ICC-ES Evaluation Report

ESR-1271

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

REPORT HOLDER:

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EVALUATION SUBJECT:

GRABBER DRIVALL® AND SUPERDRIVE® SELF-DRILLING TAPPING SCREWS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2015, 2012 and 2009 *International Residential Code®* (IRC)
- * ~~2013 *Abu Dhabi International Building Code* (ADIBC)†~~

* ~~†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.~~

Property evaluated:

Structural

2.0 USES

The Grabber DRIVALL® and SUPERDRIVE® self-drilling tapping screws described in this report are used in engineered connections of cold-formed steel framing and of sheet steel sheathing connected to cold-formed steel framing. The screws may be used under the IRC when an engineered design is submitted to the code official for approval in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 Grabber DRIVALL® Self-Drilling Tapping Screws:

Grabber DRIVALL® self-drilling tapping screws are proprietary self-drilling tapping screws, having a hex washer, modified truss or pan head. The screws are manufactured from carbon steel conforming to ASTM A510, Grades 1022 through 1026 and are heat treated and case hardened. The screws are coated with electrodeposited zinc with a coating designation of Fe/Zn 3A in accordance with ASTM F1941. Table 1 provides screw descriptions (size, tpi), point styles, head styles, head diameters, nominal shank diameters, drilling capacities and length of load-bearing area (grip length). Screws are supplied in boxes of loose screws. See Figures 1 through 3 for depictions of the screws.

3.2 Grabber SUPERDRIVE® Self-Drilling Tapping Screws:

SUPERDRIVE® screws are DRIVALL® screws packaged in collated strips and supplied in boxes for use in automated screw installation systems.

3.3 Cold-Formed Steel:

Cold-formed steel framing and sheet steel material must comply with one of the ASTM specifications listed in Section A2.1.1 of AISI S100-12 and have the minimum specified tensile strengths shown in Tables 2, 3, or 4 of this report. Base steel thickness must comply with Section A2.4 of AISI S100 and this report.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: 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, based on the grip length (see Figure 4) and drilling capacity given in Table 1.

When tested for corrosion resistance in accordance with ASTM B117, the screws meet the minimum requirement listed in ASTM F1941, of no white corrosion after three hours and no red rust after 12 hours.

4.1.2 Engineered Design: Grabber self-drilling tapping screws are recognized for use in engineered connections of cold-formed steel construction. Design of connections for use in Allowable Strength Design (ASD) must comply with Section E4 of AISI S100, using the allowable fastener tension and shear strength for the screws, shown in Table 5, and the allowable connection strengths for pull-out, pull-over, and shear (bearing) capacity for common sheet steel thicknesses provided in Tables 2, 3, and 4, respectively. Instructions on how to calculate connection design strengths for use in Load Resistance Factor Design (LRFD) are found in the footnotes of these tables. The connection strength values are applicable to connections where the connected steel elements are in direct contact with one another. For connections subject to tension, the least of the allowable pull-out, pull-over, and fastener tension strength found in Tables 2, 3 and 5,

* Deleted by the City of Los Angeles

respectively, must be used for design. For connections subject to shear, the lesser of the allowable shear (bearing) and fastener shear strength found in Tables 4 and 5, respectively, must be used for design. Design provisions for tapping screw connections subjected to combined shear and tension loading are outside the scope of this report.

For screws used in framing connections, in order for the screws to be considered fully effective, the minimum spacing between the fasteners and the minimum edge distance must be three times the nominal diameter of the screws, except when the edge is parallel to the direction of the applied force, the minimum edge distance must be 1.5 times the nominal screw diameter. When the spacing between screws is two times the fastener diameter, the connection shear strength values in Table 3 must be reduced by 20 percent (Refer to Section D1.5 of AISI S200).

For screws used in applications other than framing connections, the minimum spacing between the fasteners must be three times the nominal screw diameter and the minimum edge and end distance must be 1.5 times the nominal screw diameter. Additionally, under the 2009 IBC, when the distance to the end of the connected part is parallel to the line of the applied force, the allowable connection shear strength determined in accordance with Section E4.3.2 of Appendix A of AISI S100-07 must be considered.

