



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 31, 2021

Subject to Renewal:

April 1, 2022

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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 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 2018 version of the codes and the standards referenced therein. 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 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 TimberLOK® fasteners (Figure 1) are manufactured of 1022 carbon steel or 10B21 wire conforming to *ASTM A510*.

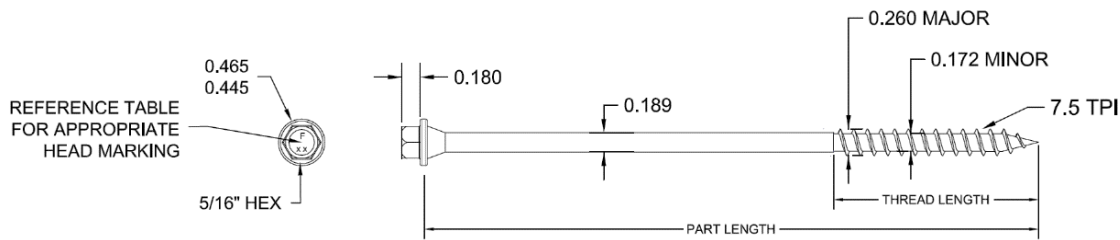


FIGURE 1: TIMBERLOK® FASTENER

- 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 *IBC 2012 2304.9.5*

4.6 The TimberLOK® fasteners evaluated in this report are designated in Table 1.

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.

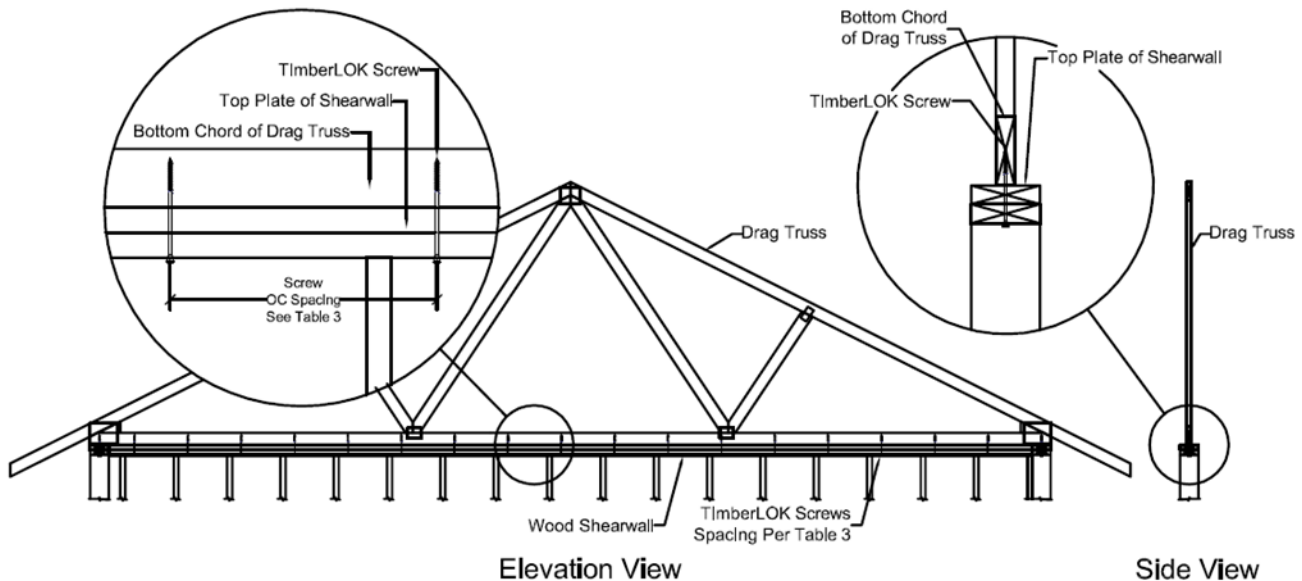


FIGURE 2: DRAG STRUT TRUSS CONNECTION TO SHEAR WALLS

- 5.1.2 Walls shall consist of either a single or double top plate designed in accordance with *IBC Section 2308.5.3.2*⁶ 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 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*

- 5.1.6 Use of TimberLOK® fasteners in buildings requiring seismic analysis in accordance with IRC Section R301.2.2 is outside the scope of this TER.
- 5.1.7 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^{1,5}

Fastener Designation	Minimum Penetration into Truss/Rafter/Wood Structural Support (in)	Species Group (Specific Gravity ^{2,4})	Uplift ³ (lbf)			Lateral (lbf)					
						F2 – Perpendicular to Wall ³			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

- Wood truss and rafter members shall be a minimum of 2" nominal thickness. Design of truss and rafter members to be by others.
- 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.
- Uplift and F2 lateral load values have been adjusted using Hankinson's equation per NDS.
- For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
- 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^{1,2,3,6}

Wood Species	Specific Gravity ^{4,5}	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

- Wood truss and rafter members shall be a minimum of 2" nominal thickness. Design of truss and rafter members to be by others.
- 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.
- Table values are based on the latera loading direction parallel to wall.
- 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.
- For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
- 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:

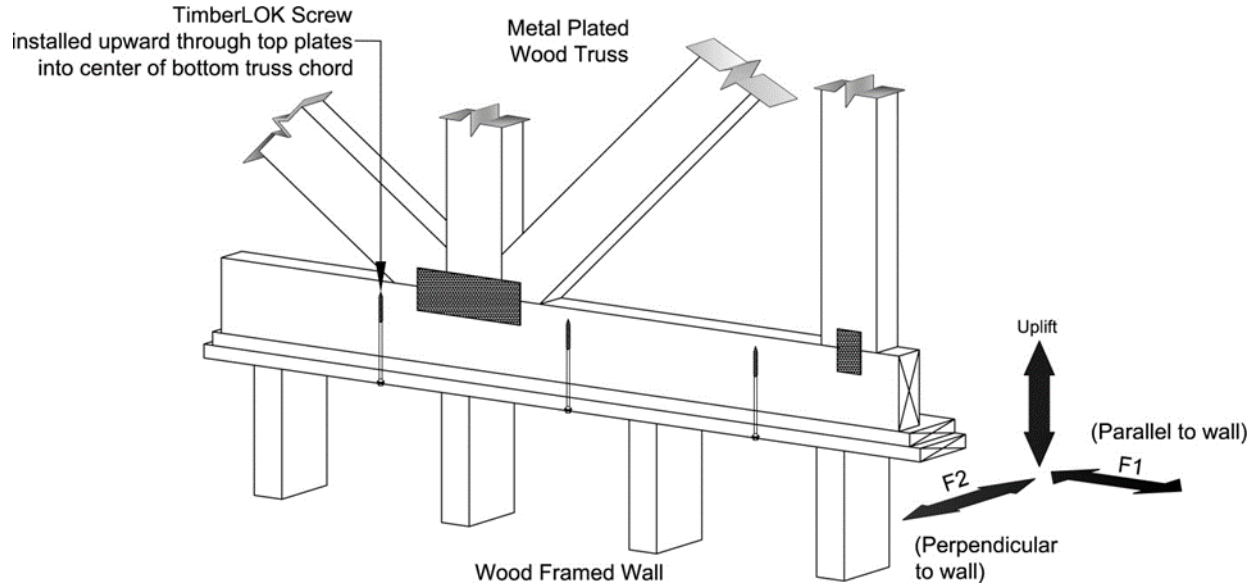


FIGURE 3. UPLIFT & LATERAL LOAD ORIENTATIONS

- 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.

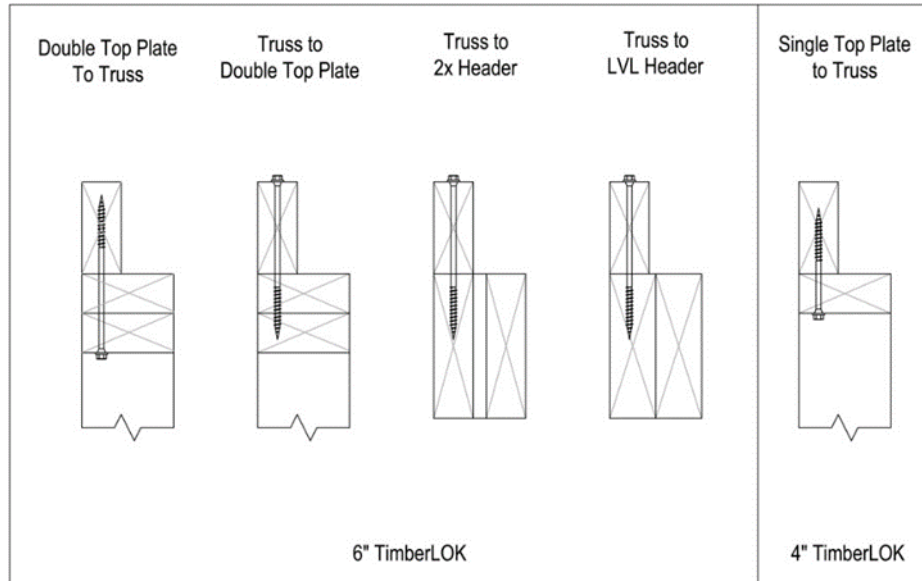


FIGURE 4: TIMBERLOK® FASTENER APPLICATIONS FOR TRUSS BOTTOM CHORD TO WALL FRAMING

- 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 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 Edge and end distance verification testing in accordance with *ASTM D1761*
- 7.2 TimberLOK® fasteners were evaluated for head pull through and withdrawal of fasteners for uplift capacity
- 7.3 TimberLOK® fasteners were evaluated for heavy duty wood screw performance when used as a truss hold-down
- 7.4 TimberLOK® fasteners were evaluated for heavy duty wood screw performance when loaded laterally
- 7.5 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.

- 7.6 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 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 Use as 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 Use 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 Use 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 1105-02: Use of FastenMaster® TimberLOK® Fasteners to Provide Uplift & Lateral Resistance to Trusses & Rafters Attached to the Tops of Walls.
- 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 TER, they are listed here.
- 8.3.1 No known variations
- 8.4 Building codes require data from valid research reports be obtained from approved sources (i.e., licensed registered design professionals [RDPs]).
- 8.4.1 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.
- 8.5 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.
- 8.6 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.”
- 8.7 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...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 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 RDP).
- 9.6 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.7 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.
- 9.8 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.
- 9.9 This TER shall be reviewed for code compliance by the AHJ in concert with IBC Section 104.
- 9.10 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 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, visit drjcertification.org.
- 11.2 For information on the current status of this TER, contact DrJ Certification.