Code Compliance Research Report
CCRR-0347

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DIVISION: 05 00 00 – Metals, 06 00 00 – Wood, Plastic and Composites
Section: 05 05 23 – Metal Fastening, 06 05 23 – Wood, Plastic, and Composite Fastenings

REPORT HOLDER:
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REPORT SUBJECT:
SFS IMPAX® AND SFS FLEX5®SELF-DRILLING STRUCTURAL FASTENERS

1.0 SCOPE OF EVALUATION

1.1 This Research Report addresses compliance with the following Codes:

- 2024, 2021 and 2018 *International Building Code®* (IBC)
- 2024, 2021and 2018 *International Residential Code®* (IRC)
- 2023 and 2020 *Florida Building Code* (see Section 9)

NOTE: This report references the most recent Code editions noted. Section numbers in earlier editions may differ.

1.2 SFS Impax and SFS Flex5 Self-Drilling Structural Fasteners have been evaluated for the following properties

- Screw Hardness
- Screw Yield and Tensile Strength
- Screw Ductility
- Corrosion Resistance
- Pull Out Strength
- Pull Over Strength
- Lap-Joint Shear

1.3 SFS Impax and SFS Flex5 Self-Drilling Structural Fasteners has been evaluated for the following uses:

- Engineered connections of cold formed steel members to cold formed steel members
- Engineered connection of cold formed steel members to hot rolled steel members
- Engineered screw connections in accordance with IRC Section R301.1.3

2.0 STATEMENT OF COMPLIANCE

SFS Impax and SFS Flex5 Self-Drilling Structural Fasteners complies with the Codes listed in Section 1.1, for the properties stated in Section 1.2 and uses stated in Section 1.3, when installed as described in this report, including the Conditions of Use stated in Section 6.

2.1 2024 IBC and IRC Evaluation Reports

The Intertek CCRR is an *Evaluation Report* for approval of an alternate material, design, or method of construction in accordance with Section 104.2.3.6.1 of the 2024 IBC and Section R104.2.2.6.1 of the 2024 IRC.

3.0 DESCRIPTION

3.1 SFS Fasteners: SFS Fasteners are self-drilling tapping screws that comply with ASTM C1513. See Table 1 for screw descriptions.

3.2 SFS IMPAX Fasteners: SFS Impax® fasteners are manufactured from carbon steel wire. The carbon steel wire conforms to ASTM A510, grade 1018-1022. The carbon steel wire is heat treated and case hardened in compliance with ASTM C1513 hardness requirement and the manufactures specifications.

SFS Impax® fasteners include MAC® and ZAC® brand fasteners.

MAC® fasteners have a cupped hex washer head and are assembled together with Impax screws at the manufacturing facility with a thin stainless-steel cap. The

stainless-steel cap will conform to the shape for the Impax fastener head.

The ZAC® hex washer head fasteners are assembled at the manufacturing facility with an Impax screw and a zinc alloy cap. The ZAC® 6-lobe head screws assembled at the manufacturing facility are comprised of a carbon steel screw body (same material and processing as the Impax screws) and a zinc alloy cap.

The SFS Impax® line is divide into four main subgroups:

- Standard drilling Capacity
- Extended Drilling Capacity
- Thin Gauge Drilling Capacity
- Architectural Clip Fasteners

3.2.1 Impax Standard Drilling Capacity: Impax® Standard Drilling Capacity fasteners are #10, #12, and 1/4" coarse threaded fasteners with hex washer heads (HWH) or cupped hex washer heads (CHWH). These screws will use drill point sizes #2 (SD2) and #3 (SD3) and have 5/16" or 3/8" across the flats (AF) dimensions.

Impax® Standard Drilling Capacity fasteners have a coating layer identified as VistaCoat. VistaCoat is a silver-colored coating layer added over the zinc layer. VistaCoat further inhibits corrosion and helps with drivability.

3.2.2 Impax Extended Drilling Capacity: Impax® Extended Drilling Capacity fasteners are #12 and 1/4" fine threaded fasteners with HWH or CHWH. These screws will use larger point diameters and flute lengths. These larger point diameter and flute lengths are identified as SD4, SD4.5, and SD5, to drill through heavier gauges. They have either a 5/16" AF or 3/8" AF.

Impax® Extended Drilling Capacity fasteners have a coating layer identified as VistaCoat. VistaCoat is a silver-colored coating layer added over the zinc layer. VistaCoat further inhibits corrosion and helps with drivability.

3.2.3 Impax Thin Gauge Drilling Capacity: Impax® Thin Gauge Drilling Capacity fasteners are 1/4 – inch coarse thread screws wth HWH or CHWH. Thin Gauge Drilling capacity fasteners are identified as SD1. They have 5/16- or 3/8-inch AF dimension.

Impax® Thin Gauge Drilling Capacity fasteners have a coating layer identified as VistaCoat. VistaCoat is a silver-colored coating layer added over the zinc layer. VistaCoat further inhibits corrosion and helps with drivability.

3.2.4 Impax Architectural Clip Fasteners: Impax® Architectural Clip fasteners are #10 and #12 coarse threaded screw. These screws will use drill point identified as SD2 and come with pancake heads with internal Philips square drives.

3.3 Flex5 Fasteners: SFS Flex5 fastener are made from alloy steel that complies with ASTM A29, grade 4037. Flex5 Fasteners also have a dual heat treatment. The drill point and lead threads of the screws are heat-treated to a relatively high hardness (minimum 52 HRC) to facilitate drilling and thread forming. The balance of the fastener is treated to a lower hardness complying wth the hardness limit of SAE J429 grade 5. The threaded portion of the screw with the lower hardness, is considered the load-bearing area and is used to transfer load between connected elements.

