ICC-ES Evaluation Report

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

REPORT HOLDER:

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EVALUATION SUBJECT:

SIMPSON STRONG-TIE® QUIK DRIVE® X SERIES SELF-DRILLING TAPPING SCREWS

1.0 EVALUATION SCOPE

Compliance with the following codes:

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

Property evaluated:

Structural

2.0 USES

The Simpson Strong-Tie® Quik Drive® X Series self-drilling tapping screws are used to resist shear and tension loads in engineered connections of combinations of cold-formed or hot-rolled steel with thicknesses ranging from 33 mils (0.083 mm) to $^1/_2$ inch (12.7 mm).

3.0 DESCRIPTION

3.1 General:

The Simpson Strong-Tie® Quik Drive® X Series screws, illustrated in Figure 1 of this report, are No. 12-24 self-drilling tapping screws complying with performance requirements of ASTM C 1513. The screws have a nominal shank diameter of 0.216 inch (5.49 mm) and have nominally 0.415-inch (10.5 mm) hex washer heads. Screw lengths are $^7/_8$ inch, $1^1/_4$ inches, and $1^1/_2$ inches (22.23, 31.75, and 38.1 mm). Table 1 of this report provides screw designations, sizes, and descriptions of point styles. The screws are supplied in boxes of individual screws, or in collated plastic strips.

3.2 Materials:

3.2.1 Quik Drive Tapping Screws: The screws described in this report are case hardened after being manufactured from carbon steel conforming to ASTM A 510, Grade 1022, and are coated with proprietary zinc coating.

3.2.2 Framing Steel: Cold-formed framing steel must comply with one of the ASTM specifications in Section A2.1 of the AISI North American Specification for Design of Cold-Formed Steel Structural Members (AISI-S100). Base steel thickness must comply with Section A2.4 of AISI-S100, and this report.

For the design values listed in Tables 3, 4, and 5 of this report, steels used to produce the connected steel members must be of ASTM A 653, SS designation, Grade 33, for steel members with a designation thickness of 33 mils and 43 mils (0.083 and 1.09 mm); ASTM A 653, SS designation, Grade 50, Type I, for steel members with a designation thickness of 54 mils to 97 mils (1.37 and 2.46 mm); ASTM A 1011, CS designation, Type B, for steel members with thicknesses of $^1/_8$ inch and $^3/_{16}$ inch (3.2 and 4.8 mm); and ASTM A 36 for steel members with the thicknesses of $^1/_4$ inch and $^1/_2$ inch (6.04 and 12.7 mm). See Tables 3, 4, and 5 for base steel thicknesses.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The nominal, allowable, and design tensile and shear strength values of the screws used in steel-to-steel connections are given in Table 2. Steel-to-steel member connection shear, pull-over, and pull-out strength values are given in Tables 3, 4, and 5, respectively, for steel complying with AISI-S100 and Section 3.2.2 of this report.

For connections subject to tension, the least of the tensile strength of screws, the connection pull-over strength, and the connection pull-out strength found, respectively, in Tables 2, 4, and 5 of this report, must be used for design. For connections subject to shear, the lesser of the fastener shear strength and the connection shear capacity found, respectively, in Tables 2 and 3 of this report, must be used for design. Connections subject to combined shear and pull-over loading must be designed in accordance with Section E4.5 of AISI-S100.

The shear strength values in Table 3 are based on a minimum spacing between the centers of fasteners of three times the diameter of the screws and a minimum distance of 1.5 times the diameter of the screw from the center of any screw to the edge of any connected part. For edge distances less than 1.5 times the diameter of the screw, the allowable shear connection strength must be evaluated in accordance with Section E4.3.2 of Appendix A of AISI-S100.

Screw thread length and point style must be selected on the basis of thickness of the fastened material and thickness of the supporting steel, respectively, in accordance with the manufacturer's published installation instructions

4.2 Installation:

Installation of the Simpson Strong-Tie® Quik Drive® X Series self-drilling tapping screws must be in accordance with AISI-S100, 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 screw must be installed perpendicular to the work surface using a screw gun or drill with a maximum speed of 2,500 rpm using a $^{5}/_{16}$-inch hex driver. The screw must penetrate through the supporting steel with a minimum of three threads protruding past the back side of the supporting steel.

5.0 CONDITIONS OF USE

The Simpson Strong-Tie® Quik Drive® X Series self-drilling tapping 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 Screws must be installed in accordance with AISI-S100, 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, this report governs.

5.2 The allowable loads (ASD) specified in Section 4.1 must not be increased when the screws are used to resist wind or seismic forces.

5.3 The screws are limited to use in cold-formed steel, cold-formed steel to hot-rolled and hot-rolled to hot-rolled connections.

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

5.5 The rust-inhibitive (corrosion-resistant) coating on the screws must be suitable for the intended use, as determined by the registered design professional.

5.6 The use of the screws in steel deck diaphragms has not been evaluated and is outside the scope of this evaluation report. Diaphragms constructed using the screws must be recognized in a current ICC-ES evaluation report.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Tapping Screw Fasteners (AC118), dated June 2010; and with the same document dated November 2009.

