



Construction Manual



Construction Training Videos

Acknowledgements

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It is with great gratitude we offer this manual to our many friends of Appalachia Service Project. Thank you for working with families to make their homes warmer, safer, and drier.

Note to the Reader

This manual is written as a guide in construction methods and techniques used by Appalachia Service Project. Due to differing conditions, tools and individual skills, Appalachia Service Project assumes no responsibility for losses incurred, injuries suffered, or for any damages. Before beginning projects, please review project plans and instructions carefully. If any questions remain, please consult with your ASP staff, Construction Consultant, or the Ministries Department. Projects should always comply with local codes and regulations, and always follow safe work practices.

Appalachia Service Project welcomes comments and feedback about ways to improve this manual. Please contact us by any of these methods:

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Construction Tools & Materials Basics

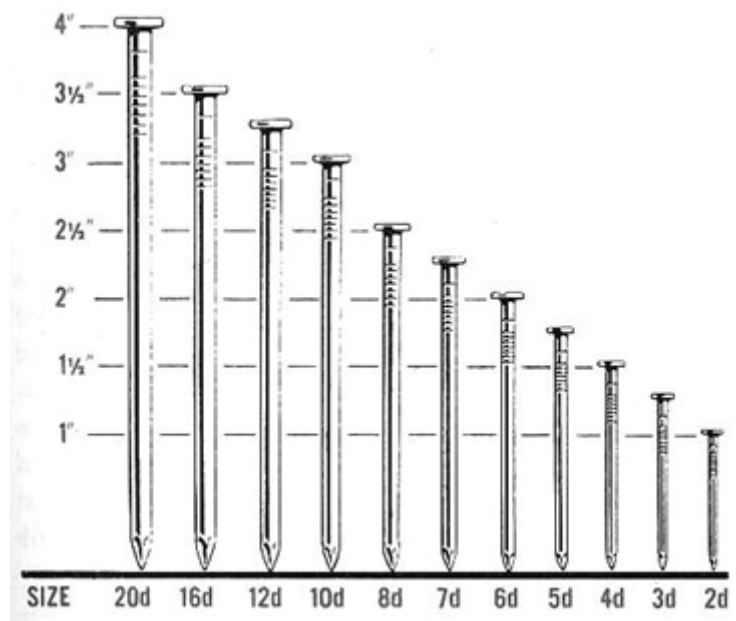
Fasteners

Interior Fasteners: not made to withstand moisture and will rust quickly if exposed to moisture.

Exterior Fasteners: coated to be protected from moisture, galvanized fasteners are exterior fasteners.

Nails

Nails are measured by “penny” which is represented by a lowercase “d.” The “d” indicates the length of the nail.



Types of Nails

Finish Nails:

- Used for trim (baseboard, door casing, etc.)
- Should be installed and then the head should be sunk $\frac{1}{8}$ " below the surface using a nail punch so it can be covered with putty
- Pre-drilling before installing finish nails can prevent nails from bending
- Interior and exterior finishing nails available



Roofing Nails:

- Used for attaching vinyl siding, vinyl soffit, vinyl underpinning, synthetic underlayment for roofing, shingles, some trim for metal roofing
- Come in a large range of length, 1 $\frac{1}{4}$ " - 2" will be adequate for most applications



Common Nails:

- Used most in wall framing
- Interior and exterior/galvanized common nails are available
 - Use galvanized with pressure treated lumber
 - Regular should be used with finished/white wood



Spiral Nails:

- Commonly used for attaching subfloor and deck boards for ramps/porches
- Has greater holding strength than common nails
- Interior and exterior spiral nails available



Ring Shank Nails:

- Used where a solid hold is desired, very difficult to work loose
- Used for attaching subfloor and deck boards for ramps/porches
- Has greater holding strength than common nails
- Interior and exterior ring shank nails available



Aluminum Trim Nails:

- Used to attach metal fascia and during vinyl siding to help hold partial cut pieces
- All exterior



Joist Hanger Nails:

- Used to attach joist hanger, hurricane ties, post boots, connection plate (See below)
- For exterior and interior use



Screws

Screw Heads

Screws come with a variety of types of heads that have specific drivers to fasten them

Phillips:

- Phillips drivers come in different sizes, the most common is #2



Straight Blade/Standard/Slotted:

- Often used in older homes prior to Phillips becoming the standard



Hex:

Hex drivers come in different sizes, the most common are 1/4" and 5/16"



Torx:

Torx drivers come in different sizes, the most common are T-25 and T-40
Trim screws will be T-10



Types of Screws

Deck Screws:

- Used for porches/ramps
- Can also be used for framing, floor repairs
- Comes in a variety of lengths with torx heads of varying sizes
- Most commonly used are 2 ½" and 3", which both have T-25 heads
- All exterior rated, can be used inside as well



Drywall Screws:

- Used to hang drywall, can also be used to fasten flooring underlayment
- Come in a variety of lengths, 1 ½" - 2" should be adequate for most applications
- Have phillips heads
- For drywall, can be installed with a Phillips dimpler bit that countersink the screw heads before mud is applied
- Only for interior use



Lathe or machine Screws: (need image)

- Used to attach rigid foam insulation, purlins/furring strips, and vinyl siding to any metal siding.
- These should ALWAYS be used in place of roofing nails when attaching siding, foam, and other materials to any metal skin on a mobile home.
- When buying be sure to purchase self-tapping to avoid the need to predrill holes.



Neoprene Screws:

- Used to install metal roofing and metal underpinning
- Have a neoprene gasket that make a watertight seal
- Have hex heads, most commonly ¼" or 5/16"
- Come in a variety of lengths, 1 ¼" - 2" should be adequate for most applications



Other Fasteners

LedgerLOKs:

- Used for porches and ramps
- Have either hex (typically 5/16") or torx (typically T-40) heads
- For exterior and interior use
- Come in a variety of lengths, 3 ½" - 4 ½" should be adequate for most applications



Joist Hanger Screws: (Simpson Strong Tie is the most common brand)

- Joist Hanger Screws are specifically designed to replace joist hanger nails as connector fasteners.
- Do Not use Deck Screws in Joist Hangers
 - Deck Screws have a thinner shank that is not designed to the shear strength of a Joist Hanger Fastener.



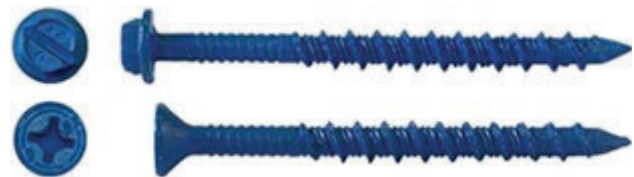
Trim Screws:

- Used as an alternative to finish nails
- Come in a variety of lengths, 2" should be used
- Most have torx heads, typically T-10



Concrete Screws:

- Used to fasten brackets to concrete or attach lumber to concrete
- For exterior or interior use
- Hole must be pre-drilled using a hammer drill and masonry bit
- Come in a variety of lengths and widths, the package will list needed size of pilot hole
- Have either hex or Phillips bits



Carriage Bolts:

- Used to attach piers to floor system in room addition.
- Come in both interior grade and galvanized for exterior use
- Hole must be drilled before bolt is installed, a 1/16" larger hole than the diameter of the bolt
- Come in a variety of widths and lengths for different applications
- Nut and washer sizes should coordinate to bolt size



Concrete Anchor:

- Used with a post boot (see below) to connect a post to concrete or to attach dimensional lumber to concrete
- Hole must be pre-drilled in concrete with a hammer drill and masonry bit
- Come in a variety of lengths and sizes, depending on application
 - Packaging will indicate size of pre-drill needed
- $\frac{1}{2}$ " x $3\frac{3}{4}$ " can be used to attach a post boot or to attach 2x material to concrete



Connection Pieces:

(All of these must be attached with specific Joist Hanger Nails or Screws)

Joist Hangers:

- Used to hang joists for porches or floor systems
- Attached with joist hanger nails through the flat surfaces and 2 ½" screws or 8d nails through the diagonal holes
- Come in different sizes according to joist size



Post Boots:

- Boots used to anchor the bottom of the post to concrete
- There are a variety of types of post boots that connect into wet concrete or hardened concrete and a concrete anchor is used to make the connections



Connection Plates:

- Used during band joist repair
- Helps reinforce holding power where a flat surface is necessary
- Attach with joist hanger nails



Hurricane Ties:

- Used to attach rafters to walls, girders to floor systems, and other connections
- Attached with joist hanger nails
- 3 holes of each surface should be filled



Fastening Information

- Determine the size of fastener needed:
 - For most cases, use a fastener twice as long as the width of the smaller material
 - Choose a fastener that will not stick all the way through the second piece of wood
- When fastening two pieces, fasten through the thinner material first
 - For example, fasten through the subfloor into the floor joist or through the deck board into the porch joist
 - When fastening at the end of a board predrill to prevent splitting
- Toe Nailing/Toe Screwing
 - Fastening nails or screws at an angle to hold pieces of wood together
 - Start fastener perpendicular to the surface, once it breaks the surface, move it to the correct angle and finish driving in fastener
 - Pre-drilling can help ensure direction of toenail/screw

Construction Adhesives and Tape

- Construction Adhesive
 - Brands include Liquid Nails, Loctite, Gorilla, Dap, etc.
 - Most used type of Construction Adhesive and will be what vols and homeowners refer to when talking about “Construction Adhesive”
 - There are different types for various materials, wet and dry uses, interior/exterior, and strengths of bonding.
 - This is used to attach subfloor to floor joists as well as many other applications



- Super Glue
 - Available in similar brands to Construction Adhesive
 - Not as commonly used but can be handy for making smaller repairs if something that is not frequently used or a personal item is broken
 - Thinner than Construction Adhesive



Construction Tools & Materials Basics

- Duct Tape
 - Commonly known as “Duck Tape” which is also a brand.
 - True Duct Tape is made from thin aluminum with a paper backing that will need to be peeled off. (Some auto racing fans may call it 200 MPH tape)
 - Common duct tape has a variety of uses (see MacGyver)
- House wrap Tape
 - Used to seal the seams in house wrap and foam insulation. Commonly used on HUGs
- Painter’s/Masking Tape
 - Blue tape typically used to mask off areas that are to be painted
 - Comes in various widths but 1 ½ and 2-inch widths will be the most common
 - Can have different adhesive strengths (read packaging). The tan masking tape is usually stickier and more difficult to remove than blue.
 - There is also green painter’s tape
- Electrical tape
 - Black (typically) rubbery tape used in electrical work
 - Can be other colors and is nice to have if you need to mark specific wires
- Plumbers tape
 - Thin Teflon-based tape that goes on pipe threads for plumbing fixtures
 - Brands include Oaty, MegaTape, Hercules, Blue Monster
 - There are different types of this tape for use on specific water and air lines vs. Gas lines.



Tools

Hand Tools

- Hammers
 - Claw - Most used. A claw hammer is used to drive and pull nails, knock boards into place,



demolition, and many other uses in construction.

- Sledge - This is a heavy-duty striking tool primarily used for demolition work or driving stakes (such as rebar for underpinning). They come in a variety of weights and sizes depending on the use.



- Screw Drivers - are used for tightening or loosening screws and come in different head shapes to match the different screw head shapes.
 - Philips Screwdriver



- Standard/Straight/Flathead Screwdriver



Construction Tools & Materials Basics

- Chisels/Marples (various sizes)
 - Used for carving, cutting, or shaping materials like wood, stone, or metal. Most commonly will be used when notching posts and to adjust to position of door strikers.



- Hand Saw - is a manually operated cutting tool used to cut materials like wood or drywall



- Hack Saw – a manually operated cutting tool used to cut through hard materials like metal and plastic, including pipes.



- Utility Knife (box knife, razor knife, etc.) – hand tool used for cutting cardboard, drywall, plastic, carpet, etc.

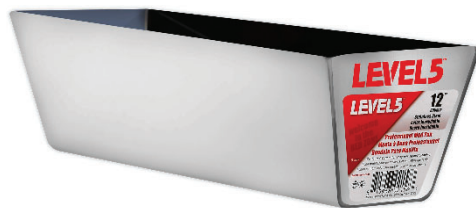


Construction Tools & Materials Basics

- Drywall trowel (putty knife, mud knife)
 - Used to spread joint compound (mud, spackle)
 - A variety of sizes (2", 6", 10", or 12") for each coat.



- Drywall Tray – used in drywall finishing that is used for mixing, holding, and applying joint compound.



- Rasp – is a hand tool with teeth used for coarsely shaping and smoothing wood or other materials. It is similar to a file but has a coarser cut, making it more aggressive for shaping.



Construction Tools & Materials Basics

- Sanding Block – will come in the form of holder to wrap sandpaper around or specific block. This will provide a flat, even surface for sanding various materials including wood and drywall.



- Keyhole/Jab Saw – this is primarily used for making internal cuts, cutting in tight spaces, and cutting holes into drywall.



- Scraper – these come in various shapes and sizes and are used to remove material from a surface such as caulk, paint, glue, etc.



Ladders

Extension Ladders:

- Set up at a 1:4 ratio, with 1' away from the wall for every 4' of height
 - When your feet are planted at the base of the ladder, you should be able to reach your arms out straight and touch the sides of the ladder
- Both feet should be firmly on the ground
 - If the ground is uneven, use a shovel or claws of a hammer to dig out for the feet so that they sit flat
- Make sure the section of ladder with feet is closer to the home
- If using extension ladder to access roof, 3' or 3 rungs of the ladder should be extended above the eave of the roof
- Always face the ladder while climbing
- Another person should hold the bottom of the ladder when it is in use
- When working from an extension ladder, never reach so far that your belt buckle will be outside of the width of the ladder



A-Frame Ladders:

- Lock bars should be all the way down when A-frame ladders are in use
- If using ladder on uneven ground, use a shovel or hammer claws to dig out the ground so that the ladder sits flat, with all 4 feet on the ground
- Do not stand or sit on the top of an a-frame ladder
- Do not stand on the last rung before the top of the ladder
- Always face the direction of the ladder, do not work backwards from an a-frame ladder
- Do not leave items sitting on top of an a-frame ladder, they can easily fall on someone who picks up the ladder



Construction Tools & Materials Basics

Power Tools:

- Use proper safety equipment when using or working around someone using power tools
- Youth should be supervised by adults when operating power tools
- Unplug and place out of walkways when not in use
- Unplug when changing blade
- If the cord of a tool is damaged, do not use it
- Do not use power tools in the rain, make sure electrical connections are dry if the ground is wet
- Use only battery powered tools on roofs - cords create tripping hazards

Circular Saw:

- Used to cut sheet goods (OSB, paneling, lauan)
- Can be used to crosscut 2x material, but the miter saw, if available, will give a more controlled cut
- For safe operation the saw depth should be set to the thickness of the material being cut
 - Unplug while adjusting
- The saw can adjust to cut angles
- Unplug and clean out any sawdust build up that occurs in the saw
- Come corded or cordless
- There are different types of blades that can be used with a circular saw, depending on the material being cut
 - General Use Wood Blade - used for cutting plywood, OSB, 2x Material
 - Finishing Blade - used for finer cuts on materials like paneling, laminate flooring, 1x trim
 - Metal Cutting Blade - used to cut metal roofing, metal underpinning panels, and rebar



Wood Blade



Finishing Blade



Metal Cutting Blade

Miter/Chop Saw:

- Used to make straight or angled cuts on 2x material or trim
- Miter saws have a rotating lock that allow the angle of the cut to be adjusted
- Compound miter saws make angle cuts in two planes
- Piece of lumber has to be flat on the saw table and pushed back against the fence when cuts are made to achieve the desired angle
- Miter saws come in different sizes - these sizes dictate the size of the saw blade they hold (8", 10", and 12")
 - Make sure replacement blades are the appropriate size
- A miter saw can have a General-Purpose Wood Blade or a Finishing Blade (as in the circular saw section above)
 - Metal cutting blades should not be put on a miter saw



Reciprocating Saw (Sawzall):

- Used largely for demolition stages, does not make particularly accurate cuts
- Come corded or cordless
- Resting the guard on the saw against the material being cut reduces vibration
- Can cut wood or metal
 - Blades come in different lengths
 - depending on application
 - Different types of blades:
 - Wood Cutting Blade - cutting wood only
 - Demolition/Bi-Metal Blades - cutting through wood that contains nails
 - Metal Cutting Blades - cutting rebar



Jigsaw:

- Used for cutting thin sheet material at curves or finishing corners of cuts
 - Good for cutting out holes for vents in subfloor or notching deck boards around posts
 - If needed, pilot holes (larger than blade) should be drilled to give the jigsaw a starting point to cut out the shape



Construction Tools & Materials Basics

- There are two types of jigsaws: T-shank and U-shank
 - Saws will hold blades that are one shape or the other, not both
 - Metal and wood blades come with both types of shanks
 - U-shank blades are shown in top image below
 - T-shank blades are shown in bottom image below
- Jigsaws can cut wood or metal (only thin sheet metal)
 - A wood cutting blade is shown in the following top image
 - A metal cutting blade is shown in the following bottom image



Table Saw:

- Used to make long, straight cuts with the grain of the wood
- Can cut at angles
- The height of the blade above the table should be adjusted to the thickness of the wood being cut
- Push sticks should always be available and used when making cuts with the table saw
- Two people should work together when cutting on a table saw, one sending the piece through and the other receiving
- Never use a table saw that does not have a guard



Oscillating Multitool

- One of the most versatile tools available
- Can be used to cut multiple materials with the proper blade or to scrape paint with the scraper attachment



Angle Grinder

- Used to cut rebar for underpinning
- Can be used to cut metal siding or roofs on mobile homes more precisely



Construction Tools & Materials Basics

Router

- A tool used to put smooth rounded or decorative edges on the corners of wood.
 - Can be used to make porch/deck and ramp handrails look nicer
 - Can also be used if a room transition needs to be made



Sanders

- Belt Sander
 - Uses a rotating belt to sand surfaces smooth
 - Larger and somewhat heavy and used primarily for sanding large areas
- Palm/Orbital Sander
 - Small sander that uses square sheets of sandpaper
 - Used in smaller areas and can be more precise than belt sanders



Electric Shears

- Used for long cuts of any metal (primarily roof metal)
- It can be used to cut rounded holes for roof vents that require two pieces of roofing metal.



Construction Tools & Materials Basics

Drills/Impact Drivers:

- Used to fasten screws or drill holes
- Drills can be corded or cordless (left side image below), impact drivers are all cordless (right image below)



- Corded drills are typically more powerful
- Cordless drills/impact drivers allow greater mobility
- Hammer drills are used to drill holes in concrete using masonry bits
 - Most hammer drills also have a regular drill setting
- Impact drivers can only use drivers/bits with a 1/4" hex shank
 - There are bits for drilling holes with hex shanks, but they are more expensive and can be difficult to find
- Drills can use both traditional drill bits and drivers/bits with 1/4" hex shanks
- Drill Bits



A



B



C



D

- (A) Traditional Bit - Can come to drill in metal or wood, come in diameters up to 1/2" and in varying lengths
- (B) Masonry Bit - Used to drill holes in masonry (concrete, brick, masonry, etc.)
- (C) Paddle/Spade Bit - Used for boring holes up to 1 1/2" in wood
- (D) Hole Saw - Used for cutting holes from 1 1/2" - 6" wood cutting and metal cutting hole saws are available

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Girders & Piers

Why girders, piers, and foundations? Girders and piers are important to a home's foundation and help maintain stability of the floor system, making the home safe and long-lasting for homeowners.

Safety

- Beware of the conditions under the home (snakes/bees/animals, wastewater, etc.)
- Make note of any pipes/wires running underneath the home
- Wear eye protection when cutting with power saws or working close by
- Make sure temporary supports are holding the weight of the girder while concrete dries
- Wear proper PPE when working underneath a home (tyvek suits, gloves, long-sleeve shirts, etc)
- NEVER JACK UP HOUSES WITHOUT HRC OR CONSTRUCTION CONSULTANT APPROVAL AND GUIDANCE.

Girder/Pier Project Planning

- How will you access underneath the house?
- Is there enough room for volunteers to work?
- Is it safe for volunteers to be under the home?
- Is it dry under the home? How will you light the work area?
- Does it call for a wooden girder/pier or a sonotube?
- Are current joists over spanned? (Span chart on page 28)
- If the joists have fallen or if the floor damage is extensive enough to where a jack might be necessary, you must gain approval from ASP's Home Repair Coordinator.
- Will you be working on the subfloor as well? Should work be done from top or bottom?
- Will you need to build the girder in place (under the house) or is there room to build it outside and then move it in?
- How many piers will you need per girder? 4x4s or 6x6s?
- Where will water to mix concrete come from?
- How close will the girder be to the ground? If within 12", pressure treated lumber should be used.
- Ensure all necessary homeownership documents are collected before disturbing land.

Measurements Needed

- How large of an area needs to be supported/how many girders are needed?
 - 16' is the maximum length for a girder, if the area to be supported is greater than 16' use 2 separate girders
- Determine post size and length
 - If the space between the ground and the bottom of the floor joists is 60" or less, use a 4x4 post
 - If the space between the ground and the bottom of the floor joists is greater than 60", use a 6x6 post

Group Leader Tips

- If there is limited space under the home, you can mark where girder will go and dig holes before putting the girder in place so there is a little more head room while digging
- Girders can become heavy- it is best to have many hands available when installing the girder.
 - Assign who will be holding/fastening and make sure everyone has what they need before getting girder into place

Quality Control

- Check nailing pattern on both sides of girder
- Make sure that all seams of materials in the girder are staggered (OSB and 2xs) and supported by posts.
- Make sure joists are resting on girder (if not, make sure they are shimmed, or blocks are added until there is contact with a joist)
- Make sure hole is 16"x16"x16" and 8" of concrete is poured in the bottom of the hole (up to bottom of the post)
- Make sure adhesive is used between 2x material and OSB.
- Make sure pier and girder are properly connected with gusset plate or Simpson tie
- Make sure joists are attached to girders with hurricane straps, every 3rd joist. If working from the top and also installing new joists, make sure that the girder is set at the correct height so that when joists, subfloor, and finished floor are added the finish height will be the same as the original level in adjoining rooms.
- For sonotubes, make sure that the saddle of the tube extends above the I-Beam instead of resting underneath.

After Work is Complete Quality Control Check

- Are there enough piers? Is everything secured properly?
- Are temporary supports removed after concrete dries?
- Has insulation been reinstalled and is the site clear of construction waste?

