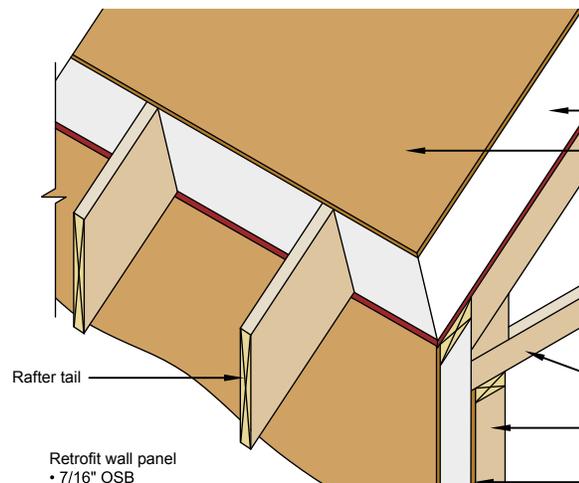
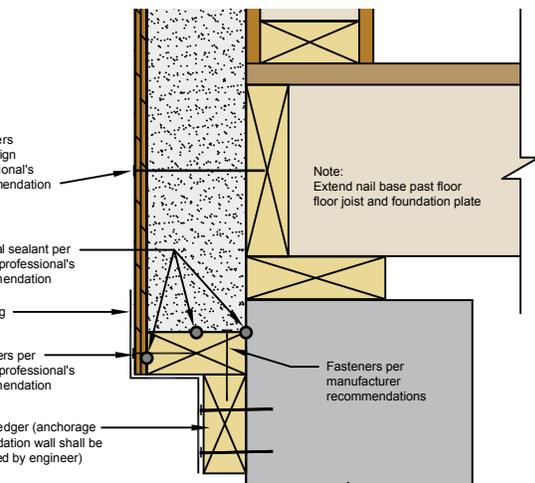


# RETROFIT WITH RIP INSULATED WALL & ROOF PANELS





# Retrofit Insulated Wall & Roof Panel Installation Guide

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The details, illustrations, and photographs in this guide are meant for illustrative purposes only. It is the responsibility of the installer to ensure that fastening specifications comply with all manufacturers' installation instructions and local building codes.

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## Definitions

BPI	Building Performance Institute
EPS	Expanded polystyrene
IRC	International Residential Code
mph	Miles per hour
max.	Maximum
nailbase	Another name for a retrofit insulated panel
o.c.	On center; reference to spacing of fasteners, studs, etc.
OSB	Oriented strand board
psf	Pounds per square feet
PVC	Polyvinyl chloride
RESNET®	Residential Energy Service Network
R-value	Thermal resistance value
Retrofit Panel	Another name for a retrofit insulated panel
SIPA	Structural Insulated Panel Association
SPF	Spray polyurethane foam
UV	Ultra violet
WRB	Weather resistant barrier
XPS	Extruded polystyrene



## Introduction

When major renovations are undertaken to modernize or add curb appeal to existing homes there is an opportunity to significantly increase energy efficiency by improving the thermal performance of the building enclosure. Retrofit insulated panels (or retrofit panels or nailbase) are an easy way to add continuous insulation and air sealing to older homes as part of a comprehensive energy retrofit plan or as an energy conservation measure when replacing siding. The composite panels consist of rigid insulating foam laminated to a single sheet of oriented strand board (OSB) structural sheathing.

Panels are cut to fit onsite and attached over the existing wall and/or roof sheathing, providing added insulation without disturbing the inside of the home. New cladding and underlayment is then installed over the retrofit insulated panels. The OSB facing serves as the fastening surface for siding or roofing

Retrofit insulated panels are available from most structural insulated panel (SIP) manufacturers and distributors. To find a manufacturer in your area, visit [www.sips.org](http://www.sips.org).

## Developing a Retrofit Strategy

Improving the thermal performance of a home with retrofit insulated panels can be one part of a comprehensive energy retrofit. The project can include adding new windows, additional roof insulation, air sealing, and upgrading heating and cooling equipment, or merely be an energy-efficient component of a re-siding job. Some homeowners choose to upgrade lighting, water heating, HVAC, and appliances to achieve even greater gains in energy efficiency.

The proper installation of retrofit insulated panels greatly reduces air infiltration in older homes; therefore, controlled mechanical ventilation is usually installed with this type of energy conservation measure to assure good indoor air quality. When a whole house thermal and air sealing effort is planned, a Building Performance Institute (BPI) or Residential Energy Services Network (RESNET) certified professional can collaborate on the whole-house strategy before installation. These professionals can conduct an energy audit to identify the most cost effective energy-efficient improvements and test existing and post-retrofit conditions to assure continued occupant safety and comfort.

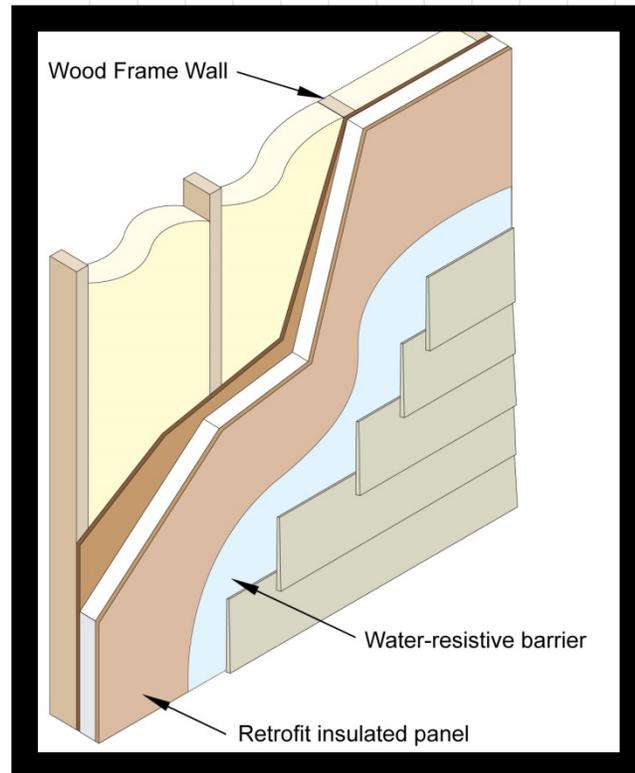


Figure 1. Retrofit Insulated Panel Over Existing Sheathing

## Panel Size and Thickness

Retrofit insulated panels are available in a variety of thicknesses and sizes. Thicker panels have a higher R-value or thermal resistance.

Table 1 covers the R-values for expanded polystyrene (EPS) retrofit panels; the most common insulation type.

**Table 1. Expanded Polystyrene (EPS) Retrofit Insulated Panel R-values at 75 degrees Fahrenheit**

Total Panel Thickness	R-Value Per ASTM C 578 <sup>A</sup> , EPS Type I	R-Value Per ASTM C 578 <sup>B</sup> , Neopor®
2"	7.9	7.5
4"	15.1	16.5
6"	22.3	25.5
7 ¾"	28.6	33.3
9 ¾"	35.8	42.3
11 ¾"	43.0	51.3

<sup>A</sup> Stated R-value includes EPS at thickness plus 7/16" OSB R-value from ASHRAE Fundamentals.

<sup>B</sup> Stated R-value includes graphite enhanced EPS, per manufacturer's ICC-ES report at thickness, plus 7/16" OSB R-value from ASHRAE Fundamentals, rounded.

<sup>C</sup> Other insulation materials with different R-values are available. Check with your retrofit insulated panel manufacturer for more information.

Determining the appropriate panel thickness is a function of the home's existing insulation and the local climate conditions. Selecting the correct panel thickness begins with determining the desired total R-value of the wall or roof system by adding the existing cavity insulation to the values in Table 1. Verify that the R-value of the retrofit insulated panel selected meets the requirements of the International Residential Code (IRC) listed in Appendix I or local code requirements.

Table 2 and Table 3 below provide general guidelines for the minimum thickness of retrofit insulated panels by climate zone to prevent condensation inside the wall or roof assembly.

**Table 2. Minimum Retrofit Insulated Panel R-Values for Walls to Prevent Condensation**

Climate Zone	Recommended R-Value of Retrofit Insulated Panel	
	2x4 walls w/R-11 cavity	2x6 walls w/R-19 cavity
Marine 4	R-7.5	R-5
5	R-14	R-7.5
6	R-14	R-14
7 and 8	R-21.6	R-21.6

**Table 3. Minimum Retrofit Insulated Panel R-Values for Roofs to Prevent Condensation\***

Climate Zone	Recommended Retrofit Panel R-Value
2B and 3B, tile roof only	R-7.5
1, 2A, 2B, 3A, 3B, 3C	R-14
4C	R-21.6
4A, 4B	R-21.6
5	R-21.6
6	R-28.3
7	R-35.9
8	R-43.5

\* With air permeable insulation below sheathing, assumes R-19 existing.

