

**Use of FastenMaster® TimberLOK® Fasteners
to Provide Uplift & Lateral Resistance
to Trusses & Rafters Attached to the Tops of Walls**

TER No. 1105-02

**OMG, Inc.
d/b/a/ FastenMaster**

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**Issue Date: June 20, 2011
Updated: February 17, 2017
Subject to Renewal: April 1, 2018**

DIVISION: 06 00 00 – WOOD, PLASTICS AND COMPOSITES
Section: 06 00 90 – Wood and Plastic Fastenings

1. Product Evaluated:

- 1.1. FastenMaster® TimberLOK® Heavy Duty Wood Screw.
- 1.2. For the most recent version of this Technical Evaluation Report (TER), visit drjengineering.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjengineering.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.
- 1.3. Requiring an evaluation report from a specific organization (ICC-ES, IAPAMO, CCMC, DrJ, etc.) is a violation of international, federal, state, provincial and local anti-trust and free trade regulations and constitutes restraint of trade. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements. Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI's scope of accreditation. For a list of accredited agencies, visit ANSI's [website](#). For more information, see drjcertification.org
- 1.4. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found [here](#)) and covered by an [IAF MLA Evaluation](#) per the [Purpose of the MLA](#) (as an example, see [letter to ANSI](#) from the Standards Council of Canada). Manufacturers can go to jurisdictions in the U.S., Canada and other [IAF MLA Signatory Countries](#) and have their products readily approved by authorities having jurisdiction using [DrJ's ANSI accreditation](#).

DrJ is a Professional Engineering Approved Source

 **Learn more about DrJ's Accreditation**

- DrJ is an ISO/IEC 17065 accredited product certification body through ANSI Accreditation Services.
- DrJ provides certified evaluations that are signed and sealed by a P.E.
- DrJ's work is backed up by professional liability insurance.
- DrJ is fully compliant with IBC Section 1703.

Technical Evaluation Report (TER)

2. Applicable Codes and Standards:¹

- 2.1. 2012 and 2015 International Building Code (IBC)
- 2.2. 2012 and 2015 International Residential Code (IRC)
- 2.3. AWC/TR-12 – General Dowel Equations for Calculating Lateral Connection Values
- 2.4. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- 2.5. ASTM A510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
- 2.6. ASTM D1761 – Standard Test Methods for Mechanical Fasteners in Wood
- 2.7. NDS – National Design Specification[®] for Wood Construction

3. Performance Evaluation:

- 3.1. TimberLOK[®] fasteners were evaluated, using their tested allowable design values, as an alternate means of attaching wood trusses and rafters to the tops of walls 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. Connections other than those addressed in [Section 3](#) are outside the scope of this TER.
- 3.3. Any code compliance issues not specifically addressed in this section are outside the scope of this evaluation.

4. Product Description and Materials:

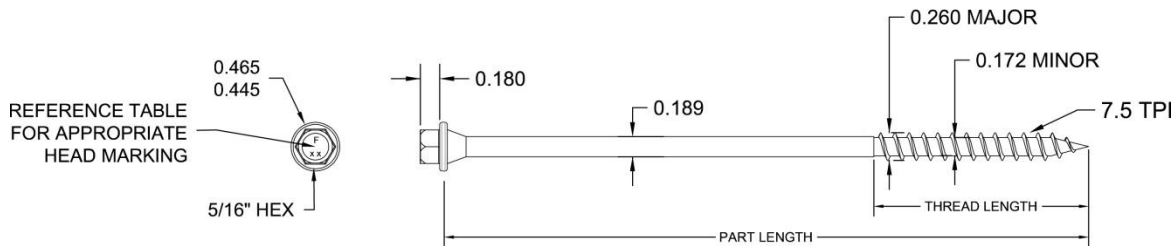


Figure 1: TimberLOK[®] Fastener

- 4.1. TimberLOK[®] fasteners are manufactured from carbon steel wire conforming to ASTM A510 with a minimum ultimate tensile strength of 60 ksi.
- 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 pressure-treated wood.
 - 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 2304.10.5](#)² and [IRC Section 317.3](#)), which allows for its use in pressure-treated (ACQ) wood.

