



CERTIFICATION



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Technical Evaluation Report

TER 1306-01

Design for Uplift Using TimberLOK®
Screws to Connect Drag Strut Trusses
to Wall Top Plates

**OMG, Inc.
DBA FastenMaster®**

Product:

**FastenMaster® TimberLOK®
Heavy Duty Wood Screw**

Issue Date:

January 25, 2013

Revision Date:

March 27, 2020

Subject to Renewal:

April 1, 2021

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES
SECTION: 06 00 90 - Wood and Plastic Fastenings

1 PRODUCT EVALUATED¹

- 1.1 FastenMaster® TimberLOK® Heavy Duty Wood Screw

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 A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*
- 2.2.4 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*
- 2.2.5 *AWC TR 12: General Dowel Equations for Calculating Lateral Connection Values*

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 TimberLOK® fasteners were evaluated using their tested allowable design values as an alternate means of attaching wood trusses, drag struts and rafters to the top of the wall below to provide uplift and lateral load resistance. The following conditions were evaluated:
 - 3.1.1 Withdrawal strength of TimberLOK® fasteners for use as an alternative to toe-nail connections, metal hurricane and seismic clips/straps or nails in tension (uplift) loaded applications.
 - 3.1.2 Shear strength of TimberLOK® fasteners for use as an alternative to toe-nail connections, hurricane and seismic clips/straps or nails in shear (lateral) loaded applications either parallel or perpendicular to wood grain.
 - 3.1.3 Head pull through strength of TimberLOK® fasteners for use as an alternative to toe-nail connections, hurricane and seismic clips/straps or nails in tension (uplift) loaded applications.
- 3.2 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.3 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 TimberLOK® fasteners (Figure 1) are manufactured of 1022 carbon steel or 10B21 wire conforming to *ASTM A510*.

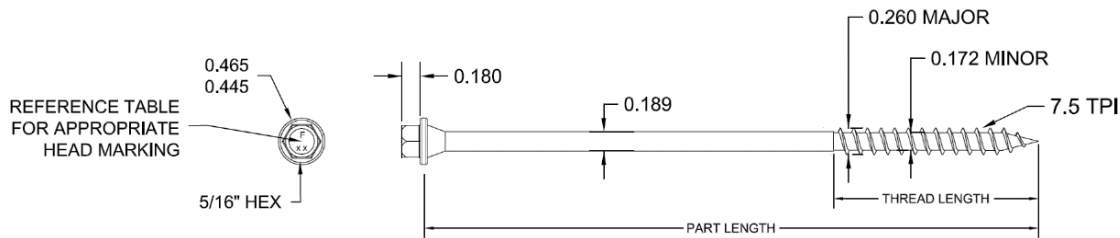


FIGURE 1: TIMBERLOK® FASTENER

- 4.2 TimberLOK® fasteners are manufactured using a standard cold-formed process followed by a heat-treating process.
- 4.3 Fasteners are approved for use in interior and exterior conditions and in chemically treated or untreated lumber.
 - 4.3.1 The proprietary coating has been tested and found to exceed the protection provided by code-approved hot-dipped galvanized coatings meeting *ASTM A153 (IBC Section 2304.10.5⁴ and IRC Section 317.3)*, which allows for its use in alkaline copper quaternary (ACQ) pressure-treated wood.
- 4.4 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.
- 4.5 In-plant quality control procedures, under which the TimberLOK® fasteners are manufactured, are audited through an inspection process performed by an approved agency.
- 4.6 The TimberLOK® fasteners evaluated in this report are designated in Table 1.

⁴ IBC 2012 2304.9.5

TABLE 1. FASTENER DESCRIPTION

Product Name	Fastener Designation ⁵	Head Marking	Overall Length (in)	Thread Length (in)
TimberLOK® 4"	TLOK04	F4.0	4	2
TimberLOK® 6"	TLOK06	F6.0	6	2

SI: 1 in = 25.4 mm

5 APPLICATIONS

5.1 Wood-Framed Construction

5.1.1 TimberLOK® fasteners are used to attach minimum 1½" wide drag strut wood truss bottom chords to wood walls that meet the requirements of IBC Section 2308 or IRC Section R602 for wood structural framing members. The fasteners provide resistance to uplift and lateral loads applied parallel and/or perpendicular to the wall or structural framing member. The fasteners also provide a load path for transferring the drag loads into the shear walls below, see Figure 1.

