

FastenMaster FlatLOK® Fasteners – Ledger Connection to Wood-Framed Walls

TER No. 1611-01

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d/b/a FastenMaster**

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DIVISION: 06 00 00 – WOOD, PLASTICS, AND COMPOSITES
Section: 06 05 23 – Wood, Plastic, and Composite Fastenings

1. Product Evaluated:

- 1.1. FastenMaster FlatLOK® Fasteners
- 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. 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](#).
- 1.4. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements, such as those found in [IBC Section 1703](#). 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.
- 1.5. Requiring an evaluation report from a specific private company (i.e. ICC-ES, IAPMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.

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.

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1.6. DrJ's code compliance work:

- 1.6.1. Conforms to code language adopted into law by individual states and any relevant consensus based standard such as an ANSI or ASTM standard.
- 1.6.2. Complies with accepted engineering practice, all professional engineering laws and by providing an engineer's seal DrJ takes professional responsibility for its specified scope of work.

2. Applicable Codes and Standards:¹

- 2.1. 2012, 2015 and 2018 International Building Code (IBC)
- 2.2. 2012, 2015 and 2018 International Residential Code (IRC)
- 2.3. ASTM A510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
- 2.4. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- 2.5. ASTM D1761 – Standard Test Methods for Mechanical Fasteners in Wood
- 2.6. AWC NDS – National Design Specification for Wood Construction

3. Performance Evaluation:

- 3.1. FlatLOK® fasteners were tested and evaluated to determine their structural resistance properties, which are used to develop reference design values for allowable stress design (ASD). The following conditions were evaluated:
 - 3.1.1. Lateral strength of ledger connections to wood framed walls in accordance with ASTM D1761. This application includes zero, one or two layers of 5/8" gypsum between the ledger and the wall studs (See [Details 1-3](#)).
- 3.2. Use in wet service conditions is outside the scope of this evaluation.
- 3.3. Any code compliance issues not specifically addressed in this section are outside the scope of this evaluation.

4. Product Description and Materials:

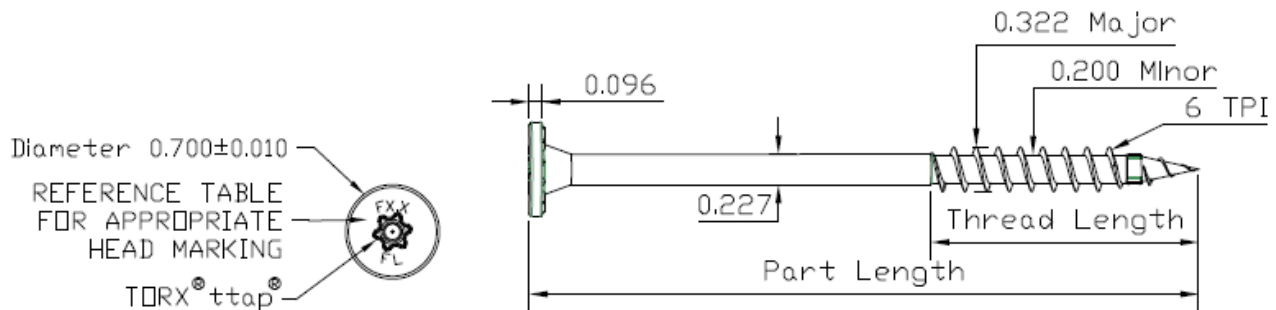


Figure 1: FastenMaster FlatLOK®

- 4.1. FlatLOK® fasteners are manufactured using a standard cold-formed process followed by a heat-treating process.
- 4.2. Fasteners are coated with a proprietary coating that exceeds the protection provided by hot-dipped galvanized coatings conforming to ASTM A153.

¹ Unless otherwise noted, all references in this code compliant technical evaluation report (TER) are from the 2018 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 2000-2015 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 was not approved. For variations in state and local codes, if any see [Section 8](#).

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- 4.3.** Fasteners are approved for use in interior or exterior conditions and in chemically treated or untreated lumber where *ASTM A153* coatings are approved for use in accordance with [IBC Section 2304.10²](#) and [IRC Section R317.3](#).
- 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 2304.10.5³](#) and [IRC Section R317.3](#)), allowing for its use in pressure treated (ACQ) wood.
- 4.3.2.** 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.
- 4.4.** The fasteners evaluated in this TER are set forth in [Table 1](#).

