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Comments:

1. **INSTALL SECOND LAYER ON FRONT PLATE:** Existing front extension 2"x6" plate is only single thickness and needs to be doubled. Use existing 2"x6" lumber stored inside.

Sequence is important for large front right rafter. Cut top angle and use piece 133 as a temporary support for rafter with long bottom overhang. Use rafter to locate top right corner of window frame. Then remove rafter and temporary support. Install valley rafter. Then cut bottom bevel connection to valley rafter while rafter is still too long so compound angle can be re-cut as needed. Then mark in place and re-cut top to final length.

Window frames have gap under rafter for fit-up. Leave open so ridge beam load transfers to window headers. Fill gap later from inside with block and bracket. Use screws on bracket so it can be removed to adjust block if needed.

2. **SPECIAL TOOLS:**
5/32" pilot drill. Manufacturers claim they don't need pilot holes. Torque without pilot hole is too much and bits break.

FASTENMASTER proprietary 8 point spider bit.
5/16" hex head socket.
Snappy 1/2" counter-bore with 3/16" pilot drill.
Angle driver for screws inside stud bays.

3. WINDOW ROUGH OPENINGS:

Small: Anderson TW21032, RO: 3'-0 1/8" x 3'-4 7/8"
Large: Anderson TW210410, RO: 3'-0 1/8" x 5'-0 7/8"
Use Brick Moulding around upper front window to maximize distance between window trim and roofing.

4. LAYOUT: Front and Back pitch is: (7 13/16") / 12"
Right and Left pitch is: (8 7/16") / 12"

5. LAYOUT: 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.

6. LAYOUT: 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.

7. LAYOUT: Follow model rafter spacing 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.

8. LAYOUT: Front foundation extends 24" out from main section. Large front gable frame overhangs door 10", or 10 1/2" including sheathing on frame. See drawings above

front door. Large front gable frame is setback 14" from small gable frame. $10" + 14" = 24" =$ foundation notch.

9. LAYOUT: Models for right, left, and small front peaks include existing first floor top plate.
10. LAYOUT: 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.
11. LAYOUT: For new joints, to compensate for warp, clamp one stud at a time into position, install screw, then remove screw. To assemble a section, drive screws through existing holes in first piece until threaded section protrudes fully on other side, align screw point with exiting hole in second piece, then tighten screws a little at a time in a torquing pattern to pull boards into location.
12. LAYOUT: Do not use toe-nails. Use metal angle brackets or framing screws.
13. BACK FRAME: 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 10" framing screw can be used to attach it to existing double plate.

Working length of screw is 10". Need 3.1875" engagement (measured basement double plate). So, $10 - 3.1875 - .25"$ protrusion = 6.5625 drilled length. $9.5 - 6.5625 = 2.9375 = 2 \frac{15}{16}"$ counterbore. Root diameter of screw is $\frac{3}{16}"$.

Pre-drill pilot hole through post center, then locate post next to existing ceiling joist on plate. Drill $\frac{5}{32}"$ location hole in plate. If long $\frac{5}{32}"$ drill not available, use long $\frac{1}{8}"$

drill to locate screw hole in plate. Screws work well with a 5/32" pilot hole.

14. **BACK FRAME:** Make back plate extension as flat and level as possible. If frame sections don't fit exactly, use metal shims to fill gaps. Cut hurricane ties as needed to make shims.
15. **BACK FRAME:** Stacking section above window will require some fit-up space. Put temporary shims under wall sections next to window frame. Attach side wall sections with screws so they can be moved up and down a half inch to provide space to assemble the window header. Remove the shims after assembly and tighten the screws to pull parts into place.
16. **ALIGNMENT PINS:** Warp makes pre-drilled holes hard to align. Use loose fitting 6 inch long pins (or maybe nails) to align pieces first, then remove pins one at a time and replace with screws.
17. **BACK FRAME:** Seal back roof joints with plywood and rubber membrane. 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.
18. **BACK FRAME:** Increase thickness of top 2x4s with 3/4" blocks between studs so roof sheathing nails don't break through.
19. **TEMPORARY INSTALLATION OF LARGE FRONT RIGHT ROOF RAFTER:** Install first time, extra long, on temporary support leg above living room window to locate new front window properly. Use screws. It will interfere with front right valley rafter support leg. Remove front rafter later to install valley rafter. Then cut front roof rafter

to length. Cut bottom compound angle first, then trim top to fit above window.

20. FRONT FRAME: 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. Make blocking from short sections of 2x6 cut to fit, two per bay. Install remaining interior second floor joists after new roof is in place. Laminate additional width to existing attic joists using truss plates and glue.

Use screws to attach new joists to existing joists. Remove screws to adjust front overhang if necessary.

21. LARGE FRONT FRAME: 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 and need for nailing block to hold short piece of trim.

22. LARGE FRONT, LEFT, AND RIGHT FRAME: 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. Or if it's too

hard to reach top of stud, attach a single gusset plate to the inside of the stud, and nail from inside. Use angle brackets with screws provided by manufacturer to hold bottom of new studs to existing plate.