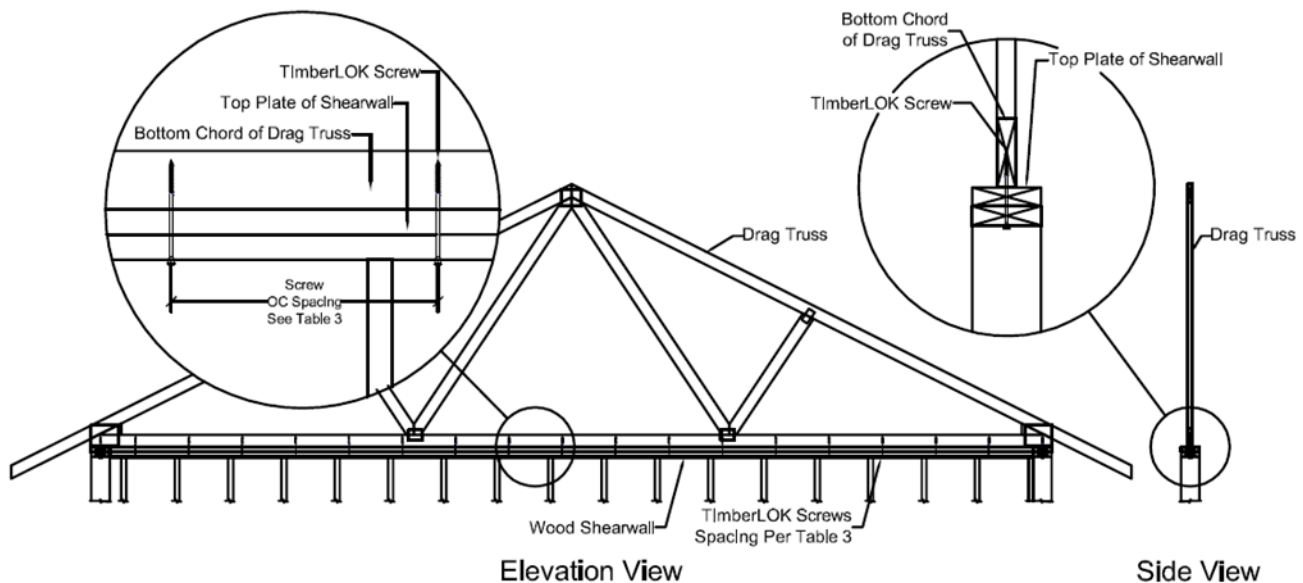


FIGURE 2: DRAG STRUT TRUSS CONNECTION TO SHEAR WALLS

- 5.1.2 Walls shall consist of either a single or double top plate designed in accordance with IBC Section 2308.5.3.2⁶ or IRC Section R602.3.2.
- 5.1.3 See Table 2 for the design procedure and TimberLOK® allowable design values.
- 5.1.4 See Section 6 for installation requirements.
- 5.1.5 TimberLOK® fasteners are used in buildings requiring design in accordance with IBC Section 1609 or requiring wind analysis in accordance with IRC Section R301.2.1.
- 5.1.6 Use of TimberLOK® fasteners in buildings requiring seismic analysis in accordance with IRC Section R301.2.2 is outside the scope of this TER.

⁵ Fastener designations are found on the product packaging. Individual fasteners may be marked according to Table 1.

⁶ 2012 IBC Section 2308.9.2.1

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

5.2 Design Concepts and Allowable Design Loads

5.2.1 Allowable design loads for uplift and lateral resistance (parallel [F1] and perpendicular [F2] to the plane of the wall or structural member, Figure 3) are provided in Table 2 for TimberLOK® fasteners. Allowable design loads are listed for selected load durations and specific gravities and are applicable to fasteners installed in accordance with the procedures described in Section 6.

TABLE 2. ALLOWABLE LOADS FOR UPLIFT & LATERAL RESISTANCE FOR SELECTED LOAD DURATIONS & WOOD-SPECIFIC GRAVITIES USING TIMBERLOK® FASTENERS

Fastener Designation	Minimum Penetration into Truss/Rafter/Wood Structural Support (in)	Species Group (Specific Gravity)	Uplift (lbf)			Lateral (lbf)					
						F2 – Perpendicular to Wall			F1 – Parallel to Wall		
			1.0	1.33	1.60	1.0	1.33	1.60	1.0	1.33	1.60
TimberLOK® TLOK04 or TLOK06	2	So. Pine (0.55)	390	520	620	255	340	410	280	375	450
		Douglas Fir-Larch (0.50)	340	450	540	240	320	385	265	350	425
		Spruce-Pine-Fir/Hem-Fir (0.42)	260	350	420	210	280	340	230	305	370

SI: 1 in = 25.4 mm, 1 lb/ft = 0.138 kg/m
 1. Wood truss and rafter members shall be a minimum of 2" nominal thickness. Design of truss and rafter members to be by others.
 2. Equivalent specific gravity of structural composite lumber (SCL) shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
 3. Uplift and F2 lateral load values have been adjusted using Hankinson's equation per *NDS*.
 4. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
 5. Allowable uplift and lateral loads for applications in which the controlling load duration is two months (i.e., 115%) or seven days (i.e., 125%) may be obtained by multiplying the corresponding tabular value in the column marked "1.0" by 1.15 or 1.25, respectively.

