

CONSTRUCTION MANUAL

(2026)

**Greater Fox Cities Area
Habitat For Humanity**

Dedication

This 2026 release of the Greater Fox Cities Area Habitat for Humanity Construction Manual is dedicated to James L. Parker, Ph.D. Jim has been an ardent supporter of this affiliate for over a quarter century. Through the years Jim has served in many capacities. Early on he sat on the affiliate's Board of Directors. For decades he worked tirelessly on countless construction sites, becoming, among other titles, the recognized expert on door and window installation. (However, out of all the construction tasks, Jim never did siding, and, if you asked him, professed to know nothing about it!)

Jim was a founding chapter editor of the affiliate's Construction Manual Committee, serving on it for over 15 years until his retirement in 2025. During his tenure, Jim marshalled his training as a scientist and his skill as a wood worker to clearly and concisely shape the instructions found in this manual. His insistence on accuracy guided all the chapter editors in their work to create the most understandable set of instructions possible. This manual would not be what it is today were it not for Jim's thorough contributions these many years.

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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, tape or sheets of poly to seal a penetration or 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.
bow	with the faces horizontal, the bend observed up or down along the face of board
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

Term	Definition
ceiling rock	see sheetrock
clearance hole	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
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	with the faces vertical, the bend observed up or down along the edge of a board
crude opening	see R.O.
cup	a curvature or bend along the wide face of a board resulting in the edges being higher or lower than the center
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
DRIcore	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
end cap	see vent cover
fascia	metal trim placed over the sub-fascia to protect and improve the aesthetics of the underlying wood structure

Term	Definition
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
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
floor trim	finish woodwork used to decorate the bottom of interior walls
flush sliding door	a sliding door, typically for a bedroom closet, where one door panel abuts to a K/J framing pair and the other door panel abuts to a perpendicular continuous wall (see also non-flush sliding door)
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.
framing nailer	pneumatic nail gun that can handle 2⅝" 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

Term	Definition
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
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
lineal	a decorative trim piece used between siding and a window or a door
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

Term	Definition
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
non-flush sliding door	a sliding closet door built into an interior wall with a King/Jack stud pair at each end (see also flush sliding door)
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
pilot hole	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
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
proud	a surface that sticks out past flush of an adjacent surface
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

Term	Definition
rim board	laminated board 1½" x 9½" 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
sheathing	typically refers to 4'x8' sheets of OSB used to cover the roof (½"), as sub-floor decking (¾") and on exterior walls (½")
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" 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 ⅛" 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

Term	Definition
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 aesthetics
smidge	a very small quantity. Not to be confused with a skosh which is only a tiny amount. Don't get me started on tad.
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
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., "opens 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
top plate	a length of 2x material that is attached to the top ends of studs when building a wall
tread	the horizontal component of a stair (i.e., the part that is stepped on)

Term	Definition
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
vent cover	a cap on the end of a pipe or duct protruding outside the house wall
upper plate	a length of 2x material that is attached to the top of top plates to strengthen the wall and tie together intersecting walls
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
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

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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 $\frac{3}{4}$ " & $1\frac{1}{2}$ " wood auger bit
Drill with $\frac{1}{2}$ " 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
Two laminated beam members
Sill seal
Egress ladder
16d nails
8d nails
 $\frac{1}{4}$ " x $1\frac{3}{4}$ " Concrete screws
 $\frac{1}{4}$ " x $2\frac{3}{4}$ " Concrete screws
 $\frac{3}{8}$ " x $2\frac{3}{4}$ " Power/wedge bolts
 $1\frac{5}{8}$ " Exterior screws
 $\frac{5}{16}$ "x $1\frac{1}{2}$ " Lag screws
 $\frac{1}{2}$ " Nuts
 $\frac{5}{16}$ " Washers
 $\frac{1}{4}$ "x1" 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" 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 $\frac{1}{8}$ ".

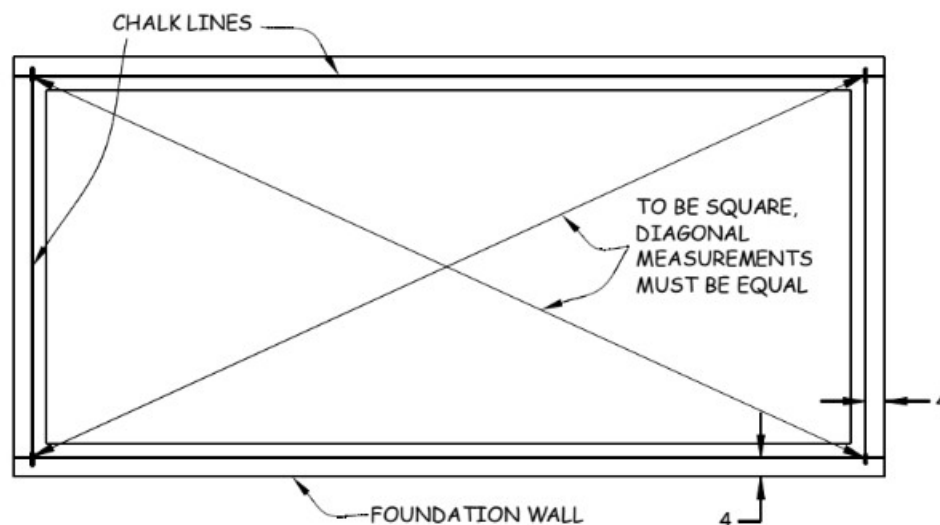


Figure 1-1. Squaring Foundation Lines.

5. Snap chalk lines on all four walls.

6. 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" 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.

7. Spray all chalk lines with clear varnish.

1.1.3. For L-Shaped or Irregularly-Shaped Foundations

1. At all outside corners of the deck (Points 1, 5, 6, 3 and 2) measure in 4" from the outside wall of the foundation. Measure in from both sides of the corner and mark to create intersecting initial corner marks.
2. 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.

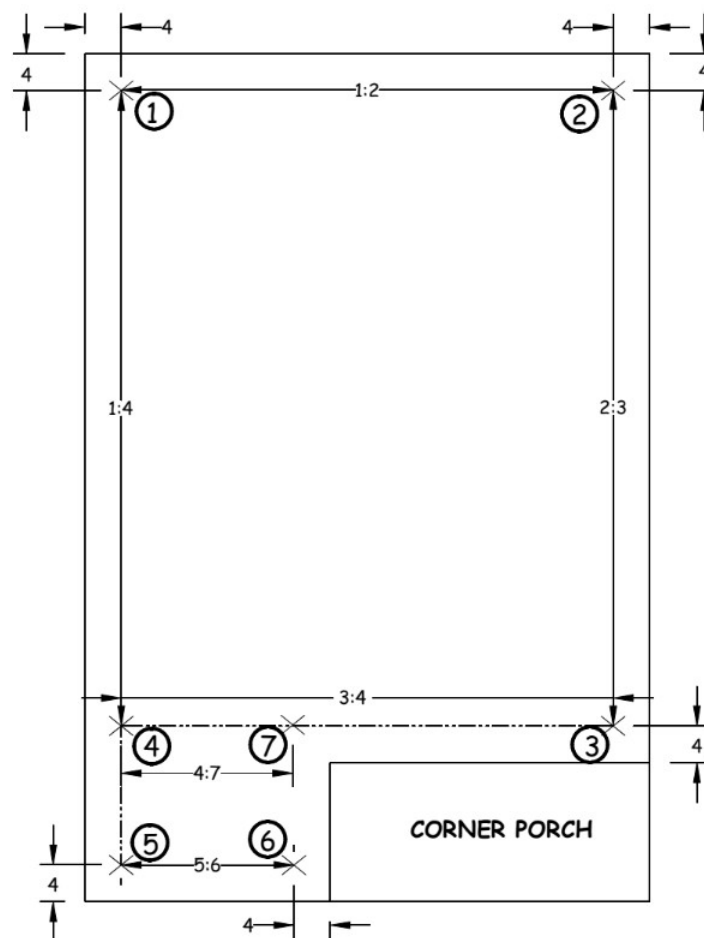


Figure 1-2. Sill Plate Layout with Corner Porch.

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” 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 beam pocket walls first. Notch sill plates at the beam pockets so they are flush with the edges of the pockets.
4. 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.
5. 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.

6. 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.
7. 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.
8. Use a $\frac{3}{4}$ " or $\frac{7}{8}$ " 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.

9. 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 $\frac{1}{2}$ " nut turned tight.

NOTE: Do NOT 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.

10. Toenail the plates with 8d nails.
11. Apply air sealing caulk between all sill plates where they abut. Also apply two lines of caulk along the length of the sill plate tops, each line about 1" from the outside edges of the plates.
12. Install a second layer of 2x6 treated sill plates in the same manner as the first layer. Make sure the seams of the first layer are overlapped by at least 4', that each plate is anchored by at least two bolts, and that there is a bolt no more than 1' from each end of a plate. If necessary, use power/wedge bolts to secure plates in this second layer. Apply air sealing caulk between all sill plates where they abut.
13. 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 $\frac{1}{4}$ "x $2\frac{3}{4}$ " concrete screws (or $\frac{3}{8}$ "x $2\frac{3}{4}$ " power/wedge bolts, whichever is more appropriate) to flatten sill plates.

TIP: When installing concrete screws or power/wedge bolts, use a wood bit to drill through the sill plate, then use a masonry bit to drill into the foundation.



Figure 1-3. Sill Plate Installation.

14. 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. The beam that supports the floor joists is made up of two laminated members,
3. Square up one end of each laminated piece.
4. 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 cut each laminated member to length.
5. Wrap both ends of the laminated piece with black flashing tape extending at least 2" beyond the edge on both the top and the bottom of the beam.
6. Lift and set each member into both beam pockets and center them in the pocket. If necessary, temporarily block them to prevent the two members from falling.
7. Clamp the two pieces together side-to-side (making sure the top of the two members are flush) and top to bottom. Nail the two members together with three 16d or 3" collated nails on 12" centers on both sides of the beam, staggering the nail lines on opposite sides of the beam.

8. 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.
9. Use 16d duplex nails to securely attach a long, temporary piece of 2x4 near the middle of the beam. Nail the other end of the 2x4 to the sill plate or drill a hole near the end and place it over a foundation bolt. This will help stabilize the beam while support posts and I-joists are being installed.
10. 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.
11. 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.
12. 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.

13. 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.

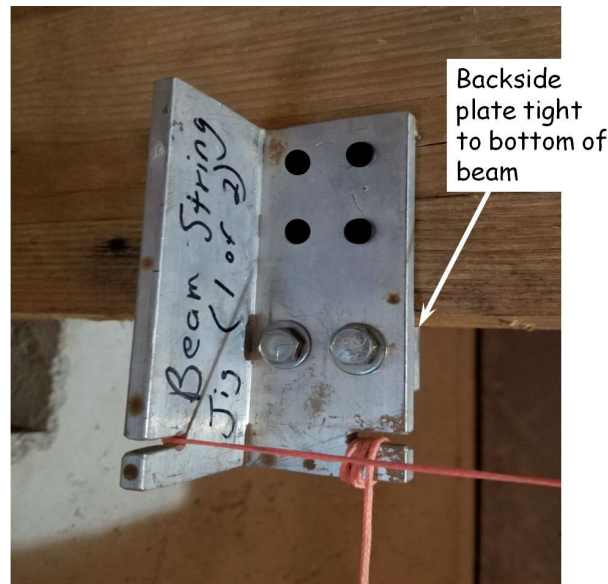


Figure 1-4. Beam String Jig.

14. 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.
15. 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.
16. 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).
17. 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.
18. Remove the adjustment pins from the support posts.
19. Leave the string line in place. It will be used to confirm the beam location during I-joist 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.

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Chapter 2. Cap Foundation

2.1 INSTALLING I-JOISTS AND SILLBOX

2.2 FRAMING STAIR OPENING

2.3 INSTALLING SUMP PUMP HOSE

2.4 INSTALLING FLOOR SHEATHING (DECKING)

2.5 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
Impact driver
Framing nailer
½" Hammer drill
Stapler
Reciprocating saw
I-joist cutting jig
Sledgehammer
Adhesive applicator
Framing square
String line
Chalk line
Stepladder
Extension ladder
Temporary Stair Cover Hardware Bin

Materials needed:

1½"x9½" Rim boards
Floor I-joists
¾" Tongue & groove decking OSB
Tapered shims
16d nails
8d nails
¾" Collated nails
2⅜" Collated nails
I-Joist hangers
LVL Joist hangers
Joist hanger nails
1½" SD screws
2½" SD screws
4" Timber screws
5/16"x4" Lag screws
½" Wedge anchors
5/16" Washers
Ice and water shield
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. Measure the width of several I-joist flanges and determine an average width. Divide that number by 2. This result will be used to offset the tape measure in the next steps for laying out the I-joists on the sill plates and lam beam.
3. Starting at the zero end as specified on the House Plan, place the end of a measuring tape on the exterior edge of the beam pocket wall sill plate. Make a mark on the non-pocket wall sill plate at 19.2".

TIP: The diamond marks on most measuring tapes correspond to multiples of 19.2".

4. Take the number calculated in Step 2 above and add that distance to the 19.2" mark. Draw a line the width of the sill plate at this location. Mark an "X" on the sill plate on the side of the line closer to the zero end.
5. Drive a nail into the center of the sill plate at the line drawn in Step 4 and hook a tape measure to this nail.
6. Proceed the remaining length of the sill plate making marks every 19.2" and marking an "X" for full-length I-joists ("SX" for any joists shorter than full-length - typically around the stair opening) on the sill plate on the side of each line closer to the zero end.
7. Repeat Steps 3-6 on the opposite non-pocket wall sill plate and on the lam beam.
8. If a foundation bolt protrudes through an area marked with an X on the sill plates, use the hammer drill with a 1/2" bit to drill two holes, each about 6" to the right and left of the foundation bolt. Install a 1/2" wedge anchor in each of these holes. Remove the nut and washer (and concrete form tab, if present) from the foundation bolt. Using a metal blade on a reciprocating saw, cut off the bolt flush with the top of the sill plate.
9. 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.
10. 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).

11. At both ends of the house and in the middle of the non-pocket walls, measure the distance from the chalk line on one non-pocket wall to the chalk line on the other non-pocket wall. If all three measurements do NOT agree, re-snap one or both of the lines. Recheck lines for squareness.
12. 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.

TIP: 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.

13. 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 3¼" 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.

14. 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 beam pocket wall sill plate every 32" o.c. from the outside edge of the non-pocket 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 non-pocket wall sill plate, install the last end block half way between the second to last end block and the outside edge of the opposite non-pocket wall sill plate.

NOTE: Adjusting 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.

TIP: 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 2⅜" 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.

TIP: 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 $2\frac{3}{8}$ " 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 $2\frac{3}{8}$ " 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, the face of any rim board above porch areas must be covered with ice and water shield (see Figure 2-1).
 - a. The standard width of the ice and water shield roll is twice the desired width for this operation, so cut it in half lengthwise.
 - b. Cut a length of ice and water shield that is 1-2' longer than the length of the porch. Center it on the porch area so it extends over the top of the rim board about 3" and hangs down at least 1" below the top of the 2" foundation foamboard. Secure in place by stapling it to the I-joists or end blocking.

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

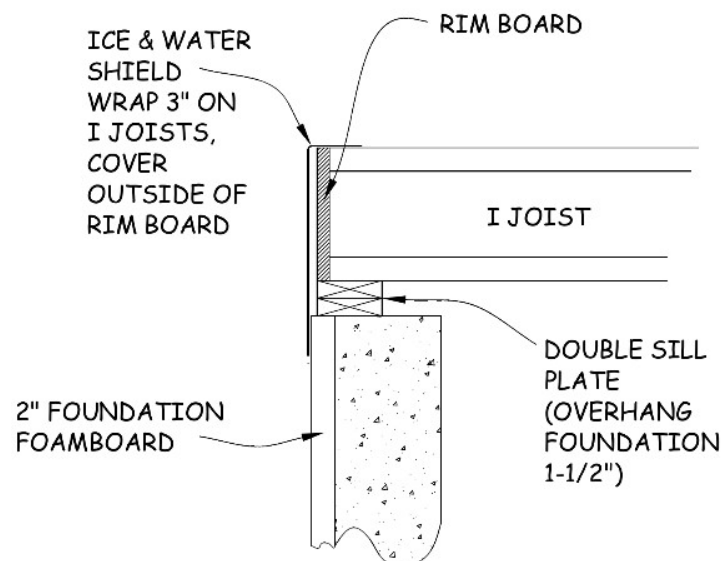


Figure 2-1. Sill Box Section.

2.2. FRAMING STAIR OPENING

1. Typical framing for the stair opening uses a combination of Laminated Veneer Lumber (LVL), 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 non-pocket wall. A third LVL beam extends parallel to the lam beam and is attached to the two perpendicular LVL beams with LVL 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 3”-5”. Cut two pieces of LVL 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. 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.
6. Place the parallel LVL beam cut in Step 5 above on the foundation next to the sill plate and between the LVL marks on the sill plate. Transfer the location(s) of the short I-joist(s) found on the sill plate (designated with “SX”) to one face of the parallel LVL beam. Attach 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 1½” SD screws (if screws not available, use joist hanger nails), one in each hole of the hanger.
7. On each of the two LVL beams that run perpendicular to the lam beam, lay out the locations, per the House Plan, where the parallel LVL beam will be attached.
8. Place 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 2⅜” collated nails.
9. Cut two pieces of 24”-36” long 2x material. Place one piece along the top edge of the parallel LVL and extending out about 12” past the vertical edge of the beam. Securely clamp the 2x material to the beam. Repeat with the other piece of 2x material on the opposite end of the parallel LVL beam.

10. Place the parallel LVL beam between the two perpendicular LVL beams, aligned with the marks made in Step 7 above, and hanging from the 2x material installed in Step 9 above. Make sure the I-joist hangers on the parallel LVL beam are outside the stairway opening (i.e., facing the sill plate on the non-pocket wall).
11. Verify the parallel LVL beam is aligned with the marks made in Step 7 above and the tops of the parallel LVL beam are flush with the perpendicular LVL beams. Secure the assembly by driving two 4" timber screws through each perpendicular LVL beam, about 2" below the top and above the bottom, into the ends of the parallel LVL beam. Remove the scrap 2x material.
12. Install an LVL joist hanger at each end of the parallel LVL beam. Secure the LVL beam inside the joist hanger using 1½" SD screws (if screws not available, use joist hanger nails) into the straight holes of the joist hanger and 2½" SD screws (if screws not available, use 16d nails) into the angled holes of the joist hanger, one in each hole.
13. Position the length of rim board cut in Step 5 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. Nail five 3¼" collated nails through each LVL beam into the ends of the rim board.
14. Measure the distance along the non-pocket wall from the rim board line on the sill plate on the nearest 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 2⅜" collated nails.
15. 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.
16. 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.
17. 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 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-joist bay through which the hose will exit. Choose the I-joist 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.
4. Reposition the sump pump hose so it exits through this hole to the exterior of the house.

2.4. 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-joist 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.

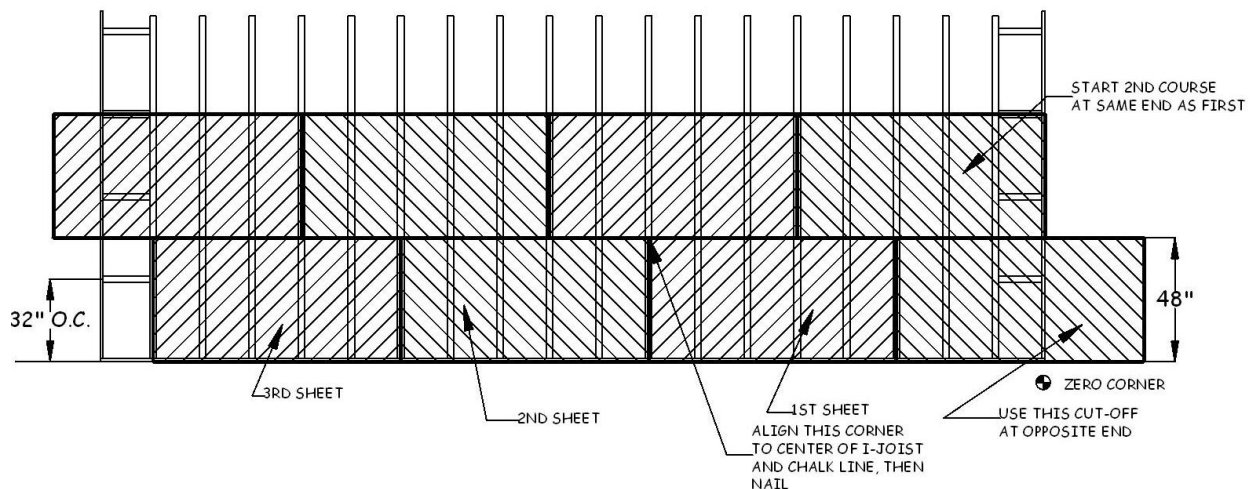


Figure 2-3. Floor Decking Layout.

2. Snap a chalk line across the floor joists at 48" from the outside edge of the rim boards on the non-pocket wall. Continue snapping additional chalk lines at intervals 1" less than 4' (e.g., 1" less than 8', 12', 16') across the remaining width of the foundation. The initial line is an alignment aid for the first row of decking; the remaining lines indicate how far to apply adhesive in Step 3 below.
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.

TIP: 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.

TIP: One method to ensure the ⅛” 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 ⅛” 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. Cut two 1" wide by 1 1/4" deep notches in the decking overhang, one on each side of the stairwell opening.
12. Thoroughly clean the Adhesive Applicator, removing as much adhesive as possible, before storing it in the Tool Trailer.

TIP: Use of a moist towelette (e.g., wet wipes) may facilitate adhesive removal.

2.5. 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" foamboard 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 for Rectangular Deck 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 ≥⅝", 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.

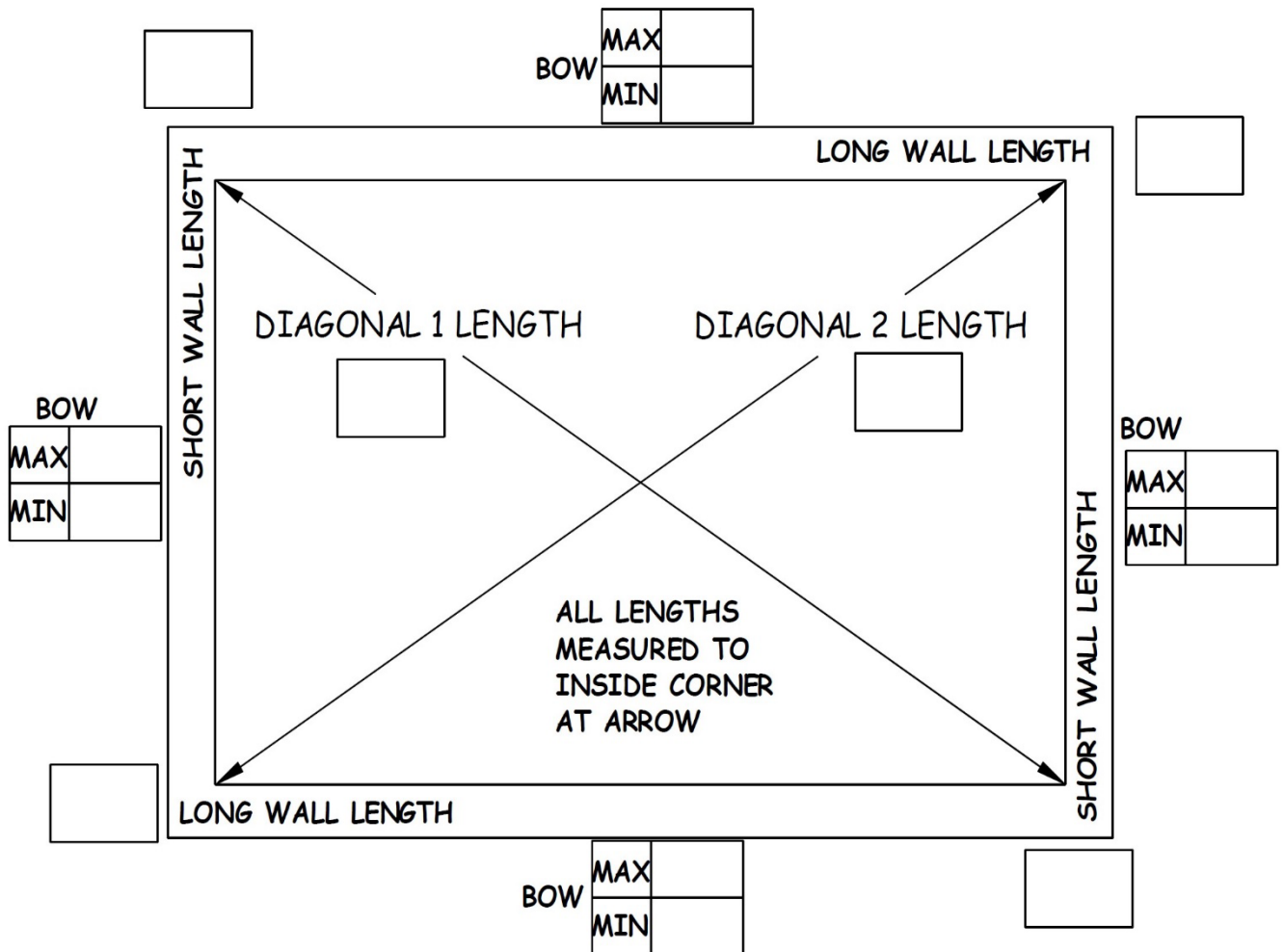


Figure 3-1. Wall Layout for Rectangular Deck Worksheet.

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

1. **Create a Rectangle** on the main deck.
 - a. Remove the Wall Layout with Corner Porch Worksheet (Figure 3-2 on the next page) from this manual. Record any measurements made in the following steps on this worksheet.
 - b. 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).
 - c. 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.
 - d. 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.
 - e. 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 ≥⅝", re-check the rectangle for square and adjust as described in Step 2 above.

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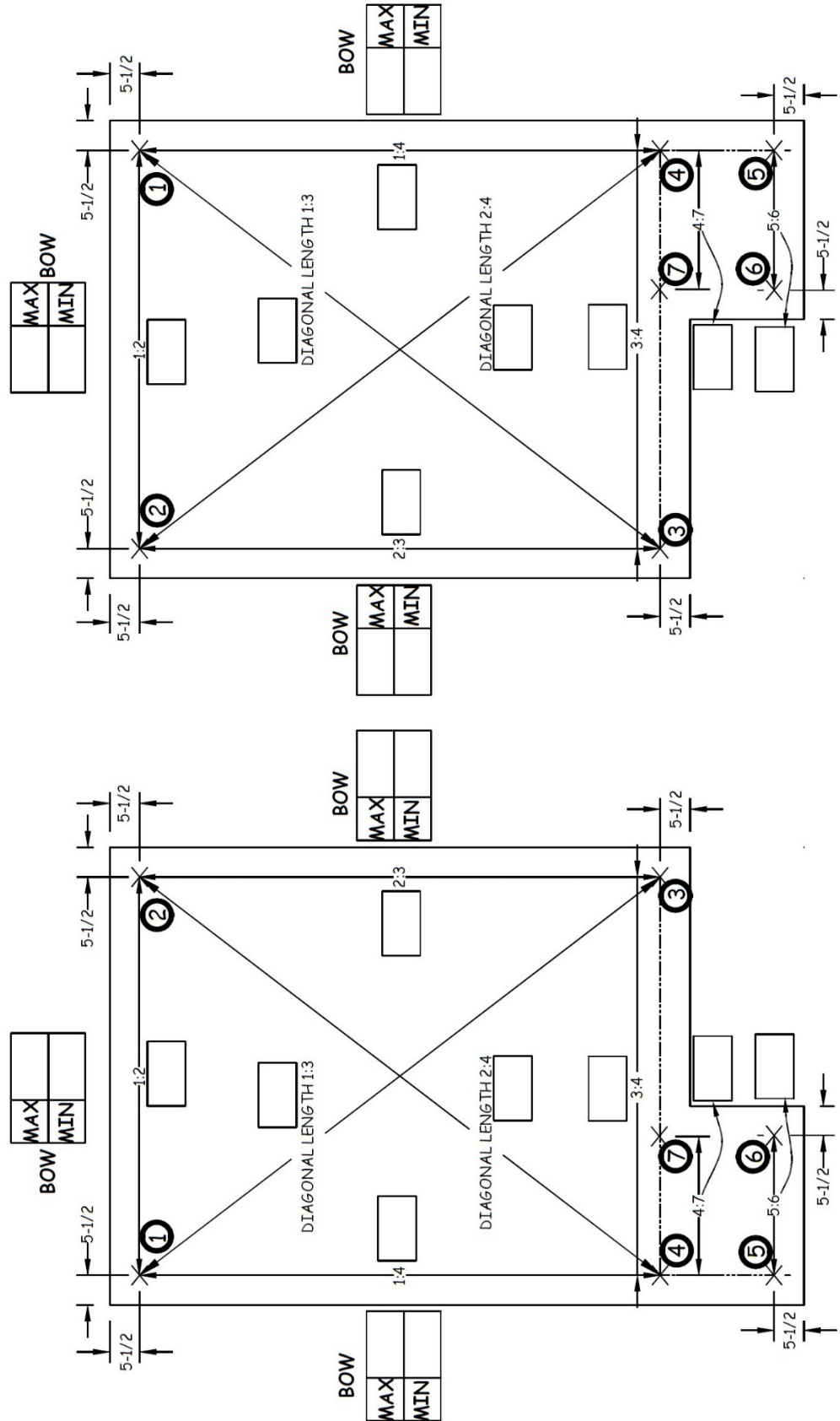


Figure 3-2. Wall Layout with Corner Porch Worksheet.

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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 (typically mounted on $\frac{1}{8}$ " plywood) of the main floor deck showing both exterior and interior walls, depicts all full-length plates and any pre-defined plate lengths (see Figure 3-3). 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.
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.

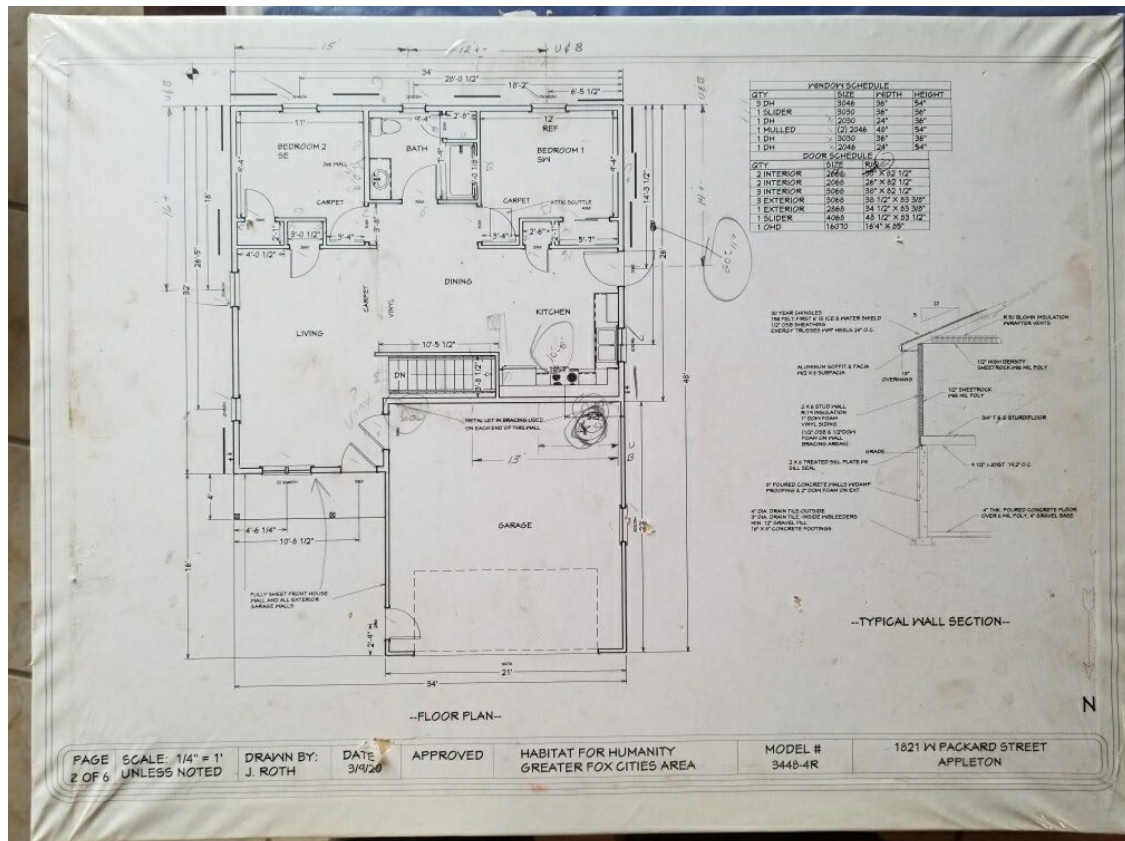


Figure 3-3. Plate Layout Drawing.

- For plates on the long walls, the studs are placed on 2' centers from the outside of the zero corner. Therefore, 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).

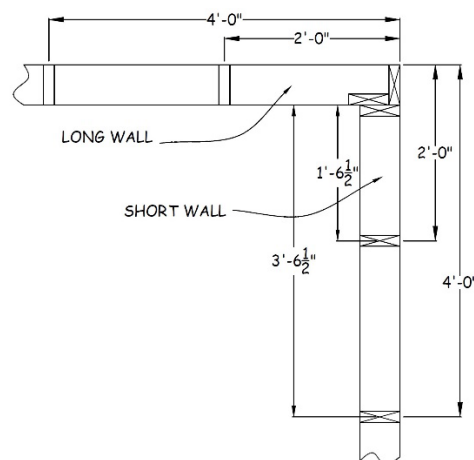


Figure 3-4. Corner Layout.

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 $\frac{1}{8}$ ", 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 $\frac{1}{8}$ " short, then mark the end stud at $1\frac{3}{8}$ " from the end instead of the typical $1\frac{1}{2}$ "; label that mark with "Do Not Move").

3.4. MARKING WINDOW AND DOOR LOCATIONS ON EXTERIOR WALL PLATES

1. 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

2. When laying out the short walls that intersect the long walls, again start at the zero end but this time extend the tape measure $5\frac{1}{2}$ " beyond the end of the plate. This offset takes into account the $5\frac{1}{2}$ " width of the intersecting long wall plate during layout.

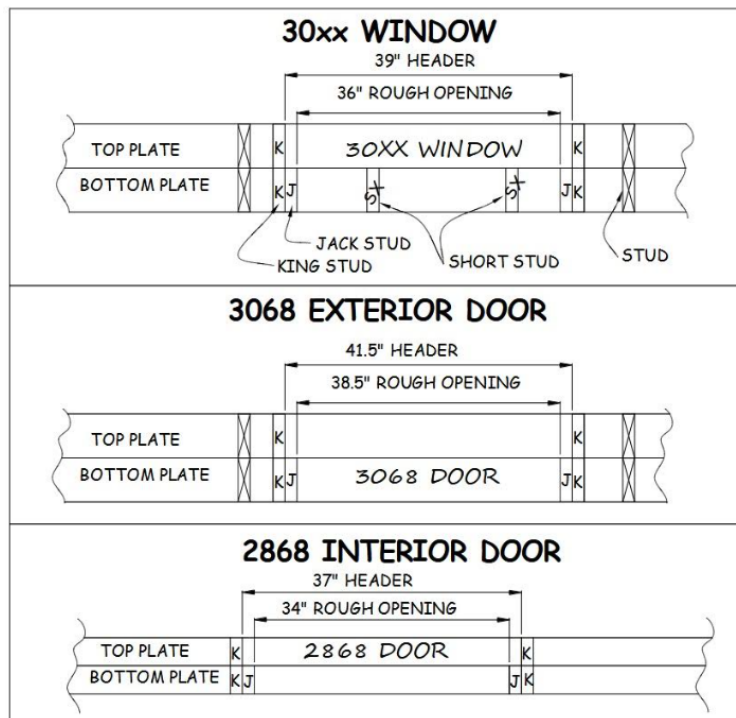


Figure 3-5. Plate Marking for Doors and Windows.

3. Using the center-line that was marked for the door and window components, mark the rough opening and then the King and Jack stud locations. 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 the height of the opening in feet and inches. For example, a 3040 window is 3'-0" wide by 4'-0" high (i.e., 36" wide by 48" high).
 - a. The rough opening for all windows equals the width of the window.

EXAMPLE: The rough opening for a 3640 window is 3'-6" = 42".
 - b. The rough opening for all exterior doors is 2½" wider than the door size.

EXAMPLE: The rough opening of a 3068 door is 3'-0" + 2½" = 38½"
 - c. The rough opening for all interior doors is 2" wider than the door size.

EXAMPLE: The rough opening of a 2868 door is 2'-8" + 2" = 34".
4. 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. The Jack studs will always be to the inside of the King Studs. Stud width is always 1½". Label the location of both King and Jack studs on the bottom plate but label only the King stud on the upper plate (see Figure 3-5).

REQUIREMENT: Any opening 6' or wider requires two Jack studs under each end of the header. Therefore, the header will be a total of 6" wider than the rough opening rather than the typical 3" used with windows and interior doors.

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 (see Figure 3-6). 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.

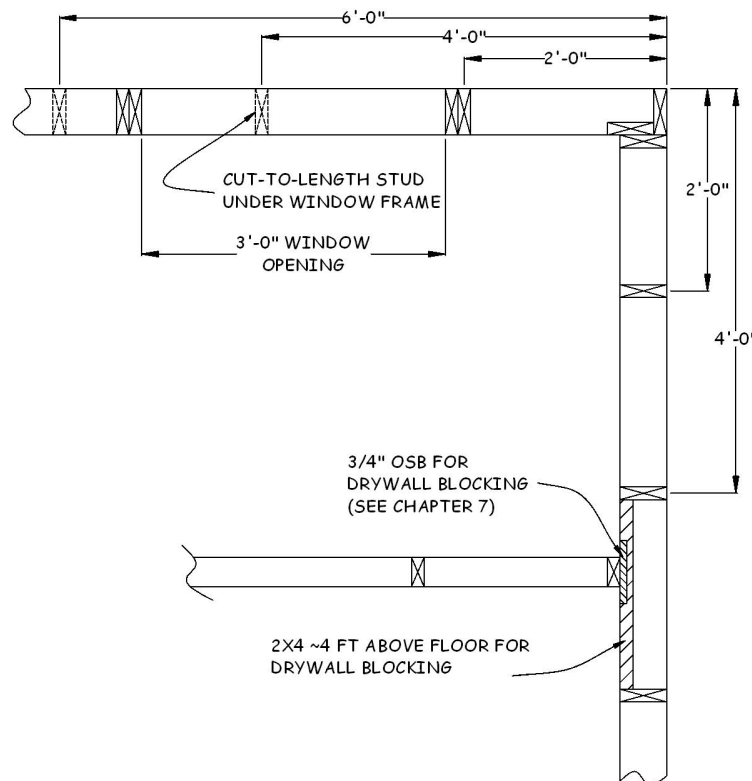


Figure 3-6. Stud and Blocking Layout.

3. 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 or, alternatively, locate an additional stud at that location (see the Construction Supervisor).
4. At a window or door component, if the wall stud location is within 1” of the King stud, move the window or door component so the King stud is located at the wall stud location.

NOTE: This does NOT apply to kitchen and bathroom windows.

5. 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.
6. 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.
7. 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 3-6). 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.”

8. 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. In addition, locate a stud at each end of these walls.

9. 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".
10. 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".
11. For homes with an attached garage, continue laying out stud locations per Figure 3-7.

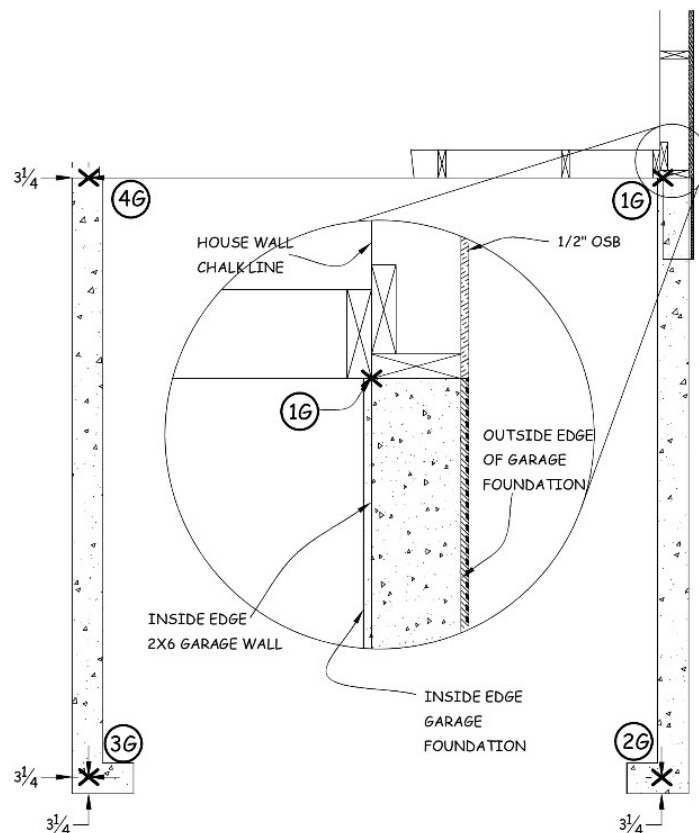


Figure 3-7. Continuing Wall Layout to Attached Garage.

12. 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.

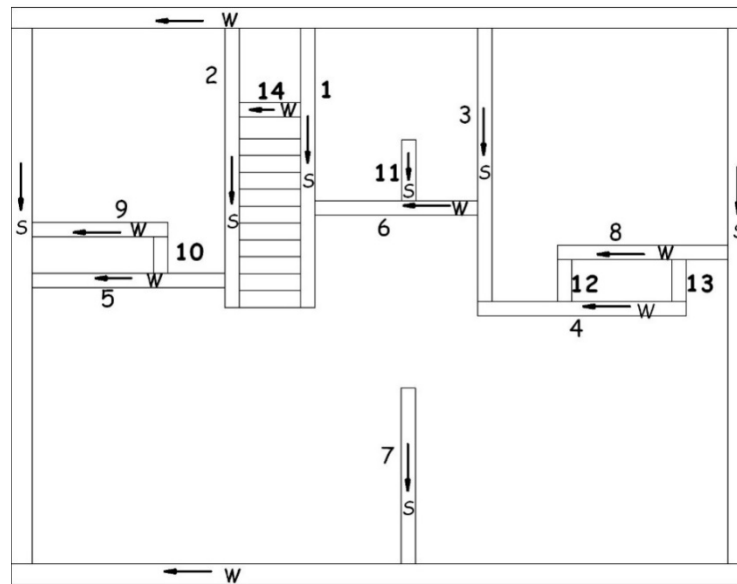


Figure 3-8. Plate Labeling Diagram.

13. 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. Regardless of whether the House Plan calls for a door at the top of the stairs, extend these walls 5" beyond the lip of the stairway opening.
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.

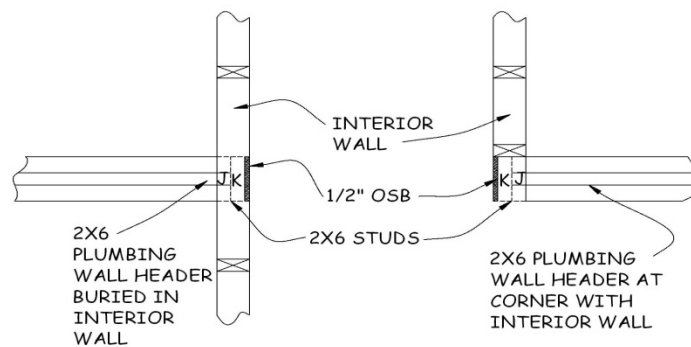


Figure 3-9. Plumbing Wall Configuration.

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).

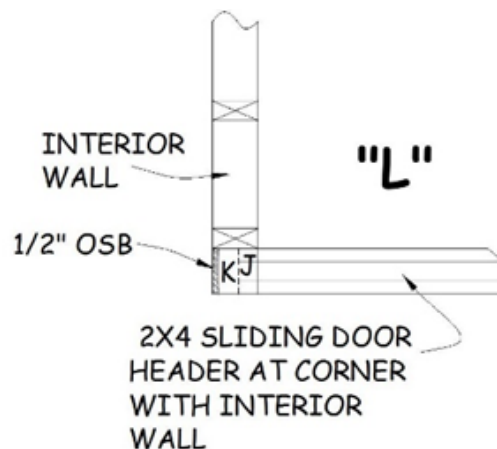


Figure 3-10. Interior L-Corner in Flush Sliding Door.

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.

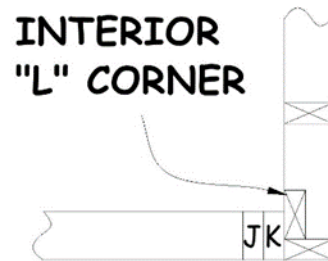


Figure 3-11. Interior L-Corner Configuration.

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. Mark the wall with the full wall length, including the 3½” x 3½” end post (see Figure 3-12).

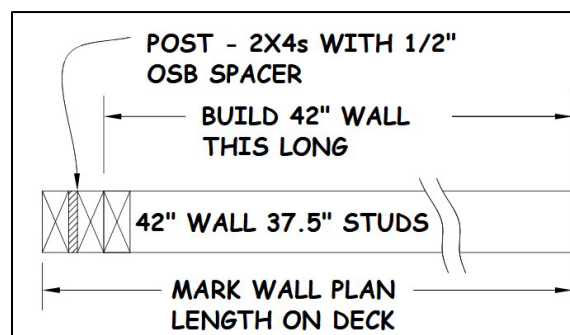


Figure 3-12. Marking Wall Plan on Deck.

- c. 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.
 - d. For any wall at the end of the stairway opening in the deck (where a platform would be built) label the DECK with ‘13¾” WALL/10¾” 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: CL . 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., 59" 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	59"	62"	82½"
60" Bifold 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 3-13 and Section 3.6.4).

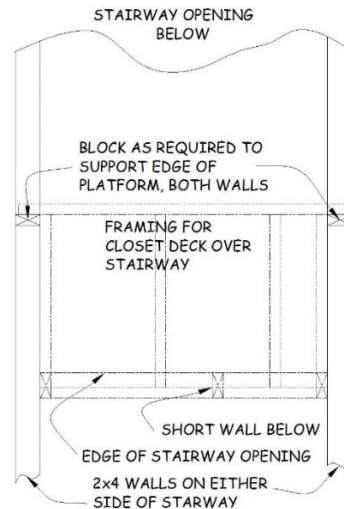


Figure 3-13. Stud Layout Around Stairway Opening.

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 3-10, 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 6.3.5 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
3¼" Collated nails
3" Collated nails (Component Bin)
5/16"x1½" Lag screws
6" Timber screws
5" Wafer head screws (Component Bin)
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
Component Bin

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan Support Documents

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 the 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 Support Documents.
5. Referring to the Component Cut List in the House Plan Support Documents, cut pre-defined pieces of 2x10 headers, 2x6 headers, 2x4 headers, 2x6 window sill pieces, and 2x4 and 2x6 Jack studs. The Component Cut 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 in the House Plan Support Documents three-ring binder in the site support box).

NOTE: The Component Cut List is designed to minimize material waste and cost, so it should be followed exactly. See Appendix A for instructions on how to develop the Component Cut List.

4.2. ASSEMBLING EXTERIOR WALL COMPONENTS

1. Referring to the Component Assembly Drawings for exterior components in the House Plan Support Documents, assemble the window and exterior door components (see Figure 4-1 for examples of exterior component assembly drawings).

TIP: It is best to work on a flat surface such as the deck or the porch. When doing so on the porch, place one or more pieces of OSB or decking under the work to protect the concrete from protruding nails.

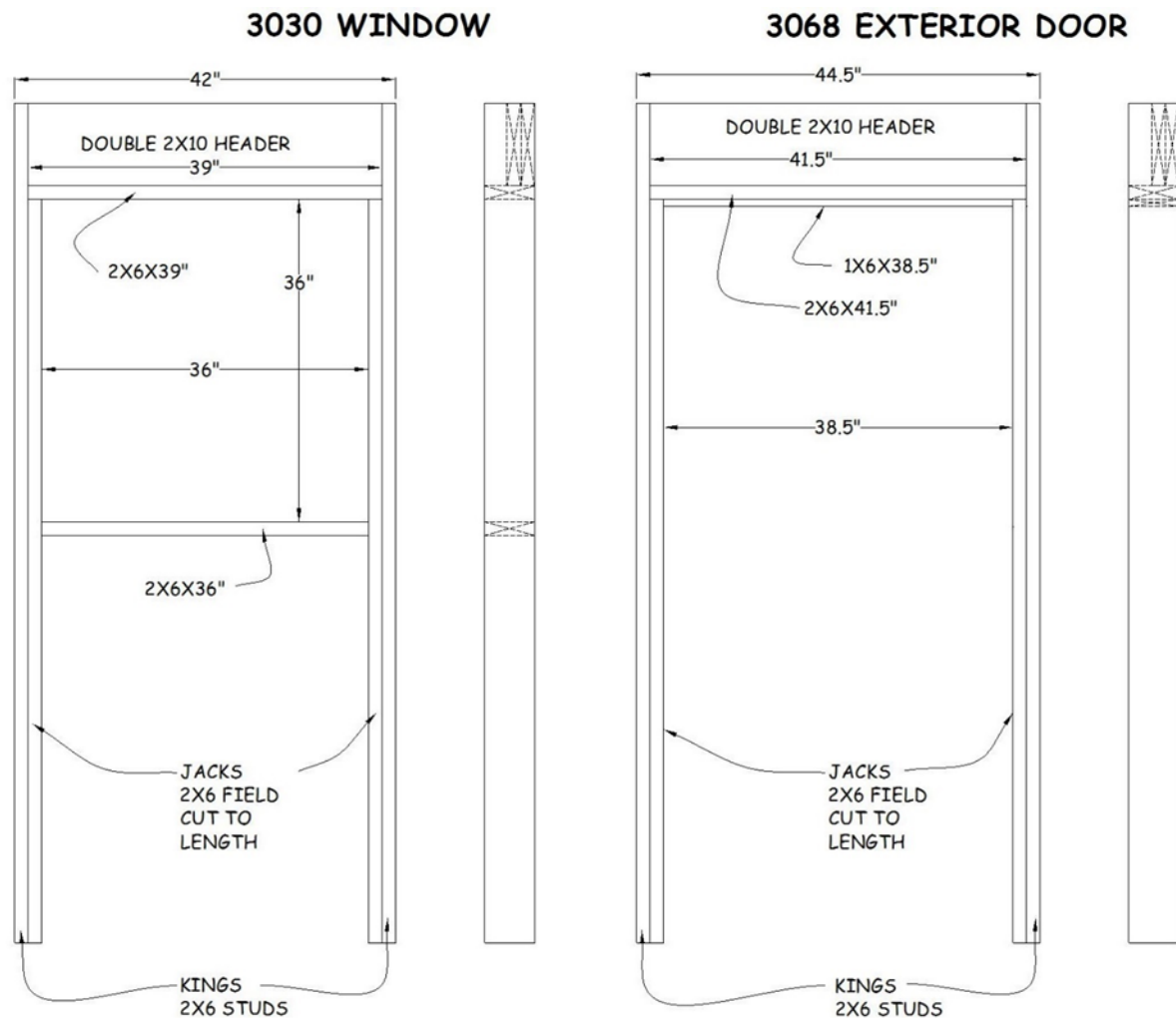


Figure 4-1. Examples of Exterior Wall Component Assembly Drawings.

2. Use 3" collated nails (Component Bin) to assemble headers and King/Jack studs. Return any unused 3" collated nails to the Component Bin.
3. Align two matching-length 2x10 pieces to create an exterior header (windows greater than 6' may require three header pieces). Before assembly, make sure any cup in the 2x10 pieces are oriented in opposite directions, with the concave surfaces of each cup facing each other, e.g. **() NOT)(**.
 - a. Ensure that the two header pieces are flush on one end and along one long edge. Nail with three rows of 3" collated nails - two about 2" from each edge and one in the middle - no more than 12" apart. Stagger the nails on opposite sides
 - b. If there is a non-flush end, trim it to ensure the two pieces are flush on both ends. If the two pieces differ in width by more than 1/8", rip the non-flush long edge to ensure the two pieces are flush on both long edges.

4. 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 with 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 3” 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.
5. Place the matching length 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 3” collated nails. Finish nailing the 2x6 to the underside of the 2x10 header with 3” collated nails. (This sequence is crucial to ensuring that the Jack studs supporting the header provide an adequate bearing surface.)
6. Select two precut 82” 2x6 pieces from Section 4.1.5 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 two 5” wafer head screws, obtained from the Construction Supervisor.
7. On exterior door components, cut a 38½” piece of 1”x6” pine board (located in the component package) and nail it to the underside of the header using 3” collated nails, ensuring the nails penetrate the 2”x10” header. This will provide an additional nailing surface and also make the top part of the door frame easier to air seal.
 8. When the component is complete, verify there are no protruding nails. Then, clearly mark the size of the component on the face of the header that is flush with the edge of the King studs.
 9. 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.

4.3. ASSEMBLING MAIN FLOOR INTERIOR WALL COMPONENTS

4.3.1. Preparation

1. Referring to the Component Assembly Drawings for interior components in the House Plan Support Documents, assemble the interior door components (see Figure 4-2 for an example of an interior component assembly drawing).

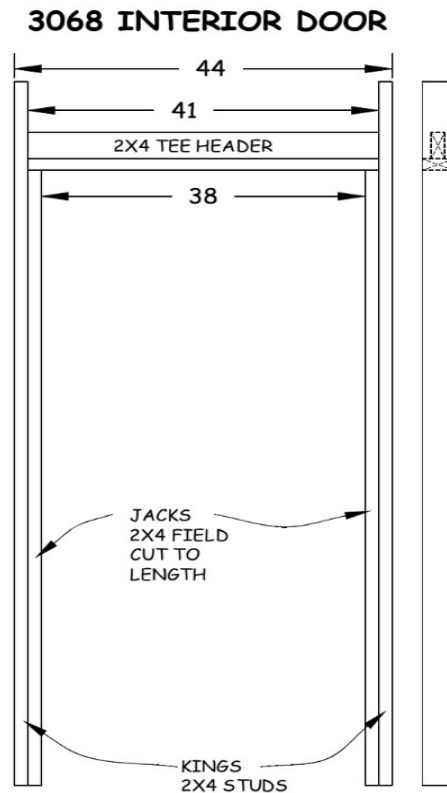


Figure 4-2. Example of Interior Wall Component Assembly Drawing.

2. From the 2x4 pieces precut in Section 4.1.5, select matching-length header pieces for each interior door. Nail together with 3" collated nails to create a "T" header (see Figure 4-3).

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.

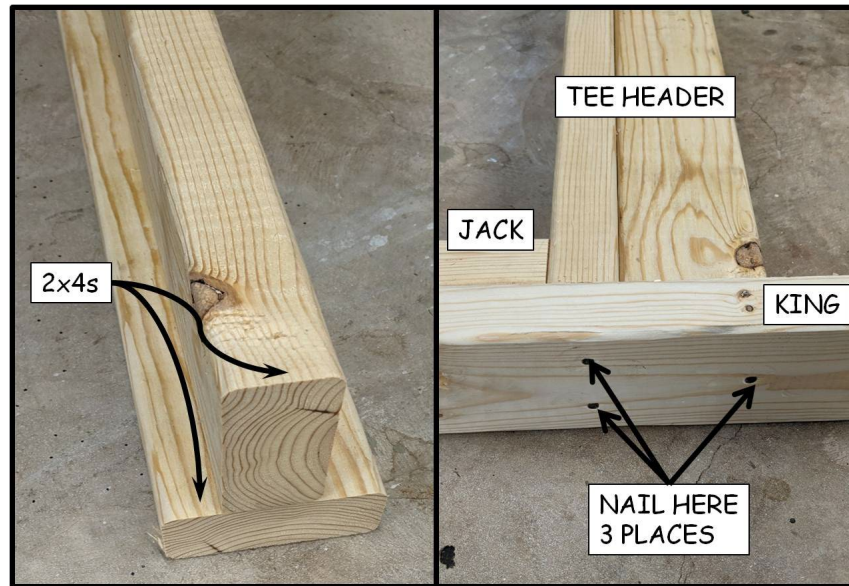


Figure 4-3. T-Header Assembly.

3. Use 3" collated nails to assemble headers and King/Jack studs. Return any unused 3" collated nails to the Component Bin.
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.

Door Type	Main Floor	Basement
Swinging Door	81"	82½"
Sliding Door	82"	83½"
Bifold Door	80"	81½"

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 92½" 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 so the horizontal portion of the "T" header is on top of the Jack studs, tight against the King studs. Nail through the King studs into both ends of the header pieces with ¾" collated nails - two nails in the horizontal piece and one nail in the vertical piece of the header (see Figure 4-2).
4. Write the door size on the header, verify the Jack studs are 81" and set the assembled door components aside.

5. 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.

4.3.3. Sliding Doors

1. A flush sliding door is positioned flush against a perpendicular side wall, and thus only needs one King/Jack pair. A non-flush sliding door is positioned entirely within a framed wall and thus needs two King/Jack pairs. (See Figure 4-4.)



Figure 4-4. Sliding Door Types; Flush (left) and Non-Flush (right)

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. For flush sliding doors, identify the appropriate header. Verify the Jack stud is 82". For each door, bundle "T" header and needed King/Jack pair together using shrinkwrap. **Do not nail header to its King/Jack pair.** Label each header with the door size and set aside with other components ensuring the labeled surface of the header is face up to facilitate later identification of the component's size.
5. For non-flush sliding doors, identify the appropriate header and place it so the horizontal portion of the "T" header is on top of the Jack studs, tight against the King studs. Nail through the King studs into both ends of the header pieces with 3" collated nails - two nails in the horizontal piece and one nail in the vertical piece of the header (see Figure 4-3).
6. For non-flush sliding doors, write the door size on the header, verify the Jack studs are 82" and set the assembled door components aside.
7. 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.

4.3.4. Bifold 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 92 $\frac{5}{8}$ " 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 so the horizontal portion of the "T" header is on top of the Jack studs, tight against the King studs. Nail through the King studs into both ends of the header pieces with 3" collated nails - two nails in the horizontal piece and one nail in the vertical piece of the header (see Figure 4-3).
4. Write the door size on the header, verifying the Jack studs are 80" and set the assembled door components aside.
5. 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.

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 92 $\frac{5}{8}$ ".
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 $\frac{1}{2}$ " 2x4 pieces for use as Jack studs in each door.
2. Nail each Jack stud to a 92 $\frac{5}{8}$ " 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 $\frac{1}{2}$ ". For each door, bundle "T" header and two King/Jack pairs together using shrinkwrap. **Do not nail header to its King/Jack pairs.** 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.

4.4.3. Sliding Doors

1. A flush sliding door is positioned flush against a perpendicular side wall, and thus only needs one King/Jack pair. A non-flush sliding door is positioned entirely within a framed wall and thus needs two King/Jack pairs. (See Figure 4-4.)
2. Select one 83½” 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 92⅝” 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 83½”. For each door, bundle “T” header and needed King/Jack pair(s) together using shrinkwrap. **Do not nail header to its King/Jack pairs.** 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.

4.4.4. Bifold Doors

1. Select two 81½” 2x4 pieces from the precut component package for use as Jack studs in each door.
2. Nail each Jack stud to a 92⅝” 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 81½”. For each door, bundle “T” header and two King/Jack pair together using shrinkwrap. **Do not nail header to its King/Jack pairs.** Label each header with the door size and the word “Basement”.
4. Move the shrink-wrapped bundle for each Basement Bifold 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.

4.5. BUILDING STAIRS

4.5.1. Calculations

1. Refer to the House Plan in the House Plan Support Documents for layout dimensions. Remove the Stair Stringer Riser Calculations Worksheet (Figure 4-5)

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". If there is hard flooring at the top of the steps, add $\frac{1}{4}$ "; this = $102\frac{1}{4}$ " working dimension.

2. Refer to the House Plan to find the number of treads and risers to be used. (13 rises and $9\frac{3}{4}$ " deep cut runs are normal). Established run/rise relationships must be followed. No rise can exceed 8". No rise can vary more than $\frac{3}{16}$ ". Treads must be at least 9" wide.

EXAMPLE: Using the assumptions in Step 1 above: the calculated rise height = $102\frac{1}{4}"/13 = 7.865$ ". To convert the decimal portion to a usable fraction, refer to Table 4-2 below. 0.865 is between 0.845 and 0.906 in the table, indicating the nearest fraction is $\frac{7}{8}$ ". Therefore, use 7- $\frac{7}{8}$ " for the rise height.

Table 4-2. Determining Rise Height Fractions.

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

Worksheet - Stair Stringer Riser Calculations

Calculate Step Rise

	Total Height - measured - basement floor to top of deck
+	Hard flooring at top? If <u>yes</u> Add 1/4" (0.25")
=	Calculated Total Height
÷	Total number of risers (typically 13, verify with Construction Supervisor)
	Calculated Riser Height (7" minimum, 8" maximum)

Calculate Bottom Step Rise

	Riser Height - as Calculated Above
-	(1-1/8") Tread thickness - SUBTRACT 1-1/8" (1.125)
=	Intermediate result
+	Hard flooring at bottom? If <u>yes</u> ADD 1/4" - 0.25 (this is RARE)
	Bottom Step Rise

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

	Riser Height - as Calculated Above
-	(3/4") Deck thickness - SUBTRACT 3/4" (0.75)
=	Intermediate Result
+	1-1/8" Tread thickness - ADD 1-1/8" (1.125)
=	Intermediate Result
-	(1/4") Hard flooring at top? If <u>yes</u> Subtract 1/4" (0.25")
	Top Step Rise (measure down this distance from underside deck and mark - Mount top edge of stringer at this line)

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 9-3/4" run because there is no riser board for this step

Figure 4-5. Stair Stringer Riser Calculations Worksheet.

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4.5.2. Layout and Cutting Stringers

1. 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 run/rise sections can now be cut from the crown edge of the 2x12.
2. 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 $7\frac{3}{4}$ ", set the gauge to this dimension on the short side of the square; set the gauge to $9\frac{3}{4}$ " on the long side of the square (see Figure 4-6).

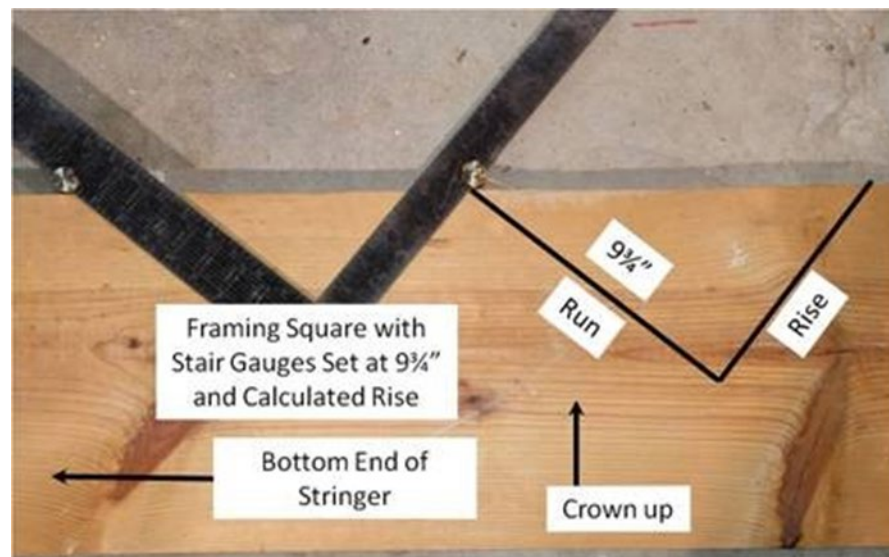


Figure 4-6. Stair Stringer Layout.

3. Mark the rise and run along the stringer until the proper number of rises needed are marked.
4. Reduce the height of the last rise at the bottom of the stringer by $1\frac{1}{8}$ " (the thickness of the tread). This will accommodate the $1\frac{1}{8}$ " thickness of the tread (see Figure 4-7).
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 $\frac{3}{16}$ ".

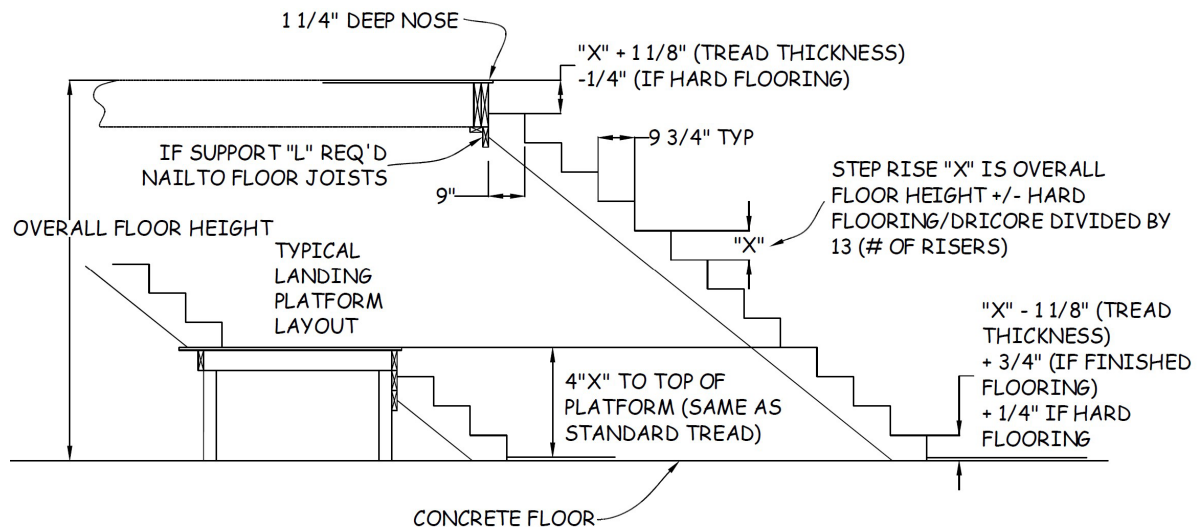


Figure 4-7. Stair Stringer Installation.

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 ($\frac{1}{8}$ " for an unfinished basement floor) 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 rise plus the thickness of the tread ($\frac{1}{8}$ " 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 4-5 (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 4-7).
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 $\frac{3}{16}$ " 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 $\frac{5}{16}$ " x $1\frac{1}{2}$ " lag screws and $\frac{5}{16}$ " 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 $\frac{5}{16}$ " x $1\frac{1}{2}$ " lag screws and $\frac{5}{16}$ " 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 $\frac{3}{4}$ " floor decking with floor joists installed on 16" centers (see Figure 4-7).
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. Remember, the bottom rise on the platform and the bottom riser on the basement

floor are both reduced by the thickness of a tread ($1\frac{1}{8}$ "). 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 SHEATHING EXTERIOR WALLS**
- 5.3 ERECTING EXTERIOR LONG WALLS**
- 5.4 ERECTING EXTERIOR SHORT WALLS**
- 5.5 COMPLETING EXTERIOR WALLS**
- 5.6 STRAIGHTENING EXTERIOR HOUSE AND ATTACHED GARAGE WALLS**
- 5.7 FRAMING FULL-HEIGHT INTERIOR WALLS**
- 5.8 ERECTING FULL-HEIGHT INTERIOR WALLS**
- 5.9 FRAMING AND ERECTING 42" HEIGHT INTERIOR WALLS**
- 5.10 INSTALLING TOP PLATES**
- 5.11 INSTALLING GABLE END BLOCKING**

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Table saw
Reciprocating saw
Jig saw
Framing nailer
Hammer tacker stapler
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
8d and 16d Nails
16d Duplex nails
2³/₈" and 3¹/₄" Collated nails
Staples
2" Drywall screws
2¹/₂" Deck screws (tan-colored)
4" and 6" Timber screws
4x8 OSB
1" Foamboard
9' House wrap
Air sealing tape
Flashing tape
Construction adhesive
Air sealing caulk
Spray foam

Personal Protection Equipment:

Safety glasses (required)
Work gloves (recommended)

Reference Materials

House Plan

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?").

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

5. 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, with the sizes written on them, are facing up.
6. For long walls, preassemble 2x6 "L" corners ensuring that end and side surfaces are flush, nailing every 10" - 12" along the length with 3¼" 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 3¼" collated nails or 16d nails into each piece. Cut four 5¼" x 92⅝" pieces of 1" foamboard, insert into the L-corner and tape 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". If the gap cannot be completely filled with foamboard, consider adding an extra stud so no gap exists.
7. Make sure the edges of all 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 3¼" 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 3¼" 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.

8. 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 3¼" collated nails or 16d nails at each end.
9. 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 2½" deck screws. If the two studs are separated, fill the gap with multiples of 1" foamboard and then screw the studs together with three 4" timber screws to create a tight stud/foamboard "sandwich." If the gap cannot be completely filled with 1" foamboard, consider adding an extra stud so no gap exists.
10. All exterior walls must be "squared" before erecting them. After each wall is assembled on the deck, align the bottom of the wall's bottom plate 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'.
11. 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.)** Once the wall has been squared, use a hammer to 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.

5.2. SHEATHING EXTERIOR WALLS

1. Sheath exterior walls with 4'x8'x½" OSB. Center full sheets on studs and flush with the bottom of the bottom plate. For nailing purposes, make sure pieces can be centered on studs. **All wind bracing must be full sheets of OSB.** Do not cut OSB to fit around windows and doors. Use full height sheets and cover both window and door openings. After the OSB has been nailed, measure and mark the location of windows and doors on the OSB. Cut out door and window openings, then nail the OSB around the window and door openings every 12".

NOTE: The two end pieces of OSB on short walls will overlap the ends of the long walls. Therefore, they cannot be put on until after the short walls are erected.

2. Check the House Plan to see where sheets of OSB wind bracing are to be located on each wall section. OSB sheets at the end of the wall should be centered on the stud located 48" from the end of the wall and flush with the bottom of 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. Consult the Construction Supervisor when deviating from the House Plan placement of any wind bracing. To install mid-wall wind bracing, 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. Fasten all **wind bracing** OSB sheets with $2\frac{3}{8}$ " 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 $2\frac{3}{8}$ " 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). Snap a chalk line on all OSB sheets indicating the location of studs within the sheet to help ensure nails do not miss the stud. After all the OSB sheets are fully nailed, pull the nails that are securing the upper plate of the wall to the deck.

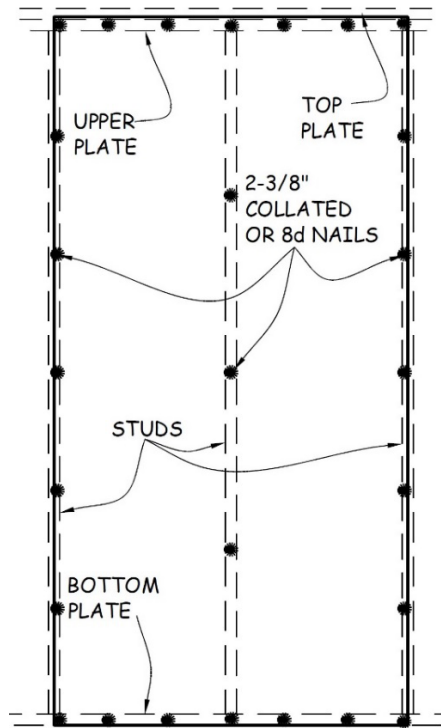


Figure 5-1. Non-Wind Bracing OSB Nailing Pattern.

4. House wrap must be installed over all exterior wall OSB. Check with the Construction Supervisor if wind bracing OSB needs to be inspected. If not, install house wrap on all walls before erecting them.
5. Attach 9' width house wrap to each wall, holding the top 2" below the top of the upper plate. Use a string line to mark the correct position. Leave enough on each wall end to wrap a minimum of 12" around each corner of the house. Roll the wrap horizontally across the wall, smoothing the wrap as you go. The wrap should be tight but not stretched.
6. Staple the house wrap every 12" across the top first. Then, starting at the top, in the middle of the wall, work downward, stapling every 24"–36" to the bottom of the OSB. Place the last staple about 1" up from the bottom of the OSB. Continue working outward from the middle of the wall, placing columns of staples 24"–36" across the wall. Make sure to keep the wrap smooth with no wrinkles. **Do not over-staple.** As at the top, staple the wrap across the bottom of the OSB every 12". Cut the wrap from

windows and doors and staple around every 12". Fold the corner wrap over onto the wall and temporarily tape it into place. Fold any wrap extending past the bottom plate up onto the wall and temporarily tape it into place.

5.3. **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 (see Figure 5-2). 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.



Figure 5-2. Air Sealing Caulk.

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.

5.4. ERECTING EXTERIOR SHORT WALLS

1. Before erecting short walls, check that the blocking between the rim board and the first/last I-joist to which the bottom plate will be nailed has been marked on the deck. If not marked, go to the basement, locate one of the blocking pieces, make appropriate measurements and transfer to the deck. 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 erecting the wall.
3. Following the procedure in Section 5.3.1, 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 3¼" collated nails through the floor plate into the blocking located in Step 1 above.
4. 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 tops of the upper plates are flush with each other and the corner is plumb. Fasten wall panels to each other by flushing the corners and nailing the adjoining end studs every 12" from bottom to upper plate with 3¼" collated nails.

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

5. 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.
6. Install OSB wind bracing on the ends of the short walls with 2⅝" collated nails or 8d nails into each stud and the upper and bottom plate with a maximum 6" spacing. If the wind bracing does not extend to the end of the adjoining wall and the gap is greater than 3", cut a piece of OSB to fill the gap and nail in place.

5.5. COMPLETING EXTERIOR WALLS

1. Along all walls measure and cut $\frac{1}{2}$ " OSB to fit **tightly** on the exterior of the sill box, between the bottom of the wall OSB and the foundation foamboard. Nail to the deck and the sill plate using three 8d nails per foot (see Figure 5-3).
2. Install house wrap on long walls (if not already done) and on short walls (see Section 5.2.5 and Section 5.2.6.). Wrap the house wrap around each wall corner and staple in place. Unfold any wrap taped up at the bottom of a wall and let it hang down. When all wrap has been stapled in place, cover all seams and tears with flashing tape.
3. Cut OSB and wrap from door openings and windows if not already done and staple around the opening every 12".

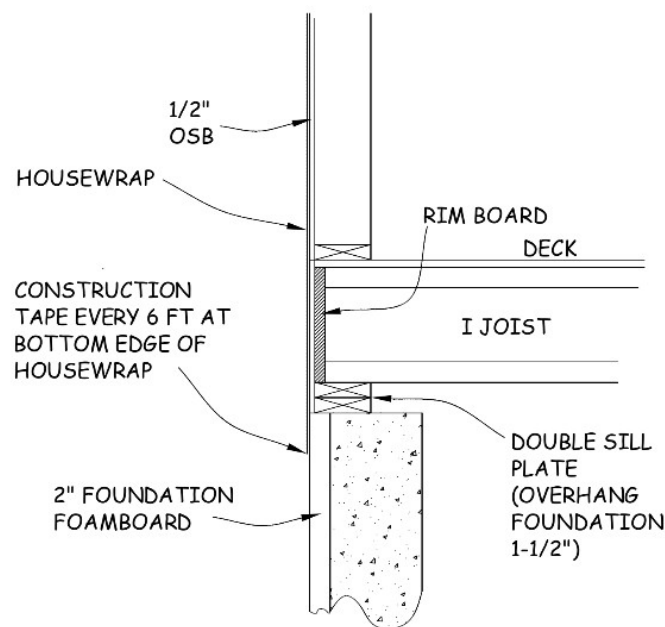


Figure 5-3. Sill Box with OSB and House Wrap.

4. Fill the inside of every window and door header with foamboard. Fill any gaps greater than $\frac{1}{8}$ " with air sealing caulk or spray foam. Cover the perimeter and any joints with flashing tape.

NOTE: 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.

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

5.6. STRAIGHTENING EXTERIOR HOUSE AND ATTACHED GARAGE WALLS

5.6.1. 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' 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. Check that each exterior wall corner is still plumb.
3. For each exterior wall corner, cut a scrap 2x4 10-12" long.
4. 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.
5. 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).

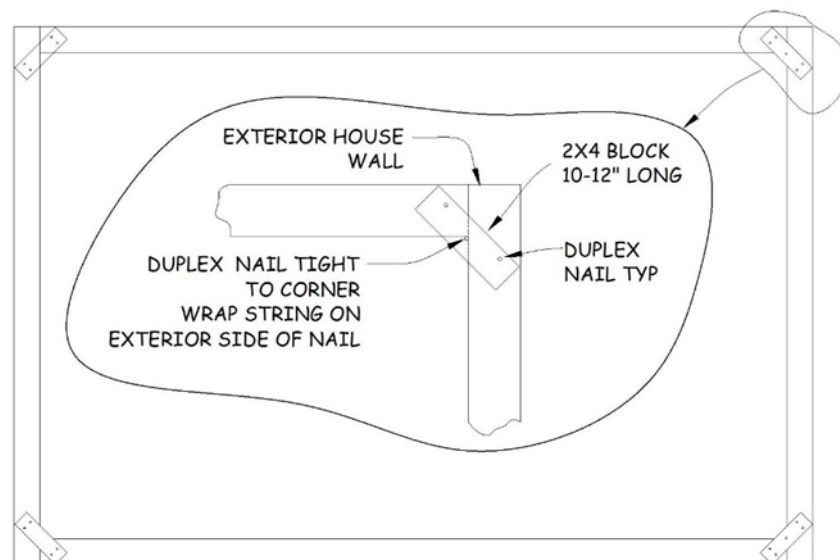


Figure 5-4. Installing String Line.

6. 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.
7. Repeat steps 5 and 6 at each exterior corner.

8. 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).
9. 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.
10. 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.

5.6.2. 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.

5.6.3. 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 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.

5.7. FRAMING FULL-HEIGHT 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?”).

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

3. Place studs with “crown up” and door components in position between plates per markings on upper and bottom plates.
4. 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 3¼” collated nails or 16d nails through the plates into the studs.

5.8. 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 84” 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 3¼” collated nails if they will hit an I-joist; otherwise, use 2½” deck screws. Check that the end stud is

plumb and tight to the exterior wall; then, nail at an angle THROUGH THE EXTERIOR WALL UPPER PLATE into the interior wall upper plate with 16d nails 3¼" collated 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 10.6.3.4 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) 1⅝" shorter than that measurement. This will be the top plate for the closet wall.
 - b. Nail the King/Jack pair to the bottom plate using 3¼" collated nails, two nails into the King stud and two into the Jack stud. Nail the upper plate to the top of the King stud using two 3¼" collated nails. Position the top plate, cut in Step 4a above, on top of the upper plate positioning it so that it will overlap onto the exterior wall upper plate by 2" and will be 3⅝" short of the interior end. This leaves room for the intersecting top plate to overlap later on.
 - c. Stand the wall up, move it into position with the bottom plate aligned with the chalk line and the exterior bottom plate end tight against the exterior wall bottom plate. Secure the bottom plate to the floor between the chalk lines using 3¼" collated nails if they will hit an I-joist; otherwise, use 2½" deck screws. **DO NOT** nail the bottom plate where the door will be hung. 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 3¼" 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. Position the door T header with one end on the Jack stud and the other end resting on the blocking in the exterior wall. Nail the end on the T header to the Jack stud with two 3¼" collated nails. Place the edge of the straight 2x4 (from Step 4d above) against the side of the closet top and bottom plates. Move the T header so it rests against the 2x4 and mark the edge of the header on the blocking between the exterior wall studs. Nail the header to the wall blocking at this mark with 3¼" 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. Verify 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.

5.9. FRAMING AND ERECTING 42" HEIGHT INTERIOR WALLS

5.9.1. Preparation

1. Before framing and erecting any 42" height walls, install 2x4 blocking between the two exterior wall studs where the wall will be located. Place this 2x4 blocking with the wide side flush with the interior surface of the studs and the top edge 42" off the floor. Secure with two 16d nails or 2½" deck screws through the end stud into the 2x4 blocking.

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

2. Frame 42" height walls the same as full-height walls using 37½" studs set 24" o.c. These walls will have both an upper and a top plate. A 42" height wall will have either a post at the interior end of the wall the same height as the wall or a full-height ceiling to floor post at the end of the wall. The House Plan will specify if the post should be full-height or not. If unsure, consult the Construction Supervisor. In both situations, build the wall 3½" shorter than the overall length of the wall to accommodate the 3½" square end posts.

5.9.2. 42" Height Walls with a Short Post

1. Build a 52" tall post of two 2x4's with a ½" layer of OSB sandwiched between to form a 3½"x 3½" square post. This post will protrude 9¼" below the sub-floor. Set the post aside while building and erecting the wall.
2. To erect the wall, run two beads of construction adhesive on the deck within the wall chalk lines keeping the adhesive ½" away from the chalk lines. Stand the wall section up with the bottom plate tight to the exterior wall bottom plate. Secure the wall to the exterior wall blocking making sure the wall is plumb. Starting at the intersection with the exterior wall, secure the wall bottom plate to the floor using 2½" deck screws.
3. The post at the end of this wall needs to be reinforced by extending it through the sub-floor and securing it to blocking below the sub-floor. Check for obstructions

below the sub-floor before cutting the hole for the post. Cut a hole in the sub-floor 3½" by 3½" that aligns with the end of the wall.

4. Insert the post into the hole in the sub-floor then attach it to the wall with the top of the post flush with the top of the upper plate using three 4" Timber screws going through the last stud into the post.
5. Beneath the sub-floor (i.e., in the basement) create blocking for the post using two 2x6 pieces positioned vertically to the floor joists, one on each side of the post. These blocking pieces need to be tight to the post. Secure the blocking to the floor joists using 3" drywall screws on each end. Secure the post to the blocking using two 6" Timber screws through the blocking on each side (see Figure 5-5). Make certain the post above the sub-floor is plumb.
6. Install the top plate extending it over the post with the end of the top plate and end of the post flush.

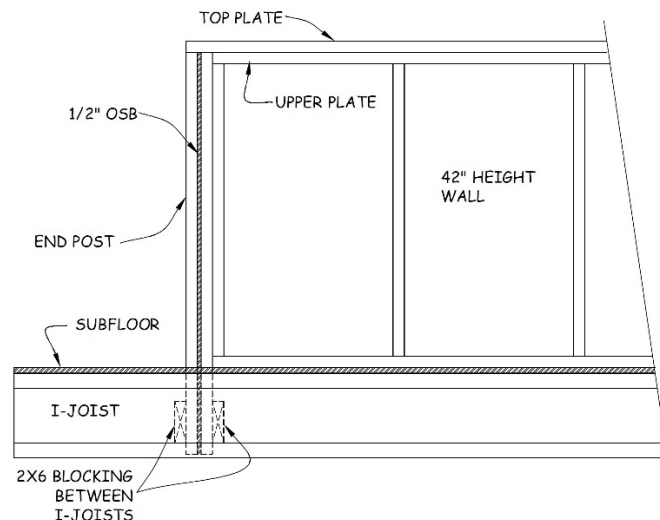


Figure 5-5. 42" Height Wall With Short Post.

5.9.3. 42" Height Walls with a Full-Height Post

1. Build a post 100" long using two 2x4's with a ½" layer of OSB sandwiched between to form a 3½"x 3½" square post. Label the post and set it on end in the basement under the stairs.
2. Frame the 42" height wall and erect it. Run two beads of construction adhesive on the deck within the chalk lines for the wall keeping the adhesive ½" away from the chalk lines. Stand the wall section up with the bottom plate tight to the exterior wall bottom plate. Secure the wall to the blocking in the exterior wall with two 16d nails making sure the wall is plumb. Starting at the intersection with the exterior wall, screw the wall bottom plate to the floor using 2½" deck screws. The full-height post will be installed at a future date after the ceiling has been sheetrocked.

5.10. 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 5-6).
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.

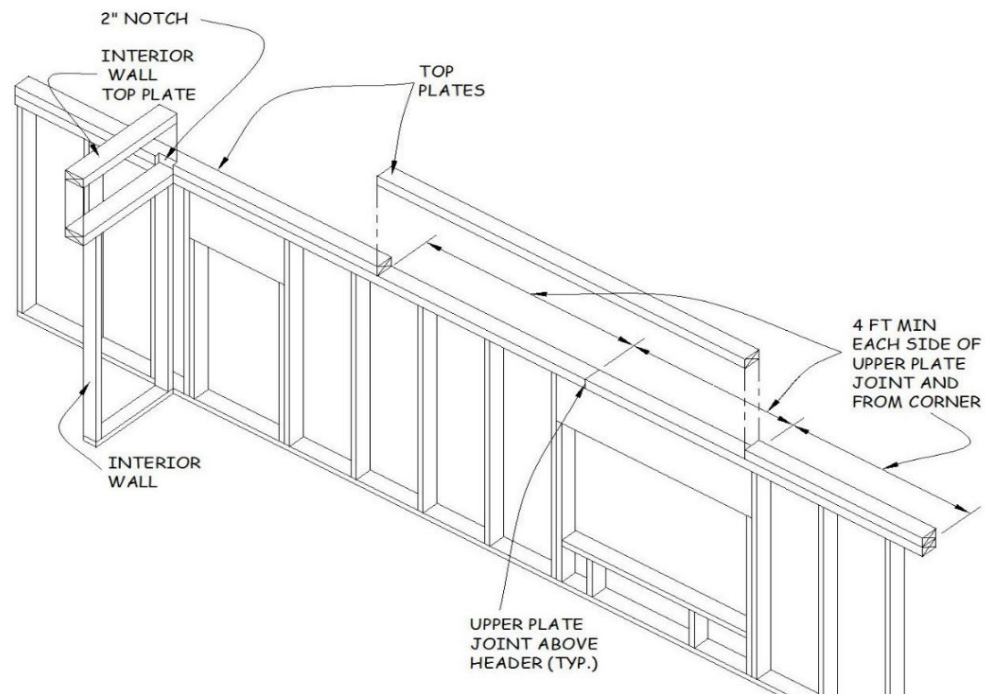


Figure 5-6. Exterior Wall Top Plate Installation.

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 5-7).

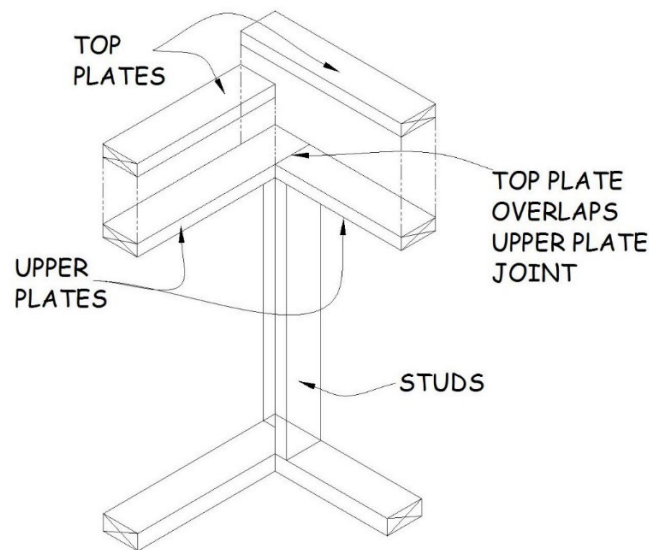


Figure 5-7. Interior Wall Top Plate Installation.

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).

5.11. INSTALLING GABLE END BLOCKING

1. Install 2x6 blocking along the top of both gable end walls keeping each end 2"-3" short of the outside top wall plate. Hold the 2x6 back 1½" from the exterior of the top plate. Nail the entire length with 16d (or 3¼" collated) nails staggered every 12". The 2x6 overhangs the plate on the interior side of the wall and serves as ceiling sheetrock blocking. See Figure 5-8.

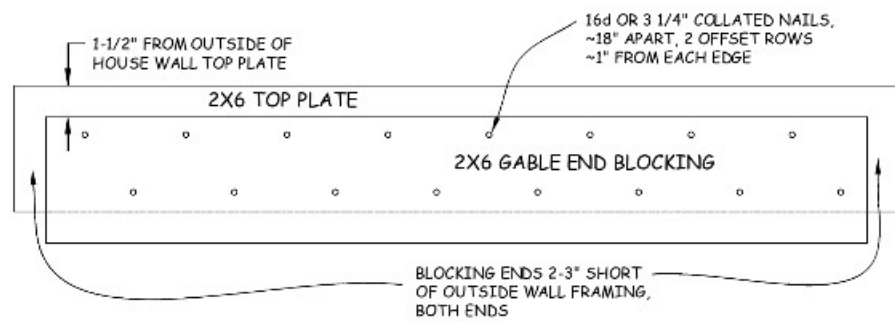


Figure 5-8. Gable End Blocking.

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
½"x3¼" OSB strips
Double 2x6 joist hangers
4x4 Post anchor brackets
Tapered shims
16d Nails
8d Nails
2⅜" Collated nails
3¼" Collated nails
1" & 2" Button nails
2½" Concrete nails
¼"x1¾" Concrete screws
4" & 6" Timber screws
Air sealing tape

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Reciprocating saw
Anchor kit
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 all of the OSB in the porch area is installed on the house wall.
2. At the house wall, measure in 3" from the porch slab edge(s) and make a pencil mark. At the 3" mark(s) on the slab, measure 1½" from the house wall OSB, and make a pencil mark. Using a straight 2x4 and 6' level, transfer the 3" mark vertically to the top plates.
3. At the corner(s) of the porch slab, measure in from each edge 3" to locate the preliminary location of the outside corner of the porch post(s) and framing.
4. The porch side frame(s) will be supported by double 2x6 joist hangers nailed to cleats on the house wall. If the garage forms one end of the porch, there will be only one side frame; otherwise, there will be two side frames. Procure one or two 3-4 ft. long 2x6(s) as required. Using the porch as a workbench, lay the 2x6(s) on the porch. Refer to Figure 6-1. On one piece, measure and mark 3" in from one end and draw a square line to locate the joist hanger and outside face of the side frame. If there are two side frames, repeat on the opposite end of the second piece.



Figure 6-1. Joist Hanger Cleats.

5. Place two small (3-4" long) pieces of 2x6 in one joist hanger and clamp the two sides of the hanger to the small blocks with the edges tight to the bottom of the hanger, as shown in Figure 6-2. Place the assembly on one of the 2x6 cleats with the inside of the joist hanger aligned with the square line, and the 2x6 block edges flush with the top edge of the cleat, leaving the measured 3" end exposed. Nail in place, filling all the hanger holes, being sure to keep the hanger and 2x6 blocks aligned. Pay particular attention to the tops to keep them flush. Repeat if there is a second side frame.



Figure 6-2. Porch Side Frame Joist Hanger.

6. Extend the line on the cleat at the 3" mark across the top edge of the cleat(s). Place the cleat(s) against the house wall, aligning the 3" mark with the mark(s) made on the top plate in Step 1, above. Align the top edge of the cleat with the top plate, and tack in place using three or four 3¼" collated nails into the framing. Double check that the tops are flush and the 3" marks are aligned, then permanently attach with four 4" timber screws into the framing.
7. At the joist hanger locations, use the straight 2x4 and level to check that the 1½" mark and face of the cleat(s) is plumb. If not adjust the mark. Determine the length of the porch side frame pieces by measuring from the (adjusted) 1½" mark to the post corner location from Step 1, above. Referring to Figure 6-3, subtract 1½" to get the working length of the outside frame piece, and subtract 3" to get the length of the inside frame piece.

EXAMPLE: Assume the measurement "L" is 59". After deducting 1½" from the measurement, the length of the outside side frame piece will be 57½".

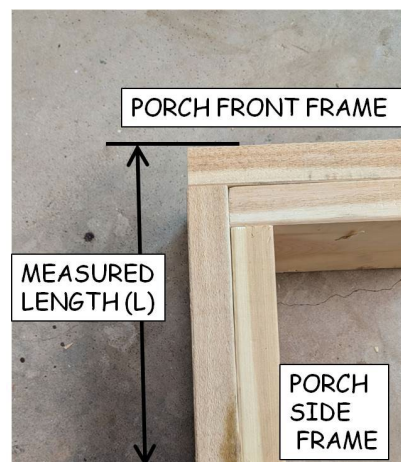


Figure 6-3. Porch Framing Corner Detail.

8. Using the working measurement, cut two 2x6's to that length. Cut two other 2x6s 1½" shorter than that length.

EXAMPLE: For a working length "L" of 59", cut two 2x6s at 57½" and two at 56".

9. For each end of the porch, assemble the 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 ¾" collated nails every 12" at an angle so points do not protrude.
10. Determine the slab pitch by laying one end of the level on the slab at the house perpendicular to the wall. Raise the lower end until the bubble is centered and measure the gap at the slab edge. Measure from the joist hanger to the slab, and add the pitch amount. Measure and mark this length on a 2x4. Clamp or screw the 2x4 to the outside of the side frame assembly, with the mark aligned the bottom of the side frame, about 6" from the outside end of the frame piece. Take each 2x6 pair and place the flush end into the joist hanger, while supporting the outside end with the 2x4. Make sure the shorter 2x6 faces the center of the porch. 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 6-4). Then, toenail the side frame through the joist hanger support with 16d nails, filling all holes.
11. 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. Using a 2x block to get the correct offset, lay the shorter piece centered on top of the longer. Starting at one end, nail the two pieces together. Angle the nails to avoid chipping the concrete if working on the porch slab. Nail with three ¾" collated nails every 24". Move the un-nailed end as required to keep the edges flush. Turn the assembly over and nail the other side, offsetting the sets of nails so the piece is nailed every 12".
12. Provide temporary supports for the front frame piece by clamping or screwing 2x lumber about 2' long to the bottom of the side frame pieces, extending past the frame about 8". Lift the front frame piece into position between the side frames, and connect the corners using 16d nails or 6" timber screws. Keep the tops flush as the connections are made.
13. 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 6-4).
14. 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.

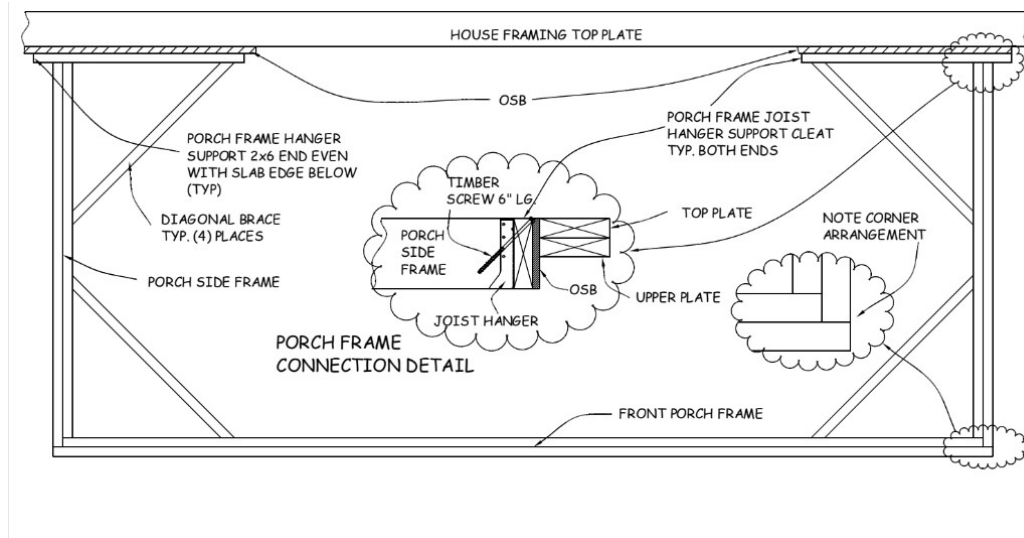


Figure 6-4. Porch Framing.

15. Confirm the location of the support post(s), by plumbing down from the framing above. Adjust the pencil marks made previously as needed. 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(s) as needed on the concrete. Repeat at the opposite end of the porch if necessary.
16. Using the same method as in Step 15, 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.
17. Set the post anchor plates to the marks made in Steps 15 and 16. Secure with $\frac{1}{4}$ "x1 $\frac{3}{4}$ " 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.
18. Assemble posts, each of which consists of two 2x4's (with their crowns opposite to each other) and $\frac{1}{2}$ "x3 $\frac{1}{4}$ " OSB, nailed together. Pre-drill a piece of green treated 2x4 measuring 3 $\frac{1}{2}$ "x3 $\frac{1}{2}$ " 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 6-5). 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 6-5. Porch Post H-Bracket.

19. Slide the post sleeves up and nail the post anchor plates to the posts with $2\frac{1}{2}$ " roofing nails. Slide the post sleeves down over the post anchor plates.

20. 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.
21. If blocking is required on the side framing to make it flush to the house wall, add an equal amount to the front, so that the porch soffit is the same width both front and side.
22. Install blocking for porch post trim rings as shown in Figure 6-6.



Figure 6-6. Porch Post Trim Ring Blocking.

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 92⅝". 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 6-7).

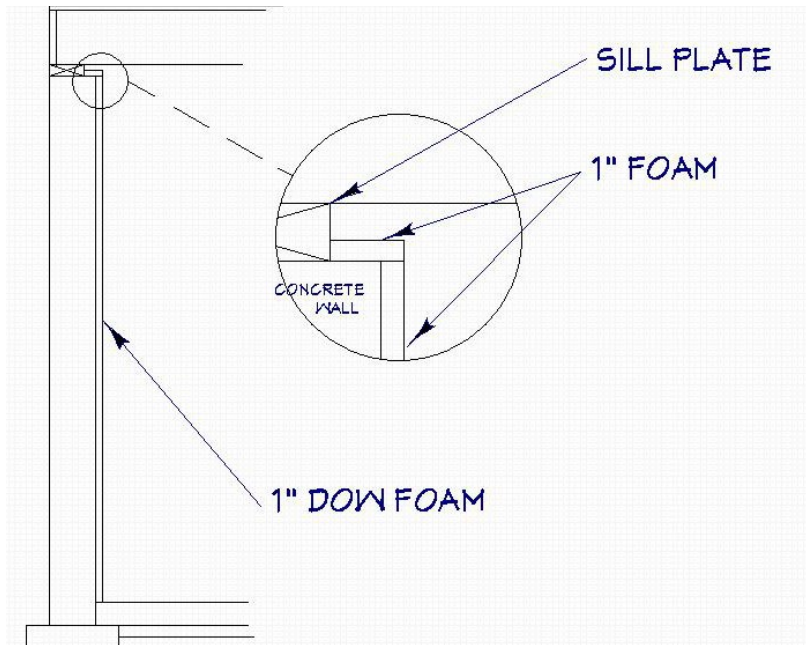


Figure 6-7. Basement Wall Insulation.

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, abut the corners of the end studs, and nail or screw blocking to the end stud of one wall (see Figure 6-8). Plumb both walls, and nail the non-blocked stud into the blocking to secure the wall.

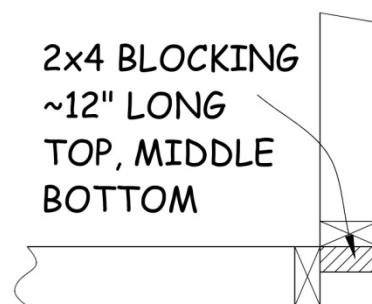


Figure 6-8. Basement Exterior Wall Corner.

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	61½"	64½"	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 6-9 (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.

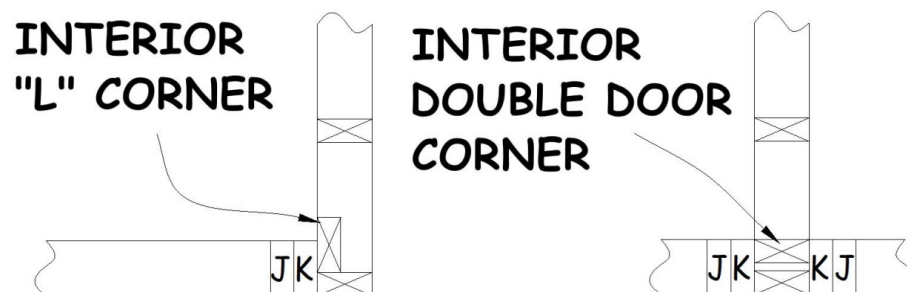


Figure 6-9. Corner Construction.

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. Where a flush sliding door intersects another wall, install a 2x4 block with the top edge $8\frac{1}{2}$ " from the floor to support the door header.
7. 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.
8. 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.

9. Foamboard insulation must be 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. Scrap 1" foamboard may also be used for this. Nail the foamboard to the studs using 1 $\frac{1}{2}$ " siding nails or 2" button nails.
10. 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.
11. 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.
12. Add Short studs as required below the sill to match the 24" stud spacing. Short studs are not required above the T-header.
13. 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 6-10).

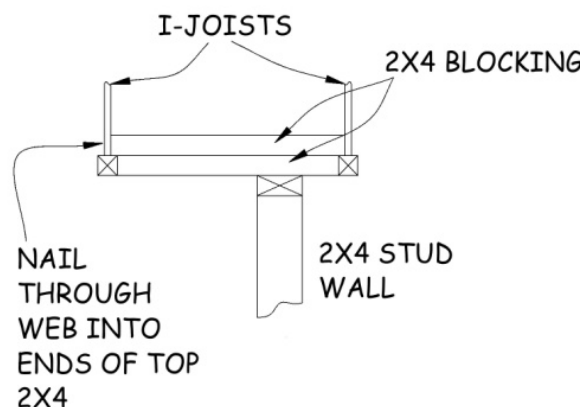


Figure 6-10. Blocking for Attaching Basement Walls Between I-joists.

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.
3. 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.
4. Measure and cut the 2x4 upper plate, cutting the ends at the same angle marked on the studs.
5. 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.
6. 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 3¼" 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.
7. 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 6-11).
8. Align a straightedge with the upper and bottom plate locations of the stud removed earlier, and mark that location on the angled brace.

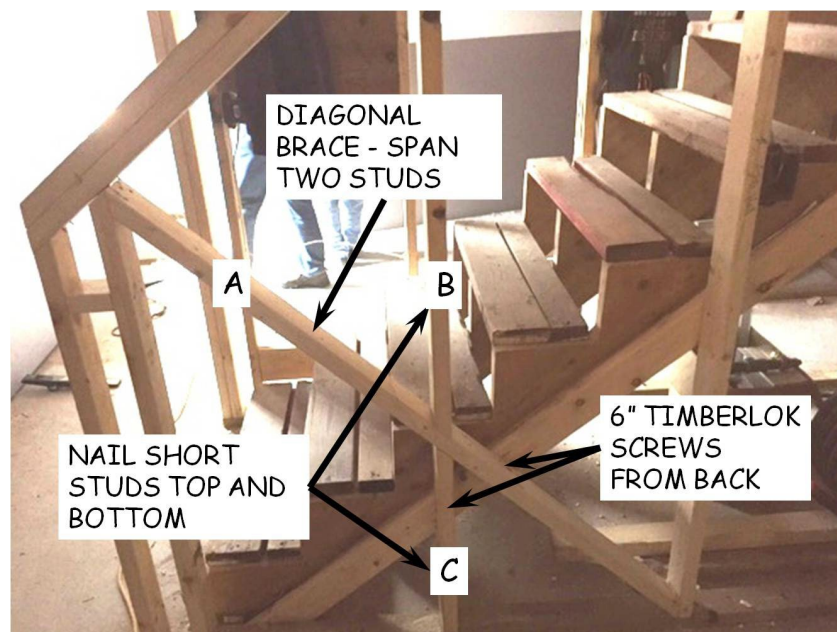


Figure 6-11. Stairway Wall Bracing.

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 6-8, “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 6-11.

6.4. FRAMING STAIRWAY CLOSET PLATFORM

1. If the House Plan calls for a kitchen cabinet rather than a closet, go to Section 6.5.
2. 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.

3. Build a 15¾” tall 2x4 wall 40” long, using 12¾” 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. When the 2x4 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 2x4 joists (16” o.c.) and ¾” OSB decking as shown in Figure 6-12. The stairway opening is typically 40” wide. Adjust the platform width as necessary to fit between the walls. The 2x4 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 2x4 will not interfere on either side (see Figure 6-13). 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”.

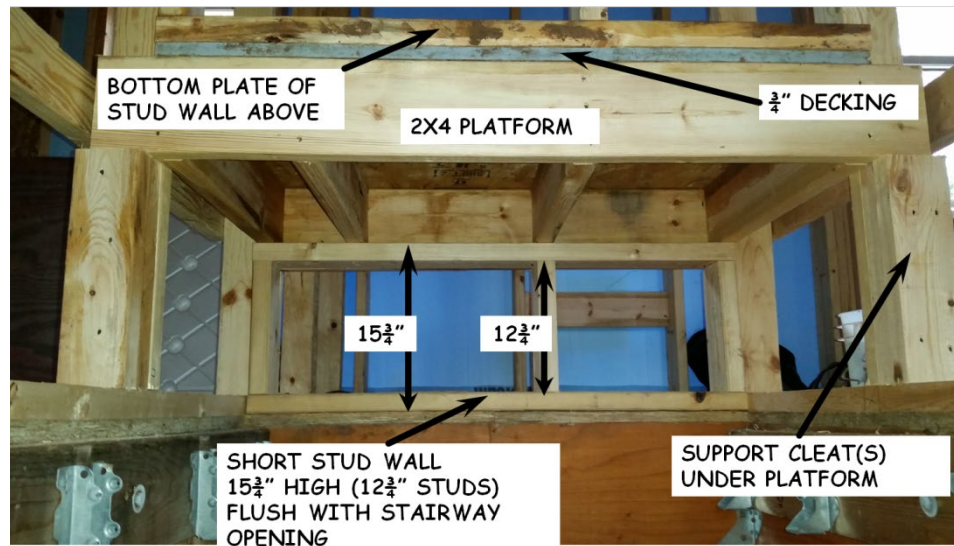


Figure 6-12. Closet Platform.

5. Set one end of the 2x4 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 2x4 can be nailed.

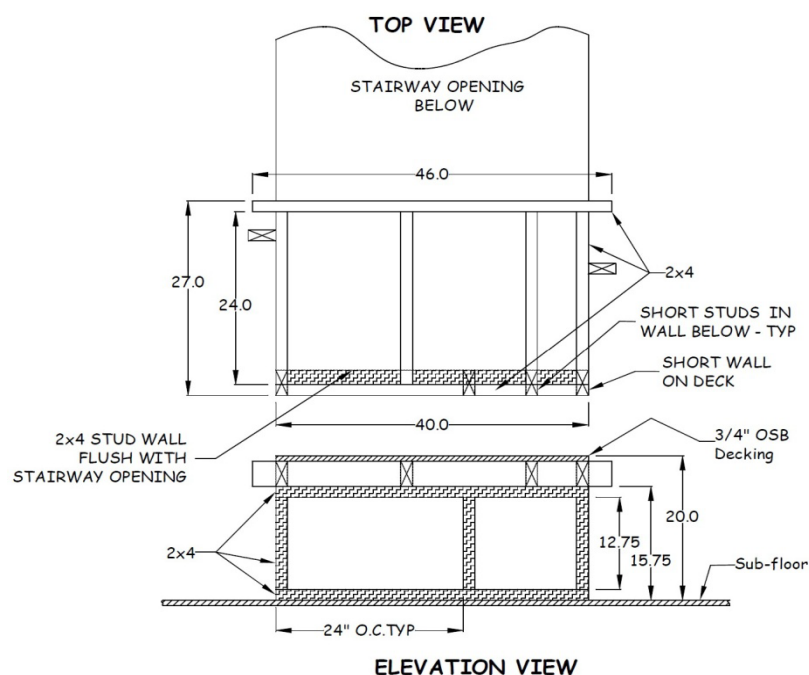


Figure 6-13. Platform for Closet Over Stairway.

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 6-14).

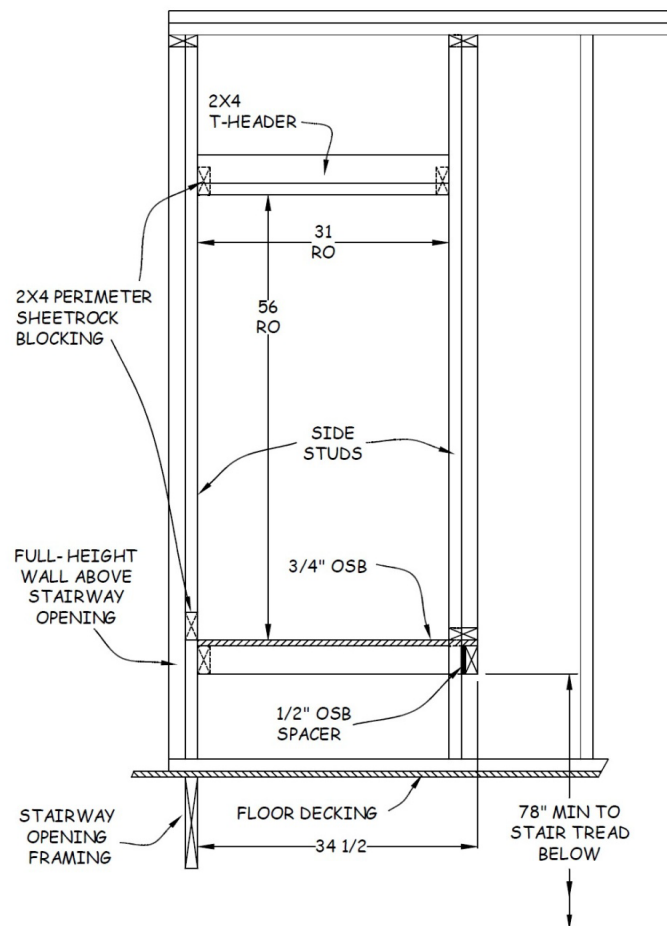


Figure 6-14. Stairway Cabinet Opening Framing.

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 Section 6.4.4.
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.

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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 BOXES

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
4x8' ½" OSB
2x4 Lumber
2x6 Lumber
16d Nails
8d Nails
3¼" Collated nails
2⅝" Collated nails
4" & 6" Timber screws
H-clips
L-clips
House wrap
Air sealing tape
Stretch wrap

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. If not installed during top plating, 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 1½" from the outside of the top plate (using a piece of 2x lumber as a guide works well). The 2x6 overhangs the plate on the interior side of the wall and serves as sheetrock blocking. Keep the ends of the blocking 2-3" short of the outside of the top plate.
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, keeping the ends of the blocking 2-3" short of the outside of the porch 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 2x6 pieces, a minimum of 64", 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, and **any crown toward the top of the truss**. 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" long 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 3¼" 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 house wrap. 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 3½" 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 3¼" 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 3½" 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 3¼" collated nails into each block.
6. Nail the sub-fascia ends to each other at the peak using 3¼" 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 1/4" spacer between the L-brace and wall OSB, just below the top edge of the OSB (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 times 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.

3. 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.

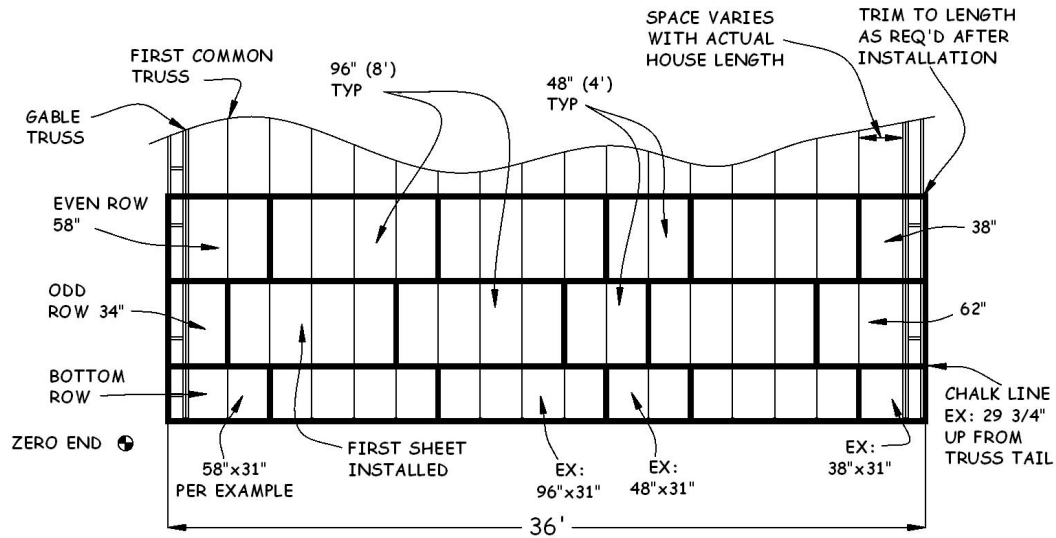


Figure 7-1. OSB Layout for 36' Roof.

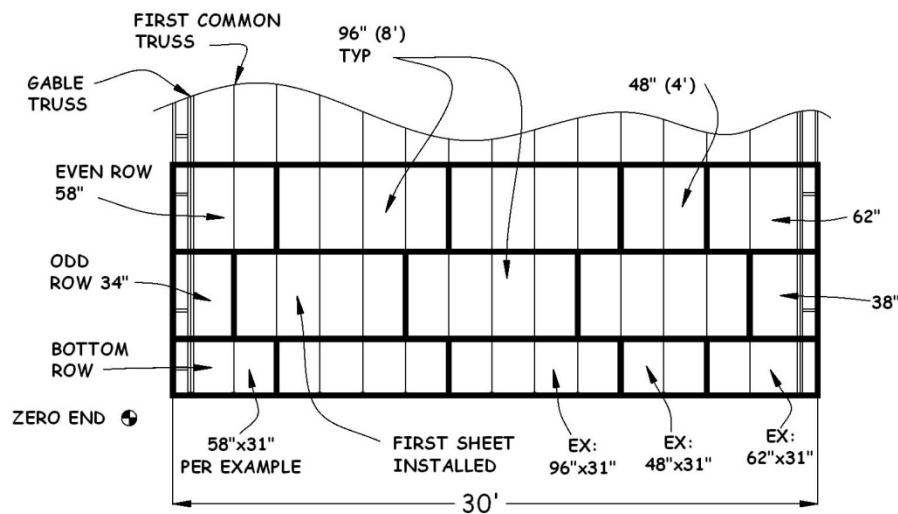


Figure 7-2. OSB Layout for 30' Roof.

4. 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 sheathing 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.

	Odd Rows				Even Rows				Totals for 4 Full Width Rows	
Total Roof Length*	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										

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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. Any row of roof sheathing narrower than 24" MUST be installed as the bottom row so that it is supported by the subfascia. The procedure below ensures that any row that is less than full-width is installed at the lower edge of the roof.
2. 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.
3. 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).
4. 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.

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'-7 ¾"</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")

5. 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.

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 $\frac{1}{8}$ " 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 $21\frac{3}{4}$ ". 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 2 $\frac{3}{8}$ " 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 $\frac{1}{4}$ " 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 $\frac{1}{2}$ " 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 BOXES

7.6.1. Assembling House Scuttle Box

1. Typically, the house scuttle box is pre-built and delivered to the site prior to the day it is to be installed. If it has not been built, use the following instructions to build one. See Figure 7-3 for a picture of the finished house scuttle box and Figure 7-4 and Figure 7-5 for a cut diagram and assembly drawing, respectively.



Figure 7-3. House Scuttle Box.

2. Cut material as shown in Table 7-3. Use scrap as available. OSB material is all ½” thick.

Table 7-3 Scuttle Box Material List.

QTY	MAT'L	SIZE (in.)	DESCRIPTION	NOTES
2	OSB	32x20	Side panel	
2	OSB	25½x20	End panel	
2	PINE	2x4x22¼	Bottom cleat	
4	PINE	2x2x16	Corner posts	Rip from 2x4
2	OSB	~ 6x6	Shipping corner	Diagonal cut
1	OSB	25x27½	Cover	
BOX	Steel	1⅝	Sheetrock screws	
AS REQ'D	25x27½	Foamboard	Insulation	Total 4” thickness

3. Cut notches 3½” high x 1½” long in the long edge of the two End Panels (see Figure 7-4). These will be the bottom edges of the two ends.

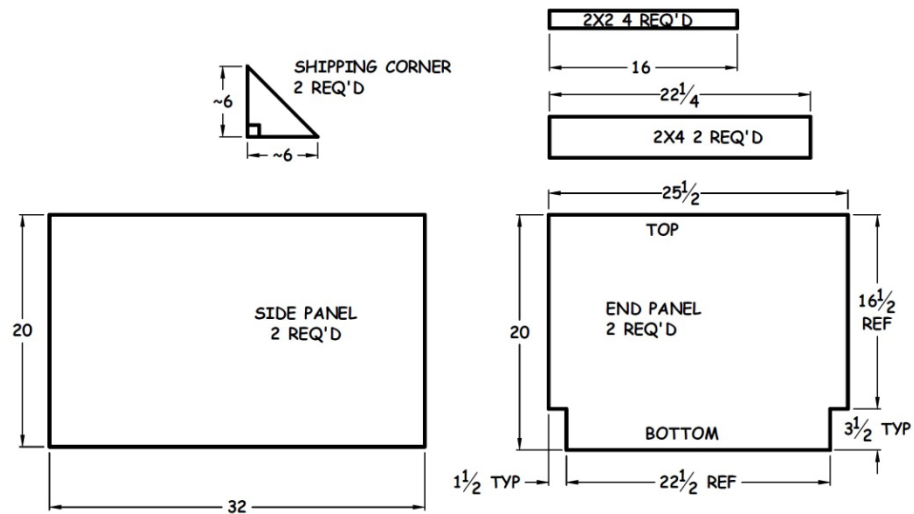


Figure 7-4. House Scuttle Box Cut Diagram.

4. Refer to Figure 7-5 for Scuttle Box Assembly. On the rough side of the End Panel, attach a 2x2x16" long Corner Post at each end using 1 5/8" sheetrock screws, through the OSB into the 2x2, one 2" from each end and two more roughly equally spaced between. Align the end of each 2x2 flush with the top of the notch, and the long edge flush with the end of the Panel. Repeat for both End Panels.

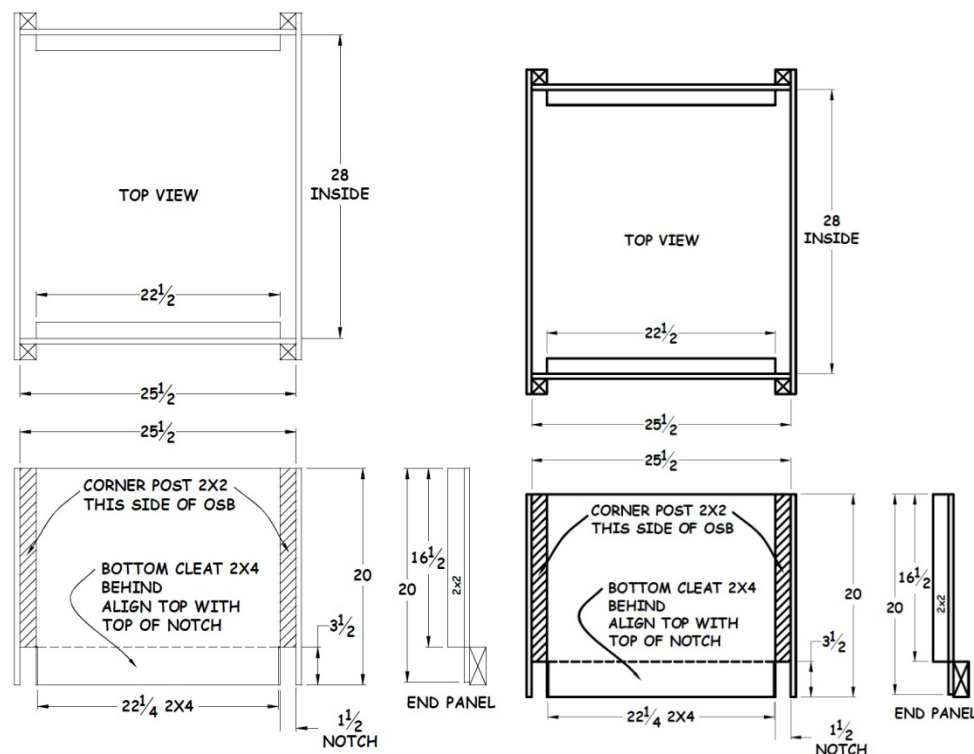


Figure 7-5. House Scuttle Box Assembly.

5. On the smooth side of the End Panel, attach one of the 2x4x16" long Bottom Cleats. Align each end of the Bottom Cleat $\frac{1}{8}$ " short of the $3\frac{1}{2}$ " edges of the bottom notches and the top edge even with the $1\frac{1}{2}$ " top edge of the notches. Use $1\frac{5}{8}$ " sheetrock screws through the OSB into the 2x4, with one 2" from each end and three more roughly equally spaced between. Repeat for the other End Panel.
6. Assemble the house scuttle box by setting the bottom edges of the two Side Panels and two End Panels on a level surface to ensure that the bottom edges of the box will be flush with each other.
7. With all smooth sides facing inward, align the end edges of the Side Panels with the outside edges of the Corner Post 2x2s. Screw the sides to the Corner Posts using $1\frac{5}{8}$ " sheetrock screws, three in each joint. Repeat at all corners. Keep the box square as the connections are being made.
8. Check that the box is square, place the square Shipping Corners tightly in two diagonally opposite corners atop the Bottom Cleat, and screw in place with two $1\frac{5}{8}$ " sheetrock screws in each piece.

7.6.2. Installing House Scuttle Box

1. Before installing the house 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 house 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 house 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 House Scuttle Box Cover

1. If the house 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 OSB cut earlier to 25"x27½" for the cover. If not found, cut a new piece. Place the OSB cover in the newly installed hole and check that it **easily fits in the opening**.
3. Cut 25"x27½" pieces of 1" and/or 2" foamboard totaling 4" of thickness.
4. Stack the foamboard on top of the OSB and stretch wrap around both the length and width to form a stable bundle (see Figure 7-6).



Figure 7-6. House Scuttle Cover Assembly.

5. Check again that the cover assembly **easily fits in the opening**.

7.6.4. Installing Garage Scuttle Box

1. Confirm the location of the garage scuttle box with the Construction Supervisor. The scuttle hole will be a 30" long opening framed in between trusses with ½" OSB walls 3" taller than the bottom truss chord. The framing lumber used should match the truss bottom chord lumber, either 2x4 or 2x6.
2. At one end of the opening, install 2x lumber between trusses with the wide face vertical. Keeping the bottom of the 2x flush with the bottom of the truss chord, nail through the bottom truss chord into one end of the 2x with two or three ¾" collated or 16d nails. Square the 2x to the truss and nail the other end as above.

3. Measure and mark 30" from the inside face of the 2x in the direction of the opening. Nail, using two 3¼" collated or 16d nails, another 2x between the trusses as at the other end of the opening. Double check that the distance between faces of the 2xs is 30".
4. Cut two pieces of ½" OSB 3" wider than the framing 2x lumber, and as long as the 2x installed between the trusses, typically 22½". Screw one piece to the outside of each 2x using four 1⅝" sheetrock screws, keeping the bottom edges flush with the bottom of the 2x and trusses.
5. Cut two more pieces of ½" OSB 33" long and 3" wider than the framing 2x lumber for the sides. Screw one piece to the outside of each truss, using five 1⅝" sheetrock screws, aligning the ends with the outsides of the 2xs installed earlier. There will be a gap at the corners; this is acceptable since there is no insulation in this area.
6. Verify the opening size, and cut a piece of ¾" decking OSB with sides and ends ½" shorter in each direction and set in place in the opening above the framing.

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 creating problems later.
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 7-7.

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.

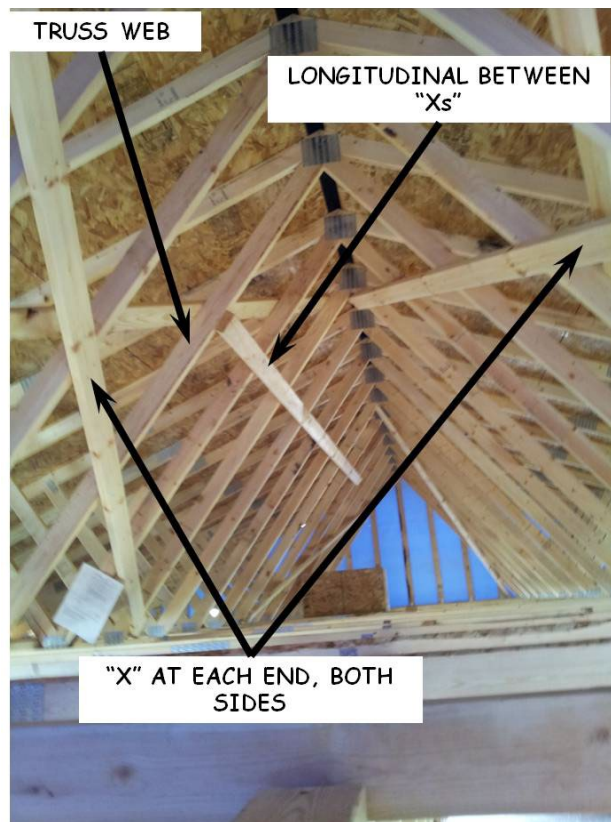


Figure 7-7. Truss Bracing.

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 7-7). 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 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
#10x3" combo construction screws
#8x2½" Trim screws
4" Timber screws
16d Galvanized finish nails
8d Galvanized finish nails
2½" Siding nails
1½" Siding nails
1¼" Soffit nails
Tapered shims
⅛"x3"x5" Shims
¼"x3"x5" Shims
⅛"x1" Variable length shims
¼"x1" Variable length shims
1/16"x1½" 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.

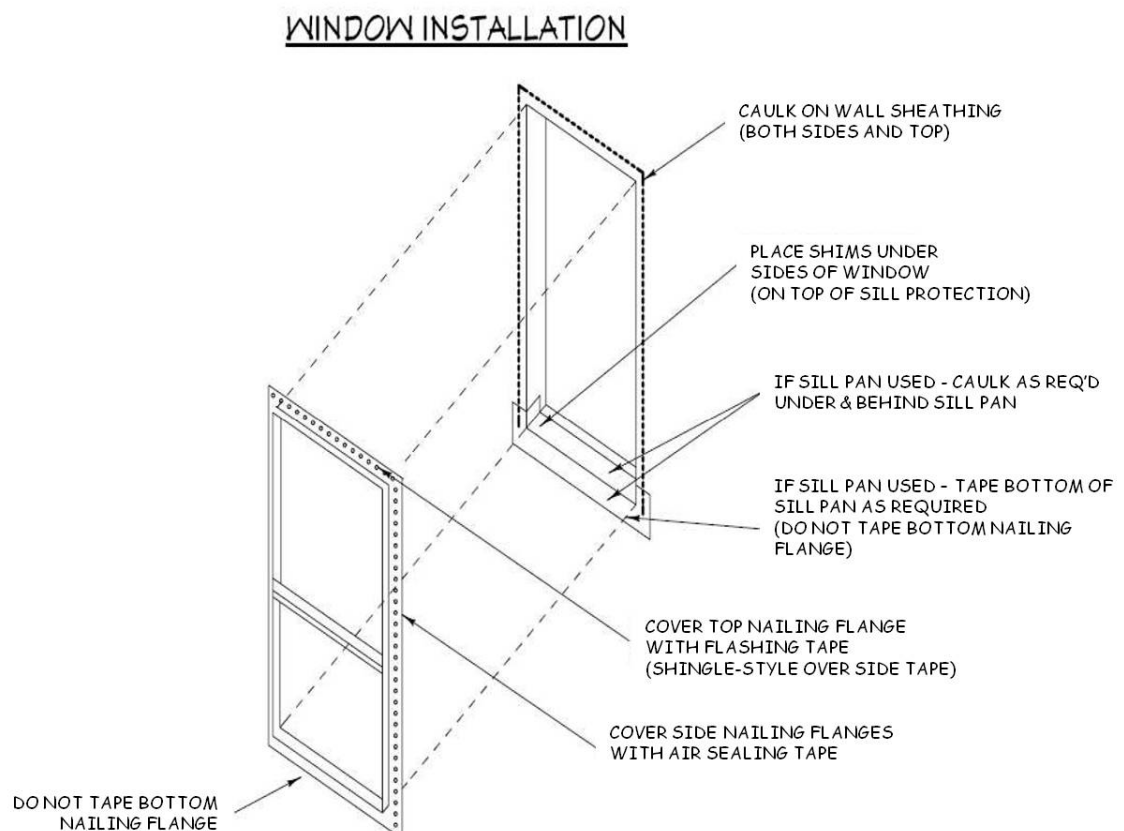


Figure 9-1. Window Installation

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

4. From the trailer, obtain tapered shims, cardboard shims, and $\frac{1}{8}$ "x1" and $\frac{1}{4}$ "x1" variable length shims. Cut the 1" variable length shims into 2-3" lengths for use under the windows.

9.1.1.2. Sill Protection Using Flashing Tape

1. Cut a length of flashing tape 8"-10" longer than the width of the window rough opening (the tape will run up the sides about 3").

NOTE: To make this tape installation easier it, can be cut in half and applied in two pieces being sure to overlap 1"-2".

2. Lay the tape on the sill so the exterior edge of the tape is $2\frac{1}{2}$ " down the wall from the top of the sill. Attach the tape to the sill and the sides of the rough opening. Make a 45° cut at each corner and fold the tape down and out to the wall. Cover the cut corner completely with 2"x4" piece of flashing tape. Add a second length of flashing tape to completely cover the window sill overlapping the first one about 1".
3. Run a continuous bead of air sealing caulk on the exterior surface of the wall up both sides and the top of the rough opening. Apply the caulk within $\frac{1}{4}$ " of the edge of the rough opening.

9.1.1.3. Sill Protection Using Sill Pans.

1. Run a continuous bead of air sealing caulk on the sill and 3" up the sides. Apply the caulk $\frac{1}{2}$ " from the exterior edge of the rough opening framing (not the wall).
2. Run a continuous bead of air sealing caulk on the exterior surface of the wall under the window and extending roughly 6" up both sides of the rough opening. Apply the caulk $\frac{1}{2}$ " from the edge of the opening.
3. Install one half of a sill pan (sill pans are labeled Left or Right) on the sill of the rough 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 and overlapping 1"-3". Press both pieces tight to the sill and the wall.
4. Run a continuous bead of air sealing caulk on the exterior surface of the wall up both sides and the top of the rough opening. Apply the caulk within $\frac{1}{4}$ " of the edge of the opening.

9.1.1.4. Check Sill for Level.

1. Using the longest level that will fit within the rough opening, check the sill for level. Assemble a minimum of $\frac{1}{8}$ " shims (to provide drainage clearance) on top

of sill protection until the windows sill is level. Ensure that no shim pieces extend past the inside of the window frame, trim as required. With all slider windows and windows 36" wide or greater, include shims for the center as well.

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 shims are in place.

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

2. Roughly center the window vertically by adding/removing shims below the right and left corners. Then center the TOP of the window frame left and right. By centering the top now, the window frame will have enough space so it can be squared later by racking the top of the window frame.
3. Place a level on top of the bottom window frame and level the bottom of the window, adjusting shims as necessary.
4. Using 2½" siding nails, nail the bottom hole in each of the side nailing flanges of the window. Make sure to pound the nails in straight. If even slightly angled, they may push the window frame in toward the window sash causing the window to become very hard to open and close (the window frame is now too narrow).

TIP: 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 window frame.

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

CAUTION: Hold the window frame firmly in place while sashes are being inserted.

7. Raise the bottom window sash just enough to create a small reveal with the bottom window frame. Check to see if the reveal is uniform. Slide the bottom window sash to the top of window frame and check for uniform reveal. If both reveals are uniform the window is square. If not, use a pry bar at the top of the window frame to rack the top of the window frame in the direction of the wider reveal until the reveals are uniform.

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. Remove these shims when the window is fully nailed.

8. Similarly, slightly lower the upper sash and check the reveal between it and the top of the window frame. Slide the top window sash to the bottom of the window frame and check for uniform reveal. Verify the top sash reveals are consistent with the bottom sash reveals. If different, then “average” the adjustment until the reveals of both sashes are similar.
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 window frame until reveals are equal. Check for proper sash movement and locking. Insert a shim to hold the bottom window frame in place and finish nailing.
10. Finish securing the nails in the leftmost and rightmost slots in the top nailing 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 (this is NOT a check for plumb). **Draw a 4”-5” long line on the wall above and below the center hole in the nailing flange on each side.** Holding the window 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 during nailing.** Do a final check of the reveal and window operation and then nail the rest of the slots.
2. If the window is protected with Flashing Tape from the sill to the wall, apply air sealing tape to the side nailing flanges, being sure to overlap the ends of the air sealing tape below the sill. Apply flashing tape to the top nailing flange, being sure to overlap the top of both side tapes. DO NOT tape the bottom nailing flange of the window to the foam board.
3. If the window is protected with sill pans, seal the window to the wall by taping the bottom of the sill pan to the wall with air sealing tape. Apply air sealing tape to each side nailing flange, being sure to overlap the tape covering the bottom of the sill pan. Apply flashing tape to the top nailing flange, being sure to overlap the top of both side tapes. DO NOT tape the bottom nailing flange of the window to the sill pan.
4. All exterior taping above must cover all nails and nail flange slots by ½”. DO NOT push tape all the way into the J-Channel.
5. Reinstall the screen in the frame.

6. Check that weep holes on the bottom window frame are clear of temporary caps/covers or debris.

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.
2. Remove bags of door accessory parts - screws, caps, covers - from the door frame and attach to one of the king studs.
3. Verify correct door type, size and 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). Set the door next to its intended location. If installing a flange-type door, verify the top nailing flange will attach to solid wood in the header. Contact the Construction Supervisor if the nailing flange will not attach to solid wood.

TIP: If installing a flange-type door, tape all three flanges to the front of the brickmold to keep them in place during installation.

4. **DO NOT INSTALL** if (a) there is any damage to the door, (b) a door is the wrong size, type or swing, or (c) **the exterior door from the house to the ATTACHED garage is NOT “Fire Rated”**. Instead, notify the Construction Supervisor.
5. Remove and discard the shipping strike plate.
6. If installing a flange-type door, skip to Step 8 below. Using a 1/8” drill bit, pre-drill the brickmold where eleven 16d galvanized casing nails will be placed - five on each side brickmold with each of the top holes 6” below the miter joint and one centered on the top brickmold. Angle the holes slightly away from the jambs to ensure that the casing nails will hit the Jack stud.
7. Keeping the miter joint tight and flush, install one #8x2½” trim screw through each side brickmold centered into the end of the top brickmold.
8. If house wrap extends through the doorway, fold it down over the threshold area and staple it to the deck in the doorway.

9. 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 wall. Cut at the corners and fold and attach to the outside.
10. Install threshold seal tape snug to corners and flush to the outside edge of the threshold.
11. The following Steps 12 and 13 are designed to reduce the difference between the width of the door frame and the width of the rough opening to roughly center the door in the opening.
12. Adjust hinge side Jack stud.
 - a. Measuring from the bottom of the hinge side jamb mark the location of the hinges on the hinge side and strike side Jack studs.
 - b. Install $\frac{1}{8}$ "x3"x5" or $\frac{1}{4}$ "x3"x5" shims **with their 5" dimension horizontal** and flush with the hinge pin side of the framing to ensure that the top hinge screws will go through the shims. Use two $1\frac{1}{4}$ " soffit nails to secure the shims.
 - c. Set a 6' level on the jamb, hinges or hinge pins, and check if the Jack stud is plumb. If NOT PLUMB, shim the top or bottom hinge areas until it is plumb.
 - d. Measure the width of the door frame at the head jamb and the threshold as well as the width of the rough opening at the top and bottom hinge locations (measure up to any installed shims).
 - i. If the difference between the door frame and the rough opening at either location is GREATER than $\frac{5}{8}$ ", install a combination of 3"x5" and cardboard shims to the hinge side Jack stud at the top and bottom hinge locations until the difference is less than $\frac{5}{8}$ " but greater than or equal to $\frac{3}{8}$ " at BOTH locations.
 - ii. The top and bottom hinge locations on the Jack stud should have a minimum of a $\frac{1}{8}$ " shim.
13. Adjust strike side Jack stud.
 - a. Add a combination of 3"x5" and cardboard shims to the strike side Jack stud at the top and bottom hinge locations until the differences are less than $\frac{3}{8}$ " but greater than or equal to $\frac{1}{4}$ " at BOTH locations.
14. Place a 6' level against the top and bottom shims and install a combination of 3"x5" and cardboard shims at the middle hinge areas on BOTH hinge and strike side jambs until flush with the level (or less than a $\frac{3}{16}$ " gap). Install the strike side middle shim with its 5" dimension vertical and centered on the deadbolt location.

9.2.2. Position and Temporarily Secure Door in Opening

1. When ready to install the door, run a bead of caulk on the wall ½” from the edge of the rough opening.
2. Set door into the rough opening, tight to the wall and hinge side Jack stud.
3. 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.

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. Re-check that the hinge side is still plumb (set level on hinges or hinge plates).
6. For flange-type door, tack two 1½” siding nails into each side nailing flange in the top and bottom slots. Position the nails in the center of the slots so the door can be adjusted.
7. If installing a flange-type door, skip this step. 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 wall (be sure someone is on the exterior holding the door in place).

9.2.3. Permanently Secure Door

1. Remove one of the hinge screws closest to the door stop from EACH of the three hinges on the door. With the door still held tight to the wall and the hinge side Jack stud, secure the door to the hinge side jamb by installing a #10 3” hinge screw in EACH of the three holes on the hinges (these screws can be found in a separate container within the Door Finish Kit).

NOTE: The tightness of these 3” screws 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.

2. Check that the hinge side of the door is still plumb. Adjust shims as needed.
3. 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 wall to ensure proper contact with the weatherstripping (a maximum of 1/8" gap). Shim behind the brickmold or nailing flange to hold it in place. Confirm that the latch and strike are aligned. If necessary, use a tapered shim to adjust the strike side jamb at the deadbolt location until the bolt is properly aligned in the bolt opening

4. 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 1/8" or greater. If not, it may be necessary to "split the difference".

5. **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.**
6. To ensure proper latch engagement, it may be necessary to have a narrower reveal in the latch area than above and below. Install strike side shims above the deadbolt location, between the deadbolt and latch, and just below the latch location. Install the deadbolt shims where the strike plate security screws will be located. Secure the shims with 2½" exterior screws behind the weatherstripping. Use enough shim to reduce the reveal in the latch area to 1/8". After tightening the screws in all three locations, check that the reveal is no more than 3/16". This step may require multiple adjustments of the shims to ensure that the reveal does not change as the screws are tightened.
7. Install shims across from the top and bottom hinge locations, and midway between the latch and top and bottom hinge. If the latch area reveal is narrower than at the top and bottom, adjust the shims so that the reveal changes gradually from the latch area to the top and bottom. This will result in a total of seven shims behind the strike side jamb.
8. Recheck the complete door operation, ensuring that contact with the weatherstripping is uniform (no gaps or light visible). Adjust as needed.
9. 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. Secure the jambs with 2½" exterior screws behind the weatherstripping. Install three screws behind the weatherstripping on the non-hinge side. **BE SURE TO HOLD BACK or PROTECT** the weatherstripping while driving the screws.

10. For flange-type doors skip this step. Secure the door on all three jambs - one nail at each HINGE shim location on each of the side jambs and one nail in the center of the head jamb - 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.

TIP: Use a nailing guard, created by drilling a ¼" hole in a 3x5" flat shim, to protect the brickmold when nailing.

11. 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.
12. Finish securing the door to the framing:
 - a. For brickmold doors, nail all of the predrilled holes in the brickmold with 16d galvanized casing nails (using the nailing guard created in Step 10 above). Make sure all nails hit a Jack stud or the header. Set nails and fill all nail holes with white finish caulk.
 - b. For flange-type doors, nail all flange slots with 1½" siding nails at the top of the slot.
13. 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.

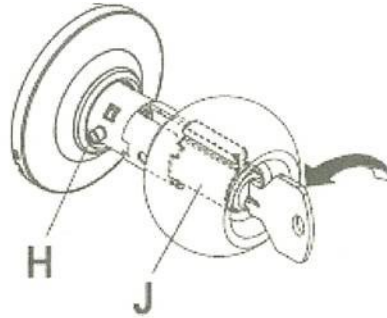


Figure 9-2. Door Lockset.

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 wall 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). For flange-type doors, apply the flashing tape to the house within $\frac{1}{4}$ " of the exterior door trim and cover all nail heads. To facilitate attaching this tape to the wall 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 wall. While progressing down the wall, use a speed square or wide putty knife to evenly press the tape to the OSB, pushing the tape into the corner between the wall 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 VENT COVER

10.2 INSTALLING DRYER VENT COVER

10.3 INSTALLING RANGE HOOD PLENUM AND VENT COVER

10.4 INSTALLING PROPER VENTS

10.5 INSTALLING WIND WASHING BAFFLE GUARD

10.6 INSTALLING BLOCKING

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Utility knife
Chalk line
Pencil

Tools and equipment needed:

Generator
Extension cord
Circular saw
Chop saw
Reciprocating saw
Long reciprocating saw blade
Impact driver/bits
Stapler
Framing nailer
Torpedo level
Stepladder
Black crayon
Clear varnish

Materials needed:

Scrap 2x lumber
Scrap OSB
Proper vents
1" Foamboard
16d Nails
3¼" Collated nails
1½" Siding nails
1⅝" Sheetrock screws
3" Sheetrock screws
Staples
Air sealing tape
HVAC tape
Air sealing caulk
Spray foam
Range hood plenum
Range vent cover
Bath vent cover
Bath fan

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan

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

10.1. INSTALLING BATH FAN AND VENT COVER

1. Install the inside edge of the bath fan over the outside edge of the tub. Center the fan along the length of the tub. If required, angle the exhaust venting to ensure that the exterior exhaust vent is not above a window or door.
2. With a reciprocating saw, cut a 6" diameter hole in the OSB on the gable truss closest to the bathroom. Locate the hole adjacent the intersection of the bottom chord of the truss with a vertical member, so that the hole is **not above** and is 6"-12" away from the side of any window or door. Cutting the hole from the interior side of the gable truss will aid in hole placement.
3. Insert the tabbed end of the vent cover sleeve into the vent cover. Ensure the seam in the vent cover sleeve is positioned towards the top of the vent cover, so that it will eventually be installed on the top side of the horizontally-positioned sleeve. Cut three 4" length strips of HVAC tape and then cut these in half lengthwise. Use five of these strips to cover the circumference of the sleeve-cover connection with $\frac{1}{2}$ " overlap. Cover the four tab holes with the remaining piece of tape, cut into four pieces, or fill with caulk (see Figure 10-2 as an example).

NOTE: Louvers on vent cover should pivot upwards.

4. Slide the vent cover pipe through the hole made in Step 2 above, level the vent cover and nail into framing with $1\frac{1}{2}$ " siding nails.
5. **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.**
6. Frame out an opening with 2x4's where the fan will go in the bottom cords of the trusses.
7. Mount the fan so that the bottom edge of the fan housing is located flush with the bottom edge of the truss chord.
8. 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 DRYER VENT COVER

1. Consult with the Construction Supervisor to identify the location where the hole should be cut in the rim board for the dryer vent.
2. Drill a $4\frac{1}{8}$ " hole through the rim board at the required location. The perimeter of this hole should be 2" below the underside of the floor deck and a minimum of 6" from adjacent I-joists.

3. Insert the tabbed end of the vent cover sleeve into the vent cover. Ensure the seam in the vent cover sleeve is positioned towards the top of the vent cover, so that it will eventually be installed on the top side of the horizontally-positioned sleeve. Cut three 4" length strips of HVAC tape and then cut these in half lengthwise. Use five of these strips to cover the circumference of the sleeve-cover connection with $\frac{1}{2}$ " overlap. Cover the four tab holes with the remaining piece of tape, cut into four pieces, or fill with caulk (see Figure 10-2 as an example).

NOTE: Louvers on vent cover should pivot upwards.

4. Slide the vent cover pipe through the hole made in Step 2, level the vent cover and nail into framing with $1\frac{1}{2}$ " siding nails.

10.3. INSTALLING RANGE HOOD PLENUM AND VENT COVER

10.3.1. 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 72" and mark on both studs. These marks represent the top of the plenum.
2. Cut a 2x4 plenum support block to fit between the two studs. Install the block flat with the bottom side at the 72" marks and the edge flush with the inside edge of the studs.

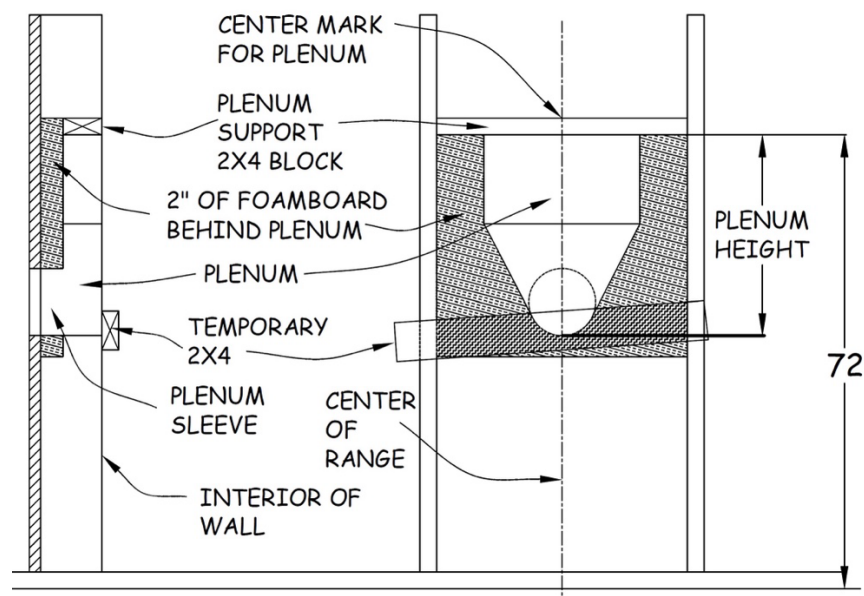


Figure 10-1. Range Hood Plenum Location.

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 (see Figure 10-1).

10.3.2. Preparing for Installation of the Plenum and Vent Cover

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 10.3.3.9.
4. Cut out the larger circle in the sheathing with a reciprocating saw.

10.3.3. Plenum and Vent Cover Installation

1. Measure the plenum height as shown in Figure 10-1.
2. Cut 2" thickness of foamboard slightly wider than the width of the stud bay (for a snug fit) and 3½" longer than the plenum height measured in Step 1. Install this foamboard between the 2x4 support block and the wall sheathing, flush with the top of the 2x4 support block (see Figure 10-1). Use tape to secure the foamboard in place if necessary.
3. From outside the house sheathing, extend the circle cut out in Section 10.3.2.4 by hand cutting with a long reciprocating saw blade completely through the 2" of foamboard just installed in the previous step.
4. Align the top of the plenum and 2x4 support block center marks made in Section 10.3.2.1 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 1⅝" 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 (see Figure 10-1).
6. From the tabbed end, cut the vent cover sleeve to a 3" length.

7. Insert the tabbed end of the vent cover sleeve into the vent cover. Ensure the seam in the vent cover sleeve is positioned towards the top of the vent cover, so that it will eventually be installed on the top side of the horizontally-positioned sleeve. Cut three 4" length strips of HVAC tape and then cut these in half lengthwise. Use five of these strips to cover the circumference of the sleeve-cover connection with $\frac{1}{2}$ " overlap. Cover the four tab holes with the remaining piece of tape, cut into four pieces, or fill with caulk (see Figure 10-2).

NOTE: Louvers on vent cover should pivot upwards.

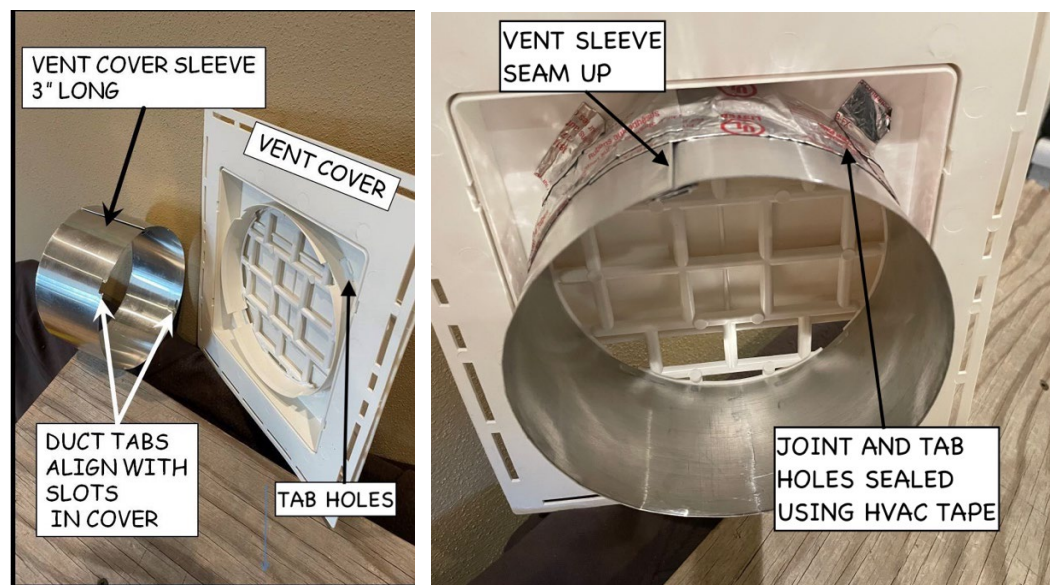


Figure 10-2 – Range Vent Cover Sleeve Assembly

8. From the outside, put a thick bead of air sealing caulk around the outer diameter of the plenum sleeve. Also, put a thick bead of caulk around the inner diameter of the non-tabbed end of the vent cover sleeve.
9. From the outside, spray foam, as required, around the outside diameter of the plenum sleeve at the penetration through the exterior sheathing and foamboard to completely seal the opening.
10. From outside the house, slide the vent cover sleeve through the hole in the sheathing and foamboard and over the plenum sleeve (there should be a minimum of $1\frac{1}{2}$ " overlap). Make sure the vent cover is tight to the exterior sheathing AND the entire plenum is flush, or slightly shy of the interior side of the wall framing so it does not cause an issue with wall rock installation.

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

11. With a torpedo or other short level, ensure the top of the vent cover is level. Secure the vent cover in place by taping (shingle style) the flanges with flashing tape.

10.4. 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 10-3.

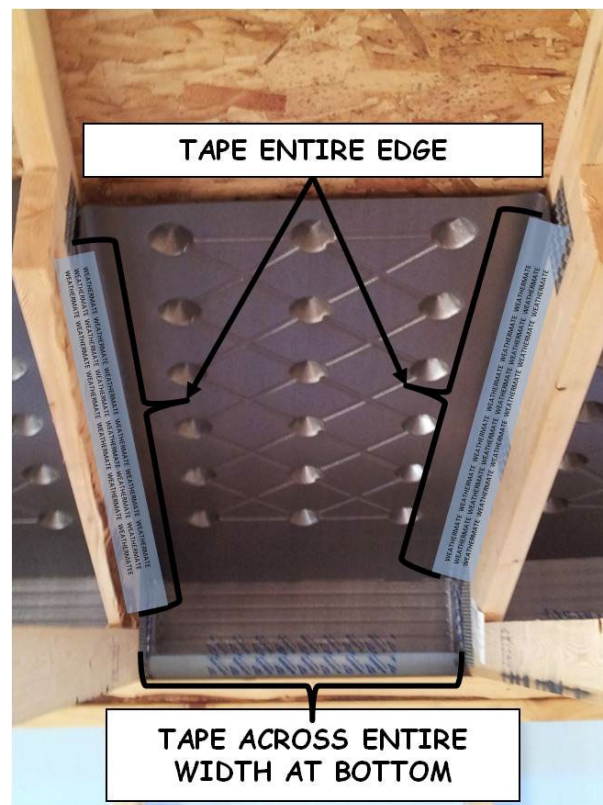


Figure 10-3. Proper Vent Installation.

10.5. 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.

10.6. INSTALLING BLOCKING

10.6.1. 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.

10.6.2. Blocking for Bathroom

1. **Grab-Bar blocking:** Install this blocking adjacent to the shower and along the back side of the toilet and the wall along the side of the 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" above the floor.

5. **Short (18") Towel Bar blocking:** Consult the House Plan and ensure that the vanity is to be installed in a corner of the bathroom. Install 2x6 blocking in the wall along one side of the vanity, and positioned so that the TOP of the blocking is 60" above the floor and extends out at least 24" from the back corner of the vanity. If the vanity is not to be installed in a corner, consult the Construction Supervisor to locate the Short Towel Bar blocking location.
6. **Long (24") Towel Bar blocking:** Install 2x6 blocking in the wall next to the shower, and positioned so that the TOP of the blocking is 60" above the floor and extends at least 36" from the edge of the shower. If it is not possible to install the Long Towel Bar blocking next to the shower, consult Construction Supervisor about alternative installation location under the window.
7. **Linen Cabinet blocking:** Install 2x6 blocking along the back and one side of where the linen cabinet will be located. Position the blocking so that the TOP of the blocking is 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 of the blocking is 26" above the floor.
9. **Tub/Shower Nailing Flange blocking:** Select one straight (no bow or crown) 2x4 stud for blocking on the long end wall where the tub/shower unit will be installed. Install the 2x6 stud vertically on the long end wall where the nailing flange will be located. Position the face of the 2x6 stud flush with the tub-side of the long end wall. For main floor shower/tub units, position the blocking 32" to center from the back wall. For basement shower units, position the blocking 35" to center from the back wall.
10. Select one straight (no bow or crown) 2x6 stud. Install the 2x6 stud on the short end wall where the nailing flange will be located. Position the face of the 2x6 stud flush with the tub-side of the short end wall with one edge of the 2x6 stud butted up against the 2x4 forming the end of the short end wall. Attach the 2x6 stud to the 2x4 stud to create an "L-corner". This will provide stiffening to the end 2x4 stud, as well as a blocking surface for nailing flange installation.
11. **Tub on Exterior Wall:** When the tub/shower is located on an exterior wall insulate the stud cavities and cover with poly following air sealing procedures (Sections 12.4 and 12.5). Cover the poly with ½" OSB or drywall scraps. Gaps of 1"-3" between OSB/drywall pieces are acceptable. Do not leave a gap at the top 24" of the tub area. Verify that there is sufficient blocking for drywall installation at the tub corners.
12. **Mark Blocking Locations:** 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.

10.6.3. Blocking for Kitchen

1. Upper Cabinets: Following the House Plan, snap a line in the cabinet area at 84" above the subfloor for the top row of cabinets and at 59" for the bottom row. With the top of the blocking even with the chalk lines secure pieces of 2x6 blocking using two 3" drywall screws or two 16d nails through the studs and into the ends of the 2x6 blocking (see Figure 10-4). Ensure the blocking is flush with the surface of the wall studs. At the refrigerator cabinet location, install 2x6 blocking 8" below the top of the upper blocking as noted above.
2. Lower Cabinets: Following the layout of the upper cabinet blocking snap a line 31" above the subfloor. With the top of the blocking even with the chalk line secure pieces of 2x6 blocking using two 3" construction screws or two 16d nails through the studs and into the ends of the 2x6 blocking (see Figure 10-4). Ensure the blocking is flush with the surface of the wall studs. Lower blocking is not needed at the range and refrigerator locations

WARNING: Do not use nail guns for toenailing.



Figure 10-4. Kitchen Cabinet Blocking

10.6.4. 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 10-5). For interior walls that are greater than 6" from a truss, make sure that blocking extends at least 1½"-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.

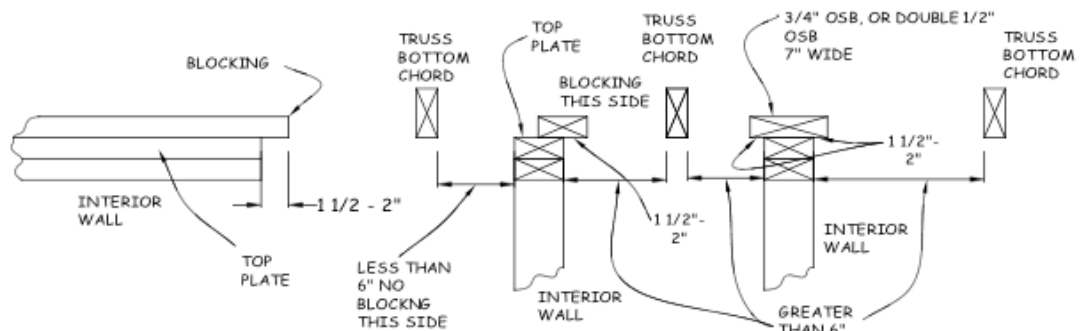


Figure 10-5. Blocking for Ceiling Rock.

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 10-6.
5. Where an interior wall intersects an interior wall (see Figure 10-6), 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.

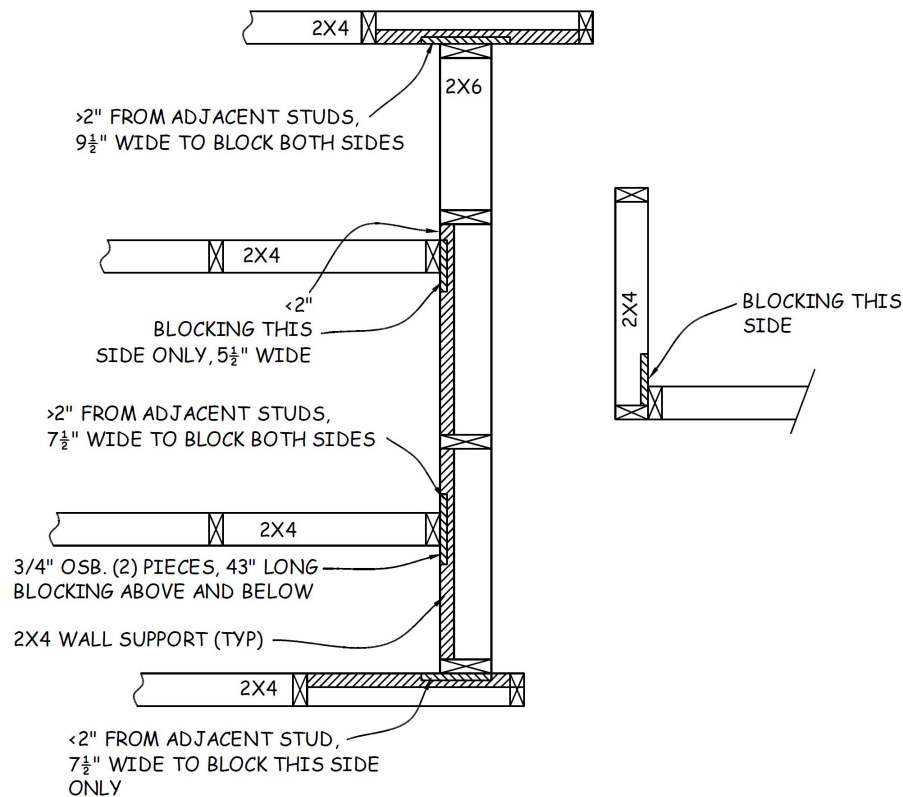


Figure 10-6. Blocking for Wall Rock.

10.6.5. 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 10-7).
2. At the top of the stairs, install a piece of 2x4 blocking where the 3/4" subfloor ends at the stair, at least 3" both above and beyond the subfloor.

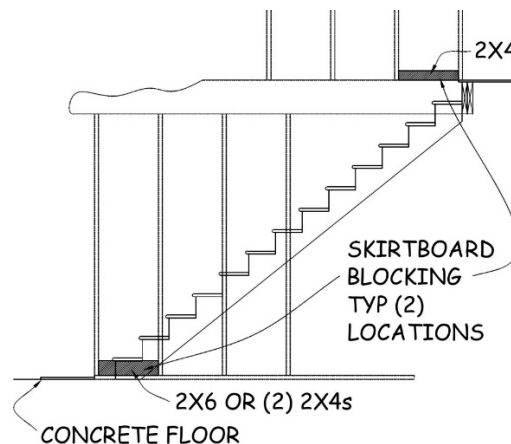


Figure 10-7. Blocking for Skirtboard.

10.6.6. 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 10-8).
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 10-8). 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.

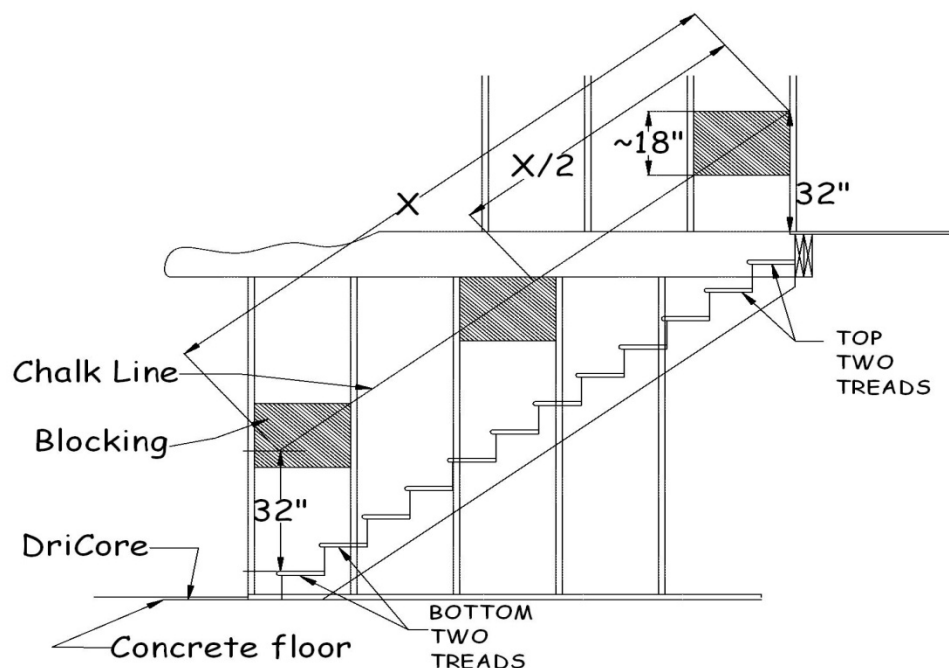


Figure 10-8. Blocking for Handrail.

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

10.6.7. Blocking for 42" Height Wall with a Full Height Post

1. Use a 6' level to plumb and locate the area directly above the end of the short wall. Secure two 2x6" pieces **flat and between** the bottom of the trusses using 3" drywall screws. Ensure the pieces are flush to the bottom of the truss.

10.6.8. 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.

10.6.9. Blocking for Closets

1. Use 3" sheetrock screws to install 2x blocking vertically on top of the bottom plate for the non-flush closet wall between the studs. Ensure that the blocking is flush with the wall studs (see Figure 10-9).



Figure 10-9. Closet Wall Blocking.

10.6.10. 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 10-10.



Figure 10-10. Cold Air Return Blocking.

10.6.11. 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.

10.6.12. 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

10.6.13. 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.

10.6.14. 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.

10.6.15. Blocking for Garage Overhead Door (OHD)

1. Center Blocking: Use 3¼" collated nails to attach 2x6" blocking centered on the OHD opening, ~1"-2" below the bottom of the truss and ending ~¼" above the garage door opening (see Figure 10-11).



Figure 10-11. OHD Center Blocking.

2. Edge Blocking: Use $3\frac{1}{4}$ " collated nails to attach 2x4" blocking flush to the inside edge of the OHD jack studs, ~1"-2" below the bottom of the truss and ending ~2" above the concrete floor (see Figure 10-12).



Figure 10-12. OHD Edge Blocking.

3. Use $3\frac{1}{4}$ " collated nails to attach 2x4" blocking between the edge and center blocking with the long edge of the blocking resting on the vinyl trim (see Figure 10-11).

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 INSTALLING EXTERIOR DOOR TOE KICK BOARD

11.7 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
Finish nailer
Soffit staple gun
Drill
Driver
2½" Hole saw
4½" Hole saw
Plank
Ladders

Materials needed:

Vinyl siding
Vinyl corners
J-channel
Undersill trim
F-channel
Soffit
Fascia
White vinyl jambs
White vinyl brickmold
Toe kick
16d Nails
8d Nails
¾" Collated nails
⅝" Collated nails
2½" Collated finish nails
1½" & 2½" Siding nails
Soffit nails
3" Sheetrock screws
#7x2½" Trim screws
6" Timber screws
Finish caulk
Air sealing tape
Personal Protection Equipment:
Safety glasses (required)

Reference Materials:

House Plan

NOTE: Figures 11-12, 11-16, 11-19 and 11-20 were provided courtesy of the Vinyl Siding Institute, Inc. Figures 11-5, 11-7, 11-17 and 11-22 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. Verify that all of the house wrap is installed with no OSB exposed . 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 OSB.
2. At each corner on the eave sides of the house, use a framing square or level to transfer the elevation of the bottom of the sub-fascia to the wall as shown in Figure 11-1. With the framing square 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.

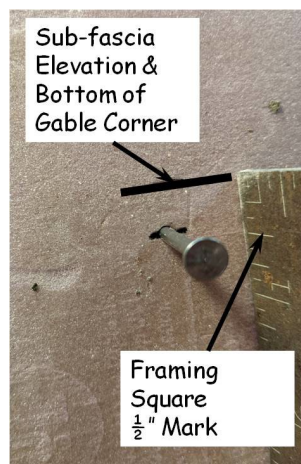


Figure 11-1. Siding Layout.

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).

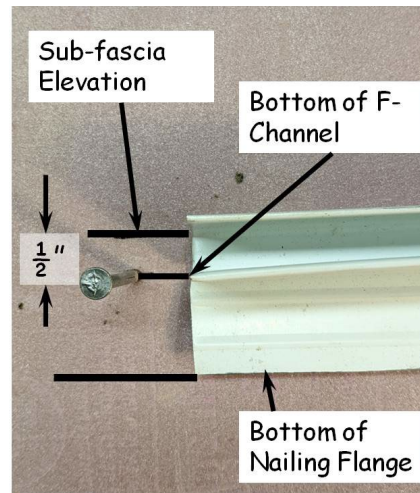


Figure 11-2. F-Channel Location.

- b. Each course of siding is 8" tall. The typical house requires $12\frac{3}{4}$ courses. The $\frac{3}{4}$ course at the top is planned so that there is approximately $2\frac{1}{2}$ " above the center butt to insert into the top undersill trim. This results in the top course being $\sim 6\frac{1}{2}$ " tall. The overall height of the siding is then $102\frac{1}{2}$ " ($12 \times 8 = 96 + 6\frac{1}{2} = 102\frac{1}{2}$ ". The bottom of the siding is thus nominally $102\frac{1}{2}$ " below the bottom of the F-channel, or the nail in Figure 11-2 above.
- c. 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 $3\frac{1}{4}$ ", $102\frac{1}{2}" - 3\frac{1}{4}" = 99\frac{1}{4}"$ to the **top of the starter strip**. The **top of the skirting** is 1" below the top of the starter strip.

- d. To mark the location of the top of starter strip and the top of skirting, 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, $99\frac{1}{4}"$ and $100\frac{1}{4}"$).
- 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. Consider fascia and lineals when determining how much to fur down the porch framing; consult with the Construction Supervisor. If lineals are included in the House Plan, determine where the top of the lineal will be, and fur down the porch framing to $\frac{1}{2}$ " above the top of the lineal (to leave room for F-channel and soffit). Determine the thickness of the furring required and attach to the bottom of the porch framing using $3\frac{1}{4}$ " collated or 16d nails.

NOTE: This procedure eliminates the need for a narrow piece of siding above the window.

2. To support the center of the porch soffit, install a 2x4 with the wide face vertical, parallel to the long edge of the porch, midway between the house wall and porch framing. Align the bottom edge of the 2x4 with the bottom of the furred porch framing. Hang the support 2x4 from the trusses using vertical 2x4s nailed to the trusses using $3\frac{1}{4}$ " 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. Overlapping this way will make the seams less visible 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' or shorter than 4'. Any piece longer than 12' will buckle and get wavy when the summer sun heats it up and expands it.
3. Install skirting with its top aligned with the skirting chalk line (created in Section 11.1.1.3) with care. Nail with $2\frac{1}{2}$ " siding nails into the center of the pre-punched slots. DO NOT nail tight. Leave a $\frac{1}{8}$ " 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.
5. Skirting is required at the bottom of the wall between the garage and house. Cut coil stock 12" wide, then bend in half to make a 6" wide strip, using the brake to tightly close the bend. Nail this strip to the bottom of the garage/house common wall(s), with the bent edge down, tight to the garage concrete floor. Use 2½" siding nails close to the top of the strip, into the studs.

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" x 5" (L-shaped) x 12" long corner (including the 1" hem on each visible edge). If the skirting is not 12", make the corner piece length match the skirting height.
3. 2"x5" L-shaped corner pieces are used next to egress well walls and porch concrete foundations. The 2" leg is inserted between the foundation or egress wall and adjacent foamboard while the 5" leg covers the end of the skirting. Fit the corner snugly to the wall or foundation. Match the length of the corner to the skirting, normally 12". At porches, trim the top of the corner piece to match the angle of the bottom of the concrete slab.
4. Corners at egress wells must be spaced 2" wider than the egress cover to allow the cover to easily fit tight to the foundation. Cut the 2" foam foundation insulation back from the window opening enough to allow proper spacing of the corners (see Figure 11-3).



Figure 11-3. Skirting Around Egress Window.

5. 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 1/2" OSB (see Figure 11-4).
 - a. 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.
 - b. 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.

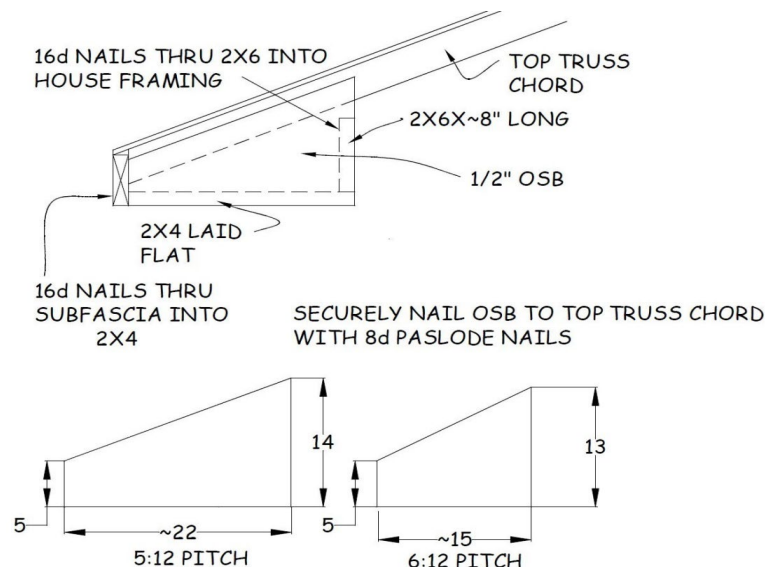


Figure 11-4. Gable Corner.

3. Cut a scrap 2x4 to the same length (eave to wall measurement from Step 1) as the OSB.

4. Cut a scrap 2x6 to 8”.
5. 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.

6. Nail the OSB to the 2x4 and the 2x6 with six 2⅜” collated nails, using either factory edges or a framing square to keep the frame pieces square to each other (see Figure 11-4).
7. 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.
8. Line up the bottom of the 2x4 frame with the bottom of the sub-fascia and the top mark on the house wall.
9. Nail the OSB to the gable truss tail with five 2⅜” collated nails.
10. Line up the gable corner block so it is flush with the corner of the house.
11. 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 OSB.
12. 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.

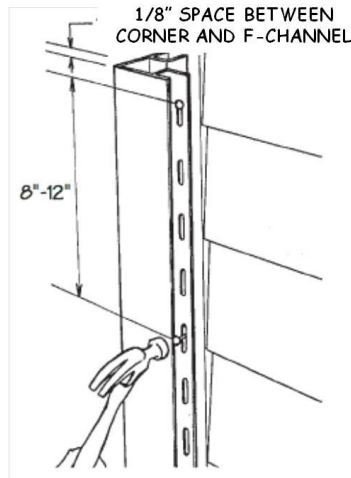


Figure 11-5. Siding Corner Post.

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. On garage walls, use 1½" siding nails into the framing. If any nails are exposed inside the garage sheathing, use an oscillating tool with a metal cutting blade to cut the nail end off flush with the inside of the sheathing.
3. 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.
4. Measure the distance from the top of the nail flange to the bottom of the top lock (see Figure 11-21). This is normally 1¼" to 1⅜". Add this measurement to 8" and 40" to obtain the height of the lower and upper quality lines in Step 4, below.
5. 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-Blocks

1. Verify that all J-blocks for exterior house lights, two outlets, and garage lights have been installed (per House Plan). When locating vent openings, do not put them in the same I-joist bay as any heating vent holes in the deck above. Locate the perimeter of the hole a minimum of 6" from I-joists and 2" below the bottom of the subfloor. If the HVAC holes have not been cut yet, write with red marker "VENT PIPES" (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 1/2" gap between the J-block and a stud, and with a 1/2" gap between the box and the bottom plate. The gaps allow for spray foam insulation. Attach using 2 1/2" siding nails through a side flange into the stud, and through the bottom flange into the bottom plate. Attach the other two sides with 1 5/8" 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 (if provided). 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 1/2" or 3/4" 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 1/4" 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 brickmold 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. The center of the garage gable-end light is located 18" directly below the peak of the soffit.
6. If the furnace air intake and exhaust pipes have been installed, and, if not done already, caulk around each pipe. Fit a color-matched J-block or white vinyl board around them by drilling two 2½" holes with the same spacing as the pipes. If no J-block is provided, use a white vinyl board 5" wide by approximately 8", or long enough so that there is 1½" of board outside the pipe on each end. Slide the J-block or board onto the pipes and install J-channel around it. Put a continuous bead of caulk on the back of the vinyl board, between the pipe holes and the board perimeter. Finish caulk the gap between the board and pipe perimeters. Cover the J-channel flange nails with shingle-style flashing tape.
7. If the galvanized HVAC fresh air intake has been installed, replace the large hex-head screws with 2½" siding nails. Air-seal the perimeter with flashing tape. Install J-channel on the top and sides of the vent, and undersill across the bottom. Cover the flanges and nails with shingle-style flashing tape.
8. 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.
2. F-channel at the gable corner should look as shown in Figure 11-6, with the nailing flange cut back to avoid issues as shown on the right, where the F-channel nailing flange is exposed when looking from below. The gable end F-channel must end just short of the outside of the sub-fascia so the end is covered by the eave fascia.
3. Except at eave-to-gable intersections, F-channel pieces must be at least 48" long.



Figure 11-6. F-Channel at Gable Corner.

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. Except above doors, around electrical service panels, and along the side of porch concrete and other unusual locations, J-channel pieces must be at least 36" long.
3. Where multiple J-channel pieces must be used for long sections, splice the ends as shown in Figure 11-7, with the overlapped end pointing away from the main line of sight. Carefully cut 1" off the nailing flange and back "hook" from one piece and insert that end into the factory end of the adjoining piece.

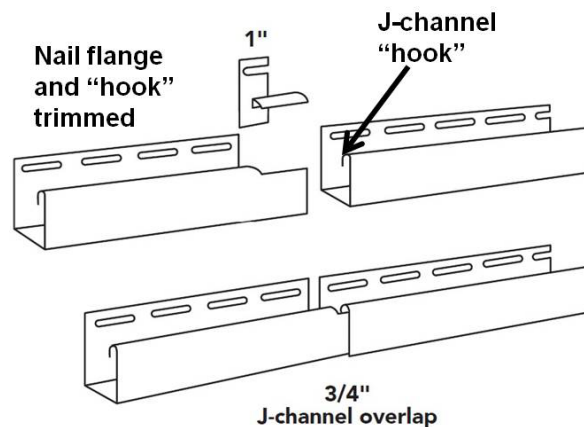


Figure 11-7. J-Channel Splice.

4. See the left side of Figure 11-8 for proper J-channel installation where the gable end meets the eave. The upper piece is inserted into the horizontal, and the back of the horizontal is relieved (the “hook” is trimmed) so that there is a smooth transition between pieces. The horizontal piece also has a rain tab bent into the top of the corner piece, and is cut to end flush with the corner piece. The right side of Figure 11-8 shows an example of incorrect installation, where the cut end of the upper piece is visible when looking up.



Figure 11-8. J-Channel at Gable Corner.

5. See Figure 11-9 for examples of unacceptable J-channel installation at the corner piece. The J-channel is short of the corner piece in both examples. Also, the top of the corner piece shown on the left has a sloppy cut at the top.



Figure 11-9. Unacceptable J-channel Installation.

6. Where a roof meets a wall, J-channel is installed vertically. Figure 11-10 shows the intersection of the end of the porch roof with the house wall. The J-channel should

end at the bottom of the undersill, and the undersill should end inside the J-channel, where a slot has been cut to receive it.

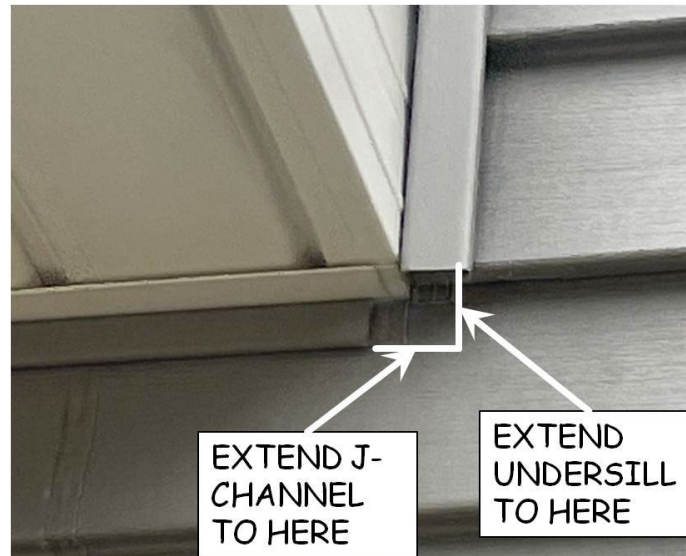


Figure 11-10. Undersill/J-Channel Corner.

7. 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 brickmold.
8. Install the door top piece of J-channel nailing flange behind the house wrap such that the wrap covers the nails and slots. Trim as necessary.
9. For door side pieces, measure from the top of the brickmold to the porch concrete, and add 1". Cut J-channel side pieces to that length. Cut a 1" notch in the top end as shown in Figure 11-11. Install the side pieces with the bottom of the notch flush with the top of the brickmold, nailing snugly every fifth slot.

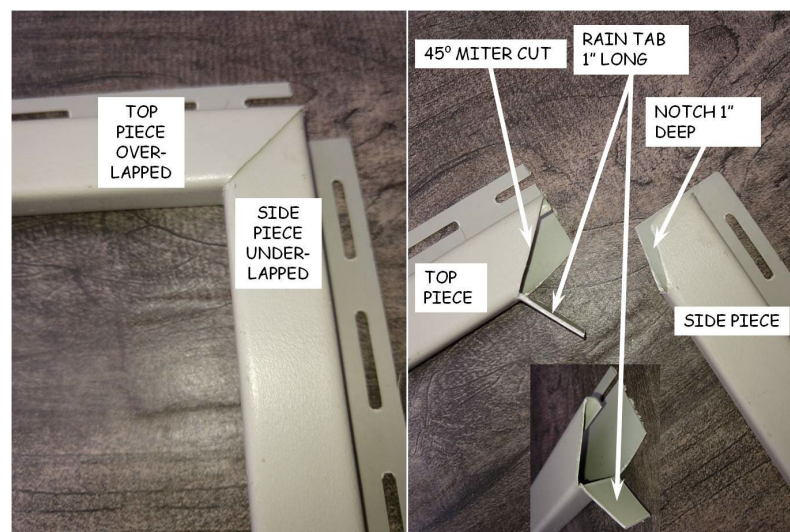


Figure 11-11. J-Channel Upper Corner Detail.

10. 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 nailing flange behind any house wrap above, and the top of the side pieces inserted behind the miter cut of the top piece. Nail snugly every fourth slot. Fold the rain tabs down into the side pieces.
11. Where a section of roof meets a wall, install the J-channel ½" above the shingles with the nailing flange behind any housewrap, if present (see Figure 11-12). Use a strip of ½" thick OSB about 2-3' long 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.

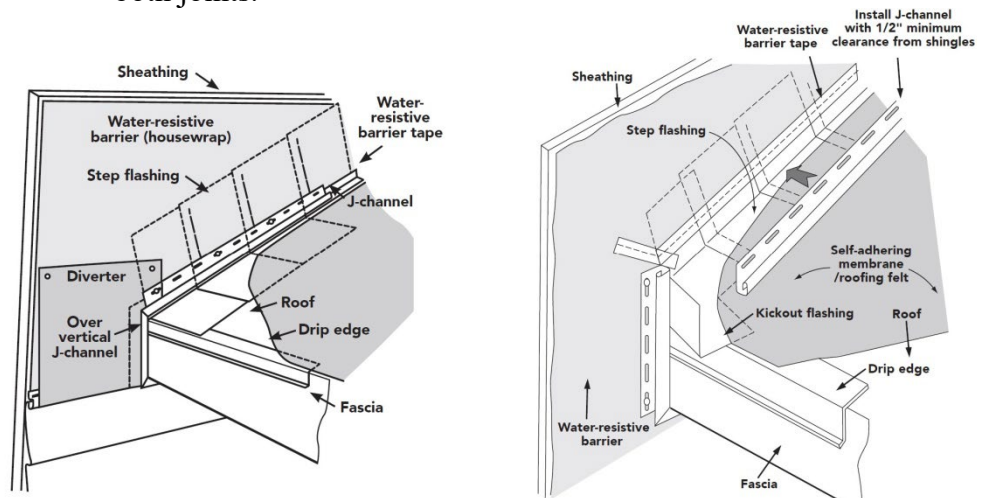


Figure 11-12. F-Channel Over Roof.

12. J-channel is installed on top of the porch concrete where it meets the house wall (see Figure 11-13). A short piece will wrap down the edge of the slab, ending 1" below the bottom of the starter strip. To provide more stability to the short piece, cut the nailing flange 4-6" long on the upper end, and nail in place with 2½" siding nails.

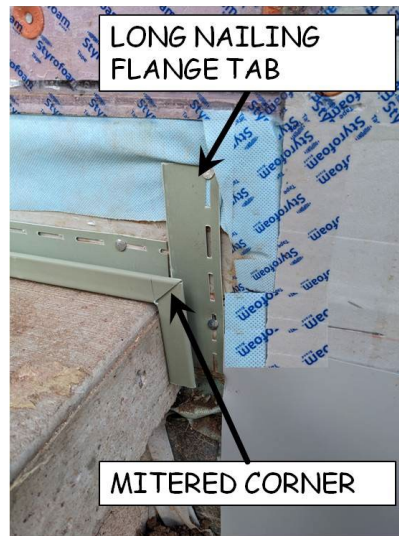


Figure 11-13. Porch Slab J-Channel.

11.1.12. Installing Undersill Trim

1. Undersill trim (or “utility trim” as noted in Figure 11-14) 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 11-14, and insert into the end of the other piece, leaving a ⅛" gap between ends.

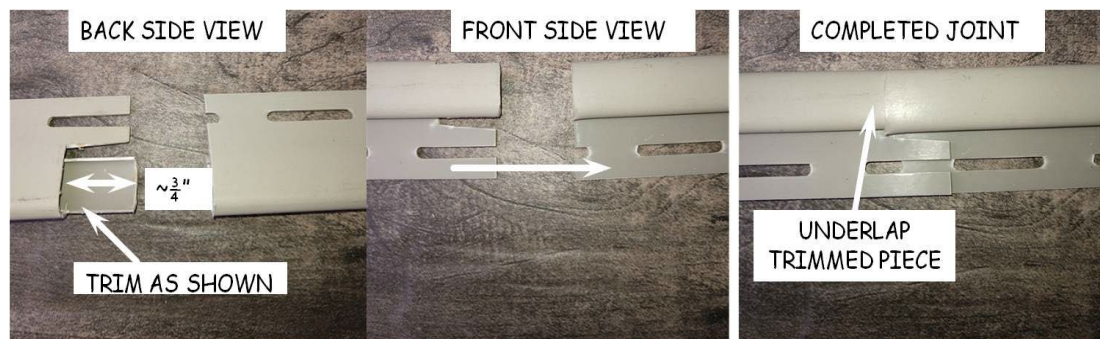


Figure 11-14. Undersill (“Utility”) Trim.

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).
4. Undersill trim is not needed around J-blocks.

5. To bring the siding forward and tight to the front inside surface of horizontal J-channel for a neat look, and to keep debris from getting into the J-channel, cut roughly 1" wide strips of ½" foamboard 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 Garage Overhead Door (OHD) Trim

1. Ensure the house wrap is neatly stapled flat to the framing around the OHD opening.
2. Install vinyl board door jambs around the OHD opening. Measure and cut the top jamb first. Measure the OHD rough opening and cut the top jamb ¼" shorter. Center the top jamb with a ⅛" gap at each end. Nail in place over the house wrap, using 2½" collated finish nails about every 18". Nail in pairs or stagger side-to-side. Ensure that the board is slightly proud of the exterior sheathing edge so that the brickmold will be tight to the jamb. Shim as required so that the top jamb is straight and level in both directions.
3. Install the side jambs in the same manner. Measure the height of the rough opening and cut the side jamb ⅛" shorter. Butt the top end snugly to the top jamb. Cut the bottom end at an angle to match the angle of the concrete, usually about 8°, so that the jamb is snug to the concrete. Shim as required so that the jamb is straight and plumb.
4. Install brickmold, starting with the top. Cut to length, with mitered ends, so that there is approximately ¼" of jamb revealed. Nail through the coved or rounded area of the molding with 2½" **collated finish nails** every 18" into the framing behind. Use a shim or other gauge to set a uniform jamb reveal along the entire length. If there are gaps between the jamb and brickmold, use a clamp to pull the brickmold tight to the jamb and nail as required. Angle any nails to be sure they don't come out the face of the jamb.

NOTE: When mitering the brickmold, relieve the back of the cut ½-1" so that the visible front of the joint is tightly closed.

5. Repeat with the side brickmold, mitering the top and cutting the bottom to end flush with the bottom of the side jambs.
6. Using the top brickmold as a guide, carefully cut the house wrap along the top of the brickmold. Bend and install a drip edge above the top brickmold, inserting the top flange behind the house wrap. The J-channel in this location must also be installed with the nailing flange behind the house wrap. Hold the house wrap up while nailing so it covers the nails when completed. (See Figure 11-15. The house wrap in the left side of Figure 11-15 is covering the drip edge and J-channel nailing flanges. The right side of Figure 11-15 shows flashing tape covering the house wrap at the corner where it has been cut to install the flashing and J-channel.)



Figure 11-15. Housewrap Over OHD.

7. Install drip flashing over the garage service door and window as described above for the overhead door. Install J-channel over the service door as for the OHD.

11.1.14. Installing Initial Siding Courses

1. 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 $\frac{1}{8}$ " gap (the thickness of a nickel) between the nail head and the siding slot (see Figure 11-16).

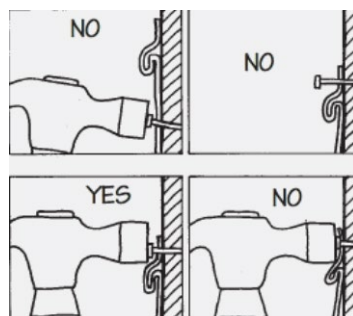


Figure 11-16. Siding Nail Head Gap.

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 11-17). 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.

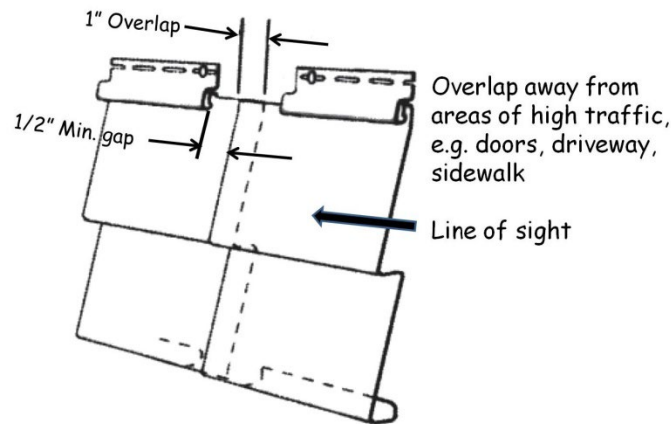


Figure 11-17. Siding Overlap.

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 (see Figure 11-18). If there is only a single row of slots, elongate the slot a smidge, using the slot tool, as necessary, to hit a stud. It's permissible to SLIGHTLY angle the nail to hit a stud as long as the head does not protrude so far that it will be visible on the next course. **Always slide each piece of siding side-to-side ¼ - ½" after nailing to be sure there is adequate clearance for temperature changes.**

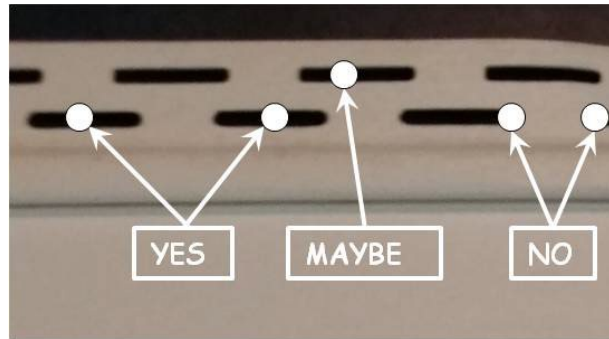


Figure 11-18. Nail Location in Siding Slots.

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

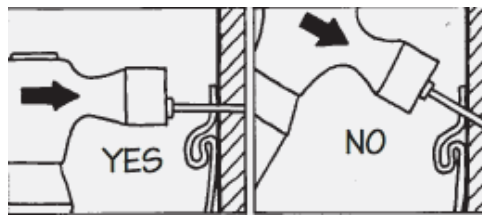


Figure 11-19. Proper Nailing Angle.

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

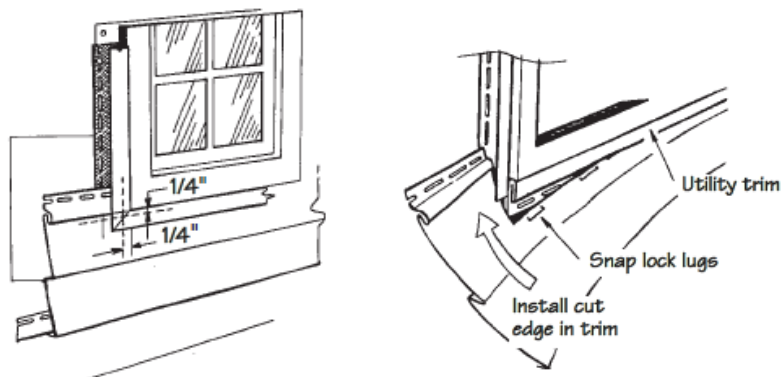


Figure 11-20. Wall Penetration Siding Clearance.

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
14	10	4	10
18	12	6	12
20	12	8	4
22	12	7	4
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
44	11	8	5
46	12	9	6
48	12	9	6
50	10	7	4
52	12	9	6
54	12	9	6
56	12	9	6
58	12	9	6
60	12	9	6

- As shown in Figure 11-21, the butt lock of each course locks into the top lock of the course below.

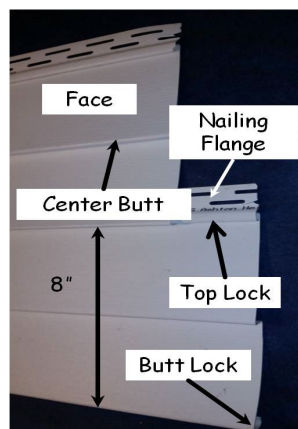


Figure 11-21. Siding Nomenclature.

4. On the 8s: The visible portion of each siding course is 8" high (see Figure 11-21). 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.

TIP: 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 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. To ensure that the top (partial) siding course is uniform, as the third and second courses from the top are being installed, measure from the bottom of the F-channel to the siding top lock every four feet. If the measurements are not equal along the entire wall, adjust the height of the last two full-width siding courses as required to make the measurements equal.
8. 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 1/8" (max) from that measurement, and rip the last course of siding to this measurement. The table saw with a 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!

9. 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 $\frac{1}{8}$ ") toward the cut edge of the piece.

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

10. 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.

11. Before the siding reaches the top of the windows on gable ends, secure the house wrap to the wall OSB 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.
12. 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.
13. 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 (see Figure 11-22 for a typical eave soffit installation). Measure from wall to outer edge of the sub-fascia and cut soffit pieces $\frac{1}{4}$ " less than that dimension.

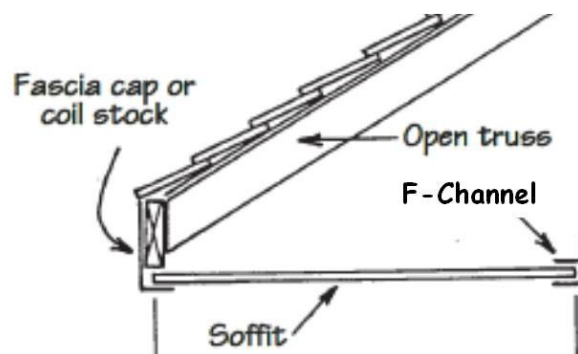


Figure 11-22. Eave Soffit.

2. Install the first soffit piece with the tongue end into the gable end F-channel and the grooved end exposed. Using a white trim nail (or the soffit stapler), attach the grooved end to the bottom of the sub-fascia. Then, nail or staple through the two valleys where it contacts the sub-fascia. Keep staples or nails within $\frac{1}{4}$ " of the outside of the subfascia

to be sure they are covered by the fascia. If using nails, they do not need to be tight to the bottom of the valley.

- 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 or staple 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.

- Install the porch ceiling soffit using one of the two patterns shown in Figure 11-23. The arrangement shown in Figure 11-24 is the preferred method if the widths of the soffit on both sides of the corner are within 1" of each other. Otherwise use the lower arrangement shown in Figure 11-23.

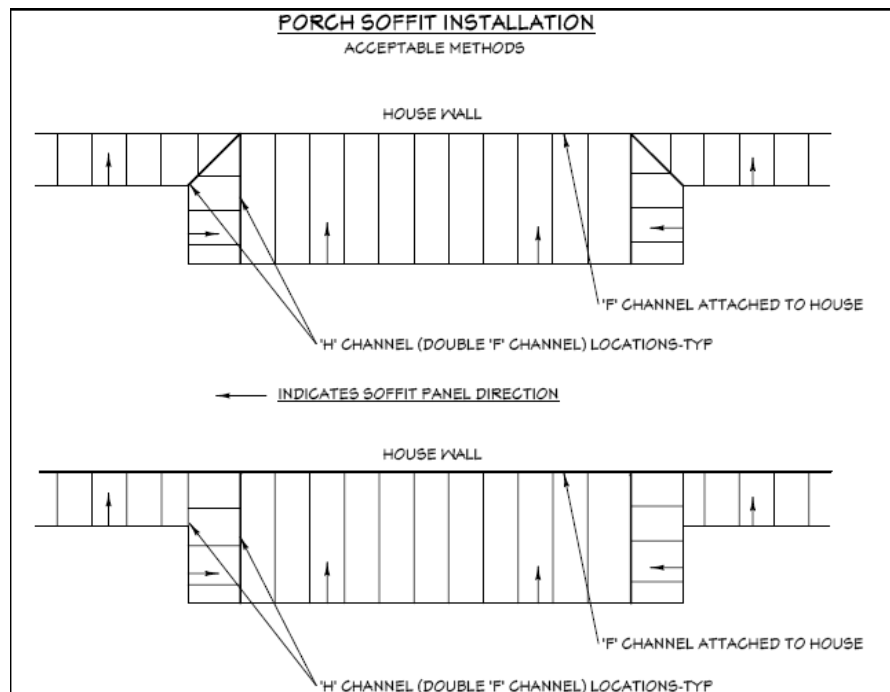


Figure 11-23. Porch Soffit.



Figure 11-24. Porch Soffit Corner.

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 1½" of the flange from the end of the fascia and bend a 1½" 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.
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 11-25. 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.

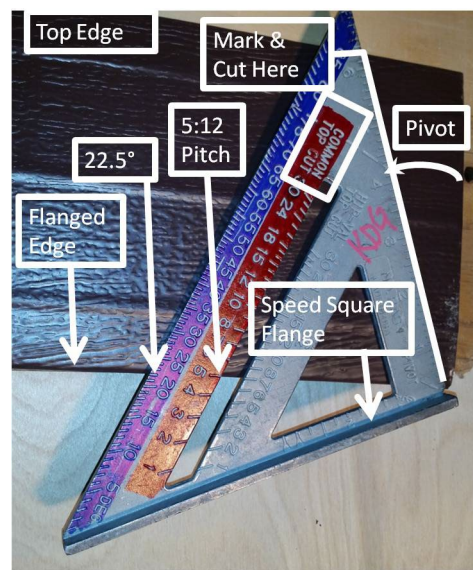


Figure 11-25. Marking Gable Eave End Fascia Angle.

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 11-26 shows the resulting piece after being cut to the correct angle.

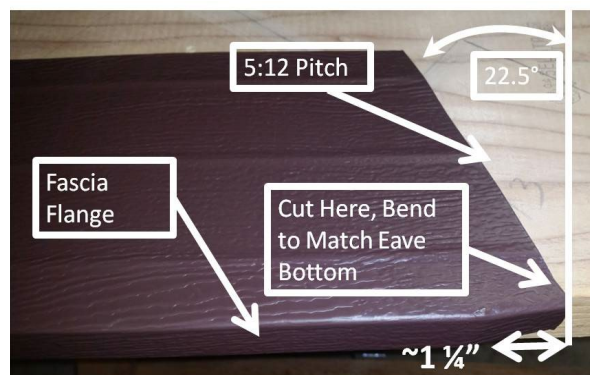


Figure 11-26. Eave End Gable Fascia.

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.
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 11-27, 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.

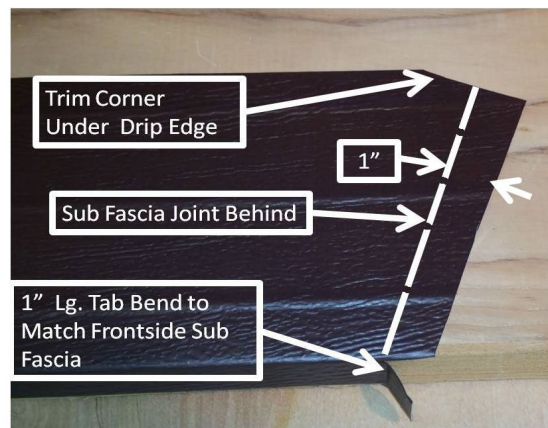


Figure 11-27. Gable Peak Back Side Fascia.

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 11-28 for the right-hand peak end cut.

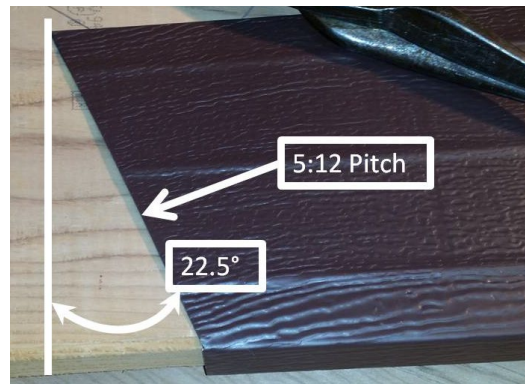


Figure 11-28. Gable Peak Front Side Fascia.

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 OSB.
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 OSB behind the siding.

11.6. INSTALLING EXTERIOR DOOR TOE KICK BOARD

11.6.1. 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" ($\pm\frac{1}{4}$ ", depending on the door install) from the wall OSB to the outside edge of the door threshold.

11.6.2. Install Filler Piece

1. Remove the temporary threshold support piece.
2. Use a $\frac{3}{4}$ " piece of OSB decking material (preferred) or two layers of $\frac{1}{2}$ " 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.

11.6.3. 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 $\frac{1}{8}$ " 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 $\frac{1}{8}$ " 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 11.6.2.4, 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.

11.7. 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;
 - ½" and ¾" 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
Flashlight/headlamp
Hammer tackler stapler
Hand saw
Caulk gun
Hand stapler
Stainless steel straightedge
6' Level
Stepladder
Push broom
Black felt tipped pen
Red marking crayon
Red utility knife blade disposal tube
Vacuum

Materials needed:

24" R-21 Fiberglass insulation
Staples
Air sealing tape
HVAC tape
Air sealing caulk
Clear finish caulk
Tongue depressor
Spray foam
Poly vapor barrier
Foamboard scrap
White soffit nails
1½" Siding nails
1¼" Sheetrock screws
Tapered shims
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. Using the edge of a stainless-steel straightedge, orient it to a horizontal position and hold it against the inside edges of the wall studs about 41" above the floor. Use cardboard shims to fill any gaps until all studs are in line at that level and secure the shims to the studs with staples. 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, or a combination of the two. Attach tapered shims with white soffit nails and cardboard shims with staples.
5. Before checking studs for level and plumb, use one of these two methods to verify the accuracy of the 6' level.
 - a. Place the level on the sub-floor and draw a pencil line along the floor at the front of the level and make a mark on the floor at level center. Observe all the bubbles in the level. Their positions should all be equally spaced within the level lines. Flip the level end for end and align to the pencil marks. The level is accurate if all the bubble positions are the same and their position did not change. Repeat with the opposite side of the level. If a level is not providing consistent readings, give it to the Construction Supervisor.
 - b. Place the level on the 1½" edge of a kitchen or door stud. Make a mark at the top of the level and at the center of the level. Observe all the bubbles in the level. Their positions should all be equally spaced within the level lines. Flip the level end for end and align to the pencil marks. The level is accurate if all the bubble positions are the same and their position did not change. Repeat with the opposite side of the level. If a level is not providing consistent readings, give it to the Construction Supervisor.
6. 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 cardboard shims to the top or bottom until the level reads plumb and staple the shims. With the level in place, fill in any gaps due to bowing with whole or peeled layers of cardboard shims to straighten the face. When completed, or 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.

7. Verify that exterior wall studs 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 $\frac{1}{8}$ ", use cardboard shims, centered on the 41" mark to bring the faces in line. When completed, or if no shimming is required, mark "OK" with a red crayon.
8. Verify that all blocking has been installed per Section 10.6.3. Complete blocking as required.
9. Remove the temporary 2x4 plenum support block positioned across the range plenum.
10. Vacuum debris from all wall cavities and from sub-floor areas along exterior wall bottom plates prior to caulking and installing insulation.
11. 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.
12. Verify that foamboard has been installed along the basement foundation walls and the foam has been pushed tight to the exterior walls using scrap 1" foamboard. If foamboard has not been secured, cut to approximately 5"x5"-8" long", slide along wall studs to push foamboard tight to the wall and secure to the studs with two 1½" siding nails. Some foamboard may require more than one 5"x5" piece to snug the sheets to the wall.
13. Verify folded coil strip has been nailed to the bottom of the common wall garage studs. If not, see instructions for installing in Section 11.1.4.5.
14. Verify exterior door reveals on strike side are between $\frac{1}{8}$ "- $\frac{3}{16}$ " wide. A wider reveal results in too little engagement of the latch into the strike plate. To correct, try backing off on the 2½" exterior screws adjacent the latch area and, if necessary, add shims behind the jam to reduce the reveal along the latch area. Verify operation of the latch and deadbolt.

12.3. AIR SEALING

12.3.1. Main Level

1. Install scrap foamboard in the following exterior wall areas:
 - a. Above exterior wall window and door headers. Use 2" foamboard and cut to fill header cavities flush to the inside face of the wall studs. See Step 8 below for instructions on sealing the perimeter of this foamboard.

- b. Between any two exterior wall studs with a gap of 3" or less. Cut and install flush to interior stud faces. If gaps exist between foamboard layers, seal with air sealing tape.
- 2. Install batt insulation behind electrical boxes along exterior walls only. Cut insulation to extend ½" beyond each box dimension and wedge it behind the box. Slide the batt all the way to the stud.
- 3. Use air sealing caulk to fill the following areas:
 - a. All holes in each of the wall and ceiling electrical boxes. Use a flashlight or headlamp to check filled holes. Re-seal where light penetrates through holes.

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

- b. The bottom of the windows. Use a tongue depressor to push caulk into the joints.
 - c. The inside joint between all exterior wall corners. Use a tongue depressor to push caulk into the joints and remove excess caulk from the corners.
 - d. The inside joint between the subfloor and the exterior wall bottom plates. Use a tongue depressor to push caulk into the joints.
- 4. Use air sealing tape to seal the gap between the poly vapor barrier and the bottom perimeter of the bath fan housing to prevent moisture transfer to the attic.
- 5. Use air sealing tape to seal all flat 2x seams (e.g., door and window components) and between upper and top plates.
- 6. Use air sealing caulk or spray foam to seal the areas listed below. Unless specified, use air sealing caulk for gaps less than ¼" wide and spray foam for gaps greater than ¼" wide.
 - a. All holes in **exterior** wall studs.
 - b. All holes, including unused holes, in the top and bottom plates on interior and exterior walls.
 - c. All holes (being used or not) or gaps in the OSB that are visible from inside the house.
 - d. Perimeter gaps around pipes extending through the sub-floor and bottom and top plates (e.g., water lines, drains, vent stack).
 - e. The gap between the windows and the window framing (rough opening). Partially fill the cavity until the exterior sheathing (blue foamboard or OSB) is no longer visible. **DO NOT FILL THE ENTIRE DEPTH** to the inside of the

window 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.

TIP: It is best to have only one experienced volunteer do the spray foaming.

7. Use spray foam to fill the following areas:
 - a. The gap between the exterior door jambs and the door framing (rough opening). Fill in multiple passes (waiting 15-20 minutes between each pass) to allow foam to fully expand before applying the next layer. Continue filling until FULLY EXPANDED foam reaches the inside edge of the framing. Trim any excess foam ONLY AFTER it has dried thoroughly.
 - b. Around the range plenum duct exit to the exterior. Seal as much gap between the bottom of the plenum duct and the foamboard as can be accessed from inside the house. The gap will be spray foamed again from outside the house before the vent cover is installed later in the build cycle.
 - c. The gap in the sub-floor around the perimeter of cold air return boots.
8. Use air sealing tape, air sealing caulk or spray foam to seal perimeter gaps between foamboard covering exterior door and window headers. If foamboard is tight to component framing (no gaps), seal with air sealing tape. If gaps are less than ¼", seal with air sealing caulk. If gaps are greater than ¼", cover perimeter with air sealing tape, poke holes every 6 – 8" and seal with spray foam. Do not remove the tape.
9. Apply CLEAR FINISH CAULK (stored with the finishing supplies) to the inside joint between the sub-floor and inside edge of each exterior door threshold plus the inside bottom perimeter of both adjoining door jambs.

12.3.2. Basement Level

1. Use air sealing caulk to fill the following areas:
 - a. All holes in wall and ceiling electrical boxes. Use a flashlight or headlamp to check filled holes. Re-seal where light penetrates through holes.
 - b. All holes in the top plates on interior and exterior walls.
2. Use air sealing caulk or spray foam to fill the areas listed below. Unless specified, use air sealing caulk for gaps less than ¼" and spray foam for gaps greater than ¼"
 - a. All holes in exterior wall studs.
 - b. All sillbox penetrations such as dryer vent, plumbing pipe, gas line, etc.

3. Use spray foam to seal the following areas:

- a. The gap in the sub-floor around the perimeter of the cold air return boots. Fill the gap from the main floor first. Once the foam has expanded, fill from the basement to ensure a complete perimeter seal
- b. The sub-floor opening under the tub. If the plumber has run drainpipe and water lines for the tub, cover the sub-floor hole for the bathtub plumbing with scrap OSB from the basement side of the drain, fasten with several 1¼" sheetrock screws, and seal tight with spray foam from the main floor side of the drain.
- c. All gaps between the top of the foundation wall foamboard and the wall upper plate.

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

- d. 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.

4. Install fiberglass 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 rim board. 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 white soffit nails – one at each end (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 or slightly below. Add extra nails to duct sides if gaps between the sub-floor cutout and the duct are greater than 1/8".

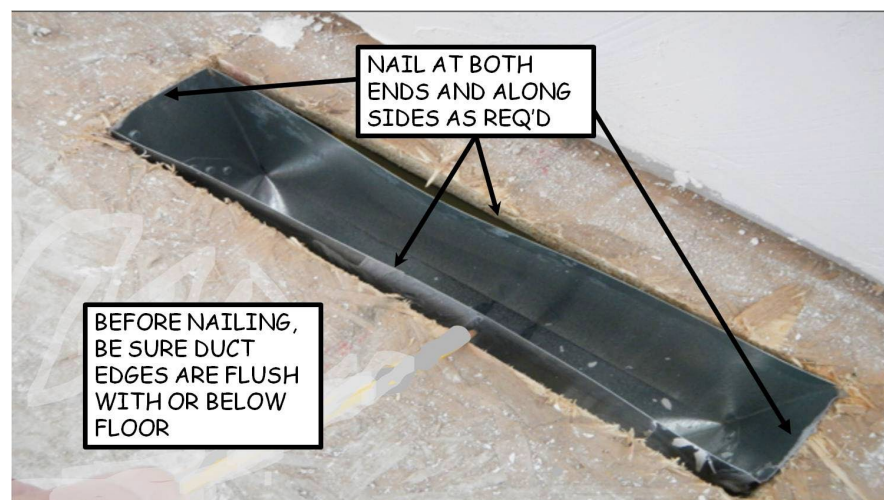


Figure 12-3. Securing In-Floor Heating Duct.

2. Seal gaps between in-floor heating ducts and OSB sub-flooring with 6" wide HVAC tape. (Use two side-by-side pieces if the roll is less than 6" wide.) Cut the tape 3" longer than the duct width. **Make sure the area is dust free before applying the tape.** Remove the peel strip, center the tape over the duct and apply

wrinkle-free 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 [>----<]). If a gap exists between the duct and the floor, pull the long sides of the duct outward to contact the sub-floor cut-out, then fold the cut ends down and seal to the duct (see Figure 12-4).



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

3. Install the temporary floor vent covers into the newly sealed floor vents.

WARNING: Covers should be installed after taping to prevent ladder accidents.

4. 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).



Figure 12-5. Sealing Cold Air Return Joints

12.4. INSTALLING INSULATION IN WALL CAVITIES

1. Before insulating exterior walls with fiberglass batt insulation, check behind all exterior wall electrical outlets to ensure insulation is installed behind all these boxes. Foamboard insulation can be installed behind all outlets except the kitchen sink base cabinet outlet and the outlet above the stove. These outlets must be insulated with fiberglass insulation. See Section 12.3.1.2.c. for instructions on installing foamboard behind exterior wall outlets.
2. Insulate all outside walls with (R-21) fiberglass batt insulation. Install loosely, never pack it in. 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.
3. While installing insulation, check to make sure the top of the insulation batt is tight to the bottom of the wall upper plate. The gap shown in Figure 12-6 is excessive and results from the batt sliding down slightly during installation.

TIP: To prevent the air gap shown in Figure 12-6, lift up the batt and hold it so its top is about 1" above the bottom of the upper plate before tucking in about 2' of each of the sides. Then tuck the top of the batt underneath the top plate.



Figure 12-6. Air Gap Between Insulation and Upper Plate.

4. Insulate around vertical PVC piping by cutting a batt into two pieces, such that the cut is directly behind the center of the pipe. Place the insulation behind the pipe and split the length along each side of the cut slightly to cover the pipe. If the pipe has a horizontal run, make another cut behind the horizontal section and split to cover.
5. Failure to fluff the insulation in the wall cavity, or compressing it as little as an inch, can significantly reduce its insulation value.

6. Split the batt in half to fit it around electrical wires (see Figure 12-7).



Figure 12-7. Insulating Around Electrical Wires.

7. 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 is 18” x 30”, cut the batt to 18 $\frac{3}{4}$ ” x 30 $\frac{3}{4}$ ”.

8. Cut out around electrical boxes, as tightly to the box as possible (see EXAMPLE below and Figure 12-8).

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.

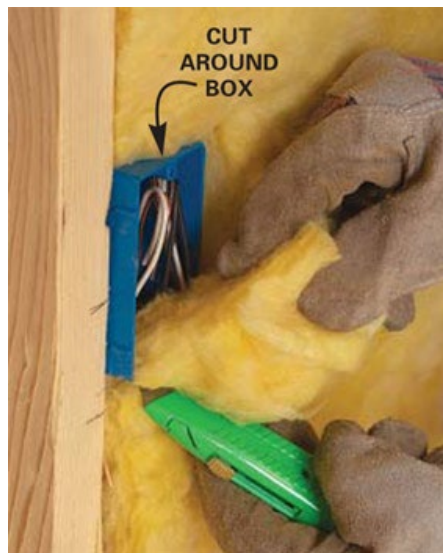


Figure 12-8. Insulating Around Electrical Box.

9. Do not insulate any ceiling areas.

10. **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.

11. 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.
12. 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.
13. Place extra pieces of batt insulation around the outside of tub enclosure for additional sound barrier.

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 framing or 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. More details on stapling are included in Section 12.5.4.
5. Use nominal 12' wide poly for ceiling areas; 8' wide poly for walls.
6. Install all ceiling poly before installing wall poly.
7. After installing poly, cut an X across corners of each electrical box. Cut slightly smaller than the inside of the box (staying ¼”–½” away from the corner) and push the poly up ½” 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 across the fold. Unfold the layers underneath this line and extend the line across 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" 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 down the center 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. Verify 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 closet header with a utility knife, or the extra can be wrapped around to cover the inside of the header (see Figure 12-9).



Figure 12-9. Extend Ceiling Poly to Cover Flush Closet Header.

- 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 at least 6" down the back and sides of the closet, and if the inside of the closet header is not wrapped per Section 12.5.2.a to completely cover the inside front down to the bottom of the header. Fold and staple all 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" 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 with air sealing tape to ensure a good seal.

NOTE: All ceiling poly seams should 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 ceiling poly where two intersecting walls and the ceiling meet to form a corner, make sure the poly is tucked tightly into the corner so the poly does not interfere with the installation of ceiling sheet rock.

9. After covering the bathroom ceiling, cut the poly over the bath fan by slicing through the poly along the inside edge of the fan housing with a utility knife. Seal the air gap by attaching the poly to the fan housing perimeter using air sealing tape.
10. If the house has a scuttle, cut an X opening for the scuttle hole, wrap poly around rough opening and staple to the scuttle framing. Trim any excess.

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

1. Create a reference chalk line 72" in from the exterior long wall by marking the bottom of the trusses located at opposite ends of the room and snapping a continuous chalk line between 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 with a utility knife. Do not unfold the poly at this point.
3. Create a reference line on the top of the folded poly. Using a felt marking pen, draw a straight line across the top of the folded poly using a T-Square, 78" in from one end. Then carefully unfold the poly around the reference line area and extend the reference line across the entire unfolded width of the poly.
4. Orient the 78" referenced end toward the exterior long wall used to create the reference line in Step 1 above. Unfold the entire length of the cut poly sheet.
5. Begin installation on the 5th or 6th truss in from an exterior wall, depending on the spacing of the first truss to the wall. Measure the distance from the bottom of the 6th truss to the exterior wall and add 6". If the 12' poly is too short to completely cover both the top and upper plates from the 6th truss, start installation on the 5th truss.
6. Lift the poly up to the starting truss and align the poly reference line with the chalk line. Align one factory edge along the back edge of the truss and staple directly under the chalk line. Aligning the reference line on the poly to the chalk line will keep the poly straight and ensure a nominal 6" of poly extension down the top of the bearing walls as the poly is installed. Add one additional staple on each side of the line. Continue stapling down the reference line toward the opposite end while

superimposing the reference line over the chalk line. **Staple the entire sheet width along the poly line first**, then staple outward toward the bearing walls.

7. Use push brooms to support the unstapled poly and keep it tight while pulling the poly toward the walls. Continue stapling every 2’.
8. Continue with more pieces until the room is completely covered. Measure the room widths required and mark a reference line 78” from the utility knife cut end of each additional 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.
9. When extending ceiling poly around an outside corner (e.g., around a corner leading into a hallway or a closet corner), align the main portion so it hangs parallel to the wall, as shown in Figure 12-10. Cut straight down from the top corner about 1” to the left side of the corner and peel back to create a convenient flange for tape sealing the corner area. Tape all outside corners where poly does not cover the joint between the upper and top plate.



Figure 12-10. Extending Poly Around a Corner.

12.5.4. Installing Wall Poly Vapor Barrier

1. Before installing wall poly, verify the centers of all stud locations are marked on the floor with a RED CRAYON. Mark any missing stud center references.
2. Poly should be installed on each exterior wall, plus wrapped around the corners of an intersecting wall to the first stud in from the corner. Measure the length of the exterior wall to be covered, plus the length required for each intersecting wall segment to be wrapped. Add one foot to this measurement to ensure sufficient length to wrap the corners and cut the poly to this length.
3. Start hanging wall poly at the top of a corner where two walls intersect. **Verify a sufficient free length exists to wrap the corner to the first stud on the wall**, but

fasten the free end last. 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 four stud section is stapled top to bottom, the corner can be stapled per instructions below. Continue hanging the balance of the poly

4. To staple corners, start from the top of the corner and **staple one stud at a time**. Push the poly into the corner with one hand and staple the poly tight to the EXTERIOR WALL CORNER STUD FIRST with the other hand (see Figure 12-11). Continue down the EXTERIOR wall corner stud, pushing the poly into the corner and stapling down the stud to the bottom plate. After the exterior wall stud has been stapled, move to the top of the intersecting wall corner stud and repeat the process before stapling the free end. Try to keep staples 1" away from the corner to allow the poly to stretch a little without tearing staple holes during sheetrock installation.

TIP: 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.



Figure 12-11. Pushing Poly Into The Corner While Stapling.

5. Staple at every stud, plate and window/door rough opening, spacing staples about 2' apart.
6. 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.
7. To install poly around closets with a flush sliding door, cut a 3½"-4" wide "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 (see Figure 12-12).



Figure 12-12. Air Sealing Around a Flush Closet Header.

8. After the poly has been installed, remove the poly covering the windows. Cut out the center portion of the poly covering the window with a utility knife, leaving about 2" of poly inside the window frame perimeter. Place these cut-outs in the bathtub for use under paint trays on painting days. At each corner, slit the poly to the frame by making 45° cuts. Wrap the poly remaining around the windows into the rough openings and staple to the framing.
9. At each exterior door, cut poly along the outside edge of the door jamb sides. 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.
10. 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.
11. Install any unusable scrap pieces of poly (i.e., those less than 36") on any interior wall (except bathroom walls) to minimize waste and reduce contributions to the landfill.
12. 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

13.7 INSTALLING FULL HEIGHT END POSTS TO 42" WALLS

Tools needed by volunteers:

Nail apron
Tape measure
Utility knife
Pencil

Materials needed:

½" Sheetrock
⅝" Sheetrock
1¼" Sheetrock screws
1⅝" Sheetrock screws
3½" Sheetrock screws
4" Timber screws
Air sealing tape

Tools and equipment needed:

Extension cord
Lighting
Driver
Screw gun
Sheetrock bit (dimple bit)
Spiral saw
4⅛" Hole saw
Chop saw
Quick clamps
Sheetrock T-square (2' and 4')
Sheetrock rasp
Sheetrock hand saw
Sheetrock lifts
Step ladders/stools
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 $\frac{1}{2}$ " and not $\frac{5}{8}$ " thick. The $\frac{5}{8}$ " sheetrock is to be used for the garage only.
2. Verify that ceiling blocking has been installed where required. Install where missing. See Section 10.6.3 for sheetrock 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. Poly that is stretched across a corner will inhibit sheetrock from fitting tight to the framing. If poly does not fit tight to corners, pull out staples and refold 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 all ceiling electrical boxes and basement HVAC ceiling ducts and damper locations have been marked with a red circle on the floor (see Sections 12.2.2 and 12.2.3 for marking instructions).
6. Verify that the cutting bits in the spiral saws are not bent and that the bit protrudes no more than the ideal length of $\frac{5}{8}$ "- $\frac{3}{4}$ " beyond the saw guard. If it is bent remove the clamping sleeve and clean the sheetrock dust from the sleeve slots (with WD-40) to ensure adequate clamping pressure. Replace the bit and position the bit in the sleeve with about $\frac{1}{4}$ " of the bit sticking out beyond the base of the sleeve and reattach the sleeve into the spiral saw (see Figure 13-1).

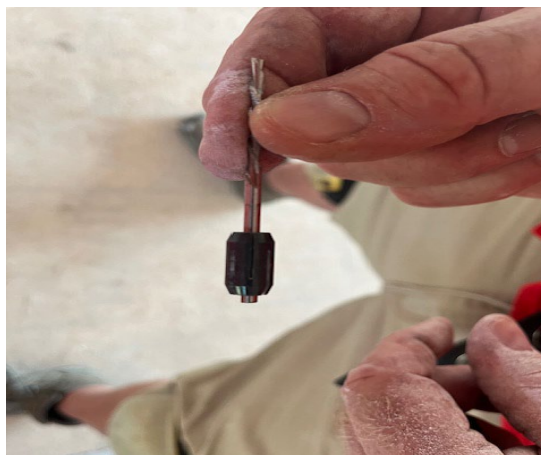


Figure 13-1. Proper Saw Bit Insert Depth.

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 that the desired minimum sheetrock width is 12" along exterior walls and 16" along interior walls; however, the wider the better along interior walls:
2. Divide the task of installing sheetrock into two functions, with a separate team for each function. Functions include cutting, installing and quality control (see Section 13.5.4 for quality check instructions).
3. Determine the best individual sheetrock widths and lengths required to complete each room (see Sections 13.4.1 and 13.4.2).

13.3. GENERAL INSTALLATION RULES

1. Install all sheetrock perpendicular to the trusses.
2. Butt factory ends to factory ends of adjacent sheets.
3. Ideally, all sheetrock pieces should butt together. Try to limit any gaps to less than 1/8". Maximum allowable gap is 1/4".
4. All sheetrock pieces must be long enough to 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).
5. House sheetrock is installed with 1 1/4" sheetrock screws; garage sheetrock is installed with 1 5/8" screws.
6. **Screws should be installed straight in (i.e., at a 90° angle to the sheetrock) and deep enough so the head is SLIGHTLY recessed (countersunk) below the paper surface of the sheetrock (see Figure 13-2). If the outer layer of paper is torn, or the gypsum is crushed between the paper layers, the screw is too deep and the holding power of the screw is compromised. Leave the screw in place but add another screw about 2" away. Adjust the depth setting of the driver to ensure the correct depth.**

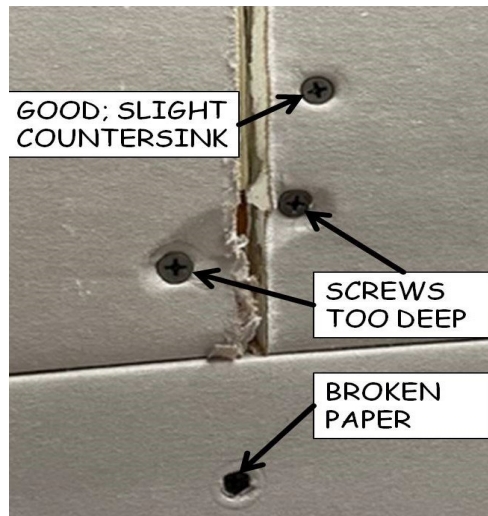


Figure 13-2. Examples of Countersunk Sheetrock Screws.

7. Keep screws 1"-2" away from the corner of the sheetrock to prevent corner cracking.
8. Each full width sheet must be fastened with seven screws on each end and five in the field.
9. Factory edges of sheetrock should butt to factory edges of adjacent pieces wherever possible. Keep cut edges toward the walls.
10. Do not force the sheetrock if the fit is tight. Forcing and mishandling can result in broken corners (see Figure 13-3). Sheetrock with broken corners should not be installed. If tight, trim to fit. If a break occurs during installation, check with the Construction Supervisor regarding acceptability. If it's OK, remove any loose paper and gypsum before completing installation.



Figure 13-3. Broken Corner.

11. End joints on each successive row should be staggered a minimum of two and preferably three trusses.
12. 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.
13. Undercut sheetrock pieces $\frac{1}{4}$ "- $\frac{1}{2}$ ". For fitting between an installed factory end and a truss center or end blocking, undercut the length by $\frac{1}{4}$ " versus the measured gap. However, if the sheet will completely fill the gap between two parallel walls, (e.g., a closet or pantry), undercut the sheet by $\frac{1}{2}$ ".
14. When fastening sheetrock to trusses that cross interior or exterior walls, hold the screws 8"-10" away from interior walls, and about 4"-6" away from exterior walls (see Figure 13-4).

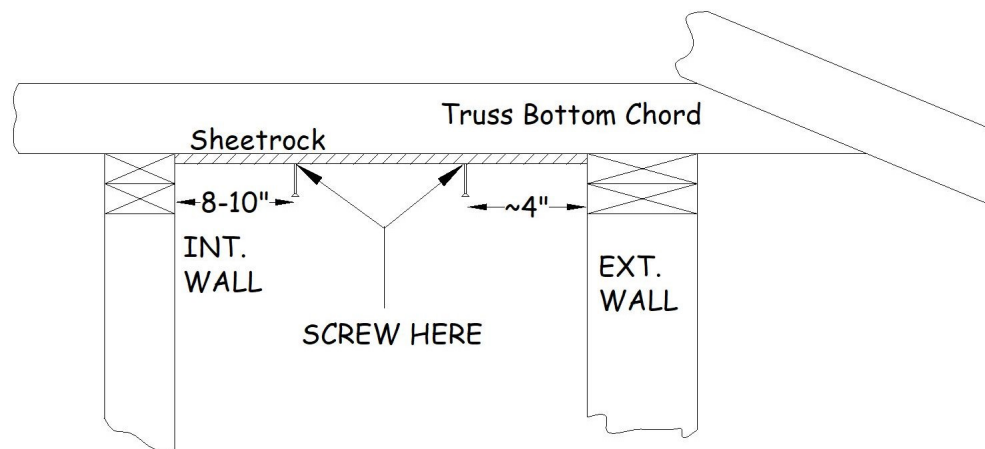


Figure 13-4. Screw Locations for Ceiling Sheetrock.

15. 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.
16. Use a spiral saw to cut out all ceiling electrical boxes (see Section 13.5.6 for marking instructions and Section 13.5.7 for sawing instructions). Sheet rock pieces covering the scuttle access can be cut with a spiral saw or a hand saw. When using a spiral saw, ask someone to run a vacuum and hold the hose end close to the leading edge of the cut to reduce spreading the dust generated by the cutting tool.
17. 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 opening.

NOTE: Do not use a spiral saw to cut openings for bath fans. The spiral bit will shred the poly tape seal between the fan housing and the vapor barrier and allow moisture to escape into the attic (see Figure 13-5).



Figure 13-5. Damaged Tape Seal from Spiral Saw Cut-Out for Bath Fan.

18. Use a 4 $\frac{1}{8}$ " hole saw to cut an access for basement HVAC adjustment dampers. See Section 13.5.9 for cutting instructions.
19. When cutting sheetrock with a hand saw, always cut facing the finish side (grey side) and cut on the push stroke only. This will prevent paper tear-out on the finish side.

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 exterior 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 the first row will provide a 12" wide final row above the exterior wall.

13.4.2. Kitchen/Dining/Living Room Layout.

1. Measure the room width (parallel to the trusses) from the exterior long wall to each of the interior wall sections.
2. Estimate the sheetrock widths required to best fill the ceiling from the exterior wall to the interior walls. Start by figuring to use a full 48" wide sheet along the exterior wall and determine the resulting widths along the interior walls. Remember, sheetrock widths must be at least 16" along interior walls and 12" along exterior walls. If 48" does not provide an adequate width along all the interior walls, adjust the starting width (e.g., 36", 24" or 12") along the exterior wall until the minimum width along all interior walls is satisfied.
3. Add ¼" to the starting width dimension determined in Step 2 above. From the exterior wall top plate, mark this width on the bottom of the first and last truss (located at opposite ends of the room). Snap a line between the marks. This line represents the leading edge of the first row. Check the distance from the outside long wall to the chalk line every 48"- 60" to verify no areas are less than the desired sheetrock width plus ¼". If there are, add ¼" to the truss marks created above and re-snap the line.
4. 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 sizes 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.

13.5. INSTALLING CEILING SHEETROCK

1. Begin installing sheetrock at an exterior wall perpendicular to the trusses.
2. Measure and draw pencil lines across the sheetrock at the truss centerline locations with a 4' T-square. Marking these lines ensures every screw hits a truss. This can be done before placing sheetrock on the lift, or when the sheetrock has been safely secured with enough screws to lower the lift.

3. Use a sheetrock lift to raise, position and hold sheetrock pieces to the ceiling. Extend the horizontal sheet support arms of the sheetrock lift as appropriate for the length of the sheet and lower the two support arms to support the bottom of the sheet. Place the sheet on the lift and raise it until it almost touches the ceiling. For the first row, position the long factory edge along the chalk line snapped in Section 13.4.2.3 for the large open room or tight to the wall for bedrooms and bathrooms. **Make sure the factory end is centered on a truss.** Safely secure with several screws in at least four trusses (ends and middle) before lowering the lift. Continue installing all pieces in the first row along the chalk line 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.

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

TIP: 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 workday

- 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 slightly 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 dimple bit is too deep, (e.g., it has completely broken the exterior paper layer of the sheetrock or crushed the gypsum), the holding power of the screw is compromised. Leave the screw in place, but add another screw about 2” away.**
- d. Verify 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.
- f. Verify any loose or torn paper from the interior face of the sheetrock has been removed.
- g. Verify any installed sheetrock with a broken area has been approved by the Construction Supervisor and loose gypsum has been removed.

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 box 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 box opening has been cut. Mark the centerlines on the sheetrock after covering the box.
7. Use a spiral saw to cut around all electrical boxes. Verify that the depth of the saw bit is $\frac{5}{8}$ "- $\frac{3}{4}$ ". Insert the saw bit 3"-4" away from the box 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. Measure and cut out holes for damper access prior to sheet installation to prevent cutting the sheet metal. 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.

NOTE: Damper access holes will be plugged with a standard hole plug that has a $\frac{1}{2}$ " flange on the outer perimeter of the plug. Keep the hole center a minimum of $2\frac{3}{4}$ " from a wall or LAM beam to ensure adequate clearance for the flange.

10. When installing ceiling sheetrock in the garage, drill a ¼" hole near the ceiling outlet and pull the wire for the garage door opener through the hole (see Figure 13-6).



Figure 13-6. Exposing Garage Door Opener Wire.

11. After completing the ceiling installation in the garage, cover the upper and top plates of the two exterior walls with 3" wide pieces of sheetrock (see Figure 13-7). Do not use pieces shorter than 48" long. If available, use ½" sheetrock scraps.



Figure 13-7. Covering Garage Exterior Wall Plates.

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 2x framing (either nominal 3½" or 5½"). Cut four sheetrock strips, each ¼" narrower than the measured width. Use ½" sheetrock for the house; ⅝" for the garage. Select pieces from narrow drop-offs having a factory edge on one of the long edges. Install them factory side up, flush with the top of the scuttle box framing.

2. If the garage has a scuttle access, retrieve the $\frac{3}{4}$ " decking OSB cover from the scuttle access. If the garage cover cannot be located, check with the Construction Supervisor. If the cover is not found, measure the length and width of the access opening and cut a new cover $\frac{1}{2}$ " inch shorter than the measured dimensions. Cut a piece of $\frac{5}{8}$ " sheetrock to the OSB dimensions, flush up the sides and attach to the OSB with the backing side toward the OSB. Secure with $1\frac{5}{8}$ " sheetrock screws. Set aside for plastering.
3. If the house has a scuttle access, locate the stretch-wrapped $\frac{1}{2}$ " OSB/foamboard cover assembly. It is typically located near the scuttle. If the assembly cannot be located, consult the Construction Supervisor. If the assembly has not been made, see instructions for cutting and stretch-wrapping components in Section 7.6.3, then cut $\frac{1}{2}$ " sheetrock to the same dimensions as the OSB portion of the assembly. Orient the assembly OSB side up, place the backing side of the sheetrock on the OSB, flush all sides to the OSB and attach with $1\frac{1}{4}$ " sheetrock screws. Set aside for plastering.

13.7. INSTALLING FULL HEIGHT END POSTS TO 42" WALLS

1. If the House Plan includes a full height post to support the end of a 42" wall, retrieve the post from underneath the basement stairs. The post is a full floor-to-ceiling length sandwich of two 2x4s and $\frac{1}{2}$ " OSB. If it cannot be located, check with the Construction Supervisor. If the post is not on site, see Section 5.10.3.1 for fabrication directions.
2. Verify the post length. When resting on the sub-floor, the top of the post should contact the bottom of the sheetrock. Trim to length as required with a chop saw.
3. Position the post in front of the 42" wall end stud and verify its length. If necessary, shim the bottom of the post with appropriate shims to ensure the top of the post contacts the sheetrock.
4. Verify the wall is plumb, then loosely quick clamp to the top and bottom of the 42" wall end stud. Plumb the post with a 6' level in both directions. Shim between the end stud and the post if required and tighten the clamps.
5. Verify both wall and post are plumb. Secure the bottom of the post through the 42" wall end stud with three 4" Timber screws. Secure the top of the post with one pair of $3\frac{1}{2}$ " sheetrock screws toe-nailed through each of the 2x4 faces.

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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

Tools and equipment needed:

Extension cord
6' Level
Lighting
Driver/Screw gun
Sheetrock bit (dimple bit)
Drill with 1/4" bit
Staple gun
Spiral Saw
2 1/2" Hole saw
Jab saw
Sheetrock hand saw
Sheetrock rasp
2' and 4' Sheetrock T-square
Foot lifter
Step ladder/stool
Putty or drywall knife
Ratcheting T-driver
Electrical box center locator
Black felt-tipped pen
Red marking crayon
Vacuum

Materials needed:

1/2" Sheetrock
5/8" Sheetrock
1 1/4" Sheetrock screws
1 5/8" Sheetrock screws
2 1/2" Sheetrock screws
1/8" Flat shims
Cardboard shims
Air sealing tape
Window edging strips

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 10.6.3).
5. Verify that the interior faces of kitchen wall studs located behind the future countertop have been checked and adjusted to the same plane per Section 12.2.4.
6. 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.
7. 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.
8. 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 tape. Also check for holes and tape any holes that develop with air sealing tape.
9. 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.
10. 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.
11. Verify exterior walls in basement are covered with 1” foamboard, gaps between the top of foamboard and the upper plate have been sealed, and the foamboard is pushed tight to the walls and held with scrap 2x or OSB.
12. Remove any residual spray foam and caulk from the face of all window frames and window components. Take care not to mar the frames. Also check the inside framing

faces of window components for any protruding nails and hammer them down flush to framing if present. On basement windows, verify the foamboard is flush or below the surrounding window framing. If necessary, trim with a rasp or utility knife (see Figure 14-1).



Figure 14-1. Trimming Foamboard Around Basement Window.

13. Remove temporary stairway handrail prior to installing sheetrock in the stairway areas.
14. Verify that the cutting bits in the spiral saws are not bent and that the bit protrudes no more than the ideal length of $\frac{5}{8}$ "- $\frac{3}{4}$ " beyond the saw guard. If it is bent remove the clamping sleeve and clean the sheetrock dust from the sleeve slots (with WD-40) to ensure adequate clamping pressure. Replace the bit and position the bit in the sleeve with about $\frac{1}{4}$ " of the bit sticking out beyond the base of the sleeve as shown in Figure 14-2 and reattach the sleeve into the spiral saw.



Figure 14-2. Proper Saw Bit Insert Depth.

14.2. PLANNING

1. Develop an installation plan to maximize efficient use of people and material to minimize building costs.

NOTE: Wall areas are measured before sheetrock day and the most efficient use of 8' and 12' sheetrock pieces are calculated from these measurements. Measurements are written on the studs – red dimensions indicate wall sections to be covered first (before adjacent walls). See Appendix B for an explanation of the measurement process.

2. Divide the task of installing sheetrock into three functions, with a separate team for each function. Functions include cutting, installing and quality control (see Section 14.4.1.7 for quality check instructions).

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. **Screws should be installed straight in (i.e., at a 90° angle to the sheetrock) and deep enough so the head is SLIGHTLY recessed (countersunk) below the paper surface of the sheetrock. If the outer layer of paper is torn, or the gypsum is crushed between the paper layers, the screw is too deep (see Figure 14-3) and the holding power of the screw is compromised. Leave the screw in place but add another 2" away. Adjust the depth setting of the driver to ensure the correct depth.**

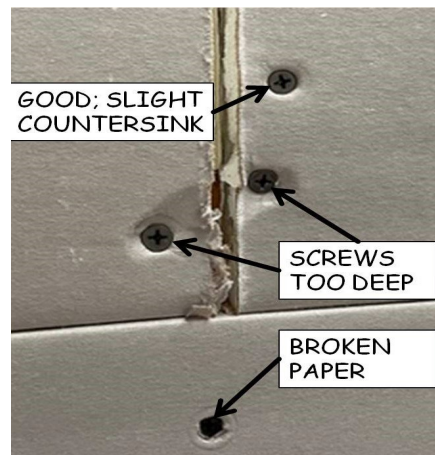


Figure 14-3. Examples of Countersunk Sheetrock Screws.

3. Full width sheets should be secured with seven screws on each end and five in the field.

4. All butt joints must be centered on a stud. Sheetrock pieces above doors or windows with headers do not need to seam on a stud, as headers and top plates provide sufficient support. Closet headers have no vertical studs to attach to.
5. 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 columns of screws). Exceptions are closet side walls, pieces covering closet door headers, window and door headers, and pieces that cover narrow areas (e.g., window framing and interior wall ends).
6. Each full width sheet must be fastened with seven screws on each end and five in the field.
7. Keep the screws used to secure bottom row sheets to wall studs or wall corner blocking 3"-4" above the floor
8. Bottom row sheets should be fastened to the bottom plate with two screws between each stud.
9. Undercut the sheetrock by the following amounts relative to the actual measured dimension:
 - by 1/2" if the piece will span the entire distance between two parallel walls (e.g. a closet or pantry).
 - by 1/4" when butting tight to an adjacent sheetrock piece (as between a sheetrock factory edge on one end and a stud or intersecting wall on the other end).
10. When measuring sheetrock to fit around exterior doors, leave a 1/2"-3/4" gap between sheetrock and the outside edge of exterior door jambs.
11. 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, and the bottom row of basement sheetrock.
12. Ideally, all sheetrock pieces should butt together. Try to limit any gaps to less than 1/8". The maximum allowable gap is 1/4".
13. Cut the bottom row of sheetrock in the basement to provide a 1/2" gap between the bottom of sheetrock and the basement floor. This limits floor moisture from being absorbed into the sheetrock. If sheets are installed without a gap, use a multi-tool with a sheetrock blade mounted on a piece of 1/2" sheetrock to cut off the bottom 1/2" (see Figure 14-4).



Figure 14-4. Alternative Method for Ensuring ½” Gap Off Basement Floor.

14. Do not force sheetrock if the fit is tight. Forcing and mishandling can result in broken corners (see Figure 14-5). Sheetrock with broken corners should not be installed. If it is tight, trim to fit. If a break occurs during installation, check with the Construction Supervisor regarding acceptability. If it's OK, remove any loose paper and gypsum before completing installation.



Figure 14-5. Sheetrock Broken Corner.

15. End joints on each successive row should be staggered a minimum of two and preferably three studs.
16. 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 14.4.1.12 for cold air returns, Section 14.4.1.13 for switch boxes, and Sections 14.4.1.14 and 14.4.1.15 for receptacle boxes). Use a 2½” hole saw to cut 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.

17. 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".
18. 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.
19. When cutting sheetrock with a hand saw, always cut facing the finish side (grey side) and cut on the push stroke only. This will prevent paper tear-outs along the finish side of the cut.
20. Keep screws 1"-2" away from the corners of sheetrock to prevent corner cracking.

14.4. INSTALLING WALL SHEETROCK

14.4.1. Walls

1. Begin installation at the top of a wall starting in a corner. Install sheets over stud areas marked with red dimensions first and finish the entire top row before installing the bottom row.
2. If wall areas have not been pre-measured, measure the total length of the wall selected for sheetrocking. 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.

3. Measure and draw pencil lines across the sheetrock at the stud centerline locations with a 4' T-square. Marking these lines ensures every screw hits a stud. Marking can be done either before installing while the sheet is still resting on the floor, or after the sheetrock has been secured to the wall with enough screws to safely hold it.
4. Position the piece tight to the ceiling sheetrock and install one or two 1¼" sheetrock screws per stud to securely hold it to the wall. Continue screw installation along the pencil lines until all top row pieces are in place and fully secured, using the recommended approaches provided in Section 14.3.
5. When sheetrocking an upper row, completely cover the upper portion of swinging doors, windows, and the front side of sliding closet doors with a single piece of sheetrock. Two butted scrap pieces can be used on the back side of the closet, provided the pieces extend at least 6" below and beyond the header.

6. Save each window cut-out for covering the windowsill and bottom of window header. Cut-outs from sliding closet doors can be used to cover the upper portion of swinging doors provided they extend at least 6" below the header and cover the header from corner to corner.
7. After installing sheetrock over windows and doors, remove the sheetrock portion covering the opening by cutting in a clockwise direction with a spiral saw along the inside edge of the framing. Set the saw bit depth to $\frac{3}{4}$ "–1".
8. 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.

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

TIP: 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 workday

- 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, hand tighten with a ratcheting T-driver until slightly 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 dimple bit is too deep, (e.g, it has completely broken the exterior paper layer of the sheetrock, or crushed the gypsum), leave the screw in place but add an additional screw about 2" away.**
- d. Verify 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. Also verify that all sheets (except narrow sheets) are attached with at least three columns of screws. If not, see Construction Supervisor.
- e. Verify each piece of sheetrock is attached to at least two studs and a section of blocking (i.e., three rows of screws) before marking "OK". Inform the Construction Supervisor if any pieces having fewer than three rows of screws are found.
- f. Verify that all narrow sheetrock strips are secured as stated in Section 14.3.15.

- g. Verify that all screws used to secure bottom row sheets to **wall studs (or wall corner blocking)** are 3"-4" above the floor. If not, remove and relocate.
 - h. Verify that each bottom row of sheetrock is attached to the bottom plate with two screws between each stud.
 - i. Verify any loose or torn paper from the interior face of the sheetrock has been removed.
 - j. Verify any installed sheetrock with a broken area has been approved by the Construction Supervisor and loose gypsum has been removed.
9. 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.
10. 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 14-6).

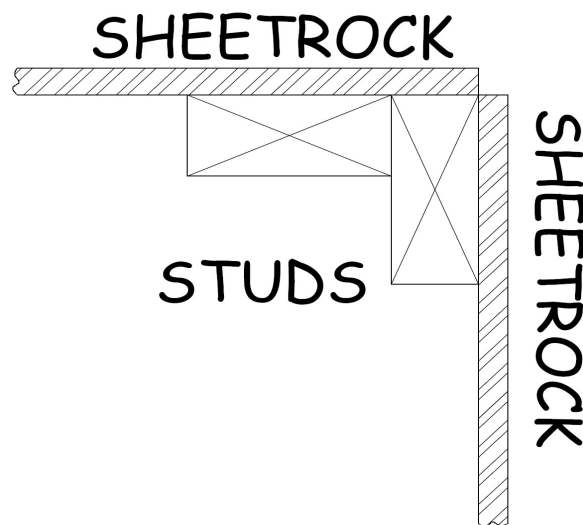


Figure 14-6. Top View of Outside Corner Installation of Sheetrock.

11. Outside corners of intersecting walls should be flush. If one corner stud is proud of the intersecting corner stud, a gap results at the corner (see Figure 14-7). To rectify, verify the problem and close the gap with cardboard shims **before securing** the sheetrock.

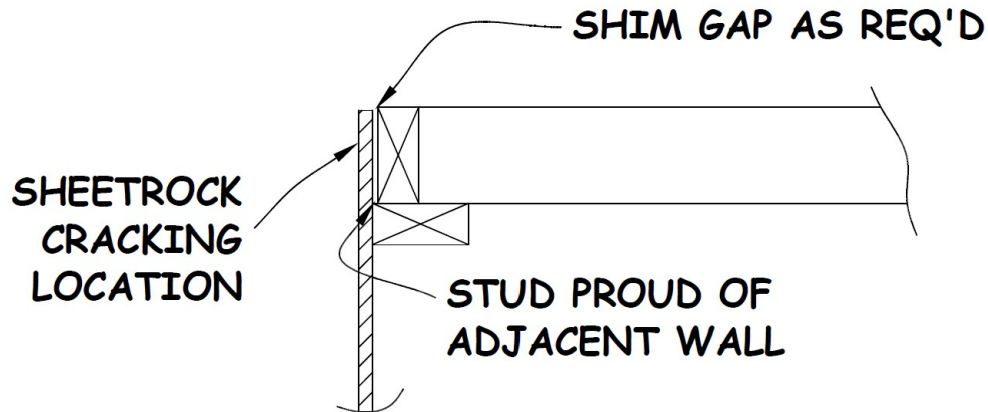


Figure 14-7. Proud Outside Corner Stud.

NOTE: If a gap exists, there is no support at the end of the sheetrock, and cracking can occur along the unsupported end (see Figure 14-8). Cracking compromises the security of the sheetrock and may cause future movement.



Figure 14-8. Cracking Resulting From One Proud Corner Stud.

12. If walls have not been pre-measured, first secure and check the top row of sheetrock. Then, install the bottom row. Start with a full sheet if possible, but select a length that will allow for a joint stagger of at least two studs. Install the bottom row of sheetrock using a pair of foot lifters to hold the sheet up snug to the

upper sheet before fastening. **For basement walls (including knee walls) sheetrock must be ½” off the concrete floor (or ledge for knee walls) to prevent moisture wicking.** Drive two screws into the bottom plate evenly spaced between each stud.

13. Cut out the opening for the cold air return before attaching the sheetrock to the wall studs. 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 or jab 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.

14. Wall outlets are cut out by hand or with a spiral saw. Single electrical boxes, such as floor level receptacles (~14” above floor) and the microwave/range receptacle are typically cut with a spiral saw after piercing with a box center locator. Wall switches and switch height single boxes are generally cut out by hand.
 - a. To cut with a spiral saw, insert a box center locator into a box. Position the sheetrock and push in to pierce the sheetrock with the center locator. Verify the depth of the spiral bit is between 5/8” and ¾” and insert the bit to the left or right of the pierced hole. Move the bit up or down to contact the inside surface of the box, then move the bit clockwise around the inside of the box. Complete the cutout by spiral cutting around the outside of the box in a counterclockwise direction.

NOTE: When using a spiral saw, ask someone to run a vacuum and hold the hose end close to the leading edge of the cut to reduce spreading the dust generated by the cutting tool.

- b. To cut out a wall switch box by hand, 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.
15. **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 (see Figure 14-9).



Figure 14-9. Pulling Wires Through Sheetrock.

16. 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.
17. Cover the plenum for the range hood with sheetrock. The opening for the hood vent will be cut out prior to cabinet installation.
18. 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 (see Figure 14-10).



Figure 14-10. Trimming Around Joist Hangers.

19. Re-install the temporary stairway handrail as soon as the sheetrock has been installed in the stairway area.

14.4.2. Window Frames

1. Verify component framing around the windows is free of residual spray foam, caulk, or protruding nails.
2. On basement windows, verify the foamboard is flush or below the surrounding window framing and trim with a rasp or utility knife (see Figure 14-1).
3. Use the window cut-out to cover the sill and the bottom of the header. Install these pieces first before sheetrocking the side pieces.
4. Place a cardboard shim on each corner of the sill, tight to the window frame. Cardboard shims are used to create a narrow gap for window edging strips.
5. Cut the sill sheetrock to fit tight to the cardboard shims and flush with the interior edge of the 2x6 window framing. Ensure that sheetrock is in good contact with the framing and check the reveal along the bottom of the window. If the reveal is uniform, go to Step 6 below. If not, verify the sill is free from debris and protruding nails. If necessary, use cardboard shims underneath the sheetrock to balance the reveal.
6. Secure the sill piece with 1¼" sheetrock screws. Push the piece tight against the shims and keep screws at least 2" out from the window frames. Screws should be installed per the pattern described in Section 14.3.15. Step back and re-check the reveal after installing screws. If the reveal is not uniform, remove screws and adjust with cardboard shims. Refasten in new holes. After installation, remove the shims used to create the edging strip gap.
7. Repeat Steps 3 through 6 above and cover the header. Then, use scrap pieces to cover the sides, maintaining a gap around the entire perimeter of each window frame per Step 3 above.
8. Measure the length and width between the installed sheetrock pieces and cut one edging strip to each of those dimensions. Clip the corners to 45° angles (see Figure 14-11) and insert the short edge into the gap. Push the beads down along the strip length. If bead strips are too long (do not lay flat), remove, re-cut and re-install.

NOTE: A maximum of two window edging strips can be butted together to form a single edging strip per section. Do not use a strip length less than 6".

9. Starting on one end, push the strip into the gap and tight to the window frame. Hold and add one staple near the row of holes closest to the window (see the right side of Figure 14-11). Repeat the push-hold-and-staple sequence every 6" along the window, keeping the strip in contact with the window frame as each staple is added.



Figure 14-11. 45° Clipped Corners and Inside Row Hole Stapling.

10. Once the edging strips have been stapled per Step 9 above, complete installation by stapling down the interior edge of the edging strips every 6"– 9" (see Figure 14-12).

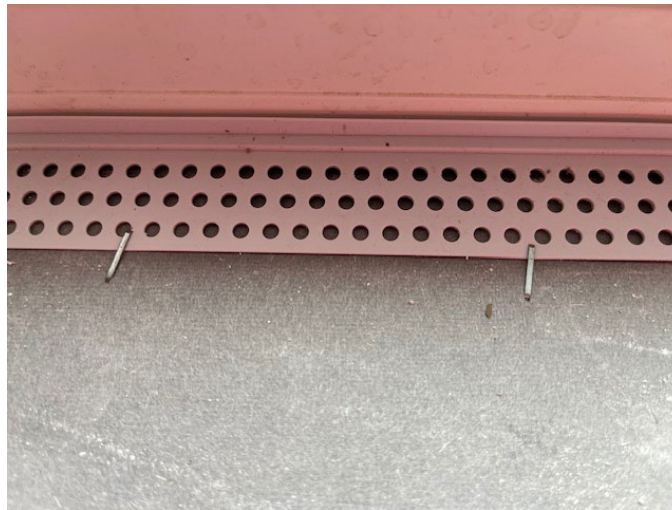


Figure 14-12. Final Staple Securement of Edging Strips.

11. Pound down any non-flush staples.

14.4.3. Shower Area

1. Sheetrock at the tub/shower nailing flange should butt to the exterior edge of the nailing flange (see Figure 14-13 for proper installation). **NEVER OVERLAP THE NAILING FLANGE.**



Figure 14-13. Sheetrocking Around Tub/Shower Nailing Flange.

14.4.4. Basement Door Area

1. On the unfinished side of the basement door, install scrap sheetrock above the door and on either side of the door to the width of at least one stud bay.
2. Use 8"-12" wide sheetrock scraps to cover all interior horizontal wall wiring between studs in the unfinished side of the basement. Cut all pieces to the same width.

14.5. FINISHING AND CLEANUP

1. Return all unused full-length sheetrock to the main floor.
2. 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.
3. When installation is complete, clean floors by dragging push brooms to remove debris, but do not remove the fine dust.

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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:

Materials needed:

Primer
Paint
Stain
Rags
Tapered shims
Disposable roller pan liners
Disposable small paint pail liners
Painter's tape
Mineral spirits
Water (for clean-up)
Plastic wrap or aluminum foil
Large garbage bags

Tools and equipment needed:

Sawhorses
Extension cords
Portable lights
Marking pen
Extension poles
Paint brushes
Paint roller frames
Paint roller covers
Paint roller scrapers
Paint roller pans
Small paint pails
Drill driver
Paint mixer
Step stools
Empty/clean 5-gallon pails
5' - 10' Garden hose

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. Most floors should already be covered with paper left by the plasterers. This is to prevent paint from spilling on floors. Wherever floors are not covered by paper, use small sheets of poly (look for these in the bath tub) under each roller pan to protect the floor. Check that exterior doors are covered by poly. If not, cover them with any left-over poly. Again, check the bath tub for poly.
3. Prepare the needed number of small paint containers, roller pans and pan liners for the number of crew and place them on the floor 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. Check all outlets and penetration areas on both walls and ceilings for excess plaster. Smooth out rough areas before painting.
7. 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.

8. 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.
9. Verify that the window frame faces have plastic window edging strips around the frames or have been covered with 2" painter's tape. Tape any uncovered frames, if necessary.
10. Turn on lights, both cage lights (hanging from ceiling) and portable lights. Place portable lights in rooms as needed.
11. Thoroughly mix all paints and stains before using. Use the drill with paint mixer for primer and paint. Use a tapered shim for stain.
12. Attach the hose to a water supply. Place four empty/clean 5-gallon pails side-by-side in the basement, in the garage, or outside 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 floor. 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 house scuttle box cover (if there is one) 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, cut 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 1"-2". 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. Check with the Construction Supervisor to determine whether the house scuttle box trim should be painted. If yes, prime the ¾" x 8' scuttle box trim. This trim should be located with the stair skirt boards, closet poles and handrail. Because the surface is stained, 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. Throw out roller pan liners and small paint pail liners. Replace roller pan liners and small paint pail liners before filling with finish paint. Clean and dry primer brushes as much as possible before finish painting. Roller covers can be re-used for painting provided primer has been scraped from the roller cover.
11. Finish coat the walls, ceilings, house scuttle box cover (if there is one) and scuttle box trim (if it is to be painted) 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. If paint is completely dry, any tape around window frames and the tub/shower flange can be removed. Run a sharp knife along the juncture of the painted wall and tape to cut the bond of paint to the tape. Gently pull the tape away. Any tape not removed on paint day 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 (if available), and the stair handrail.
2. Set up three sawhorses in a room in which painting has been finished or, if weather permits, in the garage. Make sure to protect the garage floor with poly or cardboard. 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 Construction Supervisor.

4. Stain one side and the edges of the skirtboards. Stain the side with the best appearance. Stain all sides of the stair handrail.
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 finish paint out of small paint pail liners and roller pan liners 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 pail liners 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 Construction Supervisor 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 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, dust or debris onto the house sub-floor or newly painted surfaces.

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. In areas that will have vinyl flooring, mark location of studs with painter's tape. Place a small strip of tape vertically on the wall (even if paint is not completely dry) making sure it extends no higher than two inches from the floor.
3. Leave two step stools in the basement.

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Chapter 16. Subfloor and Finish Stairs

16.1 INSTALLING MULTI-PLY SUBFLOOR

16.2 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
Putty knife
Utility knife
Broom
Adjustable bevel
Floor scraper
Red crayon

Materials needed:

¼" Subfloor
Staples
80 Grit sanding belts
1⅝" Exterior screws
2½" Exterior screws
2" #7 Trim screws
2½" Collated finish nails
2½" Finish nails
Tapered shims
¼"x3"x5" Shims
Weatherstripping
Scrap foamboard
Construction Adhesive
Spray foam
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 MULTI-PLY SUBFLOOR

16.1.1. Preparation

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. Installation

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.
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 $\frac{1}{8}$ ".
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 $\frac{1}{4}$ " off the sheet edge between these marks to allow the sheet to slide $\frac{1}{4}$ " under the adjacent sheetrock.
 - c. Open the door 90° and make a mark on the subfloor 8 $\frac{1}{4}$ " 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 doorjambs to avoid open gaps.

7. Ensure all holes for registers are cut open.

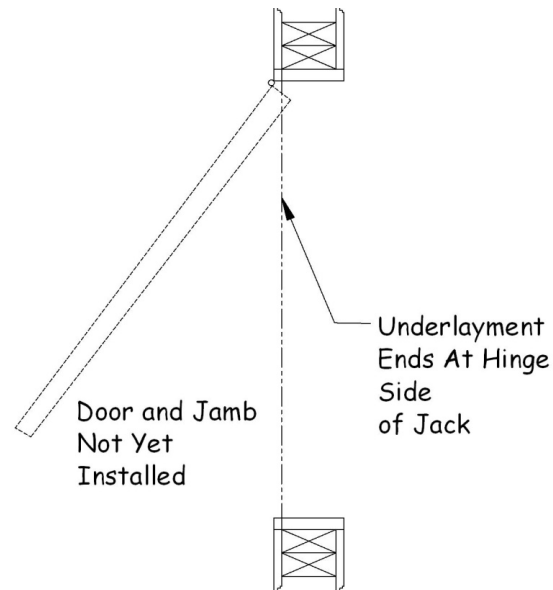


Figure 16-1. Subfloor in Interior Door Opening.

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. FINISHING STAIRS

16.2.1. 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 2½” finish nail.

NOTE: Blocking has been installed for the handrail at the top, middle, and bottom of the stairs (see Section 10.6.5 and Figure 16-2).

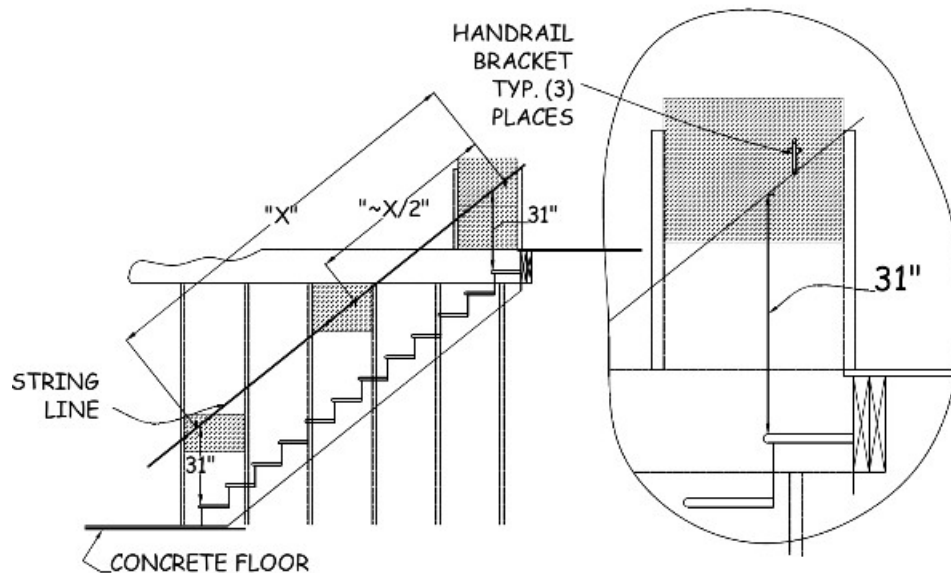


Figure 16-2. Handrail Bracket Installation.

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 at least 20" 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 shim between the bracket and the underside of the rail to ensure a tight fit.

16.2.2. 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 11 1/2" up from the 2x4 (the width of the skirtboard) about 3' apart at each end of the stairway (see Figure 16-3). Repeat on the other side of the stairway.

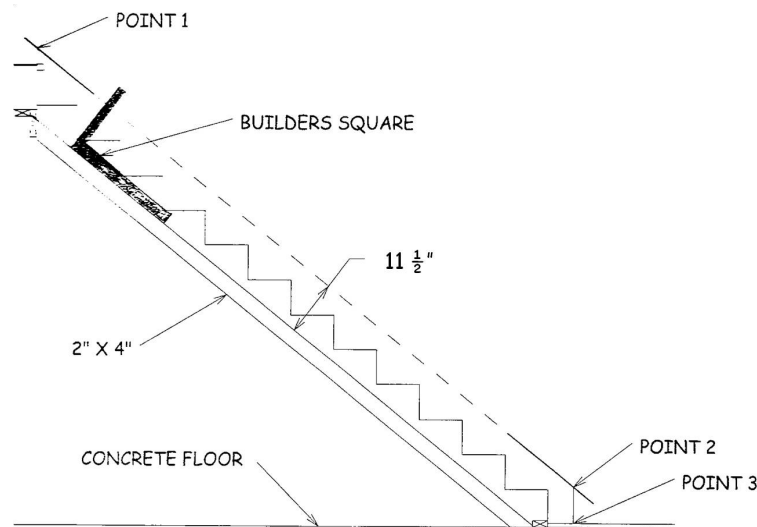


Figure 16-3. Skirtboard Installation.

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.
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 $\frac{1}{4}$ " 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 $2\frac{1}{2}$ " finish nail into the end, leaving about $\frac{1}{2}$ " 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 $\frac{1}{4}$ "x3x5 shim. Nail the skirtboard to the wall, nailing into studs or blocking with $2\frac{1}{2}$ " collated finish nails. Putty the nail holes.
20. Repeat Steps 18 and 19 for the opposite skirtboard.

16.2.3. Installing Treads and Risers

1. Verify the stringer rise is $9\frac{3}{4}$ " and stair treads are $11\frac{1}{4}$ " to $11\frac{1}{2}$ " wide. This will ensure that the stair treads do not need to be ripped to width. Consult the Construction Supervisor if the dimensions are not as above.
2. Prepare a block 2" thick (e.g., a 2" long piece of 2x4). This will be used to ensure the treads have equal nose overhang of 2" from the stringer rise, resulting in $1\frac{1}{4}$ " tread overhang once the riser below it is installed.

NOTE: Refer to Figures 4-6 and 4-7 for identification of stringer rise and stringer run.

3. 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.

4. Install the bottom tread first. Measure between the skirtboards to get the length of the tread. If the stairs are going to be carpeted, cut the tread $\frac{1}{2}$ " short. If the stairs are not going to be carpeted, cut the tread $\frac{1}{8}$ " short.
5. With the 2" block from Step 2 above against the rise of one of the stringers and a tread placed on the run of one of the stringers just above it, verify the tread does not extend past the outside face of the 2" block. This ensures the treads will not need to be ripped to width.
6. Install the first tread, starting at the bottom of the stairs. Apply a bead of construction adhesive on the run of the three stringer sections. Place the tread on the stringers, align so the tread is centered between the skirtboards and the nose of the tread is flush with the 2" thick block held against one of the outside stringers. Drill one $\frac{5}{32}$ " pilot hole through the tread into the stringer about $3\frac{1}{2}$ " from the nose of the tread. Loosely secure the tread using a $2\frac{1}{2}$ " exterior screw.

NOTE: When drilling into the tread and stringer, insert the drill bit into the chuck so that $1\frac{3}{8}$ " of the bit is exposed. This will cause the drill to penetrate $\frac{1}{4}$ " into the stringer. Always ensure the drill and screw are penetrating the stringer at its centerline to avoid splitting the wood.

7. With the other outside stringer, check flushness with the 2" block and drill and secure using a $2\frac{1}{2}$ " exterior screw as described in Step 6 above.
8. Drill and insert screws as described in Step 6 above so that the tread is secured to each stringer section with three screws (one screw $3\frac{1}{2}$ " from the nose of the tread, one screw 1" from the back edge of the tread, and one screw centered between these two). All screws should be inserted until they are flush, or slightly below, the tread surface.
9. Install the bottom riser below the tread just installed. Establish and cut the length of the riser using the same process as the bottom tread (Step 4 above). Rip the width of the riser to $\frac{1}{8}$ " less than the height between the two treads.
10. Center the riser between the skirtboards and position the riser tight against the tread above it. This will leave a small gap between the riser and the tread below it. Secure the riser to the rise of the stringers with $1\frac{5}{8}$ " exterior screws: two in each stringer (six total). Ensure the screws are installed $1\frac{1}{2}$ " from the top and bottom of the riser and on the centerline of the stringers to avoid splitting the wood. Predrilling for these screws is not necessary.
11. After a tread and riser pair is installed, remove the temporary tread from the step immediately above it.

12. Repeat Steps 4-11 above for each tread and riser, 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.

13. For the topmost tread, measure from the beam at the top of the stairs to the stringer rise immediately below where the topmost tread will be placed and add 2". Rip the top tread to this width. Install the top tread as described in Steps 6-8 above.
14. Install a riser below the topmost tread using Steps 9-10, above.
15. No riser is required above the topmost tread.

TIP: An alternative sequence is to install all (or several) of the treads first, and then install the risers.

Chapter 17. Cabinets

17.1 PREPARATION

17.2 LAYING OUT KITCHEN UPPER CABINETS

17.3 INSTALLING KITCHEN CABINET SUPPORT STRIPS

17.4 INSTALLING KITCHEN UPPER CABINETS

17.5 INSTALLING KITCHEN BASE CABINETS

17.6 INSTALLING RANGE HOOD

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
1"x4" Pine board
3/4"x2-7/8" Plywood variable length strips
3/4" Plywood, scrap
Cabinet kit
Cabinets
Countertop
1 1/4" Collated finish nails
2 1/2" Collated finish nails
Tapered shims
1/4"x1" Variable length shims
Wood glue
Wood putty
Weatherstripping
Air sealing caulk
Painter's tape
Flashing 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. PREPARATION

1. Unpack all cabinets and, if the vinyl floors are not covered with a protective paper, use the box material to cover all vinyl surfaces in the house to protect against damage.
2. Inspect the units for damage and report any to the Construction Supervisor. Check the kitchen Cabinet Plan and confirm that all required units are available on site. If a microwave is to be installed over the stove, verify the cabinet above the stove is a 12" cabinet. If not, verify that cabinets above the stove and refrigerator are both the same size, either 14" or 15".
3. Set up a temporary work bench to hold materials and tools.
4. 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 windowsill.
5. Remove all shelves from the cabinets.

17.2. LAYING OUT KITCHEN UPPER CABINETS

17.2.1. With Blocking Installed.

1. If blocking has been installed behind the sheetrock, upper cabinets will be mounted directly to the wall. Upper cabinets are installed with the bottom 54" above the floor.
2. Proceed to Section 17.4 (Upper Cabinet Installation).

17.2.2. Without Blocking Installed.

1. When blocking is not available, the upper kitchen cabinets will be installed by mounting them to 2-7/8" wide strips of 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.

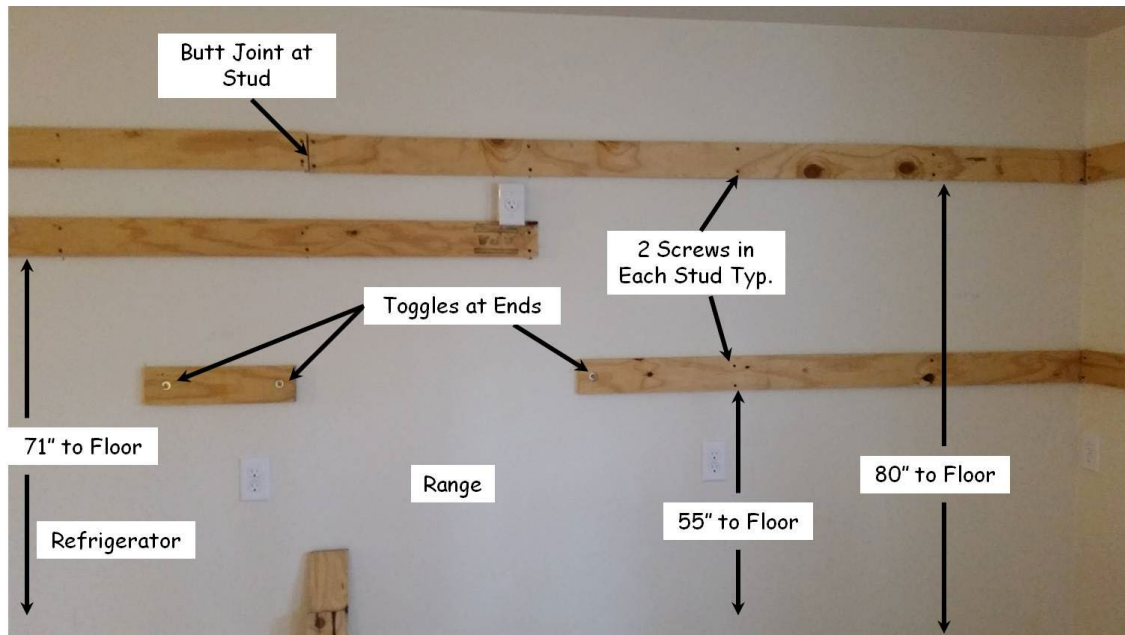


Figure 17-1. Kitchen Cabinet Support Strips.

2. 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 lines 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.
3. 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 for 14" cabinets, 70" for 15" cabinets, or 73" for 12" cabinets.

NOTE: The 71" dimension in Figure 17-1 for the bottom strip location for cabinets above the stove and refrigerator is for 14" cabinets. For other size cabinets, adjust the bottom strip position so the bottom of strip will be 1" above the bottom of the cabinet.

4. Locate all 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.

17.3. INSTALLING KITCHEN CABINET SUPPORT STRIPS

1. Locate suitable lengths of $\frac{3}{4}$ "x2-7/8" plywood strips in the trailer. 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 $\frac{3}{16}$ " clearance holes through the plywood strip at each stud location, about $\frac{3}{4}$ " from the edge of the plywood. Where the strip butts up to another strip at a stud, drill the holes $\frac{3}{4}$ " 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 $\frac{1}{4}$ "x3" winged toggle bolt before screwing the strip to the wall. With a 1" spade bit, drill a counterbore approximately $\frac{3}{16}$ " deep (two plies of the plywood). Then drill a $\frac{5}{8}$ " 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 $\frac{5}{8}$ " hole just through the sheet rock. Too deep punctures the poly behind and can wrap the drill bit with insulation.
5. Assemble a $\frac{5}{16}$ "x1" fender washer on the $\frac{1}{4}$ "x3" winged toggle bolt, insert the bolt through the $\frac{5}{8}$ " 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.

17.4. INSTALLING KITCHEN UPPER CABINETS

1. Assuming a corner countertop arrangement, temporarily assemble the countertop with it supported on sawhorses. Install the countertop toggle bolts and tighten them snugly.
2. Using the Cabinet Plan, make light pencil lines to mark the wall(s) where the countertop will end as well as the vertical end positions of each section of upper cabinets. The end lines represent the alignment positions of the upper and base cabinets and mark the openings for range and refrigerator. Before marking, verify if any base cabinets will require an end cap as defined in Section 17.5.13. The stile of an upper cabinet should align with the end cap stile directly below it.
3. Measure the overall length (OAL) from the corner of the countertop splash to each end of the countertop and use the Cabinet Plan to confirm that the upper cabinet(s) will end the required distance from the countertop end(s). If the countertop appears to be too

short and there are no filler strips to eliminate, consult with the Construction Supervisor for further direction.

4. If blocking is not installed for the base cabinets, use light pencil lines to mark the centerline of wall studs. Also, mark the centerline of the window/sink base approximately 38" above the floor. These marks will be handy when installing the base cabinets but will be covered by the countertop backsplash.
5. Check the Cabinet Plan to see if cabinet filler(s) are required between the corner and adjacent units before proceeding. If required, rip cabinet filler strips.
6. 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 1½"-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. Before drilling clearance holes, check behind the cabinet for the support block locations and make sure clearance holes will penetrate the support block. Holes should be ½" minimum from top or bottom of the support blocks. Adjust as required. If blocking has not been installed for 12", 14" or 15" cabinets, bottom mounting holes are not necessary. Attaching at the top and to adjacent stiles is sufficient to secure the cabinets.
7. If using support strips, note the location of cabinet mounting strips located on the back of cabinets. Location can vary with cabinet brand. Drill one hole through the cabinet back and check to make sure the hole is roughly centered on the plywood support strips at the 84" installation height. Holes should be ½" minimum from top or bottom of the plywood edges. Adjust drill hole position as required.
8. 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 cabinets with a 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, as tightening the screws can pull the cabinet out of plumb. Install the remaining wafer head screws, checking level and plumb as each is installed.

NOTE: For mounting all cabinets to walls, **use 2½" wafer head screws with blocking and 1¼" wafer head screws with support strips.**

9. Verify 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.
10. If filler(s) are required, attach them to the adjacent cabinet stile using cabinet clamps (or quick clamp,s if too wide). Clamp as required, keeping the ends and face flush, and install construction screws the appropriate length through the filler into the stile.

11. 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.
12. Attach the unit with wafer head screws in the two top holes. Do not fully tighten the screws at this time.
13. Because corner units have angled stiles, the units on each side of the corner unit are attached with 1⁵/₈" 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 1/8" pilot hole through the side panel at an angle into the stile, then drill a 3/16" clearance hole **through the side panel only**. Be VERY CAREFUL to not drill through the face or out the far side of the stile.
14. Attach the adjacent unit to the corner cabinet with 1⁵/₈" construction screws. Check for level and plumb, adjust as required, and install wafer head screws through the remaining back clearance holes into the wall or support strips, checking for level and plumb as you proceed, and tighten all screws.
15. Repeat on the other side of the corner unit.
16. 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.
17. Get the stiles close to flush, and check that the unit is level, hold it in place by installing wafer head screws through the two top holes. Don't tighten fully at this stage. Once the stiles are screwed together, install the remaining screws into the back.
18. Recheck that the stiles are flush; when complete, drill a 1/8" pilot hole through one stile into the second stile. Be sure the bit is set to the length of the screw so that the screw does not split the wood.
19. 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.
20. Use tapered shims as needed to keep adjacent cabinet fronts flush. Recheck for level and tighten the screws into the support strips through the cabinet backs.
21. Follow the Cabinet Plan to complete the installation of all upper cabinets.
22. If there is an electrical box along the run of upper cabinets, measure and mark the location of the outer perimeter of the box on the back of the cabinet. Cut the box opening from the back using a standard jig saw blade that cuts on the upstroke to avoid splintering on the inside surface. Verify the area around the box perimeter is sealed with

air sealing caulk. Add caulk as required. After installing the cabinet, use the depth adjustment screw located on the side of the box to flush the face of the box to the inside surface of the cabinet.

23. After the installation of the upper cabinets, disassemble the countertops and glue both edges and the spline. Reassemble the countertops 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 aside.

17.5. INSTALLING KITCHEN BASE CABINETS

1. Remove shelves, drawers and doors from the cabinets and store them in an out of the way place.
2. Check for plastic clips (shipping protectors) at the bottom of base cabinets and remove before installation.
3. Remove the protective covering from the flooring in the base cabinet areas.
4. Set the corner lazy susan unit in place with the faces 36" from each wall (see Figure 17-2).

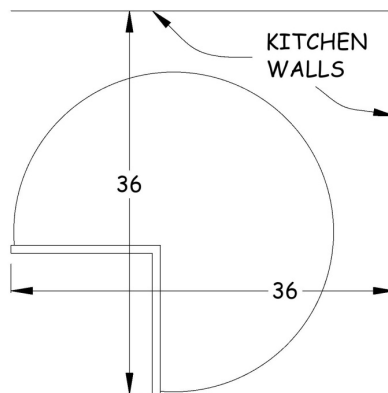


Figure 17-2. Corner Cabinet Installation

5. The sink unit may need holes to allow water pipes, drainage pipes and electrical boxes to pass through. Verify the cutout area of the sheetrock around the perimeter of the pipes and the electrical box is sealed with air sealing caulk; add caulk as required. 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.
6. 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. Cut out for the electrical box using a jig saw with a standard (upward cutting stroke) blade. After installing the base cabinet, use the box depth adjustment screw to flush the face of the box to the inside surface of the cabinet.

7. From inside the cabinet, drill 1" holes at the location of the hot- and cold-water supply lines.
8. Set the sink base in place centered below the window, then measure the space between the lazy susan 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.
9. 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.
10. 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.
11. 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.
12. Repeat Step 10 on the refrigerator end.
13. 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.
14. If the range, refrigerator or dishwasher are adjacent to the floor corner cabinet, install a cabinet end cap between the appliance and the cabinet. The stile at the front end of the end cap should align with the upper cabinet stile. 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).
15. To fasten the end cap, cut two pieces of 1"x4" pine board to approximately 2" wide x 21" long. Align the edge of one of the boards to the line from Step 14 above, 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 it to the wall with two or three 2½" sheetrock screws, one or two into the blocking or a stud and one into the bottom plate.

If no blocking or stud is available, use two ¼"x3" winged toggle bolts. 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.

16. 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 positioned out from the wall so the front of the cleat sits flush to the inside edge of the 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 wall blocking or a stud first**, then to the cleat, using two 1⅝" drywall screws through each end of the toe kick into the cleat. Countersink the screw heads so they don't interfere with the installation of the toe kick board.

NOTE: The wall stud spacing may be such that that one cannot attach the unit with 2½" wafer head screws into a stud. If so, use a ¼"x3" winged toggle bolt to attach the cabinet to the wall.

17. 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.

18. Re-install all doors and drawers. Use hinge adjustment screws to plumb and align the doors.

17.6. INSTALLING RANGE HOOD

1. Remove the electrical knockout from the junction box in the range hood.
2. Remove and discard the range hood damper.
3. 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 1¼" hole for the cord. Drill from inside the cabinet.
4. 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.
5. 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 1¼" wafer-head screws.

6. 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.
7. On the wall where the hood will go, draw a 4"x11" rectangle centered ½" below the cabinet.
8. 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.
9. Use an oscillating saw with a fine metal cutting blade to carefully cut out the metal of the range plenum at the perimeter of the sheetrock opening.
10. To prevent warm moist air from getting into the wall cavity apply flashing tape around the cutout to completely seal the space between the metal of the plenum and the sheetrock with no gaps. Apply about half of the tape width to the sheetrock, then fold the tape over to seal the cuts and apply to the inside metal surface of the plenum.

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.

11. Lift the range hood into place, sliding the vent extension into the cutout in the range plenum.
12. Install weatherstripping on the face of the sheetrock, around the perimeter of the opening, making sure there are no gaps.
13. Fasten the range hood to the pine strips with 1¼" wafer-head screws.

17.7. INSTALLING KITCHEN COUNTERTOP

17.7.1. Preparation

1. The back of the countertop is supported by 2x4s in the corner behind the lazy susan. To determine the position of the top of the 2x4's, draw level lines from the corner for mounting these supports. 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. Attach two pieces of scrap 2x4x about 26" long to the wall corners (see Figure 17-3). Hold the 2x4s even with the lines from step 1 and screw them to the wall using 3½" sheetrock screws into studs at each end.



Figure 17-3. Showing Countertop 2x4 Corner Supports.

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 $> \frac{1}{8}$ ", 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 $30\frac{1}{8}$ " clearance for the stove, measured at both the front and back of the base cabinets.
5. Determine which areas of the base cabinets will be used to secure the countertop. With the countertop temporarily in place, draw pencil 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 walls for Section 17.7.2.1 below.
6. Remove the countertop, turn it over and set it back on the horses.
7. Cut one 1x4 x 24" board for each one of the areas determined in step 5. Center the 24" pine boards over the wall marks made in step 5 above, **except over the sink base**. Pine boards should rest on top of the cabinet walls and mirror the location of the corner blocks, but should not extend inside the sink base walls, which will interfere with the installation of the sink. Sink base boards should rest on top of the walls only. Drill six $\frac{3}{16}$ " clearance holes, three per side, about 1" from each edge and secure with $1\frac{1}{4}$ " wafer head screws. Later, screws will be placed through the cabinet corner supports and into the pine boards to hold the countertop to the cabinets.

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

8. Rip a piece of 1"x4" x approximately 10" long pine board to a $\frac{3}{4}$ "x $\frac{3}{4}$ " dimension. Glue and clamp it at the front edge of the top rail 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.
9. Measure the cabinet width and cut a 1"x4" pine board to this length. Rip it to about 2" wide and glue and screw this board behind the lip of the countertop where the dishwasher (or future dishwasher) will be installed. Drill four $\frac{3}{16}$ " clearance holes and secure with four $\frac{1}{4}$ " wafer head screws.
10. Cut one 1"x4" board about 12" long to support the front end of the countertop on each side of the miter joint. Rip to about a 2" width and glue and screw it behind the lip of the countertop, one piece on each side of the joint. These boards will rest on the lazy susan front framing. Drill two $\frac{3}{16}$ " clearance holes in each board and secure with $\frac{1}{4}$ " wafer head screws.
11. If not pre-drilled, drill $\frac{3}{16}$ " clearance holes through each of the diagonal support blocks in the cabinet corners where a pine board will be located.

17.7.2. Installation

1. Use $\frac{1}{4}$ " wafer-head screws to fasten the countertop to the cabinets from the bottom of the cabinet corner support into the pine strips under the countertop.

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

2. Fasten the $\frac{3}{4}$ " x $\frac{3}{4}$ " x 10" piece on top of the sink base rail to the board under the countertop lip (where the dishwasher or future dishwasher) is located), and the two pieces under the countertop lip on each side of the miter joint over the lazy susan. Drill $\frac{1}{8}$ " pilot holes from underneath the front cabinet rails and fasten with trim screws. Check length of screws to avoid screwing through the top surface of the counter.
3. 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.

4. 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 2½" hole for the drain.
2. Level and fasten the cabinet in place with 2½" wafer head screws to the wall studs. Use ¼"x3" winged toggle bolts if studs are not available.
3. Dry fit the countertop to determine if scribing and sanding are required. If so, scribe and sand to fit per Sections 17.7.1.3 and 17.7.1.4.
4. Turn countertop over. Glue 1x4 pine strips to the underside of the countertop that will mirror the same location of the corner blocks on the cabinets. Drill six 3/16" clearance holes in each board.
5. Set the countertop in place and fasten to the cabinet to support blocks with 1¼" wafer head screws.

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. Attach one side of the linen closet to a stud with 2½" wafer head screws and use ¼" x 3" toggle bolts to attach the other side.

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 per side 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 $\frac{3}{4}$ " out from the wall surface around the entire frame perimeter.
7. Secure the top of each side with $2\frac{1}{2}$ " 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 $\frac{3}{4}$ " frame reveal. Adjust as necessary.
8. Drill two $\frac{3}{16}$ " 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 $\frac{1}{8}$ " pilot holes $2\frac{1}{2}$ " deep through the lower cabinet face frame and partially into the upper cabinet face.
10. Fasten the cabinets together with two $2\frac{1}{2}$ " trim screws. Verify reveal is still a consistent $\frac{3}{4}$ " around the frame perimeters. Secure the two sides of the upper cabinet to the framing with $2\frac{1}{2}$ " 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 $2\frac{1}{2}$ " 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 $\frac{3}{16}$ " clearance holes in the back of each cabinet per Section 17.4.6. 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 using a 54" long 2x4 for support, and mount per Section 17.4.8. Verify the cabinet is centered left-to-right and mount with $2\frac{1}{2}$ " wafer head screws in the top two holes.

5. If studs are not available for mounting, layout and install upper and lower support strips to the wall as instructed in Sections 17.2.2 and 17.3.
6. Attach the upper cabinet to the blocking behind the wall with 2½” wafer head screws. If blocking is not installed, attach one side into a stud and use ¼"x 3" winged toggle bolts on the other side if studs are not available,
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 17.6.
9. Install the toe kick board to the base cabinet per Section 17.5.17.
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 17.7.1.3 and 17.7.1.4.
11. Turn the countertop over. Drill six 3/16” clearance holes in each board. Glue and screw 1”x4” pine boards to the underside of the countertop that will mirror the locations of the corner blocks on the cabinets. Use 1¼” wafer-head screws to secure the boards to the countertop.
12. If not pre-drilled, drill 3/16” clearance holes through each diagonal corner support block and attach the countertop to the cabinet from the bottom using 1¼” wafer head screws.

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

13. Install the shelves and doors and adjust hinges as needed to align door edges.

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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:

Finish Door Kit
1 1/4" Collated finish nails
2 1/2" Collated finish nails
1 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"x3"x5" Shims
1/4"x3"x5" 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.
2. Verify correct door type, size, and swing according to the House Plan. Set the door next to its intended location.

NOTE: Before starting the following steps, using a framing square, check the bottom of the hinge and strike side jack studs for excessive twist. If either is clearly out of square it will likely require special shimming considerations. Consult with the Site Leader or Construction Supervisor.

3. If there is any damage or a door is missing or is the wrong size, type or swing, notify Construction Supervisor or Site Leader.
4. The following Steps 5 and 6 are designed to reduce the difference between the width of the door frame and the width of the rough opening to roughly center the door in the rough opening.
5. Adjust hinge side Jack stud.
 - a. Measuring from the bottom of the hinge side jamb, mark the location of the hinges on the hinge side and strike side Jack studs.
 - b. In all cases in this section, install $\frac{1}{8}$ "x3"x5" or $\frac{1}{4}$ "x3"x5" shims (using $1\frac{1}{2}$ " finish nails or $1\frac{1}{4}$ " collated finish nails) with their **5" dimension vertical** and flush with the hinge pin side of the framing to ensure that the top hinge screw will go through the shim. Use two $1\frac{1}{4}$ " finish nails or $1\frac{1}{4}$ " collated finish nails to secure shims.
 - c. Set a 6' level on the jamb, hinges or hinge pins and check if the Jack stud is plumb. If NOT PLUMB, shim the top or bottom hinge areas until it is plumb.
 - d. Measure the width (between any installed shims) 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 GREATER than $\frac{5}{8}$ ", install a combination of 3"x5" and cardboard shims to the hinge side Jack stud at the top and bottom hinge locations until the difference is less than $\frac{5}{8}$ " but greater than or equal to $\frac{3}{8}$ " at BOTH locations.
 - ii. The top and bottom hinge locations on the Jack stud should have a minimum of a $\frac{1}{8}$ " shim,
6. Adjust strike side Jack stud.

- a. Add a combination of 3"x5" and cardboard shims to the strike side Jack stud at the top and bottom hinge locations until the differences are less than $\frac{3}{8}$ " but greater than or equal to $\frac{1}{4}$ " at BOTH locations.
7. Place a 6' level against the top and bottom shims and install a combination of 3"x5" and cardboard shims at the middle hinge areas on BOTH hinge and strike side jambs until flush with the level (or less than a $\frac{1}{8}$ " gap).

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 $\frac{3}{8}$ " shim (one $\frac{1}{4}$ " and one $\frac{1}{8}$ " shim) under each side jamb; otherwise, set the jambs directly on the hard flooring.
2. Temporarily secure the door in the rough opening by installing tapered shims (as "pressure" 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 removed or adjusted later).

NOTE: This process is designed to apply horizontal pressure to hold the top of the hinge jamb tight against the hinge side shims. 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. Recheck that the hinge side is still plumb (set level on hinges or hinge plates).
5. Center the hinge side jamb between both wall surfaces.
6. Add appropriate 3"x5" and/or tapered shims at the bottom of the jamb, and temporarily secure it with one 2½" collated finish nail just above the shims on the non-hinge side of the door stop. Verify that the bottom of the hinge jamb is still centered between wall surfaces. Do the same for the strike side jamb.

NOTE: 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 $>\frac{1}{4}$ " see the Construction Supervisor. Otherwise, adjust the top and/or bottom of the strike side jamb (may need to split the difference) to get consistent contact.

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 to the non-hinge side of door stop 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/door frame 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 away from their position centered on the wall surface (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 of the bottom hinge. Shim as needed and secure with a 2½” collated finish nail.

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 still “good”. 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.

NOTE: Strike side reveals have priority over hinge side reveals.

7. While keeping consistent reveals top to bottom, install all remaining shims (nailing with 2½” collated finish nails on the non-hinge side of the doorstop) in the following strike side locations: across from the top and bottom hinges and at 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 the non-hinge 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"x3"x5" shim placed on the edge of the jambs until proper door-to-doorstop contact (jambs a maximum of ⅛" past or short of the plaster) and re-nail as needed; or,
 - move the door stop by tapping the doorstop with a ¼"x3"x5" shim until proper door-doorstop contact (maximum movement of ⅛") and re-nail 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, halfway between the hinges and similarly on the strike side. This should result in six sets of shims on each side jamb. Secure the shims with 2½" collated finish nails on the non-hinge side of the doorstop.
11. Finish securing the door on all three jambs at each shim location by putting a corresponding 2½" collated finish nail into the jamb on the opposite side of the doorstop (or the hinge side).
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 or hammer so door trim will NOT rock on the end of the sheetrock and 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 of the jamb, 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, continue to trim or scrape plaster with a utility knife, rasp or hammer) 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 exterior doors and any interior doors that will not hit a wall at 90°, install hinge stop bumpers - one in the middle hinge of interior doors and one each in the top and bottom hinges of exterior doors. Refer to Figure 18-1 for correct orientation of the bumpers.



Figure 18-1. Correct Bumper Orientation.



Incorrect Bumper Orientation.

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 $83\frac{1}{2}"$ ($82\frac{1}{2}"$ Jack height + $1\frac{1}{2}"$ bottom plate - $\frac{1}{2}"$ sheetrock thickness).
5. Check that the header is level. If not level by more than $\frac{1}{8}"$, 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 $\frac{1}{8}"$ or any gap exceeds $\frac{1}{2}"$, 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 $2\frac{1}{2}"$ 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 $1\frac{1}{2}"$ from the edge. Drill the hole with a $\frac{3}{4}"$ Forstner bit to the depth of the bit. Protect the pull with a piece of wood (e.g., a 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. Open the door packaging including the track, the door hangers, and screws. It will contain either four identical hangers or two pairs of hangers with different offsets.

4. Attach the hangers at the top of the back face of each door so there is a 2" gap between the edge of the hanger and the vertical edge of the doors. When using the four identical hangers, there is no difference between the front and rear doors. However, when using the two different pairs of hangers, the hangers with the deep offset are for the rear door; those with the shallow offset are for the front door (see Figure 18-2).
- a. When using the four identical hangers, install one screw in the top of the short arc opening and the second in the top of the long arc opening (a third screw will be installed later). This will result in the door hanging at its upper limit (see Figure 18-3A).
- b. When using the pairs of different hangers, attach each hanger with one short screw in the swivel hole and one at the top of the long arc opening (a third screw will be installed later). This will result in the door hanging at its upper limit (see Figure 18-3B).

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



Figure 18-2. Sliding Door Hangers.

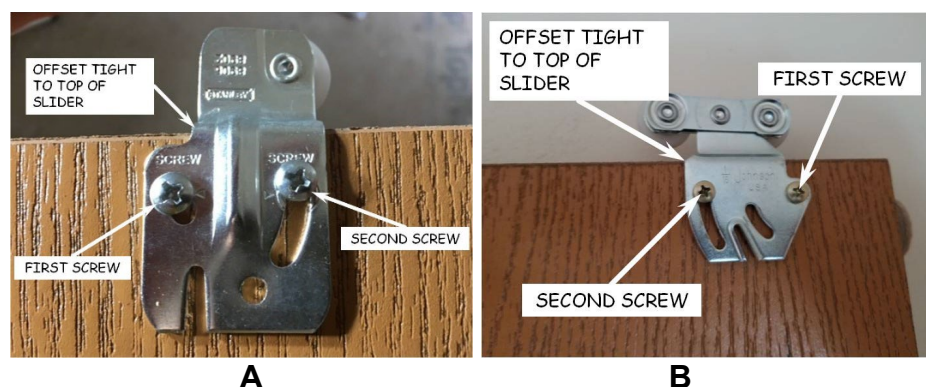


Figure 18-3. Closet Door Hanger Screw Locations.

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 the door opening, 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"-1½".
 - b. For doors over hard flooring, the gap from the bottom of the door to the installed flooring should be ⅜"-⅝". **If the hard flooring is not yet installed**, add ¼" to the specified gap range to allow for the flooring thickness. To confirm, set a door guide on the finished floor (or on a ¼"x3"x5" shim if unfinished) and slide it under the door edge. The top of the guide should be approximately ⅛" above the bottom of the door. If not, adjust door height as required.
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, 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"-⅝". If the finished floor has not yet been installed, target the shim thickness to provide a gap of ⅝".

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 round hole (see Figure 18-4A) or in the bottom of the small, curved slot (see Figure 18-4B), depending upon the type of hanger, and hand tighten all the screws.

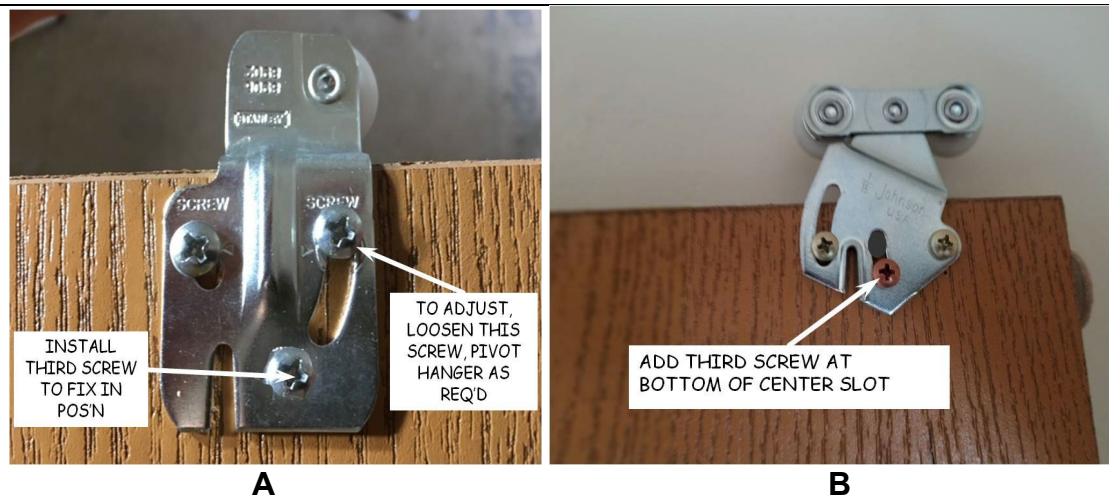


Figure 18-4. Closet Door Hanger with 3rd Screw Installed.

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 ¼”x3”x5” shims under the door edges at this center mark. Place the door guide on the shims and slide it under the edges of the overlapped doors. The top of the guide should be approximately ⅛” above the bottom of the door. If not, adjust as needed, using an appropriate mix of ¼” and ⅛”x3”x5” shims.
 - c. Create several sets of 5”x 6”-wide shims by taping together pairs of 3”x 5” shims with painter’s tape. Create pairs of both ⅛” or ¼”x3”x5” shims as dictated in Step b above. These sets of 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" 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 18-5).



Figure 18-5. Shim Adjustment for Uniform Door Reveal.

- h. Nail the paired 3"x5" shims to the floor with a 1¼" collated finish nails at each corner of each 3"x5" piece.
 - i. Leave the door guide and screws provided on the window sill for later installation.
4. For doors installed over hard flooring:
- a. Verify that the gap between the bottom of the door and the hard flooring is ⅜"-⅝" and that when closed, both doors have uniform contact with the wall, (or if the floor trim has been installed, that the bumpers are contacting the wall and floor trim).
 - b. Locate the door guide supplied with the doors. Do **NOT** use a door guide from the finish door kit for finished floors.
 - c. Move both door panels tight to the Jack stud. Adjust the sliding door guide to fit the door thickness and slide the guide under the opposite door edges. Align the left side of the guide flush with the door edges. Move the guide and doors front-to-rear until the reveal between the surface of

the front door panel and the wall corner is uniform from top to bottom (see Figure 18-5).

- d. Drill two 1/8" diameter pilot holes through the door guide mounting holes into the flooring and fasten the guide to the floor with two of the screws provided with the door hardware.
5. Measure the width of the door opening at the track and cut a piece of floor trim to that length. Using 1 1/4" collated finish nails, attach the floor trim to the pine strip, with the square edge tight to the plaster, to hide the track. Keep nails 3" from the ends to prevent splitting. Set nail heads and putty the holes.

WARNING: Do NOT use 2 1/2" collated nails because they will penetrate into the track and interfere with door movement.

6. Install bumper pads (located in the Finish Door Kit). Attach 1"x3/8" felt pads at the top of the vertical edges and 3/4"x1/8" clear pads at the of the bottom vertical edges of both doors.

18.3. BIFOLD DOORS

1. Install the track 1 3/4" back from the outer edge of the doorjamb. Fasten using 2" flathead screws.
2. Location of the pivot hole determines the direction the door will open.
3. Bottom pivot point locations must be plumb with top pivot points. The bottom pivot bracket may need to be shimmed up 1/2" to allow for carpet. Attached the bracket to the deck and doorjamb.
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 1 1/2" of the floor trim extends horizontally beyond each door jamb. Using 2 1/2" collated finish nails, attach the floor trim to the wall.
7. Set nails and putty.

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Chapter 19. Interior Finish Work

- 19.1 INSTALLING BATHROOM ACCESSORIES**
- 19.2 INSTALLING CLOSET SHELVES AND POLES**
- 19.3 INSTALLING FLOOR TRIM**
- 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

Tools and equipment needed:

Extension cord
Chop saw
Coping saw
Oscillating saw
Finish nailer

Drill driver
6' Level
Nail set
Caulk gun

Materials needed:

Casing material
2½" Collated finish nails
Wood putty
White finish caulk
Clear finish caulk
Air sealing caulk
Wood glue
Construction adhesive
Air sealing tape
Flashing tape
Weatherstripping
Stair grip strips
¼" x ¾" Cabinet trim
Bathroom mirror
Short and long towel bar
Toilet paper holder
Grab bars
Bathrobe holder
Shower curtain rod
2½" Hook and eye latches (in finished door kit)

Personal Protection Equipment:

Safety glasses (required)

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

19.1. 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 10.6.2 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 58" above the floor on the wall alongside the vanity. If this is not possible, consult the Construction Supervisor. Install the long (24") towel bar next to the shower 58" 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:** Install the mirror above the vanity, centered over the sink, 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.

19.2. 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 69¼" 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 69¼" 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 $\frac{3}{4}$ " 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 $2\frac{1}{2}$ " screw into each end.
7. Install the back cleat with one $2\frac{1}{2}$ " 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 FLOOR TRIM

19.3.1. 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 $\frac{3}{8}$ " (the thickness of a scrap piece of floor trim) off the sub-floor. 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. It may be necessary to hold the trim down tight to the floor in uneven areas of the floor before nailing. If needed, a block plane can be used to shape the trim to the floor. 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.

19.3.2. 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. Install trim in the closet platform over the stairs. As for all other trim, if installed over carpet, hold trim $\frac{3}{8}$ " off the sub-floor, otherwise install directly on finished flooring. To finish the end of the trim at the edge of the platform cut two pieces of trim, each with a 45° angle (see Figure19-1).

NOTE: This technique could be used anywhere trim needs a neat, finished end.



Figure 19-1. Trim End Finish in Closet Platform.

4. If the platform is to be carpeted, install a piece of base trim to the front top edge of the platform. Install the trim upside-down flush with the top of the platform sub-floor (see Figure 19-2).



Figure 19-2. Closet Platform Edge Trim After Carpet Installation.

5. Install trim around the top of stair skirt boards to match with nearby floor trim. There are several ways to do this depending on the stairway. See Figure 19-3 for an example of a stairway with a ledge. Consult the Construction Supervisor for other situations.



Figure 19-3. Stairway Trim Finish With Ledge.

6. When a splice is required, cut two trim pieces with matching 22.5° bevel angles. Cut the overlapping piece with the face side longer and the underlapping piece with the unfinished side longer. Plan these two pieces so the overlap is angled away from the main viewing area of the room. The overlapping piece should end about 2" past a stud so the splice can be securely nailed to the stud (see Figure 19-4). Nail the underlapping piece first along its entire length into each stud. Glue the ends of the splices, place the overlapping trim piece in position, and nail it directly into the stud. The overlapping piece should hold the underlapping in position snugly. Clean any glue residue from the splice before it dries.

TIP: Choose a piece of floor trim longer than needed for each of these overlapping pieces. Cut the angled edges of the floor trim, position in place, and then mark the length needed overall and cut the straight ends. This will avoid pieces that end up too short.

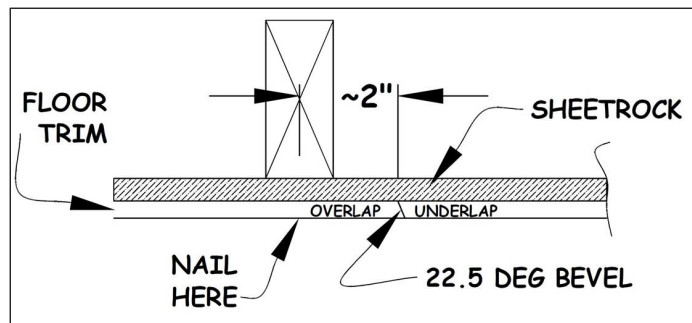


Figure 19-4. Overlapping Trim Splice.

7. Cope all inside corners and miter all outside corners. Glue each outside mitered corner.
8. Set all protruding nails and fill all holes with putty.

19.3.3. 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.

19.3.4. Coping

1. Determine which end of trim needs to be coped based on the planning from Section 19.3.2.
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 19-5).



Figure 19-5. 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 19-6).



Figure 19-6. 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 19-7).

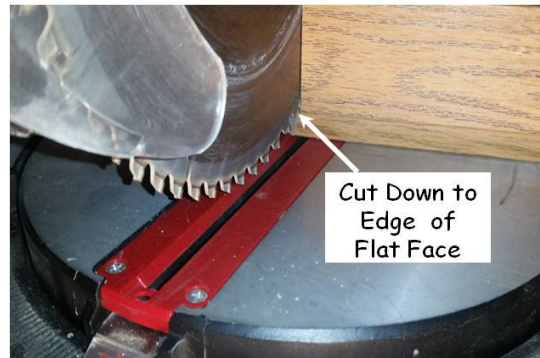


Figure 19-7. Relief Cut.

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 19-8). Cut following the uncut, curved edge of the trim. Smooth as needed with a fine, half-round file.



Figure 19-8. Coping Saw Cut.

6. Align the coped trim end tightly against the square cut corner trim end (see Figure 19-9). 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 19-9. Finished Coped Joint.

19.4. HANGING MINI-BLINDS

1. Check with the Construction Supervisor for the Mini-Blind template. If one is not available, make one from a piece of 3"x5" cardboard as shown in Figure 19-10.
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 (see Figure 19-10). 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.

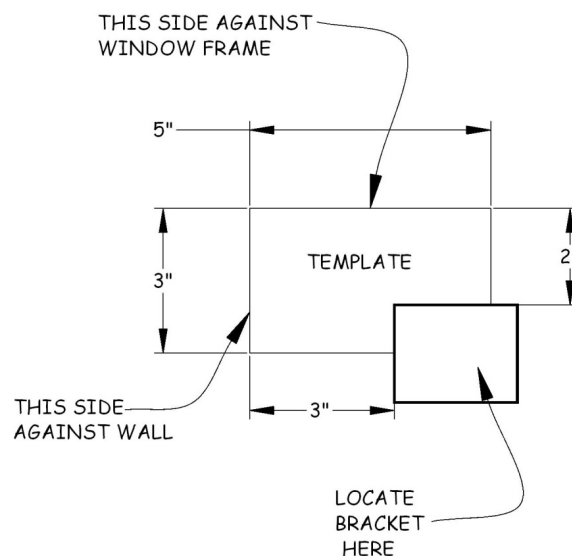


Figure 19-10. Miniblind Installation Guide.

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 centered on each stair. Cut the required number of grip strips to 30" in length. Draw a pencil line 1" back from the nose of each tread. Install the grip strips along this line and centered on each tread.

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 around the shower/tub frame where it meets the plaster with white finish caulk.
4. 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 (see Figure 19-11). If needed, use a putty knife to push the caulk into the gaps and smooth the caulk flush to the wall or ceiling surface.



Figure 19-11. Sealing Plaster Gaps Around Cold Air Returns

4. Seal gaps around basement ceiling heat ducts and plaster with air sealing caulk.
5. Caulk gaps around the perimeter of all electrical boxes that are located on main floor exterior walls and the main floor ceiling with air sealing caulk.
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 (see Figure 19-12). 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 19-12. 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. If there is a scuttle hole in the house, verify the house scuttle cover has been assembled and finished per the instructions in Sections 7.6.3 and 13.6.3. Check that the plastered side has been painted. If not, complete the assembly per these two instructions and paint it.
2. Cut a piece of fiberglass insulation for the poly/foam side of the house scuttle cover assembly. The fiberglass insulation should extend $\frac{1}{2}$ " past each edge. Fiberglass insulation for this purpose can be found under the basement stairs. **Loosely** tape the insulation onto the poly/foam side of the house scuttle cover in a cross-wise pattern using two pieces of air sealing tape. Do not compress the insulation.
3. Trim and smooth the ceiling rock and plaster flush with the top of the house scuttle hole framing. Clean the 2x4 framing in preparation for weatherstripping. Install two rows of weatherstripping 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 $\frac{1}{2}$ " away from the first. Make sure there are no gaps in the weatherstripping where pieces meet. This needs to be tightly air sealed.
4. Place the cover assembly in the attic making sure the plastered/painted side of the cover is on the bottom. Set the cover onto the frame and weatherstripping so that the attic opening is sealed.

5. Install trim around the edges of the house scuttle hole.
 - a. Cut $\frac{1}{4}$ "x $\frac{3}{4}$ " cabinet trim to fit around the upper house scuttle hole edge. Position the rounded bull nose of the trim downward. Cope corners if needed.
 - b. Position trim against the house scuttle cover (do not move scuttle cover) and nail to the edge of the opening, NOT to the scuttle cover itself, using $2\frac{1}{2}$ " collated finish nails. Set all nails and fill with putty.
6. If there is a garage scuttle hole and the cover has not been installed, install it and secure it with two hook and eye latches. Attach one hook and eye latch, approximately centered, on each long side. Attach the hook to the scuttle cover about 1" away from where the scuttle hole and cover meet. Allow the hook to hang down and make a mark where the hook contacts the edge of the scuttle hole frame. Attach the eye at this mark (see Figure 19-13).



Figure 19-13. Garage Scuttle Cover Hook and Eye Assembly.

Chapter 20. Exterior Finish Work

20.1 INSTALLING STORM DOORS

20.2 INSTALLING PORCH RAILS

20.3 INSTALLING HOUSE NUMBERS

20.4 INSTALLING MAILBOX

20.5 AIR SEALING EXTERIOR PENETRATIONS

Tools needed by volunteers:

Hammer
Nail apron
Tape measure
Square
Pencil

Materials needed:

2½” Wafer-head screws
16d Galvanized casing nails
1¼” Finish nails
2½” Collated finish nails
OSB scrap
White finish caulk
Clear finish caulk
Tapered shims
¼”x1” Variable length shims
4x4 Treated lumber
4x4 Post stake
Mailbox kit
House numbers
Mailbox numbers (if curbside mailbox)
House number board
½” or ¾” x 6” vinyl board

Tools and equipment needed:

Extension cord
Chop saw
Drill and bits
Finish nailer
Caulk gun
Sledge hammer
2’ Level
Finish door kit

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan
Door Manufacturer Instructions

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 first step in the Door Manufacturer Instructions to determine if shims will be required to match the door to this separation. If not, proceed to Step 9 below.
7. If necessary, obtain strips of ¼"x1" variable length 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 Door Manufacturer 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 ¼" shims are too thick, or not thick enough, rip ¾" wide strips of the desired thickness from the edge of a 1x pine board.

10. When securing the closer bracket to the door jamb, replace two of the screws closest to the center of the jamb with 2½" wafer head screws provided in the finish door kit.
11. Follow the remaining Door Manufacturer Instructions.

12. 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

13. 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 the Door Manufacturer, check the trailer for one and follow the directions included.



Figure 20-1. Storm Door Wind Chain.

14. Once the installation is complete, check the arrangement of the screen and glass components of the exterior of the door. The screen should be positioned above the glass component. Switch them if they are not arranged this way.

20.2. 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 side bottom 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.

20.3. INSTALLING HOUSE NUMBERS

20.3.1. 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.

20.3.2. 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. If a house number board is not available on site, one can be created using a piece of ½" or ¾" vinyl board (see Figure 20-2).

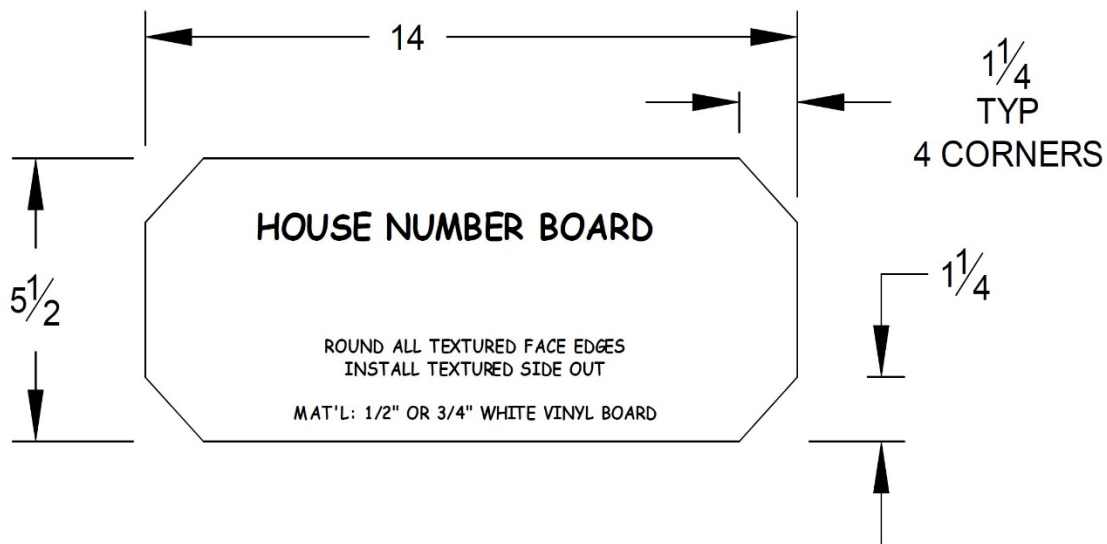


Figure 20-2. House Number Board Specifications.

4. 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.

5. Attach the numbers to the textured face of the board using 1¼" finish nails supplied with the house numbers (see Figure 20-3). 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.

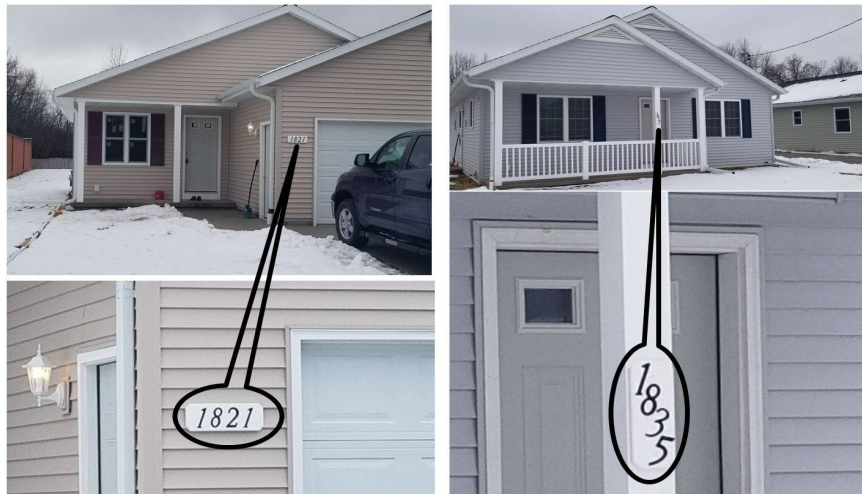


Figure 20-3. House Numbers Installed on a Board.

6. 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.
7. Position the board so its top edge is 70" above the surface of the porch or driveway. Attach the board to the post or wall by driving the screws until they countersink about ⅛".
8. Cover the screw heads with white finish caulk.

20.4. INSTALLING MAILBOX

20.4.1. 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 2½" 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).

20.4.2. 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 20-4).



Figure 20-4. 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 20-5).



Figure 20-5. Curbside Mailbox.

20.5. AIR SEALING EXTERIOR PENETRATIONS

1. Check all exterior penetrations, including water heater exhaust, furnace intake and exhaust, HVAC fresh air vent, gas line, and sump pump. Use white finish caulk to completely seal any penetrations through white vinyl board. Use clear finish caulk to seal any other penetrations.

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 PUNCHLIST

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 12.3.3.2.
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. Remove any plastic window edging strips or painter's tape from around window frames and any painter's tape from tub/shower flange.
4. Check that stair grip strips have been installed on basement stairs that do not have finished flooring. If not done, install them following directions in Section 19.6.1.
5. Use a flashlight or trouble light to double check that all nails have been set and puttied.
6. 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.

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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
2x6 studs
4x9 x ½" OSB
16d nails
16d duplex nails
8d nails
¾" Collated nails
⅝" Collated nails
4" & 6" Timber screws
Concrete anchors and 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 (104 $\frac{5}{8}$ ”).
 - b. For an attached garage, measure from the top of the top plate of the house wall to 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 4 $\frac{1}{2}$ ” (1 $\frac{1}{2}$ ” bottom plate, 1 $\frac{1}{2}$ ” upper plate and 1 $\frac{1}{2}$ ” 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 104 $\frac{5}{8}$ ”. 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).

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 3 $\frac{1}{4}$ ” 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 $\frac{1}{8}$ ” OR MORE,

adjust the corner marks to equalize the lengths by adding one-half the difference at each end of the shorter wall.

3. **Square the Rectangle.** Carefully measure the diagonals between the revised corner marks to check for square. If the diagonals differ by $\frac{1}{8}$ " 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 $3\frac{1}{2}$ " 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 $\frac{1}{8}$ " 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. Tack 8d nails at points 2 and 3 on the house deck.

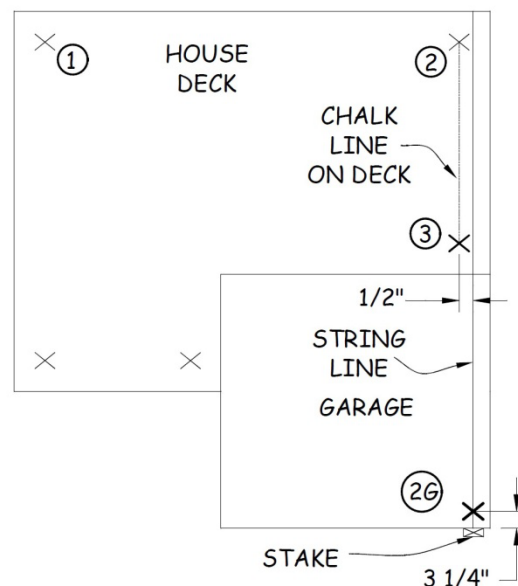


Figure 23-1. Garage Sill Plate Chalk Lines Prior to House Walls.

2. At the garage foundation, near where point 2G will be located, pound a stake into the ground next to the foundation, centered about $5\frac{1}{4}$ " 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 OHD side of the foundation, 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, 5¼" 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, extend the house wall chalk line to the edge of the house deck just above the garage foundation. Using a level, draw a plumb line on the house/garage common wall from the deck to the top of the garage foundation curb. Where the line touches the curb is Point 1G.

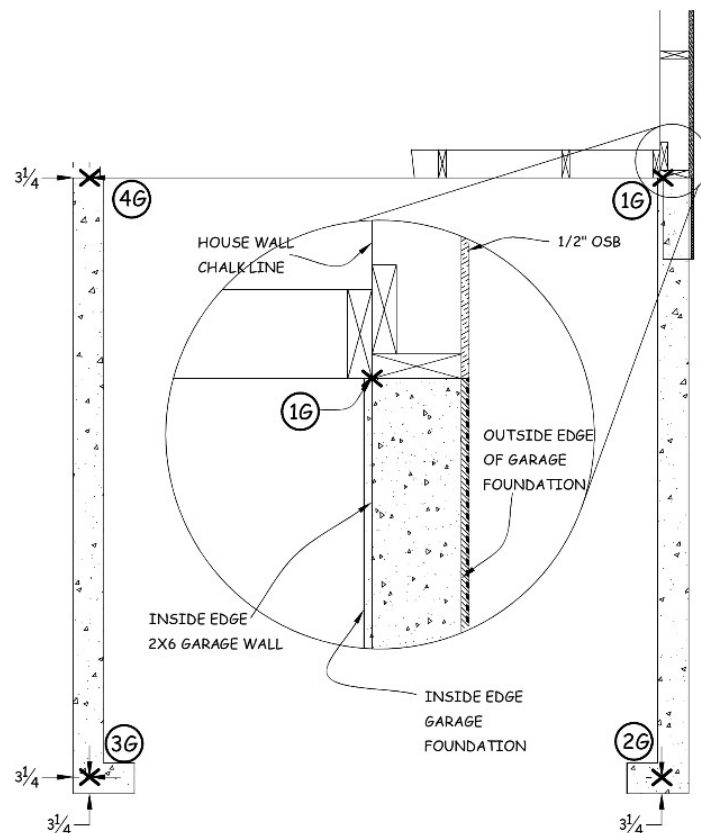


Figure 23-2. Garage Sill Plate Chalk Lines After House Walls.

3. Establish Points 3G and 4G as shown in Figure 23-2.

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 (2x6s for the house wall extended). 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 $\frac{1}{8}$ "). 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 $3\frac{1}{2}$ " beyond the end of the plate. This offset takes into account the $3\frac{1}{2}$ " 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 $2\frac{1}{2}$ " 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 $3'-0" + 2\frac{1}{2}" = 36" + 2\frac{1}{2}" = 38\frac{1}{2}"$.

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.

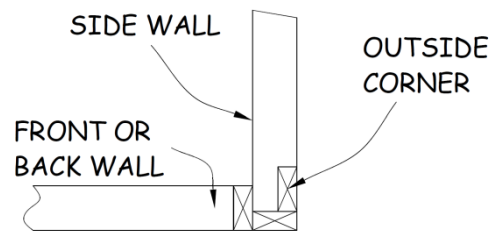


Figure 23-3. Outside L-Corner.

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 Door (OHD) 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.

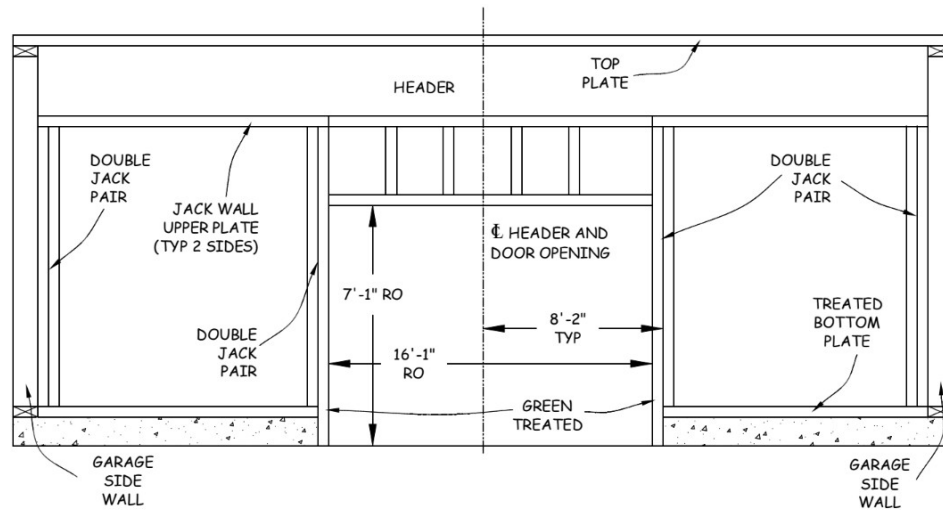


Figure 23.4. Overhead Door (OHD) Wall Assembly.

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 six untreated Jack studs by subtracting the width of the header 2x12s (typically 11 1/4") 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 104 5/8" long. $104\frac{5}{8}" - 11\frac{1}{4}" = 93\frac{3}{8}"$.

7. Cut six Jack studs to the length determined above, typically 93 3/8".

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 93¾". 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, 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.

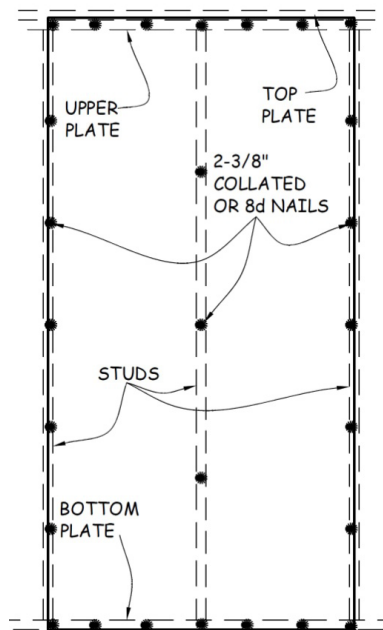


Figure 23-5. Garage OSB Nailing Pattern.

5. Starting at the zero corner, place a sheet of 4'x9'x $\frac{1}{2}$ " OSB on each end of a wall section, flush with bottom plate and overlapping $\frac{3}{4}$ " onto the stud 4' from the corner. Secure it to the studs with 8d or 2 $\frac{3}{8}$ " 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 of OSB from the corner, covering the end of the header. Glue and nail the sheet, then cut the OSB from the opening.

Appendix A. Creating Component Cut Sheets

A.1 INTRODUCTION

A.2 CREATING PROJECT WORK AREA

A.3 TRANSFERRING DOOR & WINDOW SCHEDULES

A.4 CREATING COMPONENT CUT SHEETS

A.5 COMPLETING COMPONENT LUMBER PACKAGE ORDER

A.6 TRANSFERRING FILES TO CONSTRUCTION SUPERVISOR

A.1. INTRODUCTION

1. The objective of this process is to minimize waste of lumber when cutting door and window components. The process begins by taking the door and window rough opening dimensions provided in the house Floor Plan and uses a spreadsheet to calculate the number of 2x4, 2x6, 2x10 pieces of lumber and 2x4 studs and 2x6 studs needed for the house.
2. This information is then transferred to a program called Stock Cutter. Making successive runs for 2x4, 2x6 and 2x10 lumber, Stock Cutter creates textual documentation indicating the number of 8-, 10-, 12-, 14-, and 16-foot-long pieces of lumber needed as well as bar charts showing which components are cut out of which piece of lumber.
3. When all the information has been generated, 8 files of documentation are forwarded to the Construction Supervisor.

A.2. CREATING PROJECT WORK AREA

A.2.1. Create a Components Folder

1. After installing the Stock Cutter application on your computer, create a folder named Components in your personal work area.

A.2.2. Create a Masters Folder

1. Create a Masters folder under the Components folder.
2. Copy any Master files provided by the Construction Supervisor into this folder.
3. Be sure the Masters folder also contains empty .tsk, .opt and .res files for 2x4, 2x6 and 2x10 lumber from the stock cutter program.

A.2.3. Create a Project Folder

1. Upon receiving the Floor Plan PDF file from the Construction Supervisor, create a new Project folder in the Components folder. Name this folder with the site address for the house (e.g. 2211 W Russet Ct Appleton). Use the full street address (including city) found as the name of the pdf file sent from the Construction Supervisor (however, do not include any punctuation marks).
2. All files associated with the work site will be stored in this folder. The name of each file will begin with the street address (*[site address]*) of the work site followed by a label indicating the contents of the file.
3. Copy the Floor Plan PDF file to this newly created Project folder.

A.2.4. Populate Project Folder with Master Files

1. Locate the Masters folder under the Components folder. Highlight and copy the following two files
 - !Template-Component Lumber Package Order.xlsx
 - !Template-Component Pieces.xlsx
2. Paste these two files in the Project folder.
3. In the Project folder.
 - Rename !Template-Component Lumber Package Order.xlsx to *[site address]* Component Lumber Package Order.xlsx.
 - Rename !Template-Component Pieces.xlsx to *[site address]* Component Pieces.xlsx.

A.3. TRANSFERRING DOOR & WINDOW SCHEDULES

A.3.1. Introduction

1. Open the Floor Plan PDF file found in the project folder. Locate the page with the house Floor Plan. Two tables next to the Floor Plan provide dimension specifications for all the door and window components on the main floor of the house. Confirm that the quantities and sizes of the components listed in the tables agree with that shown on the Floor Plan. Contact the Construction Supervisor if there are any differences.
2. Locate the page with the Basement Plan. If the plan shows any finished rooms in the basement, there is typically a table next to the Basement Plan providing dimension specifications for all the door components in the basement of the house. Confirm that the quantities and sizes of the components listed in the table agree

with that shown on the Basement Plan. Contact the Construction Supervisor if there are any differences.

3. If all the door and window schedules agree with the floor and basement plans, proceed to transfer the quantities and sizes of the doors and windows to the Component Pieces Cut List spreadsheet for this project.

A.3.2. Transfer Window Schedule

1. In the project folder, open *[site address]* Component Pieces.xlsx.
2. Add the site address to the Home Address field and today's date to the Date field in the lower right section of the spreadsheet.
3. The spreadsheet is divided into two primary sections labelled External Component Sizes and Interior Component Sizes. Start with the window schedule in the Floor Plan PDF file. For each window, transfer the number from the QTY column for that window to the green cell in the No. Req'd column corresponding to the size of that window.
4. Note that house windows have 2x6 walls and are tabulated in the first section of the External Component Sizes area labelled "Windows (2x6 wall)".
5. Garage windows have 2x4 walls and are tabulated in the fourth section of the External Component Sizes labelled "Garage Windows (2x4 wall)".

A.3.3. Transfer Main Floor Door Schedule

1. Once the window schedule has been transferred, proceed to process the door schedule.
2. For each exterior door, transfer the number from the QTY column for that door to the green cell in the No. Req'd column corresponding to the size of that door.
3. Note that house exterior doors have 2x6 walls and are tabulated in the third section of the External Component Sizes area labelled "House Doors (2x6 wall)".
4. Garage exterior doors have 2x4 walls and are tabulated in the fifth section of the External Component Sizes area labelled "Garage Service Door (2x4 wall)".
5. There are four different possible types of interior doors that can be installed on the main floor. All interior doors are tabulated under the Interior Component Sizes section of the spreadsheet. For each door, transfer the number from the QTY column for that door to the green cell in the Main Floor column corresponding to the size and type of that door.

6. Flush Sliding Doors are typically located perpendicular to, and abutting, external walls. On the Floor Plan, they will have a small, artificially generated, “nub” projecting from the external wall.
7. Non-Flush Sliding Doors are typically located on interior walls that do NOT intersect external walls. On the Floor Plan, they will typically show closet walls continuous with, and running parallel to the doors.
8. If a non-flush sliding door is part of a 2x6 plumbing wall, be sure to enter the quantity into the cell that is labeled “2x6 XXXX”.

A.3.4. Transfer Basement Door Schedule

1. Once the window and door schedules have been processed for the main floor, proceed to the Basement Plan.
2. If any doors are specified in the Basement Plan, first check to see if any of these doors are located under the house beam. If any doors appear to fall under the beam, follow Steps 3-7 to more precisely determine their location relative to the beam. If not, proceed to Step 9.
3. On the Foundation Plan, find the distance from INSIDE the foundation wall to the beam.
4. Examine the Basement Plan to see if any doors appear to be near the dimension determined in Step 3 above.
5. To determine the exact location of a door, record the dimension(s) on the plan that indicate how far the door is from the foundation wall used in Step 3. This dimension is from the inside of the wall framing not the foundation wall itself, so add 4½" for framed wall thickness.
6. Add 3½" for each framed wall located between the foundation wall and the wall containing the door in question.
7. Based on the sum of these dimensions, determine whether any part of the door (parallel OR perpendicular to the beam) is under the beam. If any door falls under the beam, decrease the number of 2868 or sliding doors specified in the door schedule by the number of doors located in this proscribed location.
8. Also, check to see whether any “future” in-wall doors are identified on the Basement Plan. If there are “future” doors specified that are NOT located under the beam, increase the number of 2868 doors specified in the door schedule by the number of such “future” doors.
9. For each door, transfer the number from the QTY column for that door to the green cell in the Basement column corresponding to the size and type of that door.

10. Save the *[site address]* Component Pieces.xlsx file.

A.4. CREATING COMPONENT CUT SHEETS

A.4.1. Preparation

1. Launch the Stock Cutter program.
2. Open the *[site address]* Component Pieces spreadsheet.

A.4.2. 2x10 Lumber

1. In the Stock Cutter program, activate the TASK window by clicking on the square box (containing an ellipsis, i.e. "...") in the upper righthand corner (see Figure A-1). Then, click on "Open task" and navigate to the Masters folder. Open the 2x10 Master.tsk file. In the TASK window at the upper right corner of Stock Cutter, name the task

[site address] 2x10

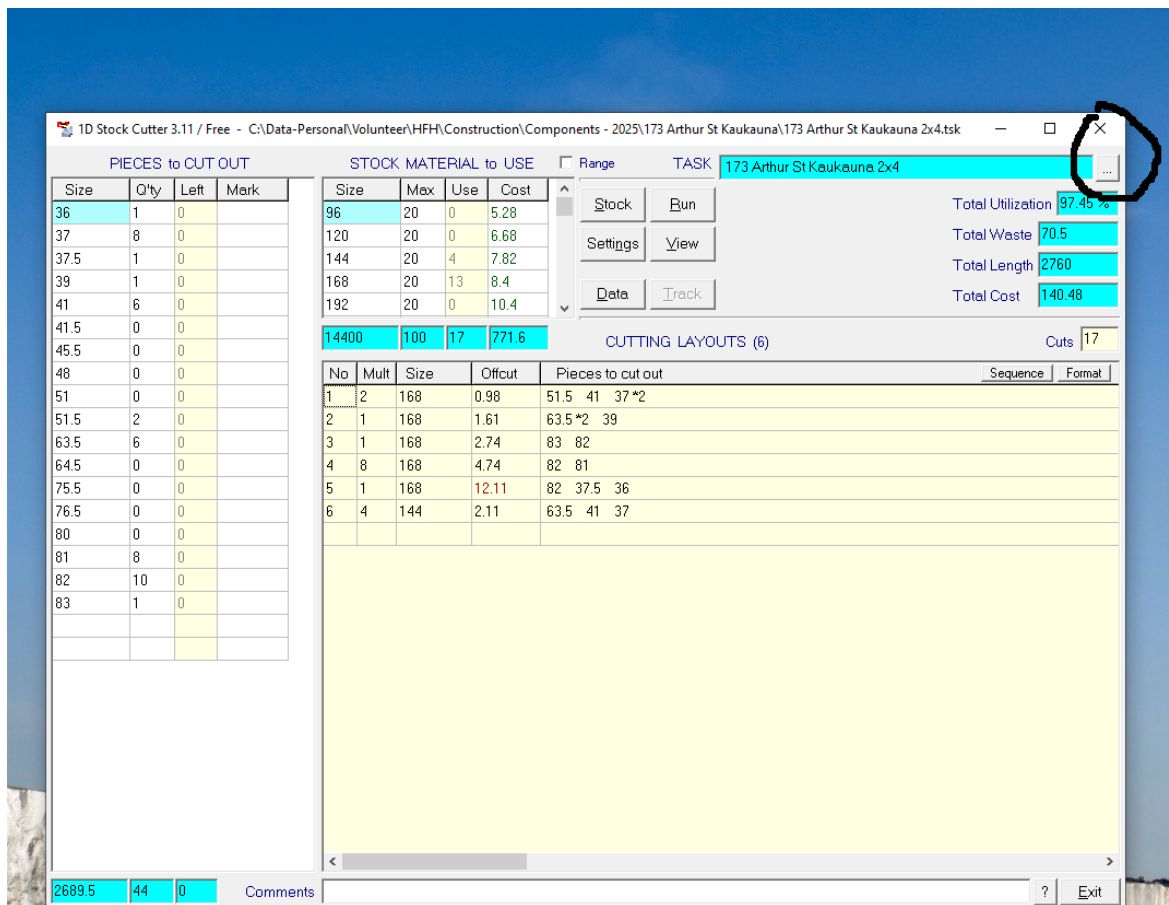


Figure A-1. Stock Cutter Ellipsis Square.

2. Do a Save As and navigate to the Project folder. Rename the 2x10 Master.tsk file to

[site address] 2x10.tsk

and save it in the Project folder.

External Component Sizes										2x10 Headers	
	No. Req'd	2x10 Header	#	2x6 Header	#	2x6 Sill	#	2x6 Jack	#	Size	No. Req'd
Windows (2x6 wall)											
16XX		21	2	21	1	18	1	82	2	21	0
20XX	1	27	2	27	1	24	1	82	2	23	0
22XX		29	2	29	1	26	1	82	2	27	2
24XX		31	2	31	1	28	1	82	2	29	0
18XX		23	2	23	1	20	1	82	2	31	0
26XX		33	2	33	1	30	1	82	2	33	0
26XX		63	2	63	1	60	1	82	2	35	0
28XX		35	2	35	1	32	1	82	2	37 1/2	2
30XX	5	39	2	39	1	36	1	82	2	39	12
32XX		41	2	41	1	38	1	82	2	41	0
34XX		43	2	43	1	40	1	82	2	41 1/2	6
36XX		45	2	45	1	42	1	82	2	43	0
38XX		47	2	47	1	44	1	82	2	45	0
40XX		51	2	51	1	48	1	82	2	47	0
50XX		63	2	63	1	60	1	82	2	51	0
60XX	1	78	3	78	1	72	1	82	4	63	0
Gable 66XX		84	2	84	1	78	1	82	4	78	3
Eave 66XX		84	3	84	1	78	1	82	4	84	0
Gable 70XX		90	2	90	1	84	1	82	4	90	0
Eave 70XX		90	3	90	1	84	1	82	4		
Total	7									Total	25

Figure A-2. 2x10 Header Assembly.

3. In the *[site address]* Component Pieces spreadsheet, find the two blue columns labelled “2x10 Headers” in the External Component Sizes section of the spreadsheet (see Figure A-2). Highlight and copy (right click/copy) all cells in both columns for which there is a number in the “No. Req’d” column.
4. Click on the Stock Cutter window and click on the top cell in the “Size” column under “PIECES to CUT OUT”. Paste (right click/Paste from clipboard/Replace) the cells copied from the spreadsheet in the previous paragraph. If a single copy of the rows is too long for the “Size” column in Stock Cutter, copy and paste smaller subsections of the cells in the spreadsheet. In this case, select “Append” rather than “Replace” to add the cells to Stock Cutter.
5. A cell at the bottom of the “Q’ty” column totals the quantities in that column. Make sure that total is identical to the “Total” at the bottom of the blue “2x10 Headers” column in the spreadsheet. If not, correct any discrepancies before proceeding.

6. Click on the Run button. This will generate a Cutting Layouts/Patterns window below the Stock Cutter window with a bar chart showing different lumber lengths and cut locations (see Figure A-3).
7. Click on the “Print” button in this window, then click on “Print current view”. Click on “OK”, change the printer name to “Microsoft Print to PDF”, and click “OK”. When the prompt asks for a file name, enter

[site address] 2x10 Cutting Layouts.pdf

and click save.

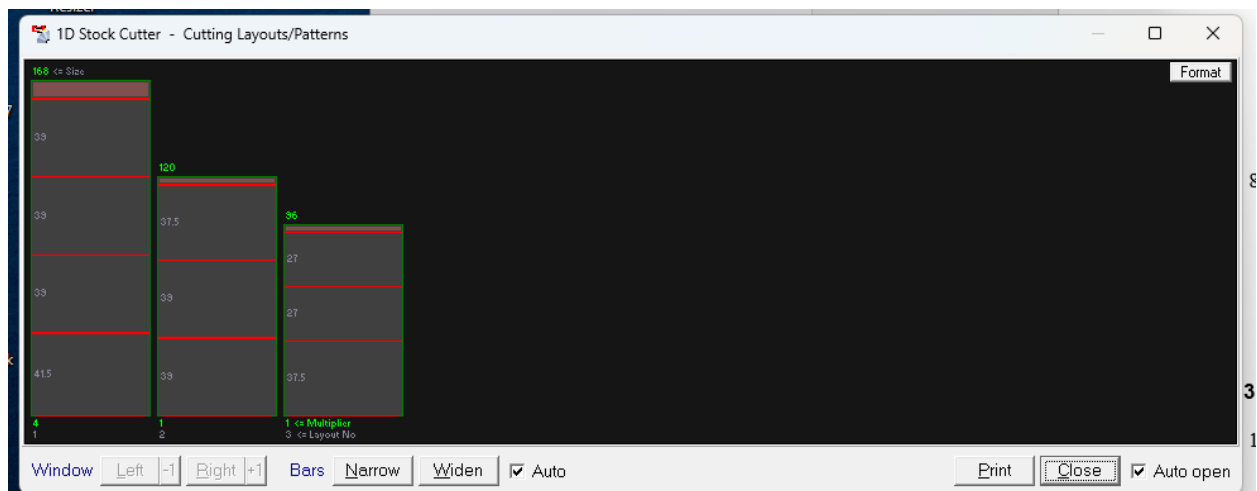


Figure A-3. 2x10 Cutting Layout.

8. Click on the “TASK” window and select “Print task report/Normal”. In the Confirm window, click on “OK”. In the Print window, change the printer name to “Microsoft Print to PDF” and click “OK”. When the Save Print Output As prompt asks for a file name, enter

[site address] 2x10 Pieces.pdf

and click save.

A.4.3. 2x6 Lumber

1. In the Stock Cutter program, activate the TASK window by clicking on the square box (containing an ellipsis, i.e. “...”) in the upper righthand corner (see Figure A-1). Then, click on “Open task” and navigate to the Masters folder. Open the 2x6 Master.tsk file. In the TASK window at the upper right corner of Stock Cutter, name the task

[site address] 2x6

- Do a Save As and navigate to the Project folder. Rename the 2x6 Master.tsk file

[site address] 2x6.tsk

and save it in the Project folder.

- In the [site address] Component Pieces spreadsheet, find the two sets of blue columns labelled “2x6 Pieces” in the External Component Sizes section of the spreadsheet (see Figure A-4). Highlight and copy (right click/copy) all cells in both columns for which there is a number in the “No. Req’d” column.

Basement (Bi-level) Windows (2x6 wall)										2x6 Pieces		2x6 Pieces	
										Size	No. Req'd	Size	No. Req'd
2030		27	3	27	1	n/a	x	36	4	18	0	45	0
3030		39	3	39	1	n/a	x	36	4	21	0	47	0
3630		45	3	45	1	n/a	x	36	4	24	1	48	0
4030		51	3	51	1	n/a	x	36	4	27	1	51	0
5030		63	3	63	1	n/a	x	36	4	28	0	51 1/2	0
Total	0									30	0	20	0
House Doors (2x6 wall)													
2868		37 1/2	2	37 1/2	1	n/a	x	82	2	31	0	57 1/2	0
3068	3	41 1/2	2	41 1/2	1	n/a	x	82	2	32	0	23	0
6068 (patio)		78	2	78	1	n/a	x	80	4	33	0	59 1/2	0
Total	3									35	0	60	0
										36	5	63	0
Garage Windows (2x4 wall) 2x4 Header 2x4 Sill 2x4 Jack										37 1/2	0	63 1/2	0
20XX		27	2	27	1	24	1	n/a	2	38	0	72	1
30XX	1	39	2	39	1	36	1	n/a	2	39	5	75 1/2	0
40XX		51	2	51	1	48	1	n/a	2	40	0	78	1
Total	1									41	0	80	0
										41 1/2	3	82	22
Garage Service Door (2x4 wall) 2x4 Header 2x4 Sill 2x4 Jack										42	0	84	0
2868	1	37 1/2	2	37 1/2	1	n/a	x	n/a	2	43	0	90	0
3068		41 1/2	2	41 1/2	1	n/a	x	n/a	2	44	0	26	0
Total	1											29	0
Colors Key												Total	39

Figure A-4. 2x6 Pieces Assembly.

- Click on the Stock Cutter window and click on the top cell in the “Size” column under “PIECES to CUT OUT”. Paste (right click/Paste from clipboard/Replace) the cells copied from the spreadsheet in the previous paragraph. If a single copy of the rows is too long for the “Size” column in Stock Cutter, copy and paste smaller subsections of the cells in the spreadsheet. In this case, select “Append” rather than “Replace” to add the cells to Stock Cutter.
- A cell at the bottom of the “Q’ty” column totals the quantities in that column. Make sure that total is identical to the “Total” at the bottom of the blue “2x6 Pieces” column in the spreadsheet. If not, correct any discrepancies before proceeding.
- Click on the Run button. This will generate a Cutting Layouts/Patterns window below the Stock Cutter window with a bar chart (see Figure A-3 for an example) showing different lumber lengths and cut locations.

7. Click on the “Print” button in this window, then click on “Print current view”. Click on “OK”, change the printer name to “Microsoft Print to PDF”, and click “OK”. When the prompt asks for a file name, enter

[site address] 2x6 Cutting Layouts.pdf

and click save.

8. Click on the “TASK” window and select “Print task report/Normal”. In the Confirm window, click on “OK”. In the Print window, change the printer name to “Microsoft Print to PDF” and click “OK”. When the Save Print Output As prompt asks for a file name, enter

[site address] 2x6 Pieces.pdf

and click save.

A.4.4. 2x4 Lumber

1. In the Stock Cutter program, activate the TASK window by clicking on the square box (containing an ellipsis, i.e. “...”) in the upper righthand corner (see Figure A-1). Then, click on “Open task” and navigate to the Masters folder. Open the 2x4 Master.tsk file. In the TASK window at the upper right corner of Stock Cutter, name the task

[site address] 2x4

2. Do a Save As and navigate to the Project folder. Rename the 2x4 Master.tsk file

[site address] 2x4.tsk

and save it in the Project folder.

3. In the *[site address]* Component Pieces spreadsheet, find the two blue columns labelled “2x4 Pieces” in the Interior Component Sizes section of the spreadsheet (see Figure A-5). Highlight and copy (right click/copy) all cells in both columns for which there is a number in the “No. Req’d” column.

Interior Component Sizes											2x4 Pieces	
	Main Floor	2x4 Jack	#	2x4 Header	#	Base ment	2x4 Jack	#	2x4 Header	#	Size	No. Req'd
Interior Doors												
1468		81	2	21	2		82	2	21	2	21	0
1668		81	2	23	2		82	2	23	2	23	0
1868		81	2	25	2		82	2	25	2	24	0
2068		81	2	29	2		82	2	29	2	25	0
2268		81	2	31	2		82	2	31	2	27	0
2468		81	2	33	2		82	2	33	2	29	0
2668		81	2	35	2		82	2	35	2	31	0
2868	2	81	2	37	2		82	2	37	2	33	0
3068	3	81	2	41	2		82	2	41	2	35	0
Total	5					Total	0				36	1
											37	4
Flush Sliding Doors											37 1/2	1
4068	1	82	1	51 1/2	2		83	1	51 1/2	2	39	1
4668		82	1	57 1/2	2		83	1	57 1/2	2	41	6
5068	1	82	1	63 1/2	2		83	1	63 1/2	2	41 1/2	0
2x6 5068		82	1	63 1/2	1*	n/a	83	x	63 1/2	x	45 1/2	0
6068		82	1	75 1/2	2		83	1	75 1/2	2	48	0
Total	2					Total	0				51	0
											51 1/2	2
NON-Flush Sliding Doors											52 1/2	0
3668		82	2	45 1/2	2		83	2	45 1/2	2	57 1/2	0
4068		82	2	51 1/2	2		83	2	51 1/2	2	59 1/2	0
2x6 4068		82	2	51 1/2	1*	n/a	83	x	51 1/2	x	63 1/2	2
4668		82	2	57 1/2	2		83	2	57 1/2	2	64 1/2	2
2x6 4668		82	2	57 1/2	1*	n/a	83	x	57 1/2	x	75 1/2	0
4868		82	2	59 1/2	2		83	2	59 1/2	2	76 1/2	0
2x6 4868		82	2	59 1/2	1*	n/a	83	x	59 1/2	x	80	2
5068		82	2	63 1/2	2		83	2	63 1/2	2	81	10
2x6 5068		82	2	63 1/2	1*	n/a	83	x	63 1/2	x	82	2
6068		82	2	75 1/2	2		83	2	75 1/2	2	83	0
2x6 6068		82	2	75 1/2	1*	n/a	83	x	75 1/2	x	Total	33

Figure A-5. 2x4 Pieces Assembly.

- Click on the Stock Cutter window and click on the top cell in the “Size” column under “PIECES to CUT OUT”. Paste (right click/Paste from clipboard/Replace) the cells copied from the spreadsheet in the previous paragraph. If a single copy of the rows is too long for the “Size” column in Stock Cutter, copy and paste smaller subsections of the cells in the spreadsheet. In this case, select “Append” rather than “Replace” to add the cells to Stock Cutter.
- A cell at the bottom of the “Q’ty” column totals the quantities in that column. Make sure that total is identical to the “Total” at the bottom of the blue “2x6 Pieces” column in the spreadsheet. If not, correct any discrepancies before proceeding.
- Click on the Run button. This will generate a Cutting Layouts/Patterns window below the Stock Cutter window with a bar chart (see Figure A-3 for an example) showing different lumber lengths and cut locations.
- Click on the “Print” button in this window, then click on “Print current view”. Click on “OK”, change the printer name to “Microsoft Print to PDF”, and click “OK”. When the prompt asks for a file name, enter

[site address] 2x4 Cutting Layouts.pdf

and click save.

8. Click on the “TASK” window and select “Print task report/Normal”. In the Confirm window, click on “OK”. In the Print window, change the printer name to “Microsoft Print to PDF” and click “OK”. When the Save Print Output As prompt asks for a file name, enter

[site address] 2x4 Pieces.pdf

and click save.

A.5. COMPLETING COMPONENT LUMBER PACKAGE ORDER

A.5.1. Studs and 1x6 Lumber

1. Open the *[site address]* Component Lumber Package Order.xlsx file found in the Project folder (see Figure A-6).
2. Add the site address to the Location field and today’s date to the Date field above the table.

HABITAT FOR HUMANITY COMPONENT CUTTING PACKAGE							
Location:		2285 W Russet Ct GC				DATE:	2/9/2024
Lumber	Studs	8'	10'	12'	14'	16'	Total
1x6					1		1
2x4	23		1	4	11		39
2x6	25		2		14		41
2x10				2	5		7
Total	48	0	3	6	31	0	88

Figure A-6. Component Lumber Package Order.xlsx.

3. Open the *[site address]* Component Pieces.xlsx file found in the Project folder. Locate the columns with the “King Studs” heading found near the lower right corner of the spreadsheet (see Figure A-7).

												King Studs			
												Multiplier> 1.25			
Bi-Fold Closet Doors												2x4 Studs		18	
4068		80	2	52 1/2	2		81	2	52 1/2	2		2x6 Studs	25		
5068	1	80	2	64 1/2	2		81	2	64 1/2	2		1x6 Fillers			
6068		80	2	76 1/2	2		81	2	76 1/2	2		34 1/2	1		
Total		1					Total		0					38 1/2	3
												1x6 Filler lineal ft Total		12.5	

A.6. TRANSFERRING FILES TO CONSTRUCTION SUPERVISOR

1. The following eight files have been created by the process detailed in this appendix:
 - *[site address]* 2x4 Cutting Layouts.pdf
 - *[site address]* 2x4 Pieces.pdf
 - *[site address]* 2x6 Cutting Layouts.pdf
 - *[site address]* 2x6 Pieces.pdf
 - *[site address]* 2x10 Cutting Layouts.pdf
 - *[site address]* 2x10 Pieces.pdf
 - *[site address]* Component Lumber Package Order.xlsx
 - *[site address]* Component Pieces.xlsx
2. Create an email addressed to the Construction Supervisor with the *[site address]* in the subject line.
3. Attach all eight files listed above to the email.
4. Send the email to the Construction Supervisor.

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Appendix B: Wall Sheetrock Layout

B.1 INTRODUCTION

B.2 LAYING OUT WALLS

B.3 CREATING SHEETROCK CUT LIST

[illegible]

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

B.1. INTRODUCTION

1. The objective of this process is to expedite wall sheetrock installation as described in Chapter 14, and to minimize material waste.
2. Prior to the first scheduled day of wall sheetrock installation (preferably prior to air sealing of the house), a layout plan for the installation of the sheetrock is created. This plan specifies the lengths of sheetrock needed on each wall and which, if any, walls need to be installed before their abutting neighbors. A cut plan is then developed indicating which sheetrock pieces will be cut from the 12- or 8-foot lengths of sheetrock provided.
3. This process is used for both the main floor and the finished areas of the basement.

B.2. LAYING OUT WALLS

B.2.1. Wall Layout Guidelines

1. All butt joints must be centered on a stud unless over a door header.
2. Butt joints on top and bottom rows should be staggered a minimum of two and preferably three studs.
3. All sheetrock pieces must be secured to at least three studs or two studs and end blocking (i.e., each sheet must have at least three columns of screws). Exceptions are closet side walls.
4. When measuring wall lengths, subtract from the length measured:
 - ½" if the piece will span the entire distance between two parallel bare stud walls (e.g. a closet or pantry).
 - ¼" when butting tight to an adjacent sheetrock piece (as between a sheetrock factory edge on one end and a stud or intersecting wall on the other end).
5. Around exterior doors, allow for a ½" - ¾" gap between sheetrock edge and the outside edge of exterior door jambs.
6. Sheetrock at the tub/shower nailing flange should butt to the exterior edge of the nailing flange. **NEVER OVERLAP THE NAILING FLANGE.**
7. Completely cover the top portion of doors and windows with a single piece of sheetrock. The only exception to this is on the interior of closets with sliding doors. The long drop on sliding door openings can be used on the interior of closet doors or above hallway doors.

B.2.2. Measuring the Walls

1. Layout can begin in any room and the process is the same for every room.
2. When measuring wall lengths, always remember to subtract an additional ½” for each intersecting wall where a piece of sheetrock will have already been installed.
3. Examine each interior corner of the room. Note whether the corner is created with blocking and/or studs. If the corner is created by two studs, it will not make any difference which wall is sheetrocked before the other intersecting wall.
4. However, if one of the studs has blocking attached to it, making it wider than the other corner component, the wall with the corner stud will be sheetrocked before the wall with the blocking.
5. Measure the length of the wall that will be installed first. If it is less than or equal to 144” (96” in the basement), subtract ½” from the length and mark this, **in red**, in two locations on one of the wall studs – once about 7’ above the floor and once about 3’ above the floor.
6. If the wall is longer than 144” (96” in the basement), determine how many pieces will be needed to cover the wall, recognizing that all sheetrock must be secured to at least three studs or two studs and end blocking. Layout the top row first and then the bottom row, making sure to stagger the seams a minimum of two and preferably three studs.
7. Determine on which stud each sheetrock piece will end. Mark the center of that stud with a vertical line about 2” long and positioned about 7’ above the floor for the top row pieces and about 3’ above the floor for bottom row pieces.
8. Measure the wall length from the corner to this vertical mark, subtract ¼”, and mark this number on one of the intermediate studs.
9. Continue measuring and marking the wall studs until the layout of both the top and bottom rows is complete.
10. Once the layout for any walls that need to be sheetrocked first has been completed, measure and mark any remaining walls in the room.
11. Repeat this process for all remaining rooms and closets in the house.

B.2.3. Recording the Wall Measurements

1. Once the layout is complete for each of the rooms, the measurements need to be recorded using a form similar to the one shown in Figure B-1. Such a form needs to provide fields to record the measurements for each of the rooms in a house.

NOTE: Figure B-1 only shows the first of three pages that constitute the complete form.

2. To record the measurements, proceed to the room and identify the first wall to be recorded.
3. Decide whether the walls will be recorded in a clockwise or counterclockwise fashion and record this on the form.
4. For each wall in the room, write the measurements for the top row in the row labelled “T” on the form. Similarly, write the measurements for the bottom row in the row labelled “B” on the form.
5. Be sure to note whether any measurement is marked in red on the wall, indicating that piece is installed before any piece on an intersecting wall.
6. If the sheetrock piece will extend over a door, add the letter “D” to the end of the measurement.

Wall Measurements for:		2211 Russet Court, Appleton					Date: 10-25-23		
Living Room	T								
	B								
Kitchen	T								
	B								
Bath	T								
	B								
Hallway	T								
	B								
Bedroom 1	T								
	B								

Figure B-1. Wall Sheetrock Measurement Form (page 1).

B.3. CREATING SHEETROCK CUT LIST

B.3.1. Transferring Room Measurements

1. Open a Wall Sheetrock Cut List spreadsheet similar to the one shown in Figure B-2.

NOTE: Figure B-2 only shows the first of three pages that constitute the complete form.

Work Site work date

Sheet	Cut	Room																
1	141 1/2	KITCH	Living Room	T	120 3/4	54 1/4	114 1/2	93 3/4D	70 1/4W	122 7/8								
2	140 1/2	DR	Counterlook	B	120 3/4	126 1/4	42 1/4	47	79	122 7/8								
3	140 1/2	DR																
4	138	BR2	Kitchen	T	23 1/2	132 3/4	45 1/4	89 1/4	91 1/2 It	115								
5	137W - 6 1/2	BR2 - DR	Clockwise	B	23 1/2	36 1/4	141 1/2	128 3/4	14-14 1/2	115								
6	137 - 6 1/2	BR2 - KITCH PANTRY																
7	134 7/8 - 8 1/4	BR2 - HALL	Bath	T	115 1/2D	105	50 3/4	35 3/4 It	105 1/2									
8	133D - 11	BR2 - BR2	Counterlook	B	74 1/4	105	50 3/4	35 3/4 It	73 1/2									
9	132 3/4 - 11	KITCH - BR2																
10	128 3/4 - 15D	KITCH - KITCH PANTRY	Stairway															
11	127 - 15 1/2	BR2 - BR1																
12	126 3/4D - 14-14 1/2	BR1 - KITCH																
13	126 1/2 - 13D	BR2 CLOS - KITCH PANT	Hallway	T	90	75 3/4		111DD		37								
14	126 1/2 - 13D	BR2 CLOS - LRCLOS		B	124 1/2			8 1/4	12 1/2	63								
15	126 1/4 - 14 1/2	LR - BR2 CLOS																
16	124 1/2 - 18 1/2	HALL - BR1 CLOS	Bedroom 1	T	126 3/4D	119 1/4	92 3/4W	68W	22	28 3/4	43 1/4							
17	122 7/8 - 13D - 7	LR - DR - LR CLOS	Counterlook	B	120 3/4	119 1/4	68 1/2	92 1/4	15 1/2	28 3/4	43 1/4							
18	122 7/8 - 11 1/2 - 8 1/2	LR - BR1 CLOS - KITCH PANT																
19	120 3/4 - 22	BR1 - BR1	Bedroom 2	T	133D	137W	138	110 7/8	33	33	80 1/2	11						
20	120 3/4 - 23 1/4	LR - KITCH PANT	Counterlook	B	127	137	113 7/8	134 7/8	27	27	80 1/2	11						
21	120 3/4 - 23 1/4	LR - KITCH PANT																
22	120 3/4 - 23 1/4	DR - KITCH PANT	Bedroom 3															
23	120 3/4 - 23 1/4	DR - KITCH PANT																
24	119 1/4 - 24 3/4	BR1 - BR1 CLOS																

page 1 of 3

Figure B-2. Wall Sheetrock Cut List (page 1).

2. Transfer each one of the wall sheetrock measurements captured on the Wall Rock Measurement Form in Section B.2.2 to the corresponding cell on the right half of the Cut List. Be sure to color code, with red, the lengths of the pieces that are to be cut for the first walls.

B.3.2. Determining Cut Combinations

1. Use the left half of the Cut List to arrange the measurements from the right side of the form in combinations that will minimize waste.

2. The standard length for wall sheetrock used is 144” for the main floor and 96” for the basement.
3. Find the longest length on the right side of the form and copy it to the topmost cell on the left side of the form along with the room in which it is located. Be sure to color code, with red, the lengths of the pieces that are to be cut for the first walls.
4. Continue in a decreasing order until all lengths 120” (72” in the basement) or greater have been copied.
5. Beginning with lengths less than 120” (72” in the basement), look for the next longest length AND a short length such that the combination of the two will be the greatest possible number less than 144” (96” in the basement). Record the combination of these measurements along with the rooms in which they are located.
6. Continue in a like manner until all lengths on the right side of the form have been copied to the left side of the form. As the longest pieces get shorter, it is entirely likely that three, four or more pieces may be cut from a single full sheet of sheetrock.
7. Once all numbers have been copied, double check that each number on the right half of the form has a corresponding entry on the left half of the form.

Appendix C. Building Range Hood Plenum

C.1 PREPARATION

C.2 LAYING OUT THE PATTERN

C.3 CUTTING OUT PLENUM BLANK

C.4 FORMING PLENUM BOX

C.5 FABRICATING EXHAUST PIPE AND END CAP

C.6 INSTALLING EXHAUST PIPE AND END CAP

C.7 SEALING PLENUM

Tools needed by volunteers:

Materials needed:

35"x24" Pre-cut coil stock
4"x5" Pre-cut coil stock
18-15/16"x4" Pre-cut coil stock
4x8 OSB
Metallized tape
Air sealing caulk
1/8"x1/4" Aluminum pop rivets

Tools and equipment needed:

Plenum pattern
Exhaust pipe pattern
End cap pattern
Plenum pattern blocks
Work surface
Sheet metal shears/aviation snips
Sheet metal crimping tool
Clamps
Compass
Scratch awl/pencil
Bar folder/sheet metal bending tools
Caulk gun
Hammer/mallet
Drill and 1/8" bits
Pop rivet gun

Personal Protection Equipment:

Safety glasses (required)
Cut resistant gloves (recommended)

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

C.1. PREPARATION

C.1.1. Inspect the Pattern for Damage

1. Look for kinks, bends, gouges. Notify the Construction Supervisor of any pattern damage.
2. Confirm plenum cut stock matches the required pattern dimensions (see Figure C-20 at the end of this appendix for a full-size pattern).
3. Use the plenum pattern or other 35" long template to cut the 24" wide coil stock to the correct length.

C.1.2. Position the Pattern

1. Place the plenum pattern over the precut sheet of coil stock (dimensions are 35"x24").
2. Ensure the pattern is positioned correctly on the precut stock (see Figure C-1).



Figure C-1. Pattern on Precut Coil Stock.

C.2. LAYING OUT THE PATTERN

C.2.1. Establish the Pattern Punch Marks

1. Use a clamp to secure the pattern to the precut coil stock from Section 1.1.3 and the table.
2. Use a punch and/or awl to make indents - using a hammer, mallet, or by hand - as indicated on the pattern (see Figure C-2 and Figure C-20). Make sure to mark the center of the exhaust collar location (see Figure C-3 and Figure C-20).

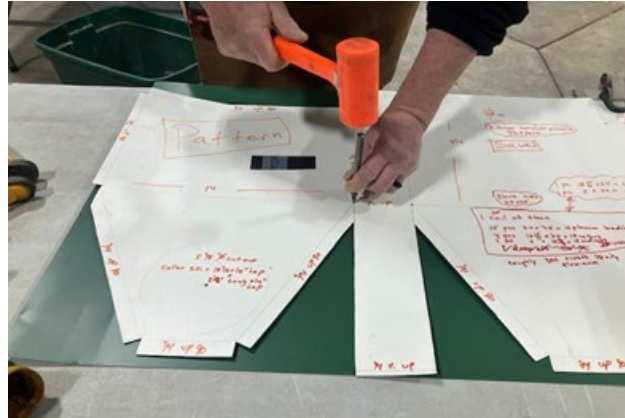


Figure C-2. Pattern Indent Marks.

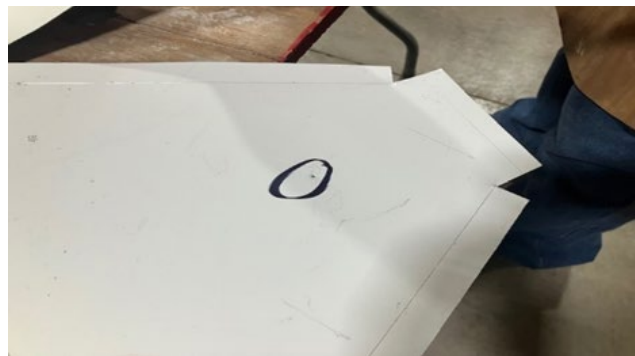


Figure C-3. Exhaust Collar Indent Mark.

C.2.2. Transfer Pattern to Coil Stock

1. With the pattern secured to the coil stock and table use a pencil or an awl (light pressure) with a straight edge to scribe the pattern outline and bending lines to the precut stock (see Figure C-4 and Figure C-20).

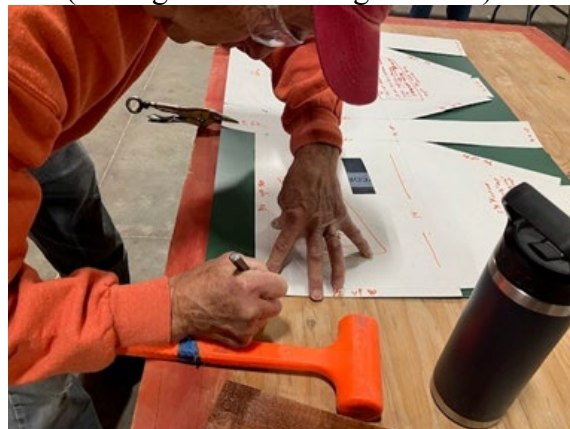


Figure C-4. Highlight Bend Lines.

C.3. CUTTING OUT PLENUM BLANK

1. Follow the pattern cut lines and remove any unneeded material using a metal shears or snips (see Figure C-5 and Figure C-20).



Figure C-5. Cutting Out Plenum Blank.

2. Notch the plenum blank corners as noted on the pattern (see Figure C-6).

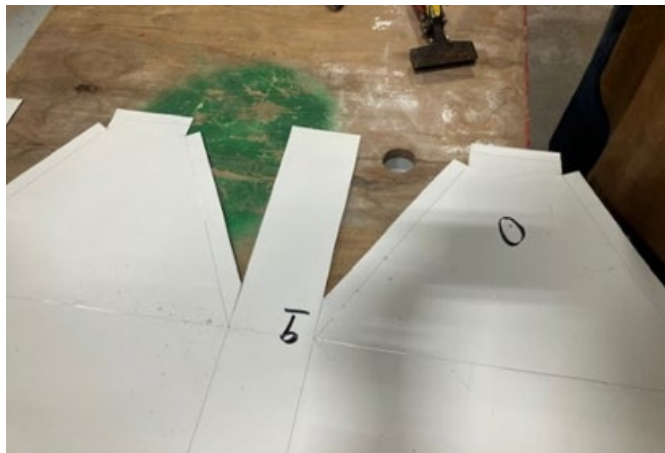


Figure C-6. Notch Plenum Blank Corners.

3. Verify the cut plenum blank matches the pattern (see Figure C-7 and Figure C-20).

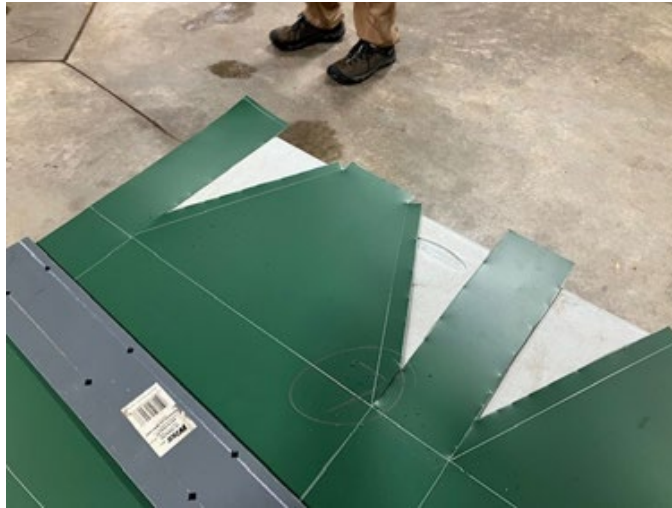


Figure C-7. Match Plenum Blank to Pattern.

4. Number the bend lines as shown in Figure C-8.

C.4. FORMING PLENUM BOX

C.4.1. Bending the Plenum

1. Using the proper bending tool (based on length of the bend), bend the plenum by the numbered sequence (see Figure C-8; see also Figure C-20 for additional reference).

NOTE: The bends are 90° and the kinks (designated with a K on the pattern) are about 45°.



Figure C-8. Plenum Blank with Bends Up.

2. Using the edge of the board or table bend tabs 8&9 down (see Figure C-9).



Figure C-9. Plenum Blank with Bends Down.

C.4.2. Creating the Plenum Box

1. Using the proper length straight edge, bend the plenum along the scribed lines to form a box (see Figure C-10).
2. The exhaust hole can be cut now or later in Section C.

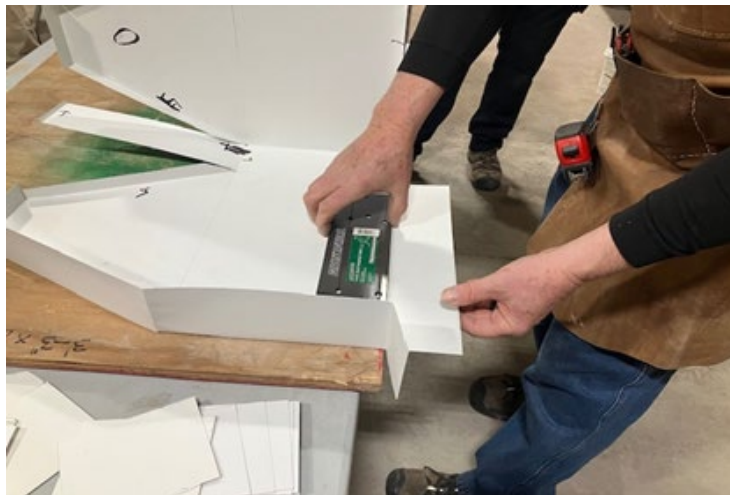


Figure C-10. Bend Plenum Edges to Form a Box.

C.4.3. Assembling the Plenum

1. Start with bottom of the plenum and align and overlap the bent edges evenly.

2. Place the narrower seam to the inside of the plenum.
3. Use a clamp to secure in place if needed.
4. Drill three $\frac{1}{8}$ " holes through both coil stock layers on the bottom edge about 1-2" from the plenum edge and about 3"-4" apart (see Figure C-11).



Figure C-11. Drilling Rivet Holes.

5. Align the drilled holes and secure with three pop rivets (see Figure C-12).



Figure C-12. Plenum with Bottom Secured.

6. Repeat Steps 1-5 for the remaining edges of the plenum (see Figure C-13).



Figure C-13. Secure All Remaining Bent Edges.

C.5. *FABRICATING EXHAUST PIPE AND END CAP*

C.5.1. Fabricating the Exhaust Pipe

1. Cut a piece of coil stock 4"x 18-15/16" long. Scribe a line 1/2" from the end of the coil stock to ensure proper circumference and 1/2" from the long edge for setting the sawtooth pattern depth (see Figure C-14).
2. Cut metal tabs in a sawtooth pattern (see Figure C-14) on the plenum end of the exhaust pipe.



Figure C-14. Plenum Exhaust Pipe.

3. Form the coil stock into a cylinder. Align one end with the scribed line (overlap). Clamp and drill two 1/8" holes about 1" from each edge. Secure with two pop rivets.

4. Bend every 4th tab at 90° to the outside of the cylinder. Leave the remaining tabs straight.
5. Using a crimping tool, crimp the end opposite the saw tooth pattern.

C.5.2. Fabricating the End Cap

1. Cut a piece of coil stock 4"x5". Create a bend on the long edges about 3/8" wide at 90°. and bend per the end cap pattern. Flanges should be about 3/8" wide (see Figure C-15).
2. Create a bend on the short edges about 3/8" wide and "kinked" at about 45° (see Figure C-15).
3. Notch the four corners of the end cap (see Figure C-15).



Figure C-15. Plenum End Cap with Notches.

C.6. INSTALLING EXHAUST PIPE AND END CAP

C.6.1. Cutting Out and Installing the Exhaust Pipe

1. If not completed in Section C.2.1, use the previous punch mark to scribe the exhaust pipe location using a compass on the plenum body (see Figure C-20).
2. Use a utility knife or the point of the shears to start the cut.
3. Using a curved shears follow the scribed line from Step 1 above and cut the opening in the plenum for the exhaust pipe (see Figure C-16).



Figure C-16. Plenum Box.

4. Place the exhaust pipe created in Section C.5.1 in the opening and secure with the previously notched metal tabs. Place about 6 tabs inside and the rest outside of the plenum. Bend the inside tabs flush to the inside of the plenum body (see Figure C-16).
5. If not done previously crimp the open end (see Figure C-17).



Figure C-17. Crimping Exhaust Pipe.

C.6.2. Installing the End Cap

1. Place the endcap created in Step C.5.2. on the end of the plenum. Drill a $\frac{1}{8}$ " hole through the end cap and into the plenum on the short edge and secure it using a pop rivet on each side (see Figure C-18).



Figure C-18. Plenum End Cap.

C.7. SEALING THE PLENUM

C.7.1. Sealing the Plenum

1. Tape all of the seams on the plenum with the metallized tape (see Figure C-19).
2. Caulk the area where the exhaust pipe meets the plenum body (see Figure C-19)

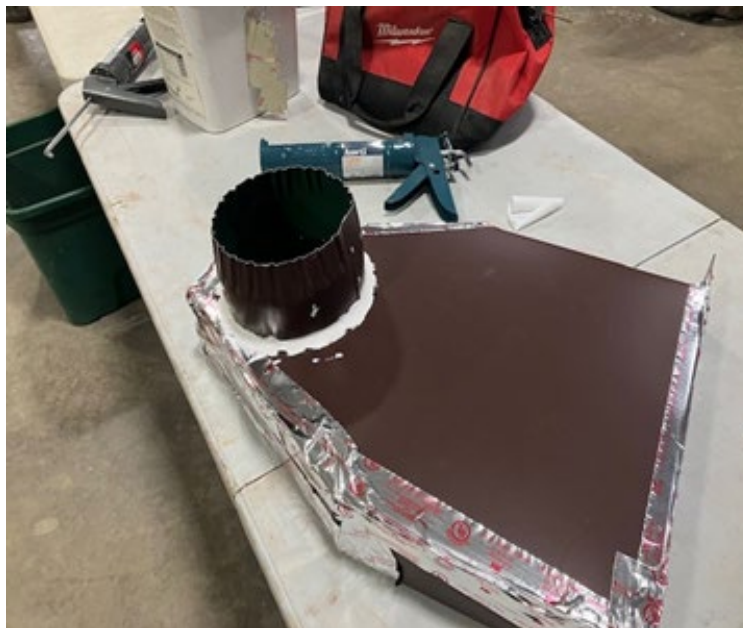


Figure C-19. Completed Plenum.

C.7.2. Quality Check

1. Verify exhaust pipe is properly crimped (see Figure C-19).
2. Verify that all seams and gaps are sealed with caulk or metallized tape (see Figure C-19).

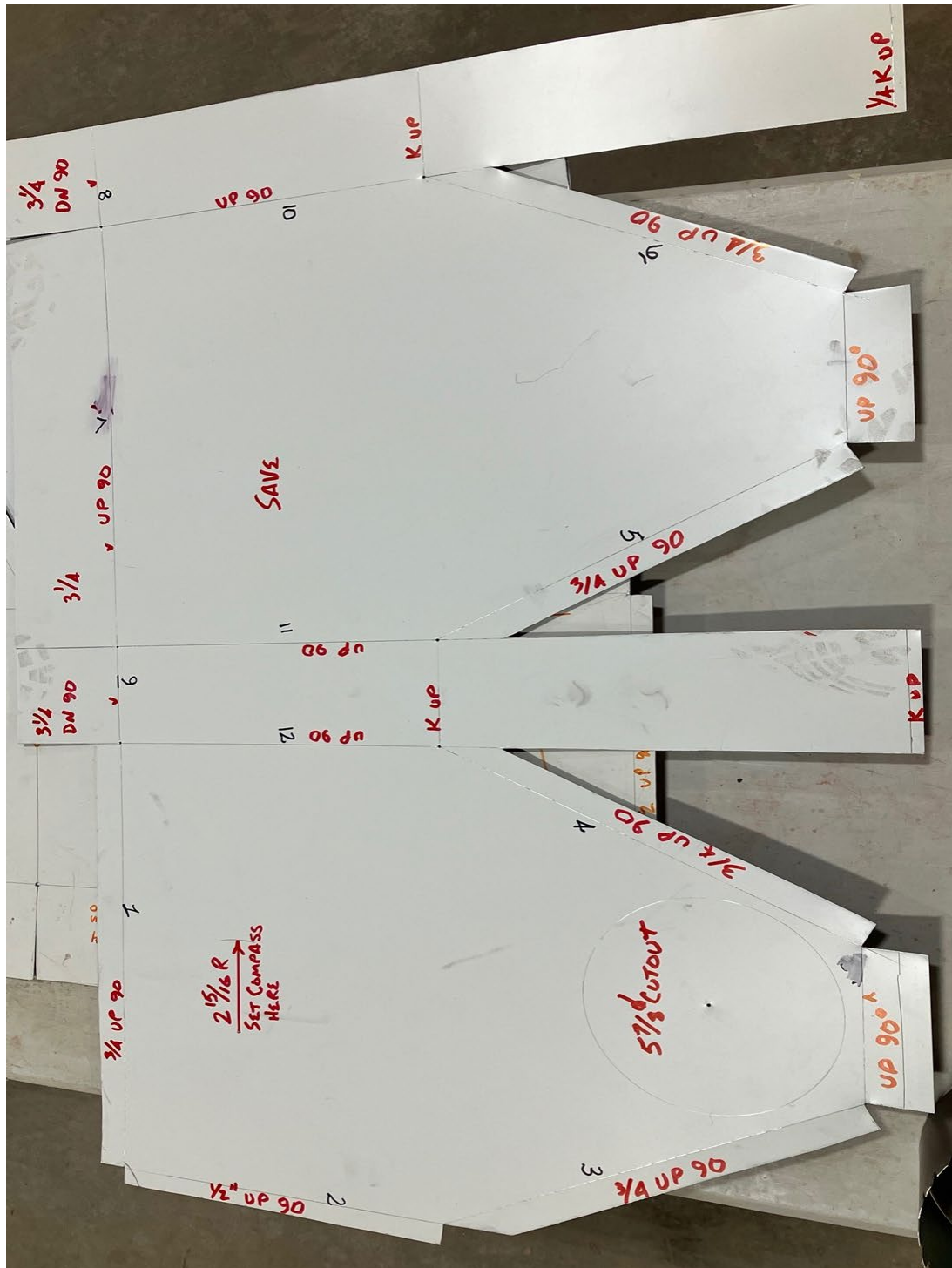


Figure C-20. Plenum Pattern with Bend Instructions.