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## Technical Evaluation Report

**TER 1802-03**

SPAX® 5/16" PowerLag® Fasteners for  
Use in Multi-Ply Truss, Sawn Lumber  
and Engineered Wood Product  
Assemblies

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

### Product:

**SPAX® 5/16" T-Star Washer  
Head PowerLag® Fasteners**

Issue Date:

February 21, 2019

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June 5, 2020

Subject to Renewal:

April 1, 2021

For the most recent version or a sealed copy of this Technical Evaluation Report (TER), visit [drjcertification.org](http://drjcertification.org).





COMPANY  
INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

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

SECTION: 06 11 00 - Wood Framing

SECTION: 06 15 00 - Wood Decking

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## 1 PRODUCT EVALUATED<sup>1</sup>

1.1 SPAX® 5/16" T-Star Washer Head PowerLag® Fasteners

## 2 APPLICABLE CODES AND STANDARDS<sup>2,3</sup>

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

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

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

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

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

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<sup>1</sup> 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 ANAB-Accredited Product Certification Body – Accreditation #1131.

Through ANAB 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](http://drjcertification.org) or call us at 608-310-6748.

<sup>2</sup> 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.

<sup>3</sup> All terms defined in the applicable building codes are italicized.

- 2.2.6 *ASTM D2395: Standard Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials*
- 2.2.7 *ASTM D4442: Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials*
- 2.2.8 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

### 3 PERFORMANCE EVALUATION

- 3.1 SPAX® PowerLag® fasteners were evaluated to determine their ability to provide multi-ply attachment in trusses, sawn lumber, and engineered wood applications.
- 3.2 Corrosion resistance in accordance with *ASTM B117* and *ASTM G85, Annex A5*.
- 3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.4 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 product evaluated in this TER is shown in Figure 1.

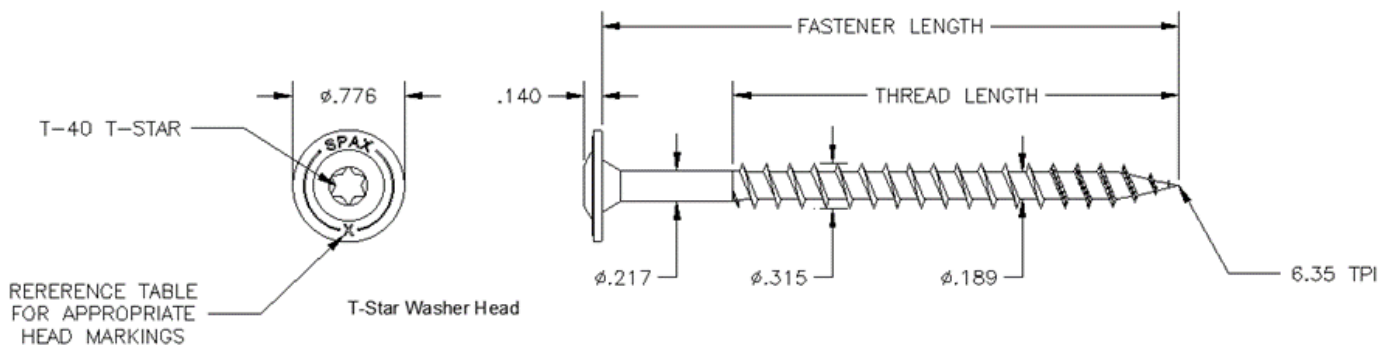


FIGURE 1. SPAX® 5/16" T-STAR WASHER HEAD POWERLAG® FASTENERS FOR MULTI-PLY ASSEMBLIES (IN)

- 4.2 SPAX® PowerLag® fasteners are manufactured with carbon steel grade 1022 or 10B21 wire conforming to *ASTM A510* or grade 17MnB3 or 19MnB4 wire conforming to *DIN 1654*.
- 4.3 SPAX® PowerLag® fasteners are manufactured using a standard cold-formed process followed by a heat-treating process. Allowable bending yield and critical dimensions are found in Figure 1 and Table 1.
  - 4.3.1 SPAX® PowerLag® fasteners have a gimlet point.
  - 4.3.2 SPAX® 5/16" PowerLag® fastener heads are T-40 T-Star drive.
- 4.4 SPAX® PowerLag® fasteners are available with proprietary coatings:
  - 4.4.1 Interior Grade: Yellow Electro-Zinc with Wax meeting *ASTM F1941*
  - 4.4.2 Exterior Grade: Proprietary HCR™ that exceed the protection provided by code approved hot-dipped galvanized coatings meeting *ASTM A153 (IBC Section 2304.10.5<sup>4</sup> and IRC Section R317.3)*.
    - 4.4.2.1 HCR™ coating is approved for use in ground contact pressure treated wood (ACQ) in general construction (freshwater) applications.