SFS Flex5 fastener have a coating layer identified as VistaCorr. VistaCorr is a silver-color coating layer.

SFS Flex5 line is divided into two main subgroups:

- Standard Drilling Capacity fasteners
- Extended Drilling Capacity fasteners.

3.3.1 Flex5 Standard Drilling Capacity: Flex5 Standard Drilling Capacity fasteners are #10, #12 and 1/4-inch coarse threaded screw with HWH. These screws have drill point sized identified as SD3. They have 5/16- or 3/8-inch AF dimension.

3.3.2 Flex5 Extended Drilling Capacity: Flex5 Extended Drilling Capacity fastener are #12 and 1/4-inch fine threaded screws with HWH. These screws have drill point sizes identified as SD4 and SD5. They have 5/16- or 3/8-inch AF dimension.

4.0 PERFORMANCE CHARACTERISTICS

4.1 Characteristic of screw hardness, yield strength, tensile strength, ductility, and corrosion resistance were all tested to ASTM C1513 and comply with minimum requirements.

4.2 SFS Impax® self-drilling screws with hex washer heads (HWH) are recognized for use in Prescriptive Design under the IRC where ASTM C1513 screws are specified and under IBC Section 2211 within the referenced AISI standards.

4.3 SFS Impax® and SFS Flex5 self-drilling fasteners are recognized for use in engineered steel-to-steel connections. Allowable Strength Design (ASD) connections must comply with section J4 for AISI S100-16(2020 w/S2) [AISI S100-16 for 2018 IBC]. ASD connections shall use the allowable fastener tension and shear strength for the screws shown in Table 2 and the allowable connection strengths for pull-out, pull-over and shear (bearing) capacity for common sheet steel thicknesses provided in Tables 3, 4 and 5 respectively. Load Resistance Factor Design (LRFD) instructions for calculation of connection design strengths are found in the foot notes of tables 2, 3, 4 and 5.

4.4 Fastener tension and shear strength; tensile pull-out capacity of screw connections, tensile pull-over capacity of screw connection; shear bearing capacity of screw connection are provide in tables 2, 3, 4, and 5.

5.0 INSTALLATION

5.1 General:

SFS Intec Impax and SFS Flex5 Self-Drilling Structural Fasteners must be installed in accordance with the manufacturer's published installation instructions, the applicable Code, and this CCRR. A copy of the manufacturer's instructions must be available on the jobsite during installation.

5.2 Application:

The screws must be installed perpendicular to the material being connected. Screws must be installed using a variable speed screw gun set not to exceed 2,500 RPM. The variable speed screw gun shall have an adjustable nose piece or depth-sensitive nose piece.

When installing a SD4, SD4.5 or SD5 points screw in material that are a 1/4 inch (6.4 mm) thick or greater, speeds recommended by the manufacture are 1,500 to 1,800 RPM. Use of impact guns are not recommended.

The installed screws must penetrate through supporting base steel. The installed screws must have a minimum of three full threads protruding past the back side of the supporting steel.

6.0 CONDITIONS OF USE

6.1 Installation must comply with this Research Report, the manufacturer's published installation instructions, and the applicable Code. In the event of a conflict, this report governs.

6.2 The connecting metal must comply with the ASTM specification listed in Section A3.1.1 of AISI S100-16(2020 w/S2) [AISI S100-16 for 2018 IBC] for cold formed steel members and Section A3 of AISC 360 for hot rolled steel members.

6.3 No increase can be taken on the allowable strength values specified on the tables at the end of this report when the screws are in use to resist wind or seismic forces.

6.4 Minimum spacing between screws and the minimum edge distance shall be three (3) time the nominal dimeter of the screw. This is for screws to be fully effective for screws used in framing connections. Exceptions are when the edge of the material is parallel to the direction of applied force in the connection. In this instance the minimum edge distance must be 1.5 times the nominal screw diameter. A reduction of twenty percent (see section D1.4 of AISI S220-20 [AISI S220-15 for 2018 IBC] must be used when spacing between screws is 2 times the fastener diameter.

Minimum spacing between the fasteners must be three (3) times the nominal screw diameter and the minimum edge and end distance must be 1.5 times the nominal screw diameter when screws are installed other than in framing connections.

Shear strengths of the connections are when the connected steel elements are in direct contact with one another.

Rupture must be checked for connections in accordance with section J6 of AISI S100-16(2020 w/S2) for the 2024 IBC. [section J6 of AISI S100-16 for 2018 IBC].

6.5 Drawings and calculations prepared by a registered design professional in the jurisdiction of the project shall be submitted verifying compliance with this CCRR and applicable local code.

6.6 Combined shear and tension connection loadings are outside the scope of the screws in this CCRR.

6.7 Evaluation of screws subject to cyclic or fatigue loading is outside the scope of this report. Applicable Seismic Design Categories shall be determined in accordance with the code for the entire assembly constructed with the screws.

6.8 The SFS Impax and SFS Flex5 Self-Drilling Structural Fasteners are manufactured under a quality control program with inspections by Intertek Testing Services NA, Inc. (AA-647).

7.0 SUPPORTING EVIDENCE

7.1 Reports of tests in accordance with ICC-ES AC118 Acceptance Criteria for Tapping Screw Fasteners approved January 2018.

8.0 IDENTIFICATION

See figures 1, 2, 3 and 4 for the SFS Impax and SFS Flex5 Self-Drilling Structural Fasteners are identified with "SFS" on the fastener head. See figure 5 for the ZAC fasteners identified with "ZAC" on the fastener head. See figures 6 and 7 for the SFS Flex5 fasteners identified with "SFS 5" on the fastener heads. The manufacturer's name (SFS), address and telephone number, the product name (Impax or Flex5the Intertek Mark as shown below, and the Code Compliance Research Report number (CCRR-0347) are on the packages of self-drilling tapping screws.