Connected members must be checked for rupture in accordance with Section E6 of AISI S100-12 under the 2015 IBC (Section E5 of AISI S100-07/S2-10 under the 2012; Section E5 of AISI S100-07 under the 2009 IBC).

4.2 Installation:

Installation of Grabber self-drilling tapping 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 variable speed screw driving tool set to not exceed 2,500 rpm. The screw must penetrate through the supporting steel with a minimum of three exposed threads protruding past the back side of the supporting steel.

5.0 CONDITIONS OF USE

The Grabber self-drilling 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 Fasteners 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 governs.

5.2 The utilization of the screws described in this evaluation report in cold-formed steel deck diaphragms is outside the scope of this report.

5.3 For ASD, the allowable screw strength or screw connection strength is not to be increased for short-duration loads such as wind or earthquake loads.

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 must be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Tapping Screw Fasteners (AC118), dated February 2016.

7.0 IDENTIFICATION

The heads of the Grabber self-drilling screws are marked (stamped) with a "G" or a special symbol as shown in Figure 1. Each container of fasteners has a label bearing the company name (GRABBER®), screw series (DRIVALL® self-drilling for loose screws or SUPERDRIVE® for screws in collated strips), fastener description (size/diameter and length), model number, point type, coating, and the evaluation report number (ESR-1271).

TABLE 1—GRABBER SELF-DRILLING TAPPING SCREW DIMENSIONAL CHARACTERISTICS

SCREW DESIGNATION (Nom. Size - tpi, head type)	DESCRIPTION (nominal size x length)	GRABBER MODEL	POINT (No.)	HEAD TYPE[1]	HEAD DIAMETER (in.)	NOMINAL SHANK DIAMETERS (in.)		OVERALL LENGTH (in.)	GRIP LENGTH (in.)	DRILLING CAPACITY (in.)	
						Minor	Major			Min.	Max.
#8-18 Hex	8 x 1/2"	08050H3	3	HWH	0.335	0.116	0.163	0.500	0.20	0.035	0.140
	8 x 5/8"	08058H3						0.625	0.25		
	8 x 3/4"	08075H3						0.748	0.32		
	8 x 1"	08100H3						1.000	0.57		
	8 x 1 1/4"	08125H3						1.250	0.82		
	8 x 2"	08200H3						2.000	1.57		
#10-15 Hex	10 x 1/2"	10050H3	3	HWH	0.399	0.132	0.186	0.500	0.20	0.110	0.175
	10 x 5/8"	10058H3						0.625	0.25		
	10 x 3/4"	10075H3						0.760	0.34		
	10 x 1"	10100H3						1.000	0.58		
	10 x 1 1/4"	10125H3						1.250	0.83		
	10 x 1 1/2"	10150H3						1.500	1.08		
	10 x 2"	10200H3						2.000	1.58		
	10 x 3"	10300H3						3.000	2.58		
#12-14 Hex	12 x 3/4"	12075H3	3	HWH	0.415	0.161	0.212	0.766	0.28	0.110	0.210
	12 x 1"	12100H3						1.000	0.52		
	12 x 1 1/4"	12125H3						1.250	0.77		
	12 x 1 1/2"	12150H3						1.500	1.02		
	12 x 2 1/2"	12250H3						2.500	2.02		
	12 x 3"	12300H3						3.000	2.52		
	12 x 3 1/2"	12350H3						3.500	3.02		
#14-13 Hex	14 x 3/4"	14075H3	3	HWH	0.500	0.189	0.243	0.750	0.22	0.110	0.220
	14 x 1"	14100H3						1.016	0.49		
	14 x 1 1/4"	14125H3						1.250	0.72		
	14 x 1 1/2"	14150H3						1.500	0.97		
	14 x 2"	14200H3						2.000	1.47		
	14 x 2 1/2"	14250H3						2.500	1.97		
	14 x 3"	14300H3						3.000	2.47		
	14 x 4"	14400H4	4					4.000	3.47	0.175	0.250
#8-16 Pan[2]	8 x 1/2"	20Z	3	Pan	0.314	0.116	0.163	0.514	0.20	0.110	0.175
#10-15 Pan[2]	10 x 5/8"	10058P3	3	Pan	0.365	0.132	0.186	0.625	0.21	0.110	0.175
	10 x 3/4"	10075P3						0.746	0.33		
#8-17 Wafer	8 x 1/2"	34Z	3	MTH	0.437	0.116	0.163	0.506	0.20	0.110	0.140
	8 x 1/2"	234Z						0.506	0.20		
	8 x 3/4"	834FZ3						0.750	0.40		
	8 x 1	35Z						0.990	0.64		
	8 x 1	235Z						0.990	0.64		
	8 x 1 1/4"	36Z						1.240	0.89		
	8 x 1 1/4"	236Z						1.240	0.89		
	8 x 1 5/8"	37Z						1.622	1.27		
	8 x 1 5/8"	237Z						1.622	1.27		
	8 x 2"	376Z						1.990	1.64		
	8 x 2 1/2"	238Z						2.490	2.14		
	8 x 3"	39Z						3.000	2.65		
#10-16 Wafer[2]	10 x 3/4"	234Z10CW	3	MTH	0.437	0.132	0.186	0.755	0.40	0.110	0.175

