Insulated Component Structures, Inc.

Construction Manual

[This manual is and always will be a "work-in-progress." It will continually be updated with lessons-learned and best-practices. With that in mind, please offer your suggestions for improving this manual based on your own experiences using our products. Thank you.]

INTRODUCTION

The choice of using **structural insulated panels (SIPs)** in the construction of a building project brings many benefits to the builder and end-user. Whether that choice was made on energy efficiency, cost, building ease and simplicity, quality, speed-of-assembly, strength, design flexibility, sound reduction, reduced maintenance, (or any number of additional items) we believe that the use of SIPs is the right choice. A building envelope properly constructed with SIPs will be more comfortable, quiet, stable, and livable while saving money on the day-to-day operation of the structure.

Insulated Component Structures' (ICS) focus is to bring to the structural panel building market the best in cutting edge technology while maintaining sound engineering for strength and efficiency, low energy use, and design flexibility, while adhering to a policy of quality assurance and delivered value.

Many innovations have been incorporated into the ICS structural panels that enhance SIPs use including framed openings for windows, doors, pockets, in-place top plate, cam-lock closures, in-place electrical boxes and chases, metal-reinforced double tongue & groove panel interface system, one-piece corners, etc. The items mentioned will be presented in more detail in the body of this manual.

This Construction Manual is a guide to the installation of ICS's structural insulated panels into a completed thermo envelope. The assembly methods presented here have been field-tested and should enhance the already ease of construction used in panelized assembly.

Should you run into any difficulties or have any questions, please do not hesitate to contact the company. Let us know if you have any additions or innovations that can be used in your current or future projects so we can incorporate them into this manual. Our goal is to make this manual a valued tool to aid and help in your project.

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I. Assumptions

This manual assumes that the installation personnel have a basic understanding of construction techniques for the project that is being undertaken. Nothing in this manual is intended to minimize any safety practices encountered on the job site. At all times observe conditions that might cause injury including job-site safety, observing proper handling techniques and the proper use of power tools. This manual is intended to help in the assembly of the exterior envelope (whether walls or walls/roof/floor) and most finishing details are left to the discretion of the builder. This manual should be used as a reference for installers and builders who are comfortable with the knowledge and skills necessary to complete the project.

Panel Introduction - Walls

The design and assembly of an ICS structure will typically include a variety of panel sizes and configurations. Illustrated in Figure 1a, assembly of ICS panels may include flat panels, panels with window openings, door openings, backers, electrical boxes w/chases, 90° corner panels, 135° angle panels, headers, or special panels to 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 tongue & groove panel interfaces molded into the panel edges and closed with “cam-locks” to provide a tight, secure joint. In special cases, 2” x 4" or 2” x 6” members are embedded into the panel for additional point-load conditions, based on decisions made by the structural engineer of record for the project. Panels are produced in 4 ½” and 6 ½” thicknesses as structural panels and 3” thickness for special enclosure applications. Other panel thicknesses are possible. The top plate is embedded into the panel in most cases.

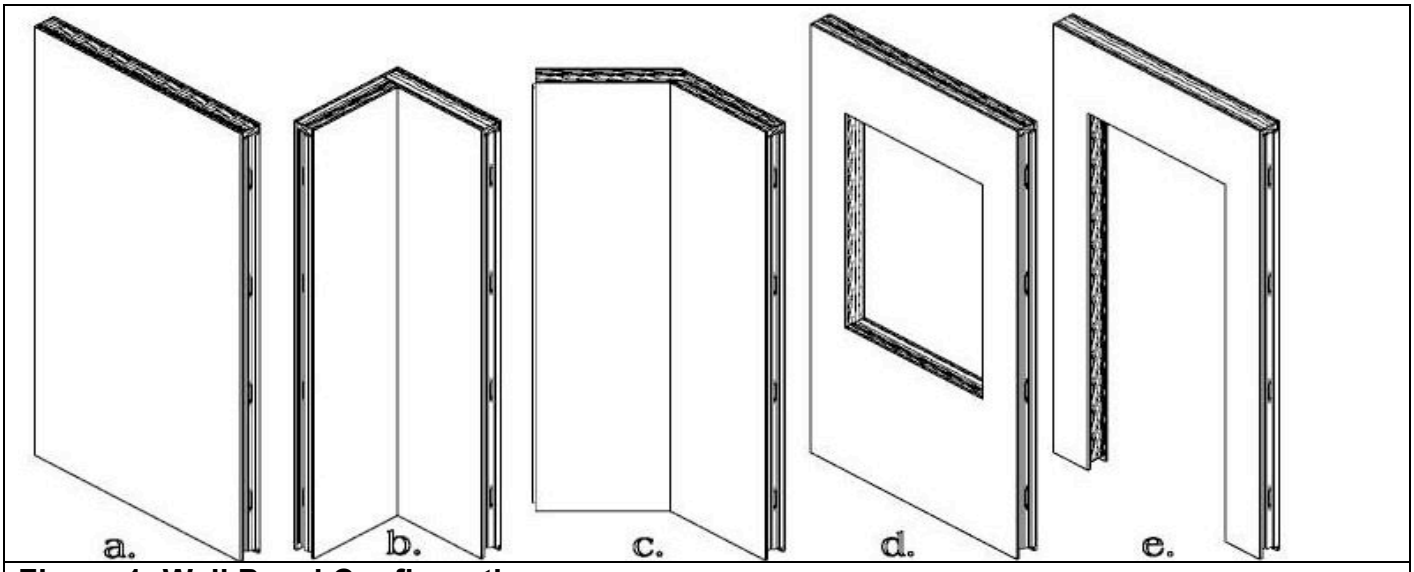


Figure 1: Wall Panel Configurations:

a. Standard flat panel; b. 90° Corner panel; c. 135° Angle panel; d. Window panel; e. Door panel.

Panel Introduction - Roof

The design and assembly of an ICS roof structure is typically fabricated-to-size to fit the roof diaphragm that is specified. Depending on the roof pitch and the spacing of supporting

members, the panels span and length is calculated to fit those members. Where the walls are typically structural systems that are attached to the foundation and roof, the roof panels must be secured to the support members and wall with mechanical screws. ICS panels are secured with a pancake head, square or torx drive screw that allows a minimum of 1 ½" penetration into the support member. Eave, ridge, and gable ends are framed with 2 x structure that is embedded into the panel ends. Angle cuts can be made at the factory to match the design intent of the structure. Several different interior surfaces have been successfully used to make a single piece installation that includes the nail base, the insulation and exposed interior finish material.

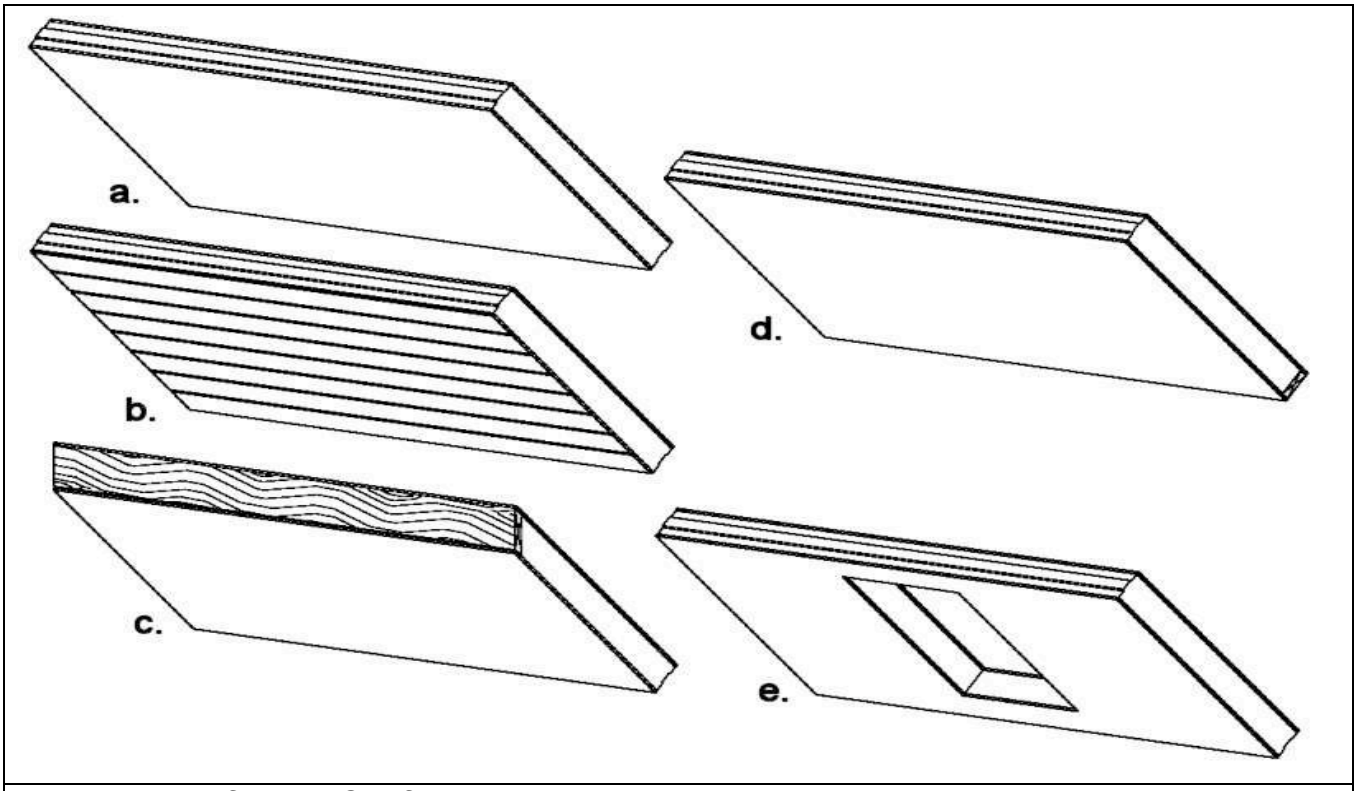


Figure 2: Roof Panel Configurations:

a. Standard Roof Panel; b. "V-Grove" Panel Surface; c. Ridge Panel; d. Eave Panel; e. Skylight Panel

Panel Introduction – Special panels

Design requirements often lead to special panels to meet the demands of a structure. Special requirements for large door openings, window openings, garage doors, and special point-loads must be addressed. The figures below are a few of the special panels' configurations that have been used to solve special requirements. Although not used in most buildings, when requirements call for maximum heat loss control the outside of first floor joists is insulated with special band panels. Band panels minimize the heat loss that usually occurs through the band joist on platform foundations.

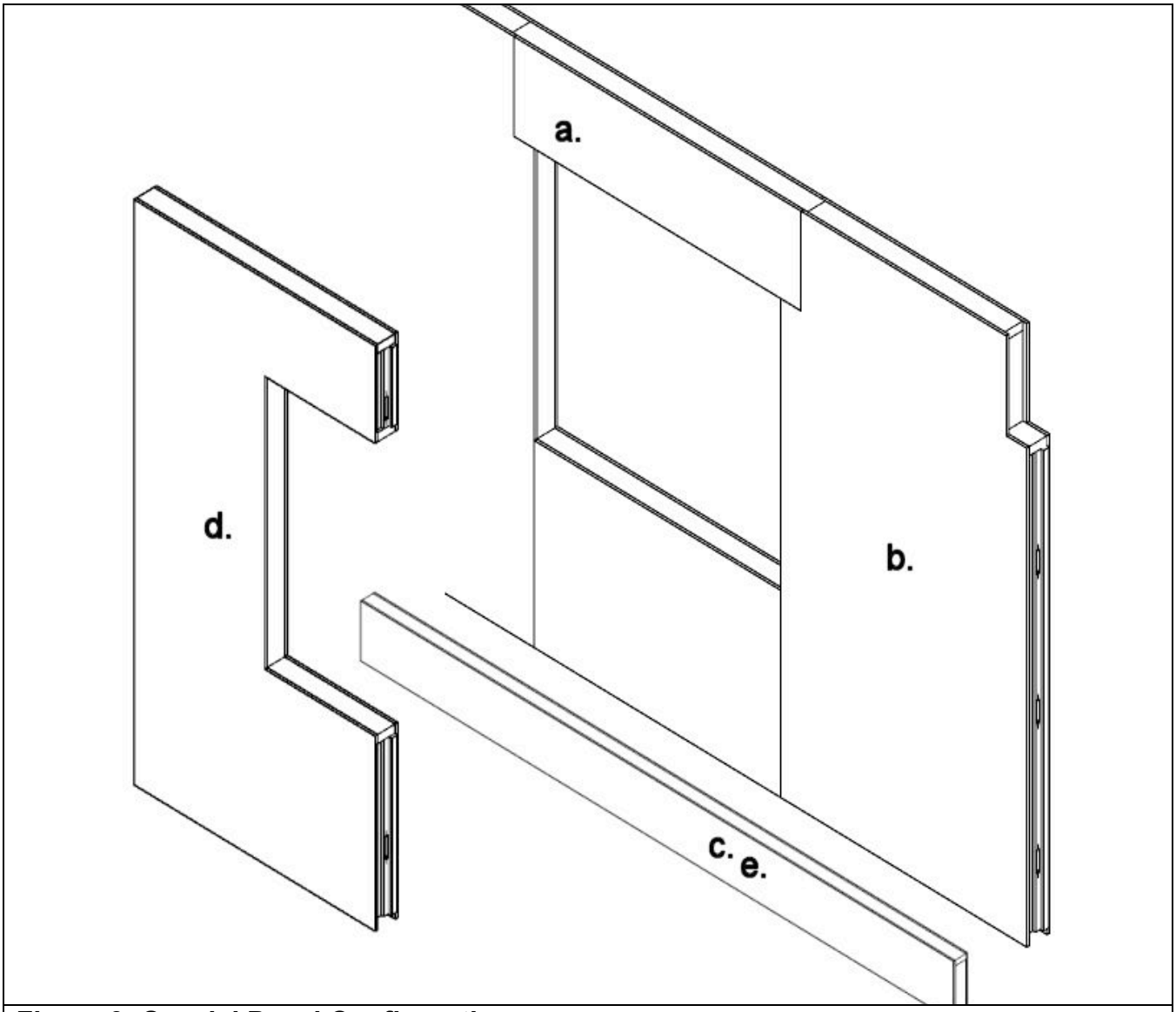


Figure 3: Special Panel Configurations:
a. Header; b. Notched Panel; c. Box Beam; d. Split Window Panel; e. Foundation Band Panel

Site Storage and Protection of Panels

Panels need to be kept off the ground and dry. When storing for a short time, the panels should be kept at least 6" off the ground with stickers, and protected from the weather by a waterproof, breathable cover. With some surfaces, exposure to the sun or weather could cause discoloration and swelling. Space the stickers no more than 4' on-center. Find a flat place to store the panels to insure the panels will not twist or take a set that will cause problems later. Extended exposure may cause damage and should not be stored at the site for more than 10 days. Panels should be located close to the location where they will be used yet kept away from possible damage from tools, vehicles, and site equipment.