CODE COMPLIANCE
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9.0 FLORIDA BUILDING CODE

9.1 Scope of Evaluation:

The SFS Impax® and SFS Flex5 fasteners were evaluated for compliance with the 2020 and 2023 *Florida Building Code – Building, Florida Building Code – Residential.* Code section referenced standards for 2020 and 2023 FBC are same as 2015 and 2021 IBC respectively, unless otherwise specified.

9.2 Conclusion:

The SFS Impax® and SFS Flex5 fasteners described in Sections 2.0 through 7.0 of this Research Report, comply with the *Florida Building Code – Building, Florida Building Code – Residential*, subject to the following conditions:

- Use of SFS Impax® and SFS Flex5 fasteners for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code – Building* and the *Florida Building Code – Residential* has not been evaluated and is outside the scope of this Research Report.
- See Section 6.0 Conditions of use for limitations
- Intertek is a quality assurance entity approved by the Florida Building Commission.

10.0 CODE COMPLIANCE RESEARCH REPORT USE

10.1 Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

10.2 Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by Intertek.

10.3 Reference to the https://bpdirectory.intertek.com is recommended to ascertain the current version and status of this report.

TABLE 1 – SFS SELF-DRILLING TAPPING SCREW DIMENSIONLS CHARACTERISTICS

	Product Line	Screw Type	Diameter Size	Nominal Major Diameter (inch)	TPI	Point Type	Head Type[1]	Across Flats (inch)	Nominal Head Diameter[3] (inch)	Coating	Nominal Shank Length (inch)	Drill Capacity[2] (inch)		Length of Load Bearing Area[4] (inch)
												Min.	Max.	
Standard Drilling Capacity	IMPAX	1	#10	0.190	16	SD3	HWH	5/16	0.400	VistaCoat	0.750	0.036	0.150	0.313
											1.000			0.563
											1.500			1.063
		2A	#12	0.216	14	SD3	HWH	5/16	0.415	VistaCoat	0.750	0.036	0.210	0.250
		2B	#12	0.216	14	SD3	HWH	5/16	0.421	VistaCoat	1.000	0.036	0.210	0.375
											1.250			0.625
											1.500			0.875
											2.000			1.375
											2.500			1.875
											3.000			2.375
											4.000			3.375
		3A	#12	0.216	14	SD3	CHWH	5/16	0.580	VistaCoat	0.750	0.036	0.210	0.226
		3B	312	0.216	14	SD3	CHWH	5/16	0.580	VistaCoat	1.000	0.036	0.210	0.349
											1.250			0.599
											1.500			0.849
		4	1/4	0.250	14	SD2	HWH	5/16	0.415	VistaCoat	1.000	0.048	0.150	0.349
											1.250			0.599
											1.500			0.849
		5	1/4	0.250	14	SD2	HWH	3/8	0.500	VistaCoat	1.000	0.048	0.150	0.334
											1.500			0.833

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TABLE 1 - SFS SELF-DRILLING TAPPING SCREW DIMENSIONLS CHARACTERISTICS (Continued)

	Product Line	Screw Type	Diameter Size	Nominal Major Diameter (inch)	TPI	Point Type	Head Type[1]	Across Flats (inch)	Nominal Head Diameter[3] (inch)	Coating	Nominal Shank Length (inch)	Drill Capacity[2] (inch)		Length of Load Bearing Area[4] (inch)
												Min.	Max.	
Standard Drilling Capacity	IMPAX	6A	1/4	0.250	14	SD2	HWH	3/8	0.500	VistaCoat	0.750	0.048	0.210	0.171
											1.000			0.421
											1.250			0.671
											1.500			0.921
											2.000			1.421
		6B	1/4	0.250	14	SD3	HWH	3/8	0.500	VistaCoat	2.500	0.048	0.210	1.921
											3.000			2.241
											4.000			2.921
	MAC IMPAX	7	#12	0.216	14	SD3	CHWH	5/16	0.580	VistaCoat	1.000	0.036	0.210	0.353
											1.250			0.603
											1.500			0.853
											2.000			1.353
	ZAC IMPAX	8[6]	#12	0.216	14	SD3	HWH	N/A	0.421	VistaCoat	1.000	0.036	0.210	0.349
											1.250			0.599
											1.500			0.849
											2.000			1.349
		9[6]	#12	0.216	14	SD3	HWH	3/8	0.421	VistaCoat	1.000	0.036	0.210	0.375
											1.250			0.625
											1.500			0.875
											2.000			1.375
											2.500			1.875
											3.000			2.375
		10	1/4	0.250	14	SD3	HWH	N/A	0.421	VistaCoat	1.250	0.048	0.210	0.584
		11	1/4	0.250	14	SD2	HWH	0.375	0.415	VistaCoat	1.000	0.048	0.150	0.349
											1.250			0.599
											1.500			0.849

TABLE 1 - SFS SELF-DRILLING TAPPING SCREW DIMENSIONLS CHARACTERISTICS (Continued)

