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EVALUATION SUBJECT: SIMPSON STRONG-TIE® SHOULDERED SELF- DRILLING TAPPING SCREWS

REPORT HOLDER:

Simpson Strong-Tie Company Inc.
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CSI DIVISION: 05 – METALS

CSI Section: 050523 – Metal Fastenings

1.0 SCOPE OF EVALUATION

1.1 Compliance to the following codes & regulations:

- 2015 International Building Code® (2015 IBC)
- 2012 International Building Code® (2012 IBC)
- 2009 International Building Code® (2009 IBC)
- 2006 International Building Code® (2006 IBC)

1.2 Evaluated in accordance with:

- ICC-ES Acceptance Criteria for Tapping Screw Fasteners (AC118), approved February 2016

1.3 Properties assessed:

- Structural

2.0 PRODUCT USE

The Simpson Strong-Tie® Shouldered Self-Drilling Tapping Screws are used with the Simpson Strong-Tie connectors to resist shear and tension loads in engineered connections for cold-formed steel curtain wall construction to cold-formed steel with thicknesses ranging from 33 mils (0.838 mm) to 118 mils (3.00 mm). The screws comply with IBC Sections 2210 and 2211.

3.0 PRODUCT DESCRIPTION

3.1 Product Information: The Simpson Strong-Tie Shouldered Self-Drilling Tapping Screws, illustrated in [Figure 1](#) of this report, are No. 14 self-drilling tapping screws complying with [ASTM C1513](#).

XSH34B1414 screws have a nominal major shank diameter of 0.242 inch (6.15 mm) and nominal minor shank diameter of 0.192 inch (4.88 mm), with 14 threads per inch. The screws have a $5/16$ -inch (7.9 mm) hex head with a 0.553-inch-diameter (14.0 mm) integral washer and a point 3 drill point. The screws are 3/4 inch (19.1 mm) in length, with a nominal 0.070-inch-tall (1.78 mm) shoulder below the head. The length of the load-bearing portion of the screw shank is 0.277 inch (7.04 mm).

XLSH34B1414 screws have a nominal major shank diameter of 0.242 inch (6.15 mm) and nominal minor shank diameter of 0.192 inch (4.88 mm), with 14 threads per inch. The screws have a $5/16$ -inch (7.9 mm) hex head with a 0.625-inch-diameter (15.9 mm) integral washer and a point 3 drill point. The screws are 3/4 inch (19.1 mm) in length, with a nominal 0.075-inch-tall (1.91 mm) shoulder below the head. The length of the load-bearing portion of the screw shank is 0.217 inch (5.51 mm).

XLSH78B1414 screws have a nominal major shank diameter of 0.242 inch (6.15 mm) and a nominal minor shank diameter of 0.192 inch (4.88 mm), with 14 threads per inch. The screws have a $5/16$ -inch (7.9 mm) hex head with a 0.625-inch-diameter (15.9 mm) integral washer and a point 3 drill point. The screws are 7/8 inch (22.23 mm) in length, with a nominal 0.135-inch-tall (3.43 mm) shoulder below the head. The length of the load-bearing portion of the screw shank is 0.342 inch (8.58 mm).

[Table 1](#) of this report provides a description of the screws recognized in this report.

3.2 Material Information

3.2.1 Shouldered Screws: The screws described in this report are manufactured from carbon steel conforming to [ASTM A510](#), Grade 1022, are case hardened, and are coated with a yellow zinc coating.