Compared to the cost of replacing and painting siding, increasing the thickness of retrofit insulated panels is relatively inexpensive, so many builders opt to exceed the minimum specification in favor of increased energy efficiency. If conducting an energy audit, a BPI or RESNET certified professional can provide a cost-benefit analysis to help determine the best panel thickness for a specific project.

Panels are commonly available in 4' x 8' size, and many suppliers offer larger formats such as 4' x 12' or 4' x 16' that can be used to extend over rim joists and complete walls as seamlessly as possible. Panel foam thickness is usually matched to dimensional lumber sizes, i.e., 3 ½", 5 ½", etc., as 2 x 4s or 2 x 6s (etc.).

## House Preparation

Prior to installing retrofit insulated panels, all existing siding and/or roofing must be removed along with the weather resistive barrier and roofing underlayment.

The wall and roof sheathing surface should be cleaned of nails and staples before beginning installation.

If the project does not include installing new windows, it is recommended that the existing windows be removed and remounted at the exterior of the retrofit panels (Figure 9). However, if the windows cannot be removed and must be left at the inside plane of the existing sheathing, a weather resistant barrier (WRB) can be installed between the existing sheathing and the retrofit panel as per manufacturer's recommendations and taped (Figure 11). A properly installed WRB at the plane of the existing sheathing will act as a secondary drainage plane for water that penetrates to

the window surface and its perimeter. When a WRB is installed at the existing window and sheathing plane it is intended to act as a secondary barrier and drain at the window and bottom of the wall.

## Structure Assessment

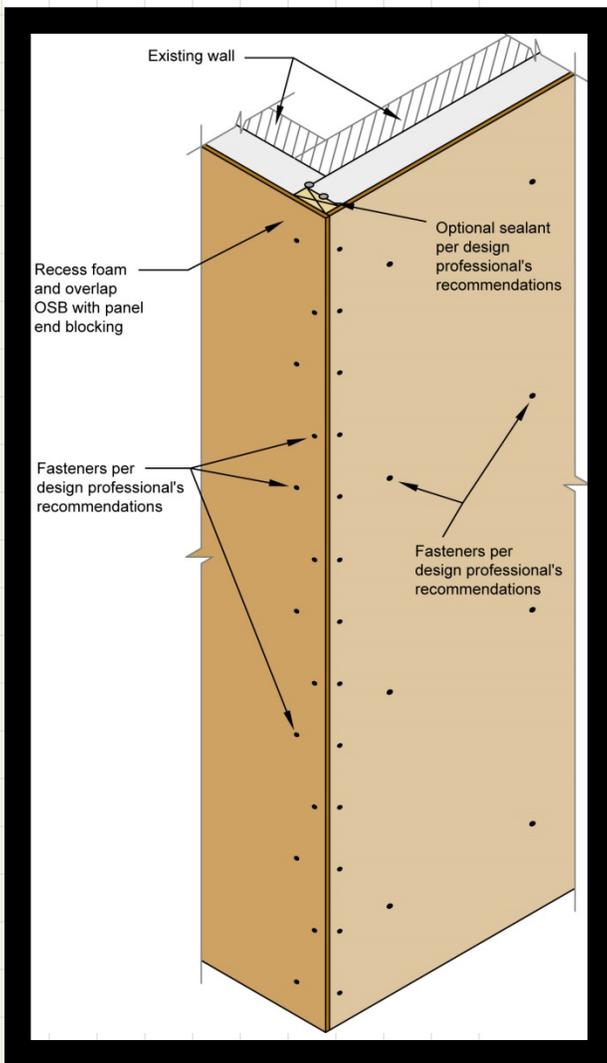
The first step in an energy retrofit is assessing the existing structure. Retrofit insulated panels can be installed over most types of wood-frame residential and block structures after the existing siding or roofing has been removed. Keep in mind that retrofit panels will increase the thickness of the wall or roof by the dimension of the panel's thickness. Existing roof overhangs should be greater than the added thickness of the wall, or provisions should be made for extending overhangs.

Consider whether doors and windows will be replaced with the retrofit. Develop an access plan for later removal and replacement without damaging the retrofit panel installation if the windows and doors will be left in place for the current project. Windows that are left in place after installation of retrofit insulated panels require complex details and dual drainage planes to assure bulk water resistance at the opening. Windows with installation flanges should always be installed on the outer face of the retrofit panels.

Other special features like dormers, roof brackets or corbels, exposed rafter tails, and cantilevers or bays may require special accommodation by a design professional. Begin with a sketch of the exterior of the house, include door and window openings, and outside dimensions.

## Key Measurements

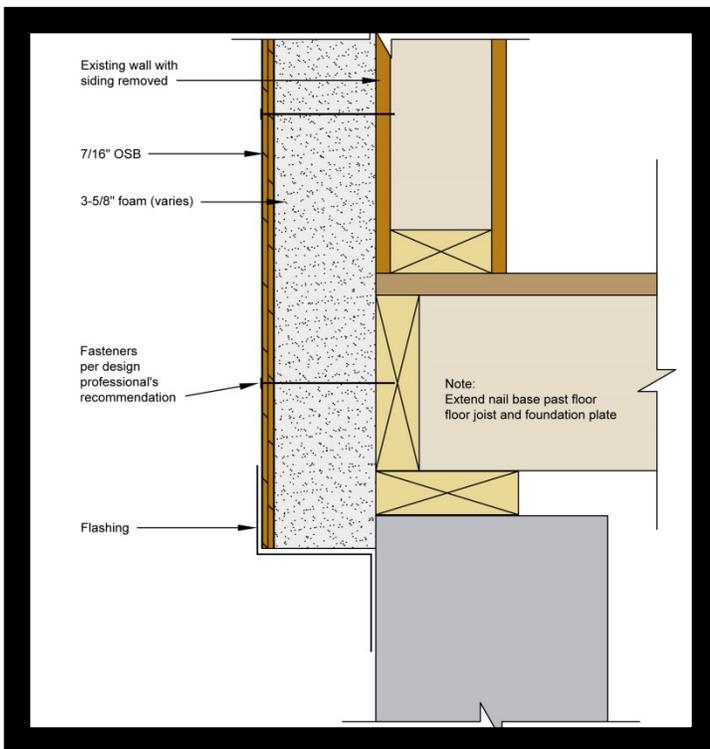
Measure the wall and roof area to determine the square footage and layout of retrofit panels that will be required. Retrofit insulated panels are a frequently-employed solution for adding insulation to vaulted ceilings or incorporating attics within a home's conditioned space. For conventional vented attics, retrofit insulated panels are often applied to the walls, only,



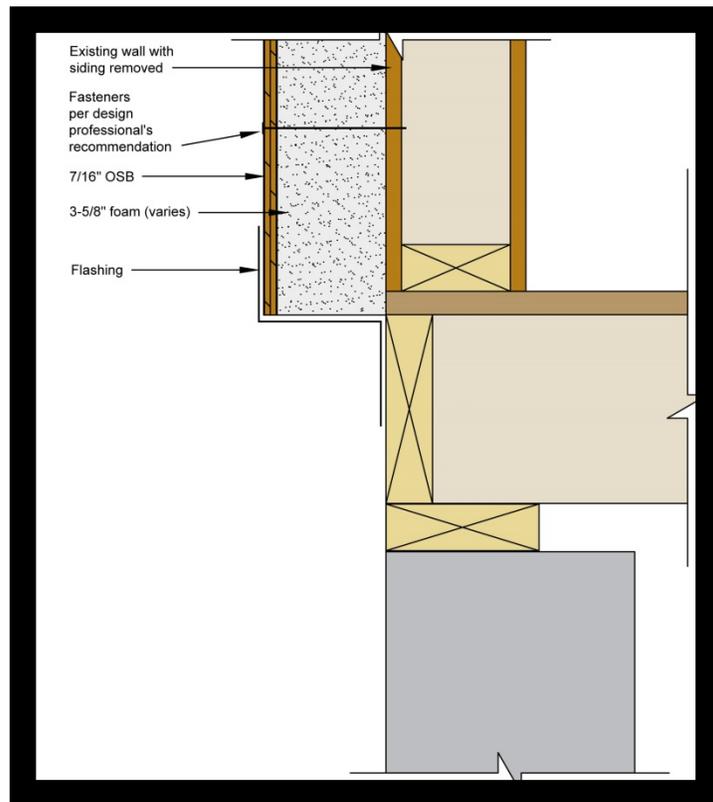
**Figure 2. Retrofit Insulated Panel Installation Detail at Outside Corner**

while bulk insulation and air sealing is added to the attic to improve whole house thermal performance.

