

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

TER No. 1802-03

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

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2105 County Road 12C
Bryan, OH 43506-8301
419-636-6715 or 800-443-9602
<http://www.spax.us>


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

1. Product(s) Evaluated:

- 1.1. SPAX® 5/16" T-Star Washer Head PowerLag® Fasteners
- 1.2. For the most recent version of this Technical Evaluation Report (TER), visit drjengineering.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjengineering.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.
- 1.3. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found [here](#)) and covered by an [IAF MLA Evaluation](#) per the [Purpose of the MLA](#) (as an example, see [letter to ANSI](#) from the Standards Council of Canada). Manufacturers can go to jurisdictions in the U.S., Canada and other [IAF MLA Signatory Countries](#) and have their products readily approved by authorities having jurisdiction using [DrJ's ANSI accreditation](#).
- 1.4. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements, such as those found in [IBC Section 1703](#). Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI's scope of accreditation. For a list of accredited agencies, visit ANSI's [website](#). For more information, see drjcertification.org.

DrJ is a Professional Engineering Approved Source

 **Learn more about DrJ's Accreditation**

- DrJ is an ISO/IEC 17065 accredited product certification body through ANSI Accreditation Services.
- DrJ provides certified evaluations that are signed and sealed by a P.E.
- DrJ's work is backed up by professional liability insurance.
- DrJ is fully compliant with *IBC* Section 1703.

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- 1.5. Requiring an evaluation report from a specific private company (i.e., ICC-ES, IAPMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.
- 1.6. DrJ's code compliance work:
 - 1.6.1. Conforms to code language adopted into law by individual states and any relevant consensus based standard such as an ANSI or ASTM standard.
 - 1.6.2. Complies with accepted engineering practice, all professional engineering laws and by providing an engineer's seal DrJ takes professional responsibility for its specified scope of work.

2. Applicable Codes and Standards:¹

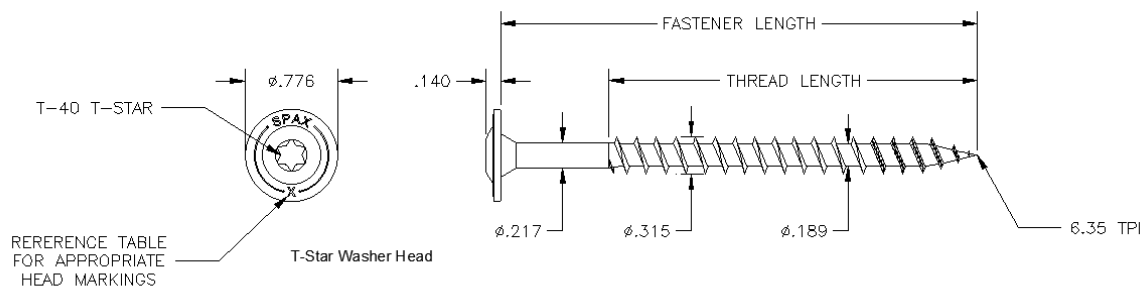
- 2.1. 2012, 2015 and 2018 International Residential Code (IRC)
- 2.2. 2012, 2015 and 2018 International Building Code (IBC)
- 2.3. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel
- 2.4. ASTM A510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
- 2.5. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
- 2.6. ASTM D1761 – Standard Test Methods for Mechanical Fasteners in Wood
- 2.7. ASTM D2395 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials
- 2.8. ASTM D4442 – Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials
- 2.9. ASTM G85 – Standard Practice for Modified Salt Spray (Fog) Testing
- 2.10. AWC/NDS – American Wood Council National Design Specification (NDS) for Wood Construction

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.

4. Product Description and Materials:

Figure 1: SPAX® 5/16" T-Star Washer Head PowerLag® Fasteners for Multi-Ply Assemblies (in.)



¹ Unless otherwise noted, all references in this TER are from the 2018 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2015 versions of the IBC and IRC and the standards referenced therein. As required by law, where this TER is not approved, the building official shall respond in writing, stating the reasons this TER was not approved. For variations in state and local codes, if any, see [Section 8](#).

