

- To keep footings directly under I-beams and other support points, size them slightly larger than the minimum required area to allow slight adjustment of the pier location during home installation.
- Design footings with a footing extension (projection beyond the base of the pier) no greater than the footing thickness. (Figure 11) Increase footing thickness if necessary.

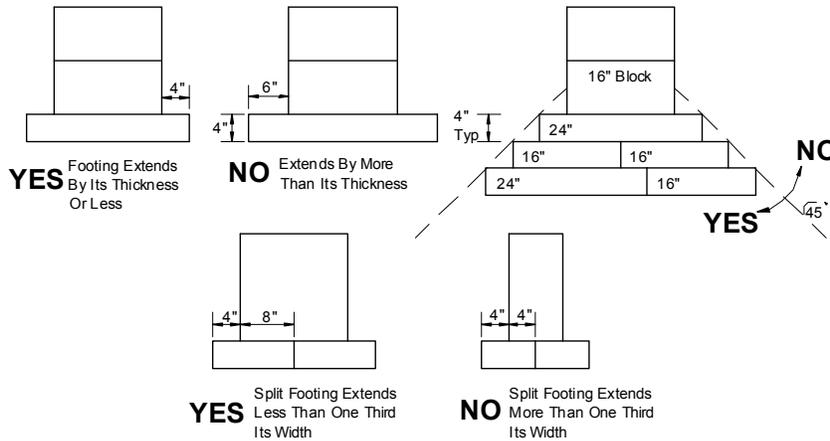


Figure 11. Maximum footing extensions

- The footing sizes shown are for square pads and are based on the surface area (square inches). Design non-square footings such that the area and depth is equal to or greater than the area and depth of the square footing shown in Table 7, and the distance from the edge of the pier to the edge of the footing is not more than the thickness of the footing.
- For four-inch thick unreinforced precast concrete footings, use the minimum footing size for the six-inch cast-in-place footing from Table 7.

STEP 6. INSTALL FOOTINGS

Construct the footings as follows:

- Maintain the distance between adjacent piers to within 10% of the tabulated spacing and so the average distance between any adjacent spans is equal to or less than the tabulated spacing.
- Whenever possible, place point load supports directly under the required locations. If plumbing, electrical, mechanical equipment interferes, place supports no more than 6 inches in either direction of the support point.
- Recess perimeter blocking supports and perimeter point load supports no more than 10 inches from the edge of the floor with added support as shown in Figure 12.



Placing Concrete anchors.

If anchors will be placed in concrete, follow instructions in **Install Stabilizing System** (p. 71) to determine anchor layout. Either place anchors immediately after the concrete has been poured or drill them in after the concrete has set.

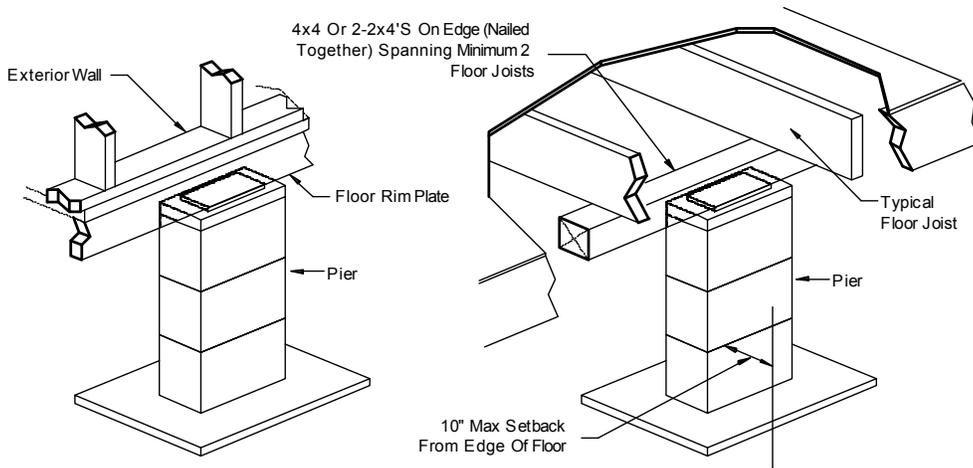


Figure 12. Perimeter supports

- If footings are rectangular, orient them so that the long side is perpendicular to the home's I-beam.
- Place the bottom of footings on firm, undisturbed soil or on controlled fill, free of grass and organic matter.
- In freezing climates protect footings from the effects of frost heave in accordance with any LAHJ requirements (see **Prepare the Site**, p. 14). Place the bottom of the footings below the frost line (insulated foundations and monolithic slabs are other frost protection options not covered in this manual).
- Make sure the top surface of the footing is level, flat, and smooth.
- In accordance with the American Concrete Institute publication ACI-308, maintain curing measures before construction or installation onto the concrete footing begins, until a minimum of 70% of the specified 28-day compressive strength has been achieved. The ACI recommended time to attain this level of strength is seven days for ASTM C150 Type 1 mixtures and 10 days for Type II mixtures. Full design live and dead loads may not be applied until the 28-day duration has elapsed for achieving full strength.



Excavation. If excavation is required, mark the footing locations on the ground with stakes before beginning to dig.

▶ go to **Set the Home** (p. 37)





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Construct Foundation

(FOR HOMES WITH LOAD-BEARING PERIMETER WALL)

Crawl space access and ventilation, shall be designed per IRC 408.

This chapter provides guidelines and recommendations for the design and construction of a basement or crawlspace foundation using a load-bearing perimeter wall. A load-bearing perimeter wall foundation system uses a wall along the outer edge of the home to support the home's outside walls. This perimeter support works with interior supports such as piers, columns, and cross beams that support the home's frame and, if multi-section, marriage line.

Follow the Steps below:

- ▼ **STEP 1. OBTAIN A FOUNDATION DESIGN** (p. 35)
- ▼ **STEP 2. EXCAVATE** (p. 35)
- ▼ **STEP 3. CONSTRUCT THE FOOTING OR SLAB** (p. 35)
- ▼ **STEP 4. CONSTRUCT THE PERIMETER WALL** (p. 35)
- ▼ **STEP 5. INSTALL INTERIOR SUPPORTS** (p. 36)
- ▼ **STEP 6. WATERPROOF FOUNDATION WALL** (p. 36)
- ▼ **STEP 7. BACKFILL AND GRADE** (p. 36)

STEP 1. OBTAIN A FOUNDATION DESIGN

If a load-bearing perimeter wall foundation design has not been provided by the home manufacturer, it is the responsibility of the retailer and/or home owner to provide a design approved by an engineer or architect, licensed in the state where the home will be installed. The approved design must comply with the LAHJ regulations for foundation design, waterproofing, and drainage, and the following:

- The foundation perimeter bearing wall must be supported with a concrete slab or continuous strip footing around the perimeter of the home. Interior piers must be supported by a slab or footings. If footings are used under interior piers, they may be designed as in **Prepare Footings**, p. 25
- Slabs must extend to the edges of the home.
- Footings and slabs must be protected from the effects of frost heave by extending the footings to or below the frost line or by using a frost protected shallow foundation design.

STEP 2. EXCAVATE

Excavate for the foundation, properly disposing of the earth that is not needed for backfill or site-grading purposes.

STEP 3. CONSTRUCT THE FOOTINGS OR SLAB

Construct the foundation according to the approved design, including the perimeter foundation wall, drainage system, footing(s), and/or slab.

STEP 4. CONSTRUCT THE PERIMETER WALL

Unless the approved design requires otherwise, construct the perimeter wall with mortared and reinforced concrete blocks or reinforced poured-in-place concrete. Install reinforcement according to the approved design or LAHJ. Install ventilation and access openings according to the approved design, or if not specified, according to the requirements in **Complete Under the Home, STEP 3 INSTALL SKIRTING** (p. 107).



Using engineered designs.

This section is NOT intended to provide a complete design for a buildable foundation. A complete design must be obtained that is suitable for the local area and sealed by a professional engineer or registered architect, licensed in the state.

Foundation ready home.

Make sure that homes to be installed on a basement or a crawlspace have been ordered with a recessed frame or as foundation-ready, where the frame is designed to avoid interference with the foundation wall.

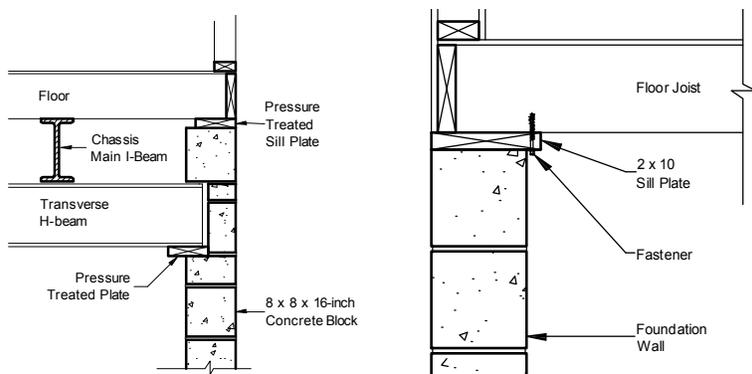
Checking the water table.

For basements, check for a high water table. The water table may vary seasonally or based on weather conditions. A geologist can perform an algae test to



When constructing pockets for an H-beam system, measure the beam depth and locate the pockets carefully. It is critical that when the home's frame rests on top of the H-beam, the perimeter of the floor rests squarely on the foundation wall sill plate (**Figure 13**). Leave room for a two-inch nominal, pressure treated wood spacer on top of the wall pockets (to prevent corrosion, the steel beams must not be in direct contact with concrete). Leave at least one inch for thermal expansion at the ends of the beams and maintain a minimum of two inches of bearing area for the beams in the pockets (yielding a minimum pocket depth of three inches).

Bolt a pressure treated wood sill plate (minimum 2 x 6) to the top of the foundation wall. If the home's siding cannot be nailed through, use a 2 x 10 sill plate that extends into the foundation 1-1/4 inches (**Figure 14**). The home can then be connected to the foundation by fastening the sill plate into the floor joists from below. Connect the home to the foundation according to the approved design. Recess nuts into the sill plate and cut off the ends of bolts so they do not project above the sill plate and interfere with the placement of the home.



determine the water table level. The foundation design must account for a high water table.

Level the wall. Make sure the foundation is level and straight with no more than a 1/4 inch vertical variation over the entire foundation and no more than 1/8 inch vertical variation over any two-foot length.

Check for Plates. When using an H-beam system, check and compensate for reinforcement plates that add thickness to the chassis beam at axle locations.

Figure 13. H-beam installation

Figure 14. Connection using 2 x 10 sill plate



Limits of

excavation. When a crane will be used, excavate no more than two feet outside the foundation perimeter. Unexcavated ground will provide a more stable base for the crane.

Footing heights. Pour footings to a height that will reduce the need to cut blocks or shim when building peri-meter walls and piers.



Backfilling. Backfill against basement walls only after the home is connected to the foundation or the basement walls may deflect inward or collapse.

STEP 5. INSTALL INTERIOR SUPPORTS

Install piers, columns and H-beams to support the interior of the home according to the approved design.

STEP 6. DAMP PROOF FOUNDATION WALL

Damp proof the foundation wall no less than up to the height of the planned backfill.

Is this a basement foundation?

- ▶ YES, go to **Set the Home**, (p. 37).
- ▶ NO, go to **STEP 7. BACKFILL AND GRADE**, (p. 36)

STEP 7. BACKFILL AND GRADE

Backfill against the foundation wall to the height of the damp proofing. Take care to not damage the drainage system. Grade the fill as per **Prepare the Site** (p. 14).

Does the approved foundation design call for ground anchors?

- ▶ YES, go to **Install Stabilizing Systems**, (p. 71).
- ▶ NO, go to **Set the Home**, (p. 37).



Set the Home

This chapter describes the process of installing the first section of the home (for single section homes this is the only section) onto the foundation.

Follow the Steps below:

- ▼ **STEP 1. PREPARE FOR SET** (p. 37)
- ▼ **STEP 2. POSITION HOME SECTION** (p. 37)
- ▼ **STEP 3. LIFT HOME** (p. 37)
- ▼ **STEP 4. CONSTRUCT PIERS** (p. 39)

STEP 1. PREPARE FOR SET

Before beginning the home set, complete the following:

- Confirm that the site is properly cleared and graded (see **Prepare the Site**, p. 14).
- Ensure that the footings are in place and properly located.
- Install any utilities that will be difficult to install (e.g. those below grade beneath the home) after the home is in place.
- Secure or remove from the home and properly store all ship loose items (refer to shipping documents for items shipped with the home).
- Inspect the home interior, exterior and all provided materials, appliances, and equipment. Immediately report any damage or shortages to the manufacturer.
- The ground moisture retarder may be installed now or after the home is complete. See **Complete Exterior Work, STEP 2. INSTALL GROUND MOISTURE RETARDER** (p. 106) for requirement and then return here.

