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ICC-ES Evaluation Report

ESR-2442

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 05 23— WOOD, PLASTIC, AND COMPOSITE FASTENINGS

REPORT HOLDER:

GRK FASTENERS, A DIVISION OF ILLINOIS TOOL WORKS, INC.

EVALUATION SUBJECT:

**RSS™ RUGGED STRUCTURAL SCREWS, RSS™ LPS PANEL SCREWS,
RSS™ LTF TIMBER FRAME SCREWS, RSS™ PHEINOX STAINLESS STEEL SCREWS,
RSS™ JTS TRUSS SCREWS AND CLIMATEK™ COATING**



“2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence”



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DIVISION: 06 00 00—WOOD, PLASTICS, AND COMPOSITES

Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:

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1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2015, 2012, 2009 and 2006 *International Residential Code*® (IRC)

Properties evaluated:

- Structural
- Corrosion resistance

2.0 USES

The RSS™ fasteners described in this report are alternate dowel-type, multi-purpose screws, less than 1/4 inch (6.35 mm) in shank diameter, used in wood-to-wood connection applications. Climatek™ coated RSS™ screws are used, when approved, where carbon steel screws must exhibit corrosion resistance when exposed to adverse environmental conditions and/or preservative treated wood, and are alternates to stainless steel or hot-dip-zinc galvanized fasteners with a coating weight in compliance with ASTM A 153, Class D. The Climatek™ coated screws have been evaluated for use with wood chemically treated with waterborne alkaline copper quatary (ACQ-D) preservative and copper azole (CA-B) preservative.

3.0 DESCRIPTION

3.1 General:

The RSS fasteners described in this report are self-tapping screws, manufactured using a cold-forming process, and, except for PHEinox stainless steel screws, are heat-treated. The fasteners, except for the PHEinox screws,

have a proprietary finish (Climatek™ coating) for corrosion protection. The fasteners have a round head with built-in shield (washer type head), rolled threads, and a Type 17 point (Zip-Tip™). The RSS, LTF, and PHEinox series of screws have 7 threads per inch, while the LPS and JTS series of screws have 8 threads per inch. See Table 1 and Figure 1 of this report for the available screw dimensions for each type of screw.

3.2 Material:

3.2.1 Fasteners: The screws are made of hardened carbon steel wire, except the PHEinox screws, which are stainless steel, with allowable tension and shear capacities as listed in Table 1 of this report. The minimum bending yield strengths of the fasteners are also listed in Table 1. All of the fasteners are produced in accordance with the approved quality control manual.

3.2.2 Coating: The proprietary Climatek™ coating consists of multiple layers of various materials, including layers of zinc and polymer.

3.2.3 Wood Members: Wood members must be solid-sawn lumber having an assigned specific gravity of 0.42 or greater. Assigned specific gravity for solid-sawn lumber must be determined in accordance with Table 12.3.3A of the 2015 ANSI/AWC National Design Specification (NDS) for Wood Construction (Table 11.3.3A of NDS-12 for the 2012 IBC; Table 11.3.2A of NDS-05 for the 2009 and 2006 IBC). The thickness of the wood main member, t_m , must be equal to or greater than the screw length less the thickness of the side member.

4.0 DESIGN AND INSTALLATION

4.1 Design:

Reference withdrawal and reference pull-through design values are given in Table 2. Reference lateral design values for wood-to-wood connections loaded parallel and perpendicular to the grain are given in Table 3.

The allowable load for a single-screw connection in which the screw is subject to tension is the least of: (a) the allowable screw tension strength given in Table 1; (b) the

reference withdrawal design value given in Table 2, adjusted by all applicable adjustment factors; and (c) the reference head pull-through design value given in Table 2, adjusted by all applicable adjustment factors. When the fasteners are used in wet service conditions, the wet service factors shown in Table 2 are applicable.

The allowable lateral load for a single-screw connection is the lesser of: (a) the allowable screw shear strength given in Table 1; and (b) the reference lateral design value

given in Table 3, adjusted by all applicable adjustment factors. When the fasteners are used in wet service conditions, the wet service factors shown in Table 3 are applicable.

Connections containing multiple screws must be designed in accordance with Sections 11.2.2 and 12.6 of NDS-15 (Sections 10.2.2 and 11.6 of NDS-12 and NDS-05 for the 2012, 2009 and 2006 IBC).