When measuring the wall area, it is important to note that panels will extend beyond the existing wall dimensions at corners by the thickness of the retrofit panel and the product should be ordered accordingly (Figure 2). Panels are non-structural, so they can be pieced together to accommodate maximum material usage. However, the reliability of the air seal and labor time management, as well as the use of optional accessory materials like splines, sealant, and spray polyurethane foam (SPF), encourage the use of complete panels whenever possible.



**Figure 3. Retrofit Insulated Panel Extended Over Rim Joist**



**Figure 4. Alternate Retrofit Insulated Panel Rim Joist Detail**

If installing retrofit insulated panels as shown in Figure 3, the panel should be located at least 8 inches above grade, as with any wood product.

## Accessories

Installing retrofit insulated panels requires the use of several specialty accessories. These may be included with the retrofit insulated panel package or it may be the responsibility of the installer to purchase the appropriate accessories prior to installation. The manufacturer of the retrofit insulated panel can provide information on the correct sealants and fasteners to use with their products.

Common accessories include:

- Sealant – caulking used to seal between retrofit insulated panels that does not react with insulating foam
- Panel screws – screws used to attach retrofit panels to structural members through the thickness of the panel
- Splines – optional strips of OSB, pre-manufactured insulated blocks, or dimensional lumber used to join two retrofit panels together that may be specified by the design professional

## Storage Onsite

Retrofit insulated panels should be protected from the elements on the jobsite. Panels should be stacked on a level surface and elevated off the ground on dunnage or stickers made of dimensional lumber. When stacking panels, the bottom panel needs to have firm contact on all pieces of dunnage and the dunnage needs to be wide enough that it will not deform the bottom panel. Panels should be stacked OSB side down and at a limited height to keep the dunnage from deforming the panels. To protect from rain and UV exposure, opaque tarps or a roofed shelter is recommended.

## Installation

Inside corners are a good place to start retrofit panel installation. Inside corners are installed using a butt joint and optional sealant per the design professional's recommendations (Figure 5).

If there are no inside corners on the structure start the layout on the longest wall at the outside corner. Work across the wall and from bottom to the top of the house, continuously. Walls are typically installed with a two-person team, dependent on overall wall height.

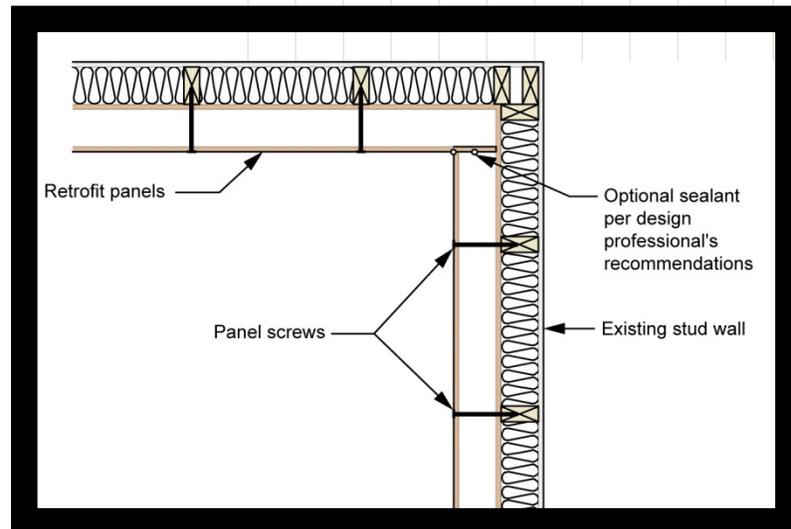


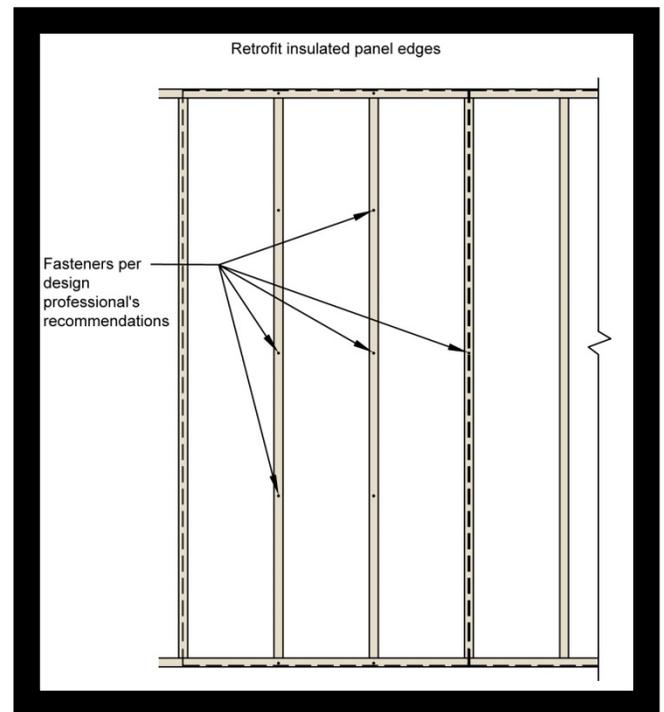
Figure 5. Inside Corner Detail.

Table 4 covers the estimated weight of retrofit panels.

**Table 4. Estimated Retrofit Insulated Panel Weight**

Panel Thickness	Estimated Retrofit Insulated Panel Weight (lbs. per panel)			
	4' x 8'	4' x 10'	4' x 12'	4' x 16'
4"	57	72	86	115
6"	64	80	96	128
7 3/4"	66	83	99	132
9 3/4"	72	90	108	143
11 3/4"	79	98	118	157

When a window or door opening in the wall is encountered, install the panel that precedes the panel with the cut out, then measure for the cut out. Cut the OSB with a circular saw then use a hot knife to remove the EPS at a work station. Size the opening and the EPS cut to accommodate the desired window detail; i.e., OSB overlapping or butting the window box. Place the sealant per the design professional's recommendations and install the panel.



**Figure 6. Wall Retrofit Insulated Panels**

## Fasteners

**Retrofit panels** are installed with screw connections driven through the retrofit panel into the structural members of the existing house wall or roof. Panel fastening schedules vary with weight of the cladding to be installed. Typical fastening patterns range from 12"

to 24" with studs spaced at 24" o.c., but actual fastening patterns will be supplied by the design professional. Panel screws are commonly supplied with the retrofit panel package.

**Wall claddings** are attached to the OSB skin of the retrofit panel with nails or screws as per the siding manufacturer’s installation directives. HardiePlank™ fiber cement lap siding has issued a Technical Bulletin covering attachment of their products to 7/16" OSB sheathing. Table 5 covers an abbreviated version of a Technical Bulletin for fastener spacing and type, wind speed zones, and fastening location for 5 ¼" wide fiber cement siding. The *References* section contains a web link to the complete bulletin.

**Table 5. Example of a Manufacturer’s Fastening Schedule for Horizontal Lap Fiber Cement to OSB Sheathing**

Basic Wind Speed (mph)	Building Height (feet)	Max. Fastener Spacing (in inches on center) for <u>11 gauge x 1 ¾"</u> roofing nail securing <u>5 ¼"</u> horizontal lap, Blind nailed			Max. Fastener Spacing (in inches on center) for <u>#8 x 1 5/8"</u> wafer head screw securing <u>5 ¼"</u> horizontal lap, Blind nailed		
		Exposure Category			Exposure Category		
		B	C	D	B	C	D
90	0-15	23	19	16	24	24	24
	20	23	18	15	24	24	24
	30	23	17	14	24	24	24
	40	22	16	13	24	24	24
110	0-15	16	13	11	24	24	24
	20	16	12	10	24	24	24
	30	16	11	9	24	24	23
	40	14	11	9	24	24	23
130	0-15	11	9	8	24	24	21
	20	11	9	7	24	24	20
	30	11	8	7	24	22	18
	40	10	8	6	24	20	17

Excerpt from Technical Bulletin Fastening JamesHardie Products over SIPs and retrofit insulated panels. Exposure categories as per IRC 2009.

Sidings of similar weight and size will have similar fastening constraints. Table 6 covers the weight of a few of the more popular wall claddings.

**Table 6. Average Weight of Wall Cladding Materials**

Type of Cladding	Weight Per Square Foot (lbs.)
Cedar, 5/8" bevel stk.	3.0 <sup>B</sup>
Fiber Cement, 5/8" smooth lap	2.3 <sup>C</sup>
Vinyl, double 4.5, .040"	0.4 <sup>A</sup>

<sup>A</sup> <http://ws680.nist.gov/bees/ProductListFiles/Generic%20Vinyl%20Siding.pdf>

<sup>B</sup> [www.csgnetwork.com/lumberweight.html](http://www.csgnetwork.com/lumberweight.html)

<sup>C</sup> [www.jameshardie.com/homeowner/products\\_siding\\_hardieplankLapSiding.py?search\\_zipcode=retail](http://www.jameshardie.com/homeowner/products_siding_hardieplankLapSiding.py?search_zipcode=retail)

**Solid lumber blocking** is often required to attach heavier items like hand rails or awnings. Lumber blocking should be sized the width of the foam and slightly larger than the object that needs to be fastened to it.

