



CERTIFICATION



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Technical Evaluation Report

TER 1711-01

**SPAX® 5/16" PowerLag® Fasteners for
Use in Deck Ledger Board Applications**

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

Product:

**SPAX® 5/16" PowerLag®
Fasteners**

Issue Date:

March 29, 2018

Revision Date:

May 3, 2022

Subject to Renewal:

July 1, 2023



COMPANY
INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 11 00 - Wood Framing

SECTION: 06 15 00 - Wood Decking

1 PRODUCT EVALUATED¹

- 1.1 SPAX® 5/16" PowerLag® Fasteners

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

- 2.1.1 *IBC—15, 18, 21: International Building Code®*
- 2.1.2 *IRC—15, 18, 21: International Residential Code®*

2.2 Standards and Referenced Documents

- 2.2.1 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*
- 2.2.2 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
- 2.2.3 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*
- 2.2.4 *ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus*
- 2.2.5 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*
- 2.2.6 *ASTM D2395: Standard Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials*
- 2.2.7 *ASTM D4442: Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials*
- 2.2.8 *ASTM F1575: Standard Test Methods for Determining Bending Yield Moment of Nails*
- 2.2.9 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

¹ For more information, visit drjcertification.org or call us at 608-310-6748.

² Unless otherwise noted, all references in this TER are from the 2021 version of the codes and the standards referenced therein. This material, design, or method of construction also complies with the 2000-2018 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 PowerLag® fasteners were evaluated to determine their ability to provide code complying attachment of deck ledger boards to the building structure.
- 3.2 For conventionally framed buildings, the ledger is required to be attached to the band joist in accordance with IBC Section 1604.8.3 and IRC Section R507.9⁴ as applicable.
 - 3.2.1 This evaluation provides fastening patterns for PowerLag® fasteners in a format similar to what is presented in IRC Table R507.9.1.3(1)⁵.
 - 3.2.2 Where a band joist is not used, as in some truss installations, an engineered design is required.
- 3.3 Ultimate connection capacities and deflections of typical ledger board connections were match tested and evaluated in accordance with the *IRC* and *IBC*.
- 3.4 Corrosion resistance in accordance with *ASTM B117* and *ASTM G85 Annex A5*.
- 3.5 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.6 Any engineering evaluation conducted for this TER was performed within DrJ's ANAB accredited ICS code scope and/or the defined professional engineering scope of work on the dates provided herein.

4 PRODUCT DESCRIPTION AND MATERIALS

- 4.1 The product evaluated in this TER is shown in Figure 1.

