



CERTIFICATION



Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1910-04

SPAX® #14 x 4" Fastener Properties

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

Product:

**SPAX® #14 x 4" T-Star plus Flat-
Head Partial Thread Multi-
Purpose Construction Screw
(XFT14P-4000)**

Issue Date:

March 3, 2020

Revision Date:

March 20, 2020

Subject to Renewal:

April 1, 2021





COMPANY
INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 00 90 - Wood and Plastic Fastenings

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

1 PRODUCT EVALUATED¹

- 1.1 SPAX® #14 x 4" T-Star plus Flat-Head Partial Thread Multi-Purpose Construction Screw (XFT14P-4000)

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

- 2.1.1 *IBC—12, 15, 18: International Building Code®*
- 2.1.2 *IRC—12, 15, 18: International Residential Code®*

2.2 Standards and Referenced Documents

- 2.2.1 *AISI S904: Standard Test Methods for Determining the Tensile and Shear Strength of Screws*
- 2.2.2 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*
- 2.2.3 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
- 2.2.4 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*
- 2.2.5 *ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus*
- 2.2.6 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*
- 2.2.7 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*

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

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

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

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

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

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



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

3 PERFORMANCE EVALUATION

- 3.1 XFT14P-4000 fasteners were tested and evaluated to determine their structural resistance properties, which are used to develop reference design values for allowable stress design (ASD). The following properties were evaluated:
 - 3.1.1 Bending yield in accordance with *ASTM F1575*
 - 3.1.2 Tensile strength in accordance with *AISI S904*
 - 3.1.3 Shear strength in accordance with *AISI S904*
 - 3.1.4 Head pull-through in accordance with *ASTM D1761*
 - 3.1.5 Withdrawal strength in accordance with *ASTM D1761*
 - 3.1.6 Lateral resistance in accordance with *ASTM D1761*
 - 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 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 XFT14P-4000 fasteners have a flat head with a T-30 6-lobe drive with post. The point is a threaded tip (Figure 1).

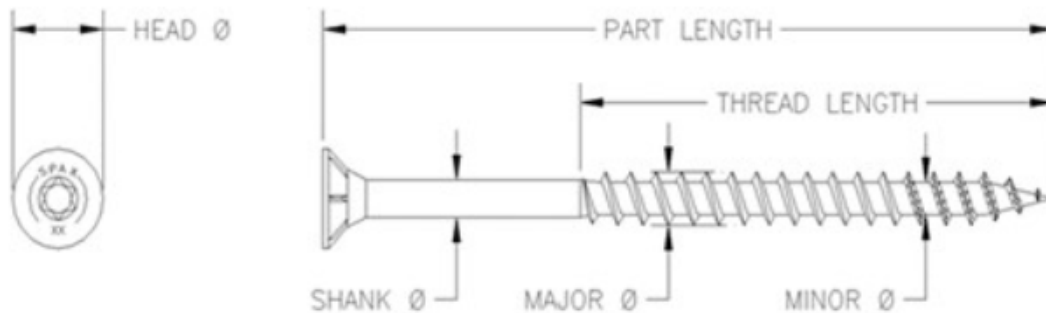


FIGURE 1. XFT14P-4000 FASTENER

- 4.2 XFT14P-4000 fasteners are made of hardened carbon steel grade 10B18 wire conforming to *ASTM A510*, or grade 17MnB3 or 19MnB4 wire conforming to *DIN 1654*.
- 4.3 XFT14P-4000 fasteners are manufactured using a standard cold-formed process followed by heat treating and coating processes.
- 4.4 The product evaluated in this TER is designated in Table 1.

TABLE 1. FASTENER SPECIFICATIONS⁵

Fastener Name	Head (in)				Length (in)		Diameters (in)			Bending Yield Strength ³ , f_{yb} (psi)	Allowable Steel Strength (lbs)	
	Style	Marking	Diameter	Height	Fastener ¹	Thread ²	Shank	Minor	Major		Tensile	Shear ⁴
#14 x 4"	T-Star plus Flat Head	n/a	0.445	n/a	4.000	2.385	0.169	0.155	0.240	160,000	990	750

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

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

4.5 XFT14P-4000 fasteners are available with proprietary coatings:

- 4.5.1 Interior Grade: Proprietary zinc plate coating that is equivalent to the protection provided by code-approved hot-dipped galvanized coatings meeting *ASTM A153*, Class D (*IBC Section 2304.10.5⁴* and *IRC Section R317.3*).
 - 4.5.1.1 Zinc plate coating is tested and recognized for use in above ground contact pressure treated lumber (ACQ-D), interior, dry/damp general construction applications (e.g., Above Ground AWPA UC1-UC2 ACQ-D).
 - 4.5.1.2 Zinc plate coated fasteners are approved for use in fire-retardant-treated (FRT) lumber, provided the conditions set forth by the FRT lumber manufacturer are met, including appropriate strength reductions.
- 4.5.2 Exterior Grade: Proprietary HCR™ coating that is equivalent to the protection provided by code-approved hot-dipped galvanized coatings meeting *ASTM A153*, Class D (*IBC Section 2304.10.5⁵* and *IRC Section R317.3*).
 - 4.5.2.1 HCR™ coating is tested and recognized for use in ground contact pressure treated lumber (ACQ-D), exterior, freshwater, general construction applications (e.g., Ground Contact AWPA UC1-UC4A ACQ-D).
 - 4.5.2.2 HCR™ coated fasteners are approved for use in FRT lumber, provided the conditions set forth by the FRT lumber manufacturer are met, including appropriate strength reductions.

