Foam Sheathing Coalition™
Tech Matters
FSC — SHARING LEADING-EDGE TECHNOLOGY

Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing

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Introduction:

Recent advancements in the *International Energy Conservation Code*, a national model energy code, are being adopted by states in an effort to improve energy efficiency in the nation's building stock. Improved energy efficient construction will likely result in changes to current construction practices. For example, increased use of continuous insulation such as rigid foam wall sheathing, with greater thickness (i.e. up to 4" in thickness), is an effective means of meeting or exceeding modern energy code requirements or green building rating requirements, such as LEED, Energy Star (EPA), and the ICC 700 National Green Building Standard. However, the use of increased thickness of foam sheathing on walls and behind cladding to meet higher energy code requirements calls for improved solutions for attachment of wall covering assemblies (i.e., cladding, furring, etc.) through the foam to the structural element it is being attached to. These connections must support the weight of the cladding and secure the cladding to the wall to resist wind and even seismic forces. So the question becomes, "How does one design the attachments for cladding materials through foam sheathing?"

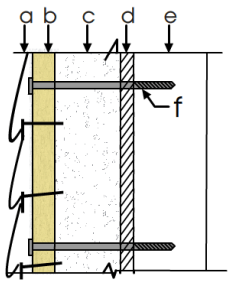
This *Tech Matters* gives a step-by-step approach for the design thought process. This approach has been confirmed through testing conducted for the Foam Sheathing Coalition, the Steel Framing Alliance and the New York State Energy Research and Development Authority (see NYSERDA's report).

Design Procedure:

STEP 1: Select an appropriate installation condition.
Select an attachment through furring, wood structural panels (WSP) or directly applied through foam sheathing for the exterior wall covering assembly (Figure 1). Ensure substrate and cladding connections are compliant with the cladding manufacturer's installation instructions and the applicable building code.

STEP 2: Determine the cladding system weight.
Add the weight of all materials on the exterior side of the foam sheathing (see 'a' and 'b' in Figure 1).

> **Step 2 Commentary:**
> Use actual weights for the materials installed. Actual cladding weights of materials can be obtained from the cladding manufacturer's material specifications. Other typical weights of building materials can be found in the Commentary to ASCE 7-05 (See Appendix A for an excerpt from *ASCE 7-05*, Table C3-1 and other weight of materials references.)



Exterior Wall Covering Assembly:
a – Cladding material and fasteners
b – Min. ¾" thick (nominal 1x3 or larger) wood furring or min. ¾" WSP*
c – Thickness of rigid foam sheathing, as required
d – Optional wall sheathing or as required by the applicable building code (e.g. gypsum sheathing, WSP or other)
e – Wall framing per code (i.e., wood or steel studs)
f – Fastener per Table 1 or by design

* Errata: For item b, a previous version of this *Tech Matters* listed ⅜" WSP in error. The correct value is ¾" WSP.

Figure 1: Illustration of Exterior Wall Covering Assembly Components
Note: Layer "d" is optional unless required by the applicable building code.

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STEP 3: Select a fastener size and spacing.
From Table 1a or 1b, select a fastener size and spacing based on:
Step 3a – The method of attachment
a. Direct attachment, Table 1a, or
b. Attachment through furring, Table 1b,
Step 3b – Cladding system weight (Step 2), and
Step 3c – The maximum thickness of foam sheathing for which the attachment is desired.

Step 3 Commentary: When using Table 1a, verify that cladding and its connections are compliant with the applicable building code and the cladding manufacturer's installation instructions. Also confirm that the fastener used is at least the diameter indicated in Table 1a. In addition, verify that the penetration and size of the cladding fastener in the wall framing material is adequate to resist code-required design wind loads to prevent pull-off of the exterior wall covering assembly (i.e., cladding and siding as well as the foam sheathing).