	Product Line	Screw Type	Size	Nominal Shank Diameter (inch)	TPI	Point Type	Head Type[1]	Across Flats (inch)	Nominal Head Diameter[3] (inch)	Coating	Nominal Shank Length (inch)	Drill Capacity[2] (inch)		Length of Load Bearing Area[4] (inch)
												Min.	Max.	
Extended Drilling Capacity	IMPAX	12	#12	0.216	24	SD4	HWH	5/16	0.415	VistaCoat	0.875	0.075	0.250	0.315
		13	#12	0.216	24	SD4.5	HWH	5/16	0.415	VistaCoat	1.250	0.075	0.250	0.525
		14	#12	0.216	24	SD4.5	HWH	3/8	0.500	VistaCoat	1.250	0.075	0.375	0.525
		15	#12	0.216	24	SD5	HWH	5/16	0.415	VistaCoat	1.250	0.075	0.500	0.520
											1.500			0.770
											2.000			1.270
		16	1/4	0.250	20	SD5	HWH	3/8	0.500	VistaCoat	3.000	0.105	0.500	2.220
		17[5]	1/4	0.250	20	SD5	HWH	3/8	0.500	VistaCoat	4.000	0.105	0.500	3.220
											5.000			4.220
											6.000			5.220
											7.000			6.220
											8.000			7.220
	MAC IMPAX	18	#12	0.216	24	SD5	CHWH	5/16	0.580	VistaCoat	2.000	0.075	0.500	1.145
	ZAC IMPAX	19	#12	0.216	24	SD4.5	HWH	5/16	0.415	VistaCoat	1.250	0.075	0.375	0.525
		20	#12	0.216	24	SD5	HWH	5/16	0.415	VistaCoat	1.250	0.075	0.500	0.520
											1.500			0.770
											2.000			1.270
Thin Gauge Drilling Capacity	IMPAX	21	1/4	0.250	14	SD1	HWH	5/16	0.415	VistaCoat	0.875	0.030	0.095	0.309
		22	1/4	0.250	14	SD1	CHWH	5/16	0.580	VistaCoat	0.875	0.030	0.095	0.341
	MAC IMPAX	23	1/4	0.250	14	SD1	CHWH	5/16	0.580	VistaCoat	0.875	0.030	0.095	0.326
	ZAC IMPAX	24	1/4	0.250	14	SD1	HWH	1/4	0.421	VistaCoat	0.875	0.030	0.095	0.326
		25	1/4	0.250	14	SD1	CHWH	5/16	0.415	VistaCoat	0.875	0.030	0.095	0.326

TABLE 1 - SFS SELF-DRILLING TAPPING SCREW DIMENSIONLS CHARACTERISTICS (Continued)

	Product Line	Screw Type	Size	Nominal Shank Diameter (inch)	TPI	Point Type	Head Type[1]	Across Flats (inch)	Nominal Head Diameter[3] (inch)	Coating	Nominal Shank Length (inch)	Drill Capacity[2] (inch)		Length of Load Bearing Area[4] (inch)
												Min.	Max.	
Architectural Clip Fasteners	Clip IMPAX	26	#10	0.190	16	SD2	PC	N/A	0.435	E-zinc	1.000	0.036	0.150	0.613
											1.500			1.113
											2.000			1.613
		27	#12	0.216	14	SD2	PC	N/A	0.435	E-zinc	1.000	0.036	0.210	0.349
Standard drilling capacity	Flex5	28	#10	0.190	16	SD3	HWH	5/16	0.399	VistaCorr	0.750	0.036	0.150	0.500
		29	#12	0.216	14	SD3	HWH	5/16	0.415	VistaCorr	0.875	0.036	0.188	0.390
											1.000			0.500
											1.500			1.000
											2.000			1.500
		30	#12	0.216	14	SD3	PUF	N/A	0.419	VistaCorr	1.000	0.036	0.188	0.500
		31	1/4	0.250	14	SD3	HWH	3/8	0.500	VistaCorr	1.000	0.036	0.188	0.460
											1.500			0.960
											2.000			1.460
Extended Drilling Capacity	Flex5	32	#12	0.216	24	SD5	HWH	5/16	0.415	VistaCorr	1.750	0.036	0.188	1.015
		33	1/4	0.250	20	SD4	HWH	3/8	0.500	VistaCorr	1.125	0.036	0.313	0.500
											1.500			0.835
											2.000			1.335
											2.500			1.835

For SI: 1 inch = 25.4 mm

1 Head styles: hex washer head (HWH), Cupped hex washer head (CHWH, 6-lobe, Phillips undercut flat head (PUF), Pancake head (PC)

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

3 For capped fasteners, the tabulated head diameter is the dimension of the underlying screw head.

4 The length of the load bearing area for IMPAX® fasteners is based on the nominal shank length of the screw minus the length of the point and the first three full threads. The length of load bearing area for Flex5 fasteners is based on the less of the length of the fully developed threaded portion heat treated to grade 5 specification s and the nominal shank length of screw minus the length of the point and the first three full threads. See Figure 8.

5 Fastener is partially threaded. Thread length is 3.63 inches.

6 The underlying fastener head is a 6-lobe head. The final capped head is HWH.

TABLE 2 – Fastener Tension and Shear Strength[1,2,3,4,5,6]

Screw Type	Fastener Description	Nominal Strength		Allowable Strength (ASD) Ω = 3 (except Screw type 31 and 33)	
		Tensile, P_{ts}	Shear, P_{ss}	Tensile, P_{ts}/Ω	Shear, P_{ss}/Ω
Impax® Standard Drilling Capacity and Thin Gauge Drilling Capacity Fasteners					
1	#10-16	2798	1572	933	524
2A, 2B, 3A, 3B, 7, 8, 9	#12-14	4002	2508	1334	836
4, 5, 6A, 6B, 10, 11, 21-25	1/4-14	4191	2777	1397	926
Impax® Extended Drilling Capacity Fasteners					
12, 13, 14, 15, 18, 19, 20	#12-24	5037	2914	1679	971
16, 17	1/4-20	6196	4081	2065	1360
Architectural Clip Fasteners					
26	#10-16	1611	1609	537	536
27	#12-14	2301	1790	767	597
Flex5 Standard Drilling Capacity Fasteners					
28	#10-16	1939	1358	646	453
29, 30	#12-24	3310	2041	1103	680
31[5]	1/4-14	3792	2542	1402	933
Flex5 Extended Drilling Capacity Fasteners					
32	#12-24	3902	2413	1301	804
33[6]	1/4-20	4613	2607	1705	964

For SI: 1 inch = 25.4 mm

1 Available strengths listed herein are based on laboratory testing.

2 For tensile connections, the lowest of the allowable fastener tensile strength, pull-out strength, and pull-over strength values must be used for design.

