



CERTIFICATION



Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1501-08

FastenMaster® FlatLOK® Fasteners

**OMG, Inc.
DBA FastenMaster®**

Product:

**FastenMaster® FlatLOK®
Fasteners**

Issue Date:

May 14, 2015

Revision Date:

June 16, 2021

Subject to Renewal:

July 1, 2022



COMPANY
INFORMATION:

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DBA FastenMaster®

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

1 PRODUCT EVALUATED¹

1.1 FastenMaster® FlatLOK® Fasteners

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*

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 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 Withdrawal strength in accordance with *ASTM D1761*
 - 3.1.2 Shear strength for use as an alternative to metal straps, ties, or fasteners in shear (lateral) loaded applications either parallel or perpendicular to wood grain in accordance with *ASTM D1761*
 - 3.1.3 Head pull-through in accordance with *ASTM D1761*
- 3.2 Use in wet service conditions is outside the scope of this TER.
- 3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.4 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 The product evaluated in this TER is shown in Figure 1.

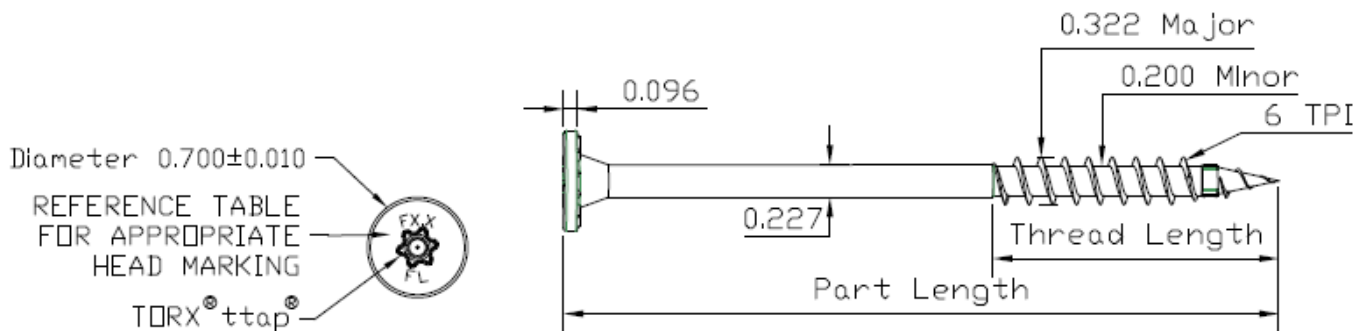


FIGURE 1. FASTENMASTER® FLATLOK®

- 4.2 FlatLOK® fasteners are manufactured using a standard cold-formed process followed by a heat-treating process.
- 4.3 Fasteners are coated with a proprietary coating that exceeds the protection provided by hot-dipped galvanized coatings conforming to *ASTM A153*.
- 4.4 Fasteners are approved for use in interior conditions and in chemically treated or untreated lumber where *ASTM A153* coatings are approved for use in accordance with *IBC Section 2304.10*⁴ and *IRC Section R317.3*.
 - 4.4.1 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*⁵ and *IRC Section R317.3*), allowing for its use in pressure treated (ACQ) wood.
 - 4.4.2 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.
 - 4.4.3 The fasteners evaluated in this TER are set forth in Table 1.

⁴ 2012 *IBC Section 2304.9*

⁵ 2012 *IBC Section 2304.9.5*

TABLE 1. FASTENER SPECIFICATIONS

Fastener Name	Head (in)			Fastener Length ¹ (in)	Shank Diameter ² (in)	Thread Length ¹ (in)	Thread Diameter (in)		Nominal Bending Yield, ³ f _{yb} (psi)	Allowable Fastener Strength (lbf)	
	Marking	Diameter	Thickness				Minor	Major		Tensile	Shear
FlatLOK®	F2.9FL	0.70	0.095	2 ⁷ / ₈	0.227	1.75	0.200	0.322	171,600	1940	1230
	F3.5FL			3 ¹ / ₂		2.00					
	F4.0FL			4							
	F4.5FL			4 ¹ / ₂							
	F5.0FL			5							
	F6.0FL			6							
	F6.75FL			6 ³ / ₄							

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 psi = 0.00689 MPa

1. Fastener length is measured from the topside 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.

5 APPLICATIONS

5.1 General

- 5.1.1 FlatLOK® fasteners are used to attach wood framing members in conventional light-frame construction and provide resistance to lateral and withdrawal loads applied parallel and/or perpendicular to the structural framing member. See Section 6 for installation requirements.
- 5.1.2 FlatLOK® fasteners are installed without lead holes, as 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 is 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 – Face Grain Applications

- 5.2.1 The reference lateral design values for shear load perpendicular and parallel to grain for FlatLOK® fasteners, as depicted in Figure 2, are specified in Table 2, Table 3, Table 4, Table 5, and Table 6.

