

Web Format Images

[Assembly Sequence](#)

[Screen Images](#)

[Large images for multi-sheet .pdf prints](#)

[Material](#)

[existingHouse](#)

[miscellaneous\\_images](#)

[foamBoard model](#)

[wallMaterial](#)

Back Frame, multi-sheet tile images for printing

[02\\_backFrame0001.pdf](#)

[02\\_backFrame0002.pdf](#)

[02\\_backFrame0003.pdf](#)

[02\\_backFrame0004.pdf](#)

[12\\_partNumbers0001.pdf](#) Back

[12\\_partNumbers0002.pdf](#) Back

Front Frame, multi-sheet tile images for printing

[02\\_frontFrame0002.pdf](#)

[02\\_frontFrame0005.pdf](#)

[02\\_frontFrame0006.pdf](#)

[02\\_frontFrame0007.pdf](#)

[02\\_frontFrame0008.pdf](#)

[12\\_partNumbers0003.pdf](#) Front

[12\\_partNumbers0004.pdf](#) Front

Left Frame, multi-sheet tile images for printing

[02\\_leftFrame0001.pdf](#)

[02\\_leftFrame0002.pdf](#)

[02\\_leftFrame0003.pdf](#)

[02\\_leftFrame0004.pdf](#)

[02\\_leftFrame0005.pdf](#)

[02\\_leftFrame0006.pdf](#)

[12\\_partNumbers0005.pdf](#) Left

[12\\_partNumbers0006.pdf](#) Left

Right Frame, multi-sheet tile images for printing

[02\\_rightFrame0001.pdf](#)

[02\\_rightFrame0002.pdf](#)

[02\\_rightFrame0003.pdf](#)

[02\\_rightFrame0004.pdf](#)

[02\\_rightFrame0005.pdf](#)

[02\\_rightFrame0006.pdf](#)

[12\\_partNumbers0007.pdf](#) Right

[12\\_partNumbers0008.pdf](#) Right

Small Front Frame, multi-sheet tile images for printing

[02\\_smallFrontFrame0001.pdf](#)

[02\\_smallFrontFrame0002.pdf](#)

[02\\_smallFrontFrame0003.pdf](#)

[02\\_smallFrontFrame0004.pdf](#)

Attic Survey, multi-sheet tile images for printing

[10\\_atticSurvey0002.pdf](#)

[10\\_atticSurvey0003.pdf](#)

[index.pdf](#)

[assembly.pdf](#)

[screen.pdf](#)

[foamBoard.pdf](#)

[wallMaterial.pdf](#)

[backPartsList.pdf](#)

[frontPartsList.pdf](#)

[leftPartsList.pdf](#)

[rightPartsList.pdf](#)

[smallFrontPartsList.pdf](#)

[material.pdf](#)

[rafterLength.pdf](#)

[trimList.pdf](#)

[rafterSpacing.pdf](#)

[sidingPanelList.pdf](#)  
[fastenerList.pdf](#)

Comments:

1. Check dimensions carefully while building. I-beam rafter size used in model is 11 7/8" x 1 3/4". Actual dimensions may be different.
2. **ADD SECOND LAYER TO FRONT PLATE.** Existing front extension 2"x6" plate is only single thickness and needs to be doubled. Use existing 2"x6" lumber stored inside.
3. Front foundation extends 24" out from main section. Large front gable overhangs door 10". Large front gable is setback 14" from small gable face. 10" + 14" = 24" = foundation notch.
4. Do not use toe-nails. Use metal angle brackets.
5. Models for right, left, and small front peaks include existing first floor top plate.
6. Frame Sections: For new joints; clamp stud in position, install screw, then remove screw. To assemble section; drive all screws half-way into existing holes, then tighten screws a little at a time in a torquing pattern to pull boards into location.
7. **Do not use toe nails for header framing. Use structural screws as provided.**
8. Bottom of window header is attached with two 8" screws on each end. 2x4 on top of header is attached with an 8" screw on each end. Use fender washers to reduce stress on 2x4. 2x4 on bottom of window rough opening is attached with an 8" screw on each end.