5.2.2 Allowable loads (plf) along the wall are listed in Table 3 for the given fastener spacing.

TABLE 3. ALLOWABLE LOADS IN POUNDS PER LINEAL FOOT BY FASTENING PATTERN

Wood Species	Specific Gravity	On-Center Spacing Between Fasteners (in)						
		4	6	8	12	16	18	24
Southern Pine	0.55	1350	900	675	450	340	300	225
Douglas Fir-Larch	0.50	1275	850	640	425	320	285	215
Spruce Pine-Fir/Hem-Fir	0.42	1110	740	555	370	280	245	185

SI: 1 in = 25.4 mm, 1 lb/ft = 0.138 kg/m
 1. Wood truss and rafter members shall be a minimum of 2" nominal thickness. Design of truss and rafter members to be by others.
 2. A load duration factor of 1.6 has been applied to these tables for wind loading per *NDS Table 2.3.2*. Adjustments to lower this factor may be made at the engineer's discretion. No further increases are allowed.
 3. Table values are based on the latera loading direction parallel to wall.
 4. Equivalent specific gravity of SCL shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
 5. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
 6. Interpolation is permitted.

5.2.3 Where it is anticipated that loads will be applied to a single fastener simultaneously in more than one direction, additional evaluation is required to account for the combined effect of these loads using accepted engineering practice.

5.2.3.1 Consult a professional engineer as needed for complex design conditions.

5.2.4 Design example to transfer lateral loads to a shear wall below, see Figure 3:

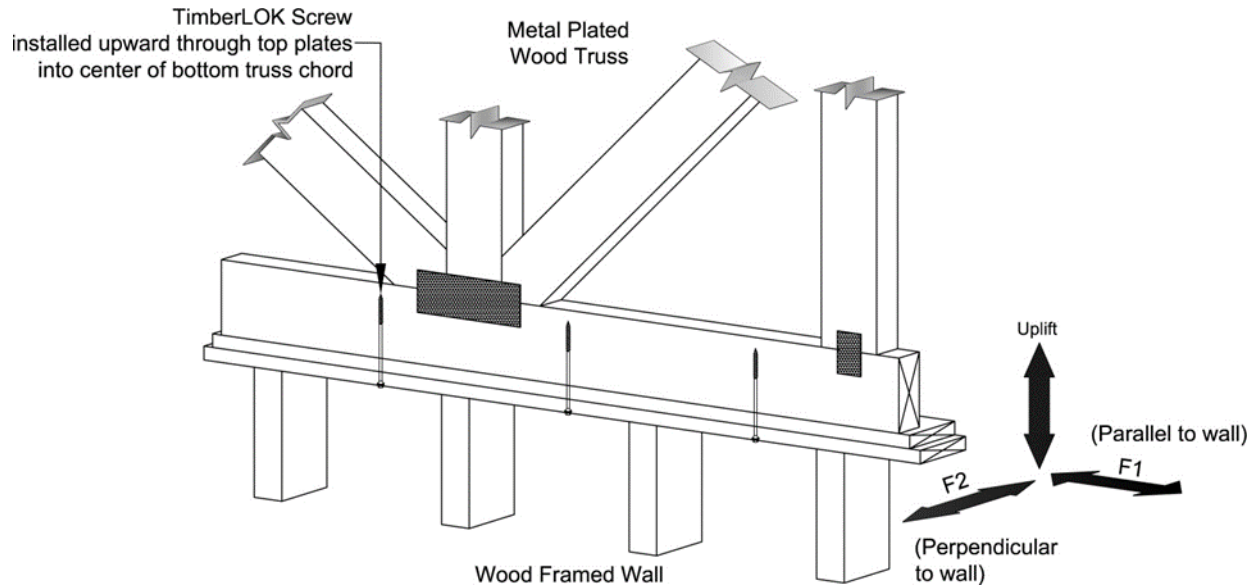


FIGURE 3. UPLIFT & LATERAL LOAD ORIENTATIONS

- 5.2.4.1 Drag force: 5000 lbs (wind)
- 5.2.4.2 Drag strut truss: 24' long
- 5.2.4.3 Shear walls are partial: 5' on one end, 7' on other end
- 5.2.4.4 Load on top chord of drag strut truss is 208.33 plf (5000/24)
- 5.2.4.5 Resistance is supplied by the two shear walls (5' + 7' = 12')
- 5.2.4.6 Resistance capacity required is 416.67 plf (5000/12).
- 5.2.4.7 Assuming the top plate of the wall is Spruce Pine-Fir, Table 3 indicates that the fasteners must be spaced at 0'-8" o.c. (555 plf allowable load).