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- 4.1. 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*.
- 4.2. 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](#).
 - 4.2.1. SPAX® PowerLag® fasteners have a gimlet point.
 - 4.2.2. SPAX® 5/16" PowerLag® fastener heads are T-40 T-Star drive.
- 4.3. SPAX® PowerLag® fasteners are available with proprietary coatings:
 - 4.3.1. Interior Grade: Yellow Electro-Zinc with Wax meeting *ASTM F1941*
 - 4.3.2. Exterior Grade: Proprietary HCR™ that exceed the protection provided by code approved hot-dipped galvanized coatings meeting *ASTM A153* ([IBC Section 2304.10.5](#)² and [IRC Section 317.3](#)).
 - 4.3.2.1. HCR™ coating is approved for use in ground contact pressure treated wood (ACQ) in general construction (freshwater) applications.
 - 4.3.2.2. 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.
- 4.4. The fasteners evaluated in this TER are set forth in [Table 1](#):

Table 1: SPAX® 5/16" PowerLag® Fastener Specifications and Strength Details										
Fastener Name	Head				Fastener Length ¹ (in.)	Shank Diameter (in.)	Thread Length ² (in.)	Thread Diameter (in.)		Nominal Bending Yield (f _{yb} , psi) ³
	Style	Marking	Diameter	Thickness				Minor	Major	
PowerLag® (5/16")	T-Star	3	0.776	0.1440	3	0.217	2.375	0.189	0.315	150,000
		3-½			3-½					
		4-½			4-½					
		5			5					
		6			6					
		6¾			6¾					

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.

- 4.5. In-plant quality control procedures, under which the SPAX® PowerLag® fasteners are manufactured, are audited through an inspection process performed by an approved agency.

5. Applications:

5.1. General

- 5.1.1. SPAX® PowerLag® fasteners are used for attaching multi-ply wood members including trusses, sawn lumber, and engineered wood products.
- 5.1.2. SPAX® PowerLag® fasteners are installed without lead holes as prescribed in *NDS*.
- 5.1.3. Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment.

² 2012 IBC Section 2304.9.5

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5.1.4. Design

- 5.1.4.1. Design of SPAX® PowerLag® fasteners is governed by the applicable code and the provisions for dowel-type fasteners in *NDS*.
- 5.1.4.2. Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

5.2. Multi-ply Connection Design Values

5.2.1. SPAX® 5/16" PowerLag® Fastener for Multi-Ply Truss and Sawn Lumber Assemblies

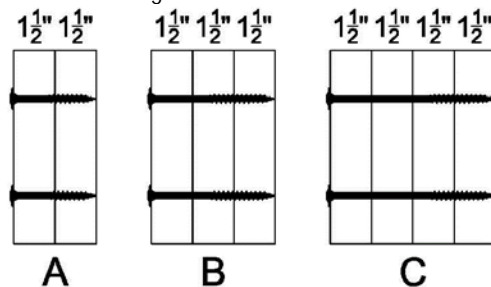
- 5.2.1.1. SPAX® 5/16" PowerLag® fasteners lengths for truss and sawn lumber assemblies have the design values set forth in [Table 2](#). Assembly conditions are detailed in [Figure 2](#).

Table 2: SPAX® 5/16" PowerLag® Fastener Allowable Design Values (plf) for Multi-Ply Truss and Sawn Lumber Assemblies															
Multiple Members		Nominal Fastener Length (in.)	Loaded Side ⁵	DF/SP						SPF/HF					
				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	Head	1770	2655	1330	1995	885	1330	1530	2295	1150	1725	765	1150
			Point	1770	2655	1330	1995	885	1330	1530	2295	1150	1725	765	1150
C	4-ply 1-1/2"	6	Head	1575	2365	1185	1780	790	1185	1360	2040	1025	1540	680	1020
			Point	1575	2365	1185	1780	790	1185	1360	2040	1025	1540	680	1020

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](#) and [Figure 2](#).
3. Wood framing shall be any species with specific gravity, G, of 0.42 or greater.
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. 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



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

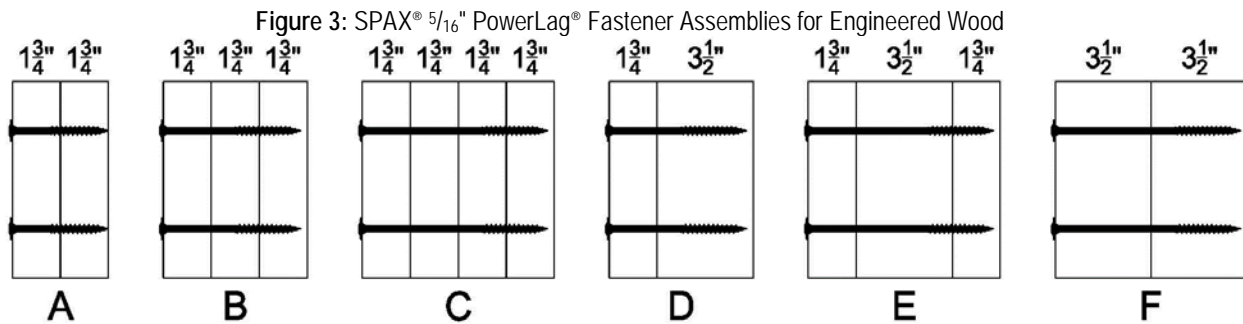
- 5.2.2.1. SPAX® 5/16" PowerLag® fasteners lengths for engineered wood assemblies have the design values set forth in [Table 3](#). Assembly conditions are detailed in [Figure 3](#).