Make Sure the Foundation Is Square and Level

Proper panel erection 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. Foundation drawings are intended to show size and bearing points for the house. Local codes and soil conditions may require additional engineering for compliance.

Follow Panel Placement Details

Each project will have a drawing showing the location of each individual panel. Panels can be relocated, but it is much easier to do it right the first time. Individual panel details (also known as "shop drawings") may be provided to facilitate the installation especially where special panels are used.

Follow Span and Structural Limits

Load limits and span limits for structural insulated panels and other building components, such as engineered joists and laminated beams, are provided by manufacturers for use in specific applications. Follow the limits carefully. All ICS panels are drawn and engineered to be installed as provided and must follow the design details provided. Do not customize or change any part of a thermal envelope design without consulting a Structural Engineer or the ICS design department. ICS SIPs are designed and assembled for "site-specific and unique" applications.

Foam Sealant is Required on All Panel Joints

ICS panels have both a tongue & groove panel interface system molded into the panel edges. (Traditional 2x splines are not used except where the structural engineer calls for embedded structural members.) This gives a very tight joint that prevents edge shifts, thermal bridges, and thermal breeches (voids). As insurance, prior to joining the panels at the joint and base, a bead of expanding foam adhesive must be placed to insure a positive joint. After the foam beads are in place, the panels are slid together and fastened with the cam-lock fasteners. In some cases, 2 x splines are used at point load distribution, and 4 x splines may be used in some instances, as described later in this manual. Failure to install the panels together properly may lessen the thermal and structural performance of the wall or roof. Inspect all panels as they are installed and make sure they are properly fastened and placed before going on to the next panel.

Follow Nail/Screw Specifications Carefully

Using the proper fasteners and spacing is very important with Structural Insulated Panels (SIPs). Table 1 provides a quick reference for nail and screw specifications with the most common applications. More complete information may be provided throughout the construction manual.

TABLE 1

FASTENER SCHEDULE

Application	Type	Spacing
Anchor foundation plates to cement/block	J-Bolts	4'-0" OC Maximum
	Simpson MA Type	Mfg'r Recommendation
	Simpson MAG Type	Mfg'r Recommendation
	Drill, Epoxy	Mfg'r Recommendation
Sill plate to foundation plate	16d nails or 3" Screws	6" OC in two offset rows
Sill plate floor system	16d nails or 3" Screws	6" OC in two offset rows
Securing ICS panels over 2 x 4 sill plate	8d nails or #10 x 1 ½" Screw	8" OC from both sides
Securing beams to beam pockets	See specific detail	On plan
Securing joist hangers to top plate	16d nails	Pre-drilled holes in hanger
Securing beams to joist hanger	1 ½" joist hanger nails	Pre-drilled holes in hanger
Securing joist to joist hanger	6d nails each side	Pre-drilled holes in hanger
4 ½" roof panels to ridge beam	6" panel screw	6" from edge @ 8" OC
4 ½" roof panels to rafter beams	6" panel screw	6" from edge @ 8" OC
4 ½" roof panels to top wall plate	6" panel screw	6" from edge @ 8" OC
6 ½" roof panels to ridge beam	8" panel screw	6" from edge @ 8" OC
6 ½" roof panels to ridge beam	8" panel screw	6" from edge @ 8" OC
6 ½" roof panels to ridge beam	8" panel screw	6" from edge @ 8" OC

(Other fasteners may be used when specific applications are required and should be applied with direction of manufacturer or engineer.)

II. GETTING STARTED

1. Foundation Design

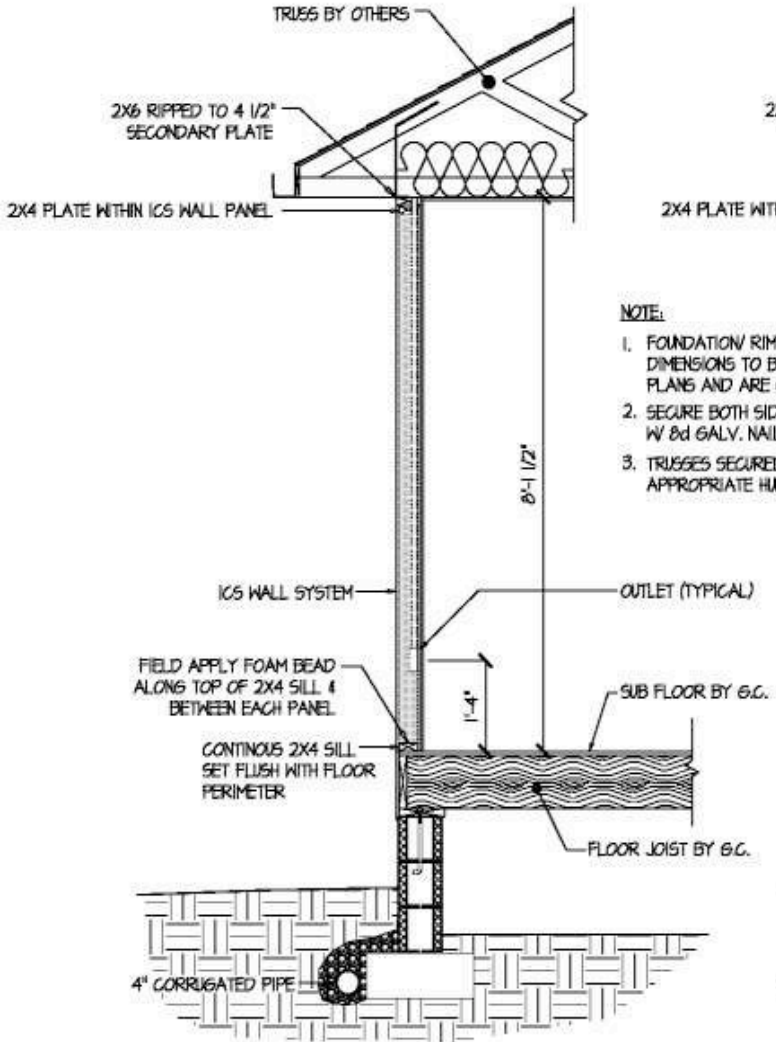
ICS panels are manufactured to work with many different foundation types utilizing several different exterior skin surfaces. With any foundation system used or panel skin surfaces, panel attachment system, or skin surface, **both the inside and outside skin surfaces must be fully supported**. To reinforce this comment: **both skins must rest on structural material!** Typically the foundation design will be for "concrete slab" or wood platform.

Wood Platform. When the floor system is a wooden deck, the ICS panel will usually fit over the sill plate that has been attached to the floor deck. Two conditions will apply for the sill plate:

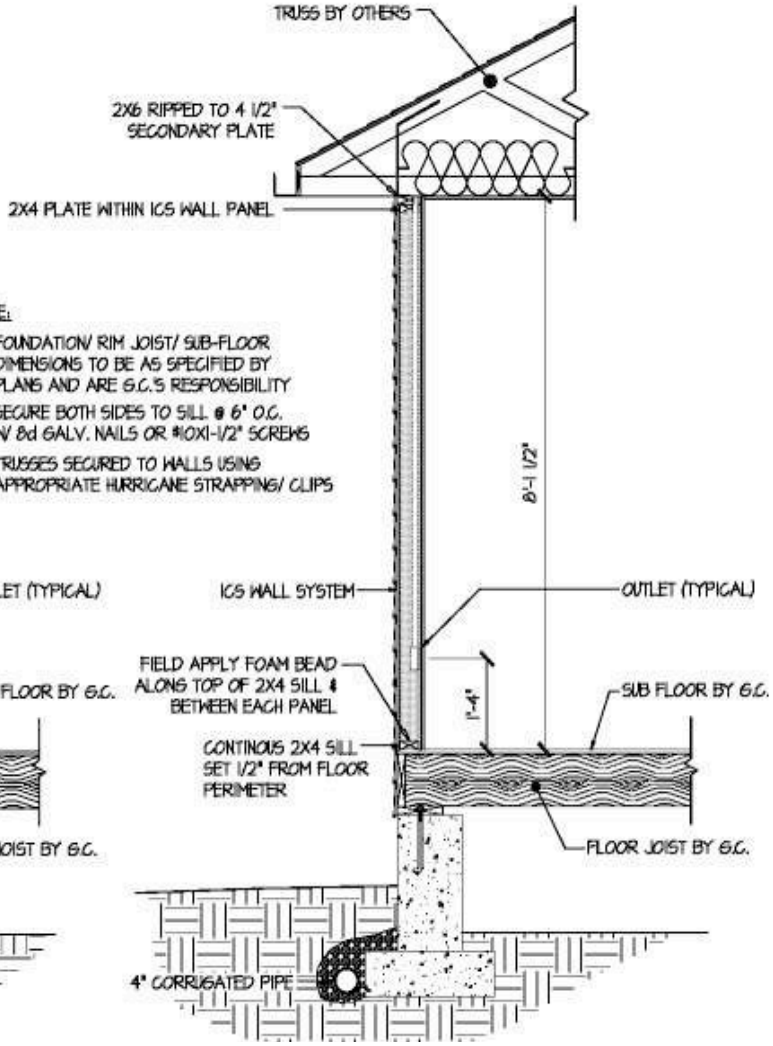
(1). If the panel specification callout is for an exterior *finished* surface material, the sill plate will be placed flush with the outside surface of the band joist and foundation. When this occurs, the panel surface skin will extend outside the band joist by the panel thickness and needs to have full support of the same material attached to the band joist. Provide flashing and sealing to insure a weather-tight mating surface.

(2). If the panel specification calls for a siding material to be installed over the outside of the panel surface, the sill plate will be inset from the face of the band joist by approximately ½". The outside of the installed panel surface should be flush with the outer edge of the rim joist and foundation. With full basement and crawlspace applications, a pressure-treated sill should be anchored to the frost wall with foundation tie straps as indicated in the plans, typically 6' o.c. and 2' from all corners. The outer edge of the sill should be flush with the outside of the foundation if the foundation matches the building dimensions. If the foundation varies from the building dimensions, if corners are not square, or if the top of the frost wall is not level enough, you will need to correct for this when setting the sill plates. It is extremely important that you provide an accurate, level, and square platform on which to set the precut structure.

(1) Finished wall panel



(2) Wall panel with secondary finish



NOTE:

1. FOUNDATION/ RIM JOIST/ SUB-FLOOR DIMENSIONS TO BE AS SPECIFIED BY PLANS AND ARE G.C.'S RESPONSIBILITY
2. SECURE BOTH SIDES TO SILL @ 6" O.C. W/ 8d GALV. NAILS OR #10X1-1/2" SCREWS
3. TRUSSES SECURED TO WALLS USING APPROPRIATE HURRICANE STRAPPING/ CLIPS

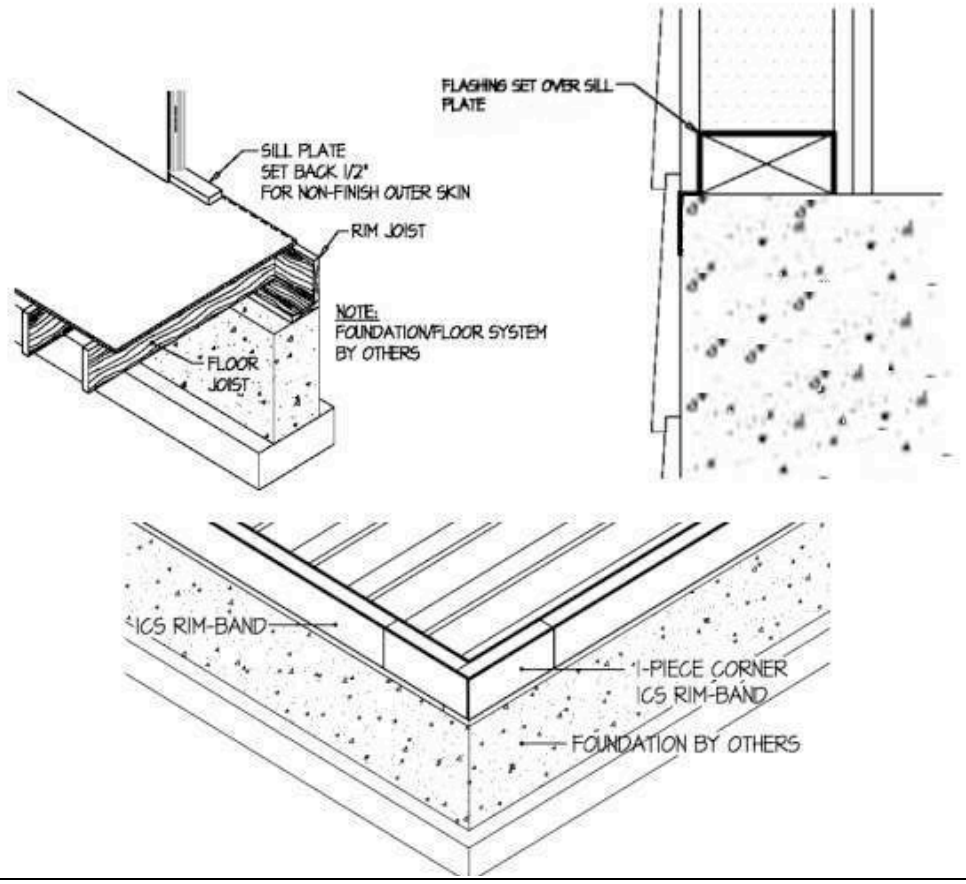
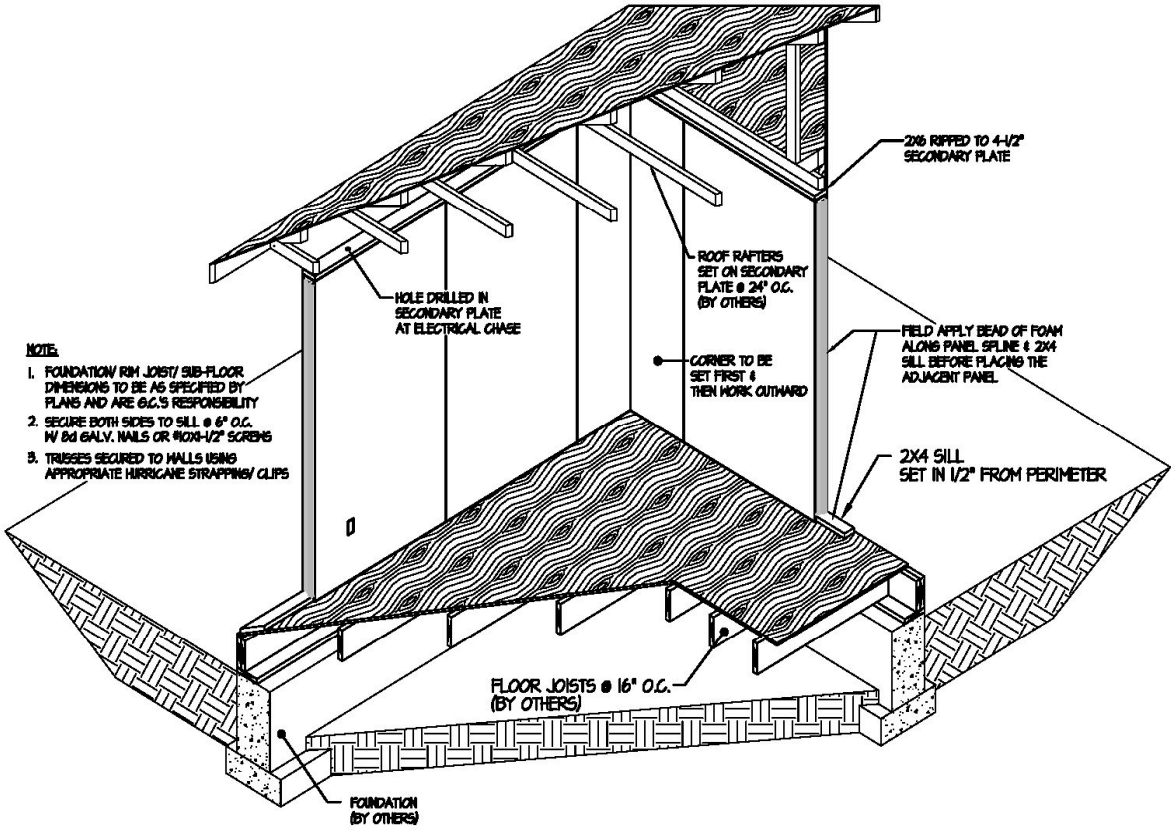


Figure 4. Sill Detail. The outer edge of the wall panels should be flush with the outside of the concrete frost wall so that full support is provided. Secure the sill plate with foundation tie straps. Interior foundation insulation is generally recommended. If using exterior insulation, bevel the top edge as shown and cover joint with a beveled skirt board. Figure 4c shows how corners overlap.