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 TimberLOK® fasteners:

- 6.2.1 Select a TimberLOK® fastener from Table 1 with a length sufficient to fully embed the 2" threaded portion of the fastener into the wall top plates or wood structural framing member. See Figure 4 for guidance.

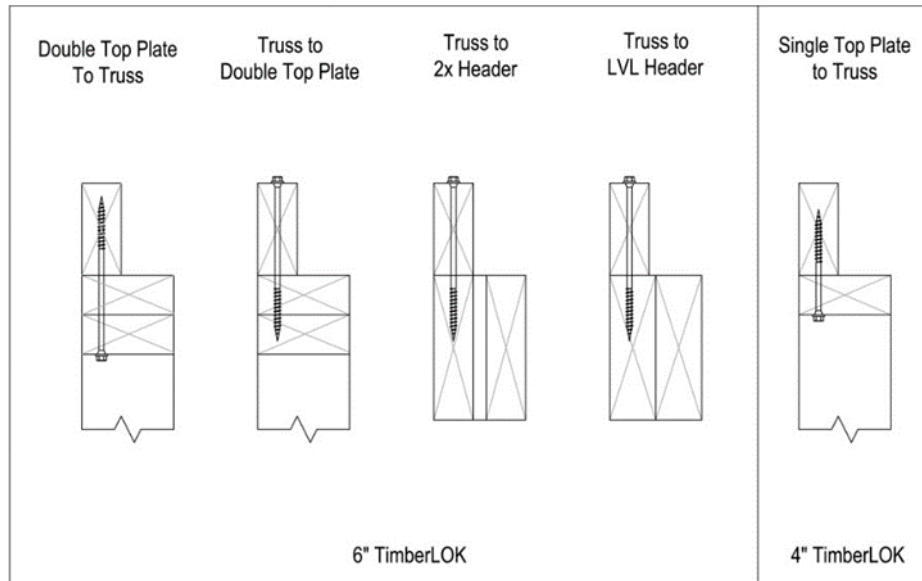


FIGURE 4: TIMBERLOK® FASTENER APPLICATIONS FOR TRUSS BOTTOM CHORD TO WALL FRAMING

- 6.2.2 Install the required number of fasteners to achieve the required lateral capacity and the uplift loads using the TimberLOK® design capacities for resistance to the uplift and lateral loads from Table 2 and Table 3.
- 6.2.3 When installed from the top down, center the screw on the truss chord and drive vertically until the head of the fastener is flush to the top of the chord. Do not overdrive.
- 6.2.4 When installed upward from the bottom of a single or double top plate, measure $\frac{3}{4}$ " in from the outer edge of the plate(s) so that the screw is centered on the truss chord ($\pm \frac{1}{4}$ ") and drive the fastener vertically until the head of the fastener is flush to the underside of the top plate(s). Do not overdrive.

7 TEST ENGINEERING SUBSTANTIATING DATA

7.1 FastenMaster® TimberLOK® data for determining:

- 7.1.1 Comparative equivalency for use as an alternative material in accordance with IBC Section 104.11 and IRC Section R104.11.
- 7.1.2 Uplift capacity of TimberLOK® fasteners as evaluated for head pull through and withdrawal of fasteners.
- 7.1.3 TimberLOK® heavy duty wood screw performance when used as a truss hold-down.
- 7.1.4 TimberLOK® heavy duty wood screw performance when loaded laterally.

7.2 Testing to ASTM D1761 for verifying edge and end distances.

- 7.3 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.

- 7.4 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 An acceptable alternative to toe-nail connections, metal hurricane and seismic clips/straps or nails to resist the uplift and lateral loads as provided for in Table 2.
 - 8.1.2 To provide resistance to uplift loads due to wind pressure applied from the drag strut truss above lifting up on the top plate of the wall, per Table 2.
 - 8.1.3 To provide resistance to lateral loads due to wind pressure applied parallel or perpendicular to the wall, per Table 2.
- 8.2 For joist/rafter and truss to top plate connections, see TER No. 1105-02: Use of FastenMaster® TimberLOK® Fasteners to Provide Uplift & Lateral Resistance to Trusses & Rafters Attached to the Tops of Walls.
- 8.3 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*.
- 8.4 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this evaluation, they are listed here.
- 8.4.1 No known variations

9 CONDITIONS OF USE

- 9.1 Structural framing members (e.g., wood, masonry, concrete, steel, etc.) connected with TimberLOK® fasteners shall be designed in accordance with the requirements of their specific design standards/specifications as referenced in the building code adopted by the jurisdiction in which the project is to be constructed.
- 9.2 Loads applied shall not exceed those recommended by the manufacturer or as defined in this TER.
- 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 FastenMaster® TimberLOK® fasteners described in this TER are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at fastenmaster.com.

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](#).