¹ Unless otherwise noted, all references in this code compliant technical evaluation report (TER) are from the 2015 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2012 versions of the IBC and IRC and the standards referenced therein. As required by law, where this TER is not approved, the building official shall respond in writing, stating the reasons this TER report was not approved. For variations in state and local codes, if any, see [Section 8](#).

² [2012 IBC Section 2304.9.5](#)

Technical Evaluation Report (TER)

- 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 as follows:

| Product Name | Fastener Designation | Head Marking | Overall Length | Thread Length |
|---------------|----------------------|--------------|----------------|---------------|
| TimberLOK® 4" | TLOK04 | F4.0 | 4" | 2" |
| TimberLOK® 6" | TLOK06 | F6.0 | 6" | 2" |

1. Fastener designations are found on the product packaging. Individual fasteners may be marked according to [Table 1](#).

Table 1: Fastener Designation for the TimberLOK® Fasteners Evaluated in This Report

5. Applications:

- 5.1. TimberLOK® fasteners are used to attach minimum 1 1/2"-wide wood trusses, sawn lumber rafters or structural composite lumber (SCL) rafters to wood walls that meet the requirements of [IRC Section R602](#) or [IBC Section 2308](#) for wood structural framing members. The fasteners provide resistance to uplift or lateral loads applied parallel and/or perpendicular to the wall or structural framing member.
 - 5.1.1. Walls shall consist of either a single or double top plate designed in accordance with [IRC Section R602.3.2](#) or [IBC Section 2308.5.3.2](#)³.
 - 5.1.2. See [Table 2](#) for the design procedure and the TimberLOK® allowable design values.
 - 5.1.3. See [Section 6](#) for installation requirements.
 - 5.1.4. TimberLOK® fasteners are used in buildings requiring wind analysis in accordance with [IRC Section R301.2.1](#), or design in accordance with [IBC Section 1609](#).
 - 5.1.5. TimberLOK® fasteners in buildings requiring seismic analysis in accordance with [IRC Section R301.2.2](#) is outside the scope of this TER.

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 2](#)] 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 values are applicable for both single and double top plate applications, as shown in [Figure 3](#).

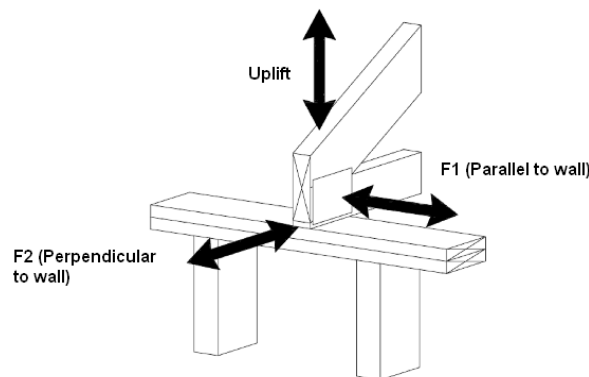


Figure 2: Uplift & Lateral Load Orientations

³ [2012 IBC Section 2308.9.2.1](#).

Technical Evaluation Report (TER)