Common Mistakes

- Girder in place, but not touching and supporting all joists
- Girder running horizontally instead of vertically
- Incorrect fasteners
- Post submerged too deep into the concrete or resting on top of concrete without bracket
- Pier to girder connected only with toe-screws
- Posts not plumb underneath girder
- Girder weight not adequately held by temporary supports

Girders & Piers

Girder Material List

Qty	Item	Notes
	2x8x___ PT	For Girder
	½" OSB	Center Strips in girder and gusset plates
	4x4x___ PT	Posts to support girder
	2x4x8 F	Temporary supports for the girder
	Concrete	(3) 60lb bags per hole or (2) 80lb bags per hole
	2x4x___ PT	Any additional blocking or sistering (if needed)
	Shims	Any areas where common joists don't sit directly in contact with girder
	Hurricane ties	Both sides of girder for every 3rd joist
	Joist hanger nails	To attach hurricane ties
	16d galvanized nails	Or 3" Deck Screws, to fasten girder together
	Construction adhesive	To glue girder components together and to attach gusset plates
	Concrete Post Boots	For each post support

Girder Recommended Tools

Safety:

- Glasses, Gloves, Ear Plugs, Masks
- Tyvek Suits/Black Plastic (based on conditions under home)

Power Tools:

- Circular Saw
- Drills/Impact Drivers
 - T-25 Driver to match deck screws

Digging/Concrete Tools:

- Shovels (Short handles may be ideal under home)
- Wheelbarrow or bucket
- Trowels Garden hoe
- Hose/Extra bucket for water

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc)
- Saw Horses
- Plumb bob
- Extension Cords/Splitters
- Caulk Gun
- Drop lights/flashlights

Sonotube Material List

Qty	Item	Notes
	Sonotube(s)	
	Concrete	(3) 60LB bags per hole or (2) 80LB bags per hole AND concrete to fill sonotube: $\pi \times \text{radius}^2 \times \text{height} = \text{volume}$ (simple concrete calculators available online to convert volume to # of bags)
	Duct Tape	
	Scrap Lumber	To brace sonotube if needed

Recommended Tools**Safety:**

- Glasses
- Gloves
- Dust Masks
- Tyvek Suits / plastic(based on conditions under home)

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc)
- Drop lights/flashlights/head lamps Extension Cord/Splitter

Power Tools:

- Reciprocating Saw
 - Wood Blade

Digging/Concrete Tools:

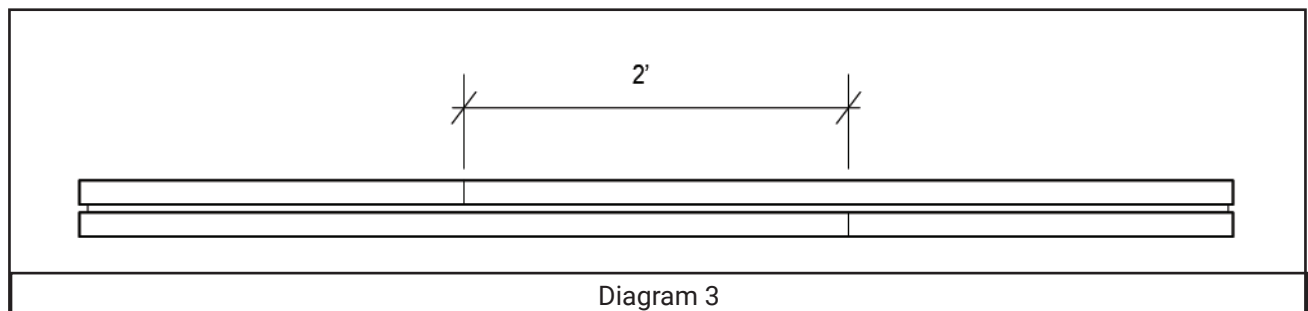
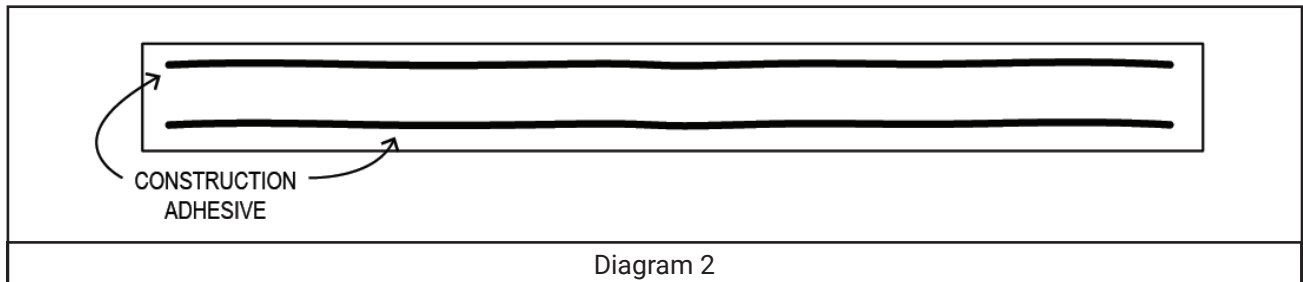
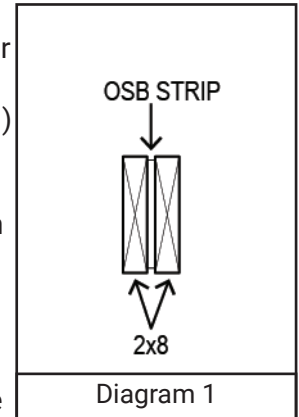
- Shovels (Short handles may be ideal under home)
- Wheelbarrow or bucket for water and to mix concrete in
- Trowels to mix/move concrete in bucket
- Garden hoe to mix concrete in
 - Cups for pouring concrete into the Sonotube

Girder Instructions

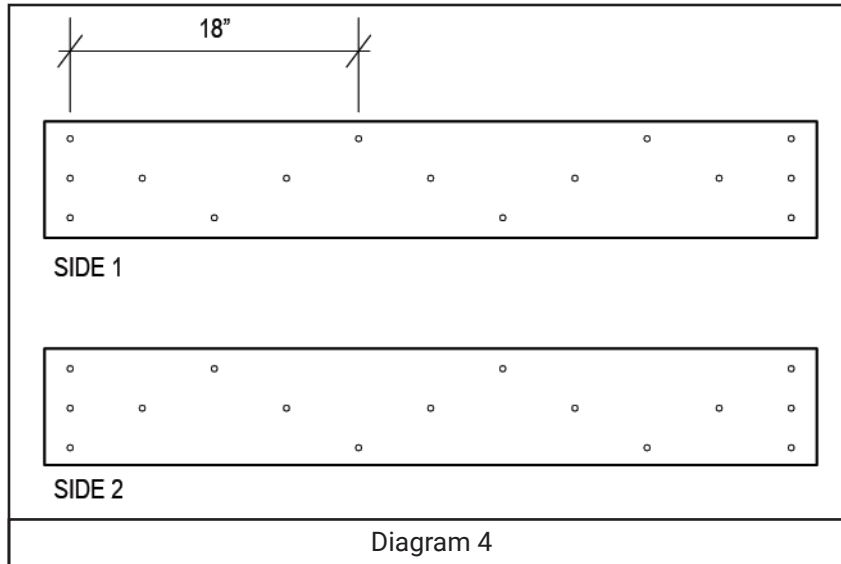
A girder is a beam that runs perpendicular to the floor joists, held up by piers, and acts as a support for a floor structure.

Construct Girder

- Cut strips of $\frac{1}{2}$ " OSB down the 8' length that are $6\frac{3}{4}$ " wide (if using 2x8) or $\frac{1}{2}$ " narrower than the 2x material that will be used
 - These OSB strips will be sandwiched between the 2x8s (See Diagram 1)
- Diagram 1 illustrates a profile view of what the girder will look like when it is put together
 - Use construction adhesive between the OSB and 2x8 material on both sides (See Diagram 2)
 - Determine which edge will be the top of the girder (that contacts the floor joists) and make sure that the 2x8 pieces are even/parallel on that edge
 - Use full length pieces of 2x8 if possible - if it is necessary to use more than one piece of 2x8 on a single side, make sure that seams are staggered and supported by a post. (See Diagram 3)
 - Allow for a minimum 2' overlap



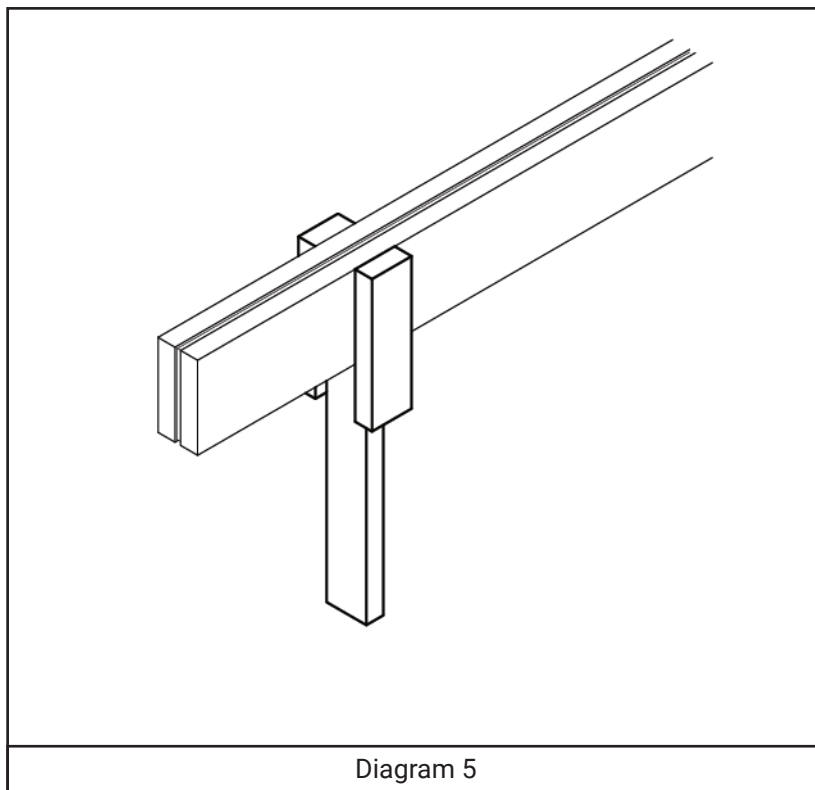
Girders & Piers



- Fasten the pieces of the girder together with 3" exterior screws or 16d galvanized nails
 - Diagram 4 shows the fastening pattern for the girder
 - Note that the pattern is opposite on each side of the girder

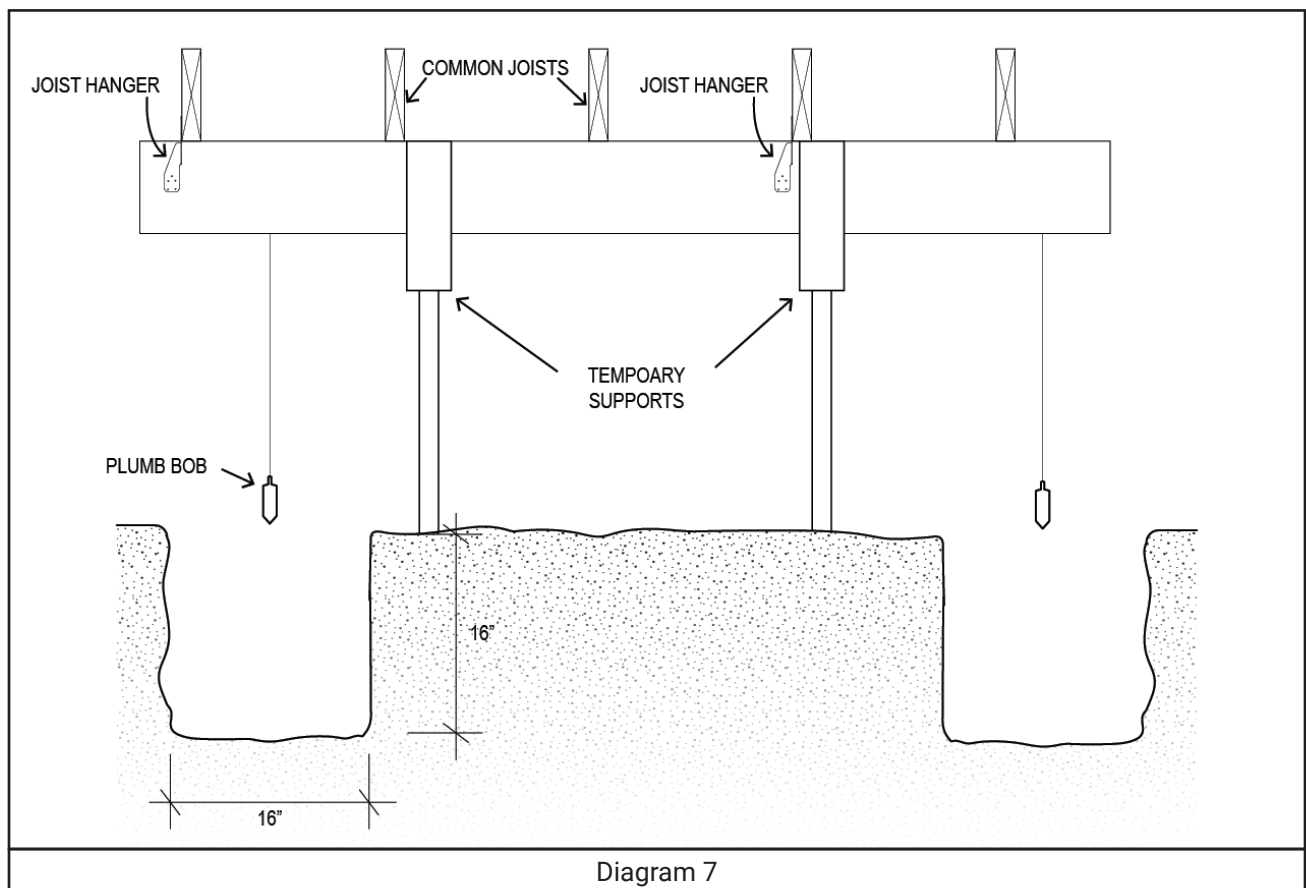
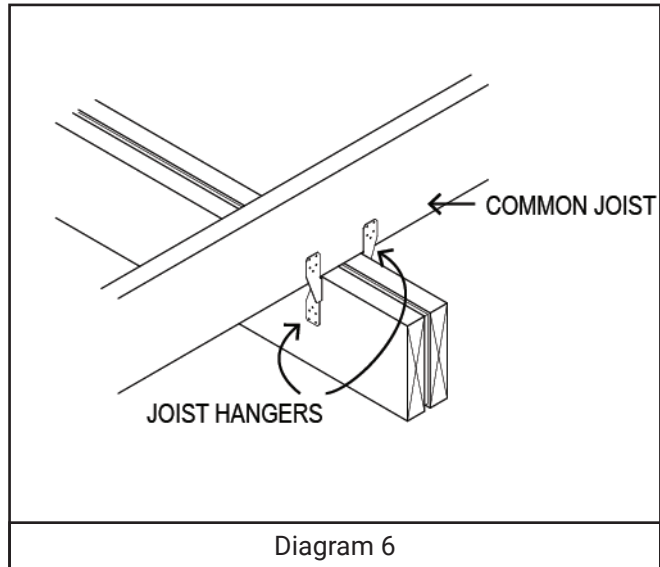
Install Girder

- To get the girder into place against the floor joists, temporary supports will be needed
 - Diagram 5 shows a possible temporary support for the girder
 - Concrete blocks and scrap lumber can also be used to hold the girder, as long as they hold the girder in place while the concrete sets



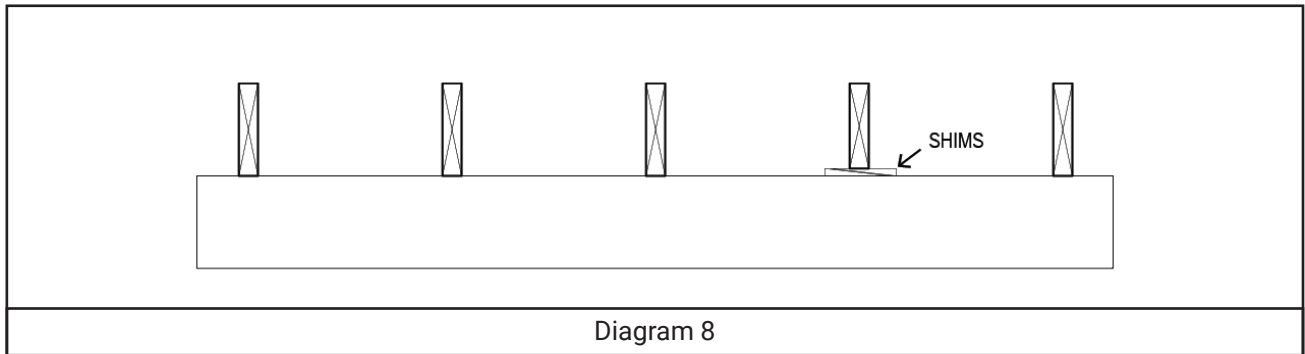
Girders & Piers

- Hang the girder from the floor joists using hurricane straps secured with joist hanger nails or joist hanger screws (See Diagram 6)
 - Put one hurricane strap on each side of the girder on every 3rd floor joist (See Diagram 7)
 - Fill 3 holes of each hurricane strap on both the girder and joist

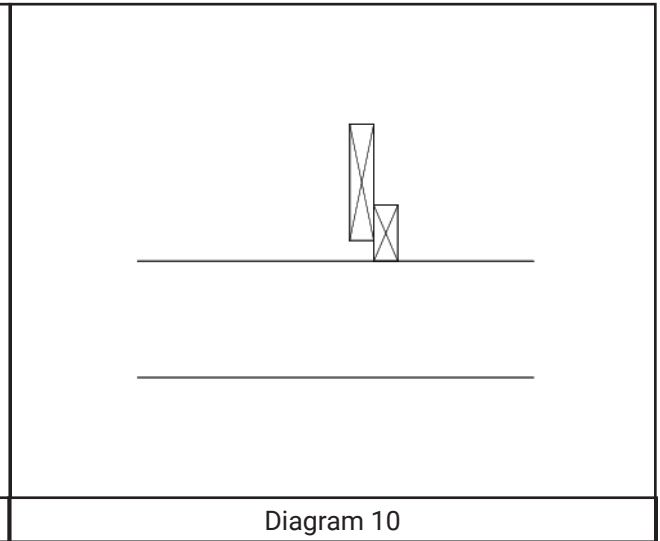
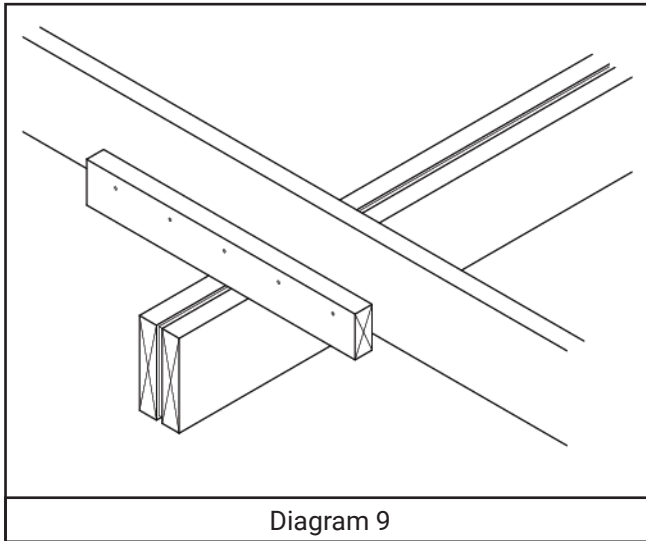


Girders & Piers

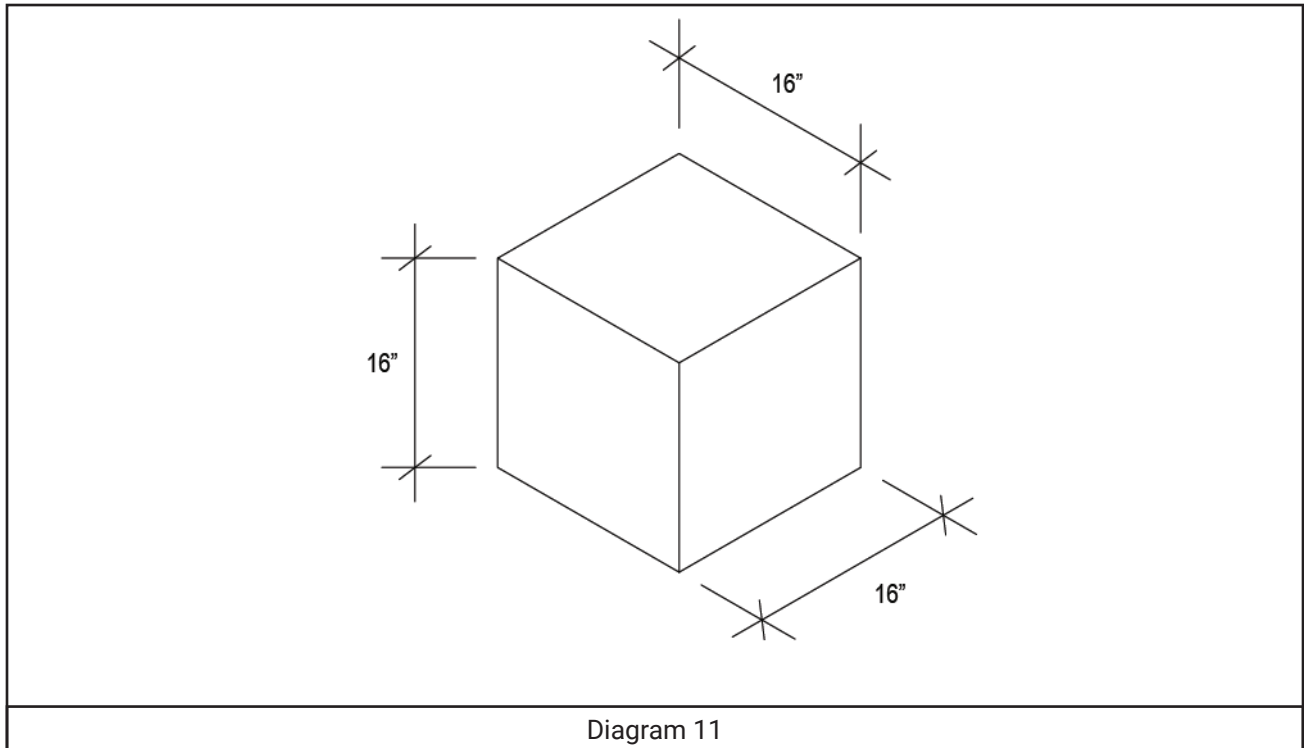
- If any of the floor joists are not in contact with the girder:
 - Do not notch the floor joist
 - If the gap is small enough, place shims in the gap (See Diagram 8)



- If the gap is too large for shims, use a 2x4 or 2x6 around 4' long attached beside the floor joist and resting on top of the girder (See Diagram 9 & 10)
- This step can be completed at any time after girder is in place.
- This step is critically important. If the joist is not contacting the girder, the girder is not doing its job.



Girders & Piers



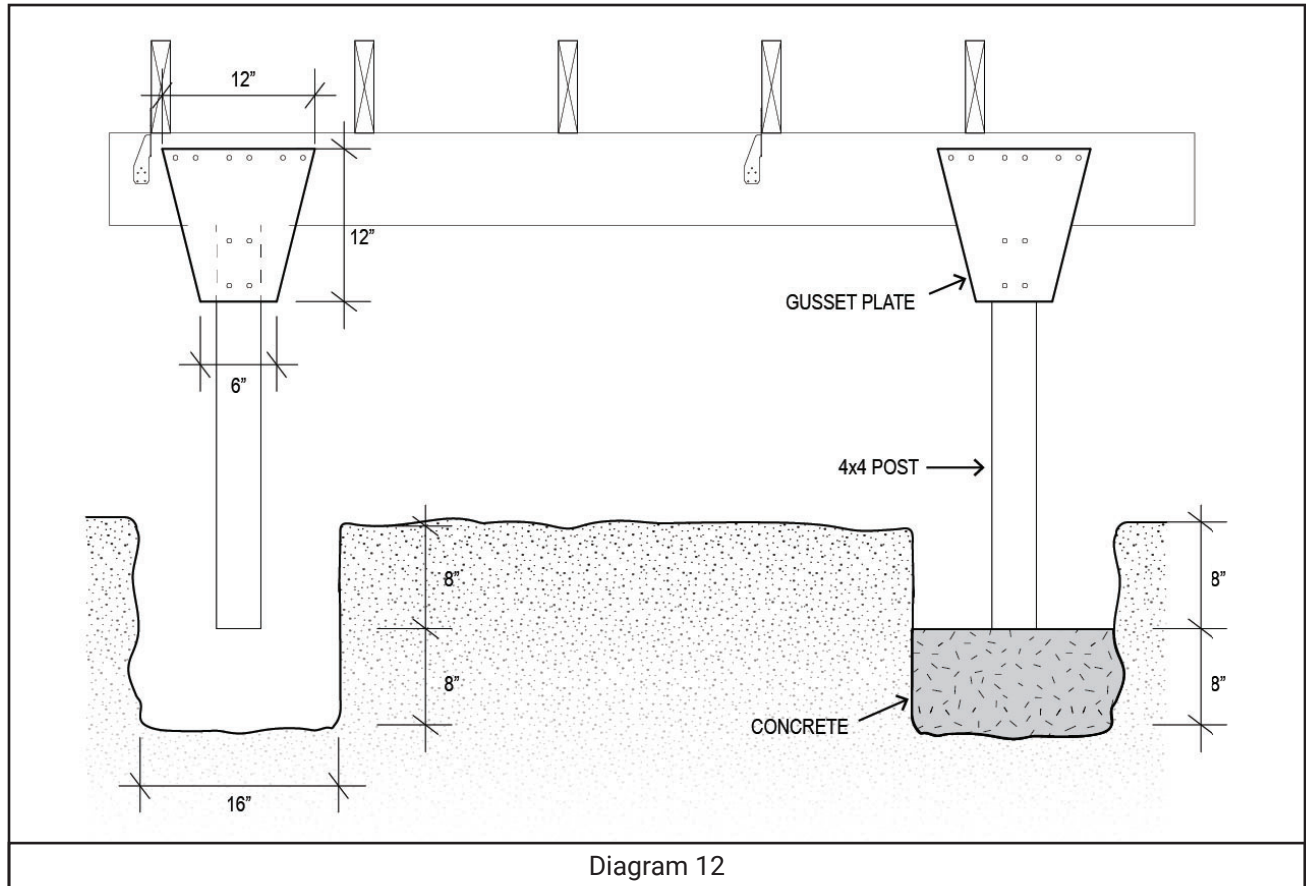
Prepare footings

- Posts will be installed underneath the girder to hold it into place, each post will rest on a concrete footing
 - Posts supporting the girder should be every 8' at the maximum
- Mark on the bottom of the girder where posts will attach
- Hang a plumb bob from where the center of the post will touch the girder and make a mark on the ground
 - This mark will be the center of the hole for the post's footing (See Diagram 7)
- Each hole will be 16"x16"x16" (See Diagram 11)
- Digging under home, short shovels or garden trowels may work best

Install Posts

- If the space between the ground and the bottom of the floor joists is 60" or less, use a 4x4 post and if the space between the ground and the bottom of the floor joists is greater than 60", use a 6x6 post
- When the girder is in place, measure from the bottom of the girder to the ground surface and add 8", cut post to this length, do this for each post of the girder
- (continued – next page)