For perimeter bearing wall foundations:

- Check that the length and width of the home match with the foundation walls.
- Check that the two main diagonal measurements of the foundation are equal.
- Check that the foundation walls and other support points are within 1/4 inch of level overall and within 1/8 inch of level within any four foot distance.
- For multi-section homes, check that each pair of diagonal measurements for each portion of the foundation corresponding to a home section are equal.
- For multi-section homes, find the electrical bonding lugs on the front or rear outriggers. Reverse them to the inside of the outrigger using star washers so they will be accessible after the home is placed on the foundation walls.
- If using an H-beam system, remove the frame's shackle hanger if it will interfere with proper placement of the beam.

STEP 2. POSITION HOME SECTION

Position the home section in its final location (if possible, move the heaviest section of the home into place first). Then place materials needed to construct support piers near their final locations under the home as determined in **Install Footing Section**.

STEP 3. LIFT HOME

There are three primary methods available to place the home on the foundation: jacking, rolling and craning. Jacks, often with roller systems, are typically used for pier and anchor foundations; roller systems are commonly used for crawlspace foundations



Clearances under the

home. After the home is leveled, the resulting distance between the bottom of the entire chassis main frame beam and the ground must be no less than 12 inches.

Utilize proper cribbing.

Manufactured homes weigh several tons. No one should be under the home (whether it is moving or stationary) unless proper cribbing is in place (**Figure 15**). Failure to utilize proper cribbing may result in serious injury or death.



Leveling during jacking. Keep the home's floor as level as possible during jacking. Twisting or warping the floor can damage the structure and finishing. Use as many jacks as necessary to keep the floor flat and level.

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with load-bearing perimeter walls; and cranes are most commonly used for basement foundations.

JACKS

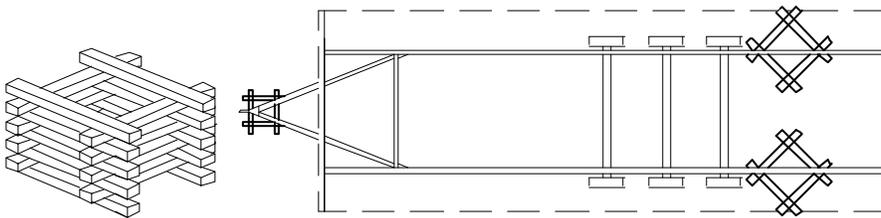
If jacks are to be used, comply with all jacking safety precautions and the procedure below. Lifting the home with jacks involves potential risks and must be done with utmost care and caution. Failure to follow jacking warnings and procedures may result in serious injury or death. Please read the Jacking Safety Precautions before lifting the home with jacks.

JACKING SAFETY PRECAUTIONS

- No one should be under the home's I-beams while the jacks are being operated or while the home is supported only on the jacks.
- Use jacks only for raising the home. Do not rely on the jacks to support the home.
- If possible, raise the home only on one side so that the other side is in contact with the ground. Leave the hitch connected to the vehicle or other stabilizing equipment.
- Obey all OSHA regulations.
- Make sure adequate safety cribbing (**Figure 15**) is in place whenever the home is placed on jacks.
- Use a minimum of two commercial quality jacks, each with a rating of at least 12 tons.
- Jack only on the main chassis I-beam, centering jacks directly under the beam.
- Do not jack on a seam (joint between flanges of twin I-beams).
- To distribute the concentrated loads from jacks to I-beam, place a minimum 3/8-inch thick steel plate, a C-channel, a 1½-inch thick hardwood block or a commercial jacking plate, between the main chassis I-beam and the jack head.
- Locate the jack base on firm ground. Never jack on freshly disturbed soil or where an underground sewer pipe may be located.
- Use a firm support under the jack base to prevent tipping or settling of the jack. A minimum 16" x 16" or larger wood or rigid fiberglass pad is recommended. Never use concrete blocks as a support for a jack.

Follow the jacking sequence outlined below to avoid overstressing structural members:

1. **Block wheels.** Block the wheels so the house does not roll.
2. **Install cribbing.** Install safety cribbing (**Figure 15**).



3. **Level lengthwise.** Locate one jack at the hitch and level the section lengthwise (such that the front and rear of the section are at the same height).
4. **Locate frame jacks.** Place a minimum of one jack just forward of the first spring hanger and another just behind the last spring hanger of the I-beam on the side of the home that is lowest (making sure not to place jacks where the piers will go). Place jacks no more than 20 feet apart and no more than 20 feet from each end of the I-beam.
5. **Lift the home.** Operating the jacks simultaneously (or sequentially in very small increments), lift the home section until it is slightly higher than the final

Figure 15. Stack 4" x 6" by 5' long timbers as shown to form safety timbers. Place safety timbers under home behind axle area and under hitch.



desired pier height.

ROLLER SYSTEMS

When using a roller system, comply with the equipment manufacturer's directions and the following sequence:

1. **Establish staging area.** Establish a staging area directly adjacent to one or both sides of the foundation.
2. **Setup rollers.** Set up the roller system according to the equipment manufacturer's directions.
3. **Fasten bump blocks.** Temporarily fasten wooden bump blocks on the sill plates at the ends of the foundation to stop the home from rolling at the desired location.
4. **Roll home.** Roll the home into place over the foundation.
5. **Remove bump blocks.** Remove the blocks before installing the next section of a multi-section home.

CRANES

When using a crane, follow these guidelines:

- Position the home section(s) and crane (taking the boom reach into consideration) such that they do not have to be repositioned during the set.
- Use enough properly sized straps to maintain balance of the home and to prevent damage to the structure.
- Place straps under walls or posts, including temporary posts used to support the opening. Do not position lifting straps under marriage wall openings.
- Use a properly sized spreader bar to maintain a vertical lift, to avoid placing compression forces on the eaves and to reduce any tendency to slip.
- Connect a rope to at least one point on the home so it can be controlled while aloft.
- Make provisions to retrieve the straps/cables after the home is set. If using a cradle system, notch the sill plate where the straps will fall. For a sling system, notch and reinforce the home's rim joist to keep the strap from slipping and allow the strap to be removed after the home is set.
- Always set the home section farthest from the crane first so that subsequent section(s) need not be lifted over previously set sections.

Have the interior foundation supports already been designed and installed as part of an approved load-bearing perimeter wall foundation?

- ▶ **YES**, go to **Complete Multi-Section Set**, (p. 44) or go to **Connect Utilities**, (p. 87) for single section homes.
- ▶ **NO**, go to **STEP 4. INSTALL PIERS**, (p. 39).

STEP 4. CONSTRUCT PIERS

For the side of the home section that is up on jacks, place piers on footings or pads following the home manufacturer's blocking plan (or tags). If no plan was provided, use the support plan developed in **Install Footings** (p. 20). Start at one end of the home section and work toward the other noting the required pier material specifications and procedure described below.

Construct piers so as to provide a stable foundation for the home using materials listed in the specifications box below and based on the location of the pier and its height as measured from the top of the footing or pad to the top of the cap. See **Table 9** for pier construction requirements.



Designing piers. Incorrect size, location or spacing of piers may result in serious structural damage to the home. Install piers at all required locations. Failure to do so may lead to sagging floors, walls, and roofs, and

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TABLE 8. PIER MATERIAL MINIMUM SPECIFICATIONS

Component	Specification
Concrete Block	Nominal dimensions of at least 8" x 8" x 16"; minimum load 8,000 lbs; confirming to ASTM designation C90, grade N.
Caps	Solid masonry (nominal 4" x 8" x 16" pre-cast concrete without reinforcement); pressure treated lumber (nominal 2" x 8" x 16"); or steel (minimum 1/2" thick, corrosion protected by a min. of a 10 mil coating of an exterior paint or equivalent).
Spacers	Nominal 2" thick boards.
Shims (also called wedges)	Hardwood, minimum 4" width by minimum 6" length by maximum 1" thick (nominal); plastic must be listed with maximum load capacity; used in pairs.
Commercial metal or pre-cast concrete piers	Available in various sizes stamped with maximum load capacity and listed or labeled for the required vertical load capacity, and where required by design, for the appropriate horizontal load capacity. Metal or other manufactured piers must be provided with protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of .30 oz per sq. ft of surface coated.
Pressure treated wood	With a water borne preservative, in accordance with AWPA Standard U1-04 for Use Category 4B ground contact applications.

TABLE 9. PIER CONSTRUCTION

Pier location	Height	Configuration	Maximum offset top to bottom	Maximum load	Mortar and reinforcement
Frame	Less than 36 in (except corner piers more than 3 blocks high)	Single-stack blocks with long side perpendicular to I-beam	1/2"	8,000 lbs.	Not required
	Between 36 in and 67 in and corner piers over 3 blocks high	Double, interlocked blocks	1" (1/2" up to 36" high)	16,000 lbs.	Not required
	Over 67 in	Designed by a registered engineer or registered architect			
Perimeter	54 in or less*	Single-stack blocks with long side parallel to perimeter rail (rim joist)	1/2" up to 36" high, 1" over 36" high	8,000 lbs.	Not required
Marriage line	54 in or less*	Single-stack blocks with long side perpendicular to the marriage line	1/2" up to 36" high, 1" over 36" high	8,000 lbs.	Not required

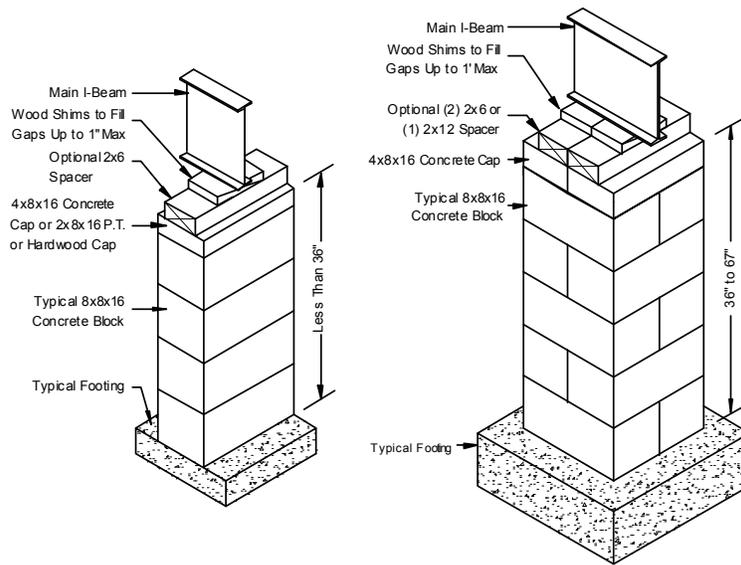
* Construct perimeter and marriage line piers over 54 inches according to the requirements for frame piers of the same height.

- 1. Prepare footing surface.** Make sure the footing surface upon which the pier sits is flat and smooth. Before placing the pier on the footing, clean dirt, rocks, or other material off the surface of the footing. For cast-in-place concrete footings, if the footing surface is uneven, create a level, flat surface by placing a treated board on the footing and mortaring on the first block (or manufactured pier base), or by placing the first block (or manufactured pier base) on a layer of premix dry sand mortar.
- 2. Stack blocks.** Stack concrete blocks with their hollow cells aligned vertically. When piers are constructed of blocks stacked side-by-side, orient each layer at right angles to the previous one (**Figure 16**) and plan blocks so that split caps will be perpendicular to the blocks they rest on and to the I-beam.

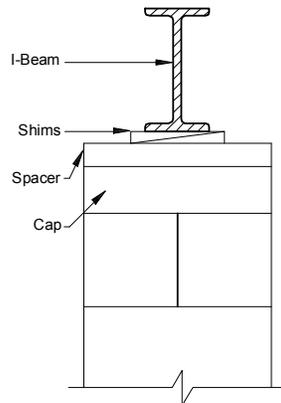


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Figure 16. Frame pier construction



- 3. Cap piers.** Place a cap on hollow block piers to evenly distribute the structural load. Use caps the same length and width as the piers they rest upon. When using split caps on double-stacked block piers, install the caps with the long dimension perpendicular to the joint in the blocks below and to the main I-beam.
- 4. Install shims.** Use shims to level the home and fill any gaps between the base of the I-beam and the top of the pier cap. Always use shims in pairs (**Figure 17**). Drive them in tightly so they do not occupy more than one inch of vertical space. When the space to be shimmed is greater than one inch and less than the minimum thickness of available caps or concrete blocks, use hardwood dimensional lumber (two inches maximum thickness) or 2" or 4" thick concrete block. For split caps, install shims and dimensional lumber/blocks over each individual cap.