7.0 IDENTIFICATION

The Simpson Strong-Tie® Quik Drive® X Series self-drilling tapping screws are marked with a "≠" on the top surface of the screw heads, as shown in Figure 1. Packages of Simpson self-drilling tapping screws are labeled with the report holder's name (Simpson Strong-Tie Co., Inc) and address, the fastener type and size, and the evaluation report number (ESR-3006).

FIGURE 1—SIMPSON STRONG-TIE® QUIK DRIVE® X SERIES SELF-DRILLING TAPPING SCREW

TABLE 1—SIMPSON STRONG-TIE® QUIK DRIVE® X SERIES SELF-DRILLING TAPPING SCREW

MODEL NO.	DESIGNATION	NOMINAL DIAMETER (in.)	NOMINAL SCREW LENGTH (in.)	HEAD STYLE	POINT (number)	NOMINAL POINT LENGTH (in.)
XQ78S1224	#12-24	0.216	$^7/_8$	Hex Washer	4	0.37
XQ114S1224	#12-24	0.216	$1^1/_4$	Hex Washer	5	0.61
XQ112S1224	#12-24	0.216	$1^1/_2$	Hex Washer	5	0.61

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

TABLE 2—SIMPSON STRONG-TIE® QUIK DRIVE® X SERIES SCREW STRENGTH (lbs)[1,2,3,4]

MODEL NO.	SIZE	NOMINAL STRENGTH		ALLOWABLE STRENGTH (ASD)		DESIGN STRENGTH (LRFD)	
		Shear: P_{ss}	Tension: P_{ts}	Shear: P_{ss}/Ω	Tension: P_{ts}/Ω	Shear: $P_{ss}*\Phi$	Tension: $P_{ts}*\Phi$
XQ78S1224	#12 x $^7/_8$″	2,800	4,260	935	1,420	1,400	2,130
XQ114S1224	#12 x $1^1/_4$″						
XQ112S1224	#12 x $1^1/_2$″						

For **SI:** 1 inch = 25.4 mm, I lbf = 4.45 N.

[1]The tabulated ASD allowable strength and LRFD design strength values are based on a safety factor of Ω = 3 and a resistance factor of Φ = 0.5, respectively.
[2]For tension connections, the lesser of tension fastener strength of screws and the allowable pull-over and pull-out capacities found in Tables 2, 4, and 5, respectively, must be used for design.
[3]For shear connections, the lesser of shear fastener strength of screws and the connection shear strength found in Tables 2 and 3, respectively, must 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 (ultimate) value of all tests determined by independent laboratory testing.

TABLE 3—SIMPSON STRONG-TIE® QUIK DRIVE® X SERIES SCREW TWO MEMBER JOINT CONNECTION SHEAR LIMITED BY TILTING AND BEARING (lbs)[1,2,3]

MODEL NO.	SIZE	NOMINAL DIA. (in.)	MINIMUM BASE STEEL THICKNESS OF STEEL MEMBERS (mil/in.)						
			33[4, 5]	43[4, 5]	54[4, 5]	68[4, 5]	97[4, 5]	$^1/_8$″	$^1/_4$″[6]
NOMINAL STRENGTH, R_n									
XQ78S1224	#12 x $^7/_8$″	0.216	550	920	1,455	1,675	2,675	2,675	2,675
XQ114S1224	#12 x $1^1/_4$″								
XQ112S1224	#12 x $1^1/_2$″								
ALLOWABLE STRENGTH (ASD), R_n/Ω									
XQ78S1224	#12 x $^7/_8$″	0.216	230	350	640	740	935	935	935
XQ114S1224	#12 x $1^1/_4$″								
XQ112S1224	#12 x $1^1/_2$″								
DESIGN STRENGTH (LRFD), $R_n*\Phi$									
XQ78S1224	#12 x $^7/_8$″	0.216	365	560	1,025	1,175	1,355	1,355	1,355
XQ114S1224	#12 x $1^1/_4$"								
XQ112S1224	#12 x $1^1/_2$"								

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]The safety factor Ω and resistance factor Φ used to determine the ASD and LRFD strengths are based on AISI/S100.
[2]For shear connection, the lesser of the allowable shear fastener strength and the allowable shear capacity found in Tables 2 and 3, respectively, must be used for design.
[3]The tabulated shear values are limited by the thinner steel member in the connection. Steel thickness for both members must be in the range of 33 mils to $^1/_4$″ inch.
[4]Values are based on steel members with a minimum yield strength of Fy =33 ksi and tensile strength of Fu = 45 ksi for 33-mil and 43-mil thicknesses, a minimum yield strength of Fy=50 ksi and tensile strength of Fu=65 ksi for 54 mil to 97 mil thickness, and a minimum yield strength of Fy = 36 ksi and Fu = 58 ksi for $^1/_8$-inch and thicker.
[5]Minimum base steel thickness must comply with AISI S201 Table B2-1. Design thickness must be the minimum base steel thickness divided by 0.95. Design thickness for steel sheets is: 33 mils = 0.0346″, 43 mils = 0.0451″, 54 mils = 0.0566″, 68 mils=0.0713″, 97 mils=0.1017″.
[6]Not applicable for XQ78S1224 screws.