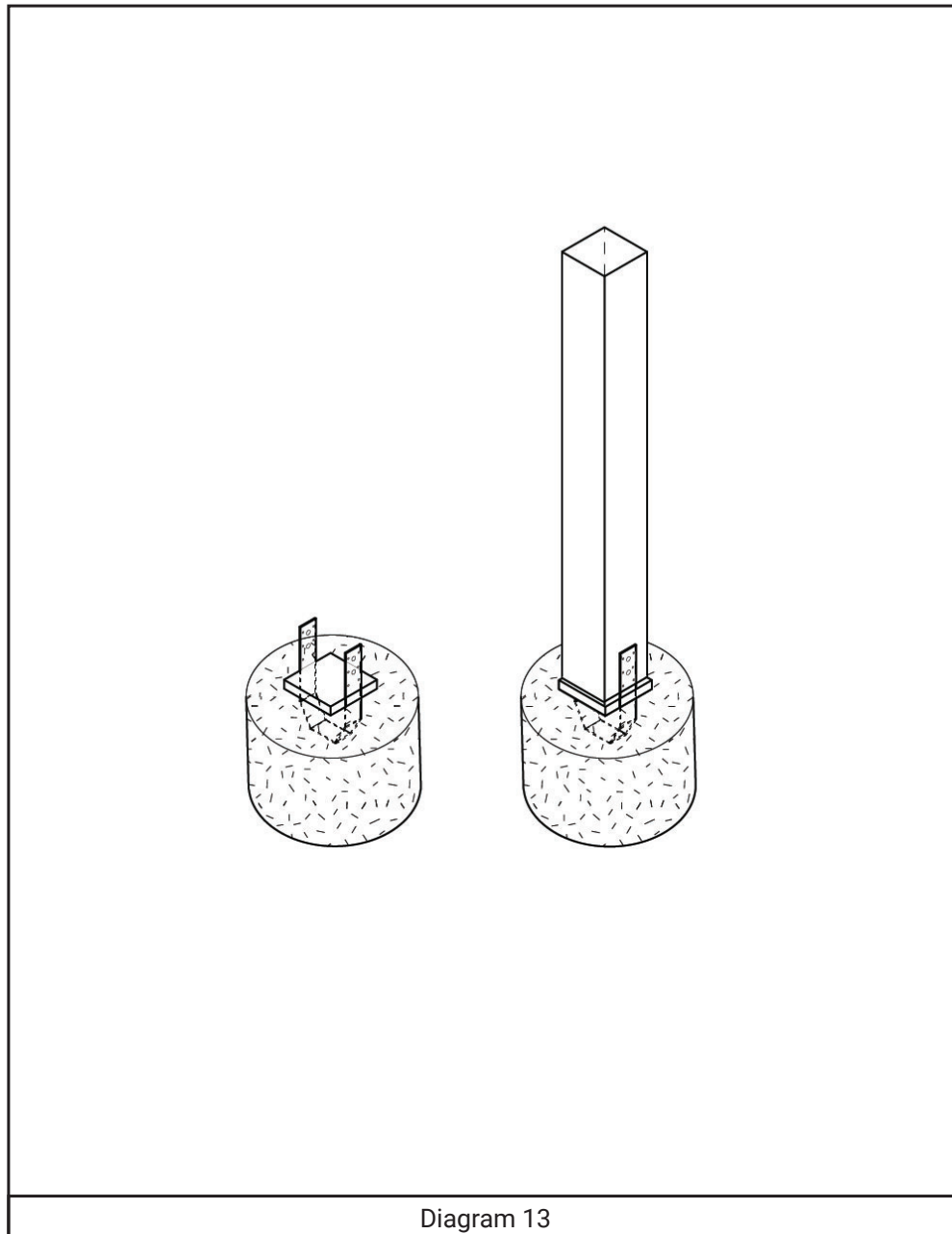
Girders & Piers



- Hang posts
 - Gusset plates or Simpson strong ties are used to tie the girder and posts together (See Diagram 12)
 - Cut gusset plates out of $\frac{1}{2}$ " OSB
 - Dimensions of the gusset plate are 6" (bottom) x 12" (top) x 12" (height)
 - Glue the gusset plate to the girder with construction adhesive
 - Attach the gusset plates to both sides of the girder at each post with exterior screws (See Diagram 12)
 - Install the post between the two gusset plates, making sure it is plumb
 - Attach Simpson Strong Tie post boot or bracket to bottom of post to tie into concrete. This can be done before hanging the post between the gusset plates to avoid limited space working in the post holes.

Pour Concrete

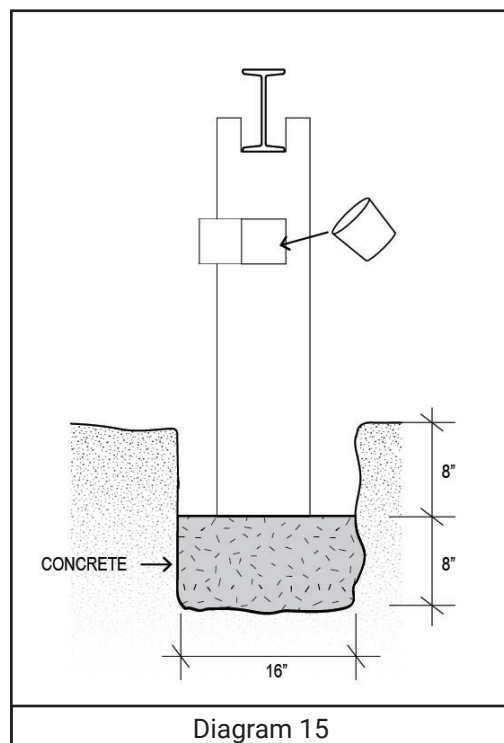
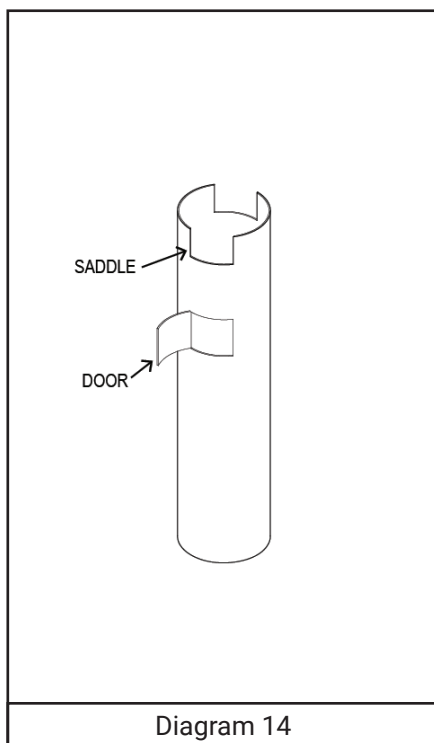
- Mix and pour 8" of concrete in hole up to the bottom of the Simpson Strong Tie post boot or bracket (See right side of Diagram 12) make sure a wet set post boot is used for this application (See Diagram 13).
- Let concrete set overnight before filling the remainder of the hole with dirt and tamping
- Leave temporary supports in place until concrete has set overnight, then remove them
- Clean up any tools used to work with concrete after use.



Pier Instructions

Sonotubes can be used as an alternative to wooden piers for a girder in particularly damp locations or they can be used under I-beams on mobile homes that need support.

- Dig holes for each sonotube
 - Use a plumb bob from the girder/I-beam to determine where the center of each hole will be
 - Each hole will be 16"x16"x16" (See Diagram 11)
- To determine the height of the sonotube measure from the bottom of the girder/I-beam to ground level and add 8"
 - Cut sonotube to this length with a reciprocating saw and wood blade
- Cut a saddle into the sonotube 3" deep and the width of the girder/i-beam (See Diagram 14)
- Cut a 4"x4" door into the side of the sonotube near the top at a place where it will be most convenient for you to pour concrete into the sonotube (See Diagram 14)
- Put the sonotube in place making sure the saddle is tight to the bottom of the girder/I-beam and the sonotube is plumb (See Diagram 15)
 - Sonotube can be held into place using duct tape or scrap lumber
- Mix and pour concrete
 - Pour directly into the hole until concrete reaches the bottom of the sonotube, then start filling the tube through the cut door at the top (See Diagram 15)
 - Occasionally, tap the side of the tube to compact the concrete as it is poured
 - When you reach the door, tape the door shut using duct tape and finish filling the sonotube from the top
 - If able you can create a trough (using a wider diameter pipe or a piece of gutter) and pour the concrete into the sonotube from outside of the crawl space, otherwise a bucket and small shovel can be used underneath the house
- Let the concrete set overnight and then backfill dirt into the hole and tamp dirt tightly
 - Remove duct tape and temporary bracing





Floors

Why Floors? Secure and sturdy floors are important for safety and accessibility of those living inside the home. A cleanable finished surface is important for air sealing and air quality in the living space.

Section Contents:

- Floor Structure 35
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 - Band Joist Repair 48
 - Additional Floor System Support . . . 51
 - Subfloor Replacement/Repair 53
- Replacing Full Room Floor System 57
- Floor Covering 62
 - Vinyl Plank 65

Floor Structure

Safety

- Wear gloves when removing debris/old structures
- Make sure to remove nails sticking out of any debris lumber
- Wear safety glasses and ear plugs when cutting or working near someone cutting with power saw
- Communicate with homeowner/block off entrance to the room if needed when removing subfloor
- Make sure all loads are supported/kicked while repairs are being made on the floor structure if needed
- Be cautious of any pipes/electric/ducts running underneath the floor system
- If a floor is open longer than a day, attempt to have temporary subfloor at the end of each day OR communicate with homeowner that the space is not accessible temporarily
- Do not jack any part of the home without approval from construction consultant/Home Repair Coordinator
- Do not use vehicle jacks in place of bottle jacks

Floor Project Planning

Framing:

- Are joists over spanned, do they need additional support?
- Do all joists need to be replaced? Could they be repaired?
- What is the root cause? Water/termites/etc. - address those issues as well
- Check the band joist - if there is any rot, what is the source?
- Will subfloor need to be removed? Can repair be made from below?
- Will any temporary support be necessary? (Kickers/Temporary Interior Walls)
- Will any permits/inspections be needed?
- How close will joists be to the ground? If within 18", they should be pressure treated lumber
- Do the existing joists run underneath the walls? How does the existing floor systems interact with one another room to room?

Subfloor:

- Why is subfloor damaged? Are there other issues that need to be addressed?
- Where will material be stored on site (needs to be kept out of the rain)
- Will insulation be needed?
- Is the framing below the subfloor in good condition?
- How many layers of existing subfloor is there? Will you need to build back up to that height?
- If subfloor is soft below a window or door be sure to check the band joist
- Will the whole room need to be replaced or just patches?
- Are there vents or any other obstacles to be aware of?
- Are joists level? Will sistering or shimming any joists be needed?
- Will any permits/inspections be needed?

Floor Joist Span Chart (Southern Pine #2)		
Joist Size	16" On Center - Maximum Span	24" On Center - Maximum Span
2x6	9'4"	7'7"
2x8	11'10"	9'8"
2x10	14'	11'5"
2x12	16'6"	13'6"

Measurements Needed

- Measure the area of the room/isolated areas to be repaired
- What size material will be needed? (thickness of subfloor and size of joists)
- What size are the current joists? Does that need to be matched?
- What is the spacing of the current joists?

Quality Control

Framing:

- Make sure site is left safe for family overnight
- Make sure joists are level
- Make sure spacing of joists is correct
- Make sure scab extends at least 2' past damaged areas
- Make sure scabs are installed on both sides of joist if possible
- Make sure common joists are properly secured into band joists

Subfloor:

- Make sure that blocking is installed as needed so that there are adequate nailers and all edges of subfloor are supported
- Make sure $\frac{3}{4}$ " OSB is used
- Make sure OSB is perpendicular to joists
- Start with tongue side of OSB to wall
- Stagger seams of OSB
- Make sure short edges of OSB are landing on joists
- Make sure OSB is adequately fastened (every 8" on perimeter and every 12" along interior)
- Make sure seams are tight
- Make sure construction adhesive is applied on joists before installation of OSB

Common Mistakes

Framing:

- Joists run from a band or sit on a girder that is not level
- Spacing is off so that edges of OSB does not fall on joists
- Scabs are too short and not fastened into solid wood
- Joist Hangers are not used to secure common joists to the band joist

Subfloor:

- Blocking not added around perimeter of room, or under corner of OSB, leaving subfloor unsupported
- Tongue of OSB is to the field, which makes it more difficult to install following pieces
- Seams lined up, reducing strength of subfloor
- Gaps between pieces of subfloor, tongue and groove not fitted together
- OSB patch is smaller than a half sheet of OSB

After Work is Complete Quality Control Check

Framing:

- Make sure insulation is installed after joist repair and before subfloor
- Are joists adequately fastened/joist hangers used?
- Are joists at an appropriate span? Are joists level?

Subfloor:

- Is subfloor level?
- Are the seams in the subfloor tight?
- Have holes been cut for all vents/pipes/etc?

Floors

Joist Repair/Replacement Materials

Quantity	Item	Purpose / Notes
	2x__x__	Scabs or replacement joist. PT if within 18" of ground
	Housewrap/Tar Paper	Wrap damaged joist to provide vapor barrier
	3" Deck Screws or 16d Galvanized Nails	To attach the scabs or install the new joist
	Joist Hangers	To install common joists to band joists
	Joist Hanger Nails	To install joist hangers

Recommended Tools

Safety:

- Glasses
- Gloves
- Ear Plugs
- Dust Masks

General:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc)
- Cats claw/nail pullers
- Pry Bars
- Extension Cords/Splitters
- Utility Knife
- Drop Lights or Flashlights
- Saw Horses
- Level

Power Tools:

- Circular Saw or Miter Saw
- Drill or Impact Driver
 - T-25 Drivers for Deck Screws
- Reciprocating Saw with metal blade
 - Metal Blade
 - Demo Blade

Band Joist Repair Materials

Quantity	Item	Purpose / Notes
	2x__x__ PT	Matched to the size of the existing band joist
	2x4x__ F	2x4 ledger, kickers, stakes
	4x4x__ PT	For temporary supports under common joists, if needed
	Concrete Blocks	For temporary supports under common joists, if needed
	Connection Plates	To attach ends of new sections of band joist
	Joist Hanger Nails	For attaching connection plates
	3" Deck Screws or 16d nails	For attaching new pieces of band joist to common joists

Recommended Tools

Safety:

- Glasses
- Earplugs
- Dust Masks
- Gloves

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc) Bottle jacks (if approved by HRC/CC)
- Sledge Hammer - to drive stakes into the ground Pry Bars
- Extension Cords/Splitters Cats Claw/Nail Puller
- Saw Horses

Power Tools:

- Circular Saw Drill/Impact Driver
 - T-25 Driver for Deck Screws Reciprocating Saw
 - Demo Blade

Floors

Subfloor Materials

Quantity	Item	Purpose / Notes
	¾" OSB	Sq Ft of area/32 SF(size of OSB) = # of sheets
	2x x	Blocking/Nailers. PT if within 18" of ground
	Construction Adhesive	To glue OSB to top of joist
	2 ½" Deck Screws/8d nails	Attaching OSB to joists
	3" Deck Screws or gavanized 16d nails	For blocking/nailers

Recommended Tools

Safety:

- Gloves
- Glasses
- Ear Plugs
- Dust Masks

General:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc)
- Chalk Line
- Framing Square
- Chisels
- Pry Bars
- Caulk Gun
- Extension Cords/Splitters
- Sawhorses

Power Tools:

- Circular Saw Drill/Impact Driver
 - T-25 Drivers for Deck Screws
 - Large drill bit to start holes for jig saw
- Jig Saw
 - Wood Blade Reciprocating Saw
 - Demo Blade
 - Wood Blade
- Oscillating Multi Tool

Full Floor System Replacement Materials

Girder Materials - See Girder Section for materials and tools

Quantity	Item	Purpose / Notes
	2x4x__ White Wood	Ledgers, kickers, stakes
	2x6x__ White Wood	Temporary bracing for interior load bearing walls
	4x4x__ PT	Temporary bracing for interior load bearing walls
	Concrete Blocks	Temporary bracing for interior walls
	2x__x__ PT Substitute Band	If applicable because of slope in the wall
	Ledger Loks	If applicable to attach substitute band Common
	2x__x__	Joists and rim joists. PT if within 18" of ground
	2x__x__	Any necessary blocking / nailers
	¾" OSB	Subfloor
	Joist Hangers	
	Joist Hanger Nails	
	Construction Adhesive	to glue subfloor to joists
	3" Deck Screws	
	2" Deck Screws or 8d Ring Shank Nails	
	Shims	

Recommended Tools

Safety:

- Gloves
- Glasses
- Ear Plugs
- Dust Masks

General:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc)
- Chalk Line
- Framing Square
- Chisels
- Pry Bars
- Caulk Gun
- Extension Cords/Splitters
- Saw Horses
- String/String Level

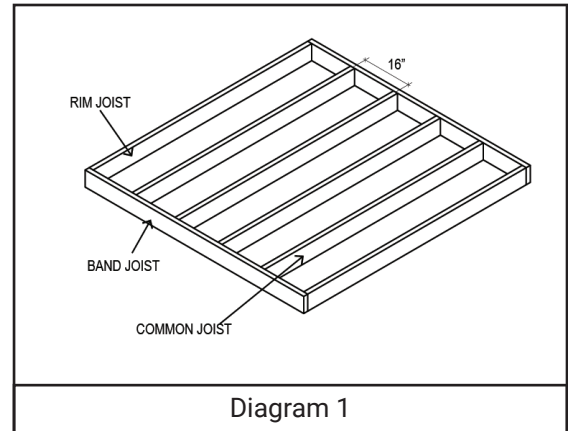
Power Tools:

- Circular Saw
- Miter Saw
- Reciprocating Saw
 - Demo Blades
- Drill/Impact Driver
 - T-25 Driver for Deck Screws
 - 5/16" Hex Driver or T-40 Driver (coordinating to ledger loks)
 - Wide bit for starting jig saw notches
- Jig Saw
 - Wood Blade
- Oscillating Multi Tool

Floor Framing

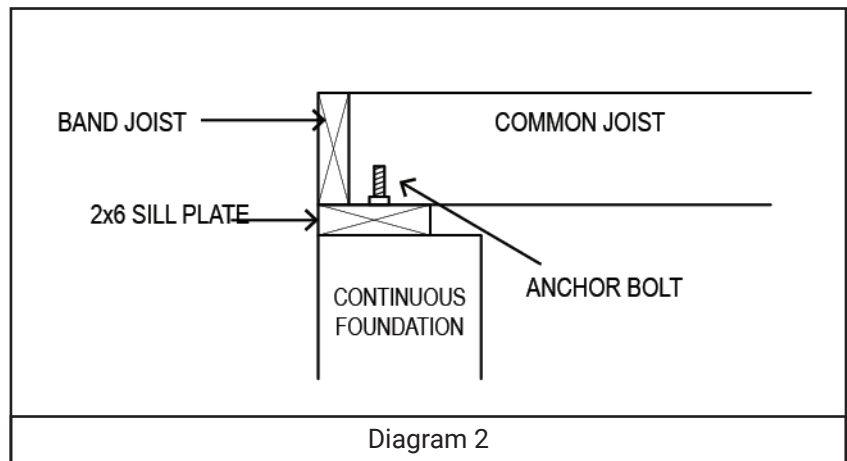
Common Joists:

- Common joists are typically spaced every 16" or 24" on center. This allows 4' or 8' sheets of subfloor to break evenly
- Common joists traditionally run perpendicular to the ridge of the roof on home
- Size of common joists depends on length of span, (see span chart on page 36)
- Common joists should be installed at each end with joist hangers or they should be resting on a sill plate or ledger



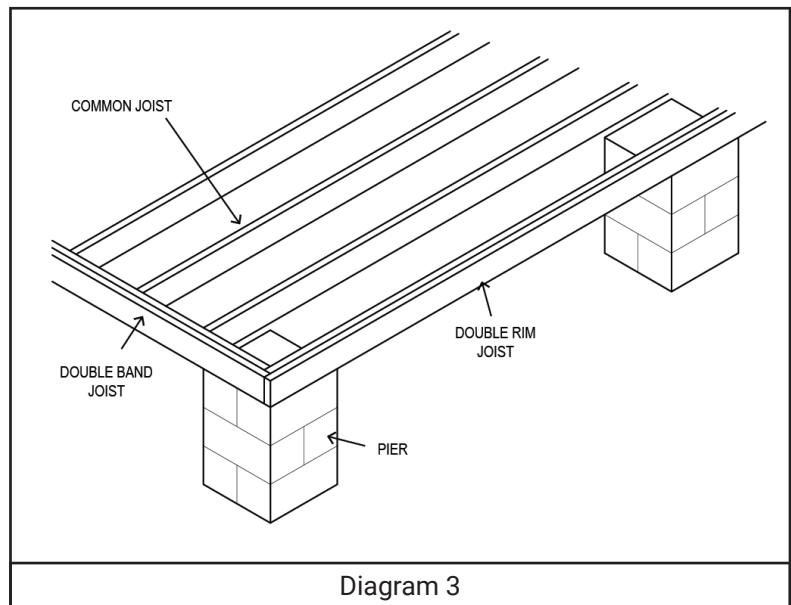
Band Joist:

- Runs perpendicular to and intersects common joists
- Typically support a load bearing wall
- There may be a double band joist over pier foundations and a single over continuous foundations (See Diagram 2 and 3)
- If the band joist is not on a continuous foundation, it supports the weight of the common joists and the entire floor system
- This "band" joist may be referred to by other names depending on construction style or region



Rim Joist:

- The two outside joists of a floor system (perpendicular to band joist)
- Run parallel to the common joists
- Similar to the band, there may be a double rim joist over pier foundation and a single over continuous foundations (See Diagram 2 and 3)
- This "rim" joist may be referred to by other names depending on construction style or region



Floors

Continuous Foundation to floor system connection:

- When completing repairs to the sill plate on this type of floor system, the existing anchor bolts will likely cause issues
 - They may need to be cut off with a metal blade and reciprocating saw
 - Replacement pieces of sill plate should be pressure treated and alternatively connected to the foundation
 - Concrete screws can be used or drop-in concrete anchors depending on the space available to work under the house
 - Look on page 7 in Construction & Tool Basics for installation instructions for concrete screws and anchors

Common Joist Repair and Replacement Instructions

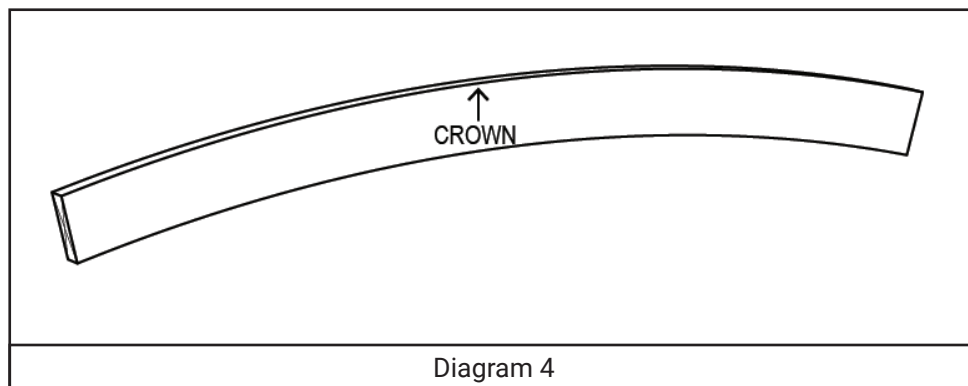
When joists need to be replaced, make sure to assess the root cause and examine why they are damaged and broken in order to address those issues as well. Many times when joist(s) are broken a girder will also need to be installed to prevent the same strain on the new members.

Depending on other work to be done on the floor system determine if the work will need to be done from above or below.

Replace or repair? **If there is extensive damage, cracking, or rot to the joist (more than one third) replace the joist rather than repair it.** Otherwise, the joist can be repaired.

