



**CERTIFICATION**



**Approved. Sealed. Code Compliant.**

## **Technical Evaluation Report**

**TER 1912-07**

**SPAX® PowerLags® Series Structural  
Wood Fasteners Properties**

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

### **Products:**

**SPAX® PowerLags® Series  
Structural Wood Fasteners**

Issue Date:

May 1, 2020

Revision Date:

April 15, 2021

Subject to Renewal:

July 1, 2022



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

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## 1 PRODUCTS EVALUATED<sup>1</sup>

- 1.1 SPAX® PowerLags® Series Structural Wood 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 *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 D1037: Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials*
- 2.2.7 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*
- 2.2.8 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*

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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.

- 2.2.9 *ASTM F606: Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets*
- 2.2.10 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

### 3 PERFORMANCE EVALUATION

- 3.1 SPAX® PowerLags® 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 *ASTM F606* and *AISI S904*
  - 3.1.3 Shear strength in accordance with *ASTM F1575* and *AISI S904*
  - 3.1.4 Head pull-through in accordance with *ASTM D1037* and *ASTM D1761*
  - 3.1.5 Withdrawal strength in accordance with *ASTM D1761*
  - 3.1.6 Lateral resistance in accordance with *ASTM D1761* and *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 Dr.J's professional scope of work.

### 4 PRODUCT DESCRIPTION AND MATERIALS

- 4.1 *General*
  - 4.1.1 The SPAX® PowerLags® series structural wood fasteners described in this report are threaded fasteners manufactured using a standard cold-forming process and subsequently heat-treated and coated.
  - 4.1.2 The fasteners are available with a variety of coatings, including proprietary coating systems designated as zinc, yellow zinc, HCR™, HCR-X™, and WIROX®.
  - 4.1.3 The SPAX® PowerLags® series structural wood fasteners are available in five different diameters and four different head types, and have lengths ranging from 1 to 24 inches (25 to 610 mm), inclusive of the threaded portion. The four head types are as follows:
    - 4.1.3.1 Hex Washer Head design (Figure 1)
    - 4.1.3.2 T-Star Washer Head design with 6-Lobe recess drive system (Figure 2)
    - 4.1.3.3 T-Star Pancake Head design with 6-Lobe recess drive system (Figure 3)
    - 4.1.3.4 T-Star plus Cylindric Head design with 6-Lobe recess drive system containing a post (Figure 4)
  - 4.1.4 For fastener diameters, lengths, and head types, see Table 1 for #14, Table 2 for ¼", Table 3 for 5/16", Table 4 for 3/8", and Table 5 for ½" series. All fasteners described in this TER are manufactured with cold-rolled threads and a gimlet point.