When designing a connection, the structural members must be checked for load-carrying capacity in accordance with Section 11.1.2 of NDS-15 (Section 10.1.2 of NDS-12 and NDS-05 for the 2012, 2009 and 2006 IBC), and local stresses within the connection must be checked against Appendix E in the NDS to ensure the capacity of the connection and fastener group.

The GRK screws may be used in connections subject to tension load only or subject to lateral load only. Use of screws which are subject to combined loading is outside the scope of this report.

Design of connections using the Climatek™ coated RSS screws must be limited to use in typical applications and limitations defined in Table 5.

The Climatek™ coated RSS screws are recognized for use in wood treated with waterborne alkaline copper quaternary (ACQ-D) preservatives with a maximum retention of 0.40 pcf (6.4 kg/m³) or in wood treated with copper azole (CA-B) preservatives with a maximum retention of 0.40 pcf (6.4 kg/m³).

4.2 Installation:

Screws must be installed in accordance with GRK Fasteners published installation instructions and this report. Screws must be installed with the minimum spacing, end distances, and edge distances to prevent splitting of the wood or as noted in Table 4, whichever is more restrictive. The screws must be installed by turning with Star Drive (Torx) bits, not by driving with a hammer.

For screws which will be loaded in tension, a pilot hole with a diameter of approximately 70% of the minor diameter of the screw must be drilled in the side member and in the main member to a depth of 50% of the thread length of the screw. For screws which will be laterally loaded, a pilot hole with a diameter of approximately 90% of the minor diameter of the screw must be drilled in the side member and a pilot hole with a diameter of approximately 70% of the minor diameter of the screw must be drilled in the main member to a depth of 70% of the thread length of the screw.

5.0 CONDITIONS OF USE

The RSS™ fasteners 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 Installation must comply with this report, the report holder's published instructions and the applicable code. A copy of the report holder's published installation instructions must be available at the jobsite at all times during installation. In the event of a conflict between the report holder's published installation instructions and this report, this report governs.
- 5.2 When the capacity of a connection is controlled by fastener metal strength, rather than wood strength, the metal strength must not be multiplied by the adjustment factors specified in the NDS.
- 5.3 Installation must be limited to connections between wood members each with a minimum specific gravity of 0.42.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Alternate Dowel-type Threaded Fasteners (AC233), dated April 2015 (editorially revised August 2015).
- 6.2 Data in accordance with the ICC-ES Acceptance Criteria for Corrosion-resistant Fasteners and Evaluation of Corrosion Effect of Wood Treatment Chemicals (AC257), dated October 2009 (editorially revised May 2015).

7.0 IDENTIFICATION

- 7.1 The RSS™ screws with Climatek™ coating are identified by the designation "RSS", "LTF", "LPS", or "JTS" on the head of each screw, along with the diameter and length in millimeters. The stainless steel RSS PHEinox™ screw is similarly identified with "RSS" on the head along with the diameter and length in millimeters. See Figure 1 for typical head markings. Packaging labels for the RSS™ wood screws include the GRK Fasteners name and address, the evaluation report number (ESR-2442), the fastener designation, the fastener size and length, the coating designation where applicable, and the compatible treated wood types (0.40 pcf ACQ-D and 0.40 pcf CA-B) where applicable.
- 7.2 The report holder's contact information is the following:

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TABLE 1—RSS™ FASTENER SPECIFICATIONS