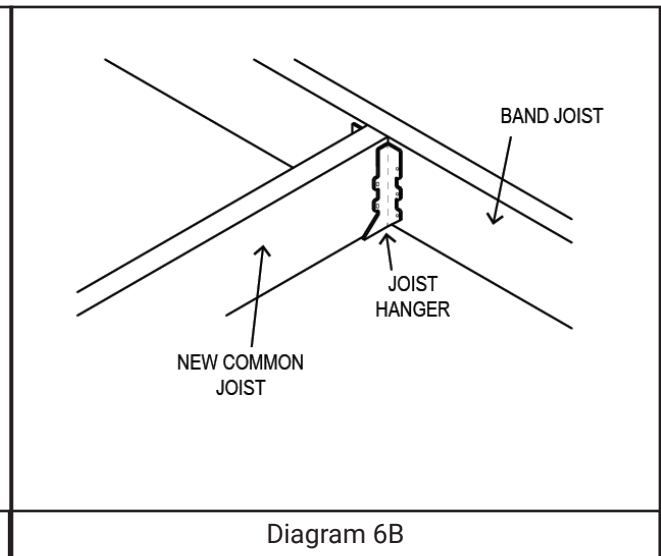
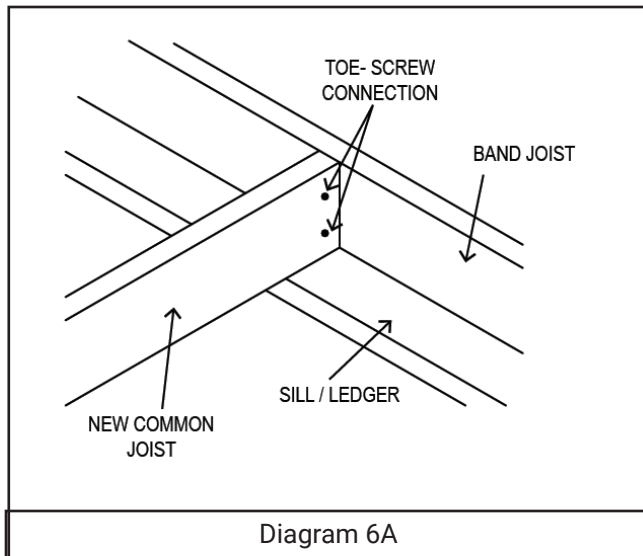
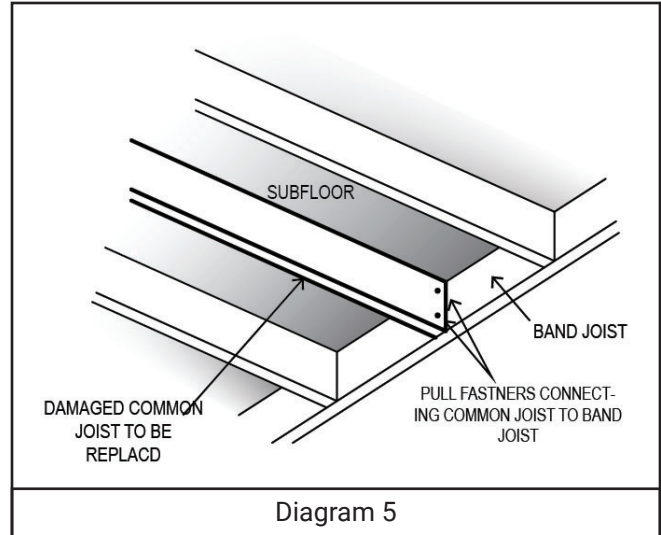
Joist Replacement

- Determine the size of the joist
 - Matching the existing size may be the only option for the available space, but make sure to compare that size to a span chart and add additional support if the joist is over spanned
 - Make sure to follow local building code on required joist sizes for floor system
- Communicate with the homeowners/other workers to make sure no one is in this area of the house while the repairs are being made
- Cut the replacement joist to length and have ready to install
 - Make sure that the fit will be snug
 - Crown the joist and install with crown facing up (See Diagram 4)



Floors

- Remove only one joist at a time (especially if working from underneath)
 - Pull nails/screws holding the joist (See Diagram 5)
 - Use a reciprocating saw with a metal blade to cut any fasteners that may be through the subfloor into the joists
- Put the new joist into place (See Diagram 6)
 - Set on top of sill plate (if applicable) or hold into place
 - Attach with 12d nails or 2 ½" screws toe-nailed into the band joist
 - If able (if there is no sill plate) add joist hangers to each end of the new joist with 1 ½" joist hanger nails or joist hanger screws into the flat holes and 2 ½" joist hanger nails or joist hanger screws into the diagonal holes
 - Make sure joists are flush with the top of the band joist so that you will have a flat and level final surface
 - Install joists every 16" O.C. (or 24" O.C. if applicable)
- Continue across the space, replacing one joist at a time

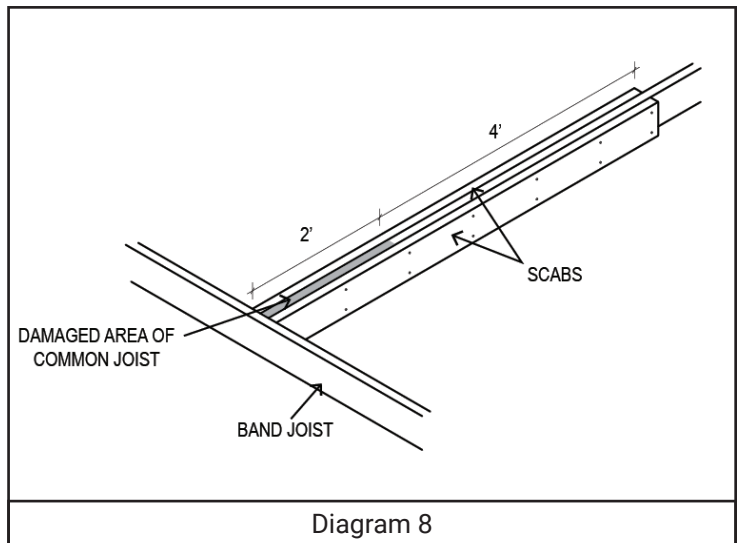
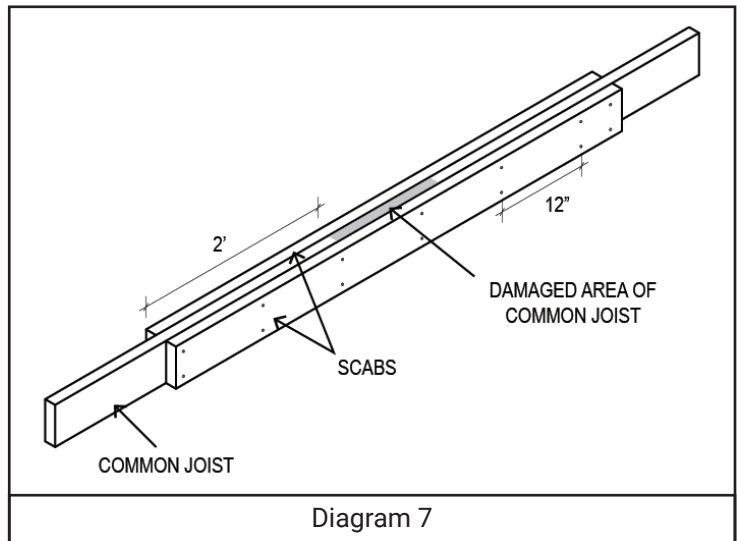


Floors

Joist Repair

If less than 1/3 of a joist is damaged and you are choosing to repair instead of replace, install a “scab” to strengthen that area of the floor.

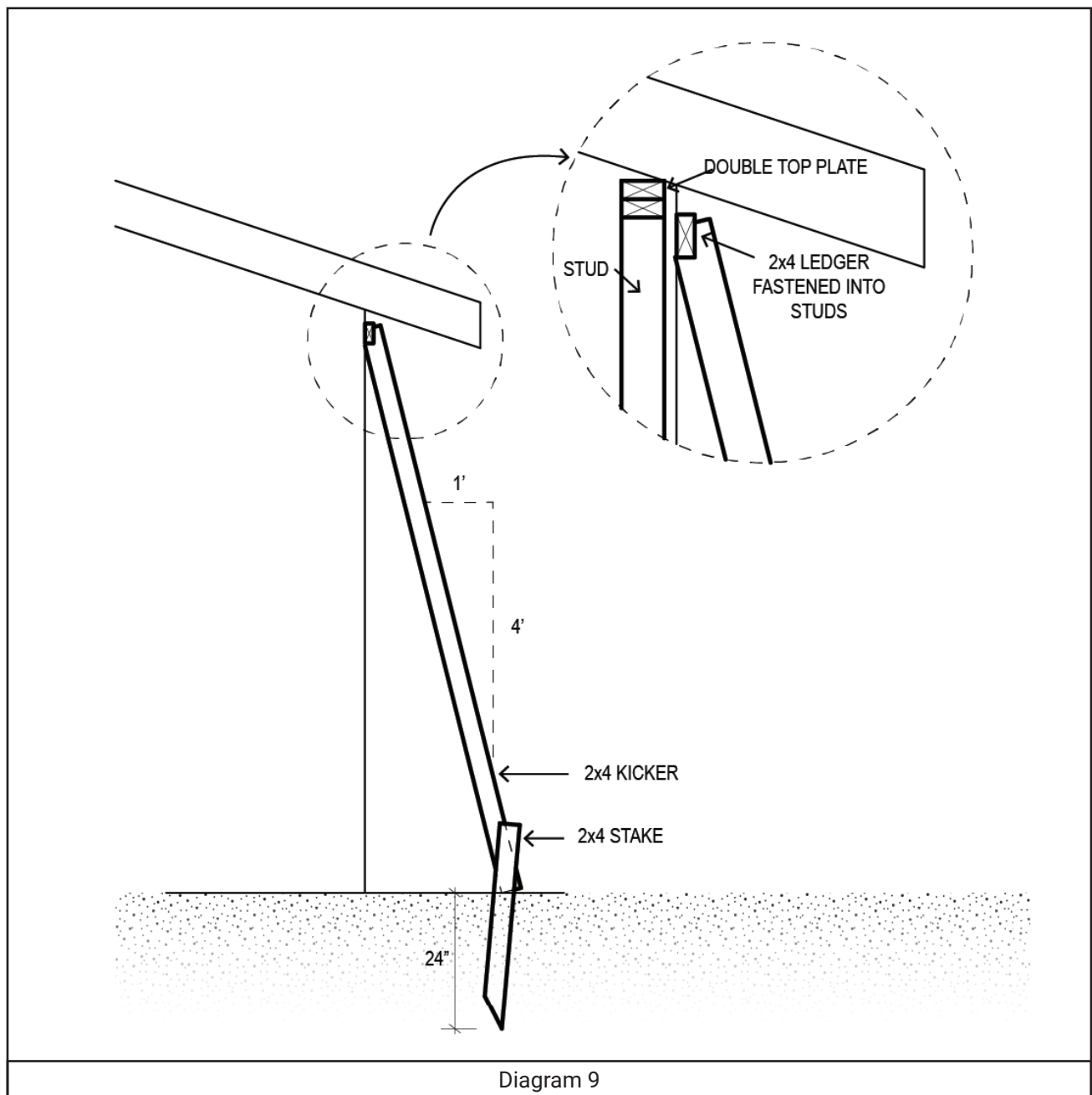
- Create a water barrier before fastening any new lumber to rotted areas of existing joists
 - Wrap the old, rotted area of the joist with housewrap/roof felt/ or synthetic underlayment
 - This helps prevent any transfer of existing rot to the new wood
- A “scab” will be installed (ideally) on both sides of the damaged joist (See Diagram 7)
 - Match the size of lumber that will be used for the repairs to the existing joist
 - The pieces of lumber used for the scab should extend 2’ minimum past the damaged area on both ends
- The piece should be cut and installed beside the damaged joist and in contact with the subfloor above
 - Install scab flush to the top of the joist
 - If there is a bow in the floor, install the scab as high as possible
 - Attach the scabs to the existing joist using 3” screws or 16d nails
 - Fasten with one screw over the other, every 12” (See Diagram 7)
 - Install scabs on both sides of the damaged joist
- If the damaged area is at the end of the joist (as common joist connects to the band joist)
 - The repairs will likely occur at the same time as the band joist repairs
 - See additional information on band joist repair below
 - The same method of wrapping the damaged area, and sandwiching the damaged area with scabs will be used
 - The scabs should overlap the good wood of the existing joist twice the length of the damage at the end (See Diagram 8)
 - For example, if there is a 2’ damaged area at the end of the joist, the scab should extend 4’ back onto the good wood of the joist. The scabs will be cut to 6’.
 - The scab should be toe-screwed into the band joist



Band Joist Repair

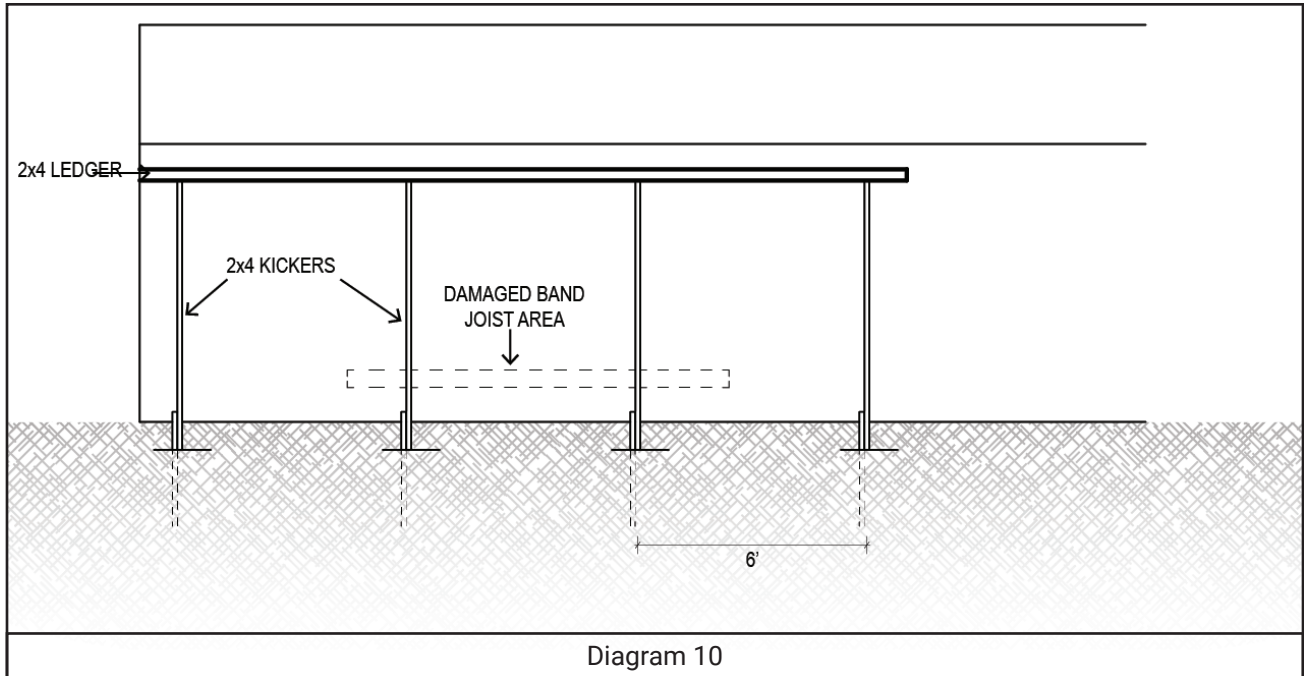
When completing band joist repair, the weight of the wall and roof will need to be temporarily supported before the needed repairs can be made. This will be done by using kickers. The common joists of the floor system will also need to be held into place temporarily, as they are usually held by the band joist.

- To install kickers:
 - Install a 2x4 ledger on the outside of the home/siding, close to the top of the wall where the top plate would be (See Diagram 9)
 - Remove siding to prevent damage if possible
 - Attach with 16d nails or 3" screws
 - Make sure 2x4 ledger is fastened into the studs

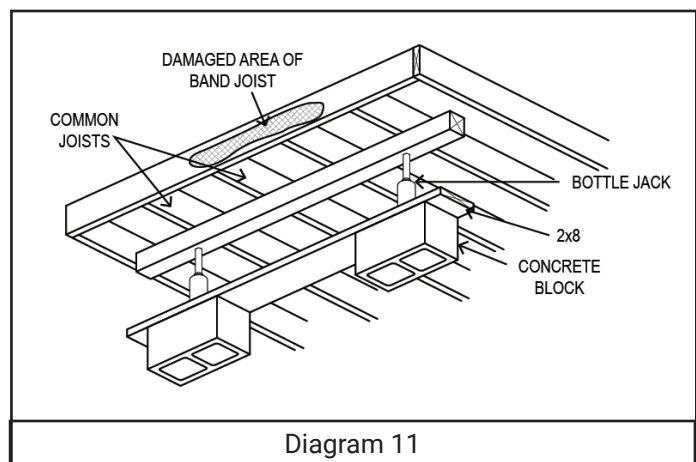


Floors

- Install 2x4 Kickers (See Diagram 9 and 10)
 - These fit snug under the ledger and run diagonally down from the ledger to the ground at a 4' down, 1' out ratio
 - Where the kicker meets the ground it should be attached to a 2x4 stake that is driven into the ground 24"
 - Attach kickers to stake with 3" screws
 - A kicker should be placed at each end and every 6' along the walls where the floor is to be repaired
 - If work will take over 2-3 days, install kickers every 4'



- The common joists of the floor system will also need to be temporarily held in place while the band joist is repaired (See Diagram 11)
 - This is done by running a 4x4 underneath and perpendicular to the common joists 1'-2' back from where the band joist repair will occur
 - Support the 4x4 with bottle jacks (with minimal pressure applied)
 - Bottle jacks in this situation are being used to hold, not lift the floor system
 - Set the bottle jacks on a concrete block
 - Level the ground underneath the block if needed
 - Place a cap block or piece of 2x8 on top of block to prevent the bottle jack from falling in the block holes.
 - If the common joists are far from the ground, you may stack 2-3 concrete block to sit the jack on, just make sure the ground is flat and the stack is very stable



Floors

- Once the weight of the wall/roof and the joists are all temporarily supported, sections of the band joist can be removed and replaced
- Repairing the band joist (See Diagram 12)
 - Always use pressure treated lumber
 - Match the size of the new lumber to the existing band joist
 - Remove damaged sections
 - A maximum of 8' of band joist should be removed and repaired at one time
 - The minimum section to be removed should be 4'
 - Plan that the ends of new sections of band joist fall onto common joists so that there is something to attach them to
 - Cuts can be made into the existing band joist to control how much is taken out at once
 - Set the depth to 1 ½" on a circular saw to cut band joist
 - Sometimes the band joist may have so much damage it does not need to be cut, but can be pulled away gently
 - When removing sections, pry gently
 - Try removing fasteners through the band joist so the piece can be lifted out of place
 - Install new section
 - When new sections of band joist are installed, the ends should fall on common joists
 - Cut replacement piece to length (whether that is a full 8' section or a smaller section)
 - Attach new section of band joist with 3" exterior screws or galvanized 16d nails through the new band joist into the ends of common joists
 - If applicable, continue working down the band joist, removing and replacing 8' sections
 - At each end of all new sections, install a metal connection plate, attach connection plate with a joist hanger nail through every hole (See left side of Diagram 12)
- Once the necessary repairs to the band joist are completed, the temporary support underneath the joists and the kickers can be removed

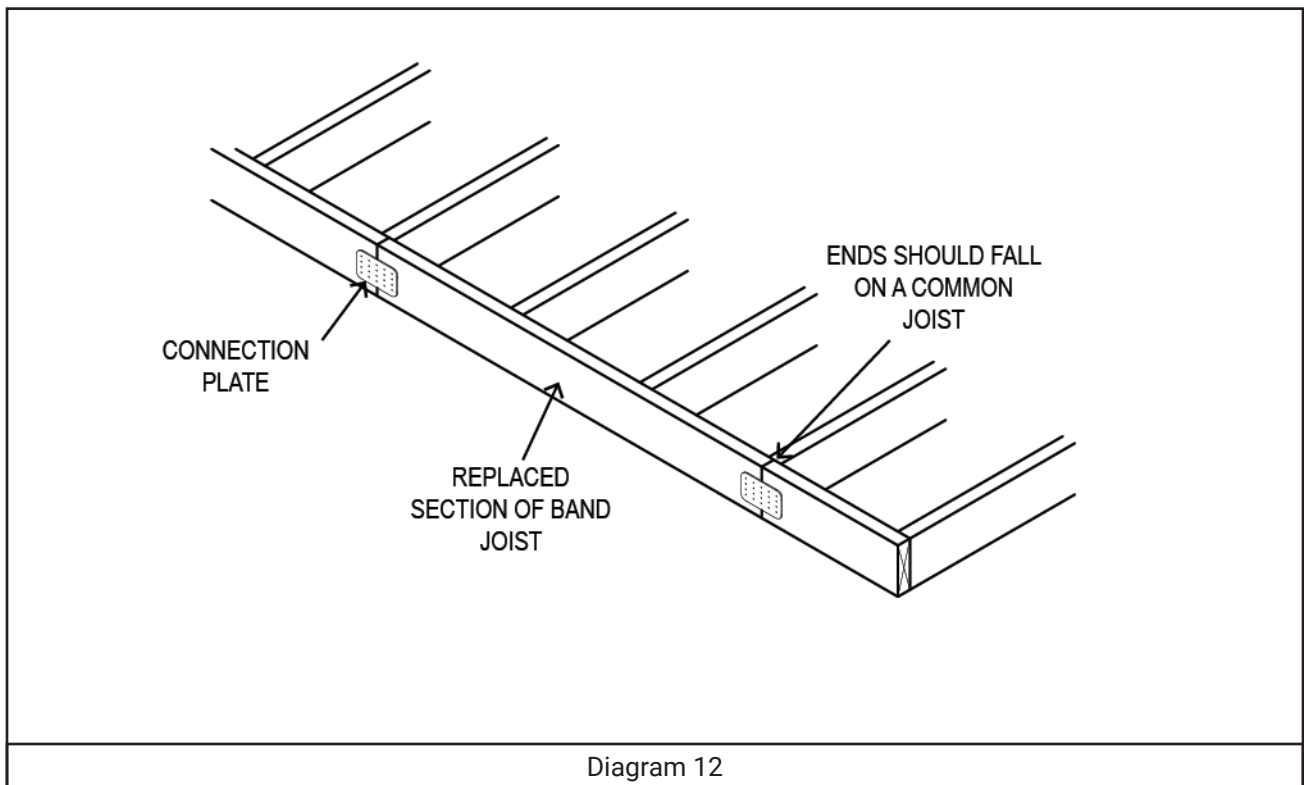


Diagram 12

Additional Floor System Support

Blocking

Blocking in a floor system is simply additional support blocks in the floor system that run perpendicular to the common joists. (See Diagram 13 - "Blocking" is any individual piece of the illustrated "bridging")

Blocking is useful:

- Around the edges of openings when replacing sections of subfloor
- Underneath toilets, water heaters, and the long edges of tubs where a lot of weight will sit
- Under the edges of cabinets
- In high traffic door ways

Blocking pieces should be the same size as the common joists and installed with 3" screws or galvanized 16d nails. Make sure blocks are flush with the tops of the joists.

Bridging

Bridging is a system of blocks installed between joists in a floor system (See Diagram 13). Bridging should be considered when there is some movement in a floor system where the joists are not overspanned. (If joists are overspanned, a girder should be used rather than bridging). Bridging can be installed in addition to girders, but not instead of.

Bridging is a good option when a larger size joist is used (2x10 or bigger) to prevent twisting.

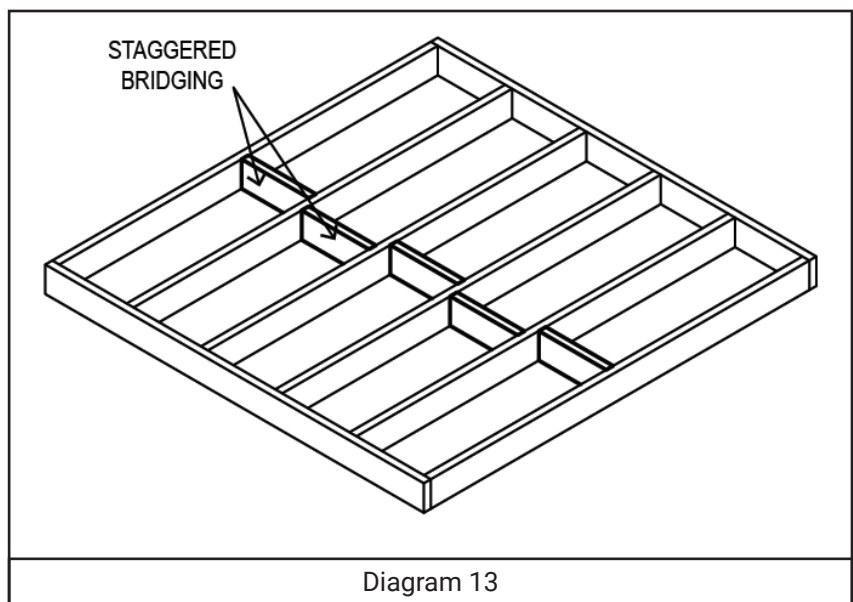


Diagram 13

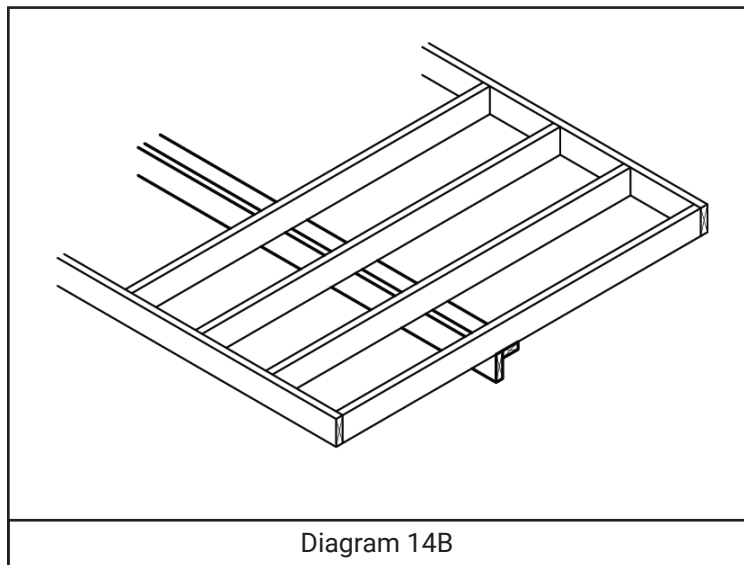
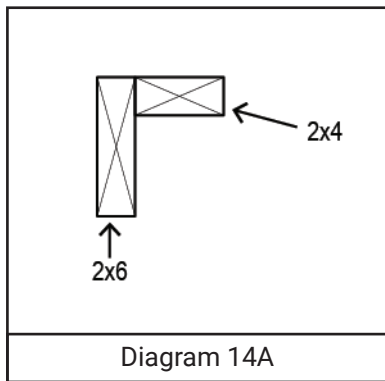
- Installing bridging:
 - Blocks used in bridging should be the same size as the joists.
 - Pieces of bridging should be staggered and face screwed through the common joists into the ends of the bridge pieces
 - Make sure tops of pieces are flush with tops of the joists
 - Install pieces using 3" screws or galvanized 16d nails
 - This is an easier support method when floor system can be accessed from the top

Floors

Stiff-Backs

Stiff-back can be installed as an additional support to floor systems that have some movement in them, but where the joists are not overspanned (If joists are overspanned, a girder should be used rather than stiff backs). If the floor simply bounces a little bit, a stiff-back is a good choice.

