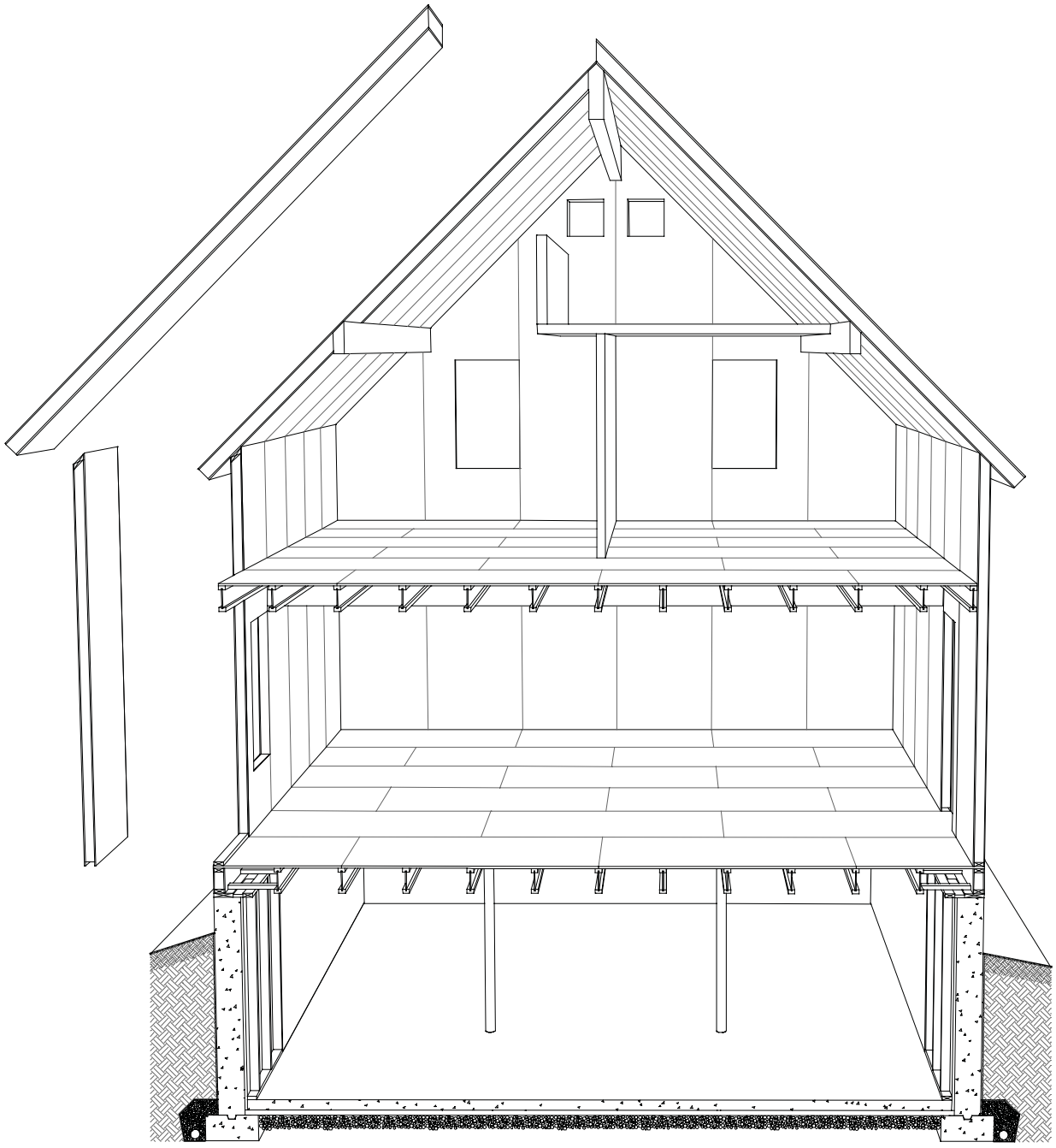
The Complete Guide to Building With Winter Panels



winterpanel

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Preface

You have chosen a superior building enclosure system with Winter Panels. This manual gives you the information you need to match the quality of the installation to the quality of the system. Winter Panel systems are energy efficient, designed and engineered for strength, design flexibility, and lasting excellence.

The building industry has changed dramatically over the last 25 years—we routinely build more complicated structures, on an accelerated schedule, in all seasons and weather, with a greater variety of materials and greater number of trade contractors. Add into this mix an intense focus on energy efficiency, and even the best of new building systems will require thoughtful application and installation.

This Winter Panel installation manual has an added focus on building science and moisture management that reflects the 21st century building environment. The central premise of this approach is the following:

> The only way to build high performance buildings—buildings that are safe, comfortable, durable and efficient—is to manage the flow of air and moisture in, around and through the building with the same level of care and attention to detail as we manage the flow of energy.

Since Winter Panels manage the flow of energy exceptionally well, Winter Panel buildings must manage the flow of moisture and air in an exceptional way as well. The relatively low drying potential of the panels must be respected in the design and construction of Winter Panel buildings. Throughout this manual, there is new information on managing moisture to protect the integrity of the panel system—during site storage, installation, enclosure, and even panel treatment during subsequent events such as trade contractor penetrations or occupant-generated interior humidity.

It's also important to place the performance of the building enclosure system, Winter Panels, in the context of the complex system we call a building. The performance of the panels is as linked to the type and quality of installation of other building systems—such as exterior claddings and windows—as it is to proper installation of the panels. For information on how installed and erected Winter Panels fit into the entire process of building performance, see the new section, **Completing the Process**.

Manual Organization

This guide replaces both the ***Winter Panel Homes Construction Manual*** and the ***Timber Framer's Guide to Stresskin Panel Installation***. This guide is made up of three sections:

- **Structurewall™ Panel System Installation** – Using Winter Panel's Structural Insulated Panels (SIPs) in place of conventional stick-framed walls and roofs for an entire structural shell.
- **Enclosing a Timber Frame with Winter Panels** – Using Winter Panel's non-structural Curtainwall™ OR Structurewall™ panels to enclose a timber frame building.
- **Completing the Process** – Weather-resistive barrier, flashing, wiring, plumbing, cabinetry, landscaping, and HVAC details to turn a Winter Panel shell into a high performance building.

Each chapter is comprised of three basic sections:

- **General or Design Information** – Usually information about how panels differ from conventional stick-frame construction.
- **Moisture Management** – Usually best practices that are well-suited to Winter Panels, so that the panel's superior thermal performance is matched by superior moisture performance.
- **Installation Sequence** – Numbered and supported by detailed graphics.

NOTE: Foundation details specific to Winter Panels can be found in the first chapter of the first section on **Structurewall™ Panel System Installation**.

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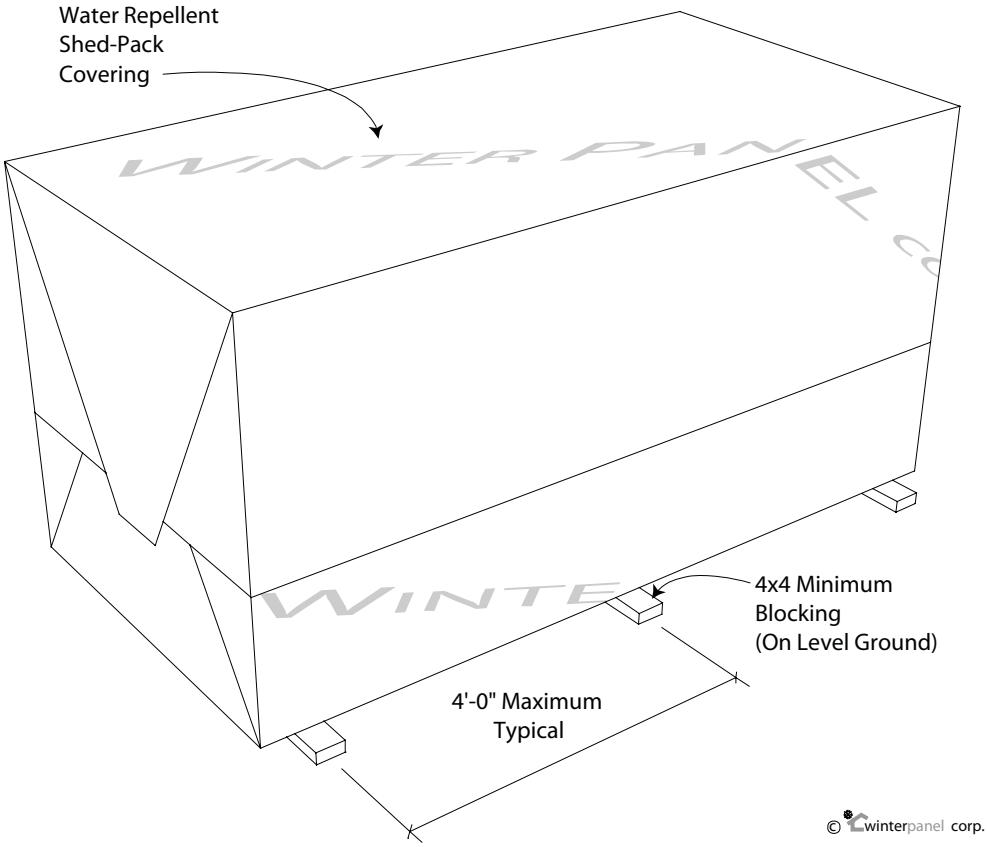

Figure 1. Panel Storage on Site. *Winter Panels are robust, but like any building material, their storage on the construction site must protect product integrity.*

Important Starter Information

Be Prepared

This guide is not designed for beginners or novice carpenters. It presupposes a basic understanding of sound construction practices, including job site safety and the proper use of power tools. The panels are relatively heavy (approximately 4 pounds per square foot) and their handling generally requires the use of some sort of mechanical lift. Installation of a Winter Panel shell generally can be accomplished with a crew of three to six. Installers of Winter Panels should have completed training by a Winter Panel representative.

Keep Panels Off The Ground And Dry

Panels should be stored on site per **Figure 1**. Make sure the ground is flat, so that panels will not deform. Some exposure to rain will not cause damage, but extended exposure will cause edge swell, requiring sanding for a smooth finish after installation. If the panels will remain at the site for more than a week or two before installation, they should be stacked in a covered location.

Make Sure The Foundation Is Square and Level

Proper panel construction depends on the foundation being square and level to within very tight tolerances. If the foundation is out of square or not level, panel installation will be much more difficult. The foundation is your responsibility. Supplied foundation drawings are intended to show size and bearing points for the supplied shell kit. Local codes and soil conditions may require additional engineering for compliance.

Follow Load And Span Limits Carefully

Load and span limits for Structurewall™ panels and other building components, such as engineered joists and laminated beams, are given in the manufacturer's literature for those products. A Winter Panel structure will be fully designed to satisfy all structural limits. Do not customize or change any part of a shell design without consulting a Winter Panel designer.

Follow Fastener Specifications Carefully

Using the proper fasteners and spacings is critical with Winter Panel Systems. See **Appendix A** - **Fastener Schedule**. More complete information is provided throughout this Guide.

Install Splines Or Blocking At All Panel Joists

Two 5/8" x 3" splines are required at all joints between panels. Two-by blocking is used at point load distribution, and 4" x 4" splines may used in some instances, as described later in this manual. Failure to install splines, or improper installation of splines, will violate the structural continuity of the shell. Panel joints must be sealed with foam sealant during installation.

Make Sure That All Panels Are Properly Routed

Winter Panels can be shipped pre-routed or blank (not pre-cut or routed). If on-site modifications are made, or if panels are found to be improperly routed, you will need to rout the panels with the proper power or hand tools described in **Appendix B**. Inspect all panels as they are installed and make sure they are properly routed.

Air Seal Every Joint And Connection

All panel joints and intersections with other building components or assemblies must be sealed with foam or other sealant during installation. Protect all sealants from freezing and extreme heat.

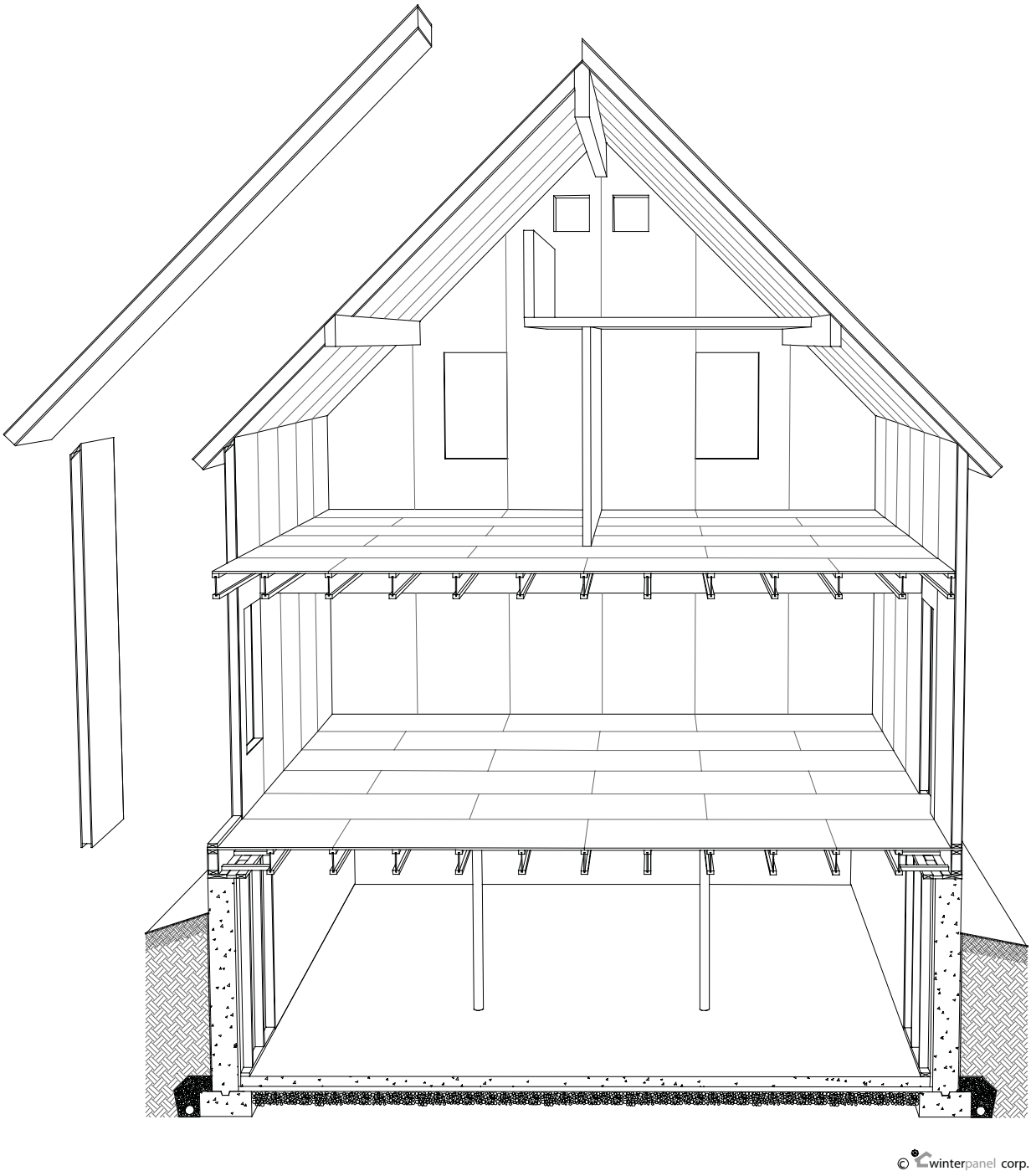

Figure 2. Breakaway Drawing of a Winter Panel building. *In Winter Panel buildings, Structurewall™ panels provide both wall and roof systems, tied together by joists, flooring and interlocking panel joists.*

Section I - Structurewall™ Panel System Installation

Introduction

The overall design and construction of a Winter Panel structure is illustrated in **Figure 2.** Structurewall™ panels provide a complete wall and roof shell. Wall panels are installed vertically from first floor deck to upper floor deck or roof. Wall panels are joined together with dual 5/8" x 3" plywood splines, and fully inset two-bys are installed for strength at wall corners and at the top and bottom of each panel.

The outside of first floor joists are insulated with special "band panels", minimizing the heat loss that usually occurs through the band joists. On the first floor, the joists (usually engineered I-joists) are supported on the sill with a band panel of the same depth forming the perimeter of the floor system. With upper floors, joists are hung from the top of wall panels. The subfloor in all levels usually extends all the way to the outside of the wall to tie floor, wall and roof assemblies together. Basement girders are usually pocketed into the foundation wall.

Laminated beams, structurally inset into wall panels, are used to carry roof or upper floor loads, with or without intermediate support from posts or interior structural walls (depending on spans and loads). Structurewall™ panels, connected with dual 5/8" x 3" splines, provide the roof and wall framing, insulation and sheathing. In the roof, the panels span either from ridge to eave, or to intermediate purlin supports, depending on roof dimensions and design loads.

The completed shell provides tremendous flexibility of interior layout because of the absence or small number of interior supports. Large open rooms, two-story cathedral ceilings and cantilevered balconies can be easily incorporated into a Winter Panel design.

Foundation

General – A fundamental difference between panel and stick-frame construction is the alignment of exterior walls with the foundation. The outside of the foundation is flush with the outer edge of the installed panels as shown in **Figure 3**. So, while the weather resistant barrier and cladding extend out and down past the foundation, the outer skin of the panel does not—it rests on and is aligned with the outer edge of the foundation.

Full Basements and Crawls: With full basement and crawlspace applications, a pressure-treated mudsill is anchored to the frost wall with threaded j-bolts or foundation tie straps as indicated in the plans or dictated by local code. The outer edge of the sill should be flush with the outside of the foundation if the foundation matches the building dimensions.

The foundation design should accommodate Structurewall™ band panels in place of a conventional band joist on the first floor deck—they are essential to maintaining the high performance that the Winter Panel system delivers for the rest of the structure. See **Figure 3**.

When the house design calls for an interior supporting girder(s) (to carry long joist spans, for example), concrete-filled structural steel pipe columns are typically specified, sized per the drawings or as indicated by the load each column will experience. These columns are set on reinforced concrete pads below the basement floor level (usually at the same elevation as the top of the footings).

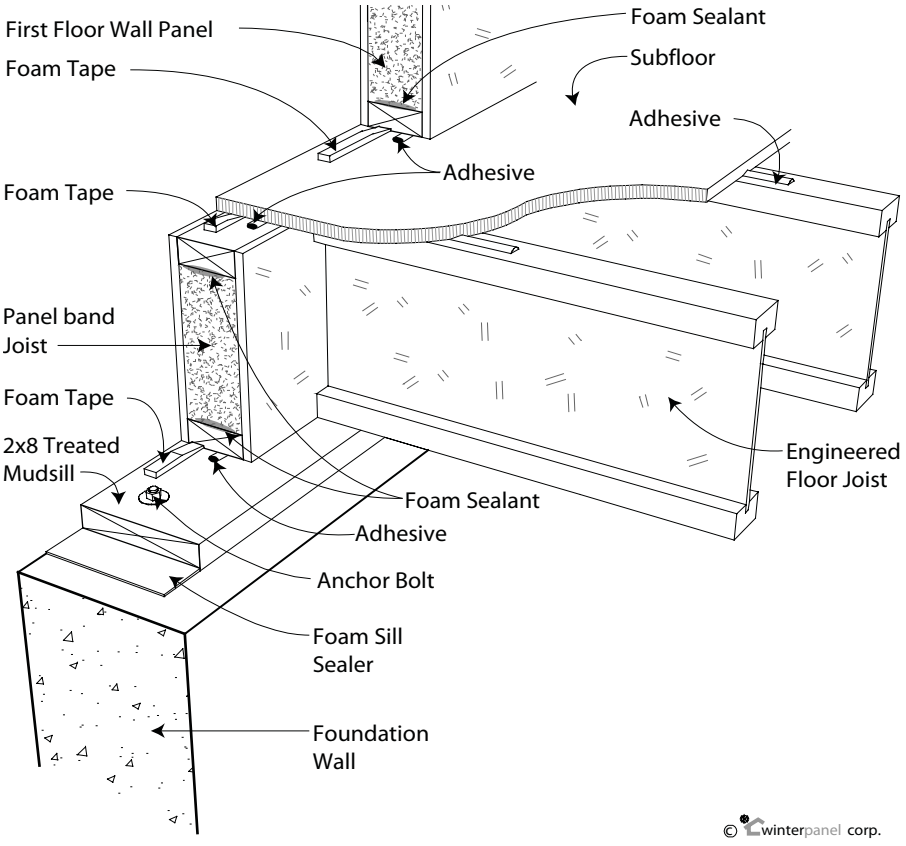

Figure 3. Foundation/First Floor Detail. *The outer edge of the wall panels should be flush with the outside of the concrete foundation wall so that full support is provided. Secure the sill plate with j-bolts or foundation tie straps.*

Basement girders are usually installed into beam pockets in the foundation wall. If the joists will rest on top of the girder, the beam pockets should be planned so that the top of the girder will be even with the top of the sills as shown in **Figure 4**. The most common practice is to set the beam pocket exactly as deep as the girder and specify a short section of pressure-treated two-by in the bottom of the beam pocket (this is the same thickness as the mudsill and will bring the top of the girder up to be even with the top of the mudsill). The beam pocket should be sized ½" larger on each side and at the end to prevent direct contact of the girder with the foundation.

For information to use Structurewall™ panels as first floor with a pier foundation, see **Appendix D**.

Moisture Management –

- **Install a capillary break**[1] between the foundation and any wood component that rests on or makes contact with the foundation, as well as between the footing and the foundation wall. Suitable materials include closed-cell foam sill sealer or rubber membrane.
- **Apply foundation damproofing**. Damproofing forms a capillary break between soil and the below-grade portion of the foundation wall.
- **Install capillary break** between basement or at-grade slab and soil beneath. Sheet plastic and 4" of ¾" (no fines) gravel beneath the basement slab or slab-on-grade forms a capillary break between the soil and the slab.
- **Install drainage mat or place free-draining backfill** in excavated trench around the foundation.
- **Install perimeter pipe drainage** and filter fabric as shown in **Figure 5.**

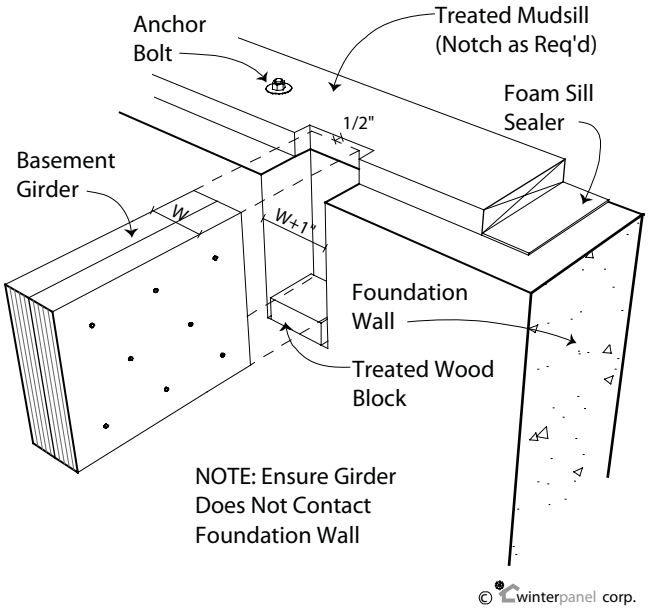

Figure 4. Beam Pocket in Foundation Wall. *Basement girders are set into beam pockets in the foundation wall. Allow ½" on each side of the girder and at the end. Size the pocket the exact depth of the girder and install a short section of pressure-treated lumber in the bottom of the pocket. This will protect the bottom of the beam and bring the top level up even with the top of the sill.*

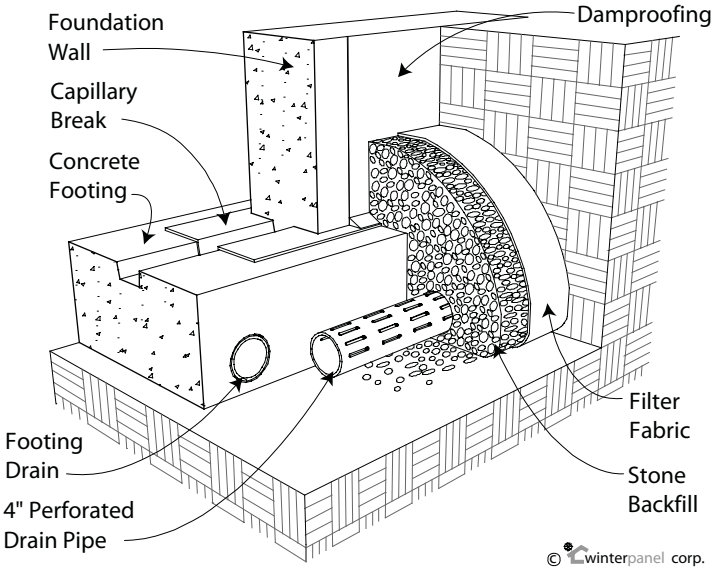

Figure 5. Foundation Drainage Detail. *The pipe keeps the foundation free of water, the gravel allows free drainage of water to the pipe, and the filter fabric keeps both the pipe and gravel clear of fine sediment.*

1 A capillary break is any material that stops the movement of water from areas of high concentration to low concentration in porous materials. Many building materials are porous (standard psi concrete, wood, brick, drywall paper). Movement of water by capillary action is often call "wicking."

Tolerances - It is extremely important that the sill plate of the house exactly match the out-to-out dimensions of the shell, and that all corners be square. Foundation width and length should be within ¼" of the dimensions called for in the plans. Check the diagonal measurements for square as shown in **Figure 6.** The diagonal measurements should be within ½". The top level of the frost wall or slab shall not vary by more than ¼" in 10' along the wall. As with any pre-cut structure, an accurate, level and square platform is essential.

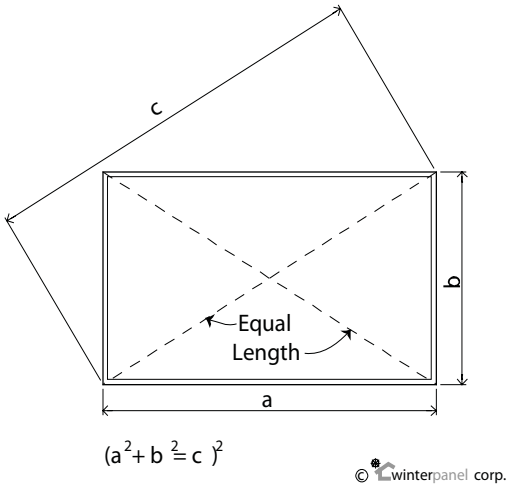

Figure 6. Checking Foundation Square. *With rectangular foundations, the diagonal should be identical.*

Installation – Full Basements and Crawlspaces

1. **Cast concrete pads** to support interior structural columns at the same time the footings are cast (before the basement floor slab). Refer to the plans for the exact location and dimension of these pads. Pads should be reinforced in accordance with commonly accepted practices and local code.
2. **Block out beam pockets** when forming the foundation walls.
3. **Install a short section of pressure-treated two-by** in the bottom of the beam pocket (this is the same thickness as the sill and will bring the top of the girder up to be even with the top of the sill). See **Figure 4**.
4. **Install beam with ½" space** at each end for air circulation.
5. **String the beam** to determine the length needed for any supporting columns. By measuring from the string, any sagging of the beam will not throw off the floor level. Cut the steel column slightly long (about 1/8") to account for settling. Also, check to make sure the basement girder is straight. If not, straighten it and brace it in place. The braces will help to hold it in place until joists are installed.
6. **Install capillary break** between the mudsill and the foundation. The most common material forming this capillary break is a closed-cell foam sill sealer. Note that this must extend under the entire mud sill; and for slab-on-grade foundation, must extend 1" wider than the mudsill to maintain the capillary break between the bottom edges of the structural panels and the foundation. See **Figure 7**.
7. **Install a termite shield** between the sill and foundation in accordance with locally accepted practices in areas where termite and ant damage is a concern.
8. **Caulk or foam all gaps** between the sill plate and the foundation for air tightness. Closed-cell foam sill sealer is not always thick enough to accomplish an air seal at this critical junction.
9. **Dealing with variations** - Slight variations in foundation dimensions can be dealt with when setting the sill, but variations outside of these tolerances will make panel installation significantly more difficult. If the foundation is supposed to be 36' long, for example, but measures 36' ½", sills can be held in ¼" from the outside of the foundation on each end, providing the exact dimension of 36'-0", out-to-out. If the diagonals do not match exactly, some adjustment can be made when setting the sills. If the diagonal measurements are not given on the foundation or first floor plan, they can be calculated by using the formula $a^2+b^2=c^2$, as shown in **Figure 6**.

   It is essential that the foundation for a Structurewall™ building be level. If panels cannot be set plumb and square on the first level, "sawtooth" panel alignment can carry through all the

way to the peak. If the foundation is not level, the sill should be shimmed to make it level. This step is important because the walls and floors rest on the sill and any discrepancies will carry through to the rest of the structure.

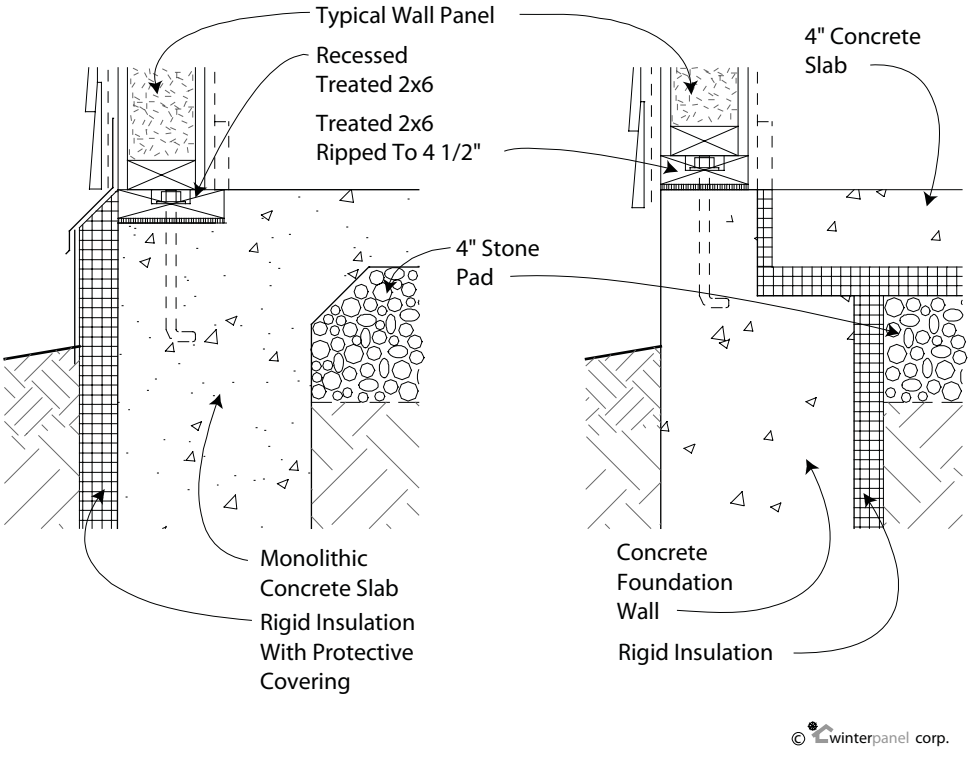

Figure 7. Slab Foundation Detail. *Two methods for installing Structurewall panels to a slab-on-grade foundation are shown. Note the slab perimeter insulation, of increasing importance with increasing number of heating degree days.*

Installation – Slab-on-grade

There are two ways to set panels on a slab foundation. A pressure-treated 2 x 6" sill can be embedded in the concrete, with the top flush with the top surface of the slab, as shown in **Figure 7**. The sill should be secured to the foundation with mud sill anchors, which are set into the wet concrete and provide a seat for the embedded sill.

An alternative is to rip a 2"x6" to 4 ½" (or the width of the panel) and secure it to the top of the slab, as shown in **Figure 7**. With this detail, conventional foundation tie straps or mud sill j-bolt anchors should be used.

Slab-on-grade Insulation -

Slab-on-grade insulation is imperative for any climate of more than 3,000 heating degree days. Less-than-effective insulation at the slab can significantly compromise the superior thermal performance of the Winter Panel building enclosure. It can be difficult to isolate the slab thermally from the soil beneath the slab and from outside air at the turned-down grade beam or stem wall. **Figure 7** shows two ways to effectively insulate a slab-on-grade foundation.

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First Floor Deck

General - The first floor deck should be designed to accommodate Structurewall™ band panels in place of conventional band joists. The sill plate must be wide enough for bearing both the band panels and the floor joists (**Figure 3**). Check the drawings and/or the floor joist manufacturer installation specifications for the bearing requirements of the joists in question. The band panels provide the same insulation value as the wall system. Band panels are installed around the entire sill perimeter.