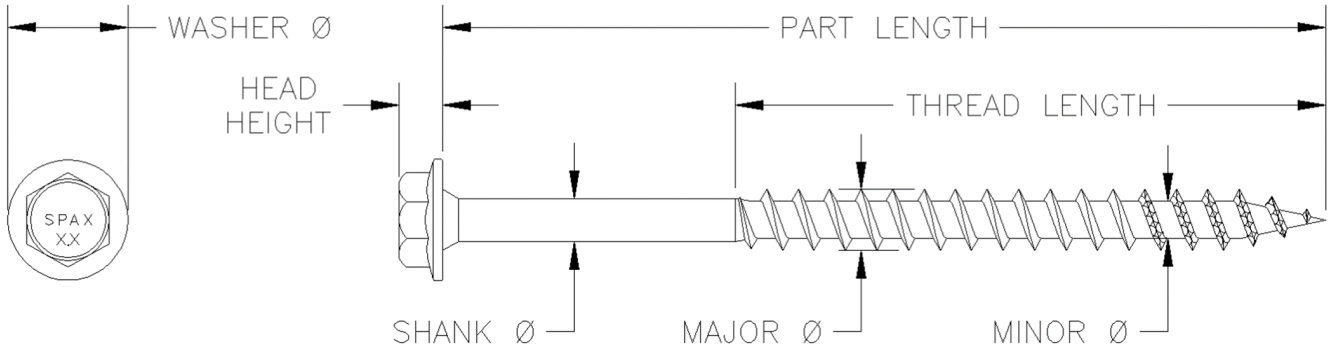


FIGURE 1. SPAX® HEX WASHER HEAD POWERLAGS® FASTENER

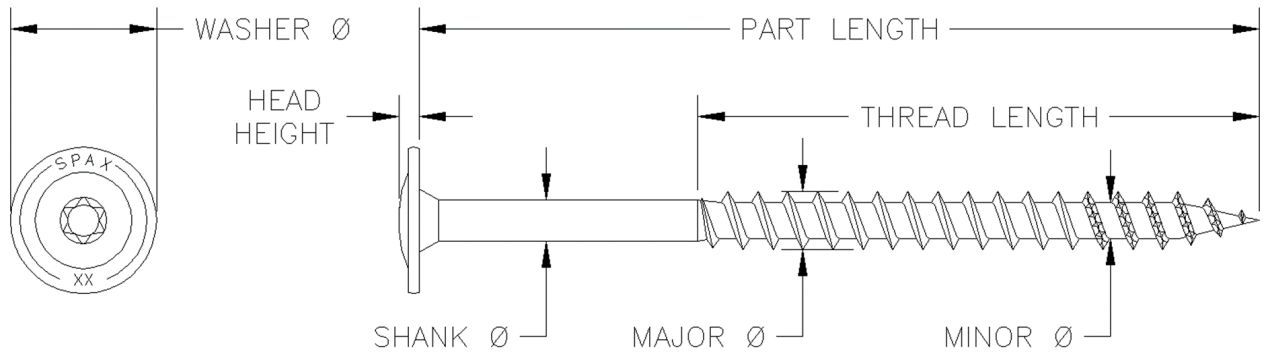


FIGURE 2. SPAX® T-STAR WASHER HEAD POWERLAGS® FASTENER

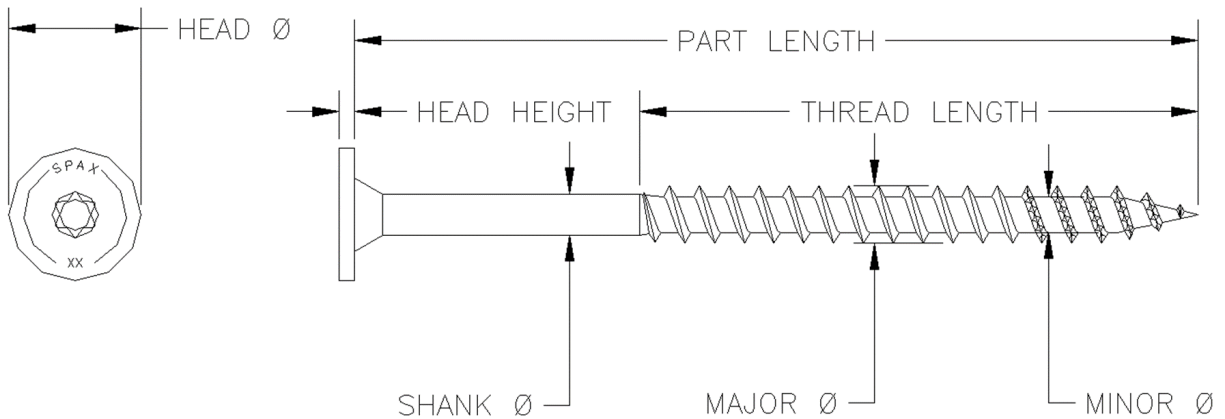


FIGURE 3. SPAX® T-STAR PANCAKE HEAD POWERLAGS® FASTENER

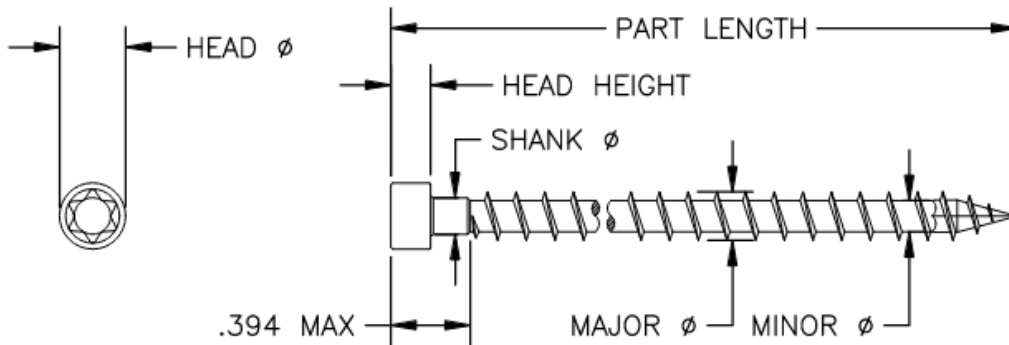


FIGURE 4. SPAX® T-STAR PLUS CYLINDRIC HEAD POWERLAGS® FASTENER

## 4.2 Fastener Material

- 4.2.1 SPAX® PowerLags® are made of hardened carbon steel grade 10B18, 1022, or 10B21 wire conforming to ASTM A510, or grade 17MnB3 or 19MnB4 wire conforming to DIN 1654.