- Build stiff-back
 - A 2x4 and 2x6 will be put together in an “L” shape (See Diagram 14A)
 - Attach with 3” screws or galvanized 16d nails
- Install perpendicular to the floor joists with the 2x4 side touching the joists (See Diagram 14B)
 - Attach with 3” screws or galvanized 16d nails, face screwed into the bottom of the joist
- Place the stiff-back through the middle of the floor system
- If multiple stiff-backs are being installed, space them evenly underneath the floor system
- This is an easier support method when floor systems can only be accessed from underneath



Subfloor Replacement and Repair

In mobile homes as well as some homes built in the 1970s and 1980s, the subfloor is typically a compressed particle board and in some older houses the flooring might be 1x6 planks. Otherwise subfloor is generally $\frac{3}{4}$ " OSB or $\frac{3}{4}$ " plywood.

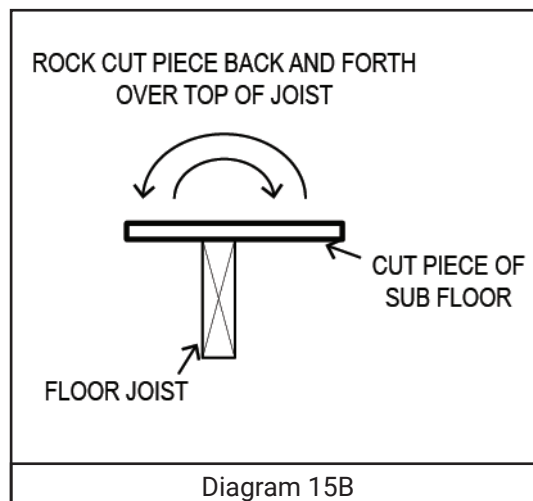
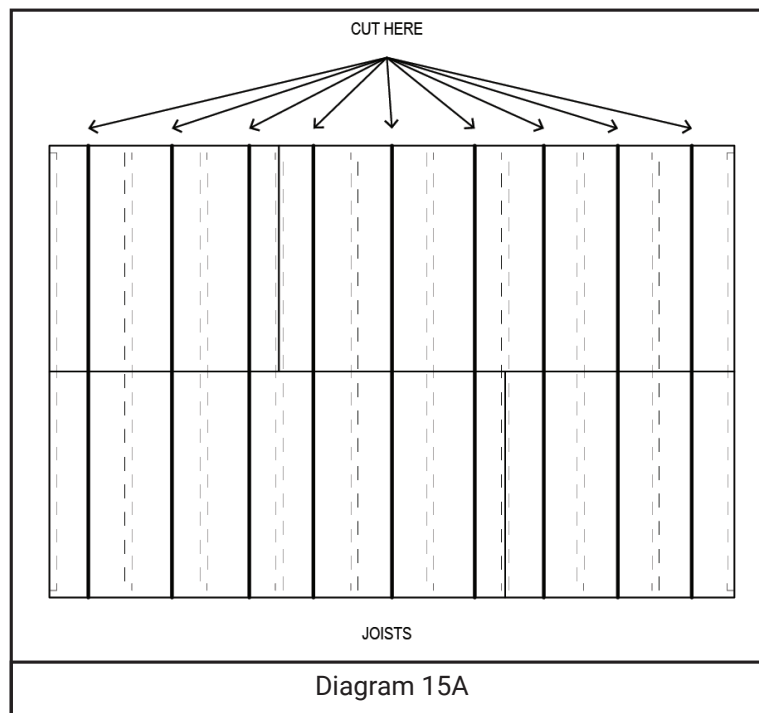
Often times there will be layers of subfloor and potentially floor coverings from previous repairs made to the home.

The material that will be used in subfloor replacement will be 4'x8' sheets of $\frac{3}{4}$ " tongue and groove OSB.

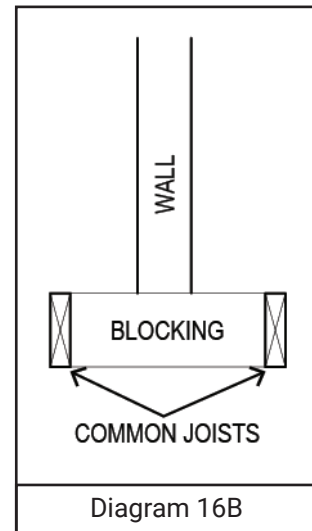
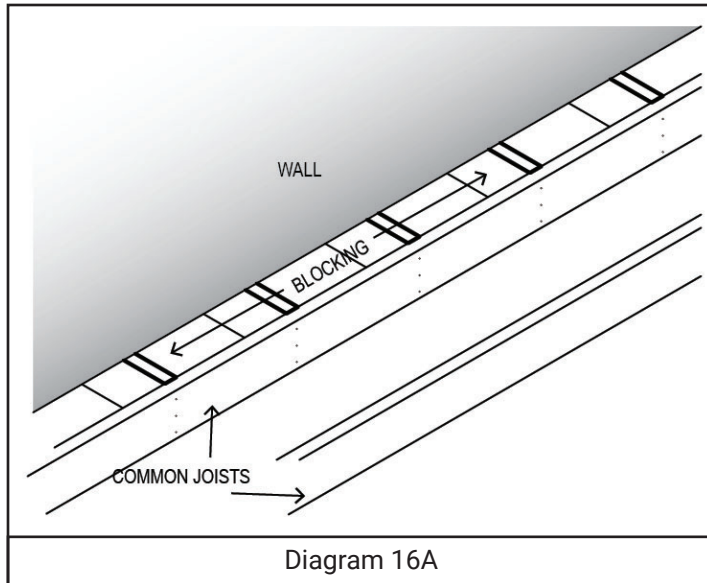
Floors

Full Room Subfloor Replacement

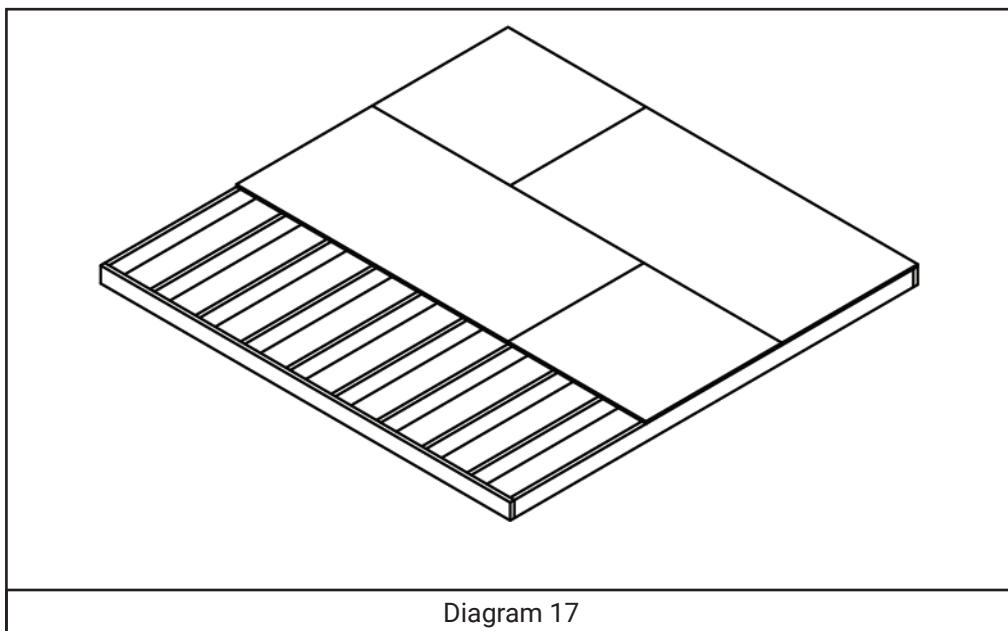
- Remove existing subfloor
 - To easily remove subfloor that has been glued to common joists:
 - Make cuts with a circular saw in the middle of the bays between the joists and rock the cut strip of flooring back and forth over the joist so that the fasteners can work loose and it will ideally come out in a large pieces (See Diagram 15)
 - Look at the nailing pattern to see where the joists are
 - Simply trying to pry up the particle board, it will most likely just crumble into small pieces, leaving glued chunks on top of the joists
 - Clean off the remaining chunks on top of the joists (a hammer and chisel work well for this)
 - If subfloor is not glued to the joists:
 - Pry pieces up carefully, bending down nails/staples as pieces are removed



Floors

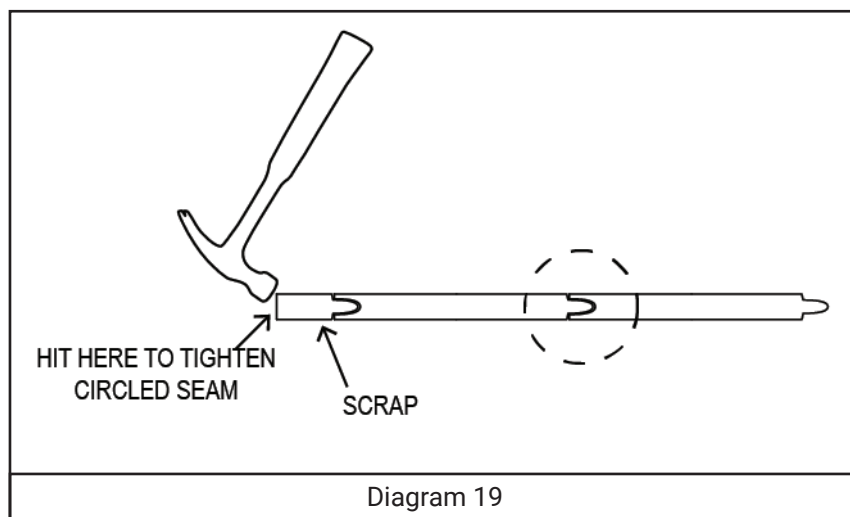
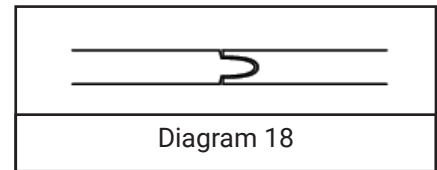


- Install any needed nailers or blocking
 - If there is any instance where the short edge of a sheet of OSB would not land on a joist, install nailers between joists so that the OSB will have a bearing surface to rest on
 - Blocking will most likely be needed where a wall runs parallel to the common joists (See Diagram 16)
 - Install with 3" screws or 16d nails.
- Double check that all floor system structure is in good shape before installing subfloor
- Plan layout of OSB
 - If possible, each sheet should cover at least 2 bays and 3 common joists.
 - It is best to avoid using small pieces of OSB because there is greater strength with fewer seams and smaller pieces can cause weaker spots in the future.
 - Seams should be staggered by at least 2 joist widths
 - All edges of OSB should be supported by one of the following: joist, blocking, tongue and groove connection



Floors

- Install OSB (See Diagram 17, facing page)
 - If insulation is not present it be installed by stapling tabs of the insulation to the vertical sides of the joists
 - OSB will run perpendicular to the common joists
 - Each 4' edge of the OSB should always land on a floor joist
 - Start with the tongue side of the OSB against the wall
 - Dry fit each piece before installing
 - After the piece is dry fitted, apply a bead of construction adhesive to the top of each joist before installing the OSB
 - Attach the OSB every 12" with 2" screws or 8d ring shank nails
 - If nails or screws miss the joists, be sure to remove them to prevent squeaking issues
 - For the second row of OSB:
 - Stagger the short seams by at least 2 joist widths
 - Interlock the tongue and groove (See Diagram 18)
 - Do not hit the groove side with a hammer to tap into place because this will damage the groove. Use a scrap piece of OSB with the tongue still attached and place it into the groove and hammer on that scrap instead (See Diagram 19)
 - The gap between the surface of the two pieces of OSB should be $\frac{1}{8}$ " maximum
 - As needed, cut out holes for vents, toilets, etc. with a jigsaw, start the cut by drilling a large hole in the middle of the planned cut and then use a jigsaw.
 - If helpful, use cardboard or some other scrap to make a template around these difficult cuts
 - Continue installing OSB in rows and following the same process until a full row will no longer fit
 - For the last row, cut the OSB to width with the tongue side remaining so that the pieces will still interlock

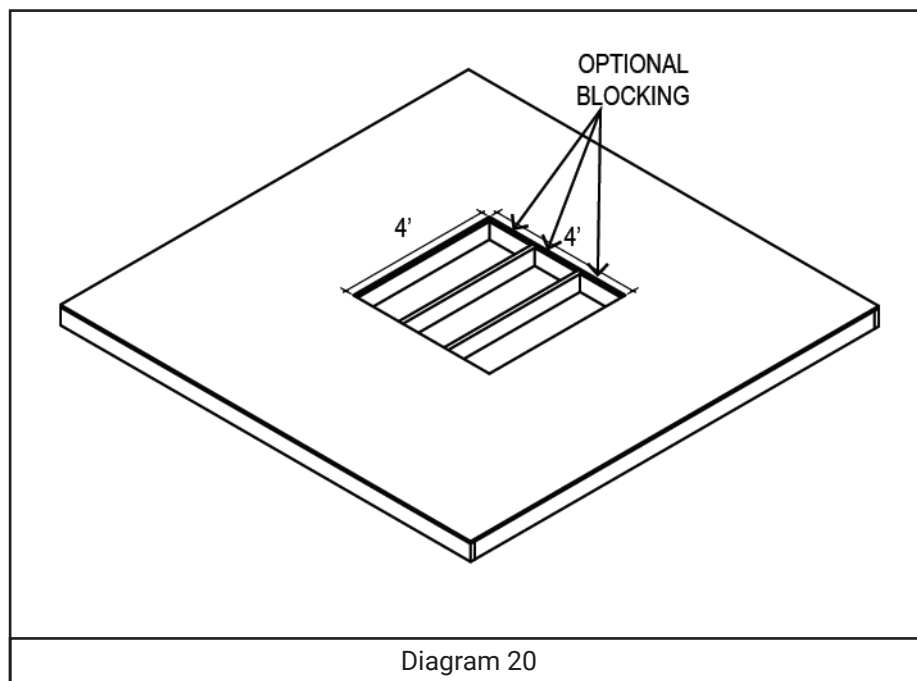


Sections of Subfloor Repair

While subfloor damage can happen anywhere in a home, common areas that need subfloor repair are around toilets, directly inside exterior doors, under/in front of kitchen sinks, and below windows.

In an effort to create solid patches with fewer seams, the minimum area that should be replaced at any time is equivalent to half sheet of OSB and should span at least 3 joists and 2 bays.

- Mark the area to be removed
 - Look at the fasteners through the subfloor to identify where the joists are
 - Use a framing square to make marks square and a chalk line to transfer the lines
 - Plan the replacement piece so that the two “short” edges will fall on top of floor joists
- Set the depth of a circular saw to $\frac{3}{4}$ ” and plunge cut into the subfloor to cut out the damaged piece
 - Pull nails that will interfere with the cut before cutting to preserve the saw blade
- Add nailers as blocking between the joists to catch the edges of replacement piece and provide additional support (See Diagram 20)
 - Nailers/blocking should be the same size as the joists and be installed with 3” screws, make sure the top of these nailers is level with the tops of the joists
- Cut the replacement piece of OSB to size
 - If necessary, cut the tongue off of the new piece
 - Dry-fit the new piece to make sure it fits in the space well
 - Make sure edges of new section will be supported with joists or nailers
- Add a bead of construction adhesive to the tops of the floor joists
- Attach the piece of OSB with 2” screws or 8d ring shank nails every 12”

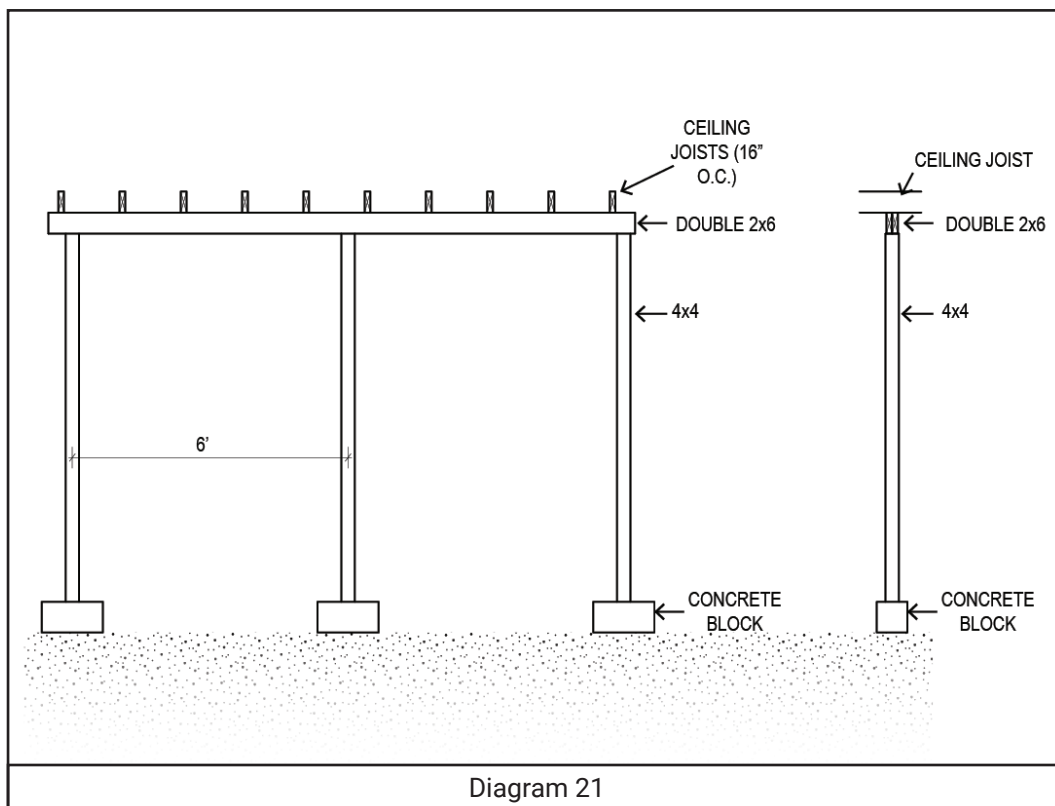


Replacing a full room floor system

There will be occasions where the entire floor system of a room (subfloor, joists, foundation, etc.) needs to be replaced. An important consideration for this type of repair is to make sure that the weight of the walls and roof are supported by something temporarily while the work is completed and permanently after the work is finished. Every situation will be different, work with construction consultant or HRC to determine most appropriate plan. Typically the load bearing walls of a home run parallel to the ridge of the roof and the first step will be to adequately support those load bearing walls.

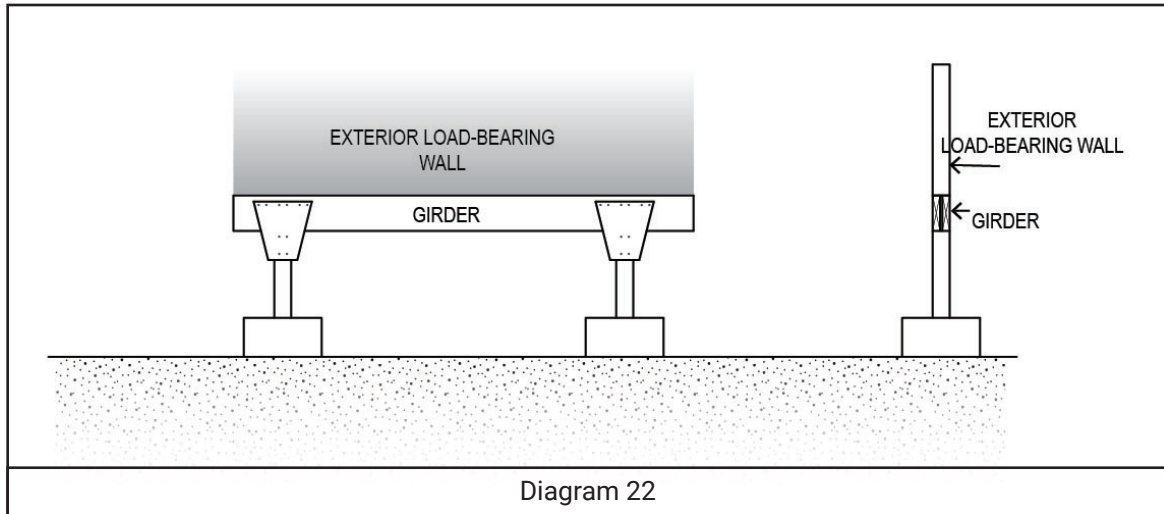
If possible, the ideal way to support load bearing walls is to build girders underneath the load bearing walls. See instructions for building girders in the "Girder" section of the manual.

- For exterior walls, the wall will likely have to be supported with kickers during this process to temporarily remove the weight of the wall and roof while the girder is installed
 - See instructions for installing kickers on page 48
- For interior walls, there will have to be temporary supports to hold the weight of the roof while the girder is installed
 - A brace will serve as temporary support for the roof/wall for interior load bearing walls: (See Diagram 21)
 - A double 2x6 will be supported by 4x4 posts sitting on concrete blocks on leveled earth
 - Assemble with 2 ½" screws or 12d nails
 - Double 2x6 should run parallel to the wall, about 1'-2' from the wall
 - 4x4 posts should be installed every 6', measured and cut snug between the double 2x6 and the concrete block
- Once all loads are accounted for, repairs can start to be made on the floor system

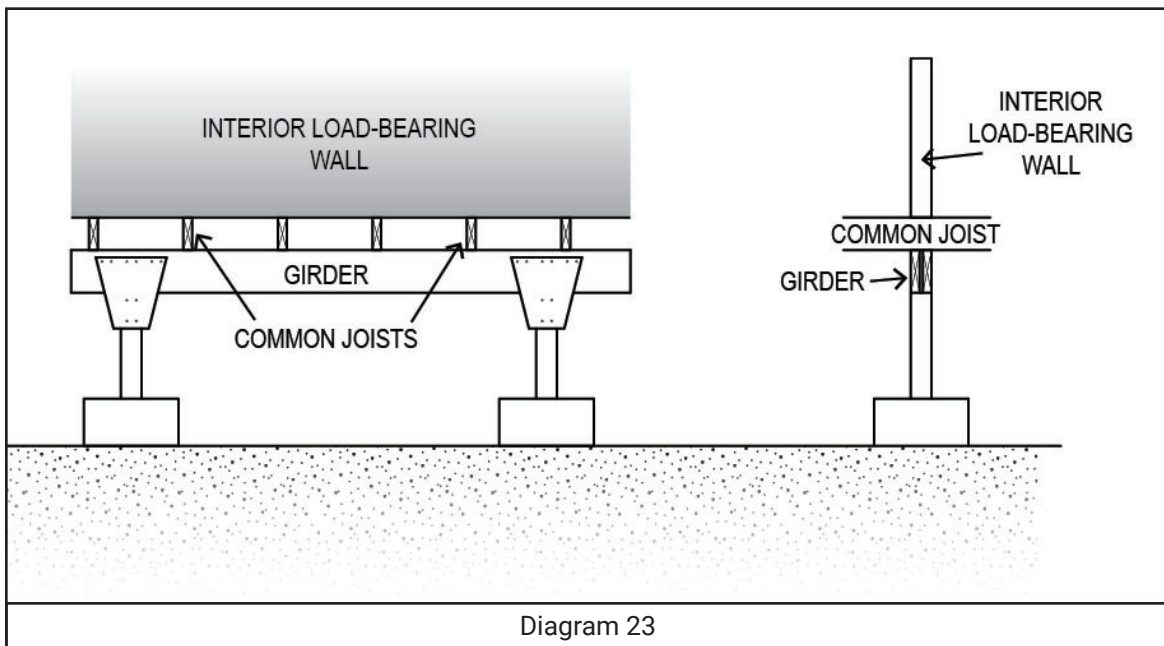


Girders may be built to support walls previously supported by the floor system to be replaced.