3.2.2 Cold-Formed Steel Members: Connected members for connections covered in this report shall be manufactured from materials in compliance with the American Iron and Steel Institute *North American Specification for the Design of Cold-Formed Steel Structural Members* ([AISI S100](#)), with base steel thickness and corresponding designation thickness and design thickness in compliance with [AISI S201](#), Table B2-1. Loads provided in this report are based on members in contact with the screw head manufactured from steel conforming with [ASTM A653](#), SS Grade 40 with a minimum yield strength of 40,000 psi (275 MPa) and a minimum tensile strength of 55,000 psi (380 MPa) or with steel conforming to ASTM A653, Grade 50 with a minimum yield strength of 50,000 psi (345 MPa) and a minimum tensile strength of 65,000 psi (448 MPa). Members in contact with screw heads shall be either No. 16 gage steel members with a minimum base metal thickness of 0.0555 inch (1.41 mm), No. 14 gage steel members with a minimum base metal thickness of 0.0713 inch (1.81 mm), No. 12 gage steel members with a minimum base metal thickness of 0.1026 inch (2.60 mm), or No. 10 gage steel members with a minimum base metal thickness of 0.1342 inch (3.41 mm), and shall have a minimum G90 zinc coating specification in accordance with ASTM A653. Loads provided in this report are based on the following material properties for members not in contact with the screw head:



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MEMBER THICKNESS DESIGNATION	DESIGN THICKNESS (in.)	MINIMUM YIELD STRESS (psi)	MINIMUM TENSILE STRESS (psi)
33 mil (20 ga.)	0.0346	33,000	45,000
43 mil (18 ga.)	0.0451	33,000	45,000
54 mil (16 ga.)	0.0566	50,000	65,000
68 mil (14 ga.)	0.0713	50,000	65,000
97 mil (12 ga.)	0.1017	50,000	65,000
118 mil (10 ga.)	0.1242	50,000	65,000

For SI: 1 inch = 25.4 mm; 1,000 psi = 6.895 MPa

4.0 DESIGN AND INSTALLATION

4.1 Design: The nominal, design, and allowable shear and tensile strengths of the screws are provided in [Table 2](#) of this report. The nominal shear strength, P_{ss} , and nominal tensile strength, P_{ts} , of the screws are the average peak values from testing. The tabulated LRFD design strength and ASD allowable strength values are based on a resistance factor, ϕ , of 0.5, and a safety factor, Ω , of 3.0, respectively.

The nominal, design, and allowable strengths for shear, pull-over, and pull-out of steel-to-steel connections are provided in [Tables 3](#), [4](#), and [5](#), respectively of this report. The resistance factors and safety factors used to determine the LRFD and ASD strengths shall comply with Section E4 of AISI S100. Tabulated values for shear strength in [Table 3](#) of this report and pull-out strength in [Table 5](#) of this report for screws installed in 97 mil (No. 12 gage) material are applicable for installations in 118 mil (No. 10 gage) steel complying with the requirements of Section 3.2.2, provided the screw extends through the steel a minimum of three exposed threads in accordance with [AISI S200](#), North American Standard for Cold-Formed Steel Framing - General Provisions Section D1.3.

For connections subject to shear, the lesser of the fastener shear strength ([Table 2](#) of this report) and the connection shear strength ([Table 3](#) of this report) shall be used for design. For connections subject to tension, the least of the tension strength of screws ([Table 2](#) of this report), connection pull-over strength ([Table 4](#) of this report), and connection pull-out strength ([Table 5](#) of this report) shall be used for design. Connections subject to combined tension and shear loading have not been evaluated and are outside the scope of this report.

The values in the tables are based on a minimum spacing between the centers of fasteners of three times the diameter of the screw, and a minimum distance of 1.5 times the diameter of the screw from the center of a fastener to the edge of any connected part.

Connected members shall be checked for rupture in accordance with Appendix A, Section E5 of AISI S100.

4.2 Installation: Installation of the Simpson Strong-Tie® Shouldered Self-Drilling Tapping Screws shall be in accordance with Section E4 of AISI S100, the manufacturer's published installation instructions and this report. Where conflicts occur, the more restrictive governs. The manufacturer's published installation instructions shall be available at the jobsite at all times during installation.

The screw shall be installed perpendicular to the work surface and shall penetrate through the supporting steel with a minimum of three threads protruding past the back side of the supporting steel. Spacing, edge distance, and end distance shall comply with Section E4 of AISI S100.