## 4.3 Corrosion Resistance

### 4.3.1 Interior Wood Applications:

- 4.3.1.1 The SPAX® PowerLags® series structural wood fasteners having the proprietary zinc, yellow zinc, and WIROX® coatings are equivalent to the protection provided by code-approved hot-dipped galvanized coatings meeting ASTM A153, Class D (*IBC Section 2304.10.5<sup>4</sup>* and *IRC Section R317.3*) when recognized for use in untreated wood and above ground contact pressure treated wood with waterborne alkaline copper quaternary, Type D (ACQ-D), to a maximum retention level of 0.40 pcf (6.4 kg/m<sup>3</sup>), interior, dry/damp general construction applications (e.g., Above Ground AWWPA UC1-UC2 ACQ-D).

### 4.3.2 Exterior Wood Applications:

- 4.3.2.1 The SPAX® PowerLags® series structural wood fasteners having the proprietary HCR™ and HCR-X™ coatings are equivalent to the protection provided by code-approved hot-dipped galvanized coatings meeting ASTM A153, Class D (*IBC Section 2304.10.5<sup>4</sup>* and *IRC Section R317.3*) when recognized for use in untreated wood and ground contact pressure treated wood with waterborne alkaline copper quaternary, Type D (ACQ-D), to a minimum retention level of 0.40 pcf (6.4 kg/m<sup>3</sup>), exterior, freshwater, general construction applications (e.g., Above Ground AWWPA UC1-UC4A ACQ-D).

### 4.3.3 Fire Retardant Treated (FRT) Wood Applications:

- 4.3.3.1 SPAX® PowerLags® proprietary coating systems designated as zinc, yellow zinc, HCR™, HCR-X™, and WIROX® are recognized for use in FRT lumber, provided the conditions set forth by the FRT lumber manufacturer are met, including appropriate strength reductions.

## 4.4 Wood Material

- 4.4.1 Wood main and side members must be solid-sawn lumber or boards having an assigned specific gravity as given in the respective tables of this TER. Assigned specific gravity must be determined in accordance with NDS Table 12.3.3A.<sup>5</sup>

- 4.5 The fasteners evaluated in this TER are set forth in Table 1, Table 2, Table 3, Table 4, and Table 5.

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

<sup>5</sup> 2012 NDS Table 11.3.3A

TABLE 1. #14 SPAX® POWERLAGS® SERIES FASTENER SPECIFICATIONS<sup>5</sup>

Fastener Designation	Head				Length (in)		Diameter (in)			Bending Yield Strength <sup>3</sup> , f <sub>yb</sub> (psi)	Allowable Steel Strength (lbs)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener <sup>1</sup>	Thread <sup>2</sup>	Shank	Minor	Major		Tensile	Shear <sup>4</sup>
#14 x 4¾"	T-Star plus Cylindric Head	T-30 6 Lobe Recess	0.320	0.200	4¾	4.356	0.170	0.155	0.240	160,000	990	750
#14 x 6¼"					6¼	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 (Figure 4).
3. Bending yield strength, F<sub>yb</sub>, 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.

 TABLE 2. ¼" SPAX® POWERLAGS® SERIES FASTENER SPECIFICATIONS<sup>5</sup>

Fastener Designation	Head				Length (in)		Diameter (in)			Bending Yield Strength <sup>3</sup> , f <sub>yb</sub> (psi)	Allowable Steel Strength (lbs)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener <sup>1</sup>	Thread <sup>2</sup>	Shank	Minor	Major		Tensile	Shear <sup>4</sup>
¼ x 2"	Hex Washer Head	⅜" Hex Driver	0.545	0.210	2	1.770	0.195	0.170	0.276	158,000	1,160	995
¼ x 2½"					2½	1.375						
¼ x 3"					3	2.360						
¼ x 3½"					3½	2.360						
All Longer Lengths					-	2.375						
¼ x 2"	T-Star Washer Head	T-30 6 Lobe Recess	0.697	0.097	2	1.375	0.195	0.170	0.276	158,000	1,160	995
¼ x 2½"					2½	1.375						
¼ x 3"					3	1.790						
¼ x 3½"					3½	1.960						
All Longer Lengths					-	2.375						