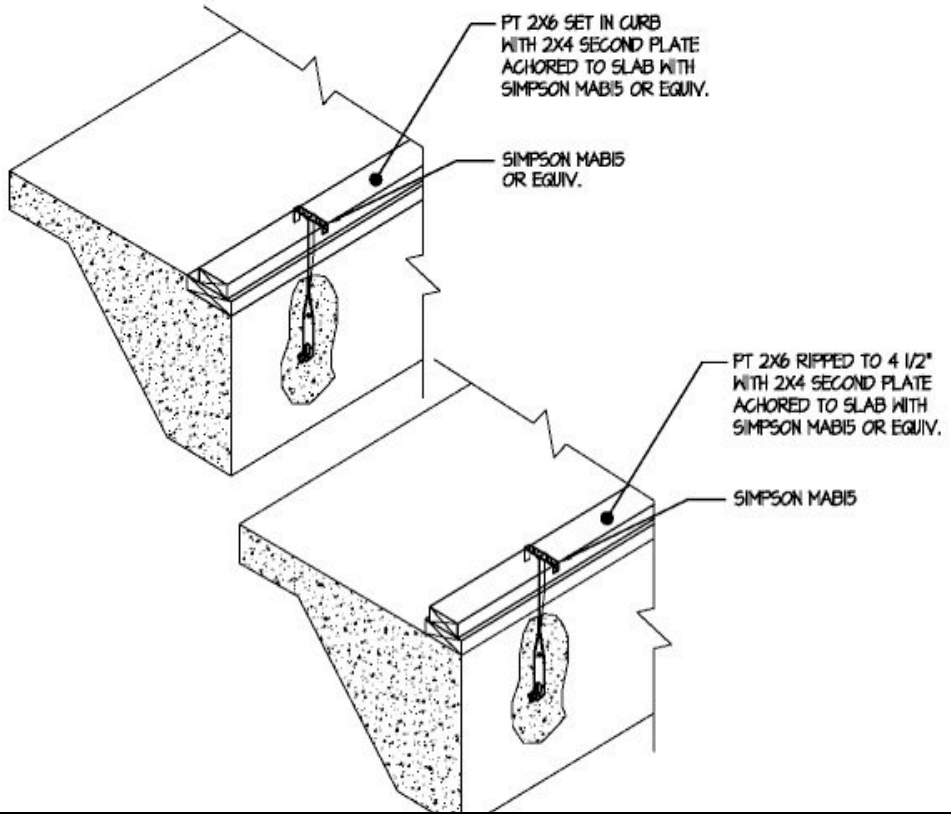


Figure 5. Slab-on-Grade Sill Detail. A 2 x 6 (1 ½" X 4 ½") pressure-treated sill can either be embedded into the concrete slab or set on top of slab followed by a second plate (1 ½" x 3 ½") and secured with mud sill anchors or suitable anchors to top of the slab.

Interior insulation is generally recommended with use in foundation slab or foundation wall systems. The rigid insulation board or framed out wall should extend up to the sill where possible. Figure 4a shows this condition or a normal basement or crawl space foundation system.

When using exterior placed rigid foundation insulation, bevel the top edge at 45 degrees extending to the top of the sill. Nail the top edge of the insulation into the sill, protecting it per insulation manufacturer's recommendations. Cover the joint with a pressure-treated skirt board that has been beveled at 45 degrees. Install drip cap flashing above the skirt board and install siding over it. Leave approximately 1/8" to 1/4" space between the bottom of the siding and the flashing to prevent rot.

With slab-on-grade foundations, there are several alternatives:

A pressure-treated 2" x 6" sill can be embedded in the concrete, with the top flush with the top surface of the slab. The sill should be secured to the foundation with mud-sill anchors, such as "MA type" as manufactured by Simpson Co. The anchors are set into the wet concrete and provide a seat for the embedded sill. Figure 5a shows this condition.

A second alternative is to rip a treated 2" x 6" to 4½" (the width of the panel) and secure it to the top of the slab. With this detail, conventional foundation anchor bolt, tie straps, or mud-sill anchors should be used. A second treated plate is placed over the sill plate allowing for ½" showing on each side of the sill plate. Common attachment is with a "MAG type" as manufactured by Simpson Co. A Simpson Mudsill Anchor Single-side can also be used. **The method of sill plate attachment to the concrete foundation must be established in advance of panel design, as it establishes wall and panel height.** Figure 5b shows this condition.

When concrete slabs are used, insulation is generally installed on the inside of the concrete pour. Figure 5a shows the common detail for use of this type of insulation.

When installing insulation to the exterior of the foundation, bevel it and install as shown in full basement application (see Figure 4b).

Important **Setting up the foundation is a step that needs to be done properly. It is extremely important that the sill plate of the house matches the dimensions of the installed structural insulated panels and that all corners be square. It should go without saying that the foundation should be level from corner-to-corner and end-to-end. Foundation width and length should be within ¼" of the dimensions called for in the plans. Check the diagonal measurements to determine the "squareness" of the foundation. The diagonal measurements should be within ½". Slight variations in foundation dimensions can be dealt with when setting the sill and the panels, but variations outside of these tolerances will make panel installation significantly more difficult.**

Slight inaccuracies in the foundation dimensions can be corrected when setting the plates and panels. When the foundation is out of dimension, an experienced installer can make adjustment to fix the problem. If in question, contact ICS for instructions on how to make the adjustments. In many cases, an "adjustment" panel is mated to an "adjustment corner" to make installation easier and provide for adjustment whether needed or not.

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

In areas where termite and ant damage is common, install a termite shield between the sill and foundation in accordance with locally accepted practices. As an added precaution, a licensed exterminator should treat the ground around the house. Ask your local building official for information on accepted practices in your area to protect against insect damage.

To seal against air infiltration under the sill, use a closed-cell foam sill sealer, and apply caulk between the termite shield (if any) and the sill.

III. FIRST-FLOOR DECK

The first floor deck is laid on joists that span from sill to sill or to basement girder. Conventional band joists are used to tie the joists together. Band panels may be installed around the whole sill perimeter.

1. Install Band Panels

Band panels are sections of panels that are the same depth as the joists used for the first floor deck. If band panels are used, they provide the same insulation value as the wall system. Assuming the sill plate is level and square, and it matches the outside dimensions of the building, the band panels can be set directly in line with the outer edge of the treated sill plate. Use the framing plan to properly position the band panels. Usually band panels are installed before the joists, but in some cases, joists will be installed first. There you will need to allow space for the thickness of the band panels in setting the joists. When installing the band panel, you need to seal butt joints with expanding foam sealant. Figure 6 shows this condition.

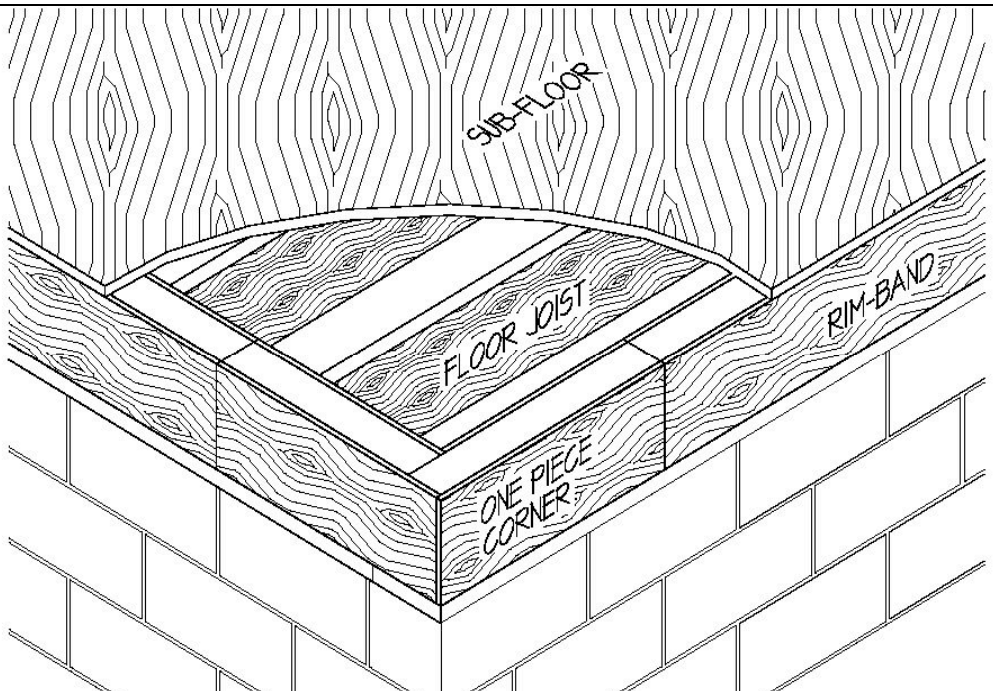


Figure 6: Band Panels: Band panels are set on the outside edge of the sill around the whole perimeter of the building. Overlap band panels on sills as called for in plans.

2. Setting Floor Joists

Many choices can be made with the floor joists. Whether using dimensional lumber, engineered floor joists, or floor trusses, the floor system must remain level and square. Most engineered floor joists and floor trusses should arrive at the building site precut. Always check the dimensions prior to cutting or installing. Check to make sure that the floor system is to dimension and not out of square. Determine if each joist can be installed correctly or needs to be modified. If the joists are not cut to the correct length as shown on the order list, check with the manufacturer to provide the correct method of adjusting to fit. Laminated beams and joists will expand with moisture, so keep them dry. Lay out joists as specified in the plans. Take note of where measurements for “o.c.” spacing of joists should begin. Nail

through the band panels into the spanning joist top chord with 16d nails, as shown in Figure 6. Each spanning joist should be nailed into the sill with two 16d nails at each end, one on each side of the web.

Joists also need to be nailed into any spanning girder they rest on. Before nailing joists into a basement girder, check to make sure the girder is straight and level. Straighten and brace it as necessary. Nail joists into girders with two 16d nails (one on each side of the web). Install joist blocking above the girders if specified in the plans. With engineered joists, follow manufacturer's specifications for bracing requirements. When using hangers off a basement girder, be sure to follow the hanger manufacturer's nailing schedule. Use two 16d nails to connect the joist hanger into the bottom flange of the joist (one on each side). The joist hanger must be pushed up against the girder before installing these nails. Double or triple joists are used at stairway penetrations or as joist headers when the joists change direction. Multiple joists should be glued and nailed together 12" o.c. at both top and bottom using 16d nails (with engineered joists, follow manufacturer's recommendations).

Use a great deal of care when working with engineered joist products. While they have considerable strength when loaded from the top, they have very little lateral strength. Do not stand or walk on engineered joists until they have been adequately braced or sheathed with subflooring. Use care when picking up long engineered joints; if they are not on edge when picked up, they can break.

3. Lay Subfloor

Lay a ¾" tongue-and-groove subfloor on top of the joists. The subfloor should extend out to the edge of the panel band joist. Run 4’ x 8' sheets perpendicular to the joists starting from the point indicated on the subfloor layout plan. Apply a bead of construction adhesive on each joist and top of band panels, and nail the subflooring on with 8d nails or 2" screws 6" o.c. along edges and 12" o.c. along intermediate joists. The two rows of fasteners at butt joints over a single joist must be staggered. It is important that the subfloor be nailed down before the adhesive starts to set up (follow manufacturer's recommendations).

4. Install Bottom Splines (First Floor Walls)

Once the floor deck is on, 2” x 4" bottom splines (bottom plates) are secured around the full perimeter. The splines should be secured to the deck and band panel (if used) around the perimeter, setting the outer edge of the spline 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 you position the 2 x 4’s. A bead of adhesive under the bottom spline is required. Foam adhesive tape should be used under all splines. Use 16d nails, spaced 6" o.c. in two staggered rows, to secure the bottom spline to the sill as shown in Figure 9.

