DrJ CERTIFICATION

Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1912-07

SPAX® PowerLag® Truss/Rafter Screw Properties

Altenloh, Brinck & Company U.S., Inc.

Product:

SPAX® PowerLag® Screws (#14 x 4¾" & #14 x 6¼")

Issue Date:

May 1, 2020

Revision Date:

June 26, 2020

Subject to Renewal:

July 1, 2021

COMPANY
INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 00 90 - Wood and Plastic Fastenings

SECTION: 06 05 23 - Wood, Plastic, and Composite Fastenings

1 PRODUCT EVALUATED[1]

1.1 SPAX® PowerLag® Screws (#14 x 4¾" & #14 x 6¼")

2 APPLICABLE CODES AND STANDARDS[2,3]

2.1 *Codes*

2.1.1 *IBC—12, 15, 18: International Building Code®*

2.1.2 *IRC—12, 15, 18: International Residential Code®*

2.2 *Standards and Referenced Documents*

2.2.1 *AISI S904: Standard Test Methods for Determining the Tensile and Shear Strengths of Screws*

2.2.2 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*

2.2.3 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

2.2.4 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*

2.2.5 *ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus*

2.2.6 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*

2.2.7 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*

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[1] Building codes require data from valid research reports be obtained from *approved sources*. Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the *building official*. DrJ is an ISO/IEC 17065 ANSI-Accredited Product Certification Body – Accreditation #1131.

Through ANSI accreditation and the IAF MLA, DrJ certification can be used to obtain product approval in any *jurisdiction* or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "certified once, accepted everywhere."

Building official approval of a licensed *registered design professional* (RDP) is performed by verifying the RDP and/or their business entity complies with all professional engineering laws of the relevant *jurisdiction*. Therefore, the work of licensed RDPs is accepted by *building officials*, except when plan (i.e. peer) review finds an error with respect to a specific section of the code. Where this TER is not approved, the *building official* responds in writing stating the reasons for disapproval.

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, visit drjcertification.org or call us at 608-310-6748.

[2] Unless otherwise noted, all references in this TER are from the 2018 version of the codes and the standards referenced therein (e.g., *ASCE 7, NDS, ASTM*). This material, design, or method of construction also complies with the 2000-2015 versions of the referenced codes and the standards referenced therein.

[3] All terms defined in the applicable building codes are italicized.

2.2.8 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

3 Performance Evaluation

3.1 SPAX® PowerLag® fasteners were tested and evaluated to determine their structural resistance properties, which are used to develop reference design values for allowable stress design (ASD). The following properties were evaluated:

3.1.1 Bending yield in accordance with *ASTM F1575*

3.1.2 Tensile strength in accordance with *AISI S904*

3.1.3 Shear strength in accordance with *AISI S904*

3.1.4 Head pull-through in accordance with *ASTM D1761*

3.1.5 Withdrawal strength in accordance with *ASTM D1761*

3.1.6 Lateral resistance in accordance with *NDS*

3.1.7 Corrosion resistance in accordance with *ASTM B117* and *ASTM G85*

3.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this TER.

3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

3.4 For connection design values for truss/rafter/joist to walls, stud to plate, and plate to rim board connections see TER 1910-02.

3.5 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within DrJ's professional scope of work.

4 Product Description and Materials

4.1 The SPAX® PowerLag® fastener is a fully threaded fastener with a cylinder head and a T-30 drive. The point is a threaded tip (Figure 1).

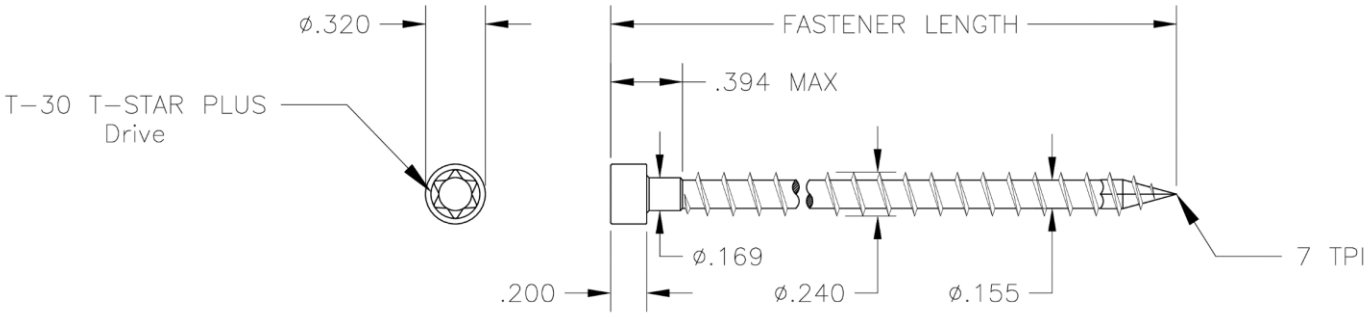

Figure 1. SPAX® PowerLag® Fastener

4.1 SPAX® PowerLag® fasteners are made of hardened carbon steel grade 10B18 wire conforming to *ASTM A510*, or grade 17MnB3 or 19MnB4 wire conforming to *DIN 1654*.