Table 1a – Siding Minimum Fastening Requirements for Direct Cladding Attachment over Foam Plastic Sheathing to Support Cladding System Weight

Cladding Fastener Through Foam Plastic Sheathing into:	Siding Fastener – Type and Minimum Size	Siding Fastener Vertical Spacing (inches)	Maximum Thickness of Foam Plastic insulating Wall Sheathing (inches)					
			16" o.c. Fastener Horizontal Spacing			24" o.c. Fastener Horizontal Spacing		
			Max. Cladding Weight:			Max. Cladding Weight:		
			3 psf	11 psf	25 psf	3 psf	11 psf	25 psf
Wood Framing (minimum 1-1/4" penetration)	0.113" diameter nail	6	4	3	1	4	2	0.75
		8	4	2	0.75	4	1.5	DR
		12	4	1.5	DR	3	0.75	DR
	0.120" diameter nail	6	4	3	1.5	4	2	0.75
		8	4	2	1	4	1.5	0.5
		12	4	1.5	0.5	3	1	DR
	0.131" diameter nail	6	4	4	1.5	4	3	1
		8	4	3	1	4	2	0.75
		12	4	2	0.75	4	1	DR
Steel Framing (minimum penetration of steel thickness + 3 threads)	#8 screw into 33 mil steel or thicker	6	3	3	1.5	3	2	DR
		8	3	2	0.5	3	1.5	DR
		12	3	1.5	DR	3	0.75	DR
	#10 screw into 33 mil steel	6	4	3	2	4	3	0.5
		8	4	3	1	4	2	DR
		12	4	2	DR	3	1	DR
	#10 screw into 43 mil steel or thicker	6	4	4	3	4	4	2
		8	4	4	2	4	3	1.5
		12	4	3	1.5	4	3	DR

Table 1a: Siding Minimum Fastening Requirements for Direct Cladding Attachment over Foam Plastic Sheathing to Support Cladding System Weight [For SI: 1 inch = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa]

Table Notes:
1. Refer to TER 1006-01, *Prescriptive Wind Pressure Performance of Foam Plastic Insulation Used as Insulating Sheathing in Exterior Wall Covering Assemblies* for information on how to size foam sheathing to resist wind pressure if the optional layer 'd' is not present or is present but not able to resist 100% of the code required design wind load.
2. Tabulated requirements are based on wood framing of Spruce-Pine-Fir or any wood species with a specific gravity of 0.42 or greater in accordance with *AFPA/NDS* and minimum 33 ksi steel for 33 mil and 43 mil steel and 50 ksi steel for 54 mil steel or thicker
3. See Appendix A, Technical Justification and Design Methodology for information on how the table values were derived.
4. Cladding weight shall include all materials supported by the fasteners on the exterior side of the foam sheathing e.g. wood structural panel sheathing may be installed between the cladding material and the foam sheathing. In such cases, both the cladding and the WSP sheathing weight must be included in the calculation for the cladding weight.
5. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.
6. Self-drilling tapping screw fasteners for connection of siding to steel framing shall comply with the requirements of AISI S200. Other approved fasteners of equivalent or greater diameter and bending strength shall be permitted.
7. DR = design required
8. For cladding system weights exceeding 25psf with any thickness of foam sheathing, a design professional should be consulted.
9. Table 1 solutions are limited to 4" maximum thickness of foam sheathing. Design is required for thicknesses of foam sheathing greater than 4".
10. For cladding attachment over foam sheathing exceeding a 4" thickness, a design professional should be consulted.