- 5. Set up level.** Set up a water level with the fluid level at the desired height of the main piers. Carefully lower the side of the section down onto the leveled piers, adjusting the final height with shims.



Curing time of mortar.

Where wet mortar is used to construct or level piers, allow it to cure to at least 80% of strength capacity (usually requiring 96 hours) before setting the home.

Figure 17. Correct shim placement



Dimensions of masonry perimeter walls.

If using a masonry perimeter enclosure, calculate pier heights so that the enclosure can be built using standard unit dimensions (without cutting).

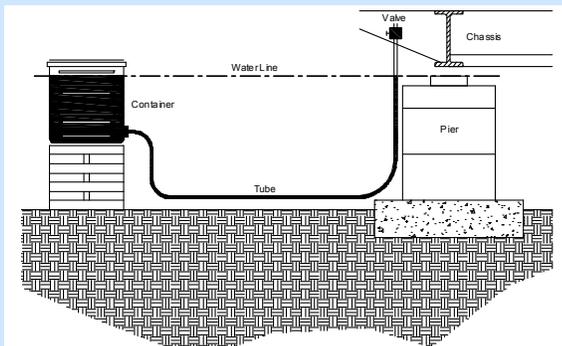
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USING A WATER LEVEL

A water level is a standard device for leveling the home. The level consists of the following components:

- One container (five gallon bucket or one gallon jug).
- 150 feet of 1/2 inch diameter plastic tubing.
- Fittings for container to tubing.
- Valve for terminal end of tubing.
- Liquid for system: colored water in warm climates, windshield washing fluid in cold climates.



How to use a water level

- Position level.** Position the level such that it can reach all piers.
 - Place container.** Place the container so that the fluid in the container is at the same level as the desired level of the top of the supports under the home, allowing for any bracing below the level of the I-beams.
 - Uncoil tubing.** Uncoil the tubing and fill with fluid, taking care not to introduce bubbles into the hose. Never allow anything to crimp or crush the tubing so as to impede the free flow of fluid.
 - Bleed air.** Hold the valve below the level of the water container; open the valve to bleed out any air and close the valve.
 - Establish height.** Locate the tubing adjacent to a pier that is set to the desired final height. Position the valve above the pier and open the valve. Move the water container up or down to where the water level is at the desired final height of the pier. Maintain the water container in that position and close the valve.
 - Level piers.** Move the tubing to the next pier. Hold the valve above the pier and open it. Set the pier height to the level of the water in the tubing and close the valve. Repeat this step until all piers are at the same level.
- Complete the opposite side.** Jack the other side of the section up and install piers following the instructions above. At the completion of this step, the section should be level from front to rear and from side to side.
 - Install perimeter and marriage line piers.** Install perimeter piers and for multi-section homes, marriage line piers. Position marriage line piers to provide equal bearing for both mating sections.
 - Remove running gear.** Remove and store, recycle or properly dispose of the hitch, axles, and wheels. These items are the property of the homeowner unless other contractual arrangements have been made.



Level the home. The home is adequately leveled if there is no more than 1/4 inch difference between adjacent pier supports (frame or perimeter) and the exterior doors and windows of the home do not bind and can be properly operated.

Water level operation. To operate the water level properly, both ends of the system must be open to the atmosphere and there must be approximately the same amount of fluid in the tubing

at all times (within a few inches).

Is this a single-section home?

- ▶ **YES**, go to **Connect Utilities**, (p. 87).
- ▶ **NO**, go to **Complete Multi-Section Set**, (p. 44).



Complete Multi-Section Set

This chapter covers the preparation and installation of additional home sections, including the structural connections between units, raising and fastening hinged roofs, and fastening the home to a load-bearing perimeter wall foundation.

Follow the Steps below:

- ▼ **STEP 1. INSTALL MARRIAGE LINE ANCHORS** (p. 44)
- ▼ **STEP 2. REMOVE PROTECTIVE SHIPPING MATERIALS** (p. 44)
- ▼ **STEP 3. COMPLETE HINGED ROOF** (p. 44)
- ▼ **STEP 4. REPAIR OR INSTALL MARRIAGE LINE GASKET** (p. 44)
- ▼ **STEP 5. POSITION ADDITIONAL HOME SECTIONS** (p. 46)
- ▼ **STEP 6. CONNECT FLOORS** (p. 48)
- ▼ **STEP 7. CONNECT ROOF** (p. 49)
- ▼ **STEP 8. CONNECT WALLS** (p. 51)
- ▼ **STEP 9. ATTACH TAG UNITS** (p. 53)
- ▼ **STEP 10. REMOVE TEMPORARY ITEMS** (p. 54)
- ▼ **STEP 11. FASTEN HOME TO FOUNDATION** (p. 54)
- ▼ **STEP 12. BACKFILL AND GRADE** (p. 54)
- ▼ **STEP 13. BUILD STAIRS** (p. 54)

STEP 1. INSTALL MARRIAGE LINE ANCHORS

Ground anchors along the marriage line are not required.

STEP 2. REMOVE PROTECTIVE SHIPPING MATERIALS

Remove all shipping protection and associated fasteners from both home sections to be joined, including plastic used to close up the open sides during transportation. Do not remove the temporary supports holding up the ceilings at major openings.

STEP 3. COMPLETE HINGED ROOF

If the home has a hinged roof that has been folded down for shipping, raise the roof using a crane or roof jacks following the procedure below:

1. **Position lift points.** Position the roof lift points (jacks or crane lift points) following the jack manufacturer or crane operator instructions. Space roof lift points equally along the length of the roof with no more than five feet from the end of the roof to the first or last lift points. Use three lift points for a roof up to 48 feet long (excluding overhangs), four lift points for up to 60 feet, and five lift points for up to 72 feet.
2. **Remove fasteners.** Remove any temporary fasteners connecting the hinged portion of the roof to the vertical king posts.



Position roof jacks.

Position jacks vertically to prevent the jack foot from kicking out or sliding.

Caution during roof raising.

Do not enter the roof cavity during the raising procedure.

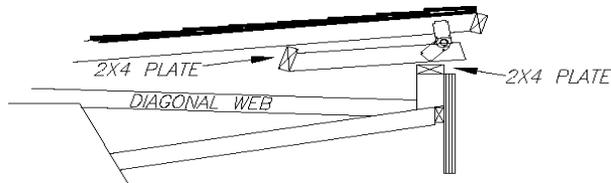
Checklists for alternate construction.

If the serial number (see the data plate or the chassis front cross member) has the letters "AC" before or after it, then the Alternate Construction on-site check list supplied with the home must be

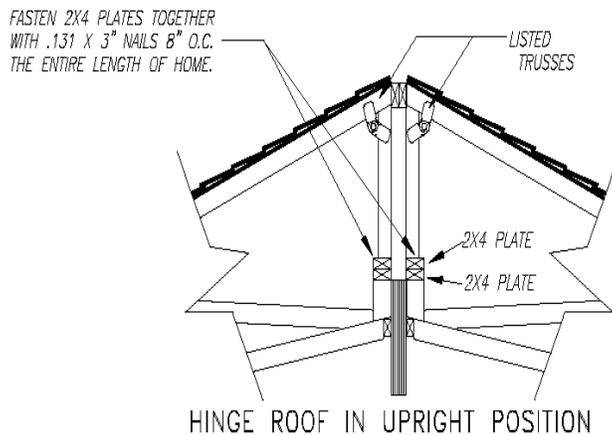


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3. **Lift roof.** Raise the roof to its intended height. A temporary slight overextension may be required during lifting. However, take care not to overextend the roof and damage the hinge. Raise the roof evenly in small increments, keeping it level throughout the entire process to prevent racking. Do not allow roofing paper and shingles to get caught in the hinge crease.
4. **Secure king posts.** Position 2x4 plate on fixed king post to 2x4 plate on hinged king post and fasten plates together with .131 x 3" nails 8" o.c. the entire length of home. (Figure 18 and Figure 19).



HINGE ROOF IN SHIPPING POSITION



HINGE ROOF IN UPRIGHT POSITION

300.045

Figure 18. Hinged roof truss In shipping position (drawing is typical, actual truss configuration may vary)

Figure 19. Hinged king post to fixed king post fastening (drawing is typical, actual truss configuration may vary)

A/C Letter for Hinged Roof

- 1) If hinged roofs are in shipping position during shipping, and then lifted & installed in the site, A/C letter is required.
- 2) If the hinged roofs are lifted & installed completely in the plant before shipping to the site, there is no A/C letter required.

5. **Redistribute Insulation.** Before closing up the attic space check that the insulation has not shifted. Re-level the insulation if needed.

6. **Install vents.** Extend plumbing vents, exhaust fans, appliance vents, and fireplace stacks through the hinged portion of the roof in strict accordance with this manual (**Prepare Appliances and Equipment**, p. 96) and/or supplemental instructions provided by the home manufacturer.

STEP 4. REPAIR OR INSTALL MARRIAGE LINE GASKET

A continuous, non-porous gasket creating a permanent air barrier must be installed on at least one side of the marriage line; along the floor, end walls and ceiling (and marriage lines for any tag units). The manufacturer has provided a marriage line gasket either installed on the home or shipped loose. If installed, inspect the gasket and repair any gaps or tears.

If not installed at the factory, install a continuous gasket between the home sections along the floor, end walls, and ceiling (**Figure 20**).

For homes with through-the-rim crossover ducts (see **Crossover Connections**, p. 59) inspect and if necessary, repair gaskets around the rim joist duct openings using 3/4-inch thick fiberglass duct board or other material acceptable to the manufacturer. Ensure that duct openings are unobstructed.

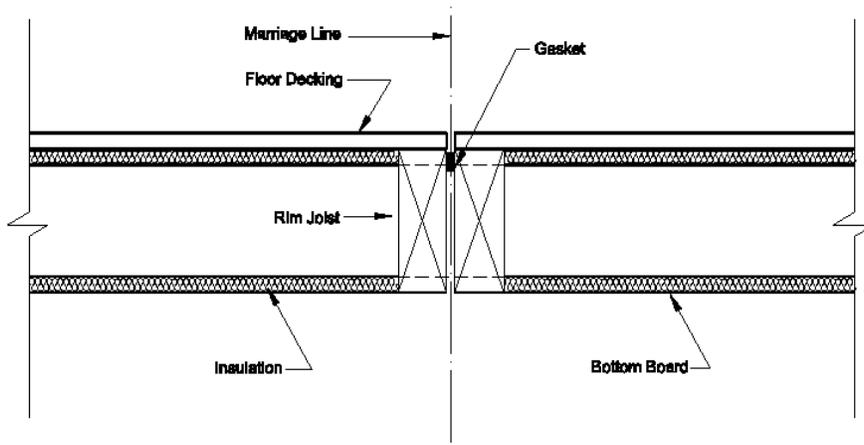


Inspecting vents. Fuel fired heating appliance and fireplace vents that pass through a hinged roof must be completed and inspected at the site prior to energizing the appliance or occupying the home. Failure to comply with this precaution may result in serious injury or death. Venting systems must be installed in conformance with the appliance manufacturer's instructions and any instructions supplied with the home.



Checking through-the-rim-ducts. Ensure that through-the-rim-duct connections are secure and tight after the home sections are together.

Figure 20. *In-floor duct showing crossover through rim joist*



STEP 5. POSITION ADDITIONAL HOME SECTION

Follow this procedure to install additional home sections:

1. **Remove obstructions.** Remove protruding nails and staples or anything else that will keep the home sections from fitting together snugly. If present, cut the temporary ceiling and floor plates at the edges of marriage line openings taking care not to damage ceiling or floor coverings or displace temporary marriage line support posts (these supports and the plates will be removed after the home sections have been structurally connected).
2. **Complete crossovers.** Before moving the two sections together, complete any crossover connections that require access through the open marriage line, including the attic duct connection (if present) and marriage wall interior electrical connections (see **Connect Crossovers**, p.59).
3. **Position section.** Position the section as closely as possible (ideally within six inches) and line up with the previously set section. If using a mechanical positioning system or crane, follow the system manufacturer's instructions or the crane operator's directions.
4. **Construct piers.** With the outside walls of the home aligned, construct the piers for the home section according to the instructions in **Set the Home** (p. 37) before continuing to the steps below.
5. **Level section.** Lower the section onto the outside piers first, inside piers last. Before releasing the mechanical positioning system, check interior doorways and other openings for misalignments that may cause problems during trim-out. The floors should be flush, level, and tight and the roof section should have little, if any, gap at the top of the marriage line. Use at least two come-alongs to pull the sections snugly together and use the water level or other leveling device to set all piers and shims.
6. **Shim gaps.** Shim any gaps up to one inch between structural elements with dimensional lumber. If any gaps exceed one inch, re-position the home to eliminate such gaps.