Fastener Name	Head (in.)			Fastener Length ¹ (in.)	Shank Diameter ² (in.)	Thread Length ¹ (in.)	Thread Diameter (in.)		Nominal Bending Yield ³ (<i>f_{yb}</i> , psi)	Allowable Fastener Strength	
	Marking	Diameter	Thickness				Minor	Major		Tensile (lbf)	Shear (lbf)
FlatLOK®	F5.0FL	0.70"	0.095"	5"	0.227"	2.00"	0.200"	0.322"	171,600	1940	1230

For SI: 1" = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 6.895 kPa.

1. Fastener length is measured from the top side of the head to the tip. Thread length includes tapered tip (see [Figure 1](#)).

2. Shank diameter based on manufactured thickness. Finished dimensions are larger, due to the proprietary coatings added.

3. Bending yield determined at shank diameter.

Table 1: Fastener Dimensions & Strength Details

5. Applications:

5.1. General

- 5.1.1.** FlatLOK® fasteners are used to attach a ledger board to a stud through one or two layers of gypsum wall board in conventional light-frame construction and provide resistance to lateral loads applied vertically to the ledger. See [Section 6](#) for installation requirements.
- 5.1.2.** FlatLOK® fasteners are installed without the lead holes prescribed in *NDS*.
- 5.1.3.** Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment.
- 5.1.4. Design**
- 5.1.4.1.** Design of FlatLOK® fasteners are governed by the applicable code and the provisions for dowel-type fasteners in *NDS*.
- 5.1.4.2.** Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

5.2. FlatLOK® Reference Lateral Design Values

- 5.2.1.** The reference lateral design values in ledger connection applications for FlatLOK® fasteners are specified in [Table 2](#) and [Details 1-9](#).

² [2012 IBC Section 2304.9](#)

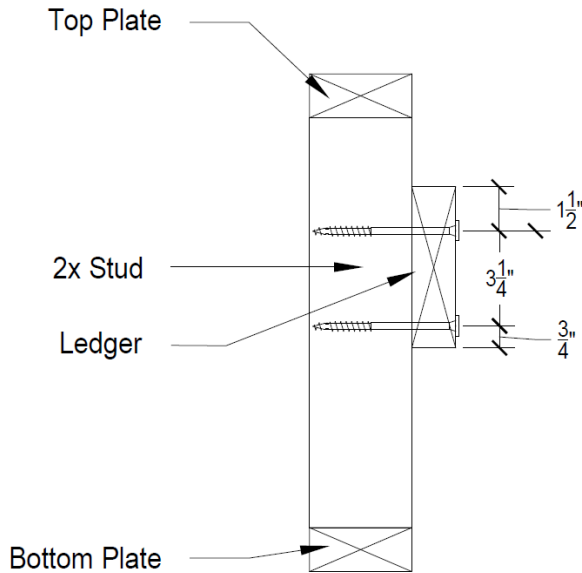
³ [2012 IBC Section 2304.9.5](#)

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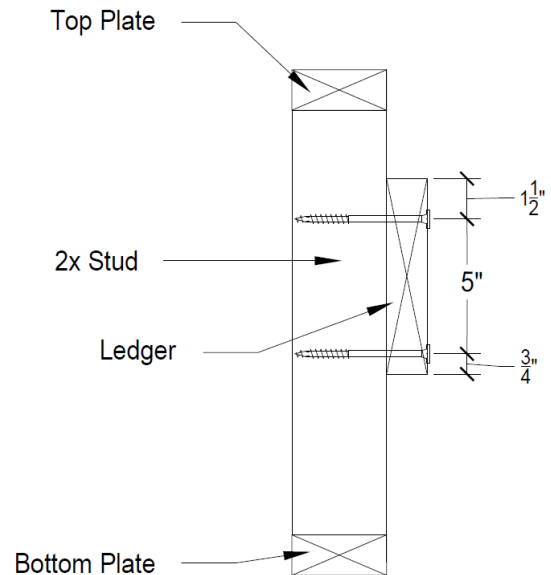
Allowable Load per Stud Connection (lbs) (Adjusted for Specific Gravity of Lumber)						
Fastener	Ledger Size	Detail ² Number	Fasteners Per Stud ¹	Lumber Species		
				Spruce-Pine-Fir	Douglas Fir-Larch	Southern Yellow Pine
FlatLOK® 5"	2x6	1, 4, 7	2	360	510	795
	2x8	2, 5, 8	2	580	735	900
	2x10	3, 6, 9	3	805	860	1075