9. Make a long plywood ruler. Attach it to the wall and use it to measure left, right, and small front gable frames. Left and right ridge beams are independent. They do not meet at the center of the building. Front to back ridge is a single line. It does match.
10. Cut slot in front roof to install front wall sections.
11. Make back plate extension as flat and level as possible. When frame sections don't fit exactly, use metal shims to fill gaps. Cut hurricane ties as needed to make shims.
12. Do not use a rim joist above front door. Let new joists overhang all the way out to make full contact under upper front wall. Install wood blocking above existing 2x6 wall. Install remaining interior second floor joists after new roof is in place. Laminate additional width to existing attic joists using truss plates and glue.
13. Cut slot in front roof to install front wall sections.
14. Attach 1 1/2" thick spacers to exterior side of gable I-rafters at nailing locations for sheathing and trim before lifting. Attach Front, Left, and Right end rafters in middle of wall frame so a 1 1/2" thick spacer on the I-beam web ends up flush with outside of frame.
15. Left and Right Wall Sections: Exact width of existing left and right side plate is unknown. For right side, install front corner on-location and use fit-up space in back corner above kitchen as needed. For left side, center frame front to back. Lift left and right end rafters up into place as a pair. Use plywood to keep rafters from falling off edge at hinge point while lifting. Join I-beam peak with plywood, nuts, and bolts. Leave bolts loose so joint can flex to fit. Put an eye bolt at peak to hold lifting pole.

Even out spacing for pieces 202 and 214 when assembling. They are pre-cut to fit mid-bay in existing frame. Shorten 1" or 2" as space permits.

16. Attach 2x4 frame top to underside of I-beam before lifting. Center the I-beam on the 2x4 so the I-beam web is 1-1/2" away from the outside of the frame and a hemFir 2x4 can be used as a nailing spacer for sheathing. Pre-drill beveled end of stud with 5/32 bit and counter-bore bottom end so 6" screw will extend about 1/4" through frame and into I-beam. Insert a 5/32" steel rod from the top as a drill-stop for the counter-bore. Lift I-beam, then locate top of each stud under I-beam and use alignment hole in stud to pre-drill 5/32" pilot hole into frame top. Insert 6" screw into counter-bored hole from underside. Clamp a temporary plywood gusset plate or board to each side of stud to make a fork to hold top of stud on location while the screw is being drilled. Use angle brackets with screws provided by manufacturer to hold bottom of new studs to existing plate.
17. Large Front Wall: Install a 3/4" thick, 12" wide piece of plywood sub-flooring on top of the floor joists above front door. Attach frame tops to underside of I-beam rafters before lifting rafters. **Center I-beam on top of wall frame. Use 2x4 hemFir web spacers to provide nailing surface for sheathing and trim.** Study roof notch above front door before building. Note flashing under overhang into notch and need for nailing block to hold short piece of trim.

Cut piece 122 midway between 119b and 120 to create a fit-up gap. Attach 122a (top piece) to I-beam rafter before lifting. Then attach 122b (bottom piece) to piece 134 and fit into place under I-beam. Then install 120 and 122.

18. Small Front Wall Section: Pre-drill beveled end of each stud with 5/32" bit to accept 4-1/2" flat head screw from top. No

counter-bore. Do not pre-drill top of frame. Locate studs one at a time on existing house plate to account for fit-up variation. Use pre-drilled hole in stud to align 5/32 pilot hole through top of frame. Drill up from the bottom. Insert 4-1/2" flat head screw from top. Use a temporary plywood gusset plate and screws on the inside as needed for fit-up. Use angle brackets with screws provided by manufacturer to hold bottom of new studs to existing plate.

19. Cut slot in front roof to install front wall sections.
20. Exact width of small front gable plate is unknown. Set first stud on right side. Let left side double stud near front door land where it may. Make it a single stud if hits existing floor joist or add another piece if it hangs over the edge. Preserve theoretical gable width so it ends up symmetric.
21. Attach small front gable roofline 2x4 on top of large front gable wall sheathing. Attach with 4-1/2" framing screws. Screws are hard to align. Do like this: Attach wall sheathing with 1-5/8" screws. Trace studs on inside of sheathing. Remove sheathing and drill small alignment holes through sheathing along stud centerline with an 8p finish nail. Draw centerline on outside of sheathing by following holes. Assemble large front gable. Clamp roofline 2x4 in position. Mark stud centerlines on inside edge of 2x4. Unclamp 2x4, connect centerline marks on inside surface of 2x4, and drill 5/32" pilot holes out from the inside surface of the 2x4. This locates the inside of the 2x4 pilot hole as close to the stud centerline as possible. Complete 5/32" pilot hole by drilling in from the outside of the roofline 2x4.
22. Plywood Wall Sheathing: Window headers are hollow and will split if face nailed. Be careful when nailing. Glue a reinforcement strip in the center void.
23. Rafter assembly is all manufactured lumber. Do not notch

I-beams. Nail through flange into ridge beam. Add a bevel-cut 2"x4" to each side of each ridge beam to support rafter flanges on upper end. Make ridge beams by laminating 2 5/16" wide I-beam with two layers of 1/2" plywood on each side. Solid microlams are too heavy.