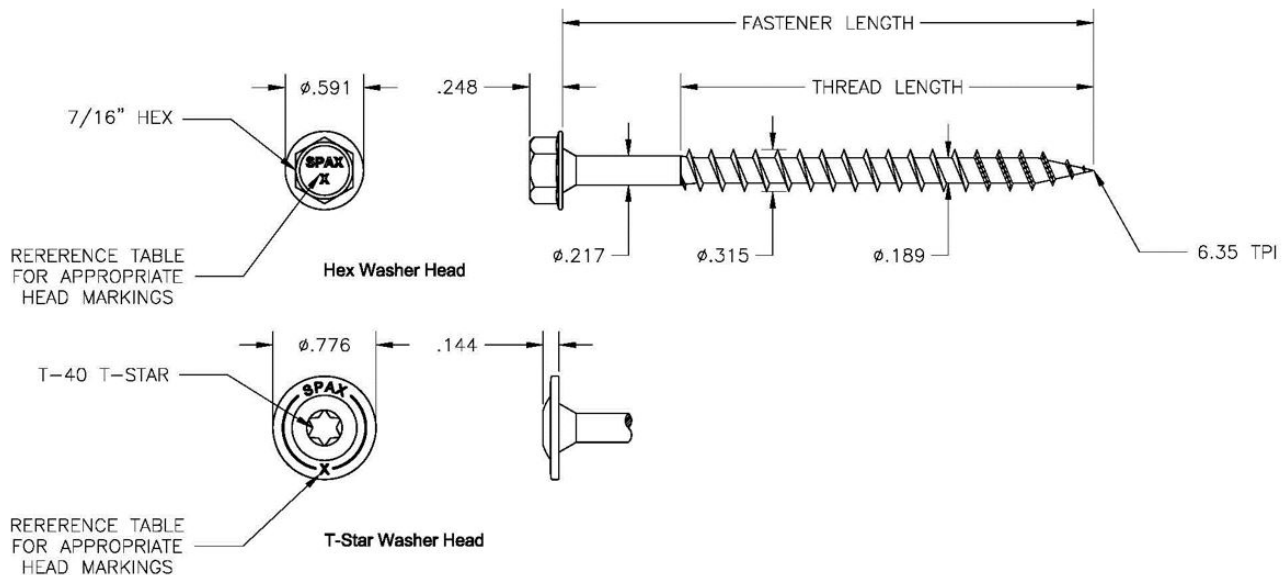


FIGURE 1. POWERLAG® FASTENERS (IN)

- 4.2 PowerLag® fasteners are manufactured with carbon steel grade 1022 or 10B21 wire conforming to *ASTM A510*, or grade 17MnB3 or 19MnB4 wire conforming to *DIN 1654*.
- 4.3 PowerLag® fasteners are manufactured using a standard cold-formed process followed by a heat-treating process. Allowable bending yield and critical dimensions are found in Figure 1 and Table 1.
 - 4.3.1 PowerLag® fastener heads are a 7/16" hex drive or a T-40 T-star drive.
 - 4.3.2 PowerLag® fasteners have a gimlet point.

⁴ 2015 *IRC* Section R507.1

⁵ 2015 *IRC* Table R507.2



- 4.4 PowerLag® fasteners are available with proprietary coatings HCR™ and HCR-X™ that exceed the protection provided by code approved hot-dipped galvanized coatings meeting *ASTM A153* (*IBC Section 2304.10.6*⁶ and *IRC Section R317.3*).
- 4.4.1 HCR™ coating is approved for use in ground contact and pressure treated wood (Alkaline Copper Quaternary, ACQ) in general construction (freshwater) applications.
- 4.4.2 HCR-X™ coating is approved for use in ground contact and pressure treated wood (ACQ) in coastal construction (saltwater) applications.
- 4.5 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.
- 4.6 The fasteners evaluated in this TER are set forth in Table 1.

TABLE 1. FASTENER SPECIFICATIONS

| Fastener Name | Head (in) | | | | Lengths (in) | | Diameters (in) | | | Bending Yield Strength ³ , f _{yb} (psi) |
|----------------------|-----------|---------|----------|-----------|-----------------------|---------------------|----------------|-------|-------|---|
| | Style | Marking | Diameter | Thickness | Fastener ¹ | Thread ² | Shank | Minor | Major | |
| PowerLag® (5/16") | Hex | 4 | 0.591 | 0.248 | 4 | 2.993 | 0.217 | 0.189 | 0.315 | 150,000 |
| | T-Star | | 0.776 | 0.140 | | 2.375 | | | | |
| | Hex | 5 | 0.591 | 0.248 | 5 | 2.375 | | | | |
| | T-Star | | 0.776 | 0.140 | | 2.375 | | | | |

SI: 1" = 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.
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.

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

5 APPLICATIONS

- 5.1 PowerLag® fasteners are used for attaching the deck ledger to the band joists of a building in accordance with *IBC Section 1604.8.3* and *IRC Section R507.9*⁷.
- 5.2 PowerLag® fasteners are installed without lead holes as prescribed in *NDS*.
 - 5.2.1 The *IRC* provides prescriptive fastener spacing for the attachment of a deck ledger to a band joist with ½"-diameter lag screws or through bolts as shown in *IRC Table R507.9.1.3(1)*⁸. Table 2 provides PowerLag® fastener spacing required to provide performance at least equivalent to the lag screws found in *IRC Table R507.9.1.3(1)*⁸ in accordance with *IBC Section 104.11* and *Section 1604.8.3* and *IRC Section R104.11* and *IRC Section R507.9*⁸ in accordance with generally accepted engineering practice. Table 2 provides PowerLag® fastener spacing for items found in *IRC Table R507.9.1.3(1)*⁹, as well as a wider range of materials commonly used for band joists.