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

1. Fastener length is measured from the underside of the head to the tip. These screws are manufactured in lengths up to 24 inches. See Table 9 for additional available lengths.
2. Thread length includes tapered tip (see Figure 1 and Figure 2).
3. Bending yield strength, F<sub>yb</sub>, 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 ASTM F1575 using shank diameter.
5. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are larger due to the proprietary coatings added.



TABLE 3. 5/16" SPAX® POWERLAGS® SERIES FASTENER SPECIFICATIONS<sup>5</sup>

Fastener Designation	Head				Length (in)		Diameter (in)			Bending Yield Strength <sup>3</sup> , f <sub>yb</sub> (psi)	Allowable Steel Strength (lbs)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener <sup>1</sup>	Thread <sup>2</sup>	Shank	Minor	Major		Tensile	Shear <sup>4</sup>
5/16 x 2"	Hex Washer Head	7/16" Hex Driver	0.591	0.248	2	1.375	0.217	0.189	0.315	150,000	1,515	1,205
5/16 x 2½"					2½	1.375						
5/16 x 3"					3	2.360						
5/16 x 3½"					3½	2.993						
5/16 x 4"					4	2.993						
All Longer Lengths					-	2.375						
5/16 x 2"	T-Star Washer Head	T-40 6 Lobe Recess	0.776	0.140	2	1.375	0.217	0.189	0.315	150,000	1,515	1,205
5/16 x 2½"					2½	1.375						
5/16 x 3"					3	1.650						
5/16 x 3½"					3½	2.050						
5/16 x 4"					4	2.375						
All Longer Lengths					-	2.375						
5/16 x 2"	T-Star Pancake Head	T-40 6 Lobe Recess	0.610	0.085	2	1.375	0.217	0.189	0.315	150,000	1,515	1,205
5/16 x 2½"					2½	1.375						
5/16 x 3"					3	1.375						
5/16 x 3½"					3½	1.375						
5/16 x 4"					4	2.375						
All Longer Lengths					-	2.375						

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

1. Fastener length is measured from the underside of the head to the tip. These screws are manufactured in lengths up to 24 inches. See Table 10 for all available lengths.
2. Thread length includes tapered tip (see Figure 1, Figure 2, and Figure 3).
3. Bending yield strength, F<sub>yb</sub>, 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 ASTM F1575 using shank diameter.
5. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are larger due to the proprietary coatings added.

TABLE 4. 3/8" SPAX® POWERLAGS® SERIES FASTENER SPECIFICATIONS<sup>5</sup>

Fastener Designation	Head				Length (in)		Diameter (in)			Bending Yield Strength <sup>3</sup> , f <sub>yb</sub> (psi)	Allowable Steel Strength (lbs)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener <sup>1</sup>	Thread <sup>2</sup>	Shank	Minor	Major		Tensile	Shear <sup>4</sup>
3/8 x 4"	Hex Washer Head	1/2" Hex Driver	0.748	0.307	4	2.375	0.270	0.236	0.394	144,000	2,430	1,855
3/8 x 4 1/2"					4 1/2	2.375						
All Longer Lengths					-	3.105						
3/8 x 4"	T-Star Washer Head	T-40 6 Lobe Recess	0.970	0.173	4	2.375	0.270	0.236	0.394	144,000	2,430	1,855
3/8 x 4 1/2"					4 1/2	2.375						
All Longer Lengths					-	3.105						

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

1. Fastener length is measured from the underside of the head to the tip. These screws are manufactured in lengths up to 18 inches. See Table 11 for all available lengths.
2. Thread length includes tapered tip (see Figure 1 and Figure 2).
3. Bending yield strength, F<sub>yb</sub>, 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 ASTM F1575 using shank diameter.
5. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are larger due to the proprietary coatings added.