Mechanical positioning system. For a pier-set home, a mechanical positioning system (such as a roller system) will make the process easier and safer and be less likely to damage the home.



Sealing gaps. Prior to completion of the exterior close-up, gaps that do not exceed one inch are permitted between structural elements provided that the gaps are closed before completion of close-up, the home sections are in contact with each other, and the marriage gasket provides a proper seal.

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STEP 6. CONNECT FLOORS

Make floor structural connections according to one of the methods described below.

Method 1: Install toed fasteners through bottom board or floor decking

Install fasteners at approximately a 45 degree angle (+/- 5 degrees) from horizontal as shown in **Figure 21** using the fastener type, size, and spacing indicated on **Table 10**. (metal straps on underside of home not required in Wind Zone I) Adjust fastener lengths for any gaps between the modules to obtain the same penetration and fill all the gaps with SPF lumber or plywood before installing the fasteners.

TABLE 10. FLOOR CONNECTION FASTENING SPECIFICATIONS

Fastener		Spacing		
Type	Size	Wind Zone I	Wind Zone II	Wind Zone III
Lag screw with washer	5/16" x 4-1/2"	36 in.	-	-
Wood screw	#8 x 4"	32 in.	-	-

* Increase fastener lengths by 3 inches for double rim joists.

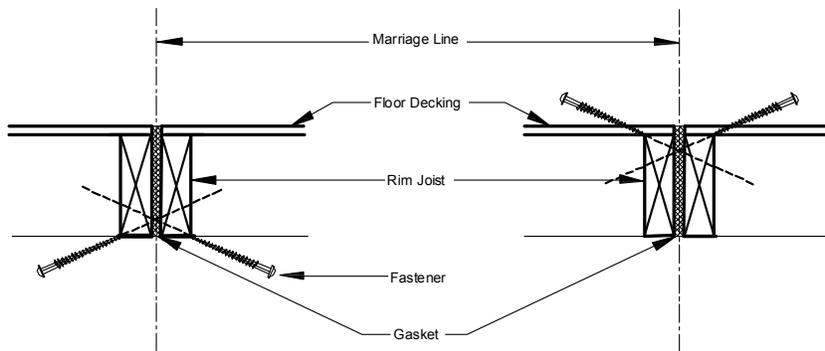


Figure 21. Floor connection through bottom board or floor decking (Fasteners must penetrate the rim joist by a minimum of 1 1/2 inches)

Stagger fasteners on either side of marriage line and offset them by half the spacing distance (**Figure 22**).

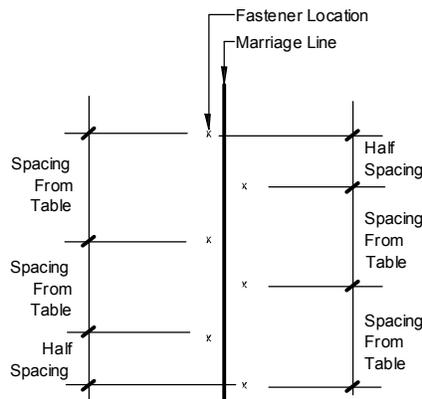


Figure 22. Staggered offset fastening along marriage line

Install additional fasteners as indicated below, making sure to repair any openings in the bottom board with tape specially made for that purpose (may be provided).

- Install two additional fasteners at each end of the home at approximately a 45 degree angle (+/- 5 degrees) from horizontal.
- If the home has a through-the-rim crossover duct, install one additional fastener at each side of the duct opening.



Patch bottom board. Use adhesive spray, mastic, and/or divergent staples in combination with bottom

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board tape for a more secure and durable connection.

Method 2: Install horizontal fasteners through rim joist

Insert 5/16" x 3" lag screws spaced per **Table 11** horizontally through rim joists and staggered top to bottom as in **Figure 23**. After installation of fasteners, repair tears or holes in the bottom board using tape specially made for that purpose.

TABLE 11. HORIZONTAL RIM JOIST FASTENER SPACING

Wind Zone I	Wind Zone II	Wind Zone III
18 in.	-	-

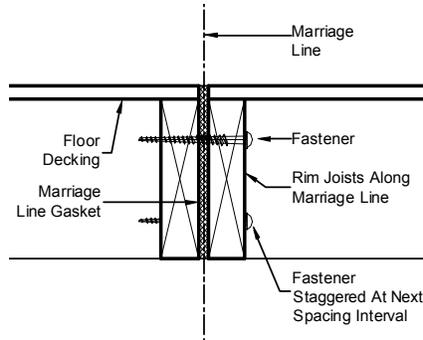


Figure 23. Horizontal fasteners through rim joists

STEP 7. CONNECT ROOF

If the marriage line along the roof is not snug, position jacks every 20 feet or less along the outside I-beam and uniformly lift the section until the roof area is tight.

Check to make sure the ceiling joint is flush before installing the connections. If not, use a jack and tee to raise whichever ceiling is low, starting at the front and working to the rear of the home. Fasten the roof along the marriage line using one of the methods below for either double or triple-section homes.

DOUBLE-SECTION HOMES

Make roof structural connections in double-section homes as described below.

Method 1: Install toed fasteners through roof sheathing

Install the fasteners through the roof deck into the ridge rail at an approximately 45 degree angle (+/- 5 degrees) from horizontal (**Figure 22**) according to the fastener spacing and specifications in **Table 12**. Stagger fasteners on each side of marriage line and offset them by half the spacing distance (**Figure 22**). Spacing indicated is on-center, both sides of ridge. Make sure fasteners penetrate the ridge rail by a minimum of 1-1/2 inches both sides of ridge. Adjust fastener lengths for any gaps between the modules to obtain the same penetration and fill all the gaps with SPF lumber or plywood before installing the fasteners. Metal straps not required in Zone I.



Closing the roof gap. Level and fasten the marriage line joint at the floor before jacking to tighten a roof gap. DO NOT use roof fasteners to close any gaps. Separation of the ridge beams and trusses may occur.

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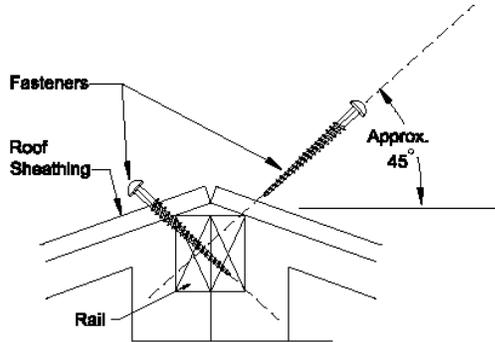


Figure 24. Toed fasteners through roof sheathing

TABLE 12. ROOF CONNECTIONS SPECIFICATIONS

Fastener		Spacing		
Type	Size	Wind Zone I		
Lag screw with washer	5/16" x 6"	28 in.		
Wood screw	#10 x 5"	24 in.		



Installing lags. If lags are used to connect roofs, use appropriately sized washers, countersink the fastener heads and fill the countersink holes with putty or caulk to prevent shingles from sinking into the holes over time.



STEP 8. CONNECT WALLS

Once the home is secured along the marriage line floor and roof, secure end walls, interior doorways, and marriage line partitions according to the appropriate method described below.

END WALLS

Method 1: Install toed fasteners through sheathing

Toe fasteners through sheathing from the exterior at an approximately 45 degree angle (+/- 5 degrees) (**Figure 24**) according to the fastener specifications and spacing requirements in **Table 13**. (stagger fasteners)

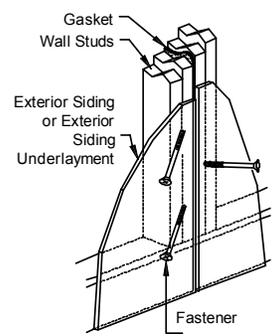


Figure 24. End wall connection toed through sheathing

TABLE 13. END WALL FASTENER SPECIFICATIONS



Fastener type	Size	Spacing
Lag screw with washer	5/16" x 5"	12in. o.c.
Wood screw	#8 x 3"	8in. o.c.
Nail	16d	8in. o.c.

MARRIAGE WALL COLUMNS, OPENINGS AND INTERIOR PARTITIONS

Make connections inside the home along the marriage walls (**Figure 25** and **Figure 26**) by installing fasteners according to the specifications and spacing requirements in **Table 14**. Toe screw 2 x 4 or 2 x 6 studs or through-screw 2 x 3 studs.

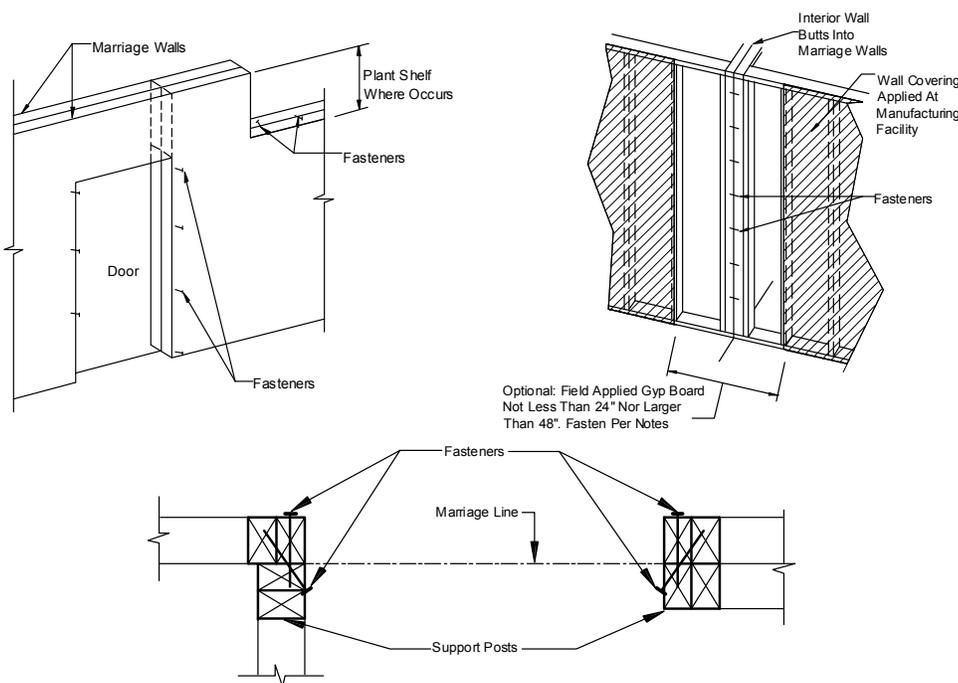


Figure 25. Marriage wall connections

Figure 26. Marriage line column connections

TABLE 14. MARRIAGE WALL CONNECTION SPECIFICATIONS

Fastener type	Size	Spacing
Wood screw	#8 x 4"	16 in. o.c.

Do additional sections (non tag) remain to be positioned?

- ▶ YES, go to **STEP 1. INSTALL MARRIAGE LINE GROUND ANCHORS**, (p. 44)
- ▶ NO, continue below.

Is there a tag unit?

- ▶ YES, go to **STEP 8. ATTACH TAG UNITS** (p. 51)
- ▶ NO, continue below.

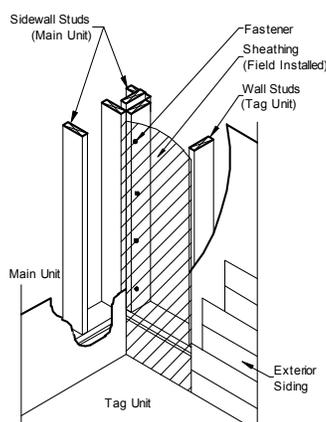
Is there a hinged roof?

- ▶ YES, go to **STEP 9. COMPLETE HINGED ROOF**, (p. 53)
- ▶ NO, go to **STEP 8. ATTACH TAG UNITS**, (p. 51)

STEP 9. ATTACH TAG UNITS

After the main unit has been set on its foundation, install all tag units according to the following procedure:

1. **Position and block the tag.** Position the tag unit as close to the main unit as possible at its intended location. Use a hitch jack to obtain approximate leveling and install pier supports according to **Set the Home, STEP 2. POSITION HOME SECTION** (p. 37).
2. **Level the unit.** Using a water level (p.42), verify that the piers are level. The elevation of all points along the lower flange of the I-beam should be no more than 3/8 inches from the desired height and should not deviate more than 3/4 inches overall.
3. **Connect floors.** Connect the floors together as described in **STEP 5. CONNECT FLOORS** (p. 47).
4. **Connect walls.** Secure the tag unit walls to the main unit sidewall using #8 x 4" screws at 12 inches o.c. (see **Figure 27**). Once the wall connections are complete, finish the siding installation.



