Technical Evaluation Report

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

TER No. 1105-02

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Division 06 00 00 – Wood, Plastics and Composites
Section 06 02 00 – Design Information
Section 06 05 23 – Wood, Plastic, and Composite Fastenings
Section 06 11 00 – Wood Framing
Section 06 17 00 – Shop-Fabricated Structural Wood
Section 06 17 53 – Shop-Fabricated Wood Trusses

1. **Product Evaluated:**
   - 1.1. FastenMaster TimberLok® Heavy Duty Wood Screw
2. **Applicable Codes:**
   - 2.1. TimberLok threaded wood fasteners were evaluated for compliance with the following building codes:
     - 2.1.1. *2003, 2006* and *2009 International Building Code* (*IBC*)
     - 2.1.2. *2003, 2006* and *2009 International Residential Code* (*IRC*)
3. **Performance Evaluation:**
   - 3.1. TimberLok fasteners were evaluated, using their tested allowable design values described below, 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 the 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 the 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 the TimberLok fasteners for use as an alternative to toe-nail connections, hurricane and seismic clips/straps or nails in tension (uplift) loaded applications.
4. **Product Description and Materials:**
   - 4.1. TimberLok fasteners are manufactured with 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 exterior conditions and in pressure-treated wood. The proprietary coating has been tested and found to exceed the protection provided by code approved hot-dipped galvanized coatings meeting ASTM A153 (*IBC* 2304.9.5[1] and *IRC* 317.3[2]).

4.4. Fasteners are approved for use in interior conditions.

4.5. 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. In-plant quality control procedures, under which the TimberLok fasteners are manufactured, are audited through an inspection process performed by an approved agency[3].

4.7. The TimberLok fasteners evaluated in this report are designated as follows:

Fastener Designation		Head Marking	Length	Length of Thread
TimberLok	TLOK06	F6.0	6"	2"

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) to wood walls that meet the requirements of *IRC* Section R602 or *IBC* 2308 or 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.

5.1.1. See Table 2 for the design procedure and the TimberLok allowable design values.

5.1.2. See Section 6 for installation requirements.

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 1] are provided in Table 2 for TimberLok fasteners. Allowable design loads are listed for selected load durations and wood-specific gravities and are applicable to fasteners installed in accordance with the procedures described in Section 6.

[1] *IBC* Section **2304.9.5 Fasteners in preservative-treated and fire-retardant-treated wood.** Fasteners for preservative treated and fire-retardant-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153...

[2] **R317.3 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood.** Fasteners and connectors in contact with preservative-treated wood and fire-retardant-treated wood shall be in accordance with this section. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153.

[3] *IBC* Section 1702 **APPROVED AGENCY.** An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been *approved.*

Fastener Designation	Minimum Penetration into Truss/Rafter/Wood Structural Support (in)	Species Group (Specific Gravity)	Uplift			Lateral					
						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 TLOK06	2	So. Pine (0.55)	357	475	571	257	342	411	282	375	451
		Douglas fir-Larch (0.50)	317	422	507	240	319	384	265	352	424
		Hem-Fir (0.43)	263	350	421	216	287	346	236	314	378
		Spruce-Pine-Fir (0.42)	255	339	408	212	282	339	231	307	370

Table Notes:
1. Wood truss and rafter members shall be a minimum of 2" nominal thickness.
2. 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.
3. Tabulated loads based on ICC-ES Report ESR-1078. 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.

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 may be required to account for the combined effect of these loads using accepted engineering practice.