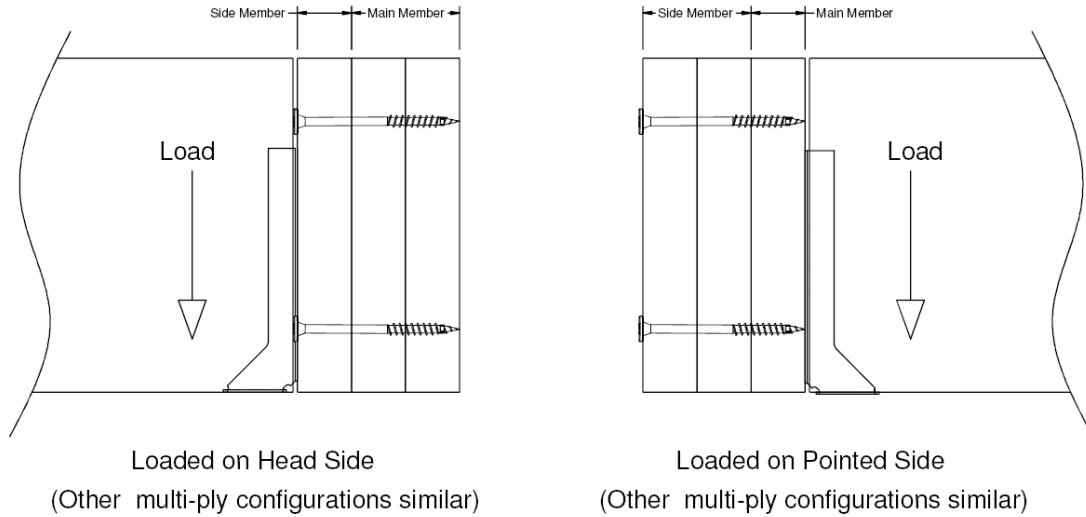


FIGURE 2. LOADING DIAGRAM FOR SHEAR PERPENDICULAR TO GRAIN

TABLE 2. FLATLOK® REFERENCE LATERAL DESIGN VALUES – DIMENSIONAL LUMBER WITH HEAD SIDE LOADING^{1,2}

FlatLOK® Fastener	Fastener Length (in)	Side Member Thickness (in)	Min. Penetration into Main Member (in)	Lateral Design Values (lbf) by Species (Specific Gravity) & Load Orientation					
				SPF (0.42)		D.Fir (0.50)		S.Pine (0.55)	
				Z Perp	Z Para	Z Perp	Z Para	Z Perp	Z Para
FL278	2 ⁷ / ₈	1 ¹ / ₂	1 ³ / ₈	200	150	240	235	270	270
FL312	3 ¹ / ₂	1 ¹ / ₂	2	200	150	240	235	270	270
FL004	4	1 ¹ / ₂	2 ¹ / ₂	200	150	240	235	270	270
FL412	4 ¹ / ₂	1 ¹ / ₂	3	320	245	480	350	550	440
FL005	5	1 ¹ / ₂	3	320	245	480	350	550	440
FL006	6	1 ¹ / ₂	3	320	245	480	350	550	440
FL634	6 ³ / ₄	1 ¹ / ₂	3	320	245	480	350	550	440

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Reference lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
- Values shall be adjusted by all applicable adjustment factors per *NDS*.



TABLE 3. FLATLOK® REFERENCE LATERAL DESIGN VALUES – DIMENSIONAL LUMBER WITH POINT SIDE LOADING^{1,2}

FlatLOK® Fastener	Fastener Length (in)	Side Member Thickness (in)	Min. Penetration into Main Member (in)	Lateral Design Values (lbf) by Species (Specific Gravity) & Load Orientation					
				SPF (0.42)		D.Fir (0.50)		S.Pine (0.55)	
				Z Perp	Z Para	Z Perp	Z Para	Z Perp	Z Para
FL412	4½	3	1½	200	–	260	–	290	–
FL006	6	4½	1½	200	–	260	–	290	–

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Reference lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
- Values shall be adjusted by all applicable adjustment factors per *NDS*.

TABLE 4. FLATLOK® REFERENCE LATERAL DESIGN VALUES – ENGINEERED LUMBER IN FACE GRAIN APPLICATIONS WITH HEAD SIDE LOADING^{1,2}

FlatLOK® Fastener	Fastener Length (in)	Side Member Thickness (in)	Min. Penetration into Main Member (in)	Lateral Design Values (lbf) by Species (Specific Gravity) & Load Orientation			
				LVL (0.50)		LSL (0.50)	
				Z Perp	Z Para	Z Perp	Z Para
FL278	2⅞	1¼	1¼	375	235	435	235
FL312	3½	1¾	1¾	375	235	435	235
FL005	5	1¾	3¼	560	350	480	350
FL634	6¾	1¾	5	560	350	480	350
FL634	6¾	3½	3¼	560	350	480	350

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Reference lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
- Values shall be adjusted by all applicable adjustment factors per *NDS*.