5.0 LIMITATIONS

The Simpson Strong-Tie Shouldered Self-Drilling Tapping Screws described in this report are in compliance with, or are acceptable alternatives to what is specified in, those codes listed in Section 1.0 of this report subject to the following conditions:

5.1 Screws shall be installed in accordance with AISI S100, the manufacturer's published installation instructions and this report. Where conflicts occur, the more restrictive shall govern.

5.2 The allowable strengths (ASD) specified in Section 4.1 of this report may not to be increased when the screws are used to resist wind or seismic loads.

5.3 The screws shall only be used with the Simpson Strong-Tie connectors for cold-formed steel curtain wall construction in accordance with IAPMO UES [ER-238](#).

5.4 The rust-inhibitive (corrosion-resistant) coating on the screws has been tested in accordance with the [ASTM B117](#) Salt Spray Method for a period of 12 hours and the screws did not show any corrosion from the coating (white corrosion) after three hours, and no corrosion from the base metal (red rust) after 12 hours. The screws shall be suitable for the intended use, as determined by a registered design professional.

6.0 SUBSTANTIATING DATA

Data in accordance with ICC-ES Acceptance Criteria for Tapping Screw Fasteners (AC118), approved February 2016, including test results from laboratories in compliance with ISO/IEC 17025.



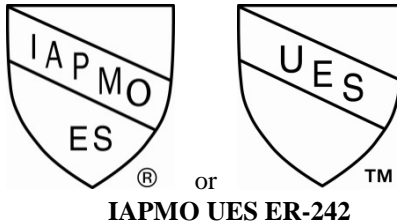
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7.0 IDENTIFICATION

The Simpson Strong-Tie Shouldered Self-Drilling Tapping Screws described in this report are identified with a “≠” on the top surface of the screw head, as shown in [Figure 1 of this report](#). Packages of the screws are labeled with the report holder’s name (Simpson Strong-Tie), the model number (XSH34B1414-XX, XLSH34B1414-XX, or XLSH78B1414-XX), where XX represents the screw quantity in the package, and the number of the evaluation report (ER-242).



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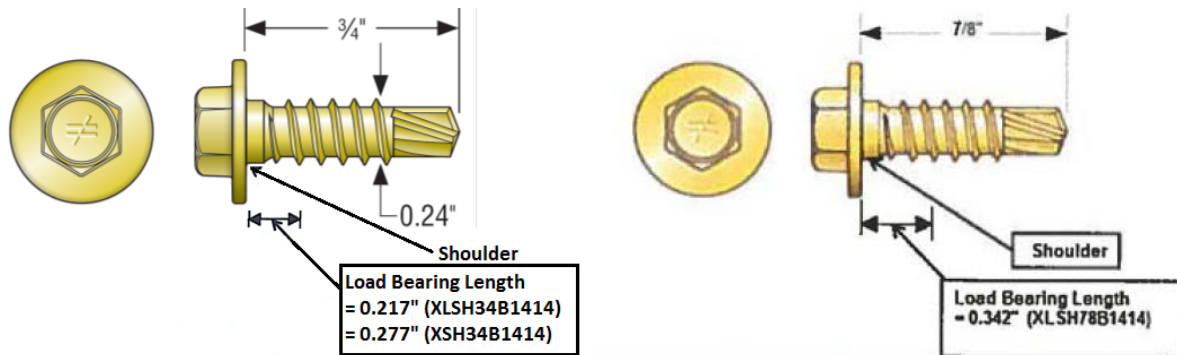
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For additional information about this evaluation report please visit
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**FIGURE 1 - SIMPSON STRONG-TIE® SHOULDERS
SELF-DRILLING TAPPING SCREW**