TABLE 5. 1/2" SPAX® POWERLAGS® SERIES FASTENER SPECIFICATIONS

Fastener Designation	Head				Length (in)		Diameter (in)			Bending Yield Strength <sup>3</sup> , f <sub>yb</sub> (psi)	Allowable Steel Strength (lbs)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener <sup>1</sup>	Thread <sup>2</sup>	Shank	Minor	Major		Tensile	Shear <sup>4</sup>
1/2" x All Lengths	Hex Washer Head	5/8" Hex Driver	0.858	0.394	-	3.150	0.335	0.295	0.480	166,000	3,415	3,245

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

1. Fastener length is measured from the underside of the head to the tip. These screws are manufactured in lengths from 4 inches to 12 inches. See Table 12 for all available lengths.
2. Thread length includes tapered tip (see Figure 1).
3. Bending yield strength, F<sub>yb</sub>, 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 ASTM F1575 using shank diameter.
5. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are larger due to the proprietary coatings added.

## 5 APPLICATIONS

- 5.1 SPAX® PowerLags® 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® PowerLags® 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® PowerLags® are specified in Table 6.

TABLE 6. REFERENCE PULL-THROUGH DESIGN VALUES (P) FOR SPAX® POWERLAGS®

Fastener Series	Head Style	Pull-Through Design Value <sup>1,2</sup> , P (lbf)		
		Wood Species (Specific Gravity <sup>3</sup> )		
		SP (0.55)	DF-L (0.50)	SPF/HF (0.42)
#14 SPAX® PowerLags®	T-Star plus Cylindric Head	285	285	235
¼" SPAX® PowerLags®	Hex Washer Head	700	640	455
	T-Star Washer Head	850	785	585
5/16" SPAX® PowerLags®	Hex Washer Head	755	680	500
	T-Star Washer Head	965	840	665
	T-Star Pancake Head	810	735	560
¾" SPAX® PowerLags®	Hex Washer Head	985	825	575
	T-Star Washer Head	1245	1085	880
½" SPAX® PowerLags®	Hex Washer Head	1185	970	865

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

- Minimum 1.5" wood member thickness
- Tabulated pull-through values shall be adjusted by all applicable adjustment factors per NDS Table 11.3.1.
- For wood species with an assigned specific gravity between 0.42 and 0.50, use the tabulated values for specific gravity (SG) 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.

5.5 Reference Withdrawal Design Values in Face Grain Applications

5.5.1 Reference withdrawal design values for SPAX® PowerLags® fasteners are specified in Table 7.

TABLE 7. REFERENCE WITHDRAWAL DESIGN VALUES (W) FOR SPAX® POWERLAGS® FASTENERS IN FACE GRAIN

Fastener Series	Head Style	Reference Withdrawal Design Values <sup>1,2</sup> , W (lbf/in)		
		Wood Species (Specific Gravity <sup>3</sup> )		
		SP (0.55)	DF-L (0.50)	SPF/HF (0.42)
#14 SPAX® PowerLags®	T-Star plus Cylindric Head	205	130	130
¼" SPAX® PowerLags®	Hex Washer Head	375	310	245
	T-Star Washer Head			
5/16" SPAX® PowerLags®	Hex Washer Head	415	300	250
	T-Star Washer Head			
	T-Star Pancake Head			
3/8" SPAX® PowerLags®	Hex Washer Head	465	300	280
	T-Star Washer Head			
½" SPAX® PowerLags®	Hex Washer Head	445	275	275

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

1. Tabulated withdrawal values shall be adjusted by all applicable adjustment factors per NDS Table 11.3.1.
2. Full withdrawal strength is calculated by multiplying the length of thread embedded in the main member by the tabulated reference withdrawal values.
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® PowerLags® fasteners are specified in Table 8, Table 9, Table 10, Table 11, and Table 12.

TABLE 8. #14 SPAX® POWERLAGS® FASTENER LATERAL DESIGN VALUES

Fastener Designation	Minimum Main Member Penetration <sup>1</sup> (in)	Minimum Side Member Thickness (in)	Reference Lateral Shear Value <sup>4,5,6</sup> , Z (lbf)					
			Wood Species (Specific Gravity <sup>2,3</sup> )					
			SP (0.55)		DF-L (0.50)		SPF/HF (0.42)	
			Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>
#14 x 4 <sup>3</sup> / <sub>4</sub> "	1.5	1.5	185	185	170	170	145	145
#14 x 6 <sup>1</sup> / <sub>4</sub> "								

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

1. Penetration depth includes the 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<sub>⊥</sub> = Lateral Design Values Perpendicular to Grain, Z<sub>||</sub> = 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.