1. Additional fasteners prohibited.
2. Minimum fastener penetration of 2¼" into the main member.
3. The above values apply where the ledger is applied either directly over the studs or with up to two layers of 5/8" gypsum between the ledger and studs.
4. Allowable loads shall be limited to parallel-to-grain loaded solid sawn main members (minimum 2" nominal). Wood side members shall be loaded perpendicular to grain.
5. Allowable loads are shown at the wood load duration factor of CD = 1.00. Loads may be increased for load duration as permitted by the building code up to a CD = 1.60. All adjustment factors shall be applied per *NDS*. For in-service moisture content greater than 19%, use $C_M = 0.70$.
6. Fasteners shall be centered in the stud and spaced as shown in the details. The stud minimum end distance is 6-3/4" when loaded toward the end and 4" when loaded away from the end. The ledger end distance is 6" for full values. For ledger end distances between 2" and 6" use 50% of the table loads. For end distances between 2" and 4", predrill using a 5/32" bit.
7. For LRFD values, the reference connection design values shall be adjusted in accordance with the *NDS*, Section 11.3.
8. Gypsum board must be attached as required per the building code.

Table 2: Fastener Design Values

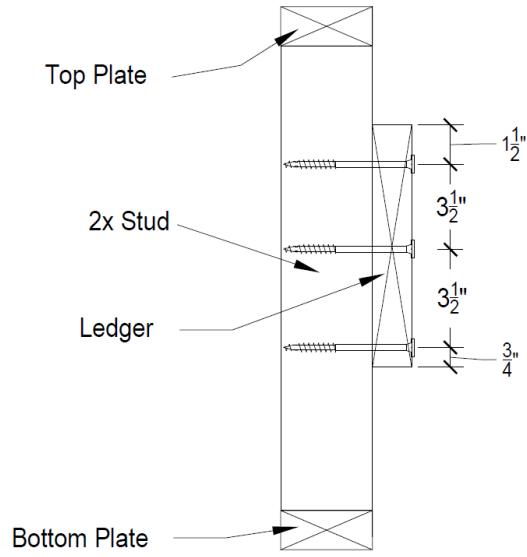


Detail 1: 2x6 Ledger Configuration with No GWB



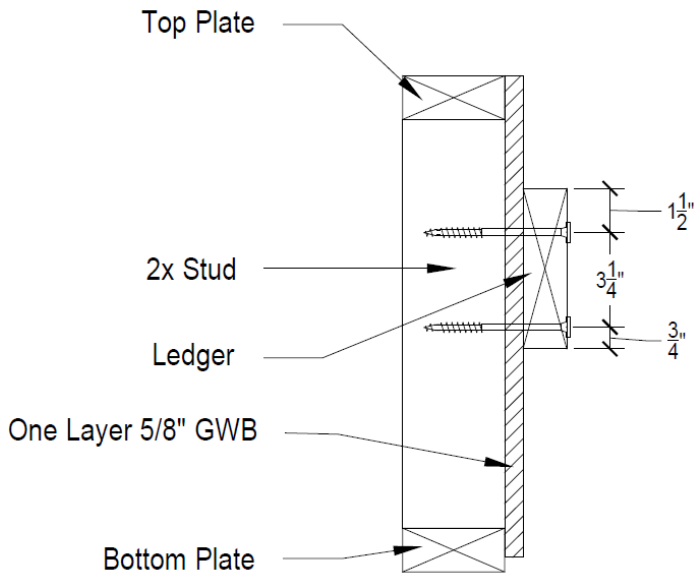
Detail 2: 2x8 Ledger Configuration with No GWB

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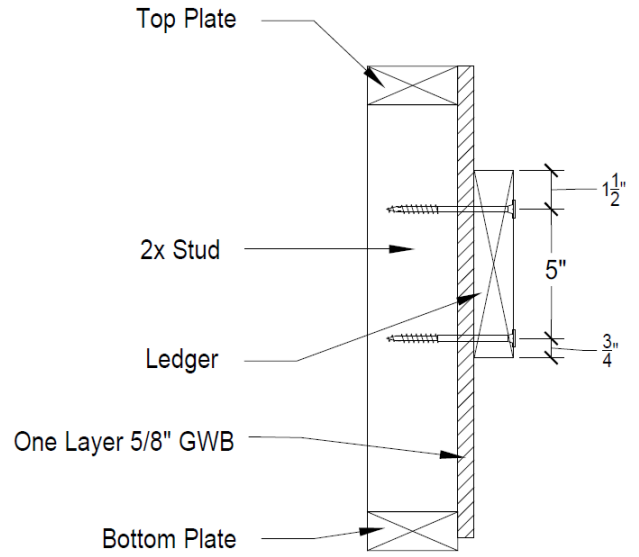