Table 1b – Furring Minimum Fastening Requirements for Application Over Foam Plastic Insulating Sheathing to Support Cladding System Weight and Resist Wind Pressure

Furring Material	Framing Member	Fastener Type and Minimum Size	Minimum Penetration into Wall Framing (inches)	Fastener Spacing in Furring (inches)	Maximum Thickness of Foam Plastic Insulating Sheathing (inches)						Allowable Wind Pressure Resistance (psf)	
					16" o.c. Furring			24" o.c. Furring				
					Siding Weight:			Siding Weight:				
					3 psf	11 psf	25 psf	3 psf	11 psf	25 psf	16" o.c. Furring	24" o.c. Furring
Minimum 1x3 Wood Furring	Minimum 2x Wood Stud	Nail (0.120" shank; 0.271" head)	1-1/4	8	4	4	1.5	4	2	1	42.6	28.4
				12	4	2	1	4	1.5	0.5	28.4	18.9
				16	4	2	0.5	4	1	DR	21.3	14.2
		Nail (0.131" shank; 0.281" head)	1-1/4	8	4	4	2	4	3	1	46.5	31.0
				12	4	3	1	4	2	0.75	31.0	20.7
				16	4	2	0.75	4	1.5	DR	23.3	15.5
		#8 wood screw	1	12	4	4	1.5	4	3	1	98.9	66.0
				16	4	3	1	4	2	0.5	74.2	49.5
				24	4	2	0.5	4	1	DR	35.1	23.4
		¼" lag screw	1-1/2	12	4	4	3	4	4	1.5	140.4	93.6
				16	4	4	2	4	3	1	79.0	52.7
				24	4	3	1	4	2	0.5	35.1	23.4
Minimum 33mil Steel Hat Channel or Minimum 1x3 Wood Furring	33 mil Steel Stud	#8 screw (0.285" head)	Steel thickness +3 threads	12	3	1.5	DR	3	0.5	DR	52.9	35.3
				16	3	1	DR	2	DR	DR	39.7	26.5
				24	2	DR	DR	2	DR	DR	26.5	17.6
		#10 screw (0.333" head)	Steel thickness +3 threads	12	4	2	DR	4	1	DR	62.9	41.9
				16	4	1.5	DR	3	DR	DR	47.1	31.4
				24	3	DR	DR	2	DR	DR	31.4	21.0
	43 mil or thicker Steel Stud	#8 screw (0.285" head)	Steel thickness +3 threads	12	3	1.5	DR	3	0.5	DR	69.0	46.0
				16	3	1	DR	2	DR	DR	51.8	34.5
				24	2	DR	DR	2	DR	DR	34.5	23.0
		#10 screw (0.333" head)	Steel thickness +3 threads	12	4	3	1.5	4	3	DR	81.9	54.6
				16	4	3	0.5	4	2	DR	61.5	41.0
				24	4	2	DR	4	0.5	DR	35.1	23.4

Table 1b: Furring Minimum Fastening Requirements for Application Over Foam Plastic Insulating Sheathing to Support Cladding System Weight and Resist Wind Pressure
For SI: 1" = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa. DR = design required

Table Notes:

1. Table values are based on:
   a. Minimum ¾" (19.1 mm) thick wood furring and wood studs of Spruce-Pine-Fir or any softwood species with a specific gravity of 0.42 or greater per *AFPA/NDS*,
   b. Minimum 33 mil steel hat channel furring of 33 ksi steel, and
   c. Steel framing of indicated nominal steel thickness and minimum 33 ksi steel for 33mil and 43 mil steel and 50 ksi steel for 54 mil steel or thicker.
2. Steel hat channel shall have a minimum 7/8" (22.2 mm) depth.
3. Self-drilling, self-tapping screw fasteners for connection of siding to steel framing shall comply with the requirements of AISI S200. Other approved fasteners of equivalent or greater diameter and bending strength shall be permitted.
4. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.
5. Furring shall be spaced a maximum of 24" o.c. in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. Furring strips installed in a horizontal direction shall be fastened at each stud with a number of fasteners equivalent to that required by the fastener spacing. (e.g. If the required nail spacing is 12" o.c. and the studs are 24" o.c., then two nails would be required ad at each stud (24/12=2)). In no case shall fasteners be spaced more than 24" (0.6 m) apart.
6. Lag screws shall be installed with a standard cut washer.
7. Lag screws and wood screws shall be pre-drilled in accordance with *AF&PA/NDS*.
8. Approved self-drilling screws of equal or greater shear and withdrawal strength shall be permitted without pre-drilling.
9. A minimum 2x wood furring shall be used where the required siding fastener penetration into wood material exceeds ¾" (19.1 mm) and is not more than 1-1/2" (38.1 mm), unless approved deformed shank siding nails or siding screws are used to provide equivalent withdrawal strength allowing the siding connection to be made to a 1x wood furring.
10. For cladding system weights exceeding 25psf with any thickness of foam sheathing, a design professional should be consulted.
11. Table 1 solutions are limited to 4" maximum thickness of foam sheathing. Design is required for thicknesses of foam sheathing greater than 4".
12. For cladding attachment over foam sheathing exceeding a 4" thickness, a design professional should be consulted.