24. **Cut valley rafter tails long as shown in model.** Let them hang out beyond post and existing wall to leave room for brackets and ensure maximum bearing. Order 1.75" thick valley rafters extra long so cut-off length can be used to make lower end support posts for valley rafters, and front and back support posts for left end I-beam rafters.
25. Fit lower end of jack rafters first. Leave upper end long. Ridge beam is under rafters so upper ends can overlap on the beam and be cut to length at overlap intersection. Bottom end of rafters intersects at valley rafter centerline, not at valley rafter edge. This means bottom end of rafters will be slightly above edge of valley rafter so intersection projects to valley centerline.
26. Bottom left side of large front gable is extra long. Locate valley rafter at end of this piece. Trim extra length later to cover front roof notch with plywood. Back left valley rafter location is similar. Edge of upright 2x4 valley rafter brace contacts end of gable frame.
27. Use 4 1/2" framing screws and carriage bolts to attach legs to rafters. Pre-drill holes in legs. Grind corners off top of middle piece so contact surface is oval and joint can roll into place.
28. front and back pitch is:  $(7 \frac{13}{16}) / 12$ "  
right and left pitch is:  $(8 \frac{7}{16}) / 12$ "
29. RIDGE BEAM hangs from valley rafter peaks. Rafter tops rest on ridge beam. Connect valley rafter peak to ridge

beam with metal ties that wrap under the ridge beam. Install one collar tie for each joist pair. Connect collar ties with boards parallel to ridge to form large triangular beam along peak.

30. **RAFTER SPACING:** Follow model layout exactly so center chimney pipe and vent pipe land in the middle of a bay. Start the chimney pipe in the basement bay above step 5 counting up from basement floor. This is the bay with two wires that go up to a wall outlet in small room. Use a plumb bob to locate chimney pipe midway between ridge beam and basement beam. Make a box to hold the bottom end of the pipe and mount the box on the floor in the small room next to the stairs.
31. Use **KNEE WALLS** under valley rafters to distribute load to outside wall through floor joists. A 1.75" x 14" laminated beam is about 7 pounds per foot.  $25 \times 7 = 175$  lbs.
32. Cut plywood templates for left side common rafter tails. Use templates for blocking on both sides of I-beams. Attach templates after rafters are in place, then trim I-beams to fit with hand saw.
33. Think about making a ramp under each valley rafter and then sliding the valley rafter up the ramp into position. Also consider making a tripod on the roof to lift the ridge beam into place.
34. **ELECTRICAL SERVICE WIRE:** Right and left side studs conflict with existing attic end rafters. The right rafters could be cut to make room for the new studs but the electrical service wire is too close on the left side. Put a temporary post on corner of new extension next to trim board and spaced away from the wall by 3 inches so there is space behind post.



The service wire is not exactly in the way. It's just too close to the work space and where the saw would cut, so its not safe to work with the electricity on.

35. Jack Rafters: 1 3/4" x 11 7/8", I-Beam  
Common Rafters: 1 3/4" x 11 7/8", I-Beam  
Valley Rafters: 1 3/4 x 14", solid  
Ridge beam: 2 5/16" x 9 1/2", I-Beam with laminated rafter support bevel.
36. Special Tools:  
Frame sections: 4.5" FastenMaster flat head screws, 5/32" pilot drill, proprietary 8 point bit.  
Window frame: 8" screws, 5/16" hex head socket.  
Back window: 3" screws above header are 6 point T30 (.216") Torx drive.  
Rafters: 6" face screws, 5/16" hex head socket.  
Pilot drills: 1/8" and 5/32" for screws, even though manufacturers claim they don't need pilot holes. Torque without pilot hole is too much and bits break.  
Snappy 1/2" counter-bore with 3/16" pilot drill.  
Angle driver for screws inside stud bays.
37. Put wiring knock-out holes in I-beam web on bottom side of rafter closer to ceiling not roof.
38. **Check proper method for attaching roof plywood to I-beam rafter flanges.** 8p nails are too long. Maybe shorter ring nails that will not break through bottom side of rafter flange or 2x4 on back frame or small front frame.
39. Consider using short pieces of rafter I-beam for [blocking between rafter tops like this](#). Cut vent holes in blocking web to permit air flow up into ridge vent. Nail bottom flange to ridge beam and position top flange perpendicular to rafter so roof sheathing can be nailed into top flange.