Detail 3: 2x10 Ledger Configuration with No GWB

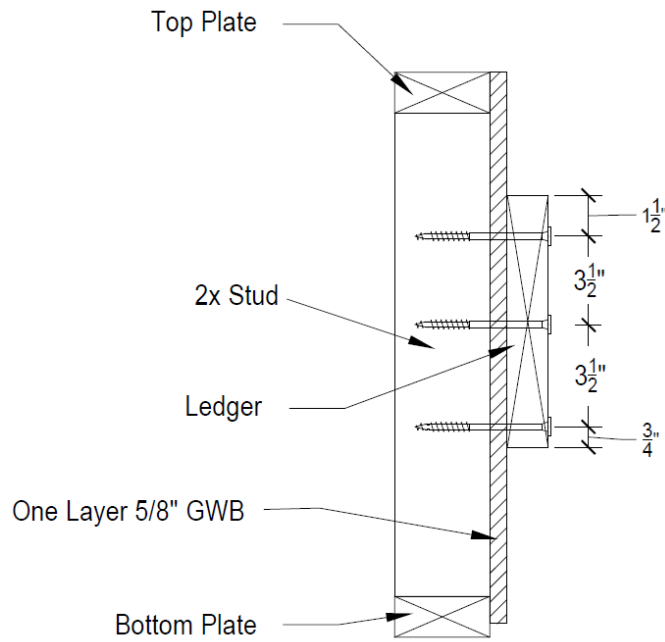
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Detail 4: 2x6 Ledger Configuration with One Layer GWB