**Roof claddings** are attached to the OSB skin of the retrofit panel per the roofing manufacturers' fastening installation instructions. In a conventional roof assembly, many of the fastener connections are made through OSB rather than as a fastener embedment in a structural member, thus there is nothing new about fastening composition shingles to a retrofit roof panel. Make certain to review manufacturer's guidelines with regard to roof pitch and nailing patterns. Consult product manufacturers about fastening specialty roofing finishes.

## Adhesives and Sealants

If sealants are used during retrofit insulated panel installation, the sealants need to be EPS compatible. These products are often supplied by the retrofit insulated panel manufacturer and can be used for foam to foam, wood to foam, or wood to wood connections. Common solvent-based construction adhesives are not compatible with EPS foam and should not be used where they are likely to come in contact with the EPS.

Another commonly used product is low-expansion, closed cell, spray polyurethane foam. Unlike sealant, spray polyurethane foam can be used to seal gaps or voids. It is recommended that all sealants and adhesives used with retrofit panels be low VOC products.

## Windows & Door Installation Using New Units

Installing retrofit insulated panels adds to the wall thickness, thus, new windows will be mounted flush with the OSB surface of the retrofit panel. A new construction, flanged, window, or pre-hung door, with exterior molding attached to the jamb will be installed flush with the OSB surface of the retrofit panel. Jamb extensions are fashioned with dimensional wood that matches the thickness of the foam in the retrofit panel. Jamb extensions are attached with long screws through the depth of the new dimensional lumber member into the existing studs at the window opening and caulked at the

building and the existing sheathing. Adhesive caulk is installed on the outside edge of the jamb extensions to adhere to the back of the OSB of the retrofit panel if the EPS foam at the window opening in the retrofit panel was routed out 1 ½" from the panel edge prior to panel installation (Figure 7). It is often easier to install the dimensional lumber after the panel has been installed.

Otherwise, the window opening can be cut into the retrofit panel so that the foam and the OSB of the retrofit panel butts to

the window box extension. Spray polyurethane foam completes panel-to-panel and foam-to-window box connections.



**Figure 7. Retrofit Panel Routed for Window Box**

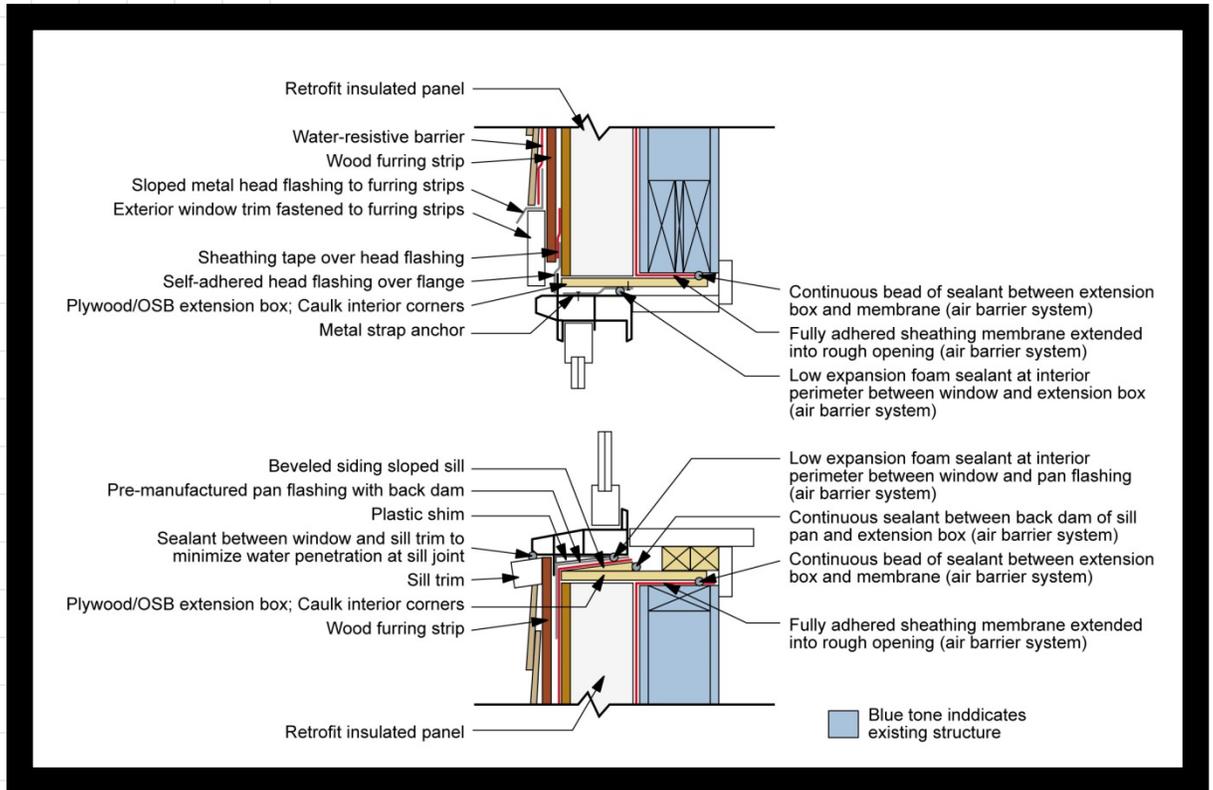
Courtesy Zero-EnergyPlans.com



**Figure 8. Window Box with Retrofit Panel**

Courtesy Zero-EnergyPlans.com

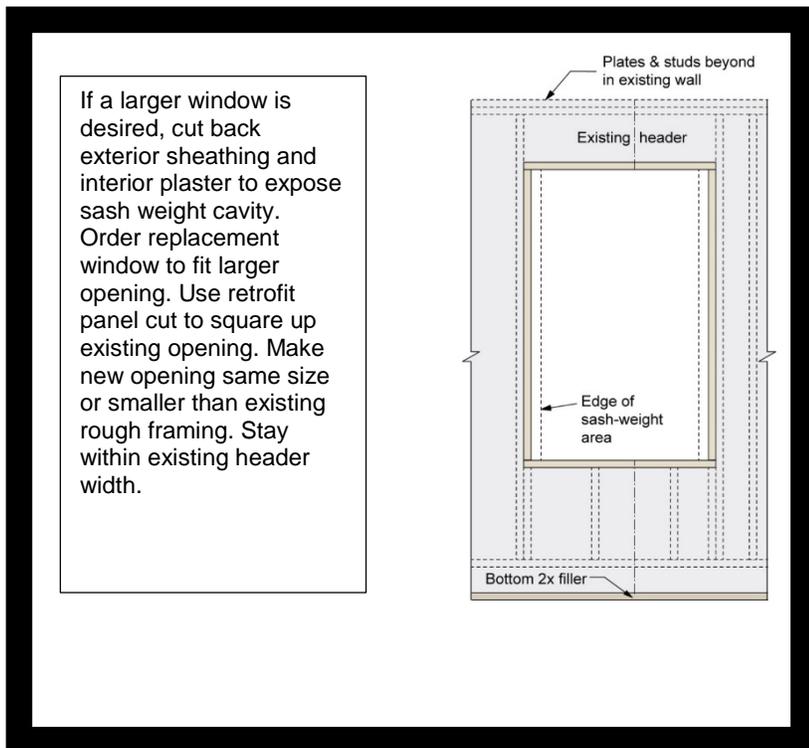
Homes with older, sash-type windows may need to have the rough opening enlarged by cutting back sheathing to expose and remove sash weights (Figure 10). In this case, a larger window is ordered and mounted on the outside as described above. Windows and



**Figure 9. Window Mounted at Exterior Plane**

doors are installed after the WRB has been installed and taped and flashed consistent with the window manufacturer’s instructions and ASTM 2112 (*References* section). Mounting an exterior window or door will require jamb extensions on the interior of the house.