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

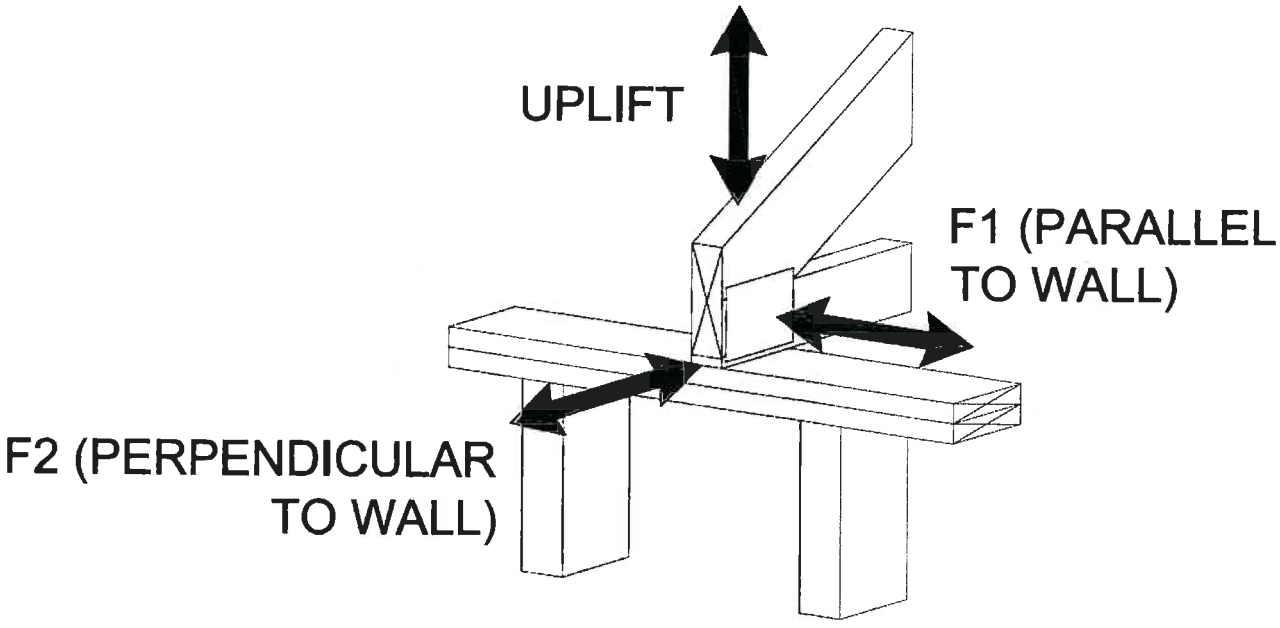

Figure 1: Uplift & Lateral Load Orientations

6. Installation:

6.1. Upward from below truss or rafter

6.1.1. 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 2.

6.1.2. 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 approximately 22.5° +/- 5° (i.e., ½ of 45°), as shown in Figure 2a.

6.1.3. If the truss, rafter or SCL is located between the wall studs, 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 2b.

6.1.4. 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 approximately 22.5° +/- 5° (i.e., ½ of 45°), as shown in Figure 2a.

6.1.5. 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, as shown in Figure 2c.

6.2. Downward from on top of the truss, rafter or SCL

6.2.1. Install one (1) TimberLok fastener at a downward angle from vertical of approximately 22.5° +/- 5° (i.e., ½ of 45°) 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 3.

6.2.2. Locate the fastener so that it penetrates within +/- ¼" 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.

6.3. 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.

6.4. The entire threaded portion of the fastener (i.e., 2") must be embedded in the wall or wood structural framing member.