⁶ 2018 *IBC Section 2304.10.5*

⁷ 2015 *IRC Section R507.2*

⁸ 2015 *IRC Section R507.1*

⁹ 2015 *IRC Table R507.2*



5.3 The maximum deck joist spans in ledger connection applications for PowerLag® fasteners are specified in Table 2 and Figure 2.

5.3.1 When installed in accordance with the spacing requirements of Table 2, PowerLag® fasteners provide equivalent performance to IRC Table R507.9.1.3(1) **Error! Bookmark not defined.**

5.4 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

TABLE 2. POWERLAG® FASTENER SPACING FOR MAXIMUM DECK JOIST SPANS^{1,4,5,10}

| Loading Condition ⁶ (psf) | Head Type | Fastener Length ² (in) | 2x Nominal Ledger Species ^{3,7,8} | Band Joist Material ⁹ | Maximum Deck Joist Spans | | | | | | | |
|---|-------------|--------------------------------------|--|----------------------------------|--|----------|-----------|-----------|-----------|-----------|-----------|---|
| | | | | | Up to 6' | Up to 8' | Up to 10' | Up to 12' | Up to 14' | Up to 16' | Up to 18' | |
| | | | | | Maximum On-Center Spacing of PowerLag® Fasteners | | | | | | | |
| LL + DL 40 + 10 | T-Star | 4 or 5 | HF/SPF | Sawn Lumber | 22 | 16 | 16 | 15 | 12 | 11 | 10 | |
| | | | | 1" min EWP | 23 | 17 | 16 | 15 | 13 | 11 | 10 | |
| | | | DF/SP | Sawn Lumber | 34 | 25 | 20 | 17 | 13 | 12 | 10 | |
| | | | | 1" min EWP | 23 | 17 | 16 | 14 | 12 | 11 | 9 | |
| | Hex Head | | HF/SPF | Sawn Lumber | 28 | 21 | 17 | 12 | 11 | 9 | 8 | |
| | | | | 1" min EWP | 21 | 14 | 11 | 9 | 8 | 7 | 6 | |
| DF/SP | Sawn Lumber | | 30 | 22 | 18 | 12 | 10 | 9 | 8 | | | |
| | 1" min EWP | | 26 | 19 | 16 | 13 | 11 | 10 | 8 | | | |
| SL + DL 50 + 10 | T-Star | | 4 or 5 | HF/SPF | Sawn Lumber | 18 | 16 | 15 | 12 | 10 | 9 | 8 |
| | | | | | 1" min EWP | 19 | 16 | 15 | 12 | 11 | 9 | 8 |
| | | | | DF/SP | Sawn Lumber | 28 | 21 | 17 | 13 | 11 | 10 | 8 |
| | | | | | 1" min EWP | 19 | 16 | 14 | 12 | 10 | 9 | 8 |
| | Hex Head | HF/SPF | | Sawn Lumber | 24 | 18 | 12 | 10 | 9 | 8 | 7 | |
| | | | | 1" min EWP | 18 | 12 | 9 | 8 | 7 | 6 | 5 | |
| DF/SP | Sawn Lumber | 25 | | 18 | 12 | 10 | 8 | 7 | 6 | | | |
| | 1" min EWP | 21 | | 16 | 13 | 11 | 9 | 8 | 7 | | | |
| SL + DL 60 + 10 | T-Star | 4 or 5 | | HF/SPF | Sawn Lumber | 16 | 16 | 12 | 10 | 9 | 8 | 7 |
| | | | | | 1" min EWP | 16 | 16 | 13 | 11 | 9 | 8 | 7 |
| | | | | DF/SP | Sawn Lumber | 24 | 18 | 13 | 11 | 9 | 8 | 7 |
| | | | | | 1" min EWP | 16 | 15 | 12 | 10 | 9 | 7 | 7 |
| | Hex Head | | HF/SPF | Sawn Lumber | 20 | 13 | 11 | 9 | 7 | 6 | 6 | |
| | | | | 1" min EWP | 14 | 10 | 8 | 7 | 6 | 5 | 4 | |
| DF/SP | Sawn Lumber | | 21 | 1 | 10 | 8 | 7 | 6 | 5 | | | |
| | 1" min EWP | | 18 | 14 | 11 | 9 | 8 | 7 | 6 | | | |
| SL + DL 70 + 10 | T-Star | | 4 or 5 | HF/SPF | Sawn Lumber | 16 | 14 | 11 | 9 | 8 | 7 | 6 |
| | | | | | 1" min EWP | 16 | 14 | 11 | 9 | 8 | 7 | 6 |
| | | | | DF/SP | Sawn Lumber | 21 | 15 | 12 | 10 | 8 | 7 | 6 |