Interior jamb extensions can be fashioned from painted drywall or trim material and fastened to the material that is used to create the window box

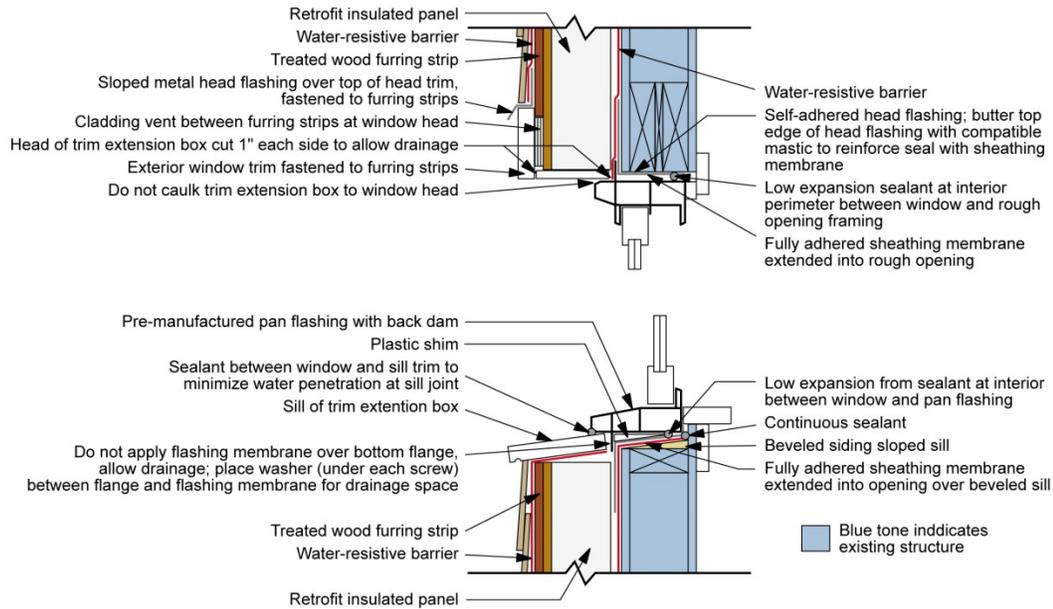


**Figure 10. Replacing Sash-Type Windows**

## Installation with Existing Windows

When the decision to keep the existing windows is made, the existing windows should be removed and remounted at exterior of the retrofit insulated panel using the process described above for new windows (Figure 11).

If the home contains older sash-type wood-frame windows that cannot easily be removed and reinstalled, they can be left in place and jamb extensions can be installed on the exterior to accommodate the thickness of the retrofit insulated panels (Figure 12).



**Figure 11. Windows Left in Place**



**Figure 12. Alternate Window Box Mount**  
Courtesy: Cold Climate Housing Research Center

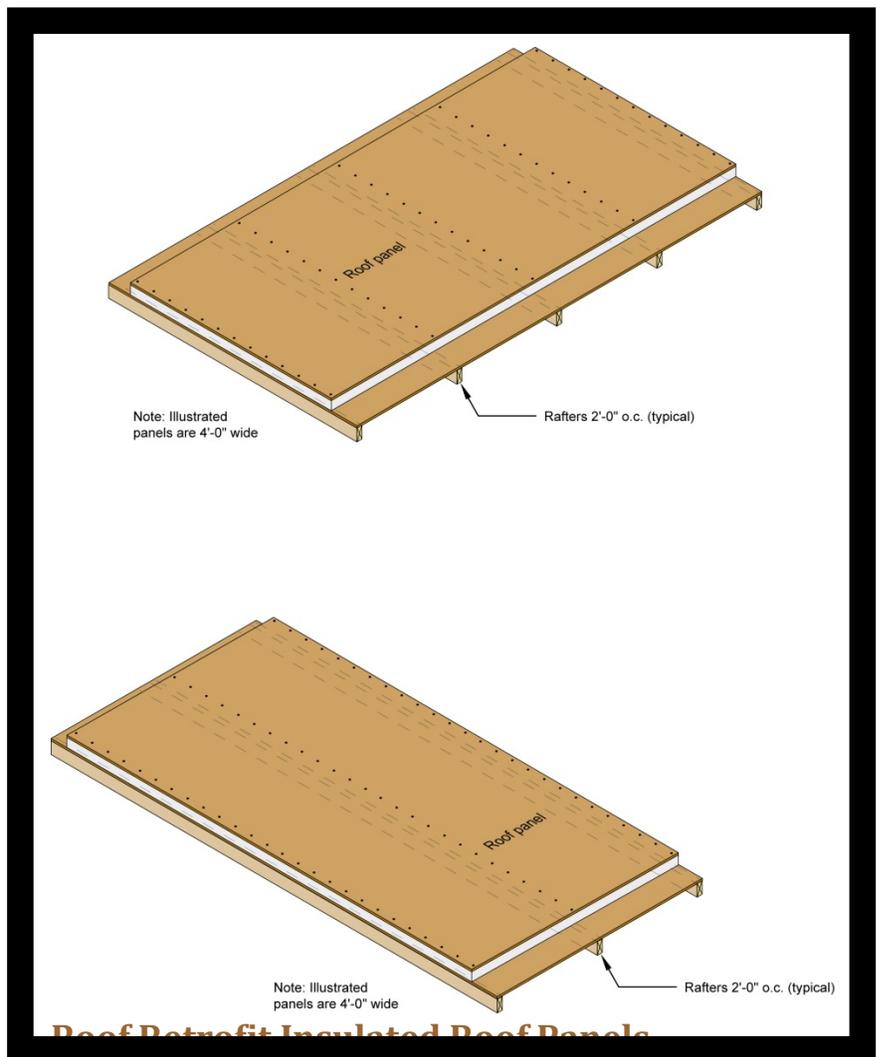
Provisions for future window replacement without compromising the air seal of the retrofit panel installation must also be made. Strip the existing window trim to determine the type of window mount. Verify that head and side flashing and sill pan are repelling water and that area around window shows no sign of water intrusion. (If there is water intrusion and the window must be removed to repair, consider remounting it at the outside face of the retrofit panels.) Once the window is well flashed

and sealed, install the new window/jamb extensions wide of the window flanges or jamb edge so that the window unit can be reached and removed at a later time without damage to the window box. The construction of the window box can be made of any number of materials, which are dependent on future window installation location and aesthetics. If the intention is to remount a future replacement window inside the wall, the jamb extensions can be formed in aluminum coil stock or other light gauge metal as flashing and the finish trim. This type of trim can be installed after the retrofit panel and should include a continuous downward-sloped sill.

In Figure 12, the window box has been created with a 1" x 8" trim board of cellular PVC. The box is supported by a steel L bracket on all four sides. To make the window accessible for a future replacement, size the box wide of the window flange and seal the window box to the retrofit panel with spray polyurethane foam (SPF). Trim inside window box at window frame with custom coil stock as required.

## **Mechanical Penetrations through the Exterior Wall**

Any plumbing or electrical penetrations through the building enclosure will also require extensions to account for the additional wall thickness. Wall mounted light fixtures will need to be removed and remounted after the retrofit panels are installed. Electrical wiring to exterior fixtures may need to be lengthened to accommodate the added width of the retrofit insulated panels. The OSB facing eliminates the need for light blocks where the fixtures are attached to the wall.



**Figure 13. Roof Retrofit Panels Applied to Structural Members**

Retrofit insulated roof panels are attached through the width of the panel to a structural member using panel screws (Figure 13). Fastening patterns will be provided by the design professional.

## Tools Used With Retrofit Insulated Panels

The OSB facing of retrofit insulated panels is easily cut using a circular saw. After marking and cutting the OSB facing, the cut can be completed by slicing through the EPS foam with an electric hot knife, a hot wire, or a hand saw. A 16 5/16" circular saw (Figure 18) with the blade depth set to the desired size of the foam that is to be removed or a double sided pull saw (Figure 19) can also be used to rout foam from the panel.

Depending on the type of panel-to-panel connection used, builders may need to recess the foam along panel edges to accept splines that are specified by the design professional. The foam at door and window box openings is also removed to accommodate the dimensional lumber frame, as per (Figure 7). An electric hot knife, hot wire, or a foam scoop will remove EPS from the OSB of retrofit insulated panels. Panels of polyurethane foam require an angle grinder attachment to mechanically remove the foam.