FASTENER DESIGNATION	LENGTH ¹ (inches)	THREAD LENGTH ² (inches)	MINOR THREAD DIAMETER (inch)	SHANK DIAMETER (inch)	OUTSIDE THREAD DIAMETER (inch)	NOMINAL BENDING YIELD STRENGTH ³ F _{yb} (psi)	ALLOWABLE STEEL STRENGTH									
							TENSILE (lbf)	SHEAR (lbf)								
RSS	1/4 x 2 1/2"	2 3/8	1 1/2	0.152	0.169	0.236	170,400	1112	754							
	1/4 x 2 3/4"	2 3/4	1 3/4													
	1/4 x 3 1/8"	3 1/8	2													
	1/4 x 3 1/2"	3 1/2	2 3/8													
RSS	5/16 x 2 1/2"	2 3/8	1 1/2	0.167	0.195	0.276	190,900	1415	982							
	5/16 x 2 3/4"	2 3/4	1 3/4													
	5/16 x 3 1/8"	3 1/8	2 1/8													
	5/16 x 3 1/2"	3 1/2	2 1/2													
	5/16 x 4"	3 7/8	2 3/4													
	5/16 x 5 1/8"	5	3 1/2													
	5/16 x 6"	5 7/8	3 7/8													
	RSS	3/8 x 3 1/8"	3 1/8							2 1/8	0.191	0.219	0.313	178,000	1941	1231
		3/8 x 4"	3 7/8							2 3/4						
		3/8 x 5 1/8"	5 1/8							3 1/2						
3/8 x 6"		5 7/8	4													
3/8 x 7 1/4"		7	4 1/2													
3/8 x 8"		7 7/8	4 3/8													
3/8 x 10"		9 3/4	5													
3/8 x 12"		11 7/8	5 7/8													
3/8 x 14 1/8"		14 1/8	5 7/8													
3/8 x 16"		15 5/8	5 3/4													
LPS	1/4 x 8"	7 7/8	2 7/8	0.152	0.171	0.240	172,600	1051	666							
LTF	3/8 x 8"	7 7/8	3 7/8	0.191	0.219	0.311	167,600	1714	1094							
	3/8 x 10"	9 7/8	3 7/8													
	3/8 x 12"	11 3/4	3 7/8													
RSS PHEInox	1/4 x 2 1/2"	2 3/8	1 1/2	0.152	0.169	0.236	111,400	628	546							
	1/4 x 3 1/8"	3 1/8	2													
	5/16 x 2 1/2"	2 3/8	1 5/8	.167	0.195	0.276	118,300	806	668							
	5/16 x 3 1/8"	3 1/8	2 1/8													
	5/16 x 4"	3 7/8	2 1/2													
	5/16 x 5 1/8"	5 1/8	3 3/8													
5/16 x 6"	5 7/8	3 7/8														
JTS	1/4 x 3 3/8"	3 3/8	1 3/8	0.152	0.171	0.240	226,300	1104	769							
	1/4 x 5"	5	1 5/8													
	1/4 x 6 3/4"	6 3/4	1 1/2													

For SI: 1 inch = 25.4 mm; 1 psi = 6.9 kPa; 1 lbf = 4.4 N.

¹The length of fasteners is measured from the underside of the head to bottom of the tip. See Figure 1.

²Length of thread includes tip. See Figure 1.

³Bending yield strength determined in accordance with ASTM F1575 using the minor thread diameter.

⁴See Figure 1 for additional dimensional information.

TABLE 2—RSS™ REFERENCE WITHDRAWAL (W) AND PULL-THROUGH (P) DESIGN VALUES¹

FASTENER DESIGNATION		THREAD LENGTH (inches)	W (lbf/in.) ²		P (lbf) ³		WET SERVICE FACTOR, C _M
			For Specific Gravities of:		For Specific Gravities of:		
			0.42 ≤ G < 0.55	0.55 ≤ G < 0.67	0.42 ≤ G < 0.55	0.55 ≤ G < 0.67	
RSS	1/4 x 2 1/2"	1 1/2	151	186	165	275	0.70
	1/4 x 2 3/4"	1 3/4					
	1/4 x 3 1/8"	2					
	1/4 x 3 1/2"	2 3/8					
	5/16 x 2 1/2"	1 1/2	165	227	207	418	
	5/16 x 2 3/4"	1 3/4					
	5/16 x 3 1/8"	2 1/8					
	5/16 x 3 1/2"	2 1/2					
	5/16 x 4"	2 3/4					
	5/16 x 5 1/8"	3 1/2					
	5/16 x 6"	3 7/8					
	3/8 x 3 1/8"	2 1/8					
	3/8 x 4"	2 3/4					
	3/8 x 5 1/8"	3 1/2					
	3/8 x 6"	4					
	3/8 x 7 1/4"	4 1/2					
	3/8 x 8"	4 3/8					
	3/8 x 10"	5					
3/8 x 12"	5 7/8						
3/8 x 14 1/8"	5 7/8						
3/8 x 16"	5 3/4						
LPS	1/4 x 8"	2 7/8	128	201	136	395	0.52
LTF	3/8 x 8"	3 7/8	163	216	202	373	0.70
	3/8 x 10"	3 7/8					
	3/8 x 12"	3 7/8					
PHEinox	1/4 x 2 1/2"	1 1/2	134	187	162	306	0.70
	1/4 x 3 1/8"	2					
	5/16 x 2 1/2"	1 5/8	136	202	199	254	
	5/16 x 3 1/8"	2 1/8					
	5/16 x 4"	2 1/2					
	5/16 x 5 1/8"	3 3/8					
5/16 x 6"	3 7/8						
JTS	1/4 x 3 3/8"	1 3/8	152	191	154	372	0.68
	1/4 x 5"	1 5/8					
	1/4 x 6 3/4"	1 1/2					

For SI: 1 inch = 25.4 mm; 1 lbf = 4.4 N.