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Table 3: SPAX® 5/16" PowerLag® Fastener Allowable Design Values (plf) for Multi-Ply Engineered Wood (LVL, PSL, LSL) Assemblies									
Multiple Members		Nominal Fastener Length (in.)	Loaded Side ⁵	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	Head	1770	2655	1330	1995	885	1330
			Point	1770	2655	1330	1995	885	1330
C	4-ply 1-3/4"	6.75	Head	1575	2365	1185	1780	790	1185
			Point	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	Head	1575	2365	1185	1780	790	1185
			Point	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, 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](#) and [Figure 2](#).
3. Wood framing shall be any species with specific gravity, G, of 0.50 or greater.
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. 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".



5.3. Spacing, Edge Distance and End Distance

5.3.1. SPAX® PowerLag® fastener spacing, edge distance and end distances shall be as specified in [Table 4](#).

Table 4: SPAX® PowerLag® 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	3-1/4	2-3/16	3-3/4	2-3/8	2-3/8

For SI: 1" = 25.4 mm

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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. 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.
- 6.3. 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.
- 6.4. Lead holes are not required.
- 6.5. For applications outside the scope of this TER, an engineered design is required.

7. Test and Engineering Substantiating Data:

- 7.1. *AWC/NDS – American Wood Council National Design Specification (NDS) for Wood Construction.*
- 7.2. Lateral resistance data in accordance with ASTM D1761, University of Montana.
- 7.3. The product(s) evaluated by this TER fall within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
- 7.4. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.5. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate, as it undertakes its engineering analysis.
- 7.6. DrJ has reviewed and found the data provided by other professional sources are credible. The information in this TER conforms with DrJ's procedure for acceptance of data from approved sources.
- 7.7. DrJ's responsibility for data provided by approved sources conforms with [IBC Section 1703](#) and any relevant professional engineering law.
- 7.8. Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *IRC, WFCM, IBC, SDPWS, NDS, ACI, AISI, PS-20, PS-2*, etc.). This includes review of code provisions and any related test data that aids 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, concrete, etc.), DrJ relies upon grade/properties provided by the raw material supplier 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.

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- 8.3. [IBC Section 104.11](#) and [IRC Section R104.11](#) ([IFC Section 104.9](#) is similar) state:

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 that are applicable to this evaluation, they are listed here:

8.4.1. No known variations

- 8.5. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

- 9.1. Where required by 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 code official 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, Registered Design Professional, etc.).
- 9.4. PowerLag® fasteners covered by this TER shall be installed in accordance with this TER and the [manufacturer's installation instructions](#).
- 9.5. For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practice.
- 9.6. Manufacturer's installation instructions shall be followed as provided in [Section 6](#) and at [spax.us](#).
- 9.7. PowerLag® fasteners are produced by Altenloh, Brinck, and Company U.S., Inc.'s facility located in Bryan, Ohio and SPAX® International GmbH & Co., KG facility located in Ennepetal, Germany.
- 9.8. PowerLag® fasteners are produced under a quality control program subject to periodic inspections in accordance with [IBC Section 1703.5.2](#).
- 9.9. Design
- 9.9.1. Building Designer Responsibility
- 9.9.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer for the Building and shall be in accordance with [IRC Section R106](#) and [IBC Section 107](#).
- 9.9.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [IRC Section R301](#) and [IBC Section 1603](#).
- 9.9.2. Construction Documents
- 9.9.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications, and details needed for the Building Official to approve such documents.

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9.10. Responsibilities

- 9.10.1. The information contained herein is a product, material, detail, design and/or application TER evaluated in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering practice, experience and technical judgment.
- 9.10.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.
- 9.10.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.
- 9.10.4. This product is manufactured under a third-party quality control program in accordance with [/IRC Section R104.4](#) and [R109.2](#) and [/IBC Section 104.4](#) and [110.4](#).
- 9.10.5. 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, and the TER shall be reviewed for code compliance by the Building Official.
- 9.10.6. 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 PowerLag® fasteners described in this TER 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 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 drjengineering.org.
- 11.2. For information on the current status of this TER, contact [DrJ Engineering](#).



- [Mission and Professional Responsibilities](#)
- [Product Evaluation Policies](#)
- [Product Approval – Building Code, Administrative Law and P.E. Law](#)