Figure 14. Electric Hot Knife



Figure 15. Spray Foam Application Gun

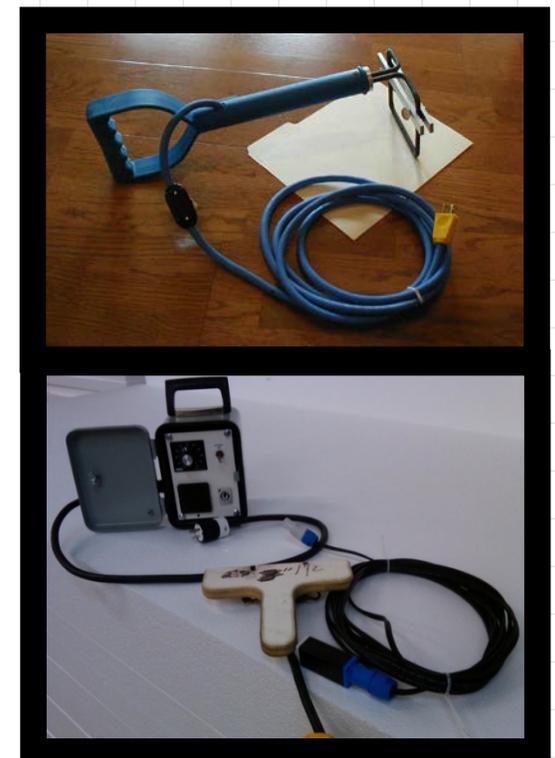


Figure 16. Electric Foam Scoop and Electric Hot Wire Tools



**Figure 17. Panel Adhesive Applicator**

## Air Sealing

Retrofit insulated panels owe their effectiveness to the combination of insulation and air sealing. Sealing is a critical part of the retrofit panel installation process. Any gaps in the air barrier can become hotspots for moisture migration. Sealing is done using low expansion polyurethane foam sealant or sealing mastic, also called panel sealant.

These sealants are sold in 20 ounce sausage rolls that are applied with the “gun” shown in Figure 17.



**Figure 18. Sixteen-Inch Circular Saw**

## Splines and Panel-to-Panel Joint Details

The preferred detail for in-plane panel connections is a butt joint (Figure 21).

Some design professionals may specify splines for in-plane panel connections in certain situations. If such unique circumstances exist, splines can be supplied by the retrofit insulated panel manufacturer. Splines are more common in roof applications than wall installations.

Dimensional lumber blocking is installed around window and door openings, on outside corners, and at the top and bottom of each panel if necessary. Blocking is not needed along the top edge if panels are installed against a solid surface. Blocking is normally installed after panels are in place except where it is not feasible to do so.



**Figure 19. Double Edged Pull Saw**  
Courtesy: Zoro Tools

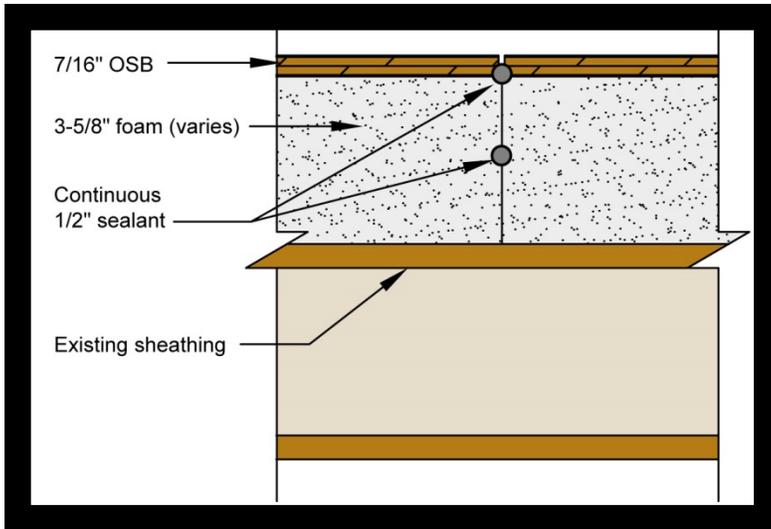


Figure 20. Butt Joint Detail with Sealant

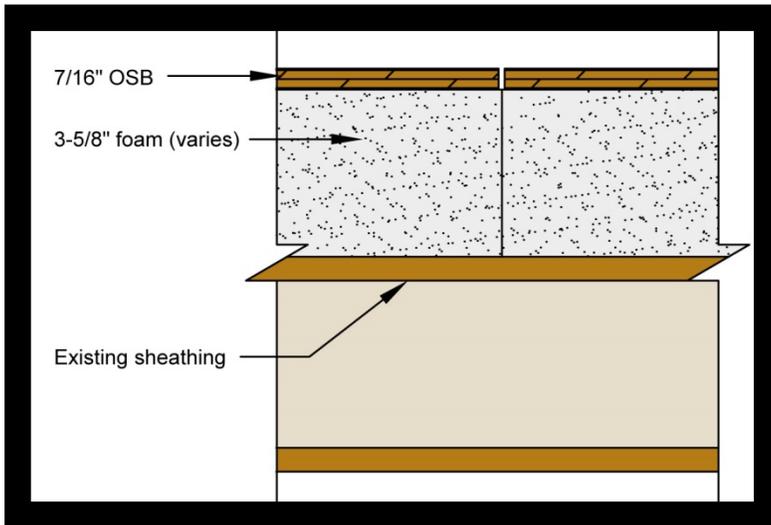
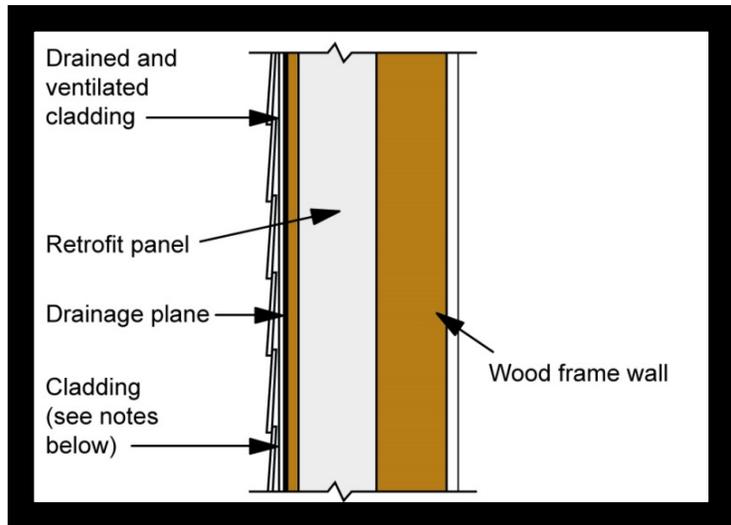


Figure 21. Butt Joint without Sealant

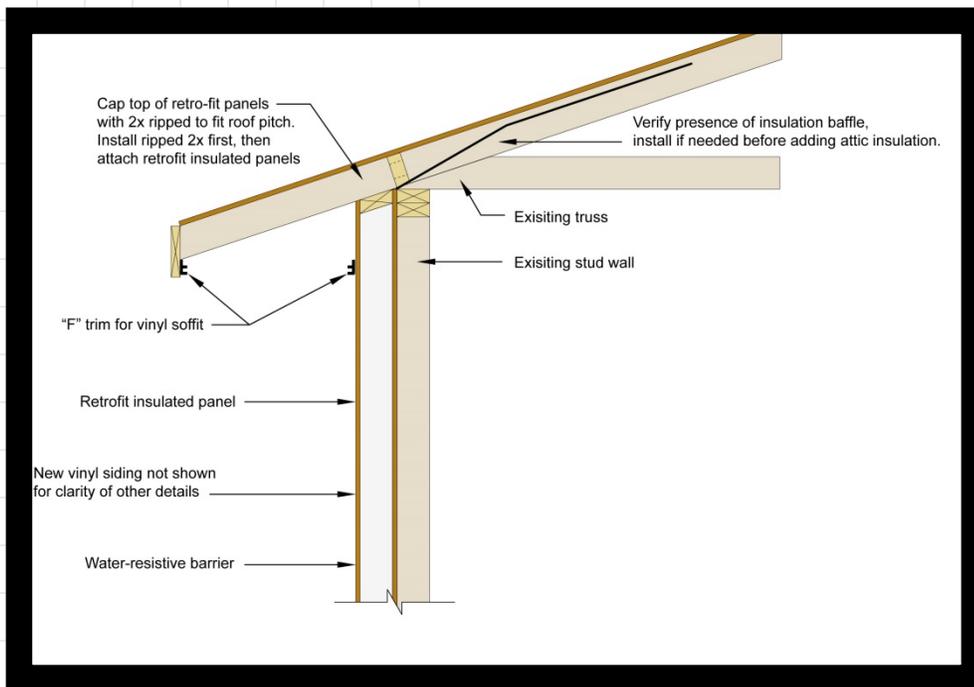
## Finishing - Walls

After retrofit insulated panels are installed over the walls of an existing home, the building must be covered with a weather resistive barrier (WRB). Windows, doors, and any penetrations must be properly flashed to protect against bulk water intrusion. Almost any type of siding or exterior finish material normally used over wood frame construction can be applied over retrofit insulated panels. Refer to the siding manufacturer's



**Figure 22. Retrofit Insulated Panel with Rain Screen**

installation instructions for fastener spacing. The 7/16" OSB facing on retrofit insulated panels offers less pullout resistance than dimensional lumber and typically requires an increased fastening schedule.



