



Technical Evaluation Report

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

TER No. 1009-01

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d/b/a/ FastenMaster

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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 12 19 – Shear Wall Panels
Section 06 16 00 – Sheathing
Section 06 17 00 – Shop-Fabricated Structural Wood

1. Product Evaluated:

1.1. FastenMaster HeadLok™ Heavy Duty Flathead Fasteners

2. Applicable Codes:

2.1. HeadLok 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. 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 bearing 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.

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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. 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 (IBC2304.9.5¹ and IRC317.3²).
- 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 HeadLok fasteners are manufactured are audited through an inspection process performed by an approved agency³.
- 4.7. HeadLok fasteners are available in the styles and sizes⁴ shown here:

Product Availability		
Length	Product SKU	Quantity
2-7/8"	FMHLGM278 -250	500
3-3/4"	FMHLGM334 -250	250
4-1/2"	FMHLGM412 -250	250
5"	FMHLGM005 -250	250
5-1/2"	FMHLGM512 -250	250
6"	FMHLGM006 -250	250
6-1/2"	FMHLGM612 -250	250
7"	FMHLGM007 -250	250
7-1/2"	FMHLGM712 -250	250
8"	FMHLGM008 -250	250
8-1/2"	FMHLGM812 -250	250
9"	FMHLGM009 -250	250
9-1/2"	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

Table 1: HeadLok™ Fastener Availability

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.

⁴ This TER only evaluates the use of HeadLok™ Fasteners when connecting through up to 4" of foam sheathing into wood framing. Connections through greater than 4" of foam sheathing require design. When connecting to steel framing members, contact FastenMaster for installation instructions.

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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. Design Procedure:

5.3.1. Calculate the fastener spacing.

Step 1: Determine the spacing between studs or framing members, either 16" or 24" on-center.

Step 2: Calculate the correct thickness of rigid foam, up to 4", needed to obtain the required insulation effect or R-value.

Step 3: Choose the furring or sheathing (substrate) material that the cladding will be affixed to:

1. Minimum $\frac{3}{4}$ " x 3- $\frac{1}{2}$ " wood or Wood Structural Panel (WSP) furring
2. Minimum $\frac{3}{8}$ " WSP sheathing

Ensure that the substrate allows for cladding connections that are compliant with the cladding manufacturer's installation and connection instructions and meet applicable building code.

Step 4: Determine the actual weight for the cladding materials being installed, per square foot, as given by the cladding manufacturer's specifications. Note:

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.
2. Wood furring may add up to 1 psf of additional weight; wood sheathing may add up to 1.5 psf depending on thickness.

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Step 5: Using these four values together, find the proper fastening pattern of between 6" and 24" on-center using [Table 2](#).

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

- 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 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 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 fasteners used at each stud.
- 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.

Table 2: Recommended Fastener Spacing for Various Thicknesses of Foam Sheathing, Stud Spacing and Cladding Weight when Connected to Wood Studs Using HeadLok Fasteners^{5,6}

5.3.2. Check for wind resistance.

Step 1: Using the information derived from Steps 1-5 in [Section 5.3](#), determine the allowable design wind pressure using HeadLok fasteners from [Table 3](#) below.

Allowable Design Wind Pressure														
Furring or WSP Installation Condition	Min. 1x4 Wood Furring at 16" o.c.				Min. 1x4 Wood Furring at 24" o.c.				Min. 3/8" WSP and 16" o.c. studs			Min. 3/8" WSP and 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	6
Connection Allowable Design Wind Pressure (PSF)	49	73	98	147	33	49	65	98	49	73	98	33	49	65

- 1) Wood framing and furring shall be minimum Spruce-Pine-Fir or any species with specific gravity, G, of 0.42 or greater.
- 2) Connection allowable design wind pressure applies to connection resistance only and shall meet or exceed design wind pressure.
- 3) Wood framing, furring, and sheathing shall be of adequate size, species, and grade to resist design loads and requirements in accordance with the applicable building code.
- 4) Where required by 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.

Table 3: Allowable Design Wind Pressure for Connections Using HeadLok Fasteners

⁵ For cladding system weights exceeding 25 psf with any thickness of foam sheathing, a design professional should be consulted.
⁶ [Table 2](#) solutions are limited to 4" maximum thickness of foam sheathing. Design required for thicknesses of foam sheathing greater than 4". For cladding attachment over foam sheathing exceeding a 4" thickness, a design professional should be consulted.

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Step 2: Based on the design wind speed (85-140mph) and wind exposure category (A-D) specific to your region, determine the design wind pressure to be resisted for your application from [Table 4](#) below.