STEP 4: Get design wind pressure requirement from the applicable building code or standard.
Step 4a – Check building code design wind pressure requirement for walls

a. *2009 International Residential Code*, Table R301.2(2), or
b. *2009 International Building Code*, Section 1609.6, or
c. *ASCE 7-05* standard, Figure 6-3
d. See examples in Table 2.

Step 4b – Verify that allowable design wind pressure for the cladding and its connections (see Note in STEP 3) and the furring attachment per Table 1b, as applicable, meets or exceeds the design wind pressure in Table 2.

Table 2 – Example of Components and Cladding 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 Wind Suction Pressure (Load)	17.4 psf	19.5 psf	24.4 psf	29.1 psf	34.7 psf	40.7 psf	48.3 psf

TABLE 2: Example of Components and Cladding Design Wind Loads

Table Notes:
1. Mean roof height shall not exceed 30' (measured vertically from grade plane to middle of roof slope).
2. Refer to 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 for wall corner zones. For lesser values away from wall corners, refer to the building code.
5. Tabulated wind pressures assume 100 percent 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.

STEP 5: Ensure fasteners selected are available in the necessary length.
Verify availability of selected fastener(s) in lengths that provide the required penetration into framing for the thickness of foam sheathing and other exterior wall covering components fastened to the wall.

STEP 6: Installation

STEP 6: Installation Commentary:

1. The fastener must fully engage the framing or stud to effectively transfer loads.
   a. If secured only to sheathing between studs, another method of attachment must be sought.
2. Install fasteners prior to utility installations in exterior walls or use a sufficient depth of framing and avoid penetrations much greater than the minimum 1.5" to avoid interference or damage.
3. In areas or conditions where the applicable building code requires seismic forces to be considered or where the design wind load conditions are excessive, a design professional should be consulted.
   a. In the *2009 IRC*, one-and-two-family dwellings in Seismic Design Categories A, B, and single-family homes in Seismic Design Category C are exempted from seismic considerations.
4. Fasteners must be installed in a manner to avoid over-driving yet snug enough to remove any gaps between the connected parts.
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*. Types with greater compressive strength are acceptable.
6. Ensure furring or sheathing material provides adequate substrate and thickness for siding fastener per code and siding manufacturer installation instructions.

Appendix A

SUPPLEMENTAL INFORMATION:
Technical Justification and Design Methodology

The design methodology used to develop the requirements in Table 1 is based on the following resources:

1. *National Design Specification for Wood Construction* – 2005 Edition, American Forest & Paper Association
2. *General Dowel Equations for Calculating Lateral Connection Values* (1999), TR-12, American Forest & Paper Association
3. *North American Cold-Formed Steel Specification* – 2007 Edition, American Iron & Steel Institute (AISI S100 standard)

Lateral (Shear) Connection Strength (Wood Framing Application) – For connections of wood-to-wood or steel-to-wood materials with a gap between the connected parts created by an intervening layer of foam sheathing, the "gap parameter" from reference 2 above was used with the *NDS* yield equations (reference 1) to determine a 5 percent offset yield lateral strength value. This value was then divided by a factor of 1.5 to provide a connection slip limit of approximately 0.015", resulting in safety factors of about 5 to 7 relative to tested connection capacities for a variety of fastener types and assembly conditions.