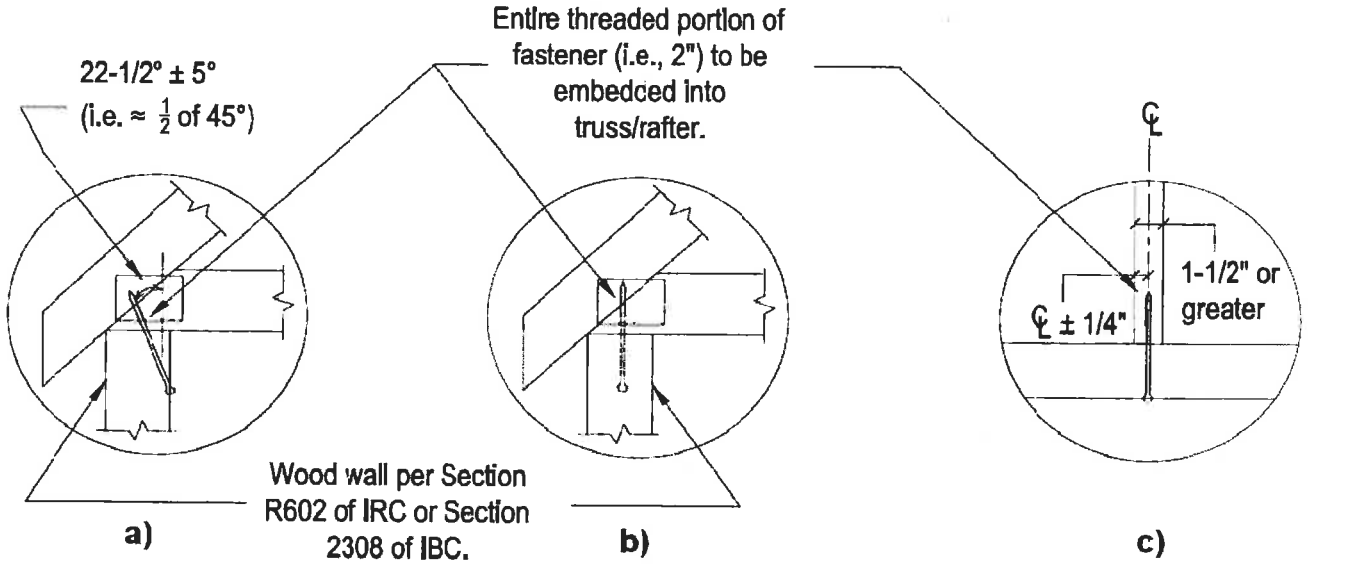

Figure 2a, 2b and 2c: Fastener Orientation Requirements for Attaching Wood Trusses, Rafters or SCL from Below to the Top of a Wood Wall or Structural Framing Member

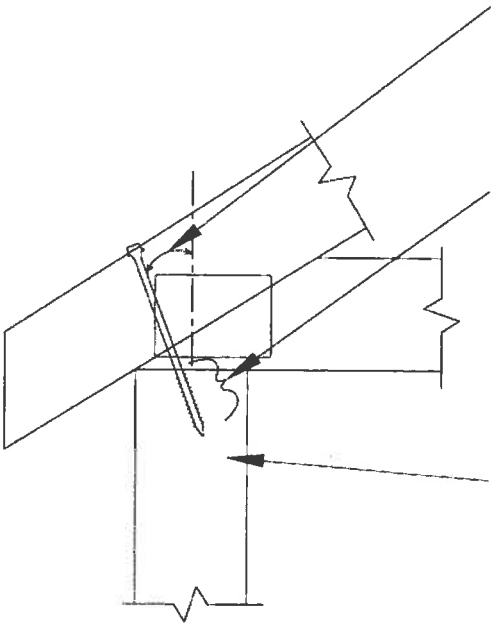

Figure 3: Fastener Orientation Requirements for Attaching Wood Trusses, Rafters or SCL from Above to the Top of a Wood Wall or Structural Framing Member

7. Findings:

7.1. 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. Conditions of Use:

8.1. The TimberLok fasteners covered by this TER shall be installed in accordance with this report and the manufacturer's installation instructions.

8.2. For conditions not covered in this TER, connections shall be designed in accordance with accepted engineering practice.

8.3. Manufacturer's installation instructions shall be followed as provided in Section 6 and at www.fastenmaster.com/details/product/timberlok-heavy-duty-wood-screw.html.

8.4. FastenMaster products are produced by OMG, Inc. at its facility located in Agawam, Massachusetts.

8.5. TimberLok fasteners are produced under a quality control program subject to periodic inspections in accordance with *IBC* Section 1703.5.2.

9. Identification:

9.1. 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.

9.2. The packaging shall include the following information:

9.2.1. OMG's name and address

9.2.2. Fastener size

9.2.3. Third party inspection agency

9.2.4. This TER number

10. References:

10.1. *National Design Specification for Wood Construction* – 2005 Edition, American Forest & Paper Association (*NDS*).

10.2. General Dowel Equations for Calculating Lateral Connection Values (1999), *TR-12*, American Forest & Paper Association.

10.3. SBCRI Test Report, SBCRI-09-0112: *Evaluation of FastenMaster's TimberLok Heavy Duty Wood Screw When Used as a Truss Hold-down*, dated July 29, 2009.

10.4. FastenMaster Technical Bulletin for TimberLok fasteners, *Truss to Top Plate Connection Details*.

10.5. FastenMaster Installation instructions for TimberLok fasteners.

11. Report Date:

11.1. This TER shall be re-evaluated one year from the issue date.

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