| | | | | | | | | | | |
|--|----------|--------|-------------|----|----|----|---|---|---|---|
| | Hex Head | HF/SPF | 1" min EWP | 16 | 13 | 11 | 9 | 7 | 6 | 6 |
| | | | Sawn Lumber | 18 | 12 | 9 | 8 | 6 | 6 | 5 |
| | | DF/SP | 1" min EWP | 12 | 9 | 7 | 6 | 5 | 4 | 4 |
| | | | Sawn Lumber | 18 | 11 | 9 | 7 | 6 | 5 | 5 |
| | | | 1" min EWP | 16 | 12 | 10 | 8 | 7 | 6 | 5 |

SI: 1" = 25.4 mm

1. Based on load duration of 1.0. Spacing may be adjusted by the applicable load duration as specified in *NDS*.
2. Fasteners are required to have full thread penetration into the main member. Excess fastener length extending beyond the main member is not reflected in the table above.
3. Solid sawn ledgers shall be HF/SPF or DFL/SP species (specific gravity of 0.42 and 0.50 respectively), designed by others. Fasteners shall be staggered from the top to the bottom along the length of the ledger while maintaining the required edge and end distances as shown in Figure 2.
4. Fasteners shall be staggered from the top to the bottom along the length of the ledger while maintaining the required edge and end distances as shown in Figure 2.
5. A maximum 5/8" structural sheathing may be installed between the ledger and the band joist.
6. Table values assume 10 psf dead load.
7. Ledger materials assumed to be in wet service condition.
8. Minimum ledger board requirements: 1 1/2" thickness and 7 1/2" depth
9. Minimum band joist requirements: SPF (specific gravity of 0.42) solid-sawn lumber 1 1/2" thick and 7 1/2" depth; EWP 1.0" thick and 7 1/4" depth
10. Tabulated on-center spacing values are applicable where a third party tested plastic washer (e.g. Deck2Wall® Spacer) is installed between the ledger board and band joist at each fastener location. The plastic washer shall be installed per the washer manufacturer's instructions and this TER. The plastic washer shall be 2" in diameter, 1/2" thick (max), with an approximate 5/16" hole in the center for the PowerLag® and three 3/16" (approx.) holes for the #8 screws. The plastic washer shall be independently fastened to the ledger with three SPAX® #8x1 5/8" or three SPAX® #8x2" screws.