For **SI:** 1 inch = 25.4 mm, 1 tpi = 0.03937 thread per mm.

[1]Head types: HWH = Hex Washer Head; MTH = Modified Truss Head

[2]Collated Drive (SUPERDRIVE®) Screw

TABLE 2—ALLOWABLE TENSILE PULL-OUT STRENGTH (P_{NOT}/Ω), pounds-force[1,2,3]

Applied Factor of Safety, Ω = 3.0						
Screw Designation	Nominal Screw Shank Major Diameter (inch)	Steel Tensile Strength				
		F_u = 45 ksi		F_u = 65 ksi		
		Design Thickness of Member Not in Contact with the Screw Head (gage, inch)				
		20	18	16	14	12
		0.0346	0.0451	0.0566	0.0713	0.1017
#8-18 Hex	0.163	77	112	207	255	462
#10-15 Hex	0.186	77	109	220	296	468
#12-14 Hex	0.212	73	112	217	284	448
#14-13 Hex	0.243	85	119	213	293	497
#8-16 Pan	0.163	51	88	170	225	326
#10-15 Pan	0.186	80	104	224	306	404
#8-17 Wafer	0.163	71	100	192	228	424
#10-16 Wafer	0.186	82	113	218	273	428

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1ksi = 6.89 MPa.

[1]For tension connections, the least of the allowable pull-out, pull-over, and fastener tension strength found in Tables 2, 3, and 5, respectively must be used for design.
[2]The allowable pull-out capacity for other member thicknesses can be determined by interpolation within the table for the values that have the same steel tensile strength, F_u.
[3]To calculate LRFD values, multiply values in the table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

TABLE 3—ALLOWABLE TENSILE PULL-OVER STRENGTH (P_{NOV}/Ω), pounds-force[1,2,3]

Applied Factor of Safety, Ω = 3.0							
Screw Designation	Nominal Screw Shank Major Diameter (inch)	Screw Head Diameter (inch)	Steel Tensile Strength				
			F_u = 45 ksi		F_u = 65 ksi		
			Design Thickness of Member in Contact with the Screw Head (gage, inch)				
			20	18	16	14	12
			0.0346	0.0451	0.0566	0.0713	0.1017
#8-18 Hex	0.163	0.335	314	391	523	590	568
#10-15 Hex	0.186	0.399	396	536	778	847	861
#12-14 Hex	0.212	0.415	336	370	522	753	856
#14-13 Hex	0.243	0.500	398	546	891	1,155	1,114
#8-16 Pan	0.163	0.314	233	321	437	513	513
#10-15 Pan	0.186	0.365	280	367	706	850	896
#8-17 Wafer	0.163	0.437	446	499	522	622	634
#10-16 Wafer	0.186	0.437	380	528	546	667	537

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1ksi = 6.89 MPa.