5. **Connect roofs.** Connect the tag unit roof to the main unit roof using #10 x 5" screws or 3/8" x 6" lag screws, toe screwed at each main unit vertical structural member (stud or truss) location. See **Figure 28** for flush roof connections and **Figure 29** for roof connections with an offset greater than two inches. Roof connections with an offset less than two inches do not require screws.



Piers under tag units.

Some tag units have special piercing needs due to the roof and/or floor construction. These will be detailed in supplemental piercing plans supplied with the home. Note that tag unit end walls are typically load bearing rather than side walls.

Figure 27. Tag unit wall connection



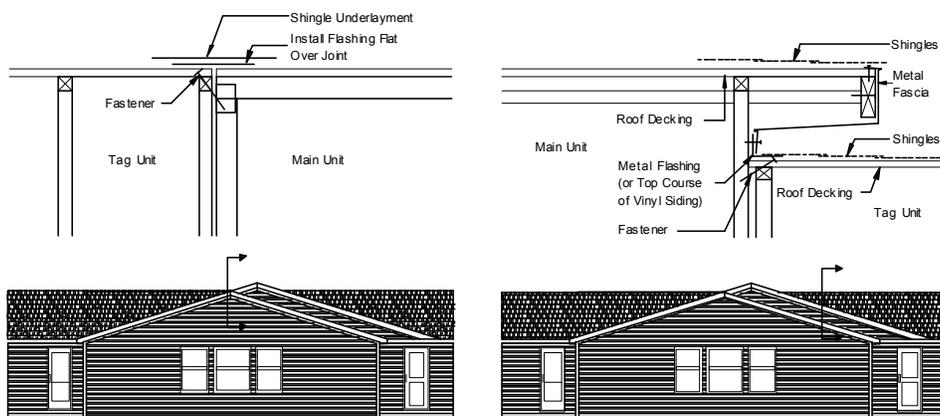


Figure 28. Tag unit flush roof connection (common)

Figure 29. Tag unit offset roof connection (not common)

STEP 10. REMOVE TEMPORARY ITEMS

Once the home is properly supported and the marriage line connections are completed, remove the temporary ridge beam supports and wall/ceiling plates used to brace the ridge beam during shipment. Take care not to damage the ceiling.

Remove and store or properly dispose of or recycle the hitch, axles, and wheels. These items are the property of the homeowner unless other contractual arrangements have been made.

Is the home supported on a load-bearing perimeter wall?

- ▶ YES, go to **STEP 11. FASTEN HOME TO FOUNDATION**, (p. 54)
- ▶ NO, go to **Complete Roof and Exterior Walls** (p. 55).

STEP 11. FASTEN HOME TO FOUNDATION

Fasten the home to the foundation (typically to the sill plate) according to the fastening schedule provided by LAHJ or approved foundation drawings.

Is the home supported on a basement foundation?

- ▶ YES, go to **STEP 12. BACKFILL AND GRADE**, (p. 54)
- ▶ NO, go to **Complete Roof and Exterior Walls** (p. 55).

STEP 12. BACKFILL AND GRADE

Backfill against the foundation wall to the height of the waterproofing, taking care to not damage the drainage system.

Grade the site as described in **Prepare the Site, STEP 3. CLEAR AND GRADE THE SITE** (p.15).

STEP 13. BUILD STAIRS

Construct the basement stairs in compliance with the local building code. Take care that adequate headroom is maintained under beams and that there is sufficient landing space at the bottom of the stairs.

- ▶ go to **Complete Roof and Exterior Walls** (p. 55).



When to backfill. Backfill against basement walls only after the home is connected to the foundation or the basement walls may deflect inward or collapse.

Cutting the chassis. Do not cut, notch, bend, or alter in any manner beams, cross-members, and other parts of the steel chassis.

Complete Roof and Exterior Walls

This chapter covers closing up and weatherproofing the home by completing the roofing and siding.

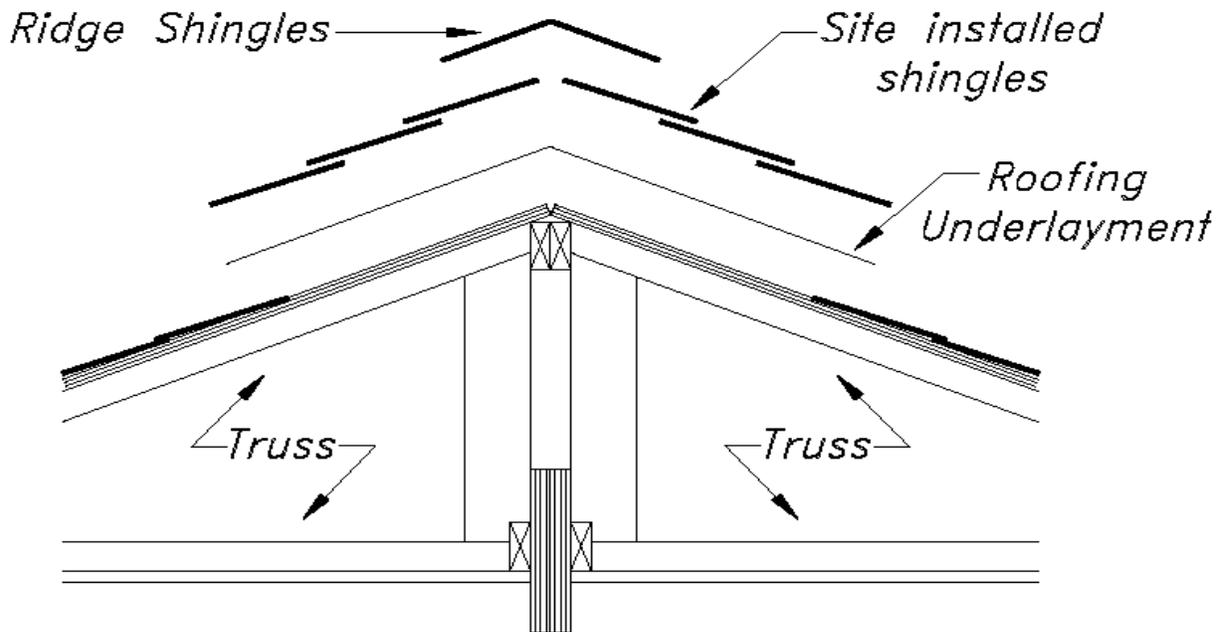
Follow the Steps below:

- ▼ **STEP 1. COMPLETE ROOF** (p. 55)
- ▼ **STEP 2. COMPLETE TAG UNIT ROOF** (p. 57)
- ▼ **STEP 3. COMPLETE SIDE WALLS** (p. 57)

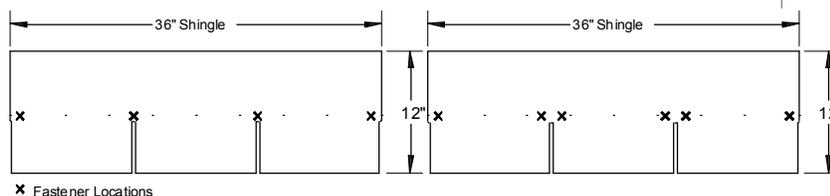
STEP 1. COMPLETE ROOF

RIDGE CLOSEUP

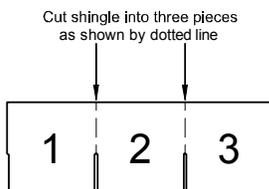
For multi-section homes, the first step in completing the exterior is sealing the roof along the ridge line (**Figure 30**). For homes with asphalt shingles, follow the procedure below.



1. **Install underlayment** (when sheathing at the ridge is installed on site). Make sure the roof sheathing is already installed (see **Complete Multi-Section Set, STEP 6. CONNECT ROOF**, p. 48). Install 15# felt or equivalent continuously along the length of the ridge, covering all exposed sheathing and overlapping sheathing joints by at least five inches on each side. Fasten using 1" x 1" x 16 ga galvanized staples.
2. **Install shingles.** If shingles have been left off at the ridge line for site installation, install them now using 1" x 1" x 16 ga galvanized staples or 12ga 1-1/4" long, 3/8" diameter head roof nails. For Wind Zone I, fasten at 5/8 inch above each tab cutout slot and one at each end of the shingle one inch in from the edge (four fasteners for a three-tab shingle) (**Figure 31**). Do not fasten through the shingle tar line.



- 3.
4. **Install shingle cap.** Starting at the opposite end of the home from the prevailing wind, install ridge cap shingles provided by the manufacturer or use 12" x 12" shingles (36" shingles cut into three equal pieces) (**Figure 32**). Install using 1" x 1" x 16 ga galvanized staples or 12 ga 1-1/4" long, 3/8" diameter head roofing nails spaced 5-5/8 inches from bottom edge and 1/2 inch to 1-1/2 inches in from both edges. Cover the exposed fasteners with tar or cement.



HINGE ROOF CLOSE-UP

For homes with hinged roofs, complete roofing underlayment and shingles along the hinge line (**Figure 33**) as follows:

1. **Install underlayment.** Attach the underlayment to the roof deck with a minimum of six-inch wide strip of cement. If necessary, trim the underlayment to allow the lowest shingle above the hinge of the roof to seal to the topmost shingle on the lower portion of the roof.



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Figure 30 installation



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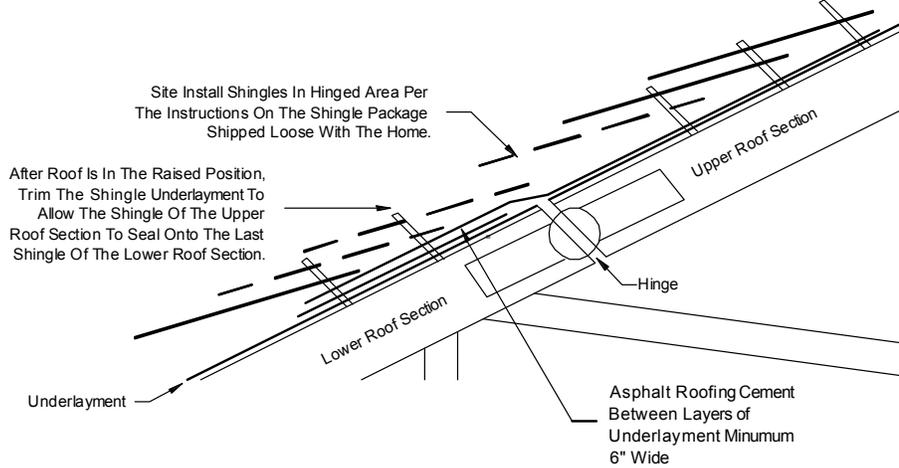
Figure 31 locations (left) and III (right).



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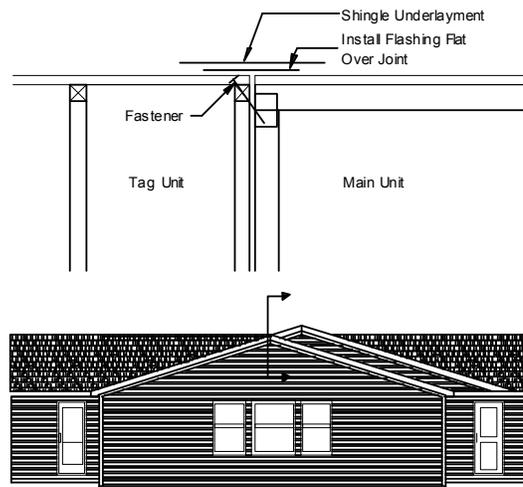
2. **Install shingles.** Install missing shingles according to the shingle manufacturer's instructions.

STEP 2. COMPLETE TAG UNIT ROOF

If the home has a tag unit, complete roofing for this unit now. The process for completing the roof is different for flush and offset roofs. Follow the instructions in the appropriate section below.