TABLE 1A – SHOULDERS SELF-DRILLING TAPPING SCREW SPECIFICATIONS

MODEL NO.	DESIGNATION	SIZE	NOMINAL DIAMETER (in.)	NOMINAL SCREW LENGTH (in.)	HEAD STYLE	WASHER DIAMETER (in.)
XSH34B1414	#14-14	#14 x 3/4"	0.242	3/4	Hex Washer	0.553
XLSH34B1414	#14-14	#14 x 3/4"	0.242	3/4	Hex Washer	0.625
XLSH78B1414	#14-14	#14x7/8"	0.242	7/8	Hex Washer	0.625

For SI: 1 inch = 25.4 mm

TABLE 1B – SHOULDERS SELF-DRILLING TAPPING SCREW SPECIFICATIONS

MODEL NO.	SIZE	DRILLING CAPACITY (in.)	POINT (number)	LOAD BEARING LENGTH (in.)	COATING
XSH34B1414	#14 x 3/4"	0.25	3	0.277	Yellow Zinc
XLSH34B1414	#14 x 3/4"	0.28	3	0.217	Yellow Zinc
XLSH78B1414	#14x7/8"	0.28	3	0.342	Yellow Zinc

For SI: 1 inch = 25.4 mm

TABLE 2 – SHOULDERS SELF-DRILLING TAPPING SCREW STRENGTHS (lbf) ^{1,2,3,4}

MODEL NO.	NOMINAL STRENGTH		LRFD DESIGN STRENGTH		ALLOWABLE STRENGTH (ASD)	
	Shear (P _{ss})	Tension (P _{ts})	Shear (φP _{ss})	Tension (φP _{ts})	Shear (P _{ss} /Ω)	Tension (P _{ts} /Ω)
XSH34B1414	3300	2875	1650	1435	1100	960
XLSH34B1414	3050	3010	1525	1505	1015	1005
XLSH78B1414	3540	4100	1770	2050	1180	1365

For SI: 1 lb = 4.45 N

¹ The tabulated ASD allowable strength and LRFD design strength values are based on a safety factor $\Omega = 3$ and a resistance factor of $\phi = 0.5$, respectively.

² For tension connections, the lowest of the fastener tension strength, pull-over and pull-out capacities found in Tables 2, 4 and 5, respectively of this report, shall be used for design.

³ For shear connections, the lesser of the fastener shear strength and the connection shear strength found in Tables 2 and 3, respectively of this report, shall be used for design.

⁴ P_{ss} and P_{ts} are nominal shear strength and nominal tension strength for the screw itself, respectively, and are the average (peak) value of all the tests.



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**TABLE 3 – SHOULDERED SELF-DRILLING TAPPING SCREW LAP-JOINT CONNECTION
SHEAR STRENGTH LIMITED BY TILTING AND BEARING (lbf)¹**

MODEL NO.	STRENGTH	MEMBER IN CONTACT WITH SCREW HEAD	MINIMUM BASE STEEL THICKNESS OF MEMBER NOT IN CONTACT WITH SCREW HEAD				
			33 mil	43 mil	54 mil	68 mil	97 mil
XSH34B1414	Nominal Strength, P_{ns}	54 mil, Grade 40 Steel	640	1075	1495	1960	2765
	Design Strength (LRFD), ϕP_{ns}		450	755	1050	1380	1945
	Allowable Strength (ASD), P_{ns}/Ω		280	475	655	860	1215
XLSH34B1414	Nominal Strength, P_{ns}	54 mil, Grade 40 Steel	880	1250	1585	2045	2665
	Design Strength (LRFD), ϕP_{ns}		620	880	1115	1440	1875
	Allowable Strength (ASD), P_{ns}/Ω		385	550	695	900	1170
	Nominal Strength, P_{ns}	68 mil, Grade 40 Steel	780	1565	1945	2175	2980
	Design Strength (LRFD), ϕP_{ns}		535	1100	1365	1530	2095
	Allowable Strength (ASD), P_{ns}/Ω		335	690	855	955	1310
XLSH78B1414	Nominal Strength, P_{ns}	97 mil, Grade 50 (with a gap equal to shoulder height, approximately 1/8" between washer and steel) ²	950	1710	2775	2985	2985
	Design Strength (LRFD), ϕP_{ns}		665	1065	1950	1950	1950
	Allowable Strength (ASD), P_{ns}/Ω		415	665	1220	1220	1220
	Nominal Strength, P_{ns}	97 mil, Grade 50 Steel	900	1380	2265	2690	3455
	Design Strength (LRFD), ϕP_{ns}		630	970	1595	1655	2255
	Allowable Strength (ASD), P_{ns}/Ω		395	605	995	1035	1410
	Nominal Strength, P_{ns}	118 mil, Grade 50 Steel	925	1445	2510	3345	3345
	Design Strength (LRFD), ϕP_{ns}		650	1020	1765	2000	2000
	Allowable Strength (ASD), P_{ns}/Ω		405	635	1105	1250	1250

