



CERTIFICATION



Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1910-05

SPAX ¼" x 2" Fastener Steel Side Plate
Application

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

Product:

**SPAX ¼" x 2" Hex Washer Head
PowerLag® (XH250-2000)**

Issue Date:

December 20, 2019

Revision Date:

December 20, 2019

Subject to Renewal:

January 1, 2021



COMPANY
INFORMATION:

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

2105 County Road 12C
Bryan, OH 43506-8301

419-636-6715

www.spax.us

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 EVALUATED¹

- 1.1 SPAX ¼" x 2" Hex Washer Head PowerLag® (XH250-2000)

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 *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 A370: Standard Test Methods and Definitions for Mechanical Testing of Steel Products*
- 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*
- 2.2.6 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*
- 2.2.7 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

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.

3 PERFORMANCE EVALUATION

- 3.1 XH250-2000 fasteners were evaluated to determine lateral design values for attaching steel side plates to wood main members in both wet and dry service conditions. The following conditions were evaluated:
 - 3.1.1 Bending yield in accordance with *ASTM F1575*.
 - 3.1.2 Lateral resistance in accordance with *ASTM D1761*.
 - 3.1.3 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 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 XH250-2000 fasteners have a hex washer head with a 3/8" hex drive. The point is a threaded drill point (Figure 1).

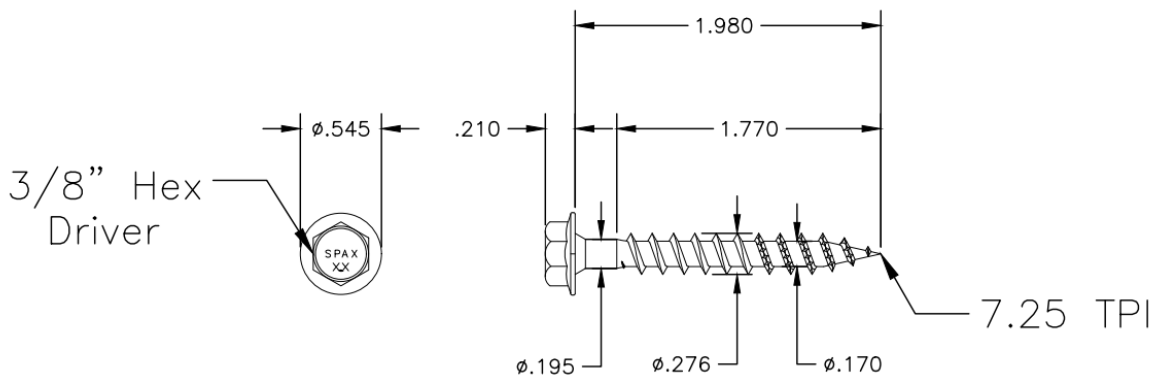


FIGURE 1. XH250-2000 FASTENER

- 4.2 XH250-2000 fasteners are made of hardened carbon steel grade 1022 or 10B21 wire conforming to *ASTM A510*, or grade 17MnB3 or 19MnB4 wire conforming to *DIN 1654*.
- 4.3 XH250-2000 fasteners are manufactured using a standard cold-formed process followed by heat treating and coating processes.
- 4.4 XH250-2000 fasteners are installed without lead holes, as prescribed in *NDS*.
- 4.5 The product evaluated in this TER is designated in Table 1.

TABLE 1. FASTENER DESIGNATION

Fastener	Fastener Length ¹ (in)	Thread Length ² (in)	Head (in)				Shank Diameter ² (in)	Diameter (in)		Bending Yield, ³ f_{yb} (psi)
			Style	Marking	Diameter	Height		Minor	Major	
XH250-2000	1.980	1.770	Hex Washer	2	0.545	0.210	0.195	0.170	0.276	158,000

SI: 1 in = 25.4 mm, 1 psi = 0.00689 MPa

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

- 4.6 The fasteners may be coated with either a proprietary HCR™ coating system or zinc plate system.
 - 4.6.1 The proprietary HCR™ coating system that exceed the protection provided by a code approved hot-dipped galvanized coating meeting *ASTM A153*.
 - 4.6.1.1 The HCR™ coating is tested and recognized for use in ground contact, pressure treated wood (ACQ-D) in freshwater applications.
 - 4.6.1.2 HCR™ coatings are permitted for use in fire-retardant-treated lumber.
 - 4.6.2 The zinc plating system provides the equivalent protection provided by a code approved hot-dipped galvanized coating meeting *ASTM A153*.
 - 4.6.2.1 The zinc plating system is tested and recognized for use in ground contact, pressure treated wood (ACQ-D) in dry-unexposed applications.

