

CONSTRUCTION MANUAL

(2022)

**Greater Fox Cities Area
Habitat For Humanity**

Revision History

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Construction Glossary

Term	Definition
3-4-5 system	a method for squaring a corner by ensuring the creation of a 90° angle. Based on the Pythagorean Theorem, in a triangle with sides in the ratio of 3:4:5, the angle formed by the intersection of the shorter two sides is 90°.
16d nail	a 3.5" nail, often referred to as a sixteen penny nail, commonly used to attach 2x4 or 2x6 lumber together
8d nail	a 2.5" nail, often referred to as an eight penny nail, commonly used to attach roofing or deck sheathing and other OSB material to trusses, joists and studs
air seal	the use of caulk, spray foam, foam board, or sheets of poly to seal every penetration and hole in the house in order to prevent air flow from exterior to interior, interior to exterior and from one level of the house to another
back bend	see hem
baffle	a panel or other device designed to direct the flow of air
batt	a unit of flat-wrapped insulation designed to be installed between framing members
beam	a horizontal structural member designed to support loads (e.g., floor joists) that are typically positioned at a 90° angle to the beam
bevel cut	any cut made at an angle other than a right angle
blocking	short lengths of 2x4 or 2x6 (sometimes OSB) installed between studs and joists or on the tops or ends of walls to provide a nailing base for cabinets, shelving, wall rock and ceiling rock. When installed between studs, the 2x lumber face is positioned vertically and located on the side of the framing where the support is required.
brickmold	trim used primarily for exterior doors
buttlock	the bottom lip of a piece of vinyl siding, shaped like a "J", that, when snapped up tightly against the top lock of the lower course of siding, secures the two pieces of siding together
burn a foot	the practice, when measuring the length of something, of beginning the measurement at the 12" mark on a tape measure (rather than the end of the tape measure) in order to obtain a more accurate measurement. Of course, this requires subtracting 12" from the length observed on the tape measure to determine the actual length measured
C-clamp	a device in the shape of a "C" designed to hold two work pieces together
casing	see door trim, floor trim, or window trim
ceiling rock	see sheetrock

Term	Definition
<u>clearance hole</u>	<u>a hole through a piece of material large enough for a bolt or the thread of a screw to pass through, but small enough to prevent the head of the screw or bolt from passing through</u>
collated nails	nails assembled in strips of paper, plastic or wire designed to be easily inserted into and used with pneumatic nail guns
common truss	one of a number of identical trusses of uniform size placed at regular intervals along the top plates of eave side walls
cope	to cut the end of one piece of molding to match the surface of a second piece, thus forming a tight-fitting corner (preferred to using a 45-deg. miter for interior corners)
corner post	formed plastic piece attached to each outside house corner; used to provide a finished edge to the corners and to conceal the ends of siding
course	a continuous range of material, as in a row of siding, floor decking or roof sheathing
crown	the upward arch observed when looking down the narrowest edge of a piece of lumber
crude opening	see R.O.
deadbolt	locking mechanism where the bolt is moved into position by turning a knob or key rather than by spring action
door trim	finish woodwork used to decorate door openings
DRlcore	a free-floating tongue and groove underlayment with a patented moisture barrier that is installed directly onto concrete basement floors
drywall	see sheetrock
duct boot	the terminal section of a home's HVAC ductwork that directs the airflow into a room
duplex nail	a double headed nail designed for temporary attachment and easy removal
eave	the lower edge of a roof that hangs over the side of a house; it consists of both the soffit and the fascia and is where the gutters are attached
egress well	excavated area outside a basement window providing an escape route in case of an emergency
fascia	metal trim placed over the sub-fascia to protect and improve the aesthetics of the underlying wood structure
F-channel	aluminum trim, roughly shaped like an "F", installed in a single horizontal course under the eaves in order to anchor one edge of the aluminum soffit
factory edge	edge of siding or drywall that has never been cut

Term	Definition
field cut	measure and cut material to fit at the time of assembly
finish nailer	pneumatic nail gun that can handle 1¼" and 2½" collated finish nails
foam board	4'x8' sheet of extruded polystyrene foam (of varying thicknesses), also known as blue board, applied to exterior surfaces of a house and around the foundation to provide insulation against heat loss
foundation	the entire sub-structure below the first floor or frame of a building upon which the building rests; usually, partly or wholly below the surface of the ground.
floor trim	finish woodwork used to decorate the bottom of interior walls
flush sliding door	a sliding closet door built into an interior wall, one end of which intersects with an exterior wall
framing nailer	pneumatic nail gun that can handle 2⅜" and 3¼" collated nails
furring strip	a strip of wood, such as a 1"x2", used to shim out and level a surface such as a wall or framing member
gable	the upper triangular-shaped portion of the end wall of a house above the eave line of a double sloped roof.
gypsum board	see sheetrock
H-channel	aluminum trim, roughly shaped like an "H", for attaching diagonally cut soffit where porch and house soffit meet
head jamb	the top of a door frame
header	a horizontal beam that sits on top of jack studs over door and window frames to provide support and strength to those openings
hem	folding the edge of a metal sheet back on itself in order to create a finished edge
hinge jamb	the side of a door frame where the door's hinges will be attached
I-joist	a beam whose cross-section is in the shape of an "I", with flanges at the top and bottom; typically used to support the first floor of the house
insulation	material inserted inside exterior walls and above ceilings to prevent loss of heat from the house
J-block	vinyl trim piece used to mount exterior lights, outlets and other protrusions through the exterior walls
J-channel	vinyl trim, roughly shaped like a "J", installed around doors, vents and under gable end soffit to hide the edges of siding

Term	Definition
jack stud	inner stud of a door or window frame that runs up to support the header at the top of the frame; sometimes referred to as the "shoulder"
jamb	typically refers to the top and two sides of a door frame, including hinge jamb and strike jamb where a door latches; sometime refers to the 2x4 or 2x6 framing to which the door jambs are attached.
joist	a beam typically used to span widely-spaced supports; for example, to support the first floor of the house
joist hanger	metal fastener used to attach joists or other lumber when they abut a cross beam or end surface
king stud	outer stud of a door or window frame that runs the entire height of the wall
laminated beam	two members, each consisting of layers of wood veneer glued together, are nailed face-to-face to create a strong beam running the length of the house down the center; this "lam beam" supports the floor joists and is in turn supported by several floor jacks
lateral bracing	two to three rows of long 2x4's, running the entire length of the house, nailed across the tops of the bottom cords of the trusses to maintain 24" spacing of the cords for ceiling sheetrock installation
level	(1) to make level or to cause to conform to a specified grade; (2) any instrument that can be used to indicate a horizontal line or plane; (3) any surface or line with zero slope.
lockset	door locking mechanism usually comprised of a handle, latch bolt, (optional) dead bolt, and plates
LVL	Laminated Veneer Lumber is an engineered wood product with multiple layers of thin wood bonded together with adhesive
Mason's line	see string line
miter	to create a joint by beveling the ends of two pieces to be joined together; for a 90° corner, each piece is typically cut at a 45° angle
molding	see trim
nail gun	a tool that uses pressurized gas to drive sleeves of collated nails; see also framing nailer and finish nailer
nailing flange	slotted plastic extension of window frame through which nails are inserted to attach window to rough opening

Term	Definition
non-flush sliding door	a sliding closet door built into an interior wall with a King/Jack stud pair at each end
o.c.	"on center", indicating a measurement is to be taken from the midpoint of one structural element (e.g., stud) to the next structural element
OSB	Oriented Strand Board is made from thin layers of wood strips arranged in specific orientations and bonded together with wax and resin
Paslode nailer	brand of a cordless nail gun that uses a pressurized gas cylinder and a battery to drive sleeves of nails; see framing nailers and finish nailers
<u>pilot hole</u>	<u>a pre-drilled hole of slightly smaller diameter than the nail or screw subsequently driven into the hole in order to attach two pieces of material</u>
pipe clamp	a device consisting of a pipe that is usually threaded at both ends, two clamp heads or jaws, and a screw mechanism for tightening the jaws together
plasterboard	see sheetrock
plumb	a condition where a vertical component is perfectly perpendicular to a level surface
poly	see vapor barrier
proper vent	a baffle installed between trusses near the eaves to allow proper ventilation and to prevent windwashing of the blown insulation
range plenum	an assembly connected to the range hood used to exhaust warm cooking air to the exterior of the house
reveal	a visual feature created when the trim around a door or window is set back (typically 3/16") to reveal the edge of the casing
rim board	laminated board 1 1/8" x 9 1/2" installed around the entire perimeter of the foundation, nailed to the ends of the floor joists and end blocking, thereby completing the sillbox
rip	to saw lumber parallel to the grain; also called flat cutting
riser	the vertical component between each tread on the stair
R.O.	"rough opening", the dimensions framed by lumber to provide an approximate opening large enough for a window or door unit to be installed
scuttle hole	an opening providing access through the ceiling into the attic; usually located inside the entrance to one of the bedrooms

Term	Definition
sheathing	typically refers to 4'x8' sheets of OSB used to cover the roof ($\frac{1}{2}$ "), as sub-floor decking ($\frac{3}{4}$ ") and on exterior walls ($\frac{1}{2}$ ")
sheetrock	a panel of gypsum plaster pressed between two thick sheets of paper; used to cover interior walls and ceilings
shim	a thin piece or wedge of metal or wood; often inserted around doors or windows during installation to help square them or beneath a piece of lumber to level it
shingling	method of applying overlapping layers of material (e.g., tape, roofing material) such that material located vertically higher is applied after the layer of material that is vertically lower; this orientation ensures proper water drainage
short stud	a structural member that is cut less than full length, such as a studding piece beneath a window; typically designated with an "SX" on when laying out the bottom exterior wall plates
siding	finish covering of the outside walls of a house; may be made of vinyl, metal or other material
sill	framing member that forms the lower side of a window or door opening
sill plate	horizontal length of treated 2x6 laid directly on a foundation on which the framework of the building is erected
sill seal	foam material about $\frac{1}{8}$ " thick and 4" wide that is placed between the sill plate and the foundation in order to air seal that gap
sillbox	the framework created by the combination of the sill plate, floor joists and rim boards which forms the foundation for remainder of the house structure
skirtboard	decorative piece of 1"x wood (usually pine or oak) nailed to the wall and running the length of the stairs
skirting	aluminum sheet about 12" wide attached about 1" below the starter strip around the entire house; serves to provide protection to the foundation wall exterior insulating foam and for esthetics
soffit	covering, usually aluminum, for the underside of an overhang
spike	see 16d nail
stacked framing	the positioning of roof trusses directly over wall studs
starter strip	a metal strip attached near the foundation around the entire house; used to anchor the bottom edge of the first course of siding securely to the house

Term	Definition
strike jamb	the side of a door frame where the door latches
strike plate	metal plate attached to a door jamb with a hole for the bolt of the locking mechanism
string line	a high-strength cord that will not sag when pulled taut; used to create straight lines and level surfaces
stringer	the structural element (usually 2x12 lumber) that supports the treads and risers of a stair; typically, there are three stringers, one on each side of the stairs and one in the middle
stud	a vertical framing member, usually 2x4 or 2x6, cut by the supplier to a standard length of 92 $\frac{5}{8}$ "; used to construct walls
sub-fascia	2x6 lumber attached horizontally to the ends of roof trusses
sub-floor decking	$\frac{3}{4}$ "x4'x8' sheets of tongue-and-groove OSB nailed to the sillbox
swing	the direction in which a door opens (e.g., "open's right" or "opens left")
tack	to partially drive a nail only far enough to secure work pieces together in order to make it easier to remove later
timber screw	a heavy-duty wood screw that can be used in place of lag screws. When driven through both top plates and into the truss from below, they hold the roof firmly to the walls of the house
toenail	drive a nail obliquely (on a slant) to attach two pieces of lumber
tread	the horizontal component of a stair (i.e., the part that is stepped on)
trim	see door trim, floor trim, or window trim
Truslock	a spacing tool designed to lock trusses in place when erecting the roof
truss	a structural frame, based on the geometric rigidity of the triangle, designed to support a roof
undersill trim	vinyl trim, roughly in the shape of a "U", for locking vinyl siding under soffit "F" channel on eave side of house and under windows
vapor barrier	material used to retard the flow of vapor or moisture into walls and thus prevent condensation within them; the vapor barrier must be a part of the warm side of the wall
wallboard	see sheetrock
wall jack	metal framework attached to the exterior of wall studs; used to support planking on which workers stand while erecting the roof
wall rock	see sheetrock
wind bracing	4'x8' sheet of OSB attached to the wall framing on the corners of the house and some central locations in order to strengthen and stabilize the structure

Term	Definition
window trim	finish woodwork used to decorate window openings
windwashing	the rearrangement of blown insulation due to movement of air through the attic
x-bracing	pairs of long 2x4's nailed from the peak of the end truss diagonally down one side of the top chords of the common trusses; nailed in an "X" pattern, this bracing prevents lateral movement of the truss system

Chapter 1. Beam and Sill Plates

1.1 ESTABLISHING SQUARE SILL PLATE CHALK LINES

1.2 INSTALLING TREATED SILL PLATES

1.3 INSTALLING LAMINATE BEAM

1.4 INSTALLING EGRESS LADDERS AND COVERS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Reciprocating saw
Drill with 3/4" & 1 1/2" wood auger bit
Drill with 1/2" masonry bit
Framing square
String line
Chalk line
Wood chisel
Caulk gun
Ratchet wrench and socket
30' tape measure
50' tape measure
6' level
Stepladder
Extension ladder

Materials needed:

2x6 treated lumber
2x4 lumber
Laminate beam
Sill seal
Egress ladder
16d nails
8d nails
1/4" x 1 3/4" Concrete screws
1/4" x 2 3/4" Concrete screws
3/8" x 2 3/4" Power/wedge bolts
1 5/8" Exterior screws
5/16" x 1 1/2" Lag screws
1/2" Nuts
5/16" Washers
1/4" x 1" Fender washers
Flat metal shims
Air sealing caulk
Spray varnish

Personal Protection Equipment:

Safety glasses (required)
Hard hat – below deck (required)
Ear protection (recommended)

Reference Materials:

House Plan
Manufacturer's Layout Plan

Safety First! Review the Safety Checklist before performing tasks in this chapter.

1.1. ESTABLISHING SQUARE SILL PLATE CHALK LINES

1.1.1. Checking the Foundation

1. Before marking the foundation, use a broom to remove any debris from the horizontal surfaces of all foundation walls.

1.1.2. For Square or Rectangular Foundations

1. At each corner of the foundation, measure in $4\frac{1}{2}$ " from the outside wall of the foundation. Measure in from both sides of the corner and mark to create an intersecting initial corner mark.
2. With a long steel tape, "burn a foot" and measure the lengths (between marks) of the long walls. Record the measurements. If the two wall lengths differ by $\frac{1}{8}$ " OR MORE, adjust the corner marks to equalize the lengths by adding one-half the difference at each end of the shorter wall. Verify that both long walls are now the same length.
3. Repeat Step 2 for the two short walls.
4. With a long steel tape, "burn a foot" and measure the diagonals between the corner marks to check for square (see Figure 1-1). If the measurements differ by $\frac{1}{8}$ " OR MORE, adjust the corner marks at each end of the short diagonal by lengthening the corresponding long wall by one-half the difference. Verify the two diagonal measurements now differ by less than $\frac{1}{8}$ ".

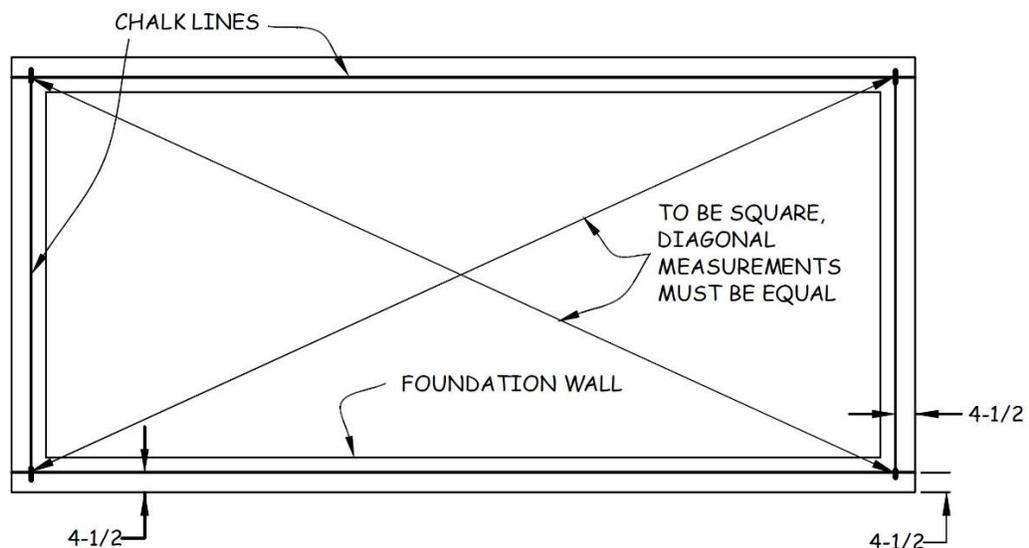


Figure 1-1. Squaring Foundation Lines.

5. Snap chalk lines on all four walls.

- Check each wall for bow every 5'-8' by measuring from the outside of the foundation to the chalk line. If the chalk line does not fall on the 4½" mark, move the entire line in or out as needed in a PARALLEL fashion (to maintain equal wall lengths) by adjusting the marks at the corners. Snap a new chalk line with a different color.

NOTE: The length of the wall being moved is unchanged, but the length of the perpendicular wall IS changed.

- Spray all chalk lines with clear varnish.

1.1.3. For L-Shaped or Irregularly-Shaped Foundations

- At all outside corners of the deck (Points 1, 5, 6, 3 and 2) measure in 4½" from the outside wall of the foundation. Measure in from both sides of the corner and mark to create intersecting initial corner marks.
- With a long steel tape, "burn a foot" and measure the distance between Points 1 and 2 (= Line 1-2) and between Points 3 and 2 (= Line 3-2). Using these measurements, locate and mark Point 4.

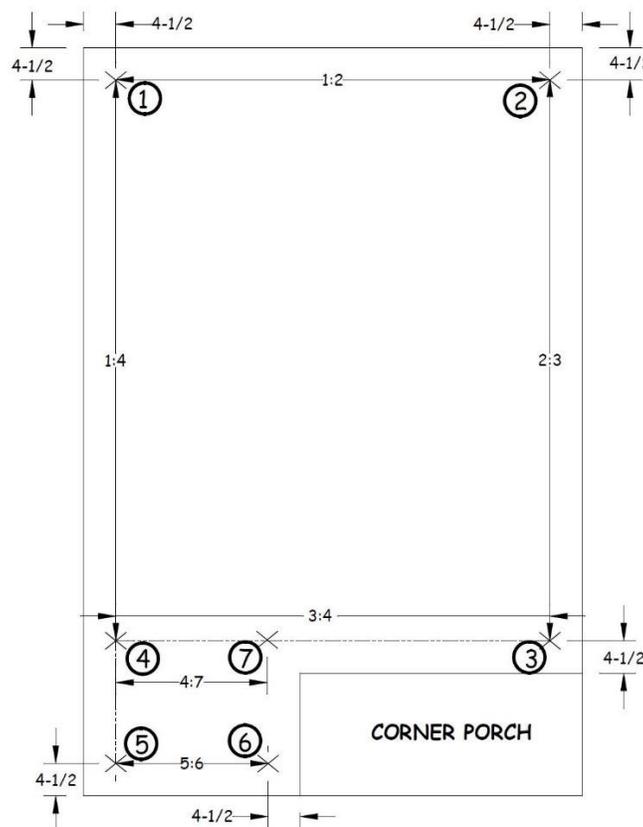


Figure 1-2. Sill Plate Layout with Corner Porch.

3. With a long steel tape, “burn a foot” and measure the diagonals between Points 1 and 3 and between points 4 and 2 to check for square. If the measurements differ by $\frac{1}{8}$ ” OR MORE, adjust the corner marks at each end of the short diagonal by lengthening the long wall by one-half the difference. Verify the two diagonal measurements now differ by less than $\frac{1}{8}$ ”.
4. Measure Line 5-6 and use this measurement to locate Point 7 on Line 4-3.
5. Measure Line 4-5 and Line 6-7. If not equal, adjust either Point 5 or Point 6 to ensure that Line 5-6 is parallel with Line 4-3.
6. In a similar manner, measure Lines 5-6 and 4-7. If not equal, adjust Point 6 or Point 7 to ensure that Line 6-7 is parallel with Line 1-5.
7. Snap chalk lines on all walls.
8. Check each wall for bow every 5’-8’ by measuring from the outside of the foundation to the chalk line. If the chalk line does not fall on the $4\frac{1}{2}$ ” mark, move the entire line in or out as needed in a PARALLEL fashion (to maintain equal wall lengths) by adjusting the marks at the corners. Snap a new chalk line with a different color.

NOTE: The length of the wall being moved is unchanged, but the length of the perpendicular wall IS changed.

9. Spray all chalk lines with clear varnish.

1.2. INSTALLING TREATED SILL PLATES

1. Trim any foamboard that extends above the top surface of the foundation so that it is flush with that surface. If the poly sheet is intact, do NOT remove it. Later, it will be extended over the outside of the rim board installed in Section 2.1.3.
2. Use a string line to check the straightness of the chalk lines created in Section 1.1. If any lines are not straight, re-snap them using a different color chalk.
3. Install sill plates on the short walls first. Notch sill plates at the beam pockets so they are flush with the edges of the pockets.
4. Check both long walls to see if any foundation bolts occur where an I-joist or LVL beam eventually will be installed, as specified in the Manufacturer’s Layout Plan. Measuring from the outside edge of the sill plate on the corresponding zero short wall, use a red crayon to mark any bolts that land where an I-joist or LVL beam will be installed. These will need special attention as described in Step 9 below.
5. Place foam sill seal on top the foundation, at least 1” back of the chalk lines. The sill seal should be about 4” wide. If the roll of sill seal is greater than 7” wide cut the roll in half yielding two discs.

6. To make sure that each sill plate member can be attached to at least two of the foundation bolts, determine the layout of 2x6 treated sill plate members for the entire foundation. Then, cut pieces for each wall to length.
7. Position the sill plate on top the foundation and against the exterior edges of the bolts. Ideally, the sill plate should be oriented so that any crown is up and any edge with wane (an edge with insufficient wood) is either positioned up and to the inside of the foundation or down and to the outside of the foundation.
8. Using a speed square, mark the location of foundation bolt clearance holes by drawing two parallel lines on the sill plate representing the outside edges of the bolt (see Figure 1-3). Determine the distance from the chalk line to the center of the bolt. Measure that distance from the interior edge of the sill plate and draw a line between the two parallel lines.
9. Use a 3/4" or 7/8" bit to drill clearance holes in the middle of the short line created in the previous step. If a hole corresponds to a bolt highlighted in red from Step 4 above, **FIRST** use a 1 1/2" spade bit to **CAREFULLY** drill a counterbore deep enough so the nut and a round 5/16" washer will sit below the surface of the sill plate.

NOTE: The diameter of the clearance hole is larger than the bolt diameter in order to facilitate the correct positioning of the plates on the foundation.

10. Place the predrilled 2x6 treated plate members over the foundation bolts. Align the interior of the sill plates with the chalk line. Secure sill plates by installing a round 5/16" washer on top of a rectangular concrete form tab over each foundation bolt followed by a 1/2" nut turned tight. If the hole has been counterbored, **ONLY** use a round 5/16" washer; then, after attaching the 1/2" nut, use a reciprocating saw with a metal blade to cut the protruding stem of the bolt off at the surface of the sill plate.

NOTE: Don't over-tighten the nuts to the point where the sill plate begins to sag or buckle as this creates problems when rim boards and floor joists are installed later.

11. Apply air sealing caulk between all sill plates where they abut and toenail the plates with 8d nails.
12. Sight along the top of the sill plates to ensure they are straight and there are no valleys or hills. To test, run a string line along all four sides. If necessary, use 1/4"x2 3/4" concrete screws (or 3/8"x2 3/4" power/wedge bolts, whichever is more appropriate) to flatten sill plates.



Figure 1-3. Sill Plate Installation.

13. Lay a thick bead of air sealing caulk on the interior side of the sill plate where it meets the foundation (see Figure 1-3). Make sure there are no gaps in the caulk when the application is complete.

NOTE: Do NOT apply air sealing caulk if the temperature is below 40°F or if the foundation surface is wet. If either condition exists, the caulking must be postponed to the next build date.

1.3. INSTALLING LAMINATE BEAM

1. Using the dimensions from the foundation wall to the beam as shown on the House Plan, mark the location of the beam on the concrete wall below the pocket.
2. Remove any protective covering that may encase the beam. Check the beam for any indication that a particular edge of the beam is designated as “UP”. If such a designation is found, be sure to position the beam in the correct orientation.
3. To determine the required beam length, measure from the back edge of the beam pockets on each end of the basement walls (take two independent measurements). Subtract 1” from the overall length and lay out that measurement on both sides of the beam. Double-check the length before cutting. Set the depth of the circular saw blade to ½” and SCORE both faces of the beam at the marked length.
4. Use 16d duplex nails to securely attach a temporary piece of 2x4 near the middle of the beam. This 2x4 must be sufficiently long (scab two pieces together, if necessary) to extend from the beam to about 6” beyond the outside edge of the foundation. Assign one person to hold the end of the 2x4 nearest the foundation until the beam is securely in both foundation pockets.

WARNING: It is critical that the person holding the long 2x4 maintain a secure grip to stabilize the beam as it is being installed in the foundation pockets and prevent it from swaying or falling over.

5. Install the beam in the foundation pockets by first positioning the beam on a long side wall so that both ends of the beam extend over the sill plates on the two short walls. Carefully slide the ends of the beam toward the pockets in the middle of the short walls. When both ends of the beam are positioned over the pocket, carefully move the beam forward until the end that is NOT scored drops into the pocket.
6. Elevate the scored end of the beam 6-12" above the level of the sill plate using 2x scrap. Trim the beam to length with a reciprocating saw, using the score lines as guides. Carefully remove the scrap 2x blocking, one piece at a time, and lower the beam into the pocket.
7. Place the beam so there is a ½" gap between each end of the beam and the back end of each pocket and so the beam is aligned with each of the marks on the concrete wall below the pockets that were established in Step 1 above.
8. Securely attach the temporary piece of 2x4 nailed to the beam in Step 4 by nailing it to the sill plate or by drilling a hole near the end and placing it over a foundation bolt. This will help stabilize the beam while support posts and I-joists are being installed.
9. Mark the mid-point of the width of the sill plates (2¾" from the outside edge of the sill plate) at both ends of the beam. Consult the Construction Supervisor if either sill plate is tipped downward toward the exterior of the foundation. Otherwise, set a 2' level as a straightedge on top of one end of the beam and extend it over the adjacent sill plate. Using flat metal shims, raise or lower the beam until the end of the level hits the sill plate at the mid-point mark. Repeat at the other end of the beam.
10. Wedge pre-cut treated lumber spacers (located in the Beam Bin in the trailer) securely between the sides of the beam and the concrete in the beam pocket. Square the beam to the foundation wall by placing the long leg of a framing square on top the foundation wall and hanging the short leg down against the face of the beam.
11. Attach support posts to the underside of the beam at proper locations according to the House Plan. Use four 5/16"x1½" lag screws and 5/16" washers to fasten the support post plate to the bottom of the lam beam making sure it is flush to the finished basement side of the beam. Set the bottoms of the posts on the concrete pads and roughly plumb them, but do not anchor at this time.

REQUIREMENT: The threaded adjustment screw and plate must rest on the concrete pad.

12. Approximately 6"-12" from one end of the beam, attach a Beam String Jig (located in the Beam Bin) to the bottom of the beam using four 1⅝" exterior screws. Repeat with the second jig at the other end of the beam. Attach a string line to the slot in one of the

jigs and pull it tightly through the slot in the jig at the other end of the beam. Secure the line by tying it to the remaining slot in the second Beam String Jig.

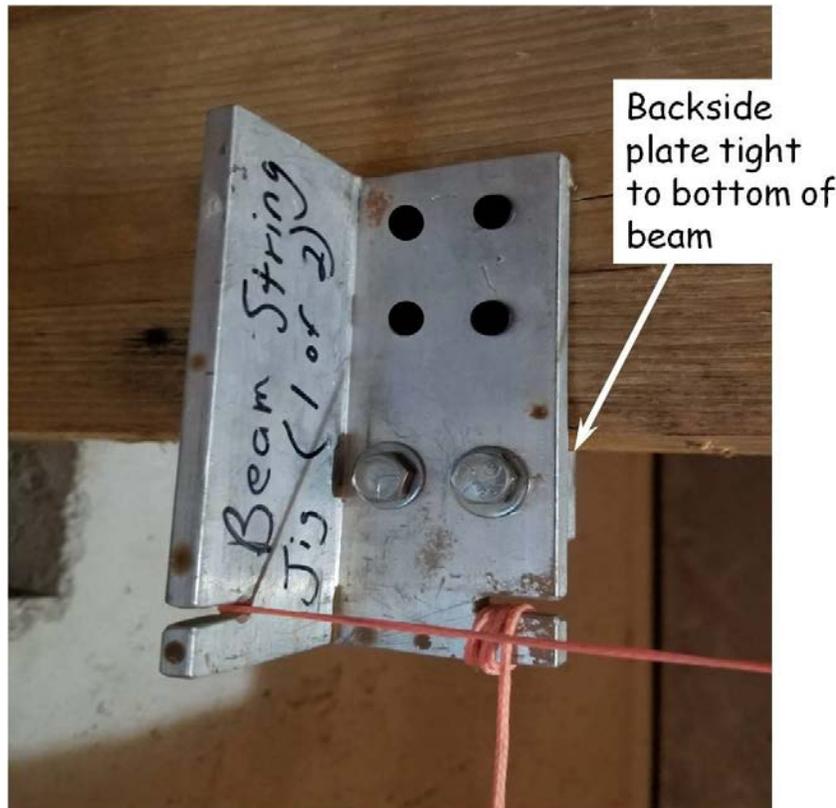


Figure 1-4. Beam String Jig.

13. If the beam is bowed, nail additional 2x4's from the beam to the sill plate, between floor joist locations, holding the end 2" back from the outside edge of the plate (to allow for later installation of the rim board). Confirm that the face of the beam is straight and parallel with the string using a scrap piece of 2x4 as a gauge block on the face of the beam along the entire length of the string.
14. Finish installing the posts. Plumb the posts and re-check that the beam is still straight. Attach each post to its concrete pad by first placing a 1/4"x1" fender washer over each of the holes in the bottom post flange and then securing with 1/4"x1 3/4" concrete screws through each washer into the pad.
15. Confirm that the bottom of the beam is straight and parallel with the string using a scrap piece of 2x4 as a gauge block on the bottom of the beam along the entire length of the string. Adjust the support posts vertically until the bottom of the beam is straight (these settings can be approximate at this point).
16. Check each I-joist above a post and the two end I-joists for crown by sight or use of a string line. All of these I-joists should be straight or have a slight crown up. Verify that

the top of the beam at the pockets is flush with the top of the sill plates at the mid-point mark established in Section 1.3.9. If not, consult the Construction Supervisor.

17. Remove the adjustment pins from the support posts.
18. Leave the string line in place. It will be used to confirm the beam location during I-joint installation.

1.4. INSTALLING EGRESS LADDERS AND COVERS

1.4.1. Install Egress Ladders

1. Remove the temporary wood egress cover and the metal egress cover underneath it in order to gain access to the egress well.
2. Hang the egress ladder on the rim of the egress well wall opposite to, and approximately centered on, the window.
3. Using a level, make sure the ladder is plumb.
4. Drill through the bottom two holes in the ladder into the egress well wall with a 3/16" drill bit.
5. Attach the ladder to the egress well wall by installing one 1³/₄" concrete screw into each hole.

1.4.2. Install Egress Covers

1. Set the metal egress cover in place - no fasteners are required.
2. Replace the temporary wood egress cover over the metal egress cover. This gives enough strength to stand on or place ladders on the egress cover when working and keeps dirt and straw from going into the egress well during landscaping.

Chapter 2. Cap Foundation

- 2.1 INSTALLING I-JOISTS AND SILLBOX
- 2.2 FRAMING STAIR OPENING
- 2.3 INSTALLING FOAMBOARD IN SILLBOX
- 2.4 INSTALLING SUMP PUMP HOSE
- 2.5 INSTALLING FLOOR SHEATHING (DECKING)
- 2.6 BASEMENT PREPARATION

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Framing nailer
I-joint cutting jig
I-joint layout jig
Sledgehammer
Adhesive applicator
Framing square
String line
Chalk line
Stepladder
Extension ladder

Materials needed:

1½”x9½” Rim boards
Floor I-joists
¾” Tongue & groove decking OSB
1” Foamboard
Tapered shims
16d nails
8d nails
¾” Collated nails
2⅜” Collated nails
Joist hangers
Joist hanger nails
2” Button nails
5/16”x4” Lag screws
5/16” Washers
House wrap
Construction adhesive
Air sealing caulk
Radon caulk

Personal Protection Equipment:

Safety glasses (required)
Hard hat – below deck (required)
Fall protection harness (required)

Reference Materials:

House Plan
Manufacturer’s Layout Plan

Safety First! Review the Safety Checklist before performing tasks in this chapter.

2.1. INSTALLING I-JOISTS AND SILLBOX

2.1.1. Installing I-Joists

1. Before proceeding with any installation, check the Manufacturer's Layout Plan and the House Plan for details (consult the Construction Supervisor if there are any differences). Verify that all materials are present in the stated dimensions. Note areas on the plan where specific dimensions will be needed.
2. Starting at the zero end as specified on the House Plan, place the end of a measuring tape on the exterior edge of the short wall sill plate and lay out the I-joist centers (typically 19.2" apart on both long wall sill plates and the lam-beam. Once the centers have been marked, use the joist layout jig to mark the two sides of the I-joist locations for each center mark and place an "X" between the marked sides for full-length joists and an "SX" for any joists shorter than full-length (typically around the stair opening). The last I-joist is typically located by measuring back 19.2" from the non-zero end of the wall in order to allow room for mechanicals.

NOTE: The diamond mark on most measuring tapes corresponds to multiples of 19.2".

3. Check the width of the rim boards (typically, they are 1 1/8", but can vary by as much as 1/8"). From the outside edge of the sill plate, measure in the thickness of the rim board on the sill plates at all four corners and snap a chalk line around the perimeter of the sill plate. This line will be used to position the I-joists. Be sure to check the line for straightness (e.g., by using a string line).
4. At both ends of the house and in the middle of the long walls, measure the distance from the chalk line on one long wall to the chalk line on the other long wall. If all three measurements do NOT agree, re-snap one or both of the lines. Recheck lines for squareness.
5. To install an I-joist, first verify that at least one end of the I-joist is square (if neither end is square, square up one end). Set the I-joist on a joist location mark made in Step 2 above so its square end is resting on the zero wall covering half of the chalk line. Mark the other end of the I-joist where it intersects the chalk line on the opposite sill plate. Cut the I-joist to that length using a circular saw and the I-joist cutting jig.

NOTE: It is better to cut the I-joist slightly short of the line rather than slightly long of the line. A short joist can always be shimmed out.

6. Position each I-joist on a joist location mark with the end on the zero wall covering half of the chalk line. Check the I-joist for wording on its face, and install so the wording is right-side up. Nail I-joists into the sill plate using six 3/4" collated nails total: at each end, one nail into each side of the flange a minimum of 2" from the

end (to avoid splitting the flange); one nail into each side of the flange directly over the joist location mark on the lam beam.

NOTE: Do NOT hand nail the I-joists with 16d nails as this may split the flange.

7. Not all I-joists can be installed on the first day because the concrete crew needs access to pour the basement floor. Ideally, I-joists are installed at both ends of the foundation and near each support post. If time allows, other I-joists can be cut and stacked next to nearby I-joists that were permanently installed.

NOTE: Installing I-joists near the support posts helps to stabilize the posts and the lam beam when the concrete floor is being poured.

2.1.2. Installing End Blocking

1. Use I-joist material for end blocking. Beginning at the zero end, mark end blocking locations on the short wall sill plate every 32" o.c. from the outside edge of the long wall sill plate.

REQUIREMENT: When measured center-to-center, the spacing of the end blocks CANNOT be greater than 32".

2. The 32" spacing needs to be adjusted when either of the following two conditions is encountered:
 - a. If the blocking location falls on a foundation bolt, move the marks for the location several inches closer to the previous set of blocking marks in order to position the blocking so it does not fall on the bolt. Then, continue marking blocking locations every 32" o.c. from this adjusted mark.
 - b. If the spacing results in the center of the last end block being positioned less than 32" from the outside edge of the opposite long wall sill plate, install the last end block half way between the second to last end block and the outside edge of the opposite long wall sill plate.

NOTE: This adjustment on the position of the last end block ensures there is sufficient room for access from the basement into this area.

3. Repeat this process along the other short wall sill plate.
4. Measure the distance from the chalk line to the end I-joist at several locations along the line. Determine a common measurement that can be used for all the blocking along that wall. Cut enough scrap I-joist material to that length to create end blocks for the entire wall.
5. Set an end block on a blocking location mark made in Step 1 above. Position the flange of the blocking so the outside edge covers half the chalk line on the sill plate.

Nail the blocking – with one 3¼” collated nail on each side of the flange – a minimum of 2” from the end of the flange.

NOTE: It is better to cut the end block slightly short of the line rather than slightly long of the line. A short block can always be shimmed out.

6. After the rim board has been installed (see Section 2.1.3 below), square the blocking and nail from the rim board into the flanges of the blocking using 2¾” collated nails - one on the top and one on the bottom.
7. Flush the top of the blocking with the top of the end I-joist and make sure the blocking is square to the I-joist. Then, toenail through the I-joist into the flanges of the blocking using 8d nails - one on the top and one on the bottom.

NOTE: It sometimes helps to clamp the pieces in place before toenailing.

2.1.3. Installing Rim Boards

1. Because the rim boards bear the weight of the outside walls, the width of the rim boards should be identical to, or slightly (no more than ⅛”) greater than the height of the I-joists. If this difference is greater than ⅛”, rip the rim boards on the table saw so they are the same as, or slightly wider than, the height of the I-joists.

NOTE: Each rim board may be different (i.e., some need to be trimmed others don't), so test each rim board separately.

2. Dry fit the rim board in its intended location. Check the rim board for a crown; if it has a crown, install crown up. If the rim board sticks up above the I-joists by more than ⅛”, repeat Step 1.
3. Apply a thick bead of air sealing caulk on the sill plate where the rim board will sit. Install the rim board rough side out. Caulk the seams where rim boards abut.
4. Nail the rim board to the I-joists using 2¾” collated nails. To avoid splitting the joist flanges, use only one nail in each top flange and only one nail in each bottom flange. For the same reason, do NOT seam rim boards on I-joists.
5. Toenail the rim board to the sill plate every 6” using 2¾” collated nails.
6. Mark the locations of all end blocking on the outside face of the rim board with a black marker.

NOTE: This helps to ensure the decking is nailed to the end blocking when the foundation is capped. It also helps locate the blocking so, when erecting exterior walls, the bottom wall plates can be secured to the blocking and not to the rim board.

7. On the first construction day, any rim board above porch areas must be covered with foamboard and house wrap (see Figure 2-1).
 - a. Cut a length of house wrap that is 1-2' longer than the length of the porch. Center it on the porch and attach it to the I-joists or end blocking so it hangs over the rim board and extends down about 1" below the top of the 2" foundation foamboard.
 - b. Rip 1" foamboard to 10⁷/₈" wide. Place the foamboard over the house wrap and fasten it to the rim board with 2" button nails so it is flush with the top of the rim board and seams are staggered with those of the rim board. Attach sufficient lengths of foamboard in these areas so it extends about 6-12" beyond the edges of the porch.

NOTE: This step must be completed before concrete can be poured in the porch areas.

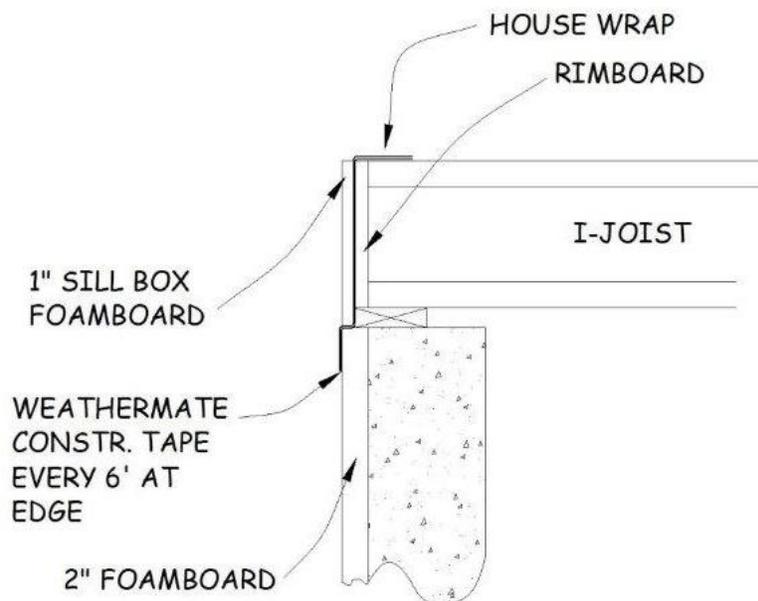


Figure 2-1. Sill Box Section.

2.2. FRAMING STAIR OPENING

1. Typical framing for the stair opening uses a combination of Laminated Veneer Lumber (LVL), lam beam and rim board material.

NOTE: Some of the following steps may need to be modified for atypical stairway configurations. Use the House Plan to guide the installation.

2. Per the House Plan, lay out joist and LVL spacing for the stairway on the sill plates and lam beam, labelling the locations for short I-joists with "SX" and the LVL positions with "LVL".

3. Stairs can run either perpendicular or parallel to the lam beam. In either case, two LVL beams extend from the lam beam to the sill plate on one long wall. A third LVL beam extends parallel to the lam beam and is attached to the two perpendicular LVL beams with joist hangers.
4. On one of the locations marked “LVL” in Step 2 above, measure from the rim board line on the sill plate to the far edge of the lam beam and add 2”-6”. Cut two pieces of LVL material to that length. Per the dimensions on the House Plan, cut a third piece of LVL material to run parallel to the lam beam between the other two pieces of LVL. Also cut a piece of rim board material to that length.

NOTE: Building Code requires the two LVL beams to extend no less than 2” and no more than 6” beyond the lam beam.

5. Layout the locations of two LVL joist hangers, one on each of the two LVL beams that run perpendicular to the lam beam. Use a scrap piece of LVL material to position the hanger so the top of the scrap piece is flush and square with the top of the LVL beam. Tack in place with three joist hanger nails – one at the top of each leg and one at the bottom of the joist hanger. Remove the scrap LVL material and secure the joist hanger to the LVL beam using joist hanger nails, one in each hole of the hanger.
6. Install the two perpendicular LVL beams on the marks established in Step 2 above and covering half the chalk line on the sill plate. Toenail the ends to the sill plate with 8d or 2³/₈” collated nails.
7. Position the length of rim board cut in Step 4 above on top of the lam beam between the two LVL beams and flush with the face of the lam beam on the stairway side of the beam. Attach each LVL beam to the rim board with five 3¹/₄” collated nails.
8. From the nearest short wall, measure the distance along the long wall from the inside edge of the sill plate on the short wall to the closest LVL beam. Repeat this measurement along the lam beam. If the measurements are not identical, adjust the location of the LVL beam on the lam beam. Mark the new location and toenail the two LVL beams to the lam beam with 8d or 2³/₈” collated nails.
9. Mark the location(s) of the short I-joist(s) on one side of the parallel LVL beam. Attach the I-joist hanger(s) to these locations, using a scrap piece of I-joist to position the hanger so the top of the scrap piece is flush and square with the top of the LVL beam. Secure the joist hanger(s) to the LVL beam using joist hanger nails, one in each hole of the hanger.
10. Place the parallel LVL beam in the joist hangers installed in Step 5 above with the joist hangers outside the stairway opening. Secure the LVL beam inside the joist hanger using 16d nails, one in each hole.
11. Measure the length of the two I-joists located at the ends of the parallel LVL beam and cut all short I-joist(s) extending from the sill plate to the parallel LVL beam to that

length. Position the I-joist(s) in the joist hangers, securely. At the other end, attach the I-joist(s) to the sill plate with 3¼” collated nails, one into each side of the flange.

12. Check perpendicular LVL beams for bow. If necessary, straighten and brace with angled 14’ or 16’ long pieces of 2x4 attached under the I-joists. These will be removed after the deck is installed.
13. Install the temporary stair cover by first attaching the temporary cover support ledgers (lengths of 2x6 with joist hangers attached) to the inside faces of the long LVL beams using 5/16”x4” lag screws and 5/16” washers. Then, insert pre-cut 2x6 temporary joists into the joist hangers. Finally, secure the pre-cut OSB temporary covers to the ledger boards with 8d nails.

NOTE: Use hardware found in the trailer in a bin labeled “Temporary Stair Cover Hardware”.

2.3. INSTALLING FOAMBOARD IN SILLBOX

2.3.1. Preparation

1. Install 1” of foamboard in the sillbox. This may be done before or after the rim board has been installed. Installation is easier if done before rim board installation, and it helps to square up the I-joists for nailing to the rim board.
2. Determine how many pieces are needed and of what length for the entire sillbox. There are two standard sizes: 9-7/16” x 18⁷/₈” for between the I-joists and 9-7/16” x 31⁵/₈” for between the end blocking. Pieces longer or shorter than normal are also needed, typically near the stairwell opening and near the corners of the foundation.
3. On the table saw that has been designated to only cut foamboard, raise the blade to ½” above the foamboard and rip the foamboard to 9-7/16” x 8’ strips. Make sure all the safety guards are in place.

NOTE: Do NOT use the DeWalt table saw for this operation

2.3.2. Cutting Foamboard to Length

1. Five 18⁷/₈” long pieces can be obtained from an 8’ strip. For pieces that are either shorter or longer than 18⁷/₈”, determine what combination of pieces to cut from an 8’ strip to minimize waste.
2. Remove the table saw’s fence and put it into the attachment compartment below the saw.
3. To cut pieces that are 18⁷/₈”, use the “cross cut sled” riding in the left track. Make sure the sled slides back and forth freely. Position the piece of foam so that it abuts the sled stop and slide the sled past the saw blade.

4. Cut other length pieces to length with a handsaw or the chop saw.)

2.3.3. Notching Foamboard Pieces

1. Unplug the saw.
2. Remove the blade guard (loosen the two thumb screws) and put the guard in the storage area below the saw.
3. Place the “Notch Cutting Jig” on the left side of the saw table so that the blade comes through the jig slot and the jig fits securely in the left side track. Make sure the blade turns freely (no contact with the jig).
4. Adjust the saw blade height so that it is 1½” above the surface of the jig.

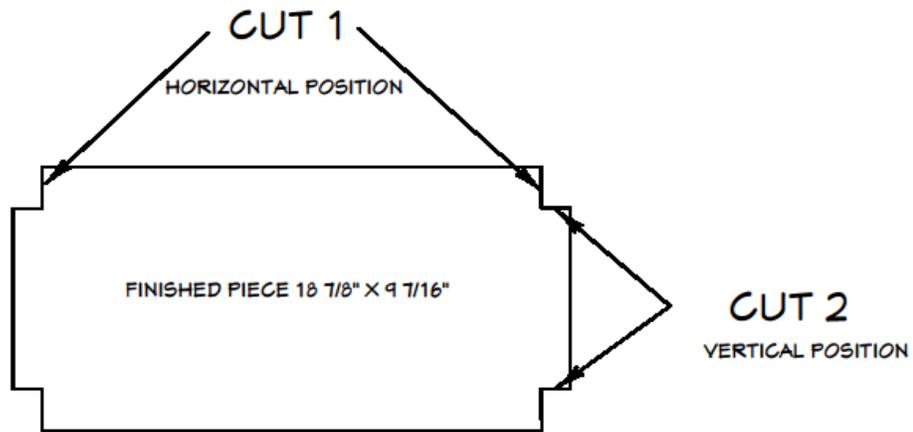


Figure 2-2. Foamboard notches.

5. Set the “adjustable notch guide” in the #1 (HORIZONTAL) notching position (lift and rotate the guide).
6. Plug the saw in and turn it on.
7. Hold the foamboard HORIZONTALLY in the jig against the stop (on the right) and push the foamboard downward into the blade until it hits the surface of the jig. Repeat for the remaining three HORIZONTAL corner cuts.
8. When all pieces have been cut HORIZONTALLY, set the “adjustable notch guide” in the #2 (VERTICAL) notching position (lift and rotate the guide as needed).
9. Hold the foamboard VERTICALLY in the jig against the stop (on the right) and push the foamboard downward into the blade until it hits the surface of the jig to complete the notching cut. Repeat for the remaining three VERTICAL corner cuts.

2.3.4. Installing Foamboard

1. Install the foamboard in the sillbox, carefully cutting around any interfering anchor bolts.
2. Between I-joists, secure the foamboard to the rim board with one 2" button nail in the center of the foamboard. Between end blocking, use two 2" button nails to secure the foamboard to the rim board.
3. Apply air sealing caulk on the inside, where the foamboard meets the sill plate and the I-joists.
4. Fill any notches around the anchor bolts with air sealing caulk.
5. Apply air sealing caulk to any seams in the foamboard.

NOTE: This process for installing the foamboard is very important because a tight air seal is needed here.

2.4. INSTALLING SUMP PUMP HOSE

1. After the sill box has been completely installed, the sump pump hose must be repositioned so it exits through a hole in the rim board.
2. Locate the I-joint bay through which the hose will exit. Choose the I-joint bay closest to the sump pump (but NOT out the front of the house) which provides the shortest and straightest run for the hose from the sump pump. If a storm sewer pipe exists, center the sump pump outlet 5-6" to the side of the pipe that is away from the corner of the house. The outlet also must be at least 12" away from the gas meter, electrical box, egress well, porch, deck, or any other exterior obstacles.
3. Using a 2½" hole saw, drill a hole centered vertically and horizontally in the sill box through the rim board (and foam board if already installed).
4. Reposition the sump pump hose so it exits through this hole to the exterior of the house.

2.5. INSTALLING FLOOR SHEATHING (DECKING)

1. Begin decking the floor at the zero corner on the side of the house that does NOT contain the stairwell. Before decking, determine the best layout of the decking. To minimize waste, determine the best I-joint on which to start a full sheet. Also, make sure that if a piece of decking is cut, the drop is useable somewhere else on the floor. Whenever possible, cut to fit at the ends of a row, although a 2"-3" overhang is acceptable. This overhang will be trimmed later after the adhesive dries.

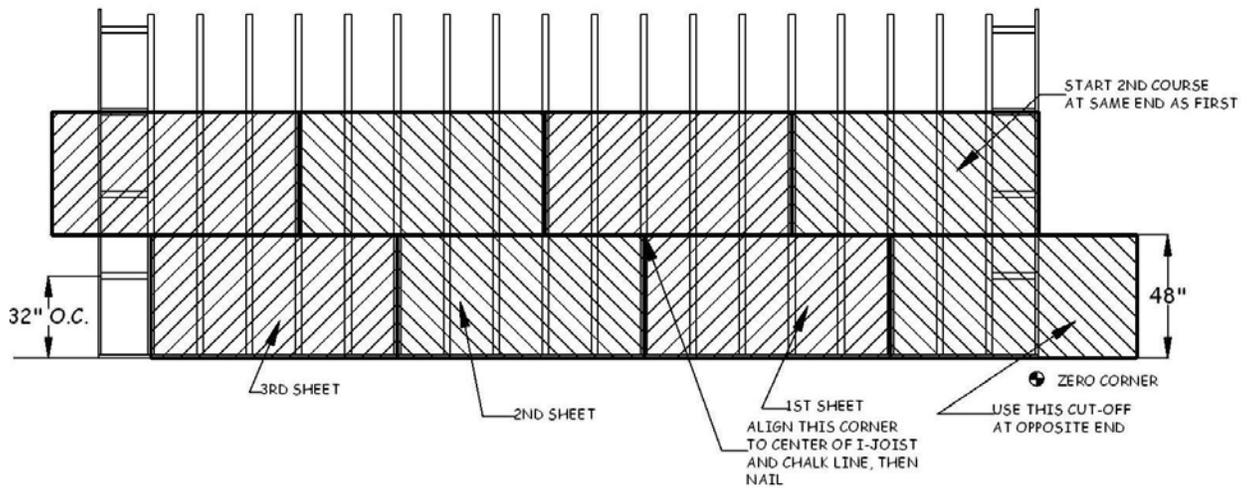


Figure 2-3. Floor Decking Layout.

2. Snap a chalk line across the floor joists at 48” from the outside edge of the rim boards on the long wall. Snap additional chalk lines at 48” intervals across the width of the foundation.
3. Apply a continuous bead of adhesive to the tops of rim boards, I-joists, and end blocking, holding it 2” back from the chalk lines created in Step 2 above. Apply two continuous beads on those I-joists where the decking edges abut. A continuous bead on the rim board creates an air seal between the decking and the rim board. Apply adhesive only when ready to install that piece of decking.

NOTE: Avoid applying excess adhesive to prevent adhesive from depositing on tools, decking, porches, and the 2x4 used when securing the decking.

4. Before laying a sheet of decking, note which side is labeled “This Side Down.” Start each row with a full sheet. Working from right-to-left, lay a ¾”x4x8 OSB (full sheet) tongue and groove floor sheathing down on the adhesive-covered I-joists, with the grooved edge flush to the first chalk line snapped in Step 2 above. Make sure the right edge is centered on the selected I-joist at both the chalk line (upper right) and the rim board (lower right). Secure the lower right corner of the sheathing to the rim board with an 8d nail. Next, make sure the upper right corner of the sheathing is still on the chalk line and centered on its I-joist. Secure it with an 8d nail. Move to the upper left corner of the sheet, center the left edge of the sheet on its I-joist and nail the corner to the I-joist. Finally, measuring from the right edge of the I-joist that is under the right edge of the sheet, make marks on the top edge of the sheet every 19.2”. Adjust the corresponding I-joists so their right edges are aligned under these marks and nail the sheet to the I-joists.

NOTE: The above instruction assumes a right-to-left installation. Be sure to switch right and left designations if the installation proceeds from left-to-right.

5. Repeat for each subsequent sheet, nailing only the top of the sheet. Align one top corner with the adjacent sheet, leaving a ⅛” gap between sheets. Make sure the other end of the

sheet is centered on its floor joist and secure the top corner adjacent to the previously installed sheet using an 8d nail. Center the other edge of the sheet on its floor joist and nail that top corner using an 8d nail. Measuring from a nailed truss that is not at a joint between sheets, make marks on the top edge of the sheet every 19.2". Adjust the corresponding I-joists so their right edges are aligned under these marks and nail the top of the sheet to the I-joists using 8d nails.

NOTE: One method to ensure the 1/8" gap between sheets is to tack an 8d nail at two locations along the edge of the previously installed sheet into the I-joist below before driving the next sheet home. After the next sheet has been installed, pull the tacked nails and re-nail them into edges of the sheets.

6. Finish nailing each sheet of decking so that there are five 8d nails in the decking field and seven nails on each of the ends. On the first row, also nail one 8d nail through the decking into the rim board midway between each I-joist. Nail two 8d nails through the decking into each piece of end blocking.

NOTE: If using the framing nailer, verify that the nail head is being sunk no more than 1/8" below the surface of the decking. Adjust the nailer as necessary.

7. When installing subsequent rows of decking, make sure to stagger the joints of the decking, preferably by two I-joists (see Figure 2-3).
8. Tightly drive the tongues of the next row of decking into the grooves of the previous row of decking with a sledgehammer and a 6' length of 2x4 scrap so as not to damage the panels. Position and nail the sheets to the I-joists following the procedure generally outlined in Step 4 to Step 6 above.

NOTE: A maximum of 1/8" is allowed between decking prior to nailing.

9. For each sheet of decking, verify that all required nails have been installed on the edges and in the field, that the nails are sunk to the proper depth, and that no nails missed the framing below the deck (remove and re-nail any that did miss). Use a red crayon to mark "OK" on each sheet that passes inspection.
10. Using a black or blue crayon, transfer the end blocking marks made in Section 2.1.3.6 to the decking, making sure each mark is at least 8-10" long. Confirm there are two nails through the decking into the blocking where each black mark lands.
11. Cut away decking over the stairwell opening leaving a 1 1/4" overhang where the top of stairs will be attached.
12. Thoroughly clean the Adhesive Applicator, removing as much adhesive as possible, before storing it in the Tool Trailer.

NOTE: Sometimes use of a moist towelette (e.g., wet wipes) may facilitate adhesive removal.

2.6. BASEMENT PREPARATION

1. Cut the floor drain flush with the surface of the concrete floor.
2. Remove any debris from the basement floor in preparation for wall layout. Use a broom to remove any remaining dirt from the floor next to all foundation walls.
3. After the basement floor is clean and dry, apply radon caulk to the concrete floor where it meets the wall and any other cracks in the floor. It is much easier to do this now than when basement walls are being framed or have been built.

NOTE: Sealing the cracks helps air seal the basement and prevents any harmful soil gases from getting in the basement.

4. Remove any plastic and framing from basement windows.
5. Remove all debris from the egress wells.
6. Locate the drain tile protruding through the stone at the bottom of the egress well. The top of the tile should be 2"-3" below the bottom of the window sill. If it extends higher than this, use a utility knife to cut off the top of the tile to the desired height. Place a 6"x6" piece of 1" foam over the top of the drain tile and cover that with at least 2" of stone to hide the drain tile. Level the remaining stone in the well so it is flush with the bottom of the window sill.

Chapter 3. Wall Layout

- 3.1 LAYING OUT EXTERIOR WALLS
- 3.2. CREATING PLATE LAYOUT DRAWING
- 3.3 CUTTING EXTERIOR WALL PLATES
- 3.4 MARKING WINDOW AND DOOR LOCATIONS ON EXTERIOR WALL PLATES
- 3.5 MARKING STUDS ON EXTERIOR WALL PLATES
- 3.6 LAYING OUT INTERIOR WALLS
- 3.7 CUTTING INTERIOR WALL PLATES
- 3.8 MARKING DOOR LOCATIONS ON INTERIOR WALL PLATES
- 3.9 MARKING STUDS ON INTERIOR WALL PLATES

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Materials needed:

2x6 Plate lumber
2x4 Plate lumber
16d Nails
8d Nails
16d Duplex nails
Spray varnish

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
50' Steel tape
Framing square
Red & blue chalk lines
String line
Felt tip marker

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan
Plate Layout Drawing

NOTE: All exterior and interior walls are framed 24" o.c.

Safety First! Review the Safety Checklist before performing tasks in this chapter.

3.1. LAYING OUT EXTERIOR WALLS

3.1.1. Deck Preparation

1. Before laying out any walls on the deck, clean the deck of excess dirt or glue that may interfere with chalk lines. Also, trim any decking that hangs over the edges of the deck or around the stair opening (but be sure to leave the 1¼" overhang where the top of the stairs will be attached).
2. If the house has an attached garage, see Section 23.1 for instructions on how to extend the following wall layouts onto the garage foundation.

3.1.2. Laying Out Exterior Walls On a Rectangular Deck

1. At each corner of the deck, measure in 5½" from the outside surface of the rim box from both sides of the corner. Using a square and a sharp pencil (in order to make future small corrections possible), create an initial intersecting corner mark (an "X", 1-2" in length in each direction).
2. **Create a Rectangle.** Remove the Wall Layout Worksheet (Figure 3-1 on the next page) from this manual. With a long steel tape, "burn a foot" and measure the lengths between the initial corner marks from Step 1 above of the opposite walls at each end (see Figure 3-1). Record the measurements on the Wall Layout Worksheet. If opposite wall lengths differ by ⅛" OR MORE, adjust the corner marks to equalize the lengths by adding one-half the difference at each end of the shorter wall.
3. **Square the Rectangle.** With a long steel tape, "burn a foot" and carefully measure the diagonals between the corner marks to check for square. Record the measurements on the Wall Layout Worksheet. If they differ by ⅛" OR MORE, adjust the corner marks at EACH end of the SHORT diagonal to lengthen the LONG wall by one-half the difference. Re-check for square and adjust as needed.
4. **Check for Rim Bow.** Check all four sides of the rim box for bow. Pull a tight string line over the new corner marks at each end of the wall. Measure between the string line and the outside of the rim box every 4'-5' and record on the Wall Layout Worksheet. If the maximum measurement is greater than 5⅝", move BOTH ends of the string line equally toward the rim board until the maximum measurement is 5½". Re-mark the two corners to the new location. Continue checking the other three sides for bow and adjust corner marks as necessary. If the bow adjustment for any wall is ≥¾", re-check the rectangle for square and adjust as cited in Step 3 above.
5. Once all four corner mark adjustments have been made, carefully re-measure the precise distances between the corner marks in all directions. Adjust the marks as needed to ensure that opposing wall lengths differ by ⅛" or less. Using these final marks, snap chalk lines for all exterior wall locations. Finally, spray all chalk lines with a clear varnish to protect them from the elements.

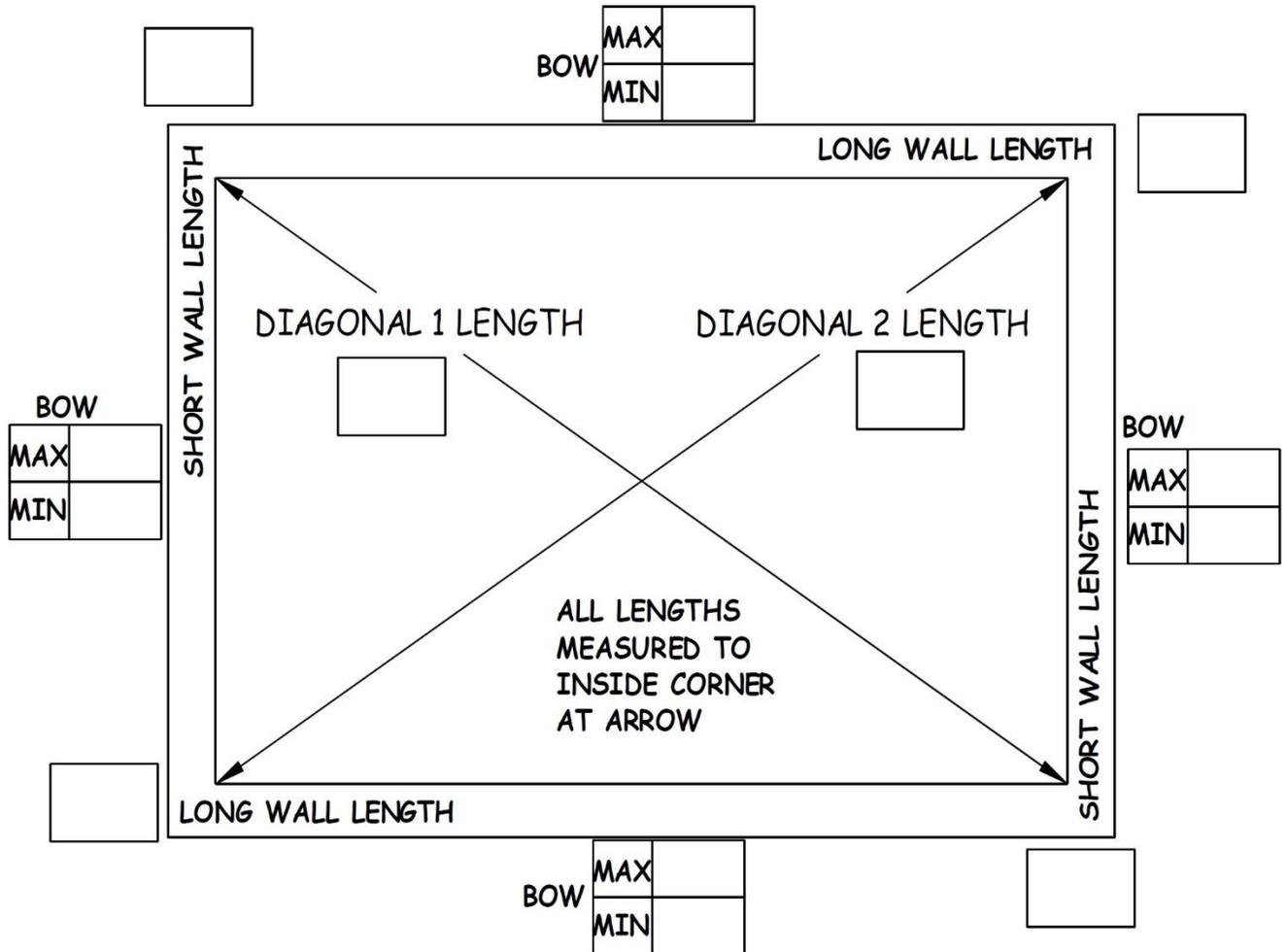


Figure 3-1. Wall Layout Worksheet.

3.1.3. Laying Out Exterior Walls on an L-Shaped Deck

1. **Create a Rectangle** on the main deck (see Figure 3-2).
 - a. As in Section 3.1.2.1 above, at all outside corners of the deck (Points 1, 2, 3, 5 and 6) measure in 5½" from the outside surface of the rim box, from both sides of the corner. Using a square and a sharp pencil (in order to make future small corrections possible), create an initial intersecting corner mark (an "X", 1-2" in length in each direction).
 - b. With a long steel tape, "burn a foot" and measure the distance between Points 1 and 2 (= Line 1-2) and between Points 2 and 3 (= Line 2-3). Using these measurements, locate and mark Point 4.
 - c. Drive an 8d nail into the outside of the rim box, roughly aligned with the corner marks at Points 1 and 5. In addition, drive an 8d nail into the rim board adjacent to Point 4.
 - d. Using the nails in the outside of the rim board (if desired), stretch a tight string line from Point 1, past Point 4 to Point 5, keeping the line directly over the two corner marks. If the line is not directly over Point 4, adjust both ends of the line equally, in the same direction, until it passes directly over Point 4. Re-mark corner marks at Points 1 and 5 and remove the string line.

NOTE: Any adjustment to the string at Point 5 **MUST** also keep the string aligned over Point 4. If not, adjust Points 1 and 5 equally until the string passes over Point 4.

2. **Square the Rectangle** on the main deck. With a long steel tape, "burn a foot" and carefully measure the diagonals between Points 1 and 3 and Points 2 and 4. If they differ by ⅛" OR MORE, adjust the corners as in Section 3.1.2.3.
3. **Check for Rim Bow** on the main deck. As in Sections 3.1.2.4 and 3.1.2.5, check the two side walls and the back wall for rim box bow. In each case, stretch a tight string line across each corner mark and measure from the line to the rim board every 3'-4'. If the maximum measurement is greater than 5⅝", move BOTH ends of the string line equally toward the rim board until the maximum measurement is 5½". Re-mark the corner marks to the new location. If the bow adjustment for any wall is ≥⅜", re-check the rectangle for square and adjust as cited in Step 2 above.

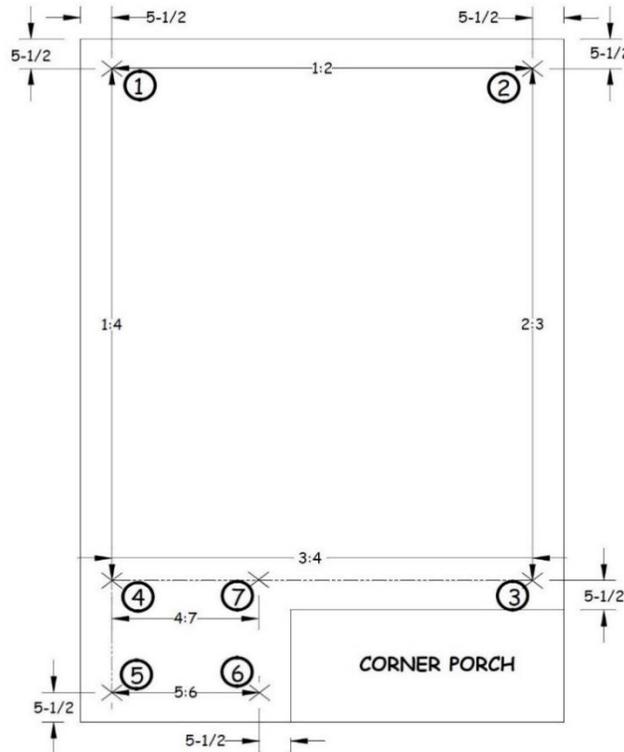


Figure 3-2. Wall Layout with Corner Porch.

4. Adjust Front Deck Extension

- a. Using nails on the outside of the deck if necessary, stretch a tight string line from Point 3 to Point 4. Measure Line 5-6 and use this measurement to locate Point 7 on Line 3-4. Mark the deck with an X.
 - b. Measure Line 4-5 and Line 6-7. If not equal, adjust either Point 5 or Point 6 to ensure that Line 5-6 is parallel with Line 3-4.
 - c. In a similar manner, measure Lines 5-6 and 4-7. If not equal, adjust Point 6 or Point 7 to ensure that Line 6-7 is parallel with Line 1-5.
 - d. Check Lines 5-6, 6-7, and 3-7 for bow (max $5\frac{5}{8}$ "") from the outside of the rim board. If necessary, move the end points of each line (3-4, 5-6, or 6-7) toward the rim board as in Step 3 above.
5. As in Section 3.1.2.5, carefully measure the precise distances between corner marks in all directions. Adjust the marks as needed to ensure that opposing wall lengths differ by $\frac{1}{8}$ " or less. Snap the lines for all exterior wall locations. Spray all chalk lines with a clear varnish to protect them from the elements.

NOTE: Snap continuous chalk lines from Point 3 over Point 7 to Point 4 and from Point 1 over Point 4 to Point 5.

3.2. CREATING A PLATE LAYOUT DRAWING

1. The Plate Layout Drawing (a 24"x36" printed layout of the main floor deck showing layout of both exterior and interior walls, typically mounted on 1/8" plywood) depicts all full-length plates and any pre-defined plate lengths. The Drawing is usually created offsite prior to the build day and stored in the construction trailer. If the drawing is not found onsite, create one using the following steps.

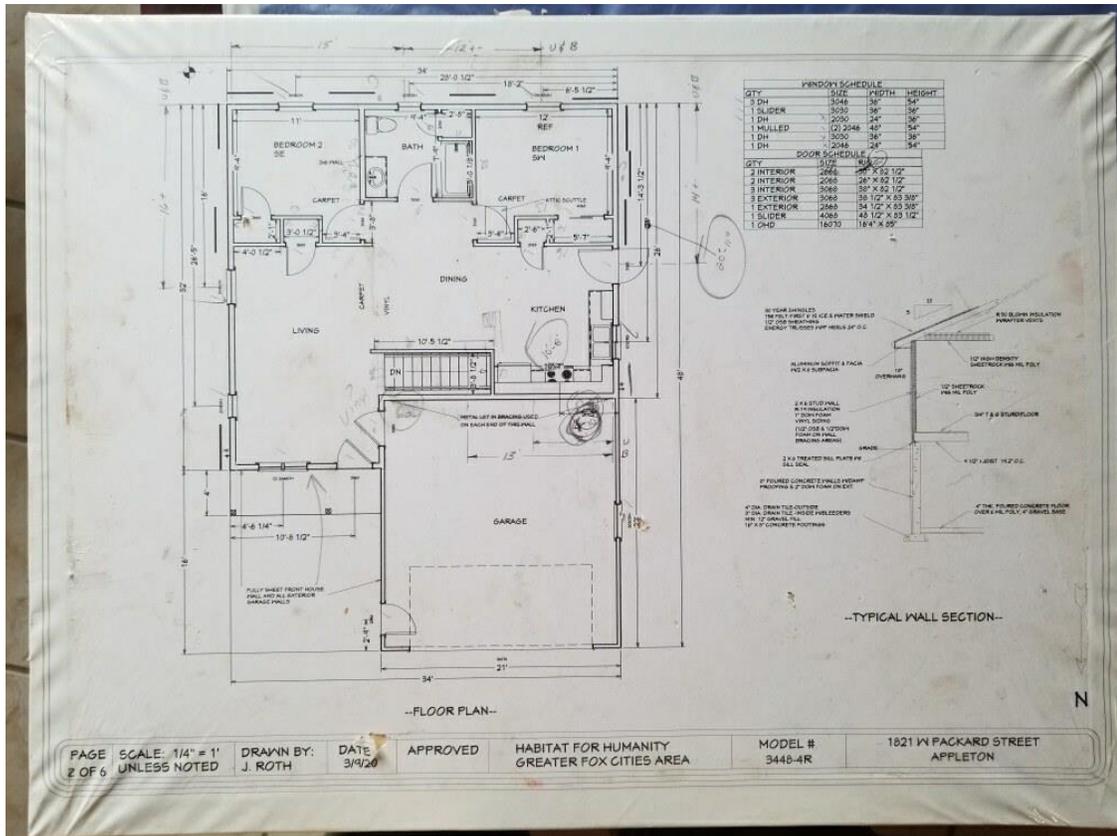


Figure 3-3. Plate Layout Drawing.

2. Obtain a printed copy of the main floor deck. Alongside the exterior walls on the print, sketch in lines representing the recommended lengths of upper and bottom plates to be cut and placed in that location. Rather than cutting every piece to length, use factory-length pieces wherever possible. Specify these uncut pieces with "+/-" to designate the actual dimensions are not exact. Factory pieces should be limited to 10', 12', 14', and 16' lengths.
3. **Bottom Plate Layout.** Starting at the zero corner, mark first along the long wall the successive locations of all pieces, both factory and **field** cut. The ends of all plates must fall between studs or **inside** a door **opening** (where it will be cut out). **NEVER locate the end of a plate under the location of a single stud.** Where factory length pieces do not fit, reduce the length of the piece so that the end falls at the desired location. The final piece

needed to reach the corner will be field cut, so its length is not specified on the Drawing. Repeat this procedure for all remaining walls.

4. For plates on the long walls, take into account that the studs are placed on 2' centers from the outside of the zero corner. Plates on the short walls will be cut 5½" shorter than that to place their ends inside the long wall plates (see Figure 3-4).

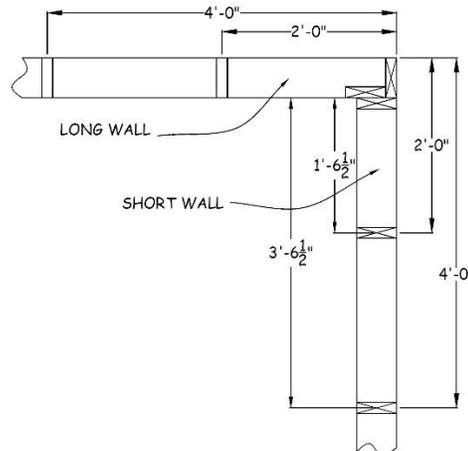


Figure 3-4. Corner Layout.

5. **Upper Plate Layout.** Again, starting at the zero corner, mark along the long wall the successive locations of all pieces, using factory length pieces as much as possible. Select lengths that end on a window or door header. If possible, match upper and bottom factory lengths at the same location. Where factory length pieces do not fit, reduce the length of the piece so that the end falls directly on a stud center (**a last resort**). The final piece needed to reach the corner will be field cut, so its length is not specified on the Drawing. Repeat this procedure for the remaining walls.

3.3. CUTTING EXTERIOR WALL PLATES

1. Before cutting the wall plates, consult the Plate Layout Drawing typically located in the construction trailer. If the Plate Layout Drawing is not found on the worksite, create one following the instructions in Section 3.2 above.
2. Identify any 2x6 lumber 18'-20' in length. Set aside at least four of the straightest for gable end preparation (ladder/outlook outside pieces). Wrap the pieces with shrink wrap and label (with red crayon) "Gable end use only".
3. Some plate lengths are shown with a (+/-) designation on the Plate Layout Drawing. This means that a standard-length 2x6 can be used without cutting. Other pieces are shown with an exact length. They should be cut precisely to that length.

4. Starting at the zero end of a long wall, lay one end of the upper and bottom wall plates 5½” past the short-wall chalk line. Then continue laying out additional plates as shown by the hand-drawn lengths on the Plate Layout Drawing.

NOTE: The chalk line of the two short walls may not be exactly 5½” from the outside of the sill box. Therefore, ALWAYS use these lines as reference in placing and cutting long wall plates rather than the outside of the sill box. Also, be sure to use lumber with good, clean, and square edges at each end of the wall plates. The outside corners at these ends will be used to precisely measure wall diagonals while squaring the assembled wall on the deck (see Section 5.2.2).

5. For the last plate of each wall, the length is not typically specified because of possible differences between the House Plan and actual deck size. Field cut these pieces to fit using the short wall chalk line and adding the additional 5½”. Before measuring, be sure the first plate is still in the correct position and all plate joints are tight.
6. Mark the inside edge of the bottom plate 5½” from each end of the plate to aid in setting these walls in the correct position during wall building. These lines should align with the short wall chalk lines.
7. Finally, tack the upper and bottom plates together with 16d duplex nails and set in location on the deck.
8. Repeat the above for the opposite long wall.
9. For the short walls, again consult the Plate Layout Drawing to identify full length and pre-defined plate lengths.
 - a. Set the first set of plates in place on the deck with one end (per the House Plan) located precisely on the long wall chalk line at the corner. Cut and place any mid-wall plates and butt tightly with the first plates. Tack with 16d duplex nails to hold in place.
 - b. Measure to the opposite long wall chalk line and field cut these pieces to fit.
 - c. Again, butt the pieces tightly and tack with duplex nails.
 - d. Repeat with the opposite short wall
10. After both sets of opposing walls are complete, recheck to be sure their lengths are equal and that ends match their respective chalk lines. If lengths differ by more than ⅛”, trim the long set of plates or move the location of the end stud of the short set (on the non-zero end) past the end of the plates (e.g., if the wall is ⅛” short, then mark the end stud at 1⅜” from the end instead of the typical 1½”; label that mark with “Do Not Move”).

3.4. MARKING WINDOW AND DOOR LOCATIONS ON EXTERIOR WALL PLATES

- Starting at the zero end, lay out the long walls first (see the House Plan to identify the zero end). Stand the plates with their outside edges facing up and make layout marks on these edges. Hook a tape to the zero end of the plates and mark the center-line location of all windows and doors using a short VERTICAL line overlaid with a “C” and an “L”, to create a mark for center line (Ⓢ). Also, label the outside edges of both upper and bottom plates with the window and door size shown on the Plate Layout Drawing (e.g., 3040 Window or 3068 Door).

NOTE: When laying out the location of the exterior doors, take special note of the location of the porch slabs and adjacent walls. The door King studs must be at least 3” from an adjacent wall to allow for trim. Verify with the Construction Supervisor where the door should be located relative to the porch center

- When laying out the short walls that intersect the long walls, again start at the zero end but this time extend the tape measure 5½” beyond the end of the plate. This offset takes into account the 5½” width of the intersecting long wall plate during layout.

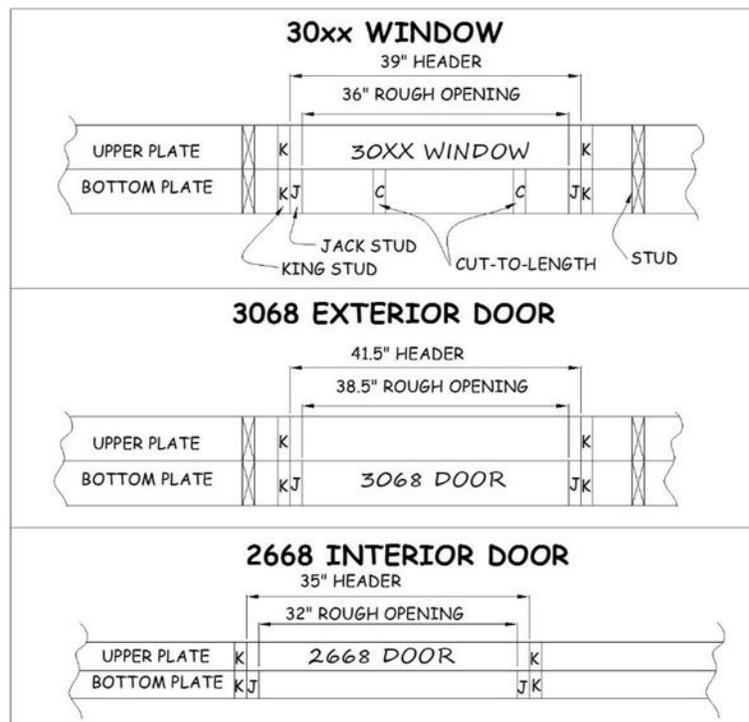


Figure 3-5. Plate Marking for Doors and Windows.

- Referring to the window or door sizes indicated on the Plate Layout Drawing, measure and mark the location of the King and Jack studs supporting the header (see Figure 3-5). Window and door sizes are indicated with a four-digit code. The first two digits represent the width of the opening in feet and inches. The second two digits represent

3.5. MARKING STUDS ON EXTERIOR WALL PLATES

1. Layout long walls first. Before marking stud locations, check opposite walls to be sure they are the same length (within $\frac{1}{8}$ "). If not, trim to equalize.

NOTE: The stud layout step is very important with 24" o.c. framing because it ensures the studs are located directly under roof trusses. This configuration, known as stacked framing, is needed to transfer load from the roof trusses (per code).

2. Starting at the zero end, hook the measuring tape on the end of the plates and mark the location of all wall studs on 24" centers. Center the stud marking jig on these center marks, mark both edges of each stud, and place an "X" within the two edge marks. If the stud marking jig is not available, use the tape measure to mark the stud edges $\frac{3}{4}$ " on either side of the center mark. In general, if using the 50-ft steel tape, do not hook the tape at the end of the plate; burn 24" and mark after that.

NOTE: By design, some stud locations will coincide with a window or door King stud. In these instances, leave the "K" designation already marked on the plates. If the "K" location is not on-center, it may need to be moved (see the Construction Supervisor or Site Leader).

3. Wherever 24" centers fall within a window, mark an "SX" on the bottom plate to represent a short stud under the window. Do not mark a stud within a door opening.
4. If the length of the long walls is not a multiple of 24", it may be necessary to add an extra stud centered 48" from the non-zero end of the wall to accommodate a full sheet of OSB wall sheathing at that end.
 - a. If the length is long by $\frac{3}{4}$ " or less, ignore the difference.
 - b. If greater than $\frac{3}{4}$ ", measure back from the non-zero end of the plates and center the extra stud at 48". If this overlaps the existing 24" o.c. stud, locate the extra stud tight to the non-zero side of that stud. (During wall building, they will be nailed together.)
 - c. If the extra stud does not contact or overlap the existing 24" o.c. stud, center the extra stud 48" from the end. (During wall building, the gap between the two studs will be filled with foamboard and the "sandwich" will be nailed or screwed tightly together.)
 - d. If the House Plan does not show OSB sheathing at the wall end, or if a window or door prevents installation of a full 48" wide sheet, see the Construction Supervisor.

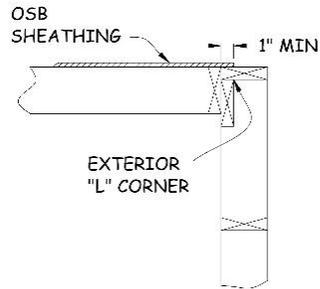


Figure 3-7. Exterior L-Corner.

5. At each end of the long walls, layout an L-corner with two 2x6 studs made up of the normal 2x6 end stud plus an extra 2x6 stud perpendicular to the end stud on the interior side of the wall (see Figure 3-7). Mark the “L” as “Corner Down” to specify that the extra 2x6 will lay face down on the deck as the wall is being built. This will place the existing 2x6 stud facing the end of the adjoining short wall forming an inside corner.

NOTE: As a general rule, outside corners are configured as “Corner Down” and inside corners are configured as “Corner Up.”

6. After marking the long walls, mark the stud locations on the short walls. Starting at the zero end, extend the tape measure $5\frac{1}{2}$ ” beyond the end of the plates and mark the stud locations on 24” centers. Place “X’s” and “SX’s” as appropriate.
7. At the non-zero end of the short walls, again extend the tape $5\frac{1}{2}$ ” past the end of the plate and measure back 48”.
8. If there is no stud centered at that location, proceed as follows:
 - a. Keeping the end of the tape $5\frac{1}{2}$ ” past the end of the short wall plates, determine if any stud is centered between 48” and $52\frac{1}{2}$ ” from the outside corner. If a stud is located within that span, the inside edge of the OSB will be nailed to that stud during wall building and the outside edge will be nailed to the long wall L-corner.
 - b. If a stud is not centered between 48” to $52\frac{1}{2}$ ” add a stud at 48”.
9. For each wall section:
 - a. Mark the inside edge of the upper plate with “UPPER” and the inside edge of the bottom plate with “BOTTOM” (see Figure 3-5). Mark the upper plate with a letter and arrow showing the compass orientation (north, south, east or west) of the plates while lying on the deck (see Figure 3-8).
 - b. If not already done, make a mark on the inside edge of the **long wall** bottom plate $5\frac{1}{2}$ ” from each end of the plate. This mark will help to align the ends of the wall with adjoining walls while it is being erected.

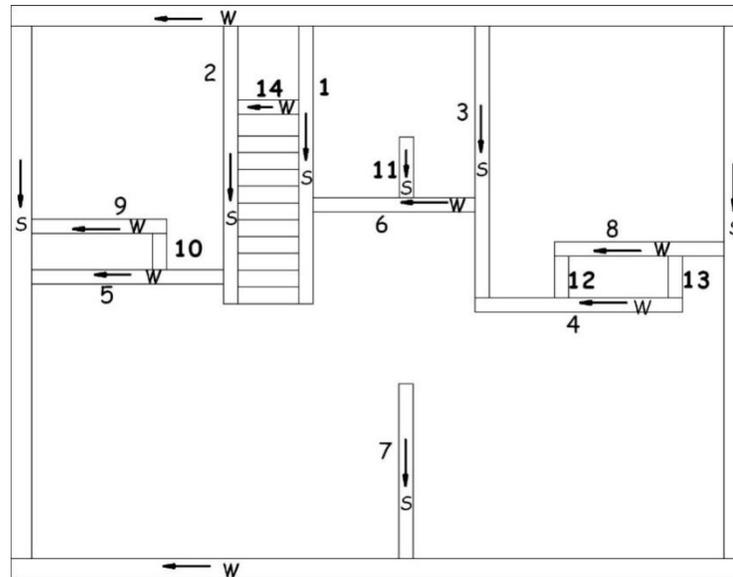


Figure 3-8. Plate Labeling Diagram.

10. Check the Plate Layout Drawing and/or deck for any intersecting 2x4 or 2x6 walls. At these locations, mark the top edges of the plates with lines $3\frac{1}{2}$ " or $5\frac{1}{2}$ " apart, as appropriate, and mark a "W" between these lines. This will aid in locating the intersecting walls during wall building.

3.6. LAYING OUT INTERIOR WALLS

1. Referring to the House Plan, lay out the location of all interior walls, snapping chalk lines for each side of the interior walls. The location of walls labeled "Ref" may not exactly match the House Plan owing to foundation differences. All interior walls that intersect an exterior wall are measured from the inside of the exterior wall.

REQUIREMENT: Bath tub/shower rough opening must be exactly $60\frac{1}{8}$ " (for a 5' tub unit) to leave extra space to install the tub.

2. Start by laying out the walls around the stairway opening since these provide reference points for several other walls. If the House Plan calls for a door at the top of the stairs, these walls should extend $4\frac{3}{4}$ " beyond the lip of the stairway opening. If not, they should extend 3" beyond the lip.
3. Check the House Plan for a special 2x6 interior "plumbing wall". (If present, this wall is wider to accommodate plumbing from the basement to the attic and is typically laid out in one of the following two configurations:
 - a. A simple 2x6 extension of a 2x4 interior wall: Lay out the full wall simply as a 2x6 wall section abutting a 2x4 section, noting which side is the flush side per the House Plan.

- b. A 2x6 sliding closet wall intersecting a 2x4 wall at 90°: The intersection of the closet wall framing with the 2x4 interior wall requires a special header configuration (see Figure 3-9). If the two walls create an “L”, butt the side of the 2x6 wall against the end of the 2x4 wall (this makes the 2x6 wall the “long” or overlapping wall). If they create a “T” (where the 2x6 wall butts up to the 2x4 wall), extend the closet header into the 2x4 wall. In both cases, lay out the Jack stud flush with the closet side of the 2x4 wall. Adjoining that will be the King stud and ½” of OSB, creating a 3½”-wide block equal in width to the 2x4 interior wall.

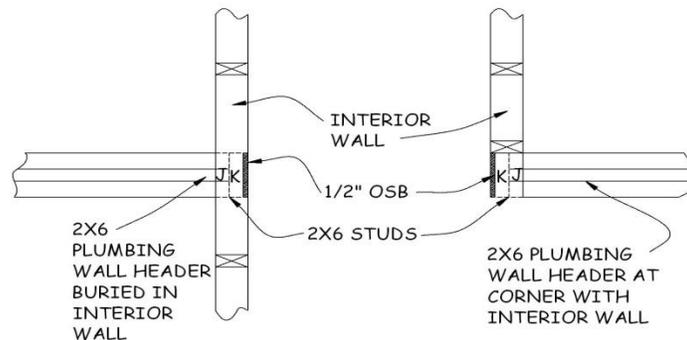


Figure 3-9. Plumbing Wall Configuration.

4. Referring to the House Plan, check for flush sliding closet walls that end at an inside corner of the closet (typically adjoining the 25” closet end wall). Similar to a plumbing wall, lay out the end of the flush sliding wall with a 3½” sandwich of Jack stud, King stud, and ½” of OSB (see Figure 3-10).

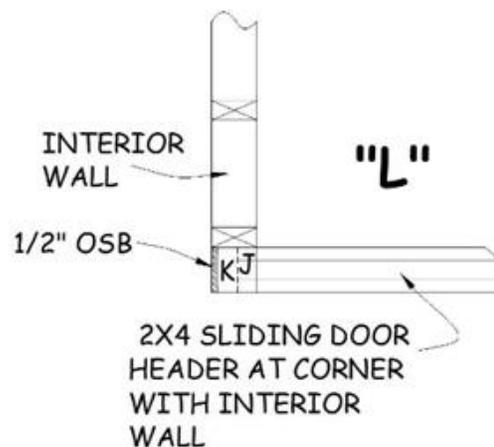


Figure 3-10. Interior L-Corner in Flush Sliding Door.

5. At corners and intersections, pay attention to whether a door will be built at that location. If so, make the room wall long and the door wall short, not the other way around. Include an “L-Corner” at the door end of the room wall and lay out the door plates so that the KJ pair abuts the L-Corner (see Figure 3-11). This allows for easy nailing through the “L” into the King stud. This configuration also provides a stronger

corner that does not depend on nailing one stud into the edge of another stud. In addition, nailing the end of the long wall to the floor provides a stronger anchor than does toenailing the KJ pair to the floor.

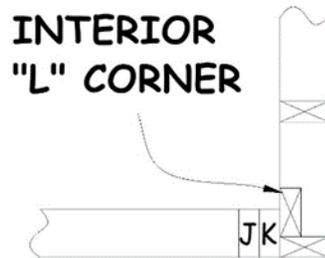


Figure 3-11. Interior L-Corner Configuration.

6. Referring to the House Plan, locate walls of unusual height:
 - a. For a 42” height wall, label the DECK with ‘42” WALL/39” STUDS’.
 - b. For a wall that is a COMBINATION of full-height and 42”-height, mark the location of the joint between the two sections ON THE DECK to ensure that two separate upper plates will be cut.
 - c. For any wall at the end of the stairway opening in the deck (where a platform would be built) label the DECK with ‘13³/₄” WALL/10³/₄” STUDS’.
7. Spray all chalk lines with clear varnish to protect them from the elements.

3.7. CUTTING INTERIOR WALL PLATES

1. Cut upper and bottom plates to match the layout on the deck. Tack the upper and bottom plates together with duplex nails and set in location on the deck
2. Recheck wall intersections to determine which wall end should abut the side of the other wall (which wall will be the “long” wall and which will be the “short” wall). This may be dictated by an adjoining door. (See Section 3.6.5 and Figure 3-11 above.)

NOTE: All closet side walls are typically the “short” wall in the layout (typically 25” long)

3. On walls that require multiple upper and bottom plates (or have a joint), stagger the upper and bottom plates by placing the upper and bottom plates at opposite ends of the wall and join at the top and bottom of separate studs (the joint between upper plates must be centered on a stud, not located above a door).

4. For any 42"-height walls, label the upper and bottom plates with '42" WALL/39" STUDS'. For any short wall that supports the closet platform above the stairway, label the plates with '13¾" WALL/10¾" STUDS'.
5. On walls that include both full-height and 42"-height sections cut separate upper plates for each section. Cut the bottom plate to span the joint.
6. If the wall will include a 3½" x 3½" full-height post at the end of the 42"-height section, cut the upper plate of the 42"-height section 1½" short to accommodate the post.
7. If a full-height post is not planned at the end of the 42"-height section, cut the bottom plate 1½" short. This will accommodate alternative methods for anchoring the end of the wall to the deck.

3.8. MARKING DOOR LOCATIONS ON INTERIOR WALL PLATES

1. Referring to the House Plan and the Table of Door Measurements (Table 3-1), begin by locating and marking the door centerlines using a short VERTICAL line. Overlay that mark with a "C" and an "L" to create a mark for center line: C . Continue to mark the King Stud/Jack Stud pairs on the wall plates.

NOTE: The separation between Jack studs (the "rough opening") for all swinging interior doors is 2" wider than the door width stated on the House Plan. For all sliding doors, the rough opening is ½" wider than the door stated door width. (See dimensions in Table 3-1.)

2. Mark the location of each door and label with the door size and type (e.g., 4068 Slider).
 - a. For bedroom and bathroom doors, locations may need to be adjusted so the hinge-side King/Jack stud pair is abutted to the adjoining wall. This places the hinge side at the corner for proper door swing and still allows room for door trim. (See Section 3.9.1.c for special stud location for these intersections.)
 - b. For SWINGING closet doors (except those at the platform end of the stairway opening) and non-flush sliding doors, locate the centerlines per the House Plan. Measure, locate, and mark the King and Jack studs as detailed in Table 3-1.

NOTE: For the closet door at the platform end of the stairway opening, locate the outside edge of the King stud flush with the outside edge of the platform short wall. This will allow room in the closet at the latch side of the door for closet shelving.

- c. For FLUSH sliding doors, locate the inside of the single King/Jack stud pair the specified rough opening distance from the exterior wall (see Table 3-1), e.g., 60½" from the wall for a 5068 door.

NOTE: Ignore what appears to be a small wall section on the house plan next to the exterior wall. This is an artifact of the CAD software and does

not represent an actual wall section. The end of the header will actually be supported inside the exterior wall.

Table 3-1. Examples of Interior Door Measurements – Main Floor.

Interior Door Type	Rough Opening Width	Header Length	Jack Stud Length
36" Swinging Door	38"	41"	81"
60" Sliding Door	60½"	63½"	82"
60" Folding Door	61½"	64½"	80"

3.9. MARKING STUDS ON INTERIOR WALL PLATES

1. Lay out studs on 24" centers on upper and bottom plates.
 - a. If the wall intersects an exterior wall, start layout from exterior wall end. (Sheetrocking of interior walls will occur first and will start from exterior walls).
 - b. If the wall intersects only an interior wall, start layout to match likely sheetrock installation.
 - c. Where a door will be attached at the end of a bathroom or bedroom wall, mark the end of the wall for a 2x4 L-corner oriented to allow nailing through the L-corner into the King stud of the door (see Figure 3-11). This is similar to the 2x6 L-corners used in the exterior walls.
 - d. Locate the plates labeled '13¾" WALL/10¾" STUDS' and layout two end studs and one interior stud 24" o.c. (see Figure 3-12 and Section 6.4).

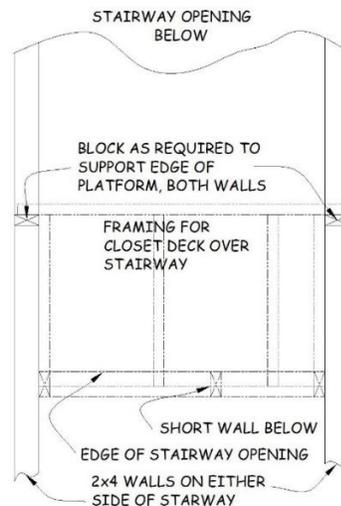


Figure 3-12. Stud Layout Around Stairway Opening.

2. For walls adjoining the stairway opening, one wall typically includes a sliding closet door next to the exterior wall. This closet usually includes a platform over the bottom of the stairs.
 - a. If this is so, layout the wall opposite the closet as usual, starting at the exterior wall.
 - b. On the closet side, layout the closet KJ studs and then continue laying out wall studs on the same centers as the opposite wall.
3. For walls adjoining the tub/shower:
 - a. The short wall next to the tub/shower will typically be 36” long. As usual, layout studs on 24” centers starting at the intersecting wall. At the opposite end, layout a 2x4-2x6 L-corner similar to that shown in Figure 3-11, with the 2x6 base of the L on the surface facing the tub. This will provide vertical blocking to which the shower flange can be attached, 31½” from the wall.
 - b. On the opposite wall, layout a similar L-corner. Center the L, with the 2x6 base facing the tub, directly opposite the L-corner on the short wall.
4. As with exterior wall plates (see Section 3.5 above), on the top edges of the interior wall plates, mark the location of any intersecting walls with lines and a large “W” between the lines to aid in locating the intersecting wall during wall building.
5. When complete, label upper and bottom plates. Mark compass orientation and label both plates and deck with an identifying number (see Figure 3-8).

4. Components and Stairs

4.1 CUTTING COMPONENT PIECES

4.2 ASSEMBLING EXTERIOR WALL COMPONENTS

4.3 ASSEMBLING MAIN FLOOR INTERIOR WALL COMPONENTS

4.4 ASSEMBLING BASEMENT WALL COMPONENTS

4.5 BUILDING STAIRS

Tools needed by volunteer:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Materials needed:

2x6 plate lumber
2x4 plate lumber
16d nails
8d nails
3/4" Collated nails
3" Collated nails (from Supervisor)
5/16"x1 1/2" Lag screws
6" Timber screws
5" Wafer head screws (from Supervisor)
5/16" Washers
Air sealing tape
Shrinkwrap

Tools and equipment needed:

Generator
Extension cord
Circular saw w/worm drive
Chop saw
Impact Driver
Framing nailer
Framing square
Framing square w/ stair gauge
Sawhorse
6' level
String line
Felt tip marker
Red crayon

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan Supporting Documents

- Component Cut List
- Component Assembly Drawings
- Plate Layout Drawing

NOTE: All exterior and interior walls are framed 24" o.c.

Safety First! Review the Safety Checklist before performing tasks in this chapter.

4.1. CUTTING COMPONENT PIECES

1. Before marking and cutting any components, sort and crown 2x4 and 2x6 stud lumber into 3 piles (straight, slightly crowned and RETURN/TO CUT). If the stud has a “slight” crown, mark the wide surface with an arrow toward the “crown up” edge. If the stud is “straight” (no crown) mark the wider surface with an arrow toward the end of the stud. If the stud has a “severe” crown, bow or other unacceptable defect put it in the RETURN/TO CUT pile (if possible place this pile near street or driveway to separate it from the two “good” piles of studs and for easier pickup by the supplier). Check for studs that are twisted. Do not use these for door components or window components.

NOTE: Be very selective (“Would you use this for your house?”) during the initial sorting of the studs as we can always go back to the RETURN/TO CUT pile if needed.

2. Use only straight studs for kitchen walls, tub walls, and the ends of sliding closet doors first, then for all other walls as available. Use straight or only slightly crowned studs for component King and Jack pairs.
3. Locate the separate bundle of lumber expressly intended for component construction. It should consist of 2x10’s, 2x6’s, 2x4’s, and one 8’ 1x6. Label the bundle with “Components” to avoid use for general construction.
4. Determine window and door sizes and dimensions from the House Plan Supporting Documents.
5. Referring to the Component Cut List, cut pre-defined pieces of 2x10 headers, 2x6 headers, 2x4 headers, 2x6 window sill pieces, and 2x4 and 2x6 Jack studs. The list specifies the lengths of material to use, how many to cut and to what length. As each piece is cut, label it with the length and check it off the cutting diagram (the diagrams are in a three-ring binder in the site support box).

NOTE: The Component Cut lists are designed to minimize material waste and cost, so should be followed exactly.

4.2. ASSEMBLING EXTERIOR WALL COMPONENTS

1. Referring to the Component Assembly Drawings, begin by assembling the window and exterior door components. (It is best to work on a flat surface such as the deck or the porch. However, place a piece or pieces of OSB or decking under the work on the porch to protect the concrete from protruding nails.)
2. Use 3” collated nails (obtained from the Construction Supervisor) to assemble headers and King/Jack studs. If 3” nails are not available, use 3¼” collated nails instead, taking care to bend over any protruding nails when assembling headers and King/Jack studs. Return any unused 3” collated nails to the Construction Supervisor.

3. When assembling headers and King/Jack studs, angle the framing nailer approximately 10°-20° from perpendicular in the direction of the wood grain before inserting nails.
4. Align two matching-length 2x10 pieces to create an exterior header (windows greater than 6' may require three header pieces).
 - a. Ensure that both ends and at least one long edge are flush. Trim if required.
 - b. Nail with three rows of 3" collated nails - two about 2" from the edge and one in the middle - no more than 12" apart. Stagger the nails on opposite sides.
5. Select two 2x6 studs for use as King studs and check for crown. Nail each stud to the header assembly with the crown DOWN (this will place the King stud the desired crown UP during wall assembly). Be sure that a flush, long edge of the header is positioned "down" towards where the Jack studs will be located. Nail three 3¼" collated nails into each header piece (for a total of six nails per King stud) taking special care that the King stud is flush with both the top and sides of the header.
6. Place the matching 2x6 header piece between the King studs and tack to the long, flush edge of the 2x10 header pair. Carefully square each end of the 2x6 to the adjoining King stud and nail through the King stud into the end of the 2x6 with three 3¼" collated nails. Then finish nailing the 2x6 to the underside of the 2x10 header with 3¼" collated nails. (This sequence is crucial to ensuring that the Jack studs supporting the header provide an adequate bearing surface.)
7. Select two precut 82" 2x6 pieces from Section 4.1.1.5 above for use as Jack studs and check for crown. (The cut list specifies a Jack stud length slightly longer than needed to accommodate varying 2x10 header widths.) Place each piece next to a King stud (crowns and bows opposite king stud if applicable), tight to the header, mark, and field cut to length.

NOTE: Before assembly, make sure the crown (and bow) of the Jack stud are opposite that of the King stud (this helps to create a straight component). Flush the narrow edges of the two studs along the length, clamp, and nail.

- a. For doors components, place the field cut Jack stud tight to the header and nail through the Jack stud into the King stud using pairs of 3" collated nails, no more than 12" apart.
 - b. For windows components, place the field cut Jack stud tight to the header and nail through the Jack stud into the King stud using pairs of 3" collated nails, no more than 12" apart. Secure the matching 2x6 sill piece to each King/Jack pair with three 5" wafer head screws, obtained from the Construction Supervisor.
8. On exterior door components, cut and nail a 38½" piece of 1"x6" pine board (located in the component package) to the underside of the header. This will provide an additional nailing surface and also make the top part of the door frame easier to air seal.

9. Clearly mark all components with the correct size of the component on the face of the header.
10. Stack components separately by size. Be sure the labeled surface of the header is face up to facilitate later identification of the component's size.

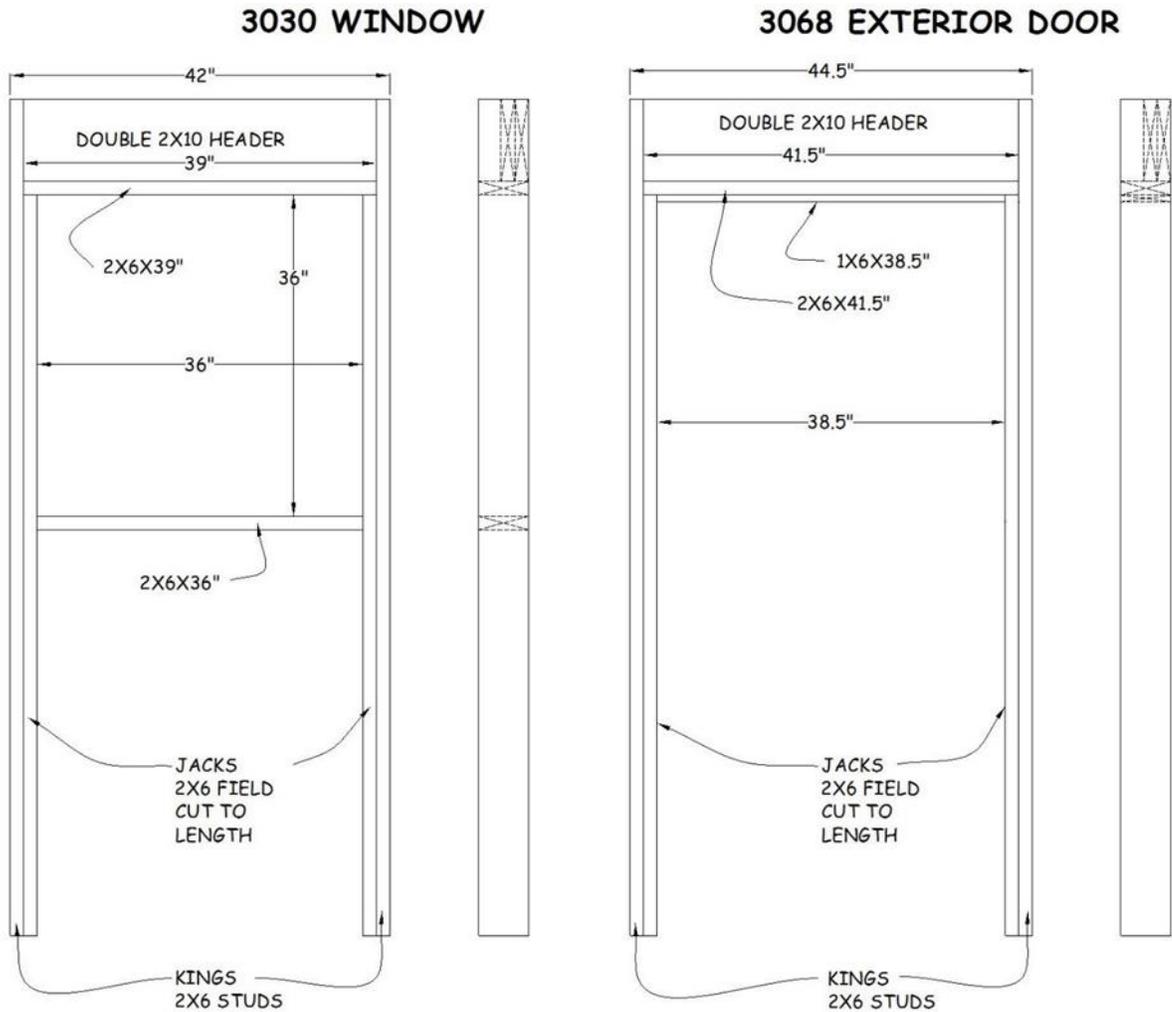


Figure 4-1. Component Assembly Drawing.

4.3. ASSEMBLING MAIN FLOOR INTERIOR WALL COMPONENTS

4.3.1. Preparation

1. Refer to the Component Assembly Drawings for interior components. From the 2x4 pieces precut in Section 4.1.1.5, select matching-length header pieces for each interior door. Nail together with 3¼” collated nails to create a “T” header.

NOTE: Some homes may include a door in a 2x6 wall designed to accommodate piping from the basement to the roof (so-called plumbing wall). The T-header for these walls consists of a vertical 2x4 and a horizontal 2x6 per the component cut list.

2. Use 3” collated nails (obtained from the Construction Supervisor) to assemble headers and King/Jack studs. If 3” nails are not available, use 3¼” collated nails instead, taking care to bend over any protruding nails when assembling headers and King/Jack studs. Return any unused 3” collated nails to the Construction Supervisor.
3. When assembling headers and King/Jack studs, angle the framing nailer approximately 10°-20° from perpendicular in the direction of the wood grain before inserting nails.
4. Be aware that Jack stud lengths are different for various door types and door locations as shown in Table 4-1 below.

Table 4-1. Jack Stud Lengths for Various Door Types and Locations.

<u>Door Type</u>	<u>Main Floor</u>	<u>Basement</u>
<u>Swinging Door</u>	<u>81”</u>	<u>82”</u>
<u>Sliding Door</u>	<u>82”</u>	<u>83”</u>
<u>Folding Door</u>	<u>80”</u>	<u>81”</u>

4.3.2. Swinging Doors

1. Select two 81” 2x4 pieces from the precut component package for use as Jack studs in each door.
2. Nail each Jack stud to a 92⁵/₈” 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3” collated nails, no more than 12” apart. Write the door size on each King/Jack pair using red crayon.
3. Identify the appropriate header and place it upside-down on top of the Jack studs, tight against the King studs. Nail through the King studs into the ends of both header pieces with two 3¼” collated nails each.
4. Write the door size on the header, verify the Jack studs are 81” long and set the assembled door components aside.

4.3.3. Sliding Doors

1. A flush sliding door needs only one King/Jack pair while a non-flush sliding door needs two King/Jack pairs.
2. Select one 82" 2x4 piece for each King/Jack pair needed, from the precut component package for use as a Jack stud in each door.
3. Nail the Jack stud to a 92⁵/₈" 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3" collated nails no more than 12" apart. Write the door size on each King/Jack pair using red crayon.
4. Identify the appropriate header. Verify the Jack stud is 82" long. For each door, bundle "T" header and needed King/Jack pair(s) together using shrinkwrap. **Do not nail header to its King/Jack stud(s).** Label each header with the door size and set aside with other components.
5. When it is time to assemble, place the T-header upside-down on top of the Jack studs, tight against the King studs. Nail through the King studs into the ends of both header pieces with two 3¹/₄" collated nails each.

4.3.4. Folding Doors

1. Select two 80" 2x4 pieces from the precut component package for use as Jack studs in each door.
2. Nail each Jack stud to a 92⁵/₈" 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3" collated nails no more than 12" apart. Write the door size on each King/Jack pair using red crayon.
3. Identify the appropriate header. Verify the Jack stud is 80" long. For each door, bundle "T" header and needed King/Jack pair(s) together using shrinkwrap. **Do not nail header to its King/Jack studs.** Label each header with the door size and set aside with other components.
4. When it is time to assemble, place the T-header upside-down on top of the Jack studs, tight against the King studs. Nail through the King studs into the ends of both header pieces with two 3¹/₄" collated nails each.

4.4. ASSEMBLING BASEMENT WALL COMPONENTS

4.4.1. Preparation

1. Do not pre-build basement door components for Bi-Level homes since King studs may need to be greater than 92⁵/₈".

2. Be aware that Jack stud lengths are different for various door types and door locations as shown in Table 4-1 above.

4.4.2. Swinging Doors

1. Select two 82” 2x4 pieces for use as Jack studs in each door.
2. Nail each Jack stud to a 92⁵/₈” 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3” collated nails no more than 12” apart. Write “Basement”, along with the door size, on each King/Jack pair using red crayon.
3. Identify the appropriate header. Verify the Jack studs are 82” long. For each door, bundle “T” header and two King/Jack pairs together using shrinkwrap. **Do not nail header to its King/Jack studs.** Label each header with the door size and the word “Basement”.
4. Move the shrink-wrapped bundle for each Basement Swinging Door into the basement to an out-of-the-way location. Place the bundle on the floor with scrap wood underneath and cover with scrap material to prevent water damage.
5. When it is time to assemble, place the T-header upside-down on top of the Jack studs, tight against the King studs. Nail through the King studs into the ends of both header pieces with two 3/4” collated nails each.

4.4.3. Sliding Doors

1. A flush sliding door needs only one King/Jack pair while a non-flush sliding door needs two King/Jack pairs.
2. Select one 83” 2x4 piece for each King/Jack pair needed, from the precut component package for use as Jack studs in each door.
3. Nail the Jack stud to a 92⁵/₈” 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3” collated nails no more than 12” apart. Write “Basement”, along with the door size, on each King/Jack pair using red crayon.
4. Identify the appropriate header. Verify the Jack stud is 83” long. For each door, bundle “T” header and needed King/Jack pair(s) together using shrinkwrap. **Do not nail header to its King/Jack stud(s).** Label each header with the door size and the word “Basement”.
5. Move the shrink-wrapped bundle for each Basement Sliding Door into the basement to an out-of-the-way location. Place the bundle on the floor with scrap wood underneath and cover with scrap material to prevent water damage.

6. When it is time to assemble, place the T-header upside-down on top of the Jack studs, tight against the King studs. Nail through the King studs into the ends of both header pieces with two 3¼” collated nails each.

4.4.4. Folding Doors

1. Select two 81” 2x4 pieces from the precut component package for use as Jack studs in each door.
2. Nail each Jack stud to a 92⁵/₈” 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3” collated nails no more than 12” apart. Write “Basement” along with door size on each King/Jack pair using red crayon.
3. Identify the appropriate header. Verify the Jack studs are 81” long. For each door, bundle “T” header and two King/Jack pair together using shrinkwrap. **Do not nail header to its King/Jack studs.** Label each header with the door size and the word “Basement”.
4. Move the shrink-wrapped bundle for each Basement Folding Door into the basement to an out-of-the-way location. Place the bundle on the floor with scrap wood underneath and cover with scrap material to prevent water damage.
5. When it is time to assemble, place the T-header upside-down on top of the Jack studs, tight against the King studs. Nail through the King studs into the ends of both header pieces with two 3¼” collated nails each.

4.5. BUILDING STAIRS

4.5.1. Calculations

1. Refer to the House Plan for layout dimensions. Remove the Stair Stringer Riser Calculations Worksheet (Figure 4-2 below) from this manual. Measure from the top of the deck to the basement floor on the end of the opening where the stairs will sit on the basement floor. Insert this dimension in the first box of the worksheet.

EXAMPLE: Overall dimension from deck to basement floor is 102”.

Subtract ¾” for DRICore; this = 101¼”. If there is hard flooring at the top of the steps, add ¼”; this = 101½” working dimensions.

Worksheet - Stair Stringer Riser Calculations

March 2022
Version 22.0

Calculate Step Rise

+		Total Height - measured as basement floor to top of deck
		Hard flooring at top? If <u>yes</u> Add 1/4" (0.25")
=		Intermediate Result
-		DriCore at bottom? If <u>yes</u> Subtract 3/4" (0.75")
=		Calculated Total Height
/		Total number of risers (from plan, this can vary, verify with supervisor)
=		Step Rise (must be minimum of 7" and no more than 8")

Adjust Bottom Step Rise

		Step Rise (as calculated above in the Calculate Step Rise section)
-	(1-1/8")	Tread thickness, Subtract 1-1/8" (1.125")
=		Intermediate Result
+		DriCore at bottom? If <u>yes</u> Add 3/4" (0.75")
=		Intermediate Result
+		Hard flooring at bottom? If <u>yes</u> Add 1/4" (0.250") - this is RARE
=		Bottom Step Rise

Adjust Top Step Rise (i.e. Determine Stringer Mount Location)

		Step Rise (as calculated above in the Calculate Step Rise section)
-	(3/4")	Deck thickness, Subtract 3/4" (0.75")
=		Intermediate Result
+	1-1/8"	Tread thickness, Add 1-1/8" (1.125")
=		Intermediate Result
-		Hard flooring at top? If <u>yes</u> Subtract 1/4" (0.25")
=		Top Step Rise (measure down this distance from the underside of the deck and make a mark - Mount top edge of stringer at this mark)

NOTE:

The **TOP** step of **each stringer** must have 3/4" (0.75") removed from the run resulting in a 9" run versus the normal 9.75" because no riser board is needed for this step

Figure 4-2. Stair Stringer Riser Calculations Worksheet.

- Refer to the House Plan to find the number of runs and risers to be used. (13 risers and 9¾” deep cut treads are normal). Established run/rise relationships must be followed. No rise can exceed 8”. No rise can vary more than 3/16”. Treads must be at least 9” wide.

EXAMPLE: Using the assumptions in Step 1 above: the calculated riser height = $101\frac{1}{2}''/13 = 7.808''$. To convert the decimal portion to a usable fraction, refer to Table 4-2 below. 0.808 is between 0.782 and 0.844 in the table, indicating the nearest fraction is 13/16. Therefore, use 7-13/16” for the riser height.

Table 4-2. Determining Riser Height Fractions.

Calculated Riser Height		Rounded to Fraction
0	0.031	0
0.032	0.094	1/16
0.095	0.156	1/8
0.157	0.219	3/16
0.220	0.281	1/4
0.282	0.344	5/16
0.345	0.406	3/8
0.407	0.469	7/16
0.470	0.531	1/2
0.532	0.594	9/16
0.595	0.656	5/8
0.657	0.719	11/16
0.720	0.781	3/4
0.782	0.844	13/16
0.845	0.906	7/8
0.907	0.969	15/16
0.970	1.000	1

4.5.2. Layout and Cutting Stringers

- Select one 2x12 stringer and place it on saw horses with the crown up toward you. The stringer is strengthened by this orientation because the tread/riser sections can now be cut from the crown edge of the 2x12.
- Attach stair gauges to the framing square and locate the precise dimensions calculated in Section 4.5.1 for run and rise. If the rise is 7¾”, set the gauge to this dimension on the short side of the square; set the gauge to 9¾” on the long side of the square (see Figure 4-3).

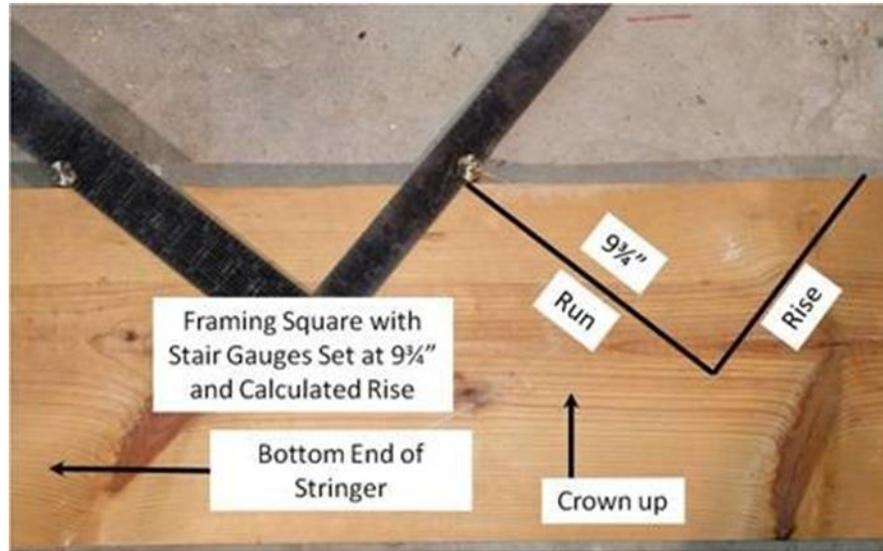


Figure 4-3. Stair Stringer Layout.

3. Mark the rise and run along the stringer until the proper number of risers needed are marked.
4. Reduce the height of the last riser at the bottom of the stringer by $1\frac{1}{8}$ " (the thickness of the tread), unless the basement floor is to be finished. If the basement floor is to be finished, reduce the height of the riser by only $\frac{3}{8}$ ". This will accommodate the $1\frac{1}{8}$ " thickness of the tread and the $\frac{3}{4}$ " thickness of the DRICore (see Figure 4-4).
5. Use a worm drive circular saw to cut out the stringer, cutting so that half of the pencil line remains.

REQUIREMENT: Building inspectors will reject a stair unit if dimensions between risers vary by more than $\frac{3}{16}$ ".

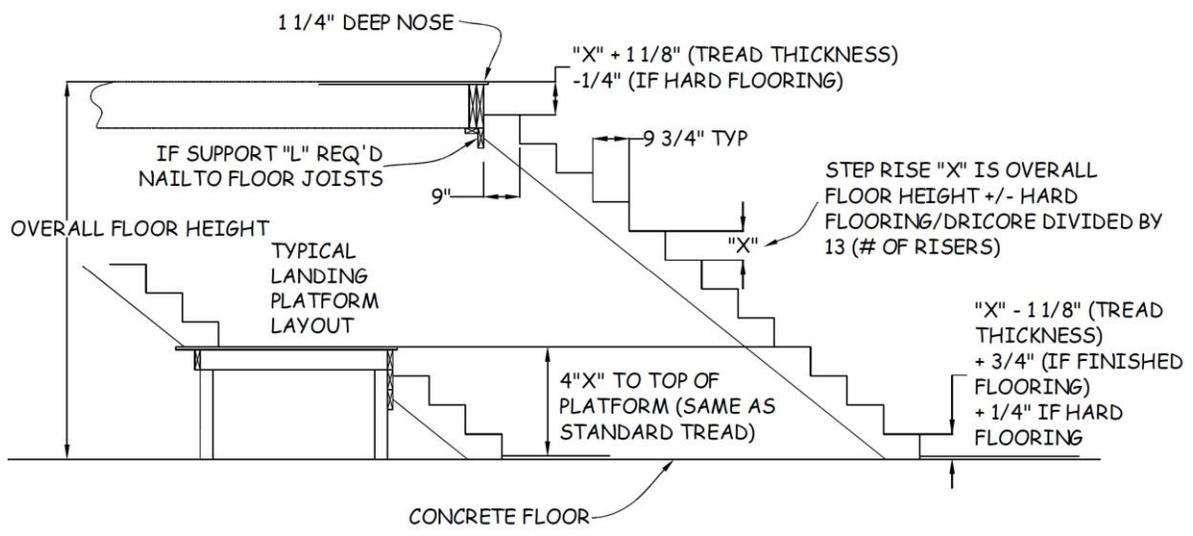


Figure 4-4. Stair Stringer Installation.

6. Cut $\frac{3}{4}$ " off the back edge of the top riser so the stringer can be fastened to the floor joist (there is no $\frac{3}{4}$ " thick riser at the top step since the floor joist serves as the finished riser).
7. Place the finished stringer in the stairwell hole to check for accuracy of installation. When set in place treads must be level and risers must be plumb. Verify that the bottom riser is equal to the height of the risers minus the thickness of the tread ($1\frac{1}{8}$ " for an unfinished basement floor) plus the thickness of the DRICore ($\frac{3}{4}$ " if the basement floor will be finished. Verify that the top tread is located below the surface of the deck by the height of the riser plus the thickness of the tread ($1\frac{1}{8}$ " minus $\frac{1}{4}$ " if hard flooring will be installed).
8. Use the one correctly cut stringer as a template to mark the other two 2x12's. Cut out the remaining stringers with care.
9. On each stringer, drill $\frac{3}{16}$ " pilot holes and use three $\frac{5}{16}$ " x $1\frac{1}{2}$ " lag screws and $\frac{5}{16}$ " washers to attach an L-bracket flush to the top of the tread and flush with the end of the stringer. Be sure to use correctly oriented brackets (left and right) on the appropriate outside stringers (either bracket can be used on the middle stringer).
10. Create a "sandwich" at the bottom of each of the outside stringers. For each of the stringers.
 - a. Cut a 2x4 slightly shorter than the bottom of the stringer.
 - b. Rip $3\frac{1}{2}$ "-wide pieces of OSB cut to a total length approximately equal to that of the 2x4.
 - c. Create the "sandwich" of 2x4/OSB/stringer by nailing the 2x4/OSB pair to the outside, bottom of the stringer with 16d or $3\frac{1}{4}$ " collated nails. (This sandwich provides a 2" gap between the stringer and the wall to allow for installation of sheetrock and a skirtboard later in the construction process.)

NOTE: Before attaching the 2x4/OSB sandwich to the outside stringers, the finished stringer to the wall, or the 2x4 support to the center stringer (see Step 11), check each cut stringer for crown. Cutting the riser/tread notches may have relieved built-in stresses, resulting in distortion. If significant movement has occurred, contact the Construction Supervisor
11. Cut a third 2x4, also slightly shorter than the stringers, and nail it to one side of the center stringer, flush with the bottom. This will provide additional stiffness during use of temporary stair treads.
12. Use the last calculation in Figure 4-2 (Top Step Rise) and measure that distance down from the underside of the deck. Make a line on the stairwell framing at this point. This line marks the location of the tops of the three stringers (Figure 4-4).

13. Before installing the stringers, attach air sealing tape to the bottom of the stringer where it will rest on the concrete.
14. Align the top of the outside stringers to the mark from Step 12 and clamp each stringer in place to a convenient stud. Drill 3/16" pilot holes using the bracket as a template, and then secure the angle bracket at the top to the rim board/lam beam using three 5/16" x 1½" lag screws and 5/16" washers.
15. Secure the two outside stringers to the stairway walls with one 6" timber screw through the stringer into each stud between stairs 4 and 9. This makes it easier to remove a stud when creating the angled stairway wall.
16. Install the center stringer with the top aligned with the mark made in Step 12, centered between the two outside stringers, attaching the top bracket with 5/16" x 1½" lag screws and 5/16" washers.
17. Install the temporary stair treads using one 2x4 and one 2x6 on each step. Attach each piece of lumber to the stringers using a SINGLE 8d nail at each end of the lumber. Treads must not extend beyond the width of the two outside stringers as this will conflict with installation of sheet rock and the skirt board. These temporary treads will be removed later when finished treads are installed.

4.5.3. Landing Design and Dimensions

1. A landing, if required, is a "joist" box made of 2x6's covered with ¾" floor decking with floor joists installed on 16" centers (see Figure 4-4).
2. Think of the landing as a step with the top surface acting as a finished stair tread.
3. Refer to the House Plan for landing location. The elevation above the basement floor is determined by the number of steps to the landing times the riser height. If the basement has DRICore, add ¾" to the height of the platform. Remember, the bottom riser on the platform and the bottom riser on the basement floor are both reduced by the thickness of a tread (1⅛"). Furthermore, the distance from the main floor to the first tread is increased by the thickness of a tread.
4. Nail the landing box to wall studs. Any vertical supports that contact the concrete floor must be green.

Chapter 5. Build Main Floor Walls

- 5.1 FRAMING EXTERIOR WALLS
- 5.2 SQUARING EXTERIOR LONG WALLS
- 5.3 SHEATHING EXTERIOR LONG WALLS
- 5.4 ERECTING EXTERIOR LONG WALLS
- 5.5 SHEATHING & ERECTING SHORT WALLS
- 5.6 COMPLETING EXTERIOR WALLS
- 5.7 STRAIGHTENING EXTERIOR HOUSE AND ATTACHED GARAGE WALLS
- 5.8 FRAMING INTERIOR WALLS
- 5.9 ERECTING FULL-HEIGHT INTERIOR WALLS
- 5.10 ERECTING HALF-HEIGHT INTERIOR WALLS
- 5.11 INSTALLING TOP PLATES

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Reciprocating saw
Framing nailer
50' Steel tape
6' level
4' level
Framing square
Chalk line
Pry bar
String line
Sledgehammer
Stepladder

Materials needed:

Pre-marked wall plates
Door and window components
2x6 and 2x4 Studs
16d Nails
16d Duplex nails
8d Nails
3/4" Collated nails
2 3/8" Collated nails
1" and 2" Button nails
2" Drywall screws
2 1/2" Deck screws (tan-colored)
4" and 6" Timber screws
4x8 OSB
1" Foamboard
1/2" Foamboard
House wrap
Air sealing tape
Flashing tape
Construction adhesive
Air sealing caulk
Spray foam

Personal Protection Equipment:

Safety glasses (required)
Work gloves (recommended)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

5.1. FRAMING EXTERIOR WALLS

1. Assemble each exterior wall on the deck and then erect it in one complete section. Assemble the two long walls first. Assemble and erect the short walls after the two long walls are up.
2. Before separating the upper and bottom plates of the long walls, check for marks on the inside edge of the bottom plate 5½” from each end of the plate. Before assembling the wall, align these marks close to the chalk lines of the adjoining short walls. Once the wall has been lifted, this will help properly position the wall end-to-end.
3. Remove the temporary nails connecting upper and bottom plates of the wall section and separate on the deck. Be sure the words “Upper” and “Bottom” remain in the same orientation.
4. If not presorted, select studs for framing walls by sighting along the edge of each stud to determine whether the stud is crowned. If crowned, mark with an arrow pointing to the high side; if not crowned, mark with an arrow pointing to one end of the stud. Do not use studs if they are severely crowned (ask yourself, “Would I use this for my house?”). Place studs with “crown up” and window and door components in position between plates per markings on upper and bottom plates. Make certain that the flush side of the window and door headers faces up. Check the jack studs in the door components for any twist. Replace if they are twisted as this will cause problems during door installation.

NOTE: Set aside the straightest studs for use in the kitchen walls and bathroom tub wall.

5. Preassemble 2x6 corners ensuring that end and side surfaces are flush, nailing every 10” - 12” along the length with ¾” collated nails or 16d nails. Place the “L” “down” at end of the wall, flush with ends and sides of the upper and bottom plates; nail with three ¾” collated nails or 16d nails into each piece.
6. Make sure the edges of the studs are flush with the edges of the plates and that the end studs or corner assemblies are flush with the ends of the plates. Using a plastic speed square with a corner cut off, make a mark on the inside face of each plate at each layout mark to ensure the stud is square to the plate prior to nailing. Align the stud to this mark on the inside of the plate and nail one ¾” collated nail or 16d nail through the plate into the bottom third of the stud. Then square the stud to the line and nail two more ¾” collated nails or 16d nails into the stud through the plate, one in the middle and one near the top, taking care to keep hands and body parts away from the nailer. Use a tool to twist the stud to square, if required.
7. Field cut short studs for each window, measuring for length next to the nearest stud. Transfer locations for these short studs from the bottom plate to the window sills and nail in place with three ¾” collated nails or 16d nails at each end.
8. The non-zero end of a wall may have an extra stud near the second-last 24” o.c. stud. If the two studs are in direct contact, screw them together with three ½” deck screws. If

the two studs are separated, fill the gap with multiples of ½” foamboard and then screw the studs together with three 4” timber screws to create a tight stud/foamboard “sandwich.”

5.2. SQUARING EXTERIOR LONG WALLS

1. After each long wall is assembled on the deck, align the bottom of the wall’s bottom plate so it is flush with the chalk line along the entire length of the wall. Use a hammer to toenail through the bottom face of the bottom plate into the deck with 8d nails approximately every 8’.
2. With a long steel tape, “burn a foot” and use diagonal measurements to square up the wall, moving the top of the wall UNTIL BOTH MEASUREMENTS ARE EXACTLY THE SAME (a difference of no more than 1/16”). **(Use good “corners” and the same edge of the tape at each end when making these measurements.)** Using a hammer, tack the upper plate to the deck with three or four 16d duplex nails through the top face so it will not go out of square.

5.3. SHEATHING EXTERIOR LONG WALLS

1. Cut four 5¼” x 92½” pieces of 1” foamboard (or two pieces of 2” foamboard) and insert into the L-corner. Tape or tack in place. Do this before attaching any OSB to the corner. Cut additional 5¼”-wide pieces of foamboard to create stud-foamboard-stud “sandwiches” where studs are less than 3” apart. Use 4” timber screws if the “sandwich” is 1½” wide or less. Use 6” timber screws if the “sandwich” is wider than 1½” but less than 3”. Drive both 4” and 6” screws at an angle so they don’t go all the way through the “sandwich”.
2. Check the House Plan to see where sheets of 4’x8’x½” OSB wind bracing are to be located on each wall section and secure them to the studs. Each OSB sheet at the ends of the wall should be centered on the stud nominally 48” from the end of the wall and flush with the bottom plate but not necessarily flush with the end studs. The “reveal” at the wall end should be consistent from top to bottom—a sign that the wall is square. Tack in place using one 8d nail in each corner. Check that the wall remains square before nailing permanently. If the House Plan calls for wind-bracing in the center of the wall, place a 4x8 sheet of OSB centered on studs and flush with the bottom plate. Mark all wind bracing sheets with a large “WB” using red crayon.
3. If one of the long walls is the front wall of the house, the rest of this wall may require sheathing with OSB. Consult the Construction Supervisor to determine if this is the case. If yes, sheathe the entire wall with OSB, cutting pieces to fit below windows. It is not necessary to put OSB above doors or windows.
4. Using a T-square, or measurements, draw a line on all OSB sheets at all studs within the sheets to help ensure that the nails do not miss. Fasten all **wind bracing** OSB sheets with 2⅜” collated nails or 8d nails into each stud and the upper and bottom plate with a maximum 6” spacing. Fasten all **non-wind bracing** OSB sheets with 2⅜” collated nails

or 8d nails following the Non-Wind Bracing Nailing Pattern: seven equally spaced nails down each side stud, five down the middle stud, and two between each stud in the upper and bottom plates (see Figure 5-1). After all the OSB sheets are fully nailed, pull the nails that are securing the upper plate of the wall to the deck.

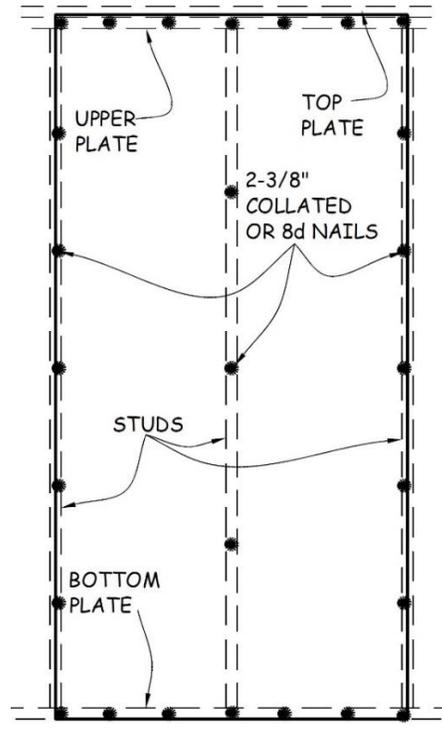


Figure 5-1. Non-Wind Bracing OSB Nailing Pattern.

5. Measure the width of the house wrap and subtract $14\frac{3}{4}$ " from that width (e.g., if the wrap is 18" wide: $18" - 14\frac{3}{4}" = 3\frac{1}{4}"$). Measure up from the bottom of the wall that amount and snap a chalk line the length of the wall above the bottom plate. Position the wrap so it extends about 12" beyond both ends of the wall and staple the top of the wrap to the chalk line at each stud and over any OSB, leaving a little slack at the edges of any OSB sheets to allow foamboard to be installed tightly to the OSB edges. Foamboard will be installed over the house wrap.

NOTE: Once the wall is erected, the wrap will hang the proper amount below the wall to shed water away from the house at any horizontal seam. The bottom of the wrap will fall slightly below the bottom of the foam sheathing and slightly over the 2" foundation foam.

6. On side and back walls, install 1" foamboard sheathing between OSB wind bracing, over the house wrap and flush to the bottom of the bottom plate. Position the foamboard so the grooved side is butted up against any OSB. If this is not possible, cut off the "tongue" of the foamboard before placing it next to the OSB. Nail the foamboard with 2" button nails following the Foamboard Nailing Pattern: seven equally spaced nails down each side stud, five down the middle stud, and two between each stud in the upper and bottom plates (see Figure 5-2). The seven nails down each side stud can be shared

between two abutting pieces of foamboard. Position the nail in the middle of the gap between the two so that the “button” holds both pieces of foamboard in place (see Figure 5-2).

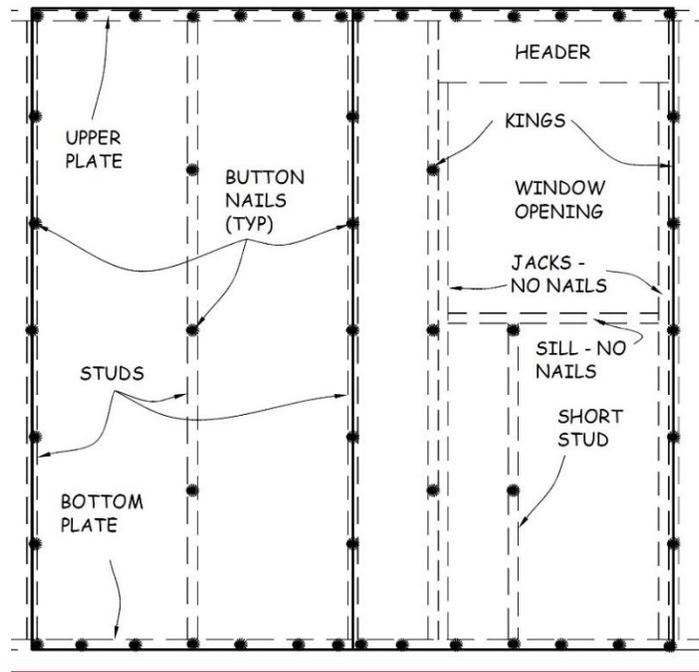


Figure 5-2. Foamboard Nailing Pattern.

7. Around windows and doors, nail only into the King studs and into the header, making sure nails are 2¼” away from the opening. Do **NOT** nail into the window sill; **nail only into the short studs (SX) below the window sill**. This will prevent nails from interfering with the window flanges during window installation.

NOTE: Avoid using full 4x8 sheets of foamboard over windows and doors. Use scrap pieces that cover at least the King/Jack pairs and are centered on short studs below windows. Fill gaps on headers and below windows with smaller pieces, but do NOT create any horizontal seams.

8. Install ½” foamboard over all OSB, flush on all sides. Nail with 1” button nails following the Foamboard Nailing Pattern described in Section 5.3.6 and shown in Figure 5-2. Tape all seams and any broken score lines with air sealing tape.

CAUTION: Install ½” foamboard over OSB designated as wind bracing **ONLY** if wind bracing inspection IS NOT required or inspection has been completed (see Construction Supervisor).

9. After the wall has been sheathed, lift the bottom edge of the house wrap up, taut onto the sheathing, and tape this edge to the sheathing with air sealing tape every 3’–5’.

NOTE: This will keep the house wrap out of the way when erecting the wall in the next section.

5.4. ERECTING EXTERIOR LONG WALLS

1. Apply two generous beads of air sealing caulk parallel to each other along the entire length where the wall will stand, except at door openings. Stay at least 2" away from the chalk line and the deck edge. Apply a bead of caulk, perpendicular to these two beads, at both ends of the floor deck and at each side of any door opening, connecting them in a large rectangle. This will help to ensure a complete air seal.
2. Assemble two temporary braces for each long wall. Attach a 2x4x24" spacer block to the lower inside end of a 14' or 16' 2x4 brace. Align the spacer block with the end of the brace and nail a single 16d duplex nail through the long brace into the center of the spacer block. This spacer block will allow clearance for the 1" foamboard on the short walls when they are erected. With one 16d duplex nail, attach a 2x4 brace to each long wall end stud near the upper plate to serve as a temporary support.
3. Stand the wall section up, and move the inside of the floor plate flush to the chalk line on the deck along its entire length. Be sure to align the 5½" marks on the bottom plates (made in Section 3.2.5) with the adjoining chalk lines (as a result, the ends of the wall may not necessarily align with the edge of the deck). Nail the wall to the deck with two 3¼" collated nails through the floor plate between each stud and into each I-joist below the OSB deck.
4. To prevent the wall from tipping over, brace it at each end using the long 2x4' braces attached to the wall in Step 2 above. Tip the wall out slightly (about ½"), rotate the 2x4 block horizontal at the end of the brace and nail it to the rim board with two 16d duplex nails. Add a second 3¼" collated nail or 16d nail through the brace into the 2x4 block. Secure the top end of the 2x4 brace with another 16d duplex nail.
5. Install turnbuckle pipe braces in the middle sections of the wall for extra support. Install them using three 2" drywall screws into the upper plate and through the floor into an I-joist. Or, screw the brace into 2x blocking secured to two I-joists with 16d duplex nails. Place the braces 10' to 12' apart.

NOTE: Do not place a turnbuckle where an interior wall will intersect an exterior wall.

5.5. SHEATHING & ERECTING SHORT WALLS

1. Before erecting the wall, locate the blocking between the rim board and the first/last I-joist to which the bottom plate will be nailed. If not marked on the deck or rim board, go to the basement, locate one of the blocking pieces, make appropriate measurements and transfer to the rim board. The blocking should be on a maximum of 32" centers.
2. After the wall is assembled on the deck (see Section 5.1), align the bottom plate so it is flush with the chalk line along the entire length of the wall. Use a hammer to toenail through the bottom face of the bottom plate into the deck approximately every 6-8' with 8d nails. This will ensure that the bottom plate will be straight before installing sheathing

3. If the House Plan calls for wind bracing in the center of the wall, place a 4x8 sheet of ½” OSB centered on studs and flush with the bottom plate. Tack to the bottom and upper plates with one 8d nail in each corner of the OSB. This will be sufficient to hold the OSB in place while raising the wall but still allow movement when plumbing the corner. Mark all wind-bracing sheets with a large “WB” using red crayon.
4. If one of the short walls is the front wall of the house, the rest of this wall may require sheathing with OSB. Consult the Construction Supervisor to determine if this is the case. If yes, sheathe the entire wall with OSB, ensuring end-of-wall OSB sheets can be properly installed after the wall is raised. Tack to the bottom and upper plates with one 8d nail in each corner of the OSB. Cut pieces to fit below windows. It is not necessary to put OSB above doors or windows.

CAUTION: Do not put OSB sheathing or wind bracing on either end of the short walls at this point. This will be done after each wall is erected

5. Attach house wrap to the short walls in the same fashion as that done in Section 5.3.5 but leave the wrap that will go under the end OSB sheathing loose. Fold this part back over the installed sheathing and temporarily tape in place.
6. Install 1” foamboard to any short wall that is not the front wall of the house as was done on the long walls (see Section 5.3.6.). Ensure end-of-wall OSB sheets can be installed properly after the wall is raised. Tape seams and any broken score lines on the foamboard with air sealing tape. If the short wall is the front wall of the house, do not put foamboard over the OSB. This will be done after the wall is raised and after wind bracing inspection (if applicable).
7. Following the procedure in Section 5.4.1, apply two generous beads of air sealing caulk on the deck. Lift the wall and lean it against the long wall braces until it can be joined at the corners. Align the bottom plate with the chalk line. Nail the wall to the deck with two ¾” collated nails through the floor plate into the blocking located in Step 1 above.
8. At each corner, remove the temporary brace on the long wall to allow the walls to come together. Before nailing the corners together, check that the upper plates are flush with each other at each corner. Fasten wall panels to each other by flushing the corners and nailing the adjoining end studs every 12” from bottom to upper plate with ¾” collated nails.

NOTE: Be sure both walls are supported before removing the long wall brace on the outside of the short wall

9. When all exterior walls have been erected, plumb and brace all corners with 2x4 bracing on the INSIDE of the house (both long and short walls). Brace with 12’–16’ 2x4s from the upper plate at the corner to the bottom plate. Nail at least once into both the upper and bottom plates with 16d duplex nails for each brace. Keep the top of the brace less than 1” above the upper plate and avoid crossing interior walls with the brace. Add a few extra nails (duplex) where the brace crosses King, Jack, or regular wall studs.

10. Install all OSB wind bracing with 2³/₈" collated nails or 8d nails into each stud and the upper and bottom plate with a maximum 6" spacing.
11. Permanently fasten any tacked, non-wind bracing OSB with 2³/₈" collated nails or 8d nails into each stud and the upper and bottom plate [following the Non-Wind Bracing OSB Nailing Pattern described in Section 5.3.4 and shown in Figure 5-1](#).
12. Unwrap house wrap and staple to each stud.
13. Install ½" foamboard over all OSB, flush on all sides. Nail [with](#) 1" button nails [following the Foamboard Nailing Pattern described in Section 5.3.6 and shown in Figure 5-2](#). Tape all seams with air sealing tape.

CAUTION: Install ½" foamboard over OSB designated as wind bracing ONLY if wind bracing inspection IS NOT required or inspection has been completed (see Construction Supervisor).

5.6. COMPLETING EXTERIOR WALLS

1. Measure and cut 1" foamboard to fit on the exterior of the sill box, **tightly** between the bottom of the wall foamboard and the foundation foamboard. Do the same below any OSB/½" foamboard wall panels. Install the foamboard with 2" button nails about 8" apart and 2" away from the top and bottom seams of the foamboard. Make sure the house wrap is **behind** this foamboard, leaving any extra wrap protruding from the seam between the bottom of the sill box foamboard and the top of the foundation foamboard (see Figure 5-3).
2. As needed, measure, cut, and nail 1" foamboard around porch corners and under the door.
3. Fill in any gaps at the corners.

NOTE: These pieces may be too narrow to nail. If so, simply tape in place using flashing tape.

4. After the sill box foamboard has been installed:
 - a. **Tightly** tape the seam between the wall foamboard and the top of the sill box foamboard with air sealing tape, taking care to completely cover the nail buttons above the seam by at least ½". Do not use an additional row of tape to cover the nails below the seam. Covering these nails is not critical.

CAUTION: House wrap must extend at least 1" over the surface of the 2" foundation foamboard (see Figure 5-3). If it does not, see the Construction Supervisor.

- b. Continue taping other seams with air sealing tape **except for** the seam between the rim board foamboard and the foundation foamboard. **Do not tape the seam**

where the house wrap emerges from below the sill box foamboard. Instead, tape the bottom of the house wrap to the foundation foamboard every 6' with a 3" piece of air sealing tape just to hold it down (see Figure 5-3).

- c. If not already done, fill all exterior corner gaps (both inside and outside corners) with foamboard and tape into place with flashing tape.
- d. At other seams, tape shingle-style, starting from the bottom, beginning with horizontal seams, and overlapping with any vertical seam above. Again, when taping horizontal seams, be sure to completely cover the button nails above the seams as in Step 4a above. Only tape over button nails at the seams (not in the field).

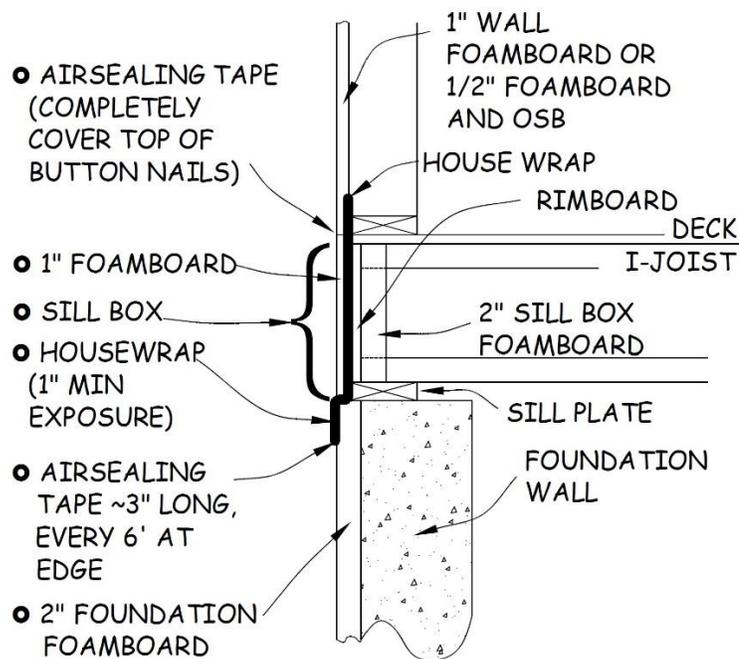


Figure 5-3. House Wrap and Foamboard Seams.

5. If not already done, cut out foamboard around windows and doors. Take time to make square cuts to prevent problems during window and door installation.

NOTE: To insure square cuts hold saw flat against the jack stud while cutting the foamboard.

6. Fill the inside of every window and door header with 2" of foamboard. Fill any gaps greater than 1/8" with air sealing caulk or spray foam. Cover the perimeter and any joints with flashing tape.

NOTE: Use pieces of foamboard that are 1" or 2" thick. This is a good spot to use scraps, as long as the pieces fit together tightly, and the joints of the multiple layers are not aligned with each other.

7. Make sure all L-corner foamboard and all stud/foamboard sandwiches are flush with interior wall studs. Trim if necessary.
8. Do not throw **ANY** foamboard scraps in the dumpster. Set aside in the basement or in black plastic bags.

5.7. ***STRAIGHTENING EXTERIOR HOUSE AND ATTACHED GARAGE WALLS***

5.7.1. **Installing String Line**

1. To straighten exterior walls, a VERY taut string line is stretched from one inside corner to another adjacent inside corner and the wall is adjusted to the string line every 8 – 10 feet and braced to hold in place.

NOTE: When there is an attached garage, treat the extended house/garage wall as one wall during this process. For straightening walls of detached garages, see Section 23.6 Straightening Garage Walls.

2. For each exterior wall corner, cut a scrap 2x4 10-12” long.
3. Drive a 16d duplex nail straight into the center of this 2x4. Be sure the nail is straight, since the nail above the 2x4 represents the inside of the wall corner. The upper part of the nail will be used to wrap the string line.
4. Place the 2x4 piece on top of the 2x6 upper plates at roughly a 45° angle so that the protruding end of the 16d duplex nail rests tightly against the “inside” corner of the upper plates of both walls (see Figure 5-4).

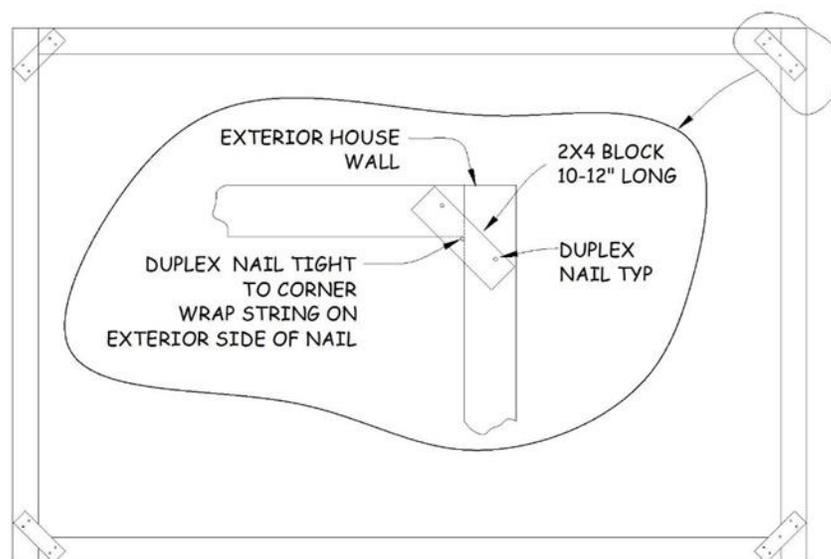


Figure 5-4. Installing String Line.

5. Nail the 2x4 to the upper plate with one 16d duplex nail on each end of the 2x4 piece. Nail securely as there will be a lot of tension on these.
6. Repeat steps 4 and 5 at each exterior corner.
7. In the first corner, start the string line on any nail other than the centered nail (feel free to add additional “tie off” nails as needed).
8. Wrap the string line on the exterior side of the protruding centered nail. This should align the string line near the inside edge of the upper plate.
9. Run the string line to the next corner and wrap it around the exterior of the protruding centered nail again. Continue until back to the starting corner. Make sure the string line is not obstructed between corners and is VERY taut.

5.7.2. Aligning the String Line to the Wall Corners

1. At each corner, verify that the string line around the corner nail is aligned with the inside of the upper plates. Adjust as necessary using an additional 8d nail to move the string line in or out.

NOTE: The string line may not be aligned to the inside of the upper plate all along the wall expanse at this point, but it must be aligned at each corner before straightening the walls between corners.

5.7.3. Straightening the Walls

1. Start 5’-7’ from the corner.
2. Place one end of a 6’ level (to be used as a straight edge) against the upper plate and the other against a nearby stud - not the stud immediately below. The level/straight edge should be at a slight angle.

NOTE: This “two-point” contact avoids problems with a bowed or twisted stud.

3. Slide the level up the wall until it reaches the string line. If the top of the level moves the string line, use the turnbuckle pipe bracing to move the wall in until the inner edge of the level lines up with the string line. If the level misses the string, move the wall outward until the inside edge lines up with the string line. The wall is now straight in that section. Add more pipe bracing or 2x4 bracing as needed to hold the wall straight.
4. Repeat this at each pipe brace, each interior wall intersection, and every 5’-7’ in between. Add more pipe bracing or 2x4 bracing as needed to hold the wall straight.
5. After straightening the walls the first time, re-check alignment with the string line a second time. Verify that the wall is plumb at each brace and at each intersecting wall location. Compare these readings to those obtained at each corner. If these

readings differ by more than $\frac{1}{8}$ ", consult with the Construction Supervisor or the Site Leader.

6. After walls are straightened and all bracing is completed, do a final check by sighting along the inside and outside edges of the upper plate of each wall at each corner. Once all walls are straight, remove the string line and the blocks.

5.8. FRAMING INTERIOR WALLS

1. Start by building the longer walls that will intersect the exterior walls. Remove the temporary nails connecting the upper and bottom plates and separate on the deck. Be sure the words "Upper" and "Bottom" remain in the same orientation.
2. If not presorted, select studs for framing walls by sighting along the edge of each stud to determine whether the stud is crowned. If crowned, mark with an arrow pointing to the high side; if not crowned, mark with an arrow pointing to one end of the stud. Do not use studs if they are severely crowned (ask yourself, "Would I use this for my house?"). Place studs with "crown up" and door components in position between plates per markings on upper and bottom plates.

NOTE: Set aside the straightest studs for use in the kitchen walls and bathroom tub wall.

3. Make sure the studs are flush with the edges of the plates and that the end studs or corner assemblies are flush with the ends of the plates. Using a plastic speed square with a corner cut off, make a mark on the inside face of each plate at each layout mark to ensure the stud is square to the plate prior to nailing. Align the stud to this mark on the inside of the plate. Nail with two $3\frac{1}{4}$ " collated nails or 16d nails through the plates into the studs.
4. If the wall is a half-height wall with a $3\frac{1}{2}$ " x $3\frac{1}{2}$ " full-height post at the end of the half-height (42") section, the upper plate of the 42"-height section will be $1\frac{1}{2}$ " short to accommodate the post. If a full-height post is not planned at the end of a 42"-height section, the bottom plate will be $1\frac{1}{2}$ " short. This will accommodate alternative methods of anchoring the end of the wall to the deck. Studs for a half-height wall are 39" long.

5.9. ERECTING FULL-HEIGHT INTERIOR WALLS

1. Start by erecting the longer walls that intersect the exterior walls. Before erecting these walls, install 2x4 blocking between the two exterior wall studs where the interior wall will be located. Place this 2x4 with the wide side flush with the interior surface of the studs and the top edge 50" off the floor. HAND NAIL with two 16d nails through the studs into the ends of the 2x4.

2. Similarly, where a flush sliding door intersects an exterior wall, install a similar 2x4 block but with the top edge 8 $\frac{1}{2}$ " above the floor. This provides support for the door header at the end opposite that of the single Jack stud.

CAUTION: For safety reasons, do NOT use a framing nailer for these first two steps.

3. For walls that do NOT include a flush sliding door, stand each wall section and position the bottom plate in line with the chalk line. Make sure the bottom plate is tight to the bottom plate of the exterior wall and then secure it to the floor using 3 $\frac{1}{4}$ " collated nails if they will hit an I-joist; otherwise, use 2 $\frac{1}{2}$ " deck screws. After checking that the end stud is plumb and tight to the exterior wall, nail at an angle THROUGH THE EXTERIOR WALL UPPER PLATE into the interior wall upper plate with 16d nails. Nail the end stud into the blocking installed between the exterior wall studs in Step 1. Check to be sure the joints at the upper and bottom plates are tight.

NOTE: If time and staffing permit, consider installing OSB drywall blocking at the end of these walls before they are attached to the exterior wall (see Section 10.5.3.4 for the number and size of the OSB pieces required). Install one piece above and one piece below the 2x4 blocking installed in Step 1 above. Attach the OSB to the end of the wall with three or four pairs of 2" drywall screws, taking care that the OSB does not contact the 2x4 blocking, the bottom exterior plates, or the upper exterior plates.

4. For walls that DO include a flush sliding door:
 - a. Measure the length of the upper plate and cut a 2x4 (or 2x6 if a 2x6 wall) 1 $\frac{5}{8}$ " shorter than that measurement. This will be the top plate for the closet wall.
 - b. Nail that piece to the wall upper plate, extending it 2" beyond the end of the wall upper plate and 3 $\frac{5}{8}$ " short of the interior end (leaving room for top plate overlap).
 - c. Stand the wall up, move it into position with the bottom plate aligned with the chalk line and the door header sitting on top of the blocking installed in Step 2 above. Secure the bottom plate to the floor between the chalk lines using 3 $\frac{1}{4}$ " collated nails if they will hit an I-joist; otherwise, use 2 $\frac{1}{2}$ " deck screws. Tack the loose end of the bottom plate in position with a duplex nail.
 - d. Using a long, straight 2x4 (8' or greater) against the closet upper and bottom plates, plumb the wall and nail the end of the top plate into the exterior wall upper plate with two 3 $\frac{1}{4}$ " collated nails. **Make sure the King/Jack side of the closet wall is plumb and straight.** This will ensure the closet door lies correctly against the wall when installed. (Once an exterior wall top plate is installed adjacent to this closet wall, it will be notched to accommodate the 2" overhang of the interior top plate.)
 - e. Again, place the edge of the straight 2x4 against the side of the closet top and bottom plates. Move the door header against the 2x4 and mark the edge on the horizontal blocking between the exterior wall studs. Nail the header to the wall blocking at this mark with 3 $\frac{1}{4}$ " collated nails

5. Install 2x4 blocking wherever two interior walls intersect and there is no stud at the point of intersection. Place the 2x4 blocking with the wide side flush with the interior surface of the studs of the wall being intersected and the top edge 50" off the floor. HAND NAIL with two 16d nails or two 2½" deck screws through the side of each stud into the ends of the 2x4 blocking.
6. Continue to build the remainder of the interior walls, standing them up, positioning to the chalk line, and nailing into place between each stud using 3¼" collated nails into the I-joist below, or 2½" deck screws where no I-joists are below the wall. Check that each wall is plumb before nailing it to the adjacent wall.
7. When erecting a bathroom tub wall use straight studs. Make sure the tub space measures 60⅞" at the back, the front, and at bottom, top, and middle.

5.10. ERECTING HALF-HEIGHT INTERIOR WALLS

1. Before erecting any half-height (42") walls, install 2x4 blocking between the two exterior wall studs where the wall will be located. Place this 2x4 blocking flush with the interior surface of the studs and the top edge 43½" off the floor. HAND NAIL with two 16d nails or 2½" deck screws through the studs into the ends of the 2x4.

CAUTION: For safety reasons, do NOT use a framing nailer for this first step.

2. Run two beads of construction adhesive on the deck, within the chalk lines for the half-height wall, keeping the beads ½" away from the chalk lines. Stand the wall section and position the bottom plate in line with the chalk lines. Make sure the bottom plate is tight to the bottom plate of the exterior wall.
3. Check that the end stud is plumb and tight to the exterior wall, then nail the end stud into the blocking installed between the exterior wall studs in Step 1. Starting at the intersection with the exterior wall, secure the half-height wall to the floor using 2½" deck screws, making sure joints at the upper and bottom plate are tight.

5.11. INSTALLING TOP PLATES

1. Walls must be tied together by nailing overlapping top plates to the tops of all walls. Top plates at the intersection of interior and exterior walls are done first.
2. The top plate on all bearing walls must extend a minimum of 4' on each side of the wall plate joint, and at each corner (see Figure 5-5.).
3. Top plates on non-bearing walls that extend into the 2" notch of the exterior top plates must be at least 16" long.
4. Where interior walls intersect exterior walls, create a notch 2" deep in the top plate of the exterior wall so it can receive the intersecting interior wall top plate. Verify that the interior wall is plumb before locating and cutting the notch.

NOTE: Notching 2" deep leaves 3½" of material on exterior 2x6 wall top plates.

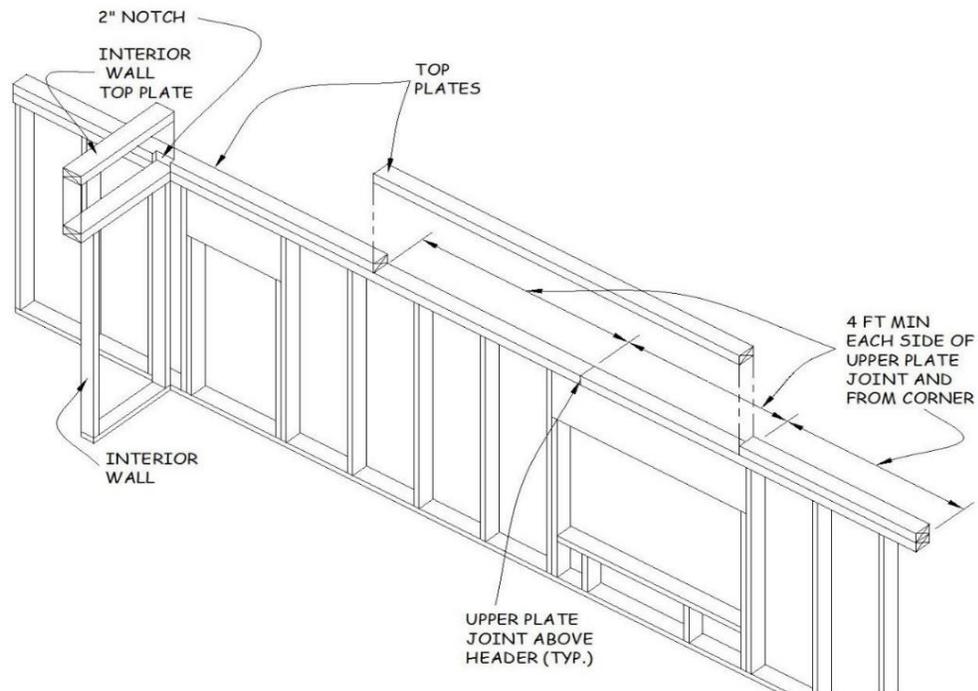


Figure 5-5. Exterior Wall Top Plate Installation.

5. To locate the notches, lay the exterior wall top plate on the wall in its final position. Mark the location of each intersecting interior wall. Place the top plate on the deck and, using a speed square, mark lines at each location. Using a circular saw with the blade set at 2" depth, cut the marked edge of the top plate at the outside of each line (this should allow enough clearance for the width of the intersecting top plate). Make multiple cross-cuts between these two cuts and knock the pieces out with a hammer.
6. When nailing top plates, use three 3¼" collated nails or 16d nails across 2x6 plates and two 3¼" collated nails or 16d nails across 2x4 plates. Nail at each intersection of top plates and nail at each stud location. Note that the top plates at an intersection overlap the joints of the walls below (see Figure 5-6).

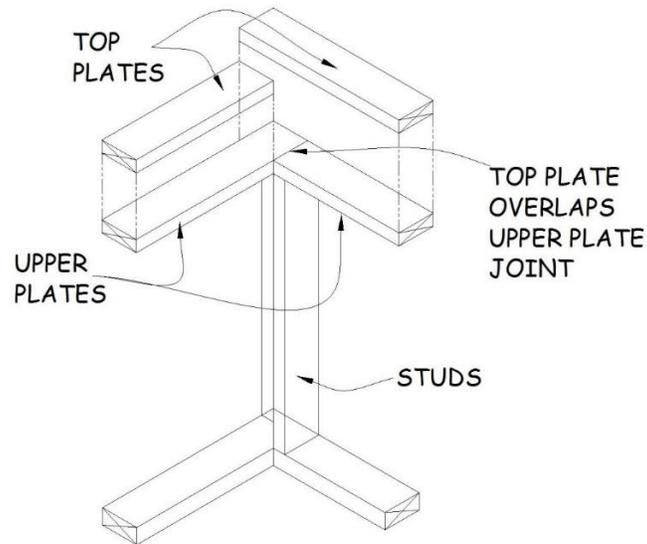


Figure 5-6. Interior Wall Top Plate Installation.

7. Nail two to four pairs of nails across exterior door and window headers. Be sure the interior edges of the top plates are flush with the edges of the plates below and that interior walls are tight to exterior walls before nailing.

NOTE: Occasionally the house will include a 2x4 interior wall butting against the end of a 2x6 plumbing wall (in a straight line). In this case, install a 2x4 top plate the full length of the wall, on the flush side. Install a 2" wide "filler" on the 2x6 section of the wall (necessary to provide nailing surface for wall sheetrock).

Chapter 6. Porch, Stairway and Basement Walls

6.1 FRAMING PORCH

6.2 FRAMING BASEMENT WALLS

6.3 CUTTING ANGLE STAIRWAY WALL

6.4 FRAMING STAIRWAY CLOSET PLATFORM

6.5 FRAMING STAIRWAY CABINET OPENING

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Materials needed:

2x6 & 2x4 Studs
2x4 Treated lumber
4x8 OSB
1/2"x3 1/4" OSB strips
1" Foamboard
Tapered shims
16d Nails
8d Nails
2 3/8" Collated nails
3 1/4" Collated nails
1" & 2" Button nails
2 1/2" Concrete nails
1/4"x1 3/4" Concrete screws
4" & 6" Timber screws
Air sealing tape

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Reciprocating saw
Framing nailer
Drill and bits
Driver
6' level
4' level
Framing Square
Chalk line
String line
Stepladder

Personal Protection Equipment:

Safety glasses (required)
Work gloves (recommended)
Hearing protection (recommended)

Reference Materials:

Door Schedule

Safety First! Review the Safety Checklist before performing tasks in this chapter.

6.1. FRAMING PORCH

1. Before proceeding check that any OSB in the porch area is covered with ½” foamboard, or that there is 1” foamboard nailed to the wall.
2. At both ends of the porch, place a straight 2x4 held against the outside edge of the concrete against the house. Using a 6’ level, plumb the 2x4 and mark the location of the concrete edges at the top of the wall. Save this 2x4 for use in Step 4 below.
3. Refer to Figure 6-1 for the following steps. At each end of the porch, nail a horizontal 4’ long 2x6 porch frame hanger support flush with the top plate using 16d (or 3¼” collated) nails, holding one end to the line made in Step 1. Once nailed, install three or four 4” timber screws spaced ~12” apart through the 2x6 into the house framing. Tighten the timber screws such that the face of the 2x6 remains vertical.
4. On the outside edge of both 2x6’s, measure in 3” and make a mark. Using a speed square extend the line from top to bottom of the 2x6. These marks represent the outer faces of the porch side framing. On those marks, install a double 2x6 joist hanger with the inside vertical edge of the hanger flush with the line, and the bottom of the hanger 5½” below the top plate. Use two short lengths (3-4” long) of 2x6 blocks set in a joist hanger to serve as a spacer to locate the inside edge of the hanger and to obtain the correct elevation and spacing between the sides of the hanger. Make sure the tops of the blocks are flush with the top plate before nailing the hanger.
5. Using the same 6’ level and straight 2x4 from Step 1, at both ends of the porch slab, plumb down from the face of the 2x6s installed in Step 3, and mark that location on the slab. Measure from that mark to the front edge of the concrete slab at both ends. (If the measurements are different, split the difference). Deduct 4½” (3” from porch edge plus 1½” front porch frame 2x6 thickness = 4½”) from that measurement; this represents the length the of the two outer 2x6 side frame members.

EXAMPLE: Assume the slab depth measures 59”. After deducting 4½” from the depth, the working measurement will be 54½”.

6. Using the working measurement, cut two 2x6’s to that length. Cut two other 2x6s 1½” shorter than that length.

EXAMPLE: For a working dimension width of 54½”, cut two 2x6s at 54½” and two at 53”.

7. For each end of the porch, assemble the side porch frame pieces. Flush one end and the edges of one of the longer 2x6s with one of the shorter 2x6s. At the other end of the assembly, use a 2x4 or 2x6 block to ensure a 1½” offset. Nail the two pieces together with 3¼” collated nails every 12” at an angle so points do not protrude. Take each 2x6 pair and place the flush end into the joist hanger. Make sure the shorter 2x6 faces the center of the porch. Stand a 2x4 (temporary post) on end on the concrete 6” from the unsupported end. Level the 2x6s and clamp and nail the 2x4 to it with two 16d duplex nails. Holding the flush end tight to the house, drive a 6” timber screw through the 2x6

joist hanger support into the ends of each of the side porch frame 2x6s (see detail in Figure 6-1). Then, toenail into it through the 2x6 joist hanger support with 16d nails.

8. At the house wall, measure the distance between the two outside faces of the end pieces. Cut one 2x6 to this length, and one 3" shorter. Lift the shorter of the two into place and nail it to the ends of the inside 2x6 end pieces, keeping the ends flush top and bottom, and the outside end pieces tight. Nail the longer of the two pieces to the ends of the outside end pieces, keeping the ends flush with the outside face of the end piece (see Figure 6-1). Use three 3¼" collated nails at each joint. Nail the 2x6 pairs together with three 3¼" collated nails every 24" along the length of the headers. Use a clamp or other method to keep the top and bottom edges flush. Put the nail in at an angle to be sure the points do not protrude.
9. Cut four 2x6 pieces about 40" long to be used as diagonal braces, after checking the length required. Cut a 45° bevel on each end. These will be installed diagonally in all four inside corners of the porch framing to hold them square (see Figure 6-1).
10. Square the 2x6 pair to the house using the 3–4–5 system or a framing square. At each end of the porch, nail one of the beveled 2x6 braces to the house and the 2x6 pair. Add the two remaining 2x6 diagonal braces. Before nailing the last two braces, sight along the front of the 2x6 pairs to make sure their face is not bowed in or out across the front of the porch. Brace as needed to straighten.

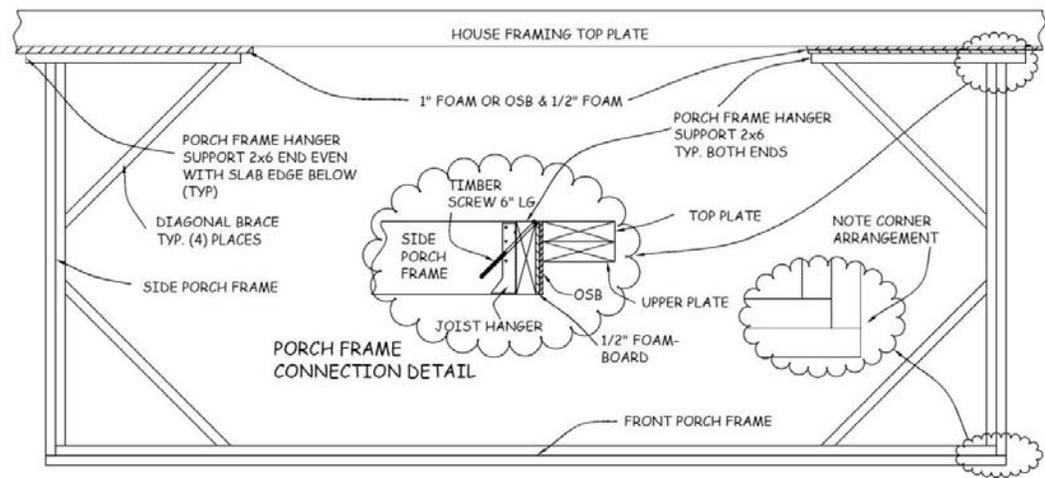


Figure 6-1. Porch Framing.

11. To locate support posts, transfer the corner of the framing above to the concrete below. Place a straight 2x4 held at each outside face at one end of the porch framing. Using a 6' level, plumb the 2x4 at each face, close to the end, and make a mark on the concrete. Repeat at the opposite end of the porch.
12. Using the same method as in Step 11, mark for a center post that in combination with one of the outside posts will "frame" the door. String a tight string line from end to end

at the marks from Step 11 and mark the outside face of the middle post. This will ensure that the bottoms of the three posts are aligned.

13. Set the post anchor plates to the marks made in Steps 11 and 12. Secure with $\frac{1}{4}$ "x $1\frac{3}{4}$ " concrete screws:
 - a. Locate the concrete screws, the $\frac{3}{16}$ " masonry drill bit, and screw drivers in the Anchor Kit.
 - b. Using a $\frac{3}{16}$ " or $\frac{1}{4}$ " drill bit, enlarge the four holes in the mounting plate.
 - c. Using a hammer drill and the $\frac{3}{16}$ " masonry bit, drill one hole, approximately 1" deeper than the length of the concrete screws. (Remove the drill bit from the hole periodically to clear concrete dust, and remove all the dust from the vicinity of the hole so it doesn't get knocked back into the hole.)
 - d. Using the hex driver, carefully drive a screw into the hole until seated tight to the anchor plate. Square the anchor plate and use it as a template to drill the other three holes. Finally, drive the other three concrete screws.
14. Assemble posts, each of which consists of two 2x4's (with their crowns opposite to each other) and $\frac{1}{2}$ "x $3\frac{1}{4}$ " OSB, nailed together. Pre-drill a piece of green treated 2x4 measuring $3\frac{1}{2}$ "x $3\frac{1}{2}$ " and screw it to the bottom of the post using two $2\frac{1}{2}$ " gold deck screws (pre-drilling prevents the green treated piece from splitting).

NOTE: Before measuring and cutting the individual posts, step away from the house and sight along the framing to be sure it is parallel with the top plate of the house wall. Adjust as required.

- a. With a solid face parallel to the front edge of the porch, set a post on top of the concrete screws of each plate and lean it against the porch framing. Pound on the top of the post to get an impression of the concrete screw heads in the bottom treated block. Remove the post and drill a $\frac{1}{2}$ " diameter by $\frac{1}{2}$ " deep hole at each screw location.
- b. Set the post in the same orientation, plumb it, and mark the post at the bottom of the framing.
- c. Label each post for position and orientation, and cut to length.
- d. Measure each post and record the length on each post. Cut the vinyl post sleeves $1\frac{1}{4}$ " shorter than that measurement. Attach the post H-bracket to the top of the posts with $1\frac{1}{2}$ " siding nails (see Figure 6-2). These brackets will be used to secure the top of the post to the porch framing). Slide the post sleeves over each post. One at a time, set one post end on the post anchor plate and raise the other end under the porch framing. Make sure to place the posts with the wide face of the 2x4 facing the street. Plumb it and nail the top of the post in place.



Figure 6-2. Porch Post H-Bracket.

15. Slide the post sleeves up and nail the post anchor plates to the posts with 1½” roofing nails. Slide the post sleeves down over the post anchor plates.
16. To allow for trim ring fit and finish, nail 2x6s to the face of the porch framing, keeping the top edges flush. Use pairs of 16d or 3¼” collated nails spaced about 18” apart.

6.2. FRAMING BASEMENT WALLS

6.2.1. Preparation

1. Before framing any basement wall, check to make sure that all cracks and separations in the floor slab are sealed.
2. Basement walls and components in Bi-level homes may need studs longer than 92½”. Check the House Plan, or with the Construction Supervisor, prior to assembling any basement walls in a Bi-level home.
3. Before building any walls, cut 1” foamboard to cover the foundation walls behind any 2x4 walls. Apply foamboard from the floor all the way up the wall and also on the top of the foundation wall where the sill plate does not cover (see Figure 6-3).

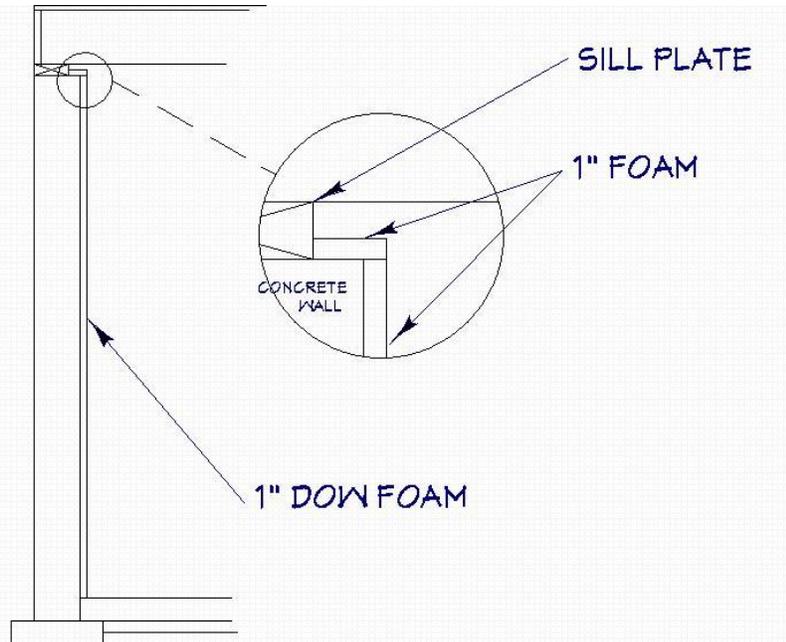


Figure 6-3. Basement Wall Insulation.

4. When applying foamboard around the egress windows, install it with 1" of vinyl and concrete exposed around the window frame perimeter.

6.2.2. Laying Out Basement Walls

1. Referring to the House Plan, lay out the location of all basement walls, snapping chalk lines on each side of the walls. The location of walls labeled "Ref" may not exactly match the House Plan owing to foundation differences. All interior walls that intersect an exterior wall are measured from the inside of the exterior wall.
2. Start by laying out the exterior walls. Where exterior walls meet, locate a stud 3 1/2" from the end of the long wall plate that runs past the short wall to provide a sheetrock nailing surface as shown in Figure 6-4.

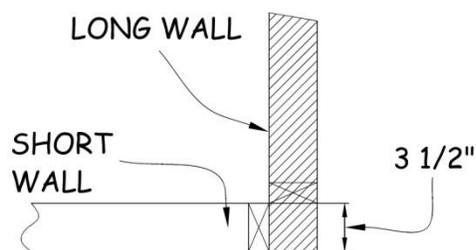


Figure 6-4. Basement Exterior Wall Corner.

3. When laying out the bathroom interior wall, note the location of any concrete floor piping penetrations for toilet and shower drains. Adjust the wall locations as

required to maintain the correct spacing from the wall to the pipe centerline as indicated in the House Plan.

4. At corners and intersections, pay attention to which wall end should abut the side of the other wall. Lay out accordingly.
5. Spray all chalk lines with sealer to protect them from the elements.

6.2.3. Cutting Basement Wall Plates

1. All basement wall bottom plates must be treated lumber. Cut upper and treated bottom plates to match the layout on the floor.
2. Check corners to determine which wall end should abut the side of the other wall. This may be dictated by an adjoining door.

6.2.4. Marking Door Locations on Basement Wall Plates

1. Referring to the House Plan and the Table of Door Measurements (Table 6-1), begin by locating and marking the door centerlines using a short VERTICAL line. Overlay that mark with a “C” and an “L” to create a mark for center line: C .

NOTE: The separation between Jack studs (the “rough opening”) for all swinging interior doors is 2” wider than the door size. For all sliding doors, the rough opening is ½” wider than the door size (see dimensions in Table 6-1).

2. Mark the location of each door and label with the door size and type (e.g., 4068 Slider).
 - a. For bedroom and bathroom doors, locate the centers such that the hinge-side King/Jack stud pair is at the INTERSECTION of the adjoining wall. This places the hinge side “tight” to the corner for proper door swing but still allows room for trim behind the door.
 - b. For SWINGING closet doors and non-flush sliding doors, locate the centerlines per the House Plan. Measure, locate, and mark the King and Jack studs per Table 6-1.
 - c. For FLUSH sliding doors, locate the inside of the single King/Jack stud pair the specified rough opening distance from the exterior wall (see Table 6-1), e.g., 60½” from the wall for a 5068 door.

NOTE: Ignore what appears to be a small wall section on the House Plan next to the exterior wall. This is an artifact of the CAD software and does not represent an actual wall section. The end of the header will actually be supported inside the exterior wall.

Table 6-1. Example Basement Door Measurements.

Interior Door Type	Rough Opening Width	Header Length	Jack Stud Length
32" Basement Swinging Door	34"	37"	82"
60" Basement Sliding Door	60½"	63½"	83"
60" Basement Folding Door	<u>61½"</u>	<u>64½"</u>	81"

6.2.5. Marking Studs on Basement Wall Plates

1. Lay out studs on 24" centers on upper and bottom plates.
2. If the wall intersects an exterior wall, start from exterior wall end (sheetrocking of interior walls will also proceed from exterior walls inward). If the wall intersects another interior wall, start layout to match likely sheetrock installation.
3. Make certain that door rough openings are at least 3" from the end of the wall panel to permit later installation of door trim. The King and Jack studs provide sufficient space for the 3" door trim.
4. Where a door will be attached at the end of a bathroom or bedroom wall, mark the end of the wall for a 2x4 L-corner oriented to allow nailing through the L-corner into the King stud of the door as shown in Figure 6-5 (similar to the 2x6 L-corners used in the exterior walls). If doors are to be attached on both sides of this same wall, omit the L-stud, and orient the additional 2x4 as shown.

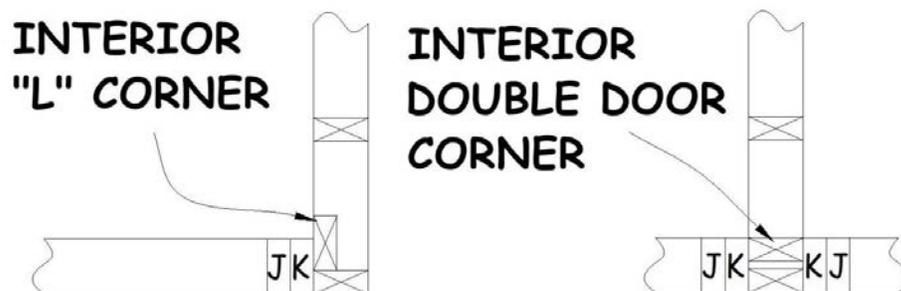


Figure 6-5. Corner Construction.

5. When complete, label upper and bottom plates and tack together with duplex nails. Mark compass orientation and label both plates and floor with an identifying number.
6. Hold the framing around the egress windows back ¼" from the outside edge of the window frames. If this is not done, sometimes finished drywall sticks past the inside frame of the window after the sheetrocking and plastering are completed.

6.2.6. Building Basement Walls

1. Basement walls are constructed in the same manner as other interior walls (see Section 5.8), but use treated bottom plates.
2. Make the height of basement walls $\frac{1}{4}$ " shorter than required so they can be set in place without force. Place upper and bottom plates on the floor in position between the snapped chalk lines. At several locations, measure the distance from the top of the two plates to the bottom of the I-joists or beam above. Subtract $\frac{1}{4}$ " from the shortest of the measurements and cut the studs to that length.

NOTE: Here's an alternative method which eliminates measuring!
Number the studs and plate locations to ensure proper placement when assembling the wall. At each stud location, stand on the top/bottom plate pair (to eliminate any gaps) and place one end of a stud on the plates. Hold it close to plumb against the floor joist or beam, and make a mark on the stud at the bottom of the joist or beam. Draw a square line at the mark, and cut the stud to length on the non-waste side of the square line ("take the line").

3. If there are any doors in the wall, cut the top end of the pre-assembled component King/Jack pairs to the correct length prior to assembling the King/Jack pairs to the header. Then install the assembly in the wall. If there is a door in the wall under the beam, omit the header and use King/Jack pairs that are the same length as the other studs in that wall (both King and Jack are the same length).
4. If the wall contains one or more windows, omit the King and any Short studs and install them after the wall is plumbed and anchored.
5. Assemble the walls in the usual fashion. Attach the upper and bottom plate to each stud using two 16d or $3\frac{1}{4}$ " collated nails through the plate into each end of the stud.
6. Tip the walls upright and align the bottom plate with the floor chalk lines. Use tapered shims to take up any space above the upper plate, and plumb the wall. Nail the bottom plate to the floor using $2\frac{1}{2}$ " concrete nails, one between each stud. Double check alignment with the chalk lines as each concrete nail is installed.
7. Recheck the wall for plumb, and nail the upper plate to each I-joist using two $3\frac{1}{4}$ " collated nails.

NOTE: Before anchoring either the top or bottom of the exterior walls, check for plumb at the corners and at several locations along the length. The masonry walls may not be plumb and it may be necessary to move the 2x4 wall away from the concrete at either the top or bottom.

8. Foamboard insulation must held tight to the foundation wall following erection of the stud wall. Nail scrap OSB or 2x lumber, using 2 $\frac{3}{8}$ " collated or 8d nails, to the wide side of studs as required to hold the foamboard against the foundation wall.
9. Window framing consists of a T-header, a sill, and two King studs (no Jack studs). Install the King studs by toe nailing with 16d nails (or 3 $\frac{1}{4}$ " collated nails) to the top and bottom plates after carefully aligning the inside faces of the King studs 1" outside of the inside vinyl window frame. Consistent reveal of the vinyl frame is important for a good look when finished.
10. Measure the distance between the King studs at the top and or bottom (they should be the same) and cut the T-header and sill 2x4 to that length. Leaving 1" of reveal of the vinyl frame below the bottom face of the header, and above the top face of the sill, nail through the King studs into the ends of the header and sill. Be sure both header and sill are level.
11. Add Short studs as required below the sill to match the 24" stud spacing. Short studs are not required above the T-header.
12. Walls parallel to the I-joists require blocking at the top. Nail 2x4s between the bottom I-joist flanges at 24" O.C., flush with the bottom of the I-joist flange (see Figure 6-6).

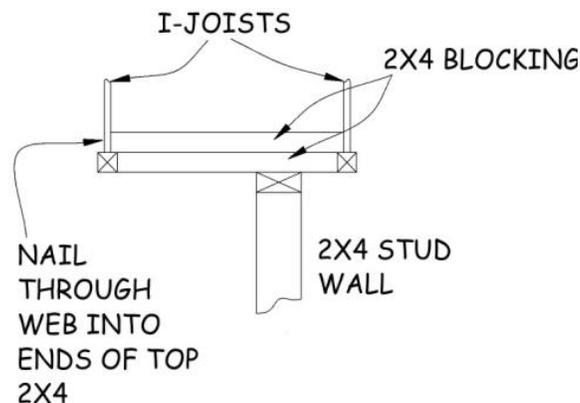


Figure 6-6. Blocking for Attaching Basement Walls Between I-joists.

6.3. CUTTING ANGLE STAIRWAY WALL

1. Both stairway walls are built and installed full height. One of these walls must be cut at an angle to allow large items (e.g., mattresses) to be turned at the bottom of the stairs. The top of the angle wall should be 42" above the nose of the stair treads.
2. Typically, the studs are not aligned with the nose of the treads so an added step is required. At the bottom of the stairs, lay a 6' straight-edge on the steps. Hook a tape under the straight-edge at the bottom stud and the upper stud, measure up 39", and make

- a mark on each stud. Place the straight edge on these marks and scribe an angled line on all the covered studs. Remove the entire middle stud.
- Using a speed square, scribe marks around the other three sides of the studs that are to be cut to aid in cutting at the proper angle. On the top stud that is not to be cut, mark the lower face to locate where the bottom edge of the upper plate will be attached.
 - Measure and cut the 2x4 upper plate, cutting the ends at the same angle marked on the studs.
 - Set a circular saw at the angle on the side of the studs (about 38°) and cut each stud at the lines scribed in Step 2 above.
 - Tack** the upper plate to the top, uncut stud, and through the upper plate into the top ends of the cut studs. **Check that the upper plate is parallel with the angle of the stairs and is 42" above the nose of the treads.** **Nail with two 16d (or 3/4" collated) nails through the upper plate into the ends of the cut studs, and through the top plate into the uncut stud at the top.**
 - To stiffen the wall, cut and nail an angled 2x4 brace between the bottom of the uncut stud and the top of the next cut stud, through the space where the stud was removed earlier (see "A" in Figure 6-7 below).
 - Align a straightedge with the upper and bottom plate locations of the stud removed earlier, and mark that location on the angled brace.

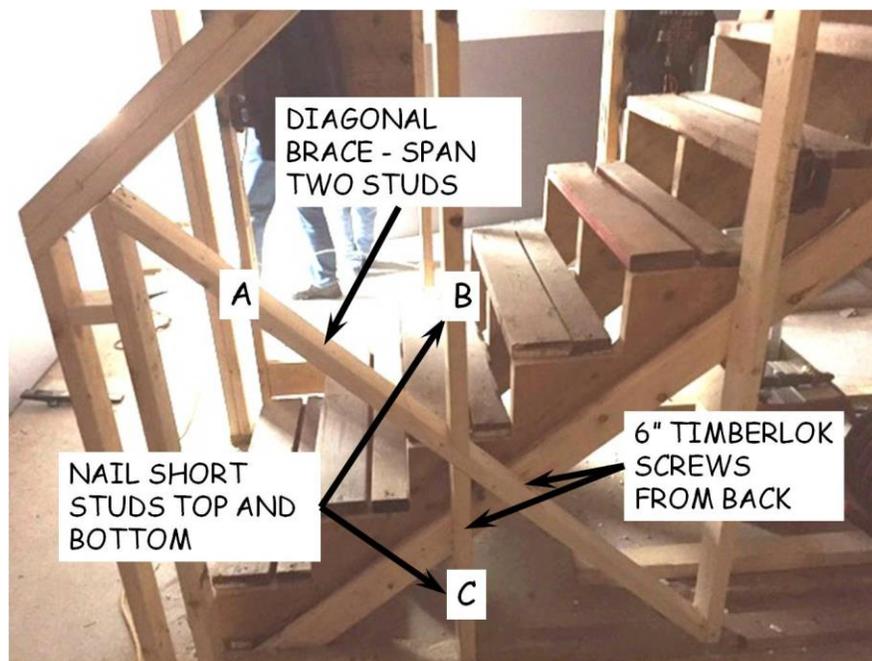


Figure 6-7. Stairway Wall Bracing.

9. Cut the original upper plate where it intersects the uncut upper stud and remove it from the underside of the floor framing.
10. Measure and cut, at the same angle, two 2x4s to fit above and below the angled brace as shown in Figure 6-7, “B” and “C”, respectively. Toenail the lower (“C”) to the bottom plate and through the diagonal brace into the top. Nail the upper (“B”) through the upper plate into the top end and then through the diagonal brace into the lower end. Use two 3¼” collated nails at each location.
11. Nail the top plate on top of the upper plate using pairs of 16d (or 3¼” collated) nails at each stud.
12. Finally, drive a timber screw through the stringer/OSB/2x4 sandwich into the diagonal brace, and another into the lower Short Stud (“C”) as indicated in Figure 6-7.

6.4. FRAMING STAIRWAY CLOSET PLATFORM

1. A bedroom closet extends over the stairway in most homes. It may extend **as far as 24”** over the opening. The top of the platform will be 20” above the ¾” OSB decking on the main floor.

REQUIREMENT: If the closet extends too far out or is too low, it will not meet code for headroom requirements, which is a minimum of 76” vertically to the stair tread below.

2. **If the House Plan calls for a kitchen cabinet rather than a closet, go to Section 6.5.**
3. Build a 13¾” tall 2x4 wall 40” long, using 10¾” long studs (**24” o.c.**) with upper and bottom plates. Nail it to the floor **with the bottom plate** flush with the stairway opening **that’s above the lower end of the stairs. Plumb the wall, and nail the ends to the adjacent studs and the bottom plate to the floor.** When the 2x6 platform is constructed in the next step, it is set on top of this wall, for a total height to the top of the **closet** deck of 20” above the floor decking.
4. Build a 27”x40” platform with 2x6 joists (16” o.c.) and ¾” OSB decking as shown in Figure 6-8 below. The stairway opening is typically 40” wide. Adjust the platform width as necessary to fit between the walls. The 2x6 that bridges the stairway opening on the cantilevered end should be 46” long so that it can be firmly supported with blocking or a stud inside the adjoining walls. Check the location of the wall studs to be sure that the 2x6 will not interfere on either side (see Figure 6-9). Once the platform is in place, with one end sitting on the short, 2x4 stud wall at the end of the opening, the other end will extend 24” over the opening. Adjust if necessary so long as the platform does not extend more than 24”.

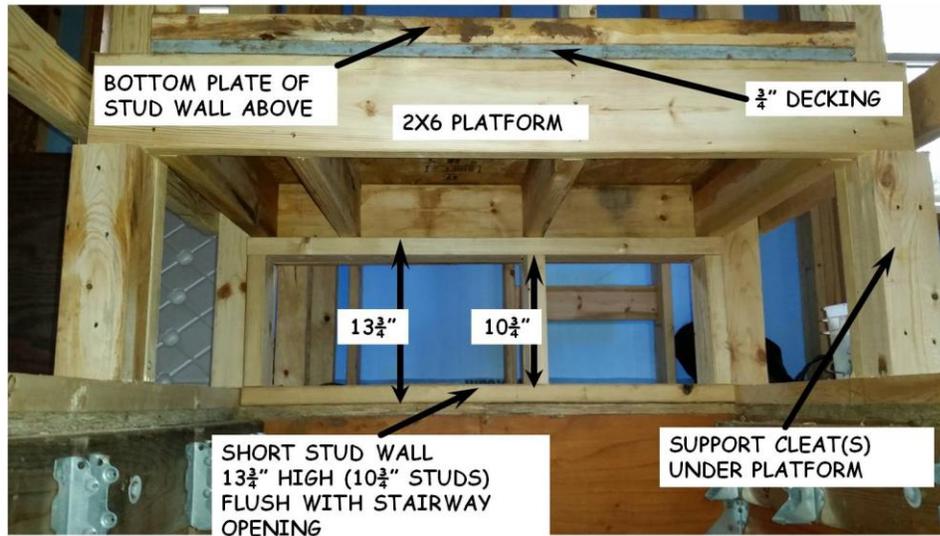


Figure 6-8. Closet Platform.

5. Set one end of the 2x6 platform on top of the short wall and nail in place. Level the platform in both directions and nail the sides of the platform to the wall studs on both sides of the stair opening. Where the 46"-long frame member extends into the side walls, do one of the following to support it:
 - a. Install blocking between the existing wall studs to give adequate support, or
 - b. Install an extra stud on either or both sides to which the 2x6 can be nailed.

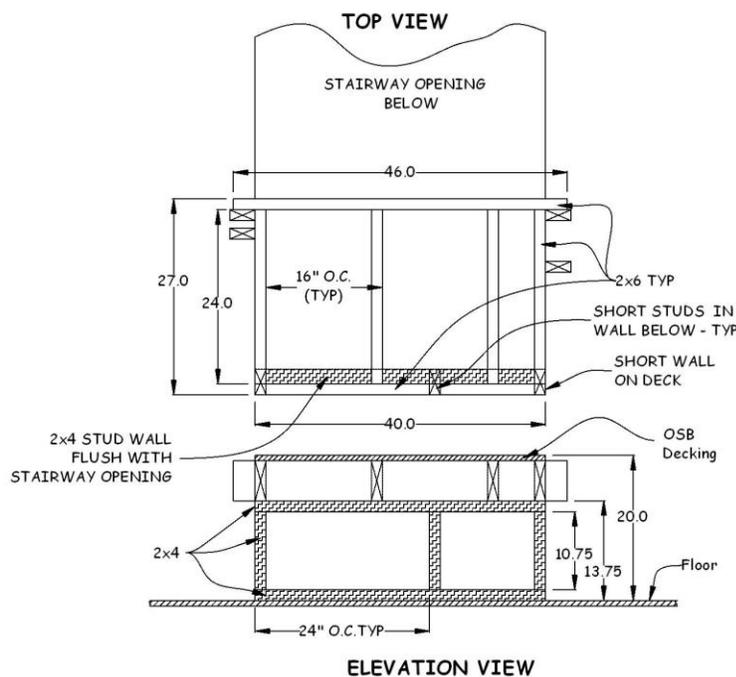


Figure 6-9. Platform for Closet Over Stairway.

6. Cover the entire platform with $\frac{3}{4}$ " OSB decking, nailing it every 9" with 8d nails. The decking can consist of more than one piece as long as the OSB edges are properly supported.
7. At the end of the platform toward the top of the stairs, build a short 2x4 wall high enough to match the height of the adjoining full-height walls. Nail to the platform and to the adjoining walls. Install blocking in the side walls if necessary.

6.5. **FRAMING STAIRWAY CABINET OPENING**

1. The opening for this cabinet cavity is typically located in the wall above one side of the stairway (the "side wall"), at the end toward the bottom of the stairs. A full height wall (the "end wall") should exist at the end of the opening above the bottom of the stairs, flush with the opening below.
2. Install a stud in the side wall flush to the stairway opening side of the end wall. Install another stud in the side wall 31" inside-to-inside from the first stud, toward the top of the stairs (see Figure 6-10).

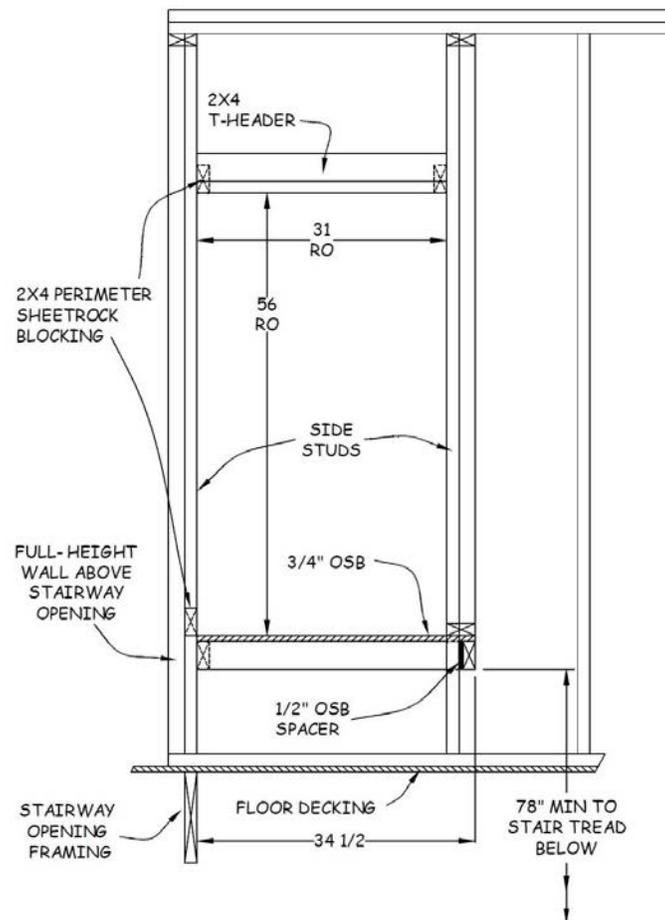


Figure 6-10. Stairway Cabinet Opening Framing.

3. Any existing studs between these two studs must be removed. These newly installed studs (the “side studs”) will define the sides of the cabinet opening.
4. Assemble a platform 40”x34½”, similar to that described in Step 6.4.4, using 2x4s rather than 2x6s.
5. Locate the stair tread that is vertically below the location of the stud that was installed 31” from the end wall. From that tread, measure vertically up 78” and mark the stud. Install the platform with the bottom of the framing at or above that height. Level the platform in all directions, and nail it with 3¼” collated (or 16d) nails through the perimeter 2x4 framing into any adjacent studs.
6. Create a short wall with the top at the level of the platform by cutting a 2x4 31” long to use as a top plate. Nail it between the side studs, flush with the top of the platform OSB decking. Provide short studs below this top plate on the same 24” O.C. spacing as the rest of the wall.
7. Create a 31” long T-header and nail it between the side studs with the bottom 56” above the platform deck.
8. Measure from the top of the platform deck to the top of the side wall top plate, and create a stud wall this height to install on top of the platform deck. Install the wall flush with the edge of the platform deck that is toward the top of the stairs. Check that the inside of the wall is flush with the side stud at the opening.
9. Nail 2x4s to serve as sheetrock blocking around the top perimeter of the cabinet cavity, with the bottoms 56” above the platform deck, the same elevation as the bottom of the T-header.
10. For the same purpose, nail 2x4s between studs in the end wall and the wall at the back of the cavity, with the bottoms even with the top of the platform.
11. Cut a 2x4 28” long and nail between the top perimeter blocking to support the cavity ceiling sheetrock. Locate the 2x4 parallel to the stairway, midway between the front and back of the cavity.

Chapter 7. Roof Framing

7.1 PREPARATION

7.2 INSTALLING ROOF TRUSSES

7.3 INSTALLING PORCH TRUSSES

7.4 SHEATHING ROOF

7.5 INSTALLING EAVE SUB-FASCIA

7.6 BUILDING AND INSTALLING SCUTTLE BOX

7.7 INSTALLING LATERALS AND X-BRACING

7.8 INSTALLING L-CLIPS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Tools and equipment needed:

Generator
Extension cord
Circular saw
Reciprocating saw
Air compressor
50' tape measure
6' level
Framing nailer
Impact driver with bits
Truss lock
Sledge hammer
Pipe clamp
Framing square
Chalk line
String line
Plank
Ladder

Materials needed:

Roof trusses
1" Foamboard
4x8' ½" OSB
2x4 Lumber
2x6 Lumber
16d Nails
8d Nails
¾" Collated nails
⅝" Collated nails
4" & 6" Timber screws
H-clips
L-clips
House wrap
Air sealing tape

Personal Protection Equipment:

Fall protection harness (required)
Safety glasses (required)
Hard hat – below roof (required)

Reference Materials:

House Plan
[Truss Plan](#)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

7.1. PREPARATION

7.1.1. Installing Planks and Gable End Blocking

1. Install a plank along the center of the house for the center truss installer to walk as trusses are installed. The plank is installed on top of interior door headers and other bracing as required. This is a 24' plank that starts at one end of the house and will be moved to the other end as the truss installation progresses. The plank needs to be supported at three points in either location.
2. Install 2x6 blocking along the top of both gable end walls (continuous along the entire length) with 16d (or 3¼" collated) nails staggered every 12". Hold the 2x6 back 1" from the outside of the top plate (using a piece of 1" foamboard as a guide works well). The 2x6 overhangs the plate on the interior side of the wall and serves as sheetrock blocking.
3. Install 2x4 blocking along the top of the porch gable end framing, holding the blocking 2" back from the outside face of the framing. Nail with 16d (or 3¼" collated) nails staggered every 12".

7.1.2. Gable End Truss Prep

7.1.2.1. Building Gable Ladders

1. The steps that follow describe building a ladder to form gable roof overhangs. A "ladder" is built using 2x6s. The sub-fascia is the "outside" leg of the ladder, another 2x6 is the inside leg, and 2x6 blocks 6" long are used as rungs.
2. Measure from the peak of each gable end truss to the tail. This is the total length of the sub-fascia. Check the roof pitch on the House Plan (the garage roof pitch may not be the same as the house roof pitch). Cut long 2x6 pieces for the SUB-FASCIA to match the length and angle (4/12 pitch = 18.4°; 5/12 pitch = 22.5°; 6/12 pitch = 26.6°) of the top chord of the gable truss and mark them for location. DO NOT use material with a pronounced crown. **If** two pieces of 2x6 are needed, make sure to seam the two pieces, with a butt joint, in the middle of a double sub-fascia spacer block.
3. For both gable end trusses, and the porch gable truss (if required) - cut INSIDE 2x6s to match the sub-fascia length above less 32", with an angle cut on the peak end to match the roof pitch. These pieces will go against the truss OSB once the ladder is completed. Lay the inside 2x6 on a corresponding sub-fascia 2x6, with the angled ends and top edges flush. From the peak of the matched angle cuts, measure and mark the top edges of the 2x6s for sub-fascia spacer blocks. The first mark is at 5" and then every 32", with the last one flush with the square end of the inside 2x6 (not necessarily at 32"). At each mark, put an X on the edge of the 2x6 toward the eave end. Make a mark for a double block (if required) where the butt joint of the 2x6 sub-fascia will be located.

4. Count the number of marks made on all three trusses. Cut that many 2x6x6" sub-fascia spacer blocks (using scrap).
5. For each gable end truss, assemble the blocks and inside 2x6s from Steps 2 through 4 above. Align one end of the block with the layout mark and flush with the edges of the inside 2x6. Nail together using two 3/4" collated nails through the long inside 2x6 into the end of each block (similar to building a stud wall).

NOTE: Each gable requires a right and a left hand "ladder"; be sure to assemble each "ladder" with the inside 2x6 arranged in the correct orientation.

6. Set the partially assembled ladder aside until the gable ends are covered with foam. Finish installing the ladders in Section 7.1.2.2.4, below.

7.1.2.2. Gable Truss Prep

1. Cut as required and remove from the top chord any OSB that extends past the truss heel.
2. If the truss top chord is a 2x6, the bottom end of the tail must be trimmed to allow later installation of the gable corners. Trim the tails by measuring vertically up the tail 2" from the long point, marking a line square to the tail end and cutting along the line.
3. Install the pre-cut 18" wide roll of house wrap the length of the bottom chord of the gable end truss. Snap a chalk line 3 1/2" above the bottom of the bottom chord, and staple the top edge of the house wrap along the line.
4. Cover the factory-installed OSB on all gable trusses by stapling house wrap shingle style, overlapping each layer 2". On the face of the house wrap, mark and draw a line at the locations of the vertical gable end truss chords using a Sharpie or other marker. This will ease later siding installation.
5. Attach the inside 2x6 side of the "ladder" built in Section 7.1.2.1 to the top chord of the gable end truss with a 3/4" collated nail midway between each 6" block, keeping the top edges flush and the angled end aligned with the truss peak. Then, add a pair of 3 1/2" screws through the inside 2x6s into the truss top chord between each block and at each end. Finally, align the peak end of the sub-fascia 2x6 to the gable peak, and nail it to the blocks using two 3/4" collated nails into each block.
6. Nail the sub-fascia ends to each other at the peak using 3/4" collated nails. Keep the face and peak aligned when nailing.

7. On one side of the center vertical truss chord, and as close to the top as possible without cutting into the truss framing, cut an opening in the OSB with a 4" hole saw for a crane lifting sling to be inserted.
8. After the truss is covered with house wrap, fold the bottom chord house wrap back toward the top of the truss and secure it with a few pieces of air sealing tape. This ensures it will not be in the way during installation of the truss.
9. On the inside face of the top chord of the non-zero end gable truss, nail scrap 2x4s using 3¼" collated nails every 12" from the peak down to both tails of the truss.

NOTE: Since the spacing between this truss and the one next to it is more than 24" o.c., this extra 2x4 provides the correct spacing to support the roof sheathing. This extra 2x4 is **NOT REQUIRED** for a detached garage.

10. If there is a gable end porch with a roof common with the house, lay one of the porch trusses on the house porch-end gable truss. Align the top chords and tails on the appropriate end of the truss. Use a marker to draw a line on the face of the house gable truss along the opposite top chord of the porch truss. This line will be used to locate a 2x4 to support the roof sheathing installed in Section 7.3.6, if required.

7.1.3. Installing L-Braces

1. L-braces are used to support the gable-end truss at each end of the house during installation, and should be located within 2' of the center plank installed in Section 7.1.1. They **must be installed so that they don't interfere with the sub fascia** when the truss is tipped up into position. L-braces are attached to a wall stud for adequate support.

NOTE: If there is a gable end porch, the L-brace must be installed far enough away from the porch frame so it doesn't interfere with installation of the porch trusses.

2. To determine the correct height of the L-brace above the top plate, locate a wall stud within 2' of the center plank location, mark the stud for future reference, and locate it on the exterior of the house. Measure the distance to it from the outside corner of the house.
3. Take that measurement to the truss to be used on that gable end, and measure that distance from the heel and make a mark. Then, at that mark, measure the vertical distance from the bottom of the bottom chord to the top of the top chord. Subtract 16" (to ensure adequate clearance for the gable sub-fascia) and mark the L-brace that distance from the top end.

4. Install the L-brace at the stud marked earlier, with the 2x6 face against the wall and the mark from Step 3 above even with the top of the top plate. Double check the height of the top of the L-brace above the top plate, and attach it to the wall using two timber screws into the stud about a foot above and below the mid-height of the stud. At the top plate, slide a ¼” spacer between the L-brace and wall foamboard, just below the top edge of the foamboard (to ensure adequate space for the bottom chord) and run three 6” timber screws into the upper and top plates (one in one, two in the other). Finally, install one more screw into the rim board.

7.1.4. Marking Wall Top Plates for Trusses

1. Beginning at the zero end, mark the locations of the trusses on the top plates of both eave walls 24” o.c. Confirm that the truss markings are positioned such that the truss is bearing completely over a stud or header.
2. At the opposite end of the zero corner, the measurement from the last common truss to the gable end truss will be more than 24” o.c. Mark the INSIDE-TO-INSIDE measurement between these trusses on the top plate - it will be used when sheathing the trusses.

7.1.5. Bracing Prep

1. For lateral bracing, select enough long 2x4’s to total twice the length of the house plus an additional 2’ for EACH overlap. If the house is 30’ wide or wider, increase the amount to three time the house length, plus overlap. Mark them as laterals and set aside.
2. For X-bracing, select eight 2x4’s, each at least 12’ long, and cut an approximate 20° angle on both ends. Orientation of the angle is irrelevant. Mark them as X-bracing and set them aside with the lateral bracing.
3. The first common truss on each end will require a temporary 2x4 spacer. Locate two scrap 2x4s, each about 30” long. On one piece, mark two lines 24” apart to use for the Zero End spacer. For the Non-Zero End, locate the measurement noted on the top plate from Section 7.1.4, and place marks that distance apart on the other 2x4 scrap.
4. Both gable end trusses will require diagonal bracing prior to setting the other trusses. At each interior end of the house, place one stud-length 2x4 and one 12’-16’ 2x4.

7.2. *INSTALLING ROOF TRUSSES*

1. **HARD HATS ARE REQUIRED ON ANY GROUND CREW.**
2. Trusses are secured to the top plate with 6” timber screws. At each truss location, begin a 6” timber screw in the joint between the top of the stud and the upper plate. The screw

- should be 20-30° from vertical and about 2-3” into the upper and top plates without going through. Be sure the screw does not protrude through the top plate surface.
3. Stand the first gable truss into position on the walls and against the L-brace.
 4. On each end of the truss, measure from the top plate to the end of the truss tail. Be sure the measurement is to the outside edge of the LONG WALL top plate, not the end of the short wall top plate. If the short wall top plate is not flush with the end of the long wall top plate, adjust the measurement accordingly. Move the gable truss so that the overhang measurement is the same on each side (for example: 22¼” on each side).
 5. With the truss tight down against the top plate and blocking, attach the truss to the L-brace support using two 4” timber screws about 12” apart so it cannot fall back on the installers. Checking that the truss is still down tight to the top plate, screw 4” timber screws through the bottom chord into the blocking or top plate every 2’-3’ until the bottom chord is tight to the blocking.
 6. Repeat for the other gable truss. Measuring from the top plate at the back of the house (the back, since it usually has an unobstructed run for a string line) to the truss tail, locate the truss at the same distance as the other gable truss. Since the overall truss length may vary slightly, measure only that end.
 7. Nail a 2x4 block to the measurement (back) end of each gable truss, then run a taut string line from one gable truss tail to the other. As the common trusses are set in place, use a 2x4 gauge block between the tail end and the string line to locate each truss.
 8. Stand the first common truss in place, maintaining the appropriate distance from the tail end to the string line. Holding one end of the truss tight to the top plate and aligned with the layout mark, run the pre-started timber screws into the bottom chord until the head is countersunk below the interior framing surface. Repeat at the other end of the truss.
 9. Install the 2x4 pre-nailed spacer prepared in Section 7.1.5.3 near the peak of the gable and common truss. The space between the gable truss and first common truss is to be the same as that measured between the two at the top plates. This secures the trusses together with the proper spacing and holds the trusses from tipping during installation.
 10. Nail one end of a 2x4 near the top of the gable truss down through the first common truss and nail the bottom end to an interior wall top plate after the gable truss is plumb. Locate the lower end of the diagonal support so that it does not interfere with the bottom chord of the next truss. This safety measure ensures the trusses cannot tip back into the house while truss installation continues.
 11. Install all common trusses as in Step 8 above. Use the metal truss-lock braces to secure the peak of each truss. These braces will also ensure maintenance of 24” o.c. spacing.
 12. When 50-75% of the trusses are installed, slide the lateral and X-bracing prepped in Section 7.1.5 into the trusses.

13. Lean four remaining trusses against the gable end truss and secure them to prevent them from falling. Continue with installation of the remaining common trusses.

7.3. INSTALLING PORCH TRUSSES

1. Porch trusses are to be centered front-to-back on the porch framing. Locate the center of the porch framing and measure 12” in each direction to locate the center of the middle two porch trusses. Continue 24” o.c. spacing in each direction as required.
2. If not already completed, use 16d or 3¼” collated nails to secure 2x6s to the outside faces of the porch framing, keeping top and bottom edges flush.
3. Nail pieces of scrap 2x4 to the top of the front porch framing spaced 2” back from the front face to serve as blocking for the porch gable truss bottom chord.
4. Make certain house wrap has been attached to the gable porch truss sheathing.
5. Install the first porch truss on the truss layout mark. If one end of the porch trusses lines up with the house trusses, align the gable truss tail with the house truss tails by sighting along the house trusses, or by using a straight 2x4 as a straight edge. If the porch roof does not have a surface common with the house roof, center the trusses side-to-side on the porch framing.
6. The remaining porch trusses are installed at the 24” layout marks and the gable porch truss is set in place with the OSB sheathing flush with the outside face of the front porch framing. Secure the trusses with 6” timber screws through the porch framing into the truss bottom chord.
7. On houses with a porch at the gable end and with no truss against the house gable truss, a 2x4 must be nailed against the house’s gable truss, aligned with the line marked in Section 7.1.2.2.9, to support the edge of the porch roof sheathing.

7.4. SHEATHING ROOF

7.4.1. Cutting Full-Width Row OSB Roof Sheathing

1. Refer to Figure 7-1 and Figure 7-2, below, which show examples of the roof sheathing layout for a 36’ and 30’ long roof, respectively. Note that each **odd** row has a **34” piece** at the zero end, and each **even** row has a **58” piece** on the zero end. Also, note that the **bottom row** is not full-width. The size of these **bottom row** pieces will be determined in Section 7.4.2.
2. Determine the non-zero end pattern, and the number of full and half-sheets. Using a large marker or crayon, write the number and size of the end pieces required on the eave side of each corner of the house. The zero end will always require two each of the 34” and 58” pieces; the non-zero end will require two each of 62” and 38”

pieces. Also, write the number of full and half-sized pieces near the middle of the house where the sheets will be staged for lifting onto the roof.

- Cut four full sheets into 34"/62" pieces, and four more sheets into 38"/58" pieces. Label each piece with the size, using a red crayon.

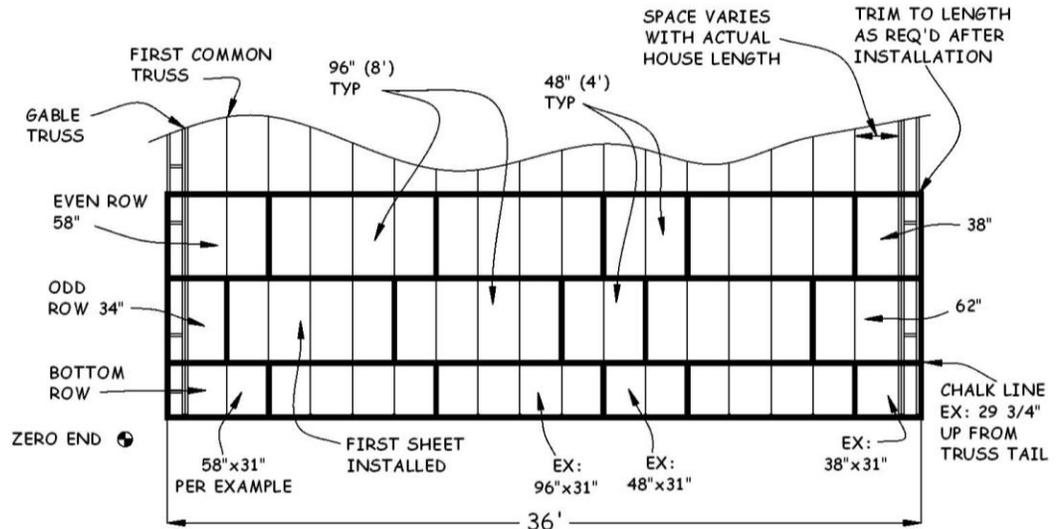


Figure 7-1. OSB Layout for 36' Roof.

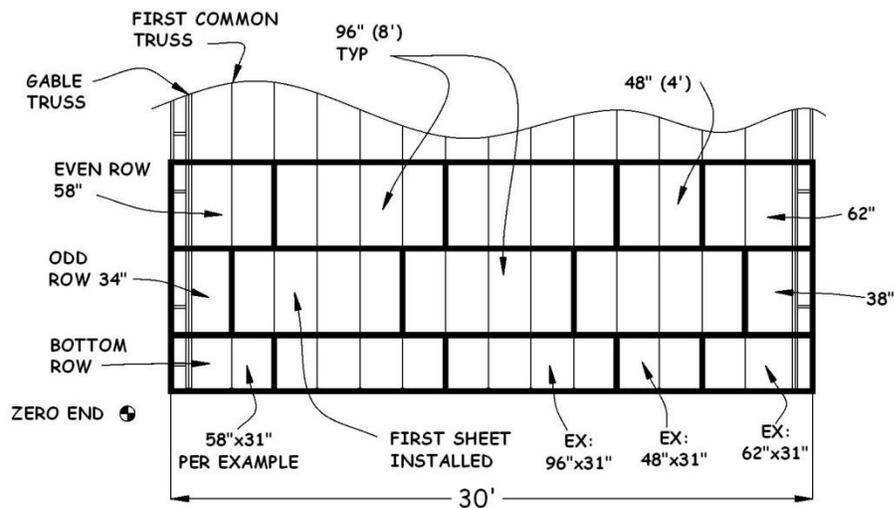


Figure 7-2. OSB Layout for 30' Roof.

- Place two 34" and two 58" pieces on each eave side of the house at the zero end, and two each of the 38" and 62" pieces on each eave side of the non-zero end. There are typically 4 rows of sheeting on each side of the house, or 8 rows total. As shown in Figure 7-1, Figure 7-2, and Table 7-1, the 62" and 38" pieces are used on the non-zero end, but not necessarily in the same row as its corresponding cutoff.

Table 7-1. OSB Roof Sheathing Cut List Worksheet.

Total Roof Length*	Odd Rows				Even Rows				Totals for 4 Full Width Rows	
	Zero End	Full Sheets	# of "4s" Req'd	Non-Zero End	Zero End	Full Sheets	# of "4s" Req'd	Non-Zero End	Total # of Full Sheets	Total # of 4s
20	34	1	1	62	58	1	1	38	8	8
22	34	2	0	38	58	1	1	62	12	4
24	34	2	0	62	58	2	0	38	16	0
26	34	2	1	38	58	2	0	62	16	4
28	34	2	1	62	58	2	1	38	16	8
30	34	3	0	38	58	2	1	62	20	4
32	34	3	0	62	58	3	0	38	24	0
34	34	3	1	38	58	3	0	62	24	4
36	34	3	1	62	58	3	1	38	24	8
38	34	4	0	38	58	3	1	62	28	4
40	34	4	0	62	58	4	0	38	32	0
42	34	4	1	38	58	4	0	62	32	4
44	34	4	1	62	58	4	1	38	32	8

*Total Roof length = Plan House length + 2 feet

5. Depending on the length of the house, a 4' piece may also be needed in the middle of the row to reduce scrap and to maintain the stagger of the joints between sheets. In the 36' example in Figure 7-1, a 4' piece is required in each row. Figure 7-2 shows a **4' piece in even rows only**. Referring to "**Total # of 4s**" in Table 7-1, determine the number of 4' pieces required. Cut full-width sheets in half to obtain the required number, label with the size, and place half of them on each eave side of the house near the middle.
6. Referring to "**Total # of Full Sheets**" in Table 7-1, determine the number of full sheets required. Place half of this number on each eave side of the house near the middle.

7.4.2. Planning OSB Roof Sheathing

1. Roof sheathing is installed with a 1¼" overhang past the truss tails. At the peak, a 2" opening is required for adequate attic ventilation. Any non-full-width row must be located at the bottom of the roof so the sub-fascia can provide adequate support. The following describes how to determine the number of rows of full-width (FW) sheets, the width of the bottom row, and the location of the chalk line to mark the bottom of the first FW row.
2. Determine the number of rows of sheathing required by measuring the length (in feet and inches) of a truss top chord. Subtract the nearest lesser multiple of four from the feet portion. Divide the multiple subtracted above by four; the result is the number of FW rows. Subtract 2" from the remainder; the result is the location of the lower edge of the first FW row, measured up along the top edge of the truss tail. Then add 1¼" to this number to get the width of the bottom row (see Example in Table 7-2).
3. Use Table 7-1 to determine the number and sizes of sheets required for the appropriate length even row, and, for each side of the house, cut that number to the width calculated in Step 2.
4. Measure up from the tail and mark the location of the chalk line (bottom of first FW row) on each gable truss. Snap a chalk line from these marks across all the trusses. This line is the guide for the installation of the bottom edge of the first full-width row of OSB sheathing.

Table 7-2. Example Roof Sheathing Calculations.

18'-7¾"	Length of truss top chord
- (16'-0")	Subtract nearest lesser multiple of 4; 16 ÷ 4 = 4 FW rows
<u>= 2'-7¾"</u>	Remainder
- 2"	Subtract 2" – Ventilation gap at peak
= 2'-5¾"	Bottom of 1 st full-width row, chalk line location (29¾")
+ 1¼"	Add 1¼" - amount sheet overhangs eave sub-fascia
<u>= 2'-7"</u>	Width of bottom row (31")

7.4.3. Installing OSB Roof Sheathing

1. For the first row, install a full-width 8' long piece of OSB with the bottom edge aligned with the chalk line and one end centered on the second truss from the zero end. With 8d nails, nail the bottom corner of the sheet at the second truss, then check the alignment of the bottom edge with the chalk line, center the other end of the sheet on its truss, and nail that bottom corner. At the top of the sheet, align the corners with the centers of their trusses and nail. Measure from the edge of the second truss and mark on the upper edge of the sheet every 24". Adjust each truss to its mark and nail.
2. Repeat for each subsequent sheet, nailing the top of the sheet only. Align one top corner with the adjacent sheet, leaving a 1/8" gap between sheet ends, and the diagonally opposite corner with the chalk line at the bottom. Nail the top corner adjacent to the previously installed sheet. Center the other top corner on its truss, recheck the alignment of the bottom with the chalk line, and nail the top corner. Measure the 24" truss spacing from a nailed truss that is not at a joint between sheets. Nail into each truss along the top of the sheet with 8d nails. DO NOT nail the bottom of the sheet at this time, since the tails will need to be straightened and spaced correctly before nailing. The sheet is secure so there is no need to nail any more than this at this time.
3. Before nailing the OSB at the gable end truss, be sure the gable truss is straight. At the wall top plate, measure between the gable truss and the adjacent common truss, and maintain that spacing between the gable truss and adjacent common truss for each sheet of OSB installed. As a check, have the ground person sight along the gable truss, since the adjacent truss may not be straight.

NOTE: The distance between the zero end gable truss and the first common truss is 21³/₄". The distance between the last common truss and the non-zero gable end truss is more than 24" and will depend on the actual house length.

4. Before proceeding with the installation of additional sheathing rows, use 16d duplex nails (one nail per truss) to fasten a row of 2x4s along the entire length of the first row, 6" up from the bottom edge of the first sheets, to serve as a stop for tools, material, and personnel.
5. Place H-clips on the OSB between each truss and start the second course (row) using the OSB piece cut earlier to stagger the OSB joints.
6. Finish nailing the sheets using 2³/₈" collated nails on every truss – seven nails on the edges and five in the field intervals. Check under the sheathing to make sure the nails hit the trusses.
7. Before nailing the OSB at the gable edges, sight along the gable sub-fascia and straighten as required, then nail the OSB edge into the sub-fascia using the prescribed pattern.

8. If the OSB extends beyond the gable end sub-fascia, trim the edge flush to, or up to ¼” short of, the outside face of the sub-fascia. Locate and mark the sub-fascia face on the OSB and snap a chalk line. Cut using a circular saw set to ½” depth.

7.5. INSTALLING EAVE SUB-FASCIA

1. On the eave side of the house, position a long 2x6 sub-fascia, crown up, tight to the underside of the sheathing. Extend one end flush to the outside face of the gable end sub-fascia, making sure the other end is centered on a truss tail. Cut to length as required. Nail the 2x6 to the ends of each truss with two 16d nails. Repeat at the other end of the eave side and then fill in between them until the eave is finished.
2. From the ground, sight along the eave sub-fascia and straighten the sub-fascia as required for appearance. Take extra time to do this. A straight piece of fascia will look better against the gutter, while crooked or wavy sub-fascia will stand out.
3. Once the sub-fascia is straight and true, nail the OSB to the eave sub-fascia using 8d nails on 8” intervals.

7.6. BUILDING AND INSTALLING SCUTTLE BOX

7.6.1. Building Scuttle Box

1. Typically, the scuttle box is pre-built and delivered to the site prior to the day it is to be installed. However, if it has not been built, use the following instructions to build one. See Figure 7-3 for a picture of the finished scuttle box and Figure 7-4 and Figure 7-5 for schematic drawings.



Figure 7-3. Scuttle Box.

2. Cut four pieces of OSB: two sides, each 32" wide by 19³/₄" high and two ends, each 25¹/₂" wide by 19³/₄" high.
3. On the smooth face of the OSB end pieces, draw a line 16¹/₂" down from the top edge. Find the centers of the two 25¹/₂" edges and draw a line on the rough face between them. Then draw two parallel lines on either side of the centerline 11¹/₄" from it to locate the inside edge of the 2x2s.
4. On the smooth face of the side pieces, locate the center of the two 32" edges, and draw parallel lines 14" to each side of that centerline. These lines will be used to locate the inside edge of the end piece at assembly.
5. At the bottom (non-factory) 25¹/₂" edge of each end piece, cut a notch 1⁵/₈" wide by 3³/₈" high in the two corners. This leaves a tab 22¹/₄" wide at the bottom that will fit with a 1/4" clearance between the truss bottom chords.

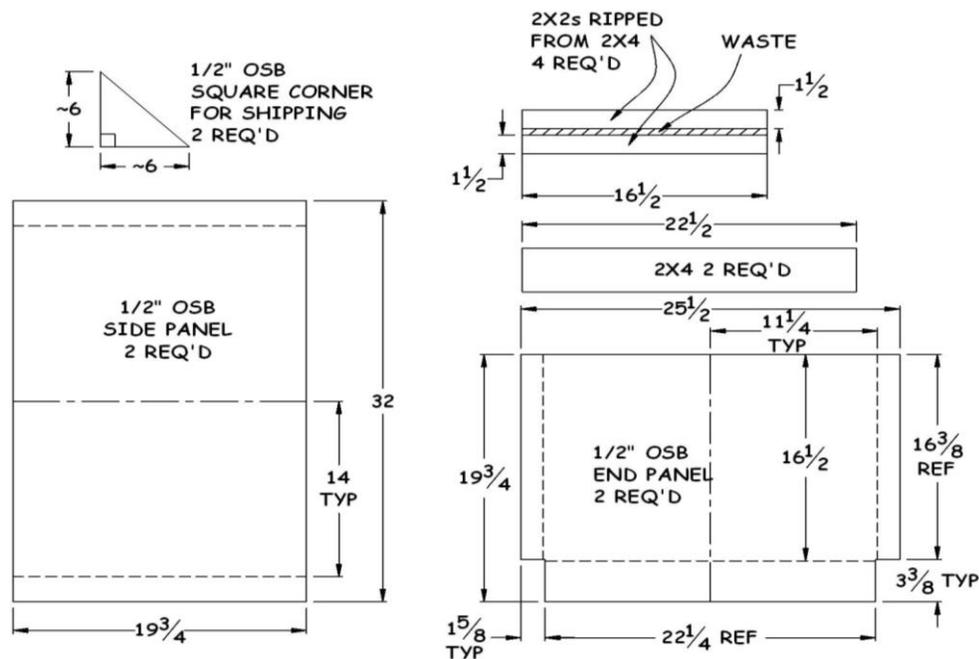


Figure 7-4. Scuttle Box Cut Diagram.

6. Cut two 2x4s 22¹/₂" long and two 2x4s 16¹/₂" long. Mark a centerline on the longer pair at 11¹/₄" from each end.
7. Rip each 16¹/₂" piece into two 2x2s (1¹/₂" square).
8. On each OSB end piece, attach one of the 2x4s to the smooth face at the 16¹/₂" line and with the centerlines aligned using a pair of 1⁵/₈" screws at each end and a pair in the middle. Check that the 2x4 extends below the OSB bottom edge, and that the 2x4 ends are slightly beyond the edge of each notch.

9. On the rough side of each end piece, attach a 2x2 even with the top of the 2x4 (flush with the top of the OSB) and aligned with the vertical line drawn earlier. Attach with 1 5/8" screws, one at each end and one in the middle.

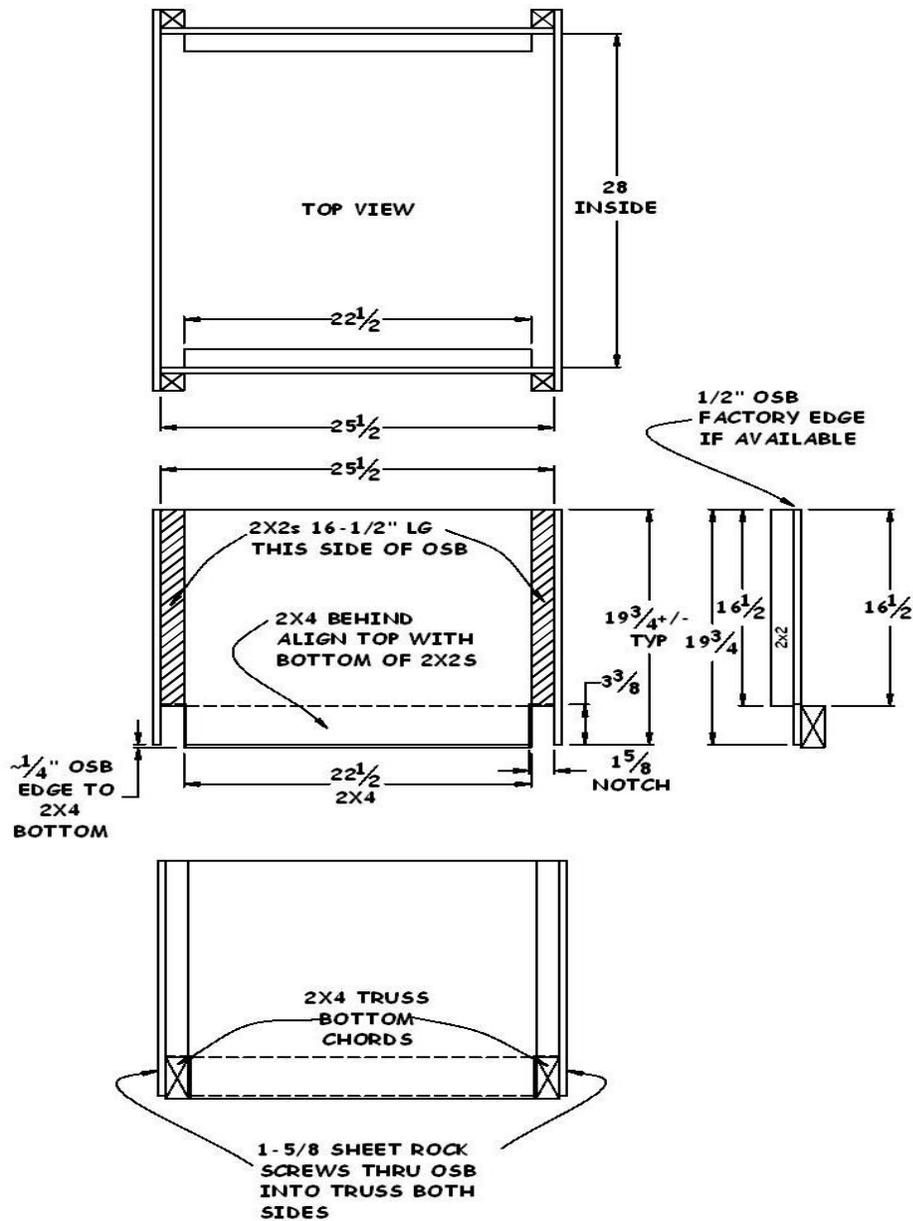


Figure 7-5. Scuttle Box Assembly.

10. Assemble the scuttle hole by setting the factory edges of the two sides and two ends on a level surface to ensure that the top edges of the box will be flush with each other.
11. With all smooth sides facing inward, align the end piece 2x2s with the vertical lines on the sides, and screw the sides to the 2x2's using 1 5/8" screws, three in each joint. Keep the box square as the connections are being made.

12. Check that the box is square, place the square shipping corners tightly in two diagonally opposite corners atop the 2x4, and screw in place.

7.6.2. Installing Scuttle Box

1. Before installing the house or garage scuttle box, confirm its location with the Construction Supervisor.
2. Lift the box (side-wise) into the attic and place it between the trusses in the location specified in the House Plan. Slide the assembled box along the trusses to optimize ease of access and clearance above.
3. When the scuttle box is located in a bedroom, line up one end of the scuttle box with the wall surface above the swinging door, so the wall rock above the door can extend up into that end of the scuttle box.
4. When the scuttle box is located in a closet or pantry (typically at the end of stairs) keep the edge of scuttle box nearest the swinging door 4" from the wall surface above the door to leave a little room for the wall mounted light fixture that goes above the door in the closet or pantry so it doesn't interfere with attic access.
5. Position the bottom of the scuttle box 2x4s flush with the bottom of the trusses and screw the bottoms of the side pieces to the truss cords with 1 $\frac{5}{8}$ " screws, four on each side. Using 16d nails, nail through the OSB and truss chords into the ends of the scuttle box's 2x4x22 $\frac{1}{2}$ " cross-pieces.
6. Remove the square shipping corners and give them to the Construction Supervisor.

7.6.3. Assembling Scuttle Box Cover

1. If the scuttle box cover has NOT been pre-assembled, assemble the cover using the following steps.

NOTE: The scuttle box cover is constructed in two pieces to aid in inserting the insulation into the scuttle box

2. Locate the piece of $\frac{3}{4}$ " OSB pre-cut earlier to 25"x27 $\frac{1}{2}$ " for the cover. If not found, cut a new piece.
3. Cut two pieces of poly about 48"x48".
4. Cut 25"x27 $\frac{1}{2}$ " pieces of 1" and/or 2" foamboard totaling 8" of thickness.
5. Center the OSB on one of the poly pieces and place a 4"-thick stack of foamboard on the OSB. Wrap the poly tightly up and over the foamboard and tape all poly edges tight to the foamboard with air sealing tape.

6. Stack two pieces of 25"x27½"x5½" (11" total thickness) fiberglass insulation on the center of the second piece of poly. Without compressing the fiberglass, wrap and tape the poly edges tight to the insulation with air sealing tape.

7.7. INSTALLING LATERALS AND X-BRACING

7.7.1. Installing Lateral Truss Bracing

1. After trusses have been installed, nail two to three rows of long 2x4 lateral bracing across the tops of the bottom chords of the trusses with two 16d nails at each truss held to a 24" spacing for ceiling sheet rock installation. Lateral bracing can be spaced a maximum of 10' apart.
2. Check the location of the scuttle hole before installing the bracing. The bracing or location of the scuttle may need to be adjusted to prevent the creation of problems later.

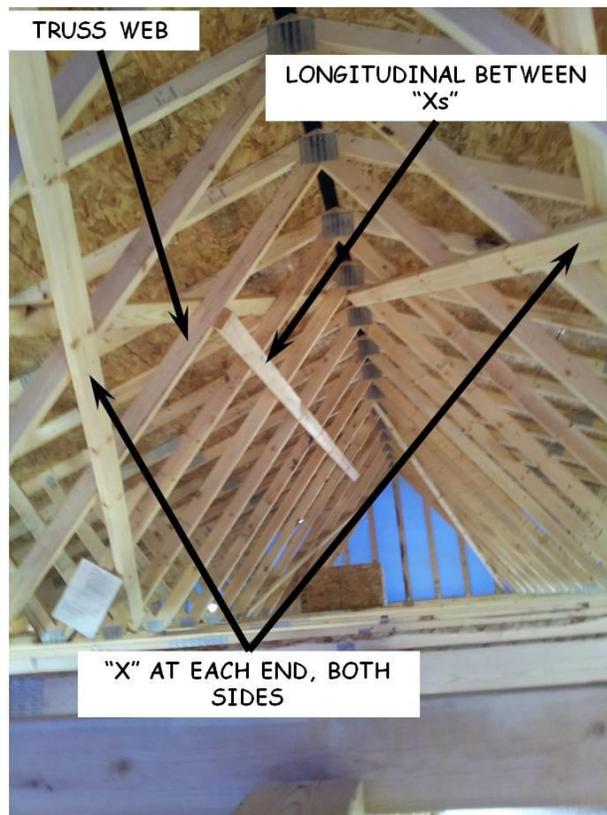


Figure 7-6. Truss Bracing.

3. Starting at one end, measure the distance at the top plates between the end truss and the first truss. In the center, set the first truss at this distance and nail the bracing to the outside end of the top plate and the first truss. From the first truss, measure and place a mark along the entire lateral brace so trusses will be spaced on 24" centers.

Nail each truss in place with two 3¼” collated nails, making sure the trusses are spaced 24” o.c.

4. When a second piece of 2x4 is needed, make certain that the lap spans back two trusses and continue the installation. Make certain that the installation runs parallel to the exterior wall to ensure the bracing is perpendicular to the trusses to ensure a square installation and 24” centers between all trusses.

7.7.2. Installing X-Bracing

1. After roof sheathing has been installed, permanently install X-bracing (diagonal). This bracing prevents lateral movement of the truss system. The bracing is nailed to the truss webs as shown in Figure 7-6.
2. X-bracing uses 2x4’s with ends cut to 22.5°. Install pairs of X-bracing at each end of the house. First, nail one 2x4 on the lower edge of the truss web, with one end butted up to the inside face of the gable end truss at the peak, and the other end at the top edge of a bottom truss chord (wherever the end falls). Using two 3¼” collated nails at each intersection of brace and web, nail the 2x4 from the peak of the gable end truss diagonally down the lower side of the common truss webs. Make certain the bottom end of the brace does not extend below the bottom truss chord or it will conflict with ceiling sheet rock installation later.
3. Nail a second 2x4 on the upper side of the same set of truss webs on the opposite diagonal forming an “X” with the first brace.
4. Repeat these steps on the remaining three corners of the house.
5. Connect the X-braces by nailing one long 2x4, horizontally, to the truss webs, about halfway down from the peak. Each end of the longitudinal bracing must be nailed to at least two truss webs to which an X brace is nailed (see Figure 7-6). If more than one longitudinal 2x4 is required to span the distance, overlap at least two trusses where they meet.

7.8. INSTALLING L-CLIPS

1. Install an L-clip at each point where a roof truss intersects with an inside wall top plate. The purpose is to hold the two firmly in place.
2. Plumb free-standing walls before installing L-clips.
3. Using joist hanger nails, fasten the shorter side of the clip to the top plate.
4. Fasten the longer side of the L-clip (the one with the slot going up) by tightly nailing a joist hanger nail at the top of the slot.

Chapter 8. Roofing

- 8.1 INSTALLING GUTTER APRON
- 8.2 INSTALLING ICE AND WATER SHIELD
- 8.3 INSTALLING ROOFING FELT
- 8.4 INSTALLING DRIP EDGE
- 8.5 INSTALLING STARTER STRIP
- 8.6 INSTALLING SHINGLES
- 8.7 INSTALLING RIDGE VENT
- 8.8 INSTALLING CAP SHINGLES

ARCHIVED CHAPTER

Volunteers for the affiliate no longer perform the tasks described in this chapter. Effective with the 2022 (Version 22.0) release of the Construction Manual, the contents of this chapter will no longer be included in the Manual.

The last complete version of this chapter can be found on the affiliate's website in the Archived Chapters section of the Construction Manual.

Chapter 9. Windows and Exterior Doors

9.1 INSTALLING WINDOWS

9.2 INSTALLING EXTERIOR HOUSE DOORS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife

Tools and equipment needed:

Generator
Extension cord
Chop saw
Putty knife
Caulk gun
Nail set
6' level
Ladder

Materials needed:

Air sealing caulk
Flashing tape
Air sealing tape
Threshold seal tape
Orange floor tape
2½" Exterior screws
#8 3" Brass-colored construction screws
4" Timber screws
16d Galvanized finish nails
8d Galvanized finish nails
2½" Siding nails
1¼" Finish nails
Tapered shims
¼"x3"x5" Flat shims
¼"x3"x5" Flat shims
⅛"x1" Flat shims
¼"x1" Flat shims
1/16"x1½" Flat cardboard shims
Sill pans (if available)
Door hardware

Personal Protection Equipment:

Safety glasses (required)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

9.1. INSTALLING WINDOWS

9.1.1. Window and Rough Opening Preparation

9.1.1.1. General Preparation

1. Unpack the windows and check for proper size and damage. Lattice windows are always installed in the front of the house. For each opening, verify the size and type – double-hung, sliding, grids – to be installed. Measure the rough opening dimensions and check for any obstructions. If any dimensions exceed the specifications by more than $\frac{5}{8}$ " , consider feasible corrections. However, any changes must maintain adequate nailing surface and keep the window top consistent with other windows for proper siding look.
2. Remove the screens and sashes from each window and set aside for later reinstallation.

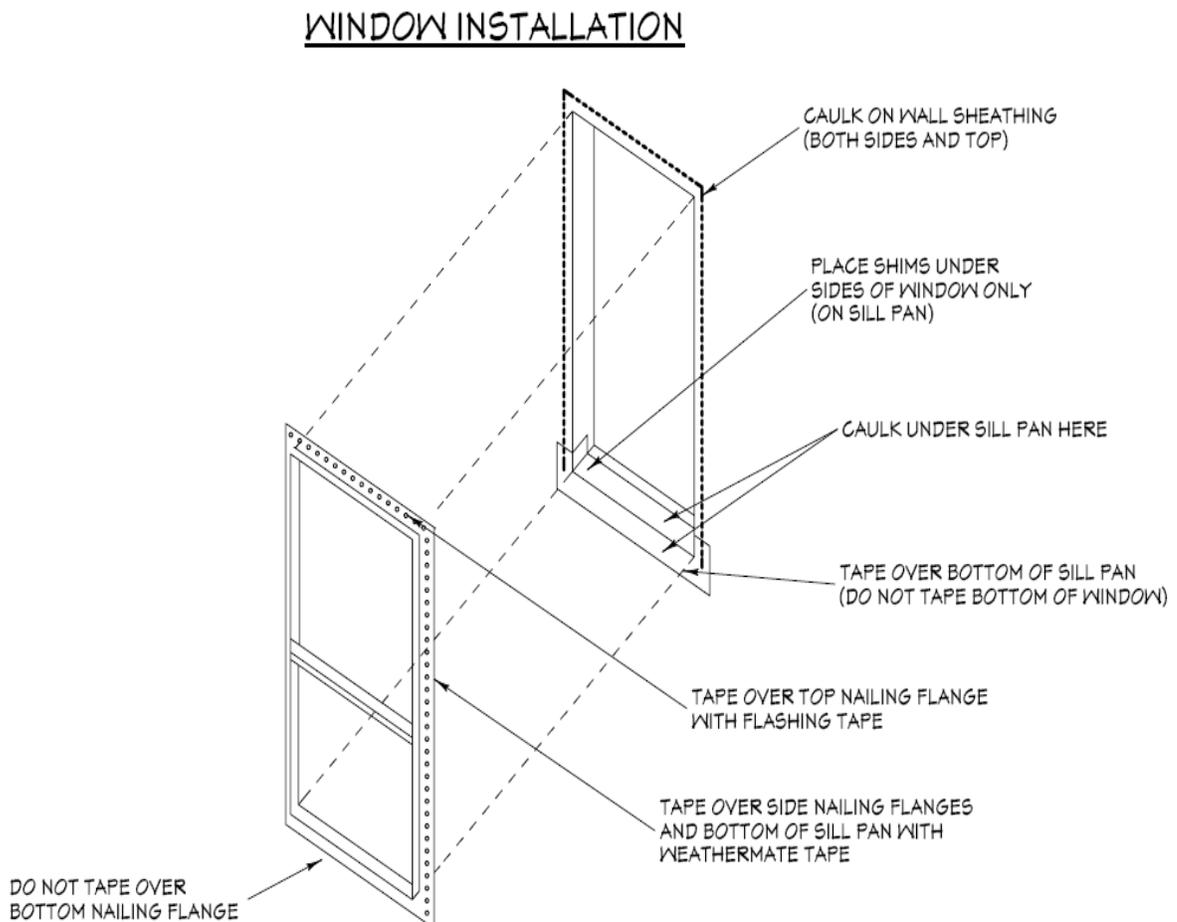


Figure 9-1. Window Installation

3. Trim any excess sheathing around the perimeter of the opening flush with the framing to allow centering the window in the frame horizontally and vertically.

4. From the trailer, obtain flat cardboard shims and 1/8"x1" and 1/4"x1" flat wood shims. Cut pieces 2-3" long for use under the windows.
5. Using the longest level that will fit within the opening, check the sill for level. Assemble enough flat cardboard shims, flat wood shims and tapered shims as necessary to level the window frame. Pieces must be sized to fit properly under the end and center frames of the window, inside the sill pan (if in use), and must be at least 1/8" thick in order to provide drainage clearance between the bottom of the window and the sill. Preferably, use at least one 1/8" or 1/4" flat shim plus a tapered shim, if needed. With all slider windows, include shims for the center frame as well.

9.1.1.2. Preparation Using Flashing Tape

1. Cut a length of flashing tape 8"-10" longer than the width of the window frame. Lay it on the sill with the inside edge approximately 2 1/2" from the outside edge of the sheathing and the inside edge of the tape at least 1/2" inside the window frame. Attach the tape to the sill and the sides of the frame. Cut at each corner and fold the tape down and out to the outside of the frame.
2. Starting and ending below the flashing tape, run a continuous bead of air sealing caulk on the exterior surface of the foamboard up both sides and over the top of the rough opening. Apply the caulk within 1/4" of the edge of the opening.
3. Place a flat and/or tapered shim combination (prepared in Section 9.1.1.1.5) on the sill at each end (directly under the end frame) and in the middle for windows equal to or greater than 36" wide.

9.1.1.3. Preparation Using Sill Pans.

1. Run a continuous bead of air sealing caulk on the sill and 3" up the sides. Apply the caulk 1/2" from the exterior edge of the sill framing (not the foamboard).
2. Run a continuous bead of air sealing caulk on the exterior surface of the foamboard under the window and extending roughly 6" up both sides of the rough opening. Apply the caulk 1/4" or less from the edge of the opening.
3. Install one half of a sill pan on the sill of the window opening. Be sure to seat the sill pan completely flat on the sill. Run a short bead of air sealing caulk along the center edge of the first half and then install the second half on top. Press both pieces tight to the sill.
4. Run a continuous bead of air sealing caulk on the exterior surface of the foamboard up both sides and over the top of the rough opening. Apply the caulk within 1/4" of the edge of the opening.

5. Place a shim (prepared in Section 9.1.1.1.5) within the sill pan at each end (directly under the end frame) and in the middle for windows equal to or greater than 36" wide.

9.1.2. Position and Temporarily Secure Window in Opening

1. Locate the top of the window by checking the labels, or by locating any weep holes (orient weep holes at the bottom of the window). Place window unit in the rough opening roughly centered left to right. Check that the spacers/shims are in place below the window frame, under the vertical frames. If not, lift the frame and put them back in place.

CAUTION: Be sure someone continues to support the window from the outside until it is secured with nails.

2. Center the window vertically by adding/removing 1"- and 1½"-wide shims below the right and left corners. Then center the TOP of the frame left and right. By centering the top now, the frame can be squared later by racking the top of the frame.
3. Place a level on the bottom frame and level the bottom of the window, adjusting shims as necessary. Push the sides of the shims tight to the inside of the window flange. Trim any protruding tapered shims flush with the frame.
4. Using 2½" siding nails, nail the bottom hole in each of the side flanges of the window. To protect the window frame when nailing, hold a shim, putty knife, or flat wrecking/pry bar flat against the frame. If the nail is missed, the hammer will hit the protective device and not the frame.

NOTE: Make sure to pound the nails in straight. If even slightly angled, they will push the frame of the window in toward the windowpane causing the window to become very hard to open and close (because the window frame is now too narrow).

5. Using 2½" siding nails, TACK nails in the center of the leftmost and rightmost slots in the top flange of the window.
6. While holding the frame in place from the outside, insert the top and bottom sashes into the frame and push them into place at top and bottom.

CAUTION: Hold the frame firmly in place while sashes are being inserted. They have to be pushed firmly to one side to insert them into the frame.

7. Raise the bottom sash just enough to create a small reveal with the bottom frame. Check to see if the reveal is uniform. If it is, this indicates the window is square. If it is not, rack the top of the window frame left or right until the reveal is uniform

and the window is square. To adjust the reveal, pry the top of the frame in the direction of the wider reveal.

NOTE: Before racking the window, place temporary shims in the lower corner opposite to where the pry bar will be inserted. This will prevent the lower frame from shifting as the top frame is racked. Be sure to remove these shims when the window is fully nailed.

8. Similarly, pull down the upper sash and check the reveal between it and the top frame. If the top sash reveal indicates a different adjustment than the bottom sash reveal, “average” the adjustment to the top frame and recheck the bottom reveal.
9. With slider windows, open both sashes slightly to see reveals on both sides. Using a small pry bar, lift the center of the bottom frame until reveals are equal. Check for proper sash movement and locking. Insert a shim to hold the frame in place and finish nailing.
10. Finish securing the nails in the leftmost and rightmost slots in the top flange of the window installed in Step 5.

9.1.3. Permanently Secure Window

1. Using a level held against the outside or inside of the window frame, verify that all four sides are straight. Draw a 4”-5” line on the foamboard above and below the center hole on each side. Holding the frame against that line, nail 2½” siding nails, snugly through the center hole of each flange to hold them straight. Use the lines on the sides to verify that the frame has not moved when nailing. Do a final re-check of the reveal and window operation and then nail the rest of the slots.
2. Seal the window frame to the wall.
 - a. When using FLASHING TAPE (see Section 9.1.1.2), apply air sealing tape to the side flanges, being sure to overlap the ends of the air sealing tape below the sill. Apply flashing tape to the top flange, being sure to overlap the top of both side tapes. DO NOT tape the bottom flange of the window to the foam board below the flange.
 - b. When using SILL PANS (see Section 9.1.1.3), tape the bottom of the sill pan to the foamboard with air sealing tape. Apply air sealing tape to each side flange, being sure to overlap the tape covering the bottom of the sill pan. Apply flashing tape to the top flange, being sure to overlap the top of both side tapes. DO NOT tape the bottom flange of the window to the foam board below the flange.
3. Reinstall the screen in the frame.

9.1.4. Installing Basement Windows and Screens

1. Clean debris from tracks.
2. Install window sashes with label right-side up.
3. Install the screen.

9.2. *INSTALLING EXTERIOR HOUSE DOORS*

9.2.1. Door and Rough Opening Preparation

1. Before removing packaging or shipping parts, inspect the door and frame. If there is any damage, notify the Site Leader or Construction Supervisor.
2. Remove bags of door accessory parts from the door frame and attach to one of the king studs for the door.
3. Verify correct door and size. Verify proper door swing according to the House Plan. Verify that the door has a hole for the deadbolt (a door without that hole is for the shed or the garage service door).
4. Using a 1/8" drill bit, pre-drill the brickmold where 16d galvanized casing nails will be placed (five on each side and three on top). Hold the holes near the upper mitered corners 3" away from the corner. Angle the holes slightly away from the jambs to ensure that the casing nails will hit the Jack stud.
5. If house wrap extends through the doorway, fold it down over the threshold area and staple it to the deck in the doorway.
6. If not already installed, cut and install a length of flashing tape sufficient to cover the width of the threshold and about 2" up each side of the Jack studs. Install with about half the width on the deck and half on the foamboard. Cut at the corners and fold and attach to the outside.
7. Install threshold seal tape snug to corners and flush to the outside edge of the threshold.
8. The following Steps 9 and 10 are designed to reduce the difference between the width of the door frame and the width of the rough opening at the hinge locations to 3/8" or less. Doing so helps to
 - Center the door in the rough opening;
 - Avoid trying to install spacers and/or thick shims once the door is in place; and,
 - Equalize the overlap of the interior trim.

9. Adjust hinge side Jack stud.
 - a. Mark the location of the hinges on the hinge side Jack stud.
 - b. In all cases in this section, install **3"x5" flat shims** (using **1¼" finish** nails) with their 5" dimension vertical.
 - c. Measure the width of the door frame at the head jamb and the width of the rough opening at the top and bottom hinge locations.
 - i. If the difference between the door frame and the rough opening at either location is LESS THAN OR EQUAL to ⅝" add a ⅛" 3"x5" **flat shim** to all three hinge locations. Go to Step d below.
 - ii. If the difference between the door frame and the rough opening at either location is GREATER than ⅝", attach a combination of ⅛" and ¼" 3"x5" **flat shims** to the hinge side Jack stud at the top and bottom hinge locations until the difference is less than ⅝" at both locations. At a minimum, each Jack stud hinge location should have a ⅛" **flat shim**.
 - d. Using a 6' level, check if the Jack stud is plumb. If NOT PLUMB, shim the top or bottom hinge areas until it is plumb.
 - e. Keeping the 6' level against the top and bottom **shims**, attach ⅛" and ¼" 3"x5" **flat shims** and/or **tapered** shims at the middle hinge area until flush with the level.
10. Adjust strike side Jack stud.
 - a. Add a combination of ⅛" and ¼" 3"x5" **flat shims** to the strike side Jack stud at the top and bottom hinge locations until the differences in opening width is less than ⅜" at both locations.
 - b. Place the 6' level against the **shims** and install a combination of ⅛" and ¼" 3"x5" **flat shims** and/or **tapered** shims at the middle hinge area until flush with the level.

9.2.2. Position and Temporarily Secure Door in Opening

1. Set door into the rough opening, tight to the foamboard and hinge side Jack stud.
2. Temporarily secure the door in the rough opening by installing shims at the very top of the strike jamb (even with the head jamb) AND at the very bottom of the strike jamb (even with the threshold). Wedge these shims in **TIGHTLY** (do NOT nail so they can be adjusted later).

NOTE: This process is designed to apply horizontal pressure to hold the hinge jamb tight against the hinge side Jack stud. The top of the

door may rub on the strike jamb at this stage, but this is normal and will be corrected later.

3. Check the reveal between the top of the door and the head jamb at the left and right corners of the door. If necessary, shim under the strike jamb or hinge jamb until these reveals are equal.
4. Re-check that the hinge side is still plumb (set level on hinges or hinge plates).
5. Tack four 16d galvanized finish nails into pre-drilled holes in brickmold, two on each side near top and bottom to hold door tight to foamboard (be sure someone is on the exterior holding the door in place).

9.2.3. Permanently Secure Door

1. With the door still held tight to the foamboard and the hinge side Jack stud, secure the hinge side jamb with 2½” exterior screws behind the weatherstripping at the top, middle and bottom hinges.
2. Check that the hinge side of the door is still plumb. Adjust shims as needed.
3. At the top door hinge, replace the two screws closest to the doorstop with #8 3” brass-colored construction screws to secure the top hinge to the Jack stud and ensure the door does not sag.

NOTE: The tightness of the 3” brass-colored screws in the top hinge can affect the reveals at either end of the head jamb. Tighten or loosen the screws, adjust shims, or adjust the strike side jamb up or down as needed to adjust the reveals.

4. Check complete door operation and verify that contact between the door and the weatherstripping is consistent (no gaps or light visible) along the head jamb and the strike jamb. It may be necessary to adjust one or both side jambs and brickmold slightly away from the foamboard to ensure proper contact with the weatherstripping (a maximum of ⅛” gap). Shim behind the brickmold to hold it in place. Confirm that the latch and strike are aligned.
5. Check the reveal on the top and the bottom of the hinge jamb. If necessary, adjust the shims against the head jamb until the top hinge jamb reveal matches the reveal just below the top hinge. If necessary, adjust and shim the bottom of the hinge jamb to match the reveal at the top, shim as needed, and secure with a 2½” exterior screw behind the weatherstripping.

NOTE: Adjusting the reveal at the top of the hinge jamb will affect the reveal at the top of the strike jamb. Check to be sure the reveal at the top of the strike jamb is ⅛” or greater. If not, it may be necessary to “split the difference”.

6. Check the reveal at the top and the bottom of the strike jamb. If necessary, adjust the shims at the bottom of the strike jamb until there is a consistent reveal at both locations.
7. While keeping consistent reveals top to bottom, install all remaining shims (using 2½” exterior screws behind the weatherstripping) in the following strike side locations: across from the top and bottom hinges as well as above and below the dead bolt location.
8. Install shims in the center of the head jamb, adjusting for a consistent reveal across the jamb. Secure the shims with a 2½” exterior screw behind the weatherstripping.
9. Recheck the complete door operation, ensuring that contact with the weatherstripping is uniform (no gaps or light visible). Adjust as needed.
10. To ensure consistent reveals along both side jambs, install additional shims on the hinge side about halfway between hinges and similarly on the strike side. This should result in five sets of shims per side (plus one extra set above the deadbolt). Secure the jambs with 2½” exterior screws behind the weatherstripping.
11. Finish securing the door on all three jambs at each shim location by nailing a 16d galvanized casing nail through the jambs about 1½”-2” from the outside edge of each jamb (between the doorstop and brickmold). Make sure all nails hit a Jack stud or the header.
12. Conduct a final verification of the complete door operation, ensuring there is uniform contact with the weatherstripping and that all reveals are consistent. Adjust as needed.
13. Nail the brickmold using 16d galvanized casing nails in the thirteen pre-drilled holes. Make sure all nails hit a Jack stud or the header.
14. Set and caulk all nails.
15. Cut a piece of 2x4 or 2x6 the length of the threshold to serve as a temporary threshold support. Position it under the threshold. Lift it up tight to the threshold and secure to the rim board with three 4” timber screws.

9.2.4. Installing Hardware and Window Trim Caps

1. Install lockset and strike plate per instructions provided. Be sure the door latches easily but tightly with little or no rattle. If it rattles, bend the tab inside the strike plate with a flat blade screwdriver until the door closes tightly.

2. Install the deadbolt. Use the specially provided security deadbolt strike plates rather than the one provided with the lockset. Set the strike plate in place, predrill into the Jack stud with a 3/16" bit, and secure with the two long screws provided.

NOTE: Make sure the deadbolt is installed so that the top of the lever turns in the direction of the bolt travel. If it does not, remove the deadbolt from the door, rotate it 180° and reinstall.

3. Make sure both the lockset and deadbolt are installed so the key direction (notches up) is the same. If necessary, the lockset can be changed to place the notches up, as follows (see Figure 9-2). Unlock the installed lock. Insert the key **half-way** (do not insert completely). Push in the retainer pin (H) on the neck of the knob and pull the knob just past the pin. Continue holding the knob and use the half-way inserted key to rotate the cylinder (J) to the correct orientation. Push in the retainer pin and push the knob back into place. **Do NOT** pull the knob and cylinder off the shaft while doing this.

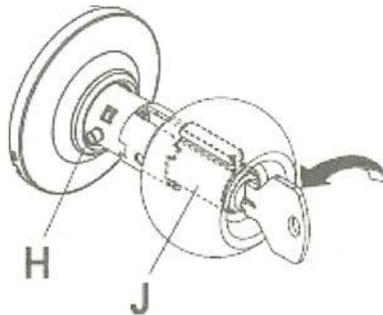


Figure 9-2. Door Lockset.

4. Verify lockset and deadbolt operation. Adjust as needed for easy operation (door closes snugly to weatherstripping and latches with little effort, the deadbolt easily engages and disengages when door is closed, and the deadbolt moves in the same direction as the top of the lever).
5. For doors with a window, install the white plastic trim caps, being careful to install them in the correct orientation. Install by hand until almost flush, or as far as possible, then use a wood shim and hammer to tap until the cover is flush with the trim surface.

9.2.5. Weatherproof/Air Seal Doors

1. If threshold covers are not available, temporarily protect the **wood** (not the aluminum) portion of the threshold with two or three layers of orange floor tape.

NOTE: NEVER use any other tape for this task. All other tapes leave a residue difficult to remove.

2. Apply flashing tape to the foamboard and the side of the brickmold making sure the tape does not extend more than $\frac{3}{4}$ " onto the brickmold (so that it will be completely covered by the siding J-channel). To facilitate attaching this tape to the foamboard and brickmold, use a 2x4 (for 4" wide tape) or 2x6 (for 6" wide tape) as a template to mark a line on the wall $3\frac{1}{2}$ " or $5\frac{1}{2}$ " from the brickmold. While gradually peeling back the release paper, align the edge of the tape to the line, and stick the edge to the foamboard. While progressing down the wall, use a speed square or wide putty knife to evenly press the tape to the foamboard, pushing the tape into the corner between the foamboard and the brickmold. Finally, press the edge of the tape to the brickmold, making sure it is tightly attached all over and is tucked tightly into the corner (radius smaller than the J-corner radius). The result will be about $\frac{1}{2}$ " of tape stuck to the brickmold.
3. Apply the flashing tape to the door sides first, then the top (shingle style). For the sides, tape can be applied in a single piece or multiple pieces (easier) not less than 20" in length and overlapping about 2" starting from the bottom (shingle style). The top piece of tape must be a single piece extending above and past the outside edges of the side tapes.
4. Install bottom "Corner Seal Pads".

10. Vents, Baffle Guard and Blocking

10.1 INSTALLING BATH FAN AND END CAP

10.2 INSTALLING RANGE PLENUM AND END CAP

10.3 INSTALLING PROPER VENTS

10.4 INSTALLING WIND WASHING BAFFLE GUARD

10.5 INSTALLING BLOCKING

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Materials needed:

Scrap 2x lumber
Scrap OSB
Proper vents
1" Foamboard
Air sealing tape
Flashing tape
16d Nails
3" Siding nails
1 $\frac{5}{8}$ " [Sheetrock](#) screws
[3" Sheetrock](#) screws
Staples
Range plenum

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Stapler
Framing nailer
Torpedo level
Stepladder
Black crayon
Clear varnish

Personal Protection Equipment:

Safety glasses (required)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

10.1. INSTALLING BATH FAN AND END CAP

1. Check for the location of the bath fan per the House Plan. It must be installed per this plan.
2. First install the fan's end cap in the opening created in Section 7.1.2.2.7.
3. Slide the vent pipe through the hole, level the end cap and nail into framing with 3" siding nails.
4. Check that the backdraft flap on the bath fan is working correctly by removing the factory-applied shipping tape securing the flap to the fan.
5. Frame out an opening with 2x4's where the fan will go in the bottom cords of the trusses.
6. Secure the fan to the framing with 1 $\frac{5}{8}$ " [sheetrock](#) screws. Make sure the fan's exhaust port is pointing toward the intended gable end. Set the fan body tight to the truss that the exhaust port points away from, to allow as much space as possible for the rigid duct to angle up and over the exhaust side truss's bottom chord.

10.2. INSTALLING RANGE PLENUM AND END CAP

10.2.1. Preparing Plenum Location

1. After sheathing the exterior of the stud bay at the stove location, install the range hood plenum. Measure from the floor up 73" and mark on both studs. These marks represent the top of the plenum.

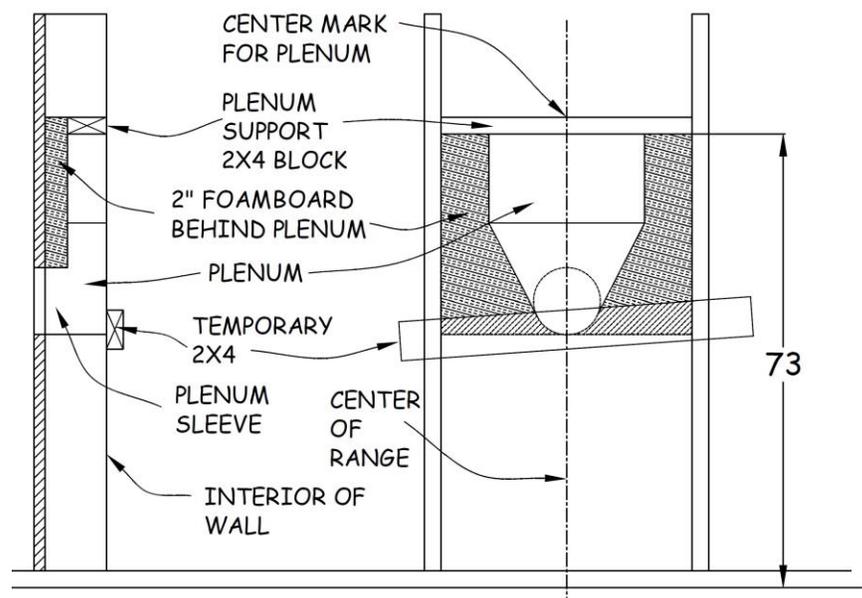


Figure 10-1. Range Plenum Location.

2. Cut a 2x4 plenum support block to fit between the two studs. Install the block flat with the bottom side at the 73" marks and the edge flush with the inside edge of the studs.
3. Note the marking on the floor indicating where the center of the stove will be. Measure from the closest end wall to that center mark or, with a 6' level, plumb up from the floor mark. Mark that measurement on the 2x4 support block installed in Step 2 above.

10.2.2. Preparing for Installation of the Plenum and End Cap

1. At the top of the plenum, measure and mark the center. Line up the plenum center mark with the 2x4 support block center mark.
2. Slide the plenum toward the exterior until the 6" diameter sleeve touches the wall sheathing.
3. Trace around the exterior of the plenum sleeve marking a 6" circle on the interior side of the sheathing. Increase the diameter of this circle by ½"-1" in order to allow room for installation of spray foam to seal the penetration in Section 10.2.3.6 below.
4. Cut out the larger circle in the sheathing.

10.2.3. Plenum and End Cap Installation

1. Cut 2" of foamboard to match the width of the space between the studs and the length from the TOP of the 2x4 supporting the plenum to the bottom of the plenum. Install this foamboard between the 2x4 and the wall sheathing, flush with top of the 2x4.
2. From outside the house sheathing, extend the circle cut out in Section 10.2.2.4 above completely through the 2" of foamboard just installed in the previous step.
3. Remove the 2" of foamboard from the stud bay. Draw a horizontal line through the diameter of the opening in the foamboard and cut the 2" of foamboard along that line. Place the foamboard pieces on the ground near the work area.
4. Align the top of the plenum and 2x4 support block center marks made in Section 10.2.2.1 above. While holding the plenum flush to the interior side of the wall framing and the 6" plenum sleeve protruding into the wall, secure the plenum to the 2x4 support block using four 1½" sheetrock screws through the plenum flanges.

NOTE: Make sure the top end of the plenum is flush with the interior edge of the wall framing.

5. Using 16d duplex nails, temporarily brace the bottom end of the plenum so it remains flush with the interior wall by nailing a piece of 2x4 across the interior edge of the two studs on either side of the plenum.
6. Measure from the outside of the exterior sheathing to the vertical face of the plenum, subtract 1", and cut the vent cap sleeve to that length.
7. Put a thick bead of caulk around the inner diameter of the vent cap sleeve. From outside the house, slide the vent cap sleeve through the hole in the sheathing and over the plenum sleeve (there should be a minimum of 1½" overlap). Make sure the vent cap is tight to the exterior sheathing AND the bottom end of the plenum is flush with the interior side of the wall framing.

NOTE: The entire plenum needs to be flush or slightly shy of the interior side of the wall framing so it does not cause an issue with wall rock installation

8. With a torpedo or other short level, ensure the top of the vent cap is level. Secure the vent cap in place by taping (shingle style) the flanges with flashing tape.
9. From the inside, caulk or spray foam, as required, around the penetration through the exterior sheathing to completely seal the opening.
10. Seal the connection between the plenum sleeve and the vent cap sleeve using flashing tape.

NOTE: The connection needs to be **completely** sealed in order to prevent ANY warm exhaust air from getting into the wall cavity.

11. Re-install the 2" of foamboard removed in Step 3 above, making sure they are positioned as specified in Step 1.

10.3. INSTALLING PROPER VENTS

1. One proper vent is placed between every truss on each side of the house. The proper vents have a flap on the bottom that is secured to the wall foamboard to prevent windwashing of the insulation.
2. To install, place the vent between the roof trusses and slide the vent toward the outside until the vent touches the foamboard. Make sure the dimples on the upper side of the proper vent are pushed up against the underside of the roof sheathing. Make sure that the bottom of the proper vent is positioned 3" above the top of the top plate (this is equivalent to the thickness of two 2x4's). Doing this will allow proper air flow above the vent and will prevent windwashing.

NOTE: If a 2x4 is used as the top chord of the truss, one piece of tape can be used to cover edges on two adjacent proper vents.

3. Staple (three per side) the sides of the vent to the trusses and tape the entire width of the bottom of the flap to the foamboard and the entire length of the two sides to the trusses using air sealing tape, as shown in Figure 10-2.

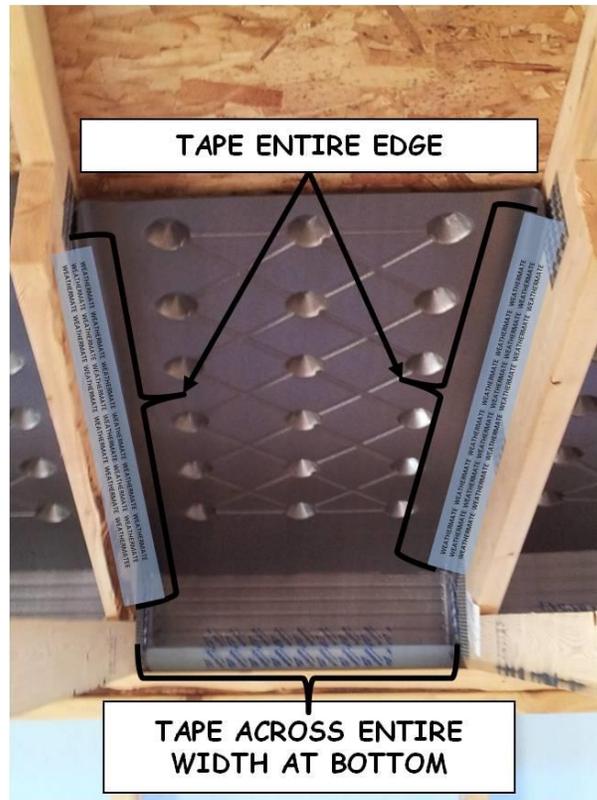


Figure 10-2. Proper Vent Installation.

10.4. INSTALLING WIND WASHING BAFFLE GUARD

1. A wind washing baffle needs to be installed on houses where the porch roof is on the eave side of the house. This baffle allows ventilation of the underside of the roof and prevents the attic insulation from being disturbed by diverting the wind up and over the insulation.
2. Install sheets of 1” foamboard between the trusses above the foamboard on the exterior wall. The sheets must extend up 24” or to within 2” of the roof sheathing (whichever is shorter). Seal all joints and gaps with air sealing tape.

10.5. INSTALLING BLOCKING

10.5.1. Safety Instruction

1. ALL blocking in stud bays **MUST** be installed by either hand nailing using 16d nails or secured using 3” sheetrock screws. Blocking can be secured either by

toenailing through the top and bottom of the blocking into the framing stud, or by driving three screws or nails through the framing stud into the end of the blocking.

WARNING: Using framing nailers to install this blocking is dangerous as an improperly aimed nailer can fire a nail that misses or passes through the wood and potentially strikes a fellow worker.

10.5.2. Blocking For Bathroom Accessories

1. **Grab-Bar blocking:** Install this blocking adjacent to the shower and toilet with the top of the blocking 36" above the floor. Install the blocking between all studs that will NOT be covered by cabinets or the shower stall.
2. First, install the 2x6 blocking in a corner stud bay by attaching three 16d nails or 3" sheetrock screws through the open stud bay into the blocking. Secure the other end of the blocking to the corner stud by toenailing or screwing through the top and bottom of the blocking into the corner stud. Successively install blocking into the adjacent stud bays by first driving three 16d nails or 3" sheetrock screws through the open stud bay into the end of the blocking. Then, attach the opposite, common end, of the blocking by toenailing or screwing through the top and bottom of the blocking into the stud.
3. **Bathroom Mirror blocking:** Install this blocking above the vanity area (see House Plan). This will provide solid backing for mounting the mirror clip hardware positioned along the bottom and the top of the mirror.
4. Install 2x6 blocking between all studs where the vanity will be installed. Position the tops of the blocking at 40" and 76" from the floor.
5. **Short (18") Towel Bar blocking:** Install 2x6 blocking covering at least a 20" span in the wall along one side of the vanity, and positioned so that the top of the blocking is 55" above the floor and extending out at least 20" from the back corner of the vanity.

NOTE: If one side of the vanity is to be located against the linen cabinet, put the blocking for the short towel bar in the wall next to the vanity, opposite the linen closet.

6. **Long (24") Towel Bar blocking:** Install 2x6 blocking covering at least a 30" span next to the shower, and positioned so that the top of the blocking is 55" above the floor and extends at least 30" from the edge of the shower.
7. **Linen Cabinet blocking:** Install 2x6 blocking along the back and one side of where the linen cabinet will be located. Position the top edges of the blocking 60" above the floor.

8. **Toilet Paper Holder blocking:** Install in the wall next to the toilet. Install 2x6 blocking covering at least a 12" span centered 32" from the wall behind the toilet and positioned so the top edge of the blocking is 26" above the floor.
9. **Tub/Shower Nailing Flange blocking:** Select two 2 straight (no bow or crown) 2x4 studs for blocking and install vertically on each end wall where the tub/shower unit will be installed. Position the face of the 2x4 stud flush with the tub-side wall. For basement shower units, position the blocking 35" to center from the back wall. For main floor shower/tub units, position the blocking 32" to center from the back wall.
10. Mark on the floor with black crayon the location and purpose of blocking for the Grab Bar (GB), Long Towel Bar (LTB), Short Towel Bar (STB), and Toilet Paper Holder (TP). Spray over crayon marks with clear varnish to avoid crayon marks wearing off.

10.5.3. Blocking For Sheetrock

1. Blocking for sheetrock must be installed in the following areas within the house and attached garage: 1) Along the top plates of walls parallel to trusses for ceiling rock; and, 2) at the end of all interior house walls where they intersect with another wall.
2. Inspect the tops of all walls for areas where blocking may be needed for ceiling rock (see Figure 10-3). For interior walls that are greater than 6" from a truss, make sure that blocking extends at least 1 1/2"-2" beyond both ends and sides of any interior wall top plates. Blocking should be continuous at the top of each wall where required.

NOTE: Blocking is only required on one side of the top of interior walls that are within 6" of a truss.

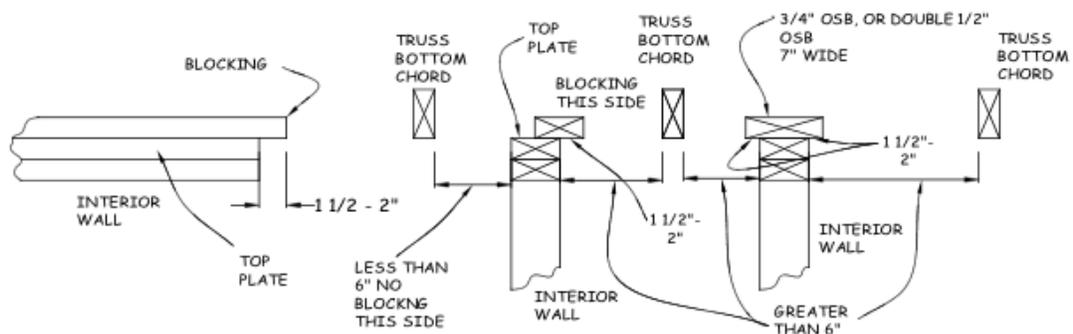


Figure 10-3. Blocking For Ceiling Rock.

3. Use scrap 2x6, side-by-side 2x4's, $\frac{3}{4}$ " OSB, or two layers of $\frac{1}{2}$ " OSB as long as the $1\frac{1}{2}$ "-2" overhang is achieved. Attach the pieces to the top of the wall with 16d nails or 3" sheetrock screws.
4. Install two 43" long pieces of $\frac{3}{4}$ " OSB blocking at the ends of any interior walls that intersect an exterior wall – one above the 2x4 ladder block and one below the 2x4 ladder block. The blocking must extend at least 2" beyond the edges of the stud, so cut the OSB to a width of $5\frac{1}{2}$ " or $7\frac{1}{2}$ " for a 2x4 wall and $7\frac{1}{2}$ " or $9\frac{1}{2}$ " for a 2x6 wall. Pre-drill four pairs of $\frac{3}{16}$ " holes, spaced evenly vertically, through the stud (about $\frac{1}{2}$ "- $\frac{3}{4}$ " in from each edge). To attach the blocking, hold the piece of OSB in place, making sure it is tight (no gaps) to the outside of the end stud (use a clamp, if necessary). Attach the OSB blocking by screwing 3" sheetrock screws through the holes in the 2x4 into the OSB, turning the screw until it is buried about $\frac{1}{4}$ " into the stud. If there is access to drive screws from the blocking side of stud, it is acceptable to use two layers of $\frac{1}{2}$ " OSB. See Figure 10-4.
5. Where an interior wall intersects an interior wall (see Figure 10-4), install blocking using 2x4's, $\frac{3}{4}$ " OSB, or two layers of $\frac{1}{2}$ " OSB. Secure the blocking to the end stud using 16d nails for 2x4 blocking and 3" sheetrock screws for OSB blocking.
6. Install blocking around the perimeter of the stair landing platform to support the bottom of the wall sheet rock, since there is no bottom plate present at that level. Nail or screw 2x4s between the wall studs with the bottom at the level of the landing floor deck.

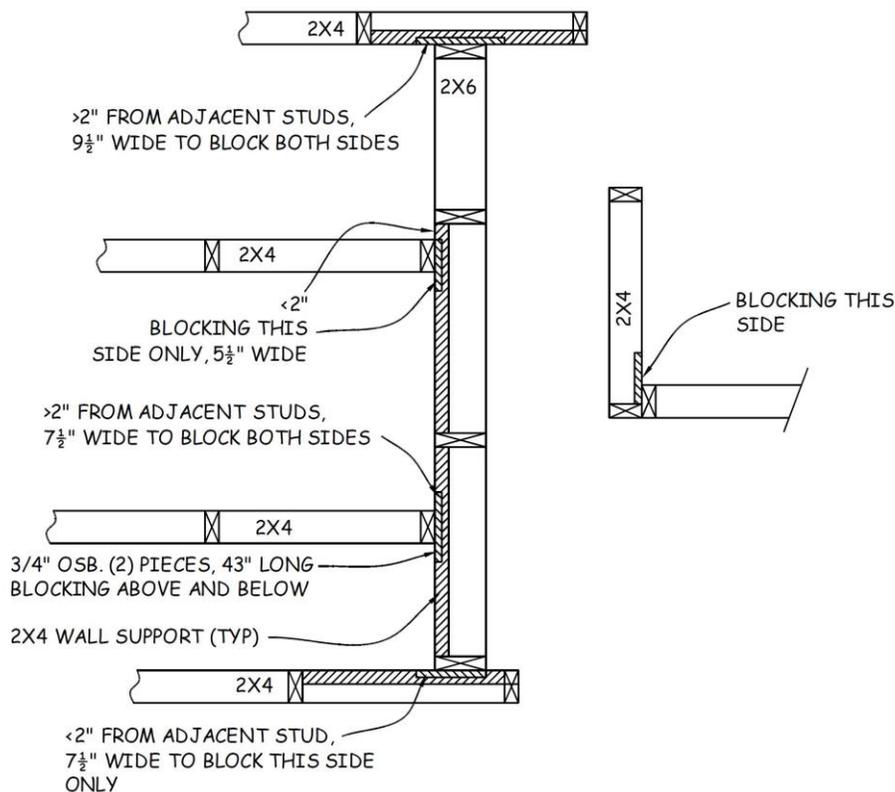


Figure 10-4. Blocking For Wall Rock.

10.5.4. Blocking For Skirtboard

1. At the bottom of the stairs, install a piece of 2x6 or two pieces of 2x4 blocking for the skirtboard, extending from the end of the stringer to at least 5" past that point (see Figure 10-5).
2. At the top of the stairs, install a piece of 2x4 blocking where the $\frac{3}{4}$ " subfloor ends at the stair, at least 3" both above and beyond the subfloor.

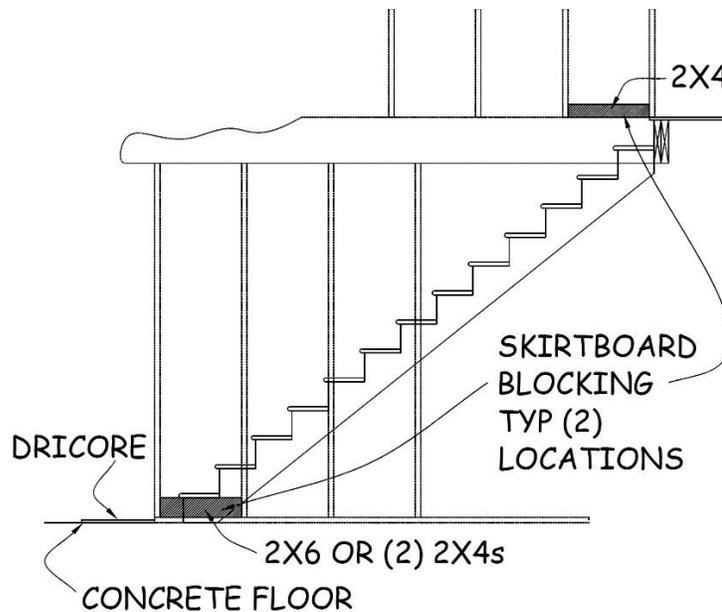


Figure 10-5. Blocking for Skirtboard.

10.5.5. Blocking For Stair Handrail

1. Straight stairways will have handrails (and require blocking) on the wall opposite the angled wall. Stairs with landing will have the handrail on the wall opposite the lower section of stairs, or the “outside” of the stairwell. The section below the landing will also require blocking.
2. The handrail bracket bottom screws will be mounted approximately 31" above a line that is defined by the nose of the treads. This will place the top of the handrail between the required 34" and 36" above the nose of the treads. To provide some latitude in the placement, measure up 32" from the decking, vertically at the edge of the floor deck, and mark the wall at that height. At the bottom of the stairs, again measure up 32" from the nose of the bottom stair tread. Snap a chalk line between the top and bottom marks. The blocking must be installed so that the top corner toward the top of the stairs is on or above this chalk line, and the bottom corner toward the bottom of the stairs is on or below this line (see Figure 10-6).

3. For blocking, use a combination of scrap 2x12's, 2x10's or 2 x6's to equal a minimum height of 18" (see Figure 10-6). The extra height helps to ensure that handrail brackets will be secured to the blocking after sheetrock is installed.
4. Install blocking between the bottom two treads, the middle two treads, and the top two treads. Find the location of the middle blocking by measuring the length of the chalk line made in Step 2, then dividing that in half. For stairs below a landing, omit the middle blocking.

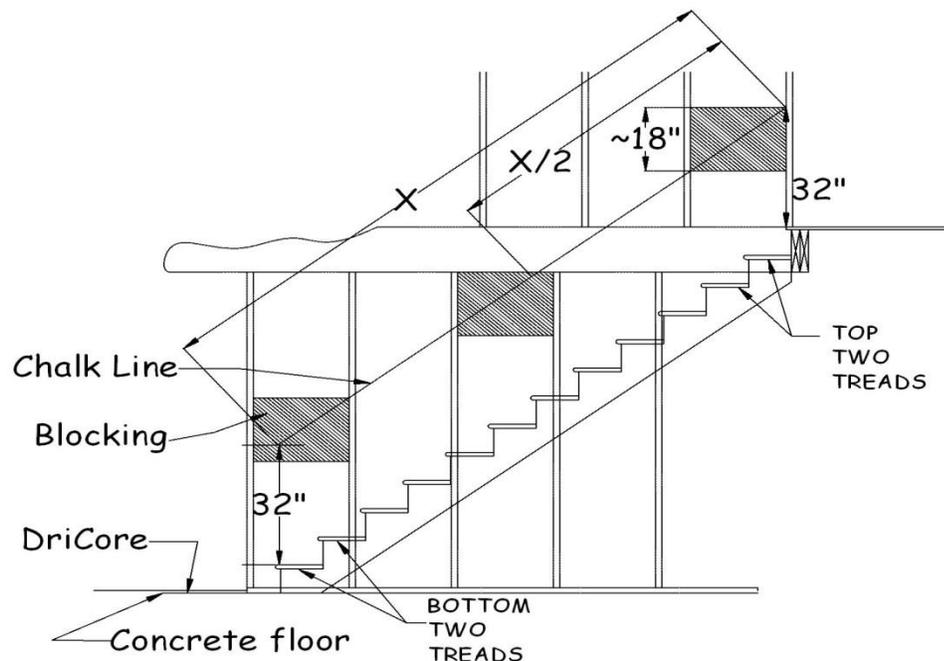


Figure 10-6. Blocking For Handrail.

5. Mark location of the blocks on the temporary stair treads to facilitate finding the blocks after plastering.

10.5.6. Blocking For Closet Pole Hangers

1. In each corner of every closet that will receive a closet pole, install a scrap piece of 2x4, at least 16" long, so there is something to attach the hanger to.
2. At the corner, make a mark 70" off the floor. Hold the piece vertically, place the top at that mark, and nail it flush to the 2x4 closet stud.

10.5.7. Blocking for Cold Air Returns

1. Blocking is required next to cold air returns to provide support for the register installation screw opposite the stud side.

2. Install blocking extending between each cold air return and the adjacent stud. Use a 9" high stack of six 2x4s on top of the bottom plate as shown in Figure 10-7.



Figure 10-7. Cold Air Return Blocking.

10.5.8. Blocking for Large Windows

1. Window openings 6' or greater need additional "squash" blocking to support the longer expanse of the opening.
2. Cut four 9½" long pieces of 2x6. Create two blocks by nailing pairs of these pieces together. Position the blocks between the sill plate and the bottom of the decking under the K/J/J on each side of the window with the face of each block against the 2" foamboard. The blocks should fit tightly but can be further secured by toenailing 8d nails through the blocks into the sill plate.

10.5.9. Blocking for House-Mounted Mailbox

1. Consult with the Construction Supervisor to determine if there will be a house-mounted mailbox installed. If yes, the top of the mailbox will be located on the latch side of the storm door, horizontally centered between the front door (and 4" lineal, if any) and the adjoining window (and 14" shutter, if any) and 43" above the porch surface. Refer to the House Plan or Construction Supervisor about the presence of lineals or shutters. If OSB sheathing exists at this location, no blocking is required; if not, blocking needs to be installed.
2. Pound a nail through the foamboard sheathing at the location described in Step 1 above to mark the location of the top, center of the mailbox. Install 2x6 blocking

above and below this nail mark and spanning a minimum of 24" centered on the mark. Position blocking against the interior side of the sheathing.

3. Mark on the floor with black crayon the location and purpose of blocking for the Mailbox (MB). Spray over crayon marks with clear varnish to avoid crayon marks wearing off

10.5.10. Blocking for Porch Railing

1. Consult with the Construction Supervisor to determine if a porch railing will be installed, and if so, its location. If yes, top and bottom porch railings will be attached to the house 5" and 36" above the porch surface. If OSB sheathing exists at these locations, no blocking is required; if not, blocking needs to be installed.
2. Pound a nail through the foamboard sheathing at the locations described in Step 1 above to mark the top and bottom porch rail attachment locations. For each nail mark, install 2x6 blocking centered vertically and horizontally on the mark and spanning a minimum of 12". Position blocking against the interior side of the sheathing.
3. Mark on the floor with black crayon the location and purpose of blocking for the Porch Railing (PR). Spray over crayon marks with clear varnish to avoid crayon marks wearing off.

10.5.11. Blocking for House Number Mounting Board

1. Consult with the Construction Supervisor to determine if a mounting board for house numbers will be installed, and if so, its location. If yes, the top of the mounting board will be located 70" above the porch or driveway surface, typically on the wall closest to the street. If OSB sheathing exists at this location, no blocking is required; if not, blocking needs to be installed.
2. Pound a nail through the foamboard sheathing at the location described in Step 1 above to mark the location of the top, center of the house number mounting board. Install 2x6 blocking with its top at this mark and spanning a minimum of 24" centered on the mark. Position blocking against the interior side of the sheathing.
3. Mark on the floor with black crayon the location and purpose of blocking for the House Number Mounting Board (HN). Spray over crayon marks with clear varnish to avoid crayon marks wearing off

Chapter 11. Siding and Soffit

- 11.1 PREPARATION
- 11.2 INSTALLING HOUSE SIDING
- 11.3 INSTALLING SOFFIT
- 11.4 INSTALLING FASCIA
- 11.5 INSTALLING SHUTTERS
- 11.6 SITE CLEANUP

Tools needed by volunteers:

Hammer
Nail apron
Tape measure

Tools and equipment needed:

Siding trailer
Generator
Extension cord
Tin snip
Crimper
Siding hook
Speed square
Utility knife
Slot tool
Framing nailer
Drill w/4 $\frac{1}{8}$ " hole saw
Plank
Ladder

Materials needed:

Vinyl siding
Vinyl corners
J-channel
Undersill trim
F-channel
Soffit
Fascia
16d Nails
8d Nails
3 $\frac{1}{4}$ " Collated nails
2 $\frac{3}{8}$ " Collated nails
1 $\frac{1}{2}$ " & 2 $\frac{1}{2}$ " Siding nails
Soffit nails
6" Timber screws
Finish caulk
Air sealing tape

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan

NOTE: Figures 11-7, 11-10, and 11-11 were provided courtesy of the Vinyl Siding Institute, Inc. Figures 11-4, 11-8 and 11-13 are modified versions of figures provided courtesy of the Vinyl Siding Institute, Inc.

Safety First! Review the Safety Checklist before performing tasks in this chapter.

11.1. PREPARATION

11.1.1. Siding Pre-Installation Steps

1. Continuing from Section 4.9, install the remainder of the wall foamboard, including any required above the porch if there is one at the gable end. Verify that all foamboard joints are taped using air sealing tape. **DO NOT** tape any horizontal seams where house wrap exits from inside the foamboard. If necessary, use a few small pieces of air sealing tape to hold the bottom edge of the house wrap in place. Caulk all penetrations using finish caulk.

11.1.2. Siding Layout

1. Refer to the House Plan, or Construction Supervisor, to determine whether there are any special siding items such as shakes, white band, gable vent, J-blocks, etc., and note those locations with a marker on the exterior foamboard.
2. At each corner on the eave sides of the house, use a framing square to transfer the elevation of the bottom of the sub-fascia to the wall as shown in Figure 11-1. With the blade (long leg) firmly against the wall, slide the square up until the tongue (short leg) contacts the bottom of the sub-fascia, and make a mark on the wall at the top of the square (this will be the sub-fascia elevation and bottom of the gable corner blocking) and $\frac{1}{2}$ " below the top of the square (this will be the top of the siding corner, or bottom of the soffit). Drive an 8d nail into the corner stud at the vertical center of the $\frac{1}{2}$ " mark.

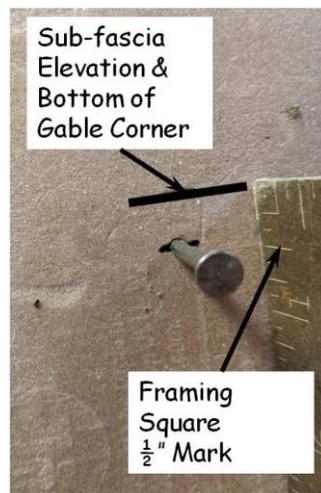


Figure 11-1. Siding Layout.

3. Locate marks as follows, making them very close to the corner and transfer them to the gable side of the house.
 - a. Carefully measure the height of the F-channel. Measure down from the top mark the overall height of the F-channel, and make a mark. This will be the **bottom of the F-channel nailing flange** ([see Figure 11-2](#)).

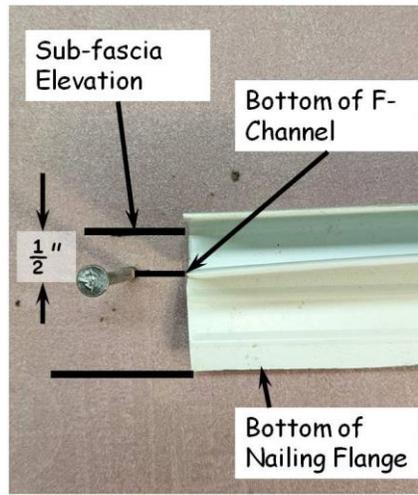


Figure 11-2. F-Channel Location.

- b. Measure the height of several starter strips, to verify they are consistent. To determine the location of the top of the **starter strip**, subtract the starter strip width from $102\frac{1}{2}$ ".

EXAMPLE: For a [typical](#) starter strip width of $3\frac{1}{4}$ ", $102\frac{1}{2}" - 3\frac{1}{4}" = 99\frac{1}{4}"$.

- c. Hook a tape measure on the nail at the bottom of the F-channel location from Step 2 above and mark the calculated distance below the nail (in the above example, $100\frac{1}{4}$ ").
 - d. Mark the location of the **top of the skirting** 1" below the top-of-starter-strip mark.
 - e. Repeat Steps a-d at each corner.

NOTE: This procedure assumes 12 siding courses at 8" each (96") and that the top course will be about $6\frac{1}{2}$ " tall, to total $102\frac{1}{2}$ ". Non-standard houses with a different wall height will require adding or subtracting increments of 4" (one half of a course-height) to the $102\frac{1}{2}$ " dimension

4. Snap a chalk line between all four sets of marks ([bottom of F-channel](#), bottom of F-channel [nailing](#) flange, top of skirting, top of starter strip) along both eave walls (be sure the chalk line is very taut, otherwise the chalk line will not be straight). Where there is a porch, underground electrical service or other obstacle that interferes with snapping the lower chalk lines, once the top chalk line has been snapped, measure

down from the snapped line to locate the lower lines at each side of the interference. Then snap chalk lines from these marks to the corresponding corner.

5. Using the marks from Step 3 above, transfer the bottom of F-channel, top of skirting, and top of starter strip marks at each corner to the gable end wall. Snap lines on both gable ends between each pair of corresponding marks (be sure the chalk line is very taut). If there is a gable end porch or other interference, see Step 4 above for instructions on snapping the lower two lines on either side of the interference.

11.1.3. Porch Soffit Prep

1. Fur down the porch framing as determined by the Construction Supervisor. Determine the thickness of the furring required and attach to the bottom of the porch framing using 3¼” collated or 16d nails.
2. To support the center of the porch soffit, install a 2x4 with the wide face vertical, perpendicular to the trusses, midway between the house wall and porch framing. Align the bottom edge of the 2x4 with the bottom of the furred porch framing and the light box(es) installed in Step 3 above. Hang the support 2x4 from the trusses using vertical 2x4s nailed to the trusses using 3¼” collated or 16d nails.

11.1.4. Installing Metal Skirting

1. Consider the foot traffic around the house to determine how to hide as many seams as possible.

EXAMPLE: If installing on the driveway side, start at the rear of the house with the first piece. Then work toward the front. This will hide the seams when the house is viewed from the street up the driveway.

2. Install metal skirting around the house. Using the “nail slot punch tool”, punch slots every 12”-18” and 1” from the top. Do not install any piece longer than 12’. Any piece longer than 12’ will buckle and get wavy when the summer sun heats it up and expands it.
3. Install skirting flush with the skirting chalk line (created in Section 11.1.1.3) with care. Nail with 2½” siding nails into the center of the pre-punched slots. DO NOT nail tight. Leave a ⅛” gap between nail head and skirting. The skirting will hang on the nails the same way the siding does.
4. Overlap all seams by 3” and hold them back from each corner and at egress wells by 1-2”. If a vertical edge will show, create a hem on the exposed end to improve its appearance and strength.

11.1.5. Installing Skirting Corners

1. Bend corner pieces with hems on both vertical edges. Install corners using 2½" siding nails.

NOTE: Make sure hems are folded TIGHT. Outside corners should be bent slightly less than 90° for snug fit.

2. Standard outside corners are finished with a 5"w x 5"w (L-shaped) x 12" corner (including the 1" hem on each visible edge).
3. Corners used next to egress wells need a finished 2"w x 5"w (L-shaped) x 12" corner. Install these corners 1" from the egress well wall to allow the cover to contact the foundation when installed.
4. The skirting over egress wells is a two-piece system that includes corner bends. Measure the width of the well (outside to outside). Divide that number by 2 and add 2" to obtain the length for each of the two pieces. Each piece will be 3" x (distance from concrete foundation to outside of house wall) x the calculated length.

11.1.6. Installing Gable Corners

1. At each corner of the house, measure from the eave end sub-fascia to the house wall (inside measurement). Measure every corner because the measurements at each corner can vary slightly.

NOTE: Most measurements will be between 21" and 22" in length for 5:12 pitch roofs, and about 15" for 6:12 pitch roofs.

2. Gable corners are built using one layer of ½" OSB (see Figure 11-3). For 5:12 pitch roofs (most common) take some scrap OSB, at least 14" wide, and as long as the measurement determined in Step 1 above (e.g. 22" length). From the nominal 22" length side, measure up from one edge of the OSB 14" and make a mark. Measure up the other edge 5" and make a mark. Draw a line to connect these two marks and cut along the line.

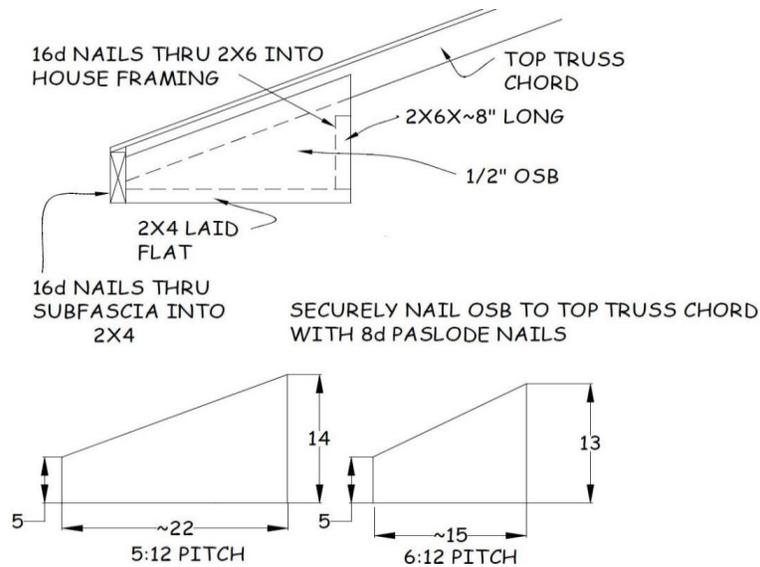


Figure 11-3. Gable Corner.

3. For 6:12 pitch roofs take some scrap OSB, at least 13” wide, and as long as the measurement determined in Step 1 above (e.g. 15” length). From the 15” side, measure up one edge 5”, and the other edge 13”, draw a line to connect the marks, and cut.
4. Cut a scrap 2x4 to the same length (eave to wall measurement from Step 1) as the OSB.
5. Cut a scrap 2x6 to 8”.
6. Assemble the gable corner by flushing the wide edge of the 2x4 with the end of the 2x6 and nailing them together with two 3¼” collated nails.

NOTE: Before assembly, double check the orientation of the frame pieces and OSB.

7. Nail the OSB to the 2x4 and the 2x6 with six 2¾” collated nails, using either factory edges or a framing square to keep the frame pieces square to each other (see Figure 11-3).
8. Lift the assembly into place between the sub-fascia and wall. The OSB that matches the angle of the roof will be up and over the outside of the gable truss tail.
9. Line up the bottom of the 2x4 frame with the bottom of the sub-fascia and the top mark on the house wall.
10. Nail the OSB to the gable truss tail with five 2¾” collated nails.
11. Line up the gable corner block so it is flush with the corner of the house.

12. Nail through the corner 2x6 into the house framing with two 3¼" collated nails. Make sure to nail into solid framing and not just the foamboard or the OSB.
13. Verify that the 2x4 is flush with the bottom of the sub-fascia; nail through the sub-fascia into the 2x4 with two 3¼" collated nails.

11.1.7. Installing Corner Posts

1. Use the corner post jig to mark nailing location of corner posts. Cut, at an angle, about 2" off the bottom end of the corner post nailing flanges so they are not visible below the bottom of the siding once installed. Install corner posts so their bottoms end 1" below the bottom of the starter strip. Use a small piece of ½" OSB or a short piece of F-channel as a temporary spacer between the top of the corner post and the gable end corner to get the correct spacing when installing the post. Leave a ⅛" gap between the top of the corner post and the temporary spacer to be sure there is enough room to install the permanent F-channel later.

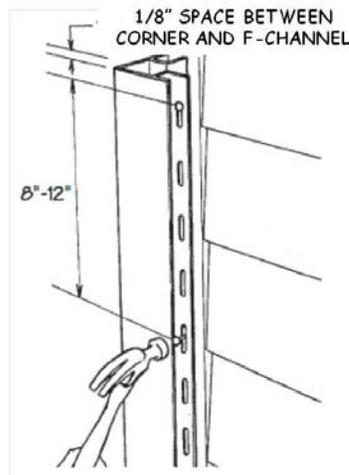


Figure 11-4. Siding Corner Post.

2. Snugly nail the top end of each flange with a nail in the TOP of the slot. Then, snugly nail the bottom and middle of each flange with nails in the center of the slots. Step back to assess straightness and squareness; adjust as required. Finally, snugly nail in the center of every fifth slot, making certain the fit remains square, straight and plumb. Use 2½" siding nails (except when being applied directly over OSB sheathing, then use 1½" siding nails), being sure to hit framing or OSB sheathing.

11.1.8. Installing Starter Strip

1. Keep the starter strip 4" short of the corners. **Do not** leave **any** gap between pieces of starter strip – **butt each one tightly to the adjacent strip**. Nail the top of the starter strip snug to the chalk line on the house every five slots using 2½" siding nails

except when installing directly onto OSB sheathing then use 1½" siding nails. Nail in the top slots only.

2. After installation, use a string line or sight down the length of the starter strip to check for rises and dips. Straighten the starter strip if rises and dips exceed ¼". Use a speed square or similar method at each corner to verify that the bottom edges of the starter strip are at the same elevation.
3. Measure the distance from the top of the nail flange to the bottom of the top lock (see Figure 11-12). This is normally 1¼" to 1¾". Add this measurement to 8" and 40" to obtain the height of the lower and upper quality lines in Step 4, below.
4. Create quality lines: At each corner of the house, and at one or two locations in between, make marks at the heights calculated in Step 3, above, measuring from the bottom of the starter strip. Snap horizontal chalk lines at both sets of marks, and verify that the middle marks are within 1/16" of the chalk line. If they are not, it means that the starter strip is not straight, or the marks were poorly measured, or the chalk line was not taut enough when snapping. Correct by rechecking that the starter strip is straight and adjust as required until the middle measurement is the same as both ends (and re-snap the chalk lines if required). If the starter strip was straight, then re-check and re-snap the chalk line as needed. These quality lines represent the top (of the nailing flange) of the first and fifth rows of siding.

11.1.9. Installing J-Block

1. Verify that all J-blocks for two exterior lights, two outlets, and all exterior pipes have been installed (per House Plan). When locating J-blocks, do not put them in the same I-joist bay as any heating vent holes in the deck above. If the HVAC holes have not been cut yet, write with red marker "HOSE BIBB" (or similar for other J-blocks) on the main floor bottom plate above where the J-block has been installed.
2. Install electrical outlet J-blocks, located per House Plan. Wall mounted J-blocks should be located where there is OSB sheathing, with the long edge vertical (ignore the markings on the J-block). Locate the J-block with a ½" gap between the J-block and a stud, and with a ½" gap between the box and the bottom plate. The gaps allow for spray foam insulation. Attach using 2½" siding nails through a side flange into the stud, and through the bottom flange into the bottom plate. Attach the other two sides with 1⅝" drywall screws through the OSB. Check for level throughout installation.

NOTE: If there is no OSB where the J-block must be mounted, consult the Construction Supervisor or Site Leader regarding additional support.

3. Use the House Plan to locate exterior hose faucet J-blocks. From inside the basement, locate a space between I-joists where there is no heating vent cut in the floor above. Drive a 6" timber screw through the rim board 2" below the underside

of the floor deck, centered between I-joists. Then locate and mark the hole on the exterior wall. Before installing the J-block, cut pieces of ½" or ¾" OSB or rim board, as required, to fill the depth of the back of the J-block. Install the J-block and OSB/rim board with its center aligned with the ¼" hole in the rim board. Ensure the J-block is level before nailing.

4. The centers of wall-mounted light J-blocks are located 12" below the top edge, and 12" from the outside edge of the exterior door brickmold, unless there is to be a window shutter on that side of the door. If so, locate the J-block centered between the brick molding and the edge of the shutter. If so, and the window is less than 43" from the door molding (assumes shutters are 15" wide), make a mark 15" from the window edge, and center the J-block between the door brickmold and this mark.
5. Install a dryer vent by drilling a 4⅛" hole through the rim board and attach the vent. See House Plan for location.
6. Verify whether there will be a second bath. If so, install the 6" vent fan outlet in the proper location.
7. All J-blocks must be air sealed using flashing tape applied shingle-style. Keep the tape edge a minimum of ½" away from the inside edges of the J-block opening so the tape won't show after siding installation. Nails, slots and all edges must be covered by the tape.

11.1.10. Installing F-Channel

1. Install F-channel on eave and gable ends by lining up the BOTTOM of the F-channel to the chalk-line created in Section 11.1.3.3 and nail snugly every 12 -18", using 2½" siding nails, (except when being applied directly over OSB sheathing, then use 1½" siding nails) being sure to hit framing or OSB sheathing. F-channel is also needed under the porch ceiling area.

11.1.11. Installing J-Channel

1. J-channel is installed around doors and vents, gables (eave to peak), above the porch roof, and on the porch gable after the porch ceiling soffit and fascia have been installed. Snugly attach using 2½" siding nails (except when being applied directly over OSB sheathing, then use 1½" siding nails) in every fifth slot, being sure to hit framing or OSB sheathing.
2. Before installing J-channel around gable-end exterior doors that are not under a porch roof, bend and install a drip cap above the door's top brick mold. Cover the top edge and nails of the drip edge with a strip of flashing tape.

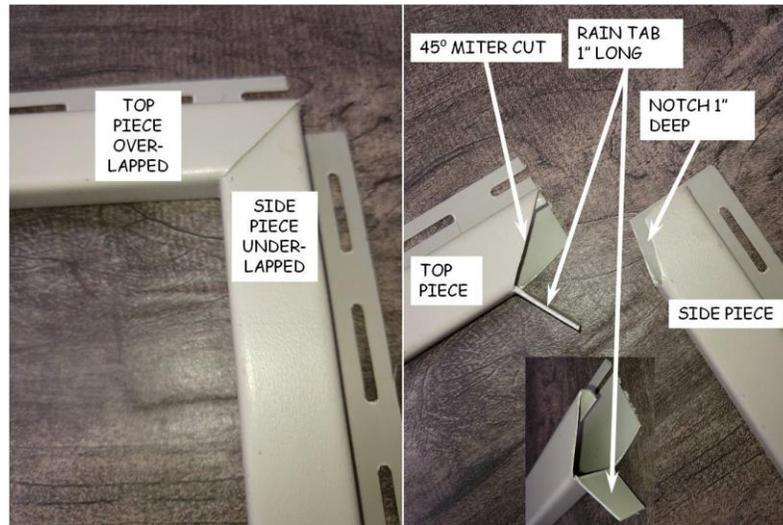


Figure 11-5. J-Channel Upper Corner Detail.

3. For door side pieces, measure from the top of the brickmold to the porch cement, and add 1". Cut J-channel side pieces to that length. Cut a 1" notch in the top end as shown in Figure 11-5. Install the side pieces with the bottom of the notch flush with the top of the brickmold, nailing snugly every fifth slot.
4. Cut the top piece to length so that both ends are flush with the exposed face of the side pieces. Cut a rain tab and 45° miter as shown and install the top piece with the top of the side pieces inserted behind the miter cut of the top piece. Nail snugly every fourth slot.
5. Above the porch roof, install the J-channel ¼" above the shingles. Use a long strip of ¼" thick underlayment as a spacer to ensure a uniform gap. Tape the top edge of the J-channel, covering the nail slots, using flashing tape. Then tape the top edge of the step flashing, covering the top edge of the J-channel tape shingle-style.

NOTE: Use a single strip of 6" wide flashing tape, if possible, to cover both joints.

6. Cut a tab on each end of the top piece. Install top piece (nailing snugly every five slots) and fold the tabs down into the vertical pieces (see Figure 11-5) so that water will run off.

11.1.12. Installing Undersill Trim

1. Undersill trim (or "utility trim" as noted in Figure 11-6) is installed below the soffit F-channel on eave sides of the house, and below any porch F-channel. Nail snugly approximately every fifth slot using 2½" siding nails (use 1½" siding nails when applying directly over OSB sheathing) being sure to hit framing or OSB sheathing.
2. Where a joint is required in the undersill, prepare one end as shown in Figure 11-6, and insert into the end of the other piece, leaving a ⅛" gap between ends.

3. Undersill trim can be used to add strength to cut areas of siding under and above windows and above doors, if the cut edge is 2" or more from the center butt or top lock. Cut the trim to the same length as the siding cut-out, and slide into place over the cut edge (do NOT nail to the house).

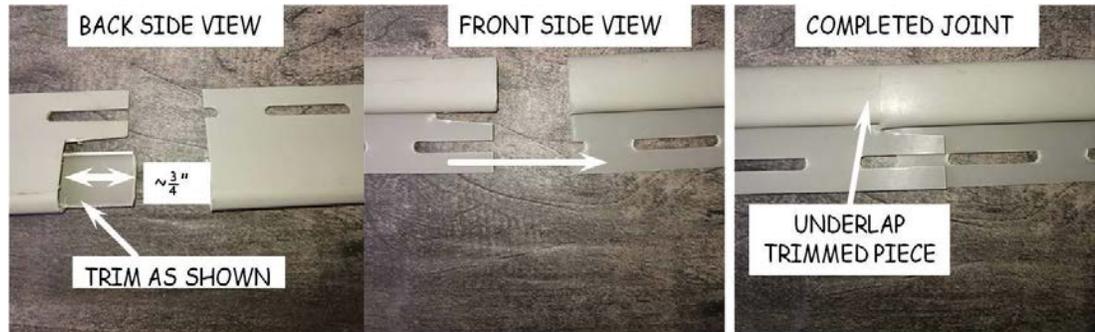


Figure 11-6. Undersill ("Utility") Trim.

4. Undersill trim is not needed around J-blocks.
5. To bring the siding forward and tight to the front inside surface of J-channel for a neat look, and to keep debris from getting into the J-channel, cut roughly 1" wide strips of 1/2" blue foam or use the nailing flange/top lock of scrap siding pieces. Insert this material behind the bottom of the cut section of the siding (between the J-channel nailing flange and the back of the siding). Seat the foam or nailing flange snugly to the bottom of the J-channel.

11.1.13. Installing Initial Siding Courses

1. The last step in Siding Prep is to install two courses of siding on all walls of the house. This ensures that each side of the house has started out straight, that the layout is accurate, and that the first course has matched the quality line. This further ensures that the siding elevation matches at each corner.

11.2. INSTALLING HOUSE SIDING

11.2.1. Rules for Hanging Siding

1. Vinyl siding expands and contracts due to temperature changes. Never drive nails tight. The siding panels must hang on the nails and be permitted to move from side to side. Leave a 1/8" gap (the thickness of a nickel) between the nail head and the siding slot (see [Figure 11-7](#)).

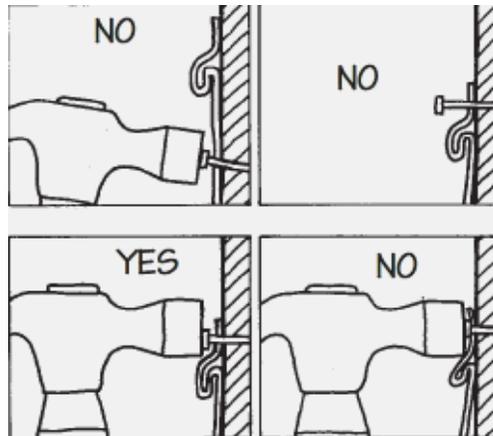


Figure 11-7. Siding Nail Head Gap.

2. Install siding with a 1" overlap between pieces and a minimum of ½" space between the top lock of the underlapping piece and the end of the overlapping piece (see Figure 11-8). Maintain a ¼" gap (⅜" when temperatures are below 40° F) at the corners (to allow for expansion) and ends of pieces, including corner posts, J-channel, J-blocks, windows, etc. Overlap the siding pieces such that in high traffic areas one cannot see into the overlapped joint.

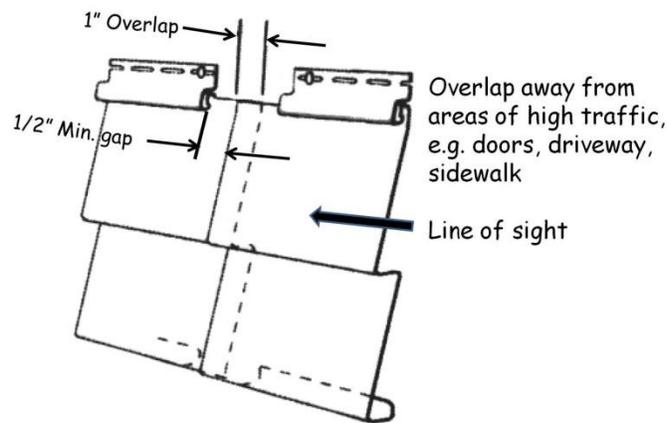


Figure 11-8. Siding Overlap.

3. Whenever possible, use factory ends at overlaps to ensure adequate spacing for expansion between ends of the nailing flange/top lock. If a cut end must be used at a joint, create a factory-like end by trimming 1½" from the nailing flange, top lock, and butt lock.
4. NEVER OVERLAP SIDING PIECES MORE THAN 1", OR RUN THE FACTORY (OR CUT) EDGE UNDER THE TOP LOCK OF THE ADJACENT UNDERLAPPING PIECE.
5. Always use 2½" siding nails, except when the siding is being installed directly over OSB (e.g., on a garage or shed). In those cases, use 1½" siding nails.

6. Always nail in the center of the slots in the lower row of slots and into a stud. Avoid nailing at angles: if a stud is not accessible from a slot in the lower row, use one of the offset slots in the upper row of slots.

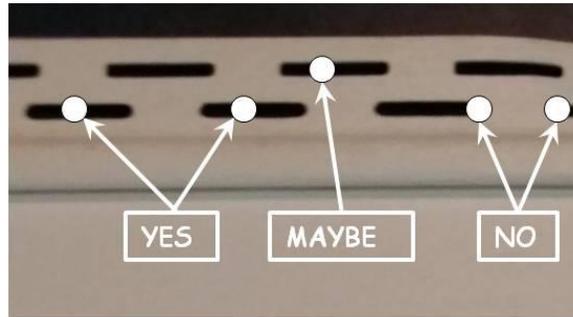


Figure 11-9. Nail Location in Siding Slots.

7. Always drive nails straight, never at an upward or downward angle.

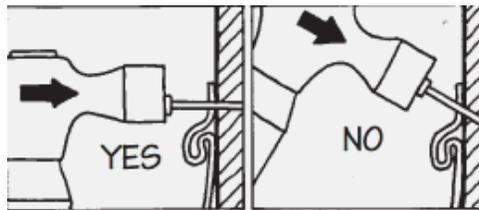


Figure 11-10. Proper Nailing Angle.

8. Be sure to leave 1/4" clearance when fitting siding around windows and other wall penetrations.

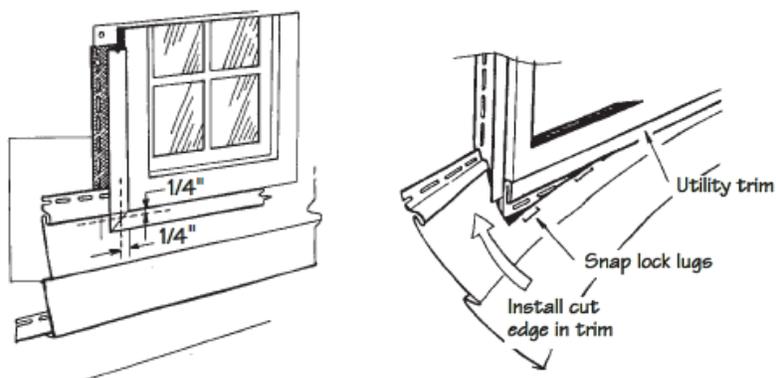


Figure 11-11. Wall Penetration Siding Clearance.

11.2.2. Hanging Siding

1. Install siding so that overlaps are not seen from the street or drive side of the house. Determine the length of the wall to be sided, and the starting end of the house based on the sightlines.
2. Start the first course with a piece that is the length indicated in Table 11-1 for the length of wall being sided. Keep installing full length pieces until a full length will not fit and then cut a piece to fit (minimum length is 3'). Begin the second course with the nominal length indicated in the table, then begin the third course with the length indicated. Repeat the pattern with the fourth, and subsequent, courses. This procedure should maintain a 3' stagger of the seams between courses, and maintain a minimum of 3' pieces.

Table 11-1. Siding Starting Pieces Cut Lengths.

Wall Length, Feet	Nominal Length of Siding Starting Pieces, Feet		
	First Course	Second Course	Third Course
25	10	7	4
26	10	7	4
28	12	9	6
30	12	9	6
32	10	7	4
34	12	9	6
36	11	8	5
38	10	7	4
40	12	9	6
42	12	9	6
<u>44</u>	<u>11</u>	<u>8</u>	<u>5</u>
<u>46</u>	<u>12</u>	<u>9</u>	<u>6</u>
<u>48</u>	<u>12</u>	<u>9</u>	<u>6</u>
<u>50</u>	<u>10</u>	<u>7</u>	<u>4</u>
<u>52</u>	<u>12</u>	<u>9</u>	<u>6</u>
<u>54</u>	<u>12</u>	<u>9</u>	<u>6</u>
<u>56</u>	<u>12</u>	<u>9</u>	<u>6</u>
<u>58</u>	<u>12</u>	<u>9</u>	<u>6</u>
<u>60</u>	<u>12</u>	<u>9</u>	<u>6</u>

3. As shown in Figure 11-12, the butt lock of each course locks into the top lock of the course below.

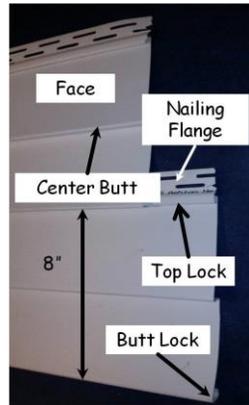


Figure 11-12. Siding Nomenclature.

4. On the 8s: The visible portion of each siding course is 8” high (see Figure 11-12). For each new course, snap the butt lock onto the top lock of the previous course along the entire piece. Nail the ends and middle, then measure up from the **BOTTOM** of the first course to the **BOTTOM** of the course being installed. Each measurement should be a multiple of 8 (e.g. 8”, 16”, 24”, 32”). At each nail position, before nailing, check the measurement and adjust up or down to an even multiple of 8, and finish nailing the entire piece. Recheck as necessary and adjust the position of the nailing flange and re-nail, if required. Small adjustments can be made by tapping the nail head up or down as required. When installing the first and fifth courses, be sure the top of the siding (the nail flange) just touches the quality line previously snapped (see Section 11.1.6.4) on the wall.

NOTE: When measuring, hold the tape vertically close to the measuring point, and be sure to observe the measurement with an eye at the same level as the measuring point to reduce parallax error.

5. As each piece is installed, pull along the top (nail flange) to ensure nails are in the studs; re-nail the siding if it pulls away. Slide the piece side-to-side to ensure there is at least $\frac{1}{4}$ ” of movement each way.
6. Step back from the house at least 10’ after every third course and look at the total appearance. Things to look for include:
 - Matching sides at the corners
 - No sagging rows
 - Minimal waves or no bulges
7. On eave walls, measure from the bottom of the F-channel to the bottom of the top lock of the last full-width row of siding at several locations and adjust the height of the last full-width row as required to produce a uniform gap. Subtract $\frac{1}{8}$ ” (max) from that measurement, and rip the last course of siding to this measurement. The table saw with a $\frac{7}{4}$ ” vinyl-cutting blade installed can be used to make the rip cut.

WARNING: Do NOT use the brake and utility knife to make this cut!

8. Crimp the cut edge at 24" intervals with side-by-side (2"-3" apart) pairs of opposite crimps (front and back). Hold the crimps about 2" away from each end so they don't interfere with overlaps. Snap siding into place while inserting the top edge and crimps into the undersill trim installed below the soffit F-channel. The piece should EASILY snap into the under sill with light to medium pressure. If it has to be FORCED into place either the width of the piece is too narrow or the crimps are too low on the piece. Cut a new, wider piece and/or set the crimps slightly closer (no more than 1/8") toward the cut edge of the piece.

NOTE: Use a 12" to 24" test piece before cutting each full piece.

9. On gable end walls, repeat Steps 1–7 until just before the siding reaches the top of the windows on the gable ends.

NOTE: Be sure to install the soffit and fascia under the porch ceiling prior to siding the porch gable.

10. Before the siding reaches the top of the windows on gable ends, secure the house wrap to the foamboard with air sealing tape. Pull the house wrap down tight, making sure it covers the nailing flange at the top of the windows, and hold the bottom edge down with 6" pieces of air sealing tape every 6'. Tape the vertical ends of the house wrap along the entire edge. Tape the ends (at each corner of the house) from top to bottom.
11. When the siding on the gable ends reaches the roof angle, a transition must be made to cut the ends of the siding pieces to the proper angle to fit into the J-channel. Use the siding angle jig to cut the proper angle.
12. Siding on porch gables begins with J-channel under the first course rather than starter strip.

11.3. INSTALLING SOFFIT

1. Start by installing soffit pieces on the eave side of the house. Measure from wall to outer edge of the sub-fascia and cut soffit pieces 1/4" less than that dimension.
2. Install the first soffit piece with the tongue end into the gable end F-channel and the grooved end exposed. Using a soffit nail, nail the grooved end to the bottom of the sub-fascia. Then, nail through the two valleys toward each end of the soffit piece where it contacts the sub-fascia. The nail head does not need to be tight to the bottom of the valley.
3. Interlock the next piece by sliding the tongue end into the F-channel and exposed groove of the previous piece, making sure the soffit does not extend past the face of the sub-fascia. Check that it is square to the wall, and nail into the sub-fascia through the flange

at the groove end of the piece, and the middle valley. Continue the length of the eave, checking for square every three or four pieces.

NOTE: To ease installation, open the sawn ends of the groove with a utility knife or screwdriver, and cut about 1/4" at a 45° from the tongue ends.

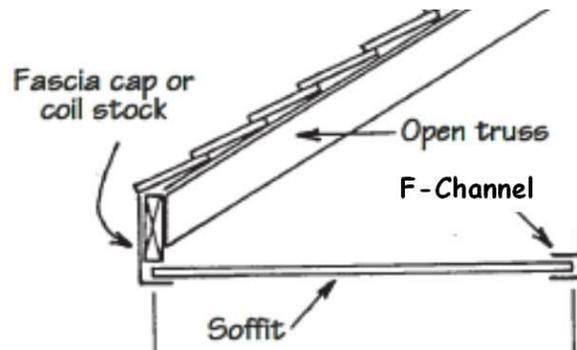


Figure 11-13. Eave Soffit.

4. Install the porch ceiling soffit using one of the two patterns shown in Figure 11-14. While both are acceptable installation methods, the second pattern is easier to install. After installation, mark the location of porch ceiling lights on the soffit panels using painter's tape or marker.

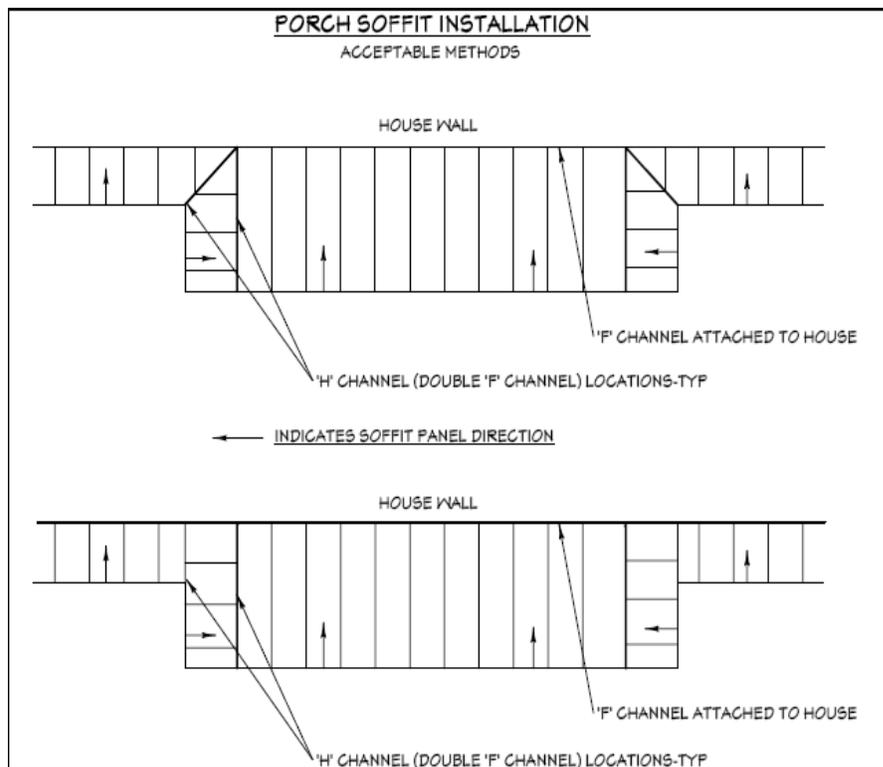


Figure 11-14. Porch Soffit.

5. When installing soffit on gable ends, start at the peak with the first piece bent in the middle. The installation process for one side of the gable will be different than described above, since the pieces will be installed by slipping the groove onto the installed piece's tongue, which is not nailed to the sub-fascia.

11.4. INSTALLING FASCIA

1. Install eave fascia first starting at the back of the house so overlaps are not seen from the front of the house. Overlap fascia pieces as required 1½", with a factory edge exposed. Fascia pieces must be at least 60" long.
2. Nail about 24-30" apart and about 6" from each end (on a full piece, only 4-5 nails are required). Do NOT try to nail through overlapping flanges. Do NOT hit the corner of fascia with a hammer as it will "kink".
3. Cut 1"-2" of the flange from the end of the fascia and bend a 1"-2" corner to fit over the corner of the gable sub-fascia. Trim the bottom corner from the bend to match the bottom edge of the gable sub fascia.
4. Push the fascia up under the gutter apron until the flange is snug to the soffit and drive a soffit nail through the fascia flange and soffit valley into the underside edge of the sub-fascia. This prevents nails from showing on the face of the fascia. Do not nail tightly; leave a ⅛" gap between the fascia and the head of the soffit nail. Make sure the fascia does not show "wrinkles" when installing.

NOTE: Another option is to pre-drill ⅛" holes into the fascia flange through the soffit valleys.

5. To finish the opposite end, repeat Step 3 above.
6. On gable ends, start at the bottom of the gable at the back of the house. Continue up the gable, shingle style, so overlaps will enable rain to wash off. At the peak, the front will overlap the back so the seam is less visible.
7. At the bottom of the gable end, the fascia must be cut at an angle to match the roof pitch. Determine the pitch from the house plan. In this example, it's 5:12. The lower end must be cut at this angle to match the eave. The point of this angle will be the flanged edge. The following figures describe a right-hand side of a gable end; the left hand will be opposite. In this example, at the peak, the RH side is the front of the house, so its cut edge will be exposed.

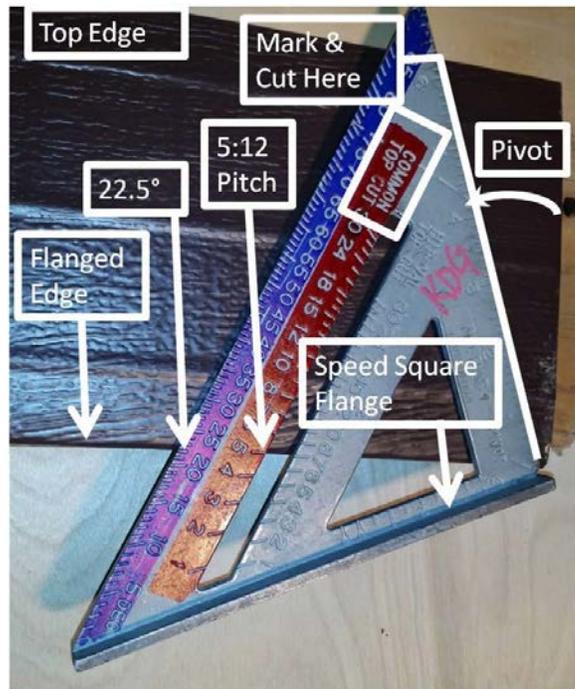


Figure 11-15. Marking Gable Eave End Fascia Angle.

8. Position the flange of a speed square along the soffit flange (or along the edge where the LONG point will be) as seen in Figure 11-15. With the square corner of the speed-square against the edge at the length desired, pivot the speed-square at the 90° corner until the “5” on the “Common/Top Cut” (red) scale is aligned with the same edge (e.g. flanged edge). Draw a line along the short edge of the speed square on the face of the fascia.
9. Cut the fascia on this line; once installed, the cut edge will be vertical and will match the eave fascia corner. For reference, the blue scale indicates degrees; a 5:12 pitch aligns with 22.5°. Figure 11-16 shows the resulting piece after being cut to the correct angle.

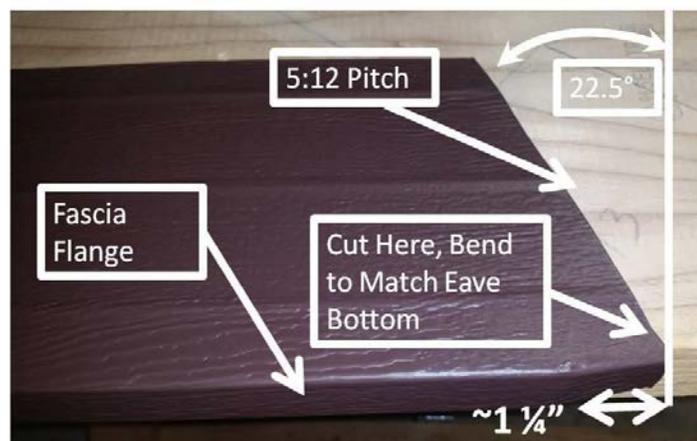


Figure 11-16. Eave End Gable Fascia.

10. At the peak, first cut a piece for the back side of the gable. This piece extends 1" past the sub fascia joint at the peak, and the factory edge will overlap the lower piece of fascia by 1½".
11. Measure from the top of the peak to the end of the fascia already installed and add 2½". Measure that distance from the appropriate factory end on the fascia and mark the top edge.

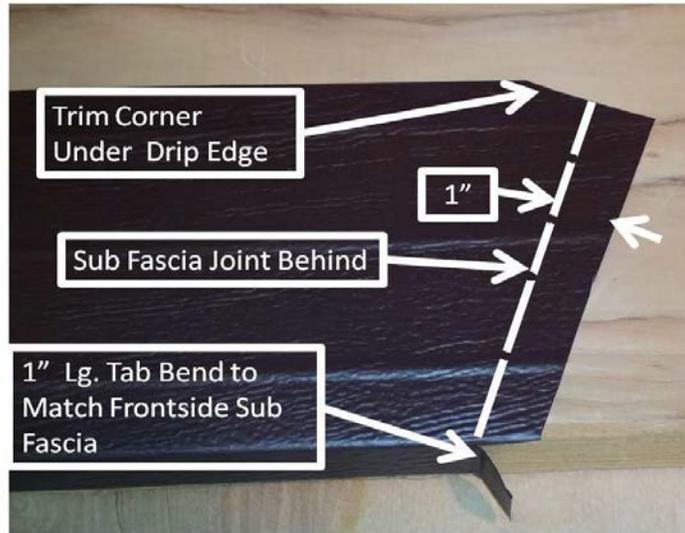


Figure 11-17. Gable Peak Back Side Fascia.

12. At the peak, the top edge of the fascia (under the roof drip edge) will be longer than the flanged edge. Follow the procedure in Step 8 above, but with the speed-square against the fascia top edge (again, the edge with the "long" point of the angle-to-be), to mark and cut the proper angle.
13. Cut the flange and trim the top corner as shown on Figure 11-17, and bend the tab to match the front-side gable angle. This small tab will cover the bottom of the joint and the top corner is trimmed to prevent any interference with the drip edge.
14. Install this piece with the flange bend snug to the bottom of the sub fascia joint.
15. Finish the peak with fascia on the front side. This piece's factory end will overlap the lower fascia by 1½". At the peak, it will have a finished 5:12 cut aligned with the peak and tight to the bend in the flange of the backside piece.
16. Measure from the end of the lower fascia piece to the peak and add 1½". Measure this distance from the appropriate factory edge and mark the top edge. Align the speed square 90° corner with this mark to mark and cut the necessary angle. See Figure 11-18 for the right-hand peak end cut.

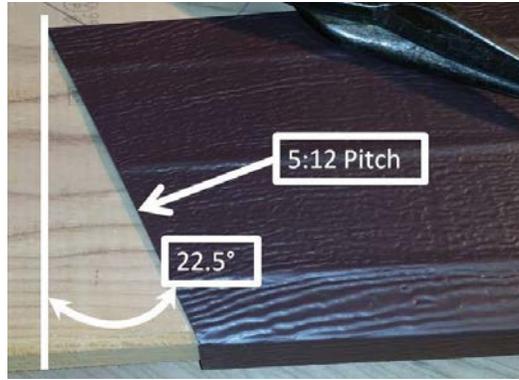


Figure 11-18. Gable Peak Front Side Fascia.

11.5. INSTALLING SHUTTERS

1. Shutters are held in place by shutter pins attached to the siding. Pins should be cut to a length of $2\frac{1}{4}$ " (the combined thickness of the shutter plus the siding) to prevent them from completely penetrating the foamboard.
2. Count the pins before drilling any holes. Different size shutters may require different numbers of pins. Use the number provided in the kit.
3. Locate and drill holes for the pins in the shutter according to the manufacturer's instructions. Then, with the shutter held in the correct installation position, use the shutter as a template to mark and drill holes for the pins through the siding. Take care to not drill all the way through the foamboard behind the siding.

11.6. SITE CLEANUP

1. On the last day of siding, the lot must be cleaned up for final grading and lawn preparation.
2. All returnable materials must be separated into piles - "wood" (lumber, OSB, I-joist, etc.), "siding-related" (vinyl and starter strip), and "metal" (soffit, F-channel, fascia, etc.) - and neatly stacked and covered with tarps. Neatly stack leftover cut siding pieces (longer than ~3') in the shed.
3. All usable scrap lumber or wood having nail holes, or too dirty to return, should be stacked near the recycle barrels to make it easy for the Logistics Crews to access it to take to another work site.
4. For future workdays, take a variety of the following from the scrap wood pile and place under the basement stairs (take from the returnable pile if there is not enough scrap):
 - Three to four full-length 2x4 studs;
 - Six to eight pieces of 2x4 or 2x6, 3'-5' long;
 - $\frac{1}{2}$ " and $\frac{3}{4}$ " OSB scraps (six to eight small- to medium-size pieces).

Chapter 12. Air Sealing and Insulation

12.1 BUILDING SCIENCE FACTS

12.2 PREPARATION

12.3 AIR SEALING

12.4 INSTALLING INSULATION IN WALL CAVITIES

12.5 INSTALLING POLY VAPOR BARRIER

Tools needed by volunteers:

Nail apron
Tape measure
Utility knife
Pencil

Tools and equipment needed:

Extension cord
Lighting
Hammer tacker stapler
Hand saw
Caulk gun
Hand stapler
Stainless steel straightedge
Stepladder
Push broom
Black felt tipped pen
Red marking crayon
Red utility knife blade disposal tube
Vacuum

Materials needed:

24" R-19 Fiberglass insulation
Staples
Air sealing tape
HVAC tape
Painter's tape
Air sealing caulk
Spray foam
Poly vapor barrier
Foamboard scrap
White trim nails
2³/₈" Collated nails
3¹/₄" Collated nails
1¹/₄" Sheetrock screws
Tapered shims
Flat cardboard shims
OSB and 2x scrap
Garbage bag

Personal Protection Equipment:

Safety glasses (required)
Work gloves (recommended)
Dust mask (recommended)
Hearing protection (recommended)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

12.1. **BUILDING SCIENCE FACTS**

1. All of the affiliate's homes are Focus on Energy New Homes Program and Energy V3 certified. The average air leakage of homes built in 2011 was 53% better than certification requirements. This was achieved by focusing on the details of energy conservation at every step of the building process, from framing to installing appliances. These efforts provide a great end product that benefits not only the families but the environment as well.
2. The primary leakage concern is the building envelope, which is any surface between conditioned and unconditioned air. The building envelope should be a closed system, which means that all air/moisture flowing in or out of the building is "intentional" and controlled. Capping the "lid" (ceiling to the attic) is the most critical because it is the highest pressure point of the building envelope. For the walls, creating a completely sealed, 6-sided box for each wall cavity ensures that no air/moisture can be transported through the wall cavity. Maximum insulation efficiency (R-value) is ONLY achieved within "dead" air space. ANY airflow through the fiberglass batt insulation can reduce the R- value by 50% or more.
3. The average home experiences a 30% heat loss as a result of warm air leaking out of the house. Therefore, it is important to control both air and moisture movement by being VERY intentional about sealing every penetration and hole in the building envelope as well as from one level to the next. The most common leakage areas are doors and windows, foundation cracks, sump pits, sill/rim board areas, floor to wall seams, floor to ceiling seams, interior penetrations (i.e. one level to another) and exterior penetration (i.e. inside to outside).
4. It is critical to keep moisture where it can be seen (not hidden in walls or attics) by using appropriate air/moisture barriers/retarders. All building materials (e. g. OSB, sheetrock, plaster, fiberglass insulation, rigid or spray foam, poly/plastic, paint etc.) qualify as air and/or moisture barriers or retarders with varying permeability ratings (the rate at which moisture can pass through). Following is an example of how a moisture barrier/retarder can easily be compromised:

EXAMPLE: A 4'x8' area of ½" sheetrock has a permeability rating of 90 (6 mil poly is rated at 0.06). At 70°F and 40% RH, ⅓ quart of water will diffuse through this sheet over a given amount of time. By simply adding a 1" square hole, moisture diffusion increases to 30 quarts of water over the same amount of time (i.e., several gaps around electrical boxes could easily add up to this 1" square).

12.2. **PREPARATION**

1. Mark all stud center locations on the floor with a red crayon prior to installing poly vapor barrier.

2. Mark the location of all HVAC ducts, basement ceiling duct dampers, and plumbing pipes that will protrude through the sheetrock using a red marking crayon. Draw a 6"-8" rectangle directly beneath ceiling heat vents, and in front of cold air return ducts and mark an "X" across corners. Draw a red circle for each pipe on the floor directly in front of the pipe or directly beneath the damper for HVAC damper controls.
3. Verify that all wall and ceiling electrical boxes are identified by a spray-painted pattern, about equal to the width of the box on the floor. If there are any electrical boxes that are not marked, use a red marking crayon and draw a rectangle the approximate size of the box on the floor, directly beneath or in front of the box.
4. Verify that the wall studs behind the countertop are all in the same plane to ensure the countertop will fit flush to the wall. Use the edge of a stainless steel straightedge to check the inside edge of the wall studs about 41" above the floor and shim any gaps until all studs are in line at that level. If the gap is ¼" or more, taper off each shim to a zero thickness upward about 20" and downward about 10" from the 41" height. Use tapered or cardboard shims. Attach shim(s) with white trim nails.
5. Verify that the Jack studs of sliding door openings are straight and plumb. Using a 6' level on the face of the Jack stud, verify Jack studs on all sliding door frames are straight and plumb to within 1/16". Check for plumb first. Add shims (side-by-side) to plumb the stud, then check again with the level and fill in any gaps due to bowing with layers of cardboard shims to straighten the face. If no shimming is required, mark "OK" with a red crayon or marking pen on the Jack stud face to indicate the studs have been checked.
6. Verify that exterior wall stud faces adjacent to flush sliding doors are straight, plumb and in the same plane. Use a 6' level to check the two closest studs to the eventual door location for plumb and straightness, as described in Step 5 above. Then turn the level to horizontal and check the three closest studs to the door location about 41" off the floor to determine if the exterior wall stud faces are in the same plane. If off by more than 1/8", use shims, centered on the 41" mark to bring the faces in line. Mark "OK" with a red crayon if no shimming is required.
7. Verify that all blocking has been installed per Section 10.5.3. Complete blocking as required.
8. Remove the temporary 2x4 plenum support block positioned across the range plenum.
9. Vacuum debris from all wall cavities and from sub-floor areas along exterior wall bottom plates prior to caulking and installing insulation.
10. Vacuum debris from the sub-flooring around all in-floor heating ducts as well as the inside area around the top of the duct. Also, vacuum inside the cold air return boots, particularly the joint between the duct and the boot. This will create clean surfaces for flashing and HVAC tape application.
11. Verify that foamboard has been installed along the basement foundation walls and the foam has been pushed tight to the exterior walls using scrap wood. If foamboard has not

been secured, slide scrap OSB or 2x pieces along wall studs to push foamboard tight to the wall and secure with 3/4" collated nails for 2x or 2 3/8" collated nails for OSB.

12.3. AIR SEALING

12.3.1. Main Level

1. Fill all holes in each of the wall and ceiling electrical boxes with air sealing caulk.

NOTE: It is not necessary to caulk the attic light electrical box.

2. Use air sealing caulk or spray foam to seal all holes in both **interior and exterior** wall studs. This is recommended to help insulate and to create a fire block.
3. Fill all holes, including unused holes, in the top and bottom plates on interior and exterior walls with air sealing caulk.
4. Use air sealing caulk or spray foam to seal all holes (being used or not) or gaps in the foamboard or OSB that are visible from inside the house. If holes are open to the outside (e.g., through the sill box), seal with finish caulk.
5. Seal around the range plenum duct exit to the exterior with spray foam.
6. Fill the gap between the exterior door jambs and the door framing (rough opening) with spray foam (or air sealing caulk if gap is less than 1/4"). Fill cavity until **FULLY EXPANDED** foam reaches the inside edge of the framing. Fill in multiple passes (waiting 15-20 minutes between each pass) to allow foam to fully expand before applying the next layer. Trim any excess foam **ONLY AFTER** it has dried thoroughly.
7. Seal the bottom of the windows with air sealing caulk.
8. Partially fill the gap between the windows and the window framing (rough opening) with spray foam (or air sealing caulk if the gap is less than 1/4"). Fill the cavity until neither the window flange nor the exterior sheathing (blue foam board or OSB) is visible. **DO NOT FILL THE ENTIRE DEPTH** to the inside of the window frame (too much expanding foam can bow the frame). Trim any excess foam **ONLY AFTER** it has dried thoroughly. If more than one pass is required, wait 15-20 minutes between passes to allow foam to fully expand before applying the next layer.

NOTE: It is best to have only one experienced volunteer do both the door and window spray foaming.

9. Apply a bead of air sealing caulk to the following areas and use a tongue depressor to push caulk into the seams:

- a. The inside seam between the sub-floor and inside edge of each exterior door threshold plus the outside perimeter of both adjoining door jambs.
 - b. The inside seam between all exterior wall corners.
 - c. The inside seam between the sub-floor and the exterior wall bottom plates.
10. Seal the inside seam between the upper plate and the top plate of exterior walls with air sealing tape.
 11. Seal the inside seam between the exterior door and window components with air sealing tape.
 12. Install foamboard instead of fiberglass behind all PVC pipes, insulating from the bottom plate to just beyond the height of the pipe, and to at least the width of the pipes. Cut all foam pieces to the same width. Install up to three layers of scrap foamboard behind each pipe, then fill in around the rest of the stud bay with fiberglass insulation. Stagger seams between foam layers. Do not force foamboard behind the pipe. Forcing can push out the exterior foamboard and put stress on the pipe joints.
 13. Install scrap foamboard behind exterior wall blocking and in front of overhead electrical box blocking. Use scrap foamboard to fill the space behind or in front of 2x blocking. Attach the foamboard to blocking with air sealing tape.
 14. Install foamboard above window and door headers. Use air sealing caulk to seal the perimeter of the foamboard to framing. If foamboard is flush with the framing, seal the perimeter with air sealing tape.
 15. Use scrap foamboard to insulate behind electrical boxes along exterior walls. Cut foamboard to the overall dimension of the box and gently wedge it behind the box. Push foam all the way to the stud. Do not force the foam; if the fit is too tight it will bulge out the exterior foamboard. If too loose, use spray foam or bits of fiberglass to wedge the foamboard in place.

12.3.2. Basement Level

1. Fill all holes in all of the wall and ceiling electrical boxes with air sealing caulk.
2. Fill all holes in the top plates on interior and exterior walls with air sealing caulk to create a fire block.
3. Use air sealing caulk or spray foam to fill all holes in both interior and exterior wall studs.
4. Use finish caulk or spray foam to seal all sillbox penetrations such as dryer vent, plumbing pipe, gas line, etc.

5. Use air sealing caulk or spray foam to fill any holes in the subfloor such as water lines, drains, vent stack etc.
6. If gaps exist between the top of the foundation wall foamboard and the wall upper plate, fill with sealing caulk if the gap is $< \frac{1}{4}$ " or spray foam if $> \frac{1}{4}$ ".
7. If the plumber has run drain pipes for the tub, cover the hole in the floor for the bathtub plumbing with scrap OSB, fasten with several $1\frac{1}{4}$ " sheetrock screws, and seal tight with spray foam or air sealing caulk if gaps are $< \frac{1}{4}$ ".

REQUIREMENT: This is a Building Code and a Focus on Energy New Homes program requirement.

8. If there is a 6" bath fan vent duct (for a future bathroom) exiting through the sill box, use spray foam to seal the vent perimeter around the sillbox foamboard. Push a garbage bag into the duct from the inside (see Figure 12-1). Completely fill the duct and the sill box around the vent with fiberglass insulation (see Figure 12-2).



Figure 12-1. Plastic Bag Inserted Into Future Fan Vent Duct.



Figure 12-2. Insulation Filled Around Future Fan Vent Duct.

9. Install fiberglass insulation in front of foam insulation in all sillboxes. For long walls, cut insulation into 19" lengths, rotate 90°, then cut these in half to yield two 11.5" x 19" pieces. For short walls, cut to 32" lengths, rotate 90°, then cut these in half to yield two 11.5" x 32" pieces. Install tight to the foam. Do not compress. Manipulate insulation to cover sillbox corners.

12.3.3. HVAC

1. Secure every in-floor heating duct to the OSB sub-floor by nailing it with two soffit nails (see Figure 12-3). Prior to nailing, adjust the duct up or down as needed so the top edge is flush with the top of the sub-flooring.

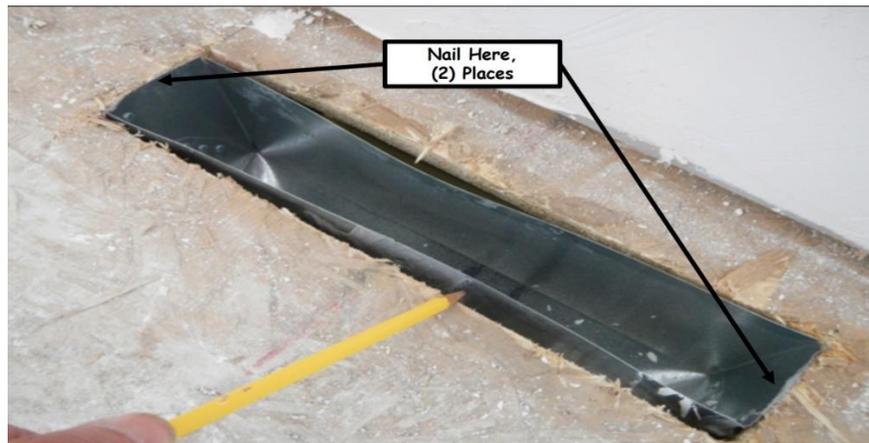


Figure 12-3. Securing In-Floor Heating Duct.

2. Seal gaps between in-floor heating ducts and OSB sub-flooring with a 6" wide piece of **HVAC** tape. Cut the tape 3" longer than the duct width. Remove the peel strip, center over the duct and apply to the OSB. Make a cut down the center of the tape (long direction), stopping 1" short of each duct side. Make four short diagonal cuts from each corner to each end of the center cut, (e.g. cut looks like this [>----<]). Fold the cut ends down and seal to the duct (see Figure 12-4).



Figure 12-4. Sealing In-Floor Heating Duct.

3. Seal the joints between the cold air return ducts and the cold air return boots with HVAC tape. Try sealing the outside surface of the joint first, which is accessed

from the basement. If this is too difficult to reach, seal from the inside. Cut tape into 3” wide pieces, 4”-6” long and apply to the joint in shingle fashion (see Figure 12-5).

NOTE: The tape shown in Figures 12-4 and 12-5 is flashing tape, not HVAC tape (revised pictures forthcoming). Instead, be sure to use the silver HVAC tape for sealing ducts.



Figure 12-5. Sealing Cold Air Return Joints

12.4. INSTALLING INSULATION IN WALL CAVITIES

1. Batt type insulation performs best when installed properly. Failure to seal all air leaks can cause the insulation to lose up to half of its insulation R-value.
2. Failure to fluff the insulation in the wall cavity, or compressing it as little as an inch can cause the insulation value to go from an R-19 to an R-10.
3. Insulate all outside walls with (R-19) batt insulation. Install loosely, never pack it in.
4. Split the batt in half to fit it around electrical wires (see Figure 12-6).



Figure 12-6. Insulating Around Electrical Wires.

5. For those areas where the batt needs to be “cut to size”, cut the batt $\frac{3}{4}$ ” larger than the size of the area.

EXAMPLE: If an area measures 18” x 30”, cut the batt to 18 $\frac{3}{4}$ ” x 30 $\frac{3}{4}$ ”.

6. Use foamboard to fill any wall cavity less than 3” wide. It is very hard to fill such a small space effectively with the batt insulation. Seal any joints or gaps between the interior layers of foamboard with air sealing tape. Use air sealing tape, air sealing caulk or spray foam to seal the perimeter gap between foamboard and studs.
7. Cut out around electrical boxes, as tightly to the box as possible (see Figure 12-7).

EXAMPLE: If the box measures 4” for the height, 3” for the width and 3” for the depth, cut out the insulation only to that size. Be sure to install insulation behind the box.

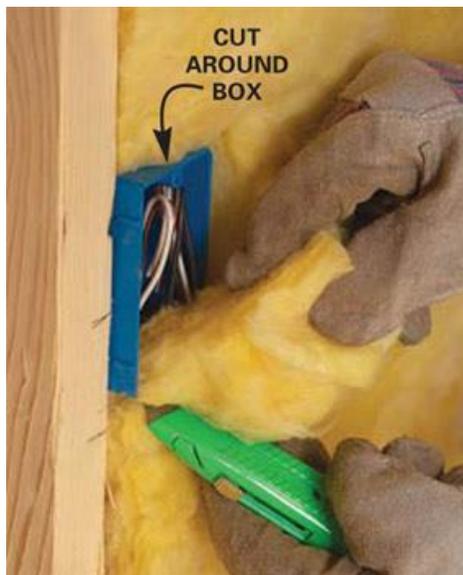


Figure 12-7. Insulating Around Electrical Box.

8. Do not insulate any ceiling areas.
9. **Do not cover thermostat and doorbell chime wires with insulation.** Feed them through the insulation, at the height they are attached to the studs, so they are visible for the crews installing vapor barrier and sheetrock.

NOTE: The chime wire is typically located above the thermostat wire.

10. If the bathroom vanity light is not running through an electrical box, feed the wire through the insulation (so it visible at the height it is attached to the stud) and leave it hanging in the stud bay. The electricians will drill a hole later and fish out vanity wire through the wall rock.
11. Take time to ensure insulation is fluffed/pulled out so it is flush to the interior face of the wall studs. Make sure insulation fills the entire space from top plate to bottom plate and from stud to stud. The sharp end of a pencil inserted into the edges of the insulation works well to fluff the batts.

12.5. INSTALLING POLY VAPOR BARRIER

12.5.1. General Poly Installation Rules

1. Minimize the number of staples (more is not better) to reduce the number of holes in the poly. An adequate stapling interval is 2’.
2. Use air sealing tape to seal any holes or punctures in the poly.
3. All poly overlaps must cover two studs (including corner stud) or trusses.
4. **BEFORE STAPLING CORNERS** at wall intersections, be sure to “tuck” poly **COMPLETELY** into the corners and tight to the ceiling blocking. Use a hand stapler to push the poly into the corners before stapling. A folded poly corner not cleanly conforming to the shape of the corner framing and may result in a tear that will compromise the barrier or could break off a corner of the sheetrock upon installation.

NOTE: Folded and stapled corners should be checked early in the day by crew mentors to verify installers understand how to make tight corners. Poly corners not tight to the framing should be pulled out and re-stapled or slit and taped with air sealing tape.

5. For poly installation, consider these orientation definitions:
 - a. **WIDTH** of a room runs parallel to the trusses.
 - b. **LENGTH** of a room runs perpendicular to the trusses.
6. Use nominal 12’ wide poly for ceiling areas; 8’ wide poly for walls.

7. Install all ceiling poly before installing wall poly.
8. After installing poly, cut an X across corners of each electrical box. Cut slightly smaller than the inside of the box (staying $\frac{1}{4}$ "– $\frac{1}{2}$ " away from the corner) and push the poly up $\frac{1}{2}$ " around the outside of the box for a snug fit. Pushing the poly up keeps it out of the way of the spiral saw bit. TAPE WITH AIR SEALING TAPE ONLY IF THE FIT IS NOT TIGHT.

12.5.2. Installing Ceiling Poly Vapor Barrier in Bedrooms and Bathrooms

1. Install poly in bedrooms and kitchen/dining/living room first. Bathrooms, closets and hallway areas are generally completed last, often utilizing scrap pieces of poly.
2. Create a reference chalk line on the bottom of the trusses. A reference line is used to keep the poly straight during installation, and to ensure a nominal 6" poly covering along the top of all walls. Determine the width (parallel to the trusses) of the ceiling area to be covered with poly. Divide this measurement in half and make a midpoint mark on the bottom of both end trusses in the room. Snap a chalk line between the marks.
3. Measure the width of each room to determine the best utilization of the poly. In general
 - a. If the room width is $> 10'$, cut the poly 1' longer than the room width (parallel to the trusses). Fold the cut length of poly in half. Use a felt marking pen to draw a straight, continuous line along the fold. Unfold the layers underneath this line and draw the line on all folded layers. This poly line will be used to align the poly to the reference chalk line created in Step 2 above.
 - b. If the room width is $< 10'$, cut the poly 1' longer than the room length (perpendicular to the trusses). Use the factory crease line down the middle of the 12' wide sheet to align the poly to the reference chalk line created in Step 2 above.
4. Begin installation at room center, at an exterior wall that is parallel to the trusses. Unfold the poly sheet, and at the poly reference line, or the center crease line, grab the poly in a cape-like (or tent-like) fashion, behind the shoulders, and walk it up a step ladder to the ceiling. Extend the poly forward so it hangs down the top of the wall about 6"-8" and align the poly reference/crease line to the reference chalk line. Starting at one end, staple at room center. Add one additional staple on each side of center. Continue toward the opposite wall, making sure to align the poly reference/crease line with the chalk line, stapling the center area only with three staples per truss.
5. Once the center is stapled, use push brooms to support the poly and keep it tight while stapling toward the walls. Ensure that at a minimum, the top and upper plates of all walls are completely covered with ceiling poly.

6. The wall portion above closets with flush sliding door headers should be completely covered with ceiling poly. Because these areas are exposed to the exterior wall, they require a vapor barrier.
 - a. Extend poly down from the ceiling to cover the header, then staple the poly to the top plate, header and jack stud. Trim any extra poly along the bottom of the header with a utility knife.
 - b. Slit the poly that extends beyond the closet along the front corner of the 25” closet wall, extend it back toward the interior wall and staple it to the trusses. Fold the poly at the corner where the header meets the exterior wall and tape with air sealing tape.

NOTE: There is no blocking around the exterior wall end of headers supporting flush sliding doors, so these corners cannot be stapled unless there is an exterior stud very close to the header. Make sure the unstapled poly corners are loose enough to allow installation of sheetrock without stretching the poly.

- c. Use a separate piece of ceiling poly on the inside of bedroom closets. Make sure the piece is large enough to extend 12” down the back and sides of the closet, and to completely cover the inside front down to the bottom of the header. Fold and tape the poly along the header corner at the exterior wall. Fold and staple all other inside corners tight to the framing.
7. If the poly length is insufficient to cover the entire ceiling area of a room, cut an additional piece and overlap the seam a minimum of two trusses. Make sure to include this overlap and the 6”-8” extension down the wall in the measurement prior to cutting. Center the overlap end of the new poly piece on the bottom chord of the truss, complete the stapling, then tape the seam along the truss chord to ensure a good seal.

NOTE: All ceiling poly seams must be parallel to the trusses, with the exception of outside corners, support posts, entry areas into bedrooms, etc.

8. Tape all ceiling seams with air sealing tape.

NOTE: When taping the poly at the point where two intersecting walls and the ceiling meet, make sure the poly and tape are tucked tightly into the corner so as to not interfere with the installation of sheet rock.

9. After covering the bathroom ceiling, cut the poly over the bath fan by slicing through the poly along the outer edge of the fan flange with a utility knife. Attach the poly to the fan flange using air sealing tape.

10. Cut an X opening for the scuttle hole, wrap poly around rough opening and staple. Trim any excess.

12.5.3. Installing Ceiling Poly Vapor Barrier in Kitchen/Living Rooms

1. Create a reference chalk line 6' in from the exterior long wall and make a mark on the bottom of the trusses located at opposite ends of the room. Snap a continuous line from these marks.
2. Measure the room width (parallel to the trusses) at one end of the room. Unwind the poly from the bottom of the roll and cut off a length 1' longer than the measured room width. Use a felt marking pen, create a poly reference line by drawing a straight line across the top of the poly, 6½' from one end.
3. Unfold the poly, orienting the 6½' referenced end toward the exterior long wall. This will align the line on the poly to the chalk line and ensure a nominal 6" of poly extension down the top of the long wall as the poly is installed. The main objective is to ensure that at a minimum, there is poly covering the upper and top plates.
4. Begin installation on the 5th or 6th truss, depending on the spacing of the first truss to the outside wall. Measure the distance from the bottom of the 6th truss. Poly length is 12'-4". If the poly is too short, start installation on the 5th truss. Lift the poly up to the starting truss and align the poly line with the chalk line. Align one poly factory edge along the center of the truss and staple directly under the chalk line. Add one additional staple on each side of the line. Continue stapling toward the opposite end. Staple the entire sheet along the poly line first before stapling outward toward the bearing walls.
5. Use push brooms to support the poly and keep it tight while pulling the poly toward the walls. Continue stapling every 2'.
6. Continue with more pieces until the room is completely covered. Measure the room widths required and mark a reference line 7' from the cut end of each piece. All additional poly sections must overlap the previous poly a minimum of two trusses. Center the overlap end of the new poly piece on the bottom chord of a truss, complete the stapling, then tape the seam along the truss chord with air sealing tape.

12.5.4. Installing Wall Poly Vapor Barrier

1. Before installing wall poly, verify that the centers of all stud locations have been marked on the floor with a RED CRAYON. Mark any missing stud center references.
2. Install the wall poly on all exterior walls. Staple at every stud, plate and window/door rough opening, spacing staples about 2' apart. When wrapping around corners, extend the poly to cover the first stud on the intersecting wall. Use care in wrapping in and around corners so the poly does not bunch up or "stretch" across the corner. Tuck poly tightly into the corner before stapling and keep staples

- 1” away from the corner to avoid tearing or puncturing poly. Overlap seams a minimum of two studs (including corner stud).
3. To facilitate hanging poly and provide quality corners, begin in a corner of an exterior wall, **verify a sufficient free length exists to wrap the corner to the first stud on the adjacent intersecting wall**, and align the factory cut edge of poly along the top edge of the wall top plate. Staple along the top plate for **at least** four studs, then continue stapling down these studs to the bottom plate. When this initial section is stapled, secure the corner, and then secure the short free end to the adjacent wall stud and continue toward the opposite end.
 4. To install poly around closets without a flush sliding door, wrap the poly around the front closet wall and staple to the Jack or King stud supporting the header. Use a separate piece to wrap the exterior wall corners inside the closet.
 5. To install poly around closets with a flush sliding door, cut a “U” shaped slot in the poly to fit around the header, enter the closet and continue wrapping to the first interior wall stud past the exterior/interior wall corner. Staple the corner tight to the framing before completing the attachment to the interior wall stud in the closet. Use air sealing tape to seal the slot to the folded ceiling poly on each side of the header.
 6. After the poly has been installed, remove the poly covering the windows. At each corner, make a 2” long 45° cut toward the interior of the window, then finish by cutting straight down and straight across to cut out a rectangular piece of poly. Place these rectangles in the bath tub for use under paint trays on painting days. Wrap the poly remaining around the windows into the rough openings and staple to the frame.
 7. At each exterior door, cut poly along the outside edge of the door jamb. Roll poly up from the bottom and tape it above the door with a small piece of air sealing tape. This will be unrolled during plastering/painting to help protect the door surfaces and hardware from plaster and paint.
 8. When installing poly over loose wires (e.g., bathroom vanity light, thermostat, etc.), push the wire through the poly at its stud attachment height and leave it hanging outside the poly. Seal the hole with air sealing tape if poly is not tight to the wire.
 9. Install any unusable scrap pieces of poly on any interior wall (except bathroom walls) to minimize waste and reduce contributions to the landfill.
 10. Tape all seams that have less than a two stud overlap with air sealing tape.

Chapter 13. Ceiling Sheetrock

13.1 PREPARATION

13.2 PLANNING

13.3 GENERAL INSTALLATION RULES

13.4 CEILING SHEETROCK LAYOUT

13.5 INSTALLING CEILING SHEETROCK

13.6 FINISHING SCUTTLE BOX COVERS

Tools needed by volunteers:

Nail apron
Tape measure
Utility knife
Pencil

Materials needed:

½” Sheetrock
5/8” Sheetrock
1¼” Sheetrock screws
15/8” Sheetrock screws
1” or 2” Foamboard, scrap
Air sealing tape

Tools and equipment needed:

Extension cord
Lighting
Driver
Screw gun
Sheetrock bit (dimpler bit)
Spiral saw
4½” Hole saw
Sheetrock T-square (2’ and 4’)
Sheetrock rasp
Sheetrock hand saw
Sheetrock lift
Step ladders/stool
Putty or drywall knives
Ratcheting T-driver
Black felt-tipped pen
Chalk line
Vacuum

Personal Protection Equipment:

Safety glasses (required)
Dust mask (recommended)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

13.1. PREPARATION

1. Verify that the sheetrock supply staged for the house installation is ½” and not ⅝” thick. The ⅝” sheetrock is to be used for the garage only.
2. Verify that ceiling blocking has been installed where required. Install where missing. See Section 10.5.3 for blocking requirements.
3. Verify that the poly vapor barrier in the corners will not interfere with the installation of sheetrock. Poly should be neatly tucked into corners to allow sheetrock to fit squarely into corners. If poly will inhibit sheetrock from fitting tight to the framing, pull out staples and refold it if possible, or cut poly in the corners and re-seal with air sealing tape. Also check for holes and cover any holes with air sealing tape.
4. Where ceiling trusses cross interior walls, mark the truss center locations on the wall top plate with a felt-tipped pen. Where ceiling trusses cross exterior walls, no mark is necessary - they will be aligned with wall studs.
5. Verify that a starting point for sheetrock has been identified in the kitchen/dining/living room area. If not, check with the Construction Supervisor or Site Leader for help in making this determination (see Section 13.4.2).

13.2. PLANNING

1. Develop an installation plan to maximize efficient use of people and material to minimize building costs. When considering the installation plan, keep in mind these general requirements:
 - The desired minimum sheetrock width is 12” along exterior walls and 16” along interior walls; however, the wider the better along interior walls.
 - Factory ends should butt to factory ends.
2. Divide the task of installing sheetrock into two functions, with a separate team for each function. For example, one team conducts the measuring and cutting, and installs each sheet with enough staggered 1¼” drywall screws to secure the sheet to the ceiling. Another team pencil marks the truss centerlines using a 4’ T-square, completes sheetrock securement, and conducts quality checks of all the screws (see Section 13.5.4 for quality check instructions).
3. Determine the best individual sheetrock lengths required to complete each row (see Section 13.5.2 and accompanying note).
4. Determine the sheetrock width for the first and last rows. For kitchen/dining/living rooms, this will typically be completed before the start of the workday. Check with the Construction Supervisor for the marked-up floor plan drawing showing the location of

full width sheets. If this layout has not been completed, use the house floor plan or make a sketch of the rooms and add dimensions as instructed in Section 13.4.2 below.

13.3. GENERAL INSTALLATION RULES

1. House sheetrock is installed with 1¼" sheetrock screws; garage sheetrock is installed with 1⅝" screws.
2. All sheetrock pieces must be attached to at least three trusses or two trusses and end blocking (i.e., each sheet must have at least three rows of screws).
3. Each full width sheet must be fastened with seven screws on each end and five in the field.
4. Factory edges of sheetrock should butt to factory edges of adjacent pieces wherever possible. Keep cut edges toward the walls.
5. End joints on each successive row should be staggered a minimum of two and preferably three trusses.
6. After cutting sheetrock, measure and record the length on the drop and set the drop aside. To maximize efficiency, always check the drop pile first before cutting from a longer sheet.
7. Undercut sheetrock pieces ¼"-½". For fitting between a factory end and a truss center or end blocking, undercut the length by ¼" versus the measured gap. However, if the entire sheet will be installed between two short walls, (e.g., a closet or pantry), undercut the sheet by ½".
8. When fastening sheetrock to trusses that cross interior or exterior walls, hold the screws 8"-10" away from interior walls, and about 4" away from exterior walls (see Figure 13-1).

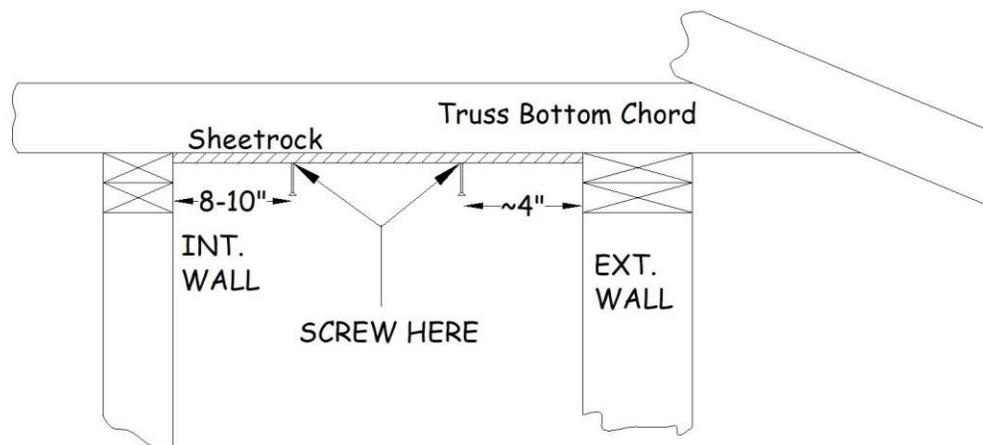


Figure 13-1. Screw Locations for Ceiling Sheetrock.

9. Where the trusses run parallel to the walls, screw into blocking on top of the walls unless a truss is less than 6" from the wall. In this case, screw into the truss since there should be no blocking on the top of the wall. This process helps to prevent plaster from cracking if roof trusses move with changes in the weather.
10. Use a spiral saw to cut out all ceiling electrical boxes (see Section 13.5.7 for sawing instructions). Sheet rock pieces covering the scuttle access can be roto-zipped or cut with a hand saw. Prior to sheet installation, cut the fan opening with a hand saw so the perimeter of the cut is flush with the inside edge of the fan duct, or up to ½" larger.

NOTE: Do not use a spiral saw to cut openings for bath fans.

11. When using a spiral saw, run a vacuum to reduce spreading the dust generated by the cutting tool. This will result in a cleaner work environment.
12. Use a 4⅛" hole saw to cut an access for basement HVAC adjustment dampers. See Section 13.5.9 for cutting instructions.

13.4. CEILING SHEETROCK LAYOUT

13.4.1. Bedroom and Bathroom Layout.

1. Measure the room width (parallel to the trusses) from the exterior wall to the opposite interior wall (ignore walls inside closets).
2. Determine the total number of full 4' wide sheets that will fit into the measured length.
3. Subtract the total full sheet width from the room length. If the result is 12" or greater, continue with Step 4. Otherwise, proceed to Step 5.
4. If the result is 12" or greater, start the installation along the interior wall with a full 4' wide sheet. The row width along the exterior wall will meet the 12" minimum requirement.

EXAMPLE: If room width is 13'-2", three 4' wide sheets will fit into the ceiling area of the room for a total sheet width of 12', leaving a 13'-2" - 12' = 1'-2" or 14" wide row above the exterior wall.

5. If the result is less than 12", trim the first row of sheets to ensure the row above the exterior wall is at least 12" wide.

EXAMPLE: If room width is 12'-6", three 4' wide sheets will fit into the ceiling area of the room for a total sheet width of 12'. Since 12'-6" - 12' = 6", trimming 6" off of the first row will provide a 12" wide final row above the exterior wall.

13.4.2. Kitchen/Dining/Living Room Layout.

1. If these rooms have off-set and parallel interior walls, determining the optimum sheetrock widths can be difficult. The challenge is to determine the starting point. The starting point is a line parallel to the exterior wall that defines the end of the interior wall pieces and the beginning of the first full width row of sheetrock. If a starting point has not been pre-determined, follow the instructions below as they relate to the example provided in Figure 13-2 (where the cross-hatching indicates the first row of sheetrock).
2. Measure the room widths (parallel to the trusses) from the exterior wall to each parallel interior wall. Then measure the offset distances between each of the interior walls. Mark these dimensions on the floor plan drawing. Verify any provided dimensions indicated as reference (REF.).
3. Examine the plan drawing with added dimensions. Starting with the interior wall furthest from the exterior wall, determine if a full width sheet will work there. (In Figure 13-2, a full width sheet would result in less than a 16" width along the interior stairway and closet wall).

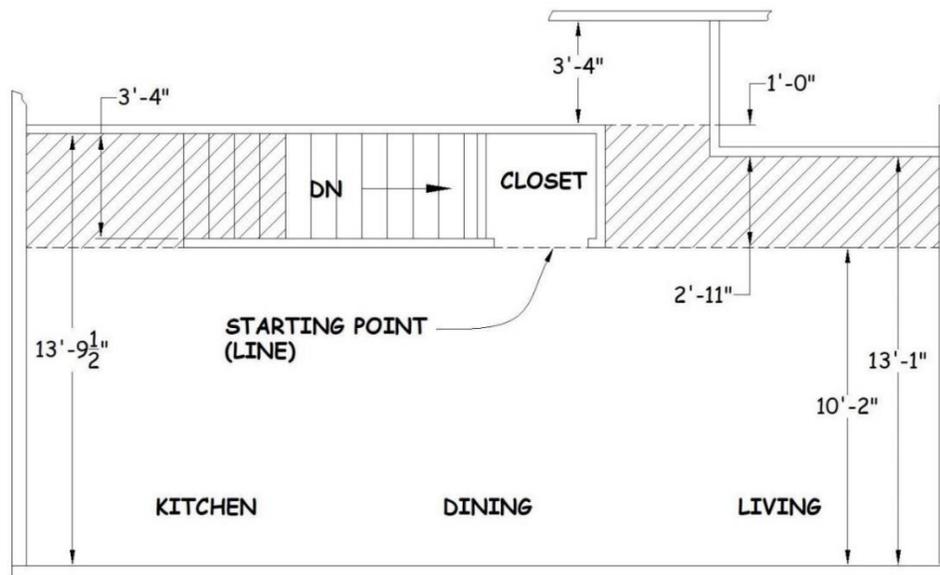


Figure 13-2. Determining the Starting Point Along Interior Common Area Walls.

4. If a full width sheet cannot be used, use the plan drawing to evaluate another option, e.g. a 2' piece or a 3' piece. (In Figure 13-2, a 2'-11" piece installed along the interior bedroom wall will provide a good starting point. It satisfies the 16" minimum width along the interior wall and the 12" minimum width along the exterior wall. The width along the exterior wall will be 2'-2", i.e., 10'-2" minus two full width rows.)

NOTE: If a full width sheet cannot be used for the first or last row, consider using a 1'-11½" piece. The drop will fit into most closets.

5. Also evaluate hallway areas extending from the kitchen/dining/living room areas. (In Figure 13-1, note that by extending the 2'-11" piece around the corner and into the hallway, a narrow filler piece could be avoided.)
6. Once a starting point has been determined, mark the trusses and snap a chalk line from one end of the room to the other. Verify the line is parallel to the exterior wall before installing sheetrock. Re-snap the line if it is out of parallel by more than 1/8".

13.5. INSTALLING CEILING SHEETROCK

1. Once the row widths have been determined, installation can begin at either side of the starting point line in common areas, but bedrooms and bathroom installation should start above an interior wall.
2. Begin installing sheetrock at a wall corner, perpendicular to the trusses. Determine the total length of the first row by measuring the room length (perpendicular to the trusses). Next, determine how many full-length sheetrock pieces can be used to fill the length and the size required for the end sheets. The standard size used for main floor ceiling sheetrock is 12' long; basement sheets are 8' long.

NOTE: Every sheet must be attached to at least three trusses or two trusses and end blocking. Also, all butt joints must be centered on a truss.

3. Extend the horizontal sheet support arms of the sheetrock lift as appropriate for the length and lower the two supports for the bottom of the sheet. Place the sheet on the lift and raise it until it almost touches the ceiling. Push the sheet tight against adjacent edges and **make sure the factory end is centered on a truss**. While raising the sheet tight to the trusses, verify that the sheet is tightly placed to the wall or adjacent sheet and that the factory end is still centered on the truss. Secure with several screws in at least three trusses (ends and middle) before lowering the lift. Continue installing all pieces before moving to the next row.
4. Conduct the quality control checks listed below on **every screw**. When completed, mark "OK" on every sheet with a piece of sheetrock used as a chalk. Conducting quality checks as soon as each individual sheet is installed is preferred over waiting until a room is complete. This helps identify any bad habits or equipment problems early in the installation process and helps ensure that the quality checks are not rushed at the end of the work day

NOTE: Never write on sheetrock with marking crayons or felt tipped marking pens.

- a. Use a putty knife to make certain the head of each screw is recessed below the surface of the sheetrock (a slight dimple is best). Slide the putty knife along the sheetrock surface and move it over every screw. Listen for a "click". If a screwhead is exposed, tighten until recessed.

- b. If a screw “spins” during driving or seems loose during tightening, it is not secured to a truss or blocking and must be removed and relocated.
 - c. If the screwhead or dimpler bit has completely broken the exterior paper layer of the sheetrock, the holding power of the screw is compromised. Leave the screw in place, but add an additional screw about 2” away.
 - d. Check screw count on each full width sheet to ensure there are seven screws on each end and five in the field. Add screws if the actual number is short of the desired count
 - e. Remove and relocate any screws located less than about 8”-10” from an interior wall or 4” from an exterior wall where trusses run perpendicular to that wall.
5. After completing the first row, continue to the next row (adjacent where the first row ended). Start with a full sheet if possible, but select a length that will allow for a joint stagger of at least two and preferably three trusses.
 6. Before covering electrical boxes and scuttle access with sheetrock, measure from the center of the opening to the edges of two adjacent surfaces oriented 90° to each other. Write these dimensions on an adjacent panel or scrap piece for reference when cutting out the opening. Install the sheetrock over electrical box openings with enough screws to hold the panel. To prevent driving screws through the sheetrock, do NOT fasten within 24” of electrical boxes until after the opening has been cut.
 7. When using a spiral saw to cut around an electrical box, locate the mid-point of the box from the instructions in Step 6 above and mark this point on the sheetrock. Verify that the depth of the saw bit is $\frac{5}{8}$ ”- $\frac{3}{4}$ ”. Insert the saw bit 3”-4” away from the mid-point and move it horizontally until resistance from the outside edge of the box is encountered. Then proceed to move the bit counterclockwise around the outside perimeter of the box. Moving the saw in a counterclockwise direction helps hold the saw bit against the outside surface of the electrical box.

NOTE: It is important to keep the bit outside the electrical boxes to prevent cutting the wires. If a wire is cut, or insulation is damaged, report it to the Construction Supervisor.

8. When using a spiral saw to cut the scuttle opening, insert the bit near the scuttle frame, work the bit toward the framing, and cut counterclockwise around the inside edge of the framing.
9. Cut out holes for damper access prior to sheet installation. Determine the center of the damper control lever from two adjacent references, transfer the center to the sheet, and cut with a $4\frac{1}{8}$ ” hole saw. Verify adequate access before securing the sheet.

13.6. FINISHING SCUTTLE BOX COVERS

1. Cover the bottom framing of both house and garage scuttles. For each box, measure the width of the scuttle box framing (either nominal 3½” or 5½”). Cut four sheetrock strips, each ¼” narrower than the measured width, and install them flush with the top of the scuttle box (thus allowing the scuttle cover to fit tight along the top of the framing).
2. Cut a 25”x27½” piece of sheetrock for the house scuttle box cover. Screw the sheetrock to the OSB portion of the cover with 1¼” screws and set aside for the plasterers.
3. Verify the size of the OSB scuttle cover for the garage scuttle and cut a piece of 5/8” sheetrock to the OSB dimensions. Screw the sheetrock to the OSB portion of the cover with 1½” screws and set aside for the plasterers.

Chapter 14. Wall Sheetrock

14.1 PREPARATION

14.2 PLANNING

14.3 GENERAL INSTALLATION RULES

14.4 INSTALLING WALL SHEETROCK

14.5 FINISHING AND CLEANUP

Tools needed by volunteers:

Nail apron
Tape measure
Utility knife
Pencil

Materials needed:

½” Sheetrock
5/8” Sheetrock
1¼” Sheetrock screws
15/8” Sheetrock screws
2½” Sheetrock screws
Tapered shims
Flat cardboard shims
Painter’s tape
Air sealing tape

Tools and equipment needed:

Extension cord
6’ Level
Lighting
Driver/Screw gun
Sheetrock bit (dimpler bit)
Spiral Saw
2½” Holesaw
2’ and 4’ Sheetrock T-square
Sheetrock rasp
Sheetrock hand saw
Foot lifter
Step ladder/stool
Putty or drywall knife
Ratcheting T-driver
Black felt-tipped pen
Red marking crayon
Vacuum

Personal Protection Equipment:

Safety glasses (required)
Dust mask (recommended)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

14.1. PREPARATION

1. Verify that the sheetrock supply staged for house installation is ½” thick. The ⅝” thick sheetrock is to be used for the garage only.
2. Verify that all stud centers have been marked on the floor with red crayon. Mark any missing stud center references.
3. Verify that all electrical boxes, HVAC ducts, and protruding pipe locations have been marked on the floor. Mark any that are missing (see Sections 12.2.2 and 12.2.3 for marking instructions).
4. Verify that all walls have blocking where required. Install blocking where missing (see Section 10.5.3).
5. Verify that the Jack studs of sliding door openings have been checked for straightness and plumb. If they are not shimmed or do not have “OK” written on the stud faces, check and shim per instructions provided in Section 12.2.5.
6. Verify that the exterior wall studs adjacent to flush sliding doors have been checked for straightness and plumb. If they are not shimmed or do not have “OK” written on the stud face, check and shim per instructions provided in Section 12.2.6.
7. Verify that the poly vapor barrier in the corners will not interfere with installing sheetrock. Poly should be neatly tucked into corners to allow sheetrock to fit squarely into corners. If poly will prevent sheetrock from fitting tight to the framing, pull out staples and refold if possible, or cut poly in the corners and re-seal with air sealing. Also check for holes and tape any holes that develop with air sealing tape.
8. Verify that the doorbell chime and thermostat wires are not covered with insulation or vapor barrier, and that the bathroom vanity light wire is either hanging outside the vapor barrier or connected to an electrical box. If these wires are not visible, locate and uncover them before installing the sheetrock.
9. Verify that cold air return boots don't extend more than ½” beyond the face of the wall studs. Use a piece of sheetrock or 2x long enough to span adjacent studs and try sliding it down past the boot. If contact is made, manually push boot back to within ½”. This ensures that covers fit tight to the wall after plastering.
10. Remove any residual spray foam and caulk from the face of all window frames. (Do not mar the painted frames.) Apply 2” painter's tape along the outside edge of the frame and continue around the entire frame perimeter. This protects the frame during plastering and painting.
11. Remove temporary stairway handrail prior to installing sheetrock in the stairway areas.

14.2. PLANNING

1. Develop an installation plan to maximize efficient use of people and material to minimize building costs.
2. Divide the task of installing sheetrock into two functions, with a separate team for each function. For example, one team conducts the measuring and cutting, and installs each sheet with enough staggered 1¼” sheetrock screws to secure the sheet to the wall. Another team pencil marks the stud centerlines using a 4’ T-square, completes sheetrock securement, and conducts quality checks of all the screws (see Section 14.4.1.3 for quality check instructions).
3. Determine the best individual sheetrock lengths required to complete each row (see Section 14.4.1.1 and accompanying note).

NOTE: Some sites will have wall areas pre-measured by a dedicated team who will cut and deliver sheets to all rooms for installation by the crews.

14.3. GENERAL INSTALLATION RULES

1. House sheetrock is installed with 1¼” sheetrock screws; garage sheetrock is installed with 1⅝” screws. The exception is the garage sheetrock covering the common house/garage wall which requires 2½” sheetrock screws.
2. All sheetrock must be secured to at least three studs or two studs and end blocking (i.e., each sheet must have at least three rows of screws).
3. Each full width sheet must be fastened with seven screws on each end and five in the field. In addition, bottom sheets should be fastened to the bottom plate, two screws between each stud.
4. For each room, begin installation at the top of an interior wall corner, where it abuts an exterior wall. In situations where an exterior wall has no intersecting interior wall (e.g. an open kitchen/living room wall), start from the top of either exterior wall corner. Complete the entire top row before moving on to the bottom row.
5. Undercut the sheetrock by the following amounts relative to the actual measured dimension:
 - by ½” if the piece will span the entire distance between two walls (e.g. a closet or pantry).
 - by ¼” when butting tight to an adjacent sheetrock piece (as between a sheetrock on one end and a stud or intersecting wall on the other end).
6. Factory edges of sheetrock pieces should butt to factory edges of adjacent pieces wherever possible. Try to limit cut edges to inside and outside corners, filler pieces above doors and windows and the bottom row of basement sheetrock.

7. End joints on each successive row should be staggered a minimum of two and preferably three studs.
8. After cutting sheetrock, measure and record the length on the drop and set the drop aside. To maximize efficiency, always check the drop pile first before cutting from a longer sheet.
9. Holes for plumbing and HVAC ducts are typically pre-cut prior to installation and electrical boxes are cut with a spiral saw after installation (for cutting instructions, see Section 14.4.1.8 for cold air returns, Section 14.4.1.9 for switch boxes, and Sections 14.4.1.10 and 14.4.1.11 for receptacle boxes). A 2½” hole saw or a sheetrock hand saw (keyhole type) can be used for cutting the opening for the sink drain.

NOTE: When cutting with a spiral saw, run a vacuum to reduce dust generated by the cutting tool. This will result in a cleaner work environment.

10. When sheetrocking the upper row, completely cover the upper portion of doors and windows with sheetrock. Preferably use a single sheet to cover, but if two pieces are used the seam should be at least 6” inside the widow/door framing.
11. Sheetrock pieces above doors or windows with headers do not need to seam on a stud, as headers and top plates provide sufficient support.
12. Keep sheetrock ½”–¾” away from the outside edge of exterior door jambs. This helps facilitate door trim installation. To accomplish this, pre-cut the sheetrock before installing.
13. When attaching narrow strips of sheetrock (e.g., ends of walls, inside face of sliding closet doors, 4 x 4 posts, window frames, etc.), use two screws at each end, and fill in between with two staggered rows, every 12”-16”.
14. All exposed wall foamboard in the entire house must be covered by sheetrock, per Building Code. Pay particular attention to covering edges of foamboard in the basement.

14.4. INSTALLING WALL SHEETROCK

14.4.1. Walls

1. Measure the total length of the first wall selected for sheetrocking (see Section 14.3.3). Then, determine how many full-length sheets can be used to fill the measured length and the size required for the end pieces. The standard size for main floor wall sheetrock is 12’ long; basement sheets are 8’ long.

NOTE: Every sheet must be attached to at least three studs or two studs and end blocking. All butt joints must be centered on a stud.

2. Position the piece tight to the ceiling rock and install enough staggered 1¼” sheetrock screws to secure it to the wall. Continue installation until all top row pieces are in place and fully secured, using the recommended approaches provided in Section 14.3.
3. Conduct the quality control checks listed below on **every screw**. When completed, mark “OK” on every sheet with a piece of sheetrock used as a chalk. Conducting quality checks as soon as each individual sheet is installed is preferred over waiting until a room is complete. This helps identify any bad habits or equipment problems early in the installation process and helps ensure that the quality checks are not rushed at the end of the work day.

NOTE: Never write on sheetrock with crayons or felt tipped marking pens.

- a. Use a putty knife to make certain the head of each screw is recessed below the surface of the sheetrock (a slight dimple is best). Slide the putty knife along the sheetrock surface and move it over every screw. Listen for a “click”. If the screwhead is exposed, tighten until recessed.
 - b. If a screw “spins” during driving or seems loose during tightening, it is not secured to framing and must be removed and relocated.
 - c. If the screwhead or dimpler bit has completely broken the exterior paper layer of the sheetrock, remove and relocate the screw.
 - d. Check the screw count on each full width sheet to ensure there are seven screws on each end and five in the field. Add screws if the actual number is short of the desired count.
 - e. Check to ensure that all narrow sheetrock strips are secured as stated in Section 14.3.13.
4. When installing the top row of sheetrock, install screws about 1½” down from the ceiling. There is 2½” of wood support for the top row of screws (below the ceiling sheetrock). Screw straight in, NOT at an angle. Screwing straight in will reduce the number of screw heads that need to be reset.
 5. Install corner screws 1”-1½” in from the corner rather than at the very edge of the sheetrock (there is sufficient blocking width at all inside corners.) Screw straight in, NOT at an angle.
 6. After installing sheetrock over windows, remove the sheetrock portion covering the window by cutting with a spiral saw along the inside edge of the framing. Set the saw bit depth to ¾”-1”.

NOTE: Save the window cutout for sheetrocking the window sill and the bottom of the window header.

7. When the top row of sheetrock is secured and checked, install the bottom row of sheetrock using a pair of foot lifters to hold the sheet up snug to the upper sheet and fasten as in Section 14.3. For basement walls (including knee walls) sheetrock must be ½” off the concrete floor (or ledge for knee walls) to prevent moisture wicking. Place sheetrock scraps under the lower edge to provide proper spacing. Drive two screws into the bottom plate evenly spaced between each stud. This tightens the connection of the sheetrock to the framing, improves air sealing and makes it easier to install base trim.
8. Before covering a cold air return, determine the distances from both sides as well as the top and bottom of the duct boot to adjacent sheetrock surfaces. Transfer these dimensions to the sheet to be cut and use a square to mark the lines for the cut-out. Cut the bottom first, then both sides with a hand saw. Scribe and snap off the top. As an alternative, the duct opening can be cut with a spiral saw after installation, but it is more challenging because the sheet metal is very thin. Take care to preserve the bottom section of sheetrock under the duct boot.

NOTE: If the room opposite the return duct has not been sheetrocked, set the sheetrock in place and trace the perimeter of the duct on the back side of the sheetrock. This will simplify the process.

9. Before covering a wall switch, temporarily position the sheetrock where it will be installed and mark the right and left edge of the box on the sheet. Extend these marks down about 6”. Measure from the bottom of the upper sheet to the bottom of the switch box and transfer this dimension to the bottom sheet. This is the height of the cut. Use a hand saw to cut the left and right sides down to the measured height, then use a utility knife to score the bottom side and snap off the cut-out.
10. Before covering a receptacle, determine the approximate vertical and horizontal centers of the box and record the measurements on a scrap piece. (Receptacle mid-points are typically about 14 ½” off the floor; kitchen counter receptacles are about 44 ½” off the floor.) Install enough screws to secure the sheet. To prevent driving screws through the sheetrock, do NOT fasten within a 24” radius of the box until after the opening has been cut.
11. Use a spiral saw to cut out all receptacles. Verify that the depth of the saw bit is ⅝”-¾”. Locate the approximate midpoint of the receptacle (per the preceding step). Insert the saw bit about 3” to the left or right of the midpoint. Move the bit horizontally toward the center of the receptacle until resistance from the outside edge of the box is encountered. Then, proceed to move the bit counterclockwise around the outside perimeter of the box. Moving the saw in a counterclockwise direction helps hold the saw bit against the outside surface of the electrical box.

NOTE: It is important to keep the bit outside the box to prevent cutting the electrical wires. If a wire is cut, or insulation is damaged, report it to the Site Leader or Construction Supervisor.

12. **Do not bury doorbell chime or thermostat wires behind sheetrock.** Drill a ¼” hole in the sheetrock at the height the wire is attached to the stud and thread the wire through the hole.
13. If the bathroom vanity light wire is not running through an electrical box, leave it hanging at its attached height outside of the poly vapor barrier and sheet the wall. The electrician will drill through the sheetrock and fish the wire out at the appropriate location for the vanity light.
14. On outside corners of walls, install a piece of sheetrock on the first wall so its corner side edge is flush with the outside edge of the corner stud. Score and snap (or saw-cut) this piece flush to the corner. (An acceptable tolerance is a maximum of ¼” short of the corner, but do not allow the piece to extend past the outside edge of the corner stud.) Form a recessed corner by installing the second sheetrock piece on the adjacent wall so its edge is flush with the other outside edge of the corner stud. The outside corner ends of the sheetrock should not overlap the corner (see Figure 14-1).

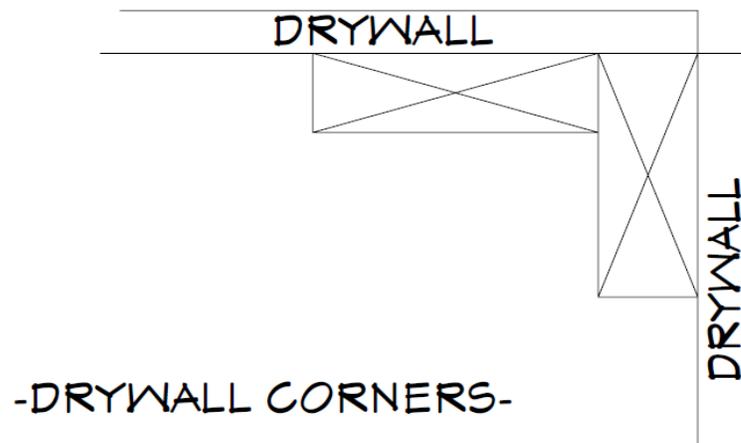


Figure 14-1. Outside Corner Installation of Sheetrock.

15. Cover the plenum for the range hood with sheetrock. The opening for the hood vent will be cut out during cabinet installation.
16. When sheetrocking the portion of the stairwell opening below the stairway closet platform, do not cover the joist hangers on the left and right side of the LVL. Cut the sheetrock short of the hangers and the plasterers will fill in the gap.
17. Re-install the temporary stairway handrail as soon as the sheetrock has been installed in the stairway area.

14.4.2. Window **Frames**

1. After removing the window cut-out (see Section 14.4.1.6), cut and install the four window frame pieces. Use the window cut-out for the sill and the bottom of the header and install these first; then look for other scrap to cover the side framing.

2. Cut all window frame pieces to fit tight to the window frame and flush with the interior edge of the 2x6 window framing. If the windows have sill pans, it is not necessary to fill the pans with a foamboard filler prior to securing the sheetrock to the sill. Secure the single layer sheetrock with 1¼" sheetrock screws. Keep screws at least 2" out from the window frames. Screws should be installed per the pattern described in Section 14.3.13.
3. Step back and review all window frame pieces for straightness (e.g., any noticeably high or low areas or bulges). If present, investigate the cause and adjust as necessary, using shims behind the sheetrock.

14.4.3. Shower Area

1. Sheetrock at the tub/shower flange should butt to the exterior edge of the flange. **NEVER OVERLAP THE FLANGE.**

14.4.4. Basement Door Area

1. On the unfinished side of the basement door, install sheetrock above the door and on either side of the door to the width of at least one stud bay. This will allow finish trim to be installed around the door opening later.
2. Use 8"-12" wide sheetrock scraps to cover all interior horizontal wall wiring between studs in the unfinished side of the basement.

14.5. FINISHING AND CLEANUP

1. Any leftover pieces of sheetrock (**no full sheets**) may be given to the homeowner if they want them. Lean these pieces up against a wall underneath the stairs, supported by a few short scraps of 2x material to keep them off the floor.
2. When installation is complete, clean floors by dragging push brooms to remove debris, but do not remove the dust. Leaving dust is desirable because it facilitates plaster spill removal from the subfloor after plastering.

Chapter 15. Painting

- 15.1 PLANNING AND PREPARATION
- 15.2 PRIMING AND PAINTING
- 15.3 STAINING
- 15.4 CLEAN-UP
- 15.5 PREPARATION FOR NEXT BUILD DAY

Tools needed by volunteers:

Tools and equipment needed:

Sawhorse
Extension cord
Portable light
Marking pen
Extension pole
Paint brush
Paint roller frame
Paint roller cover
Paint roller scraper
Paint roller pan
Small paint pails
Drill driver
Paint mixer
Stepladder
Empty/clean 5-gallon pail
5' - 10' Garden hose

Materials needed:

Primer
Paint
Stain
Rags
Tapered shims
Roller pan liners
Disposable small paint pail liners
Painter's tape
Mineral spirits
Water (for clean-up)
Plastic wrap or aluminum foil
8' Wide roll of poly

Personal Protection Equipment:

Safety glasses (required)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

15.1. PLANNING AND PREPARATON

1. Determine a painting plan.
 - a. Assign crews as follows
 - Two to three volunteers per room for priming and painting: one or two for cutting in the corners and one to roll the ceiling and walls.
 - One to cut in around all of the windows and the tub/shower insert.
 - One to paint the stairwell.
 - If possible, one to mix paint and keep painter's roller pans and pails filled.
 - b. Start in one of the larger main floor rooms and in the stairwell. The stairwell takes a long time and the larger main floor room can be used for staining once painting is finished.
 - c. As crews finish one room, they can be assigned to another room, as needed, or can stain skirtboards, closet poles and the basement stairway handrail (see Section 15.3).
 - d. Plan to completely prime the entire house before starting the finish painting. Finish painting can begin as soon as priming is completed and primer has dried for a minimum of one hour.
 - e. All plastered walls and ceilings must be painted with one primer coat and then one finish coat. Ceilings and walls are all painted the same color.
2. To prevent paint spillage on floors, cut and distribute sheets of poly from an 8' wide poly roll in the sizes indicated in Table 15-1. Place one of the 8'x10' sheets in one of the larger rooms and a 3'x3' sheet wherever a roller pan will be used. Exterior doors may already be covered by poly. Check the bathroom tub area for smaller pieces of saved poly before cutting smaller pieces for under roller pans.

Table 15-1. Poly Sizes and Function.

Approximate Dimensions	Function
8' x 16'	Cover for base and door trim, if present
8' x 10'	Place under 5-gallon paint mixing and pouring area
8' x 12'	Cover for stair skirtboard, handrails and closet poles
8' x 10'	Cover for tub/shower area
3' x 3'	Place under each roller pan
4' x 7'	Cover for inside of both exterior doors, if needed

3. Place one or two primer/paint pails on the large poly tarp in one of the large rooms with the rest kept out of the way in a secondary location until needed. This will allow for easier movement around painting equipment when painting this room. Prepare the

needed number of small paint containers, roller pans and pan liners for the number of crew and place them on the tarp near the paint supply.

4. Open windows, if weather permits, to provide fresh air.
5. Dust off window sills and clean edges around tub/shower of excess plaster before painting. Wipe clean with a damp rag.
6. Tape a poly cover over the inside of both exterior doors (if not already done) to protect them from paint splatters. Keep the door closed when painting around the door.
7. Tape a poly cover over the tub/shower unit before painting bathroom walls and ceiling. Completely cover the shower flange with tape/poly. Cut additional pieces to cover the top side of the tub if needed.
8. Verify that the window frame faces have been covered with 2" painter's tape. Tape any uncovered frames.
9. Turn on lights, both cage lights (hanging from ceiling) and portable lights. Place portable lights in rooms as needed.
10. Thoroughly mix all paints and stains before using. Use the drill with paint mixer for primer and paint and use shims for stain.
11. Attach the hose to a water supply. Place four empty/clean 5-gallon pails side-by-side in the basement and fill each with water. Designate one pail for washing hands and wetting rags, two pails for sequentially washing brushes, and one for a final rinse of washed brushes.

15.2. PRIMING AND PAINTING

1. Prime and paint only plastered surfaces. Do NOT prime or paint garage or unfinished basement areas.
2. After pouring primer from a supply pail, use a brush to immediately wipe off the side of the pail to prevent pooling of paint on the drop cloth. This will help keep shoes clean and prevent slipping.
3. Start priming by rolling and cutting in ceilings first. These can be done simultaneously by having each person start at opposite ends of a room. Walls can be done as soon as the ceiling is completed. Prime walls from the ceiling down.
4. Prime walls, ceilings and scuttle box cover using rollers. Use brushes to cut in all corners and surfaces that cannot be reached with a roller. When cutting in wall and ceiling corners, prime about a 3" wide border on each side of the corner. Use a good amount of primer and feather out the edges to prevent heavy paint lines.

5. Refill rollers as soon as additional pressure is needed to squeeze primer from the roller. This is easier on the arm and shoulder muscles and avoids paint roller lap marks which can occur along roller edges when pushing the roller too hard against plastered surfaces. Check for drips and lap marks after each ceiling and wall is finished and roll out before they dry. Check doors (including hardware) and windows for drips and spatters; clean immediately with a damp rag.
6. Hold the primer 1" away from all edges of exterior doors. This will keep primer off the door. The 1" unpainted strip will be covered by the door trim.
7. When dipping brushes into primer, limit depth to 2" or less. This will help to prevent dripping down the handle and extend brush life by limiting the amount of paint drying at, or in, the ferrule (the metal piece that wraps around the bristles).
8. Prime the ¾" x 8' scuttle box trim. This trim should be located with the stair skirt boards, closet poles and handrail. It is stained but needs to be painted. Due to the stained surface it may need several coats of primer and paint
9. Wait at least one hour after priming to apply the finish paint. Generally, once all priming has been completed, finish painting can begin immediately if the same sequence of rooms and areas is followed.
10. After priming, transfer as much leftover primer as possible back into the 5-gallon supply pail by scraping roller covers with the roller scrapers and brushing out residual primer from small containers and roller pan liners. Replace roller pan liners and small paint containers before filling with paint for finish painting. Clean and dry primer brushes before painting. Roller covers can be re-used for painting provided primer has been scraped from the roller cover.
11. Finish coat the walls, ceilings, scuttle box cover and scuttle box trim using the same techniques and sequence as for priming.
12. When painting is completed, use a portable light to look for any areas where paint is too light, and for paint drips. Hold the light 1'-2' from the wall and move it around, checking all painted surfaces. Touch up areas as needed. This is most easily done by two people, one holding the light and the other doing the touch up.
13. Remove painter's tape as soon as possible after painting except from around window frames. Window frame tape will be removed on finishing day.
14. Wipe spatters off doors, door handles, hinges, strike plates, window glass, and tub/shower areas with a damp rag.

15.3. STAINING

1. Stain stair skirtboards, closet poles and the handrail.

2. Set three sawhorses up in a room in which painting has been finished. Cover the top of the sawhorses with rags or poly and place skirtboards, closet poles and hand rail on them.
3. Inspect surfaces and edges for damage or roughness. Sand if necessary. Report damage to the Site Leader.
4. Stain one side and the edges of the skirtboards. Stain the side with the best appearance.
5. Apply stain evenly with a rag, wiping off excess with a dry rag.
6. Leave in place to dry.
7. Use mineral spirits for any clean up.

15.4. CLEAN-UP

1. Brush paint from small paint pails and roller pans into the supply pail. Scrape residual paint from roller covers into the paint supply pail.
2. Remove and dispose of roller covers. Dispose of tray liners and any small pails with excessive residual paint build-up. Rinse roller frames with water and wipe clean before putting them away.
3. Clean and rinse brushes using the water filled pails and give to the Site Leader for evaluation. Cleaned brushes can be re-used. Dispose of those that are damaged or deemed unable to be re-used. If painting cannot be completed in one day, wet brushes and rollers can be kept for up to several days when wrapped tightly in plastic wrap or sealed in foil
4. Open the top sash of all windows about 1". This will allow moisture to escape and helps paint dry. Start any fans.
5. If floors are covered with paper, remove all paper being careful not to transfer any spilled paint onto the house floor.

15.5. PREPARATION FOR NEXT BUILD DAY

1. Secure covers on pails containing primer/paint. Use a marking pen to note approximate volume (e.g., full, half full, etc.) on the covers. Remove lids from empty pails. Place all pails, including empty pails, in one of the large main floor rooms.
2. Stack all ¼" multi-ply panels that are on-site inside the house.
3. Transfer all but ten pieces of DRICore to the basement.

Chapter 16. Subfloor, DRICore and Finish Stairs

16.1 INSTALLING SUBFLOOR

16.2 INSTALLING DRICORE

16.3 FINISHING STAIRS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure

Tools and equipment needed:

Extension cord
Belt sander
Drill driver
Finish nailer
Table saw
Air compressor
Pneumatic stapler
Shop vac
Skirtboard Template
Sheetrock square
DRICore seating [bar](#)
Putty knife
Utility knife
Broom
Adjustable bevel
Floor scraper
[Dead blow hammer](#)
[Red crayon](#)

Materials needed:

¼” Subfloor
DRICore
Staples
80 Grit sanding belts
1⅝” Exterior screws
2½” Exterior screws
2” #7 Trim screws
2½” Collated finish nails
2½” Finish nails
¼” [Flat wood shims](#)
Weatherstripping
Scrap foamboard
Construction Adhesive
Pneumatic tool oil
[Stair handrail, brackets, and screws](#)
[Stair skirtboards](#)
[Stair treads](#)
[Stair risers](#)

Personal Protection Equipment:

Safety glasses (required)
Dust masks (recommended)
Ear plugs (recommended)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

16.1. INSTALLING SUBFLOOR

16.1.1. Multi-ply Subfloor Prep

1. Check for floor squeaks. Where found, drive a 2½” exterior screw through the sub floor into the floor joists to eliminate the squeak.
2. Scrape the entire floor to remove any plaster, debris, or protruding nails or staples.
3. Using a belt sander, sand the OSB sub floor seams to ensure the seams are flush so the subfloor will lay flat.
4. Vacuum the floor.
5. Verify that all floor vents in the hard flooring areas (at a minimum) are nailed in place and air sealed per instructions in Section 12.3.3.
6. Wherever the subfloor will cover existing stud location marks on the floor, transfer the marks to the wall with a red crayon (no higher than 2” off the floor).
7. Snap a chalk line 47¾” out from the wall surface (plaster). Lay subfloor sheets tight to the chalk line, butted tightly against each other, and located slightly under the plaster wall. Adjust as required and tack first row in place.
8. If the subfloor provided does not contain x’s pre-marked on the sheet, mark lines ½” from each edge, then lines every 4” in both directions to layout a series of intersecting lines to use as stapling guide. Also, make marks every inch on the lines ½” from each edge.
9. Plug the compressor into an outside outlet WITHOUT using an extension cord (the compressor can draw high current). Tilt the compressor and close the pressure relief valve (horizontal position). Connect one or two compressor lines. Turn the compressor on and set the pressure to about 80 psi.

NOTE: At the end of the day, tilt the compressor and slowly open the pressure relief valve (vertical position) to release the air and drain any moisture from the tank. Set the compressor back down to ensure all moisture drains out.

10. Place a few drops of pneumatic oil into the air inlet of the pneumatic power stapler.

NOTE: This may have to be done a few times throughout the day or after encountering stapling issues like multiple staples being fired or staples suddenly not countersinking properly (and the air compressor pressure is fine).

11. Connect the power stapler to a compressor line.

16.1.2. Installing Multi-ply Subfloor

1. Alternate rows of subfloor should be staggered 12"–24" in order to avoid a point with four corners. Multi-ply seams must be at least 6" from any parallel sub floor decking. When installing subfloor over DRICore in basement bathrooms, offset the subfloor seams and parallel DRICore seams by 6" minimum.
2. Plan the layout so a full sheet is placed in front of all doors.
3. Begin the second row with a half-sheet and tack pieces in place as they are laid. Gaps between sheets must be less than 1/8".
4. Where an exterior door enters a carpeted area, the subfloor should extend 8" outside the arc of the door in both the open and closed positions, and the inside corner should be trimmed to a 24" radius. Install the sheet per the following instructions:
 - a. Place a sheet of subfloor on the floor in front of the front door, tight to the left and right door jambs. Position the sheet so it's 8" beyond the edge of the door. Mark the 8" position on the floor.
 - b. Make a mark on the sheet along the outside edge of each door jamb. (These marks will be used to realign the sheet after trimming.) Trim 1/4" off the sheet edge between these marks to allow the sheet to slide 1/4" under the adjacent sheetrock.
 - c. Open the door 90° and make a mark on the subfloor 8 1/4" beyond the edge of the door. Use a T-square to extend this mark across the sheet and trim along this line.
 - d. Locate the center point for scribing a 24" arc on the transition corner of the subfloor. Make a mark 24" in from the corner on both sides. Use a T-square to extend these marks and tack in a nail at the intersection of the lines. Place the loop of a string on a pencil, place the pencil tip at the edge of the sheet, and wrap the string around the nail. Hold the pencil tight and draw the arc between the sheet edges. Trim the radius with a jig saw.
 - e. Re-install the sheet against the door jambs with the sheet edge under the sheetrock and the corner 8" beyond the edge of the closed door. Secure the sheet to the floor.
 - f. Fill in the space behind the door with a single piece of scrap subfloor.
5. Seams between hard flooring and carpeting should be midway under the bottom of a door when closed. Doors when closed are not located in the middle of the doorjamb. Use the edges of the jack stud as reference. For doors swinging inward, use the inside edge of the jack stud for the location of the end of the subfloor. For doors swinging outward, use the outside edge of the jack stud. (See Figure 16-1.)

6. Subfloor should extend under doorjamb to avoid open gaps.
7. Ensure all holes for registers are cut open.

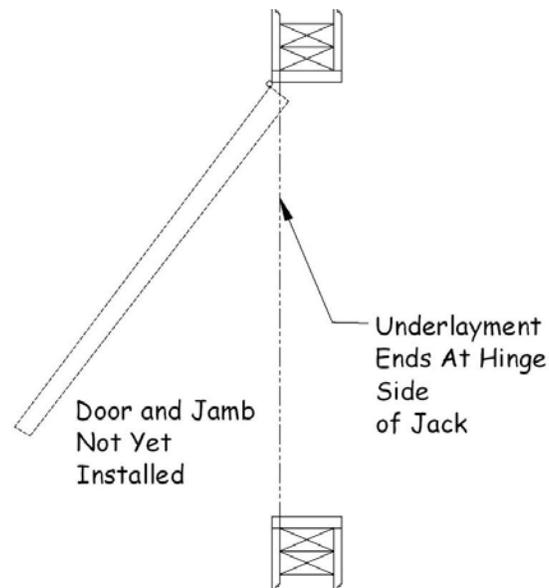


Figure 16-1. Subfloor in Interior Door Opening.

8. When stapling, constantly check to make sure the gun is loaded with staples and that the compressor air pressure is high enough to ensure staples are countersunk **below** the surface of the sheet (**otherwise each staple will have to be countersunk by hand**).

NOTE: Some of the power staplers have a depth adjustment feature that can be used to adjust the stapling depth.

9. Adjust the exhaust outlet of the power stapler to vent away from the finished wall surface. This is critical to avoid “staining” the plaster and making painting difficult.
10. Start the stapling process **at one end of the floor** by first “tacking” several sheets before completing the stapling process. Start at the center of each sheet and then staple vertically, horizontally, and then diagonally every three or four X’s.
11. When several sheets have been “tacked”, completely staple each sheet by again moving from the center toward the edges. **Do not staple edges of the floor before stapling the interior.** In the field of each sheet, place one staple at each “X” mark and one in the middle of every four “X” marks (this will make the average spacing of each staple about 3”).
12. At all seams, staple the edges at 1” intervals about $\frac{3}{8}$ ” from the edge of the sheet. At all other edges (against a wall, next to carpeting, in the doors, or along the tub or shower), staple only at the X’s. **Drive all staples parallel with the grain of the sheet.**

13. Quality check each subfloor sheet by verifying that all staples have been installed at the appropriate spacing and that they are set below the surface. Check with a putty knife or ice scraper. Set offending staples with a hammer.

NOTE: Shining a flashlight or treble light straight down on the surface helps to identify missing staples (indicated by no reflection).

16.2. INSTALLING DRICORE

16.2.1. Preparation

1. Use a floor scraper to remove large drops of plaster from the floor. Use a vacuum to remove scraped debris.
2. Use a putty knife to remove excess plaster along the bottom of the sheetrock. Look for large build-ups that would interfere with floor trim installation and remove or smooth. Excess plaster can interfere with shim placement during DRICore installation.
3. Transfer all stud center marks from the floor to the walls. Use a red crayon to mark the bottom 1"-2" of the plastered sheetrock.

16.2.2. Layout

1. Layout is required to determine a good starting point and to ensure that a minimum of 6" of each piece of DRICore is installed along each wall and the bottom of the stair stringer.
2. Generally, the starting point should be one of the walls in the basement hallway or the wall at the base of the stairway. Start at that point and work outward. If the basement has two bedrooms, starting along the common wall will allow two crews to work in opposite directions after completion of the first row.
3. Once the location of the starting row has been established, measure the overall length to be covered. Divide the measured length by the locked dimension of the DRICore to determine the number of full and partial sheets required to complete the row. If the partial sheet length is less than 0.26 of a full piece, the first piece will need to be trimmed to ensure the last piece is at least 6" long.

EXAMPLE: The distance from the stairway wall to an exterior bedroom wall is 237". Each DRICore piece is 23.25 inches square when locked. Dividing 237 by 23.25 = 10.19. In this case, a full sheet cannot be used to start the row because the last piece will only be 4½" long (0.19 x 23.25 = 4.42"). Therefore, at least 1.58" (6"-4.42") will have to be removed from the first piece in order for the last piece in the row to be a minimum of 6".

4. After adjusting for the *length* of the first row, determine an acceptable *width* for the first row. Lay some full sheets of DRICore along the starting wall and obtain the measurements from the edge of the sheets to **all** intersecting walls to the right and left of the starting row edges. Record these dimensions and determine a desired width that provides the 6" minimum along all intersecting walls. If this is not possible, inform the Construction Supervisor and refer to Section 16.2.3.6.
5. Before installing the first row, snap a chalk line as a reference for maintaining a straight row during installation. Near each end of the row, place a 1/4"x 3x5 flat wood shim on the floor, oriented vertically and butted up against the starting wall. From each spacer, make a pencil mark on the floor, parallel to the wall, that represents the desired first row width + width of a DRICore tongue. Snap the line between these two marks.

16.2.3. Installation

1. If starting with a piece along a wall, cut off the tongue portion of each edge that will face the wall. Before cutting a piece, make sure the DRICore orientation is correct. Both grooved edges should face outward away from the starting wall(s) after the cut. After cutting, set the drops in a common location and check this supply for usable pieces along the final row of each room.

WARNING: Each piece of DRICore has two tongue edges and two grooved edges. After cutting the initial piece, make sure that all subsequent pieces have the same groove and tongue orientation prior to cutting.

2. Place a 1/4" flat wood shim along the wall between each piece. The shim maintains an adequate gap to allow the floor to float. Keep edges on the chalk line.
3. To seat the tongue and groove, lay the DRICore seating bar along the grooved edge so that pounding will not damage the edge of the DRICore piece. Use a dead blow hammer to hammer the seating tool. As the first row is installed, keep the edges on the chalk line. This might take repeated adjustments as the pieces will move during assembly. Also check installed pieces periodically to ensure seams between pieces have not opened. Use the seating bar and hammer to close all gaps.
4. Each successive row of DRICore should be staggered at least 6" to avoid a point with four corners.
5. Use the drop cut from the last piece in a row as the first piece in the next row whenever possible. Before starting the second row, make sure that the seams of all second row pieces will overlap the seams of the first row by at least a 6".
6. Occasionally, some pieces along walls will be less than 6", especially in closets. Should this occur, attach them to adjacent DRICore pieces with construction adhesive to ensure they stay locked. Remove residual adhesive.

16.2.4. **Finishing and Cleanup**

1. After completion, walk slowly over the traffic areas of the floor to check for DRICore that moves when walked on. If found:
 - a. Drill a 3/8"-1/2" hole through each piece that moves.
 - b. Force several squeezes of construction adhesive through the hole so that it spreads out like a leveler. When dry, the glue will fill the low spot and help to adhere the DRICore to the floor.

NOTE: Do this AT THE END OF THE WORK DAY to allow the adhesive to dry without foot traffic.

2. Remove shims and save for re-use.

16.3. **FINISHING STAIRS**

16.3.1. **Installing the Handrail**

1. All stairways with more than three risers require handrails.

NOTE: For safety reasons, it is recommended that the permanent handrail be installed before installing the skirtboard and permanent treads.

2. A handrail should be continuous for the entire length of the stairs except:
 - At an intermediate landing, or
 - At an intermediate wall where the horizontal offset between the two rails is less than 12".
3. At the top and bottom stair treads, measure vertically 31" above the nose of the treads and mark the wall. Pull a string line very tight between these marks. This line represents the location of the bottom holes in the three handrail mounting brackets and will place the top of the handrail about 35" above the stairs. Adjust this level slightly up or down for special circumstances. The top of the handrail must be located at least 34" but no more than 36" above the nose of the stair treads.
4. Along this line, first mark the wall for locations of the top and bottom handrail brackets. Locate the top bracket 10-12" from the top end of the stairway wall and the bottom bracket 10-12" from the bottom end of the stairway wall, or from door trim if present (see Figure 16-2). Check for blocking or stud with an 8d or 2 1/2" finish nail.

NOTE: Blocking has been installed for the handrail at the top, middle, and bottom of the stairs (see Section 10.5.5 and Figure 16-2).

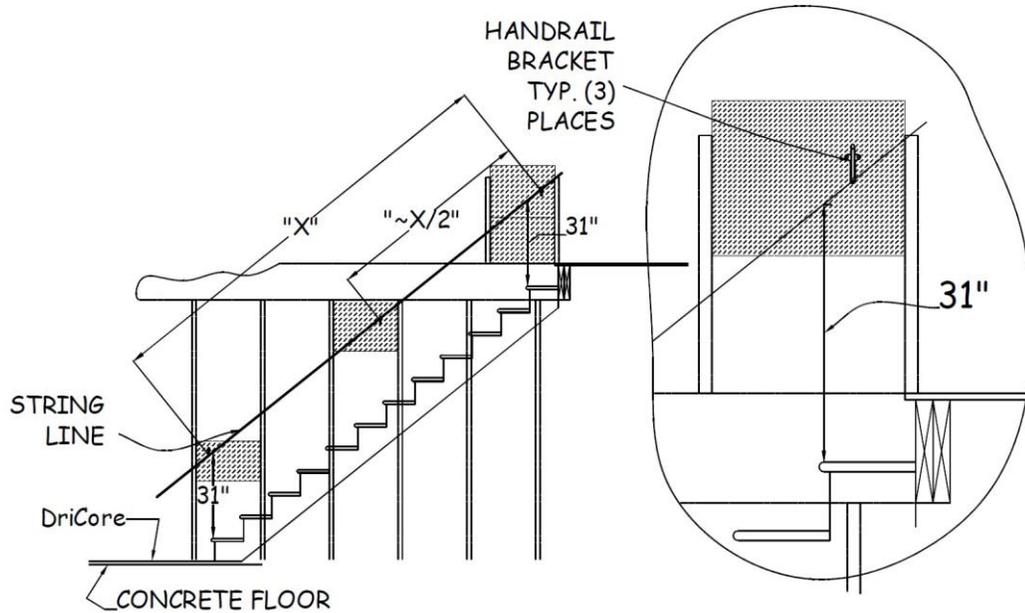


Figure 16-2. Handrail Bracket Installation.

5. Install handrail brackets at both top and bottom locations. The middle bracket will be installed after the handrail is cut to length.
6. Cut the handrail to a length such that each end will be 2"-3" from the end of the wall or door trim. Once the returns are installed (Steps 12 & 13 below) this will provide adequate room for hand grip without so much room that the railing flexes or moves.
7. With the flat side of the handrail firmly on the bed of the saw, cut opposite 45° miters on each end of the handrail (the miters will be perpendicular, not parallel, to each other). These mitered ends of the handrail provide a surface for installing a return back to the wall.
8. Before attaching the handrail to the top and bottom brackets, locate the center of the handrail and, using a 1/8" drill bit and the short brass screws provided, attach the middle bracket to the flat underside at this location. Once the rail is attached at the top and bottom, this bracket will be centered approximately half way between the top and bottom brackets - an exact location is not necessary.
9. Set the flat side of the handrail on the top and bottom handrail brackets in the position defined in Step 7 above. Again, using a 1/8" drill bit and the short brass screws provided, attach the handrail clip to the bottom of the handrail.
10. Standing at the top and bottom of the stairs, sight along the handrail and raise and lower the center bracket along the wall until any bow in the rail is minimized. Screw the bracket to the wall with the long brass screws provided.

11. Cut opposite 45° miters on a piece of handrail approximately 15-18” long (this length will allow safely cutting short pieces off each end). Install the handrail and move the mounting brackets under the handrail to their farthest positions from the wall. Measure from the long end of the miter to the wall at each end (the distances may not be the same). Carefully cut (square cut) two pieces these lengths from the short, mitered piece.
12. At each end of the rail, check the fit of the miters and if acceptable, apply wood glue to the miter cuts of both the handrail and the return piece. Set the return piece in place, and hold in place with a clamp. If necessary, wedge a tapered shim between the wall and the end of the return to ensure good contact at the glue joint.
13. Using a 1/8” drill, predrill the miter joint and screw the return to the rail using 2” #7 trim screws. Use one screw in each direction, with a slight vertical offset to avoid the second screw hitting the first. Wipe off any excess glue and putty the holes. If the return is not tight to the wall, loosen the screws holding the bracket to the rail, push the return tight to the wall, and retighten the screws. If necessary, insert a small shim between the bracket and the underside of the rail to ensure a tight fit.

16.3.2. Installing Skirtboards

1. Scrape wall surfaces behind the stair stringers to ensure skirting will lay flat on the wall surface.
2. Clean off any dirt or plaster on the 2x4 on either side of the outside stringers. This will allow the skirtboard to sit firmly down on the 2x4.
3. On each side of the top of the stairway, cut a 1” wide notch in the subfloor overhang, flush with the header, so the skirtboard can rest tightly against the header. Using a square, draw a 4” long plumb line on the wall aligned with the face of the header. This represents the top end of the skirtboard.
4. At the bottom of the stairs, use a level to draw about an 8” plumb line 4” from the end of the stringer. Sometimes the wall ends there, or there is a door opening that will not allow you to go 4” past because of the trim that goes on the door; draw the line as far as possible up to 4”.
5. Lay the 24” side of a framing square on the 2x4. Make two marks 11½” up from the 2x4 (the width of the skirtboard) about 3’ apart at each end of the stairway. Repeat on the other side of the stairway. (See Figure 16-3.)

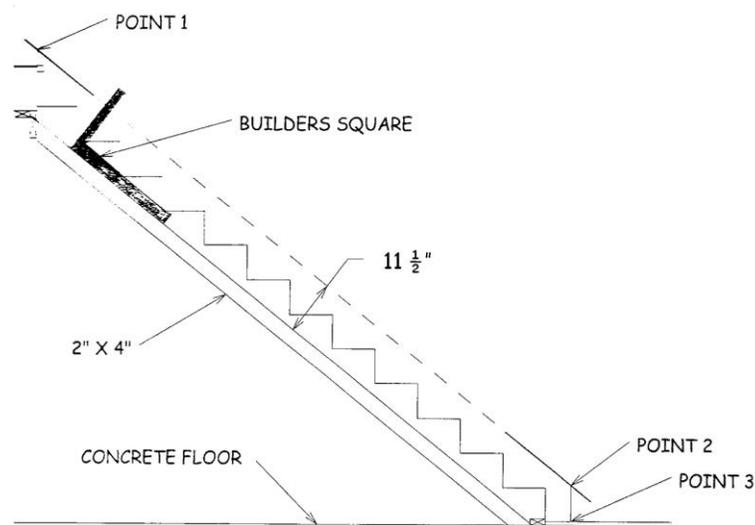


Figure 16-3. Skirtboard Installation.

6. Place a 6' level on the two marks at the top of the stairway (from Step 5) and scribe a line across the two marks to a point that intersects the plumb lines from Step 3. This creates Point 1, which must be at least 3" above the floor to be higher than the floor trim (see Figure 16-3). Then, using the two marks at the bottom of the stairway (from Step 5), draw a line to a point that intersects the plumb line. This intersection is Point 2 (see Figure 16-3). Repeat on the opposite side of the stairway.
7. Measure from Point 1 to Point 2; this is the total length of the top edge of the skirtboard. Then, measure from Point 2 (on the wall) straight down to the floor. This measurement minus $\frac{1}{4}$ " is the dimension to Point 3. Subtract another $\frac{1}{4}$ " if there will be hard flooring at the bottom. If the DRICore is not yet installed, subtract another $\frac{3}{4}$ " from the measurement to account for that thickness.
8. Compare measurements from both sides of the stairway. If the 2x4s have not been installed exactly the same on each side, there may be small differences between the measurements of the two sides. If they are different, make the following adjustments until the measurements are the same (to allow cutting both skirtboards at the same time):
 - a. Measure up to Point 1 on both sides. Adjust the point as required so that both sides are at the highest measurement of the two sides, and a minimum of 3" above the subfloor.
 - b. At the bottom, measure up to Point 2 on both sides, and adjust as required so that both are at the highest measurement of the two sides.
 - c. Finally, measure the distance from the adjusted Point 1 to the adjusted Point 2 on both sides to get the length of the top of the two skirtboards. These measurements should be equal within $\frac{1}{4}$ ". If not, recheck measurements above.

9. If the bottom of the skirtboard ends close to an outside corner, adjust the length so that the skirtboard ends flush with the corner (base trim will end flush with the face of the skirt), or it ends at least 1" back from the corner to allow for base trim to wrap around the corner.
10. If the bottom of the skirtboard ends close to a door opening, the length may need to be adjusted so there is adequate room (1-2") to install base trim between the door casing and the end of the skirtboard. However, the end of the skirtboard (Point 2-to-Point 3 line) must be at least 4" past the end of the stringer. If there is insufficient space for both base trim and door trim, first eliminate base trim and second rip or notch the door trim to fit.
11. Locate the Skirtboard Template provided as a starting guide in cutting the two ends of the skirtboard. If the template is 2' or less in length, cut a new template and transfer the angles at the two ends from the old template to new template. The angles may be approximate only. However, plan to measure, mark, and cut the ends of the template to match the specific circumstance of the stairs being worked on. Once modified to fit, use the template to layout and cut both ends of the skirtboard.
12. To establish the correct angles, place the template at the top of the stairs, tight against the edge of the flooring, and exactly aligned with the line drawn on the wall in Step 5. If necessary, tack it to the wall with two 2½" finish nails to keep it in place.
 - a. If the vertical edge of the template is perfectly parallel with the plumb line on the wall, that angle should be used in laying out and cutting both ends of the template and the skirtboard.
 - b. If the vertical edge of the template is not parallel with the plumb line, set an adjustable bevel on the top of the template and align it with the plumb line and lock it. This will be the angle to be cut the template at both ends - at the top, with the adjustable bevel set on the top end of the template and at the bottom with the bevel square set on the bottom end of the template. These cut edges will then be parallel.
 - c. Move the template to the bottom of the stairs, again aligning with the lines drawn in Step 6. Confirm that the end is plumb. If not, recheck the top and bottom lines and adjust as necessary. Measure the distance from Point 2 to Point 3 and transfer that dimension to the template. Cut the bottom of the template 90° to the vertical at that point.
 - d. Move the template to the opposite side of the stairway and confirm angles and dimensions. Adjust as necessary to stay within ¼" tolerances.
13. Set the skirtboard on saw horses with the unfinished side up (any tear out from the circular saw will then be on the unfinished side). Lay the template on the board and orient it to establish the proper cut orientation at the top of the skirtboard. If the top

- angle of the template is correct, use it to mark for cutting. If not, use the adjustable bevel angle established above. This will establish Point 1 (see Figure 16-2).
14. Measure along the top of the skirtboard to locate Point 2 at the distance measured in Step 6. With either the template or the adjustable bevel, as appropriate, mark the correct angle for the bottom end vertical cut. Check to be sure the top and bottom cuts will be parallel.
 15. Transfer the Point 2-to-Point 3 measurement from Step 8 to the skirtboard (keep in mind that the skirtboard is held ¼” off the floor) to locate Point 3. From Point 3 (on the skirtboard), create a 90° corner with a pencil line; this edge will run along the floor.
 16. Before cutting the skirtboard, recheck all measurements for angles and lengths and adjust until correct. Cut the first skirtboard and test fit on both sides of the stairway. Use it as a template to cut the second piece by placing the unfinished sides together.
 17. Before installing the skirtboards, stain both ends.
 18. Prior to placing the skirtboard in position, measure from the final Point 1 to the floor and mark the upper edge of the skirtboard at this dimension down from the peak. Drive a 2½” finish nail into the end, leaving about ½” exposed. This will provide a “handle” to help lift the board into position.
 19. Place the skirtboard in position, apply pressure from the bottom to seat it firmly in the notch in the floor, and lift it up at both ends to match with Points 1 and 2. Lift it enough to cover any layout pencil lines on the wall. If the basement is not to be finished, hold the skirtboard off the floor with a temporary ¼” spacer. If it is to be finished (with DRICore), use a piece of DRICore along with a ¼” spacer to set the height of the skirting off the floor. Nail the skirtboard to the wall, nailing into studs or blocking with 2½” collated finish nails. Putty the nail holes.
 20. Repeat Steps 18 and 19 for the opposite skirtboard.

16.3.3. Installing Treads and Risers

1. For safety reasons, only remove the temporary treads from one step at a time.

WARNING: Make certain that the stairway gap is never unattended during this process.

2. Install the bottom riser first. Measure between the skirtboards to get the length of the riser. If the stairs are going to be carpeted, cut the riser ½” short. If the stairs are not going to be carpeted, cut the riser ⅛” short.

3. The riser may need to be ripped to the proper width. The riser should be flush or slightly under the horizontal cut in the stair stringer that will support the tread immediately above it.
4. Center the riser between the skirtboards and secure the riser to the stringers with 1⁵/₈" exterior screws: two in each stringer (six total). Predrilling for these screws is not necessary.
5. Install the first tread, starting at the bottom of the stairs. Establish and cut the length of the tread using the same process as the bottom riser (Step 2 above).
6. Verify the tread has a 1¹/₄" overhang from the riser immediately below it. Rip to width if necessary.
7. Apply a bead of construction adhesive on the three stringer sections. Place the tread on the stringers and drill three 5/32" pilot holes through the tread into each stringer. Secure the tread using 2¹/₂" exterior screws.
8. After a tread is installed, remove the temporary tread from the step immediately above it.
9. Repeat Steps 2–8 for each riser and tread, proceeding up the stairway.

NOTE: Cut no more than 2-3 treads and risers to length at a time, in case distance between the skirtboards varies along the stairway.

10. For the topmost tread, about 3/4" will need to be ripped from the tread to achieve the 1¹/₄" overhang from the riser immediately below it. No riser is required above the top tread.

Chapter 17. Cabinets

- 17.1 LAYING OUT KITCHEN UPPER CABINETS
- 17.2 INSTALLING KITCHEN CABINET SUPPORT STRIPS
- 17.3 INSTALLING KITCHEN UPPER CABINETS
- 17.4 INSTALLING RANGE HOOD
- 17.5 INSTALLING KITCHEN BASE CABINETS
- 17.6 KITCHEN COUNTERTOP PREPARATION
- 17.7 INSTALLING KITCHEN COUNTERTOP
- 17.8 INSTALLING BATHROOM VANITY
- 17.9 INSTALLING OPTIONAL CABINETS

Tools needed by volunteers:

Nail apron
Tape measure
Hammer
Square
Utility knife
Pencil

Tools and equipment needed:

Extension cord
Lighting
Finish nailer
Chop saw
Table saw
Circular saw
Oscillating saw
Jig saw
Belt sander
Drill
Driver
Wood chisel
Framing square
Caulk gun
6' Level
3' Level
Cabinet & miscellaneous clamps
Rubber mallet
Cabinet kit
Stepladder

Materials needed:

2x4 Lumber, 54" long
3/4"x2-7/8" Plywood strips, variable lengths
3/4" Plywood, scrap
Cabinet filler strips
Weatherstripping
Countertop toggle bolts
1/4" Collated finish nails
2 1/2" Collated finish nails
Tapered shims
Wood glue
Wood putty
Flashing tape
Air sealing caulk
Painter's tape

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

Cabinet Plan

Safety First! Review the Safety Checklist before performing tasks in this chapter.

17.1. LAYING OUT KITCHEN UPPER CABINETS

1. Check the kitchen Cabinet Plan and confirm that all units are available on site. Unpack all cabinets and use the box material to cover all vinyl surfaces in the house to protect against damage. Inspect the units for damage and report any to the Construction Supervisor
2. Set up a temporary work bench to hold materials and tools.
3. Remove the doors on all cabinets by removing the screws from the stiles (leave the hinges on the doors). Collect the hinge screws and all cabinet related hardware in a container and store on the window sill.
4. The upper kitchen cabinets will be installed by mounting them to 2-7/8" wide strips of $\frac{3}{4}$ " thick plywood. This installation method is used because the screws holding up the cabinets go into the continuous plywood, rather than having to precisely locate the cabinet screws to hit a stud while holding them in place. The cabinets are 30" tall, with the top of the cabinet 84" and the bottom 54" from the floor. The top plywood support strip will be located about 1" down from the top, and the bottom of the lower strip about 1" up from the bottom of the cabinets. The following steps refer to Figure 17-1.

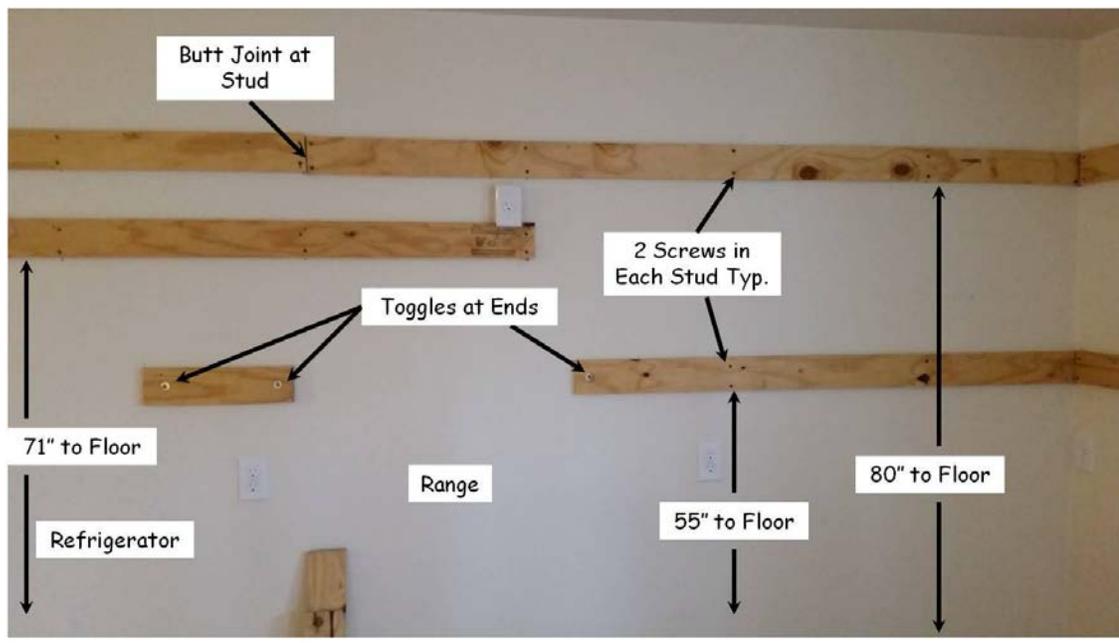


Figure 17-1. Kitchen Cabinet Support Strips.

5. Using the Cabinet Plan, mark the position(s) of the upper cabinets on the walls using light pencil lines. The Plan will specify an overall length (OAL) of the cabinets. Using a level, draw a horizontal line 80" up from the floor extending from the corner for the OAL of the cabinets. The OAL line will be approximately $\frac{3}{4}$ " short of the eventual end of the cabinets, since they will be mounted $\frac{3}{4}$ " off the wall.

6. Do the same with another line 55" up from the floor, except where the range and refrigerator will be located. These areas need lines 71" from the floor.
7. Locate all of the studs within the cabinet outline, and tack 2½" finish nails into each at the previously drawn lines. These nails will serve to temporarily support the plywood during installation, and will aid in locating the support strip installation screws. Also, with pencil, mark the stud locations approximately 38" above the floor. These marks will be handy when installing the base cabinets, but will be covered by the countertop backsplash.
8. Assuming a corner countertop arrangement, temporarily assemble the countertop with it supported on sawhorses. Install the countertop toggle bolts and tighten them snugly. Measure from the corner of the splash to each end, and confirm that the cabinet(s) will end the required distance from the countertop end(s). Rip cabinet filler strips to lengthen the cabinet width, if required. If the countertop appears to be too short and there are no filler strips to eliminate, consult with the Construction Supervisor for further direction.

17.2. INSTALLING KITCHEN CABINET SUPPORT STRIPS

1. Locate, in the trailer, suitable lengths of ¾"x2-7/8" plywood strips. Determine the lengths required per the Cabinet Plan, and cut to length. Many installations have more than 8' of cabinets, so the plywood strips must be butted together at a stud.
2. Rest the support strips in place on the nails and mark the stud locations. Lower the strips, and drill two 3/16" clearance holes through the plywood strip at each stud location, about ¾" from the edge of the plywood. Where the strip butts up to another strip at a stud, drill the holes ¾" from the edges and the end, at an angle so the screws will hit the stud when installed.
3. If the end of a support strip lands between studs, prepare the end for a ¼"x3" winged toggle bolt before screwing the strip to the wall. With a 1" spade bit, drill a counterbore approximately 3/16" deep (two plies of the plywood). Then drill a 5/8" through hole in the center of the counterbore.
4. Hold the strip to the wall again, and mark the location of the toggle bolt hole on the wall. Lower the strip once more, and carefully drill a 5/8" hole just through the sheet rock. Too deep punctures the poly behind, and can wrap the drill bit with insulation.
5. Assemble a 5/16"x1" fender washer on the ¼"x3" winged toggle bolt, insert the bolt through the 5/8" hole in the plywood strip, then thread the toggle onto the bolt with the wings pointing toward the plywood. Put the strip up in position against the wall, and gently pound the toggle through the sheet rock. To provide an air seal for the hole, put two or three pumps of air sealing caulk into the sheetrock hole behind the support strip, and a bit behind the washer, and tighten the screw. Do not over-tighten!

6. Attach the strips using two 2½” exterior screws into all studs. At the corner, a 3½” sheetrock screw may be necessary, because the screw may need to be driven at an angle to hit the stud.

17.3. **INSTALLING KITCHEN UPPER CABINETS**

1. Prepare each cabinet for installation by drilling four 3/16” clearance holes in the back, drilling from inside to prevent unsightly breakout inside the cabinet. Holes should be located about 1” from each side, and about 2” from the cabinet top and bottom. Double units need six holes, with an additional pair behind the center stile. The corner cabinet will need four holes in each side – two as described above, and two in each side near the beveled section.
2. Begin the installation with the corner cabinet. Cut a 2x4 54” long and use it to support the cabinet under the front frame as it is held in place. Level across the top front, and check each side for plumb. Install a 1¼” wafer head screw in an upper hole on each side. Double check level and plumb, and shim as necessary to make certain this unit is level and plumb. Install the remaining 1¼” wafer head screws, checking level and plumb as each is installed.

NOTE: Tightening the screws can pull the cabinet out of plumb.

3. Check the Cabinet Plan to see if filler(s) are required between the corner and adjacent units before proceeding.
4. Check that the spacing on each side of the window will be equal. If required, adjust the width of the filler strip (if any) to be sure that the window reveal will be equal on both sides, and that the upper cabinets end even with the base cabinets.
5. If filler(s) are required, attach them to the adjacent cabinet stile. Clamp as required, keeping the ends and face flush, and install construction screws the appropriate length through the filler into the stile.
6. Using the 54” long temporary support 2x4 as noted above, start on either side, hold the adjacent upper cabinet next to the corner unit, and clamp the stiles and/or side panels together using quick clamps. Adjust the position until the stiles and/or filler piece are flush.
7. Attach the unit to the support strip with 1¼” wafer head screws in the two top holes. Do not fully tighten the screws at this time.
8. Because corner units have angled stiles, the units on each side of the corner unit are attached with 1⅝” construction screws through the top and bottom of the corner unit SIDE PANEL into the stile and/or filler of the adjacent unit. Drill a ⅛” pilot hole through the side panel at an angle into the stile. Be VERY CAREFUL to not drill through the face or out the far side of the stile.

9. Attach the adjacent unit to the corner cabinet with 1⁵/₈" construction screws. Check for level and plumb, adjust as required, and install 1¹/₄" wafer head screws through the remaining back clearance holes into the support strips, checking for level and plumb as you proceed, and tighten all screws.
10. Repeat on the other side of the corner unit.
11. The next units are attached using the 54" 2x4 temporary support as before and clamping the stiles together using cabinet clamps and/or other clamps as required. Take care not to mar the finish on the stiles when clamping.
12. Get the stiles close to flush, and check that the unit is level, hold it in place by installing 1¹/₄" wafer head screws into the support strip through the two top holes. Don't tighten fully at this stage. Once the stiles are screwed together, come back and install the remaining screws into the back.
13. Recheck that the stiles are flush; when complete, drill a 1¹/₈" hole through one stile into the second stile. Be sure the bit is set deep enough so that the screw does not split the wood.
14. Screw the stiles together using 2¹/₂" trim screws. USE CARE when tightening - it's easy to break the screws. Turn the screws in until the heads are flush. Repeat as required for the remaining upper units. Two or three screws are usually adequate to ensure the stiles are flush and the joint is tight along the entire length.
15. Use tapered shims between support strips and cabinets as needed to keep adjacent cabinet fronts flush. Recheck for level, and install the remaining 1¹/₄" wafer head screws into the support strips through the cabinet backs.
16. Follow the Cabinet Plan to complete the installation of all upper cabinets.

17.4. INSTALLING RANGE HOOD

1. Remove the electrical knockout from the junction box in the range hood.
2. Based on the knockout location, determine a hole location in the cabinet bottom for the cord to be inserted. Use a spade bit to drill a 1¹/₄" hole for the cord. Drill from inside the cabinet.
3. From inside the cabinet above the range, drill four 3/16" clearance holes for the range hood pine strips in the cabinet bottom. The holes should be about 2" from each side, and 2" from the front and back.
4. Glue and screw 1x4 pine strips on the underside of the cabinet over the range to hold the exhaust fan. Screw DOWN into the strips from inside the cabinet with 1¹/₄" wafer-head screws.

5. Remove the screws from the vent extension and re-secure it to the range hood with flashing tape cut to ~2" width. Be sure there are no gaps at the corners.
6. On the wall where the hood will go, draw a 4"x11" rectangle centered ½" below the cabinet.
7. Use an oscillating saw to cut out the sheetrock on the lines from above and remove. Be sure the top edge of the cutout is at least ½" below the bottom of the cabinet to provide for an air sealing surface (see Figure 17-2).

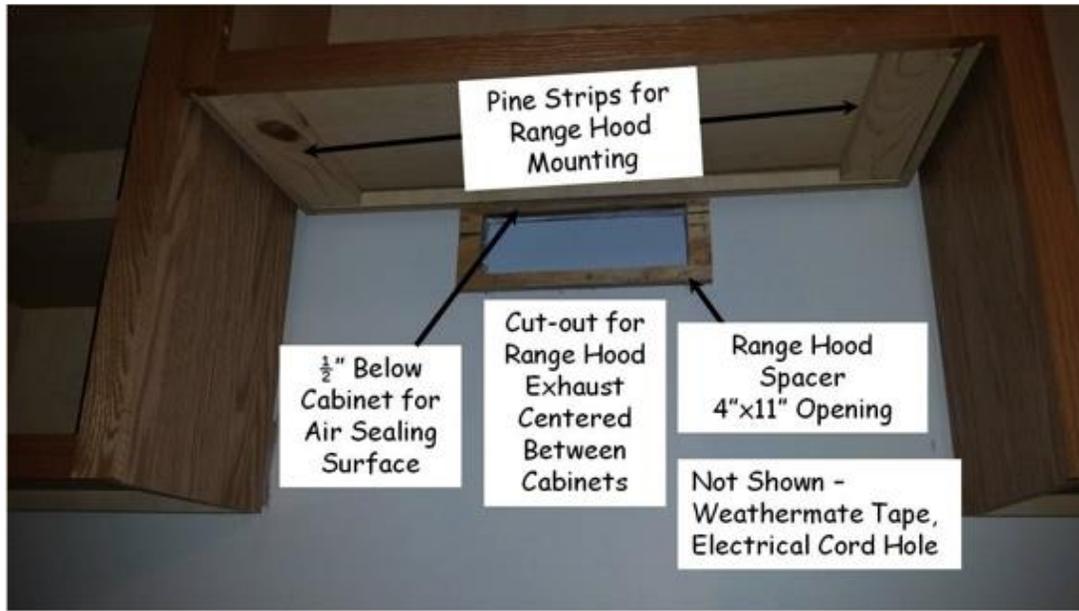


Figure 17-2. Range Hood Mounting Frame.

8. Using an oscillating saw with a fine metal cutting blade, carefully cut out the metal of the range plenum at the perimeter of the sheetrock opening.
9. If not supplied, cut a 6"x13" rectangular piece from ¾" plywood. Use a jig saw to remove a 4"x11" rectangle from this piece, leaving a frame 1" wide on all sides.
10. Align the inside edges of this frame with the wall cutout completed in Step 9 above, and secure in place using flashing tape. The top edge of the spacer will be recessed ½" behind the cabinet. Completely seal the space between the metal of the plenum, the sheetrock, and the plywood spacer, with no gaps, to prevent warm moist air from getting into the wall cavity.
11. Install weatherstripping on the face of the plywood spacer, around the perimeter of the opening, making sure there are no gaps.

NOTE: Thoroughly sealing this area is critical to ensure that warm, moist air from cooking does not enter the wall cavity and cause moisture and mold problems in the future.

12. Lift the range hood into place, sliding the vent extension into the cutout in the range plenum.
13. Make sure the back of the range hood fits tight against the range hood spacer frame so there are no gaps between the back of the hood and the weather stripping.
14. Fasten the range hood to the pine strips with 1¼” wafer-head screws.

17.5. INSTALLING KITCHEN BASE CABINETS

1. Remove drawers from the cabinets and store them in an out of the way place.
2. Set the corner carousel unit in place with the faces 36” from each wall as shown in Figure 17-3.

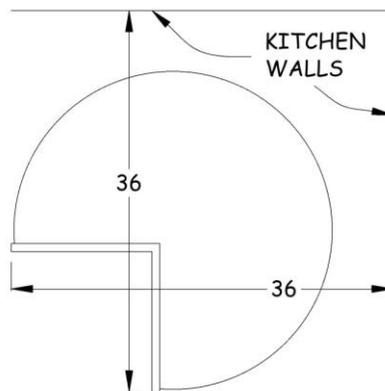


Figure 17-3. Corner Cabinet Installation

3. The sink unit may need holes to allow water pipes, drainage pipes and electrical boxes to pass through. Measure the location of the pipes and electrical box, using the window/cabinet centerline and floor as references. Transfer these measurements to the back and/or bottom of the cabinet.
4. The drain piping typically requires a 2½” hole. If that size hole saw is available, use that to make the hole. Otherwise, locate a spray can or similar object to use as a template, draw a round hole that size, then use a jig saw to cut the hole.
5. From inside the cabinet, drill 1” holes at the location of the hot and cold water supply lines.
6. Set the sink base in place centered below the window, then measure the space between the carousel and sink base frames. Refer to the Cabinet Plan to determine the width of any filler required adjacent to the corner unit. Attach as described for the upper cabinets.
7. Check the countertop length. The range is typically on the opposite side of the corner unit from the sink. The edge of the countertop adjacent to the range should end flush

with the cabinet above. Assemble per the Cabinet Plan the required unit(s) located between the range and corner unit. Clamp and screw the stiles together as described for the uppers.

8. Place this assembly next to the corner unit. Locate the end opposite the corner flush with the upper cabinet that is next to the range hood opening above. To align the ends, use a level against the stiles of both upper and lower units.
9. Measure the gap between the corner unit and the one adjacent, and rip a filler piece to that width. Attach it to the stile adjacent to the corner unit as described for the upper units, then assemble that cabinet (or assembly) to the corner unit.
10. Repeat Step 9 on the refrigerator end.
11. Check that the top of the assembled cabinets is level, and that the face is straight. Shim under the corners, and/or between the back and wall as required. Attach the assembly to the wall using 2½" wafer head screws into studs. Complete for all base cabinets.
12. If the range, refrigerator or dishwasher are adjacent to the floor corner cabinet, install a cabinet end cap between the appliance and the cabinet. Cut the front hardwood filler attached to the end cap to width (to allow enough room for the appliance). Notch the front lower corner of the end cap to match the cabinet toe kick. Hold the cut-to-width filler against the cabinet stile, and mark on the floor the location of the inside edge of the panel. With a framing square, draw a line square to the cabinet front from the mark to the wall (check for square to the wall).
13. Cut two pieces of 1x4 x 21" pine scrap. Align the edge of one of the pieces of pine board to the line from Step 12, on the corner cabinet side of the line. Screw it to the floor with three 1⅝" sheetrock screws. Place the second piece against the wall, on top of the first piece, with the bottom end flush on the floor piece, plumb it, and anchor to the wall (two or three 8d nails into a stud or ¼"x3" winged toggle bolts if no stud). Put the end cap in place, anchor it to the cabinet stile in the usual way, and nail the back and bottom of the end cap to the pine boards or plywood with 1¼" collated finish nails.
14. Sometimes there is a standalone cabinet at one end of the lineup. This cabinet will be fastened to a cleat. Determine the location of the cabinet and mark the outside of the front corners on the floor. Turn the cabinet over and measure the inside width of the toe kick base. Cut a cleat from scrap 2x4 or 2x6 1" shorter than that length. Align the cleat on the floor centered between the corner marks and out from the wall slightly more than the depth of the cabinet toe kick. Screw the cleat to the floor using two 2½" sheetrock screws. Set the standalone unit in place over the cleat and verify the position is correct. Secure the base of the cabinet to the cleat using two 1⅝" drywall screws through each end of the toe kick into the cleat.

NOTE: The wall stud spacing may be such that that one cannot attach the unit with screws into a stud. If so, use a ¼"x3" winged toggle bolt to attach the cabinet to the wall.

15. Install toe kicks with 1¼” collated finish nails, two into each end, and pairs spaced approximately 12” apart along the length.

NOTE: If the Cabinet Plan includes a cabinet that may be removed for a future dishwasher, minimize the number of screws during installation. Cut a separate toe kick for this cabinet so the toe kick can then be easily removed without affecting the adjoining toe kicks.

17.6. KITCHEN COUNTERTOP PREPARATION

1. Lay a piece of 1x4 on top of the base cabinets near the wall corner. Place a 6' level on top of the 1x4 with the level extended into the corner, adjust to level and while holding the level tight to the wall, draw a line on the wall along the bottom of the level. Repeat on the other wall.
2. To provide support for the countertop in the corner, attach 2x4 scrap lumber about 26” long to the wall corner. Hold the top of the 2x4s even with the line from Step 1 and screw them to the wall using 3½” sheetrock screws into studs at each end.
3. Dry fit the mitered countertop by setting it in place to determine the need for scribing and sanding the back splash. If any gaps are > ⅛”, tape the top of the back splash with painter’s tape to protect the laminate. With the flat side of a carpenter’s pencil against the wall (to match the largest gap between the backsplash and the wall), scribe a pencil line on the backsplash. Use a belt sander to remove excess material and avoid chipping the back splash. Sand leaving half of the pencil mark.
4. Dry fit the countertop by setting it in place to double check the fit is correct. If not, re-scribe and sand again to ensure a snug fit to the wall. The belt sander can be used to do fine adjustments, including putting a bevel (bottom farther from wall) on the edge of the backsplash. Make sure there is 30⅛” clearance for the stove, measured at both the front and back of the base cabinets.
5. Determine at what areas of the cabinets the countertop will be screwed to the cabinets. With the countertop temporarily in place, draw lines from below along the cabinet walls. There are usually corner blocks pre-installed in every corner of the cabinets that will work. Note the perimeter of the sink base for Step 17.7.1 below.

17.7. INSTALLING KITCHEN COUNTERTOP

1. Turn the countertop over and glue and screw 1x4x24” pine strips to the underside of the countertop that will mirror the same location of the corner blocks on the cabinets, except over the sink base. Drill three 3/16” clearance holes from inside the cabinet at the center and 1” from each end before securing with 1¼” wafer head screws. Later, screws will be placed through these cabinet corner supports to hold the countertop to the cabinets. Locate the pine boards so that they will lie on top of the cabinet walls. Be sure that the pine boards are outside of the sink base walls so they don’t interfere with the installation

of the sink, and that the pine boards are located such that they will rest on TOP of the cabinet WALLS when the countertop is installed.

2. Rip a piece 1x4 pine board about 10" long to a 3/4"x3/4" dimension. Glue and clamp it at the front edge of the sink base cabinet, centered on the sink location. This will support the narrow front edge of the countertop that remains after the sink opening is cut out. Glue and clamp a 6"-10" piece of 1x4 on top of the lazy susan at the front of the corner miter joint to support the miter joint.

NOTE: Do not place ANY blocking INSIDE the sink base cabinet

3. Drill 3/16" clearance holes through each of the diagonal support blocks in the cabinet corners where a pine board will be located.
4. Disassemble the dry fit and glue both edges and the spline. Reassemble and bolt units together making certain that top surfaces of both countertops are flush. Snug all bolts while checking that the top joined edges are flush along the length of the joint. Use a rubber mallet (NOT THE DEADBLOW HAMMER) to gently tap the countertop to make fine adjustments. Wipe off excess glue with a damp paper towel and verify that joined edges remain flush. Finish tightening the bolts uniformly, then set the countertop in place
5. Use 1 1/4" wafer-head screws to fasten the counter top to the cabinets from the bottom of the cabinet corner support into the pine strips under the counter top.

CAUTION: Check length of screws to avoid screwing up through the top of the counter, ruining the unit.

6. If a pantry cabinet is to be placed next to the countertop, it may be necessary to carefully chisel a notch in the proud edge of the cabinet stile to fit around the countertop.

NOTE: Ensure that the chisel is very sharp before attempting this notch.

7. Once the countertop is installed, reinstall all doors and drawers. Use the hinge adjustment screws as needed to plumb and align the doors. Remove the shipping pins from the lazy susan, and adjust it as required to align the door edges with the stiles and provide a uniform gap.

17.8. INSTALLING BATHROOM VANITY

1. Determine the location of the vanity from the drawing and drill 1" holes from inside the vanity through to allow for water supply lines. Cut a 2 1/2" hole for the drain.
2. Level and fasten the cabinet in place with 2 1/2" wafer head screws to the wall studs (use 1/4"x3" winged toggle bolts if needed).
3. Dry fit the countertop to determine if scribing and sanding are required. If so, scribe and sand to fit per Sections 17.6.3 and 17.6.4.

4. Turn countertop over. Glue and screw (using 1¼" wafer-head screws) 1x4 pine strips to the underside of the countertop that will mirror the same location of the corner blocks on the cabinets.
5. Set the countertop in place and fasten to the cabinet following the same procedure used for the kitchen countertop (see Section 17.7).

CAUTION: Check length of screws to avoid screwing up through the top of the counter, ruining the unit.

6. If a linen cabinet is to be placed next to the vanity, it may be necessary to carefully chisel a notch in the proud edge of the cabinet stile to fit around the countertop.

17.9. INSTALLING OPTIONAL CABINETS

17.9.1. Stairway Cabinets.

1. If there is an opening prepared in the kitchen for a built-in cabinet over the stairway, install a lower and upper cabinet in the opening. Unpack the units and inspect for damage. Report any damage to the Construction Supervisor.
2. Measure the outside dimensions of the two cabinets and verify they will fit into the rough opening. The opening should be 30"x55½".
3. Remove the drawers from the lower (base) cabinet. Cut off the bottom of the cabinet flush with the top of the toe kick with a circular saw.
4. Remove the shelves and doors from the upper cabinet by removing the screws from the stiles (leave the hinges on the doors). Store the hinge screws in a container and save.
5. Install the lower cabinet first. Drill two 3/16" clearance holes from inside the cabinet frame, 1½" inside the frame, about 2" down from the top and 2" up from the bottom.
6. Place the lower cabinet into the opening. Use a 3' level to verify the cabinet is level and plumb, shim underneath the cabinet, as necessary. Check to ensure the face frame protrudes ¾" out from the wall surface around the entire frame perimeter.
7. Secure the top of each side with 2½" wafer head screws. Tighten gradually and check for level and plumb as each is installed. Repeat with the bottom screws. Re-check for level and plumb and a uniform ¾" frame reveal. Adjust as necessary.
8. Drill two 3/16" clearance holes per side in the upper cabinet at the locations described for the lower cabinet (see Step 5 above).

9. Install the upper cabinet on top of the lower cabinet. Flush the upper and lower frame faces and clamp together. Drill two 1/8" pilot holes 2 1/2" deep through the lower cabinet face frame and partially into the upper cabinet face.
10. Fasten the cabinets together with two 2 1/2" trim screws. Verify reveal is still a consistent 3/4" around the frame perimeters. Secure the two sides of the upper cabinet to the framing with 2 1/2" wafer head screws.
11. Install door trim around the perimeter of the cabinet frame to conceal the gap between the cabinet and the opening. Orient the trim with the thicker edge against the cabinet frame. Miter cut and glue the corners and nail with 2 1/2" collated finish nails.
12. Install the shelves and doors in the upper cabinet doors and adjust hinges, if necessary, to align door edges. Insert the drawers into the lower cabinet.

17.9.2. Barista Cabinets.

1. Barista cabinets are a modified set of two upper cabinets. For this installation, one has a toe kick added to one of the cabinets. The base cabinet is mounted directly under the upper cabinet. This arrangement is typically centered between the end of a wall and a closet.
2. Remove the shelves, then remove the doors by taking out the screws from the stiles (leave the hinges on the doors). Collect the hinge screws and any related hardware and save.
3. Drill four 3/16" clearance holes in the back of each cabinet per Section 17.3.1. Drill from inside the cabinet to avoid unsightly breakout.
4. Check the Cabinet Plan for location. Determine if there are two wall studs within the width of the cabinet. If there are, install cabinet directly to the wall. Mount 54" off the floor. Use a 3' level to draw a light level pencil line on the wall at 54" above the floor. Verify the cabinet is centered left-to-right and mount with 2 1/2" wafer head screws in the top two holes. Refer to Section 17.3.2 for leveling and cabinet support instructions for installation. Shim as necessary to ensure cabinet is level and plumb, then install the bottom screws.
5. If studs are not available for mounting, layout and install upper and lower support strips to the wall as instructed in Sections 17.1 and 17.2.
6. Attach upper cabinet to the support strips with 1 1/4" wafer head screws (refer to instructions in Section 17.3).
7. Build and attach a toe kick base to raise the lower cabinet to the same toe kick height as the other kitchen base cabinets. See Construction Supervisor for details.

8. Make sure the sides of the base cabinet are aligned with the upper cabinet sides and install per base cabinet instructions provided in Section 17.5.14.
9. Install the toe kick board to the base cabinet per Section 17.5.15.
10. Dry fit the countertop to the wall to determine if scribing and sanding the backsplash are required. If so, scribe and fit per Sections 17.6.3 and 17.6.4.
11. Turn the countertop over. Using 1¼” wafer-head screws, glue and screw 1x4 pine strips to the underside of the countertop that will mirror the locations of the corner blocks on the cabinets.
12. Install the countertop per Sections 17.7.3–17.7.5.
13. Install the shelves and doors and adjust hinges as needed to align door edges.

Chapter 18. Interior Doors

18.1 SWINGING DOORS

18.2 SLIDING DOORS

18.3 BIFOLD DOORS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Pencil

Tools and equipment needed:

Extension cord
Chop saw
Finish nailer
Drill driver
1/8" Drill bit
Sheetrock rasp
6' Level
Saw horses
Finish door kit

Materials needed:

1/4" Collated finish nails
2 1/2" Collated finish nails
1/4" Trim nails
2 1/2" Trim nails
1 1/2" Finish nails
2" Flathead screws
2 1/2" Wafer-head screws
3" Phillips brass-colored construction screws
Painter's tape
Tapered shims
1/8" & 1/4" 3"x5" Flat wood shims
Cardboard shims
Floor trim
Door trim
Doors
Door guides
Door hardware
1"x3/8" Door edge felt pads
3/4"x1/8" Door edge clear pads
Wood putty
Padding (e.g., cardboard)

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan

Safety First! Review the Safety Checklist before performing tasks in this chapter.

18.1. SWINGING DOORS

18.1.1. Door and Rough Opening Preparation

1. Before removing packaging and shipping parts, check door and frame for damage. If damaged, notify Construction Supervisor or Site Leader.
2. Verify correct door and size. Verify proper door swing according to the House Plan.

NOTE: Before starting the following steps, using a framing or carpenter's square, check the bottom of the hinge and strike side jack studs for excessive twist. If either is clearly out of square and is likely to cause difficulty in installing the door, replace the King/Jack stud pair with straight pieces.

3. The following Steps 4 and 5 are designed to reduce the difference between the width of the door frame and the width of the rough opening at the hinge locations to $\frac{3}{8}$ " or less. Doing so helps to
 - Center the door in the rough opening;
 - Avoid trying to install spacers and/or thick shims once the door is in place; and,
 - Equalize the overlap of the interior trim.
4. Adjust hinge side Jack stud.
 - a. Mark the location of the hinges on the hinge side Jack stud.
 - b. In all cases in this section, install 3"x5" flat shims (using 1½" finish nails or 1¼" collated finish nails) with their 5" dimension vertical.
 - c. Measure the width of the door frame at the head jamb and the width of the rough opening at the top and bottom hinge locations.
 - i. If the difference between the door frame and the rough opening at either location is LESS THAN OR EQUAL to $\frac{5}{8}$ " add a $\frac{1}{8}$ " 3"x5" flat shim to all three hinge locations. Go to Step d below.
 - ii. If the difference between the door frame and the rough opening at either location is GREATER than $\frac{5}{8}$ ", attach a combination of $\frac{1}{8}$ " and $\frac{1}{4}$ " 3"x5" flat shims to the hinge side Jack stud at the top and bottom hinge locations until the difference is less than $\frac{5}{8}$ " at both locations. At a minimum, each Jack stud hinge location should have a $\frac{1}{8}$ " flat shim.
 - d. Using a 6' level, check if the Jack stud is plumb. If NOT PLUMB, shim the top or bottom hinge areas until it is plumb.

- e. Keeping the 6' level against the top and bottom spacers, attach 1/8" and 1/4" 3"x5" **flat shims** and/or **tapered** shims at the middle hinge area until flush with the level.
5. Adjust strike side Jack stud.
 - a. Add a combination of 1/8" and 1/4" 3"x5" **flat shims** to the strike side Jack stud at the top and bottom hinge locations until the difference in the opening width is less than 3/8" at both locations.
 - b. Place the 6' level against the **flat shims** and install a combination of 1/8" and 1/4" 3"x5" **flat shims** and/or **tapered** shims at the middle hinge area until flush with the level.

18.1.2. Position and Temporarily Secure Door in Opening

1. Set door into the rough opening, tight to the hinge side Jack stud. If in a carpeted area (see the House Plan), insert a piece of 3/8" scrap floor trim under each side jamb; otherwise, set the jambs directly on the **hard** flooring.
2. Center the hinge side jamb between both wall surfaces.
3. Temporarily secure the door in the rough opening by installing **tapered** shims at the very top of the strike jamb (even with the head jamb). Wedge these shims in TIGHTLY (do NOT nail so they can be adjusted later).

NOTE: This process is designed to apply horizontal pressure to hold the top of the hinge jamb tight against the hinge side Jack stud. The top of the door may rub on the strike jamb at this stage but this is normal and will be corrected later.

4. Check the reveal between the top of the door and the head jamb at the left and right corners of the door. If necessary, shim under the strike jamb or hinge jamb until these reveals are equal.
5. Recheck that the hinge side is still plumb (set level on hinges or hinge plates).
6. Verify that the bottom of the hinge jamb is still centered between wall surfaces, add appropriate **flat and/or tapered** shims at the bottom of the jamb, and **temporarily** secure it with one 2 1/2" collated finish nail just above the shims. Do the same for the strike side jamb. This will help to hold the bottom of the side jambs in place for the remainder of the installation but can still be easily moved if necessary.
7. Close the door to check contact with the doorstop. If the gap between the door and door stop is >1/4" see the Construction Supervisor. Otherwise, adjust the top and/or bottom of the strike side jamb to get good contact before nailing the hinge jamb.

18.1.3. Permanently Secure Door

1. With the door still held tight to the hinge side Jack stud, secure the hinge side jamb with one 2½” collated finish nail at the top, middle, and bottom hinges.
2. Check that the hinge side of the door is still plumb. Adjust shims as needed.
3. At the top door hinge, replace the screw closest to the doorstop with a #8 3” construction screw (brass-colored) to secure the top hinge to the Jack stud and ensure the door does not sag over time.

NOTE: Tightness of the 3” brass screw in the top hinge can affect the reveals at either end of the head jamb. Tighten or loosen the screw and/or adjust shims as needed. Or, adjust the strike side jamb up or down as needed.

4. Check complete door operation and verify that contact between the door and the doorstop is consistent (no gaps or light visible) along the head jamb and the strike jamb. It may be necessary to adjust one or both side jambs from the centered position (a maximum of ⅛” past or shy of the wall surface). Confirm that latch and strike are aligned.
5. Check the reveal on the top and the bottom of the hinge jamb. If necessary, adjust the shims against the head jamb until the top hinge jamb reveal matches the reveal just below the top hinge. If necessary, adjust and shim the bottom of the hinge jamb to match the reveal at the top. Shim as needed and secure with a 2½” collated finish nail on one side of the doorstop.

NOTE: Adjusting the reveal at the top of the hinge jamb will affect the reveal at the top of the strike jamb. Check to be sure the reveal at the top of the strike jamb is ⅛” or greater. If not, it may be necessary to “split the difference.”

6. Check the reveal at the top and the bottom of the strike jamb. If necessary, adjust and shim at the bottom of the strike jamb until there is a consistent reveal at both locations.
7. While keeping consistent reveals top to bottom, install all remaining shims (nailing with 2½” collated finish nails on the same side of the doorstop) in the following strike side locations: across from the top and bottom hinges and above the door latch location.
8. Install shims in the center of the head jamb, adjusting for a consistent reveal across the jamb. Secure the jamb with a 2½” collated finish nail on one side of the doorstop.

9. Recheck the complete door operation, making sure that contact with the doorstop remains consistent (no gaps or light visible) along the head jamb and the strike jamb. Adjust as needed by:
 - lightly tapping on a ¼” flat shim placed on the edge of the jambs until proper door-to-doorstop contact (try to keep jambs ⅛” or less past or short of the plaster); or,
 - tapping the doorstop with a ¼” flat shim until proper door-doorstop contact (limit moving the doorstop to ⅛”) and re-nailing as needed; or,
 - removing the doorstop, closing the door, and re-installing the doorstop until proper door-to-doorstop contact (a last resort option).
10. To ensure consistent reveals along the side jambs, install additional shims on the hinge side, about halfway between the hinges and similarly on the strike side. This should result in six sets of shims on each side jamb. Secure the jambs with 2½” collated finish nails on one side of the doorstop.
11. Finish securing the door on all three jambs at each shim location by putting a 2½” collated finish nail into the jamb along the opposite side of the doorstop.
12. Conduct a final verification of the complete door operation ensuring there is uniform contact with the doorstop and all reveals are consistent. Adjust as needed.
13. Set and putty all nail holes.

18.1.4. Install Door Trim

1. Pre-cut door trim is provided for interior doors. Uncut trim is provided for exterior doors and must be field-cut to fit. Refer to the House Plan to see if the door is over carpeting or over a finished floor.
2. Check wall thickness vs. doorjamb thickness. If the wall is thicker, trim or scrape plaster with a utility knife or rasp so door trim will fit tight to both the door jamb and the plaster.
3. For exterior doors, miter-cut top pieces to extend about 3/16” past each corner of the door jamb. For all doors, cut side pieces to fit.
4. If the door is over a carpeted area, keep the trim off the floor with a piece of ⅜” floor trim. If the door is over finished flooring, cut the trim to be tight to the floor.
5. Door trim **MUST** be tight to the jamb. Before nailing, hold the trim piece in place and check the inside edge. If it is tight the **ENTIRE** length, push the outside edge tight to the wall. If the inside edge stays tight to the jamb, proceed with nailing. If the trim rocks back and forth and the inside edge does not stay tight to the jamb,

chip away or hammer the plaster until the trim is TIGHT against the jamb and the plaster.

6. Door trim is usually delivered in separate pieces. A primary objective during installation is to achieve a uniform reveal between the door jamb and the edge of each trim piece - typically, about 3/16".

NOTE: If trim is delivered preassembled (glued and screwed at the corners), be sure that jamb-to-trim reveals are consistent on all three sides before nailing.

7. Cut two pieces of scrap left- and right-side door trim, about 6-12" in length. Using painter's tape, tape each piece along the respective side jambs with a 3/16" reveal with the jamb and with the inside miter joint corner about 3/16" above the corner of the jambs.
8. Set the top trim piece in place above the top jamb and with the ends tight to the side pieces. If necessary, adjust the two side pieces left or right, up or down until all reveals with the door jambs are equal and the miter corners are tight
9. Using a 2½" collated finish nail, attach one end of the top trim to the header, placing the nail about 2" from the end and one-third of the way down from the top edge. Repeat at the other end. Angle the nails slightly up to ensure hitting the header.
10. Remove the two scrap pieces and install the side trim butted to the mitered top trim, maintaining a tight miter joint and consistent reveal from top to bottom.
 - a. If the side trim is too long and the miter joint is good, turn the side trim upside down and mark where it meets the top edge of the top trim; cut the side trim to that length.
 - b. Test for proper length and for a tight miter joint. Trim either if needed.
 - c. Apply glue to the mitered joint and attach side trim using five 2½" collated finish nails evenly spaced top to bottom (be sure the top and bottom nails are at least 2" away from the end and all are about one-third of the way from the outside edge of the trim). Angle the nails slightly outward to ensure hitting the Jack stud.
11. Finish securing the top trim by installing a 2½" collated finish nail at the center, about one-third of the way down from the top edge.

12. Recheck that the entire length of the inside edge of each trim piece is tight to the jamb. If not, at any loose spots hold the inside edge tight to the jamb, angle a 2½” collated finish nail from the center of the trim piece, away from the jamb into the Jack stud.

NOTE: Do not attempt to drive collated nails into the edge of the jamb (this is likely to split the trim). If necessary, pre-drill pilot holes through the trim piece only with a 2½” trim nail and hand nail with 1¼” trim nails to ensure being tight to the jamb.

13. Set nails as needed and fill with putty.
14. For exterior doors, follow the same procedure as for interior door trim.

18.1.5. Install Door Hardware

1. Install lockset, verify door lockset operation and adjust as needed. Lockset should operate easily and door should rest against entire doorstop and latch snugly with no play. If the door does not latch snugly, bend the tab inside the strike plate with a flat-blade screwdriver until it does. (In the worst case, the strike plate may have to be moved toward the door stop.)
2. For interior doors that will swing against a wall at 90°, install a door bumper where the door handle will hit the wall. To locate this spot, rub the center of the doorknob with a red crayon, press the doorknob against the wall, and turn the knob to mark the wall. Center the door bumper on this mark and install with the screw and anchor provided with the bumper (if not hitting a stud or blocking). If hitting a stud or blocking, simply anchor with the screw provided.
3. For both exterior doors and any interior doors that will not hit a wall at 90°, install hinge stop bumper - one in the middle hinge of interior doors and one in the top and bottom hinges of exterior doors

18.2. SLIDING DOORS

18.2.1. Door and Opening Preparation

1. Before removing packaging and shipping parts, check doors and frame for damage. If damaged, notify the Site Leader or Construction Supervisor.
2. Select a pair of doors that match in visual appearance (grain pattern, grain direction, color, etc.). Check to see if the doors have been predrilled for door pulls. If they have, pairs will have holes approximately 36” from the bottom of the door and on opposite edges.
3. Put the two doors together (surface to surface) and check for crown. Install with the concave faces together and with the best side facing toward the room.

4. Before installing the door track, confirm that the door height is 80" and that the rough opening height is ~83" (82" Jack height + 1½" bottom plate - ½" sheetrock thickness).
5. Check that the header is level. If not level by more than ⅛", consult with the Site Leader or Construction Supervisor.
6. Use a 6' level to check the Jack stud and the flush closet wall for plumb or gaps. If either is out of plumb by more than ⅛" or any gap exceeds ½", consult with the Site Leader or Construction Supervisor.
7. Install the track 2" back from the room side wall surface with the track roller guides facing the rear of the closet. Attach with only three 2½" wafer-head screws (one at each end and one in the middle), in case the track has to be lowered later to achieve the proper gap at the floor.

18.2.2. Install Door Hardware

1. Do not lean the doors against the wall to install hangers or door pulls. Instead, set up saw horses with padding (e.g., cardboard) and lay the doors on them for installation of door hardware.
2. Install the door pulls in the pre-drilled holes. If holes are not pre-drilled, install the door pulls 36" above the bottom of the door and 1½" from the edge. Drill the hole with a ¾" Forstner bit to the depth of the bit. Protect the pull with a piece of wood (e.g., a flat or tapered wood shim) and hammer it tightly into the hole.

NOTE: When deciding on which edge of the doors to install the door pulls, remember that the doors will be positioned so the overlapping edge of the front door is not visible when entering the room. Install the pulls at the door edges closest to the walls.

3. Turn the doors over. Attach the hangers on the top of each door so there is a 2" gap between the edge of the hanger and the vertical edge of the doors. The hangers with the deep offset are for the rear door; those with the shallow offset are for the front door (see Figure 18-1). Using two screws supplied with the sliding door kit, attach each hanger with one screw in the swivel hole and one at the top of the long curve (a third screw will be installed in the small, center slot later). This will result in the door hanging at its upper limit (see Figure 18-2).

WARNING: Do not use an impact driver when installing or loosening hanger screws in this or any of the following steps.



Figure 18-1. Sliding Door Hangers.

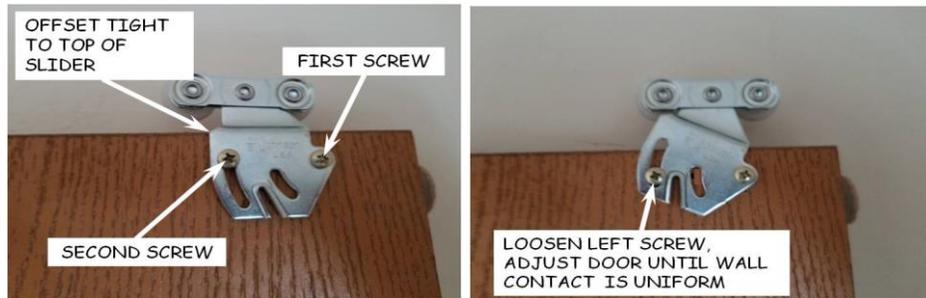


Figure 18-2. Closet Door Hanger Screw Locations.

18.2.3. Hang the Door

1. Hang the doors on the track. Starting with the rear door, tilt the top of the door into the closet and engage the rollers in the roller guide at the back of the track. Repeat with the front door and engage the rollers in the guide inside the front of the track.
2. Close the doors. At the middle of each door, measure the gap from the bottom of the doors to the floor.
 - a. For doors over future carpeting, the gap from the bottom of the door to the subfloor should be 1"-1³/₈".
 - b. For doors over **hard** flooring, the gap from the bottom of the door to the installed flooring should be ³/₈"-⁵/₈". **If the hard flooring is not yet installed**, add ¹/₄" to the specified gap range to allow for the flooring thickness.
3. Loosen the screws in the long slots and adjust the doors up and down as necessary until the gap below the doors falls within specification and the door edges have uniform contact with the walls from top to bottom. If the floor trim has already been installed, go ahead and install the bumper pads as described in Section 18.2.4.6 below. Adjust the doors to provide bumper contact to the wall/trim.

NOTE: Before adjusting the doors, verify that the front and rear doors are not reversed but in their intended positions (i.e., door pulls are close to the walls not the door centers).

4. If the doors have been lowered to their lowest level and the gap is greater than the upper limit, remove the doors and the track and install a shim of appropriate thickness between the track and the header with 1¼” or 2½” collated finish nails.

NOTE: If cutting a track shim for doors over installed vinyl floors, target the shim thickness to provide a gap of ⅜” versus the allowable gap range of ⅜”-5⁄8”. If the finished floor has not yet been installed, target the shim thickness to provide a gap of 5⁄8”.

5. If the doors have been raised to their highest level and the gap is less than the lower limit, it will be necessary to cut off the bottom of the doors. See the Site Leader or Construction Supervisor for direction.
6. Verify that the bottom gap is still within specification and the contact between the door side edges and the wall is uniform top-to-bottom. If so, add the third screw to each hanger, in the bottom of the small, curved slot, and hand tighten all the screws (see Figure 18-3).

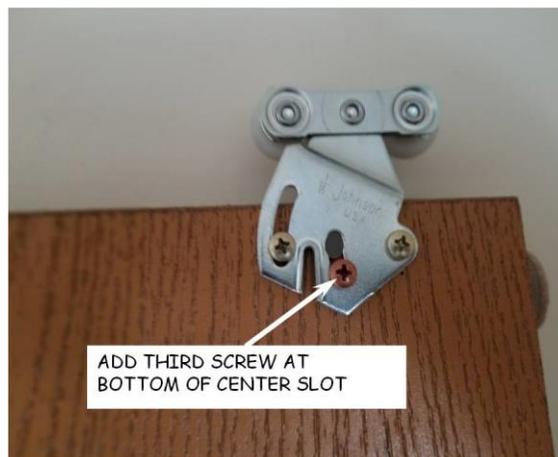


Figure 18-3. Closet Door Hanger with 3rd Screw Installed.

18.2.4. Finish Doorway Installation

1. Finish screwing the track to the header using 2½” wafer-head screws. One screw per every other hole is sufficient.
2. Cut a ¾”x1¼” pine strip. With the ¾” face against the track, install the strip along the front of track so trim can be attached. Nail this to the header with 2½” collated finish nails.
3. For doors installed over carpeted areas:
 - a. Measure the door opening and mark a pencil line on the floor at the midpoint of the opening.

- b. Slide two layers of $\frac{1}{4}$ " flat shims under the door edges at this center mark. Verify that the gap between the bottom of the door to the top of the shims at the middle of the door opening is between $\frac{3}{4}$ "- $\frac{7}{8}$ ". If adjustment is needed, use an appropriate mix of $\frac{1}{4}$ " and $\frac{1}{8}$ " flat shims.
- c. Create several sets of 5"x 6"-wide flat shims by taping together pairs of 3"x 5" flat shims with painter's tape. Create pairs of both $\frac{1}{8}$ " or $\frac{1}{4}$ " shims as dictated in Step b above. These shims will be used to support the door guide.
- d. Move the front door panel tight to the Jack stud end of the opening (non-flush side).
- e. Center the paired shims on the midpoint mark made in Step a. above. Orient the 5" dimension parallel to the doors.
- f. Locate the appropriate door guide from the Finish Door Kit. Do **NOT** use the guides supplied with the doors for carpeted areas.
- g. Adjust the door guide sliders to fit the doors. Slide the door guide under the door edges and roughly center it on the paired 3"x5" flat shims. Keep the guide centered on the shims and move the shims until the reveal between the door and the corner of the wall is uniform from top to bottom (see Figure 18-4).



Figure 18-4. Shim Adjustment for Uniform Door Reveal.

4. Door pulls should be installed at the same height as interior doorknobs and in the middle of the two inner panel fronts.
5. On 4-panel doors (two bi-fold doors opening in opposite directions), align the doors by moving the top or bottom pivot point.
6. Measure the width of the door opening, add 3" to that measurement, and cut a piece of floor trim that long. Place the bottom edge of the floor trim flush with the top edge of the door opening and centered so that 1½" of the floor trim extends horizontally beyond each door jamb. Using 2½" collated finish nails, attach the floor trim to the wall.
7. Set nails and putty.

Chapter 19. Interior Finish Work

- 19.1 INSTALLING FLOOR TRIM
- 19.2 INSTALLING CLOSET SHELVES AND POLES
- 19.3 INSTALLING BATHROOM ACCESSORIES
- 19.4 HANGING MINI-BLINDS
- 19.5 INSTALLING APPLIANCES
- 19.6 INSTALLING BASEMENT STAIR GRIP STRIPS
- 19.7 COMPLETING CAULKING
- 19.8 COMPLETING AIR SEALING
- 19.9 INSTALLING HVAC VENT COVERS
- 19.10 INSTALLING SCUTTLE COVER

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Materials needed:

Casing material
2½” Collated finish nails
Wood putty
White and clear finish caulk
Air sealing caulk
Wood glue
Construction adhesive
Air sealing tape
Flashing tape
Weatherstripping
Stair grip strips

Tools and equipment needed:

Extension cord
Chop saw
Coping saw
Oscillating saw
Finish nailer
Drill driver
6’ Level
Nail set
Caulk gun

Personal Protection Equipment:

Safety glasses (required)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

19.1. INSTALLING FLOOR TRIM

19.1.1. Preparation

1. Make sure all door trim has been installed.
2. If the studs are not marked on the floor, use an 8d finishing nail to locate one and then use a tape to locate the others at 24" o.c.
 - a. Start on one side of an electrical box, then the other side if no success. Alternatively, start about 23" from the intersection with an exterior wall, or under a window King stud.
 - b. On basement walls that are unfinished on one side, measure on the back side and transfer to the inside.
 - c. Drive the nail into the wall just below the level of the top of the floor trim (beware of steel posts in the basement).
 - d. If a stud cannot be located, do not nail above the bottom plate when installing trim.
3. Scrape away excess plaster on walls near the floor. Pay particular attention to inside corners.
4. In carpeted areas, hold floor trim off the floor the thickness of a scrap piece of floor trim ($\frac{3}{8}$ "). In areas with hard flooring, install floor trim directly on, and tight to, the finished flooring, making certain the trim contacts the floor along its entire length. Do not install trim that goes over hard flooring until the flooring has been installed.
5. Do not install floor trim in the kitchen or bathroom until cabinets have been installed.

19.1.2. General Installation Instructions

1. In each room, start by installing the floor trim on a wall with two inside corners and cut that piece with straight end cuts. Typically, this is the wall opposite the door. Plan the installation to avoid pieces that have both ends coped, or one end coped and the other beveled.
2. Floor trim should not be cut to fit around cold air return vents. Because return vent covers are installed sufficiently high above the floor, the trim will run under the return vent covers.

NOTE: If the trim does not fit under the cold air return vent cover, notify the Construction Supervisor and consider raising the cover if possible.

3. All inside corners must be coped and all outside corners must be mitered. Glue each outside mitered corner.
4. When a splice is required, cut matching 22.5° bevels arranged so the overlap is angled away from the main viewing area of the room with the underlapping piece falling 2” away from the edge of a stud. Nail the underlapping piece along its entire length into each stud. Glue the ends of the splice pieces, place the overlapping trim piece in position, and nail it directly into the stud. The overlapping piece should hold the underlap in position snugly. Clean any glue residue from the splice before it dries.
5. Make sure all nails are set and fill holes with putty.

19.1.3. Installing Floor Trim

1. Using 2½” collated finish nails, nail about 1” from the top of the floor trim into studs (24” o.c.). Nail into the bottom plate only if necessary. If nailing into the bottom plate, stay 1” above the bottom of the trim and angle the nail slightly downward to hit the plate.

NOTE: Do not nail square cut ends of floor trim at an inside corner. Cut the “coped” piece long enough to hold the square end tight to the wall. (This avoids splitting the square-end piece.)

2. When installing very short pieces, any nail may split the wood. Instead, use construction adhesive to hold a short piece in place.
3. When installing trim at a transition point from hard flooring to carpet, hold the trim tight to the hard flooring section and use a scrap piece of floor trim to hold the trim off the floor in the carpeted section. The depth of the hard flooring equals the thickness of the scrap piece of floor trim so the trim is equal height through the transition point. If a transition strip has been installed over the junction of the hard flooring and carpeted area, use a scrap piece of floor trim placed against the wall as a guide and use the oscillating saw to cut the transition strip away from the wall, making space for the trim to be installed.

19.1.4. Coping

1. Determine which end of trim needs to be coped based on the planning from Section 19.1.2.
2. Bevel cut - Using the chop saw, cut a 45° bevel on the end to be coped so that the back side of the trim is longer than the face side (see Figure 19-1).



Figure 19-1. Base Trim Bevel Cut.

3. Relief cut - Turn the trim piece so the bottom edge is up and the face side is toward the front of the saw. Set the saw at 15°. Align the saw blade at the intersection of the 45° beveled edge and the face of the trim (see Figure 19-2).



Figure 19-2. Relief Cut Alignment.

4. Cut down to the edge of the flat face (about ½” from the bottom) leaving the curved edge in place (see Figure 19-3).

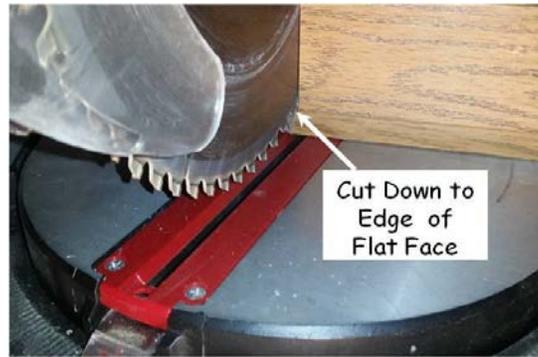


Figure 19-3. Relief Cut.

5. Coping saw cut - Hold the trim piece on a flat, stable surface. Use a coping saw with the narrowest blade and finest teeth spacing available. Hold the blade at about a 5° back angle (see Figure 19-4). Cut following the uncut, curved edge of the trim. Smooth as needed with a fine, half-round file.



Figure 19-4. Coping Saw Cut.

6. Align the coped trim end tightly against the square cut corner trim end (see Figure 19-5). Nail the coped trim piece. Do not nail the square cut trim piece. The coped end should hold the square cut trim piece in place snugly.



Figure 19-5. Finished Coped Joint.

19.2. INSTALLING CLOSET SHELVES AND POLES

19.2.1. Installing Clothes Closets

1. Determine the number of shelf brackets needed - typically, one bracket for each stud, except for any studs within 10" of a corner.
2. Make sure the angles of each bracket for a given closet are identical (i.e., they form the same angle between the wall and the shelf).
3. Cut the shelf and the clothes pole for length: $\frac{1}{4}$ " less than the wall dimension.
4. Starting with the two end brackets, mark the back wall 69 $\frac{1}{4}$ " from the floor to locate the top of the bracket. Using a small finishing nail at a spot that will be hidden by the shelf, verify the presence of blocking about 1" from each corner. Place the top of a bracket at the 69 $\frac{1}{4}$ " mark and mark the center of the top hole. (This will allow later adjustments to level the shelf.) Pre-drill and attach the bracket using a 2" white screw in this hole. Do not drive a screw into the bottom hole at this point.
5. The floor should be marked for location of other studs in the closet. If so, using a 6' level, locate and mark the stud locations 69 $\frac{1}{4}$ " above the floor. Using a small finishing nail, confirm the stud location just above these marks where it will be hidden by the shelf.

NOTE: If the floor is not marked, search for a stud by driving a finish nail into the wall along the floor. (Test at less than 2" above the floor so that any holes will be covered by the floor trim.) Once located, continue as above.

6. Stand the shelf on its long edge on the two corner brackets and against the back wall. Place a level on the top of the shelf and use this "straight edge" to adjust the two corner brackets for level. It can then be used to establish the height of the remaining bracket(s).

NOTE: In basement closets, the floor may not be sufficiently level at the back of the closet to allow the above procedure to work. Instead, mark both corners at 69 $\frac{1}{4}$ " but install only one bracket to start. Using two people, again stand the shelf on edge on that single bracket. Place the level on the shelf as above, hold the second bracket against the wall at the opposite end of the level, and adjust until the shelf is level. Mark and attach intermediate brackets as above.

7. Hold any additional brackets tight against the shelf edge where studs have been located and mark the center of the top hole in each bracket. Attach these additional bracket(s) using a 2" white screw in the middle of the top hole.

8. Lay the shelf down on all the brackets. Step back and look at the shelf to confirm that it is level (e.g., Is it parallel to the door header? Does it have any dips or rises?). Adjust bracket heights as needed and recheck.
9. Use a speed square (NOT a level) against the bottom of the shelf and the vertical edge of the bracket to ensure the bracket is vertical. Secure the bracket to the wall stud with a 2" white screw through the bottom hole of the bracket.
10. Use a speed square against the front edge of the shelf and along the side of the top edge of the bracket to ensure that the bracket is square to the wall/shelf. Secure the bracket to the shelf with two ¾" white screws.
11. Install the clothes pole with a ¾" white screw into the hole in the back side of each bracket. Be sure the "best" side of the pole is facing forward in order to hide any defects or blemishes on the pole.

19.2.2. Installing Linen Closet

1. Shelf heights and depths are specified in Table 19-1.

Table 19-1. Linen Closet Shelf Dimensions.

Height of Cleat (top)	Shelf Depth
24" (bottom shelf)	23"
40"	23"
56"	23"
72"	12"

2. Cut strips of 2" wide cleats from ¾" pine for both sides and back walls. Bevel the front corners of the side cleats to avoid catching linens, towels, etc.
3. Cut side cleats so they fit the full depth of the closet (ensuring overlap with a stud or blocking on both ends). Cut back cleats to fit snugly between installed side cleats.
4. Find location of side and back wall studs.
5. Measure and mark all cleat heights. Use a level to confirm that shelves will be level from front to back and across the front and back edges.
6. Install side cleats first to ensure they firmly catch the corner studs since these will carry the majority of the weight. Secure with one 2½" screw into each end.
7. Install the back cleat with one 2½" screw into each end. Be sure to drive the screw with enough of an angle to catch the stud.
8. Paint cleats to match wall color

9. Cut shelves for length and install. Do **not** nail the shelves to the cleats.

19.3. INSTALLING BATHROOM ACCESSORIES

1. All bathroom accessories should be fastened to previously installed blocking whenever possible. The location of bathroom accessories blocking is specified in Section 10.5.2 and should be indicated on the bathroom floor in black marker. Consult Construction Supervisor if blocking is not indicated.
2. **Towel Bars:** Install the short (18") towel bar 52" above the floor on the wall alongside the vanity. If it is not possible to install alongside the vanity, the towel bar can be installed over the vanity countertop, on the side of the linen cabinet, 15" above the countertop. Install the long (24") towel bar next to the shower 52" above the floor. If it is not possible to install it next to the shower, it can be installed under the window, 3" below the window sill.
3. **Toilet Paper Holder:** Install the toilet paper holder on the wall next to the toilet so the top of the holder is 24" above the floor with the center of the holder 32" out from the wall behind the toilet.
4. **Mirror:** Center the mirror over the vanity with the bottom of the mirror 2" above the counter back splash. Position the short sides of the mirror at the top and bottom. Fasten the mirror using three plastic support clips at both the top and bottom of the mirror.
5. **Grab Bars:** Check with the Construction Supervisor whether grab bars are to be installed. If yes, install them adjacent to the shower and toilet, each positioned 33" above the floor (see the House Plan for the size and specific location of the bars).
6. **Bathrobe Holder:** Install the bathrobe holder at the end of the tub wall, 65" above the floor.
7. **Shower Curtain:** Install shower curtain rod.

19.4. HANGING MINI-BLINDS

1. Create a template from a piece of 3"x5" cardboard as shown in Figure 19-6.

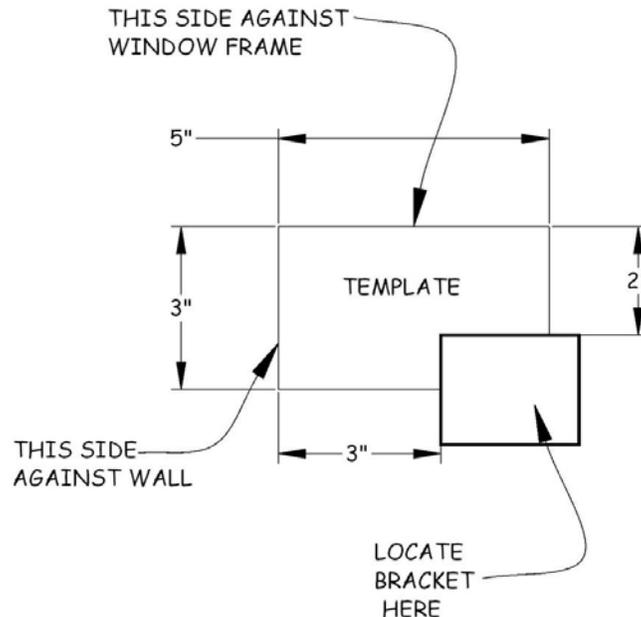


Figure 19-6. Miniblind Installation Guide.

2. Hold the template against the top of the window frame (against the header) and install the blind mounting brackets on each side of the window as shown in Figure 19-6. For cordless mini blinds, adjust the mounting brackets left or right to avoid interfering with the mini blind's raise/lower mechanism
3. Install mini blind by snapping it into the brackets, being sure to center the mini blind in the opening. Secure by tightening the bottom screw to "clamp" the mini blind into the bracket.

19.5. INSTALLING APPLIANCES

1. When sliding appliances into position, be very careful not to mar the floor.
2. Remove the stove from its shipping container. Install the anti-tip equipment per the manufacturer's directions found in the container. Plug in the power cord and slide the stove into position between the kitchen cabinets, being sure to engage the anti-tip equipment. If necessary, adjust the leveling legs so the appliance is level side-to-side and front-to-back, and flush with the counter top.
3. Remove the refrigerator from its shipping container. Install shelving and clean the outside of the appliance. Plug in the power cord and slide the refrigerator into position between the kitchen cabinets. If necessary, adjust the leveling legs so the appliance is level side-to-side and slightly elevated in the front so the door swings.

19.6. INSTALLING BASEMENT STAIR GRIP STRIPS

1. If the basement is unfinished there will be no flooring on the stair treads. Instead, install a grip strip to each stair. Consult the Site Leader or Construction Supervisor for installation instructions.

19.7. COMPLETING CAULKING

1. Cut only a small opening in the caulk tube and take care not to apply too much caulk. Clean up any excess caulk immediately (acrylic/latex with wet rag, silicone with mineral spirits).
2. Make sure all surfaces to be contacted by caulk are clean and dry. Remove all plaster, paint, dust, etc.
3. Caulk all around each window frame where it meets the plaster with white finish caulk.
4. Caulk all around the shower/tub frame where it meets the plaster with white finish caulk.
5. Caulk around all countertops, in both kitchen and bathrooms, where they meet a wall or cabinet. Use white finish caulk against a wall and clear finish caulk against a cabinet. Keep the caulk to about 1/8" on both the counter back splash and the wall.

19.8. COMPLETING AIR SEALING

1. Verify that all the following air sealing has been completed. If not, complete it as per the instructions in Section 12.3.
2. Seal gaps around the top and sides of cold air return boot and duct joints with flashing tape.
3. Seal gaps between cold air return frames and plaster with air sealing caulk. If needed, use a putty knife to push the caulk into the gaps and smooth the caulk flush to the wall or ceiling surface. See Figure 19-7.



Figure 19-7. Sealing Plaster Gaps Around Cold Air Returns

4. Seal gaps around basement ceiling heat ducts and plaster with air sealing caulk.
5. Caulk all holes around electrical boxes on the main floor with air sealing caulk. Uncoil wires from inside the box and caulk wire holes from inside.
6. Using air sealing caulk or spray foam, fill all penetration areas around the sill box where foam was fully or partially cut out. This must be completed after all sub-contractor work is done.

19.9. INSTALLING HVAC VENT COVERS

1. Before installing HVAC vent covers on cold air returns and basement ceiling warm air registers be sure all air sealing in Section 19.8 has been completed. Main floor warm air vent covers will be installed after carpeting has been installed.
2. Verify openings for cold air return vent covers are the correct size and covers will fit. Clear any plaster that prevents cold air return vent covers from lying flat against the wall. Reshape the metal, if needed. Cold air return vent covers should sit on top of floor trim as shown in Figure 19-8. If the floor trim has not been installed, use a scrap piece of trim to determine the height of the cold air return vent covers. The vent cover should fully cover the opening; if it does not, notify the Construction Supervisor.



Figure 19-8. Positioning Cold Air Return Vent Covers.

3. Verify openings for basement ceiling heat vent covers are the correct size and the covers will fit properly. Clear any plaster that prevents the covers from fitting flat against the ceiling. Make sure air flow adjusters operate easily.
4. Install HVAC vent covers using the provided installation screws being sure the screws go into studs or blocking.

19.10. INSTALLING SCUTTLE COVER

1. Verify the scuttle cover has been assembled and finished. If not, complete per the instructions in Sections [7.6.3](#) and 13.6. There should be two sections for the cover: the bottom piece (consisting of sheetrock, OSB, foam, and poly) and the top piece (consisting of foam and poly only). If the piece with the sheetrock has not been painted, paint it the same color as the ceiling.
2. Trim and smooth the ceiling rock and plaster flush with the top of the 2x4 framing of the scuttle opening. Clean the 2x4 framing in preparation for weatherstripping. Install two rows of weatherstripping all around the top edge of the 2x4 scuttle box framing. The first row should be flush with the side of the frame and the second row about ½” away from the first. Make sure there are no gaps in the weather stripping where pieces meet or at corners where pieces meet. This needs to be tightly air sealed.
3. Place the two sections of the scuttle cover into the attic (the two sections are too large to be installed into the attic as one piece). Place the top piece (poly and foamboard only) on top of the bottom piece (sheetrock, OSB, foam and poly) making sure the sheetrock is at the very bottom. Tape all four sides together using air sealing tape. Set the cover onto the frame and weatherstripping as one unit so the attic opening is sealed.
4. Install trim around the edges of the scuttle hole.
 - a. Cut ¼”x ¾” cabinet trim to fit around the upper scuttle hole edge. Position the rounded bull nose of the trim downward. Cope corners as needed.
 - b. Position trim against the scuttle cover (do not move scuttle cover) and nail to the edge of the opening, NOT to the scuttle cover itself, using 2½” collated finish nails. Set all nails and fill with putty.

Chapter 20. Exterior Finish Work

- 20.1 INSTALLING STORM DOORS
- 20.2 INSTALLING TOE KICK BOARD
- 20.3 INSTALLING PORCH RAILS
- 20.4 INSTALLING HOUSE NUMBERS
- 20.5 INSTALLING MAILBOX
- 20.6 AIR SEALING EXTERIOR PENETRATIONS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Pencil

Materials needed:

Toe kick
3" [Sheetrock](#) screws
2½" #7 Trim screws
16d Galvanized casing nails
1¼" Finish nails
2½" Collated finish nails
OSB scrap
White finish caulk
[Tapered](#) shims
[¼"x1" Flat wood shims](#)
4x4 Treated lumber
4x4 Post stake
Mailbox kit
House numbers
House number board
Mailbox numbers (if curbside mailbox)

Tools and equipment needed:

Extension cord
Chop saw
Drill and bits
Finish nailer
Caulk gun
Sledge hammer
2' Level

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan

Safety First! Review the Safety Checklist before performing tasks in this chapter.

20.1. INSTALLING STORM DOORS

1. Review the House Plan and consult with the Construction Supervisor to determine door swing. The following structural features should be considered, in order of decreasing priority, when establishing the door swing: location of the mailbox (if mounted on the house); locating the hinge side on the south or west side of the rough opening; location of the porch railing; the sidewalk approach; and, at the back door, the location of the light fixture.
2. Check the picture on each door label. If one has more aesthetic features, install it on the front door.
3. Confirm there are five casing nails through the brickmold into the Jack wall studs on each side of the exterior door.

NOTE: The weight of the storm door assembly can cause the brickmold of the exterior door to pull away.

4. Lay the packaged storm door on saw horses with the inside of the door facing up. Cut around the perimeter of the box and remove the door from the box. Check the door for damage and that all parts are present. (Save the box for later use as a carpet cover.)
5. Measure the opening between brickmold at top, middle, and bottom of the door. Average the three values.
6. Refer to the Larsen Door instruction step 1 to determine if flat wood shims will be required to match the door to this separation.
7. If necessary, obtain strips of 1/4"x1" flat wood shims from the construction trailer for use between the storm door frame and the brickmold to close this separation.
8. To begin, install shims on the hinge side with trim nails. Make sure the shims are flush with the outside of the brickmold so they are not visible from inside after the storm door is installed.
9. Carefully follow steps 2 through 4c in the Larsen Door instructions. Temporarily tack or hold the strike side rail in place on the strike side, close the door carefully, and determine the need for shims on the strike side of the door. If needed, install shims with trim nails.

NOTE: If the 1/4" strips are too thick, or not thick enough, rip 3/4" wide strips of the desired thickness from the edge of a 1x pine board.

10. Follow the remaining Larsen Door instructions.

11. Before installing the door top rail, place a bead of finish caulk on the back side of the channel.

NOTE: This prevents water from getting between the storm door and the brickmold

12. Install the wind chain by attaching the head jamb chain bracket 19" from the storm door hinge side jamb and the storm door chain bracket 18" from the storm door hinge side jamb (see Figure 20-1; note the orientation of the brackets). Use a small duplex nail located 3" from the hinge side jamb to attach the wind spring (this dimension can be adjusted to ensure the chains are "taut" and stay above the top edge of the upper window thereby concealing the chain from the exterior when the storm door is closed). If a wind chain is not provided by Larsen, check the trailer for one and follow the directions included.



Figure 20-1. Storm Door Wind Chain.

20.2. INSTALLING TOE KICK BOARD

20.2.1. Background

1. The purpose of this installation is to (1) support the door threshold and (2) to trim out the area under the door. The standard exterior door threshold overhang measures 2" ($\pm 1/4$ ", depending on the door install) from foamboard to the outside edge of door threshold. This installation assumes the 1" foamboard is in place over the rim board and behind the concrete porch (if not, install and thoroughly apply finish caulk to all seams).

20.2.2. Install Filler Piece

1. Remove the temporary threshold support piece.
2. Use a ¾” piece of OSB decking material (preferred) or two layers of ½” OSB for the filler piece.
3. Measure the length from outside to outside of the brickmold and subtract 2”. Measure the width (height) from the top of the concrete to the bottom of the brickmold and subtract 1”. Cut the OSB to these dimensions.

NOTE: It is very important to keep this OSB a minimum of 1” off the concrete so it doesn’t absorb moisture and swell or decay.

4. Install the OSB tight to the underside of the threshold (for proper support) using eight 3” sheetrock screws evenly spaced across the top and bottom of the OSB.

20.2.3. Install Toe Kick Trim

1. Measure the distance between the two J-channels next to the vertical pieces of the brickmold. Cut the toe kick board material to that length.
2. Measure the width (height) from the top of the concrete to the bottom of the brickmold. Check both ends for any variation in dimensions. Subtract ⅛” from the measurement at each end and, on the grain-finished face of the board, mark and connect the points. Cut the board to this width, tapering the cut as required. This reduced dimension allows the toe kick to be positioned with a ⅛” gap at the bottom so it is easier to install and not tight to the concrete.
3. On the face of the OSB installed in Section 20.2.2.4, apply a bead of construction adhesive around the perimeter (holding the bead 1” back from each edge) and from corner to corner (forming an “X”). Attach the toe kick board with the GRAIN-FINISHED FACE OUT to the OSB using six 2½” collated finish nails. Nail through the area where the OSB is located, remembering that the OSB is 1” up from the concrete and 1” short on each end.

20.3. INSTALLING PORCH RAILS

1. Separate porch rail components from the stretch wrap and arrange them into groups according to where they will be installed. Verify that the number of spindles equals the number of holes in the bottom set of porch rails, and that the rail lengths are correct for each side.
2. Install the front bottom railing by first placing a short piece of 2x4 spacer next to each post with their 3½” faces positioned vertically. Slide attachment sleeves onto each end of the railing and place the railing on the spacer blocks. The porch concrete may be

- pitched, so step away from the porch and, by sight, check that the bottom rail is aligned with the siding. Shim on top of the 2x4 spacers as required.
3. With the sleeve centered on the post, drill pilot holes and attach each sleeve to the porch post using four long, white-headed, square drive screws provided in the railing kit.
 4. Insert the spindles along the length of the railing.
 5. Slide attachment sleeves onto each end of the top railing. Position the top railing so each spindle slides completely into the corresponding slot on the railing. Confirm the top railing is parallel to the siding by sighting from in front of the house. Then, repeat Step 3 to anchor the top railing to the porch post.
 6. Install one bottom side railing by first placing one short piece of 2x4 spacer (3½” face positioned vertically) next to the front post. Place two short pieces of 2x4 spacers (1½” faces positioned vertically) next to the siding. Slide attachment sleeves onto each end of the railing and place the railing on the spacer blocks.
 7. Using shims, adjust the height of the railing next to the house siding until it is level. If there is siding on the opposite end, sight along the bottom rail to verify it aligns with the siding. Verify that the railing is parallel to the edge of the porch concrete. Then, attach the rear sleeve to the house using four long, white-headed, square drive screws provided in the railing kit. Do not drive screws so tight as to distort the vinyl siding.
 8. Drill pilot holes and attach the front sleeve to the porch post using four long, white-headed, square drive screws provided in the railing kit.
 9. Insert the spindles along the length of the railing.
 10. Slide attachment sleeves onto each end of the top railing. Position the top railing so each spindle slides completely into the corresponding slot on the railing. Confirm the railing is level. Then, attach the railing sleeves to the porch post and the house using four long, white-headed, square drive screws provided in the railing kit.
 11. Repeat Steps 6-10 for the railing on the other side of the porch.
 12. If the kit contains plugs, install the plugs over each screw. Match the mark on the plug to the mark on the collar.

20.4. INSTALLING HOUSE NUMBERS

20.4.1. Installing House Numbers Directly on a Porch Post

1. Verify the house number from the elevation page of the House Plan.
2. If a house number board is not being used, install house numbers directly on one of the two porch posts forming the entrance to the porch. Arrange the numbers so they are equally staggered vertically and horizontally on the post.

3. Install the first digit so that its top edge is 70” above the surface of the porch. Install additional numbers below the first about 1” apart.
4. For each nail hole on the number, drill a pilot hole through the vinyl sheath of the post. Attach the number to the post using 1¼” finish nails supplied with the house numbers.
5. Repeat for each of the remaining numbers.

20.4.2. Installing Board Mounted House Numbers

1. Verify the house number from the elevation page of the House Plan.
2. House number boards are available in two colors – white and sand/tan. Consult with the homeowner or the Construction Supervisor to determine which color to use.
3. Consult with the Construction Supervisor to determine where the board will be installed. Typically, it is installed horizontally on the wall closest to the street. If this is a garage wall, center the board between the garage door and the garage corner. If this is a house wall, look for the location of blocking indicated on the floor inside the house in black marker. If the porch posts are 6” wide, it can be installed vertically on one of the porch posts.
4. Attach the numbers to the board using 1¼” finish nails supplied with the house numbers (see Figure 20-2). For a horizontal orientation, arrange the numbers so they are centered horizontally and vertically and equally spaced. For a vertical orientation, arrange the numbers so they are equally staggered vertically and horizontally.

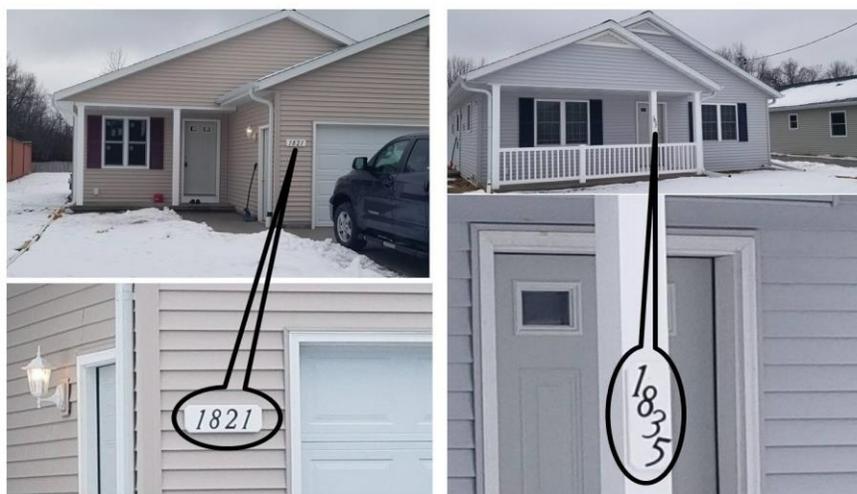


Figure 20-2. House Numbers Installed on a Board.

5. Make a mark 1” in from each short edge of the board and centered between the two long edges of the board. Carefully start a 2½” #7 trim screw at each mark.

6. Position the board so its top edge is 70" above the surface of the porch or driveway. Attach the board to post or wall by driving the screws until they countersink about $\frac{1}{8}$ ".
7. Cover the screw heads with white finish caulk.

20.5. INSTALLING MAILBOX

20.5.1. Installing House Mailbox

1. If the mailbox is being attached to the siding, first determine where the blocking is located by looking for indications on the inside floor in black marker (typically, on the latch side of the storm door). Position the mailbox so its topmost edge is slightly above the siding butt lock or center butt roughly 43" above the concrete porch. Mark the mailbox attachment points on the siding. At each mark, drive a $2\frac{1}{2}$ " screw through the vinyl siding into the OSB behind the siding. Hang the mailbox on the screws and tighten them.

NOTE: US Postal Service regulation recommends the top of a mailbox be 41"-45" above the surface of the porch.

2. If the mailbox is being installed on the porch rail, be sure to position it near the front of the porch so it doesn't interfere with the opening of the storm door (and is convenient for the US Postal Service to deliver the mail). Position the mailbox so its topmost edge is flush with the top of the porch rail. Mark the mailbox attachment points on the vertical edge of the porch rail. Drill pilot holes into the railing and attach the mailbox (if available, use the self-threading screws used to assemble the railing).

20.5.2. Installing Curbside Mailbox

1. Proper mailbox placement is important for city crews as well as postal carriers. Snowplows, street sweepers and garbage trucks can damage mailboxes that extend over the road. Postal regulations state the mailbox (presumably the mailbox door) must be no more than 6-8" away from curb/street and the opening 41-45" above the surface of the road.
2. Cut a 36" length from a 48" piece of 4x4 treated lumber.
3. Insert the 12" drop from Step 2 into the sleeve of the 4x4 post stake. Position the post stake centered 24" back from the pavement or curb (street side). While checking for plumb, drive the post stake into the ground until the bottom of the 4x4 area of the post stake hits the ground.

NOTE: Using the scrap piece of 4x material protects the post stake from damage when driving it into the ground.

4. Remove the scrap piece of 4x4 and insert the 36" post cut in Step 2 into the sleeve of the stake. Tighten the clamp mechanism to secure the post to the stake, making sure the post is plumb, using shims if necessary (see Figure 20-3).



Figure 20-3. Installation of Mailbox Post.

5. Install mailbox per manufacturer's instructions.
6. Apply self-adhesive mailbox numbers to both sides of the mailbox. Install numbers with no gaps between them, horizontally positioned to reach the back of the mailbox, and vertically centered on the smooth surface of the mailbox side (see Figure 20-4).



Figure 20-4. Curbside Mailbox.

20.6. AIR SEALING EXTERIOR PENETRATIONS

1. Check all exterior penetrations, including water heater exhaust, furnace intake and exhaust, gas line, and sump pump. Completely seal any gaps with finish caulk.

Chapter 21. Final Finish Work

21.1 COMPLETING PUNCHLIST

21.2 CLEANING HOUSE

21.3 INSTALLING HVAC WARM AIR VENT COVERS

21.4 INSTALLING CLEAN FURNACE FILTER

21.5 FINISHING TOUCHES

Tools needed by volunteers:

Nail apron
Tape measure
Square
Utility knife
Pencil

Materials needed:

Air sealing caulk
1¼” Hard finish nails
Furnace filter
Paint
Wood putty
Cleaning supplies
Painter’s tape
Cardboard pieces

Tools and equipment needed:

6’ level
Caulk gun
Vacuum cleaner
Broom
Flashlight/trouble light

Personal Protection Equipment:

Safety glasses (required)

Safety First! Review the Safety Checklist before performing tasks in this chapter.

21.1. COMPLETING PUNCLIST

1. Consult with the homeowner, compile a punchlist, and address all outstanding items on the list.

21.2. CLEANING HOUSE

1. Remove window labels and wash windows. Install screens.
2. Clean shower and sinks.
3. Clean countertops.
4. Sweep basement floor.
5. Vacuum carpets.
6. Wipe up hard flooring.
7. Remove all scraps, cardboard, etc.
8. Clean off concrete slabs.

21.3. INSTALLING HVAC WARM AIR VENT COVERS

1. Check that proper air sealing has been done around all warm air registers as explained in Section 12.3.3.3.
2. Clear any debris from inside or around the register.
3. Replace any temporary vent covers with permanent covers. Make sure vent cover adjusters work easily.

21.4. INSTALLING CLEAN FURNACE FILTER

1. Mark the direction of the “air flow” on the furnace filter door (see Figure 21-1) to remind homeowners of the proper orientation for the filter when they subsequently replace it.



Figure 21-1. Furnace Air Flow Direction.

2. If there is a 1” thick “construction furnace filter” in place, remove it and replace it with a new 5” thick filter (if possible, show the homeowners how to do this and let them practice). Make sure the filter is installed with the proper air flow direction as shown on the side of the filter.

21.5. FINISHING TOUCHES

1. Re-hang doors removed for carpet installation.
2. Use paint to touch-up all marks on walls. Leave one gallon of touch-up paint for the homeowner.
3. Use a flashlight or trouble light to double check that all nails have been set and puttied.
4. Lay protective cardboard over flooring. Cover living room carpeting first, then hallways and into bedrooms. Cover hard flooring last, if there is available cardboard. Make sure all cardboard is dry before using.

Chapter 22. Shed Construction

- 22.1 BUILDING SHED FLOOR
- 22.2 BUILDING SHED WALLS
- 22.3 BUILDING SHED ROOF
- 22.4 ASSEMBLING SHED
- 22.5 FINISHING SHED

ARCHIVED CHAPTER

Volunteers for the affiliate no longer perform the tasks described in this chapter. Effective with the 2022 (Version 22.0) release of the Construction Manual, the contents of this chapter will no longer be included in the Manual.

The last complete version of this chapter can be found on the affiliate's website in the Archived Chapters section of the Construction Manual.

Chapter 23. Garage Construction

23.1 PREPARATION

23.2 ESTABLISHING CHALK LINES

23.3 MEASURING AND CUTTING WALL PLATES

23.4 MARKING STUD LOCATIONS ON GARAGE WALL PLATES

23.5 ERECTING GARAGE WALLS

23.6 STRAIGHTENING GARAGE WALLS

23.7 INSTALLING TOP PLATES AND SHEATHING WALLS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Pencil

Materials needed:

2x4 studs
4x9 x ½” OSB
16d nails
16d duplex nails
8d nails
¾” Collated nails
⅝” Collated nails
4” & 6” Timber screws
Concrete screws
Sill seal

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Saws-all
Drill driver
Framing nailer
6’ level
4’ level
Framing square
Pry bar
Concrete anchor kit
String line
Chalk line
Stepladder

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

Garage Plan
Plate Layout Drawing

Safety First! Review the Safety Checklist before performing tasks in this chapter.

23.1. **PREPARATION**

1. Garages are constructed with two “side” walls, one wall with an overhead door (the “OH door wall”), and one “back” wall, which is opposite the OH door wall.
2. Before the walls are erected, establish the length of the wall studs.
 - a. For a detached garage, use standard nominal 9’ 2x4 garage studs (104⁵/₈”).
 - b. For an attached garage, measure from the top of the upper plate of the house wall the top of the garage foundation curb. Do this at both locations where the garage meets the house. If the two measurements are not the same, split the difference. Subtract 4½” (1½” bottom plate, 1½” upper plate and 1½” for the top plate) and that will be the 2x4 stud length. The studs may need to be cut to proper length from 2x4 lumber.

NOTE: These measurements should be very close to 104⁵/₈”. If so, consider using the nominal 9’ garage studs instead of cutting other lumber (see Construction Supervisor for directions).

3. In attached garages, measure and record the height of the foundation curb at both the service door and overhead door locations (typically ~4”).
4. After establishing the stud lengths, prebuild the window and door components (see Section 23.5 for window and service door component instructions). In all cases, note that garage components are built with 2x4 rather than 2x6 lumber.

NOTE: Window King and Jack studs will all rest on the garage wall bottom plate. However, in attached garages with a foundation curb, the service door Jack studs must be treated, since they will rest on the garage floor.

5. Confirm that adequate 9’ studs and OSB sheathing are on site.
6. Measure the opening in the garage foundation curb or slab for the OH and service doors, and determine a plan to correct if necessary.

23.2. **ESTABLISHING CHALK LINES**

23.2.1. **Detached Garage**

1. At each of the four corners, measure in 3¼” from the outside of the foundation and make a mark. Using a square and a sharp pencil (in order to make future small corrections possible), create an initial intersecting corner mark (an “X”, 1-2” in length in each direction).
2. **Create a Rectangle.** With a long steel tape (and a helper), compare the lengths of the two side walls, and OH door and back walls by measuring between the initial

corner marks from Step 1 above. If opposite wall lengths differ by 1/8" OR MORE, adjust the corner marks to equalize the lengths by adding one-half the difference at each end of the shorter wall.

3. **Square the Rectangle.** Carefully measure the diagonals between the revised corner marks to check for square. If the diagonals differ by 1/8" OR MORE, adjust the corner marks at EACH end of the SHORT diagonal to lengthen the SIDE wall by one-half the difference. Re-check for square and adjust as needed.
4. Hold a string line between marks on each wall, and check that the concrete foundation is at most 3 1/2" outside of the string. If not, adjust the marks on that wall as required.
5. Once all four corner mark adjustments have been made, carefully re-measure the precise distances between the corner marks on all four walls. Adjust the marks as needed to ensure that opposing wall lengths differ by 1/8" or less. Using these final marks, snap chalk lines for all wall locations. Finally, spray all chalk lines with a clear varnish to protect them from the elements.

23.2.2. Attached Garage

23.2.2.1. Establishing Chalk Lines Before Building House Walls.

1. When the house exterior wall plate layout lines have been squared and snapped, refer to Figure 23-1. At points 2 and 3 on the house deck, measure 1/2" toward the edge of the deck and make marks. Tack 8d nails at the marks.

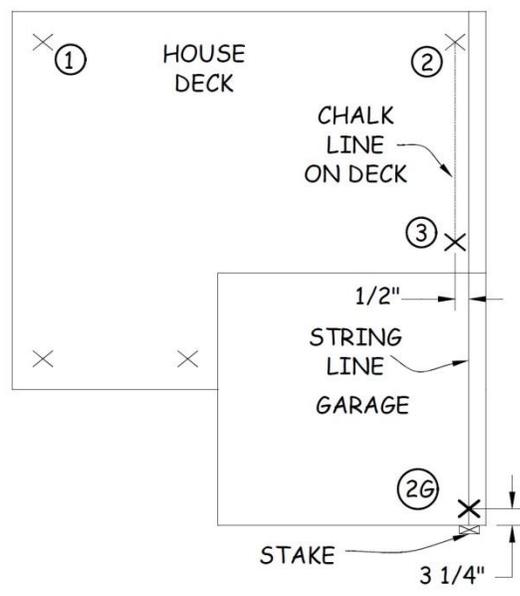


Figure 23-1. Garage Sill Plate Chalk Lines Prior to House Walls.

2. At the garage foundation, near where point 2G will be located, pound a stake into the ground next to the wall, centered about 5¼” from the corner. The top should be just above the elevation of the house deck.
3. Run a string line from Point 2 past Point 3 to the top of the stake, and adjust the stake-end of the string line so that the line just touches the nail at Point 3. Mark the top of the stake at the string line location, and then tack an 8d nail in the stake at the mark. Pull the line tight, and anchor it around the nail.
4. Using a framing square, locate and mark Point 2G on the garage foundation. Stand one leg of the square on the concrete, checking to be sure it’s level, then move the square to just touch the line with the vertical leg. Place a mark on the concrete at the corner of the square, 3¼” in from the front of the foundation. This is Point 2G.

23.2.2.2. Establishing Chalk Lines After Building House Walls.

1. If the house walls are built and erected before the garage wall bottom plate lines have been located and marked, use the following procedure to locate Point 2G.
2. At the wall common with the exterior house wall, determine the location of the outside of the house framing. Measure 5” in toward the garage interior and make a mark on the garage foundation where it touches the house wall (see detail in Figure 23-2). This establishes Point 1G. Measure from Point 1G to the outside of the curb, X in Figure 23-2. Establish Point 2G at the other end of the garage wall by measuring X” in from the outside of the curb, and 3¼” in from the front of the curb. Establish Points 3G and 4G as shown in Figure 23-2.

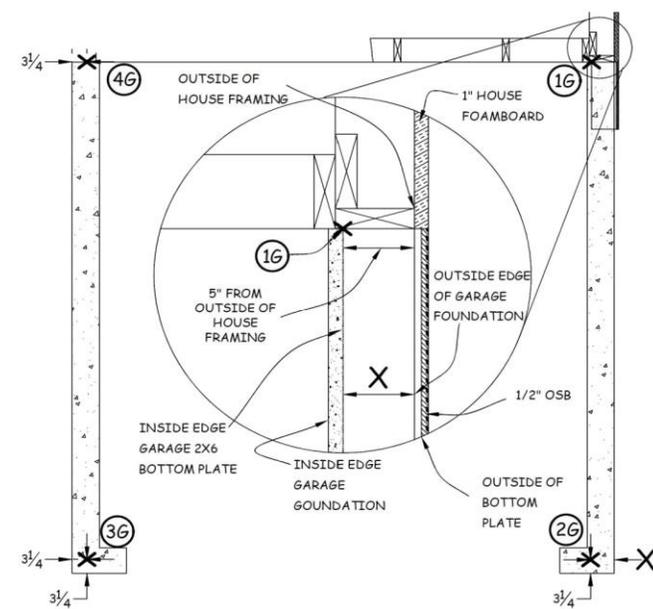


Figure 23-2. Garage Sill Plate Chalk Lines After House Walls.

3. Before squaring the garage wall, use a string line to check that the garage foundation is parallel to the house wall. Space the string line out from the house wall by tacking a 2x block to the house wall at Point 2, at the elevation of the bottom plate. Anchor the string line to the face of the block and stretch it toward Point 2G. With a helper, hold the Point 2G end such that the string is outside of Point 1G. Check that the string is 7½" from Point 2G. If it is not, consult with the Construction Supervisor to correct as required.
4. In a similar manner to that described in Section 23.2.1 for a detached garage, square the foundation. Using a long steel tape, measure between the marks of opposite walls and adjust to equalize. Then, measure the diagonals between the corners and adjust wall lengths to achieve a square foundation.
5. From those final marks on each corner snap chalk lines. Spray chalk lines with clear varnish to weatherproof.

23.3. MEASURING AND CUTTING WALL PLATES

1. Use treated 2x4s for garage bottom plates, except for the house/garage extended wall, where treated 2x6s are used. The two side walls will be the long walls - i.e., they will extend past the back and OH door walls. Cut bottom plate lengths as required to have at least two anchors in each plate. The side wall plates will extend past the OH door and back wall plates by 3½" at each end.
2. Use 2x4s for upper plates. Cut plates to required lengths so they end in the middle of a stud.

NOTE: In selecting pieces, use standard lengths of 8' to 16' wherever possible.

3. Position the bottom plate on top of the foundation and against the exterior sides of the anchor bolts. Ideally, the bottom plate should be oriented so that any crown is up and any edge with wane (an edge with insufficient wood) is either positioned up and to the inside of the foundation or down and to the outside of the foundation.
4. Using a speed square, mark the location of foundation bolt clearance holes by drawing two parallel lines on the sill plate representing the outside edges of a bolt (see Figure 1-3). Determine the distance from the chalk line to the center of the bolt. Measure that distance from the interior edge of the sill plate and draw a line between the two parallel lines.
5. Use a ¾" or ⅞" bit to drill clearance holes in the middle of the short line created in the previous step.

NOTE: The diameter of the clearance hole is larger than the bolt diameter in order to facilitate the correct positioning of the plates on the foundation.

6. After cutting the upper and bottom plates according to the Garage Plan, tack the plates together with 16d duplex nails and set them in location on the garage floor.

23.4. MARKING STUD LOCATIONS ON GARAGE WALL PLATES

23.4.1. Detached Garage

1. If the garage is attached, go to Section 23.4.2.
2. Lay out studs on the side walls first. Before marking the stud locations, check opposite walls to be sure they are the same length (within 1/8"). If not, trim to equalize. Both sets of side wall plates may be marked at the same time.
3. Starting at the front of the garage (where the OH door wall meets the side wall), lay out the side walls first. Stand the plates with their outside edges facing up and make layout marks on these edges. Hook a tape on the end of the plates at the front of the garage and mark the location of all wall studs on 24" centers.
4. Determine the approximate location of any window, or service door and mark one of the existing stud location marks as a King for one side of the window or door. Mark a Jack stud next to it, then mark a King/Jack pair the appropriate distance (the window width or door RO width) and write the window or door size on the bottom plate (e.g., 3030 Window, 3068 Service Door).
5. When laying out the back walls, start at one end but this time extend the tape measure 3½" beyond the end of the plate. This offset takes into account the 3½" width of the intersecting side wall plate. Place "X's" and "SX's" as appropriate.
6. The separation between the Jack studs (the "rough opening") for all windows equals the width of the window being located. The rough opening for the service door is 2½" wider than the door size. The first two digits in the window or service door code are the width in feet and inches, not inches.

EXAMPLE: A 3030 window is 3'-0" wide (not 30") wide; in this example, the rough opening between the Jack studs is 3'-0" or 36". For a 3068 service door, the rough opening is 3'-0" + 2½" = 36" + 2½" = 38½".
7. Label the King and Jack stud locations with "K" or "J" to specify the location of the pre-built window and door components during wall assembly.
8. Wherever 24" centers fall within a window or door, mark an "SX" to represent a short stud on the top and bottom plate above and below the window and on the top plate only for door openings.
9. Label the upper plate "Header Up" to specify that the window or service door header will lie above the deck while the wall is built. It will place the header flush with the outside of the wall when erected.
10. At each end of the side walls, lay out an L-corner with two 2x4 studs made up of the normal 2x4 end stud plus an extra 2x4 stud perpendicular to the end stud on the exterior side of the wall (see Figure 23-3). Mark the "L" as "Corner Up" to specify

that the corner assembly will lay face up on the deck as the wall is being built. This will place the existing 2x4 stud facing the end of the adjoining short wall forming an outside corner.

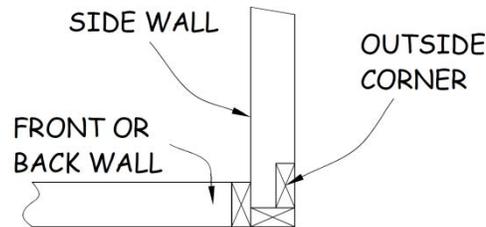


Figure 23-3. Outside L-Corner.

23.4.2. Attached Garage

1. In order to use whole sheets for exterior sheathing and to ensure that trusses land above a stud, the garage part of the extended house/garage wall must continue the house wall stud layout.
2. Locate a house wall stud that is 24" O.C. with the rest of the wall – not a Jack or King. Hook a tape on that stud, and with the garage bottom plate in place on the foundation, measure an integer multiple of 24" to the garage wall bottom plate and mark the location of the side of the first garage wall stud. Mark the rest of the studs 24" O.C. from this mark.
3. Line up the OH door end of the opposite wall plate(s) with the extended house/garage wall plate, and transfer the stud marks from one set of plates to the other.
4. Determine the approximate location of any window or service door and designate one of the existing stud location marks as a King for one side of the window or door. Mark a Jack stud next to it, then mark a King/Jack pair the appropriate distance (the window width or door RO width) away, and write the window or door size on the bottom plate, (e.g., 3030 Window, 3068 Service Door).

23.5. ERECTING GARAGE WALLS

23.5.1. Construct Service Door Component

1. Cut two King studs to the length determined in Section 23.1.1.
2. For **detached** garages, cut two 82" Jack studs from pine 2x4s. For **attached** garages, cut two 82" Jack studs from treated 2x4s (these will extend past the bottom plate to rest on the concrete floor).

3. Nail each Jack stud to a King stud, with the bottoms and edges flush and the crowns opposite, using pairs of 3¼” collated nails no more than 12” apart.
4. Cut two 2x10 header pieces and one 2x4 header piece 3” longer than the rough opening of the door (e.g., 41½” for a 3068 door).
5. Nail the 2x10s together with two rows of 3¼” collated nails. Tack the 2x4 to one long edge of the 2x10 pair, taking care to keep three edges flush.
6. Working on a flat surface, place the header between the King studs, flat surface up, and the 2x4 resting on the top of the Jack studs.
7. Square the 2x4 to the King stud, tight to the top of the Jack studs, and nail through the King into the 2x4 with two 3¼” collated nails.

NOTE: It is critical that the header be tight against the top of the Jack stud to properly transfer roof load to the foundation.

8. Keeping the exterior surfaces of the header and King studs flush, nail the King studs to the header with three 3¼” collated nails into the ends of each 2x10. Finish nailing the 2x4 header piece into the underside of the 2x10’s with 3¼” collated nails.
9. Cut a piece of ½” OSB the size of the header and nail it to the side that the 2x4 projects from. Label the opposite side of the header “Inside”.
10. Cut a 1x4 “filler” piece to fit between the Jack studs and nail it to the underside of the header. This helps to limit the gap between the header and the top of the door jamb. (See Figure 4-1.)

23.5.2. Construct Window Components

1. The bottom of the window header is at the same elevation as the bottom of the service door header.
2. For **detached** garages, determine the length of the window Jack studs by subtracting the thickness of the bottom plate (1½”) and the height of the foundation curb at the window location from 82”. In an **attached** garage, window Jack studs are 82” - the same length as the service door Jack studs.
3. Cut a 2x4 sill piece the width of each window (e.g., 36” for a 36”-wide 30XX window).
4. Construct double 2x10, 2x4 headers similar to that for the door, but 3” wider than the width of the window (e.g., 39” wide for a 36”-wide 30XX window).
5. On each Jack stud, measure down from the top and mark the stud with the height of the window (e.g., 24” for a 3020 window).

6. Nail the Jack studs to the King studs with pairs of 3¼” collated nails, no more than 12” apart.
7. Place the header tight to the top of the Jack studs, flush the appropriate surfaces, and nail through the King stud into the ends of the header pieces with 3¼” collated nails.
8. Place the sill piece between the Jack studs at the mark made in Step 4 above and square to the frame surface. Drive one 6” timber screw through the King/Jack pair into each end of the sill.
9. As with the door header in Step 6 above, cut and attach a piece of OSB to one side of the header. Label the opposite side “Inside”.

23.5.3. Assemble and Erect the Side and Back Walls

1. Remove the temporary nails connecting the upper and bottom plates of the wall section and separate on the deck. Be sure the words “Upper” and “Bottom” remain in the same orientation.
2. Select studs for framing walls by sighting along the edge of each stud to determine in which direction the stud is crowned; mark with an arrow pointing to the high side. Place studs with “crown up”.
3. Assemble each wall on the garage floor and then erect in one entire section. Assemble the two side walls first. Assemble and erect the back wall after the two side walls are up.
4. Place the separate window and service door components in place between the upper and bottom plates with the “Header Up” orientation (this places the “smooth” surface of the header on the outside of the wall).
5. Nail all wall sections together with 3¼” collated nails using two nails through the plates into the ends of each stud. Always make sure that the edges of the studs are flush with the exterior edges of the plates.
6. Place foam sill seal on the foundation wall slightly back from the chalk line. Stand the wall section up, making sure the bolts emerge through each pre-drilled hole. Align the wall so it is flush with the chalk line, then add the washer and nut to each bolt and tighten.
7. For a detached garage, temporarily brace each end of the side walls using two 12-14’ 2x4s nailed near the top of the end studs, with the bottom end resting on the ground in an “A” shape.
8. For an attached garage, one end of the front and and/or side walls will connect to the house wall and can be plumbed and secured to the house. The other end of each wall should be braced as described in Step 7 above.

9. For both attached and detached garages, make sure the side walls lean out slightly when they are braced so they will not interfere with the installation of the back and OH door walls.
10. The back wall is constructed, erected and braced in the same manner as the side walls. Fasten walls to each other by flushing the corners and nailing with 3¼” collated nails the adjoining end studs every 12” from bottom to upper plate.
11. At the inside of each wall corner, nail a long 2x4 brace into the upper plate and run it diagonally down to the bottom plate. Plumb the wall corner. Nail the brace into the bottom plate and into two of the wall studs with one 16d duplex nail at each point. After the side and back walls are up and braced, build and erect the OH door wall.

23.5.4. Assemble and Erect the Overhead (OH) Wall

1. Erect the side and back walls, and stabilize them before laying out the OH door wall. Refer to Figure 23-4 for the following steps.

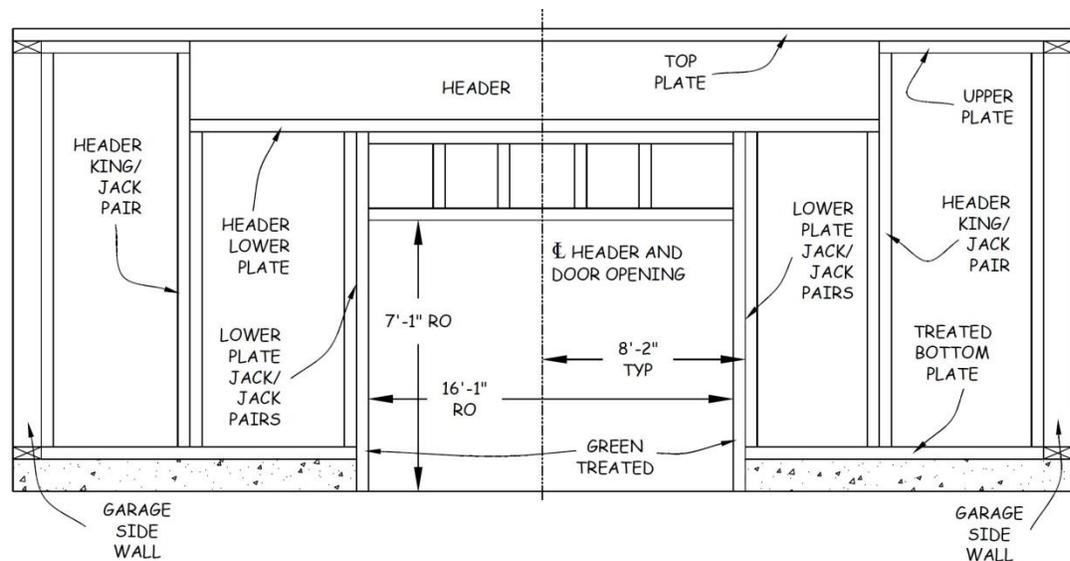


Figure 23.4. Overhead (OH) Wall Assembly.

2. Unless otherwise specified, the overhead door rough opening is 16'-1” wide and 7'-1” high. The height must be measured from the flat concrete slab.
3. Check that the ends of the header pieces are square and that they are the same length; trim as necessary.
4. Measure the length of the header pieces, then measure and mark the centerline location.
5. Cut 2x4s to create a header lower plate that end-to-end will match the length of the header.

6. Determine the length of the four untreated Jack studs by subtracting the width of the header 2x12s (typically 11¼") from the length of the King studs. Measure the width of the 2x12s in several locations, and use the average.

EXAMPLE: Garage studs are typically 104⁵/₈" long. $104\frac{5}{8}" - 11\frac{1}{4}" = 93\frac{3}{8}"$.
7. Cut four Jack studs to the length determined above, typically 93³/₈".
8. Nail together two King/Jack pairs using 3¼" or 16d nails with crowns opposite, keeping one end and the edges flush.
9. Measure the distance between the ends of the garage foundation wall at the OH door opening. Measure and mark on the garage slab the centerline of the OH door opening. From the OH door opening centerline, measure 8'-2" toward each side and make a mark on the garage foundation. The 8'-2" measurement is half of the 16'-1" RO (8'-½") plus 1½" for the treated Jack stud.
10. Measure from the 8'-2" marks to the inside of the side wall bottom plate, and cut treated bottom plates to those lengths. Label with their locations.
11. Locate and drill anchor bolt holes in the bottom plate(s) as described in Section 23.3 above.
12. Lay one of the header pieces in the OH door opening with its centerline mark aligned with the OH door opening centerline mark on the slab.
13. Measure from each end of the header to the side walls and cut upper plates that length. Label with their location and orientation, and tack, using 16d duplex nails, to their respective bottom plates, flushing the side-wall ends.
14. Lay the bottom and upper plates on the garage foundation with the ends snug to the side walls. Mark each end of the header on the respective bottom plate; this is the location of the center of the header King/Jack pairs. The OH-door end of the upper plate should align with this mark.
15. The OH door wall plates are typically about 2' long, so there should be no need to mark studs 24" O.C. Mark the plates to locate a stud at the side-wall ends of each plate pair.
16. The length of the two green treated Jack studs will be as follows. Add the height of the foundation curb (3½" from the example above) and 1½" (bottom plate thickness) to the length of the non-treated Jack stud determined in the previous example (Step 6 above).

EXAMPLE cont'd: Jack studs determined above are 93³/₈". Foundation curb height measured at 3½"; bottom plate = 1 ½". $93\frac{3}{8}" + 3\frac{1}{2}" + 1\frac{1}{2}" = 98\frac{3}{8}"$ length of treated Jack studs.

17. Cut the bottom of two treated 2x4s to the same angle as the inclined portion of the OH door opening (usually about 10°). Measure and mark the length determined above from the short side of the angle cut, and square cut the top of the 2x4s to that length.
18. Determine the height of the ladder-like wall below the header by subtracting the RO height, 7'-1" (85"), from the length of the treated Jack stud.

EXAMPLE cont'd: $98\frac{3}{8}"$ length of treated Jack studs minus $85"$ (7'-1") = $13\frac{3}{8}"$. Stud length: $13\frac{3}{8}" - 3"$ (top and bottom plates) = $10\frac{3}{8}"$.
19. Construct a ladder-like wall the height determined above, 16'-1" long.

NOTE: 16' 2x4s are typically $\frac{1}{2}$ -1" longer than the nominal length. Use 16'-1" 2x4s if available, otherwise cut them to 15'-10 $\frac{1}{2}$ " long and use a 2x4 3" longer than the stud length determined above as a spacer at one end.
20. Cut short studs to the length determined above and assemble a 16'-1" long wall in the usual fashion with studs 24" OC. If 16' 2x4s are not available, arrange the upper and lower plates so that any joints are staggered and land in the middle of a stud.
21. Position the ladder wall between the treated Jack studs, and nail the upper plate of the ladder wall to the header lower plate, keeping the edges flush. Toenail or screw the ladder wall lower plate to the treated Jack studs at each end.
22. With the bottom treated plates on the garage foundation, and the upper plates on the garage slab, assemble the wall as shown on Figure 23-4 with all of the components described above except the header pieces.
23. Raise the wall and secure it to the anchor bolts and side walls after plumbing in two directions.
24. Nail the two header pieces together, keeping the edges and ends flush. Arrange with crowns opposite, and use clamps as necessary to align the edges and pull the pieces tight together. Use three 3 $\frac{1}{4}$ " collated or 16d nails every 36" on one side, then turn the pair over and repeat on the other side, staggering the nail pattern 18", to end with three nails every 18".
25. Check for residual crown, and install with the crown up. Carefully lift the header into position and secure.

23.6. STRAIGHTENING GARAGE WALLS

23.6.1. Attach String Line

1. To straighten the exterior walls, a stretch a VERY taut string line from one inside corner to an adjacent inside corner. The wall is adjusted to the string line every 8'–10' and braced to hold.
2. For each exterior wall corner, cut a scrap length of 2x4 about 10-12" long.
3. Drive a 16d nail into the approximate center of this 2x4, leaving the nail about ½" above the 2x4 (this is left to wrap the string around), and approx. 1" sticking out the bottom. Be sure the nail is straight, since the nail above the 2x4 represents the inside of the corner.
4. At the exterior wall "inside" corner, place the 2x4 on top of the 2x6 upper plates at roughly a 45° angle so that the point end of the 16d nail rests tight against the "inside" upper plates of both walls (nail resting tightly against the inside of the corner). See Figure 5-2.
5. Nail the 2x4 to the upper plate with two 16d or duplex nails on each end of the 2x4. Nail securely as there will be a lot of string tension on these.
6. In the first corner, attach the string line on any nail other than the centered nail (feel free to add additional "tie off" nails as needed)
7. Wrap the string the exterior of the centered nail, aligned with the inside edge of the upper plates on each wall
8. Continue around the exterior walls, repeating Steps 4 thru 6 at each corner, until back at the starting corner. Make sure the string is not obstructed between corners and is VERY taut.
9. At each corner, verify that the string is aligned with the "inside" of the upper plates and adjust as needed.

23.6.2. Straighten the Walls

1. Start approximately 5'-7' from the corner.
2. Place one end of a 6' level against the top plate and the other against a nearby stud - not the stud immediately below. (This "two-point contact avoids problems with a bowed or twisted stud.)
3. Slide the level up the wall until it reaches the string. If the top of the level touches the string, adjust the bracing to move the wall in until the inner edge of the level lines up with the string. If the level misses the string, move the wall outward until

the inside edge lines up with the string. The wall is now straight in that section. Then brace appropriately.

4. Move approximately to the mid-point of the wall and repeat Steps 2 and 3.
5. Repeat Steps 1 thru 4 for the remaining exterior walls. After bracing for all exterior walls is completed, recheck the alignment (using the string line) and remove string and blocks.

23.7. INSTALLING TOP PLATES AND SHEATHING WALLS

1. Walls must be tied together by nailing overlapping top plates to the tops of all walls. Top plates at the intersection of interior and exterior walls are done first.
2. The top plate on all walls must be lapped a minimum of 4' on each side of the upper plate joint, and at each corner.
3. Top plates of the garage walls that intersect the house walls must extend into the house exterior top plates by 2" and must be at least 16" long.
4. When nailing top plates, use two 16d nails across 2x4 plates. Nail at each intersection of top plates and nail at each stud location.

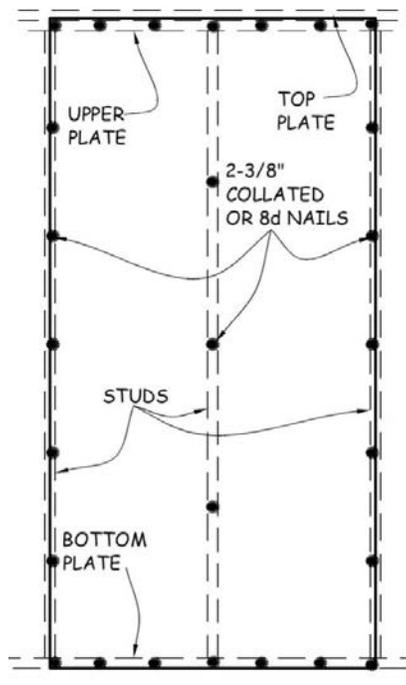


Figure 23-5. Garage OSB Nailing Pattern.

5. Starting at the zero corner, place a sheet of 4'x9'x1/2\" OSB on each end of a wall section, flush with bottom plate and overlapping 3/4\" onto the stud 4' from the corner. Secure it to

the studs with 8d or 2³/₈" collated nails into each stud and the top and bottom plate using the nailing pattern shown in Figure 23-5.

NOTE: The OSB is secured with seven nails equally spaced in each edge stud, five in the center stud, and two in each plate equally spaced between each stud.

6. Continue sheathing across the wall, holding the OSB even with the bottom of the bottom plate and tight against the previous sheet.
7. On the OH door wall, place a whole sheet from the corner, covering the end of the header. Glue and nail the sheet, then cut the OSB from the opening.

Chapter 24. Picnic Table Construction

24.1 CUTTING PICNIC TABLE COMPONENTS

24.2 ASSEMBLING PICNIC TABLE

24.3 FINISHING TOUCH

24.4 MATERIALS SHEET

ARCHIVED CHAPTER

Volunteers for the affiliate no longer perform the tasks described in this chapter. Effective with the 2022 (Version 22.0) release of the Construction Manual, the contents of this chapter will no longer be included in the Manual.

The last complete version of this chapter can be found on the affiliate's website in the Archived Chapters section of the Construction Manual.