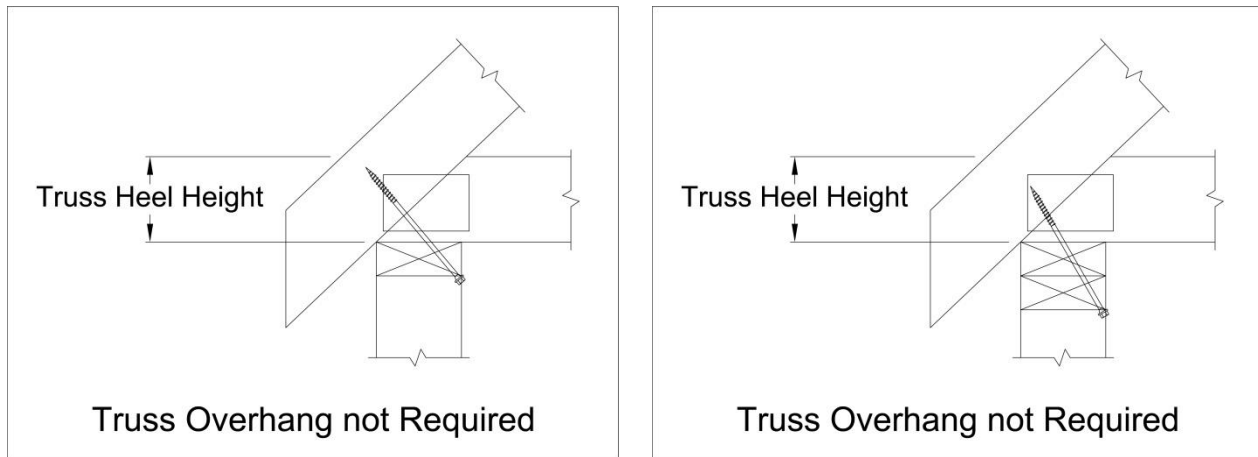


Figure 3: Installation of TimberLOK® Fasteners on Walls with Single or Double Top Plates

| Fastener Designation | Minimum Penetration into Truss/Rafter/Wood Structural Support (in.) | Species Group (Specific Gravity) | Uplift (lbf) | | | Lateral (lbf) | | | | | |
|-----------------------------|---|----------------------------------|--------------|------|------|-----------------------|------|------|----------------------------|------|------|
| | | | | | | F1 – Parallel to Wall | | | F2 – Perpendicular 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 |

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. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
 4. 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.

Table 2: Allowable Loads for Uplift & Lateral Resistance for Selected Load Durations & Wood-Specific Gravities Using TimberLOK® Fasteners

- 5.2.2.** Where it is anticipated that loads will be applied to a single fastener simultaneously in more than one direction, additional evaluation using accepted engineering practice is required to account for the combined effect of these loads.
- 5.2.3.** Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment.
 - 5.2.3.1.** Consult a professional engineer as needed for complex design conditions.

Technical Evaluation Report (TER)

6. Installation:

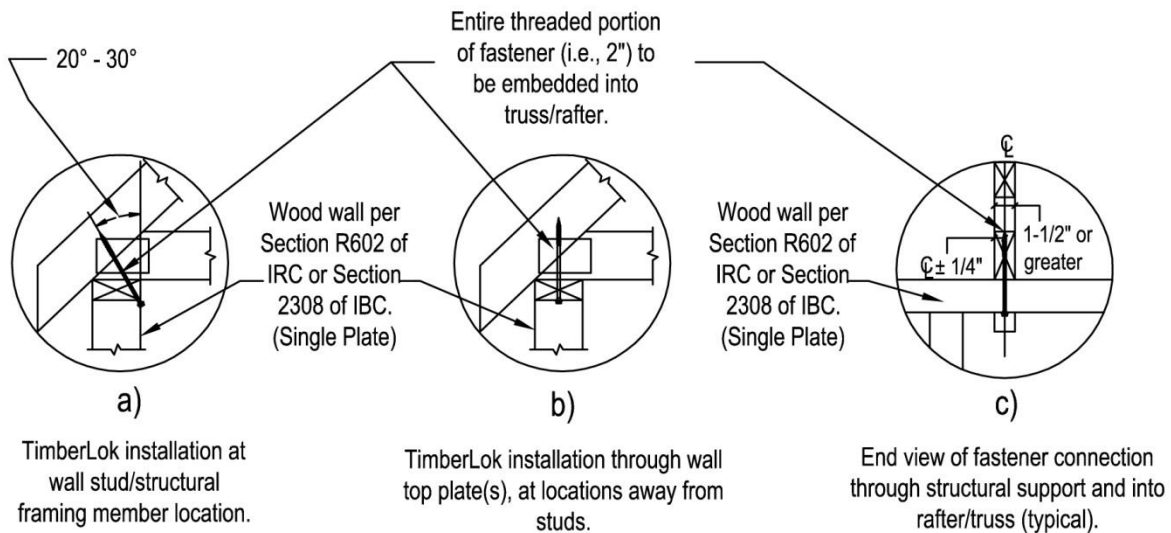


Figure 4a, 4b & 4c: Fastener Orientation Requirements for Attaching Wood Trusses, Rafters or SCL from Below to the Top of a Wood Wall or Structural Framing Member