40. **JACK RAFTER CONNECTION TO VALLEY RAFTER:** Use two 6" framing screws on an angle through blocking face. Use drill guides as shown on drawings. There is one guide for front and back rafters, and another for left and right rafters.

Drill 5/32" pilot hole for screw through bearing area, about 1/8" from short side edge where thickness is greatest. Start the drill on the end of the rafter so the connection point is in the right place. Add 5/16" hex nuts and a washer under screws for spacers if necessary.

Use 1 1/4" x 18 gauge metal strap between jack rafter bevel and valley rafter. Buy strap material in long roll and cut to length as needed. Start strap on outside face parallel to plumb cut then fold around bottom rafter flange. Slide to contact bottom screw and fold around bevel. Do not nail strap to I-beam flange.

Test screw size, entrance angle, and location with wood mock-up for both front and back, and left and right rafter skew angles. Note strength of structural screws.

[6" hex head TimberLOK screws](#). 82 valley rafters.  $2 \times 82 = 164$  screws.  $(82 \text{ straps} \times 27")/12 = 184.5 \text{ ft} \Rightarrow 200 \text{ ft}$  roll of strap material.

Skew Hangers: They don't fit well. Don't use them.

Expensive.

Simpson Strong Tie: LSSUI25, 1 3/4"

USP: LSSH179, 1 3/4"

41. Install four, approximately 90 degree brackets at valley rafter peak. Put two brackets on the outside surface of each pair of rafters.

42. Use 8" screws and hangers to join left and right ridge

beams at center junction. Drill pilot hole from end grain contact point out to screw entrance point so screws are centered on contact area.

43. Use double metal 2x4s for collar ties. Place them back to back and slide to necessary length. Use two long metal 2x4 rails to join collar ties parallel to ridge to create triangular box beams from the collar ties and ridge.
44.  $1 \frac{3}{4}$ " I-beam flange depth:  $(1.75-.375)/2 = .6875" = 11/16"$ .
45. Ridge I-beam web width is  $9.5 - 2(1.375) = 6.75"$ . I-beam web stiffeners require  $1/8"$  gap between stiffener and flange on both ends of stiffener so right side I-beam stiffener maximum width is  $6.75 - 2(.125) = 6.5"$ .
46. Windows:  
Small: Anderson TW21032, RO:  $3'-0 \frac{1}{8}" \times 3'-4 \frac{7}{8}"$   
Large: Anderson TW210410, RO:  $3'-0 \frac{1}{8}" \times 5'-0 \frac{7}{8}"$   
Use Brick Moulding around upper front window to maximize distance between window trim and roofing.
47. Minimize cuts into existing back roof. Make pedestals. Use 9.5" long, triple 2x4s to make short adapter posts between existing top plate and back wall. Counter-bore hole in middle section so a 12" framing screw can be used to attach it to existing double plate.

Working length of screw is 12". Need 3.1875" engagement (measured basement double plate). So,  $12 - 3.1875 - .25"$  protrusion = 8.5625. Root diameter of screw is  $3/16"$ .

Pre-drill pilot hole through post center, then locate post next to existing ceiling joist on plate. Drill  $5/32"$  location hole in plate. If long  $5/32"$  drill not available, use long  $1/8"$  drill to locate screw hole in plate. Screws work well with a  $5/32"$  pilot hole.