TABLE 9. 1/4" SPAX® POWERLAGS® FASTENER LATERAL DESIGN VALUES

Fastener Designation	Minimum Main Member Penetration <sup>1</sup> (in)	Minimum Side Member Thickness (in)	Reference Lateral Shear Value <sup>4,5,6</sup> , Z (lbf)					
			Wood Species (Specific Gravity <sup>2,3</sup> )					
			SP (0.55)		DF-L (0.50)		SPF/HF (0.42)	
			Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>
1/4 x 2"	1.375	0.625	305	285	265	235	250	225
1/4 x 2 1/2"								
1/4 x 3"								
1/4 x 3 1/2"	2.375	1.5	400	370	360	335	350	310
1/4 x 4"								
1/4 x 4 1/2"								
1/4 x 5"								
1/4 x 5 1/2"								
1/4 x 6"								
1/4 x 6 1/2"								
1/4 x 7"								
1/4 x 7 1/2"								
1/4 x 8"								
1/4 x 8 1/2"								
1/4 x 9"								
1/4 x 10"								
1/4 x 11"								
1/4 x 12"								
1/4 x 13"								
1/4 x 14"								
1/4 x 15"								
1/4 x 16"								
1/4 x 18"								
1/4 x 20"								
1/4 x 22"								
1/4 x 24"								

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

1. Penetration depth includes the 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<sub>⊥</sub> = Lateral Design Values Perpendicular to Grain, Z<sub>||</sub> = 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.



TABLE 10. 5/16" SPAX® POWERLAGS® LATERAL DESIGN VALUES

Fastener Designation	Minimum Main Member Penetration <sup>1</sup> (in)	Minimum Side Member Thickness (in)	Reference Lateral Shear Value <sup>4,5,6</sup> , Z (lbf)					
			Wood Species (Specific Gravity <sup>2,3</sup> )					
			SP (0.55)		DF-L (0.50)		SPF/HF (0.42)	
			Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>
5/16 x 2"	1.375	0.625	340	305	310	280	265	230
5/16 x 2 1/2"								
5/16 x 3"								
5/16 x 3 1/2"	2.125	2.125	400	380	360	340	325	300
5/16 x 4"								
5/16 x 4 1/2"	2.375	1.5	440	405	405	375	380	355
5/16 x 5"								
5/16 x 5 1/2"								
5/16 x 6"								
5/16 x 6 1/2"								
5/16 x 7"								
5/16 x 7 1/2"								
5/16 x 8"								
5/16 x 8 1/2"								
5/16 x 9"								
5/16 x 10"								
5/16 x 11"								
5/16 x 12"								
5/16 x 13"								
5/16 x 14"								
5/16 x 15"								
5/16 x 16"								
5/16 x 18"								
5/16 x 20"								
5/16 x 22"								
5/16 x 24"								

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

1. Penetration depth includes the 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<sub>⊥</sub> = Lateral Design Values Perpendicular to Grain, Z<sub>||</sub> = 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.



TABLE 11. 3/8" SPAX® POWERLAGS® LATERAL DESIGN VALUES

Fastener Designation	Minimum Main Member Penetration <sup>1</sup> (in)	Minimum Side Member Thickness (in)	Reference Lateral Shear Value <sup>4,5,6</sup> , Z (lbf)					
			Wood Species (Specific Gravity <sup>2,3</sup> )					
			SP (0.55)		DF-L (0.50)		SPF/HF (0.42)	
			Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>
3/8 x 4"	2.375	1.5	530	485	475	440	445	405
3/8 x 4 1/2"								
3/8 x 5"								
3/8 x 5 1/2"								
3/8 x 6"								
3/8 x 6 1/2"								
3/8 x 7"								
3/8 x 7 1/2"								
3/8 x 8"								
3/8 x 8 1/2"								
3/8 x 9"								
3/8 x 10"								
3/8 x 11"								
3/8 x 12"								
3/8 x 13"								
3/8 x 14"								
3/8 x 15"								
3/8 x 16"								
3/8 x 18"								

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

1. Penetration depth includes the 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<sub>⊥</sub> = Lateral Design Values Perpendicular to Grain, Z<sub>||</sub> = 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.