[1]For tension connections, the lower of the allowable pull-out, pull-over, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.
[2]The allowable pull-over capacity for other member thicknesses can be determined by interpolation within the table for the values that have the same steel tensile strength, F_u.
[3]To calculate LRFD values, multiply values in the table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

TABLE 4—ALLOWABLE SHEAR (BEARING) OF SCREW CONNECTION OF COLD FORMED STEEL (P_{NS}/Ω), pounds-force[1,2,3]

Applied Factor of Safety, Ω = 3.0								
Screw Designation	Nominal Screw Shank Major Diameter (inch)	Screw Head Diameter (inch)	Steel Tensile Strength					
			F_u = 45 ksi		F_u = 65 ksi			
			Design Thickness of Thinner Member (gage, inch)					
			20	18	16	14	12	
			0.0346	0.0451	0.0566	0.0713	0.1017	
#8-18 Hex	0.163	0.335	152	235	337	355	330	
#10-15 Hex	0.186	0.399	164	253	510	593	526	
#12-14 Hex	0.212	0.415	175	262	544	731	753	
#14-13 Hex	0.243	0.500	181	287	554	797	826	
#8-16 Pan	0.163	0.314	152	232	293	349	349	
#10-15 Pan	0.186	0.365	164	252	485	554	586	
#8-17 Wafer	0.163	0.437	152	234	413	417	413	
#10-16 Wafer	0.186	0.437	164	252	509	592	537	

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1ksi = 6.89 MPa.

[1]For shear connections, the lower of the allowable connection shear and fastener shear strength found in Tables 4 and 5, respectively, must be used for design.
[2]The allowable connection shear capacity for other member thicknesses can be determined by interpolation within the table for the values that have the same steel tensile strength, F_u.
[3]To calculate LRFD values, multiply values in the table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

TABLE 5—FASTENER STRENGTH, pounds-force[1,2,3,4]

SCREW DESIGNATION	NOMINAL SCREW SHANK MAJOR DIAMETER (inch)	NOMINAL FASTENER STRENGTH (tested)		ALLOWABLE FASTENER STRENGTH	
		Tension, P_{ts}	Shear, P_{ss}	Tension, (P_{ts}/Ω)	Shear, (P_{ss}/Ω)
#8-18 Hex	0.163	1894	1403	631	468
#10-15 Hex	0.186	2455	1910	818	637
#12-14 Hex	0.212	2534	2814	845	938
#14-13 Hex	0.243	3658	4000	1219	1333
#8-16 Pan	0.163	1922	1176	641	392
#10-15 Pan	0.186	2765	2028	922	676
#8-17 Wafer	0.163	2089	1452	696	484
#10-16 Wafer	0.186	2373	2084	791	695

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1ksi = 6.89 MPa.

[1]For tension connections, the lower of the allowable pull-out, pull-over, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.
[2]For shear connections, the lower of the allowable connection shear and fastener shear strength found in Tables 4 and 5, respectively, must be used for design.
[3]To calculate LRFD values, multiply the Nominal Fastener Strength values in the table by the LRFD Φ factor of 0.5.
[4]See Section 4.1.2 for fastener spacing and end distance requirements.

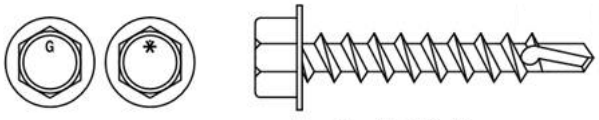

FIGURE 1—HEX WASHER HEAD SCREW

FIGURE 2—PAN HEAD SCREW

FIGURE 3—WAFER (MTH) HEAD SCREW

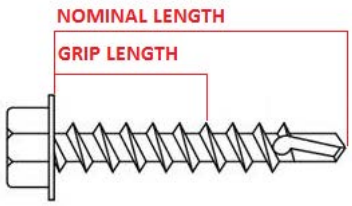

FIGURE 4—EXPLANATION OF GRIP LENGTH