4.2 SPAX® PowerLag® fasteners are manufactured using a standard cold-formed process followed by heat treating and coating processes.

4.3 The fasteners evaluated in this TER are set forth in Table 1.

TABLE 1. FASTENER SPECIFICATIONS[5]

Fastener Name	Head (in)				Length (in)		Diameters (in)			Bending Yield Strength[3], f_{yb} (psi)	Allowable Steel Strength (lbs)	
	Style	Marking	Diameter	Height	Fastener[1]	Thread[2]	Shank	Minor	Major		Tensile	Shear[4]
#14 x 4¾"	T-Star plus Cylindric Head	None	0.320	0.200	4.750	4.356	0.169	0.155	0.240	160,000	990	750
#14 x 6¼"					6.250	5.856						

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 psi = 0.00689 MPa

1. Fastener length is measured from the topside of the head to the tip.
2. Thread length includes tapered tip (see Figure 1).
3. Bending yield strength, F_{yb}, is determined in accordance with *ASTM F1575* using minor thread diameter when fastener is tested in threaded section.
4. Shear strength is determined in accordance with *AISI S904* using minor thread diameter when fastener is tested in threaded section.
5. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are larger due to the proprietary coatings added.

4.4 SPAX® PowerLag fasteners are available with a proprietary coating:

4.4.1 Interior Grade: Proprietary zinc plate coating that is equivalent to the protection provided by code-approved hot-dipped galvanized coatings meeting *ASTM A153*, Class D (*IBC* Section 2304.10.5[4] and *IRC* Section R317.3).

4.4.1.1 Zinc plate coating is tested and recognized for use in above ground contact pressure treated lumber (ACQ-D), interior, dry/damp general construction applications (e.g. Above Ground AWPA UC1-UC2 ACQ-D).

4.4.1.2 Zinc plate coated fasteners are approved for use in fire-retardant-treated (FRT) lumber, provided the conditions set forth by the FRT lumber manufacturer are met, including appropriate strength reductions.

5 APPLICATIONS

5.1 SPAX® PowerLag® fasteners are used to attach wood framing members in conventional light-frame construction and provide resistance against head pull-through, withdrawal, and shear loads.

5.2 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

5.3 *Design*

5.3.1 Design of SPAX® PowerLag® fasteners is governed by the applicable code and the provisions for dowel-type fasteners in *NDS*.

5.3.2 Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

5.4 *Head Pull-Through Design Values*

5.4.1 Reference design values for head pull-through for SPAX® PowerLag® fasteners are specified in Table 2.

[4] 2012 *IBC* Section 2304.9.5

TABLE 2. HEAD PULL-THROUGH DESIGN VALUES FOR SPAX® POWERLAG® FASTENER

Member Type[1] (Specific Gravity)	Head Pull-Through Design Value[2,3] (lbs)
SPF (0.42)	235
DF-L (0.50)	285

SI: 1 in = 25.4 mm, 1 lbf = 4.45 N

1. Minimum 1.5" thickness
2. Tabulated pull-through values shall be adjusted by all applicable adjustment factors per *NDS* Table 11.3.1.
3. For wood species with an assigned specific gravity greater than 0.50, use the tabulated values for specific gravity of 0.50.

5.5 *Reference Withdrawal Design Values in Face Grain Applications*

5.5.1 Reference withdrawal design values for SPAX® PowerLag® fasteners are specified in Table 3.

TABLE 3. REFERENCE WITHDRAWAL VALUES FOR SPAX® POWERLAG® FASTENER IN FACE GRAIN

Minimum Penetration into Wood Member[1] (in)	Member Type (Specific Gravity)	Reference Withdrawal Value[2,3] (lbf)
2½	SPF (0.42)	350
	DF-L (0.50)	350
	SP (0.55)	520

SI: 1 in = 25.4 mm, 1 lbf = 4.45 N, 1 lb/ft = 0.0146 kN/m

1. Fastener penetration is the threaded length embedded in the wood member, including the tip.
2. Tabulated withdrawal values shall be adjusted by all applicable adjustment factors per *NDS* Table 11.3.1.
3. For wood species with an assigned specific gravity between 0.42 and 0.50, use the tabulated values for specific gravity of 0.42. For wood species with an assigned specific gravity between 0.50 and 0.55, use the tabulated values for specific gravity of 0.50. For wood species with an assigned specific gravity greater than or equal to 0.55, use the tabulated values for specific gravity of 0.55.

5.6 *Lateral Design Values*

5.6.1 Reference lateral design values for shear load parallel and perpendicular to grain for SPAX® PowerLag® fasteners are specified in Table 4.