Lateral (Shear) Connection Strength (Steel Framing Application) – For steel-to-steel connections with a gap between the connected parts created by an intervening layer of foam sheathing were analyzed per *AISI S100* and nominal shear values were further reduced by a "gap reduction factor." Together with application of a safety factor of 3, a connection slip limit of about 0.015" was achieved resulting in actual safety factors of about 5 to 7 relative to tested connection capacities.

The design approach as described above and relevant test data are addressed in the following reference:

Fastening Systems for Continuous Insulation, Final Report 10-11, April 2010, New York State Energy Research and Development Authority (NYSERDA), Albany, NY. April 2010.
http://www.nyserda.org/publications/fastening_systems_for_continuous_insulation.pdf (8/27/10)
The above report served as the basis for the New York State Building Commission's approval of generic fastener connection requirements consistent with those provided in this *Tech Matters.*

References:
ASCE 7-05 Commentary, Table C3-1, Minimum Design Dead Loads

TABLE C3-1 MINIMUM DESIGN DEAD LOADS

Component	Load (psf)	Component	Load (psf)
CEILINGS		Decking, 2-in. wood (Douglas fir)	5
Acoustical Fiber Board	1	Decking, 3-in. wood (Douglas fir)	8
Gypsum board (per 1/8–in. thickness)	0.55	Fiberboard, 1/2-in.	0.75
Mechanical duct allowance	4	Gypsum sheathing, 1/2-in.	2
Plaster on tile or concrete	5	Insulation, roof boards (per inch thickness)	
Plaster on wood lath	8	Cellular glass	0.7
Suspended steel channel system	2	Fibrous glass	1.1
Suspended metal lath and cement plaster	15	Fiberboard	1.5
Suspended metal lath and gypsum plaster	10	Perlite	0.8
Wood furring suspension system	2.5	Polystyrene foam	0.2
COVERINGS, ROOF, AND WALL		Urethane foam with skin	0.5
Asbestos-cement shingles	4	Plywood (per 1/8-in. thickness)	0.4
Asphalt shingles	2	Rigid insulation, 1/2-in.	0.75
Cement tile	16	Skylight, metal frame, 3/8-in. wire glass	8
Clay tile (for mortar add 10 psf)		Slate, 3/16-in.	7
Book tile, 2-in.	12	Slate, 1/4-in.	10
Book tile, 3-in.	20	Waterproofing membranes:	
Ludowici	10	Bituminous, gravel-covered	5.5
Roman	12	Bituminous, smooth surface	1.5
Spanish	19	Liquid applied	1
Composition:		Single-ply, sheet	0.7
Three-ply ready roofing	1	Wood sheathing (per inch thickness)	3
Four-ply felt and gravel	5.5	Wood shingles	3
Five-ply felt and gravel	6	FLOOR FILL	
Copper or tin	1	Cinder concrete, per inch	9
Corrugated asbestos-cement roofing	4	Lightweight concrete, per inch	8
Deck, metal, 20 gage	2.5	Sand, per inch	8
Deck, metal, 18 gage	3	Stone concrete, per inch	12

*Weights of masonry include mortar but not plaster. For plaster, add 5 lb/ft^2 for each face plastered. Values given represent averages. In some cases there is a considerable range of weight for the same construction.