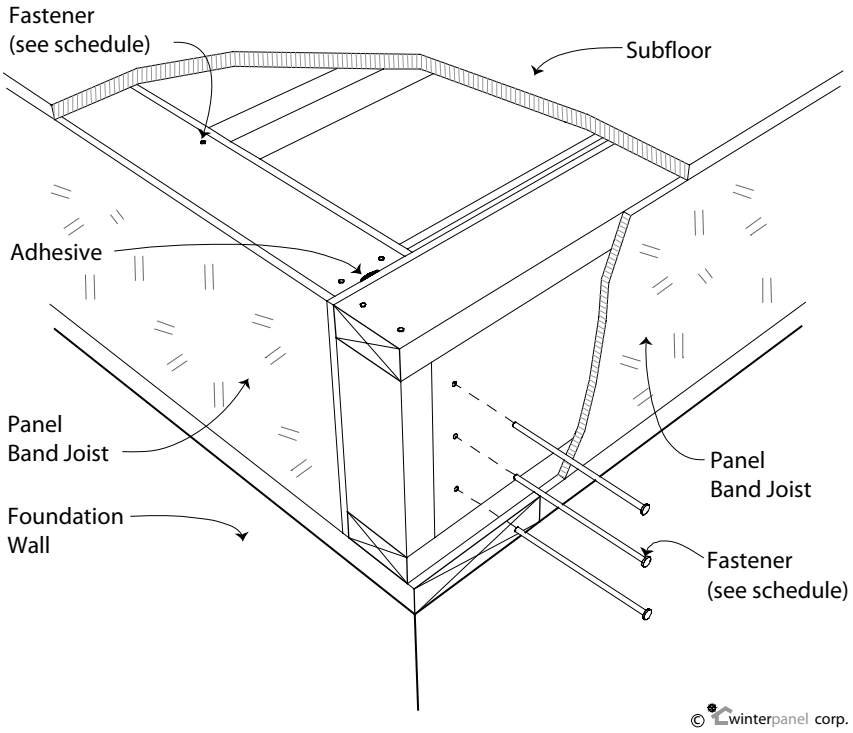

Figure 8. Band Panel Placement. *Band panels are set on the outside edge of the sill around the whole perimeter of the building. Overlap band panels on sills as called for in plans and with joints opposite that of the sill layout.*

Moisture Management – The sooner the band panels are weather-protected, the better. Installation of the first floor decking provides rough cover for the band panels and should be accomplished at the same time as band panel installation. Any panel joints in the band panels must be air-sealed—see **Figure 22** for in-line panel joint air sealing procedures.

Installation –

NOTE: The following are methods of achieving air tightness at panel joints (See **Figures 3, 8 and 9**):

- Use foam tape and construction adhesive to bond mudsill to bottom plate and all plates to structural floor decks.
- Use construction adhesive at all vertical joints of panels to panels at corners (two-by end blocking to inner skin of OSB of perpendicular panel).
- Use foam sealant to air seal all two-by plates and blocking into the rout of the panel core.

NOTE: If your structure is slab-on-grade, go directly to step #6.

1. **Set band panels** with overlap opposite that of the mudsill, as shown in **Figure 8**. Use foam as a bed when installing plates into the panel routs. The band panels must be set directly in line with the outer edge of the pressure-treated mudsill, assuming the sill plate is level and square and it matches the outside dimensions of the building. If the mudsill is not straight and level, the band panels must be shimmed to avoid a “sawtooth” assembly. Band panels are sections of Structurewall™ panel that are the same depth as the joists used for the first floor deck (9 ½”, 11 7/8”, etc.). Use the framing plan to properly position the band panels. In most cases, band panels are installed before the joists. If for some reason the floor joists must be installed before the band panels, allow space for the thickness of the band panels when setting the joists.

NOTE: Set butt joints in band panels so that they do not align with butt joints in bottom plates.

2. **Air seal all joints**. Use construction adhesive at the corner overlap of the band panels and foam sealant at all panel butt joints.
   NOTE: Airsealing the panel butt joints can be done from either side of the panel, although it is generally done on the inside. The procedure for injecting the foam sealant is described in **Figure 22**. This air sealing procedure can be done anytime before access to the panel is closed off by subsequent work. Particularly in cold weather, the procedure should be done after the building is weathertight and at least semi-conditioned.

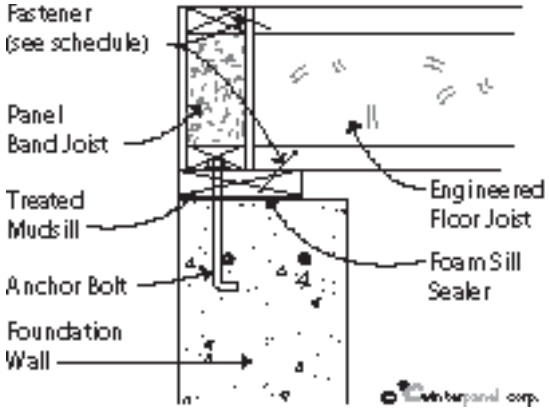

Figure 9. Securing Floor Joists to Band Panels. *Floor joists are secured to the band joist panel with toe nails through the two-by blocking at the top of the band panel.*

3. **Set first floor joists** per standard construction practice and manufacturer instructions. If you are using engineered floor joists, be sure to follow manufacturer installation requirements—they are NOT the same as for solid sawn floor joists.
4. **Angle-nail through the band panels** into the spanning joist top chord with 16d nails, as shown in **Figure 9**.
5. **Install first floor deck** per standard construction practice and manufacturer instructions.
6. **Set construction adhesive bed and foam tape** for bottom two-by plates. Once the floor deck is on, the bottom plates are secured around the full perimeter. The plates should be secured to the deck and band panel around the perimeter, setting the outer edge of the plate ½" in from the edge of the deck so that the outer surface of the wall panels will be flush with the deck and band panel. Use a scrap of ½" wood as a gauge when positioning the two-bys. A bead of construction adhesive under the bottom plate is required. Foam adhesive tape is also used under all plates.
7. For the two "long" walls, **secure the bottom plates to the sill**, using 16d nails, spaced 6" o.c. in two staggered rows as shown in **Figure 10.**
   NOTE: "Long" walls are those that run all the way to the end/edge of the structure. "Short" walls are those that are inset and fit in between "long" walls. Check the plans and make sure that you set bottom plates to match the overlap of panels at the corners per the plans.
   If the "long" walls are being assembled on the deck, the adjacent "short" wall plates are not installed at this time—see the next section on wall assembly. If you are installing all of the bottom plates at this time, the "short" wall bottom plates will be held back ½" from meeting the longer plate to allow the side wall inner skin to fit into the corner. (see **Figure 10**).

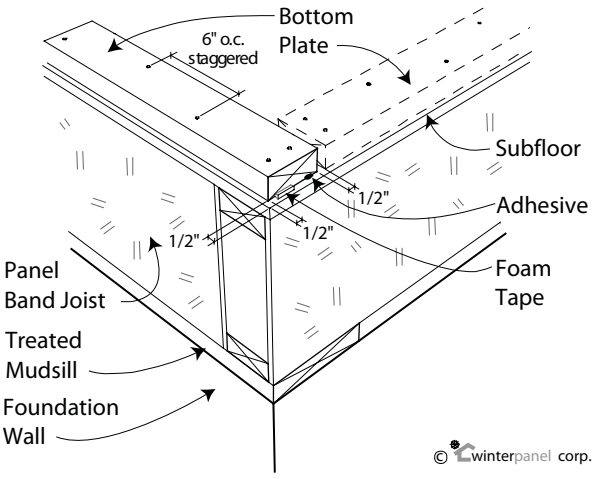

Figure 10. Securing Bottom Plates to First Floor Deck. *Two-by bottom plates are secured so that the wall panels will fit over them and be snug against the deck. Install a continuous bead of construction adhesive underneath the bottom plates to ensure an airtight bond.*

NOTE: Do NOT set “short” bottom plates until the “long” walls have been tilted in place. This allows a flat platform for assembling the “long” panels.

Generally, panels are joined together on the deck, then tilted up into position onto the bottom plate that has been installed shortly before erection. The two “long” walls are erected first, followed by the end (gable) walls. See the next section on wall assembly.
NOTE: IF exterior foundation insulation is being used, it must be installed prior to backfilling the foundation. Since the outside skin of the panel MUST bear directly on mudsill, which is aligned with the foundation, exterior foundation insulation will be proud with respect to the above-grade assemblies. A flashing and/or water table detail is required to maintain the drainage plane of the building. See **Figure 78.** Interior basement insulation is covered in the section, **Completing the Process**, of this manual.

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Wall Panels

General - The Structurewall™ panels as delivered need to be assembled into wall elevations as shown in the panel cut drawings. For two-story structures, the drawings will also show the location and type of any beam pockets for carrying beams, either pre-cut pockets or pockets cut on site. Winter Panel strongly recommends the factory pre-cutting and routing of panels. For detailed instructions on site-cutting and routing of panels, see **Appendix B**.

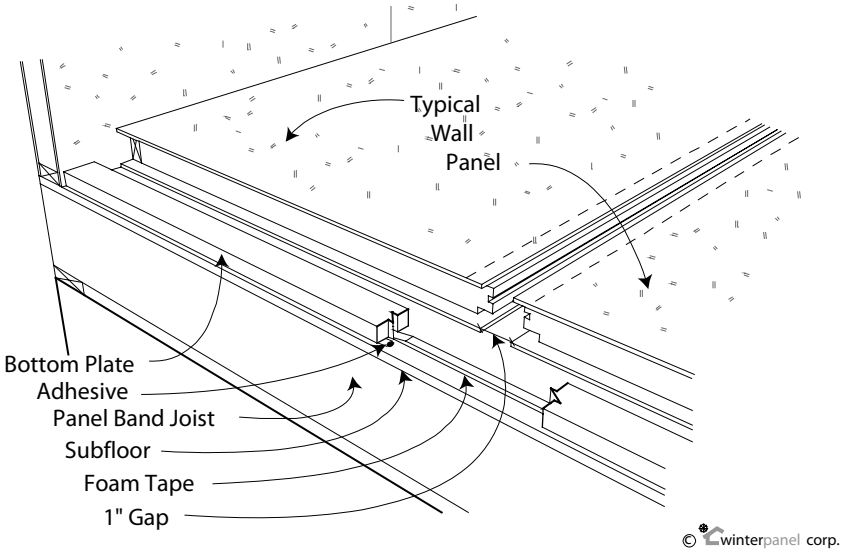


Figure 11. Panel layout for First Wall. *Lay panels out on deck. Join panels before tilting wall up onto bottom plate.*

Moisture Management - One of the most important ways that moisture can get into Structurewall™ assemblies is air-transported moisture—the water vapor that gets carried along during air leakage. The Structurewall™ air sealing detail (the routed keyhole formed by adjacent panels) reduces air leakage at panel joints. After the panels are assembled and before they are covered, the routed keyholes must be foamed per the installation instructions given below (see step #19 below).

Installation – First Wall

NOTE: For two-story structures for which carrying beam pockets will be site-cut, see **Appendix B** and the steps for cutting beam pockets in the next chapter of this Guide. While carrying beam pockets can be cut and routed after the wall is standing up, it is easier to accomplish this on-site with the panels on sawhorses prior to the wall being assembled and erected.

1. **Organize the panels for the first "long" wall**, and for which the bottom plate has been attached to the deck/band panel.
2. **Lay the panels flat on the deck**, outer skin up, to match the panel drawings as shown in **Figure 11**. Leave a 1" gap between panels. The inner panel surfaces will be down. Set the panel bottoms against the attached bottom two-by plate to help align and square the panels.

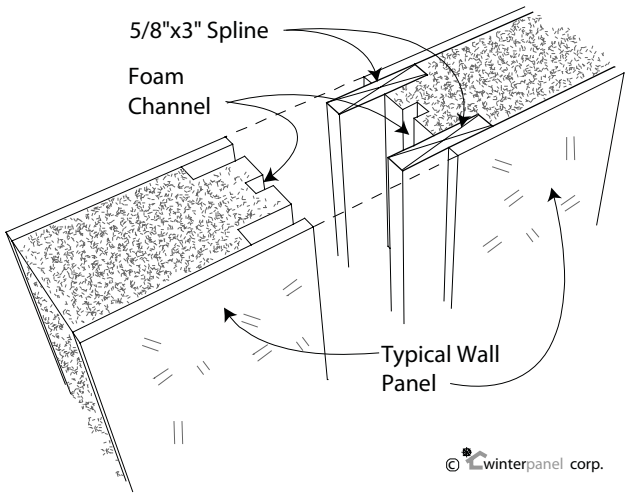
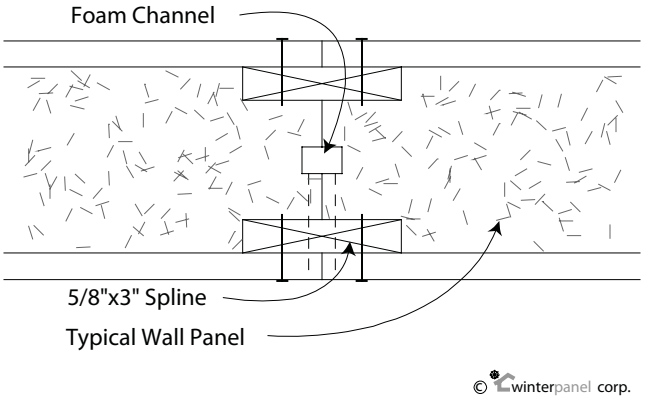


Figure 12. Dual Plywood Splines. *Dual plywood splines are typically used to join panels.*

NOTE: The next 3 steps—inserting splines, standing up panels, cinching adjacent panels of a wall tightly together—can be done in any order. The important thing is that the order of actions results in a square wall assembly that matches the dimensions of the floor deck.

3. **Insert the plywood splines** at panel seams (inside then outside plywood spline), making sure that these splines do not extend into the 1 ½" routs for the two-by plates at top and bottom of panel. You may also set panels together, and then slide/tap splines in from top.
   NOTE: If plywood splines are slid in after the adjacent panels are pulled together, orient the plywood splines with any bow against the panel skins, so that the spline does not cut into the foam core as it is worked into the panel.
   Panel joints are usually made with dual 5/8" x 3" plywood splines as described above and shown in **Figure 12 and 13**. In some situations, the plans will call for stronger two-by spline joints between panels, as shown in **Figure 14 and 15**. Full-width routs are made in panels to the required depth for two-by or dual two-by splines. Embed these two-by splines into routed grooves with foam sealant just before pulling panels together, and secure with 8d nails, as shown. Refer to **Figure 14**.
4. If necessary, **cinch panels together** so that the long margins of each panel are drawn completely together. Make sure that as you cinch the panels together, the panels are still lined up along the bottom two-by plate (to avoid a "sawtooth" configuration of the wall panels). Truck straps and a come-along (or equivalent gear) accomplish this task.
   NOTE: The two most important features of the complete wall are:
   a. The overall wall length match the plate and foundation dimensions.
   b. All panel joints are tight enough for the plywood splines to join the panels. Gapping the panel joints as much as ½" for overall wall length is fine, but this makes the panel air sealing detail that much more important at panel joints.

Figure 13. Dual Plywood Spline Joint. *This figure shows how the factory panel routing creates pockets for inserting the plywood splines and a foam channel for the air sealing detail.*



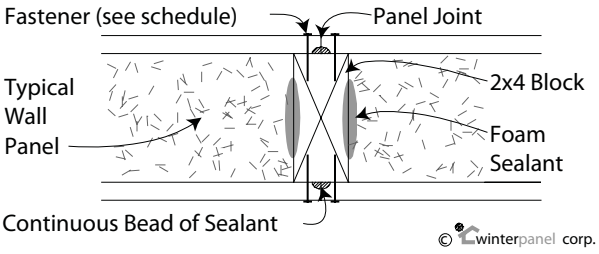
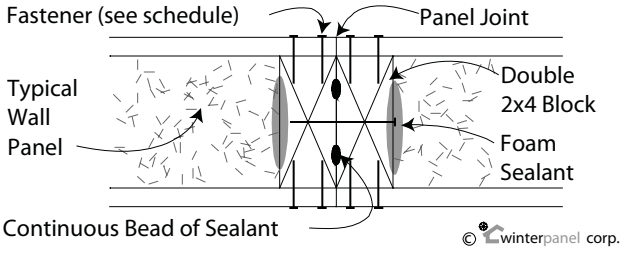


Figure 14. Single Two-by Spline Joint. *Stronger two-by splines may be called for in certain situations where greater load-bearing capacity is required at panel joints.*

Figure 15. Double Two-by Spline Joint. *Stronger double two-by splines may be called for in certain situations where greater load-bearing capacity is required at panel joints.*



5. **Install two-by edge/corner blocking**. Apply a bead of foam sealant in the panel edge just prior to corner blocking installation. The two-by edge/corner blocking should run from bottom rout to the top plate.

NOTE: For two-story structures where there are beam pockets open to the top of the panels, it is generally easier to NOT install top plates on walls that have carrying beam pockets—see the next chapter on second-floor decks for more information.

6. **Nail outer skin along seam splines** (6d at 6” o.c. typical) and top of outer skin to installed top plate (6d at 6” o.c. typical).
7. **Tilt up wall**. Apply a bead of foam sealant onto the bottom plate just prior to tilting up the wall. Brace wall as required to keep it straight and plumb. Brace end of walls on the outside edge as shown in **Figure 16**.
8. **Plumb and straighten this first wall** and then nail off the inner splines to panels (6d at 6” o.c. typical) and along the top plates (8d at 6” o.c. typical).
9. Second (opposite) Wall: **Repeat procedure for first “long” wall**.
10. Third & Subsequent (adjacent) Walls:
    NOTE: The end walls are also joined on the deck and raised into place as entire walls, but the tight spacing between long walls can make their erection a little more difficult.
    Secure the two-by bottom plates to the deck/band panel.
11. **Install the edge/corner blocking** in the end panels. As before, apply a bead of foam sealant in the edge rout just prior to edge/corner blocking installation. See **Figure 17**.

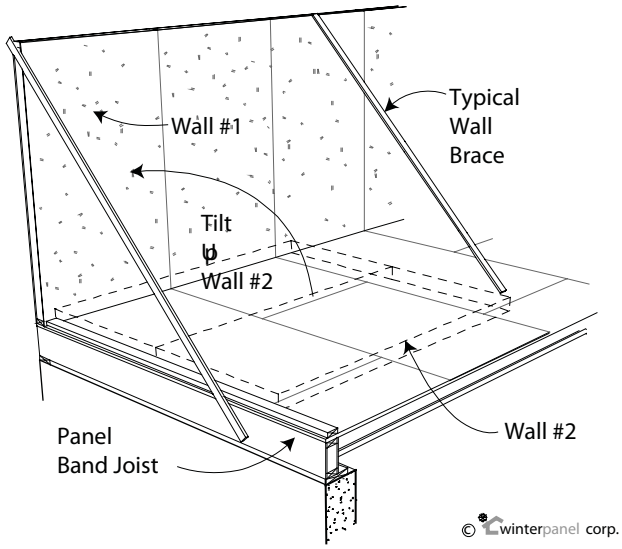


Figure 16. Bracing Wall Ends. *As shown, this frees up floor space for assembly of the next wall into the corner and also provides a stop to aid in setting the panel.*

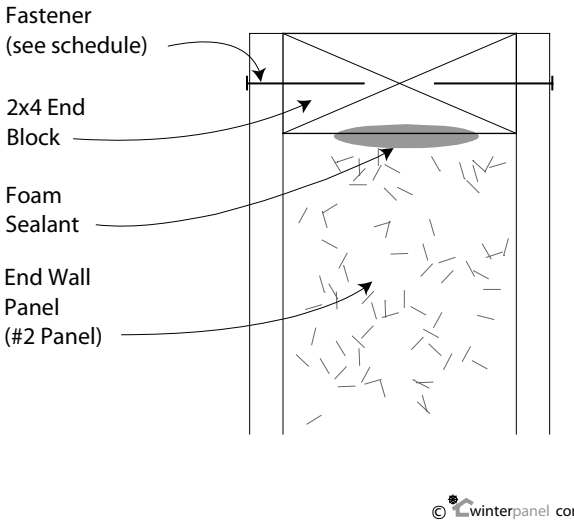
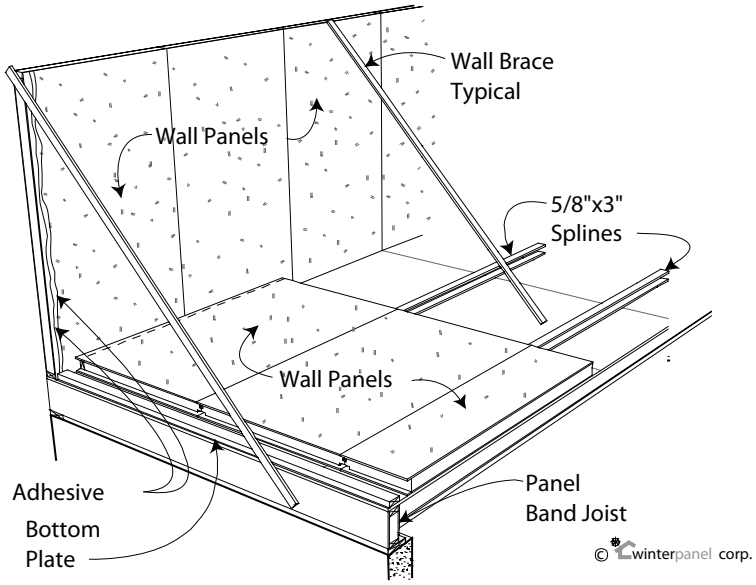


Figure 17. Installing Two-by Corner Blocking. *The bed of foam sealant completes the air seal between the panel and the corner blocking.*

12. **Lay out the panels** against the bottom plate for alignment. The last panel will be quite tight, but you should be able to force it in.
13. After all panels are in place on the deck, **slide in the inner and outer plywood splines** from the top (toward the center of the house), as shown in **Figure 18**.
14. **Nail off the outer splines** (top side of wall).
15. **Apply two beads of construction adhesive** along the OSB edges of the “long” wall where the two-by edge/corner blocking will contact the adjacent wall. See **Figure 18 and 19**.
16. **Raise the end wall into place**. As you raise the wall, you may need to release the brace holding the “long” wall(s) plumb to make room for the end wall and minimize the scraping off of the construction adhesive.

Figure 18. Inserting Splines into End Wall. *Install plywood splines into end wall after panels have been laid out in position. Note how the beads of adhesive are applied to the long wall (where this wall will contacts the end wall) prior to standing up the end wall.*



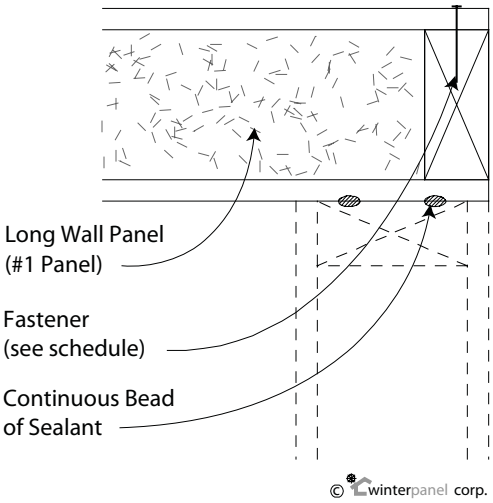


Figure 19. Panel Corner Joints*. Note the beads of adhesive connecting these two panels.*

17. **Install the top two-by plates**, foaming the routed groove first. See **Figure 20**. Top plate joints should be staggered so that they offset panel seams.
18. **Nail off the inner splines** and fasten through the corners into the edge/corner blocking with panel screws (see **Appendix A - Fastener Schedule**), as shown in **Figure 21**. Use the same procedure for the opposite end wall.

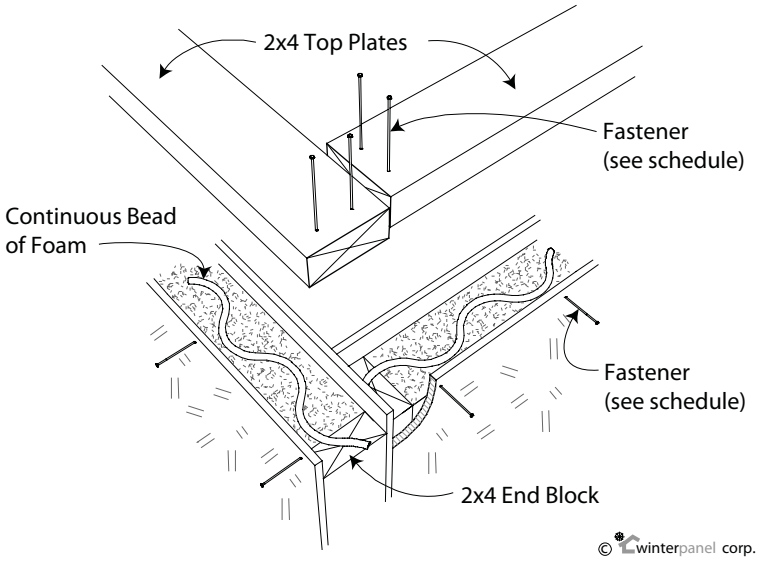


Figure 20. Installing Top Plates. *Top plates can be installed either before or after raising wall sections. Follow nailing schedule per installation instructions. Note the continuous bead of foam sealant into which the plates are set.*

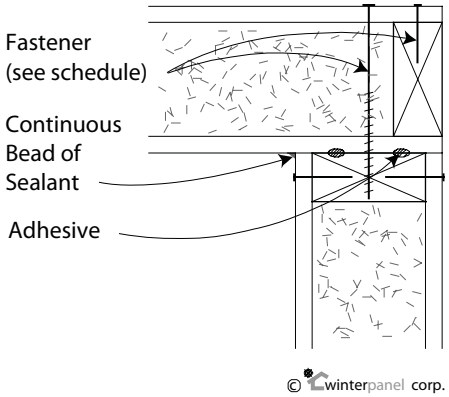


Figure 21. Fastening Panel Corner Joints. *Note the panel-to-panel fastener and the continuous bead of sealant on the interior of the corner panel joint.*

19. **FOAM ALL ROUTED KEYHOLES IN ADJACENT PANELS**. See **Figure 22**.
    NOTE: This spray foaming procedure to air seal panel joints can be accomplished from either the interior or the exterior; it is strictly a matter of convenience. But IF any panels are pre-routed with electrical wiring chases, either do not foam the joints until after the wiring has been run or place a small tube in the pre-routed chase to keep the foam from closing off the chase. See the chapter on electrical wiring for more information.
    a. **Drill 3/8" holes** approximately 12" apart, taking care to drill deep enough (through the inner plywood spline) to reach the routed keyholes, but no deeper than the second spline (this would be approximately 2 ¼" in 4 ½" panels and 3 ¼ " in 5 ½" panels).
    b. **Inject foam sealant** to fill the routed channel between the panels. This is a bit of an art, but one way to determine how long to spray is to inject foam sealant in the first hole, timing how long it takes foam sealant to expand out the adjacent hole. Cut this time in approximately half and then inject all subsequent holes for that amount of time.
    c. **Repeat** this procedure until excess foam sealant can be seen from every hole.
20. These same panel joints can be further protected from air leakage: **Apply a thin 12" wide adhesive membrane to the joints** or fill whatever space is left at the panel joint with a sealant.

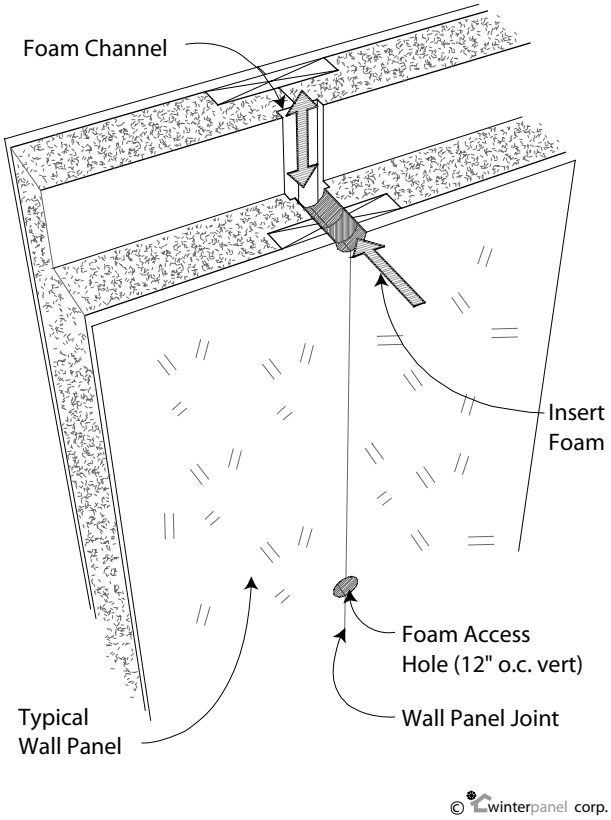


Figure 22. Foaming In-line Panel Joints. *The drilled holes are for foaming of the panel joint, making the air barrier continuous at in-line panel joints.*

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Door and Window Openings

General – Typically, rough openings for windows and doors are factory pre-cut and routed for window and door openings (Consult both **Appendix B** and Winter Panel for site modifications to Structurewall™ panels). The routed grooves are 1 ½" deep so that two-by frame members (blocking) can be fully inset around the whole window or door perimeter (**Figure 23 and 24**). This technique is used both when the opening is within one panel and when the opening extends into adjoining panels. The two-by frame members for some openings may be factory installed.

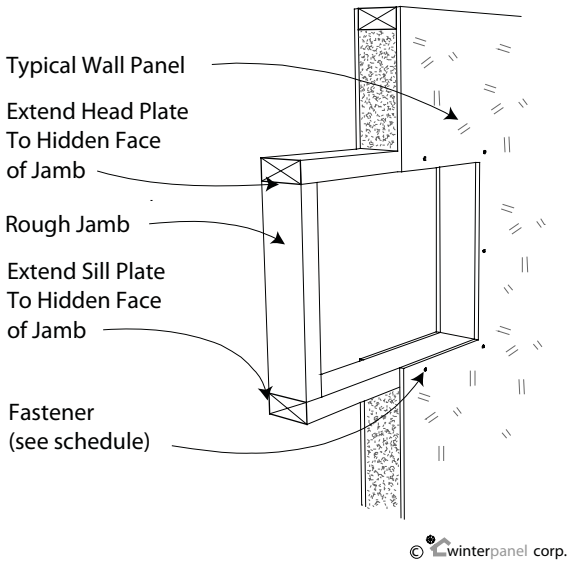


Figure 23. Rough Opening for Window. *The perimeters of window openings are routed out 1 ½" and two-bys installed. The sill and header should overlap side members, as shown.*

Very wide windows and double or sliding glass doors may span more than a full panel. In this case, the plans may call for a more substantial header over the window or door inset into the adjacent panels. Either a box beam, insulated header, or built-up structural header will be used as structural requirements dictate (**Figures 25 and 26**). Note the difference in these figures between "heavy loading" and "point loading" and larger spans.

Moisture Management – The exposed edges of door and window rough openings should be weather-protected as soon as possible. See the third section of this manual, **Completing the Process.**

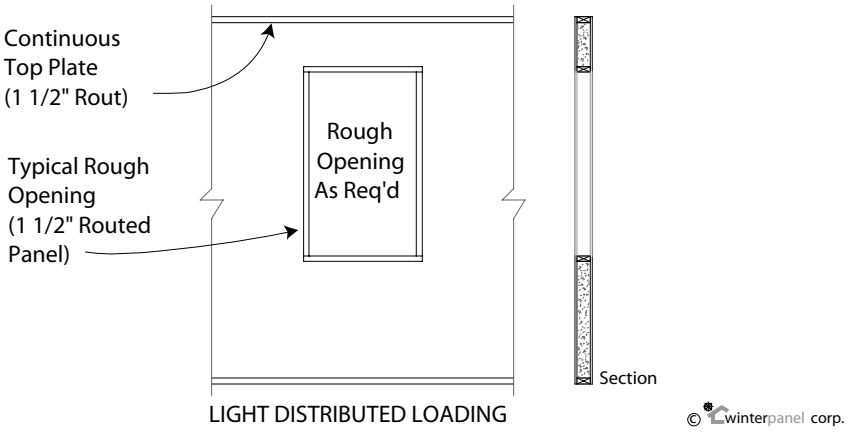


Figure 24. Opening with Light Distributed Loading. *Note the continuous top plate for this type of rough opening in a single panel.*

Installation –

NOTE: All two-by blocking of the rough opening is installed into a bed of foam sealant to maintain air tightness around the rough opening.

1. **Install sill and header two-by blocking** into rough opening **first**, extending the full width of the rough opening, as shown in **Figure 23**.
2. **Install side blocking** into rough opening per **Figure 23**.
3. **Nail or screw blocking** to panels (see **Fastener Schedule—Appendix A**) every 6”.

NOTE: For large rough openings that involve a box beam or built-up structural header, follow the house plan installation requirements—see **Figure 25 and 26**.

NOTE: Top plates are usually installed in top of wall before a wall is tilted into place. But when panels are installed, top plates must be fastened to the panel OSB skins with fasteners every 6”, inside and out (see **Fastener Schedule—Appendix A**).

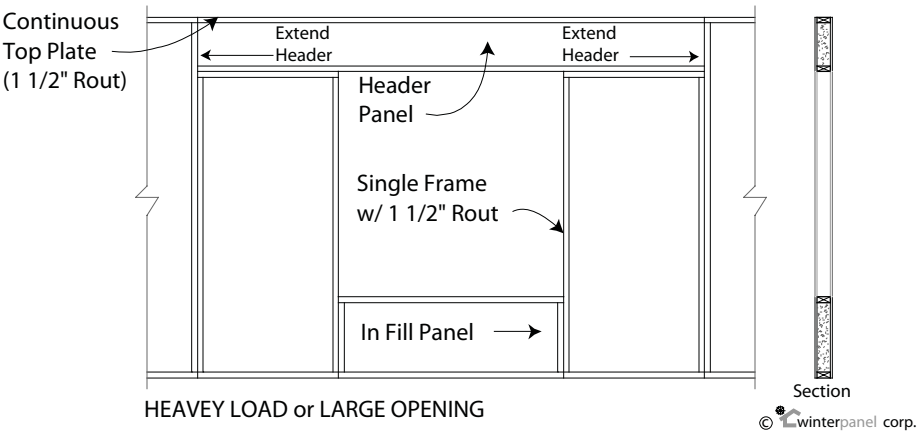
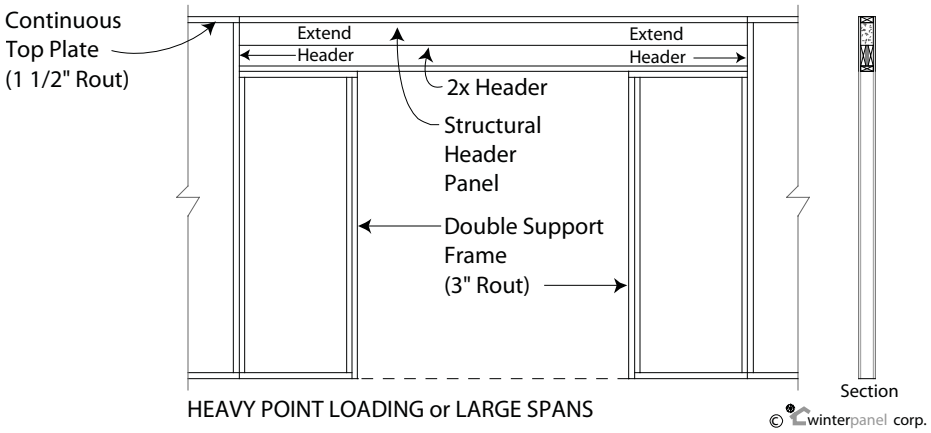


Figure 25. Heavy Load or Large Window Opening. *The type of header used above a window or door opening depends on the width of the opening and the structural loading above the opening. Follow the plans carefully for the header details.*

Figure 26. Large Door Opening. *The type of header used above a window or door opening depends on the width of the opening and the structural loading above the opening. Follow the plans carefully for the header details.*



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Second Floor Deck

NOTE: For single-story Structurewall™ systems, go directly to the next chapter, **Second-Story Wall Panels and Roof Beams**.