- 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. Installation where double wall top plates are used.
 - 6.2.1. Upward from below truss or rafter.
 - 6.2.1.1. Select a TimberLOK® fastener with a length sufficient to fully embed the 2" threaded portion of the fastener into the truss or rafter. See [Figure 5](#) for guidance.
 - 6.2.1.2. Install one (1) TimberLOK® fastener upward through the wall top plate(s) or wood structural framing member and into the center of the truss, rafter or SCL, as shown in [Figure 4a, 4b and 4c](#).
 - 6.2.1.2.1. If the truss, rafter or SCL is located directly over a wall stud, insert the fastener at the joint between the inside top edge of the stud and the inside bottom edge of the top plate at an upward angle from vertical of 20°-30°, as shown in [Figure 4a](#).
 - 6.2.1.2.2. If the truss, rafter or SCL is located between the wall studs (double top plate application only), insert the fastener near the middle of the bottom face of the top plate(s) straight upward into the truss, rafter or SCL, as shown in [Figure 4b](#).
 - 6.2.1.2.3. If the truss, rafter or SCL is located on top of a wood beam or header, insert the fastener approximately 3" below the top edge of the beam or header at an upward angle from vertical of 20°-30°, as shown in [Figure 4a](#).
 - 6.2.1.3. Locate the fastener in line with the truss, rafter or SCL above so that it penetrates within +/- 1/4" of the centerline of the narrow edge of the truss, rafter or SCL, as shown in [Figure 4c](#).
 - 6.2.1.4. Use a 1/2" low RPM/high torque drill to drive the fastener head flush with the surface of the wall framing or wood structural framing member.
 - 6.2.2. Downward from on top of the truss, rafter or SCL.
 - 6.2.2.1. Select a TimberLOK® fastener with a length sufficient to fully embed the 2" threaded portion of the fastener into the wall top plates or wood structural framing member.
 - 6.2.2.2. Install one (1) TimberLOK® fastener at a downward angle from vertical of 20°-30° through the center of the truss, rafter or SCL and into the wall top plate(s) or wood structural framing member, as shown in [Figure 5](#).
 - 6.2.2.3. Locate the fastener so that it penetrates within +/- 1/4" of the centerline of the narrow edge of the truss, rafter or SCL and at or near the center of the wall top plate(s) or wood structural framing member.

Technical Evaluation Report (TER)

6.2.2.4. Use a ½" low RPM/high torque drill to drive the fastener head flush with the surface of the wall framing or wood structural framing member.