3 For shear connections, the lesser of the allowable fastener shear strength and allowable shear (bearing) strength must be used for design.

4 To determine the design strength value multiply the value by the applied safety factor of 3.0 and then multiply again by the LRFD resistance factor of 0.5. For all but Screw type 31 Flex5 1/4-14 and Screw type 33 Flex5 1/4-20

5 For Screw type 31 Flex5 1/4-14 to determine the design strength value multiply the value by the applied safety factor of 2.71 and then multiply again by the LRFD resistance factor of 0.59.

6 For Screw type 33 Flex5 1/4-20 to determine the design strength value multiply the value by the applied safety factor of 2.71 and then multiply again by the LRFD resistance factor of 0.59.

TABLE 3 – Allowable Tensile Pull-out Capacity of Screw Connections (lbf)[1, 2, 4, 5, 6, 7, 8]

SCREW TYPE	FASTENER DESCRIPTION	NOMINAL DIAMETER (inch)	POINT STYLE	NOMINAL THICKNESS OF MEMBER NOT IN CONTACT WITH THE FASTENER HEAD (inch)										
				0.030	0.036	0.048	0.060	0.075	0.105	0.125[3]	0.141[3]	0.187[3]	0.250[3]	0.313[3]
Impax® Standard Drilling Capacity Fasteners														
1	#10-16	0.190	SD3	*	70	103	128	-	343	-	441	*	*	*
2A, 2B. 3A, 3B, 7, 8, 9	#12-14	0.216	SD3	*	84	115	133	-	350	-	-	972	*	*
4, 5, 11	1/4-14	0.250	SD2	*	104	136	166	-	410	-	-	1153	*	*
6A, 6B, 10	1/4-14	0.250	SD3	*	*	112	125	194	329	-	-	828	*	*
Impax® Extended Drilling Capacity Fasteners														
12	#12-24	0.216	SD4	*	*	*	*	194	299	441	-	-	627	*
13, 14, 19	#12-24	0.216	SD4.5	*	*	*	*	186	336	552	-	-	1257	-
15, 18, 20	#12-24	0.216	SD5	*	*	*	*	186	336	552	-	-	1257	-
16	1/4-20	0.250	SD5	*	*	*	*	*	302	527	433	906	-	-
Impax® Thin Gauge Drilling Capacity Fasteners														
21-25	1/4-14	0.250	SD1	101	110	150	158	-	*	*	*	*	*	*
Impax® Architectural Clip Fasteners														
26	#10-16	0.190	SD2	*	85	118	139	222	373	-	-	*	*	*
27	#12-14	0.216	SD2	*	92	127	143	218	185	-	-	-	*	*
Flex5 Standard Drilling Capacity Fasteners														
28	#10-16	0.190	SD3	*	82	120	135	215	-	-	466	*	*	*
29, 30	#12-14	0.216	SD3	*	80	117	138	-	357	-	-	915	*	*
31	1/4-14	0.250	SD3	*	*	152	191	265	437[9]	572	-	924	*	*
Flex5 Extended Drilling Capacity Fasteners														
32	#12-24	0.216	SD5	*	*	*	125	-	279	-	-	821	-	1037
33	1/4-20	0.250	SD4	*	*	*	191	275	445[9]	-	-	923	-	1322

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa

1 Available strengths listed herein are based on laboratory testing.

2 Except where noted otherwise values are based on grade 33 steel members with a minimum yield strength of F_y = 33 ksi and a minimum tensile strength of F_u = 45 ksi.

3 Values are based on steel members complying with ASTM A36, with minimum yield strength of F_y = 36 ksi and a minimum tensile strength of F_u = 58 ksi.

4 For tensile connections, the lowest of the allowable fastener tensile strength, pull-out strength, and pull-over strength values must be used for design.

5 Available capacity of other member thicknesses may be determined by interpolating within the table

6 To determine the design strength value multiply the value by the applied safety factor of 3.0 and then multiply again by the LRFD resistance factor of 0.5

7 (*) Indicates the given steel member thickness is outside the given fastener's drill capacity limits.

8 (-) Indicates the given steel member thickness was not tested

TABLE 3 – Allowable Tensile Pull-out Capacity of Screw Connections (lbf)[1, 2, 4, 5, 6, 7, 8](Continued)

9 To determine the design strength value multiply the value by the applied safety factor of 2.71 and then multiply again by the LRFD resistance factor of 0.591

TABLE 4 – Allowable Tensile Pull-over Capacity of Screw Connections[1, 2, 3, 4, 5, 6, 7, 8, 9]