TABLE 4. SPAX® POWERLAG® FASTENER LATERAL DESIGN VALUES

Minimum Main Member Thickness[1] (in)	Side Member Thickness (in)	Species[2] (Specific Gravity)	Reference Lateral Shear Value, Z (lbf)	
			$Z_{\parallel}$	$Z_{\perp}$
1½	1½	SPF (0.42)	145	145
		DF (0.50)	170	170
		SP (0.55)	190	190

SI: 1 in = 25.4 mm, 1 lbf = 4.45 N

1. Penetration depth does not include length of tapered tip.
2. The species applies to both the main and side members. Where the members are different specific gravities, use the lower of the two.
3. For wood species with an assigned specific gravity between 0.42 and 0.50, use the tabulated values for specific gravity of 0.42. For wood species with an assigned specific gravity between 0.50 and 0.55, use the tabulated values for specific gravity of 0.50. For wood species with an assigned specific gravity greater than or equal to 0.55, use the tabulated values for specific gravity of 0.55.
4. The fastener shall be oriented perpendicular to grain, and the underside of the fastener head shall be installed flush with the surface of the side member.
5. $Z_{\perp}$ = Lateral Design Values Perpendicular to Grain, $Z_{\parallel}$ = Lateral Design Values Parallel to Grain.
6. Tabulated lateral design values shall be adjusted by all applicable adjustment factors per *NDS* Table 11.3.1.

6 INSTALLATION

6.1 Installation shall comply with the manufacturer's installation instructions and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

6.2 SPAX® PowerLag® fasteners shall be installed using a T-30 or SPAX® T-30 plus driver bit.

6.3 Fasteners shall not be struck with a hammer during installation.

6.4 Lead holes are not required.

6.5 The fastener head must be installed flush to the surface of the wood side member being connected. The fastener must not be overdriven.

6.6 Minimum penetration is 1½" unless otherwise stated in this TER.

6.7 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with Table 5.

TABLE 5. MINIMUM SPACING, EDGE DISTANCE, AND END DISTANCE REQUIREMENTS

Connection Geometry	Minimum Spacing (in)
Edge Distance – Load in any direction	½
End Distance – Load parallel to grain, towards end	2⅝
End Distance – Load parallel to grain, away from end	1¾
End Distance – Load perpendicular to grain	1¾
Spacing between Fasteners in a Row – Parallel to grain	2⅝
Spacing between Fasteners in a Row – Perpendicular to grain	1¾
Spacing between Rows of Fasteners – In-line	⅞
Spacing between Rows of Fasteners – Staggered	½

SI: 1 in = 25.4 mm

1. Edge distances, end distances, and spacing of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table, whichever is the more restrictive.
2. Values for "Spacing between Rows of Fasteners – Staggered" apply where the fasteners in adjacent rows are offset by one half of the "Spacing between Fasteners in a Row"

7 TEST ENGINEERING SUBSTANTIATING DATA

7.1 Testing for bending yield by SBCRI in accordance with *ASTM F1575*

7.2 Testing for tensile strength by SBCRI in accordance with *AISI S904*

7.3 Testing for shear strength by SBCRI in accordance with *AISI S904*

7.4 Testing for head pull-through by SBCRI in accordance with *ASTM D1761*

7.5 Testing for withdrawal by SBCRI in accordance with *ASTM D1761*

7.6 Testing for corrosion by Element in accordance with *ASTM B117* and *ASTM G85*

7.7 Some information contained herein is the result of testing and/or data analysis by other sources which conform to *IBC* Section 1703 and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.

7.8 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *IBC, IRC, NDS®,* and *SDPWS*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 FINDINGS

8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the product(s) listed in Section 1.1 are approved for the following:

8.1.1 Provide resistance to head pull-through loads as shown in Table 2.

8.1.2 Provide resistance to reference withdrawal loads as shown in Table 3.

8.1.3 Provide resistance to lateral loads applied to the fastener in a wood as shown in Table 4.

8.2 *IBC* Section 104.11 (*IRC* Section R104.11 and *IFC* Section 104.9 are similar) states:

> **104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code…Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.

8.3 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this evaluation, they are listed here.

8.3.1 No known variations

9 CONDITIONS OF USE

9.1 Wood main and side members must have a moisture content of less than or equal to 19 percent.

9.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this TER.

9.3 Where required by the *building official*, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of *permit* application.

9.4 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.

9.5 Design loads shall be determined in accordance with the building code adopted by the *jurisdiction* in which the project is to be constructed and/or by the Building Designer (e.g., *owner* or *registered design professional*).

9.6 At a minimum, this product shall be installed per Section 6 of this TER.

9.7 This product is manufactured under a third-party quality control program in accordance with *IBC* Section 104.4 and 110.4 and *IRC* Section R104.4 and R109.2.

9.8 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the *owner* or the owner's authorized agent. Therefore, the TER shall be reviewed for code compliance by the *building official* for acceptance.

9.9 The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the *building official's* inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10 IDENTIFICATION

10.1 The product(s) listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.

10.2 Additional technical information can be found at www.spax.us.

11 REVIEW SCHEDULE

11.1 This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjcertification.org.

11.2 For information on the current status of this TER, contact DrJ Certification.