5 APPLICATIONS

- 5.1 XH250-2000 fasteners are used to resist shear load parallel or perpendicular to grain when attaching steel side plates to solid sawn wood framing.
- 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 *Lateral Design Values*
 - 5.3.1 Design of XH250-2000 fasteners is governed by the applicable code and the provisions for dowel-type fasteners in *NDS*. No further duration of load increases are permitted.
 - 5.3.1.1 Lateral design values for fasteners in Douglas Fir-Larch with a steel side plate are provided in Table 2.

TABLE 2. REFERENCE LATERAL DESIGN VALUES FOR SINGLE SHEAR CONNECTIONS IN WOOD WITH STEEL SIDE PLATE^{1,2}

Fastener ³	Main Member ⁴	Side Member Thickness (in)	Service Condition ⁵	Load Parallel to Grain (lbs)	Load Perpendicular to Grain (lbs)
XH250-2000	DF-L (0.50)	¼	Dry	425	400
			Wet	310	355
		½	Dry	380	385
			Wet	325	355

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

1. Reference lateral design values apply to two-member single shear connections where the main member is wood with a specific gravity equal to or greater than 0.50 and the side member is a steel side plate with a tensile strength (F_u) of at least 65 ksi.
2. Values shall be adjusted by all applicable factors per *NDS*.
3. The fastener is oriented perpendicular to grain.
4. The entire fastener must be embedded in the main member. The tip of the fastener shall not extend beyond the backside of the main member.
5. The dry service condition is defined as lumber with an in-service moisture content of less than or equal to 19%. The wet service condition is defined as lumber with an in-service moisture content of greater than 19%.

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 XH250-2000 structural wood fastener must be installed with a ½ inch (12.7 mm), low rpm/high torque electric drill (450 rpm) or impact wrench using the appropriate driver bit.
- 6.3 Fasteners shall not be struck with a hammer during installation.
- 6.4 Lead holes are not required.

- 6.5 The bottom of the fastener head must be installed flush to the surface of the steel member being connected. The fastener must not be overdriven.
- 6.6 The entire fastener must be embedded in the main member. The tip of the fastener shall not extend beyond the backside of the main member.
- 6.7 Minimum requirements for fastener spacing, edge distance, and end distance shall be in accordance with Table 3.

TABLE 3. MINIMUM SPACING, EDGE DISTANCE, AND END DISTANCE REQUIREMENTS

Connection Geometry ^{1,2}	Minimum Spacing (in)
Edge Distance – Load in any direction	1½
End Distance – Load parallel to grain, towards end	3
End Distance – Load parallel to grain, away from end	2
End Distance – Load perpendicular to grain	2
Spacing between Fasteners in a Row – Parallel to grain	3
Spacing between Fasteners in a Row – Perpendicular to grain	2
Spacing between Rows of Fasteners – In-line	1
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 lateral resistance in accordance with *ASTM D1671* conducted by Structural Building Components Research Institute (SBCRI)
- 7.2 Testing for bending yield in accordance with *ASTM F1575* conducted by SBCRI
- 7.3 Testing for tensile strength of steel in accordance with *ASTM A370* by SBCRI
- 7.4 Testing for corrosion in accordance with *ASTM B117* and *ASTM G85* conducted by Element
- 7.5 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.
- 7.6 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 lateral loads applied to the fastener in a wood main member with a steel side plate.

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 For XH250-2000 fasteners installed in dry lumber, the wood member must have a moisture content of less than 19 percent.
- 9.2 Zinc-plated fasteners are approved for interior, dry use only.
- 9.3 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.
- 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.

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.