23. LEFT AND RIGHT FRAME: 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.
24. LEFT FRAME: Even out spacing for left window STUDS 202 and 214 next to when assembling. They are pre-cut to fit mid-way between existing studs. Shorten 1" or 2" as space permits.
25. SMALL FRONT FRAME: Exact width of small front gable plate is unknown. Set first corner stud on right side. Align small front gable with plywood roof sheathing plate connected to large right front rafter. Let left side double stud land where it may. Notch double stud if it hits existing floor joist or add another piece if it hangs over the edge. Preserve theoretical gable width so it ends up symmetric. Do not cut existing ceiling joist.
26. SMALL FRONT FRAME: Increase thickness of top 2x4s so roof sheathing nails don't break through. Fit studs in place. Pre-drill beveled end of each stud with 5/32" bit. Stud screws go up through bevel into top 2x4.
27. SMALL FRONT FRAME: Attach small front left gable roof-line 2x4 on top of large front gable wall sheathing. Clamp 2x4 on location and attach from outside with a minimum

number of temporary screws through the 2x4 and into the plywood. Don't try to locate the studs and nail from the outside. Nails will miss or split the studs. Then go inside, and fasten the 2x4 with 1 5/8" screws through the plywood from the back side. Go back outside and remove the temporary screws.

28. PLYWOOD SHEATHING: Window headers are hollow and will split if face nailed. Be careful when nailing. Glue a reinforcement strip in the center void.
29. PLYWOOD SHEATHING: 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.
30. PLYWOOD SHEATHING: 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. Use drip cap flashing above window top.
31. **FLASHING:** Install flashing on top of sheathing before trim, siding, and shingles are installed. Leave a gap between shingles and trim near places where trim intersects roofing material.
32. ROOF FRAME:
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.
33. RIDGE: 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 $6.75 - 2(.125) = 6.5"$.

34. RIDGE: Connect left and right ridge beams at center junction with 8" screws and hangers. Drill pilot hole from end grain contact point out to screw entrance point so screws are centered in contact area.
35. RIDGE: Connect all four valley rafters at the peak with brackets so the two pairs lean on each other directly and no vertical load is placed on the ridge beam center junction. A 2" thick block fits between valley rafter pairs.
36. RIDGE: Ridge beams hang 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 collar ties between joist pairs. Connect collar ties with boards parallel to ridge to form large triangular beam along peak.
37. RAFTERS: $1 \frac{3}{4}"$ I-beam flange depth: $(1.75-.375)/2 = .6875" = 11/16"$.
38. END RAFTERS: Attach $1 \frac{1}{2}"$ thick 2x4 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 $1 \frac{1}{2}"$ thick spacer on the I-beam web ends up flush with outside of frame.
39. FRONT END RAFTERS: 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.
40. VALLEY RAFTERS: **Cut valley rafter tails long.** Let them hang out beyond post and existing wall to leave room for

brackets and ensure maximum bearing.

41. VALLEY RAFTERS: Connect valley rafters to gable ends to distribute point load under valley rafter. Use straps from valley rafter to top of gable rafters so valley rafter hangs from gable end walls. Use large 90 degree bracket around corner above living room and kitchen valley rafters to tie valley rafter to end gables. Put a diagonal corner beam under bottom of living room and kitchen valleys. A 1.75" x 14" laminated beam is about 7 pounds per foot. $25 \times 7 = 175$ lbs.
42. VALLEY RAFTERS: 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. If valley rafters are just too heavy to lift, cut along centerline and install as two pieces, each 7 inches wide. Join 7" wide pieces with metal straps.
43. RAFTERS: Rafter assembly is all manufactured lumber. Do not notch I-beam flanges. Nail through flange into ridge. Add 3/4" shim strip and 1 1/2" x 2 1/2" bevel strip to top of ridge beam to support rafter flanges on upper end. Bevel strip can be laminated from 3/4" boards. Adjust to fit back peak first, so top of rafters matches top of back frame. Other peaks will self adjust. Laminate 2 5/16" wide I-beam with 1/2" plywood on each side if needed. Solid ridge beams are too heavy.
44. RAFTERS: 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.

45. RAFTERS: Use 4 1/2" framing screws or maybe 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.
46. RAFTERS: 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.
47. RAFTERS: Put wiring knock-out holes in I-beam web on bottom side of rafter closer to ceiling not roof.
48. RAFTERS: **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.
49. RAFTERS: Use short pieces of rafter I-beam for blocking between rafter tops as shown in model to increase ridge stiffness. Notch blocking web on one end about 2" deep by full width for fit-up and to permit air flow up into ridge vent. Do not notch flange. Nail bottom flange to ridge beam bevel and position top flange perpendicular to rafter so roof sheathing can be nailed into top flange. Do not toe nail flange to flange.
50. RAFTERS: METAL CROSS BRACING. Run lines of cross bracing parallel to ridge about one third down from peak.
51. RAFTERS: **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. 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"

52. RAFTERS: 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.
53. 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.

54. TRIM: Space trim 2" away from sheathing with two strips of 1" plastic decking material. Allow siding to slide about 2" under a 3/4" x 5 1/2" PVC trim board. Align decking strips with top edge of rafter. Cantilever roof plywood over decking and nail cantilevered plywood into decking strips. Raise trim to cover edge of 1/2" plywood roof sheathing. Do not use drip edge to cover plywood end grain. Cover plywood edge with the trim board. Then put roofing drip edge on top of trim. Trim material must not require paint. Decking strip max width = $(5.5 - .125)/2 = 2.6875$ Trim siding overlap = $5.5 - .5 - 2.6875 = 2.3125$ ".

55. ROOFING:

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.

56. SIDING: Install panel siding 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.

57. SIDING: Use 4' x 8' x 3/16" thick wood siding panels. Layer sheets to cover horizontal seams. Top triangle is 3 layers thick, window sides and bottom are two layers thick, and outboard side triangles are one layer thick. Underlayers can be smaller pieces with air ventilation gaps.

58. 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?