TABLE 5. FLATLOK® REFERENCE LATERAL DESIGN VALUES – ENGINEERED LUMBER WITH POINT SIDE LOADING^{1,2}

FlatLOK® Fastener	Fastener Length (in)	Side Member Thickness (in)	Min. Penetration into Main Member (in)	Lateral Design Values (lbf) by Species (Specific Gravity) & Load Orientation			
				LVL (0.50)		LSL (0.50)	
				Z Perp	Z Para	Z Perp	Z Para
FL312	3½	1¾	1¾	330	235	260	235
FL005	5	3½	1½	330	235	260	235
FL634	6¾	5	1¾	330	235	260	235
FL634	6¾	3¼	3½	330	235	260	235

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Reference lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
- Values shall be adjusted by all applicable adjustment factors per *NDS*.



5.3 FlatLOK® Reference Lateral Design Values – Edge Grain Applications

TABLE 6. FLATLOK® REFERENCE LATERAL DESIGN VALUES – DIMENSIONAL & ENGINEERED LUMBER IN EDGE GRAIN APPLICATIONS^{1,2}

FlatLOK® Fastener	Fastener Length (in)	Side Member Thickness (in)	Min. Penetration into Main Member (in)	Lateral Design Values (lbf) by Species (Specific Gravity) Parallel to Grain Loading			
				SPF (0.42)	D.Fir (0.50)	S.Pine (0.55)	LSL ³ (0.50)
FL006	6	3½	2½	235	300	285	225

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Reference lateral design values apply to two-member single shear connections where both members are of the same specific gravity, and the fastener is oriented perpendicular to grain. Where the members are of different specific gravities, use the lower of the two.
- Values shall be adjusted by all applicable adjustment factors per *NDS*.
- Minimum thickness 1¼"

5.4 FlatLOK® Reference Withdrawal Design Values

5.4.1 The design provisions for withdrawal noted in *NDS* Table 12.2B apply to FlatLOK® fasteners, unless otherwise noted in this TER. Reference withdrawal design values for FlatLOK® fasteners in select lumber species are specified in Table 7, Table 8, and Table 9.

TABLE 7. FLATLOK® REFERENCE WITHDRAWAL DESIGN VALUES – FACE GRAIN APPLICATIONS^{1,2}

Thread Penetration into Main Member (in)	Reference Withdrawal Design Values (lbf) by Species (Specific Gravity)				
	SPF (0.42)	D.Fir (0.50)	S.Pine (0.55)	LVL (0.50)	LSL (0.50)
1	90	145	140	140	140
1¼	125	190	210	210	220
1½	160	240	280	275	295
1¾	195	285	355	345	375
2	230	335	425	410	450

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Values shall be adjusted by all applicable adjustment factors per *NDS* Section 11.3 for wood screws.
- Fastener penetration is that threaded length embedded in the main member, including the tip.

TABLE 8. FLATLOK® REFERENCE WITHDRAWAL DESIGN VALUES – EDGE GRAIN APPLICATIONS^{1,2}

Thread Penetration into Main Member (in)	Reference Withdrawal Design Values (lbf) by Species (Specific Gravity)				
	SPF (0.42)	D.Fir (0.50)	S.Pine (0.55)	LVL (0.50)	LSL (0.50)
1	100	160	125	125	125
1 ¹ / ₄	145	215	190	185	195
1 ¹ / ₂	190	275	260	240	265
1 ³ / ₄	235	330	325	300	335
2	280	390	390	360	405

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Values shall be adjusted by all applicable adjustment factors per *NDS* Section 11.3 for wood screws.
- Fastener penetration is that threaded length embedded in the main member, including the tip.

TABLE 9. FLATLOK® REFERENCE WITHDRAWAL DESIGN VALUES – END GRAIN APPLICATIONS^{1,2}

Thread Penetration into Main Member (in)	Reference Withdrawal Design Values (lbf) by Species (Specific Gravity)				
	SPF (0.42)	D.Fir (0.50)	S.Pine (0.55)	LVL (0.50)	LSL (0.50)
2	175	295	285	–	–

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Values shall be adjusted by all applicable adjustment factors per *NDS* Section 11.3 for wood screws.
- Fastener penetration is that threaded length embedded in the main member, including the tip.