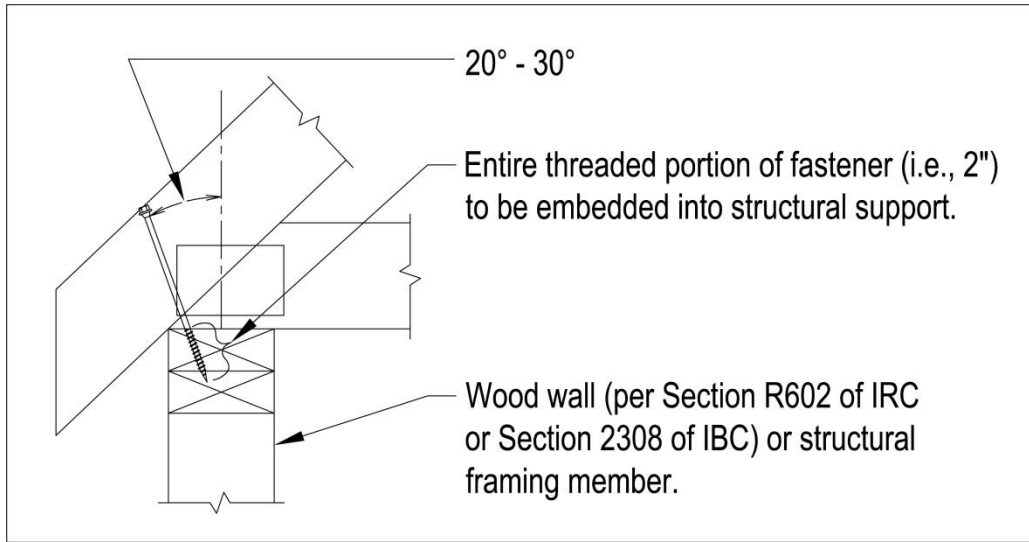


Figure 5: Fastener Orientation Requirements for Attaching Wood Trusses, Rafters or SCL from Above to the Top of a Wood Wall or Structural Framing Member

6.3. Installation where single top plates are used.

- 6.3.1. Select a TimberLOK® fastener with a length sufficient to fully embed the 2" threaded portion of the fastener into the truss, rafter or SCL.
- 6.3.2. Where the truss, rafter or SCL is located directly over a wall stud, insert the fastener at the joint between the inside top edge of the stud and the inside bottom edge of the top plate at an upward angle from vertical of 20°-30°, as shown in [Figure 6](#).
- 6.3.3. Ensure that the angle is sufficient to prevent the fastener from protruding out of the truss, rafter or SCL.
- 6.3.4. Locate the fastener in line with the truss, rafter or SCL above so that it penetrates within +/- ¼" of the centerline of the narrow edge of the truss, rafter or SCL.
- 6.3.5. Use a ½" low RPM/high torque drill to drive the fastener head flush with the surface of the wall framing or wood structural framing member.
- 6.3.6. Where the centerline of the truss, rafter or SCL is not located directly over the stud, install the fastener vertically up through the top plate and into the truss, rafter or SCL, as shown in [Figure 4b](#).

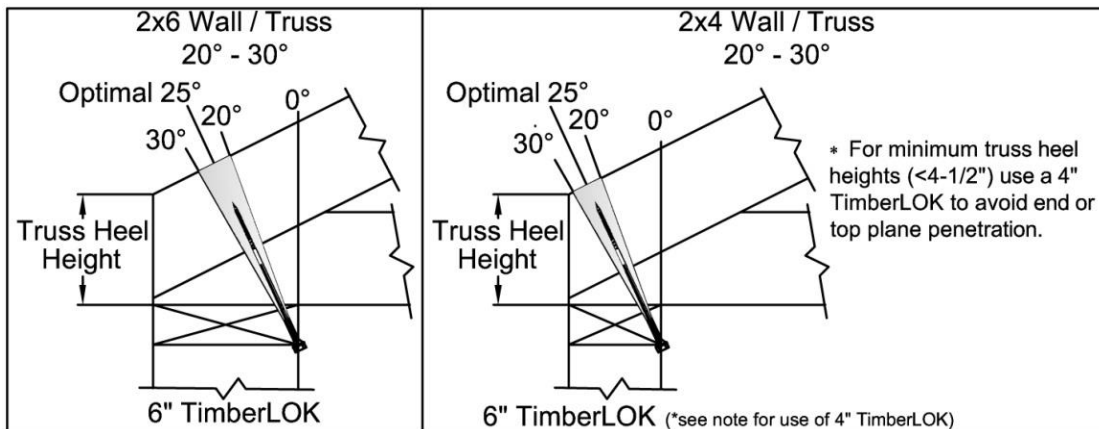


Figure 6: Installation of TimberLOK® Fasteners into a Single Top Plate

Technical Evaluation Report (TER)

7. Test and Engineering Substantiating Data:

- 7.1. FastenMaster® TimberLOK® test reports and supporting data for determining:
 - 7.1.1. Comparative equivalency for use as an alternative material in accordance with [IRC Section R104.11](#) and [IBC Section 104.11](#).
 - 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. The product(s) evaluated by this TER falls within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
- 7.4. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineered alternative means of compliance. This TER assesses compliance with defined standards, generally accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.5. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate as it undertakes its engineering analysis.
- 7.6. DrJ has reviewed and found the data provided by other professional sources are credible. This information has been approved in accordance with DrJ's procedure for acceptance of data from approved sources.
- 7.7. DrJ's responsibility for data provided by approved sources is in accordance with professional engineering law.
- 7.8. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IRC*, *WFCM*, *IBC*, *SDPWS*, etc.). This includes review of code provisions and any related test data that helps with comparative analysis or provides support for equivalency to an intended end-use application.