Screw Type	Fastener Description	Nominal Outer Diameter	Head Type	Nominal Effective Pull-Over Diameter (in)	Nominal Thickness of Member in Contact with the Fastener Head (in)									
					0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250	0.313
Standard Drilling Capacity Impax® Fasteners														
1	#10-16	0.190	HWH	0.400	*	309	403	510	673	873	1006	*	*	*
2A	#12-14	0.216	HWH	0.415	*	321	419	530	633	908	1047	1605	*	*
2B, 8, 9	#12-14	0.216	HWH	0.421	*	336	425	538	673	921	1062	1628	*	*
4, 11	1/4-14	0.250	HWH	0.415	*	321	419	530	663	908	1047	1605	*	*
5, 6A, 6B	1/4-14	0.250	HWH	0.500	*	387	505	639	799	1094	1261	1934	*	*
10	1/4-14	0.250	HWH	0.421	*	*	425	538	673	921	1062	1628	*	*
Extended Drilling Capacity Impax® Fasteners														
12, 13, 15, 19, 20	#12-24	0.216	HWH	0.415	*	*	*	*	663	908	1047	1605	2163	*
14	#12-24	0.216	HWH	0.500	*	*	*	*	799	1094	1261	1934	2607	3516
16	1/4-20	0.250	HWH	0.500	*	*	*	*	*	1094	1261	1934	2607	3516
Thin Gauge Drilling Capacity Impax® Fasteners														
21, 25	1/4-14	0.250	HWH	0.415	265	321	419	530	663	*	*	*	*	*
24	1/4-15	0.250	HWH	0.421	269	326	425	538	673	*	*	*	*	*
Architectural Clip Impax® Fasteners														
26	#10-16	0.190	PC	0.435	*	337	439	556	695	951	1097	*	*	*
27	#12-14	0.216	PC	0.435	*	337	439	556	695	951	1097	1682	*	*
Flex5 Standard Drilling Capacity Fasteners														
31[6, 7]	1/4-14	0.250	HWH	0.500	*	*	719[6]	921[7]	840	*	*	*	*	*
Flex5 Extended Drilling Capacity Fasteners														
33[6, 7]	1/4-20	0.250	HWH	0.500	*	*	719[6]	921[7]	840	*	*	*	*	*

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa

1 Available strengths listed herein are based on laboratory testing.

2 Except where noted otherwise values are based on grade 33 steel members with a minimum yield strength of F_y = 33 ksi and a minimum tensile strength of F_u = 45 ksi.

3 Values are based on steel members complying with ASTM A36, with minimum yield strength of F_y = 36 ksi and a minimum tensile strength of F_u = 58 ksi.

4 Available capacity of other member thicknesses may be determined by interpolating within the table

5 To determine the design strength value multiply the value by the applied safety factor of 3.0 and then multiply again by the LRFD resistance factor of 0.5

TABLE 4 – Allowable Tensile Pull-over Capacity of Screw Connections[1, 2, 3, 4, 5, 6, 7, 8, 9] (Continued)

6 To determine the design strength value multiply the value by the applied safety factor of 2.73 and then multiply again by the LRFD resistance factor of 0.586

7 To determine the design strength value multiply the value by the applied safety factor of 2.83 and then multiply again by the LRFD resistance factor of 0.565

8 (*) Indicates the given steel member thickness is outside the given fastener's drill capacity limits.

9 Shading indicates that the value exceeds the allowable fastener tensile strength from Table 2 and will not govern the design of the connection.

TABLE 5 – Allowable Shear (Bearing) Capacity of Screw Connections (lbf) [1, 2, 3, 4, 7, 8, 9]

Screw Type	Fastener Description	Nominal Outer Diameter	Point Style	Nominal Thickness of Steel in Contact with the Head (in)	Nominal Thickness of Steel not in Contact with the Head (in)										
					0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250	0.313	0.375
Standard Drilling Capacity and Architectural Impax® Fasteners															
1	#10-16	0.190	SD3	0.030	143	154	178	201	231	231	231	*	*	*	*
				0.036	143	188	203	219	238	277	277	*	*	*	*
				0.048	143	188	289	301	317	348	*	*	*	*	*
				0.060	143	188	289	404	410	*	*	*	*	*	*
				0.075	143	188	289	404	564	*	*	*	*	*	*
				0.105	143	188	289	*	*	*	*	*	*	*	*
				0.125	143	*	*	*	*	*	*	*	*	*	*
2A, 2B, 8, 9	#12-14	0.216	SD3	0.030	152	167	196	225	262	262	262	*	*	*	*
				0.036	152	200	220	240	265	315	315	*	*	*	*
				0.048	152	200	308	325	347	391	420	*	*	*	*
				0.060	152	200	308	430	441	464	479	*	*	*	*
				0.075	152	200	308	430	601	616	626	*	*	*	*
				0.105	152	200	308	430	601	919	*	*	*	*	*
				0.125	152	200	308	430	601	*	*	*	*	*	*
4, 5, 11	1/4-14	0.250	SD2	0.030	164	182	220	257	304	304	304	*	*	*	*
				0.036	164	215	241	267	300	365	365	*	*	*	*
				0.048	164	215	331	355	386	446	*	*	*	*	*
				0.060	164	215	331	463	480	*	*	*	*	*	*
				0.075	164	215	331	463	647	*	*	*	*	*	*
				0.105	164	215	331	*	*	*	*	*	*	*	*
				0.125	164	215	*	*	*	*	*	*	*	*	*

TABLE 5 – Allowable Shear (Bearing) Capacity of Screw Connections (lbf) [1, 2, 3, 4, 7, 8, 9] (Continued)