<sup>4</sup> 2012 IBC Section 2304.9.5



4.4.2.2 HCR™ coated fasteners are approved for use in fire-retardant-treated lumber, provided the conditions set forth by the fire-retardant-treated lumber manufacturer are met, including appropriate strength reductions.

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

TABLE 1. FASTENER SPECIFICATIONS

Fastener Name	Head				Fastener Length <sup>1</sup> (in)	Shank Diameter (in)	Thread Length <sup>2</sup> (in)	Thread Diameter (in)		Nominal Bending Yield <sup>3</sup> , f <sub>yb</sub> (psi)
	Style	Marking	Diameter (in)	Thickness (in)				Minor	Major	
PowerLag® (5/16")	T-Star	3	0.776	0.1440	3	0.217	2.375	0.189	0.315	150,000
		3-1/2			3-1/2					
		4-1/2			4-1/2					
		5			5					
		6			6					
		6 3/4			6 3/4					

For SI: 1" = 25.4 mm, 1lbf = 4.45 N, 1 psi = 6.895 kPa.

1. Fastener length is measured from the underside of the head to the tip.
2. Thread length includes tip (see Figure 1).
3. Determined in accordance with methods specified in ASTM F1575, based on minor thread diameter using a 5% offset of the load displacement curves developed from bending tests.
4. Fastener dimensions are as measured on uncoated fasteners.

## 5 APPLICATIONS

- 5.1 SPAX® PowerLag® fasteners are used for attaching multi-ply wood members including trusses, sawn lumber, and engineered wood products.
- 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 *Multi-ply Connection Design Values*
  - 5.4.1 SPAX® 5/16" PowerLag® Fastener for Multi-Ply Truss and Sawn Lumber Assemblies
    - 5.4.1.1 SPAX® 5/16" PowerLag® fasteners lengths for truss and sawn lumber assemblies have the design values set forth in Table 2. Assembly conditions are detailed in Figure 2.



TABLE 2. ALLOWABLE DESIGN VALUES (PLF) FOR MULTI-PLY TRUSS AND SAWN LUMBER ASSEMBLIES<sup>3,4</sup>

Multiple Members		Nominal Fastener Length <sup>1,2</sup> (in)	Loaded Side <sup>5,6</sup>	DF-L/SP (0.50)						SPF/HF (0.42)					
				12" O.C.		16" O.C.		24" O.C.		12" O.C.		16" O.C.		24" O.C.	
Assembly	Components			2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows
A	2-ply 1-1/2"	3	Either	1710	2565	1285	1930	855	1285	1410	2115	1060	1590	705	1060
B	3-ply 1-1/2"	4.5	Either	1770	2655	1330	1995	885	1330	1530	2295	1150	1725	765	1150
C	4-ply 1-1/2"	6	Either	1575	2365	1185	1780	790	1185	1360	2040	1025	1540	680	1020

For SI: 1" = 25.4 mm, 1plf = 14.59 N/m

1. Fastener length is measured from the underside of the head to the tip.
2. Thread length includes tip (see Figure 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 greater than 0.50, use the tabulated values for specific gravity of 0.50.
4. Allowable loads are based on a load duration factor  $C_D = 1.0$  and shall be multiplied by all applicable adjustment factors per the *NDS*.
5. The tabulated allowable design loads may be applied to either side of the beam (head or point side of the fastener). Where loads are applied to both sides of the beam simultaneously, the total load applied to the beam shall not exceed the tabulated load.
6. All design values are also applicable to top-loaded assemblies with even loading across the width of the entire assembly. For top-loaded members, fasteners shall be installed in two (2) rows with a maximum distance of 32" o.c. between fasteners in the same row.

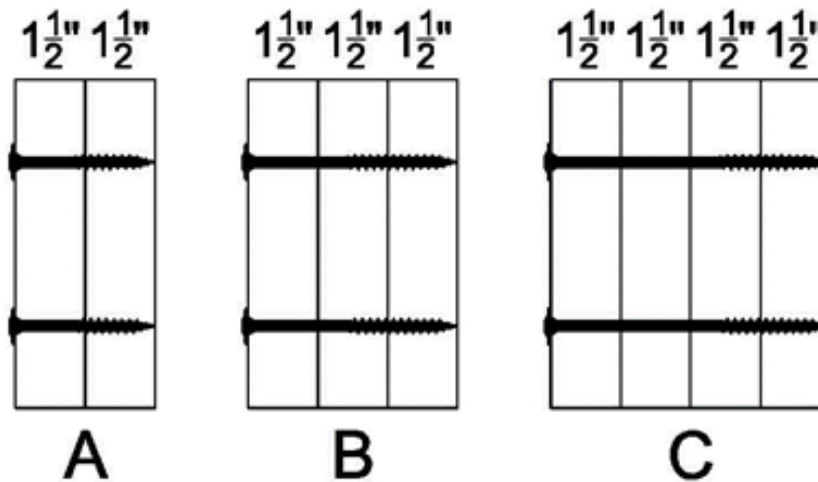


FIGURE 2. SPAX® 5/16" POWERLAG® FASTENER ASSEMBLIES FOR TRUSS AND SAWN LUMBER

5.4.2 SPAX® 5/16" PowerLag® Fastener for Multi-Ply Engineered Wood (LVL, PSL, LSL) Assemblies

5.4.2.1 SPAX® 5/16" PowerLag® fasteners lengths for engineered wood assemblies have the design values set forth in Table 3. Assembly conditions are detailed in Figure 2.