5.5 FlatLOK® Reference Head Pull-Through Design Values

5.5.1 The reference design values for head pull-through for FlatLOK® fasteners are specified in Table 10.

TABLE 10. FLATLOK® REFERENCE HEAD PULL-THROUGH DESIGN VALUES¹

Min. Side Member Thickness (in)	Head Pull-Through Design Values (lbf) by Species (Specific Gravity)					
	SPF (0.42)	DF (0.50)	SP (0.55)	LVL (0.50)	LSL (0.50)	7/16" OSB
1.5	395	530	595	650	750	100

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

- Values shall be adjusted by all applicable adjustment factors per *NDS* Section 11.3 for wood screws.

5.5.2 Edge and End Distance:

5.5.2.1 Fastener edge and end distances shall be as specified in Figure 3 and Table 11.

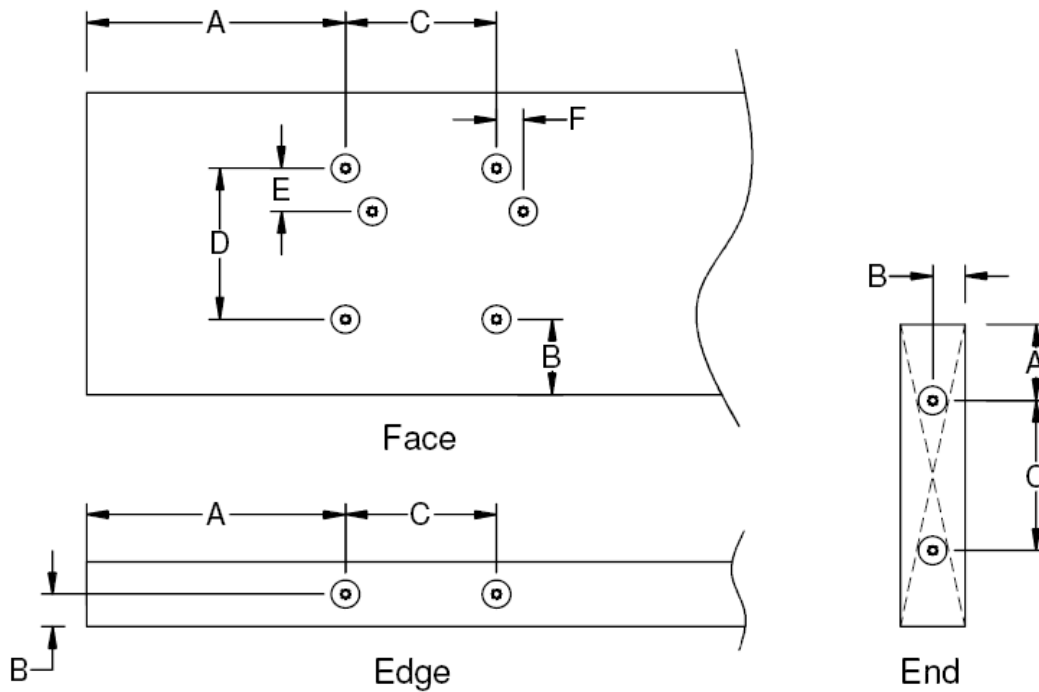


FIGURE 3. FLATLOK® EDGE AND END DISTANCE REQUIREMENTS

TABLE 11. FLATLOK® EDGE AND END DISTANCE REQUIREMENTS

Letter	Installed Condition	Minimum Distance or Spacing (in) ¹		
		Face	Edge	End
A	Min. End Distance	6	6	1 ³ / ₄
B	Min. Edge Distance	1 ³ / ₄	³ / ₄	³ / ₄
C	Min. Spacing Between Fasteners in a Row	3 ¹ / ₂	3 ¹ / ₂	3 ¹ / ₂
D	Min. Spacing Between Non-Staggered Rows	3 ¹ / ₂	NA	NA
E	Min. Spacing Between Staggered Rows	⁵ / ₈	NA	NA
F	Min. Stagger Between Fasteners in Adjacent Rows	⁵ / ₈	NA	NA

SI: 1 in = 25.4 mm

1. Edge distances, end distances, and spacing of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table – whichever is more restrictive

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 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 Withdrawal, shear, and head pull-through testing in accordance with *ASTM D1761*
- 7.2 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.
- 7.3 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 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 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.
 - 8.2.1 No known variations
- 8.3 Building codes require data from valid research reports be obtained from approved sources (i.e., licensed registered design professionals [RDPs]).
 - 8.3.1 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.
- 8.4 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.
- 8.5 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.”
- 8.6 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 The FlatLOK® fasteners covered in this TER shall be installed in accordance with this TER and the manufacturer's installation instructions, as provided in Section 6 and at fastenmaster.com/products/flatlok-structural-wood-screw.html.
- 9.2 For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practice.



- 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 The product(s) listed in Section 1.1 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.