FLUSH ROOFS

For flush roofs, complete roofing along the marriage line and at the valley line as follows (see **Figure 34**):



Marriage line

Method 1: Install metal flashing (minimum 30 ga x minimum 6" wide) over the joint between the main roof dormer and tag unit roof. Secure the flashing to the roof decks on both dormer and tag unit roofs with roofing nails or 16 ga staples with a one inch crown and long enough to fully penetrate the roof decks. Space fasteners maximum two inches o.c. near the edge of the flashing. Overlap seams in the metal by at least two inches. After flashing is complete, install shingles per shingle manufacturer instructions and ridge cap/vent according to **STEP 1**.

COMPLETE ROOF (p. 55).



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MODEL MANUFACTURER'S INSTALLATION MANUAL



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Method 2: Install two layers of roofing underlayment or equivalent over the joint between the main roof dormer and tag unit roof lapping the factory installed underlayment a minimum of six inches on each side and fully cemented at the laps. Install shingles per shingle manufacturer instructions and ridge cap/vent according to **STEP 1**.

COMPLETE ROOF (p. 55).

Valley line

Along the bottom of the valley, shingles and one or more layers of roll roofing may need to be installed. If fastened to the roof at the factory, unroll the roofing, overlap the tag roof and trim the roofing to the roof edge. If shipped loose, install the roll roofing at the valley, lapping it under the factory installed roll roofing a minimum of 12 inches and fully cement the roofing at the lap. Complete shingles at the valley either by interweaving them or by trimming back approximately four inches from the valley line and fully cementing the exposed shingle edges.

STEP 3. COMPLETE SIDE WALLS

Siding necessary to complete the exterior has been provided with the home. Follow the siding manufacturer's instructions (found on or with the packaging or as an addendum to this manual) and to complete the exterior siding as follows:

1. **Remove shipping protection.** Remove temporary shipping protection from walls.
2. **Complete crossovers.** Complete any crossover connections in the walls, including: electrical, stereo speaker, doorbell, telephone, and intercom wires.
3. **Install siding.** Fasten siding only at stud locations, avoiding electrical wires that are present in the walls.
4. **Install close-up of strips.** If siding has been installed on the end walls at the factory, fasten close-up strips securely along both edges and seal the edges with a waterproof sealant.
5. **Install trim.** Install any matching trim required to complete the installation.
6. **Seal penetrations.** With a waterproof sealant, seal any penetrations in the siding that may have been caused by temporary shipping protection.

▶ go to **Connect Crossovers** (p. 59).



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Covering

Do not cover label on home.

Removing

temporary protection before installation. Serious damage may result.

Connect Crossovers

This chapter covers crossover connections between units of multi-section homes, including ducts and electrical, water, waste, gas, telephone, and cable TV connections.

Follow the Steps below:

- ▼ **STEP 1. CONNECT DUCTS** (p. 59)
- ▼ **STEP 2. CONNECT ELECTRICAL CROSSOVERS** (p. 62)
- ▼ **STEP 3. INSTALL ELECTRICAL BONDING** (p. 64)
- ▼ **STEP 4. CONNECT WATER LINES** (p. 65)
- ▼ **STEP 5. CONNECT DRAIN, WASTE, AND VENT LINES** (p. 66)
- ▼ **STEP 6. CONNECT GAS LINES** (p. 68)
- ▼ **STEP 7. CONNECT TELEPHONE AND CABLE TV WIRING** (p. 68)

STEP 1. CONNECT DUCTS



Qualified personnel. Use only qualified personnel to make crossover connections. Consult the LAHJ for licensing or any additional crossover connection requirements.

Access for service. Whenever possible maintain access to connection areas for future maintenance.

Make tight connections. Permanent, durable, and tight crossover duct connections are critical to the proper performance of the home. Leaky ducts can result in severe moisture problems in the home, discomfort from rooms not receiving the proper amount of conditioned air, and high utility bills from wasted heating and/or cooling energy.

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**Cover exposed metal.**

Completely cover all exposed metal connectors with insulation. Apply sealants and tapes only to surfaces that are dry and free of dust, dirt, and grease.

IN THE FLOOR CROSSOVER DUCT**Through the rim joist**

With a through-the-rim joist design, the duct in each floor section terminates at an opening in the marriage line rim joist. Fixed through-the-rim crossovers employing a marriage line gasket such as in **Error! Reference source not found.** were completed in **Complete Multi-Section Set, STEP 3. REPAIR OR INSTALL MARRIAGE LINE GASKET** (p. 44) and require no additional work here. Connect other through-the-rim joist ducts using the following method based on the design of the home.

There are 6" x 18" fiber glass crossover trunks at the marriage wall locate

Through the rim joist at two locations. Remove the 2x_ material over each opening which has been added for transit and to protect from weather/rodents. The trunk crossover has been completed. The gaskets have been shipped loose with the home & are to be field installed to each marriage wall rim joist opening. (nail or staple to rim joist 6" o.c. min.) Use typical multi-wide mating procedures shown in this manual to complete the floor connection. Test the crossover ducts/gaskets for leaks.

In-floor duct board crossover

Join ducts as follows (**Figure 35**):

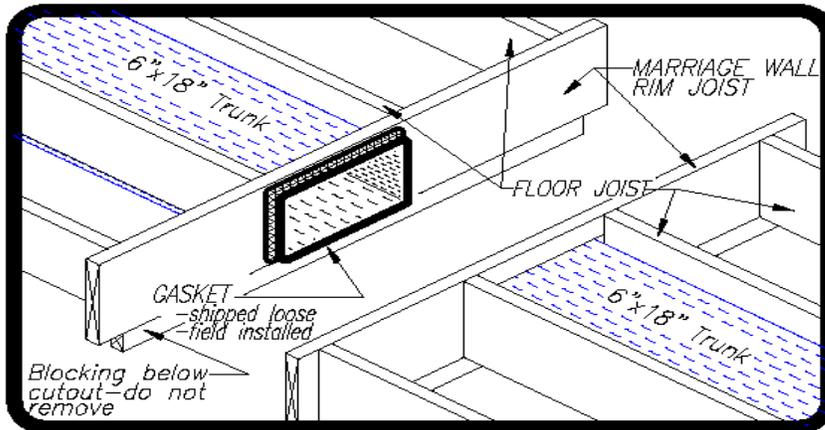


Figure 35. In-floor duct with crossover.

Rim Joist Cutout Locations & Foundation Blocking Requirements

- when marriage wall is above the joist cutout, no marriage wall foundation blocking is required
- when marriage wall opening is greater than 60", and joist cutout falls in the opening, each end of the marriage wall will have foundation blocking. No additional blocking is required below joist cutout.
- when marriage wall opening is less than 60", and joist cutout falls in the opening, marriage wall foundation blocking is required below joist cutout
- when loop system is used with the Lindsay Unified Floor System or the Clear Span 2000 Floor System, no additional blocking is required at the rim joist cutout.

STEP 2. CONNECT ELECTRICAL CROSSOVERS

Multi-section homes may have one or more electrical crossovers located in the wall(s) and/or floor(s) along the marriage line(s).

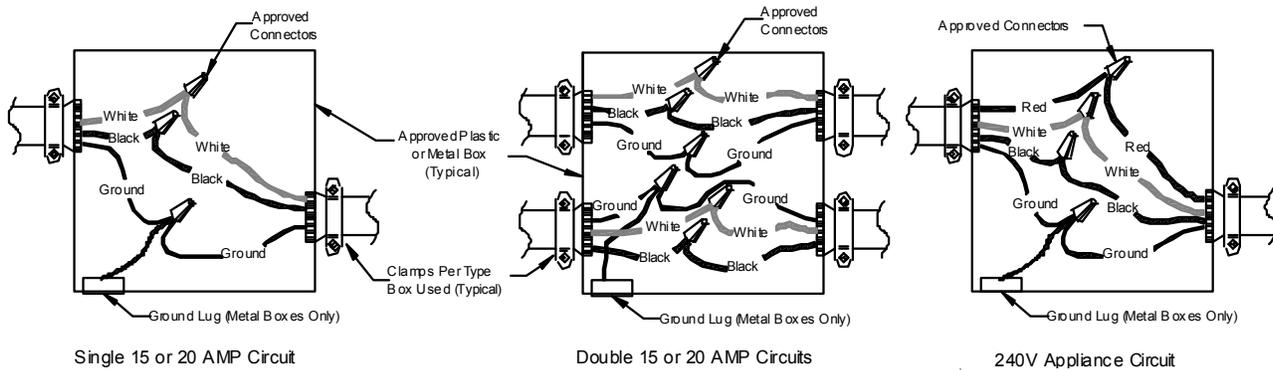
JOINING WIRES

Two types of connections may be present at these locations—snap connectors and junction boxes. Identify matching circuits if multiple circuits exist at a single crossover location. These will be coded for identification. Connect snap connectors according to the connector manufacturer's installation instructions, including fastener requirements.

Connect wires in junction boxes as follows (**Figure 36**):

Pull wires. Pull circuit wires into the junction box, sliding them through a romex connector and secure snugly. (**Figure 36**) Do not over-tighten.

1. **Strip wires.** Remove the outer jacket that holds the circuit wires together providing a minimum of four inches of free wire in the box.
2. **Connect wires.** Connect wires together matching like colors, using appropriately sized wire nuts. Use the ground wire to ground the junction box and/or cover plate(s), if metal. Junction boxes may contain single or multiple 15 or 20-amp circuits, or a single 240-volt appliance circuit.
3. **Replace cover.** Reposition the junction box cover and secure using machine (not sheet metal) screws.



Use qualified electricians. All electrical work must be performed by a qualified electrician and comply with the 2005 NEC.

Disconnect power. Turn off power to the home before making connections.

Proper use of GFCI circuits. Ensure Ground Fault Circuit Interrupted (GFCI) circuits are connected to the proper GFCI protected circuits from the power supply.

Figure 36. Types of junction box wiring connections

FLOOR CROSSOVER

When making electrical connection(s) in the floor, use one of the wiring options described below:

Method 1: Access panel

1. **Access wires.** Find the crossover location(s) and remove the access panel(s) if attached. If access panel openings are not provided, cut through bottom board to expose the wiring (**Figure 37**).
2. **Route wires.** Pass the wires through predrilled holes or notches in the rim joist or if there is a single bumped-out access panel as in **Figure 38**, then under the rim joists. If holes or notches have not been provided and there is no bumped-out access panel, drill maximum one-inch diameter hole(s) half-way up the rim joists on each home section, making sure the holes align and feed the wire through the hole.
3. **Connect wires.** Connect wires via a junction box or snap-connector(s) as



Using snap connectors. Do not use oversized nails or drive nail heads into snap connectors. Some connectors are designed for one-time use only – a new connector must be used if they become separated.

Protect cables. Cover all cables with conduit or



resistant and protective material.

- described above.
- Secure wires.** Secure wires with staples to adjacent joists or studs within eight inches of junction box or snap-connector(s).
 - Install smash plates.** For notched perimeter joists, install steel wire protectors (smash plates).
 - Seal bottom board.** Replace insulation and re-install access panels and/or seal the bottom board with tape specially made for that purpose (may be provided). The access panel(s) may be temporarily installed near the crossover location or shipped loose with the home.

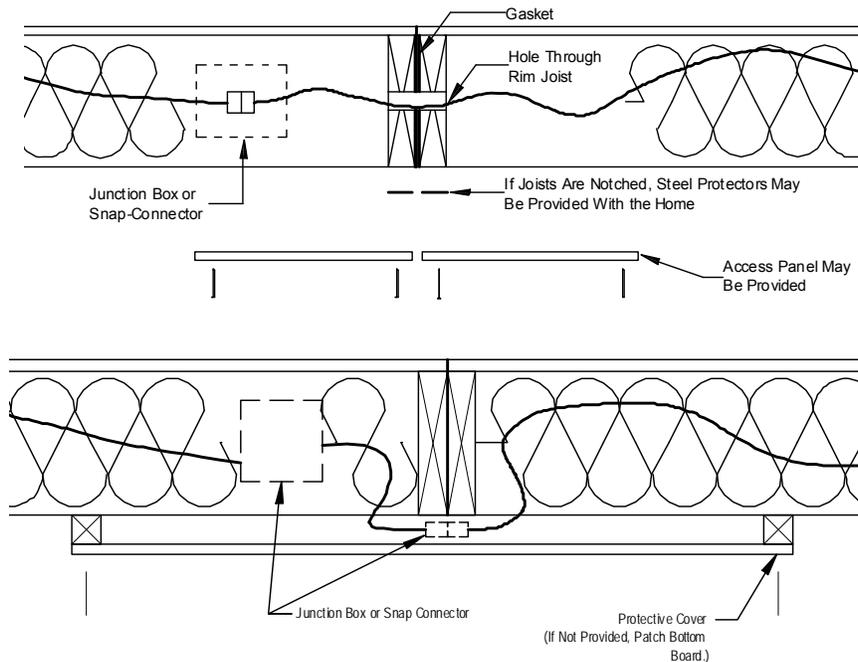


Figure 37. Electrical crossover floor wires with flush access panels

Figure 38. Floor electrical crossover wires with bumped-out access panel

Method 2: Junction box with conduit

- Access boxes.** If junction boxes are not exposed, access them inside the floor by cutting the bottom board or by removing the access panel(s). Remove the junction box covers.
- Connect wires.** If wire is coiled inside one junction box, insert it into provided flexible conduit and pass it under the rim joists to the opposing box and make the connection as described above. If no coiled wire is provided, install provided ship-loose conduit with wire making connections in both boxes (**Figure 39**).
- Cover boxes.** Replace and secure covers on junction boxes.
- Seal floor.** Replace any displaced insulation and replace access panel or seal the bottom board with tape specially made for that purpose (may be provided).