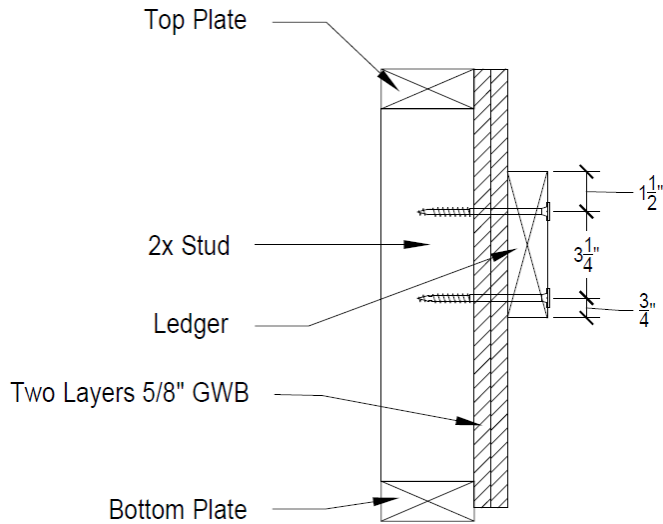


Detail 5: 2x8 Ledger Configuration with One Layer GWB

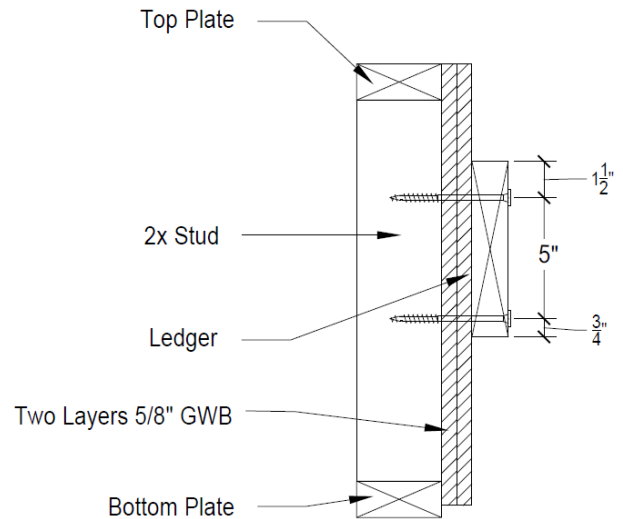


Detail 6: 2x10 Ledger Configuration with One Layer GWB

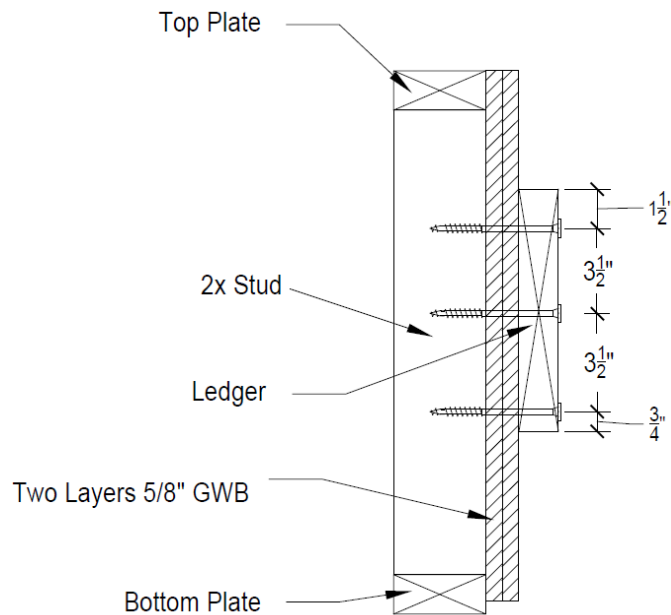
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Detail 7: 2x6 Ledger Configuration with Two Layers GWB



Detail 8: 2x8 Ledger Configuration with Two Layers GWB



Detail 9: 2x10 Ledger Configuration with Two Layers GWB

6. Installation:

6.1. FlatLOK® fasteners shall be installed in accordance with the applicable code, the approved construction documents, this TER, the [manufacturer's installation instructions](#), *NDS*, and standard framing practice as applied to wood fasteners.

6.1.1. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

6.2. Use a 1/2" low RPM/high torque drill to drive the fastener head flush with the surface of the framing member using the driver bit included with the fasteners.

7. Test and Engineering Substantiating Data:

7.1. Testing for lateral strength by SBCRI, under contract with Qualtim, Inc., in accordance with *ASTM D1761*.

7.2. *ASTM A510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.*

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- 7.3. *ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.*
- 7.4. *National Design Specification for Wood Construction (NDS).*
- 7.5. The product(s) evaluated by this TER fall 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.
- 7.6. 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 engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.7. 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.
- 7.8. DrJ has reviewed and found the data provided by other professional sources are credible. The information in this TER conforms with DrJ's procedure for acceptance of data from approved sources.
- 7.9. DrJ's responsibility for data provided by approved sources conforms with [IBC Section 1703](#) and any relevant professional engineering law.
- 7.10. 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, NDS, ACI, AISI, PS-20, PS-2*, etc.). 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, concrete, etc), DrJ relies upon grade/properties provided by the raw material supplier to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8. Findings:

- 8.1. When used in accordance with the provisions of this TER and the provisions of the applicable building codes defined in [Section 2](#), FlatLOK® fasteners have the reference design value properties defined herein and are approved for use as an alternative to those fasteners prescribed by the applicable code.
- 8.2. [IBC Section 104.11](#) ([IRC Section R104.11](#) and [IFC Section 104.9](#) are 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, 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*.
- 8.3. 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:
 - 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 TER 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.

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- 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 FlatLOK® fasteners covered in this TER shall be installed in accordance with this TER and the [manufacturer's installation instructions](#).
- 9.5. For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practice.
- 9.6. [Manufacturer's installation instructions](#) shall be followed as provided in [Section 6](#) and at fastenmaster.com/products/flatlok-structural-wood-screw.html.
- 9.7. FlatLOK® fasteners products are produced by OMG, Inc. at its facility located in Agawam, Massachusetts.
- 9.8. FlatLOK® fasteners are produced under a quality control program subject to periodic inspections performed by an approved agency in accordance with [IBC Section 1703.5.2](#).
- 9.9. Design
 - 9.9.1. Building Designer Responsibility
 - 9.9.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer for the Building and shall be in accordance with [IRC Section R106](#) and [IBC Section 107](#).
 - 9.9.1.2. 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](#).
 - 9.9.2. Construction Documents
 - 9.9.2.1. 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.
- 9.10. Responsibilities
 - 9.10.1. The information contained herein is a product, material, detail, design and/or application TER evaluated in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering practice, experience and technical judgment.
 - 9.10.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.
 - 9.10.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.
 - 9.10.4. This product is manufactured under a third-party quality control program in accordance with [IRC Section R104.4](#) and [R109.2](#) and [IBC Section 104.4](#) and [110.4](#).
 - 9.10.5. 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.
 - 9.10.6. 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 FlatLOK® fasteners described in this TER are identified by a label on the packaging material bearing the manufacturer's name, product name, certification mark, and other information to confirm code compliance.
- 10.2. Additional technical information can be found at fastenmaster.com.

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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](#)