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. Drive the fasteners through the ledger and sheathing into the band joist until the built-in washer head is drawn firm and flush to the ledger board. Do not overdrive.
- 6.3 Install PowerLag® fasteners such that the threads fully engage the band joist material and the fastener tip extends beyond the back face of the band joist material when fully seated against the installed ledger.
 - 6.3.1 A third party tested plastic washer (e.g., Deck2Wall® Spacer) may be installed between the ledger board and band joist at each fastener location. The plastic washer shall be installed per the washer manufacturer's instructions and this TER.
 - 6.3.1.1 The third party tested plastic washer shall be 2" in diameter, 1/2" thick (max), with an approximate 5/16" hole in the center for the PowerLag® and three 3/16" (approx.) holes for the #8 screws.
 - 6.3.1.1.1 The third party tested plastic washer shall be independently fastened to the ledger with three SPAX® #8x1 5/8" or three SPAX® #8x2" screws.
- 6.4 Lead holes are not required.
- 6.5 Figure 2 shows a detail of the PowerLag® fastener deck connection, including minimum edge and end distances.
- 6.6 Stagger the PowerLag® fasteners from the top to the bottom along the length of the ledger while maintaining the required edge and end distances.

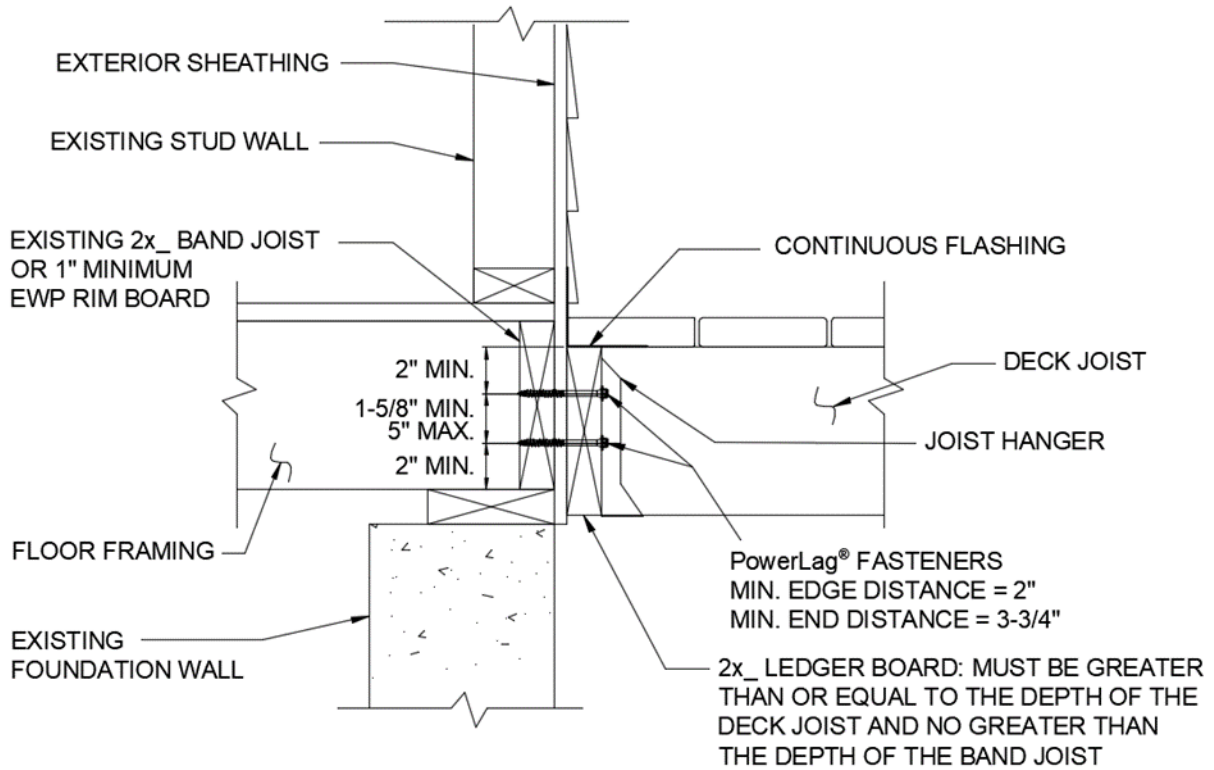


FIGURE 2. POWERLAG® FASTENER DECK CONNECTION

6.7 For applications outside the scope of this TER, an engineered design is required.

7 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, shear, and tensile strength testing in accordance with *ASTM F1575*
- 7.1.2 Lateral resistance and withdrawal resistance testing in accordance with *ASTM D1761*
- 7.1.3 Head pull-through resistance testing in accordance with *ASTM D1037*
- 7.1.4 Corrosion resistance testing in accordance with *ASTM B117* and *ASTM G85, Annex A5*
- 7.1.5 Deck ledger assembly testing in general accordance with *ASTM D1761*

7.2 *DCA 6, Prescriptive Residential Wood Deck Construction Guide; AF&PA; 2010*

7.3 Information contained herein is the result of testing and/or data analysis by sources which conform to IBC Section 1703 and/or professional engineering regulations. DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.

7.4 Where appropriate, DrJ’s analysis is based on provisions that have been codified into law through state or local adoption of codes and standards. The providers of the codes and standards are legally responsible for their content. DrJ analysis may use code-adopted provisions as a control sample. A control sample versus a test sample establishes a product as being equivalent to that prescribed in this code in quality, strength, effectiveness, fire resistance, durability, and safety. Where the accuracy of the provisions provided herein is reliant upon the published properties of materials, DrJ relies upon the grade mark, grade stamp, mill certificate, and/or test data provided by material suppliers to be minimum properties. DrJ analysis relies upon these properties to be accurate.



