



CERTIFICATION



Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1009-01

Use of FastenMaster® HeadLOK®
Fasteners to Attach Cladding and/or
Furring to Wood Framing through Foam
Sheathing

OMG, Inc.
DBA FastenMaster®

Product:

FastenMaster® HeadLOK®
Heavy Duty Flathead Fasteners

Issue Date:

March 27, 2011

Revision Date:

March 31, 2021

Subject to Renewal:

April 1, 2022



COMPANY
INFORMATION:

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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 12 00 - Structural Panels
SECTION: 06 16 00 - Sheathing
SECTION: 06 17 00 - Shop-Fabricated Structural Wood

1 PRODUCT EVALUATED¹

- 1.1 FastenMaster® HeadLOK® Heavy Duty Flathead 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 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*
- 2.2.3 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
- 2.2.4 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*
- 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 The HeadLOK® fasteners were evaluated, using their tested allowable design values described below, as an alternate means of attaching cladding systems over exterior mounted rigid foam insulation. The following properties were evaluated:
 - 3.1.1 Dowel bending strength of HeadLOK® fasteners for use as an alternative to wood screws or lag screws in shear, where the fasteners are applied horizontally and the load is applied vertically.
 - 3.1.2 Withdrawal strength of HeadLOK® fasteners for use as an alternative to wood screws or lag screws in tension where the fasteners are applied horizontally and the load is applied vertically causing the fastener to pull out.
 - 3.1.3 Head pull through strength of HeadLOK® fasteners for use as an alternative to wood screws or lag screws in tension where the fasteners are applied horizontally and the load is applied vertically causing the fastener head to pull through.
 - 3.1.4 Shear strength of the HeadLOK® fasteners for use as an alternative to wood screws or lag screws in shear where the fasteners are applied horizontally and the load is applied vertically either parallel or perpendicular to wood grain.
- 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 Dr.J'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 HeadLOK® fasteners are manufactured with carbon steel wire conforming to *ASTM A510* with a minimum ultimate tensile strength of 60 ksi.
- 4.2 HeadLOK® fasteners are manufactured using a standard cold-formed process followed by a heat-treating process.
- 4.3 HeadLOK® 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 Section 2304.10.5*⁴ and *IRC Section R317.3*).
- 4.4 HeadLOK® fasteners are approved for use in interior conditions.
- 4.5 HeadLOK® 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 HeadLOK® fasteners are available in the styles and sizes shown in Table 1.

⁴ 2012 IBC Section 2304.9.5

TABLE 1. HEADLOK® FASTENER AVAILABILITY

Length (in)	Product SKU	Quantity per Box
2 $\frac{7}{8}$	FMHLGM278 -250	500
3 $\frac{3}{4}$	FMHLGM334 -250	250
4 $\frac{1}{2}$	FMHLGM412 -250	250
5	FMHLGM005 -250	250
5 $\frac{1}{2}$	FMHLGM512 -250	250
6	FMHLGM006 -250	250
6 $\frac{1}{2}$	FMHLGM612 -250	250
7	FMHLGM007 -250	250
7 $\frac{1}{2}$	FMHLGM712 -250	250
8	FMHLGM008 -250	250
8 $\frac{1}{2}$	FMHLGM812 -250	250
9	FMHLGM009 -250	250
9 $\frac{1}{2}$	FMHLGM912 -250	250
10	FMHLGM010 -250	250
11	FMHLGM011 -250	250
12	FMHLGM012 -250	250
13	FMHLGM013 -250	250
14	FMHLGM014 -250	250
15	FMHLGM015 -250	250
16	FMHLGM016 -250	250
18	FMHLGM018 -250	250
SI: 1 in = 25.4 mm		

5 APPLICATIONS

- 5.1 HeadLOK® fasteners are used to attach wall sheathing, furring and/or cladding to the wall framing through an intermediate layer of foam sheathing to provide resistance to transverse loads in conventional light-frame wood construction.
 - 5.1.1 See Table 2 for a prescriptive solution to fastener spacing requirements for various installation conditions.
- 5.2 HeadLOK® fasteners are used to support the dead load of wall sheathing, furring and/or cladding when connected to the wall framing through an intermediate layer of foam sheathing.
 - 5.2.1 See Table 2 for fastening requirements for various siding weight and framing conditions.
- 5.3 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment.