Example Design Wind Loads								
Design Wind Speed (mph) & Exposure	85/B	90/B	100/B	110/B	120/B	130/B	140/B	
	-	-	85/C	90/C	100/C	110/C	120/C	-
	-	-	-	85/D	90/D	100/D	110/D	-
Design Negative Wind Pressure Load to be Resisted (psf)	17.4	19.5	24.4	29.1	34.7	40.7	48.3	

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 building code for wind load.
 4) Tabulated wind pressures are from ASCE 7-05, 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 not otherwise distributed or shared with other wall assembly layers.

Table 4: Example of Components and Cladding Design Wind Loads

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](#)).

5.3.3. Design Example:

Given

Foam Sheathing Thickness:	4"
Cladding Material:	Fiber cement lap siding
Cladding Weight from Manufacturer Data:	3 psf
Design Wind Speed/Exposure:	100/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. We'll use 1x4 (min.) wood furring in a vertical orientation over studs in this example ([Figure 1a](#)).

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 5 psf requires maximum 24" o.c. fastener spacing.

Step 4: From [Table 3](#), the connection allowable design wind pressure resistance is 33 psf.

Step 5: Check the applicable building code to verify the wind pressure resistance required. [Table 4](#) gives an example of the 2009 IRC wind pressures, and this example's connection resistance of 33 psf exceeds the required resistance for wind speeds up to 90 mph in Exposure C and 110 mph, Exp. B of 29.1 psf.

Step 6: The minimum length of HeadLok fastener required is 0.75" (furring) + 4" (foam) + 2.0" (penetration) = 6.75". Select a 7" HeadLok (GM point) fastener. Note:

1. Add length for thickness of additional sheathing material layer behind foam, if included.
2. Verify furring provides adequate thickness for siding fastener per code or siding manufacturer's installation instructions, or specify an appropriate siding fastener for use in ¾"-thick furring.

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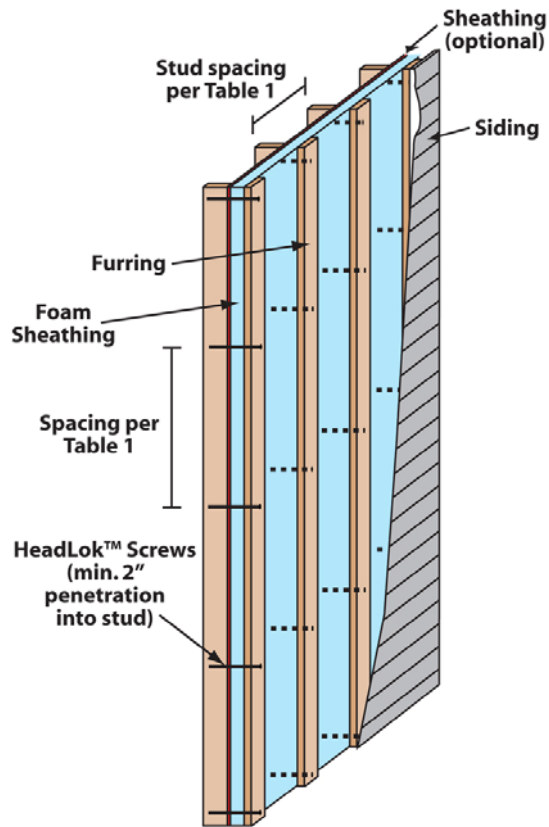


Figure 1a: Illustration of Exterior Wall Covering Assembly with Vertically-Oriented Furring

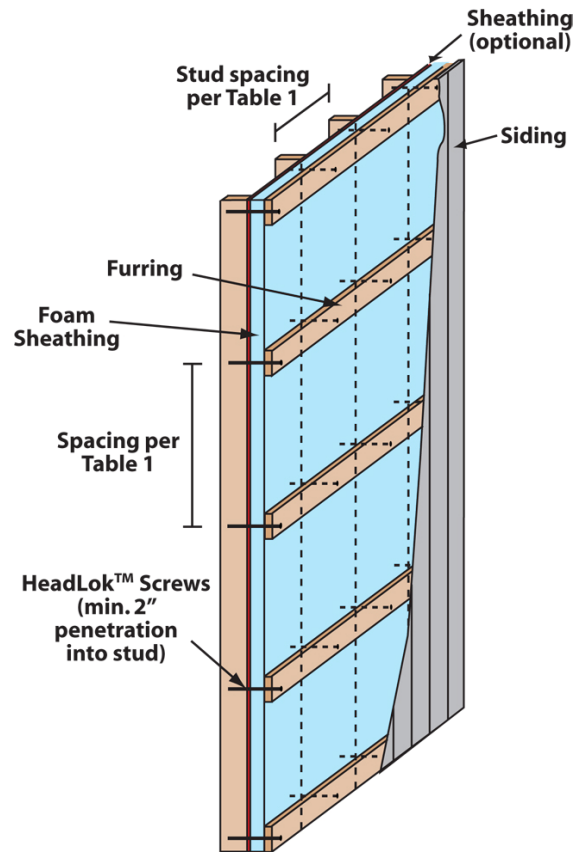


Figure 1b: Illustration of Exterior Wall Covering Assembly with Horizontally-Oriented Furring

6. Installation:

- 6.1. Add up the total thickness of furring, rigid insulation and sheathing 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.
- 6.2. Using a high torque ½" drill, drive the HeadLok through the center of the furring strip and into the insulation and wall framing.
- 6.3. Fasteners should be aligned 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.
- 6.4. 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
- 6.5. [Figure 1a](#) and [1b](#) provide example graphics of two types of furring installations as a guide.