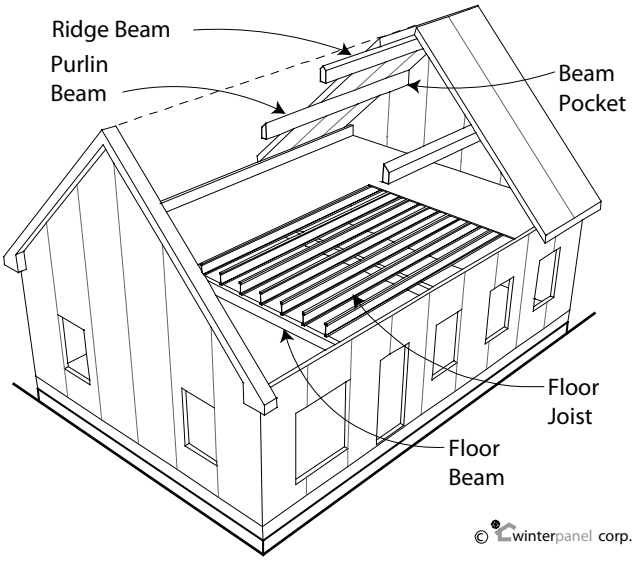


Figure 27. Beam Schematic. *Load carrying beams may be called for in different locations, depending on the structural requirements of the house. Beams are set into beam pockets in the wall panels, which distribute the load into the wall panels.*

General – Structurewall™ panel systems carry load from stories above with carrying beam(s)—that fit into pre-cut or site-cut panel pockets—and top-bearing joist hanger systems. The way that these framing members transfer their load to the wall panels is a bit different than standard framing; attention to these differences is expressed in the installation procedures laid out below.

Moisture Management – The sooner the wall panels are weather-protected, the better. Installation of the second floor decking provides rough cover for the first floor wall panels and should be accomplished as soon as possible. Liquid water management of wall panels is covered in detail in the section of this manual entitled, **Completing the Process**. Note that if top-bearing joist hangers are employed for the floor deck, they introduce a small space into the panel and floor assembly and air sealing at this junction is critical.

Installation – Carrying beams

NOTE: Carrying beam and carrying beam pockets can be for a second-story floor deck, for purlins running from gable to gable in the roof assembly, or for ridge beams in roof assemblies (see **Figure 27**). They are covered here in this section on second floor decks, but the installation instructions given here apply regardless of where the beams actually occur in the structure and its construction sequence.

NOTE: Beam pockets can fall in three different locations—top of a single panel, top of a panel joint between two panels, field of a panel. The location of the beam pockets affects installation.

Beam pocket at top of single panel (**Figure 28**):

1. **Secure two-by blocking**—adhesive and fasteners—to the ends of the carrying beam—along the bottom and the two sides of the beam. Note that the bottom block extends 3 inches beyond the beam, and the side blocks extend to the top of the beam. How the side blocks lap with the top plates is a matter of preference and order of installation. This is not true for the relationship between the side and bottom blocks--the bottom block must run long.
2. **If** the carrying beam pocket has not been pre-cut in to the panel receiving the beam, **cut the inner OSB skin** of the panel and rout out the panel foam core ¼" larger than the dimensions of the beam side and beam blocking.
3. After the blocking is secured to the beam ends, **apply a bead of foam sealant** into the routed grooves of the beam pocket and **set the beam into position**.
4. **Fasten through the OSB skins into the blocking** from both the inside and out with 2 ½" fasteners 2" o.c. as shown in **Figure 28** below. Also, fasten through the outer OSB skin into the end grain of the beam with 3" screws or 16d nails in two staggered rows.

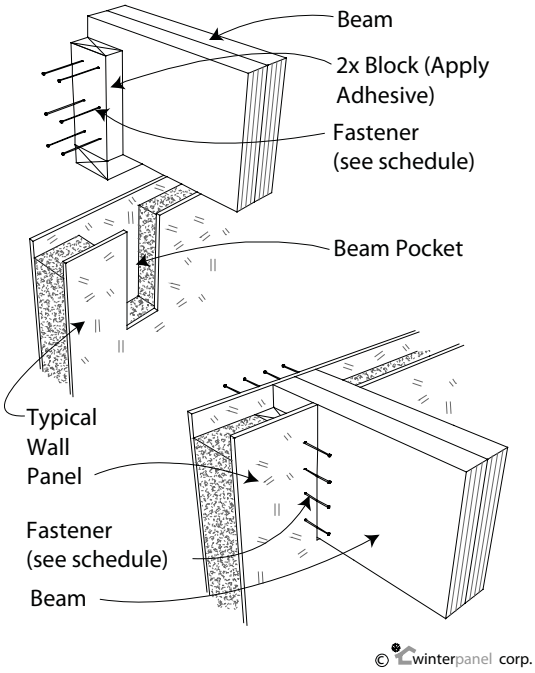


Figure 28. Beam Pocket at Top of Wall—In Field of Panel. *Beams or girders to support the second-floor wall are usually set into beam pockets at the top of wall panels. If the pocket does not align with a wall panel seam, the foam is routed out on both sides and below for three two-by "scabs".*

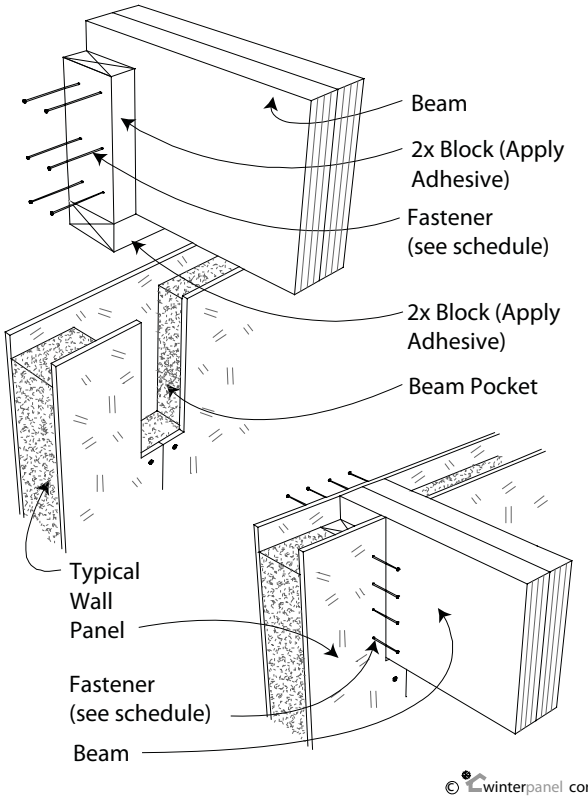


Figure 29. Beam Pocket at Top of Wall—At Panel Seam. *If the beam pocket aligns with a panel seam, then the splines need to be held down 1½ " for the two-by bottom block.*

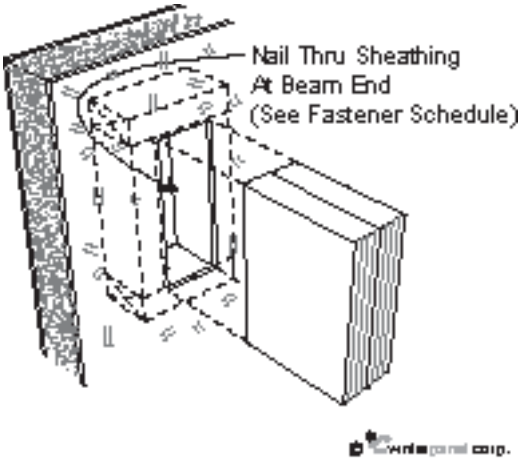


Figure 30. Beam Pocket in Panel Face. *If the beam cannot be dropped into the pocket from above, the beam is slid in from the interior. The four two-by scabs are set into the panel before the beam is inserted and adhesive is applied to lock in the beam.*

Beam pocket in panel joint (**Figure 29)**:

1. **Secure two-by blocking**—adhesive and fasteners—to the ends of the carrying beam—along the two sides and bottom of the beam.

NOTE: The panel splines that extend up to the bottom of the beam pocket Must be held DOWN 1 ½" for the bottom two-by block. In some cases, heavier splines than the dual 5/8" x 3" plywood splines will be called for in panel joints under beam pockets. Such splines could be two-by or dual two-by or even 4" by 4", depending on the structural loading conditions. To fully carry the load from the beam, closer nail spacing may be called for than usual for securing panels into the spline(s). Be sure to follow Winter Panel Homes specifications carefully.

2. **If** the carrying beam pocket has not been pre-cut in to the panel receiving the beam, **cut the inner OSB skin** of the panel ¼" larger than the dimensions of the beam. Then rout out the panel foam core to the dimensions of the beam side blocking.
3. After the blocking is secured to the beam ends, **apply a bead of foam sealant** into the routed grooves of the beam pocket and set the beam into position.
4. **Fasten through the OSB skins into the blocking** from both the inside and out with 2 ½" fasteners 2" o.c. as shown in **Figure 29**. Also, nail through the outer OSB skin into the end grain of the beam with 3" screws or 16d nails in two staggered rows.

Beam pocket in panel face (**Figure 30**):

NOTE: This situation may be found when a lower wall extends above the second floor level on a long wall or when a second-floor girder is set into full-height gable-end wall panels.

1. **If** the beam pocket is not pre-cut, **cut out the inner OSB skin** ¼" larger than the dimensions of the beam.
2. **Rout out the foam core** of the panel to receive the beam and to receive the four scabs of beam blocking.
3. **Cut the top and bottom blocks** 3" greater than the width of the beam and pocket.
4. **Apply foam sealant** into the routed areas for the blocking and install the four sections of blocking into the bottom of the beam pocket.
5. **Apply several beads of adhesive** to the surface of the blocking just before inserting the beam end.
6. **Install the beam**. Because the beam cannot be dropped into the pocket from above, it may be necessary to flex the walls out to get the beam in place.
7. **Fasten through the outer OSB skin into the end of the beam** with 3" screws in two staggered rows, 2" OC per **Figure 30**.
8. **Apply foam sealant** on both sides and top of the beam to seal it into the panel.

Installation – Floor joists

NOTE: Whenever floor joists run to Structurewall™ panels (as opposed to running to a carrying beam), the structural configuration of the panels requires the use of special top-bearing joist hangers (see **Figure 31**).

1. **Refer to the house plan** to find the proper joist spacing.
2. **Secure the joist hanger** to both the top of the top plate (using special joist hanger nails supplied by the manufacturer) and to the side of the top plate (through the inside OSB skin) with 16d nails.
3. **Use two 6d nails** to connect the joist hanger to the bottom flange of the joist (one on each side). The joist hanger must be pushed up against the wall before installing these nails.

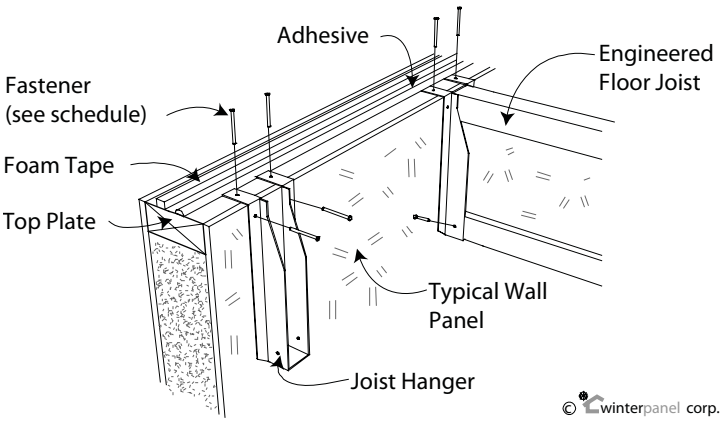


Figure 31. Setting Joist Hangers for Second Floor Deck. *The second floor deck is "hung" from the continuous top plates, which were set into the wall panels. Follow joist hanger manufacturer's instructions, and use nails supplied with the hangers.*

NOTE: Double or tripled joists may be called for at girders and at stair or masonry penetrations. All multiple joist members must be adhered and nailed together per manufacturer's recommendations. "Laminated veneer lumber" joists are generally used for multiple joists. Joist hangers are secured to the face of the multiple joists as shown in **Figure 32**. Be sure to check plans and use specified hangers—these may vary depending on structural considerations. Face-mounted hangers are generally called for when the carrying beam is of microlam construction.

4. **Nail and adhere** the edge joists through the top and bottom of the joist flanges as shown in **Figure 33**. Use appropriate fasteners per beam manufacturer specifications.

Installation – Second Floor Deck

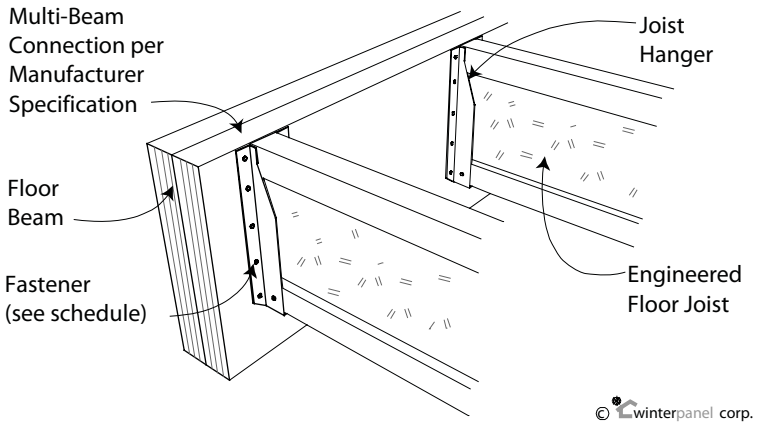
1. **Install the second floor deck** as you would any structural floor system. Follow local code and manufacturer recommendations for layout and fastening schedule/details. See **Figure 34**.

NOTE: Top-bearing joist hangers create a small space between the floor deck and the top of the panel/panel top plate. The foam tape and continuous beads of construction adhesive are critical air sealing details at this junction.

Installation – Second Story Wall Bottom plates

1. **Set the foam tape**, as shown in **Figure 34**.
2. **Install two-by bottom plates** on the long walls first as you did on the first floor deck. Bottom plates should be set ½" in from the outside of the decking so that the outside of the panels will be flush with the outside of the deck (see **Figure 35**).
3. **Secure the bottom plates** with 3" screws or 16d nails, 6" o.c. in two staggered rows.

Figure 32. Securing Joists to Girders or Joist Headers. *Joist hangers are attached to multiple joists just as they are attached to panel top plates. Follow Winter Panel plans carefully for joist hanger specifications. Make sure multiple joists are laminated together as per manufacturer's recommendations.*



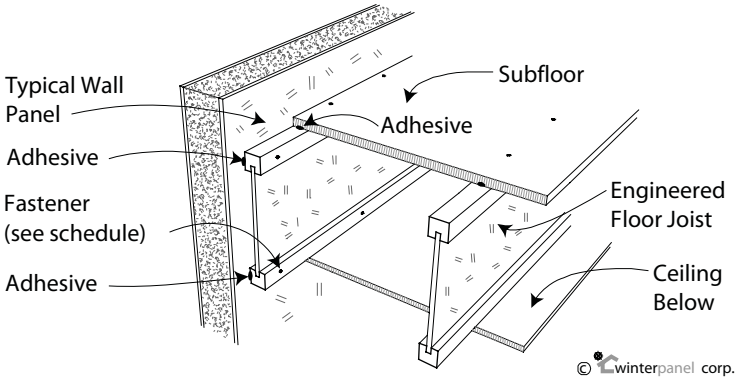
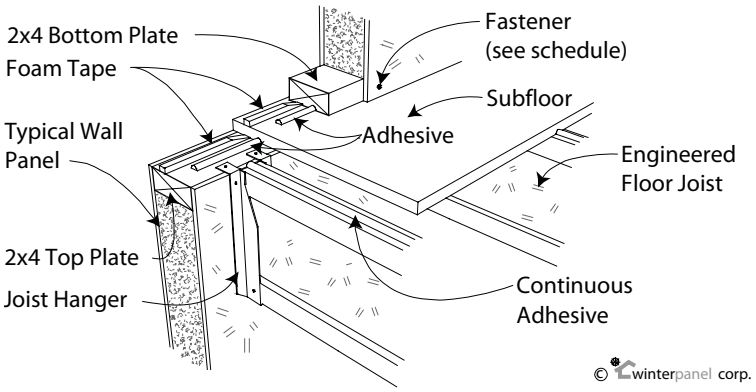


Figure 33. Securing Edge Joist to Sidewall. *Adhere and nail the edge joists to the wall panels at both the top and bottom to prevent deflection of the floor at the wall edge.*

Figure 34. Laying Second Floor Deck. *The second floor decking extends all the way to the outside of the wall panels to fully tie the walls together. Apply foam tape as shown, both between the top plate and the deck and the deck and the second floor bottom plate.*



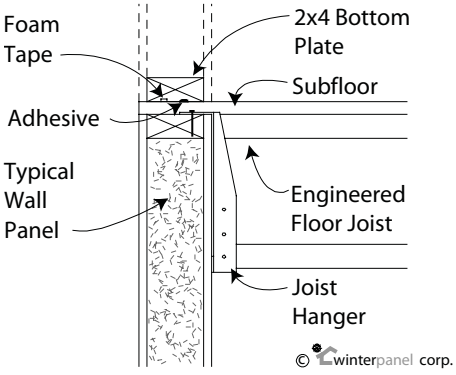


Figure 35. Installing Second Floor Bottom Plate. *Once decking is installed, the bottom plates for upper walls are secured (use the same order of assembly as with the first floor). The bottom plates should be set ½" in from the outside edge of the decking.*

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Second Story Walls, Deck & Roof Beams

General – Gable-end wall panels often support laminated beams, which carry much of the roof load as shown in **Figure 27**. The top edge of second story gable wall panels are typically cut to match the roof pitch and have pre-cut purlin and ridge beam pockets. The configuration of the top edge of second story eave walls can vary with the pitch of the roof, the length of eave overhangs, and the manner in which overhangs are accomplished (extension of panels beyond the eave wall or stick-built add-ons). The structural design flexibility afforded by Structurewall™ panels means that floor joists can and often do run parallel rather than perpendicular to eave walls.

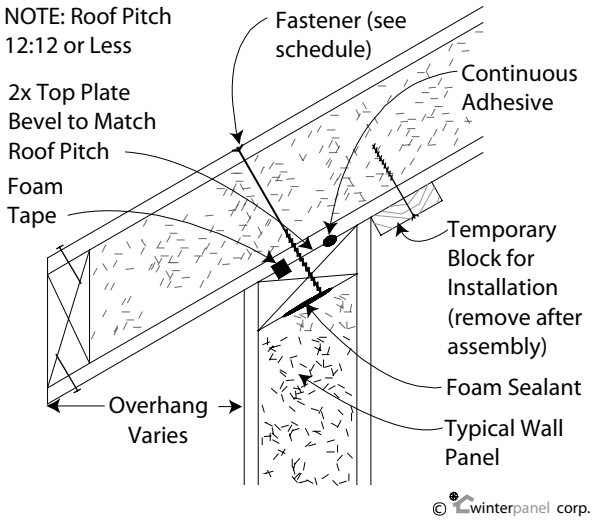

Figure 36. Wall-Roof Intersection with Shallow Roofs. *If a roof with a large overhang or roof pitch less than 12:12 is needed, the wall panels are cut at the roof angle, routed out and fitted with custom-cut top plates. Roof panels are then secured with adhesive and long twist nails or screws.*

Moisture Management – As with any wood structure, the shorter the time the panels spend exposed to the elements, the better. And remember that all of the air-sealing details in the installation procedures below are important in keeping air-transported moisture out of the all panel joints. Liquid water management of wall panels is covered in detail in the section, **Completing the Process**.

Installation – Second story wall top plates

NOTE: The same procedures are used on the second floor as for the first story walls (see previous chapter), although the tops of the eave panels may be specially cut to match the roof slope. Note, too, that there may be a stagger in the height of the eave walls in relation to the gable end walls, depending on building design (see **Figure 2**). The installation sequence of second story walls, floors, and plates is dependent on design—refer carefully and completely to your plans. Since there is a lot of variation in installation based on design, read each installation procedure below carefully, making sure that the steps apply to your installation.

For "shallow" pitched roofs[1] (See **Figure 36**):

1. As needed and as specified on the plans, **rip the appropriate bevels on eave top plates**, using a wider dimension two-by to create a parallelogram shape to the plate that matches the rout at the eave panel's top edge (see **Figure 36**). This configuration is most common with roof pitches less than 12:12. Refer to **Appendix C** for a table of bevel rips and roof pitches. **NOTE**: In this case, the bevel rips on the eave wall top plates are the same as the bevel rips on the eave end-blocking of a plumb cut roof panel.
2. Just prior to installing second story wall top plates, **apply foam sealant** in the routed beds that will receive the top plates.
3. **Install second story eave wall top plates.**
   NOTE: If there is a second story floor deck on a "low-sloped roof" structure, the joists will almost certainly run from gable to gable and be installed with top-bearing joist hangers and run on a gable end wall height different than the eave walls. See **Figure 37**.

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1 Or for any wall panel where the top margin of the panel is cut at an angle to match the roof pitch.

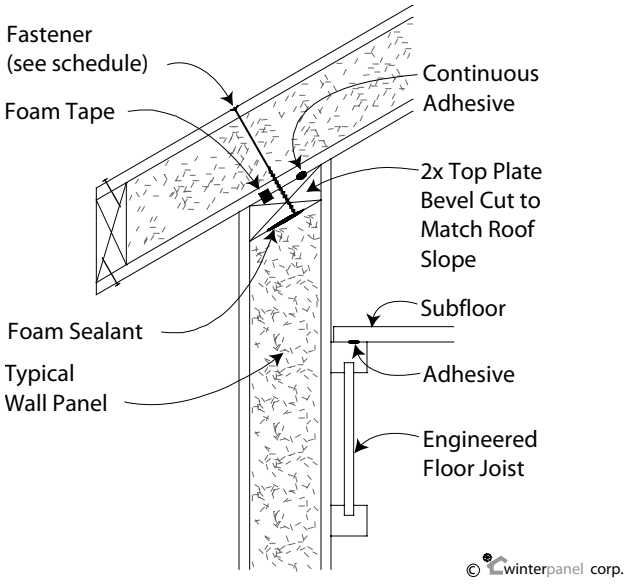

Figure 37. Attic Joist and Floor Detail with Shallow Slope Roofs. *Typically, the floor joists in this situation will run to the gables and not to the eaves.*

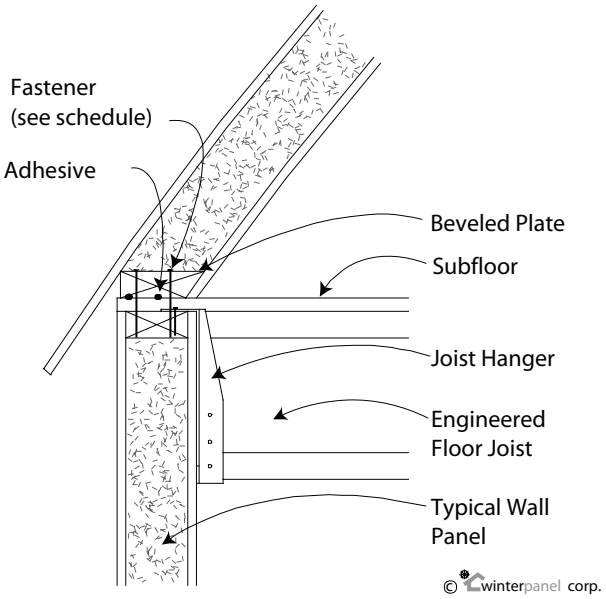

Figure 38. Wall-Roof Intersection with Shallow Roofs. *With roof pitches steeper than 12:12, a bevel cut bottom plate is used at the eaves to secure the roof panels to the top floor deck or walls. This is true for the popular Bow roof, as shown here.*

4. If there is a second floor deck, **install joists and sheathing** per manufacturer's specifications and local code, in terms of layout and nailing patterns.

For steeply pitched roofs[2] (See **Figure 38**):

5. If there is a second story floor deck at the height of the eave walls, **install top-bearing joist hangers and floor deck** as per the first floor installation procedures.
6. Rip the inside edge of the roof panel bottom plates to match the roof pitch. This is typical for roof pitches 12:12 and greater (most common on Bow Cape designs). Refer to the plans and **Appendix C** for a table of bevel rips and roof pitches, as needed.
7. **Install roof panel eave bottom plates**, taking care to line up the inner skins of the wall and roof panels—see **Figure 38**.
8. **Assemble and erect second story gable end walls**, installing top plates except as indicated by the location of top-open beam pockets.
9. **Air seal all panel plywood-splined panel joints per Figure 22**. This installation step must be completed before access is eliminated by installation of interior or exterior components.

Installation – Purlins and ridge beams

NOTE: These beams are installed in exactly the same way as second floor girders, described previously. If the plans call for supporting posts, install them as specified.

There are generally three laminated beams: two purlins in mid-span and one ridge beam. There may be additional roof beams, depending on the house design, or there may not be a ridge beam. If a ridge beam is used, it is cut to match the roof slope on both sides with a 1" flat spot at the center on top. Purlins are cut to match the roof slope on one side with a 2" flat spot left on top.

---

2 Or for any wall panel where the top of the panel is NOT cut at an angle, and it is the bottom plate of the roof panel that matches the roof pitch.

1. **Attach two-by pocket blocking** and do all prep work on the beam pockets (routing out foam core, pre-placing bottom blocking when beam is inserted rather than dropped into pockets, etc.) prior to any beam installation procedure.
2. **Set laminated roof beams** in place with a crane and one person at each gable end peak.
3. **Secure the beams** in place per the plans and discussion in previous chapter.
4. **Install gable end top plates** being sure to foam seal and fasten the top plates as described previously (if their installation was held off to allow the placement of beams in top-open beam pockets).

Installation - Temporary roof bracing

There is no single set way to establish temporary roof bracing. The important thing is that the bracing protect the beams from deflection that can occur as individual roof panels are placed. See **Figure 39** for a representative temporary roof bracing system.

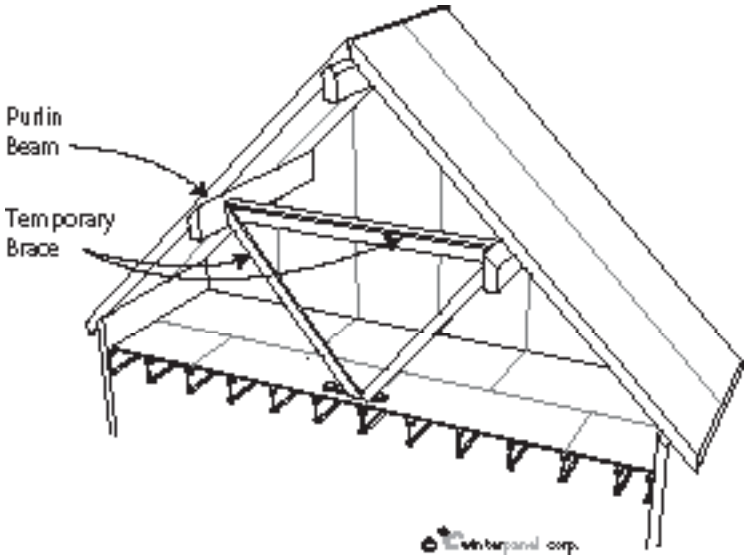

Figure 39. Temporary Roof Bracing—Representative Method.
Methods for bracing can vary with building type. The degree of sophistication for temporary roof bracing is largely a function of the total dead load of the roof structure.

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Roof Panels

General – On smaller roofs, a single course of panels will span from eave to ridge. But frequently, there will be two courses of panels on each side of the roof. The lower course will span from the eave to a purlin beam, and the upper course will span from purlin to the ridge beam. Roof panels are also more likely to be deeper than wall panels, requiring longer fasteners. Winter Panel strongly recommends that your design include a ridge beam because of the difficulties in installation and air sealing a roof assembly without a ridge beam.

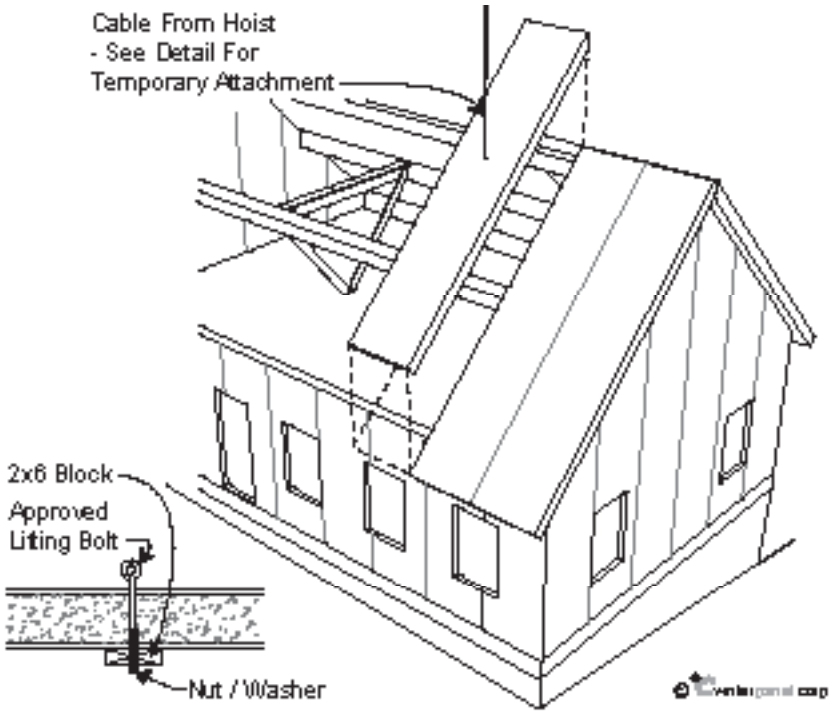

Figure 40. Hoisting Roof Panels With a Crane. *Be sure to follow accepted safety practices when lifting panels onto the roof. Never let anyone get underneath the panel as it is being lifted.*

There are three different ways to handle roof valleys with panels—support the valley on a beam, spline the valley like an inverted beamless ridge, or (for smaller valleys such as at dormers) run the smaller roof on top of the larger roof at the valley. Each of these is a design feature covered in this chapter.

Moisture Management – As with any wood structure, the shorter the time the panels spend exposed to the elements, the better. Install the roofing underlayment as soon as possible after roof panel installation—this is covered in the section, **Completing the Process**. The air sealing details between the roof panels and the ridge have proven to be a critical performance feature. Make sure that the air seal in this area is both continuous and robust.

Note that valleys are much more prone to substantial and concentrated wetting if the roof assembly experiences precipitation before roofing underlayment can be installed. Install a continuous weather-resistive barrier on all roofs as soon as possible, but particularly on roofs with valleys.

Installation – Placing the first roof panel

NOTE: It is possible to install roof panels without a crane. Winter Panel, however, strongly recommends the use of a crane in terms of efficient, safe and proper placement of the panels.
NOTE: There are a variety of ways to hoist the panels to the roof. The one described here is by far the safest, although perhaps not the most expedient. Installers assume their own risk with all methods, but Winter Panel only recommends this method.

1. **Drill a hole** (no smaller than 3/8”) completely through the panel, offset slightly from the center (toward the top end of the panel and somewhat to the side), and insert an approved lifting bolt (rated to lift at least two times the anticipated load), as shown in **Figure 40**.
2. **Place a 2” X 6” block or “spanner”** on the backside of the panel with the bolt extending through the spanner and the spanner extending the width of the panel. Secure the lifting assembly with a washer and nut.

NOTE: The security of this lifting assembly is largely based on the strength of the bolt. Routinely check the bolt for fatigue. In any case, treat the assembly with respect: Under no circumstances should anyone get underneath a panel being hoisted onto a roof!

3. **Fasten temporary stop block** on inside of panel, per **Figure 36**.
4. **Place roof panels in opposition**, one on each side of the ridge, working down from gable to gable.

NOTE: The only exception to the rule of installing opposing panels is for a roof assembly without a ridge beam. See step # 19 below.