TABLE 4—SIMPSON STRONG-TIE® QUIK DRIVE® X SERIES SCREW PULL-OVER STRENGTH IN TWO MEMBER JOINT CONNECTIONS (lbs)[1,2]

MODEL NO.	SIZE	NOMINAL DIA. (in.)	MINIMUM BASE STEEL THICKNESS OF STEEL MEMBERS IN CONTACT WITH THE SCREW HEAD (mil)[3, 4]				
			33	43	54	68	97
NOMINAL STRENGTH, R_n							
XQ78S1224	#12 x $^7/_8$″	0.216	875	985	1,770	1,930	3,400
XQ114S1224	#12 x $1^1/_4$″						
XQ112S1224	#12 x $1^1/_2$″						
ALLOWABLE STRENGTH (ASD), R_n/Ω							
XQ78S1224	#12 x $^7/_8$″	0.216	290	400	720	790	1390
XQ114S1224	#12 x $1^1/_4$″						
XQ112S1224	#12 x $1^1/_2$″						
DESIGN STRENGTH (LRFD), R_n*Φ							
XQ78S1224	#12 x $^7/_8$″	0.216	440	640	1,155	1,260	2,160
XQ114S1224	#12 x $1^1/_4$″						
XQ112S1224	#12 x $1^1/_2$″						

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]The safety factor Ω and resistance factor Φ used to determine the ASD and LRFD strengths are based on AISI/S100.
[2]For tension connection, the lesser of tension fastener strength of screws and the allowable pull-over and pull-out found by Tables 2, 4 and 5, respectively, must be used for design.
[3]Values are based on steel members with a minimum yield strength of Fy=33 ksi and tensile strength of Fu=45 ksi for 33 mil to 43 mil thickness, a minimum yield strength of Fy=50 ksi and Fu=65 ksi for 54 mil to 97 mil thickness.
[4]Minimum base steel thickness must comply with AISI S201 Table B2-1. Design thickness must be the minimum base steel thickness divided by 0.95. Design thickness for the steel sheets is: 33 mils=0.0346", 43 mils=0.0451", 54 mils=0.0566", 68 mils=0.0713", 97 mils=0.1017".

TABLE 5—SIMPSON STRONG-TIE® QUIK DRIVE® X SERIES SCREW PULL-OUT STRENGTH IN TWO MEMBER JOINT CONNECTIONS, lbs[1,2]

MODEL NO.	SIZE	NOMINAL DIA. (in.)	MINIMUM BASE STEEL THICKNESS OF STEEL MEMBERS NOT IN CONTACT WITH THE SCREW HEAD (mil/in.)[3, 4]							
			33	43	54	68	97	$^3/_{16}$″	$^1/_4$″	$^1/_2$″[5]
NOMINAL STRENGTH, R_n										
XQ78S1224	#12 x $^7/_8$″	0.216	205	280	505	640	1,130	1,990	3,370	4,260
XQ114S1224	#12 x $1^1/_4$″									
XQ112S1224	#12 x $1^1/_2$″									
ALLOWABLE STRENGTH (ASD), R_n/Ω										
XQ78S1224	#12 x $^7/_8$″	0.216	80	115	200	260	460	730	1,375	1,420
XQ114S1224	#12 x $1^1/_4$″									
XQ112S1224	**#12 x $1^1/_2$″**									
DESIGN STRENGTH (LRFD), R_n*Φ										
XQ78S1224	#12 x $^7/_8$″	0.216	125	185	320	415	735	1,170	2,135	2,160
XQ114S1224	#12 x $1^1/_4$″									
XQ112S1224	#12 x $1^1/_2$″									

For **SI:** 1 inch = 25.4 mm, I lbf = 4.45 N.

[1]The safety factor Ω and resistance factor Φ used to determine the ASD and LRFD strengths are based on AISI/S100.
[2]For tension connection, the lesser of tension fastener strength of screws and the allowable pull-over and pull-out found in Tables 2, 4 and 5,respectively, must be used for design.
[3]Values are based on steel members with a minimum yield strength of Fy = 33 ksi and tensile strength of Fu =45 ksi for 33 mil to 43 mil thickness, a minimum yield strength of Fy = 50 ksi and Fu = 65 ksi for 54 mil to 97 mil thickness, and a minimum yield strength of Fy = 36 ksi and Fu = 58 ksi for 1/8″ and thicker.
[4]Minimum base steel thickness must comply with AISI S201 Table B2-1. Design thickness must be the minimum base steel thickness divided by 0.95. Design thickness for the steel sheets is: 33 mils = 0.0346″, 43 mils = 0.0451″, 54 mils = 0.0566″, 68 mils = 0.0713″, 97 mils = 0.1017″.
[5]Not applicable for XQ78S1224 screws.