

## 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 screw  
4" Timber screws  
16d Galvanized finish nails  
8d Galvanized finish nails  
2½" 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)

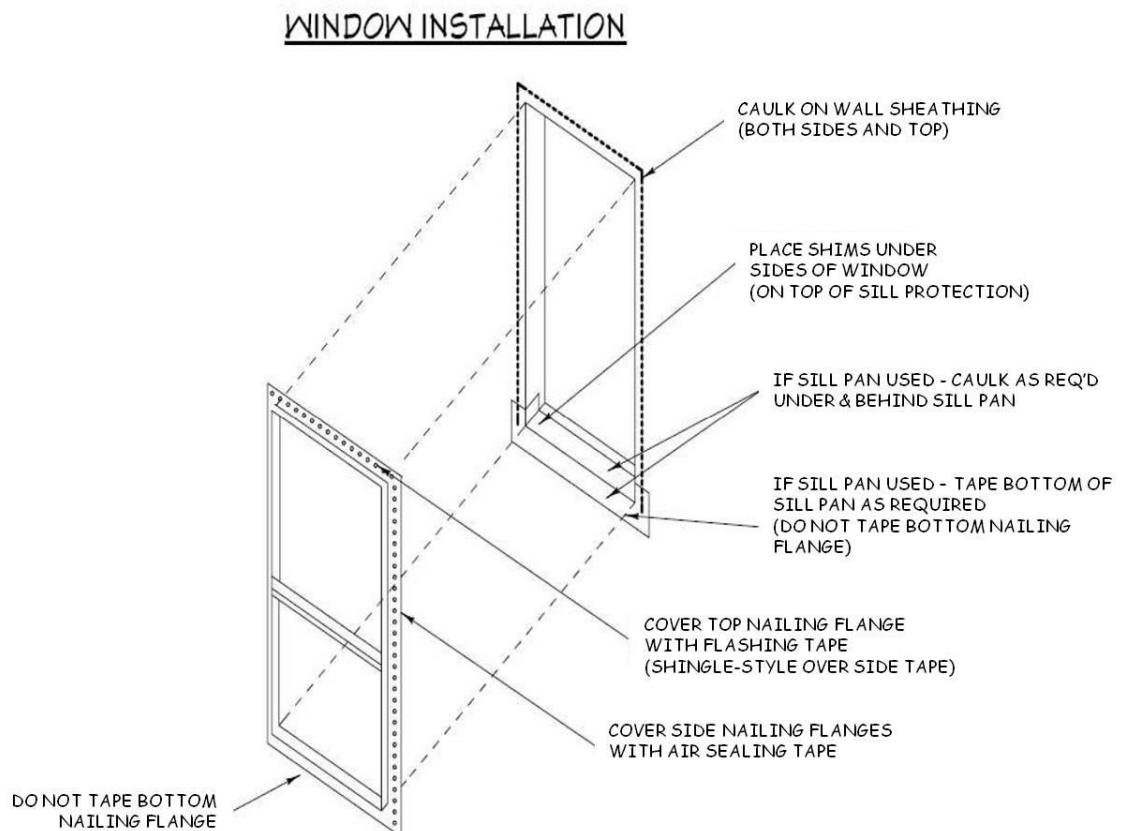
**Safety First! Review the Safety Checklist before performing tasks in this chapter.**

## 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 foamboard from the top of the sill. Attach the tape to the sill and the sides of the rough opening. Make a  $45^\circ$  cut at each corner and fold the tape down and out to the foamboard. 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 foamboard 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 foamboard).
2. Run a continuous bead of air sealing caulk on the exterior surface of the foamboard under the window and extending roughly 6" up both sides of the rough opening. Apply the caulk  $\frac{1}{2}$ " 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 foamboard.
4. Run a continuous bead of air sealing caulk on the exterior surface of the foamboard 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 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 foamboard 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 foamboard, 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 foamboard by taping the bottom of the sill pan to the foamboard 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.
4. **DO NOT INSTALL** if there is any damage to the door; a door is the wrong size, type or swing; or **the exterior door from the house to the ATTACHED garage is NOT “Fire Rated”**. Instead, notify the Site Leader or Construction Supervisor.
5. Remove and discard the shipping strike plate.
6. 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 #8x2 1/2” 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 foamboard. 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. Set door into the rough opening, tight to the foamboard and hinge side Jack stud.