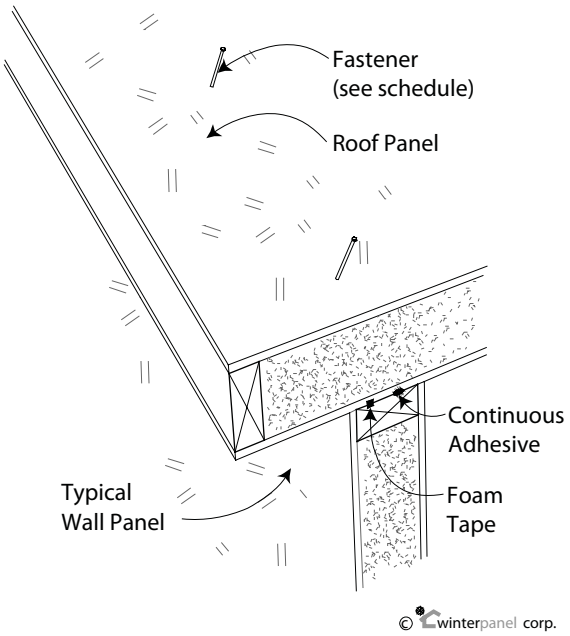

Figure 41. Installing Edge Roof Panel—With Gable Overhang. *Follow the plans carefully to determine the proper amount of overhang, if any. Apply two beads of adhesive and nail roof panel to the wall panel as shown.*

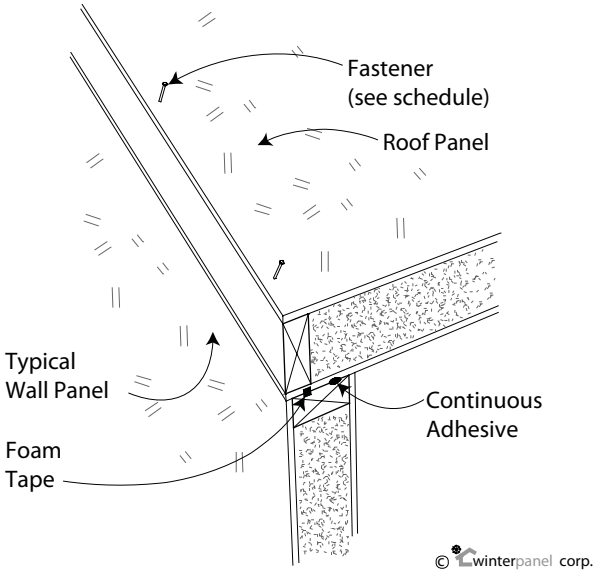

Figure 42. Installing Edge Roof Panel—No Overhang or Flush at Gable. *Apply adhesive and nail roof panel to the wall panel as shown.*

5. **If** there are two courses of roof panels, **place and secure ALL of the 1st course panels first**.
6. **Apply a continuous bead of adhesive and foam tape** to the top plate of the gabled end and roof panel bottom plate or eave wall top plate, and one bead on the purlin bevel.
7. **Place the first panel so that it is lined up with the gable end wall**, either overhanging or flush as called for in the plans (**Figures 41 and 42**). This panel will have two-by routs on its gable and eave edges to receive end blocking.
8. **Fasten the roof panel**—at the eave edge as shown in **Figure 42** (and for steeply pitched roofs as shown in **Figure 43**) and in the field of the panel as shown in **Figure 44**. See the **Fastener Schedule - Appendix A** and refer to the plans.
   NOTE: The general rule for panel fastener length is to use nails or screws 1 ½" longer than the panel thickness if the fastening substrate is hardwood, 2 ½" longer if the fastening substrate is softwood.

<u>Installation</u> – Placing subsequent roof panels

NOTE: Ridge details and procedures are an integral part of panel installation but are covered in the last section—read the subsection on ridge beam details BEFORE you begin installation of any panels that attach to the ridge.

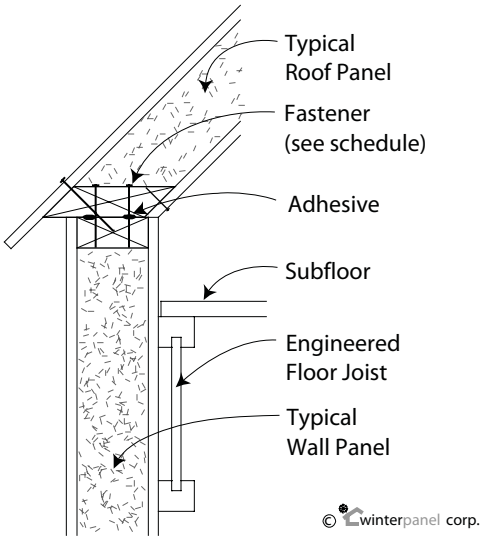

Figure 43. Securing First Roof Panel at Eave. *Attachment to already installed bottom plate in steep roofs (over 12:12) is shown. If there is an attic floor, there may not be room to nail the inside skin to the bottom plate. For shallow roofs, see* ***Figures 36 and 37****.*

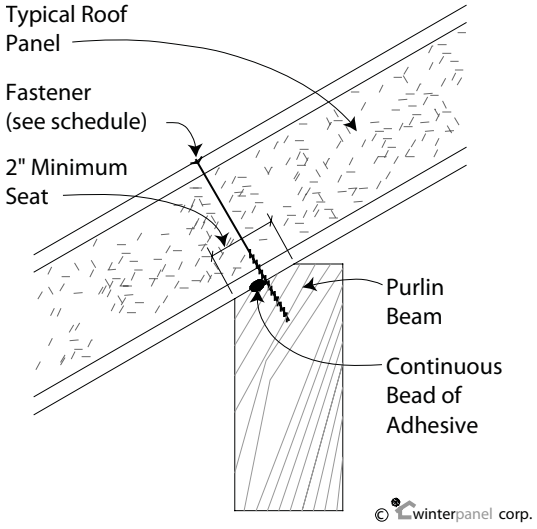

Figure 44. Fastening Full-Span Purlin into Purlin. *With full panels spanning from eave to ridge, apply adhesive on the purlin and space the fasteners 12" o.c.*

9. **Apply construction adhesive** just prior to and wherever the next panel will be placed.
10. **If** there is more than one course of roof panels, **install but do not set the fasteners** where the top edge of the panel will rest on the purlin, until all the panels in the course are in place and the plywood splines installed.
    NOTE: The top edge of the panel should only have one routed groove (next to the outer OSB skin) where a single plywood spline will be used to join the panels. Because both upper and lower panels will be nailed into the purlin at this joint, only a single plywood spline is required between them. See **Figure 45**.
11. **Fasten the eave edges of the first course of panels**, the method of attachment depending on the eave plate configuration. For steeply pitched roofs, nail through the outer OSB skin into both the bottom roof and top wall plate using 16d nails 6" o.c. as shown in **Figure 43**. Nail through the inner OSB skin into the bottom plate (from inside the house) with 6d nails 6" o.c.
    For shallow pitched roofs, fasten the eave edge of the roof panel per **Figures 36 and 37**.
12. **Secure adjacent first course panels** from above and below with plywood splines and fasteners along the panel's long dimension. Abut the OSB skins tightly. As each panel is joined with splines to the previous one and fastened into the purlin and bottom plate, go back and sink the fasteners which hadn't been fully set in the previous panel.

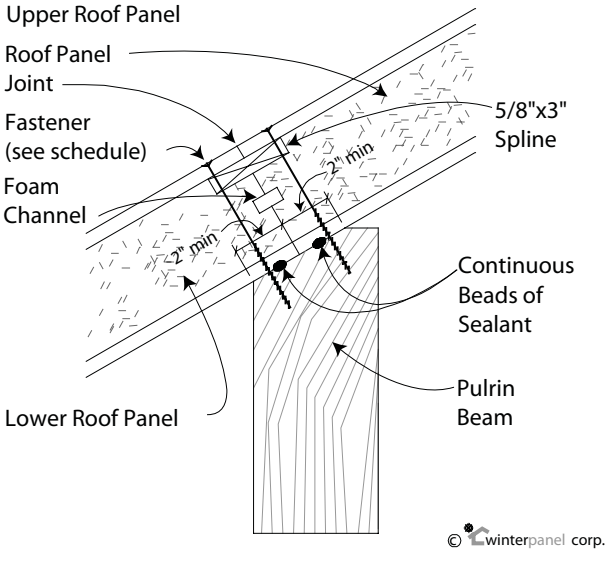

Figure 45. Installing Second Course of Roof Panels. *After the bottom course of panels is in place, install the second course from the purlin to the ridge beam. Panels are joined with a single plywood spline as well as twist nails or screws into the purlin. Apply foam sealant after joining panels.*

NOTE: As before, these plywood splines can be slid in from the top after panels are set or the plywood splines can be placed in one panel before the next panel is abutted.

13. Once a full course of roof panels is in place, **install plywood splines** where these panels will abut the upper course of panels (over the purlins). These short-dimension splines fit into the grooves of the outer OSB skin at the outer edge of each panel.
    NOTE: The last panel along the side of the roof will have two-by end blocking set into the outer edge. It will either end flush with the gable or overlap, depending on the house design. Install this end blocking in a bed of foam sealant.
14. **If** the roof has two courses of panels, **install the second course of panels** in just the same manner, spanning from purlin to ridge, as shown in **Figure 45**. Apply a bead of adhesive on the purlin and ridge, as shown, and use fasteners per the **Fastener Schedule**, 12" o.c.
    NOTE: Make sure that you maintain the pattern of installing panels in opposition on both sides of the roof.
    At the bottom edge of the second course, make sure the panels fit into the plywood splines and secure to the purlin with panel screws 12" o.c. As panels in the upper course are installed, remember to go back and tightly set the top of the lower course of panels into the purlin.
    If the roof has just one course of panels (single panels span from eave to ridge), simply fasten into the purlins at the mid-point, as shown in **Figure 44** (no horizontal spline joint will be required).
15. **Air seal all plywood-splined panel joints**, per the procedure for drilling and spray foaming detailed for first story walls (See **Figure 22**).
    NOTE: While the access holes for spray foaming the channel are often done from the interior, panel joints resting on purlins must be drilled from the exterior and accomplished before any roofing paper or roof cladding is installed.

<u>Installation</u> - details at the ridge

NOTE: There are two types of ridges with Structurewall™ panels—ridges with ridge beams and ridges without ridge beams.

Ridge with beam – see **Figure 46**

16. **Apply a CONTINUOUS bead of construction adhesive** on each edge of the beam that will contact the roof panel.
17. **Fasten through the panel into the beam** with panel fasteners every 12" along the ridge (use fasteners per panel thickness and the **Fastener Schedule - Appendix A**). Make sure the bottom of the miter cut aligns with the center line of the ridge beam to ensure a tight fit when the opposite roof panel is installed.

Winter Panel typically cuts the peak angle of each top course roof panel so that the peak joint is slightly splayed (see **Figure 46**). This provides clear access to spray foam for an air tight seal at this important joint.

An alternative is to leave an intentional gap to accommodate spray foam sealant and an air seal at the peak.

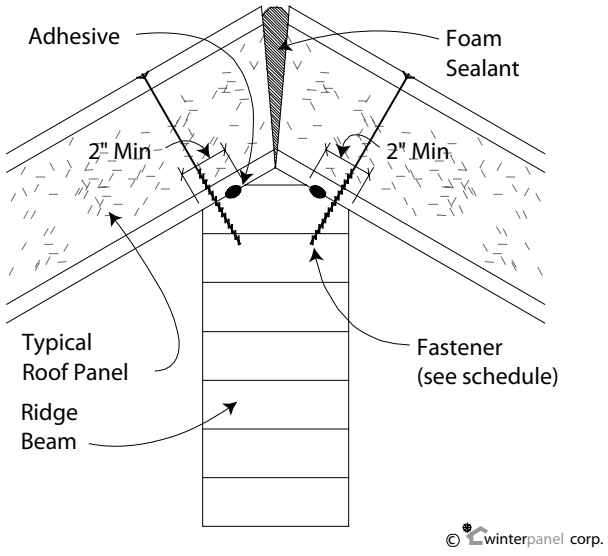

Figure 46. Securing Panels at Ridge. *Roof panels are miter cut at the ridge and secured with twist nails or screws 12" o.c.*

Ridge without a beam - see **Figure 47**
NOTE: Winter Panel strongly recommends designs that use a ridge beam, particularly in terms of the installation challenges of a ridge without a beam.

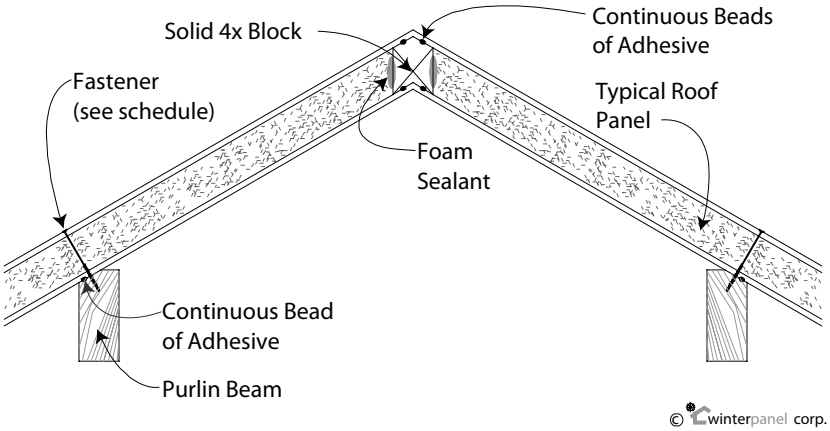

Figure 47. Joining Panels at Ridge Without Ridge Beam. *Specially cut ridge blocking joins the roof panels at the peak. Once assembled, the panels and ridge block are joined with adhesive and fasteners, angled through the OSB and into the purlins and ridge.*

19. There are three different ways to complete the roof assembly if there is no ridge beam.
    a. **Install the full-length ridge blocking** in the first panel while temporarily supporting the spline at the far gable to hold the spline in place as opposing panels are installed. Be sure to foam the panel top edge before installation.
    b. **Install all of the panels on one side of the roof** and then install the full-length ridge spline. Note that this requires more substantial temporary bracing to keep purlins from bowing and potentially introducing a swale in the plane of the roof.
    c. **Install a group of roof panels**, all installed on one side and then install just a section of the ridge spline that is approximately the same length as the group of installed panels. This method also breaks the rule of only installing opposing panels and requires additional bracing of the purlins to keep purlins from bowing and a swale developing in the plane of the roof.
20. To install opposing panels into the ridge spline:
    a. **Position the panel** so that the top of the panel contacts the ridge spline first.
    b. **Pivot the panel downward** so that the top groove fits around the ridge spline and the bottom of the panel rests on the purlin (bead of adhesive on purlin, foam sealant in panel rout).
    c. **Push/pull the panel sideways,** to close the joint (foamed) with the adjacent panel.
    d. **Hammer in a 4' section of plywood spline** into the seam over the purlin.
    e. **Attach to the purlin as before**; 12" o.c. for each panel with fasteners per the plans or **Fastener Schedule**.
21. **FOAM ALL ROUTED KEYHOLES IN ADJACENT PANELS**. Refer to **Figure 22**.
    NOTE: IF your panels are pre-routed with electrical wiring chases, either do not foam the joints until after the wiring has been run or place a small tube in the pre-routed chase to keep the foam from closing off the chase. See the section on electrical wiring for more information.
    a. **Drill 3/8" holes approximately 12" apart**, taking care to drill deep enough (through the inner plywood spline) to reach the routed keyholes, but not past the second spline (this would be approximately 2 ¼" in 4 ½" panels and 3 ¼" in 5 ½" panels).
    b. **Insert nozzle of foam sealant** can into first hole and inject until the foam sealant expands out of the next hole.
    c. **Repeat this procedure** on every other hole.

A NOTE ON ROOF PENETRATIONS: Openings for roof windows and skylights should be pre-cut when the panels arrive at your site. Penetrations for chimneys and vents are typically cut later by the mason or plumber, after the house has been fully closed in. For smaller penetrations (within a single panel), two-by framing may already be inset into the routed edges of the opening. For larger openings, these two-bys will have to be installed after the panels are set in place on the roof since they will extend into more than one panel.

If any additional roof openings are to be incorporated into the house, the openings can be cut and routed as described in **Appendix B**. If you plan on adding additional roof openings, make sure the structural integrity of the roof will not be affected. Consult Winter Panel if uncertain.

Installation – creating valleys with panels

See **Figure 48** below for the three different ways that roof valleys can be configured with Structurewall™ panels. Check the building plans to determine which configuration applies. Essentially, treat valleys as inverted ridge/roof.

23. **Install valley beam**, valley spline or valley bottom plate, foaming and fastening as before.
24. **Install opposing panels**, foaming and fastening as before.
25. **Install a self-healing valley membrane**.

NOTE: Install a continuous, weather-lapped drainage plane on the completed roof as soon as possible. See the section on **Completing the Process** for more information.

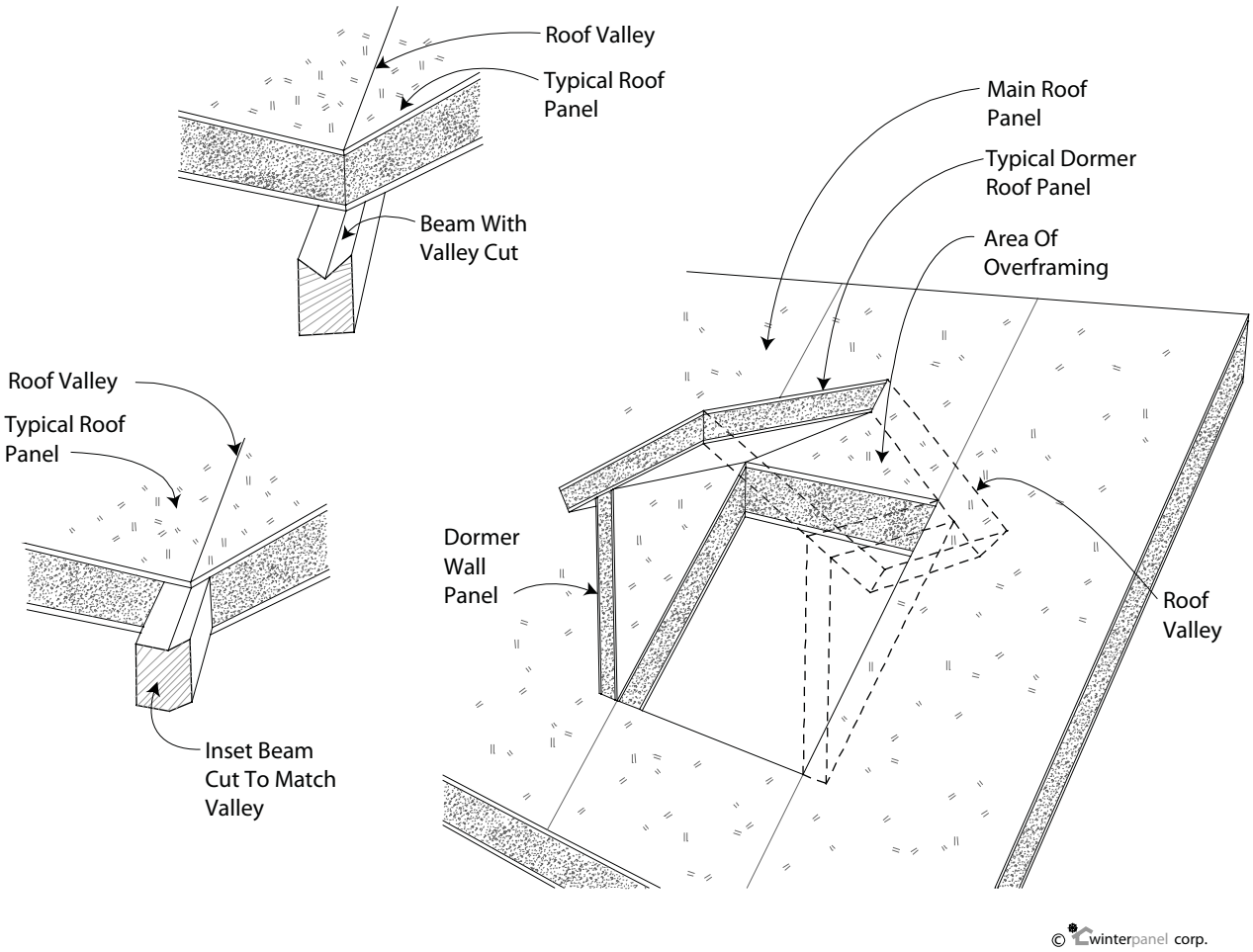

Figure 48. Roof Valley Configurations. *Of the three roof valley configurations shown, the preferred method (in terms of thermal, air leakage, and water management) is the supporting valley rafter, aesthetics permitting.*

Eave & Gable Overhang Details

Design - Eave detailing is up to the builder. The roof pitch and roof/wall joint details govern the eave detail to some extent, but there is considerable flexibility in design. Several common eave details are shown in **Figure 49**. Details using both the extended outer skin and the full overlap are shown.

The same is true for gable end and rake details—they are somewhat governed by panel eave configuration, but there is considerable design flexibility. **Figure 50** on the following page shows the most common finishing details with both flush rakes and gable end overhangs. To simplify the installation of siding, the rake board can be held out ¾" with blocking, or notched. When the roof panels end flush with the wall panels, a simple rake can be used. The roof panel is cut flush with the wall panel, a two-by is inset into the roof panel edge, and two rake boards are nailed on as shown.

With a gable overhang, the detail is similar, except that the exposed section of panel is sheathed with a soffit and the rake boards are a slightly different. A somewhat more ornate rake detail can be made by attaching a rake extension to the edge of the roof panel.

Moisture Management – Overhangs—particularly on eaves but also on gable ends—are among the most important features to manage the liquid water that a structure sees. Prevailing wind direction and speeds are the best factors to consider from a moisture management perspective, but often the aesthetics of Winter Panel designs support the functional importance of eave and gable overhang details as well. Be sure that the roof weather-resistive barrier extends over the entire roof assembly, including all gable and eave finish details. It is also important that all wood components of the overhang details be primed on all six sides even, and especially, all cuts.

Installation –

1. **Install** all eave and gable details per the plans.
2. **Prime ALL six sides** of every component.

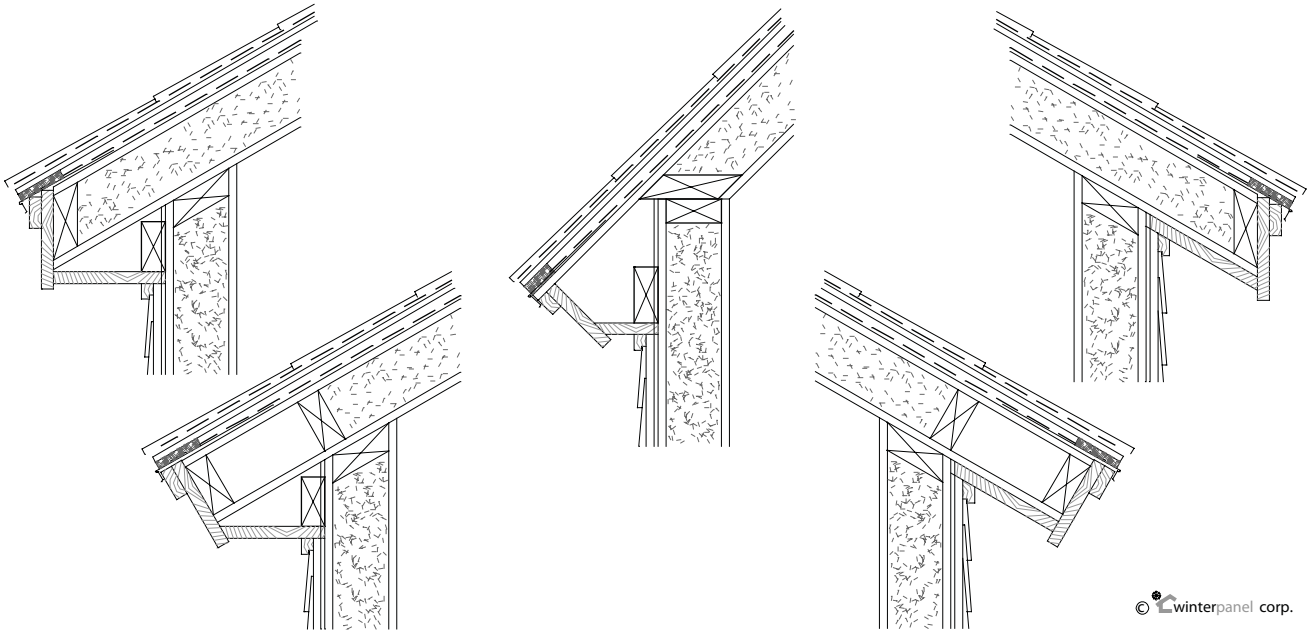

Figure 49. Eave Details. *Eave detailing is up to the builder. As can be seen, there is considerable design flexibility.*

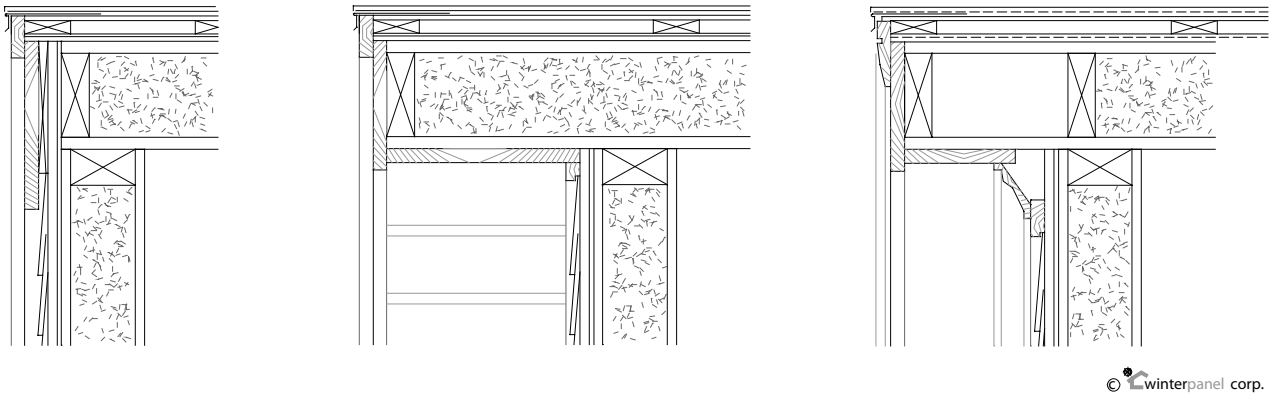

Figure 50. Rake Details. *Flush and overhanging gable-end rake details are shown. As with eaves, you have considerable flexibility in design.*

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Section II - Enclosing a Timber Frame with Winter Panels

Introduction

Both the Winter Panel Structurewall™ and Curtainwall™ panel systems can be used for timber-frame buildings.

The non-structural CurtainWall™ panel system is specifically designed for timber-frame buildings, both walls and roofs. Unlike infill wall systems used in conventional timber-frame (where panels are cut and fit around posts, girts, and corner braces), the entire CurtainWall™ panel system sits outside the timber frame. This gives the CurtainWall™ panel system superior energy performance, water management, and interior appearance, particularly when the panel dimensions, layout, and building design are coordinated to “hide” as many panel joints as is possible behind timber-frame elements.

Winter Panel Structurewall™ panels are either recommended or required for timber-frame buildings where any one or more of the following is needed:

- A sturdy nail base (for hanging kitchen cabinets, for example);
- Added stiffness (at larger overhangs, long wall runs, and for unsupported roof spans greater than 4 feet);
- Added weatherability of panels (when either local climate or construction conditions mean the panels will “see” more weather);

Of course, a 15-minute fire-rated material, such as drywall, must be used as the interior finish with Structurewall™ panels, but this approach does manage exposed drywall joints better (see the next section on timber-frame walls). And with more and more Winter Panel packages going out for “hybrid” structures (part timber-frame/part conventional), many builders are moving toward the Winter Panel recommendation for Structurewall™ panels for the entire structure.

Walls

General – The major considerations when installing panels in a timber frame structure are ease of installation, ease of interior finishing and minimizing panel waste. Usually this means having as many panel edges as possible aligning with timber frame members.

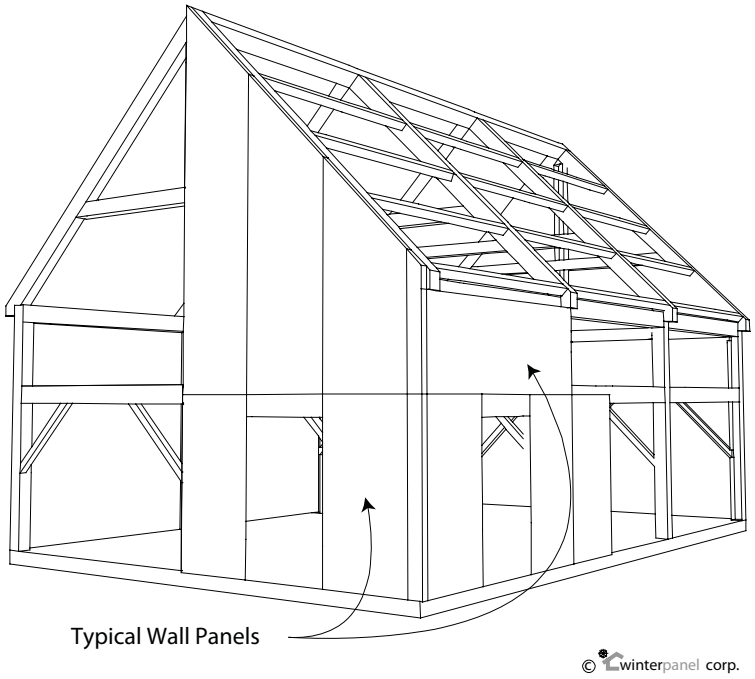


Figure 51. Wall Panel Installation. *Panels can be installed either vertically or horizontally depending on the framing system used.*

Winter Panel recommends the use of StructureWall™ panels (OSB skin-foam core-OSB skin) with an added interior and covering layer of drywall in place of CurtainWall™ panels (OSB skin-foam core-drywall or finished panel). The frame layout for the walls of most of today's timber frame structures will not accommodate hiding all or most panel joints behind framing. Since the panels are fastened directly to the timber frame, any movement in the frame (typically timber shrinkage as the frame equilibrates to the interior environment) is telegraphed to the panels and expressed as cracks in exposed drywall joints. Separating out the drywall layer from the panels, and using the much stiffer Structurewall panels means fewer exposed joints and little to no visible expression of timber frame movement on finished interior walls.

Wall panels can be installed either vertically or horizontally. To avoid long unsupported spans, vertical installation--spanning from the sill to a girt or plate--is recommended. Depending on the frame design, however, it can make sense to apply panels horizontally as shown in **Figure 51**.

At the sill, the panels usually rest on a 2"x10" or 2"x12" pressure-treated mudsill and are fastened into the band joists as shown in **Figure 52**. If a more traditional timber framing technique is used with timber sills as shown in **Figure 53**, the panels are installed on the outside of the timber sill and extend down to the top of the foundation wall. And as with any pre-cut structure, an accurate, level and square platform is essential.

Moisture Management –
NOTE: The moisture performance of Winter Panel walls can be affected by the moisture performance of the foundation.
Foundation:

- **Apply foundation damproofing.** Damproofing forms a capillary break between soil and the below-grade portion of the foundation wall.
- **Install capillary break**[1] between basement or at-grade slab and soil beneath. Sheet plastic

1 A capillary break is any material that stops the movement of water from areas of high concentration to low concentration in porous materials. Many building materials are porous (concrete, wood, brick, drywall paper). Movement of water by capillary action is often call "wicking."

and 4" of ¾" (no fines) gravel beneath the basement slab or slab-on-grade forms a capillary break between the soil and the slab.

- **Install drainage mat or place free-draining backfill** against the foundation.
- **Install perimeter pipe drainage and filter fabric** as shown in **Figure 5**.

Walls:

- **Install a capillary break** between the foundation and any wood component that rests on or makes contact with the foundation. Suitable materials include closed-cell foam sill sealer or rubber membrane.
- Make sure that the **weather-resistive barrier extends down** to protect the joint between the bottom of the wall panel and the supporting mudsill.
- **Air-seal every panel joint** with foam sealant (the ¼" spaced joints at framing-supported joints and the routed/splined-grooves at unsupported panel joints).

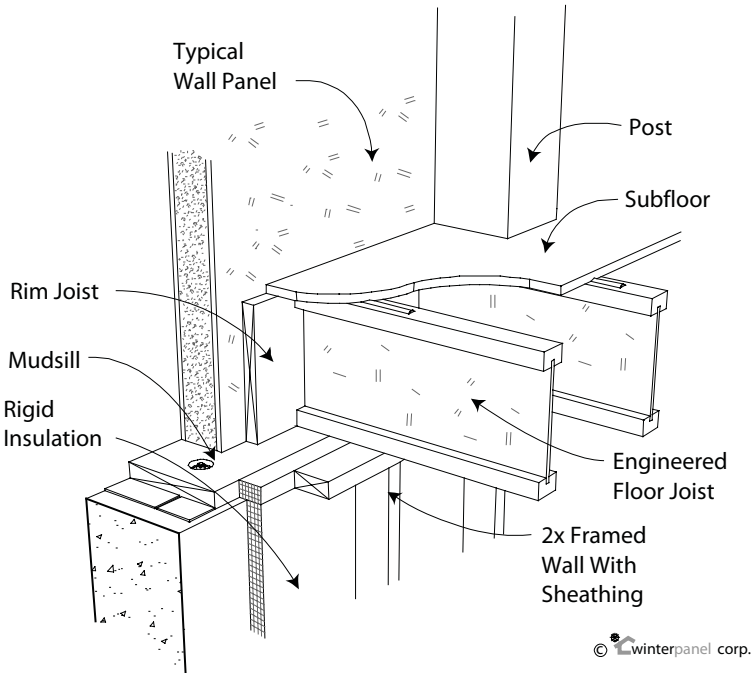


Figure 52. Panel Attachment at Sill. *This detail varies with building design--it must be worked out at the design stage. In general, the outer panel surface should be flush with the outside of the finished frost wall (with or without exterior insulation).*

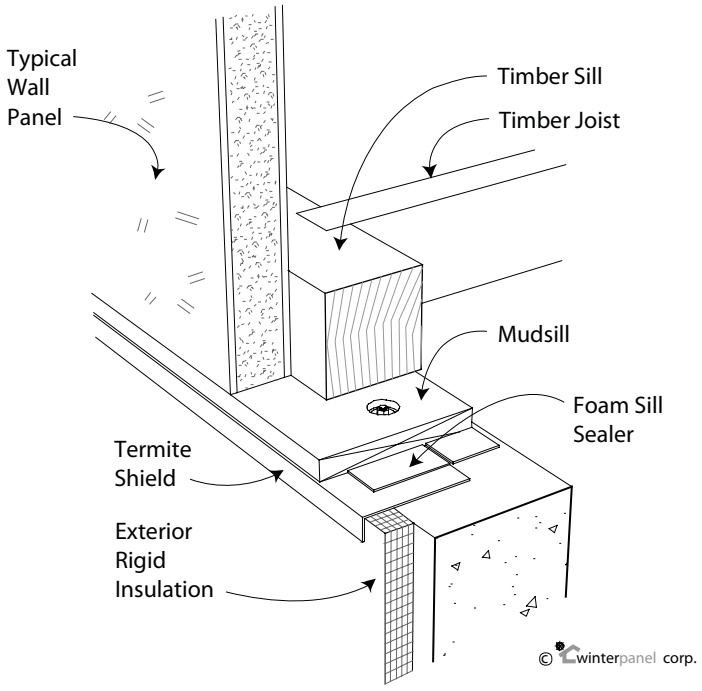


Figure 53. Timber Sill Detail. *If a timber sill is used, the panel attachment detail at the bottom of the wall will differ. Rest the panel on a pressure-treated sub-sill and secure the bottom edge into the timber sill.*

Installation – Walls

NOTE: Most timber framers using Winter Panels order "blank" panels, cutting and routing panels on site for specific applications such as corners, rough openings, and gable panels along the roof line. See **Appendix B** for cutting and routing procedures.