¹Values must be multiplied by all applicable adjustment factors, in accordance with the NDS. When the fasteners are used in wet service conditions, the wet service factors shown in the table are applicable.

²Tabulated reference withdrawal design values are in pounds per inch of thread penetration into the side grain of the main member, and must be multiplied by the thread length embedded in the member in order to get the total withdrawal design value in pounds. Length of CEE threads must not be included in the withdrawal value determination.

³Tabulated pull-through design values are based on a minimum side member thickness of 3/4 inch.

TABLE 3—RSS™ REFERENCE LATERAL DESIGN VALUES (Z) FOR SINGLE SHEAR (TWO-MEMBER) CONNECTIONS¹
[For Sawn Lumber with Both Members of Identical Specific Gravity]

FASTENER DESIGNATION	SIDE MEMBER THICKNESS, t (inches)	FASTENER PENETRATION INTO MAIN MEMBER, p (inches)	REFERENCE LATERAL DESIGN VALUE, Z (lbf) FOR SPECIFIC GRAVITIES OF:				WET SERVICE FACTOR, C _M	
			0.42 ≤ G < 0.55		0.55 ≤ G < 0.67			
			Parallel to Grain, Z _∥	Perpendicular to Grain, Z _⊥	Parallel to Grain, Z _∥	Perpendicular to Grain, Z _⊥		
RSS	1/4 x 2 1/2"	3/4	153	137	175	175	0.70	
	1/4 x 2 3/4"	3/4						2
	1/4 x 3 1/8"	3/4						2 3/8
	1/4 x 3 1/2"	3/4						2 3/4
	5/16 x 2 1/2"	3/4	168	133	214	178		
	5/16 x 2 3/4"	3/4						2
	5/16 x 3 1/8"	3/4						2 3/8
	5/16 x 3 1/2"	3/4						2 3/4
	5/16 x 4"	1 1/2	239	236	333	257		
	5/16 x 5 1/8"	1 1/2						3 1/2
	5/16 x 6"	2	265	299	472	289		
	3/8 x 3 1/8"	3/4	188	156	251	220		
	3/8 x 4"	1 1/2	224	205	274	264		
	3/8 x 5 1/8"	1 1/2						3 5/8
	3/8 x 6"	2	270	296	325	288		
	3/8 x 7 1/4"	2 3/4	423	291	593	304		
	3/8 x 8"	3 1/2						4 3/8
	3/8 x 10"	3 1/2						6 1/4
3/8 x 12"	3 1/2	8 3/8						
3/8 x 14 1/8"	3 1/2	10 5/8						
3/8 x 16"	3 1/2	12 1/8						
LPS	1/4 x 8"	5	249	257	358	219	0.62	
LTF	3/8 x 8"	4	433	315	556	402	0.70	
	3/8 x 10"	6						3 7/8
	3/8 x 12"	8						3 3/4
PHEinox	1/4 x 2 1/2"	3/4	162	134	215	185	0.70	
	1/4 x 3 1/8"	3/4						2 3/8
	5/16 x 2 1/2"	3/4	151	149	181	175		
	5/16 x 3 1/8"	3/4						2 3/8
	5/16 x 4"	1 1/2	249	229	337	272		
	5/16 x 5 1/8"	1 1/2						3 5/8
5/16 x 6"	2	302	340	449	358			
JTS	1/4 x 3 3/8"	1 3/4	157	168	217	217	0.70	
	1/4 x 5"	1 3/4	168	221	241	237		
	1/4 x 6 3/4"	1 3/4						5

For SI: 1 inch = 25.4 mm ; 1 lbf = 4.4 N.

¹Values must be multiplied by all applicable adjustment factors, in accordance with the NDS. When the fasteners are used in wet service conditions, the wet service factors shown in the table are applicable.