Variation to Method 2: A junction box may be installed only on one side with the other side containing conduit behind an access panel. Bring the conduit to other side and make one connection in the junction box.



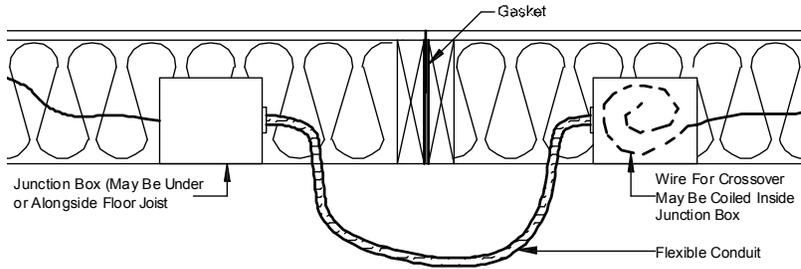


Figure 39. Under the rim joist electrical crossover connection with conduit

WALL CROSSOVERS

Connect electrical, phone, cable television, and stereo speaker wires in marriage walls and/or partition and end walls.

If access panels into the marriage walls are not provided, then the connection should have been made prior to bringing the home sections together. If access panels are provided in marriage, end or partition walls, remove the panels, join the wires as described above using the provided snap-connector, junction box, or at a receptacle, and re-attach the access panel (**Figure 40** for marriage walls and **Figure 41** for partitions and end walls).



Avoid damaging crossover wires.

Carefully fold marriage wall crossover wires so they stay within a single bay and are not sandwiched between studs when the sections are pulled together.

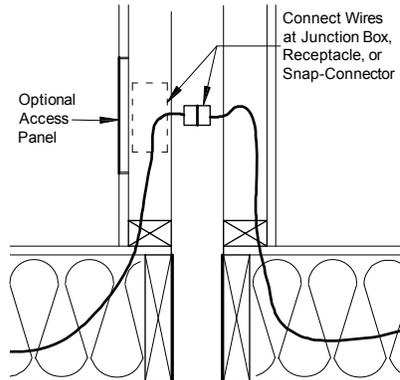


Figure 40. Inside marriage wall crossover connection

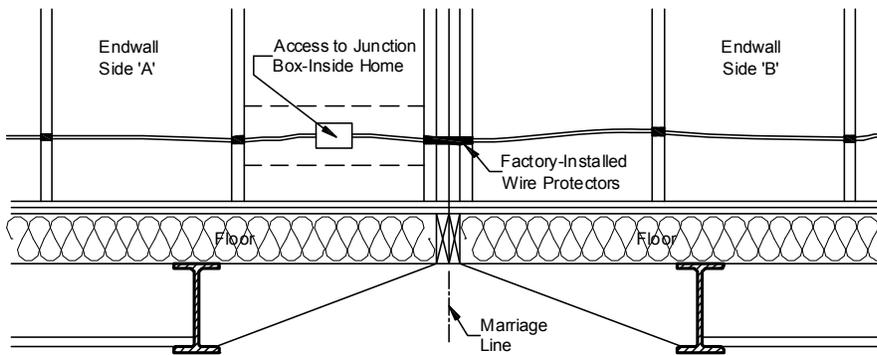


Figure 41. Inside partition or end wall electrical crossover connection

STEP 3. INSTALL ELECTRICAL BONDING

To ensure all metal parts are effectively grounded, electrically bond all chasses together as follows (**Figure 42**):

1. **Find lugs.** Determine if solderless ground lugs are provided on the front or rear frame outriggers or headers.
2. **Attach wire.** If lugs are provided, uncoil the bonding wire (#8 minimum bare



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copper wire) from one side of the home and connect it to the lug provided on the opposing side using the provided paint penetrating star washer, tighten the set screw firmly on the wire and repeat for any additional home sections.

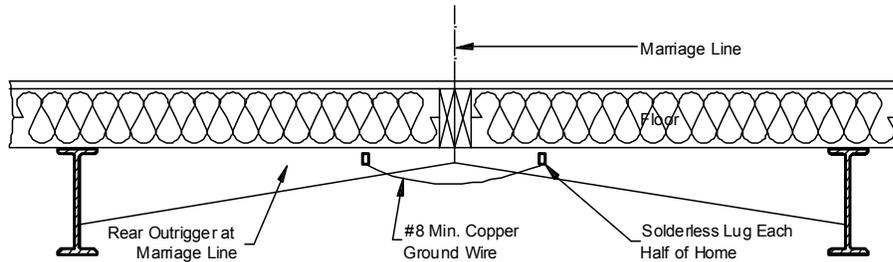


Figure 42. *Electrical bonding of multi-section homes*

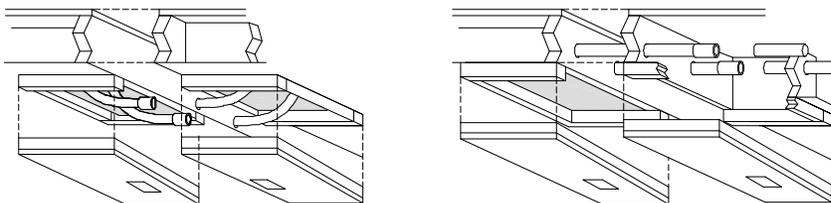
3. **Attach strap.** If ground lugs and copper wire are not provided, attach the provided four-inch bonding strap to each pair of adjacent chasses with two #8 x 3/4" self-tapping metal screws (one screw each side).

STEP 4. CONNECT WATER LINES

Connect water lines inside the floor through access panels or below the bottom board as follows:

WATER LINES ACCESSED THROUGH PANELS

1. **Remove panels.** Remove access panels from each home section.
2. **Remove caps.** Remove shipping caps from ends of water lines.
3. **Pull lines.** Pull water lines through holes in rim joist. If holes are not provided, drill round holes in the center of the rim joist, with a maximum diameter of one third the rim joist depth (**Figure 43**).
4. **Connect pipes.** Connect threaded water lines using provided connector fittings (do not use lubricants or sealants). Connect non-threaded water lines using provided fittings and cement, inserting pipe to full depth of each fitting (a short connector pipe may be provided to bridge the gap between sections).
5. **Test.** Test connections for leaks.
6. **Seal floor.** Securely replace insulation and access panels.



Applying cement. Follow cement manufacturers instructions with respect to application and drying time. Allow cement to fully cure before filling pipes with water.

Figure 43. *Water line crossover with access panels*

WATER LINES DROPPED BELOW BOTTOM BOARD

1. **Remove caps.** Remove protective shipping caps from ends of pipes and make sure pipe ends are clean and smooth.
2. **Connect pipes.** Connect threaded water lines using flexible pipe or a rigid connector line (if provided) and connector fittings (do not use lubricants or sealants). Connect non-threaded water lines, pipe, and elbows with cement provided, inserting pipe to full depth of each fitting (**Figure 44**).
3. **Test.** Test connections for leaks.
4. **Protect pipes.** Wrap water lines with insulation and bottom board shipped loose with home or otherwise protect to prevent freezing. Tape bottom board using tape



Choosing cement type. Use the proper cement for water lines as it may differ from the cement used for the DWV system.

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specially made for that purpose (may be provided) and staple with 7/16" x 1/2" staples at four inches o.c. around bottom board using a divergent (stitch) stapler or equivalent. If heat tape is used it must be listed for manufactured home use and be installed in compliance with manufacturer instructions.

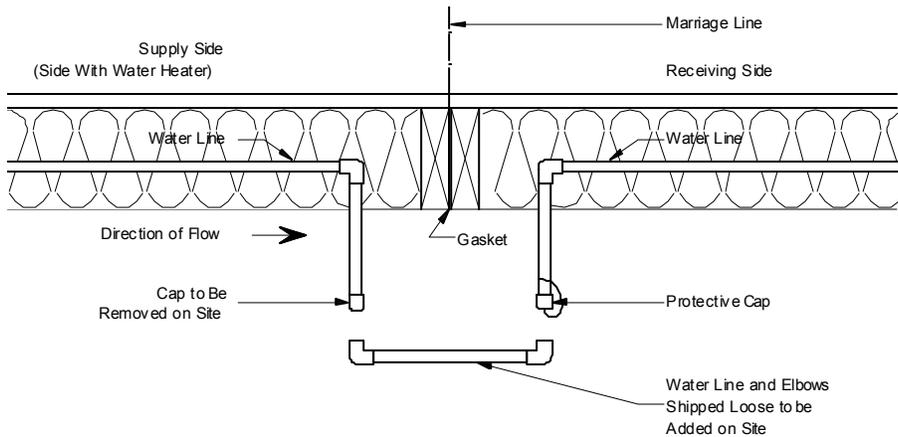


Figure 44. Water line crossover through bottom board

STEP 5. CONNECT DRAIN, WASTE, AND VENT LINES

Complete portions of the drain, waste, and vent (DWV) system that are below the floor as follows:

1. **Remove caps.** Remove shipping covers from pipes extending through the bottom board; inspect pipes and fittings and clean them of dirt, obstructions, and burrs.
2. **Assemble pipes.** Using the drain schematic drawing provided with the home, begin assembling the DWV system starting at the location farthest from the sewer/septic connection and working towards the outlet, fastening the pipe with cement or adjustable screw-clamp connectors, if provided (**Figure 45**). As the system is assembled, support the piping with temporary blocking. Unless otherwise noted on the schematic diagram, provide a minimum 1/4 inch per foot slope towards the sewer/septic using a plumber's level. Where a slope of 1/4 inch per foot cannot be maintained, use a minimum slope of 1/8 inch per foot and install of a full-size clean-out at the uppermost point of the run (**Figure 46**).



Providing required clearances. Provide the drain outlet with a minimum clearance of three inches in any direction from all parts of the structure or any appurtenances and with not less than 18 inches unrestricted clearance directly in front of the drain outlet. Provide any cleanouts with a minimum clearance of 12 inches directly in front of its opening.