Component	Load (psf)
FLOORS AND FLOOR FINISHES	
Asphalt block (2-in.), 1/2-in. mortar	30
Cement finish (1-in.) on stone-concrete fill	32
Ceramic or quarry tile (3/4-in.) on 1/2-in. mortar bed	16
Ceramic or quarry tile (3/4-in.) on 1-in. mortar bed	23
Concrete fill finish (per inch thickness)	12
Hardwood flooring, 7/7-in.	4
Linoleum or asphalt tile, 1/4-in.	1
Marble and mortar on stone-concrete fill	33
Slate (per mm thickness)	15
Solid flat tile on 1-in. mortar base	23
Subflooring, 3/4-in.	3
Terrazzo (1-1/2-in.) directly on slab	19
Terrazzo (1-in.) on stone-concrete fill	32
Terrazzo (1-in.), 2-in. stone concrete	32
Wood block (3-in.) on mastic, no fill	10
Wood block (3-in.) on 1/2-in. mortar base	16
FLOORS, WOOD-JOIST (NO PLASTER)	
DOUBLE WOOD FLOOR	
Joint sizes (in.) — 12-in. spacing (lb/ft²) / 16-in. spacing (lb/ft²) / 24-in. spacing (lb/ft²)	
2 × 6 — 6 / 5 / 5	
2 × 8 — 6 / 6 / 5	
2 × 10 — 7 / 6 / 6	
2 × 12 — 8 / 7 / 6	
FRAME PARTITIONS	
Movable steel partitions	4
Wood or steel studs, 1/2-in. gypsum board each side	8
Wood studs, 2 × 4, unplastered	4
Wood studs, 2 × 4, plastered one side	12
Wood studs, 2 × 4, plastered two sides	20
FRAME WALLS	
Exterior stud walls:	
2 × 4 @ 16-in., 5/8-in. gypsum, insulated, 3/8-in. siding	11
2 × 6 @ 16-in., 5/8-in. gypsum, insulated, 3/8-in. siding	12
Exterior stud walls with brick veneer	48

Component						Load (psf)
Windows, glass, frame, and sash						8
Clay brick wythes:						
4 in.						39
8 in.						79
12 in.						115
16 in.						155
Hollow concrete masonry unit wythes:						
Wythe thickness (in inches)		4	6	8	10	12
Density of unit (105 pcf)						
No grout		22	24	31	37	43
48 in. o.c.			29	38	47	55
40 in. o.c.	grout		30	40	49	57
32 in. o.c.	spacing		32	42	52	61
24 in. o.c.			34	46	57	67
16 in. o.c.			40	53	66	79
Full grout			55	75	95	115
Density of unit (125 pcf)						
No grout		26	28	36	44	50
48 in. o.c.			33	44	54	62
40 in. o.c.	grout		34	45	56	65
32 in. o.c.	spacing		36	47	58	68
24 in. o.c.			39	51	63	75
16 in. o.c.			44	59	73	87
Full grout			59	81	102	123
Density of unit (135 pcf)						
No grout		29	30	39	47	54
48 in. o.c.			36	47	57	66
40 in. o.c.	grout		37	48	59	69
32 in. o.c.	spacing		38	50	62	72
24 in. o.c.			41	54	67	78
16 in. o.c.			46	61	76	90
Full grout			62	83	105	127
Solid concrete masonry unit wythes (incl. concrete brick):						
Wythe thickness (in mm)		4	6	8	10	12
Density of unit (105 pcf)		32	51	69	87	105
Density of unit (125 pcf)		38	60	81	102	124
Density of unit (135 pcf)		41	64	87	110	133

*Weights of masonry include mortar but not plaster. For plaster, add 5 lb/ft² for each face plastered. Values given represent averages. In some cases there is a considerable range of weight for the same construction.

Weight of Portland Cement Plaster (Stucco)

On wood framing, three-coat plaster is typically installed over metal lath to a 7/8" nominal thickness. A typical plaster mixture weighs about 142 pounds per cubic foot, roughly the same as mortar, and this amount of material would cover about 13.7 sq ft at 7/8" thick. The metal lath may add a small additional amount of weight, so the end result is that three-coat stucco weighs about 10.4 lbs per sq ft (psf) installed.