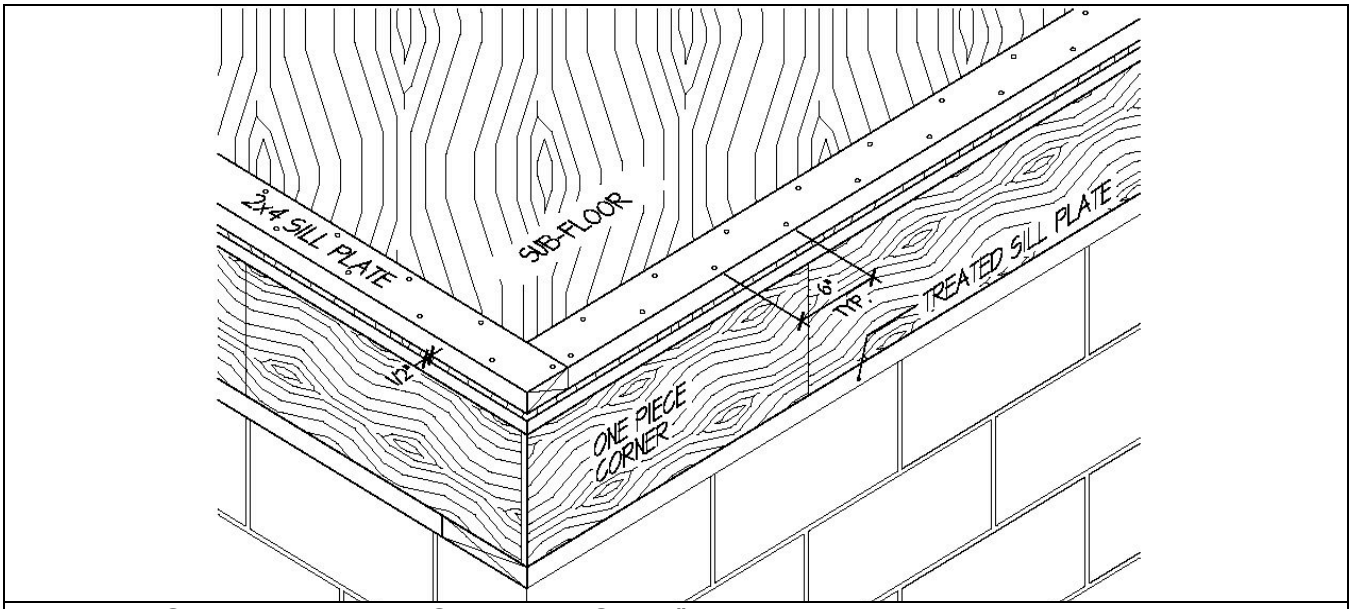


Figure 9: Securing Bottom Splines to Sill: 2” x 4" bottom splines are secured so that the wall panels will fit over them and be snug against the deck. Caulk underneath the bottom splines to ensure a tight seal.

Corner lapping of the 2” x 4" bottom splines must be done in the same manner as the wall panels that fit over them (see panel elevation key plan). The shorter spline must be held back ½" from meeting the longer spline to allow the side wall inner skin to be set into the corner. (See Figure 9). Set the longer splines first (those extending all the way to the corner). Try to set butt splices in this bottom spline so that they do not coincide with panel splices. Do not set shorter bottom splines until the longer walls have been tilted in place. Generally, the corner panel is set first (see below) and panels are joined to the corner moving both directions to stabilize the wall sections. Exterior walls are erected first, followed by the end (gable) walls.

IV. WALL PANELS — ASSEMBLY AND ERECTION

Sort the panels for orderly access according to panel layout drawings. Beginning with a corner panel (Figure 10), then work your way outward around the perimeter of the building. Place a continuous bead of expanding foam along center of panel and along sill plate before setting adjacent panel in place and sliding together. Lock panels together using 5/16" hex wrench provided. Prior to erecting a panel, check to see if the panel has any electrical chases or conduits showing on the bottom of the panel. If so, the sill-plate and subfloor must be drilled in the corresponding locations to allow for installation of wires to feed the conduits, outlet boxes, and switch boxes in the panels.

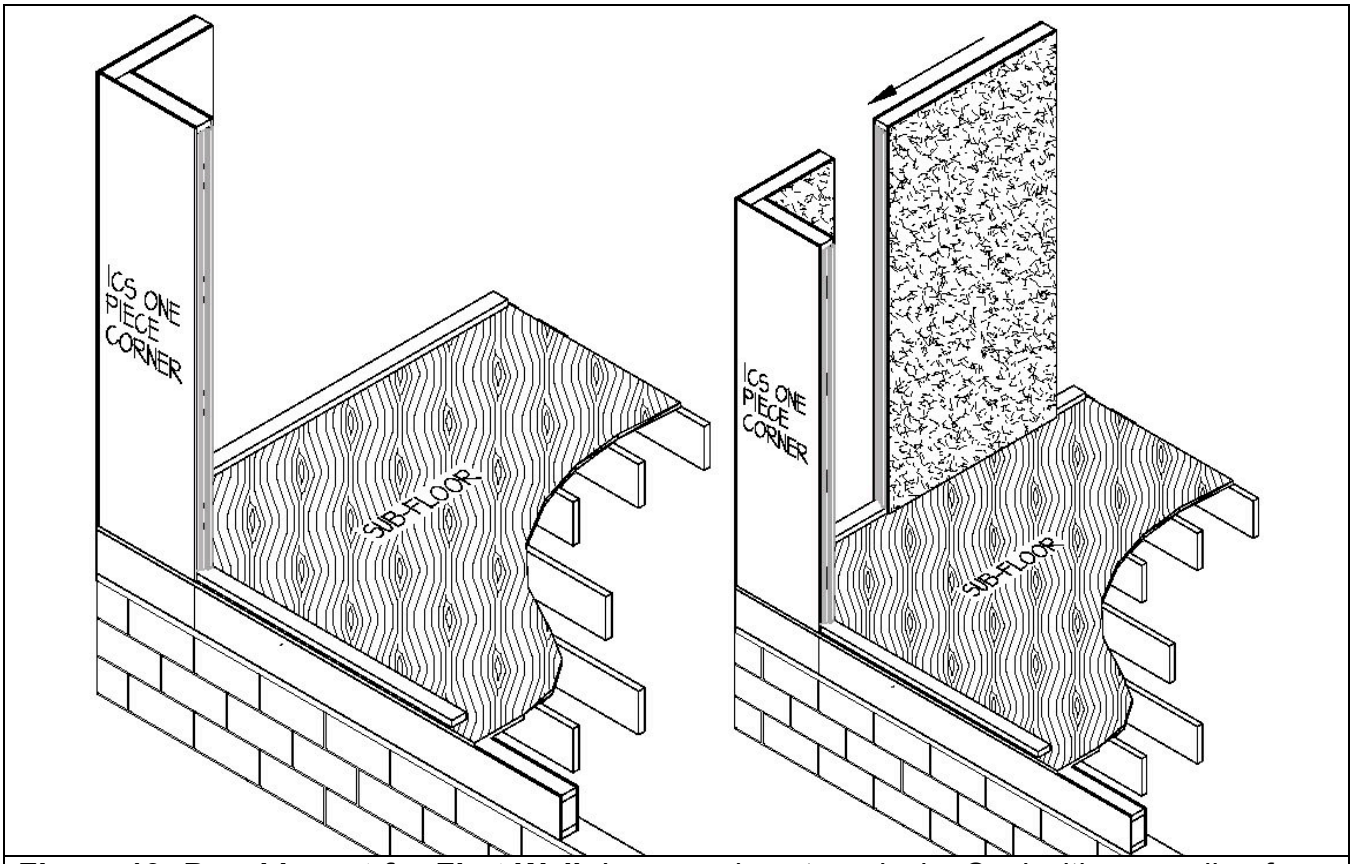


Figure 10: Panel layout for First Wall: Lay panels out on deck. Seal with expanding foam (Handi Foam or equivalent) at sill-plate-to-panel interface and at panel-to-panel interface.

Panel joints are profiled and only fit together one way, male to female. To prevent moisture migration through the wall, the joint must be sealed with expanding foam sealant.

The foam sealant suggested is medium rise foam applied with a metering gun, such as supplied by Fomo Products, Inc. Starting with the installed corner, from the bottom apply a bead (about ¼" to 3/8") along the edge of the panel in the groove between the oriented-strand board (OSB) skin and the metal-reinforced tongue (see Picture A-1). Next, apply a bead to the panel to be installed adjacent to the standing panel in the same method, starting from the bottom and apply a bead (about ¼" to 3/8") along the edge of the panel in the groove between the OSB skin and the metal-reinforced tongue. Apply sealant to the base plate and place the panel over the plate and bring the panels together.

Picture A-1: Foam is applied with metering gun and foam canister along edge of panel against the metal-reinforced tongue. Start from bottom continuing to top. Apply to base plate and edge of top plate, if embedded.

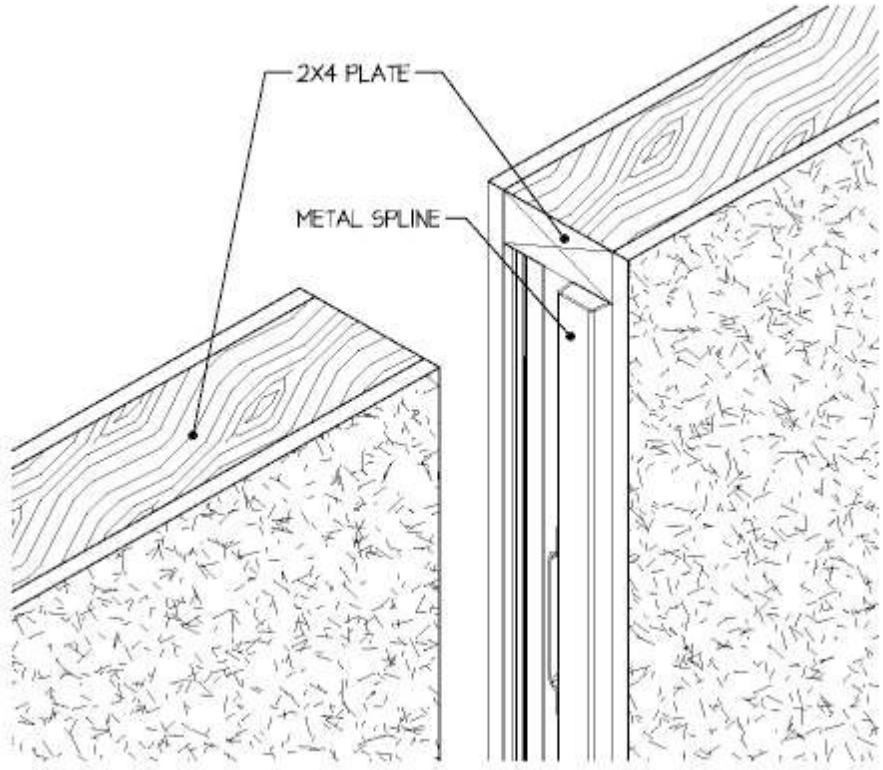


Figure 11: Panel Profiles: Panels are profiled for interlocking, with "male" side having a "cam-lock hook" & "female" side having a "strike pin." To assure a tight seal without risk of moisture migration, place a bead of foam sealant along the metal-reinforced tongue edge of each panel before joining.

In some situations, the plans will call for additional point loads to be transferred to the foundation. As shown in Figure 12, the panel joint has 2x4's profiled and set with the panel ends. Once foamed-in-place and the panels securely locked together, they provide very strong support for point loads.

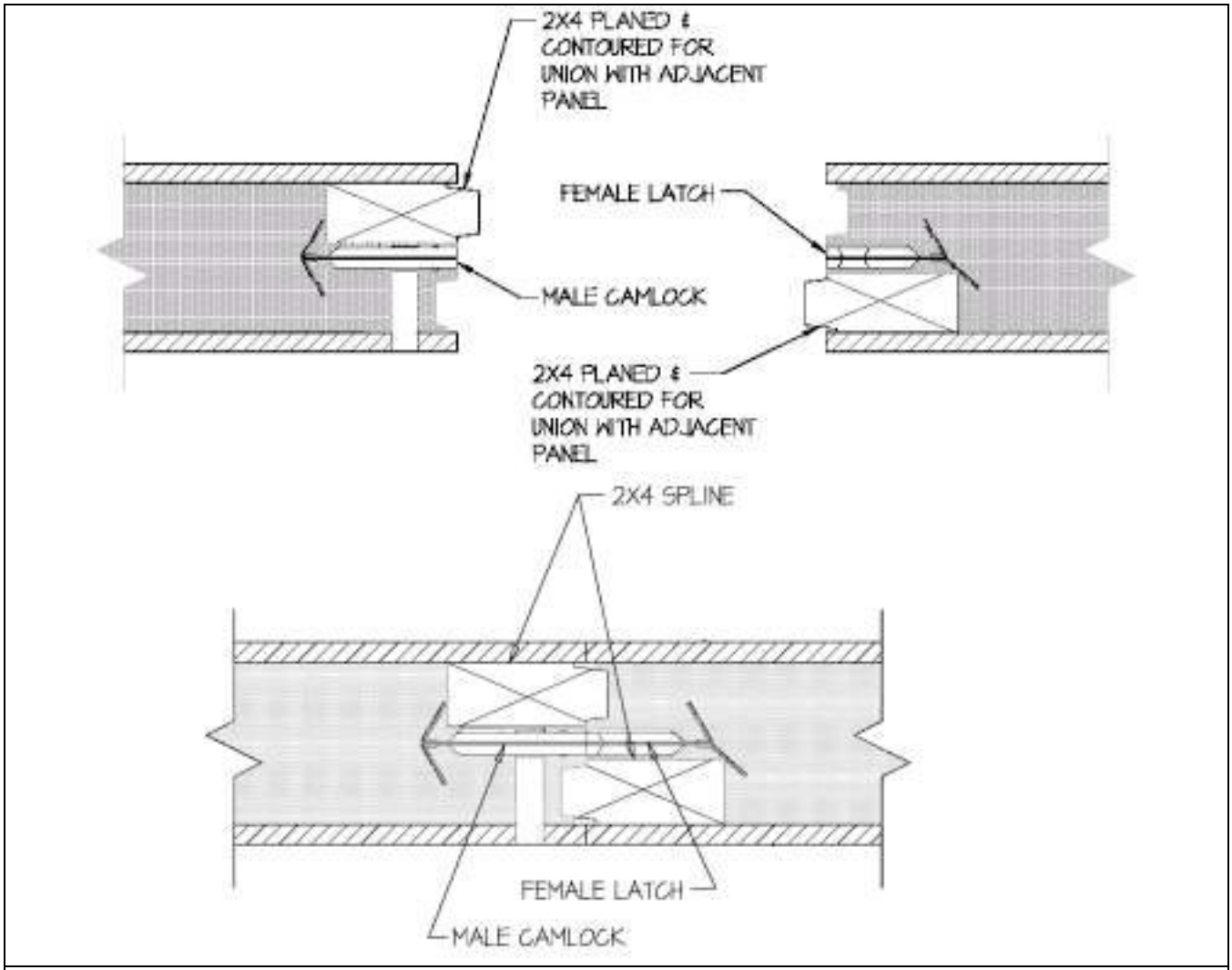


Figure 12: Spline Joints: 2"x4" profiled splines may be used in certain situations where greater load-bearing capacity is required at panel joints.

Starting with the bottom or top most lock, insert the 5/16" hex wrench into the access hole and mate the wrench with the lock. The lock will only rotate 270 degrees from full open to full close. The lock works by rotating until the latch hits the pin in the opposing lock. When this contact is made, the latch goes into a cam action and draws the panels together. If the latch does not engage the pin, it must be "re-set" by rotating it back counter-clockwise until it meets resistance. It the panels do not close using the locks or the gap is too wide for the latch to engage the pin, truck straps or "come-alongs" (or equivalent apparatus) can be used to pull the wall assembly tightly together. If using a sledge hammer, make sure a block is placed against the panel and it comes in contact with both panel skins before striking the panel. If a cam-lock is missing, or breaks, or cannot be secured, it is not critical. Just make certain that the joint is sealed, that it is as tightly together as possible, and that the panels are properly nailed to the sill-plate and top-plate.