Figure 45. Drain crossover connection

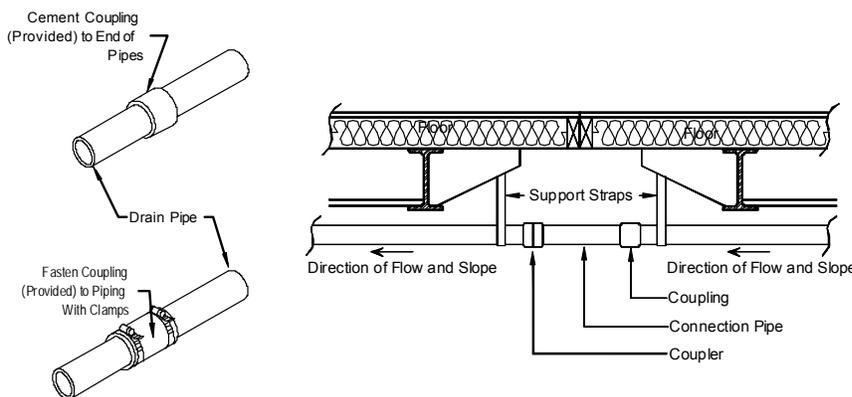
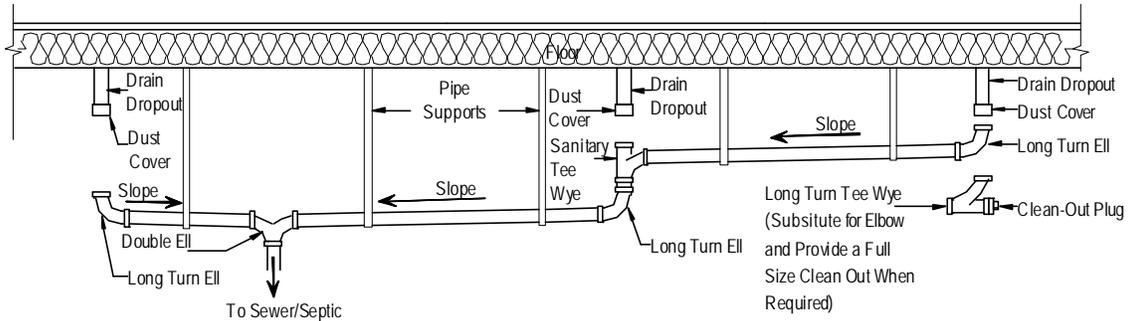
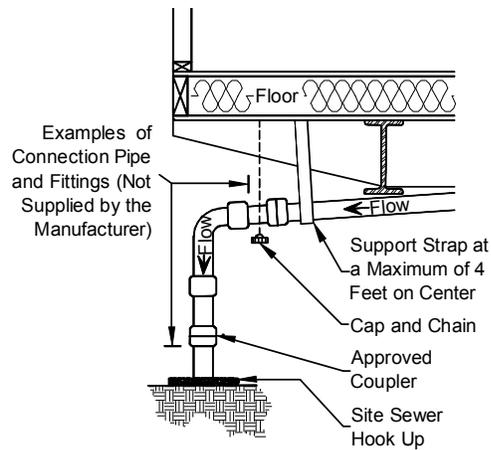


Figure 46. DWV system



3. **Test.** Conduct a two-part leakage test on the completed drainage system as follows:
 - Part 1. With all fixtures connected, and all tub and shower drains plugged, fill the system with water to the rim of the toilet bowl through a higher fixture. Release all trapped air, replace tub and shower plugs, backfill fixtures, and allow the system to stand at least 15 minutes. Check for leaks. Drain the system. If leaks are found, repair and retest.
 - Part 2. Plug all fixtures, sinks, showers, and tubs and fill with water. Release the water in all fixtures simultaneously to obtain the maximum possible drain piping flow. As water is draining, check for leaks. If any are found, repair and retest.
4. **Connect to outlet.** Connect the main drain line to the site sewer/septic hook-up, using an approved elastomer coupling (**Figure 47**).

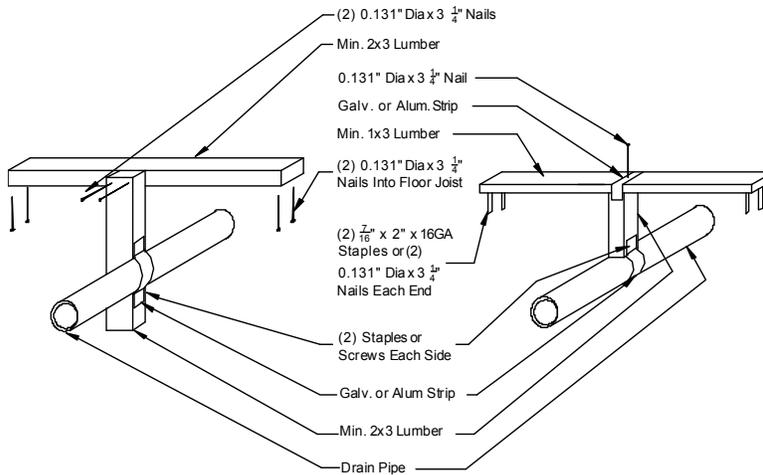


5. **Install supports.** Install permanent drain line supports at a distance of four feet o.c. or less (see **Figure 45**, **Figure 47**, and **Figure 48**).



Choosing glues. Use only solvents and glues compatible with the pipe (ABS or PVC). Follow manufacturer's instructions.

Figure 47. DWV connection to sewer/septic



- 6. Insulate.** Replace all insulation and make sure all potentially exposed portions of the DWV system are well insulated to protect against freezing.

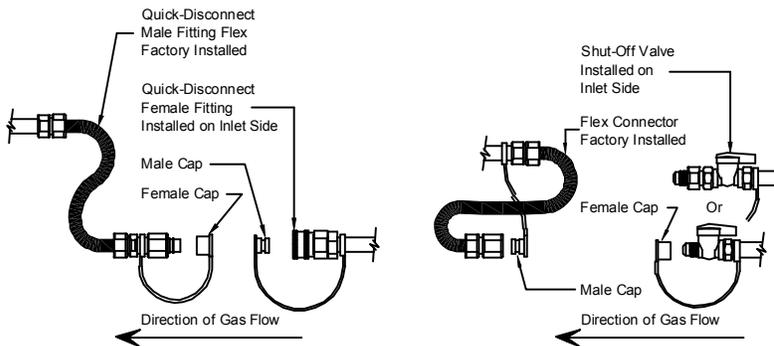
STEP 6. CONNECT GAS LINES

The gas crossover connection may use quick disconnect fittings or threaded connectors. Find the connection location below the floor at the marriage line and gather the connectors (they may be shipped loose if not present under the home).

For quick disconnect fittings (**Figure 49**), remove any dust caps and then with one hand, pull back on the quick disconnect device, snap it over the quick disconnect adaptor and release it to complete the connection.

For threaded connectors (**Figure 50**), remove the black cap and nipple (or any other plugs, such as a black iron plug) from both the supply and receiving sides and screw the connector onto the supply and return pipes as necessary.

Check for leaks before connecting to gas service (see **Connect Utilities, STEP 3. CONNECT GAS SERVICE**, p. 93).



STEP 7. CONNECT TELEPHONE AND CABLE TV WIRING

Install telephone and cable television wiring in accordance with the requirements of the LAHJ, the NEC, and NFPA No.70-2005. When making crossover connections or installing telephone or cable television wires, do not run them in the same raceway as, or in close proximity to, high voltage electrical conductors or cables.

Wires should only be installed by trained professionals.

▶ go to **Complete the Interior** (p. 69)

Figure 48. DWV pipe support options



Protect pipes from freezing. If the home is to be left unheated in cold weather, pour antifreeze solution into all drain traps, including sinks, tubs, and toilets. Be sure that the antifreeze is safe for the fixtures and P-traps.

Installing quick disconnect fittings. Do not use tools, lubricants, or sealants with quick disconnect fittings.

Gas test precautions. Do not connect to gas service until tests described in Connect Utilities have been successfully completed.

Figure 49. Gas crossover with quick disconnect fittings

Figure 50. Gas crossover with threaded connectors



Installing wiring. When installing telephone and cable television wires, do not damage electrical wires, plumbing lines, or ducts. Serious personal injury or death could result from damage to electrical wires.

Complete the Interior

This chapter covers the completion of the home's interior finishes including finishing walls, ceilings, flooring, trim, and miscellaneous items.

Follow the Steps below:

- ▼ **STEP 1. ALIGN MARRIAGE WALLS** (p. 69)
- ▼ **STEP 2. FINISH GYPSUM BOARD** (p. 69)
- ▼ **STEP 3. COMPLETE WALL AND CEILING FINISHES** (p. 70)
- ▼ **STEP 4. COMPLETE CARPET** (p. 70)
- ▼ **STEP 5. COMPLETE TRIM** (p. 70)
- ▼ **STEP 6. INSTALL SHIP LOOSE ITEMS** (p. 70)

STEP 1. ALIGN MARRIAGE WALLS

Align and secure walls at marriage line openings as follows:

1. **Align walls.** Align walls and clamp in place.
2. **Fasten walls.** Secure clamped walls together with metal straps or long screws so they do not move when the clamps are removed. Insert wood wedges in gaps between walls, and glue and screw to create a tight connection.
3. **Fill gaps.** Fill any remaining gaps with wood or sheathing material.

Does the home require patching and finishing gypsum board walls or ceilings?

- ▶ **YES**, go to **STEP 2. FINISH GYPSUM BOARD**, (p. 69)
- ▶ **NO**, go to **STEP 3. COMPLETE WALL AND CEILING PANELS**, (p. 70).

STEP 2. FINISH GYPSUM BOARD

Finish all unfinished gypsum board walls and ceilings as follows:

1. **Install panels.** Install ship loose gypsum panels using a 1/4 inch diameter bead of adhesive on all framing members and minimum 1-1/2 inch long drywall screws, nails, or staples at six inches o.c. along panel edges and 12 inches o.c. in the field into framing members.
2. **Mud seams.** Mud and tape all seams and corners, filling all fastener depressions. Follow mud manufacturer's directions.
3. **Paint.** When the final coat of mud is dry, prime and paint all unfinished gypsum board to match existing paint color and finish texture.

Does the home have pre-finished interior wall panels at the marriage line?

- ▶ **YES**, go to **STEP 3. COMPLETE WALL AND CEILING PANELS**, (p. 70)
- ▶ **NO**, go to **STEP 4. COMPLETE CARPET**, (p. 70).



Fastening gypsum. When attaching gypsum board, depress, but do not break the paper face with the fastener. Breaking the paper will weaken the connection.

Using alternative materials. Obtain the home manufacturer's approval before using interior finish materials other than those provided with the home.

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STEP 3. COMPLETE WALL AND CEILING FINISHES

Install interior ship loose wall and/or ceiling panels using a 1/4 inch diameter bead of polyvinyl acetate (PVA) adhesive on all framing members and fasten with minimum 1-1/2 inch long staples or nails at six inches o.c. along panel edges and 12 inches o.c. in the field into framing members.

STEP 4. COMPLETE CARPET

Install and seam ship loose or rolled carpet as follows:

1. **Prepare floor.** Clean the floor of all dirt and debris and smooth the floor deck at the marriage line seams as necessary to ensure a level and smooth surface.
2. **Lay pad.** Lay down the carpet pad, if provided.
3. **Stretch carpet.** Ensuring all carpet "grain" runs in the same direction, fit and secure the carpet using a power carpet stretcher. Stretch the carpet up to the seam and tack it down temporarily until the carpet is seamed.
4. **Butter carpet.** "Butter" with carpet adhesive the edges of the carpet along the seam.
5. **Seam carpet.** Place heat bond tape under the seam with the glue side next to the carpet and apply heat from a seaming iron to the top of the seam, pressing the carpet into the glue.
6. **Keep scraps.** Retain reasonable size carpet scraps to protect carpet and flooring during move-in.

STEP 5. COMPLETE TRIM

Using fine gauge wire staples or pin nails, install ship loose molding and wainscot paneling to finish trimming out ceilings, marriage line walls, front and rear end walls, and passageway doors where necessary.

STEP 6. INSTALL SHIP LOOSE ITEMS

Remove all strapping, blocking, and packaging from appliances, windows, and doors. Install any drapes, mini-blinds, mirrors, door stops, closet shelves, and hardware per the product manufacturer's installation instructions.

Proceed based on the foundation type:

- ▶ Pier and ground anchor, go to [Install Stabilizing Systems](#), (p. 71)
- ▶ Load bearing perimeter wall, go to [Connect Utilities](#) (p. 87).



Installing carpet. Only experienced carpet installers should install carpet. Failure to follow the carpet manufacturer's directions may void the carpet warranty.



Stagger seams.

Stagger all seams. For example, locate the carpet pad seam three inches to left of marriage line and the carpet seam three inches to right of marriage line.



Install Stabilizing Systems

This chapter covers the design and installation of the stabilizing system which secures the home against lateral and upward forces caused by wind. The system covered here uses earth (or ground) anchors and steel straps connected to the home's longitudinal steel beams and/or exterior walls. Stabilizer plates may also be used to prevent the anchor head from moving laterally in the ground. An anchor, strap, and stabilizer plate (if used) together are referred to as a tie-down.

All tie-downs must be listed.

Anchors can also be mounted in concrete footings when there is enough concrete mass (weight) to resist the lateral and upward forces. This type of system is not covered in this manual.

Approved anchoring systems other than what is shown in this manual may be used when approved by local authority having jurisdiction.

When an installer does not provide support and anchorage in accordance with the approved manufacturer's installation instructions, or encounters site conditions (such as areas that are subject to flood damage or high seismic risk) or other conditions that prevent the use of the instructions provided in this manual, the installer must obtain special site-specific instructions or use a design approved by a registered engineer or registered architect.

Follow the Steps below:

- ▼ **PIER CONSTRUCTION** (p. 72)
- ▼ **TIEDOWN INSTALLATION AND PLACEMENT** (p. 74)
- ▼ **TIEDOWN SPACINGS** (p. 78)
- ▼ **MATE LINE ANCHORAGE** (p. 80)
- ▼ **LONG. ANCHORAGE** (p. 81)
- ▼ **INSTALL STRAPS** (p. 82)
- ▼ **TIGHTEN AND ADJUST STRAPS** (p. 86)