TABLE 4—CONNECTION GEOMETRY

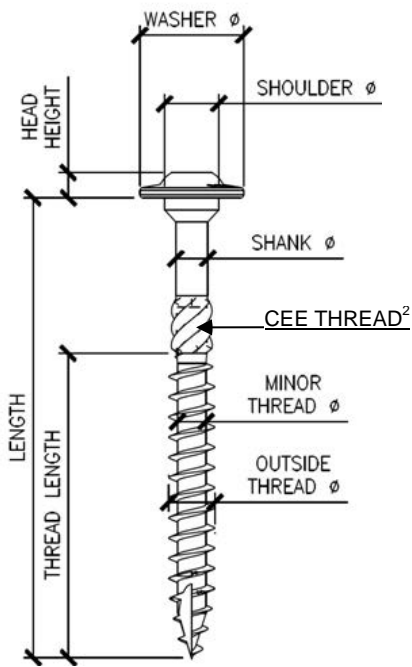
CONNECTION GEOMETRY/ CRITERIA	DIAMETERS ¹	RSS, LPS, JTS & RSS PHEinox 1/4" NOMINAL DIAMETER (inches)	RSS & RSS PHEinox 5/16" NOMINAL DIAMETER (inches)	RSS & LTF 3/8" NOMINAL DIAMETER (inches)
Minimum Edge Distance				
Loading Parallel to Grain	8	1 1/2	1 5/8	1 7/8
Loading Perpendicular to Grain, Loaded Edge	8	1 1/2	1 5/8	1 7/8
Loading Perpendicular to Grain, Unloaded Edge	8	1 1/2	1 5/8	1 7/8
Minimum End Distance				
Tension Load Parallel to Grain	15	2 5/8	3	3 3/8
Compression Load Parallel to Grain	10	1 3/4	2	2 1/4
Load Perpendicular to Grain	10	1 3/4	2	2 1/4
Spacing (Pitch) Between Fasteners in a Row.				
Parallel to Grain	15	2 5/8	3	3 3/8
Perpendicular to Grain	10	1 3/4	2	2 1/4
Spacing (Gage) Between Rows of Fasteners				
In-Line	5	7/8	1	1 1/8
Staggered	2 1/2	1/2	1/2	5/8
Minimum Penetration into Main Member for Single Shear Connections	6	1 1/8	1 1/4	1 3/8

For SI: 1 inch = 25.4 mm.

¹Diameter is the shank diameter as specified in Table 1.

TABLE 5—EXPOSURE CONDITIONS FOR FASTENERS WITH INTENDED USE AND LIMITATIONS OF RECOGNITION

EXPOSURE CONDITION	TYPICAL APPLICATIONS	RECOGNITION LIMITATIONS
Corrosion Resistance of Fasteners		
1	Treated wood in dry use applications	Limited to use where equilibrium moisture content of the chemically treated wood meets the dry service conditions as described in the NDS.
3	General construction	Limited to freshwater and chemically treated wood exposure, e.g., no saltwater exposure.



SCREW TYPE	HEAD STAMP	WASHER Ø ± 0.020 inch	HEAD HEIGHT ± 0.010 inch	SHOULDER Ø ± 0.010 inch	CEE THREAD ² (inches)
RSS & RSS PHEinox 1/4 (6.00 mm)		0.533	0.110	0.244	LENGTH ≥ 3 1/8
RSS & RSS PHEinox 5/16 (7.00 mm)		0.620	0.157	0.301	LENGTH ≥ 3 1/8
RSS 3/8 (8.0 mm)		0.689	0.181	0.364	LENGTH ≥ 3 1/8
LTF 3/8 (8.0 mm)		0.688	0.181	0.364	LENGTH ≥ 3 1/8
LPS 1/4 (6.0 mm)		0.535	0.090	0.244	NO
JTS 1/4 (6.3 mm)		0.534	0.090	0.244	LENGTH ≥ 5

For SI: 1 inch = 25.4 mm.

NOTES:

1. See Table 1 for length, thread length, shank diameter, outside thread diameter and minor thread diameter.
2. CEE thread on screws with lengths greater than or equal to those indicated. Not used for withdrawal calculations.
3. Dimensions given if not otherwise stated are in inches.

FIGURE 1—FASTENER DIMENSIONS