5 APPLICATIONS

- 5.1 XFT14P-4000 fasteners are used to attach wood framing members in conventional light-frame construction and provide resistance against head pull-through, withdrawal, and shear loads.
- 5.2 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.
- 5.3 Design
 - 5.3.1 Design of XFT14P-4000 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 load duration shall be in accordance with the applicable code.

⁴ 2012 *IBC Section 2304.9.5*

⁵ 2012 *IBC Section 2304.9.5*

5.4 Head Pull-Through Design Values

5.4.1 Design values for head pull-through for XFT14P-4000 fasteners are specified in Table 2.

TABLE 2. HEAD PULL-THROUGH DESIGN VALUES FOR XFT14P-4000 FASTENER

Member Type (Specific Gravity) ^{1,2}	Member Description ³	Head Pull-Through Value ⁵ (lbs)
SPF ² (0.42)	Dry	190
	Wet	135
SP ² (0.55)	Dry	240
	Wet	155
LVL (0.50) ⁴	Dry	350

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

- For wood species with an assigned specific gravity between 0.42 and 0.55, use the tabulated values for specific gravity of 0.42. 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.
- Minimum thickness is 1.5".
- 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%.
- LVL member minimum thickness is 1.5". Listed specific gravity is an equivalent specific gravity.
- Tabulated withdrawal values shall be adjusted by all applicable adjustment factors per *NDS* Table 11.3.1.

5.5 Reference Withdrawal Design Values in Face Grain Applications

5.5.1 Reference withdrawal design values for XFT14P-4000 fasteners are specified in Table 3.

TABLE 3. REFERENCE WITHDRAWAL VALUE FOR XFT14P-4000 FASTENER IN FACE GRAIN

Member Type (Specific Gravity) ^{1,2}	Member Service Condition	Penetration ⁴ into Member (in)	Reference Withdrawal Value (lbs/in) ^{5,6}
SPF (0.42)	Dry	1	130
	Wet	1	95
SP (0.55)	Dry	1	205
		2	240
	Wet	1	140
		2	170
LVL (0.50) ³	Dry	1	180
		2	225

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

- For wood species with an assigned specific gravity between 0.42 and 0.55, use the tabulated values for specific gravity of 0.42. 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.
- 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%.
- Listed specific gravity is an equivalent specific gravity.
- Fastener penetration is the threaded length embedded in the wood member, including the tip.
- The full design withdrawal value (W) in pounds is equal to: $W = w_1 + [w_2 + (w_2 - w_1)] * (L_T - 1)$; where w_1 = reference withdrawal corresponding to 1" penetration, L_T = embedded thread length (minimum 1"), and w_2 = reference withdrawal corresponding to 2" penetration.
- Tabulated withdrawal values shall be adjusted by all applicable adjustment factors per *NDS* Table 11.3.1.

5.6 Reference Lateral Design Values

- 5.6.1 Reference lateral design values (lbs) for shear load perpendicular and parallel to the side member grain for XFT14P-4000 fasteners are specified in Table 4.
- 5.6.2 Reference lateral design values in Table 4 apply to two-member single shear connections where:
 - 5.6.2.1 The main member has an assigned specific gravity equal to or greater than 0.55.
 - 5.6.2.2 The main member is loaded parallel to grain.
 - 5.6.2.3 The fastener is oriented perpendicular to grain.
 - 5.6.2.4 The fastener penetrates the face of the side member and edge of the main member.
 - 5.6.2.5 The minimum edge distance in the main member is nominally 3/4". Care shall be taken not to split the wood. See Table 5 for other spacing, edge, and end distance requirements.

TABLE 4. LATERAL DESIGN VALUES FOR XFT14P-4000 FASTENER^{4,5,6}

Main Member Species (Specific Gravity) ^{1,3}	Side Member Species (Specific Gravity) ^{2,3}	Reference Lateral Shear Value, Z (lbf)	
		Z _⊥	Z
SP (0.55)	SPF (0.42)	NT	180
	SP (0.55)	285	205
	LVL (0.50)	410	290

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

1. Main member is loaded parallel to grain.
2. For side member wood species with an assigned specific gravity between 0.42 and 0.55, use the tabulated values for specific gravity of 0.42. 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.
3. Main member and side member minimum thickness is 1.5".
4. Z_⊥ = Lateral Design Values Perpendicular to Side Member Grain, Z_{||} = Lateral Design Values Parallel to Side Member Grain (see Figure 2).
5. Tabulated lateral design values shall be adjusted by all applicable adjustment factors per NDS Table 11.3.1.
6. NT = Not Tested