TABLE 12. 1/2" SPAX® POWERLAGS® LATERAL DESIGN VALUES

Fastener Designation	Minimum Main Member Penetration <sup>1</sup> (in)	Minimum Side Member Thickness (in)	Reference Lateral Shear Value <sup>4,5,6</sup> , Z (lbf)					
			Wood Species (Specific Gravity <sup>2,3</sup> )					
			SP (0.55)		DF-L (0.50)		SPF/HF (0.42)	
			Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>	Z <sub>  </sub>	Z <sub>⊥</sub>
1/2 x 4"	2.375	1.5	585	475	550	400	500	370
1/2 x 4 1/2"								
1/2 x 5"								
1/2 x 5 1/2"								
1/2 x 6"								
1/2 x 6 1/2"								
1/2 x 7"								
1/2 x 7 1/2"								
1/2 x 8"								
1/2 x 8 1/2"								
1/2 x 9"								
1/2 x 10"								
1/2 x 11"								
1/2 x 12"								

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

1. Penetration depth includes the 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<sub>⊥</sub> = Lateral Design Values Perpendicular to Grain, Z<sub>||</sub> = 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® PowerLags® shall be installed using the driver bits specified in Table 1, Table 2, Table 3, Table 4, and Table 5, as applicable.
- 6.3 Fasteners shall not be struck with a hammer during installation.
- 6.4 *Lead Hole Requirements*
  - 6.4.1 Lead holes are not required for #14, 1/4", and 5/16" SPAX® PowerLags®.
  - 6.4.2 Lead holes of 0.175" (4.45 mm) diameter are required for 3/8" SPAX® PowerLags®.
  - 6.4.3 Lead holes of 0.200" (5.08 mm) diameter are required for 1/2" SPAX® PowerLags®.
- 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 main member penetration is 1 1/2" unless otherwise stated in this TER.

6.7 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with Table 13.

TABLE 13. MINIMUM SPACING, EDGE DISTANCE, AND END DISTANCE REQUIREMENTS

Connection Geometry	Minimum Spacing/Distance <sup>1,2,3</sup> (in)				
	#14	1/4"	5/16"	3/8"	1/2"
Edge Distance – Load in any direction	1/2	1/2	5/8	2 1/4	2 3/4
End Distance – Load parallel to grain, towards end	2 5/8	3	3 3/8	4 1/2	5 1/2
End Distance – Load parallel to grain, away from end	1 3/4	2	2 1/4	1 3/8	1 3/4
End Distance – Load perpendicular to grain	1 3/4	2	2 1/4	1 3/8	1 3/4
Spacing between Fasteners in a Row – Parallel to grain	2 5/8	3	3 3/8	2 3/4	3 3/4
Spacing between Fasteners in a Row – Perpendicular to grain	1 3/4	2	2 1/4	1 3/8	1 3/4
Spacing between Rows of Fasteners – In-line	7/8	1	1 1/8	See NDS Table 12.5.1D	
Spacing between Rows of Fasteners – Staggered	1/2	1/2	5/8		

SI: 1 in = 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.
- 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"
- 3/8" and 1/2" diameter screws require lead holes. See Section 6.4 for lead hole requirements.

## 7 TEST ENGINEERING SUBSTANTIATING DATA

- 7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:
- 7.1.1 Bending yield testing in accordance with *ASTM F1575*
  - 7.1.2 Tensile strength testing in accordance with *AISI S904*
  - 7.1.3 Shear strength testing in accordance with *AISI S904*
  - 7.1.4 Head pull-through testing in accordance with *ASTM D1761*
  - 7.1.5 Withdrawal testing in accordance with *ASTM D1761*
  - 7.1.6 Lateral connection testing in accordance with *ASTM D1761*
  - 7.1.7 Corrosion resistance testing in accordance with *ASTM B117* and *ASTM G85*
- 7.2 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.
- 7.3 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 6.
  - 8.1.2 Provide resistance to reference withdrawal loads as shown in Table 7.
  - 8.1.3 Provide resistance to lateral loads applied to the fastener in a wood as shown in Table 8, Table 9, Table 10, Table 11, and Table 12.
- 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. Where fasteners are installed in a wet service condition, the appropriate reduction factors shall be applied per NDS Table 11.3.1.
- 9.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this TER.
- 9.3 In cases where fastener metal capacity (instead of the wood member) controls the connection design, the allowable connection strength shall not be multiplied by the adjustment factors specified in *NDS*.
- 9.4 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.
- 9.5 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.6 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*).
- 9.7 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.8 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.
- 9.9 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.
- 9.10 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](http://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](http://drjcertification.org).
- 11.2 For information on the current status of this TER, contact [DrJ Certification](#).