[source: Portland Cement Association (PCA) website: http://www.cement.org/stucco/faq_weight.asp]

Weight of Dimensional Lumber*

Nominal Size (in x in)	Actual Size (in x in)	Actual Size (mm x mm)	Weight (lb/ft)
1 x 1	3/4 x 3/4	19 x 19	0.14
1 x 2	3/4 x 1 1/2	19 x 38	0.27
1 x 3	3/4 x 2 1/2	19 x 64	0.47
1 x 4	3/4 x 3 1/2	19 x 89	0.64
1 x 6	3/4 x 5 1/2	19 x 140	1.00
1 x 8	3/4 x 7 1/4	19 x 184	1.32
1 x 10	3/4 x 9 1/4	19 x 235	1.69
1 x 12	3/4 x 11 1/4	19 x 286	2.05
2 x 2	1 1/2 x 1 1/2	38 x 38	0.55
2 x 3	1 1/2 x 2 1/2	38 x 64	0.94
2 x 4	1 1/2 x 3 1/2	38 x 89	1.28
2 x 6	1 1/2 x 5 1/2	38 x 140	2.00
2 x 8	1 1/2 x 7 1/4	38 x 184	2.64
2 x 10	1 1/2 x 9 1/4	38 x 235	3.37
2 x 12	1 1/2 x 11 1/4	38 x 286	4.10
2 x 14	1 1/2 x 13 1/4	38 x 337	4.83
3 x 3	2 1/2 x 2 1/2	64 x 64	1.52
3 x 4	2 1/2 x 3 1/2	64 x 89	2.13
3 x 6	2 1/2 x 5 1/2	64 x 140	3.34
3 x 8	2 1/2 x 7 1/4	64 x 184	4.41
3 x 10	2 1/2 x 9 1/4	64 x 235	5.62
3 x 12	2 1/2 x 11 1/4	64 x 286	6.84
3 x 14	2 1/2 x 13 1/4	64 x 337	8.05
3 x 16	2 1/2 x 15 1/4	64 x 387	9.27
4 x 4	3 1/2 x 3 1/2	89 x 89	2.98
4 x 6	3 1/2 x 5 1/2	89 x 140	4.68
4 x 8	3 1/2 x 7 1/4	89 x 184	6.17
4 x 10	3 1/2 x 9 1/4	89 x 235	7.78
4 x 12	3 1/2 x 11 1/4	89 x 286	9.57
4 x 14	3 1/2 x 13 1/4	89 x 337	11.28

*Weight is based on softwood lumber having a weight of 35 lbs/ft^3

[source: http://www.engineeringtoolbox.com/softwood-lumber-dimensions-d_1452.html]

Design Example:

Given

Foam Sheathing Thickness:	4"
Cladding Material:	Fiber cement lap siding
Design Wind Speed/Exposure:	90/B
Seismic Design Category:	B (exempt)
Wood Framing:	2x6 at 24" o.c.

Solution

STEP 1: Use 1x3 (min.) wood furring (vertical orientation over studs).

STEP 2: Consult siding manufacturer data for siding weight (2.3 psf) and add 0.5 psf for furring. Total = 2.8 psf (Use 3 psf).

STEP 3: Using Table 1b (and column for 3 psf siding weight), min. 1x3 wood furring at 24" o.c. attached to studs can be attached with a ¼" diameter lag screw at 24" o.c. through furring and foam sheathing and penetrating framing a minimum of 1-1/2". Other fastening solutions in Table 1b are also possible.

STEP 4: From Table 1b, the furring connection allowable design wind pressure resistance is 23.4 psf, which is greater than the design wind load of 19.5 psf from Table 2 (OK).

STEP 5: The minimum length of fastener required is 0.75" (furring) + 4" (foam) + 1.5" (penetration) = 6.25". Select a 6-1/2" or 7" lag screw. *Note: Add length for thickness of additional sheathing material layer behind foam, if included. Verify furring provides adequate thickness for siding fastener per code or siding manufacturer's installation instructions. If needed, specify a thicker furring (i.e., 2x4) or an appropriate siding fastener for use in ¾"-thick furring.*

DISCLAIMER: