000
PLANO, TEXAS 75024
(800) 879-8000
www.us.hilti.com

DRILIT® SCREWS

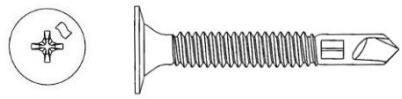

FIGURE 1—#10-24 PHILLIPS WAFER HEAD TYPE 1 SCREW

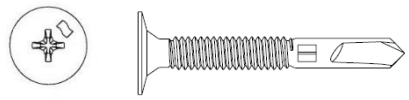

FIGURE 2—#12-24 PHILLIPS WAFER HEAD TYPE 2 SCREW

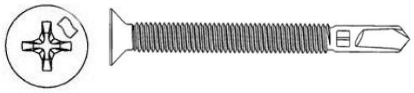

FIGURE 3—#12-24 PHILLIPS FLAT HEAD TYPE 3 SCREW

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

BI-FLEX® SCREWS

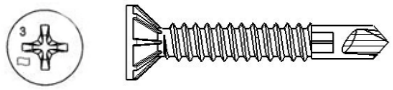

FIGURE 5—#10-24 PHILLIPS WAFER HEAD TYPE 5 SCREW

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

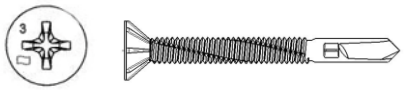

FIGURE 7—1/4-20 PHILLIPS FLAT HEAD TYPE 7 SCREW

DRIL-FLEX® SCREWS

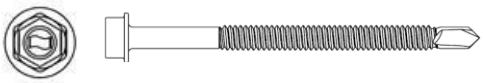

FIGURE 8—1/4-20 INDENTED HEX WASHER HEAD TYPE 8 SCREW

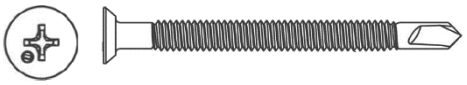

FIGURE 9—1/4-20 PHILLIPS UNDERCUT FLAT HEAD TYPE 9 SCREW

TABLE 1—SCREW DESCRIPTIONS

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	0.813	8
9	1/4	20	0.250	PUFH	0.460	#4	0.110	0.312	0.813	9

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

[1]Head styles: PWH = Phillips Wafer Head; PFH = Phillips Flat Head; IHWH = Indented Hex Washer Head; PUFH = Phillips Undercut Flat Head.
[2]The 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—FASTENER SHEAR (lbf), TENSION (lbf) AND BENDING MOMENT (in-lb) 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	—
9	1/4	20	2865	4592	—	955	1531	—	1433	2296	—

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

[1]For tension connections, the lower of the pull-out and fastener tension strength must be used for design.
[2]Nominal strengths average (ultimate) values based on laboratory tests.
[3]The 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.
[4]The 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]

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[5]	—	—	407[6]	—	—	—
2,3	#12	24	134[5]	—	—	435[6]	—	442	—
4	¼	20	168[5]	—	—	453[6]	—	985	—
BI-FLEX® SCREWS									
5	#10	16	108	—	—	501[5]	—	—	—
6	#12	24	89	—	—	379[5]	—	563	—
7	¼	20	56	—	—	386[5]	—	779	—
DRIL-FLEX® SCREWS									
8,9	¼	20	204[5]	260[5]	423[5]	524[6]	914[6]	1044	1206

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

[1-6]**See notes following Table 3B.**

TABLE 3B—DESIGN (LRFD) TENSION PULL-OUT CAPACITY OF SCREW CONNECTIONS (lbf)[1,2,3,4]

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[5]	—	—	651[6]	—	—	—
2,3	#12	24	214[5]	—	—	696[6]	—	707	—
4	1/4	20	268[5]	—	—	726[6]	—	1576	—
BI-FLEX® SCREWS									
5	#10	16	173	—	—	801[5]	—	—	—
6	#12	24	142	—	—	606[5]	—	901	—
7	1/4	20	90	—	—	617[5]	—	1246	—
DRIL-FLEX® SCREWS									
8,9	1/4	20	326[5]	416[5]	677[5]	838[6]	1462[6]	1670	1930

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

[1]For tension connections, the lower of the pull-out and fastener tension strength must be used for design.
[2]Available strengths are based on laboratory tests, with safety factors/resistance factors calculated in accordance with AISI S100.
[3]Values are based on steel members with a minimum yield strength of F_y = 33 ksi and a minimum tensile strength F_u = 45 ksi.
[4]Unless 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.
[5]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.
[6]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.

TABLE 4—MINIMUM FASTENER SPACING AND EDGE DISTANCE IN STEEL[1]

BASIC SCREW DIAMETER (inch)	MINIMUM SPACING (inch) (3d)	MINIMUM EDGE DISTANCE (inch) (1.5d)
0.190 (#10)	9/16	5/16
0.216 (#12)	11/16	3/8
0.250 (1/4)	3/4	3/8

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

[1]The registered design professional is responsible for determining the required spacing, edge distance and end distance for the fasteners in the attached wood structural panel or other miscellaneous building material.

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:

DEWALT

EVALUATION SUBJECT:

DRILIT®, BI-FLEX® AND DRIL-FLEX® SELF-DRILLING STRUCTURAL SCREWS (DEWALT)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that 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:

- 2020 *City of Los Angeles Building Code* (LABC)
- 2020 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The 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 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 2018 *International Building Code®* (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, as applicable.

This supplement expires concurrently with the evaluation report, reissued September 2023.

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:

DEWALT

EVALUATION SUBJECT:

DRILIT®, BI-FLEX® AND DRIL-FLEX® SELF-DRILLING STRUCTURAL SCREWS (DEWALT)

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Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The 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*. The design requirements shall be determined in accordance with the *Florida Building Code—Building and Florida Building Code—Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-4367 for the 2018 *International Building Code®* and *International Residential Code®* meet the requirements of the *Florida Building Code—Building and Florida Building Code—Residential*, as applicable.

Use of the DEWALT 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 61G20-3, 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 evaluation report, reissued September 2023.