NOTE: Timberframe wall panels can be configured and installed in one of the following ways (See **Figure 54**):

- StructureWall™ panels with a 5/8" space between panels and the timberframe; ½" drywall slips in this space after the structure is weathertight[2] (**top of Figure 54**).
- StructureWall™ panels with ½" drywall tacked to the outside of the timberframe just prior to wall panel installation (**middle of Figure 54**).

2 *This also means that ALL of the drywall work is done at the same time by the drywall contractor.*

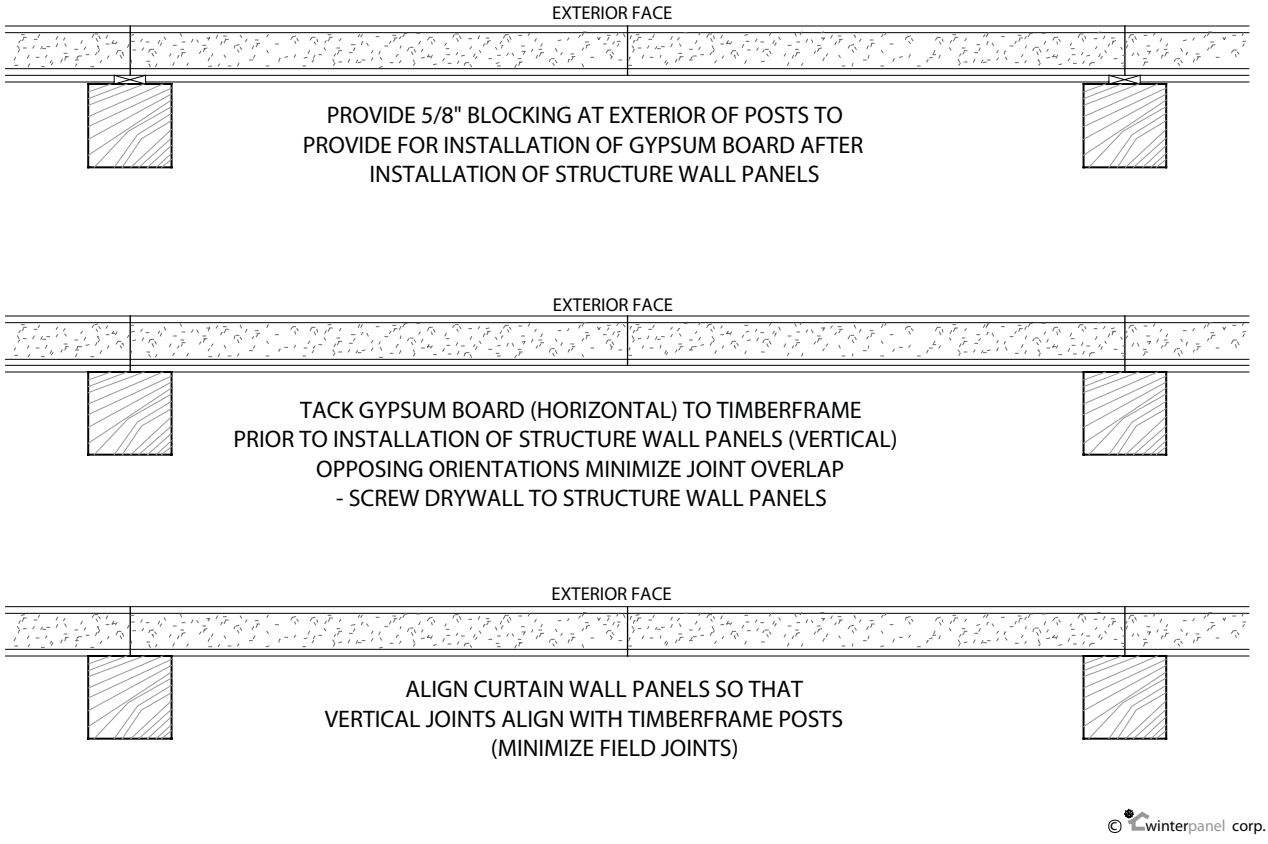


Figure 54. Timberframe Wall Configurations. *There are advantages to each of the panel configurations shown here and as discussed in the text.*

- CurtainWall™ panels with panel joints hitting timberframing as is possible (**bottom of Figure 54**).

All of the installation instructions below apply to all three situations—installers simply need to be aware from the start of wall panel installation which configuration applies.

1. Per the drawings and with particular attention to the corner detail, **set a corner panel first**, securing the panel temporarily with four fasteners at the corners. Fasteners should be spaced in 1" – 2" from the panel edge and penetrate 1 ½" into hardwood framing and 2 ½" into softwood framing.
   NOTE: If this panel is to be joined with the next panel using spline(s), both this panel and the next must be factory-routed for the spline(s) or routed on site BEFORE the panels are placed; see **Appendix B**.
2. **Place the next panel** per the spacing as noted below:
   a. Framing-supported panel joint: Space panels apart ¼" to accommodate subsequent air sealing of the joint with foam sealant.
   b. Unsupported panel joint: With or without splines installed into the first panel, place the second panel and tap the panels together for a tight joint.
      NOTE: Whether splines are installed in the first panel prior to placement of the second panel, or slid into the joint between the two panels after the second panel has been installed, is completely a matter of installer preference.
3. After confirming proper panel alignment (no "sawtooth" from panel to panel), **corner-fasten the second panel**.
   NOTE: For unsupported panel joints, take care not to seat any fasteners too tightly, such

that panel compression at the routed groove makes inserting the splines more difficult.

4. **Return to the first panel and complete panel fastening** per the **Fastener Schedule** and as shown in **Figure 55** (6 inches o.c. at panel edges, 12 inches o.c. everywhere else).
5. **Repeat** steps 1 through 4 for all subsequent wall panels.

NOTE: All bevel-cut top-of-wall eave and all slope-cut top-of-wall gable panels are factory-configured or must be site-cut (see **Appendix B**) for a ¼ - ½" space between the top of the wall and roof panel to accommodate subsequent foam sealing. See Figure **61**.

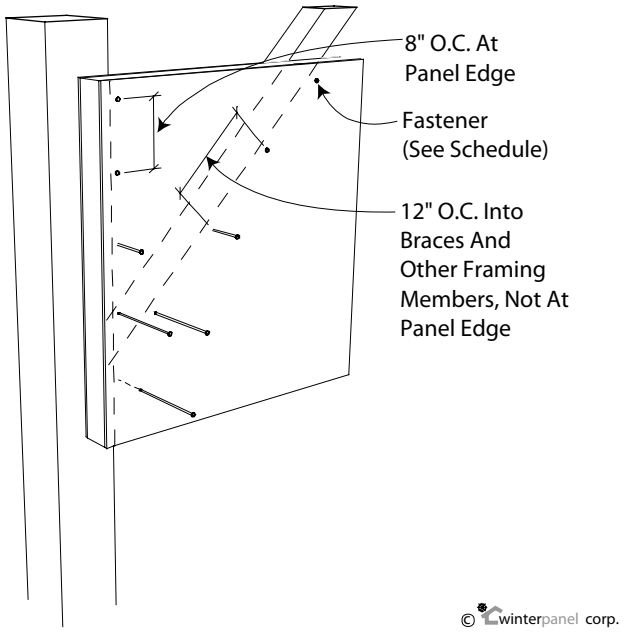


Figure 55. Panel Attachment to Frame. *Allow 1-1/2" nail or screw penetration into hardwood frames. For softwood frames, allow 2-1/2" nail penetration or 1-1/2" screw penetration. Use 8" on center spacing at panel edges and 12" o.c. spacing where the mid-point of a panel rests on a framing member.*

6. **Foam all joints**. All joints must be foam sealed prior to coverage by either the weather-resistive barrier (on the exterior) or drywall (on the interior). Foam sealing splined- and routed-panel joints is in part dependent on the configuration of the exterior walls as discussed above, but in general is done in the following way (see **Figure 22)**:
    a. **Drill 3/8" diameter holes** every 12 inches, penetrating through the first spline and into the foam channel
    NOTE: With Curtainwall™ panels, this is best done from the exterior. With Structurewall spaced out 5/8" for later drywall installation, the splined panel joints have both splines and spray foaming can be accomplished from the inside or out. With Structurewall™ panels where the drywall is installed before the panels, there is only one spline on the outside of the panel, and the foam sealant procedure is done from the exterior.
    b. **Insert the foam sealant** nozzle tube into the drilled hole approximately half the thickness of the panel and spray for approximately 5 seconds (adjusting the spray time based on trial and error).
    c. After the foam sealant has set up, **shave off any protruding foam sealant** flush with the panel surface.

<u>Installation - Outside Corner Details</u>

NOTE: The installation directions below are dependent on the wall panel configuration/installation system (Structurewall™ with spacers and "later" drywall installation, Structurewall™ with "same time" drywall installation, or Curtainwall™).

There are three main ways to handle outside corners:

- Simple Overlap – **Figure 56a**
    1. **Install the first panel ¼ - ½" shy** of the perpendicular face of the corner post, using the same fasteners and schedule as detailed above.
    2. **Identify the opposing corner panel**—it has, or must be site-cut for, a routed pocket

to receive two-by blocking. If it has not already been installed, install the two-by corner blocking using 1¼" screws or 6d nails every 6". Refer to **Appendix B** to accomplish a site-routed two-by blocking pocket.

3. **Install second panel** with the routed edge flush with the outside plane of the first panel.
4. **Inject foam** sealant into the space between the panels to air seal the panel joint.

- Cut Overlap – **Figure 56b** (tighter corner)
  1. On the first panel to be installed at the corner, **cut out the inside skin** (typically drywall) **and foam** to the thickness of the intersecting corner panel (typically 4 ½").
  2. **Fasten this panel to the corner post**, per the fastening schedule detailed above. On the second corner panel to be installed, rout out a corner two-by blocking pocket per **Figure 56b**. Fasten this panel to the corner post, per the fastening schedule detailed above.
  3. **Fasten the extended outer skin of the first panel** to the two-by corner blocking in the second panel.

- Corner Filler Panel – **Figure 56c** (corner post dimensions and wall layout permitting, the most efficient panel usage detail)
  1. **Install the first panel** ¼ - ½ inch shy of the perpendicular face of the corner post, using the same fasteners and schedule as detailed above.
  2. **Install the filler corner panel**, with the two-by corner blocking to the outside of the corner and using the same fastener schedule as detailed above.
     NOTE: At least two inches of bearing for the third panel must remain on the corner post.

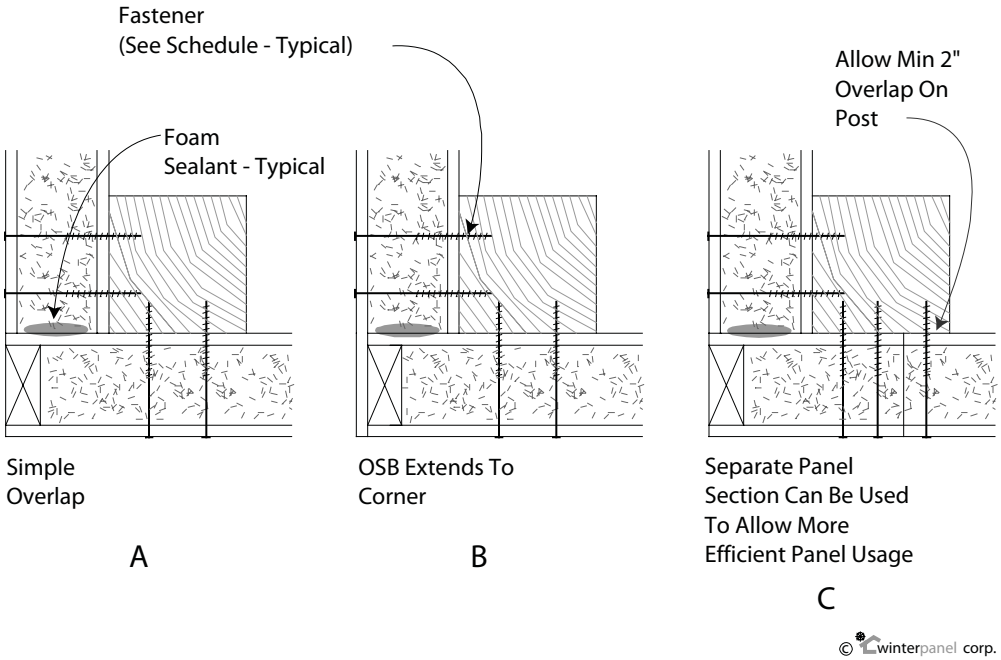


Figure 56. Corner Details. *Three different options for panel overlaps at corners are shown here. The simple overlap in 56a is the easiest, while the overlap in 56b affords a somewhat tighter seal against moisture and wind. 56c shows the use of a short panel section to form the overlap. Depending on your framing system, this detail may enable you to use materials more efficiently. Note that in 56a & c, holding the top panel back ¼" from the other panel can yield a better space to inject foam sealant to make an airtight joint.*

3. **Install the third panel** leaving a ¼ - ½ inch space between the panels.
4. **Foam seal** the space between the panels to air seal the panel joints.

Installation - Inside Corner Details

NOTE: For inside corners, both panel edges need to be reinforced with two-by blocking for added strength because the post does not provide full support to the corner.

There are three main ways to handle inside corners—Post Offset (**Figure 57a**), Notched Post (**Figure 57b**) and Corner Trim (**Figure 57c**). The steps for all three corner details are the same (except for a couple of additional steps for the Corner Trim method that are described at the end):

1. **Rout out a 1½" two-by blocking pocket** in the right hand panel #1 and fasten the two-by into this pocket.
2. **Cut out the outside skin** and foam core of the left hand panel #2 (see **Figure 57**).
3. **Rout out a 1½" two-by blocking pocket** in the left hand panel #2.
4. **Install the right hand panel #1** a strong ½" shy of the corner post (so that the extended inner skin of panel #2 can slip into this space).
5. **Run two continuous beads** of construction adhesive on the outside skin of panel #1 where the inset two-by blocking for panel #2 will be attached to panel #1.
6. **Fasten and adhere the two-by blocking** to panel #1.
7. **Slip panel #2 into the ½ inch slot** and over the two-by blocking.
8. **Fasten the outer skin of panel #2** to the two-by blocking.
9. **(Optional)** Steeply toe nail or screw panel #1 into the post, being careful not to use fasteners long enough to penetrate the inside corner of the post.

- Corner Trim – **Figure 57c**
  1. **Install interior corner trim** to cover the exposed interior panel joint. This corner can also be built out with structural lumber and cover trim for greater strength.
     NOTE: If there is no post at an inside corner, use Structurewall™ panels and build the corner as shown in **Figure 57c**, but without the post. Then apply drywall to the interior panel surfaces and treat as a typical drywall inside corner.

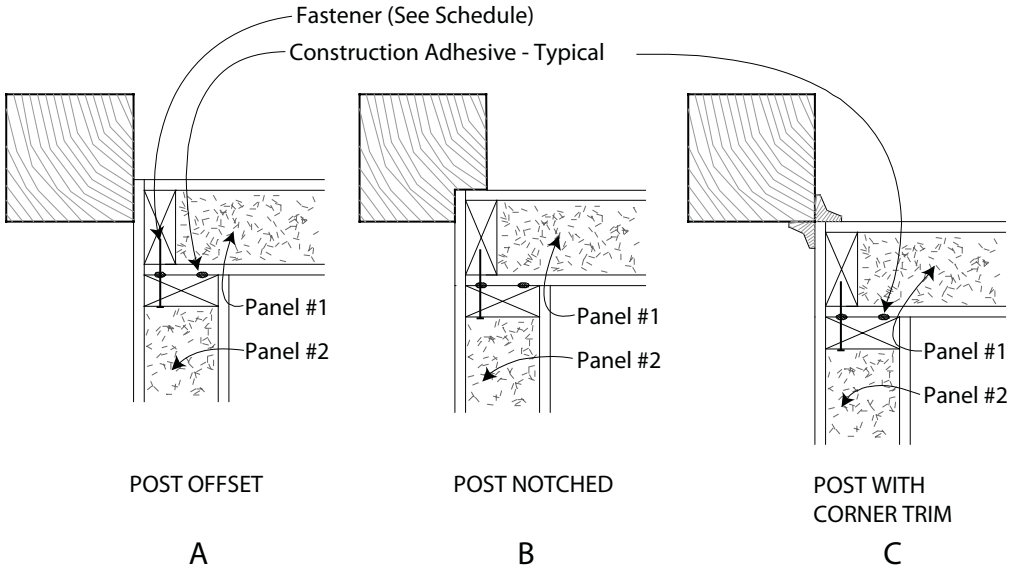


Figure 57. Inside Corner Details. *Inside corners are somewhat more complicated than outside corners because the drywall will be exposed on the interior. The OSB and foam must be cut out, leaving the drywall extending out to overlap, with inset two-bys as shown. The panels can be secured to the corner post in several different ways, as illustrated.*

****

Door and Window Openings

General - Properly framing doors and windows begins with the panel layout. Full-width panels should abut door openings so that two-by blocking can run from sill to girt or plate. Use two-bys here, rather than the dual plywood splines, for added strength. See **Figure 58**.

Rough openings cut into panels (e.g. most windows openings) should not be closer than 6" on the panel edge. Leaving less than 6" to the edge of a panel will increase the likelihood of breakage during installation.

Rough openings for windows should be cut before the panels are installed. Though it is possible to cut openings after the panels are installed, cutting them before is easier and safer because you can work on a horizontal surface. Panels are usually cut with a 16" circular saw with carbide blade (available for sale or rent from Winter Panel). A handsaw is required for finishing corner cuts. Follow window and door manufacturers' guidelines for the rough opening sizes.

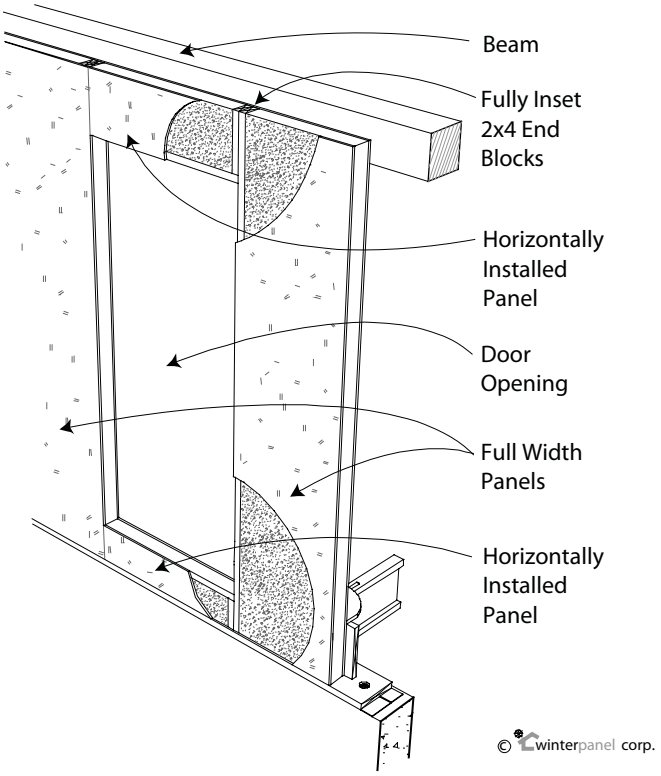


Figure 58. Rough Opening for Door. *At rough openings for doors, inset two-bys should extend all the way from sill to girt or plate, with short panel sections used to fill in above and below the door.*

Moisture Management – The exposed edges of door and window rough openings should be weather-protected as soon as possible. See the section of this manual, **Completing the Process**.

Installation – Window openings (See **Figure 59**)

1. Working on the flat, use a 16" circular saw with carbide blade to **cut the rough opening**, finishing the cuts at the corners with a handsaw (do NOT overcut with circular saw). If more than one panel is involved in the rough opening, cut the second panel.
   NOTE: In situations where less than 6" of panel would be left on either side of the rough window opening, the panel should be ripped at the window edge and a panel joint made there, or the window placement should be changed.
2. **Rout out 1 ½" of foam** around the perimeter of the rough opening in the panels to accommodate two-by blocking. At the corners, complete removal of the foam using a chisel or the claw of a hammer.
3. **Seat the rough opening perimeter two-by blocking** into a bed of foam sealant. The sill and header blocking run long so that the side members transfer some of the load carried by the header to the sill.
4. **Fasten** rough opening perimeter blocking with 8d nails or 1 5/8" screws, at 6" OC spacing.

Installation – Door and Large Window Openings (See **Figures 58 and 60**)

1. **Rout out 1 ½"** on the side of both full panels abutting the rough opening from top to bottom.
2. **Seat the two-by blocking** in the abutting panels into a bed of foam sealant.
3. **Cut two-by blocking "cripples"** 1 ½ inches shy of the rough opening; glue and screw the" cripples" to the full-length two-by blocking of the abutting panels.
4. Using cut-off horizontal panel section if available, **rout out 1 ½"** for the header and sill two-by blocking of the rough opening.
5. **Lay a bed of foam sealant** into the routed ends of the horizontal panels.
6. **Slide horizontal panel sections** into place over the "cripple" scabs of the abutting panels.
7. **Install header and sill two-by blocking** to complete the rough opening. This blocking is installed into a bed of foam sealant as well.

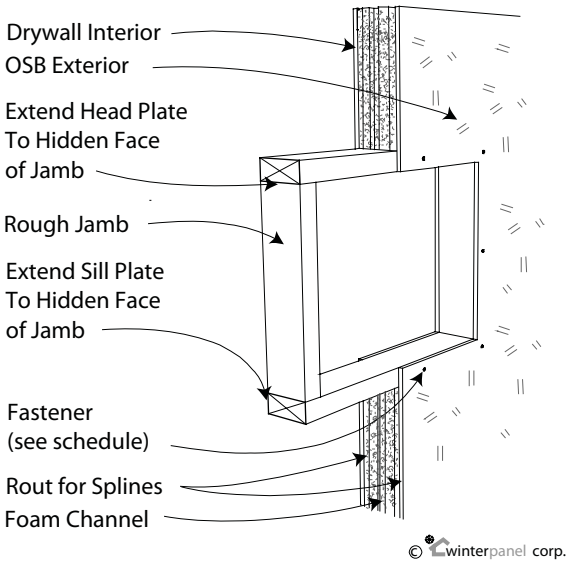


Figure 59. Window Openings. *When you frame around window openings, have the sill and headers overlap the vertical rough jambs. In routing out the foam around window openings, you will have to remove foam by hand with a chisel or other tool at corners where the router cannot reach.*

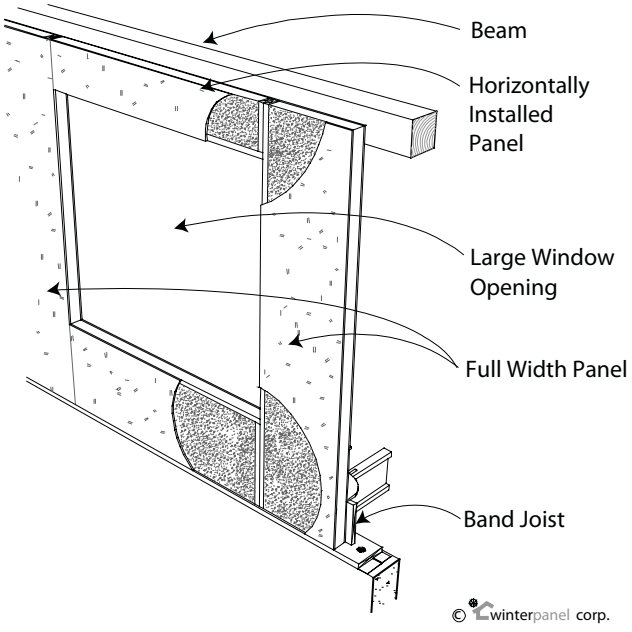


Figure 60. Framing Around Large Window Openings. *Treat large windows like doors in terms of framing. On both sides of the opening, insert two-bys into panel edges, and scab on short two-by cripples into which the filler panels can slide. Use horizontal panel sections above and below the opening to increase strength.*

Roof

General – Curtainwall™ panels are almost exclusively used for roof panels in timber frame structures.

Layout: To optimize material use and simplify your work with stresskin panels, it helps to plan ahead when you design your frame. Try to have as many panel joints align with framing members as possible.

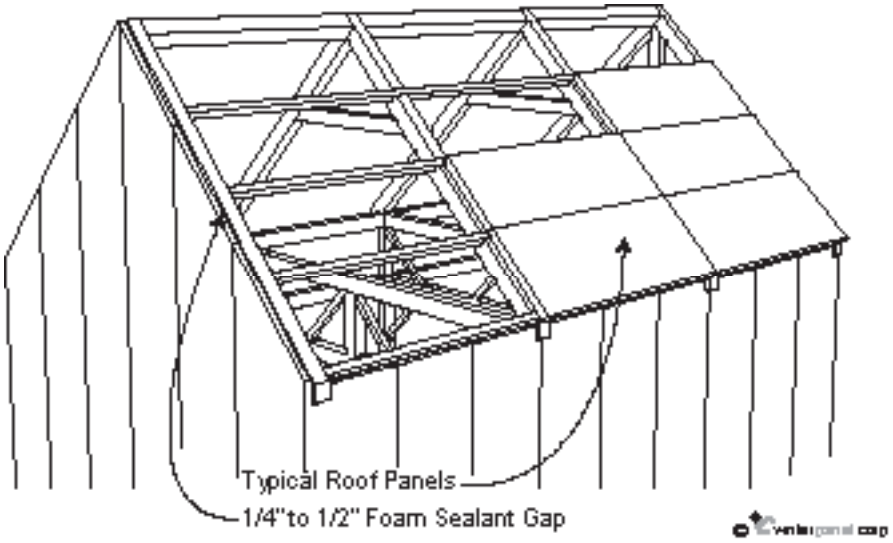


Figure 61. Rafter-Purlin Roof Framing. *With major rafters and 4' o.c. purlins spanning them, install panels parallel to the roof ridge. Note that a gap must be left between the top of the wall panel and the roof panel for foam sealing of this joint for air tightness.*

Moisture Management – It's tempting to recommend that the cutting of all roof openings should be left until components such as chimneys or roof windows are about to be installed, keeping the entire structure more weathertight in the interim. But cutting and particularly routing the panels in place can be difficult and dangerous, particularly when the cut and rout involves splines or blocking at panel joints. Temporary sheathing of some sort over the opening is overall the best approach. Get weatherlapped roofing underlayment down as soon as possible to protect the panels and the structure.

Air sealing details are critical to manage air-transported moisture in high performance stresskin panels. See details below.

Installation – Roof Panels

1. **Pre-cut and rout all roof openings** (roof windows, chimneys, vents) more than one square foot while the panels are still at ground level. See **Appendix B**.
2. Place roof panels per the orientation and lifting details discussed below.

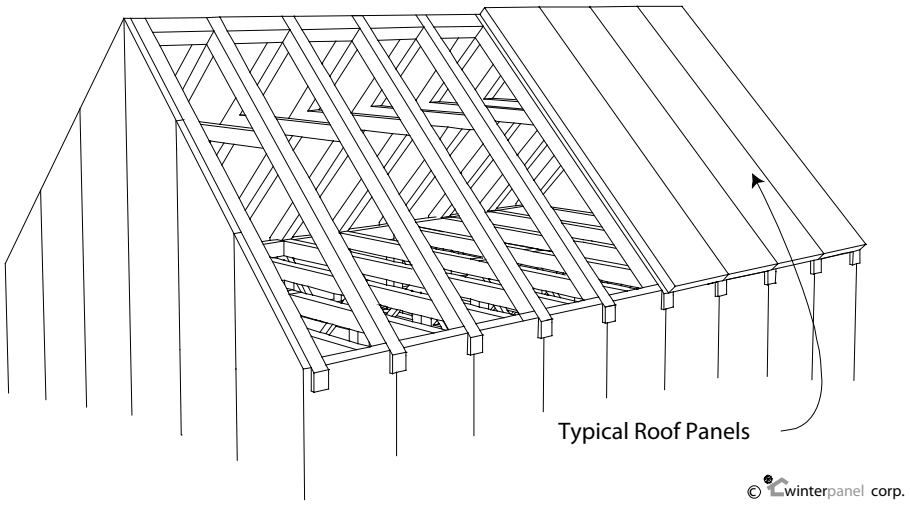


Figure 62. Rafter-Only Roof Framing. *With rafters 4' o.c., run panels perpendicular to the roof ridge.*

Roof panels may be applied with the long dimension oriented either parallel or perpendicular to the roof ridge, depending on the timber framing system used. If a rafter-purlin system is used, with purlins 4' on-center (o.c.) spanning major rafters as shown in **Figure 61**, the panels should be applied parallel to the roof ridge. Ends of panels are secured to rafters, while purlins support the side edges.

If a rafter-only framing system is used with rafters 4' o.c., as shown in **Figure 62**, panels are usually run perpendicular to the roof edges with side edges supported on rafters.

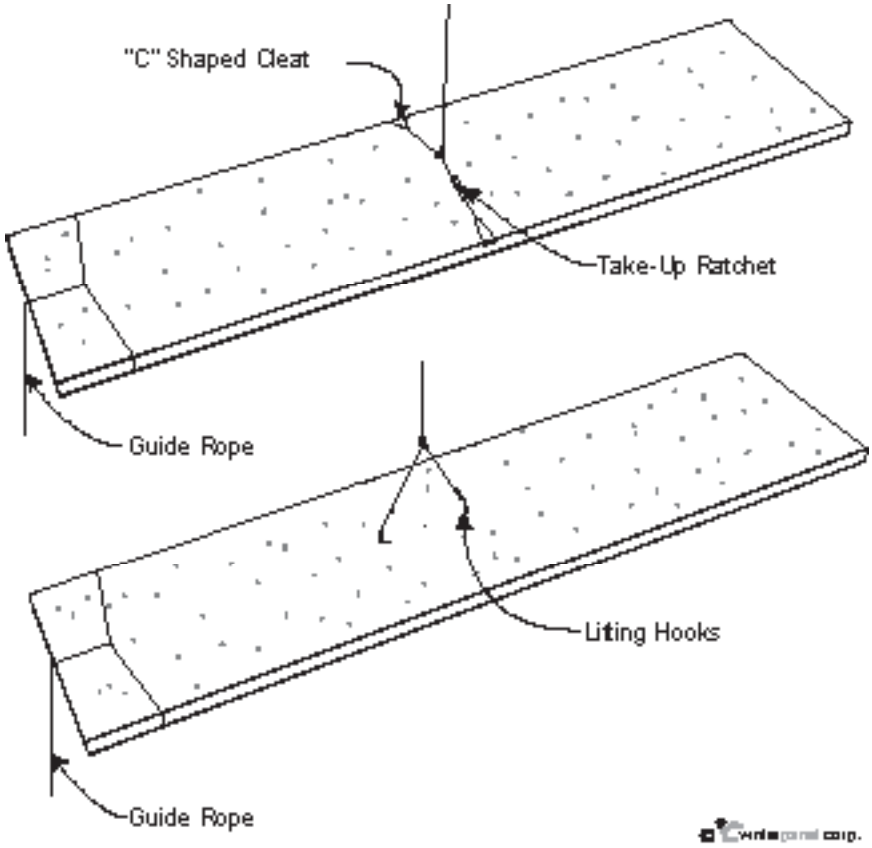


Figure 63. Picking Up Panels. *There are two recommended options for picking up panels. The top method uses edge cleats, the bottom custom made hooks Whichever method you choose, use great care, and do not stand beneath a panel being lifted!*

It is easier if roof panels are installed with both side edges supported on framing members. Allow at least 2" of bearing surface on the wood. Whenever possible, the panel ends should also rest on framing members (see **Figures 61 and 62.**) In an ideally-framed roof, all four edges of each panel will be supported by timbers. This will leave no exposed edges on the interior, and no drywall taping will be required.

Lifting: There are a number of ways to get panels up on the roof. The preferred (and safest) method is to use a crane. The crane can set panels on the roof quickly and accurately. Do as much prep work as possible (cutting panels, etc.) before the crane arrives to avoid delays when the crane is at your site.

Two methods for crane-lifting panels are shown in **Figure 63**. A truck tie-down strap with cleats that dig into the foam and hold the OSB can be used. Or, custom made hooks can be driven into the OSB top skin for lifting the panel. With either method, the panel may slip due to improper attachment or unsteady crane operation. Under no circumstances should anyone get underneath a panel being hoisted onto the roof.

If a crane is not available, it is possible to pull panels up onto the roof by hand or by winch. These technique are not recommended by Winter Panel. Winter Panel assumes no liability for injury or damage caused by failure of any type of winch, come-along, block-and-tackle, or strap.