8 FINDINGS

- 8.1 When used in accordance with this TER and the manufacturer's installation instructions, PowerLag® fasteners are a suitable alternative to the requirements of the IBC Section 1604.8.3 and IRC Section R507.9¹⁰.
 - 8.1.1 PowerLag® fasteners with HCR™ coating is approved for use in ground contact and pressure treated wood (ACQ) in general construction (freshwater) applications.
 - 8.1.2 PowerLag® fasteners with HCR-X™ coating is approved for use in ground contact and pressure treated wood (ACQ) in coastal construction (saltwater) applications.
- 8.2 HCR™ and HCR-X™ Coated Fasteners are approved for use in fire-retardant-treated lumber, provided the conditions set forth by the fire-retardant-treated lumber manufacturer are met, including appropriate strength reductions.
- 8.3 Building codes require data from valid research reports be obtained from approved sources (i.e., licensed registered design professionals [RDPs]).
 - 8.3.1 Building official approval of a licensed RDP is performed by verifying the RDP and/or their business entity is listed by the licensing board of the relevant jurisdiction.
- 8.4 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 and employs RDPs.
- 8.5 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.”
- 8.6 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10¹¹ 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...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*.

9 CONDITIONS OF USE

- 9.1 PowerLag® fasteners covered by this TER shall be installed in accordance with Section 6 of this report and the manufacturer's installation instructions.
- 9.2 PowerLag® fastener spacing shall not exceed Table 2 for code compliance and the installation conditions considered.
- 9.3 For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practice.
- 9.4 PowerLag® fasteners are produced under a quality control program subject to periodic inspections in accordance with IBC Section 1703.5.2.
- 9.5 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.
- 9.6 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.7 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 RDP).
- 9.8 At a minimum, this product shall be installed per Section 6 of this TER.

¹⁰ 2015 IRC Section 507.2

¹¹ 2018 IFC Section 104.9



- 9.9 This product has an internal quality control program and a third-party quality assurance program in accordance with IBC Section 104.4 and Section 110.4 and IRC Section R104.4 and Section R109.2.
- 9.10 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.
- 9.11 This TER shall be reviewed for code compliance by the AHJ in concert with IBC Section 104.
- 9.12 The implementation of this TER for this product is dependent on the design, quality control, third-party quality assurance, proper implementation of installation instructions, inspections required by IBC Section 110.3, and any other code or regulatory requirements that may apply.

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 spax.us.

11 REVIEW SCHEDULE

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