Underneath exterior load bearing walls where the full floor system is being replaced, a girder should be built to support that load bearing wall (See Diagram 22)

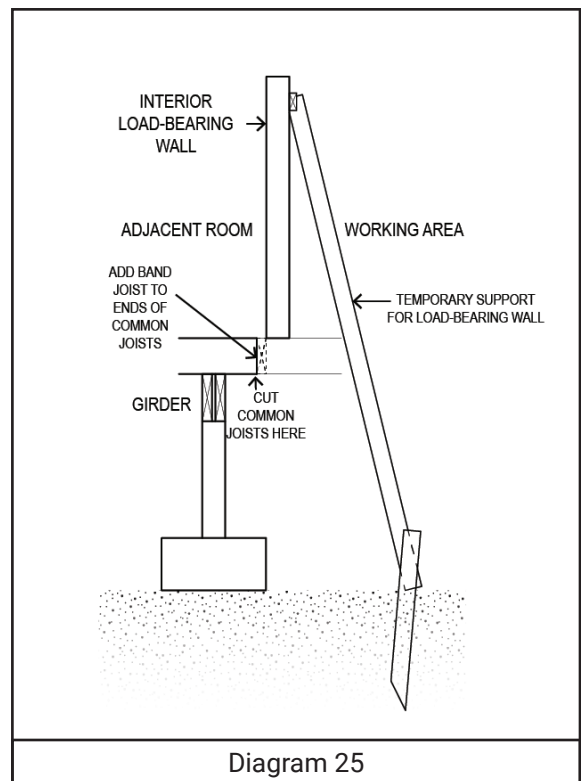
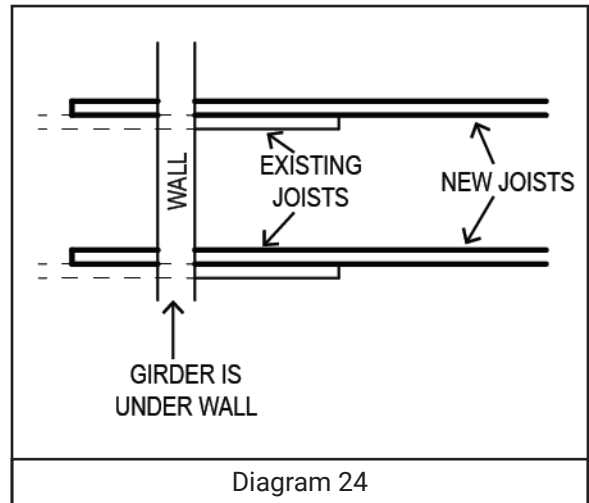


- See instructions for building girders on page 27
- The girder should fit snug underneath the base plate of the wall (rather than under common joists), and between piers
- This girder will also act as the band joist for the floor system later when the common joists are installed

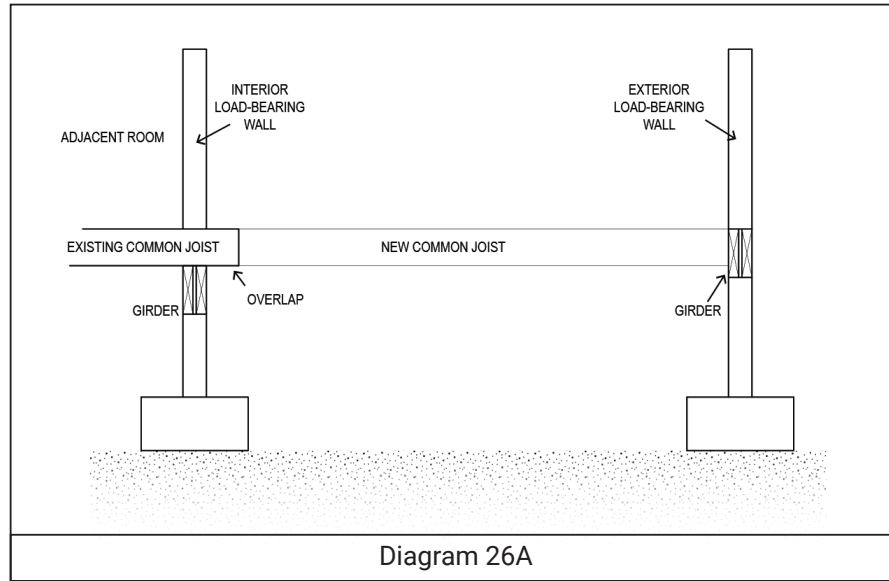


Floors

- Joists coming in from another room (on the other side of an interior load bearing wall) may cause interference with building a girder to support this interior wall.
 - If the joists are in good condition below this interior wall (See Diagram 23):
 - There can be a girder built underneath these joists
 - See instructions for building girders on page 27
 - Existing joists can be left extending several feet into the room where the floor repairs are being made so that the old and new joists can be sistered together over the new girder (See Diagram 24)
 - If the joists directly underneath the interior load bearing wall need to be replaced: (See Diagram 25)
 - A girder will need to be added underneath the floor system in the adjacent room to hold the joists
 - See instructions for building girders on page 27
 - Common joists should be cut and a band joist should also be added to the end of these joists to tie the floor system of that room together
 - Make sure temporary support for interior load bearing wall is in place before cutting joists
 - After the girder is installed and the adjacent floor system is supported, the existing floor structure in the working area can be removed
 - A girder should be built underneath the interior load bearing wall (See Diagram 22 - the girder will be in the same location except the wall will be an interior wall)
 - The girder should fit snug underneath the base plate of the wall (rather than under common joists)
 - This girder will also act as the band joist for the floor system later when the common joists are installed



Floors

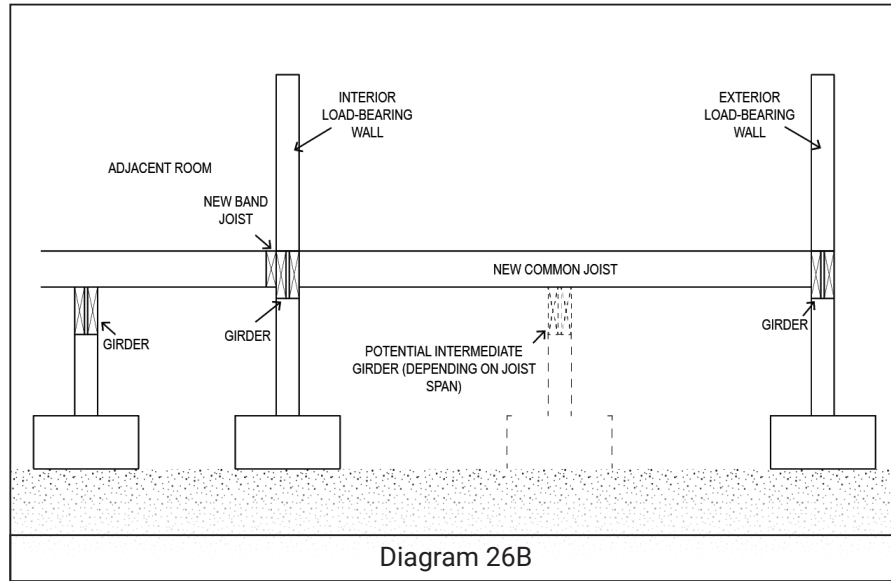


- Diagram 26 shows two options for how the new floor system could work, depending on the conditions of the joists in the adjacent room
- Once the girders are installed underneath the load bearing walls, all kickers and temporary supports can be removed
- Girders installed underneath walls are not necessarily going to be level, because the walls are likely not level if the floor system is sagging
 - The control point for the level of the floor will most likely be the door to the room
 - At the door, measure down the thickness of the finished floor and the subfloor added together (if applicable) this will indicate the tops of the common joists
 - Transfer this line across the girder/band joist with a long level
 - Transfer the level across the room using a string level and make a mark for the top of the joists on this side of the room as well
- If there is a dramatic slope in the girder, a wide substitute band joist (like a 2x8 or 2x10) can be attached to the girder level (See Diagram 27, facing page)
 - Attach with ledger locks one over the other, every 24"
 - If this substitute band board is used on either side, common joists will connect to it rather than directly to the girder

New Joists can now be installed

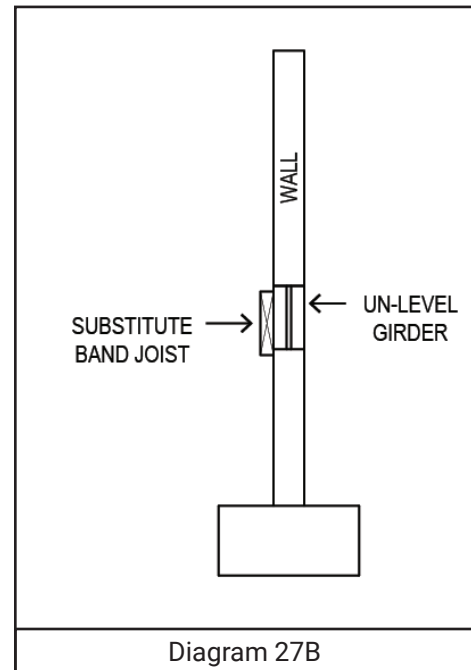
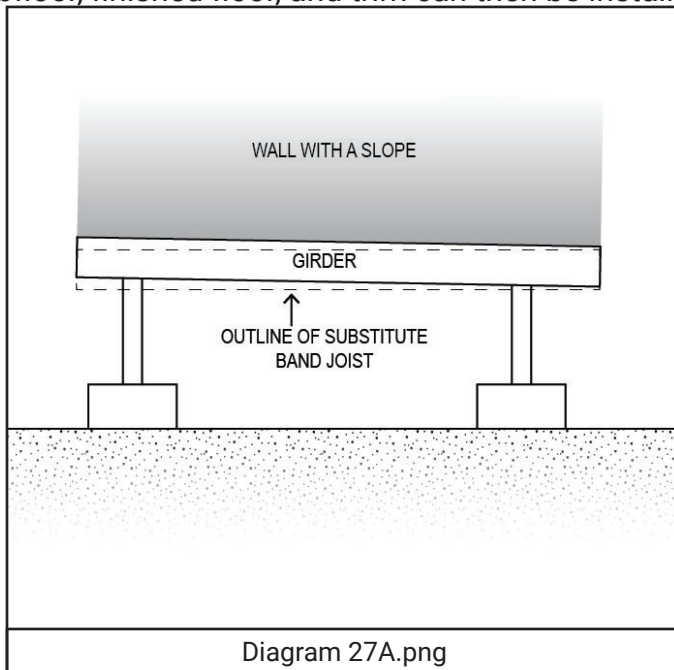
- Determine the size of the joist to be used, based on span chart and any additional girders that will be installed
- Make sure that new joists are installed level
- Install every 16" on center
- The girder (or substitute band joist) will act as the band joist and common joists will connect directly to it using joist hangers coordinating to the size of joists
 - Use 1 ½" joist hanger nails or joist hanger screws through the flat surfaces and 2 ½" joist hanger nails or joist hanger screws through the diagonals
- Make sure that a joist is installed underneath non-load bearing walls or that blocking is included to support those walls (See Diagram 16)

Floors



- Intermediate girder(s) can be used to support the new common joists as needed (See Diagram 26B)
 - See instructions for building girders on page 27
 - If using intermediate girders one common joist can be installed near each end of the room and then girders can be built up to the bottom of them (rather than trying to figure out what height to build the girder)
 - This way the girder can be installed with less common joists as obstacles
 - Make sure that the girders extend underneath the non-load bearing walls so that the floor system will provide support for them
 - After the girder is installed, the remainder of the common joists can be installed

Subfloor, finished floor, and trim can then be installed



Floor Coverings

Floor Covering Project Planning

- Make sure flooring material sits in home and acclimates to temperature for 48 hours
- Is the subfloor level? Will you need to level with lauan or floor leveling compound?
- What wall of the room will the flooring start on? (Try for parallel to long side of room when possible.) Do you need to match direction of flooring in other areas of the home?
- Are there any vents/obstacles in the floor to be aware of?
- Make sure flooring installation kits are available
- Make sure the homeowner understands and are okay with how the floor needs to be maintained. (If using anything other than vinyl, communicate with the homeowner that product cannot be wet mopped.)
- Account for 10% extra when ordering floor covering material.
- What will you need to move out of the way? Will you need to factor in disconnecting any appliances? Can you do half of an area and then shift to complete the other?

Measurements Needed

- Measure the area of the floor
- Measure the perimeter of the room for baseboard
- Order an extra 10% for waste and mistakes
- Quantity and length of transition strips

Quality Control

- Account for ¼" of space around the perimeter so that the flooring has room to expand and contract
- Make sure subfloor area is as clean as possible before flooring installation
- Make sure the flooring runs parallel to the long side of room if possible
- On the first row, make sure that the sticky tab faces the field (For laminate, tongue against the wall and groove facing out)
- Make sure there are no gaps or spaces between pieces of flooring.
- Make sure to apply pressure on seams to adhere properly
- Make sure seams are staggered by at least 12"
- Make sure cut pieces of flooring are no smaller than 12"
- If using laminate flooring, make sure foam underlayment is installed beforehand.

Common Mistakes

- Subfloor is not swept clean before flooring is installed
- Flooring too tight to wall which can cause buckling later
- Spaces/cracks left between pieces of flooring allowing edges to chip and dirt to gather (for vinyl this reduces water tightness)
- Not planning out rows so that pieces are both too short and seams are staggered (at least 12")
- Not allowing flooring to acclimate to temperature in the space
- Cut edges in the field causing the subsequent piece to not adhere properly

Floors

After Work is Complete Quality Control Check

- Remove spacers (if applicable)
- Install baseboard and transition strips to protect edges of floating floor system
- Determine if quarter round trim will be needed if spaces around perimeter are too wide for only baseboard trim to cover
- Clean area and remove any construction waste
- Remind homeowners of necessary floor maintenance (no wet mopping for laminate)

Floor Covering Materials

Quantity	Item	Purpose / Notes
Vinyl Plank Flooring		
____Sq Ft	Flooring	Add 10% for waste. SF needed x 1.1 = Total Flooring to Order (SF)
____Sq Ft	Lauan or floor leveling compound	To help provide a smooth surface or fill in gaps
	Drywall Screws	To fasten lauan (if applicable)
____Sq Ft	6 mil plastic	vapor barrier, only if installation is over concrete subfloor
	Floor Registers	Measure size for each one
	Transition Strips	Measure length for each doorway

Baseboard materials list/recommended tools on page 204

Recommended Tools

Safety:

- Glasses
- Ear Plugs

Power Tools: (Laminate)

- Laminate Saw or Miter Saw (For Laminate and Underlayment)
 - Finishing blade
- Jig saw - to cut notches around vents/etc.
 - Wood Blade
- Circular Saw
- Drill/Impact Driver
 - Phillips Driver (or dimpler bit)
 - Large bit to start holes for jig saw

Power tools: (Vinyl Flooring, if using lauan)

- Circular Saw
- Drill/Impact Driver
 - Phillips Driver (or dimpler bit)

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc)
- Shop Vac or broom/dustpan
- Oscillating Multi Tool
- Extension Cords
- Snips/ Hack Saw
- Saw Horses
- Utility Knife

Flooring Underlayment

Flooring underlayment is installed over subfloor, before finished flooring to help provide a smooth surface or cover any gaps left from subfloor patches.

Clean area well before installing underlayment.

Lauan Underlayment:

- Lauan is a ¼" plywood that comes in 4'x8' sheets
- Lauan should be installed perpendicular to the subfloor
- Seams of lauan should not line up with seams of the subflooring
- Seams of the lauan should be staggered by 2'
- Fasten lauan with drywall screws using a dimpler bit every 6" around the edges and every 12" in the field
- Seams should be tight and there should not be any gaps

Vinyl Plank Floor Covering

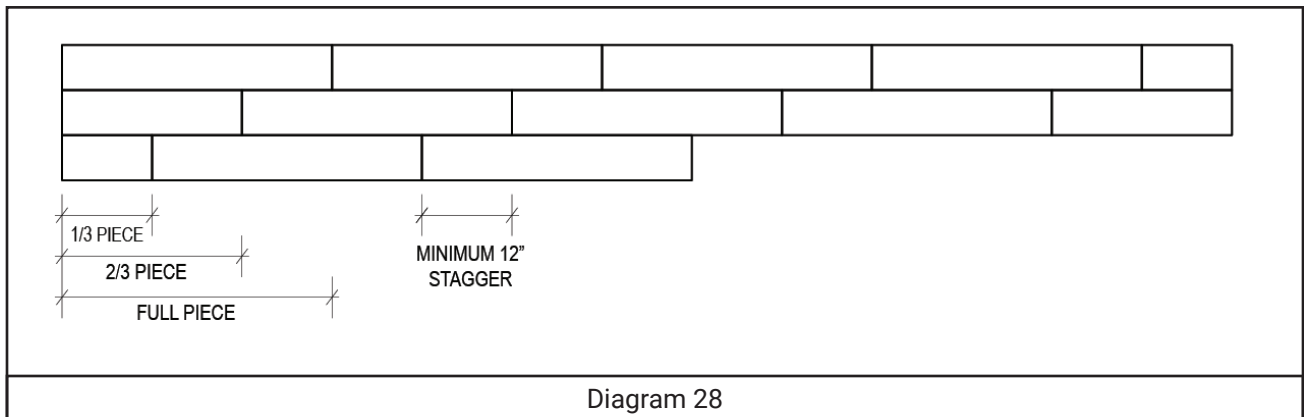
Vinyl Plank Flooring Covering - Basic Information

- Water resistant flooring (good for kitchens/bathrooms/laundry)
- This material is flexible enough to be used on surfaces that are not completely flat
- Must be allowed 48 hours to acclimate to the room temperature before installation
- Pieces are cut by scoring with a utility knife and bending to break
- If there are any gaps in the subfloor greater than $\frac{1}{4}$ ", they need to be filled with floor leveling compound before flooring is installed
- If installing flooring on a concrete subfloor, a 6mm moisture barrier should be laid (seams should be taped and barrier should be run 6" up the wall)
- Vacuum/sweep before and during installation, particles that get on the sticky tab will keep it from adhering well

Vinyl Plank Planning and Preparation Instructions

Each flooring manufacturer may have directions that vary from these general directions. Refer to the flooring manufacturers: instructions, videos and other resources for more specific information about minimum piece length, acclimation period, wall spacing, how the pieces interlock and other details

- Determine the layout of the flooring in the room
 - Typically plank style flooring is installed parallel to the long wall of the room
 - The shortest piece that should be used is 12"
 - Make sure that each row is started with a size piece that will allow the last piece in the row to also meet the 12" minimum
 - For example, if the pieces of flooring are 3' and the length of a room is 12' 6"...
 - Do: Cut at least 6" off of the first piece in the row so that the last piece will meet the 12" minimum
 - Do not: install four full length pieces and then one 6" piece
 - Be cautious of which edge you trim so that the pieces still have the correct locking edge
 - Seams of each row will be staggered by at least 12" (See Diagram 28)
 - So long as it works with the 12" minimum length for pieces at the end of the row, start the first row with a full piece, the second row with $\frac{2}{3}$ of a piece, and the third row with $\frac{1}{3}$ of a piece and then repeat this pattern
 - If this pattern does not work with the length of the room, find a staggering pattern that does

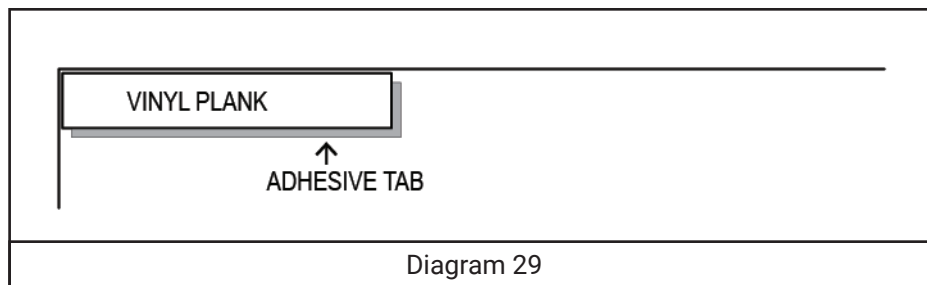


Floors

- The first row that is installed may need to be cut to a smaller width to avoid the last row in the room being very narrow
 - Measure the width of the room and divide by the width of a piece
 - For example, if the width of the room is 10'2" and the pieces of flooring are 6"...
 - **Do not:** install a full width piece on the first row and then end up with the last row being 2" wide
 - **Do:** Cut the width of the first row to 4" allowing the width of the last row to also be 4"
- When doing flooring in multiple rooms, try planning to run flooring from one room to the next if possible. If not, make sure to have transitions strips for doorways to protect the edge of new flooring.
- Cut door jambs to allow flooring to slide underneath them
 - Lay a piece of flooring beside the door jamb and mark the height where the cut will need to be
 - Use a hand saw or oscillating saw to make this cut
- Use spacers where the flooring butts up to the wall to create a ¼" gap
 - These will be removed after the floor install is completed
 - This allows the whole floor to float and expand/contract over time
 - Spacers are usually included in laminate installation kits or scraps of flooring can be used
- Make sure subfloor is clean of debris before laying flooring and make sure any fasteners are driven flush with subfloor so that the flooring won't be compromised over time.
- See the following instructions for specifics on Laminate and Vinyl Plank

Vinyl Plank

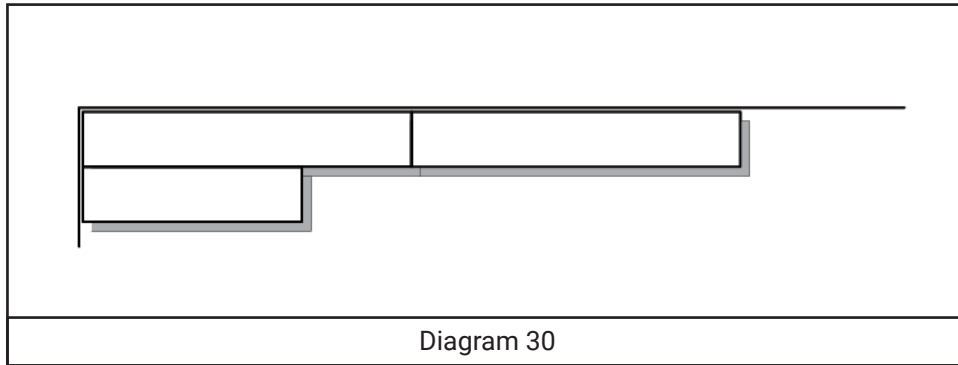
- **Vacuum/sweep before and during installation, particles that get on the sticky tab will keep it from adhering well**
- **Make sure any fasteners used in subfloor/underlayment are driven in correctly so that the flooring won't be compromised after installation**
- For the first row:
 - The adhesive tab will be facing the room (See Diagram 29)
 - Work across the starting wall and overlap the adhesive tab of pieces on the short edges



- Seams
 - Seams should be tight; you should not be able to tell where the seam is when running your finger over it
 - If the seam is not tight, you can pull the pieces apart and try again, this may not be easy because of the adhesive seam
 - There is about a 15-minute window for working with these pieces before the adhesive material starts to cure
 - Cut edges should only be used against the walls
 - Use a roller over the seams to help the flooring to adhere to one another

Floors

- Following rows:
 - Start with a piece that allows for the required 12" stagger
 - The non-tab side of the next row of pieces will be installed over the adhesive tab of the previous row (See Diagram 30)
 - Continue down the row and install full pieces until you reach the last piece in the row
- Rather than measuring each piece at the end of each row when there is less than a full length



remaining, you can rotate a full piece 180° and hold it into place, make a mark where this piece and the previous overlap, cut here

- Cut edges of vinyl should always be towards the wall, never in the field
 - Be cautious when working that all edges are overlapping appropriately
 - Be careful when cutting that cuts are being made off the correct side and the necessary factory edge is remaining

Baseboard

Additional information for baseboard/trim found on page 212 In the Paint and Trim Finishing Chapter of the Manual.

Floors

Blank Page



Walls, Windows & Doors

Walls

Why walls? Walls support the roof and provide means for insulating the home.

Safety

- If repair needs to be made to load bearing walls, make sure that kickers are used to support the weight of the roof (instructions for kickers are on page 35)
 - Load bearing walls are typically parallel to the ridge of the roof
- If cutting into siding/sheathing or drywall for wall repair, be cautious of wires that may run through the wall
- If repairing an exterior wall from the outside, make sure to check for any potential hazardous siding materials (asbestos, lead paint, etc)

Wall Project Planning

- Will band joist/floor system need repair as well? (If yes, that should be done first)
- During repairs will any temporary support be needed?
- Is it an exterior wall? Will it need to be insulated?
- Will there be a window or door?
- Is there room to build the wall then raise it into place?
- Will any permits/inspections be needed?
- Make sure site can be left safe for family overnight.
- Are there any obstacles to be aware of? (Venting, electrical, plumbing, etc)
- Does framing need to be adjusted in order to accommodate a mobile home wall dimensions?