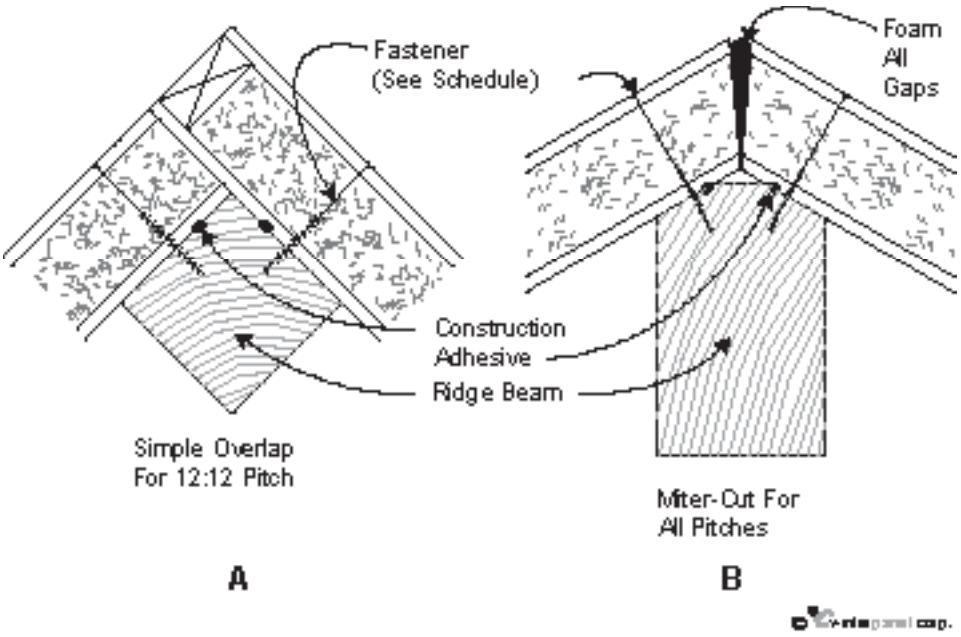


Figure 64. Common Ridge Details. *The two most common ridge details are shown here. With a 12:12 roof pitch, a simple overlap as shown in 64a can be used. With most other pitches, the panels can be miter cut as shown in 64b.*

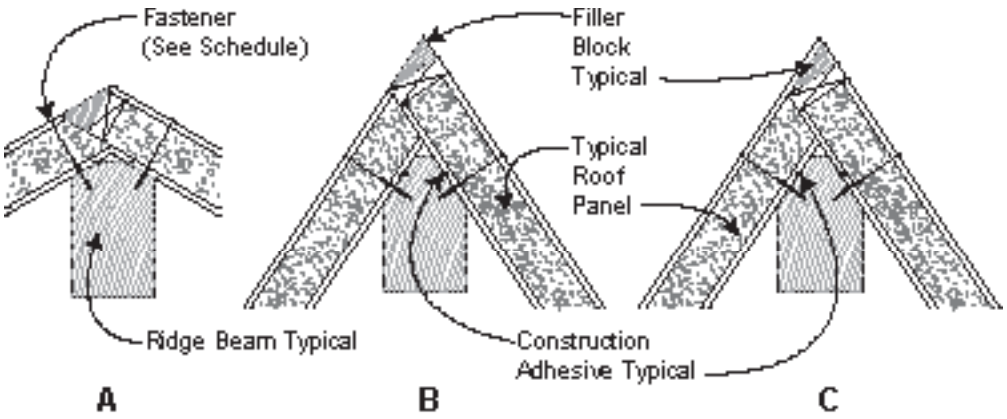


Figure 65. Alternate Ridge Details. *Several alternative ridge details, which make use of filler blocks, are shown here. With very steep pitches, details b or c may be the only alternatives, because a miter cut would be too sharp an angle to cut with a 16" circular saw. In option c, the OSB extends up to the peak providing added protection against rain.*

<u>Installation</u> – Ridge Details

1. Using **Figures 64 and 65**, **select the ridge detail** to employ based on roof pitch, ridge beam configuration, panel layout, and the plans.
2. For every ridge except **64b**, **rout top edge** of right hand panel for the inset two-by blocking.
3. **Modify the left hand panel** per each sub-option below:
    a. **64a** (12:12 pitch): Cut the length of the panel ¼ to ½ inch shy of the top of the ridge beam.
    b. **64b** (all pitches): Miter-cut both panels such that the ridge panel joint is slightly open (5° "V" or ¼ to ½ inch gap) at the top.
    c. **65a** (shallow pitches): Miter cut from the drywall side to match the roof pitch (protect the drywall with any thin-profile strip material).
    d. **65b** (steep pitches): Miter cut from the OSB side of the panel, completing the cut with a hand saw as required.
    e. **65c** (steep pitch alternative): Set the angle and then the blade depth so that the cut leaves the outer skin to extend to the panel peak.
4. **Place the left hand panel first**, per the appropriate **Figure 64 or 65**, tacking the panel on the corners. Panels for details **64a, 65a, and 65b** should run ¼ to ½ inch shy of the peak (to

accommodate foam sealant).

5. **Place the right hand panels**. After enough panels have been placed to assure square placements (no “sawtooth pattern expressed at the peak), place the right hand panel two-by blocking (except for detail **64b**) into a bed of foam sealant into the routed pocket.
6. **Complete the ridge** per the appropriate ridge detail:
    a. **64a**: Foam seal the ¼” to ½” gap between the two panels.
    b. **64b**: Foam seal the open “V” groove at the peak.
    c. **65a&b**: Foam seal the gap between the two panels; then run two continuous beads of construction adhesive on the inset blocking and screw the bevel block into the inset two-by blocking.
    d. **65c:** Run continuous beads of construction adhesive on the inset blocking and underside of the left hand panel extended outer skin. Then screw through both the outer skin sheathing and the bevel block into the inset two-by blocking.

Installation – Roof Valleys

NOTE: Panel junctions at roof valleys should rest on V-cut valley rafters as shown in **Figure 66**.

1. **Split the valley angle**, then steepen the angle a few degrees to leave the top of the panel joint open for foam sealant.
2. **Install the valley panels in opposition**, tacking the panels at first to ensure square and tight panel fits.
3. **Foam** seal the open “V” groove at the panel joints in the valley.
4. **Flash the valley** prior to application of the roofing underlayment and cladding.

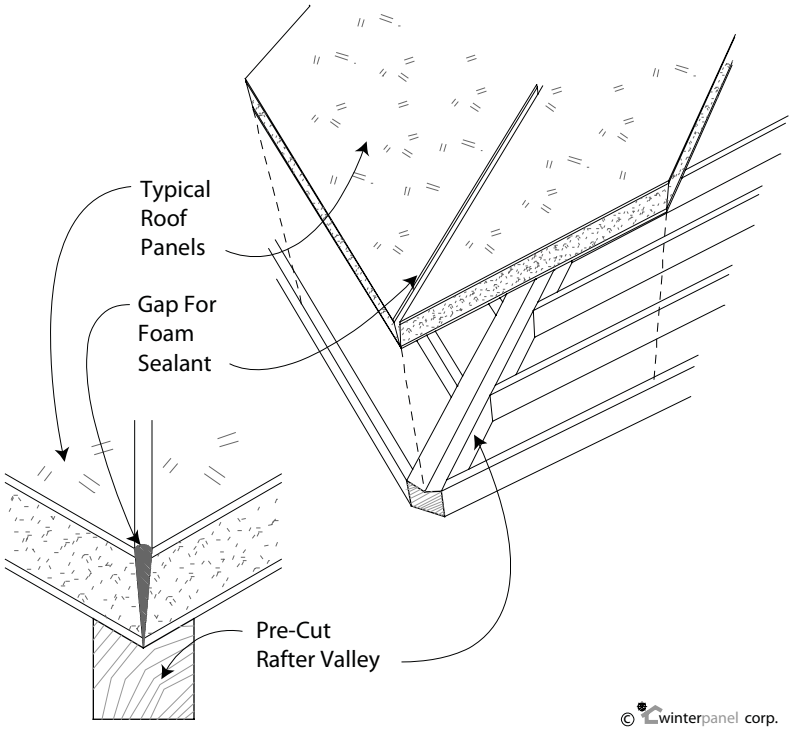


Figure 66. Valley Details. *At roof valleys, panels are joined by making equal miter cuts. For the tightest seal, cut the angles slightly wide (open at the top) or leave a ¼” space and fill the gap with foam sealant.*

Installation – Roof Openings

1. For roof openings of more than 1 square foot, **place two-by blocking around the opening** perimeter into a bed of foam sealant, then fasten the blocking to the panel outside skin. As with wall windows, the sill and header two-bys should overlap the side members.
2. **Place temporary sheathing over the rough opening** as weather protection, making sure that the sheathing used is appropriate for the dimensions of the opening, in terms of worker safety.

NOTE: Openings for chimneys and large roof windows or skylights should be outlined by timber framing as shown in **Figure 67.** Timber framing may have to be added if the opening is large enough to cut across a standard-spaced rafter or purlin.

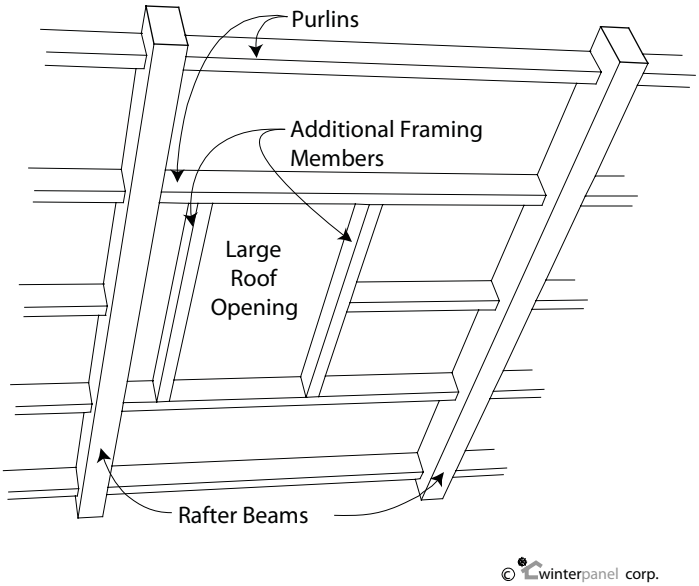
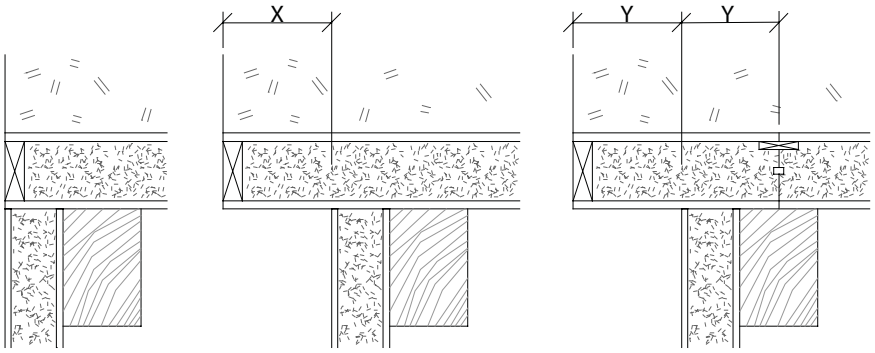


Figure 67. Framing in Large Roof Openings. *Whenever a large roof opening requires cutting a purlin or rafter, the roof framing must be altered to fully support the panels. Be sure to take this into account when designing the frame.*

Filler blocks may have to be installed at the top and bottom to allow you to bring the roof and ceiling surfaces right up to the chimney. Refer to the building code in your area for the required spacing around a chimney or flue pipe. When in doubt, provide a minimum 1" air space between the chimney and panels.



X= PANEL SPANNING A RAFTER BAY
MAXIMUM OVERHANG: 12" CURTAINWALL and 24" STRUCTURE WALL

Y= NARROW PANEL SECTIONS: MAXIMUM OVERHANG IS EQUAL TO THE SPAN RESTING ON WALL PANEL EDGE AND RAFTER

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Figure 68. Roof Edge at Gable End. *The detail at gable ends depends on the overhang and on how to use panels most efficiently. With no over hang, simply overlap the roof panel over the top of the wall panel as shown. With an overhang, either the full roof panel can overhang the wall panel or it can end on the outside rafter and a filler can be used to provide the overhang. Note the limitation on how much a filer panel can extend out and over the gable: at least half the filler panel must bear on the wall and timber frame ("Y" dimension above).*

Installation – Gable-End Detail

Selecting the best gable-end option is a function of desired aesthetics, the need to weather-protect the gable end wall, and efficient use of panels. **Figure 68** shows three different ways to treat the gable end of the roof. In all cases, the roof edge must be reinforced with inset two-by blocking. Any exposed Curtainwall™ inner-skin drywall must be protected by trim or wood soffit material. Note the limits on overhang width based on panel configuration at the gable.

Note too, that the gable-end option shown in **Figure 68** accommodates the use of Structurewall™ for greater strength and weatherability than the Curtainwall™ panels. Regardless of the gable-end treatment employed, be sure to foam seal or caulk all panel joints for air tightness of the overall roof assembly. **Figure 69** shows three representative ways in which gable ends can be trimmed out.

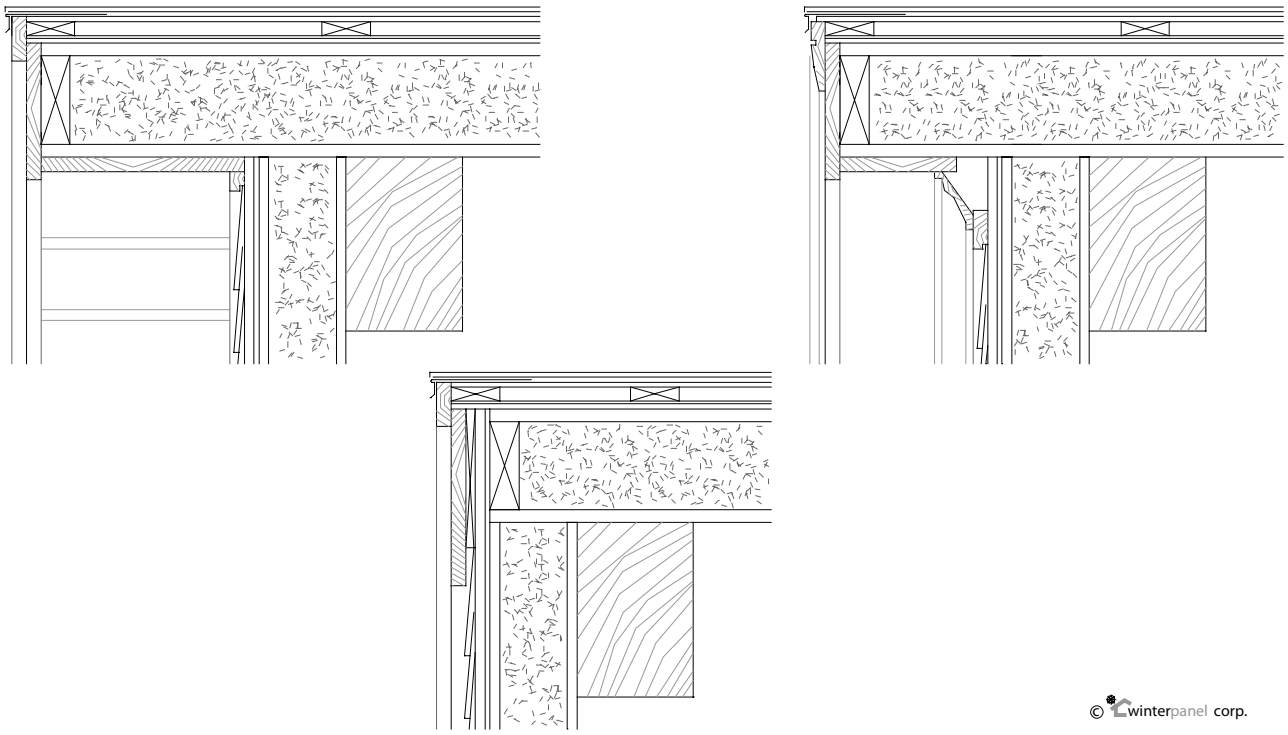

Figure 69. Trim Options at Gable. *Several options for trim at the gable end roof edge are shown here. The trim can be as simple or ornate as desired.*

Installation – Eave-End Detail

Selecting the best gable-end option is a function of desired aesthetics, the need to weather-protect the eave end wall, and efficient use of panels. **Figure 70** shows a variety of ways to treat the eave end of the roof. In all cases, the roof edge must be reinforced with inset two-by blocking. Any exposed Curtainwall™ inner-skin drywall must be protected by trim or wood soffit material.

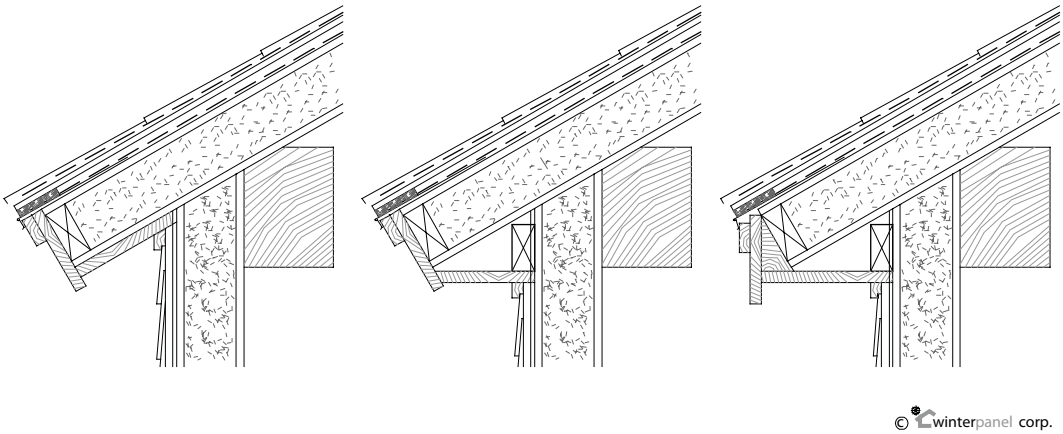

Figure 70. Eave Details. *You have lots of choices with eave details, depending primarily on aesthetic preference.*

Section III - Completing the Process

Introduction

Since you, the installer of the Winter Panel shell, have gone to great lengths to maintain the system's high performance in terms of energy flow and moisture flow, it is critical that all those who come after you know how to follow up on your commitment in their work on the shell. This section covers everything that can and should happen to the Winter Panel shell as it becomes a completed building.

Structurewall™ panels are made up of three layers, each with low or very low vapor permeability (Less so with Curtainwall™ panels, but still a significant issue). This means that while the panels can dry if they get wet, they dry slowly. And since two of the three components are made of wood (or wood and paper in Curtainwall™ panels), the best policy is to simply keep the panels dry, and design details of the building enclosure that promote drying of the whole enclosure.

Moisture gets into assemblies in three ways:

1. liquid water penetration (leaks--by gravity and wicking--by capillarity),
2. air-transported moisture (air leaks), and,
3. diffusion gradients (vapor drive typically inside to outside during the heating season, and outside to inside during the cooling season—if you have one).

Generally, you worry in this order too—water leaks, air leaks, vapor pressure gradients—because the wetting that can take place from each of these phenomena are orders of magnitudes apart. So, we need to do the following to manage the different types of moisture:

1. flash and drain,
2. seal for air tightness, and
3. design assemblies that dry and provide whole-house interior moisture control.

It's important to remember that so long as the panels are protected from liquid water and air penetration, they are very robust with respect to vapor gradients. The OSB skins have relatively low vapor permeability, and the foam core is essentially vapor impermeable (Curtainwall™ panels with EPS cores and an interior drywall skin are more vapor permeable, but as a whole the panels also have low vapor permeability). So, wall assemblies simply need to provide some outward drying potential for the outside OSB skin, and some inward drying potential for the inside skin, whenever possible. In general, it is only the most severe of cold and/or the most humid of interior environments where special attention must be paid to the overall vapor profile of a Winter Panel building enclosure.

Having said that, in the real world, less than perfect water management and air tightness are likely and suggest that provision for drying of the OSB panel skins is a safe bet. And every activity done in, on, or through the panels subsequent to their assembly has the potential to change their performance. Whether it is wiring runs drilled by the electrician, flashing installed by the carpenter, or the type of sealer chosen by the painter, this section provides important information on how the panels work structurally and hygrothermally (how they work in terms of heat and moisture flow).

The Weathertight Roof

General – Any Winter Panel roof should have a continuous drainage plane/ weather-resistive barrier installed as soon as possible, per **Figure 71**. The sequence of installation to achieve the proper weather lap is detailed below. Note that Winter Panel strongly recommends back-venting of ALL roof claddings to increase the drying potential of the outer skin of OSB.

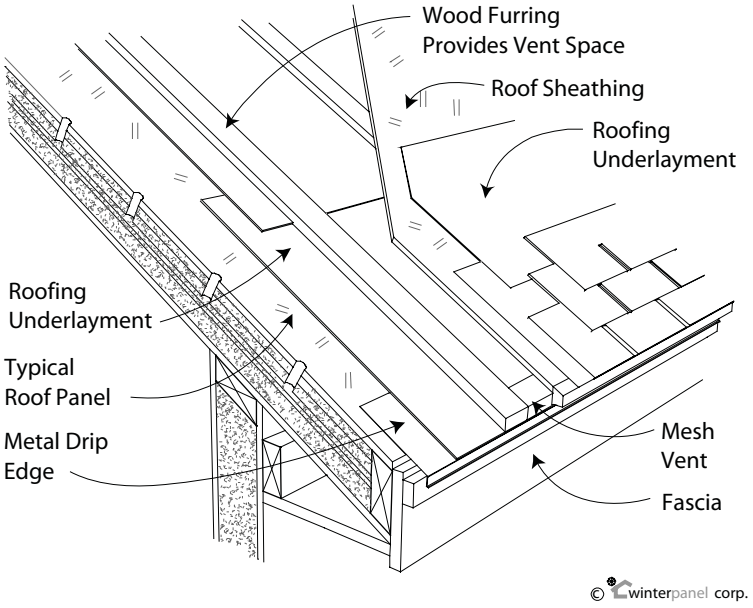

Figure 71. Typical Roof Finish. *Note the use of drip edge, eave membrane, and the weatherlap of each roof element.*

Installation –

1. **Secure drip edge**. Eave drip edge is strongly recommended for all climates; gable drip edge is recommended for climates with wind-driven weather events and where annual precipitation is 40” or greater.

2. **Secure eave course of rubberized membrane**. Peel-and-stick membrane is required on all eaves by many local codes, as a first line of defense against ice dams. Structurewall roof systems are much less likely to develop ice dams than other roof systems, but it is still a good detail that you may be required to do, in any event.
   NOTE: A 3’ course of the same rubberized membrane is required in all valleys on a Winter Panel panel roof.

3. **Secure first course of roof underlayment**. Winter Panel requires roofing underlayment rated to comply with ASTM D226 (Type I) or ASTM D4869 (Type I)—this is commonly referred to as 15# asphalt-impregnated roofing paper. Winter Panel recommends ASTM D4869 (Type II)-rated roofing underlayment—this is commonly referred to as 30# asphalt-impregnated roofing paper. This is particularly true if the roofing underlayment will not be covered with a cladding in a week or less, or if high winds are common or predicted at the site.

   NOTE: The roofing underlayment should be vapor permeable.[1] The use of a rubber membrane (water and vapor impermeable) over the entire surface of the roof virtually eliminates any drying potential of the outer skin of OSB. In this case, liquid water penetration concerns have completely trumped any drying potential. It becomes imperative, in this case, that ALL sources of water and air leakage into the panels from the interior are eliminated. The practicality of this situation is the reason that Winter Panel recommends that a continuous water and vapor impermeable barrier NOT be installed over an entire panel roof assembly.

1 Vapor permeable is defined as a perm rating of 5 perms or more per ASTM E-96, dry cup.

4. **Secure all courses**, observing the proper weatherlap. A top course at the peak should overlap each side of the roof.

   NOTE: Do NOT cut into either the roofing underlayment or the panels for the installation of roof windows or chimneys until the actual installation and subsequent flashing installation. Follow roof window manufacturer specifications for installation and flashing. Refer to **Figure 72** for proper chimney flashing. If the chimney is located within a roof slope, a “cricket” must be installed per **Figure 73**.

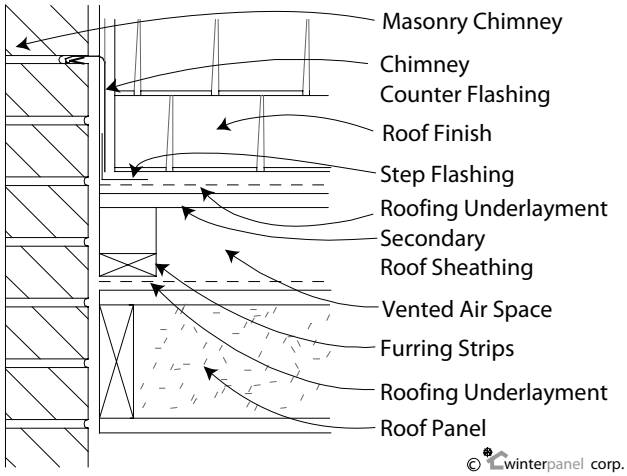

Figure 72. Typical Chimney Flashing. *Note the let-in step flashing and the proper weatherlap*

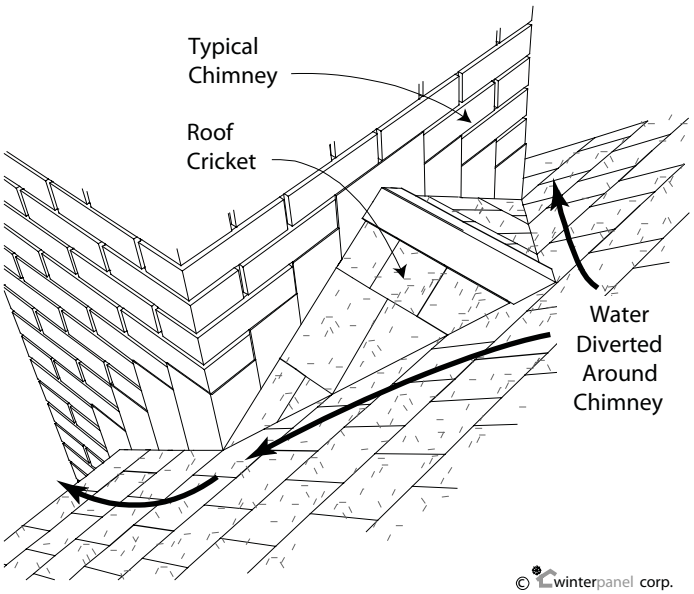

Figure 73. Roof Cricket. *The cricket is a non-structural liquid water diverter on the “uphill” side of the chimney.*

5. **Install roof cladding** per manufacturer installation requirements. Winter Panel strongly recommends that ALL roof claddings be back-vented with either furring strips or spacer mesh. See **Figure 74**.

   NOTE: Any cladding can be used with a structurewall roof system:

   a. Asphalt roofing shingles - Not many roofing shingle manufacturers will warrant their shingles if installed directly over roof panels--check with your supplier/manufacture and others if you are planning on this installation method. If the roofing shingles are back-vented (see **Figure 71**), install:
      i. a vapor-permeable roofing underlayment over the panels.
      ii. furring strips or spacer mesh.
      iii. secondary sheathing (as nailing base for cladding).
      iv. roofing underlayment.
      v. roofing shingles

   b. Standing seam metal – Winter Panel recommends that a standing seam metal roof be installed over a system of furring strips to backvent the cladding, with the furring strips or spacers diagonaled as shown in **Figure 74** or installed with “flow-through” spacers. With either technique, the spacers enable water that gets past the cladding to drain without restriction down and off the roof.

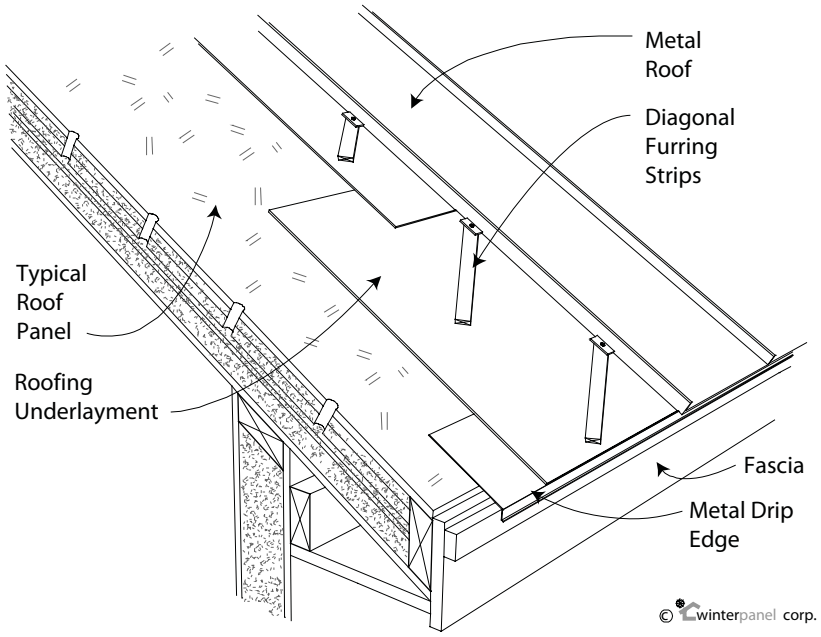

Figure 74. Backventing of Roof Cladding. *The diagonal furring strips (or spacer mesh) do not restrict water that could penetrate the roof cladding.*

6. **Flash**. ALL penetrations must have a flashing detail to manage liquid water; caulks or sealants can NOT be the primary or first line of defense for liquid water penetration.
   NOTE: The attachment of any special system to the roof panels should be accomplished per the manufacturer’s specifications and in consultation with Winter Panel. A good example is solar systems such as photovoltaic or solar hot water panels. Attaching these systems will involve penetrating the panels and possibly through-bolting—this should be an engineering exercise, not an on-site decision.
7. **Install interior gypsum board** such that its joints do not line up with Structurewall™ panel joints. Do NOT attach drywall screws into the plywood splines at panel joints.
   NOTE: There is absolutely no need for a vapor retarder on the interior of Structurewall, except in the most severe cold climates—12,600 heating degree days and greater. If your building inspector does not share this view, refer him or her to Winter Panel or to the building science resources on the web.
   NOTE: Using an interior latex paint (with relatively high vapor permeable) gives some drying potential to the interior for the inside OSB skin of the panels. Whenever possible (except in the most severe cold climates), use interior finishes with a perm rating of 2 or more.

Weather Tight Walls

General - The degree to which exterior walls must be protected from liquid water penetration is a function of building design (overhangs and other architectural sheltering), climate, and site conditions. Follow the sections below for completing the Winter Panel building enclosure or contact Winter Panel for guidance.

Installation – weather-resistive barrier

1. **Install a weather-resistive barrier** (building paper or housewrap)—shingle fashion and weather lapped—to form a continuous drainage plane on the entire exterior wall assembly. The weather-resistive barrier must be of relatively high vapor permeability (greater than 5 perms) unless otherwise specified by the plans or construction documents. For housewraps, follow the manufacturer's requirements or recommendations for taping or otherwise treating seams. Perforated products are not acceptable. The weather-resistive barrier material must maintain its water resistance with sustained direct contact between the outer OSB skin of panels and fully back-primed claddings or trim. Consult with the housewrap manufacturer if you are unsure of the material's performance.

NOTE: A weather-resistive barrier is **required**, not recommended, for all Winter Panel exterior walls.

NOTE: Keep the weather-resistive barrier clean—dirt and other contaminants can reduce its water repellency.

2. **Flash all window and door openings**, as shown representatively in **Figure 75 and 76**. Note that rough opening flashing is in addition to, not in place of, flashing of the window or door unit.

3. **Install all windows and doors, integrating flashing with the weather resistive barrier, per Figure 75 or 76**. A water-tight sill flashing with backdam or sloped sill is required for all windows and doors in Winter Panel assemblies.

NOTE: Figure 75 shows a flanged window installation. Windows without flanges that sit completely inside the wall assembly (inset) are more sheltered by the assembly and are recommended where exterior wall depth permits, particularly in Curtainwall™/timberframe structures. See **Figure 76**.

NOTE: A flanged window or door can be used in an inset installation. In this case, the bucks would be two-by instead of one-by as shown and the rough opening made larger to accommodate the larger buck.

NOTE: Figures 75 - 78 are based on weatherlapping the flashing components. The sequence is as important as the materials involved. The proper flashing sequence is dependent on a number of factors, but most importantly:

a. whether the window unit or the weather-resistive barrier is installed first, and,
b. the type of wall cladding.

NOTE: A sloped sill in the rough opening plus a membrane covering the sill can restrict the rough opening enough to require ADDING ½" to the height of the rough opening of windows and doors.