Brace wall as required to keep it straight and plumb. Brace end of walls on the outside edge as shown in Figure 13. This allows room on deck for assembly of gable end walls and

provides a stop in tilting up these panels. With the panel in position, plumb and straight, secure the bottom of each panel to the plate using the suggested attachment schedule.

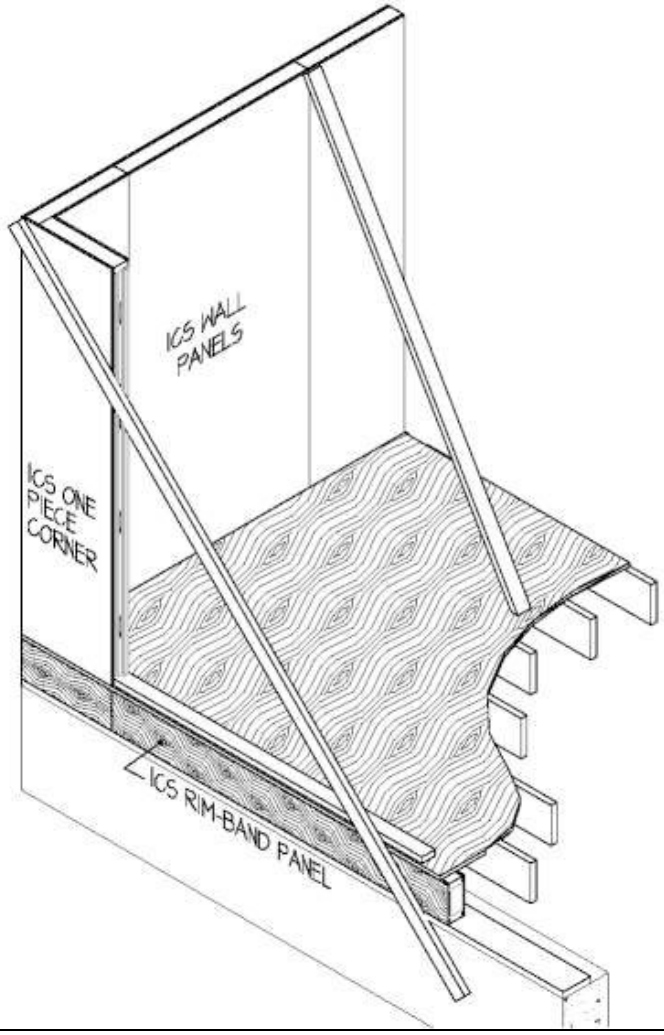
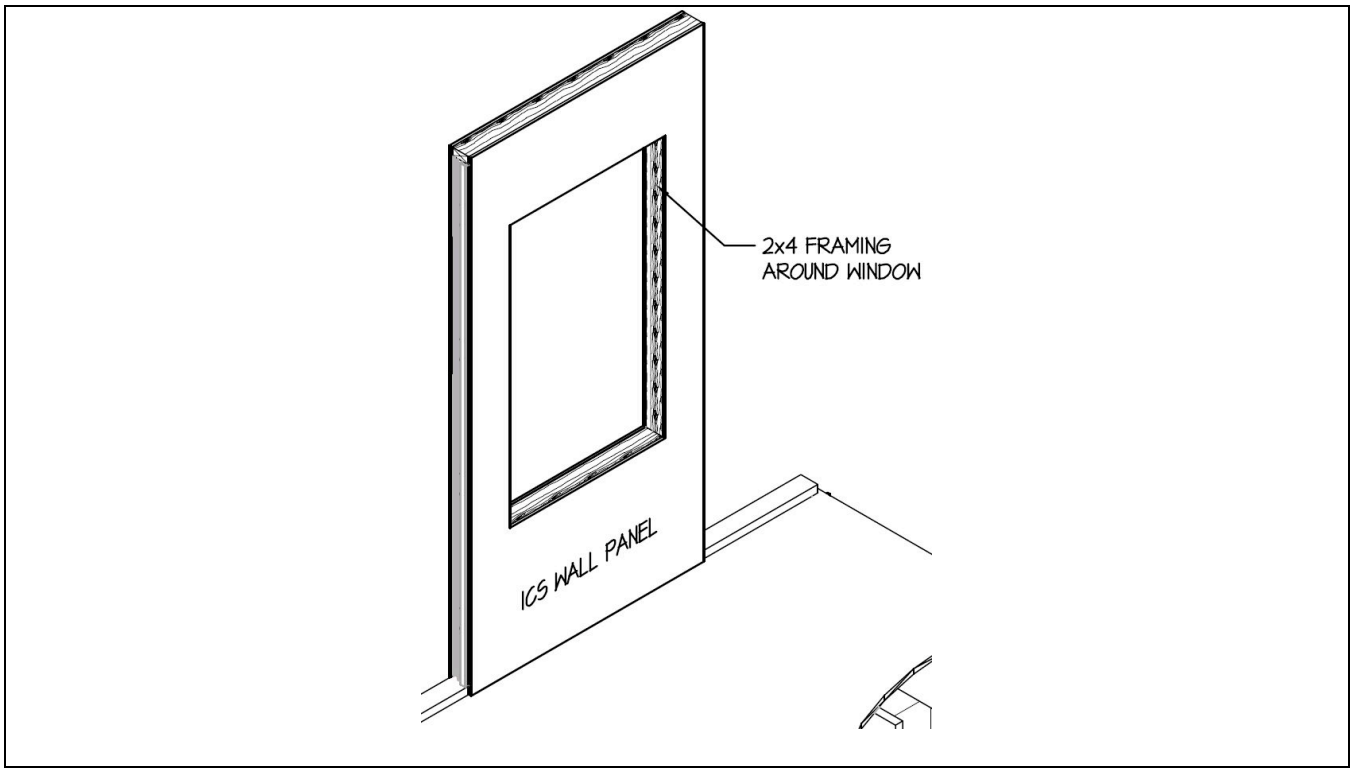


Figure 13: Bracing Wall Ends: Brace end of walls as shown. This frees up floor space for assembly of next wall into the corner and also provides a stop to aid in setting the panel.

Once the first set of the walls is accomplished and braced in position, continue to install the panels as detailed in the panel layout drawing with the numbered panels. Make sure that the panels are laid out and set in the proper position. The last panel and corner will be quite tight, but you should be able to force it in. It is suggested that the base plate on the return of a corner not be secured until the corner is set. After the corner is set, the plate is installed into the cavity on the return end and secured. This condition is common and is used to make up for foundation incontinency and panel growth. The last panel in the thermo envelope can be best installed by tipping the wall out and sliding that panel into the widened opening. Apply the beads of foam as described above. When in position, cam-lock the panel into position. As you complete 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 adhesive.

1. Door and Window Openings

Panels should arrive from the factory with rough openings framed to receive windows and doors if the door or window fits within a single panel. The openings are framed with 2x4's all around. If load conditions call for a header, voids for the header and king-studs, cripples, or trimmers are left in the panel for assembly in the field with customer-supplied 2x material (Figure 16). This technique can be used both when the opening is within one panel and when the opening extends into adjoining panels. The rough openings for some windows will have perimeter splines factory-installed when the panels arrive.



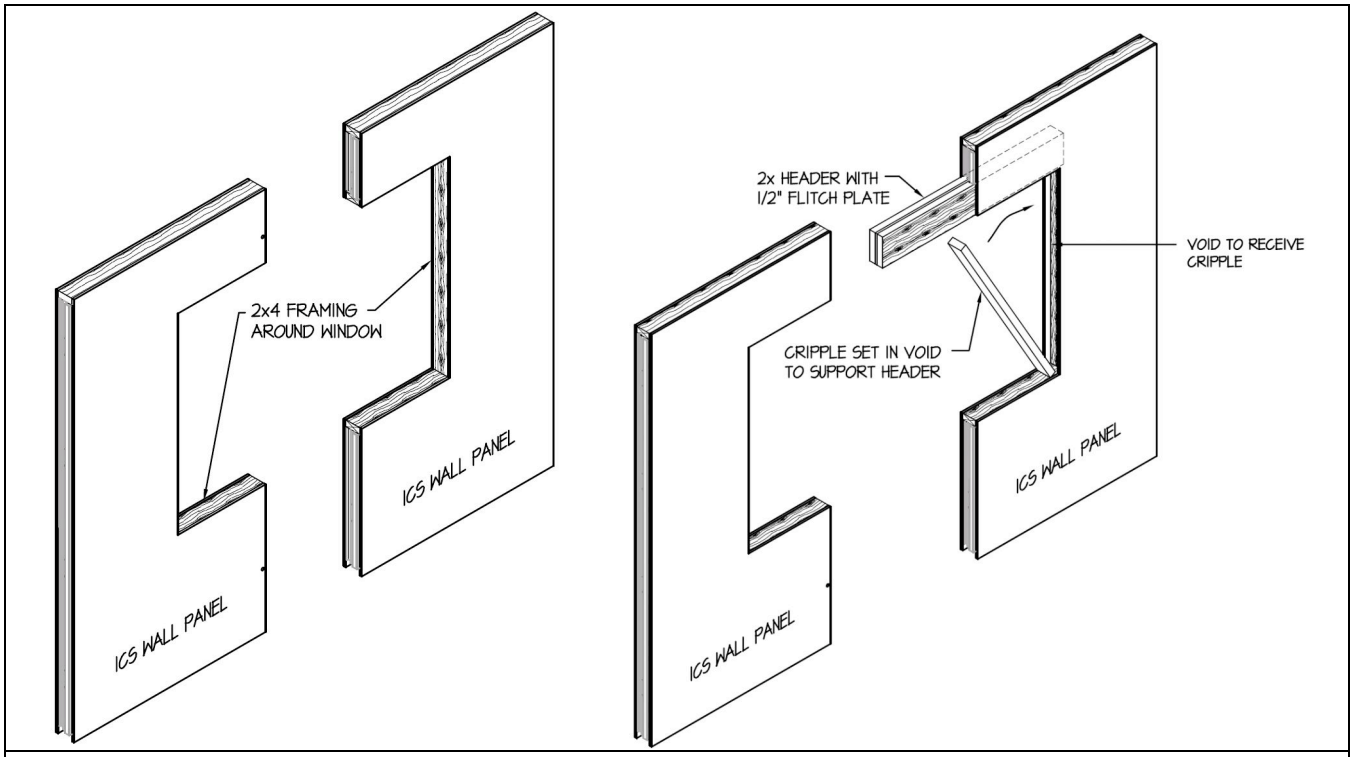


Figure 16: Rough Opening for Window: The perimeters of window openings are routed-out 1½" and 2" x 4"s installed. The sill and header should overlap side members, as shown.

With all rough openings for windows and doors, the sills and headers should overlap the side members as shown in Figure 16. This helps distribute the load carried by the header. The OSB should be secured to the framing around rough openings from both sides with 8d nails or 2" screws spaced every 8".

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. A box beam, insulated header, or built-up structural header, such as an LVL, will be used as structural requirements dictate (see Figure 17).

V. SECOND-FLOOR DECK

1. Installing Beams

As the first floor walls are going up, you must consider how supporting girders or beams will be installed. Depending on the house design and size, there may only be purlin beams to support roof panels, or there may be girders to support second-floor joists as well. With either type, installation is basically the same.

Beam Pockets at the Top of a Panel Wall

The beam ends are set into beam pockets in the wall panels, as shown in Figure 19. How these beam pockets are made and how beam ends are prepared and set into place depends on where the pockets are located in a panel. If the beam pocket is at the top of a wall panel – as is common with second-floor girders spanning the width of a house – the pocket is open at the panel top, as shown in Figure 20. The beam pocket should be precut and routed-out to allow the beam end with special reinforcing scabs to be dropped down into it from above.

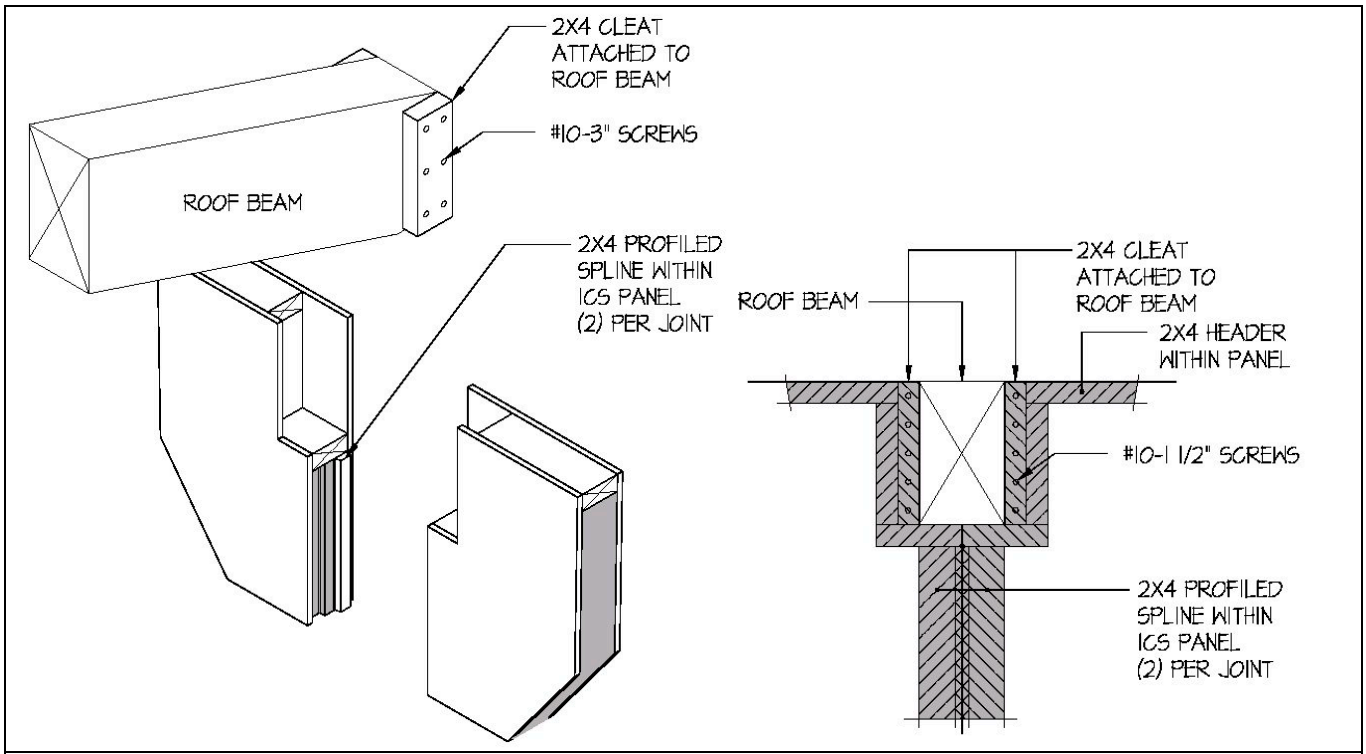


Figure 20: Beam Pocket at Top of Wall: Beams or girders to support the second-floor wall are usually set into beam pockets at the top of wall panels. If the pocket does not align with a wall panel seam, the foam is routed-out on both sides and below for 2" x 4" scabs.

If the beam pocket does not fall on a panel joint, then foam is routed-out to a depth of 1½" on both sides and the bottom, as shown in Figure 20. 2" x 4" scabs are secured to the beam ends with two beads of construction adhesive and two offset rows of 16d nails 2" o.c. After the scabs are secured to the beam ends, apply a bead of expanding foam sealant into the routed grooves of the beam pocket and set the beam into position above. Once in place, nail through the OSB skin into the scabs from both the inside and outside with 8d nails 2" o.c. as shown in Figure 20. Also, nail through the outer OSB skin into the end grain of the beam with 16d nails 2" o.c. in two staggered rows.

To fully carry the load from large spans, beams, or high wall applications, a structural engineer should be consulted. The panel joint or support may need additional members or have a need to use closer nail spacing than usual for securing panels. Be sure to follow ICS and structural engineering specifications carefully.

Beam Pocket in a Panel Face

Beam pockets will not always be at the top of a panel wall and open at the top. In some cases, the beam pockets will be located in a panel face. 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. In either case, the inner OSB skin is cut to the exact dimensions of the beam and the foam removed.

After the beam pocket is cut, the foam on the bottom of the pocket is routed out 1½" for a 2" x 4" scab. Apply a bead of expanding foam sealant into the routed groove and inset the 2" x 4". Nail through the OSB from both sides into this scab with 16d nails 2" o.c. Then apply several beads of adhesive to the top surface of the scab just before inserting the beam end. Because the beam cannot be dropped into the pocket from above, it may be necessary to flex the wall out as the beam is inserted. Once in place, nail through the outer OSB skin into the end grain of the beam with 16d nails 2" o.c. in two staggered rows to secure it in place. Apply expanding foam sealant on both sides and top of the beam to seal it into the panel.

2. Installing Joists

Joists for the second floor are installed in a much different manner than those for the first floor. Nail joist hangers into the top spline of the first floor wall panels as shown in Figure 23.

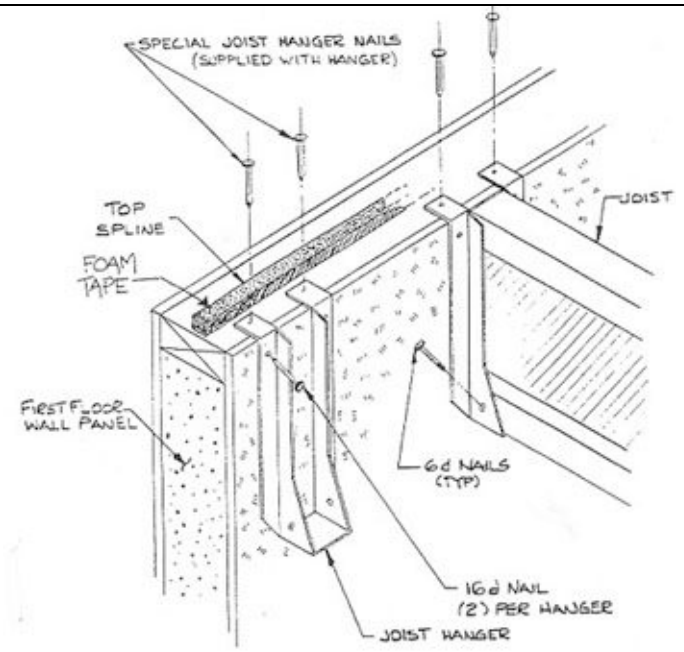


Figure 23: Setting Joist Hangers for Second-Floor Deck: The second-floor deck is "hung" from the continuous top splines that were set into the wall panels. Follow joist hanger manufacturer's instructions, and use nails supplied with the hangers.

Refer to the house plan to find the proper joist spacing. The joist spacing in different portions of the floor may vary depending on the span. The top of the installed joists should be at the same height as the top of the wall panels and top splines. Hangers are secured both to the top of the spline with special joist hangers, and to the side (through the OSB) with 16d nails. 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. Doubled or tripled joists may be called for as girders and at stair or masonry penetrations. All multiple joist situations require the members to be glued and nailed together as per manufacturer's recommendations. "Laminated veneer lumber (LVL)" joists are generally used for multiple joists. Joist hangers are secured to the face of the multiple joists as shown in Figure 24. Be sure to check plans and use the hangers specified; these may vary depending on structural considerations. Face-mounted hangers are generally called for when the carrying beam is of microlam construction.

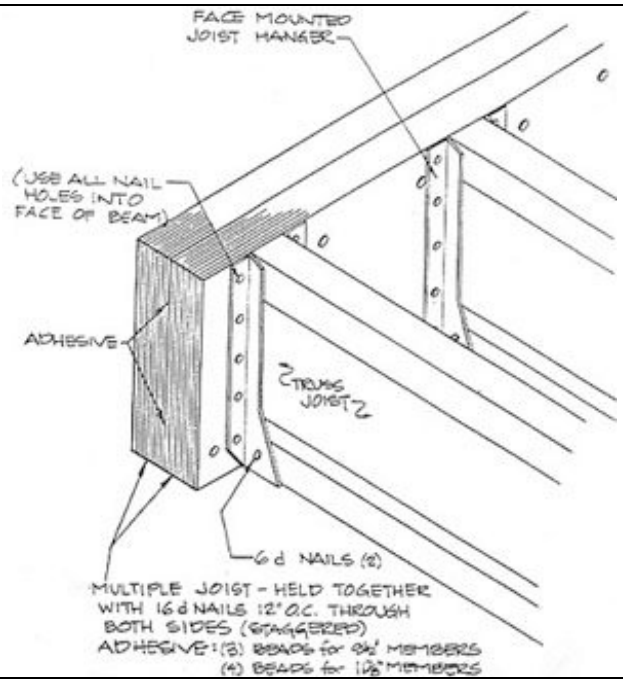


Figure 24: Securing Joists to Girders or Joist Headers: Joist hangers are attached to multiple joists just as they are attached to top splines. Follow the architect's plans and manufacturers installation instructions carefully for joist hanger specifications. Make sure multiple joists are laminated together as per manufacturer's recommendations.

At gable-ends and other places where wall panels extend up above the floor level, the edge joists (which run along wall parallel to the spanning joists) also need to be nailed and glued into the panels they rest against. This is done to prevent deflection of the floor next to the wall. Nail and glue the edge joists through the top and bottom of the joist flanges as shown in Figure 25. Use 12d nails (minimum) at a spacing of 12" o.c.

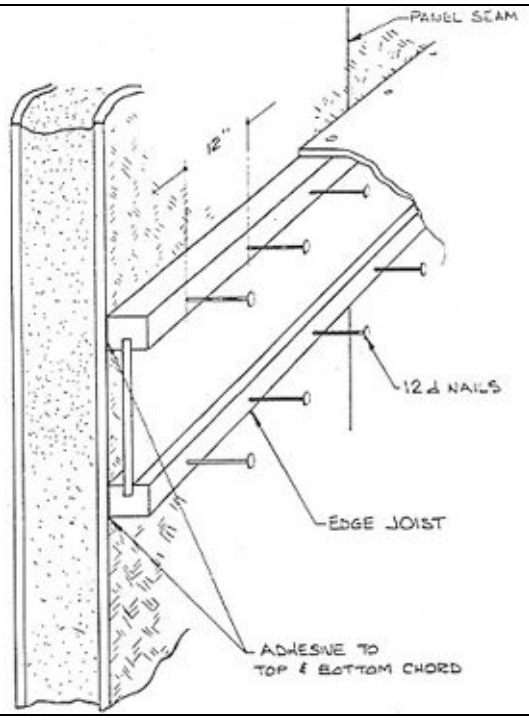


Figure 25: Securing Edge Joist to Sidewall: Glue and nail the edge joists to the wall panels at both the top and bottom to prevent deflection of the floor at the wall edge.

3. Installing Second-Floor Deck

With the second-floor joists in place, the subfloor is then installed. Use the subfloor layout from the second-floor framing plan (note starting point for placing subfloor sheets); ¾" tongue-and-groove OSB is most common. As with the first-floor deck, lay the sheets of flooring perpendicular to the joists and flush with the outside of the wall or covering the edge joists (whichever situation exists). Stagger the sheets as was done on the first floor. Place a bead of construction adhesive on the top of each joist before laying the subflooring, as shown in Figure 26. Only glue as much as you can cover within the setting time of the adhesive, as recommended by the manufacturer.

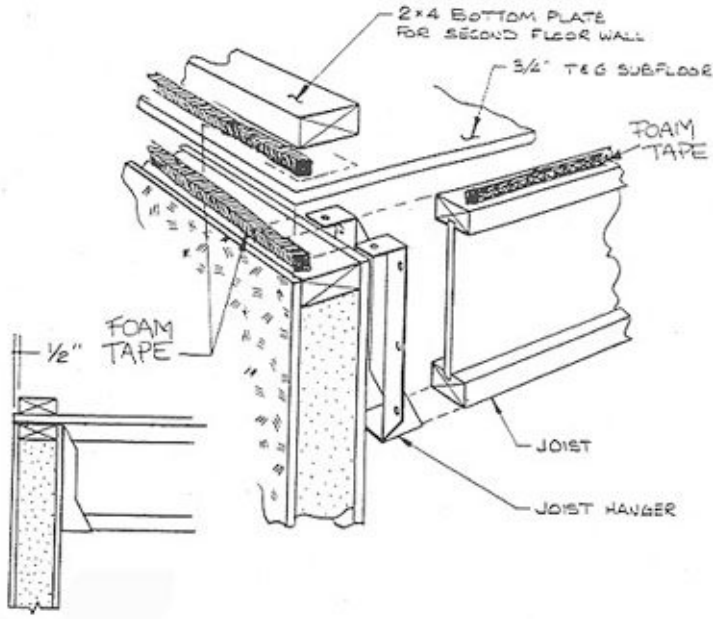


Figure 26: Laying Second-Floor Deck: The second-floor decking extends all the way to the outside of the wall panels to fully tie the walls together. Apply foam tape as shown, both on the top spline and joists. Once decking is installed, the bottom splines for upper walls are secured (use the same order of assembly as with the first floor). The bottom splines should be set ½" in from the outside edge of the decking.

4. Setting Bottom Spline for Upper Walls

With the floor deck in place, install a 2" x 4" bottom spline (bottom plate) on the long walls first as you did on the first-floor deck. It 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 20). Secure the spline with adhesive and 16d nails or 3" screws, 6" o.c. in two staggered rows.

VI. INSTALLING SECOND-STORY WALL PANELS AND ROOF BEAMS

The same procedures are used here as for the first-story walls (see Section IV) although the tops of the panels are often specially cut to match the roof slope. Cap all wall panels with 2" x 4" top splines or beveled splines as specified. If an attic floor is called for at this location, install joist hangers as discussed for the second floor except that the joist hanger brackets will need to be bent so that the joist hangers can hang vertically (see Figure 31). Gable-end wall panels often support laminated beams, which carry much of the roof load as shown in Figure 19. These beams are installed in exactly the same way as they were for second-floor girders, described previously. If supporting posts are called for in the plans, install them as specified. There are generally three laminated beams installed in this manner: two purlin beams in mid-span and one ridge beam at the roof peak. There may be additional roof beams, depending on the house design, or there may not be a beam at the ridge. 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. For ease on the construction site, laminated roof beams should be set into place with a crane and one man at each gable end peak (Figure 27). The 2" x 4" scabs should be attached and all prep work should be done on the beam pockets before the beams are hoisted onto the roof. Refer to the framing plan.

Figure 27: Setting Roof Beams: Beams are most easily installed with a crane. Finish all the prep work (securing scabs, installing joist hangers, etc.) before the crane arrives to reduce idle crane time.

1. Install Temporary Braces Between Roof Beams

Before installing roof panels, the roof beams must be braced and supported to prevent movement or deflection during installation of roof panels. To prevent the centers of the roof beams from spreading or pushing in while under unequal pressure during installation of roof panels, you must install temporary bracing as shown in Figure 28. This brace has excellent strength both in compression and tension. Bracing should be spaced no more than 12' o.c. Once final interior framing is completed, the brace(s) can be removed.

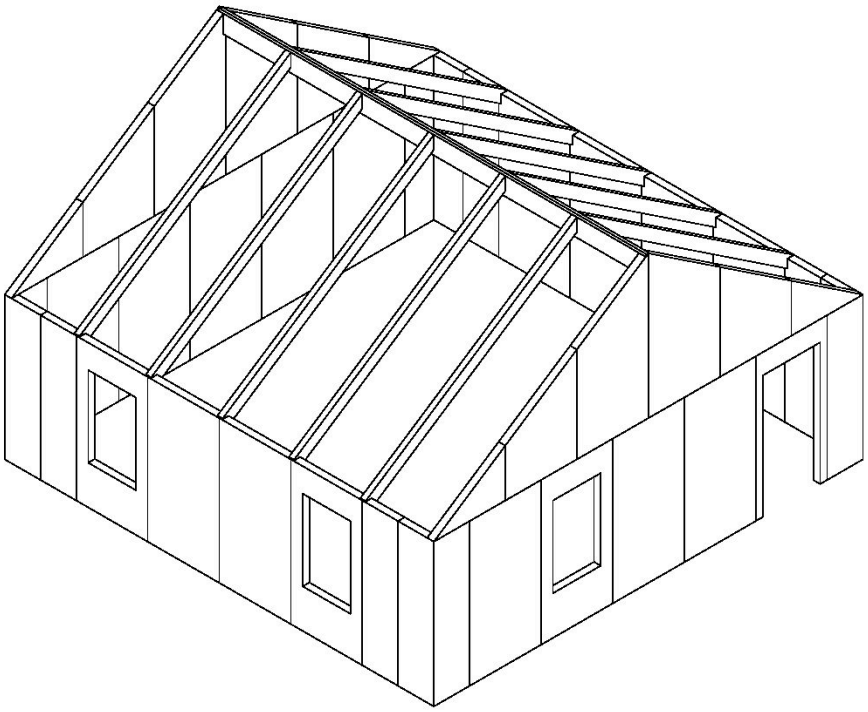


Figure 28: Temporary Bracing for Purlin and Ridge Beams: Temporary bracing for purlins is required while roof panels are installed to prevent spreading or movement. Bracing is removed after interior partition walls have been framed-in.

2. Install Custom-Cut Bottom Spline for Roof Panels

There are two different ways to secure roof panels at the eaves. Follow plans carefully. With steep roof pitches (generally over 12:12), the bottom edges of roof panels may fit into specially cut bottom splines, which are secured to the attic subfloor as shown in Figure 29. Because this bottom spline is used for a panel installed at an angle, it is custom-cut for the precise roof angle in the plans. Install the bottom roof spline so that the inner skins of the wall and roof panels line up. With a floor deck, the spline will be secured on top of the subflooring. The roof spline will be cantilevered over the wall panel somewhat, the amount dependent on the roof pitch. Secure the bottom roof spline into the attic subfloor and/or top spline of the wall panels with construction adhesive and 16d nails 6" o.c. in two staggered rows. If a roof with a large overhang or roof pitch less than 12:12 is needed, a different method is used for joining roof and wall panels at the eave. With this technique, shown in Figures 30 and 31, the roof panel rests fully on the top spline of the wall panel, which is cut at a bevel matching the pitch of the roof.

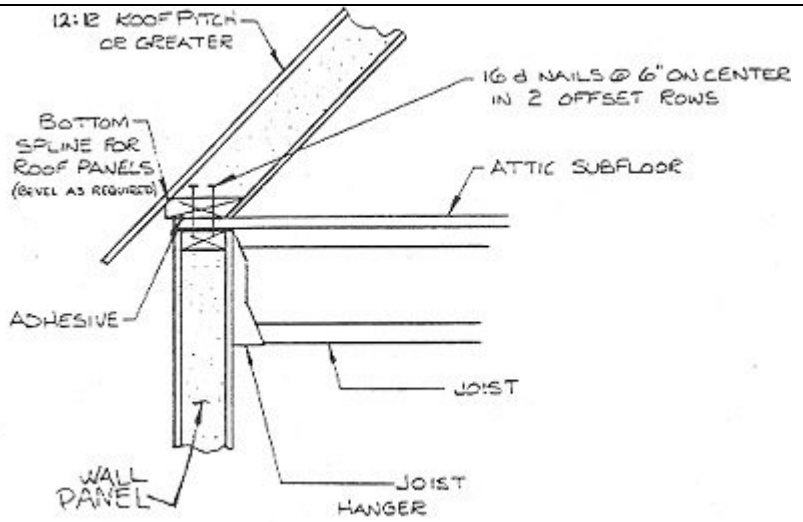


Figure 29: Installing Bottom Spline for Roof Panels: With roof pitches steeper than 12:12, a specially cut bottom spline is used at the eaves to secure the roof panels to the top floor deck or walls.

A specially cut 2” x 6" (with parallelogram cross-section) is used as the top spline for the wall panels (an identical custom-cut 2” x 6" is used as the end-spline of a plumb-cut roof panel). To accept this top spline, the wall panels require special routing (they should arrive pre-routed). Secure roof panels with both long twist nails and adhesive. For 4½" roof panels, use 6" twist nails 12' o.c. set through the roof panel into the top spline. With 6½" roof panels, use 8" twist nails. Apply two beads of construction adhesive between the top spline and roof panel before nailing. With cathedral ceiling applications, temporary blocks of wood can be used to hold the roof panels in place during installation, as shown in Figure 30. See the roof panel drawings or section views for locations of such blocks. Remove blocks after the assembly is completed and the glue has set.

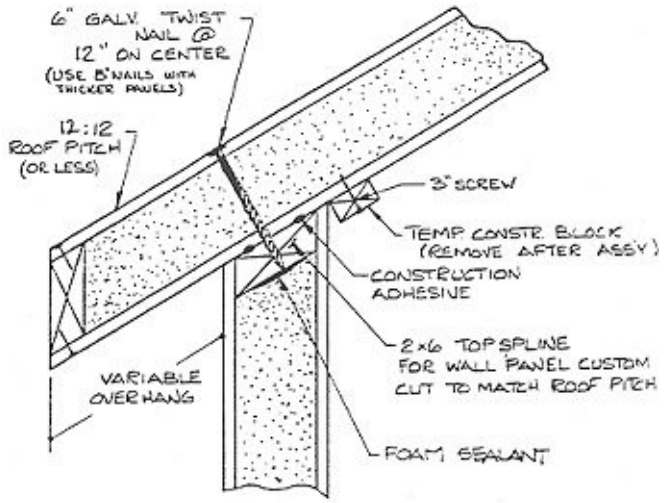


Figure 30: Wall-Roof Intersection with Shallow Roofs: If a roof with a large overhang or roof pitch less than 12:12 is needed, the wall panels are cut at the roof angle, routed-out and fitted with custom-cut top splines. Roof panels are then secured with adhesive and long twist nails.

When this detail is used in houses with an attic floor, the joist hangers will be installed as shown in Figure 31. The top flange of each joist hanger will have been bent to match the roof angle and nailed to the top wall spline. The attic subfloor and finish floor cannot extend all the way to the wall, but that will not matter since the floor will not be loaded here anyway.

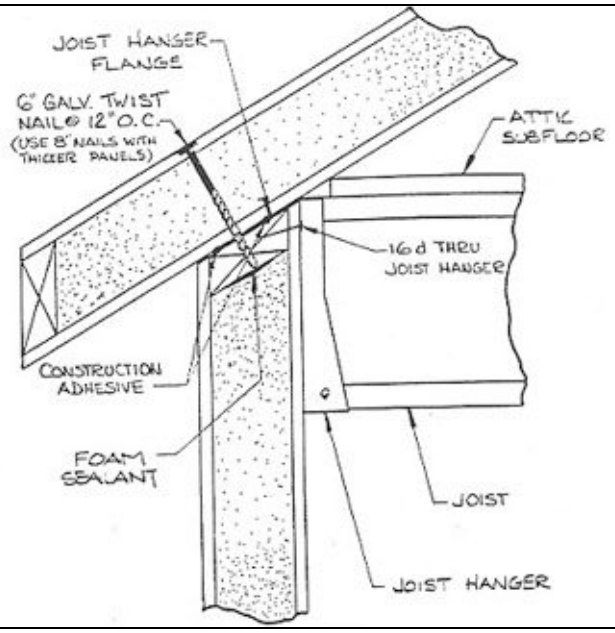


Figure 31: Attic Joist and Floor Detail with Shallow Slope Roofs: Bend the top flange of joist hangers to fit over the angled top spline on the wall panels and nail in place. The attic floor will extend above the wall-roof intersection slightly.

3. Lifting Panels Onto the Roof

Panels should be lifted onto the roof with a crane or suitable lifting device. Remember, they are being placed high and in a difficult place to handle by hand. Lifting panels up by hand or with hand winches is not recommended. A mechanical device can set panels on the roof quickly, accurately, and safely.

To lift panels onto the roof, drill a hole through each panel, offset slightly from the center (toward the top end of the panel and somewhat to the side), and insert an eye-bolt. The bolt should penetrate a section of 2” x 6" extending the width of the panel, and be secured on the bottom with a washer and nut. Use a 5/16" or larger eye bolt. It is very important to note that the bolt or attachment may fail. Under no circumstances should anyone get underneath a panel being hoisted onto a roof. Place panels in position to join them together with the use of expanding foam. This will permit the setting and attaching the panels before the foam has begun to harden.

4. Securing the First Roof Panel

Occasionally, there will be two courses of panels on each side of the roof. The lower course will span from the eave to the purlin beam, and the upper course will span from the purlin to the ridge beam (on smaller roofs, single panels will span the whole roof slope). Set all the lower panels first, on both sides of the roof. Start at one end and move along it, securing panels one by one. The first panel, which will have a 2” x 4" installed in the outer and lower edges, is lined up with the gable end wall, either overhanging or flush as called for in the plans (Figure 33). Apply two beads of adhesive to the edge of the metal splines of the gabled end and beveled side walls and one bead on the purlin bevel. Secure the panel with 6" panel screws through the panel into the beams, purlins, wall panels per nailing schedule as shown in the illustration. When thicker panels are used for the roof, use nails or screws at least 2" longer than the panel thickness.

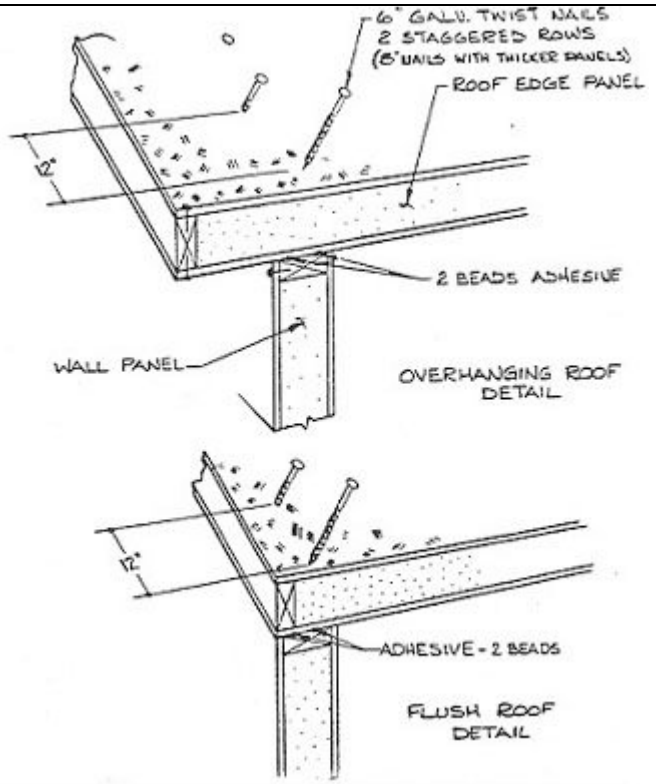


Figure 33: Installing Edge Roof Panel: Follow the plans carefully to determine the proper amount of overhang, if any. Apply two beads of adhesive and nail roof panel to the wall panel as shown.

Where the top edge of the panel will rest on the purlin, install panel screws 12" o.c. But do not set the screws tightly along the top edge of the panel until all the panels in the course are in place. In some applications, special manufacturing is provided to install a single spline along the top edge of the roof panel. The top edge of the panel should only have one groove (next to the outer OSB skin) where a single 7/16” x 3" 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 spline is required between them. At the bottom of the roof panel, the method of attachment depends on how the framing was done (refer back to Figures 29, 30 and 31). If the bottom of the roof panel fits into a bottom roof spline, attach this beveled 2” x 4" spline to the deck or top wall spline with 16d nails at 6" o.c. in two staggered rows with two beads of adhesive. Nail through the outer OSB skin into both the bottom roof spline and top wall spline using 16d nails 6" o.c. as shown in Figure 34. If possible, also nail through the inner OSB skin into the

bottom spline (from inside the house) with 6d nails 6" o.c. This may not be possible if there is a floor at the wall-roof intersection (predominantly used for the bow cape).

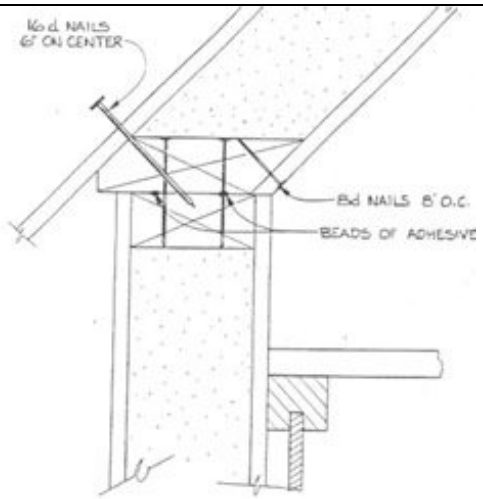


Figure 34: Securing First Roof Panel at Eave: Attachment to already-installed bottom spline in steep roofs (over 12:12) is shown. If there is an attic floor, you may not be able to nail the bottom OSB skin into the spline. For shallow roofs, see Figures 30 and 31.

If the roof panels extend down over wall panels with top splines cut at an angle as shown in Figures 30 and 31, secure the roof panels with two beads of adhesive and 6" or 8" twist nails 12" o.c. The nails extend through the roof panel and into the top spline in the wall panel. Do not nail off the top edge of the panel unless it runs all the way to the ridge. This will make it easier to join the upper row of panels to this first row, before nailing them both to the purlin.

5. Installing Other Roof Panels

Subsequent panels are installed in just the same manner. Panels are drawn tightly together by the use of the cam-locks or, where difficulty is encountered, with the aid of a come-along or ratcheting truck tie-down strap. Pull the panels together before securing them to the purlins, wall panels, or splines at the joints. Follow this procedure with each roof panel being installed. Secure the two panels together from both above and below, as shown in the illustration, making sure the OSB skins abut tightly. As each panel is joined with splines to the previous one and nailed into the purlin and bottom spline, go back and sink the nails that haven't been fully set in the previous panel. The last panel along the side of the roof will have a 2x material set into the outer edge. It will either end flush with the gable or overlap, depending on the house design. Once a full course on one side of the roof is in place, begin installing the second course of panels in just the same manner, spanning from purlin to ridge, as shown in Figure 36. At the bottom edge of the second course, make sure the panels fit into the plywood splines and secure to the purlin with twist nails 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.

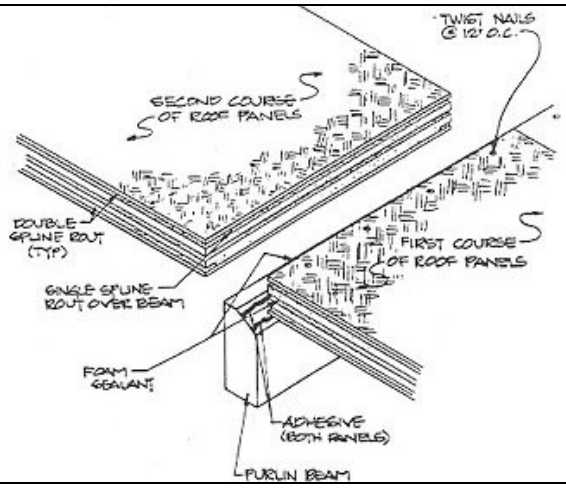


Figure 36: Installing Second Course of Roof Panels: After the bottom course of panels is in place, install the second course from the purlin to the ridge beam. Panels are joined with a single plywood spline as well as twist nails into the purlin. Apply foam sealant after joining panels.

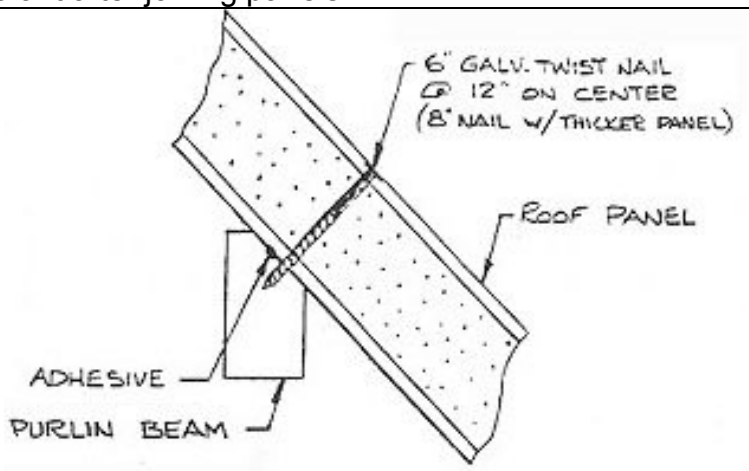


Figure 37: Nailing Full-Span Panel into Purlin: With full panels spanning from eave to ridge, apply adhesive on the purlin and space the nails 12" o.c.

The top edge of each panel in the uppermost course is usually cut for the proper roof angle. A bead of adhesive should be applied along the ridge beam and panels installed as shown in Figure 38. The panels should be placed to rest on the ridge beam and purlin, and then pulled together with the adjacent panel in the upper course (this double spline joint must be foamed after closure). Nail through the panel into the beam with 6" galvanized twist nails every 12" along the ridge (use 8" nails for thick panels). 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.

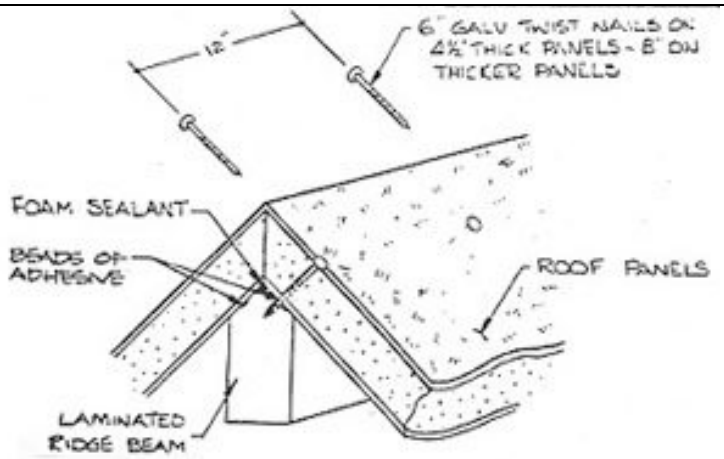


Figure 38: Securing Panels at Ridge: Roof panels are miter cut at the ridge and secured with twist nails 12" o.c.

In some cases, especially for smaller roofs, single panels will span the full roof from eave to ridge. In this case, the panels will simply be nailed into the purlins at the mid-point, as shown in Figure 37, and no horizontal spline joint will be required. Apply a bead of adhesive on the purlin, as shown, and use 6" galvanized twist nails 12" o.c. The top edge of each panel in the uppermost course is usually cut for the proper roof angle. A bead of adhesive should be applied along the ridge beam and panels installed as shown in Figure 38. The panels should be placed to rest on the ridge beam and purlin, and then pulled together with the adjacent panel in the upper course (this double spline joint must be foamed after closure). Nail through the panel into the beam with 6" galvanized twist nails every 12" along the ridge (use 8" nails for thick panels). 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. Alternatively, you can leave an intentional gap and fill it after panels on both sides of the roof are installed. Use foam sealant or caulk, depending on the size of the gap. Moisture could cause the edges of the OSB to swell, creating an uneven roof surface. In some cases, there will be no ridge beam, so roof panels will have to meet at the peak without support. In this case, the panels are joined at the peak as shown in Figure 39. Along one side of the roof, specially cut 2x material splines are inserted into routed grooves at the top edge of the panels, foamed, and nailed into place from above and below. Beveled splines for the other roof side are attached to those of the first side with two rows of adhesive and 16d nails at 6" o.c. in two staggered rows. When the final roof panels are installed, the upper routed edge (with bead of foam) must first engage the beveled plate at the ridge. The panel bottom must pivot 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 foaming groove). The panel is now pulled sideways, to close the joint (foamed) with the adjacent panel. A 4' section of plywood spline is hammered into the seam over the purlin. Attachment to purlin is as before; 12" o.c. for each panel with 6" or 8" nails, depending on panel thickness.

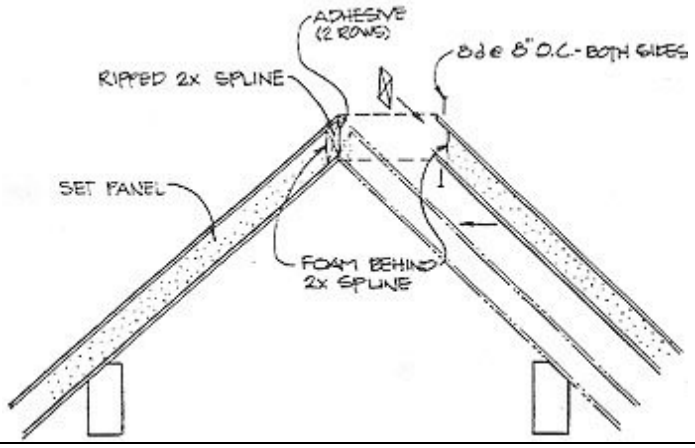


Figure 39: Joining Panels at Ridge Without Ridge Beam: Specially cut splines are inserted into the top edges of panels. Once these splines have been installed, the panels are joined with adhesive and 16d nails, angled through the OSB and into the splines.

6. Eave Details

Several different details can be used with structural insulated panels. Eave detailing is up to the builder but offered are several different details. The roof pitch and roof/wall joint details govern to some extent the eave detail, but there is considerable flexibility in design. Several common eave details are shown in Figure 40. Details using both the extended outer skin and the full overlap techniques are shown (refer back to Figures 29 and 30).

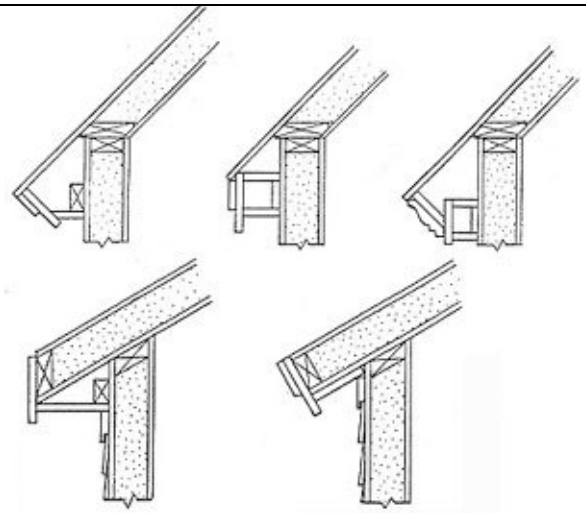


Figure 40: Eave Details: Eave detailing is up to the builder. As can be seen, there is considerable design flexibility.

7. Gable-End Overhang and Rake Details

As discussed previously and shown in Figure 33, roof panels may either overhang the wall or be finished flush at gable-ends. Figure 40 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 such as that shown in Figure 41a can be used. The roof panel is

cut flush with the wall panel, 2x material is installed into the roof panel edge, and two rake boards are nailed on as shown. With an overhang, the detail is similar, except that the exposed section of panel is sheathed with a soffit and the rake boards are a little different, as shown in Figure 41b. A somewhat more ornate rake detail, such as that shown in Figure 41c, can be made by attaching a rake extension to the edge of the roof panel.

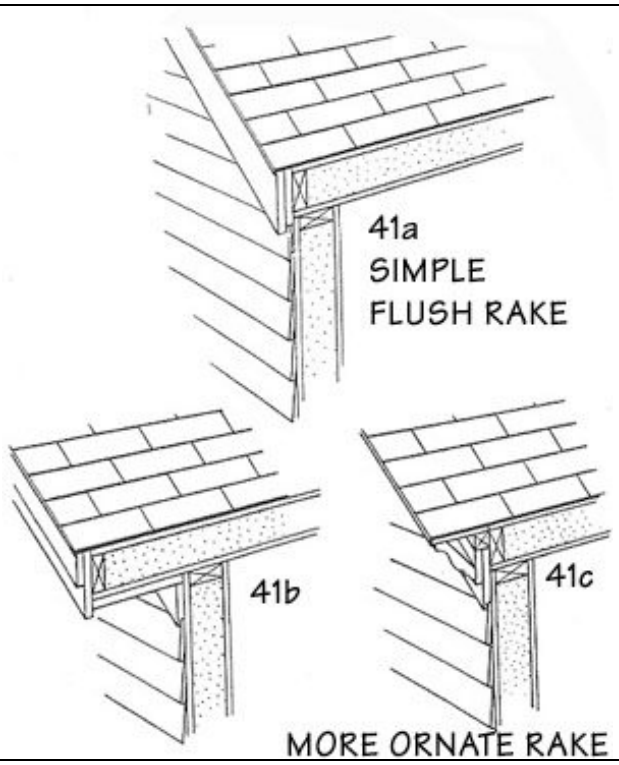


Figure 41: Rake Details: Flush and overhanging gable-end rake details are shown. As with eaves, you have considerable flexibility in design.

8. Roof Penetrations

Openings for roof windows and skylights should be framed and precut 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 one panel), 2x framing may already be inset into the routed edges of the opening. For larger openings, the 2x material 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 installed as described in the individual panel plan. If you plan on adding roof openings, make sure the structural integrity of the roof will not be affected. Consult ICS and/or your structural engineer if uncertain.

VII. FITTING WINDOWS AND DOORS

Follow manufacturer's instructions when installing windows and doors. Generally, window units will be shimmed from the inside, and then nailed from the outside through the mounting flange into the outer skin and 2" x 4". Depending on the window design in the sill area, it may be desirable to shim the bottom of the window up slightly into the center of the opening to provide a gap for foaming below the sill. Once secured in place, the window installation is completed by foaming the cavity between the window frame and rough opening. The low-expanding foam necessary is provided with the shell package. Do not use high-expanding foam in this application. It is important not to fill the cavity all the way, as the expanding foam may warp the window frame and make the window difficult to open. Set the foam nozzle ¾" into the cavity and apply a heavy bead of foam that does not totally fill the cavity, but continuously "welds" the window unit to the opening. The foam provides extremely good adhesion and will provide most of the holding power. If you find the window is difficult to open after the foam cures, you can make a kerf through the foam with a handsaw to relieve pressure. Door installation is similar to that of windows. Follow manufacturer's installation instructions for plumbing, shimming, caulking, and nailing. Foaming should be done with care as with windows.

VIII. FINISHING HOUSE EXTERIOR

Installation of exterior siding and roofing are the responsibilities of the builder. There are a number of important considerations to keep in mind, however. Before installing exterior wall siding over structural insulated panels, inspect all joints. Seal any panel joints, cracks, or gaps with a suitable exterior grade caulk or foam sealant. Horizontal siding, such as clapboards, may be installed directly over the OSB surface of panels. Felt, Tyvek, or rosin paper may be used, if desired. Since studs are not found in SIPs, siding should be installed by increasing the nail or screw pattern recommendations of the siding manufacturer by 25%, and using screws or ring-shank nails. Number 1 or clear-grade siding is recommended to cut down on possible warping or cupping. Care must be taken with board-and-batten siding. Warping or buckling of boards may be a problem, especially with wider boards. There are a number of techniques that can be used. One technique is to leave a small gap between boards and attach battens with screws through the gaps between boards. The boards are allowed to "float." With wide boards, cupping can be reduced by applying a bead of adhesive along the center of the board. Alternatively, board-and-batten siding can be applied over horizontal strapping and nailed on in a conventional manner. The use of a semi-transparent or solid color stain is recommended on the exterior siding. Because of the solid wall construction, moisture can sometimes build up between the outside of the panels and siding, causing paint to blister. Direct application of premium roofing shingles have been approved by the manufacturer and will carry the standard warranty. In some cases, it may be that a "cold roof" is recommended. A typical cold roof consists of 1x3 strapping running from eve to ridge 16" o.c. with another layer of sheathing applied on top of that. With a typical soffit and ridge vent, cold air is allowed to flow under the shingles and reduce shingle temperatures when exposed to direct sunlight. Roofing should be done according to the manufacturer's instructions. Use of textured shingles may be a good idea because they will hide slight variations in the roof surface, swollen panel edges and other imperfections. Rigid shingles, such as wood, tile, or slate should be applied over horizontal strapping according to the manufacturer's instructions.

IX. FINISHING HOUSE INTERIOR

Interior partition walls and finishing are the responsibility of the builder. Standard framing practices are recommended. Interior stud walls are secured to the wall panels with construction adhesive and screws. Apply two beads of adhesive and use 2¼" to 2½" screws o.c. in staggered rows. Before applying drywall to the interior of the house, observe the areas where the exterior panels intersect. Any gaps larger than ¼" should be foamed, and all roof/wall panel and wall corner seams should be caulked with silicon caulk. Check window openings, especially skylights, to be certain that they are tightly sealed. You may choose to use either ½" or 5/8" drywall. With the panels installed vertically, run sheets horizontally where possible. This avoids possible separation of drywall joints. To attach drywall to the panels, use 1" to 1¼" drywall screws or ring-shank nails spaced 8" o.c. around the perimeter and 12" o.c. elsewhere. Drywall adhesive is recommended but not required. It will improve the "solid" feeling of the wall. Apply beads of adhesive along the perimeter and 12" o.c. over the rest of the bonding area.

X. PLUMBING AND WIRING

Wiring chases are provided by ICS within the ICS panel where specified by the customer. Electrical boxes are foamed-in-place and ready to receive wires. ICS does not recommend putting plumbing in exterior walls. Pipes should be installed in interior walls, or come up within cabinets on exterior walls.

XI. CABINET ATTACHMENT

Backing material or nail base may be added to the interior of the ICS panel for attaching cabinets, where specified by the customer. Cabinets are generally attached by screwing them directly into stresskin walls. For optimal strength, cabinets should be hung before exterior walls have been drywalled. Lightweight cabinets can be installed after the drywall is up. Use the proper length screws to penetrate through the cabinet backs (and drywall, if it has been installed) and into the OSB, usually 1½". Because the OSB is continuous, screws can be placed closer than 16" to achieve adequate strength, with a spacing of 6” to 8" recommended. Even closer spacing and adhesive may be necessary, or toggle bolts can be used through the inner panel skin for heavy cabinets. 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 that extend up to the ceiling. Cabinets can also be secured to the top-plates and sill-plates.

APPENDIX: Cutting and Routing Panels

Structural insulated panels can be cut with large-diameter circular saws. Several manufacturers offer a 16" saw with carbide blade that works very well with most cuts. This saw has a 6 3/16" depth of cut at 90 degrees and 4 3/16" at 45 degrees. Miter cuts less than 50 degrees will require finishing with a handsaw. A handsaw may also be required for finishing corner cuts around windows and doors. Routing of panel edges is required where 2” x 4"s will be inset for reinforcement at various other locations described in this manual. A 2” x 4" spline joint is made by making a full-width rout ¾" deep in both panels to be joined. For a fully inset 2” x 4" (door and window openings. etc. are usually installed at the factory as a integral part of the panel), 1½" of foam is routed-out from the panel edge. Router heads with cutting blades for these different types of routs are available. Always rout the panels before setting them on the sill-plate. Try to do your routing in a clear area with plenty of room to maneuver. Wear goggles and a dust mask for safety. Further information on cutting and routing panels is available from ICS.

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