5.4 Design Procedure

5.4.1 Calculate the fastener spacing:

- 5.4.1.1 Step 1: Determine the spacing between studs or framing members, either 16" or 24" o.c.
- 5.4.1.2 Step 2: Calculate the correct thickness of rigid foam, up to 4", needed to obtain the required insulation effect or R-value.
- 5.4.1.3 Step 3: Choose the furring or sheathing (substrate) material that the cladding will be affixed to:
 - 5.4.1.3.1 Minimum $\frac{3}{4}$ " x $3\frac{1}{2}$ " wood or Wood Structural Panel (WSP) furring
 - 5.4.1.3.2 Minimum $\frac{3}{8}$ " WSP sheathing
 - 5.4.1.3.3 Ensure that the substrate allows for cladding connections that are compliant with the cladding manufacturer's installation and connection instructions and meet the applicable building code.
- 5.4.1.4 Step 4: Determine the actual weight for the cladding materials being installed, per square foot, as given by the cladding manufacturer's specifications.
 - 5.4.1.4.1 Typical cladding weights are 1.3 psf for vinyl siding, 2.5 psf for cement board siding, 11 psf for Portland cement stucco and 25 psf for adhered masonry veneer; use actual weights for materials installed.
 - 5.4.1.4.2 Wood furring may add up to 1 psf of additional weight; wood sheathing may add up to 1.5 psf, depending on thickness.
- 5.4.1.5 Step 5: Using these four values together, find the proper fastening pattern of between 6" and 24" o.c. using Table 2.

TABLE 2. RECOMMENDED FASTENER SPACING FOR VARIOUS THICKNESSES OF FOAM SHEATHING, STUD SPACING, AND CLADDING WEIGHT WHEN CONNECTED TO WOOD STUDS USING HEADLOK® FASTENERS^{1,2,3,4,6,7,8,9}

Stud Spacing ¹ (in)	Foam Thickness (in)	Maximum Allowable Cladding Weight (psf) to be Supported ⁵									
		10	15	20	25	30	10	15	20	25	30
		Fastener Spacing (in) When Using Minimum 3/4" x 3 1/2" Wood or WSP Furring					Fastener Spacing (in) When Using Minimum 3/8" WSP Sheathing				
16	1										
	1.5	24 o.c.		16 o.c.		12 o.c.		12 o.c.			
	2				12 o.c.					8 o.c.	
	3			12 o.c.		8 o.c.			8 o.c.		6 o.c.
	4	16 o.c.	12 o.c.			6 o.c.			6 o.c.	NA	
24	1	24 o.c.		16 o.c.		12 o.c.					
	1.5			12 o.c.		12 o.c.			8 o.c.		
	2	16 o.c.	12 o.c.	8 o.c.		6 o.c.				6 o.c.	
	3				6 o.c.			8 o.c.	6 o.c.		
	4	12 o.c.		6 o.c.		NA		8 o.c.	6 o.c.	NA	

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

1. Wood framing (studs) shall be a minimum of 2" nominal thickness.
2. Wood framing and furring shall be minimum Spruce-Pine-Fir or any species with specific gravity, G, of 0.42 or greater.
3. Wood framing, furring, and sheathing shall be designed by others and shall be of adequate size, species, and grade to resist design loads and requirements in accordance with the applicable building code.
4. Furring may be installed vertically or horizontally and shall be installed at the same on-center spacing as the studs. All fasteners shall be installed through the furring and into the studs with a minimum 2" of penetration. Alternately, where the furring is installed horizontally, and where the required fastener spacing is 8" o.c. or 12" o.c., the furring may be installed at 16" o.c. or 24" o.c., respectively, provided two (2) fasteners are installed at stud location. Likewise, where the fastener spacing is 6" o.c., the furring may be installed horizontally at 12" o.c. and two (2) fasteners used at each stud. Where multiple fasteners are used, furring or sheathing (substrate) shall be of adequate size to provide proper edge, end, and fastener spacing distances.
5. Maximum allowable cladding weight shall include weight of furring, sheathing, cladding and other supported materials.
6. Furring type and thickness shall be selected based on the cladding manufacturer's installation requirements (e.g., required fastener penetration into furring).
7. When using horizontal furring, or where durability of the furring is a concern due to moisture between the cladding and the sheathing, consideration should be given to using preservative treated furring.
8. Tabulated solutions are limited to 4" maximum thickness of foam sheathing. Special design required for thicknesses of foam sheathing greater than 4". For cladding attachment over foam sheathing exceeding 4" thickness, a design professional should be consulted.
9. Foam plastic insulation shall be a minimum 15 psi compressive strength and shall be in conformance to ASTM C578 or ASTM C1289, as applicable.
10. For cladding system weights exceeding 30 psf, a design professional should be consulted.