TABLE 3. FASTENER ALLOWABLE DESIGN VALUES (PLF) FOR MULTI-PLY ENGINEERED WOOD (LVL, PSL, LSL) ASSEMBLIES<sup>3,4</sup>

Multiple Members		Nominal Fastener Length <sup>1,2</sup> (in)	Loaded Side <sup>5,6</sup>	12" O.C.		16" O.C.		24" O.C.	
Assembly	Components			2 Rows	3 Rows	2 Rows	3 Rows	2 Rows	3 Rows
A	2-ply 1-3/4"	3.5	Either	2175	3265	1635	2455	1090	1635
B	3-ply 1-3/4"	5	Either	1770	2655	1330	1995	885	1330
C	4-ply 1-3/4"	6.75	Either	1575	2365	1185	1780	790	1185
D	2-ply 1-3/4" & 3-1/2"	5	Either	1770	2655	1330	1995	885	1330
E	3-ply 1-3/4" & 3-1/2"	6.75	Either	1575	2365	1185	1780	790	1185
F	2-ply 3-1/2"	6.75	Either	2360	3540	1775	2665	1180	1770

For SI: 1" = 25.4 mm, plf = 14.59 N/m

- Fastener length is measured from the underside of the head to the tip.
- Thread length includes tip; see Figure 1.
- Wood members shall have an equivalent specific gravity of 0.50 or greater.
- Allowable loads are based on a load duration factor  $C_D = 1.0$  and shall be multiplied by all applicable adjustment factors per the *NDS*.
- The tabulated allowable design loads may be applied to either side of the beam (head or point side of the fastener). Where loads are applied to both sides of the beam simultaneously, the total load applied to the beam shall not exceed the tabulated load.
- All design values are also applicable to top-loaded assemblies with even loading across the width of the entire assembly. For top-loaded members up to 18" deep, fasteners shall be installed in two (2) rows with a maximum distance of 24" o.c. between fasteners in the same row. Use three (3) rows for members deeper than 18".

### 5.5 Spacing, Edge Distance and End Distance

5.5.1 SPAX® PowerLag® fastener spacing, edge distances, and end distances shall be as specified in Table 4.

TABLE 4. SPACING, EDGE DISTANCE, AND END DISTANCE REQUIREMENTS

Fastener Name	Shank Diameter (in)	Min. Edge Distance (in)	Minimum Spacing (in)				Minimum End Distance (in)		
			Between Rows		Between Fasteners in Row		Parallel to Grain		Perpendicular to Grain
			Non-Staggered	Staggered	Parallel to Grain	Perpendicular to Grain	Toward Bearing	Away from Bearing	
PowerLag® (5/16")	0.217	1 3/4	1 1/8	5/8	3/4	2 3/16	3 3/4	2 3/8	2 3/8

For SI: 1" = 25.4 mm

- 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.

## 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 Installation Procedure

- The 5/16" PowerLag® structural wood fastener must be installed with a 1/2" (12.7 mm), low rpm/high torque electric drill (450 rpm) or impact wrench using the appropriate driver bit. Do not overdrive.
- Install PowerLag® fasteners such that as many threads fully engage the main member (final member in multi ply assembly) as possible when head is fully seated against the lumber.
- Lead holes are not required.
- For applications outside the scope of this TER, an engineered design is required.



## 7 TEST ENGINEERING SUBSTANTIATING DATA

- 7.1 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*
- 7.2 Lateral resistance data in accordance with *ASTM D1761*, University of Montana.
- 7.3 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.
- 7.4 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 in accordance with this TER and the manufacturer's installation instructions, PowerLag® fasteners are suitable to provide multi-ply attachment in trusses, sawn lumber, and engineered wood applications.
  - 8.1.1 PowerLag® fasteners with HCR™ coating are approved for use in ground contact pressure treated wood (ACQ) in general construction (freshwater) applications.
- 8.2 HCR™ and HCR-X™ Coated Fasteners are approved for use in fire-retardant-treated lumber, provided the conditions set forth by the fire-retardant-treated lumber manufacturer are met, including appropriate strength reductions.
- 8.3 *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*.
- 8.4 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.
  - 8.4.1 No known variations

## 9 CONDITIONS OF USE

- 9.1 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.
- 9.2 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.3 *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*).
- 9.4 At a minimum, this product shall be installed per Section 6 of this TER.



- 9.5 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.
- 9.6 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.
- 9.7 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.