**Figure 23. Soffitt Detail for Vinyl Siding**

In cold and wet climates (where average annual rainfall exceeds 20"), it is recommended that siding be installed with a vented air space between the siding and the weather resistive barrier, also known as a rain screen (Figure 22). This detail allows any moisture that enters the wall assembly to dry, increasing the durability of the structure. Consult a qualified building science professional and local building codes to determine if a vented cladding system is the best choice for your climate.

## Finishing – Roofs

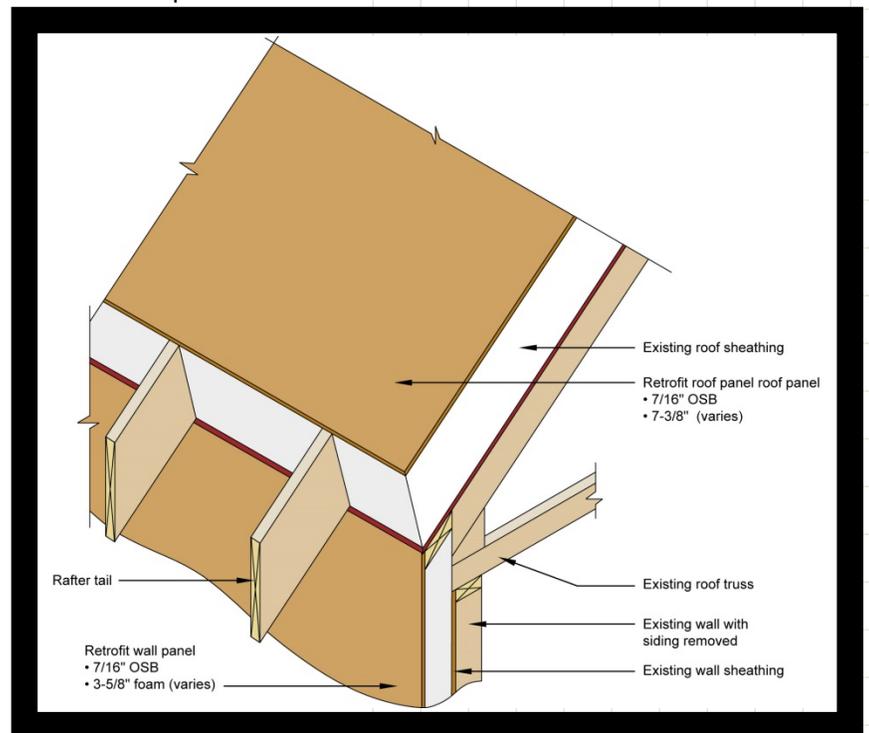
In roof applications, retrofit insulated panels need to be covered with standard roofing underlayment and roofing shingles.

A design professional may require a vented or "cold roof" in extremely cold or wet climates. This is accomplished by installing a second layer of roof sheathing over furring strips, followed by another layer of roofing underlayment, or by using a retrofit insulated panel with pre-formed ventilation channels.

## Roof/Wall Details

If the project is using retrofit insulated panels for the walls only and not enclosing the attic space with retrofit insulated panels, the wall retrofit insulated panels should be installed flush with the existing eaves. Inspect the attic and verify that an insulation baffle is present and that it extends down to the heel of the truss, maintaining the air barrier. Once this is complete, a new fascia and soffit can be installed.

One way to approach the intersection of wall and roof retrofit panels, whereby the wall panel encapsulates the attic area right up to the bottom of the roof deck, is shown in Figure 24. The original truss overhang was removed prior to installation of the wall panel. When an attic is very leaky where the truss meets the outside wall, covering that poor connection with the wall panel and sealing it to the bottom of the roof retrofit panel incorporates the old attic space into the conditioned space of the remodeled house. Roof overhangs can be rebuilt in several ways.



### Precut Pockets

Figure 24 shows how dimensional lumber rafter tails can be embedded in precut pockets in the foam that are fabricated by the retrofit insulated panel manufacturer. This option requires advanced coordination with the retrofit panel manufacturer but saves labor onsite and creates fewer opportunities for air leakage.

The rafter tails are secured through the OSB facing and sealed in place with expanding foam. Blocking running along the panel edge provides the primary support, although larger overhangs may require a kicker brace as well.

#### **Extending Overhangs at Panel Joints**

Another method for extending overhangs is to place dimensional lumber rafter tails at panel intersections. The foam is recessed in the field to accept the dimensional lumber matching the full thickness of the panel. They are secured through the OSB surface of the retrofit insulated panels.

#### **SIP Overhang**

A third option is to create an overhang using a structural insulated panel (SIP). SIPs and retrofit insulated panels are readily available from the same suppliers. If SIPs of non-standard thickness are available, they will interface seamlessly with standard retrofit insulated roof panels.

## Additional Wall Details

### Estimation Sheet

#### Walls

Walls (from below sill plate line to above top plates, as roof trusses/rafters allow)		SQ. FT.
Add: Gable ends		SQ. FT.
Add: Dormer sides		SQ. FT.
Add: Upper gambrel walls or parapets		SQ. FT.
 Subtotal (walls)		 SQ. FT.
 Subtract: Large areas not covered (garage doors, sliding doors, windows)		 SQ. FT.
 Total wall panel area take-off (subtract uncovered area from subtotal)		
 Divide wall square footage by panel size		
 Total number of 4 x 8 panels to order		
Total number of 4 x 10 panels to order		
Total number of 4 x 12 panels to order		

#### Roofs

Total roof panel area take-off		SQ. FT.
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#### Lumber - Walls

Treated lumber for ledgers		LF
Bottom blocking		LF
Blocking at outside corners		LF
Window blocking		LF
 Total - wall lumber		 LF

#### Lumber - Roofs

Perimeter blocking for fascia attachment		LF
Rafter tail extensions		LF
Soffit framing (if required)		LF

Total - roof lumber

LF

\_\_\_\_\_

**Screws**

Wall panel screws -  
approx. 1 per 2 sq. ft. of wall panel area

\_\_\_\_\_

Roof panel screws -  
approx. 1 per 2 sq. ft. of wall panel area

\_\_\_\_\_

**Sealants**

Tubes of mastic sealant

\_\_\_\_\_

Cans of expanding foam

\_\_\_\_\_

### **Additional Deep Energy Retrofit Considerations**

The existing heating or cooling system may be too large for the home after the thermal performance has been improved, causing the HVAC equipment to operate less efficiently and effectively. Oversized HVAC equipment results in uncomfortable conditions and fails to properly dehumidify or deliver fresh air, creating the potential for mold growth and other indoor air quality concerns. To achieve the best energy efficiency results and maintain good indoor air quality, older equipment should be replaced. All natural combustion equipment should be tested for proper draft by a RESNET or BPI certified analyst after the retrofit.

### **Other Recommendations**

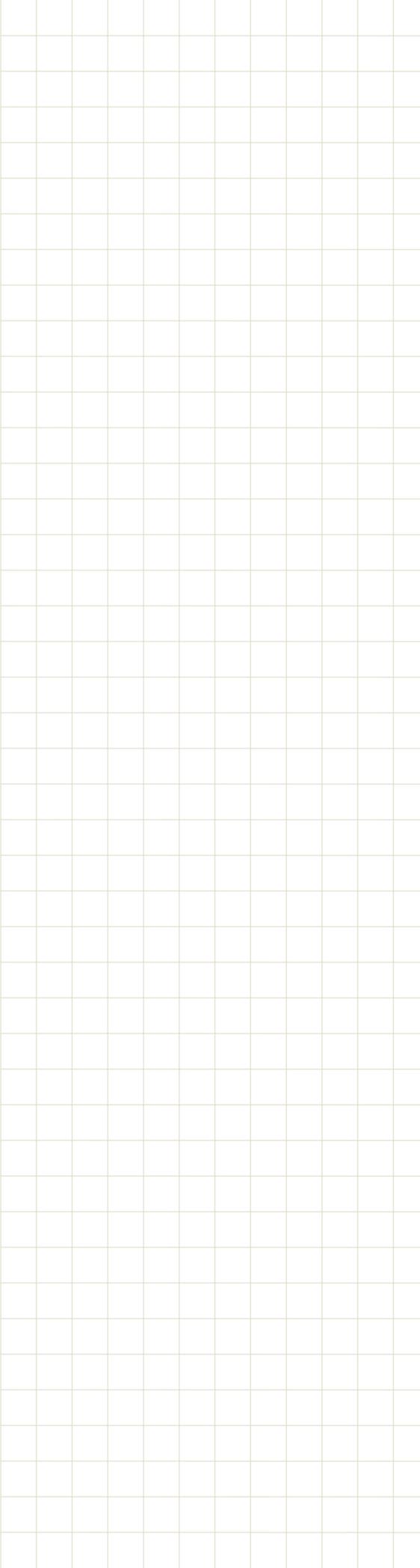
#### **Do**

Use single component SPF in 24 oz. dispensing canisters for use in top load foam guns for affordability and ease of application.