5.4.2 Check for wind resistance:

5.4.2.1 Step 1: Using the information derived from Steps 1 through 5 in Section 5.4.1, determine the allowable design wind pressure using HeadLOK® fasteners from Table 3.

TABLE 3. ALLOWABLE DESIGN WIND PRESSURE FOR CONNECTIONS USING HEADLOK® FASTENERS^{1,3,4}

Furring or WSP Installation Condition	Min. 1x4 Wood Furring ² 16" o.c. studs				Min. 1x4 Wood Furring ² 24" o.c. studs				Min. 3/8" WSP ² 16" o.c. studs			Min. 3/8" WSP ² 24" o.c. studs		
	HeadLOK® Fastener Spacing in Furring or Sheathing (in)	24	16	12	8	24	16	12	8	12	8	6	12	8
Connection Allowable Design Wind Pressure (psf) ⁵	49	73	98	147	33	49	65	98	49	73	98	33	49	65

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

1. Wood framing and furring shall be minimum Spruce-Pine-Fir or any species with specific gravity, G, of 0.42 or greater.
2. Wood framing, furring, and sheathing shall be designed by others and shall be of adequate size, species, and grade to resist design loads and requirements in accordance with the applicable building code.
3. Connection allowable design wind pressure applies to connection resistance only and shall meet or exceed design wind pressure.
4. Where required by the applicable building code, adequate resistance of connections and materials to seismic forces shall be provided based on local seismic ground motion hazard and the weight of the supported cladding system.
5. For use with the Allowable Stress Design load combinations of ASCE 7.

5.4.2.2 Step 2: Based on the design wind speed (110-150 mph) and wind exposure category (B-D) specific to your region, determine the design wind pressure to be resisted for your application from Table 4.

TABLE 4. EXAMPLE OF COMPONENTS & CLADDING DESIGN WIND LOADS^{1,2,3,4,5}

Design Wind Speed (V_{ult}) (mph) & Exposure	110/B	115/B	120/B	130/B	140/B	150/B
	-	-	-	110/C	120/C	130/C
	-	-	-	-	110/D	120/D
Design Negative Wind Pressure Load to be Resisted (psf) ⁶	17.5	19.1	20.8	24.4	29.1	34.5

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

1. Mean roof height shall not exceed 30' (measured vertically from grade plane to middle of roof slope).
2. Refer to applicable building code for wind exposure descriptions (B = typical suburban/wooded terrain; C = open flat terrain; D = ocean/lake exposure).
3. Where topographic effects occur (e.g., wind speed up due to hill-top exposure), refer to the building code for wind load.
4. Tabulated wind pressures are from ASCE 7-10, for wall corner zones. For lesser values away from wall corners, refer to the building code.
5. Tabulated wind pressures assume 100% of wind load is resisted by the cladding/foam sheathing or furring/foam sheathing layer and are not otherwise distributed or shared with other wall assembly layers.
6. Wind pressures are given as 0.6W as defined in ASCE 7-10 for comparison to the allowable Design Wind Pressure of the fasteners as shown in Table 3

5.4.2.3 Step 3: Verify that the allowable design wind pressure using HeadLOK® fasteners (Table 3) meets or exceeds the design wind pressure for your project (Table 4).

5.4.3 Design Example:

Given

- Foam Sheathing Thickness: 3"
- Cladding Material: Fiber cement lap siding
- Cladding Weight from Manufacturer Data: 3 psf
- Design Wind Speed/Exposure: 120/B
- Seismic Design Category: B (exempt)
- Wood Framing: 2x6 at 24" o.c.

Solution

Step 1: Choose the furring type and orientation that will be used. This example uses 1x4 (min.) wood furring in a vertical orientation over studs (Figure 1).

Step 2: Consult siding manufacturer data for siding weight (3 psf) and add 1 psf for furring. Total = 4 psf.