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7. Test and Engineering Substantiating Data:

- 7.1. *National Design Specification for Wood Construction* – 2005 Edition, American Forest & Paper Association (*NDS*).
- 7.2. General Dowel Equations for Calculating Lateral Connection Values (1999), *TR-12*, American Forest & Paper Association.
- 7.3. Testing conducted for the Foam Sheathing Coalition, the Steel Framing Alliance and the New York State Energy Research and Development Authority (NYSERDA) ([Test Report](#)).
- 7.4. Testing conducted for the Foam Sheathing Coalition by Progressive Engineering, Inc., Evaluation of Siding Attachment Methods Using Various Materials, [Test Report #2010-128](#), dated 3/9/2010.
- 7.5. HeadLok fastener design property calculations for HeadLok Screws based on *TR-12*, *NDS* and NYSERDA reports, Crandell, 2010.
- 7.6. HeadLok fastener performance from the FastenMaster Technical Bulletin for HeadLok fasteners.
- 7.7. FastenMaster Installation instructions for HeadLok fasteners.

8. Findings:

- 8.1. When used and installed in accordance with this TER and the manufacturer's installation instructions, HeadLok fasteners are acceptable for 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.
- 8.2. HeadLok fasteners evaluated herein and installed in accordance with this TER meet the requirements of the 2003, 2006 and 2009 *IRC* for positive and negative wind pressure resistance.
- 8.3. HeadLok fasteners evaluated herein and installed in accordance with this TER meet the requirements of the 2003, 2006 and 2009 *IRC* for lateral shear strength to support cladding materials installed over foam sheathing.
- 8.4. HeadLok fasteners evaluated herein and installed in accordance with this TER meet the requirements of the 2003, 2006 and 2009 *IBC* for positive and negative wind pressure resistance.
- 8.5. HeadLok fasteners evaluated herein and installed in accordance with this TER meet the requirements of the 2003, 2006 and 2009 *IBC* for lateral shear strength to support cladding materials installed over foam sheathing.
- 8.6. Use of HeadLok fasteners to connect bracing materials in braced wall panels or shear walls is outside the scope of this TER.

9. Conditions of Use:

- 9.1. HeadLok fasteners covered by this TER shall be installed in accordance with this report 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. Manufacturer's installation instructions shall be followed as provided in [Section 6](#) and at www.fastenmaster.com/details/product/headlok-heavy-duty-flathead-fastener.html.
- 9.5. Headlok fasteners are produced by OMG, Inc. at their facility located in Agawam, Massachusetts.
- 9.6. Headlok fasteners are produced under a quality control program subject to periodic inspections in accordance with *IBC* Section 1703.5.2.
- 9.7. Install fasteners prior to utility installations in exterior walls to avoid accidental penetration of utilities (e.g. electrical wiring, plumbing, etc.).

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- 9.8. Foam sheathing shall be minimum Type II (expanded polystyrene) or Type X (extruded polystyrene) per *ASTM C578* or Type 1 (polyiso) per *ASTM C1289*.
- 9.8.1. Types with greater compressive strength are acceptable.
- 9.9. Ensure furring or sheathing material provides adequate substrate and thickness for the application of the siding fastener per code requirements for siding application and siding manufacturer's installation instructions.
- 9.9.1. 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.

10. Identification:

- 10.1. 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.
- 10.2. The packaging shall include the following information:
- 10.2.1. OMG's name and address
 - 10.2.2. Fastener size
 - 10.2.3. Third party inspection agency
 - 10.2.4. This TER number

11. Review Schedule:

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



Responsibility Statement

The information contained herein is a product, engineering or building code evaluation performed in accordance with the referenced building code, testing and/or analysis using generally accepted engineering practices. Product, design and code compliance quality control is the responsibility of the referenced company. Consult the referenced company for the proper detailing and application for the intended purpose. Consult your local jurisdiction or design professional to assure compliance with the local building code. Qualtim, Inc. (www.qualtim.com) and SBC Research Institute (www.sbcricri.info) do not make any warranty, express or implied, or assume any legal liability or responsibility for the use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this report.