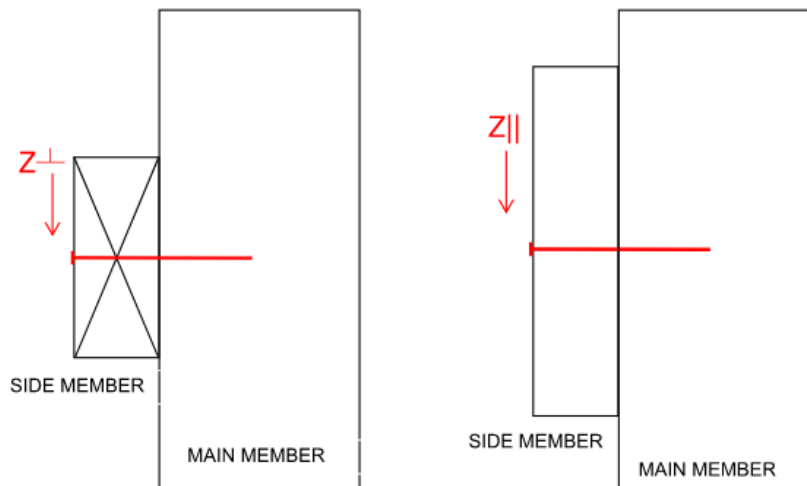


FIGURE 2. LATERAL LOAD DIRECTIONS

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 XFT14P-4000 fasteners shall be installed using a T-30 or SPAX® T-30 plus driver bit.
- 6.3 Fasteners shall not be struck with a hammer during installation.
- 6.4 Lead holes are not required, except where the fastener is installed in LVL less than 1.5" from the end of the board. In this case, a minimum 1/8" diameter pilot hole is required.
- 6.5 The top of 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 The entire fastener must be embedded in the wood connection. The tip of the fastener shall not exceed 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 5, unless otherwise noted in this TER.

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

Connection Geometry ^{1,2}	Minimum Spacing (in)
Edge Distance – Load perpendicular to grain	1½
Edge Distance – Load parallel to grain	¾
End Distance – Load parallel to grain, towards end	1¾
End Distance – Load parallel to grain, away from end	7/8
End Distance – Load perpendicular to grain	¾
Spacing between Fasteners in a Row – Parallel to grain	1¾
Spacing between Fasteners in a Row – Perpendicular to grain	7/8
Spacing between Rows of Fasteners – In-line	½
Spacing between Rows of Fasteners – Staggered	½
SI: 1 in = 25.4 mm 1. Edge distances, end distances, and spacing of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table, whichever is the more restrictive. 2. Values for "Spacing between Rows of Fasteners-Staggered" apply where the fasteners in adjacent rows are offset by one half of the "Spacing between Fasteners in a Row"	

7 TEST ENGINEERING SUBSTANTIATING DATA

- 7.1 Testing for bending yield by SBCRI in accordance with *ASTM F1575*
- 7.2 Testing for tensile strength by SBCRI in accordance with *AISI S904*
- 7.3 Testing for shear strength by SBCRI in accordance with *AISI S904*
- 7.4 Testing for head pull-through by SBCRI in accordance with *ASTM D1761*
- 7.5 Testing for withdrawal by SBCRI in accordance with *ASTM D1761*
- 7.6 Testing for lateral resistance by SBCRI in accordance with *ASTM D1761*
- 7.7 Testing for corrosion by Element in accordance with *ASTM B117* and *ASTM G85*

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

8 FINDINGS

- 8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the product(s) listed in Section 1.1 are approved for the following:
- 8.1.1 Provide resistance to head pull-through loads as shown in Table 2.
- 8.1.2 Provide resistance to reference withdrawal loads as shown in Table 3.
- 8.1.3 Provide resistance to lateral loads applied to the fastener in a wood as shown in Table 4.
- 8.2 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.9 are similar) states:

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

- 8.3 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this evaluation, they are listed here.
- 8.3.1 No known variations

9 CONDITIONS OF USE

- 9.1 For XFT14P-4000 fasteners installed in dry lumber, the wood member must have a moisture content of less than 19 percent.
- 9.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.
- 9.3 Where required by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.
- 9.4 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.5 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the Building Designer (e.g., owner or registered design professional).
- 9.6 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.7 This product is manufactured under a third-party quality control program in accordance with IBC Section 104.4 and 110.4 and IRC Section R104.4 and R109.2.



- 9.8 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the *owner* or the owner's authorized agent. Therefore, the TER shall be reviewed for code compliance by the *building official* for acceptance.
- 9.9 The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the *building official's* inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10 IDENTIFICATION

- 10.1 The product(s) listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at www.spax.us.

11 REVIEW SCHEDULE

- 11.1 This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjcertification.org.
- 11.2 For information on the current status of this TER, contact [DrJ Certification](#).