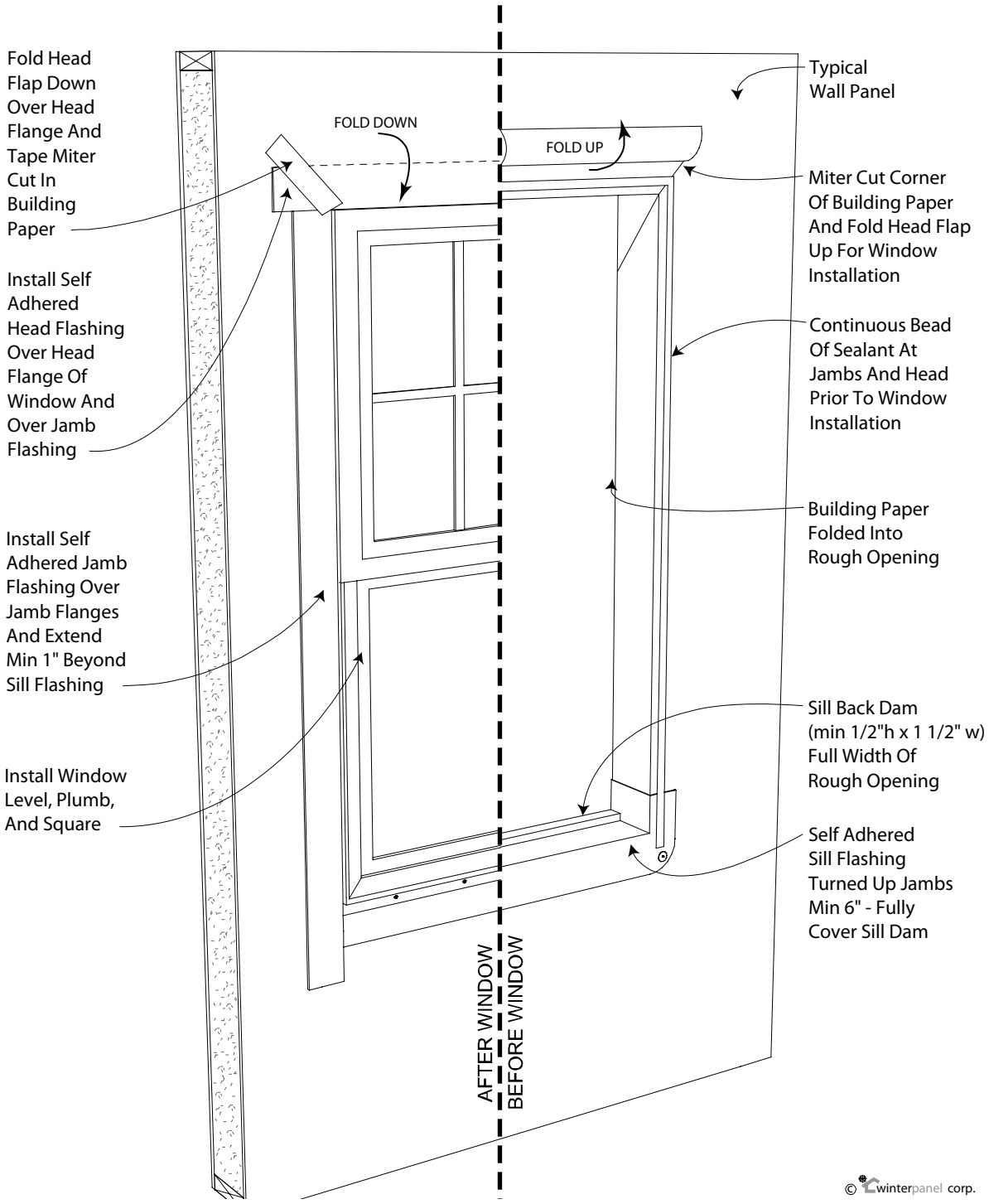

Figure 75. Flashing the Rough Opening and Unit--Flanged Window. *Note how both the rough opening and the unit are flashed. How much the steps for flashing the rough opening and unit overlap or affect each other is a function of a number of factors, including the type of wall cladding and whether or not the weather-resistive barrier or the unit is installed first.*

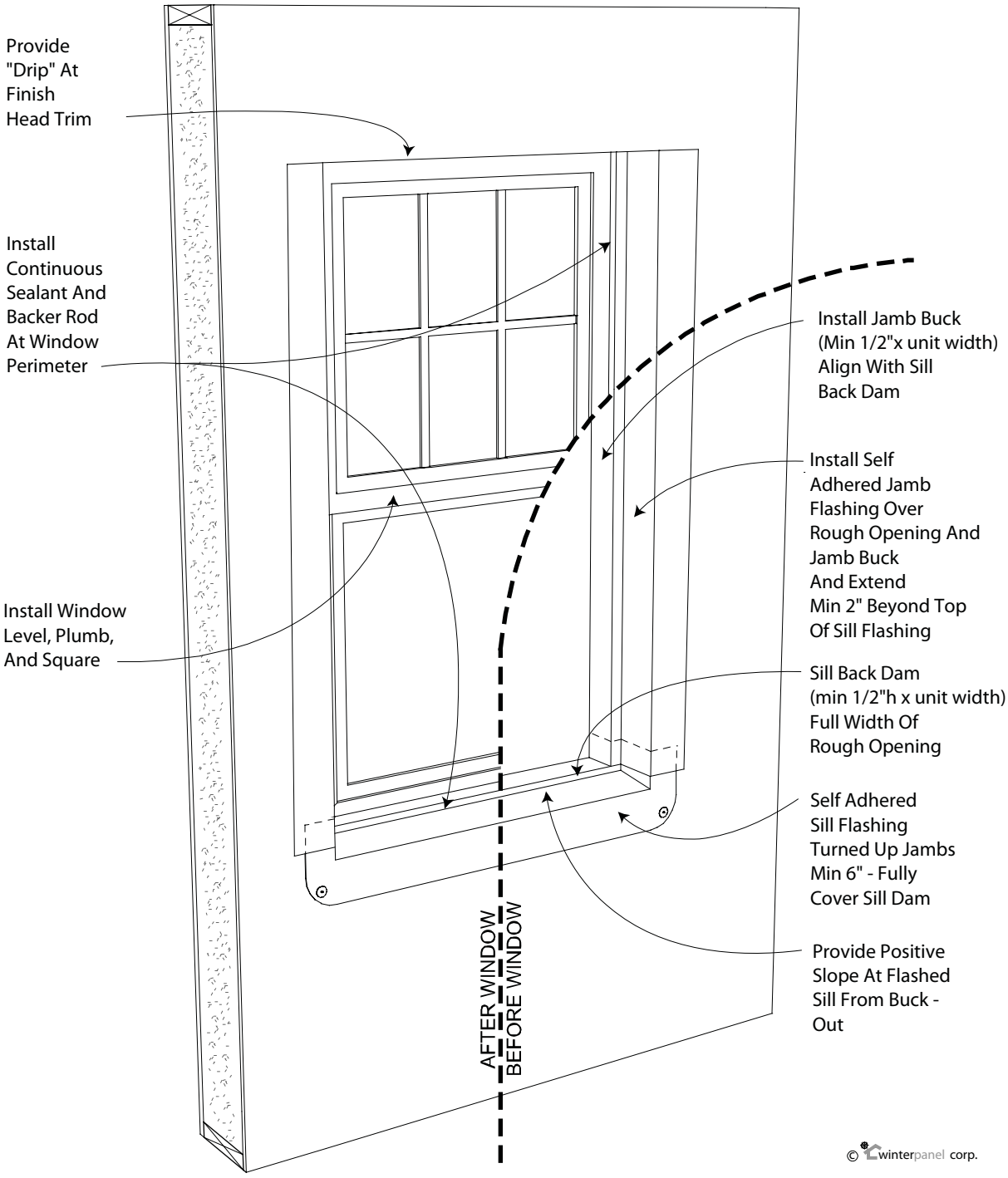

Figure 76. Flashing the Rough Opening and Unit--Inset Window . *If the inset window rough opening is "bucked" as shown, the "buck" is flashed as a part of the rough opening flashing.*

3. **Use flashed mounting blocks** wherever possible on miscellaneous wall penetrations—outdoor spigots, lighting, electrical house feed, etc. See **Figures 77**. Depending on the

penetration and cladding, a rubber boot can be used as well. Both significantly reduce or even eliminate the reliance on caulks and sealants for water management.

4. **Air seal ALL penetrations** in the exterior wall assembly with foam sealant. This includes but is not limited to: window and door rough openings, electrical and plumbing penetrations, exhaust ducting, etc.
5. **Install wall claddings** per these general requirements:
    a. Keep cladding up and off of roofs and decks a minimum of ¾", with continuous rolled or step flashing protecting the space between the intersecting shed roof/deck or gable roof, respectively.

    And per the cladding-specific requirements below:

    b. All wood claddings must be backprimed or sealed to reduce/prevent chemical interaction between bare wood and the weather-resistive barrier. An air space between the wood cladding and the weather-resistive barrier (back venting) is recommended, particularly in areas with more than 40" of rain annually, and/or where wind-driven rain is a common occurrence—see **Figure 78**. Back-vented wood claddings are required for all coastal locations. Back-vented claddings can be accomplished with furring strips or mesh.

    NOTE: If wood claddings are not installed with an air space, paints or stains must be vapor permeable to promote drying of the wall assembly to the exterior.

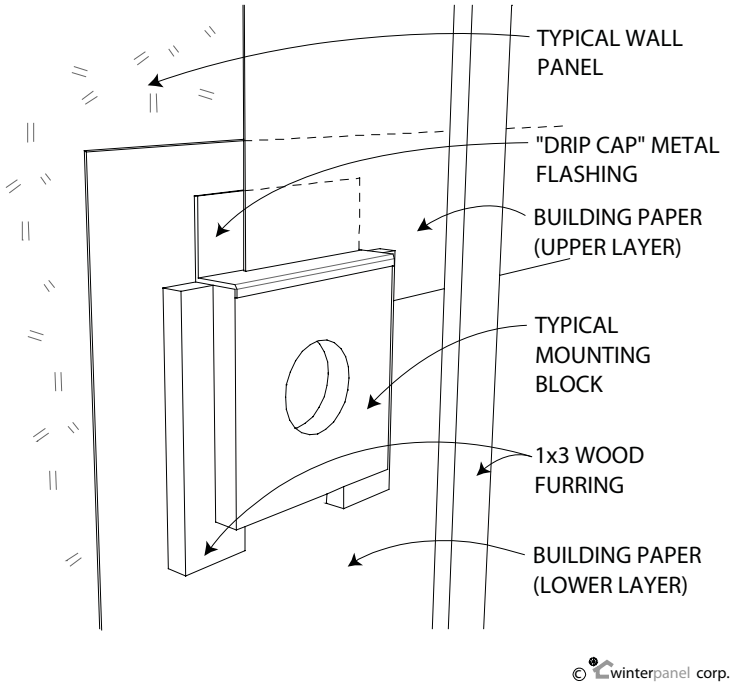

Figure 77. Flashed Mounting Block . *Note that a system of flashing rather than caulk or sealant manages water.*

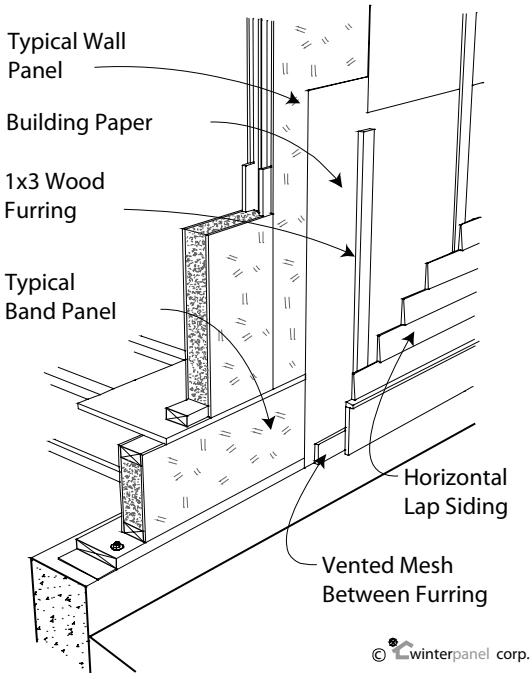

Figure 78. Backvented Wood Lap Siding. *Furring strips as shown (or spacer mesh) provides excellent drying potential for the wall cladding.*

NOTE: For board and batten claddings, apply the cladding over horizontal strapping and fasten in a conventional manner. See **Figure 79**.

c. Stucco must be installed with both a bond break material and weather-resistive barrier. The exterior layer serves as a bond break between the stucco and the rest of the wall assembly and the interior layer serves as the drainage plane or weather-resistive barrier. If the interior layer is variegated (for example, Tyvek StuccoWrap®), it creates a small but effective space for liquid water drainage.

d. The increasingly-popular manufactured stone veneers, such as Cultured Stone®, can by code be directly applied to a weather-resisitve barrier over Winter Panels. However, Winter Panel strongly recommends de-coupling this reservoir cladding from the panels, as shown in **Figure 80**.

d. Brick must be installed with a minimum 1" air space and top and bottom venting of the air space. The dedicated air space behind the brick must be kept free and clear of mortar droppings.

e. Vinyl and metal siding must be installed without caulking or sealants. Because these claddings contract and expand a great deal, caulk and sealants at penetrations in the cladding do more to retain than shed water and moisture.

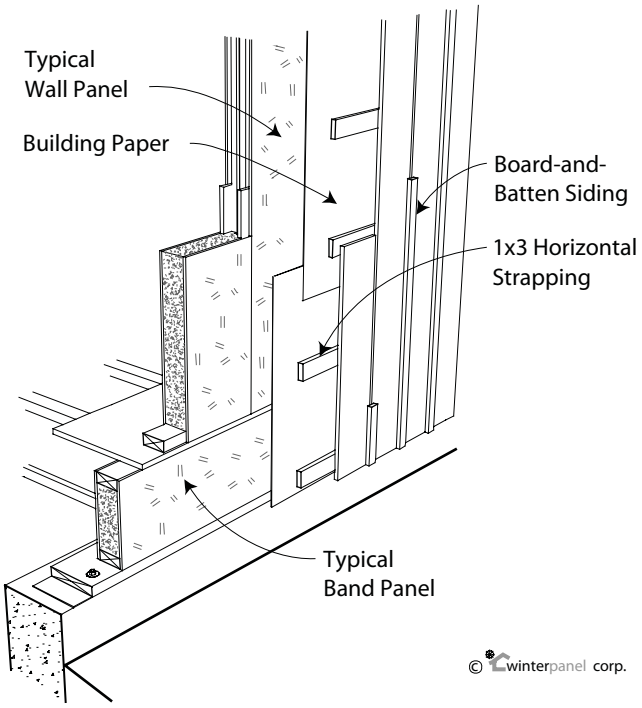

Figure 79. Board-and-Batten Siding. *The horizontal strapping disconnects the panels from the contraction and expansion associated with this type of cladding and will help reduce cupping.*

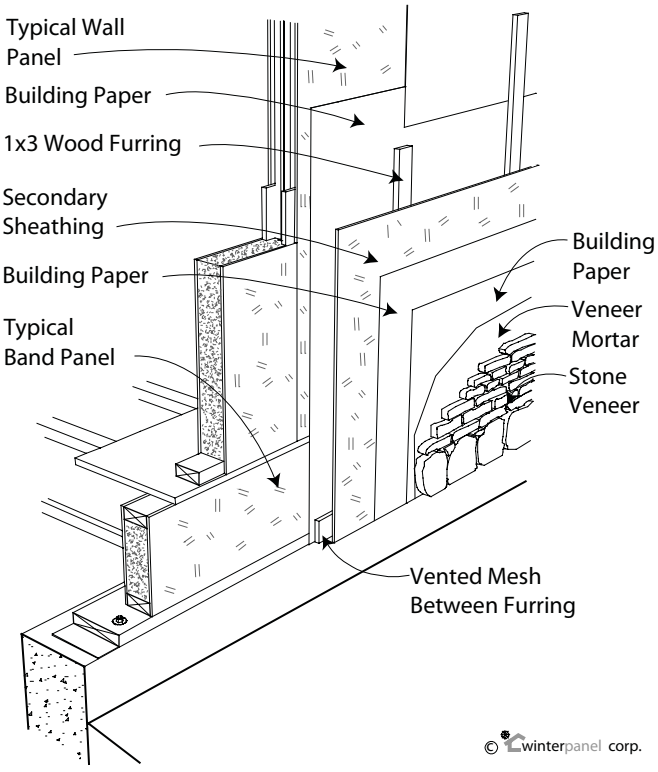

Figure 80. Manufactured Stone Veneers. *The secondary sheathing and furring strips completely disconnect this wall cladding from the rest of the wall assembly, creating superior drying potential for this reservoir cladding.*

And remember that j-channels and other trim details are NOT flashing—they are cosmetic stops. These claddings are inherently “air-leaky” and are not known to react with weather-resistive barriers so no dedicated air space (furring or space mesh) is needed.

6. **Install decks and balconies** or other attached elements using weatherlapped flashing details per **Figure 81**. Whenever possible, avoid attaching ground level elements such as decks to the Winter Panel shell. If you are unsure of the nature of the structural relationship between any attached elements and the wall panels, consult directly with Winter Panel.

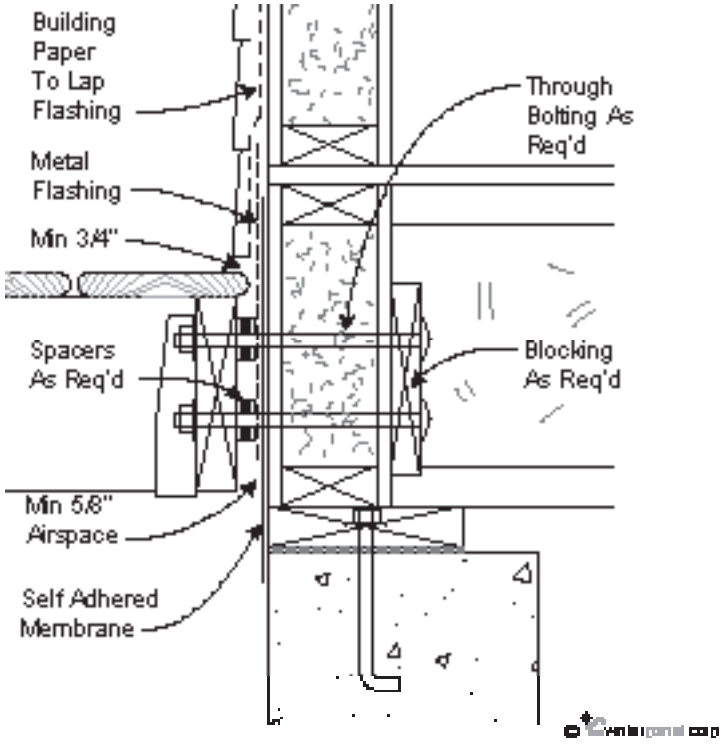

Figure 81. Deck Flashing Detail. *Note the space maintained between the deck frame and the structure, and the wall cladding and the deck boards.*

7. **Install interior gypsum board** so that joints do not line up with panel joints. Do NOT attach drywall screws into the plywood splines at panel joints.
   NOTE: There is absolutely no need for a vapor retarder on the interior of Structurewall™ or Curtainwall™ panels, except in the most severe cold climates—12,600 heating degree days and greater. If your building inspector does not share this view, refer him or her to Winter Panel.
   NOTE: Using an interior latex paint—with relatively high vapor permeable—gives some drying potential to the interior for the inside of the panels. Whenever possible (except in the most severe cold climates), use interior finishes with a perm rating of 2 or more.
8. **Install interior basement insulation**. Both crawlspaces and full basements should be insulated to match the excellent thermal performance of the above-grade panel shell. For full basements, follow the insulation recommendations of the latest International Residential Code for the climate zone in which the home is located. For crawlspaces, Winter Panel strongly recommends an unvented, conditioned space with the insulation located on the exterior walls (inside or outside) as opposed to the underside of the first floor assembly.

****

Electrical Wiring

General –
Properly wiring a Winter Panel building with Structurewall™ panels or a timber-frame house sheathed with Curtainwall™ panels is not difficult, but it does require using non-standard techniques. The techniques described below are for exterior walls. Interior partition walls are framed in standard fashion, with studwalls providing the wiring chases. To simplify your wiring, try to make use of interior wall cavities or separate chases, whenever possible. Long horizontal runs of wire for the first floor should be run in the basement, with short upward extensions for receptacles and switches. If you plan on concealing wiring that must run in exterior walls, Winter Panel can pre-rout electrical chases, so long as they are specified on the plans.

Consult your local code official about specific requirements, and make sure he or she understands that they satisfy all local codes. Your code officials may not be familiar with stresskin panels and the wiring techniques they require, so you may need to spend some time with them to adequately explain the system.

There are essentially seven ways to run wiring on exterior walls that are made up of foam core panels:

1. surface-mounted - **Figure 83**
2. site-built baseboard raceway - **Figure 84**
3. wall edge wiring chase - **Figure 85**
4. external drilled access - **Figure 86**
5. factory-rout - **Figure 87**
6. “skip” routing—Structurewall™ only **Figure 88**
7. up from the bottom - **Figure 89**

Each has its advantages in terms of ease of installation, cost, future modifications, and appearance.

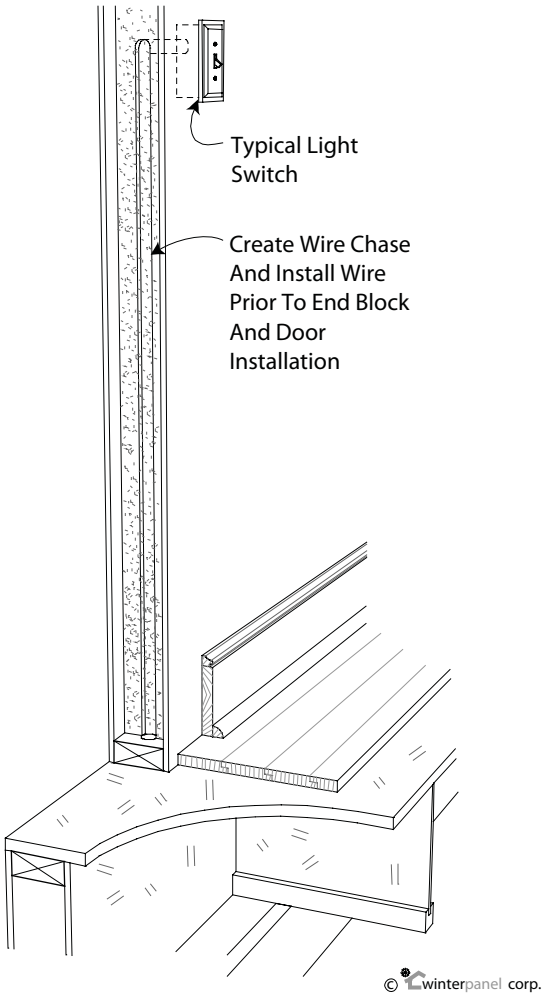

Figure 82. Door Jam Wiring Chase. *Use this technique for installing light switches and exterior door lights. But make sure you plan for it before you install the panels, so that the wire can be run as the door opening is roughed in.*

NOTE: All of these methods handle floor level or bottom-of-the-wall outlets. To handle switches on exterior walls, use a door jam wiring chase. See **Figure 82**.

Installation – Door jam wiring chase: **Figure 82**

1. **Run wiring** up along the pre-routed panel edge of the door opening (or if the panel has not been pre-cut for the door, the wiring is run after the opening has been cut and the 1 ½” rout completed for the door buck).
2. **Drill a ¾” hiole** to make a horizontal chase to the switch on the interior or the light fixture on the exterior. Alternately, the wire itself can be pushed through the foam.
3. **Set the door jamb two-by blocking** (or buck) into the routed panel edge, embedding the wire securely and safely into the insulation.

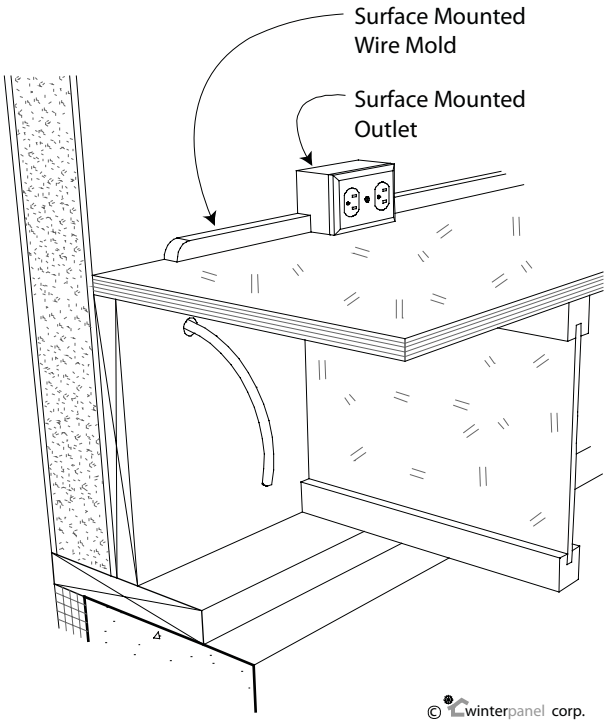

Figure 83. Surface-Mounted Wiring. *Surface-mounted wire mold is run along the wall near floor level where it will be out of the way and fairly inconspicuous. Long horizontal runs should be carried in the basement, with extensions through the floor for receptacles.*

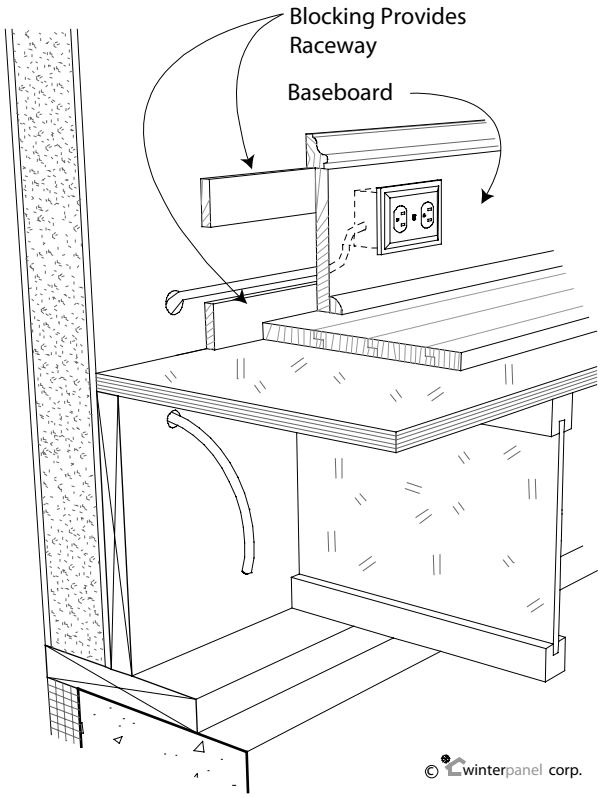

Figure 84. Baseboard Raceway Wiring Chase. *With this wiring technique, you build a baseboard system, which is set out from the wall surface, providing a chase for wires. Modifications to the wiring can easily be made by pulling off sections of baseboards.*

Manufactured surface mounted wiring - **Figure 83**
Surface-mounted wiring is one of the simplest methods of wiring. Special preformed channel (wire mold) is used, which contains the wire and mounts directly on the wall surface as shown in **Figure 83**. Wire mold is available in metal or plastic from most electrical suppliers, along with all the necessary fittings and elbows for you particular applications.

Surface-mounted wiring has been used for decades in commercial buildings, but only recently has it made its way into houses. Most homeowners have not wanted the wiring to be visible. Surface-mounted wiring is becoming more acceptable, however, particularly with the availability of more attractive wire mold. A big advantage to surface-mounted wiring is the ease with which modifications can later be made. This can be an important consideration to some homeowners. Another advantage of this method is that the thermal integrity of the panel is unaltered.

Installation – **Install surface mounted wiring and molding** per **Figure 83**, local electrical code, and manufacturer recommendations.

Curtainwall™ vs. Structurewall™ – This method works equally well for Curtainwall™ and Structurewall™ enclosures.

Site/shop-built baseboard raceway - **Figure 84**
A specially-made baseboard is used, which extends out from the wall at least an extra ¾" to provide a chase for wiring. These baseboards are usually shop-manufactured and cut to length on-site. Receptacles are inset into the baseboard. A slight variation of this technique makes use of surface-mounted, low-profile, baseboard hydronic or electric heating units manufactured in Europe. These baseboard heaters, which stand out little more than a wood baseboard, have a built-in wiring chase. The system is quickly gaining popularity both here and abroad. Distinct advantages of this method are that the thermal integrity of the panel is unaltered and future wiring modifications can be done easily.

Installation –
1. **Use shallow electrical boxes,** using the knock-outs on the ends of the boxes.

Curtainwall™ vs. Structurewall ™– This method works equally well for Curtainwall™ and Structurewall™ enclosures.

For timberframe structures, you will either have to pre-rout the posts from the outside or drop the wire down into the basement to get around the posts; and it is likely that the electrical boxes will need to be recessed a short distance into the panel.

For Structurewall™ applications, the drywall can be held up off the floor most of the height of the baseboard so that the shallow electrical boxes do not have to be recessed at all—they can be surface-mounted to the inner OSB skin of the panel.

Wall edge chase – **Figure 85**
5/4 stock baseboard totally conceals the chase. With this technique, wiring can be done after panel installation, and future modifications can easily be made by pulling off a section of baseboard. As with the surface-mounted methods, the advantages of this system are ease of future modifications and unaltered thermal integrity of the panels.

Installation –
1. (For second-story timberframed) **Rout the posts** before installing panels.
2. **Hold back the flooring** and/or subflooring ¾", and use a baseboard made of 5/4 stock.
3. **Use shallow electrical boxes**, using the knock-outs on the ends.

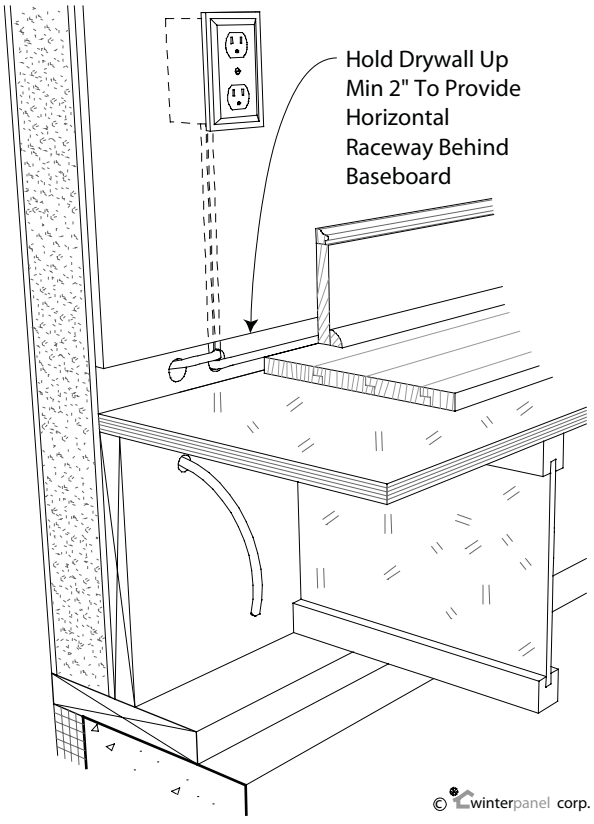

Figure 85. Wall Edge Wiring Chase. *By running wires in the space created by the held-up drywall, long horizontal lengths of wire can usually be run quite easily. This technique is a good choice on upper floors. On the first floor, horizontal runs can more easily be carried in the basement.*

Curtainwall™ vs. Structurewall™ – This method works equally well for Curtainwall and Structurewall enclosures.

For timberframe structures, the details of this technique will vary. If the posts are set on top of the subfloor and the sublfloor was held back ¾", there will be a continuous

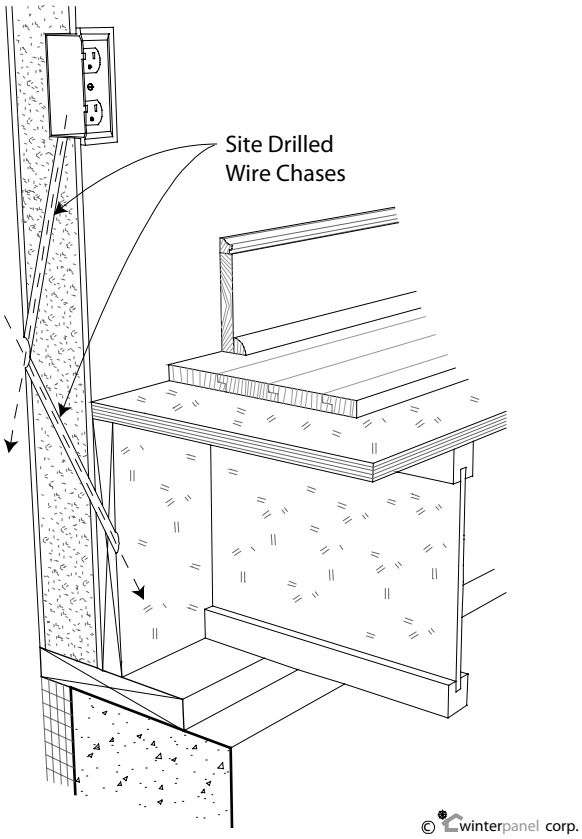

Figure 86. Drilled External Access. *Holes drilled to meet on the outside of the panel halfway between the outlet hole and the basement allow a two-step wiring feed process.*

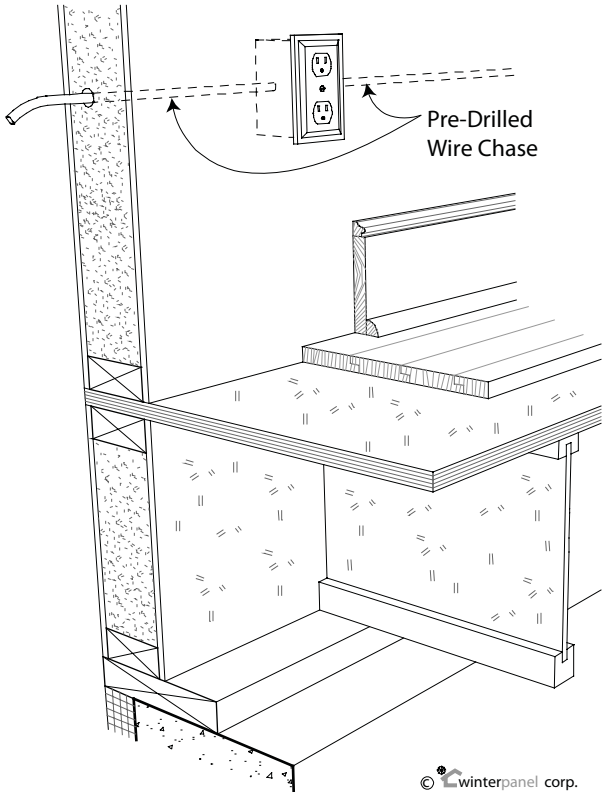

Figure 87. Pre-Drilled Panel Wiring. *Wiring runs are laid out in the drawings and then the wiring runs are routed in the factory during the panel manufacturing process.*

wiring chase the full length of the wall. If, on the other hand, the posts are set directly on the sill, the posts will have to be routed just below the floor height before panels are installed, or the wire will have to drop down into the basement to get around posts.