2. Temporarily secure the door in the rough opening by installing shims at the very top of the strike jamb (even with the head jamb) AND at the very bottom of the strike jamb (even with the threshold). Wedge these shims in **TIGHTLY** (do NOT nail so they can be adjusted later).

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

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

### 9.2.3. Permanently Secure Door

1. With the door still held tight to the foamboard and the hinge side Jack stud, secure the hinge side jamb with 2½” exterior screws behind the weatherstripping at the top, middle and bottom hinges. **BE SURE TO HOLD BACK** or **PROTECT** the weatherstripping while driving the screws.
2. Check that the hinge side of the door is still plumb. Adjust shims as needed.
3. At the top door hinge, replace the two screws closest to the doorstop with #10 3” combo construction screws to secure the top hinge to the Jack stud and ensure the door does not sag. These screws can be found in a separate container within the Door Finish Kit.

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

4. Check complete door operation and verify that contact between the door and the weatherstripping is consistent (no gaps or light visible) along the head jamb and the strike jamb. It may be necessary to adjust one or both side jambs and brickmold slightly away from the foamboard to ensure proper contact with the weatherstripping (a maximum of ⅛” gap). Shim behind the brickmold to hold it in place. Confirm that the latch and strike are aligned. If necessary, use a tapered shim to adjust the strike side jamb at the deadbolt location until the bolt is fully seated in the strike plate



5. Check the reveal on the top and the bottom of the hinge jamb. If necessary, adjust the shims against the head jamb until the top hinge jamb reveal matches the reveal just below the top hinge. If necessary, adjust and shim the bottom of the hinge jamb to match the reveal at the top, shim as needed, and secure with a 2½” exterior screw behind the weatherstripping.

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

6. **Check the reveal at the top and the bottom of the strike jamb. If necessary, adjust the shims at the bottom of the strike jamb until there is a consistent reveal at both locations.**
7. 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 ⅛". 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.
8. 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.
9. Recheck the complete door operation, ensuring that contact with the weatherstripping is uniform (no gaps or light visible). Adjust as needed.
10. To ensure consistent reveals along both side jambs, install additional shims on the hinge side about halfway between hinges and similarly on the strike side. This should result in five sets of shims per side. Secure the jambs with 2½” exterior screws behind the weatherstripping.
11. Finish securing the door on all three jambs - 1 nail at each HINGE shim location on each of the side jambs and 1 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.

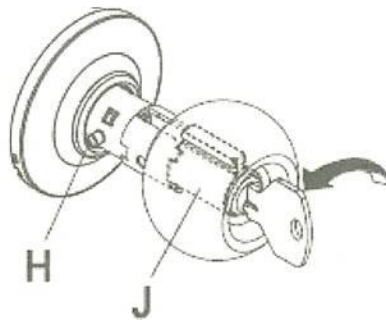
12. Conduct a final verification of the complete door operation, ensuring there is uniform contact with the weatherstripping and that all reveals are consistent. Adjust as needed.
13. Using 16d galvanized casing nails, nail (using the nailing guard created in Step 11 above) all of the predrilled holes in the brickmold. Make sure all nails hit a Jack stud or the header.
14. Set nails and fill all nail holes with white finish caulk.
15. Cut a piece of 2x4 or 2x6 the length of the threshold to serve as a temporary threshold support. Position it under the threshold. Lift it up tight to the threshold and secure to the rim board with three 4" timber screws.

### 9.2.4. Installing Hardware and Window Trim Caps

1. Install lockset and strike plate per instructions provided. Be sure the door latches easily but tightly with little or no rattle. If it rattles, bend the tab inside the strike plate with a flat blade screwdriver until the door closes tightly.
2. Install the deadbolt. Use the specially provided security deadbolt strike plates rather than the one provided with the lockset. Set the strike plate in place, predrill into the Jack stud with a 3/16" bit, and secure with the two long screws provided.

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

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



**Figure 9-2. Door Lockset.**

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

### 9.2.5. Weatherproof/Air Seal Doors

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

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

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

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