#### **Don't**

Use single component SPF in extremely cold weather.  
Manufacturers suggest spray foam be used at as close to room

temperature as is practical, however lower end of use ranges vary by product from 60°-25°.



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## Appendix I

### IRC Requirements for Exterior Foam Insulation

Section 601.3.1 of the 2009 International Residential Code (IRC) provides worst case guidance as to the minimum thickness of exterior foam required to prevent moisture accumulation in wall cavities in cold climates where class III vapor retarders were used on the interior walls (no vapor barrier, painted drywall). Table 1 contains these minimum R-values for exterior wall foam application by climate zone, as referenced by the IRC.

**Table 7. Minimum R-Value of Exterior Wall Foam Application in Cold Climate Zones**

Climate Zone	Minimum R-value of Exterior Foam Insulation	
	2x4 walls	2x6 walls
Marine 4	R-2.5	R-3.75
5	R-5	R-7.5
6	R-7	R-11.25
7 and 8	R-10	R-15

The IRC provides similar guidance for the use of exterior foam on roofs when the interior insulation is air permeable and the attic is unvented with Table R806.4 *Insulation for Condensation Control*, reported here as Table 2. \*These minimums may be added to the minimum R-values established by the Chapter 11 (IRC) energy requirements.

**Table 8. Minimum Exterior Rigid Foam R-Value in Unvented Attic\***

Climate Zone	Minimum Rigid Board R-Value
2B and 3B, tile roof only	None required
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

\* with air permeable insulation below sheathing.

## Appendix II

### Sample fastening schedule for retrofit insulated panels

The following fastening schedule was taken from a deep energy retrofit project and used to attach retrofit insulated panels in the listed thickness to wood-framed 2 x 4 walls. The panels support horizontal vinyl siding. Actual fastener spacing will depend on the panel thickness, cladding type, screw type, stud spacing, and other factors. Table 9 is shown for demonstration purposes only. Each job will receive specific fastening instructions based on custom factors.

**Table 9. Typical Fastening Schedule**

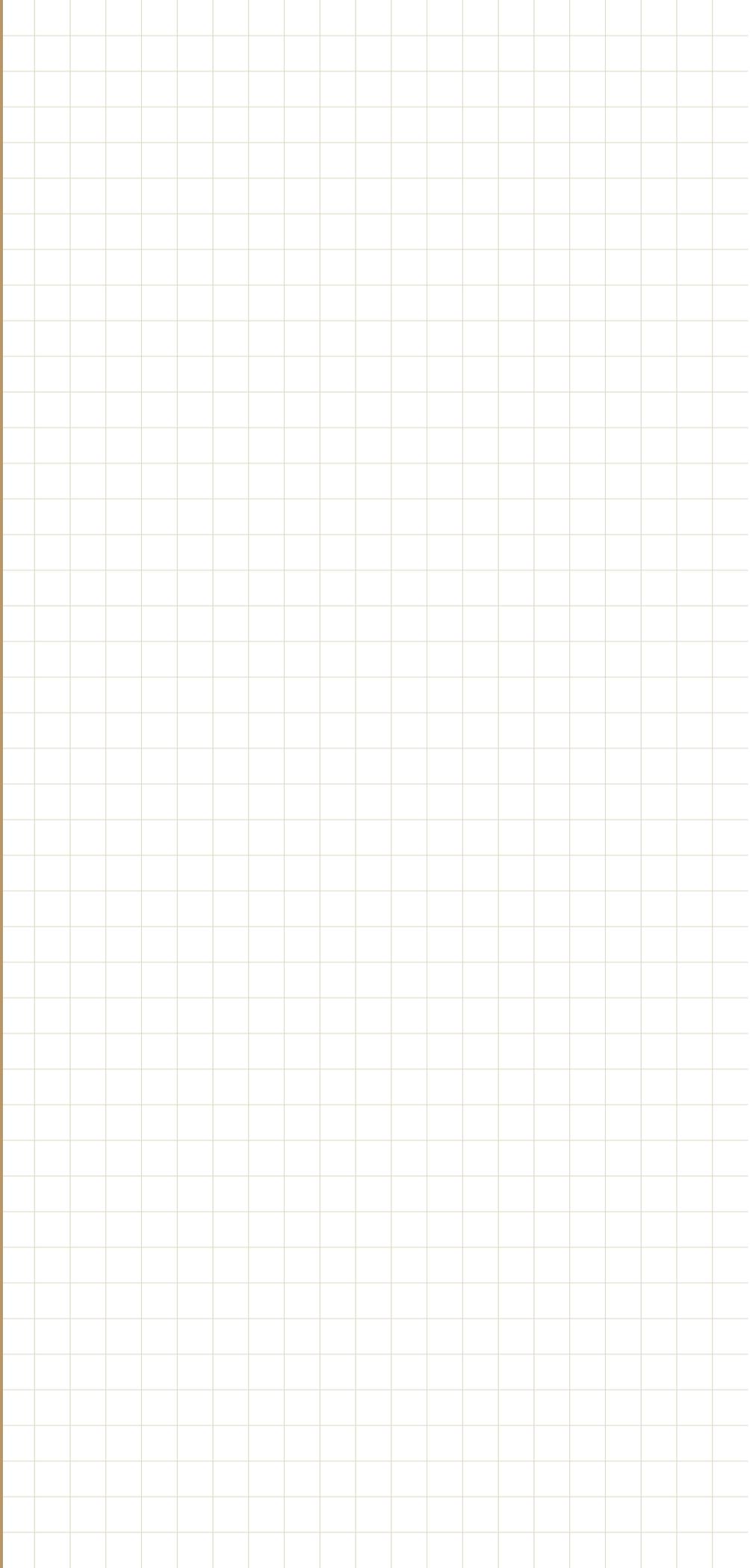
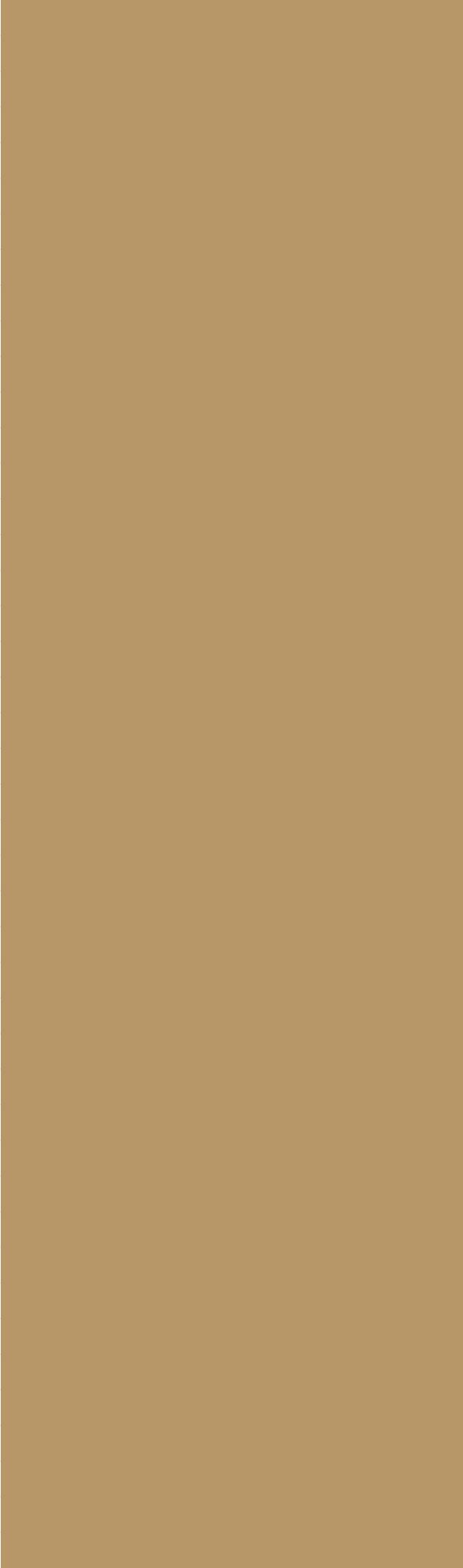
Panel Thickness	Screw Length	Screw Spacing
2"	4"	24" o.c.
4"	6"	24" o.c.
6"	8"	16" o.c.

1. Panel joints should occur between supports
2. Screw spacing is into each stud/rafter/truss
3. Fasten to studs spaced at 16" on center











**Structural Insulated  
Panel Association**