This technique is particularly appropriate for upper floor applications where there is no basement for horizontal wiring runs. With 2" tongue-and-groove pine decking on the second floor held back ¾", a fairly large wiring chase will be created which should be able to hold all necessary wire. On upper floor applications with this technique, posts will usually have to be routed to provide a continuous wiring chase.

Drilled External Access - **Figure 86**
With horizontal runs of wire in the basement, this is an easy way to install outlet receptacles at the standard height of 16-18" above floor level. Though some of the steps described may sound awkward, they are quite easy after some practice.

Installation –

1. **Cut hole for outlet box** in the panel at the desired or required height.
2. **Dig out foam** insulation to required depth for box.
3. **Drill a ¾-1" diameter hole** from the outlet box hole through to the outside of the panel. Drill at an angle downward that lands the outside hole halfway down the distance between the

outlet and the basement access.

4. From this outside hole, **drill a ¾-1" diameter hole** down and into the basement, angling the drill so that the drill does not strike the foundation wall but also does not penetrate above the floor level.

NOTE: The outside hole may need to be slightly enlarged to accomplish this next step.

5. **Feed wiring** up from the basement to the outside hole, then loop it back through this same hole to the hole cut for the outlet box.
6. I**nstall receptacle** using Madison straps or another suitable type of fastener.
7. **Use foam sealant** to fill and airseal the two drilled holes.
8. **Install metal plate wire guard** over the exterior hole or ensure that the wire is deep enough in the panel to satisfy the electrical code.

Curtainwall™ vs. Structurewall™ – This method works equally well and is essentially the same for Curtainwall™ and Structurewall™ enclosures.

Pre-Drilled Panel Wiring - **Figure 87**

Wiring layout is part of the building design and runs that must be located in exterior walls are drilled in the factory. Make sure when foam sealing that the channel/wire chase is NOT filled in.

Installation –

1. **Run wiring** as and after walls are erected.
2. As required, **drill holes** to turn outside corners, **foam sealing** these holes and protecting with metal plates as required by code.

"Skip" rout (Structurewall™ only) – **Figure 88**

This technique involves a vertical rout on the inside OSB skin from the outlet box as shown in the figure.

1. **Cut hole for outlet box** in OSB and rout out foam (Remember: drywall will be added; the receptacles should end up flush with the drywall).

2. **Rout through the inner OSB skin** and foam vertically, using the 12" "skip" pattern. The groove should extend approximately 2" into the panel. You will be unable to rout the groove all the way to the floor level.

   NOTE: ROUT PANELS VERTICALLY ONLY. DO NOT ROUT HORIZONTALLY; IT WILL DAMAGE Panel STRUCTURAL INTEGRITY.

3. From the floor below, **drill an angled hole upward** through the band or edge joist into the wall panel underneath the receptacle and routed groove. The hole should not penetrate the floor at all. You can connect this hole with the routed channel using an electrical fish, or you can simply push the wires through.

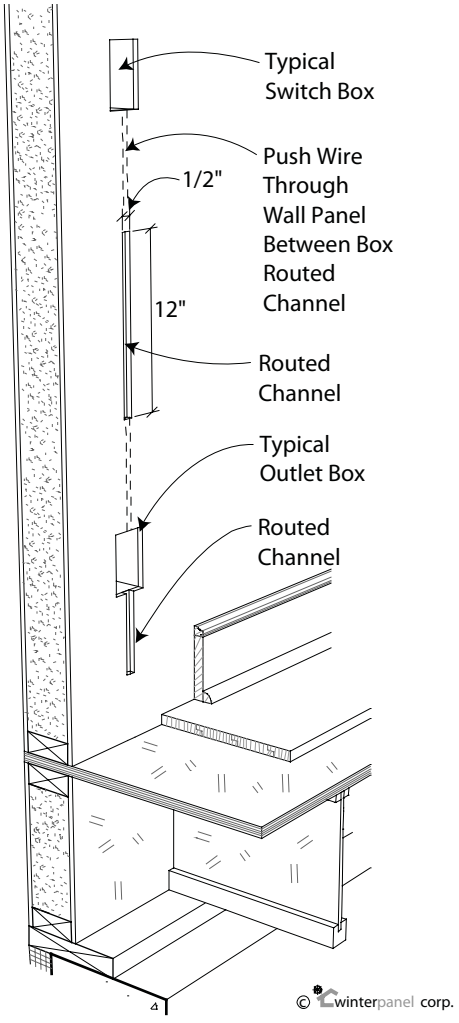

Figure 88. Vertical Surface Rout. *The surface rout is then easily covered by drywall. This technique can work for switches as well as outlets.*

4. **Pull up enough wire** from the lower level to connect the receptacle. Set the wires far enough into the routed groove so that trim nails or drywall fasteners cannot hit them, then secure them in place with a bead of foam sealant (low expanding type). Drywall and the baseboard will cover this.

5. **Install the receptacle** and secure it to the OSB with Madison straps.

Curtainwall™ vs. Structurewall™ – Since a vertical rout in the inside skin of a Curtainwall panel is in the drywall, it cannot be easily patched or covered; since the Structurewall panel will have a layer of drywall over it, the vertical rout is concealed.

Up from the bottom – **Figure 89**
Care must be taken to "fish" well to minimize damage to the foam and thermal integrity of the wall.

1. **Cut holes** for the receptacles at the required height. Cut through the inner OSB skin and rout out foam to the proper depth (Remember that drywall will be added to the wall; the receptacles should end up flush with the drywall).
2. In the floor below, directly under each receptacle hole, **drill an upward-angled ¾" hole** through the bottom plate of the first floor wall panel.
3. **Use an electrician's "fish" from below and push up through the foam**. Do not push the fish further up than is necessary. If the fish does not end up in the cavity routed for the outlet box, an assistant should probe in the foam from above. It will take a little practice to become proficient with this, but after a while it is quite easy.
4. **Attach the wire** or wires to the lower end of the fish and pull them up to the hole cut for the box.
5. **Connect the wires and secure the receptacle** to the OSB with Madison straps.

Curtainwall™ vs. Structurewall™ – This technique can be used in either type of panel, although a timber sill makes it a bit more challenging.

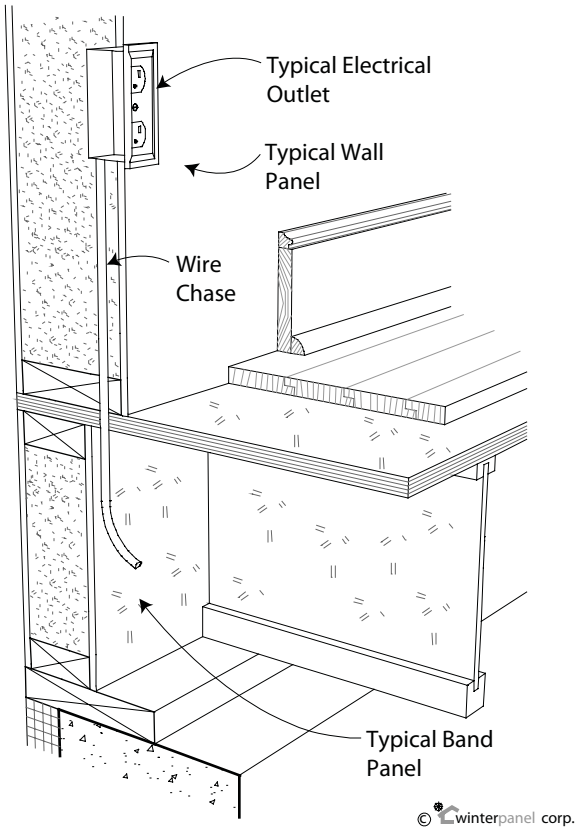

Figure 89. Up from the Bottom. *The drill bit must be long enough to penetrate up through the plates but not too long to fit in the rim joist area.*

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Plumbing

General:
Plumbing details are no different than those for conventional structures. Wherever there is even a remote chance of freezing weather, plumbing should not be installed in exterior walls (this includes most of the United States). This rule stands whether stud walls or stresskin panels are used. The only plumbing which should penetrate the outer shell of a house is the pipe for an outside spigot or the waste line for a structure built on piers (See **Appendix D**).

Installation:

1. **Install all plumbing lines in interior** wall and floor assemblies.
2. **Air seal and flash all plumbing penetrations** in the building enclosure. Avoid relying solely on caulk for water management of any plumbing penetrations.

****

Cabinet Attachment

General - As with other finishing details, cabinet attachment is the responsibility of the builder. Because studs are not spaced every 16” along exterior walls as with conventional construction, a variety of methods can be used to secure cabinets, based on the type of panel, type of cabinet and the load it will experience. For optimal strength, cabinets should be hung before exterior walls have been drywalled.

Installation – Cabinets on Structurewall panels

NOTE: In timberframe structures where Curtainwall panels make up exterior walls, Structurewall panels can be designed into the structure on walls where cabinets are planned.

NOTE: Run drywall so that drywall does not line up with panel joints.

Secure cabinets with the appropriate length screws to gain full purchase into the inner OSB skin of the panel. Although a lighter fastening schedule may work, Winter Panel recommends 4 to 6 inch spacing on the inner OSB skin of the Structurewall panel. When in doubt, use construction adhesive and toggle bolts, as well.

NOTE: Another alternative for full-height cabinets is to secure them both to the wall as described above, and also into the ceiling joists. This will only work for cabinets which extend up to the ceiling.

Installation – Cabinets on Curtainwall panels

Secure cabinets in one of the two following ways:

1. ***(Recommended)*** **Build out a two-by grid** for cabinet attachment, adequately securing the grid to Curtainwall top and bottom plates or other structural elements capable of bearing cabinet load. See **Figure 90**.
2. ***Secure cabinets up and into the timber frame or floor framing*** *above* using a closed soffit above the cabinets or with cabinets run up to the frame or ceiling. Make sure that the cabinets are built in such a way that the top of the cabinet can carry most of the load or reinforce the cabinet to accommodate this loading.

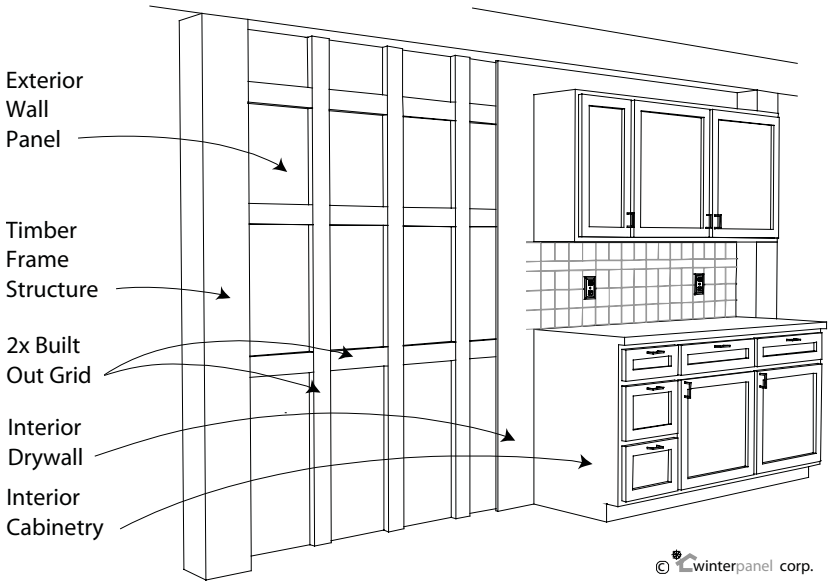

Figure 90. Cabinets on Two-by Built-out Grid. *Grid is attached to top and bottom plates (and/or timberframe structural elements) of Curtainwall panels.*

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At-Grade Details

General – Once you get the water off of the building you need to move it away from the building—see **Figure 91**. Some of us build where the soils are so deep and well-drained that little needs to be done to protect the below-grade portion of the building from the roof load of water—congratulations to those half-dozen builders. The rest of us need to consider the following at-grade details to manage that load.

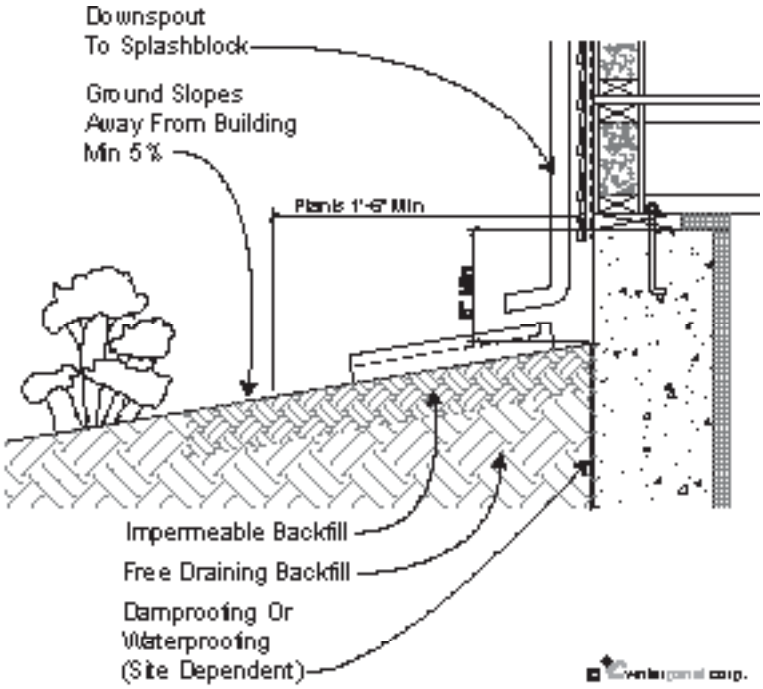

Figure 91. At-grade Surface Drainage Detail. *This is best practice for moving water away from the structure.*

Installation – exposed foundation treatment

1. **Paint or otherwise treat** the exposed portion of the foundation to reduce water penetration. We don't dampproof the exposed portion of the foundation for aesthetic reasons, but that does not mean that it should not be kept from getting wet. Concrete below 5000 psi is porous enough to move quite a bit of water by capillary movement into the structure. A breathable coating, such as latex paint, means that splashing water will not as readily get into the concrete but the concrete can still dry to the outside if it is experiencing some other moisture source.

Installation – finished grade

1. **Establish finished grade** at least 6 inches below the sill plate of the building. This creates a clear demarcation between the site and the structure. This is particularly important in environments that support carpenter ants and termites where this space forms an easy inspection zone for their activity.
2. Make sure that any **irrigation heads are targeting landscape**, NOT the building.

Installation – Roof drainage and/or surface features

1. **Install a roof drainage system**[1] – This is a system of gutters/leaders/splashblocks. Make sure that leaders are properly aligned with splashblocks and that splashblocks are sloped at least 5% away from the structure.

NOTE: If the structure has overhangs of 18 inches or more, or you are building in an environment with less than 20 inches of rain annually and the rain is not confined to one or two events, you can probably dispense with most or all surface features to manage water at-grade. Otherwise, consider any or all of the surface features described in # 2 below.

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1 A roof drainage system is not really an at-grade detail, but its link to the alternative surface features is strong enough to include it in this section of the Guide.

NOTE: If the roof drainage system is hardpiped into a below-grade site stormwater system, this system must drain to daylight.

2. **Install a system of surface features** - See **Figure 91**. Some climates (or clients) cannot tolerate a gutter system. Elements a through c below are necessary to manage roof load water at ground level:
    a. 5% slope away from building for a minimum of the first 3’ around the building perimeter and ideally the first 10’.
    b. Variegated surface material such as mulch, bark pellets, roundstone or gravel for the first 18” around the building perimeter or more to match the dropline of the building’s overhang.
    c. Hold back plantings at least 18” from the structure.
    d. Consider a cap of impermeable soil just below the surface soil, this cap sloped away from the building and extending a minimum of 3’ from the structure.
    e. As much as possible, keep hardscape surfaces far enough off the structure to prevent extensive splashback from roof load onto the structure at grade.

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Interior Moisture

General –
You have done due diligence on your Winter Panel building enclosure:

- You have weatherlapped and flashed to control liquid water penetration.
- You have air sealed all penetrations and panel joints to control air-transported moisture.
- You have back-vented claddings whenever possible (and as indicated by hygrothermal conditions your site and home will experience) to promote drying of assemblies.

You simply need to do two, or perhaps three, more things:

- Manage indoor humidity to protect the structure against moisture drives created by occupant activities during the winter and space cooling during the summer.
- Manage liquid water in "wet" areas of the home.
- Install all ducts and the air handler inside conditioned space, IF you are installing a central forced air space conditioning system. Given the nature of Winter Panel enclosures, keeping all ducts and mechanical equipment in conditioned space should not be difficult. Consult the plans or check with your HVAC contractor.

Managing interior relative humidity –
Winter Panel Corporation strongly recommends that all of its buildings comply with the ventilation standard of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) - Standard 62.2 2004, "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings."[1] This includes:

1. **Install spot exhaust fans**, ducted to the outside, in the following rooms:
    a. Kitchen (no less than 100 cfm and no more than 200 cfm)
    b. Baths (50 cfm)
    c. Laundry (50 cfm)
    d. Attached garages (triggered by garage door operation to run for five minutes)

NOTE: the use of EPA Energy Star-rated exhaust fans means lower cost of operation and quieter operation.[2]
NOTE: Moisture of Construction - Since you are building a tight structure with Winter Panels, it is just that much more important that you manage the moisture load of new building materials given off into the building in surprisingly large quantities during the first several months. The biggest load usually comes from the foundation—temporary supplemental dehumidification may be needed during the first few weeks or even months after the building is enclosed to handle this initial moisture loading.

2. **Install a mechanical ventilation system**. A Winter Panel building is airtight so fresh air needs to be introduced to the building in a dedicated manner. Mechanical ventilation systems include:

    a. Balanced systems – systems where the amount of air coming in and going out is the same.
        i. Heat recovery ventilators -
        ii. Energy recovery ventilators
        For more information on both types of balanced ventilation systems, see, for

1 See the ASHRAE website: http://www.ashrae.org/ .
2 See the EPA Energy Star website for information on qualifying exhaust fans: http://www.energystar.gov/.

example, the Home Ventilation Institute.[3]

b. Supply systems – systems that bring in outside air and so may slightly pressurize the home. For example, see central fan integrated supply (CFIS) ventilation systems.[4]
NOTE: Slightly pressurizing a home is an acceptable practice in all but the coldest of climates—9,000 heating degree days (HDD) or less (but also depending on interior moisture regimes).

c. Exhaust systems – systems that rely exclusively on exhaust and so may slightly depressurize the home.[5]
NOTE: Slightly de-pressurizing a home is an acceptable practice in all but hot humid climates (ASHRAE-defined warm-humid climates).

3. **Install a "climate center" control** that includes a hygrometer or humidistat as well as a thermostat. Or, supply the homeowner with a stand-alone hygrometer that provides feedback on interior relative humidity conditions. Guidance should be given to homeowners to maintain low to moderate wintertime humidity levels
4. **Discourage homeowners from using ventless combustion appliances**, such as kerosene heaters. Independent of any combustion safety issues, these units dump significant amounts of moisture into your home, whether you need/want it or not.

Managing "wet" rooms –

1. **Install appropriate materials in tub and shower surrounds**. See **Figure 92**. This includes cementitious backerboard or non-paper faced gypsum board (NOT moisture-resistant [MR] gypsum board) with a waterproof surface treatment and the tub or shower surround weatherlapped with respect to the lip of the tub or shower basin.
2. **Install a pan, with drain outlet, underneath all clothes washers** particularly in locations with living space below the clothes washer.
3. **Install a single-throw shut-off** on the clothes washer hot and cold supplies.

HVAC ducts in conditioned space –

For homes with central forced air systems, think of the air handler and ducts as the "lungs" for the house. They need to be inside conditioned space—not in vented attics, vented crawlspaces, garages. Keeping them inside conditioned space eliminates a whole host of indoor air quality and building durability concerns.

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3 *http://www.hvi.org/.*
4 *http://www.fancycler.com/*
5 *For more information see the Home Ventilation Institute - http://www.hvi.org/.*

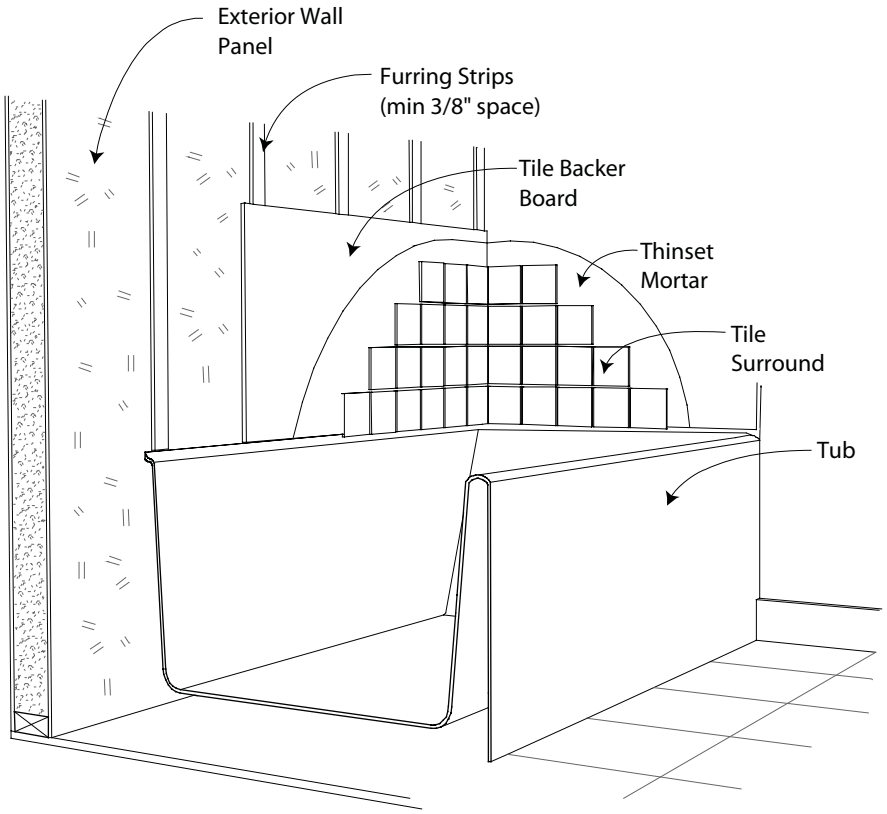

Figure 92. Tub and Shower Surround Detail. *Note that both the materials and their installation are matched to the intense wetting and humidity regime of the bathroom environment.*

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APPENDICES

APPENDIX A

Fastener Schedule

Type	Application	Spacing	Comments
Panel screw (or ringshank nail equivalent)	Through panels into two blocking or beam*	8 - 12” OC	Specified and supplied by Winter Panel**
Nail - 16d common	Two-by to two-by blocking, plates	variable	Galvanized recommended
6d ringshank nails (or 2” screws)	Panel to plywood spline	6” O.C.	Coarse thread galvanized recommended
8d common nails (or Screws – 2 ½ ” “drywall”)	Panel to two-by blocking or plates	6” O.C.	Coarse thread galvanized recommended

* Panel screw lengths – Panel screw lengths must be equal to or greater than the panel thickness plus 1 ½” penetration in hardwood, 2 ½” penetration in softwood.
** Specifications for fasteners – If you select fasteners other than those specified and supplied by Winter Panel, you must verify the holding power or withdrawal limit of the substitute fastener. When in doubt, contact Winter Panel for guidance or additional information.

APPENDIX B

Cutting and Routing Panels

A 16” circular saw and special router bits (available from Winter Panel for purchase or rent) are the only special tools required to custom cut and rout either Structurewall™ or Curtainwall™ panels. **NOTE:** Wear eye protection and a dust mask for all cutting and routing of panels. ALL cutting and routing of panels should be done at ground level with the panels on the flat. It is difficult to do justice to this topic in an appendix. Further information on cutting and routing panels is available from Winter Panel.

Directions –

1. ***Use a large-diameter circular saw for panel cuts.*** Winter Panel offers a 16” saw with carbide blade for sale or rent which works very well with most cuts. This saw has a 6 3/16” depth of a cut at 90 degrees and 4 3/16” at 45 degrees. Miter cuts greater than 50 degrees will require finishing with a handsaw. A handsaw may also be required of finishing corner cuts around windows and doors.
2. ***Always rout the panels before setting them on the frame***. Router heads with cutting blades for these different types of routs are available for rent or purchase from Winter Panel Homes. Try to do your routing in a clear area with plenty of room to maneuver. Wear goggles and a dust mask for safety.

For plywood spline panel joints:

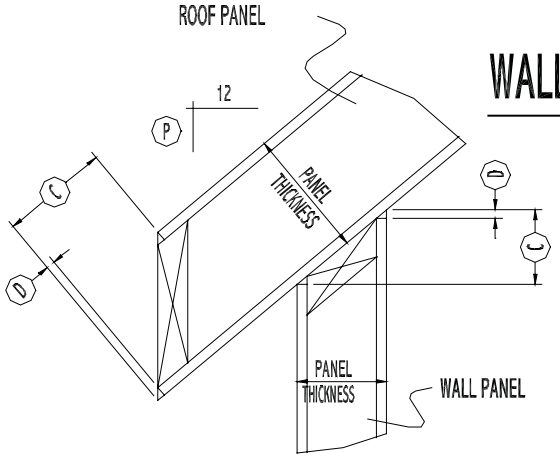
3. ***Rout two 5/8” parallel grooves*** in the foam next to the inner and outer skins to a depth of 1 ½”.
4. ***Rout a ¾” notch in the foam*** between the spline grooves to accommodate the foam sealant when the panels are joined together.

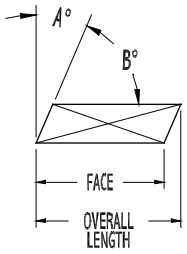
For two-by panel joints:

5. ***Make a full-width rout ¾” deep*** in both panels to be joined. For a fully inset two-by (around door and window openings, at wall corners, etc.), 1 ½” of foam is routed out from the panel edge.

- ***Angle cuts greater than 50º*** - Set the 16” circular saw to its full depth and complete the angle cut with a handsaw. Whenever possible, cut from the OSB side of the panel.
- ***Cuts leaving one skin*** – Make this cut by setting the cutting depth of the circular saw to approximately 4 inches (so it does not quite reach the lower skin). Break off the cut skin and most of the foam, then complete removal of the remaining foam with a paint scraper. If this cut must be made from the drywall skin side of the panel, lay out any thin profile material under the base plate of the saw to protect the drywall during the cut.

APPENDIX C





WALL/ROOF BEVEL PLATES

PANEL THICKNESS	PITCH P/12	A°	B°	C	D	FACE	OVERALL LENGTH	LUMBER SIZE
$4\frac{1}{2}$"	3	14.04°	75.96°	$1\frac{1}{8}$"	$\frac{1}{8}$"	$3\frac{3}{4}$"	$4\frac{1}{8}$"	2 x 6
	4	18.44°	71.56°	$1\frac{1}{2}$"	$\frac{3}{16}$"	$3\frac{13}{16}$"	$4\frac{5}{16}$"	
	5	22.62°	67.38°	$1\frac{7}{8}$"	$\frac{3}{16}$"	$3\frac{15}{16}$"	$4\frac{9}{16}$"	
	6	26.57°	63.43°	$2\frac{1}{4}$"	$\frac{1}{4}$"	$4\frac{1}{16}$"	$4\frac{13}{16}$"	
	7	30.26°	59.74°	$2\frac{5}{8}$"	$\frac{5}{16}$"	$4\frac{3}{16}$"	$5\frac{1}{16}$"	
	8	33.69°	56.31°	3"	$\frac{3}{8}$"	$4\frac{3}{8}$"	$5\frac{3}{8}$"	
	9	36.87°	53.13°	$3\frac{3}{8}$"	$\frac{3}{8}$"	$4\frac{1}{2}$"	$5\frac{5}{8}$"	2 x 8
	10	39.81°	50.19°	$3\frac{3}{4}$"	$\frac{7}{16}$"	$4\frac{11}{16}$"	$5\frac{15}{16}$"	
	11	42.51°	47.49°	$4\frac{1}{8}$"	$\frac{7}{16}$"	$4\frac{15}{16}$"	$6\frac{5}{16}$"	
	12	45.00°	45.00°	$4\frac{1}{2}$"	$\frac{1}{2}$"	$5\frac{1}{8}$"	$6\frac{5}{8}$"	
$5\frac{1}{2}$"	3	14.04°	75.96°	$1\frac{3}{8}$"	$\frac{1}{8}$"	$4\frac{3}{4}$"	$5\frac{1}{8}$"	2 x 6
	4	18.44°	71.56°	$1\frac{13}{16}$"	$\frac{3}{16}$"	$4\frac{7}{8}$"	$5\frac{3}{8}$"	
	5	22.62°	67.38°	$2\frac{5}{16}$"	$\frac{3}{16}$"	5"	$5\frac{5}{8}$"	2 x 8
	6	26.57°	63.43°	$2\frac{3}{4}$"	$\frac{1}{4}$"	$5\frac{3}{16}$"	$5\frac{15}{16}$"	
	7	30.26°	59.74°	$3\frac{3}{16}$"	$\frac{5}{16}$"	$5\frac{3}{8}$"	$6\frac{1}{4}$"	
	8	33.69°	56.31°	$3\frac{5}{8}$"	$\frac{3}{8}$"	$5\frac{9}{16}$"	$6\frac{9}{16}$"	
	9	36.87°	53.13°	$4\frac{1}{8}$"	$\frac{3}{8}$"	$5\frac{13}{16}$"	$6\frac{15}{16}$"	
	10	39.81°	50.19°	$4\frac{9}{16}$"	$\frac{7}{16}$"	6"	$7\frac{1}{4}$"	
	11	42.51°	47.49°	$5\frac{1}{16}$"	$\frac{7}{16}$"	$6\frac{1}{4}$"	$7\frac{5}{8}$"	2 x 10
	12	45.00°	45.00°	$5\frac{1}{2}$"	$\frac{1}{2}$"	$6\frac{9}{16}$"	$8\frac{1}{16}$"	
$6\frac{1}{2}$"	3	14.04°	75.96°	$1\frac{5}{8}$"	$\frac{1}{8}$"	$5\frac{11}{16}$"	$6\frac{1}{16}$"	2 x 8
	4	18.44°	71.56°	$2\frac{3}{16}$"	$\frac{3}{16}$"	$5\frac{13}{16}$"	$6\frac{5}{16}$"	
	5	22.62°	67.38°	$2\frac{11}{16}$"	$\frac{3}{16}$"	$5\frac{15}{16}$"	$6\frac{9}{16}$"	
	6	26.57°	63.43°	$3\frac{1}{4}$"	$\frac{1}{4}$"	$6\frac{1}{8}$"	$6\frac{7}{8}$"	
	7	30.26°	59.74°	$3\frac{13}{16}$"	$\frac{5}{16}$"	$6\frac{3}{8}$"	$7\frac{1}{4}$"	
	8	33.69°	56.31°	$4\frac{5}{16}$"	$\frac{3}{8}$"	$6\frac{5}{8}$"	$7\frac{5}{8}$"	2 x 10
	9	36.87°	53.13°	$4\frac{7}{8}$"	$\frac{3}{8}$"	$6\frac{7}{8}$"	8"	
	10	39.81°	50.19°	$5\frac{7}{16}$"	$\frac{7}{16}$"	$7\frac{3}{16}$"	$8\frac{7}{16}$"	
	11	42.51°	47.49°	$5\frac{15}{16}$"	$\frac{7}{16}$"	$7\frac{7}{16}$"	$8\frac{13}{16}$"	
	12	45.00°	45.00°	$6\frac{1}{2}$"	$\frac{1}{2}$"	$7\frac{3}{4}$"	$9\frac{1}{4}$"	

APPENDIX D

First Floor Deck – On Piers

General – Structurewall™ panels can be used as the first floor deck. This is an excellent way to establish the bottom boundary for living space over a pier foundation. Although use of panels in this way is usually limited to warmer climates and seasonal structures in colder climates, this limitation is generally more related to plumbing issues than the capacity of the panels either structurally or thermally. In general, in-line loading of the floor panels (transferring wall and roof loads directly through the floor panels to carrying beams on the piers) is recommended. For specific guidance on compressive and cantilever loading of Structurewall floor panels, consult Winter Panel or a professional engineer.

Moisture Management – Penetrations in the Structurewall™ floor for utilities, such as sewer, must be completely sealed against air leakage. In warmer climates, insect shields and/or other forms of pest management on and about every pier are essential. Under no conditions should a pier foundation be enclosed in such a way that the free flow of air under the Structurewall™ floor panels is restricted.

The OSB skin of all Structurewall™ panels can manage incidental but not sustained wetting. Protect the Structurewall™ floor deck from soaking rains. If the deck does get wet, remove ponding water as soon as possible.

Installation –

1. **Install a capillary break** between the piers and the bearing beams. Any closed cell foam material or membrane impermeable to water constitutes a capillary break.
2. **Set first course of floor panels** perpendicular to the bearing beams. When the length and width of the installed panel grid is large enough, square the panel assembly by checking diagonal measurement—see Figure 6.
3. **Join adjacent panels** using procedures detailed in the section on first floor walls.
4. **Secure floor panels** to bearing beams using panel screws per the fastener schedule and provided by Winter Panel or the equivalent.

NOTE: The floor assembly must also be square in relation to the bearing beams. Since the bearing beams are not necessarily square to each other, care must be taken to configure the panel assembly to the system of bearing beams such that no cantilever of panel to beam exceeds Winter Panel requirements and so that no beam extends out beyond the floor assembly.

5. **Place all subsequent floor panels**, squaring up the assembly and installing end blocking so that blocking breaks do NOT coincide with panel joints.

NOTE: All end blocking must be installed with a foam sealant bed as an air sealing detail.

6. **Foam seal all panel joints per Figure 22**.

NOTE: Plumbing and electrical details can be challenging with Structurewall™ first floor assemblies. Wiring can be run exposed on the outside surface of the panel if shielded to code requirements. Plumbing supplies and waste traps must be protected from heat loss and freezing. An utility chase, heat tape, or a combination of the two, is recommended.

NOTES

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