48. Seal back roof joints with plywood, shingles, and roof cement. Use house wrap to make seals around posts. Cut slot in existing front peak for new wall. Seal slot with blue tarp or house wrap stapled to front and back of new wall sheathing and use nailing strips to hold tarp to roof.
49. Cover each frame section with 1/2" plywood sheathing and house wrap. Assemble on ground with screws so it can be disassembled later and moved into place. Nail 1/2" plywood sheathing to frame during final installation to create a hurricane shear wall. Studs are dry and hard. Expect to pre-drill nails.
50. **Gable Overhang Trim Detail:** Space trim 1.5" away from sheathing. Cut plastic decking into spacers of a sufficient width to allow metal siding to slide about 2" under 1" x 5.5" trim board and maybe a second 2 1/2" wide piece on top, similar to shed and existing house. Trim must cover edge of plywood roof sheathing. Then put roofing drip edge on top of trim. Trim assembly must not require paint.
51. Use drip cap flashing above window top. Window trim sides go on top of metal siding, but cut a bevel on back of side trim to hold a vertical line of caulk where trim meets siding.
52. Install standing seam metal siding with stainless nails, on large front, back, left, and right gables. Small front gable is all shingles. Install horizontal drip edge at same height as top plate on existing house so bottom line of end gable siding matches bottom line of large front gable.
53. Front roof notch, and front door roof intersection: Cover with metal siding material. Do not use any material in these two locations that has to be painted.
54. Roofing Issues:

1. Use 30# tar paper under shingles. Synthetic underlayment is water impermeable and does not allow moisture to dry from the outside. This can cause sheathing to rot when water from humid air condenses on the bottom side of the underlayment.
2. Don't drive nail heads through shingles because nail gun was set incorrectly.
3. **Don't crack ridge cap because it was too cold to bend.** Find a way to bend shingles on a cold day without creating a fire hazard. Think about using steam from a steam cleaner with a form on the ground that matches roof pitch. Center peak intersection will be slightly irregular because roof pitches are not all the same. Use small pieces of shingle and roof cement to build up a tight fitting multi-layer cap over ridge intersection. Inspect and verify long term water seal with no hollow soft spots before scaffolding is removed. Consider a metal ridge cap that's used for metal roofing material.
4. Ridge cap ends: **Make first ridge cap shingle a double layer.** Use starter piece cut to match overlap pattern. See manufacturer's instructions which are likely to say 7" starter with roofing cement for wind protection. Use roof cement to glue the second layer of the first and last ridge cap piece. Use two face nails on last ridge cap piece. Cover exposed nail heads with roof cement and shingle sand collected from inside of bundle package.
5. Shingle overhang beyond metal drip edge should be 1/2 inch according to instructions on CertainTeed bundle wrapping when shed was built.
6. Install roofing brackets correctly:

- a. Bump on bottom of roofing bracket can cut through hot shingle. Use double scrap layer under bracket for protection.
- b. Do not install roofing bracket under shingles, and then break a shingle when removing bracket.
  - b.i. Reasonable Bracket Method: Put screws straight through top surface of shingle, but it's hard to find out exactly where rafter is, and don't want multiple test holes.
  - b.ii. To locate rafter, put a #6 x 3/4" round head screw with a fender washer in the plywood to make a bump at the rafter center, then press roofing underlayment or shingle onto screw head to mark location on underside. Remove small locator screw, then make a hole in the shingle at the marked location. Attach roofing bracket through hole at rafter center with sufficiently strong screw and washer.
  - b.iii. When finished, fill screw hole with #6 x 1" stainless flathead screw and cover with tar and shingle sand from bundle wrapper.
7. Use 5/8" thick ridge vent all the way out to end of ridge.
8. Drip edge: Use 3/4" stainless flashing nails. Install starting at bottom of roof so overlap from above will keep water out. Plan ahead so top piece is as long as possible. Short piece of drip edge at peak looks terrible.
9. Use 3" overlap for rake edge underlayment shingles.
10. Do not overlap horizontal starter strip under first row.
11. Do not nail step flashing to wall. Nail to roof only. This will allow flashing to be pulled out from under siding if

it needs to be replaced.

#### 55. Risk Management:

1. Specify goals with cost to complete quantified for each step before work begins. Consider labor by the hour, not to exceed a specified amount for a pre-determined goal.
2. Start and finish dates shall be established.
3. Exit quality criteria shall be both design plan and building code. Specify what will happen if builder does not follow plan configuration.
4. Builder shall provide proof-of-insurance with liability limits, or self-insure. Builder shall provide statement to release owner from liability under all circumstances.
5. Builder shall provide protection from weather damage if delay occurs. Is builder bonded? What happens if builder initiates dispute or does not meet completion requirements and leaves job undone and exposed to weather damage?