For SI: 1 inch = 25.4 mm, 1 lb = 4.45 N

1. The tabulated shear values are based on screws installed through a pre-drilled 1/4 inch diameter hole in the steel member in contact with the screw head, with the shoulder of the screw snug to the steel member not in contact with the screw head.
2. The tabulated shear values are based on screws installed through a pre-drilled 3/16 inch diameter hole in the steel member in contact with the screw head, with the shoulder of the screw snug to the steel member not in contact with the screw head.

**TABLE 4 – SHOULDERED SELF-DRILLING TAPPING SCREW
CONNECTION PULL-OVER STRENGTH (lbf)¹**

MODEL NO.	STRENGTH	MINIMUM BASE STEEL THICKNESS OF MEMBER IN CONTACT WITH SCREW HEAD			
		54 mil	68 mil	97 mil	118 mil
XSH34B1414	Nominal Strength, P_{nov}	1955	-	-	-
	Design Strength (LRFD), ϕP_{nov}	1180	-	-	-
	Allowable Strength (ASD), P_{nov}/Ω	735	-	-	-
XLSH34B1414	Nominal Strength, P_{nov}	2445	2660	-	-
	Design Strength (LRFD), ϕP_{nov}	1475	1605	-	-
	Allowable Strength (ASD), P_{nov}/Ω	920	1005	-	-
XLSH78B1414	Nominal Strength, P_{nov}	-	-	4100	4100
	Design Strength (LRFD), ϕP_{nov}	-	-	2050	2050
	Allowable Strength (ASD), P_{nov}/Ω	-	-	1365	1365

For SI: 1 inch = 25.4 mm, 1 lb = 4.45 N

1. The tabulated pull-over values are based on screws installed through a pre-drilled 1/4 inch diameter hole in the member in contact with the screw head.



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TABLE 5 – SHOULDERED SELF-DRILLING TAPPING SCREW CONNECTION PULL-OUT STRENGTH (lbf)

MODEL NO.	STRENGTH	MINIMUM BASE STEEL THICKNESS OF MEMBER NOT IN CONTACT WITH SCREW HEAD				
		33 mil	43 mil	54 mil	68 mil	97 mil
XSH34B1414	Nominal Strength, P_{not}	325	455	675	920	1410
	Design Strength (LRFD), ϕP_{not}	190	300	440	600	630
	Allowable Strength (ASD), P_{not}/Ω	120	185	275	375	390
XLSH34B1414	Nominal Strength, P_{not}	300	400	620	860	1330
	Design Strength (LRFD), ϕP_{not}	195	255	400	560	870
	Allowable Strength (ASD), P_{not}/Ω	120	160	250	350	540
XLSH78B1414	Nominal Strength, P_{not}	260	415	660	1010	1775
	Design Strength (LRFD), ϕP_{not}	160	235	430	660	1160
	Allowable Strength (ASD), P_{not}/Ω	100	145	270	410	725

For SI: 1 inch = 25.4 mm, 1 lb = 4.45 N