Screw Type	Fastener Description	Nominal Outer Diameter	Point Style	Nominal Thickness of Steel in Contact with the Head (in)	Nominal Thickness of Steel not in Contact with the Head (in)										
					0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250	0.313	0.375
Standard Drilling Capacity and Architectural Impax® Fasteners															
6A, 6B, 10	1/4-14	0.250	SD3	0.030	164	182	220	257	304	304	304	*	*	*	*
				0.036	164	215	241	267	300	365	365	*	*	*	*
				0.048	164	215	331	355	386	446	486	*	*	*	*
				0.060	164	215	331	463	480	514	537	*	*	*	*
				0.075	164	215	331	463	647	677	697	*	*	*	*
				0.105	164	215	331	463	647	1063	*	*	*	*	*
				0.125	164	215	331	463	647	*	*	*	*	*	*
Thin Gauge Drilling Capacity Impax® Fasteners															
21, 24, 25	1/4-14	0.250	SD1	0.030	164	182	220	257	*	*	*	*	*	*	*
				0.036	164	215	241	267	*	*	*	*	*	*	*
				0.048	164	215	331	*	*	*	*	*	*	*	*
				0.060	164	215	*	*	*	*	*	*	*	*	*
Architectural Clip Impax® Fasteners															
26	#10-16	0.190	SD2	0.030	143	154	178	201	231	231	231	*	*	*	*
				0.036	143	188	203	219	238	277	277	*	*	*	*
				0.048	143	188	289	301	317	348	*	*	*	*	*
				0.060	143	188	289	404	410	*	*	*	*	*	*
				0.075	143	188	289	404	564	*	*	*	*	*	*
				0.105	143	188	289	*	*	*	*	*	*	*	*
				0.125	143	*	*	*	*	*	*	*	*	*	*
27	#12-14	0.216	SD2	0.030	152	167	196	225	262	262	262	*	*	*	*
				0.036	152	200	220	240	265	315	315	*	*	*	*
				0.048	152	200	308	325	347	391	420	*	*	*	*
				0.060	152	200	308	430	441	464	479	*	*	*	*
				0.075	152	200	308	430	601	616	626	*	*	*	*
				0.105	152	200	308	430	601	919	*	*	*	*	*
				0.125	152	200	308	430	601	*	*	*	*	*	*

TABLE 5 – Allowable Shear (Bearing) Capacity of Screw Connections (lbf) [1, 2, 3, 4, 7, 8, 9] (Continued)

Screw Type	Fastener Description	Nominal Outer Diameter	Point Style	Nominal Thickness of Steel in Contact with the Head (in)	Nominal Thickness of Steel not in Contact with the Head (in)										
					0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250	0.313	0.375
Extended Drilling Capacity Impax® Fasteners															
12	#12-24	0.216	SD4	0.030	152	167	196	225	262	262	262	262	*	*	*
				0.036	152	200	221	242	268	320	320	320	*	*	*
				0.048	152	200	308	325	347	391	420	420	*	*	*
				0.060	152	200	308	430	441	464	479	525	*	*	*
				0.075	152	200	308	430	601	616	626	656	*	*	*
				0.105	152	200	308	430	601	919	919	919	*	*	*
				0.125	152	200	308	430	601	919	1094	*	*	*	*
				0.187	152	200	308	430	601	919	*	*	*	*	*
13, 14, 19	#12-24	0.216	SD4.5	0.030	152	167	196	225	262	262	262	262	262	*	*
				0.036	152	200	221	242	268	320	320	320	320	*	*
				0.048	152	200	308	325	347	391	420	420	420	*	*
				0.060	152	200	308	430	441	464	479	525	525	*	*
				0.075	152	200	308	430	601	616	626	656	656	*	*
				0.105	152	200	308	430	601	919	919	919	919	*	*
				0.125	152	200	308	430	601	919	1094	1094	1094	*	*
				0.187	152	200	308	430	601	919	1094	1640	*	*	*
				0.250	152	200	308	430	601	919	1094	*	*	*	*

TABLE 5 – Allowable Shear (Bearing) Capacity of Screw Connections (lbf) [1, 2, 3, 4, 7, 8, 9] (Continued)

Screw Type	Fastener Description	Nominal Outer Diameter	Point Style	Nominal Thickness of Steel in Contact with the Head (in)	Nominal Thickness of Steel not in Contact with the Head (in)										
					0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250	0.313	0.375
Extended Drilling Capacity Impax® Fasteners															
15, 20	#12-24	0.216	SD5	0.030	152	167	196	225	262	262	262	262	262	262	262
				0.036	152	200	221	242	268	320	320	320	320	320	320
				0.048	152	200	308	325	347	391	420	420	420	420	420
				0.060	152	200	308	430	441	464	479	525	525	525	525
				0.075	152	200	308	430	601	616	626	656	656	656	656
				0.105	152	200	308	430	601	919	919	919	919	919	919
				0.125	152	200	308	430	601	919	1094	1094	1094	1094	1094
				0.187	152	200	308	430	601	919	1094	1640	1640	1640	*
				0.250	152	200	308	430	601	919	1094	1640	2187	*	*
16	1/4-20	0.250	SD5	0.030	164	182	220	257	304	304	304	304	304	304	304
				0.036	164	215	241	267	300	365	365	365	365	365	365
				0.048	164	215	331	355	386	446	486	486	486	486	486
				0.060	164	215	331	463	480	514	537	608	608	608	608
				0.075	164	215	331	463	647	677	697	759	759	759	759
				0.105	164	215	331	463	647	1063	1063	1063	1063	1063	1063
				0.125	164	215	331	463	647	1063	1266	1266	1266	1266	1266
				0.187	164	215	331	463	647	1063	1266	1893	1893	1893	*
				0.250	164	215	331	463	647	1063	1266	1893	2531	*	*

TABLE 5 – Allowable Shear (Bearing) Capacity of Screw Connections (lbf)[1, 2, 3, 4, 7, 8, 9](Continued)