8. Findings:

- 8.1. When used and installed in accordance with this TER and the manufacturer's installation instructions, TimberLOK® fasteners can be used 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](#).
- 8.3. When used and installed in accordance with this TER and the manufacturer's installation instructions, TimberLOK® fasteners can be used as an acceptable alternative to provide resistance to uplift loads due to wind negative pressure applied from the truss above lifting up on the top plate of the wall, per [Table 2](#).
- 8.4. When used and installed in accordance with this TER and the manufacturer's installation instructions, TimberLOK® fasteners can be used as an acceptable alternative to provide resistance to lateral loads due to wind pressure applied parallel or perpendicular to the wall, per [Table 2](#).
- 8.2. [IBC Section 104.11](#) and [IRC Section R104.11](#) ([IFC Section 104.9](#) is similar) state:

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, at least 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*.⁴
- 8.3. This product has been evaluated with 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 that are applicable to this evaluation, they are listed here:

⁴ The last sentence is adopted language in the 2015 codes.

Technical Evaluation Report (TER)

8.3.1. No known variations

- 8.4. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

- 9.1. Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this report and the installation instructions shall be submitted at the time of permit application.
- 9.2. Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the code official for review and approval.
- 9.3. Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.
- 9.4. The TimberLOK® fasteners covered in this TER shall be installed in accordance with this report and the manufacturer's installation instructions.
- 9.4.1. For conditions not covered in this TER, connections shall be designed in accordance with accepted engineering practice.
- 9.4.2. Manufacturer's installation instructions shall be followed as provided in [Section 6](#) and at fastenmaster.com/details/product/timberlok-heavy-duty-wood-screw.html.
- 9.5. Manufacturer's installation instructions shall be shipped to the jobsite with the materials or otherwise be available on the jobsite for inspection.
- 9.6. 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.
- 9.7. Loads applied shall not exceed those recommended by the manufacturer or as defined in this TER.
- 9.8. FastenMaster® products are produced by OMG, Inc. at its facility located in Agawam, Massachusetts.
- 9.9. TimberLOK® fasteners are produced under a quality control program subject to periodic inspections in accordance with [IBC Section 1703.5.2](#).
- 9.10. Design
- 9.10.1. Building Designer Responsibility
- 9.10.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer (e.g., Owner, Registered Design Professional, etc.) for the Building and shall be in accordance with [IRC Section R106](#) and [IBC Section 107](#).
- 9.10.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [IRC Section R301](#) and [IBC Section 1603](#).
- 9.10.2. Construction Documents
- 9.10.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.
- 9.11. Responsibilities
- 9.11.1. The information contained herein is a product, engineering or building code compliance technical evaluation report performed in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering procedures, experience and technical judgment.
- 9.11.2. DrJ technical evaluation reports provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated section.
- 9.11.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.

Technical Evaluation Report (TER)

- 9.11.4. This product is manufactured under a third-party quality control program in accordance with [/RC Section R104.4](#) and [R109.2](#) and [/BC Section 104.4](#) and [110.4](#).
- 9.11.5. 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, and the TER shall be reviewed for code compliance by the Building Official.
- 9.11.6. The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party inspection process, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to assure accurate compliance with the applicable building code.

10. Identification:

- 10.1. The fasteners are identified by the designation, "TimberLOK®" on the packaging. The head of each fastener is marked with an "F6.0" corresponding to the length of the fastener (i.e., 6") to be used for the applications described in this TER.
- 10.2. The packaging shall include OMG's name and address, fastener size, third-party inspection agency and TER number.
- 10.3. 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 drjengineering.org.
- 11.2. For information on the current status of this TER, contact [DrJ Engineering](#).



- [Mission and Professional Responsibilities](#)
- [Product Evaluation Policies](#)
- [Product Approval – Building Code, Administrative Law and P.E. Law](#)