- Step 3: Using Table 2, min. 1x4 wood furring at 24" o.c. attached to studs at 24" o.c. supporting up to 10 psf requires maximum 16" o.c. fastener spacing.
- Step 4: From Table 3, the connection allowable design wind pressure resistance is 49 psf.
- Step 5: Check the applicable building code to verify the wind pressure resistance required. Table 4 gives an example of the *IBC* wind pressures (*ASCE 7-10*), and this example's connection resistance of 49 psf exceeds the required resistance of 34.5 psf for wind speeds of 150 mph in Exposure B, 130 mph in Exposure C and 120 mph in Exposure D.
- Step 6: The required minimum length of HeadLOK® fasteners is 0.75" (furring) + 3" (foam) + 2.0" (penetration) = 5.75". Select a 6" HeadLOK® fastener.

Note:

1. Add length for thickness of additional sheathing material layer behind foam, if included.
2. Verify that furring provides adequate thickness for siding fastener per code or siding manufacturer's installation instructions, or specify an appropriate siding fastener for use in 3/4"-thick furring.
3. Verify that furring is adequate to resist the required design loads.

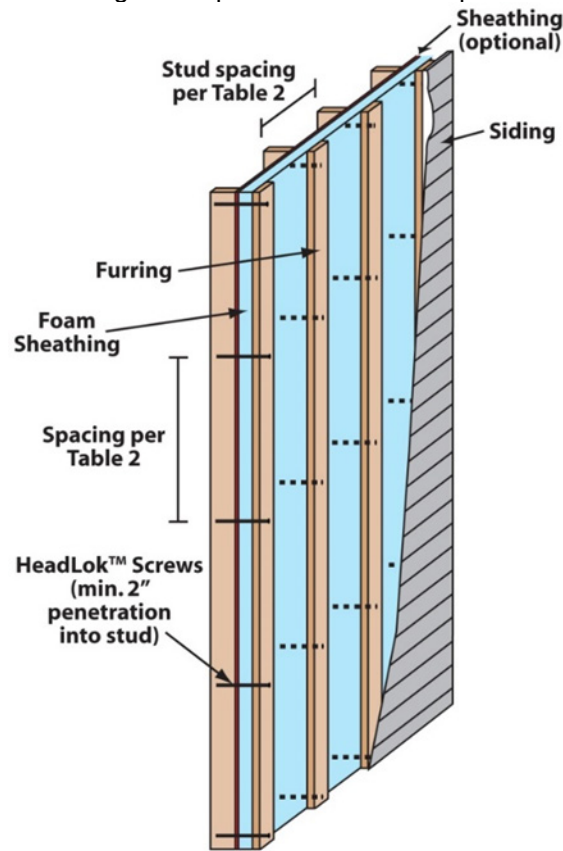


FIGURE 1. EXTERIOR WALL COVERING ASSEMBLY WITH VERTICALLY ORIENTED FURRING

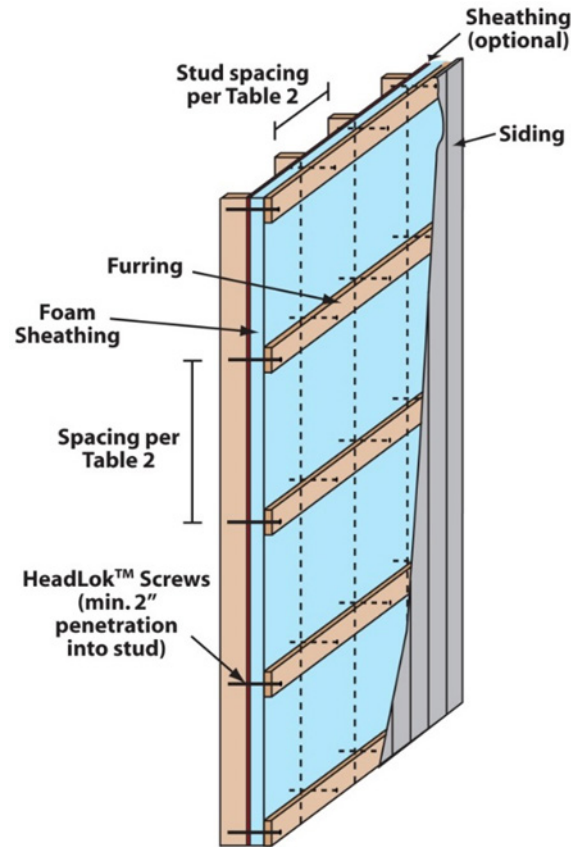


FIGURE 2. EXTERIOR WALL COVERING ASSEMBLY WITH HORIZONTALLY ORIENTED FURRING

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 Add up the total thickness of furring, rigid insulation and sheathing, and then select the appropriate length of HeadLOK® fastener (see Table 1) that will attach these combined materials and provide a minimum 2" penetration into the wood framing.
- 6.3 Using a high torque ½" drill, drive the HeadLOK® through the center of the furring strip and into the insulation and wall framing.
- 6.4 Fasteners should be aligned perpendicular to the face of the wall stud so that the point engages the center of the wall stud and at a minimum distance of 3" from the end of the stud or furring material.
- 6.5 Fasteners must be installed in a manner to avoid over-driving yet snug enough to remove any gaps between the layers of materials being fastened.
- 6.6 Figure 1 and Figure 2 provide example graphics of two types of furring installations as a guide.



7 SUBSTANTIATING DATA

- 7.1 HeadLOK® fastener design property calculations for HeadLOK® screws based on *TR 12*, *NDS*, and *NYSERDA* reports; Crandell
- 7.2 HeadLOK® fastener performance from the FastenMaster® Technical Bulletin for HeadLOK® fasteners
- 7.3 FastenMaster® installation instructions for HeadLOK® fasteners
- 7.4 Cladding Attachment Over Thick Exterior Insulating Sheathing; P. Baker, P. Eng, and R. Lepage, Building Science Corporation
- 7.5 Initial and Long-Term Movement of Cladding Installed Over Exterior Rigid Insulation; Peter Baker; Building Science Corporation
- 7.6 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.
- 7.7 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 listed in Section 1.1 is approved for the following:
 - 8.1.1 Use as an alternative material, design and method of construction for the attachment of furring, sheathing or cladding over foam sheathing and into wood framing
 - 8.1.2 Use per the listed editions of the *IRC* for positive and negative wind pressure resistance
 - 8.1.3 Use per the listed editions of the *IRC* for lateral shear strength to support cladding materials installed over foam sheathing
 - 8.1.4 Use per the listed editions of the *IBC* for positive and negative wind pressure resistance
 - 8.1.5 Use per the listed editions of the *IBC* for lateral shear strength to support cladding materials installed over foam sheathing
- 8.2 Use of HeadLOK® fasteners to connect bracing materials in braced wall panels or shear walls is outside the scope of this TER.
- 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 HeadLOK® fasteners covered by this TER shall be installed in accordance with this TER and the manufacturer's installation instructions.
- 9.2 HeadLOK® fastener spacing shall not exceed Table 2 for the installation conditions considered.
- 9.3 For conditions not covered in this TER, connections shall be designed in accordance with accepted engineering practice.
- 9.4 Install fasteners prior to utility installations in exterior walls to avoid accidental penetration of utilities (e.g. electrical wiring, plumbing, etc.).
- 9.5 Foam sheathing shall be minimum Type II (expanded polystyrene) or Type X (extruded polystyrene) per ASTM C578 or Type 1 (polyiso) per ASTM C1289.
- 9.5.1 Types with greater compressive strength are acceptable.
- 9.6 Ensure furring or sheathing material provides adequate substrate and thickness for the application of the siding fastener per the code requirements for siding application and the siding manufacturer's installation instructions.
- 9.6.1 For example, if the siding manufacturer requires the fastener for the siding to penetrate more than $\frac{3}{4}$ " into the furring, a 1" x 4" furring strip (actual dimension of $\frac{3}{4}$ " x 3 $\frac{1}{2}$ ") would not be adequate, and a thicker furring strip, such as a 2" x 4", would be required.
- 9.7 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.
- 9.8 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.9 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).
- 9.10 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.11 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.
- 9.12 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.
- 9.13 This TER shall be reviewed for code compliance by the AHJ in concert with IBC Section 104.
- 9.14 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 listed in Section 1.1 is 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.
 - 10.1.1 The fasteners are identified by the designation, "HeadLOK®" on the packaging. The head of each fastener is marked with an "F" followed by a number corresponding to the length of the fastener.
 - 10.1.2 The packaging shall include OMG's name and address, fastener size, third-party inspection agency, and TER number.
- 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.