Screw Type	Fastener Description	Nominal Outer Diameter	Point Style	Nominal Thickness of Steel in Contact with the Head (in)	Nominal Thickness of Steel not in Contact with the Head (in)										
					0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250	0.313	0.375
Flex5 Standard Drilling Capacity Fasteners															
28	#10-16	0.190	SD3	0.036	-	249	-	-	-	*	*	*	*	*	*
				0.048	-	-	333	-	-	*	*	*	*	*	*
				0.060	-	-	-	433	-	*	*	*	*	*	*
				0.075	-	-	446	-	490	*	*	*	*	*	*
29, 30	#12-14	0.216	SD3	0.036	-	266	-	-	-	-	-	*	*	*	*
				0.048	-	-	343	-	-	-	-	*	*	*	*
				0.060	-	-	-	515	-	-	-	*	*	*	*
				0.075	-	-	655	-	669	-	*	*	*	*	*
				0.105	-	-	-	-	-	657	*	*	*	*	*
31	1/4-14	0.250	SD3	0.036	-	218[5]	329	363	363	363	363	*	*	*	*
				0.048	-	214	346[6]	461	484	484	484	*	*	*	*
				0.060	-	214	329	461	605	605	605	*	*	*	*
				0.075	-	214	546[6]	461	643	756	*	*	*	*	*
				0.105	-	214	329	461	643	1059	*	*	*	*	*
Flex5 Extended Drilling Capacity Fasteners															
32	#12-14	0.216	SD5	0.048	-	-	334	-	-	-	-	-	-	-	-
				0.060	-	-	-	465	-	-	-	-	-	-	-
				0.075	-	-	617	-	639	-	-	-	-	-	-
				0.105	-	-	-	-	-	773	-	-	-	-	-
				0.125	-	-	-	-	-	-	-	-	-	-	-
				0.187	-	-	-	-	-	-	-	-	836	-	*
33	1/4-20	0.250	SD4	0.048	-	214	329	461	484	484	484	484	484	*	*
				0.060	-	214	329	461	605	605	605	605	605	*	*
				0.075	-	214	329	461	643	756	756	756	756	*	*
				0.105	-	214	458[6]	461	643	1059	1059	1059	*	*	*
				0.125	-	214	329	461	643	1059	1211	1362	*	*	*
				0.187	-	214	329	461	643	1059	1362	*	1898	*	*

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa

1 Except where noted otherwise values are based on grade 33 steel members with a minimum yield strength of F_y = 33 ksi and a minimum tensile strength of F_u = 45 ksi.

2 For shear connections, the lesser of the allowable fastener shear strength and the allowable shear (bearing) strength must be used for design.

2 Available capacity of other member thicknesses may be determined by interpolating within the table

TABLE 5 – Allowable Shear (Bearing) Capacity of Screw Connections (lbf)[2, 3, 4, 5, 6, 7, 8](Continued)

4 To determine the design strength value multiply the value by the applied safety factor of 3.0 and then multiply again by the LRFD resistance factor of 0.5

5 To determine the design strength value multiply the value by the applied safety factor of 2.96 and then multiply again by the LRFD resistance factor of 0.54

6 To determine the design strength value multiply the value by the applied safety factor of 2.71 and then multiply again by the LRFD resistance factor of 0.591

7 (*) Indicates the given steel member thickness is outside the given fastener's drill capacity limits.

8 (-) Indicated the given steel member thickness was not tested of calculated

9 Shading indicated that the value exceeds the allowable fastener shear strength from Table 2 and will not govern the design of the connection.

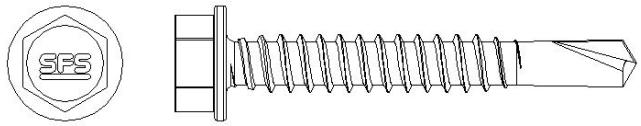

Figure 1: Impax® Hex Washer Head

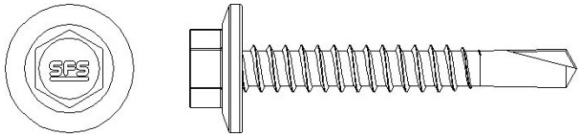

Figure 2: Impax® Cupped Hex Washer Head

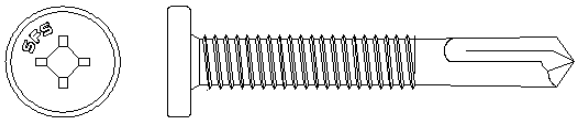

Figure 3: Clip Impax® Pancake Head

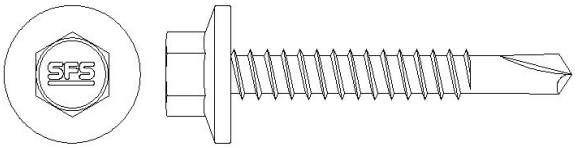

Figure 4: Impax® Stainless Steel MAC Cap

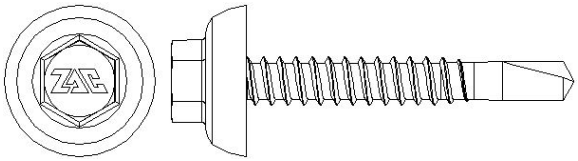

Figure 5: Impax® Zinc-Alloy ZAC Cap

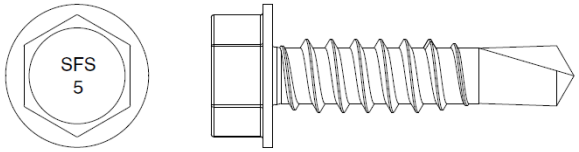

Figure 6: Flex5 Hex Washer Head

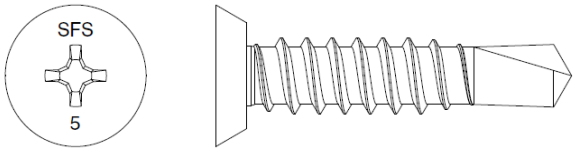

Figure 7: Flex5 Undercut Flat Head

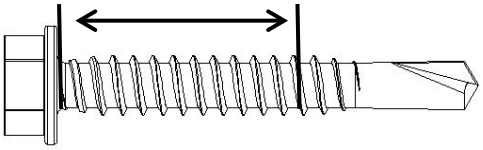

Figure 8: Load Bearing Area