Measurements Needed

- Square footage of sheathing/siding/drywall to be repaired
- Height of room
- Size/spacing of studs to be repaired
- Measurements of windows/doors if applicable

Quality Control

Framing:

- Place a bead of caulk on floor before raising the wall into place
- Does the wall have/need a double top plate?
- Check spacing for studs (16" o.c.)
- Check that studs are plumb and flush with one another on the interior side
- Make sure necessary blocking is added for siding and drywall
- Make sure headers are supported by jack studs
- Are necessary cripples for windows and doors installed

Sheathing:

- If working from the outside of a home, make sure your sheathing ties into the floor system
- Sheathing is installed starting from the bottom of the wall
- Make sure sheathing is ½" material
- Make sure OSB is perpendicular to studs
- Stagger seams of OSB
- Make sure each sheet covers at least 2 stud bays/3 studs
- Make sure sheet is adequately fastened (every 6" on perimeter and every 12" along interior)
- Make sure the edge of OSB lands on the middle of a stud

Common Mistakes

Framing:

- Double top plate not overlapping intersecting walls
- Studs not spaced appropriately
- Blocking not added and siding/drywall not adequately secured
- Studs not plumb or flush

Sheathing:

- Sheathing runs vertically
- Sheathing is started from top of wall
- Seams lined up, reducing strength of sheathing
- Gaps between sheets of sheathing
- OSB patch does not span 3 studs
- Sheathing is not fastened appropriately

After Work is Complete Quality Control Check

- Are there nailers for drywall in the corners?
- Are double top plates connecting the walls?
- Are studs flush to each other?
- Will the wall need to be insulated before drywall?
- Make sure all gaps are sealed in sheathing to prevent air and light entering room

Wall Material List

Quantity	Item	Purpose / Notes
	Studs or 2x__x__ F	Vertical members of wall framing
	2x__x__ F	Double Top/Bottom Plate; King/Jack/Cripple Studs
	2x10x__ F	Header for Windows/Doors
	7/16" OSB	Wall Sheathing and Middle of Header <i>SF of wall/32 (SF in one piece) # of pieces needed</i>
	3" screws or 16d Nails	For attaching framing
	2 ½" screws or 8d Nails	For sheathing
	Construction Adhesive	Under bottom plate of wall

Recommended Tools

Safety:

- Glasses
- Gloves
- Ear Plugs
- Masks

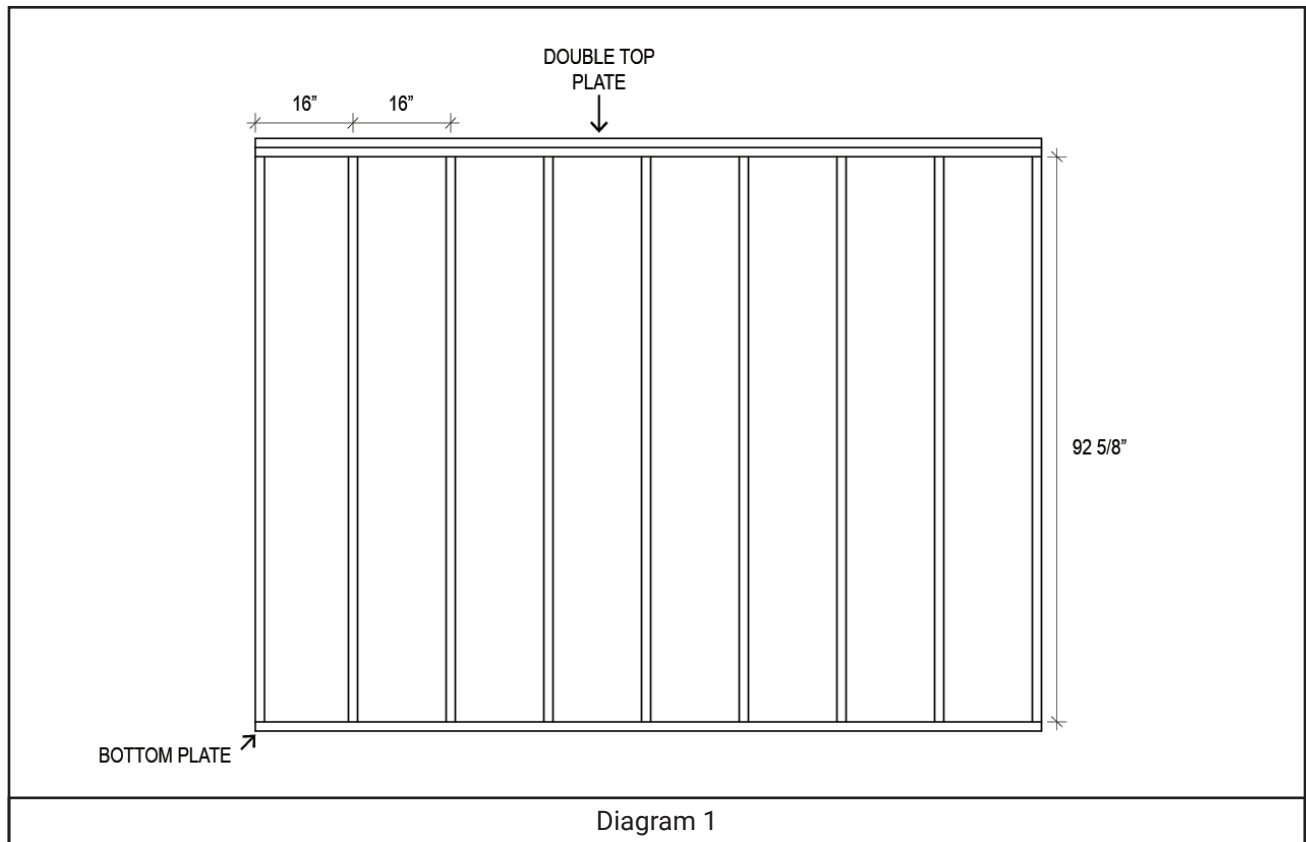
General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc)
- Saw Horses
- Extension Cords/Splitters
- Caulk Gun
- Level
- Chalk Line
- Prybars
- Ladders

Power Tools:

- Miter Saw
- Circular Saw
- Jig Saw
- Reciprocating Saw
 - Metal Cutting Blade - cutting nails while removing damaged areas
 - Wood Cutting Blade
- Drill/Impact Driver
 - T-25 drivers for deck screws

Wall Components



- Bottom Plate
 - Sits on subfloor
 - Bottom of studs rest on bottom plate
- Studs
 - Vertical members of a wall
 - Typical length of pre-cut studs is 92 $\frac{5}{8}$ "
 - When combined with double top plate and bottom plate, finished wall height is just over 8'
 - Most commonly studs are placed 16" or 24" on center (Start on one end of the wall and continue the Studs across the wall even if they are interrupted by windows and/or doors)
 - Studs should be level and plumb.
- Double Top Plate
 - The lower top plate holds the top of the studs
 - The upper top plate is added after the walls are constructed and is used to tie intersecting walls together
- 2x4s are the most common lumber size for wall framing

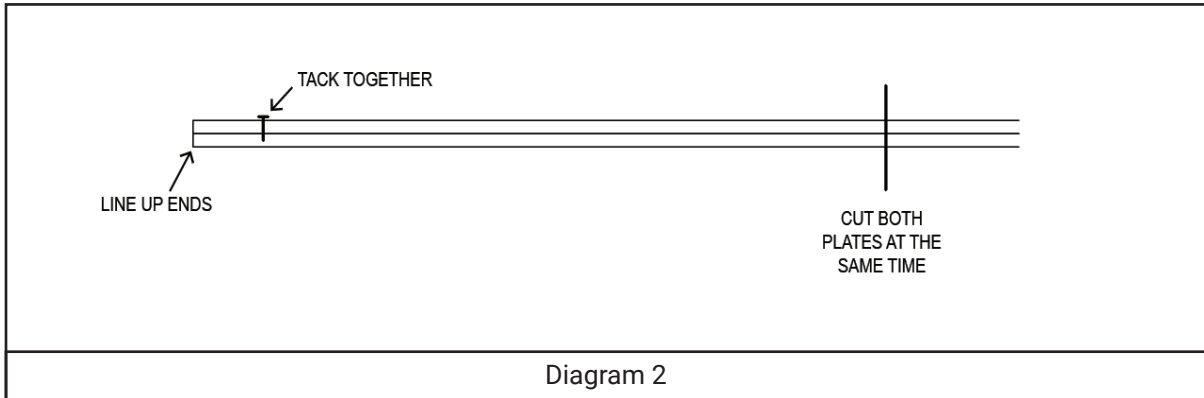
Walls, Windows & Doors

Building New Walls

Ideally, it is best to build walls laying on flat ground then move them into place.

Top and bottom plate: (See Diagram 2)

- Top and bottom plate should be cut to the same length
- Line up one end of the top and bottom plate well and then tack them together temporarily with a screw or nail
- Measure and cut through both plates for a wall at the same time



Door and Window Openings (Headers)

Headers are horizontal beams in walls that carry the roof load over window or door openings (See Diagram 3). The table below helps determine the size of material needed for headers in different applications.

If header is supporting a second or third story consult you construction consultant, or Home Repair Coordinator before proceeding

Table 1: Allowable Span for Double Headers			
Dimension of Lumber	Supporting Roof Only	One Story Above	Two Stories Above
(2)-2x6	4'	2'	N/A
(2)-2x8	8'	6'	4'
(2)-2x10	10'	8'	6'

Window openings: (See Diagram 3)

- The rough opening for a window should be 1" taller and 1" wider than the actual window size
- The bottom of the window must be at least 18" off of the floor
- Determine what the height of the window will be and if possible line up the top of the windows and doors on a wall/in a room
- In bedrooms at least one window or door must meet egress requirements, allowing someone to get out of it in an emergency
 - Check with local inspector for these requirements
- Window framing:
 - King studs: run from top plate to bottom plate, beside jack studs
 - Jack studs: run from bottom plate to bottom of header
 - The spacing of jack studs should be the width of the rough opening inside to inside
 - Header: beam that sits on top of jack studs, between king studs, and supports the weight of the roof across the window opening (instructions for building below)
 - Sill: sits on top of cripples between jack studs and forms bottom of rough opening
 - Cripples: short studs that run from sill to bottom plate or header to top plate. Cripples are necessary for nailing drywall/sheathing and transferring the load from the top plate to the header

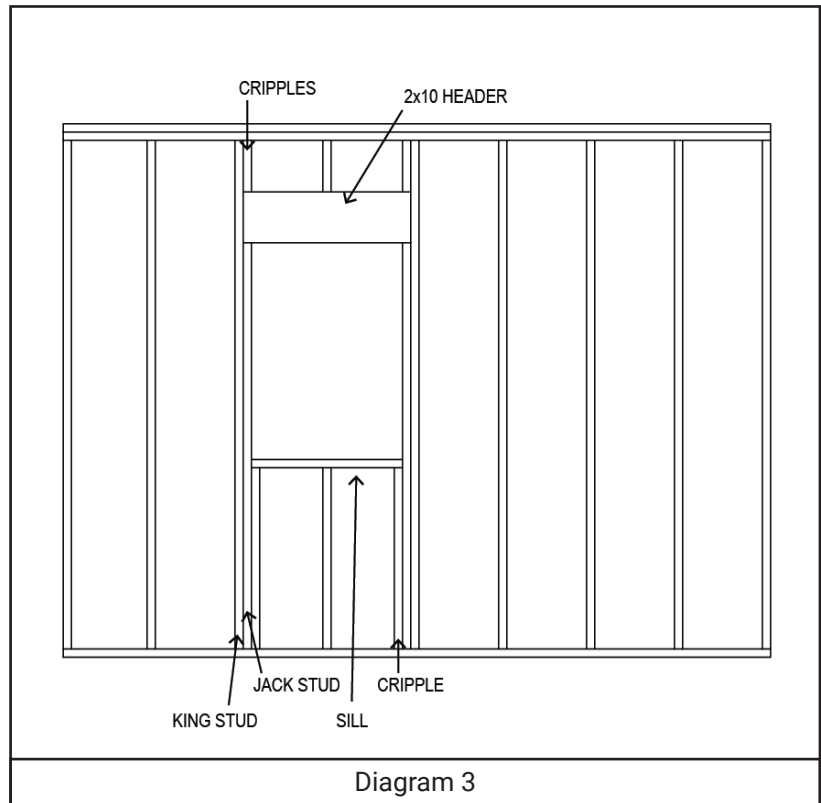
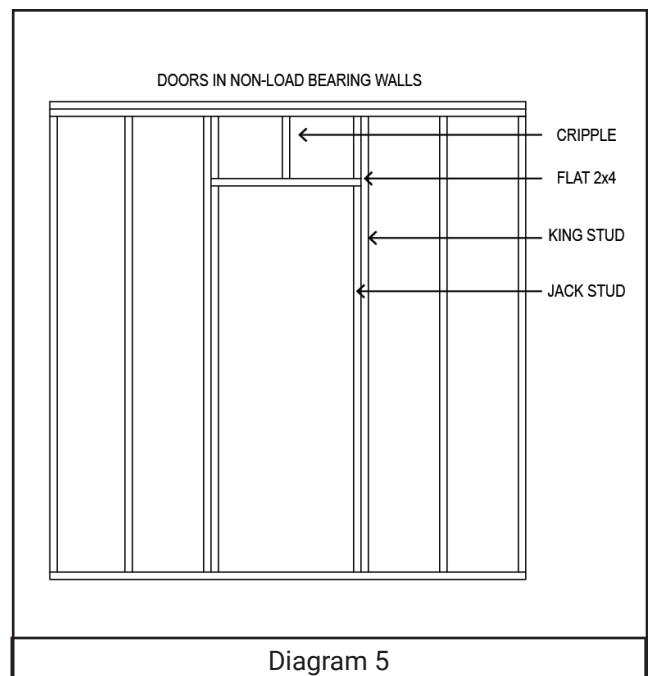
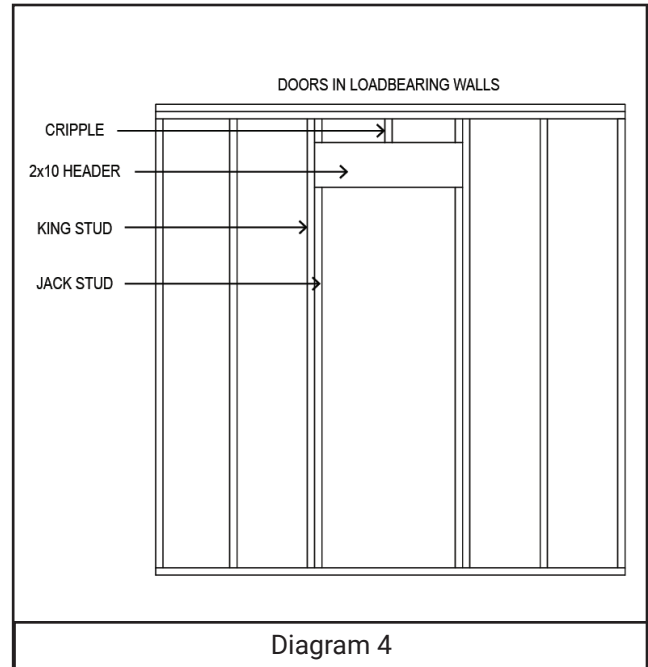


Diagram 3

Walls, Windows & Doors

Door openings: (See Diagram 4)

- Door framing will vary depending on whether the door is in a load bearing wall, doors on non-load bearing walls can be framed differently
- The rough opening for a door should be 2" wider and 2" taller than the door:
 - The bottom plate of the wall should be left in place until the wall is stood and secured, then cut out using a reciprocating saw
 - Account for this 1 ½" when making the rough opening (jack stud should only be cut ½" longer than the actual door size and the other 1 ½" will come from the bottom plate being cut out)
- Think about which way the door will swing when determining the location of the door frame
 - Framing for doors in load bearing walls: (See Diagram 4)
 - King studs: run from top plate to bottom plate, beside jack studs
 - Jack studs: run from bottom plate to bottom of header
 - The spacing of jack studs should be the width of the rough opening inside to inside
 - Header: beam that sits on top of jack studs, between king studs and supports the weight of the roof across the door opening (instructions for building below)
 - Cripples: short studs that run from header to top plate
 - Framing for doors in non-load bearing walls: (See Diagram 5)
 - King studs: run from top plate to bottom plate, beside jack studs
 - Jack studs: run from bottom plate to flat 2x4 at top of door opening
 - The spacing of the jack studs should be the width of the rough opening inside to inside
 - Flat 2x4: sits on top of the jack studs, between king studs
 - Cripples: short studs that run from the flat 2x4 to the top plate



Walls, Windows & Doors

Laying out plates: See Diagram 6 A-D

- Mark on one plate for where studs will fall, marks can be transferred from one to the other
- It is important when laying out the studs to do it in a way that when sheathing and drywall are hung that their ends will fall on studs (8' from the corner should fall in the center of a stud)
- Hook the tape measure on the end of the plate and make marks $\frac{3}{4}$ " before 16" spacing
 - $\frac{3}{4}$ " is half of the width of a stud
 - These marks are where the leading edge of the studs
 - Marks will be at 15 $\frac{1}{4}$ ", 31 $\frac{1}{4}$ ", 47 $\frac{1}{4}$ ", 63 $\frac{1}{4}$ ", 79 $\frac{1}{4}$ ", 95 $\frac{1}{4}$ " etc. (See Diagram 6A)
 - Transfer these marks all the way across the plate (See Diagram 6B)
 - Use a speed square to mark the other side of the stud (See Diagram 6C)
 - "Xs" indicate where studs will sit
- Determine where window/door openings will be
 - Make marks on the plate for the king/jack/cripple studs
 - If possible, a stud in the regular layout can double as a king stud
- Lay plates beside one another and transfer marks onto the blank plate using a speed square
 - Make sure ends are flush

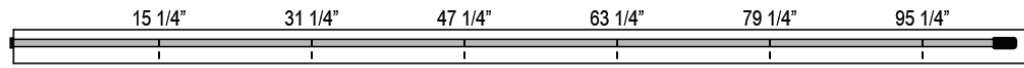


Diagram 6A

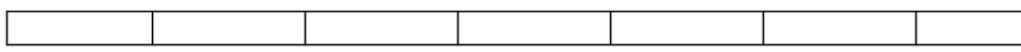


Diagram 6B

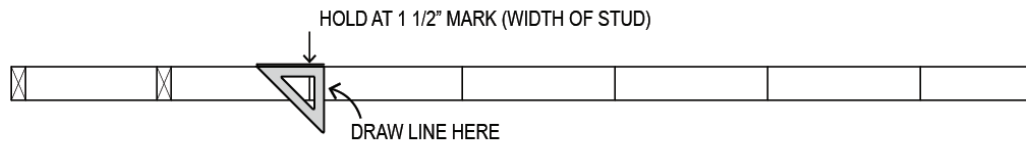


Diagram 6C

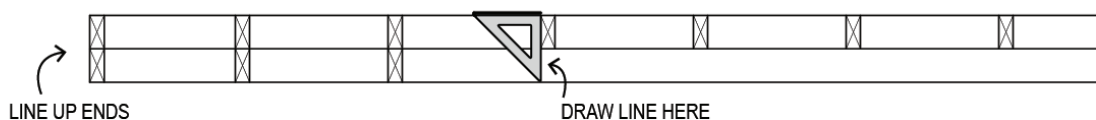
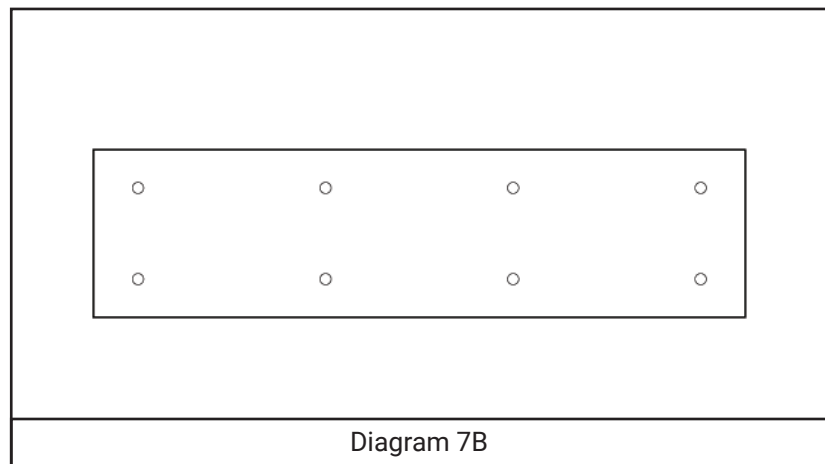
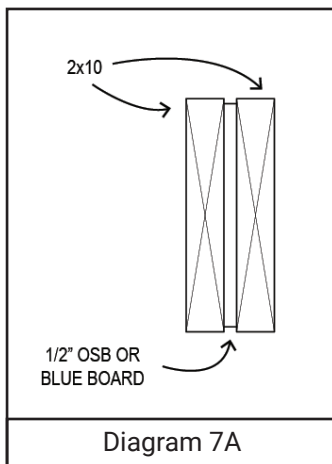


Diagram 6D

Walls, Windows & Doors

Build headers: (See Diagram 7 A-B)

- Headers should be sized according to table 1 on page 74 with a strip of ½" OSB or ½" bluefoam in between. The added strip makes the header the same depth as the wall framing.
- The length of the header should be the width of the rough opening plus 3"
- Pieces should be glued together with construction adhesive
- Fasten header together with 16d nails or 3" screws



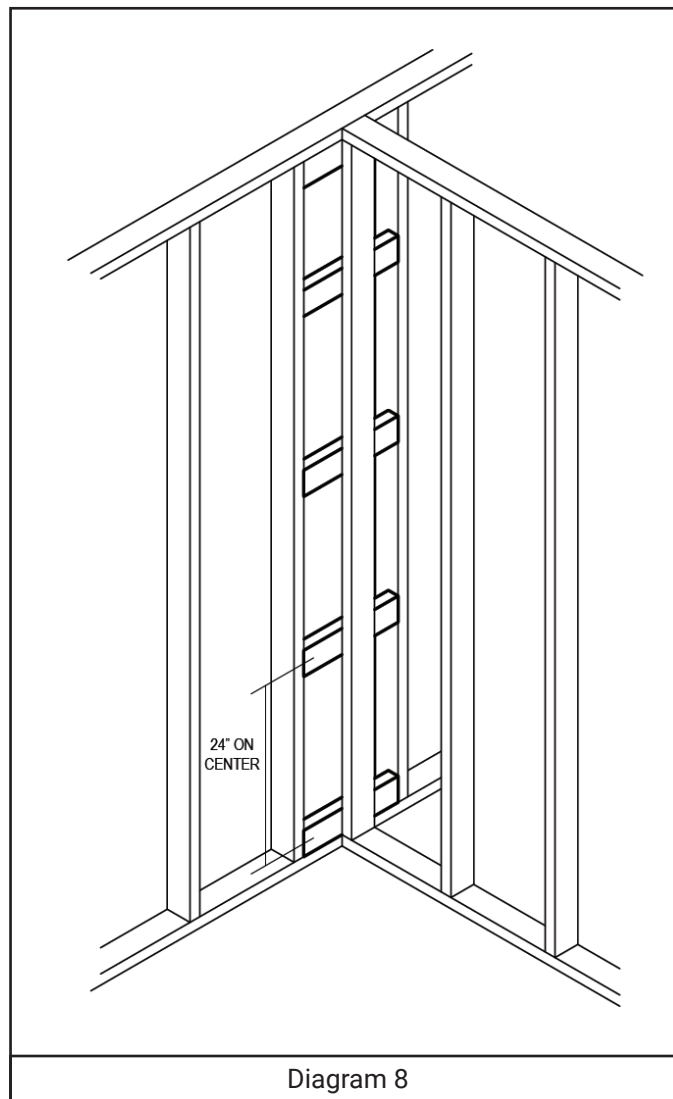
Construct wall:

- Cut the components (jacks/cripples/etc.) to length based on the rough opening
- Studs will be fastened into place using 3" screws or 16d nails, fastened through the face of the plate
 - Use 2 nails or screws into each end of the stud
- Lay the top plate (second top plate will be added later), bottom plate, studs, and door/window components forming the wall shape on the ground
- Order of installation:
 - Place king studs first
 - Add header/flat 2x4, fastening in through the king studs
 - Install jack studs, butting up underneath header/flat 2x4
 - Install sill and cripples at bottom of wall, fastening through sill into top of cripples
 - Install cripples over the header, toenail into header
 - Install regular studs at any time

Walls, Windows & Doors

Ladder blocking: (See Diagram 8)

- Ladder blocking will need to be installed anywhere an interior wall intersects an exterior wall so that there is framing to secure drywall and connecting walls to
- Ladder blocking will be 2x4 blocks, spaced 24" on center, between studs that interior wall will intersect with



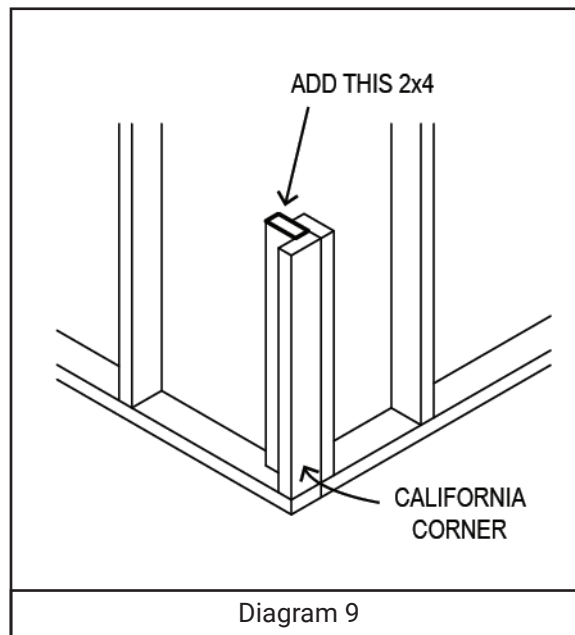
Stand the wall:

- For exterior walls, add a bead of caulk on the subfloor where the bottom plate will sit
- Raise walls into place
 - Attach to ladder blocking and/or other walls where they intersect using 3" screws or 16d nails
 - Attach to the subfloor, fastening into joists where possible
 - Add temporary bracing if needed to help support the wall until the double top plate is installed

Walls, Windows & Doors

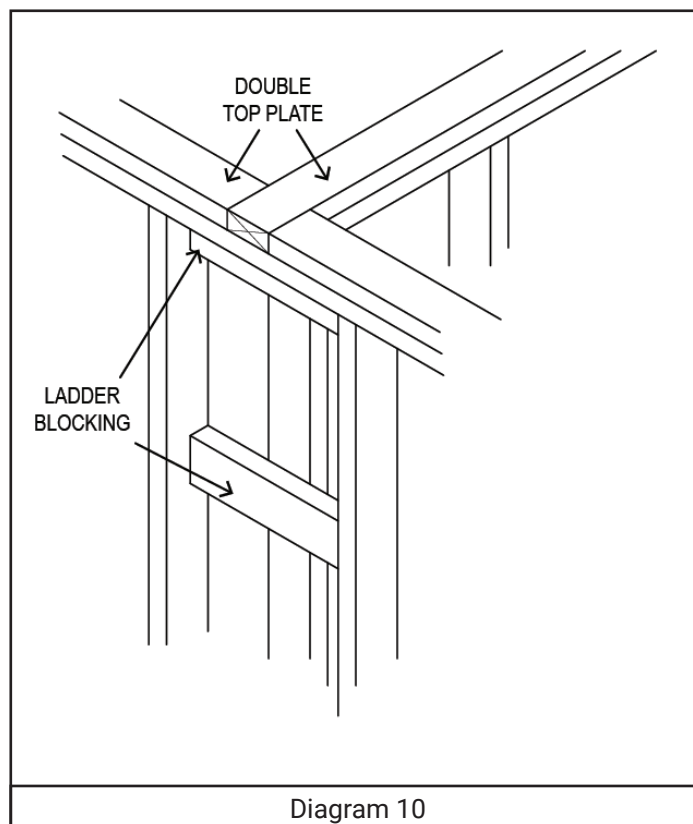
Corners: (See Diagram 9)

- California corners can be used to create a nailer for drywall where walls intersect



Double top plate: (See Diagram 10)

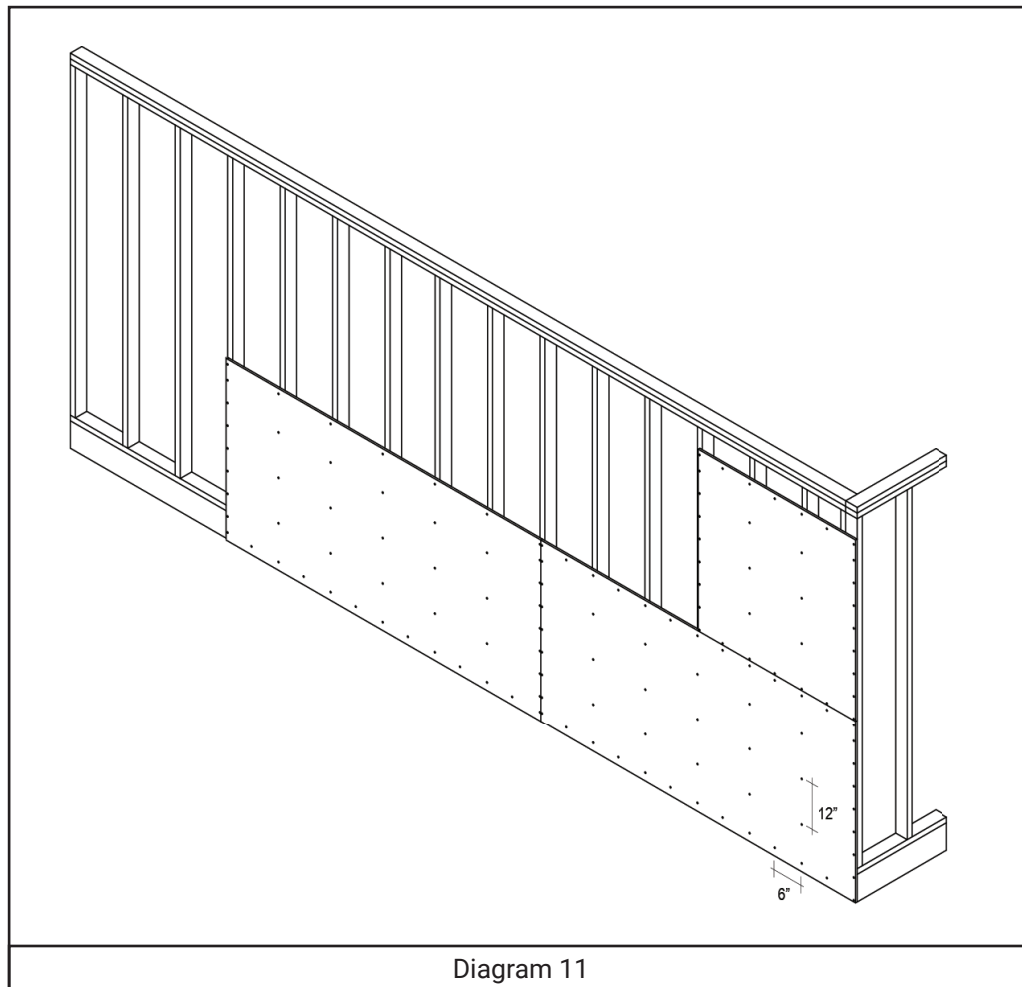
- Double top plate sits directly on top of top plate and is fastened with screws or 16d nails
- This plate is used to tie walls together and hold them in place



Walls, Windows & Doors

Sheathing Walls

- Exterior walls should be sheathed with 7/16" OSB
- The sheathing provides lateral support and air sealing
- Plan layout of OSB
 - OSB will run horizontally, perpendicular to the studs
 - Rows of OSB should run from the bottom of the floor system to the top of the wall
 - Each sheet should cover at least 2 bays and 3 studs
 - It is best to avoid using small pieces of OSB if possible because there is greater strength with fewer seams
 - Seams should be staggered by at least 2 stud widths
- Install OSB
 - Start at the bottom of the floor system, installing lower courses first and working up the wall
 - Each 4' edge of the OSB should always land on a stud
 - Attach the OSB with 2" screws or 8d ring shank nails every 6" on the edges and 12" in the field
 - Cut out holes for vents/etc. using a jigsaw, start holes using a wide drill bit as needed
 - Continue installing OSB in rows; following the same process until a full row will no longer fit
 - For the last row, cut the OSB to width with the upper edge falling even with the top of the double top plate
- After Sheathing is installed, wrap with house wrap to prevent unwanted air flow



Walls, Windows & Doors

Repairing Existing Walls

- If the bottom plate of the wall/or studs are to be removed to be repaired, temporary bracing must be added
 - If there is extensive damage to the bottom plate, there will likely also be issues with the floor system, see band joist repair (pg. 35) and floor repair (pg. 32)
 - Kickers can be installed (see page 37)
 - An interior temporary wall could be installed instead of kickers
 - Set back far enough from working area to still have access to repairs
 - Mount flat 2x4 on both ceiling and floor and wedge studs in between to hold the weight of the roof
 - This method should be used if replacing entire studs because kickers are fastened into wall studs
- Bottom plate repair (See Diagram 12)
 - Cut out damaged bottom plate and cut fasteners holding studs into bottom plate using a reciprocating saw
 - Only remove bottom plate in 8' sections at a time
 - When replacing bottom plate, make sure that ends of a new piece will fall under a stud, or add a block from the old plate to the new between studs
 - Attach to floor with 16d nails or 3" screws

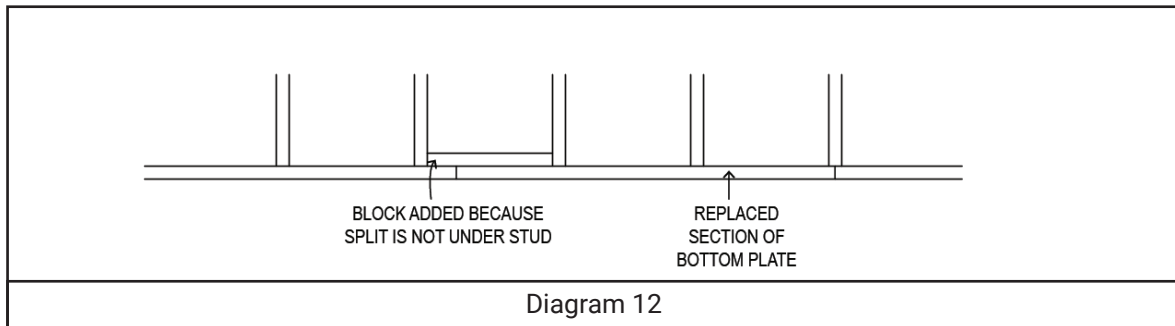


Diagram 12

Walls, Windows & Doors

- Damaged studs can be cut and scabbed or replaced completely
 - Stud replacement
 - Remove existing stud, cutting or pulling fasteners in both top and bottom plate
 - Cut a new stud to length to fit between the top and bottom plate
 - Toe-nail stud into the top plate and bottom plate using 12d nails or 3" screws
 - Scabbing studs (See Diagram 13)
 - Remove the bad piece of stud
 - Replace the damaged piece with a new section
 - Add scabs on either side of the stud to brace the repaired stud
 - Scabs should extend 2' past the damaged area
- Once all damaged components have been repaired, remove kickers/temporary support wall

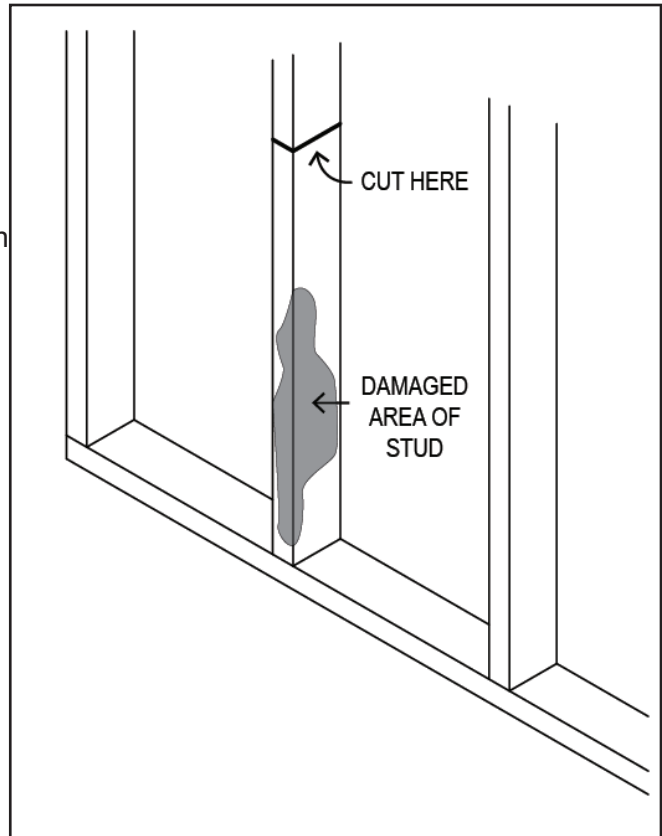


Diagram 13A

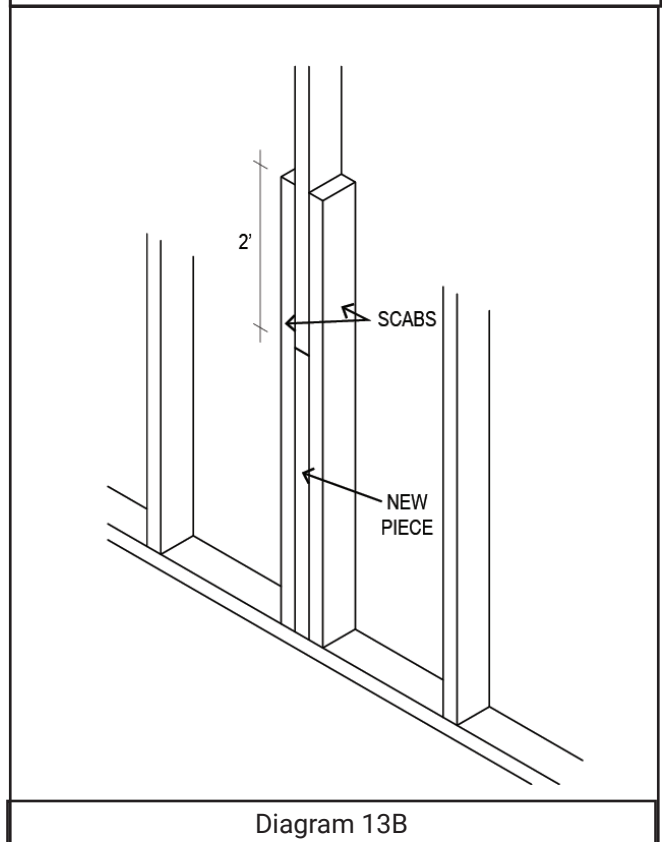


Diagram 13B

Windows

Why windows? Windows allow sunlight, reduce energy demand and are a means of egress in case of emergencies.

Safety

- Wear gloves if working with broken glass
- Be cautious while transporting and installing windows

Window Project Planning

- Rough opening for window should be 1" wider and 1" taller than actual window
- Does the window need to be an egress window? (Egress windows must be in bedrooms)
- Will framing need to be adjusted before replacing any windows?
- Make sure site can be left safe for family overnight
- Will the window need to be a replacement window or a new construction window?
- Will the window need to be specially ordered?
- Will exterior siding or interior drywall need to be repaired after window installation?
- New windows that are in plastic wrapping should never be left in direct sunlight

Measurements Needed

- Rough opening for window size
- For Egress Windows:
 - At least 24"x24" in dimensions
 - Sill heights above the floor is 44" or less

Quality Control

- Make sure the window operates properly
- Make sure caulk is used on back side of window flange
- Use flashing tape to seal sides of window framing AND around window flanges
- Install window flashing tape in proper order
- If shims are needed for a window without a flange install on sides and bottom but not top
- Make sure to seal space between window and framing (spray foam for windows and doors)
- Make sure window is level and square

Common Mistakes

- Flashing tape installation done out of order
- Shims installed on all sides
- Regular spray foam used (Window/door spray foam should be used)
- Incorrect amount of spray foam used (too little is not sufficient and too much can crack windows)

After Work is Complete Quality Control Check

- Is window sealed/insulated well?
- Is install trim/casing on the inside and outside of the window?
- Does inside of window stay dry during rain?
- Does window open/shut properly?

Window Material List

Quantity	Item	Purpose / Notes
	Windows	Light and safety in case of emergency
	Flashing Tape	To seal around framing and flanges
	2 ½" Deck Screws or 12d Galvanized Finish Nails	To attach window to framing
	Exterior Silicone Caulk	To seal around window
	Shims	To level window to framing
	Window/Door Spray Foam	To help fill gaps between window and framing
	½" OSB or black plastic	To seal window opening temporarily if needed

See Trim section on page 212 for materials list and recommended tools

Recommended Tools

Safety:

- Glasses
- Gloves

General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc)
- Torpedo Level or 2' level
- Caulk Gun
- Utility Knife
- Ladders

Power Tools:

- Drill
 - T-25 Driver to match screws for installing window
 - Small drill bit to pre-drill for finish nails

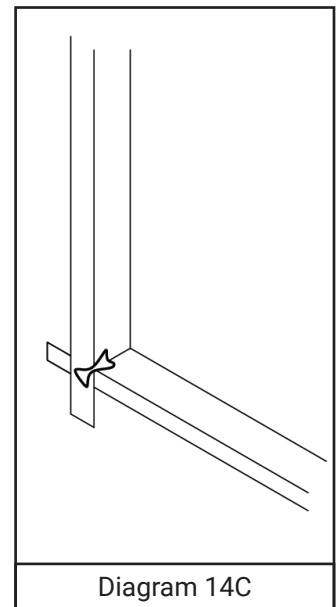
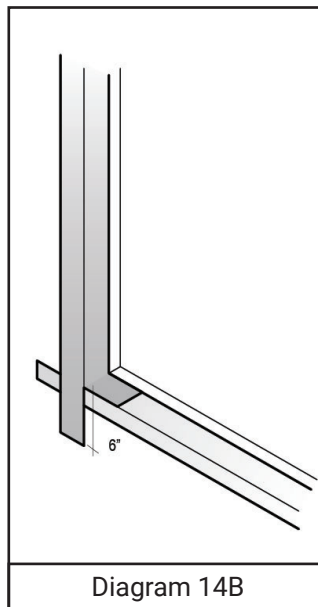
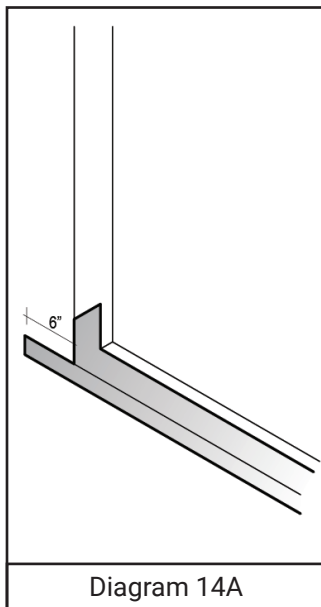
Walls, Windows & Doors

Installing Windows

Each window manufacturer may have directions that vary slightly from these, refer to manufactures directions for specifics about screw/nail placement, shim location and sealing details.

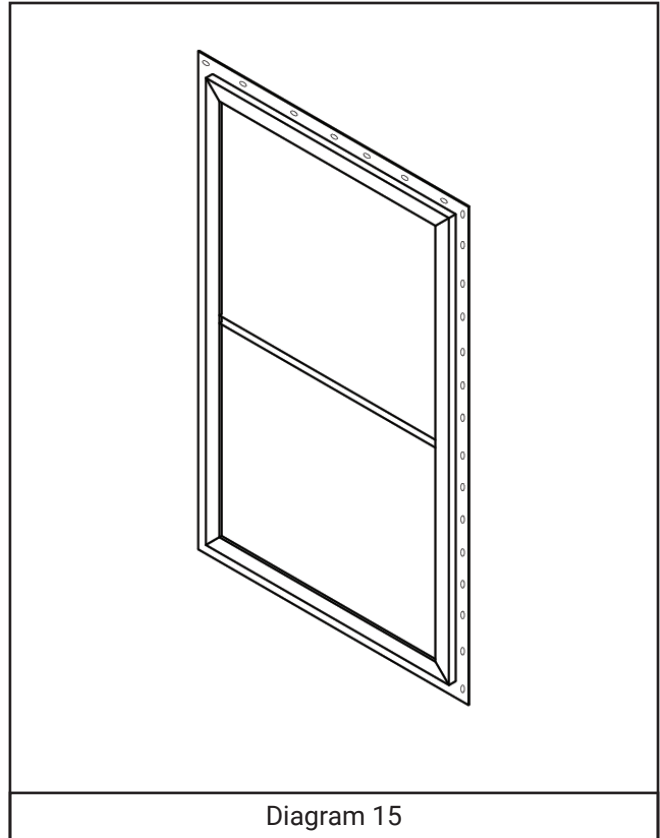
Windows with flanges

- 6" flashing tape should be used across the bottom and both sides of the window opening (See Diagram 14.) Make sure to install as described to be water-tight.
 - Piece across the bottom should be installed first
 - 3" of the tape should be folded into the window frame and the other 3" should be on the outside of the wall
 - Tabs should be cut in the tape and 6" of tape should extend past the window opening on the wall
 - Cut two bowtie shapes and add them to the bottom corners after the bottom and side strips of tape have been installed
 - Top pieces will be installed after window is installed



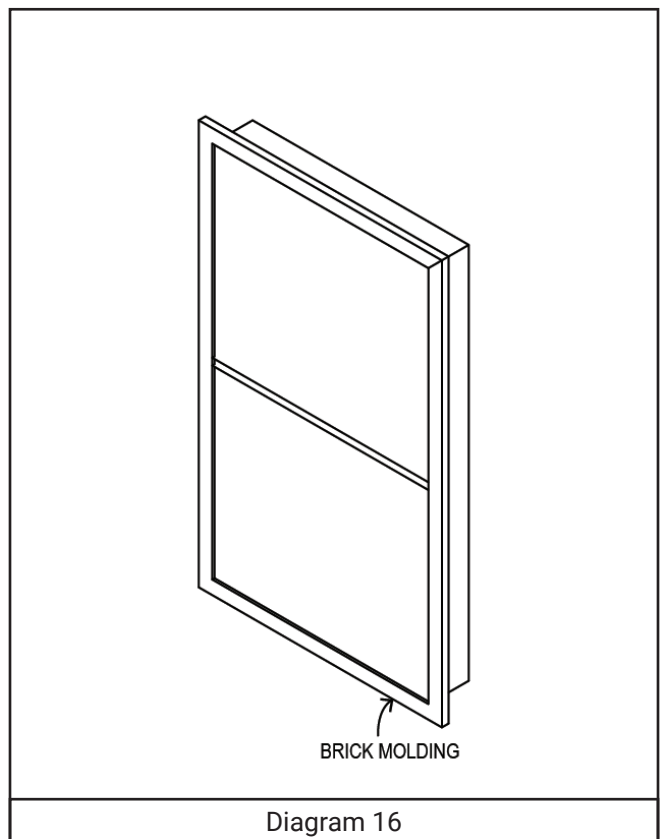
Walls, Windows & Doors

- Place the window into the opening
 - Tack in top corners and one bottom corner using 2 ½" exterior screws
 - Adjust to level and plumb using the three screws
- When the window is level, square and plumb, back the screws out enough to stick a caulk gun behind the window flange, without removing the screws all the way
- Run a bead of window caulk behind the top and sides of the window flange
 - Do not caulk along the bottom
- Fasten the screws back in and fill in every other hole around the flange with screws
- Add a strip of flashing tape across the top of the window flange, extending 6" past the opening on either side



Windows Without Flanges

- Windows that don't have flanges typically have brick molding on the outside
- Test fit the window into the space
- Add a bead of window caulk to the sides and top of the window where the brick molding will sit
- Place the window into the opening
- From the inside, add shims to the bottom and sides (none across the top)
 - Shim window to level and plumb
 - Trim shims so that they do not extend past the studs into the room
 - There should be at least three shims on both sides and on the bottom
- Attach the window to the rough opening of the frame through the sides, top and bottom of the window using 12d finish nails
 - Put at least three nails into each side/top/bottom
- From the inside, use window/door spray foam (not regular spray foam) to fill voids between the window and the framing



Doors

Why doors? Exterior doors allow access in and out of the home and interior doors allow for privacy in the living space.

Safety

- Communicate with homeowners when a door is being removed
- Be cautious while transporting and installing doors

Door Project Planning

- Rough opening should be 2" wider and 2" taller than the door
- Does the door need to be replaced or could it be repaired?
- Do you need an interior door or an exterior door?
- What kind of lockset will be needed?
- Will the door need to be specially ordered?
- What swing will the door need to be? How will the door interact with the space it is opening into?
- Make sure site can be left safe for family overnight.
- At what phase of the project will this be done?
 - Should be before siding and before porches (especially if any repair needs to be done to the frame)
- Will exterior siding or interior drywall also need to be repaired after door installation?
- Doors for ADA compliance should be 36" wide

Measurements Needed

- Size of rough opening

Quality Control

- Is there caulk under the sill?
- Make sure the door is shimmed to plumb
- For exterior doors make sure that shims are behind hinges
- Make sure to insulate between the door jamb and frame (use window/door specific spray foam)
- Doors should swing into the room or home.

Common Mistakes

- Door slightly sloped and not opening/closing properly
- Shims anywhere between the frame and rough opening (not behind hinges)
- Regular spray foam insulation used
- Incorrect door swing

After Work is Complete Quality Control Check

- Does the door open and close well? Do the locking mechanisms work properly?
- Is the lock/knob working correctly?
- Are there any gaps around the door that need to be insulated?
- Has the door been painted?

Door Material List

Quantity	Item	Purpose / Notes
	Door(s)	Entrance/Exit to home or room
	Shims	To level door to framing
	3" Screws	To attach doors to framing
	Exterior Silicone Caulk	To seal around door
	Window/Door Spray Foam	To help fill gaps between door and framing
	Door Lockset	To provide security and privacy

Recommended Tools

Safety:

- Glasses
- Gloves

General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc) Phillips Head Screwdriver - for installing lockset
- Step Ladder
- 2' Level or 4' Level
- Caulk Gun
- Utility Knife

Power Tools:

- Drill
 - Phillips Driver
 - T-25 Driver - for deck screws
 - Small Drill Bit - to pre-drill for finish nails

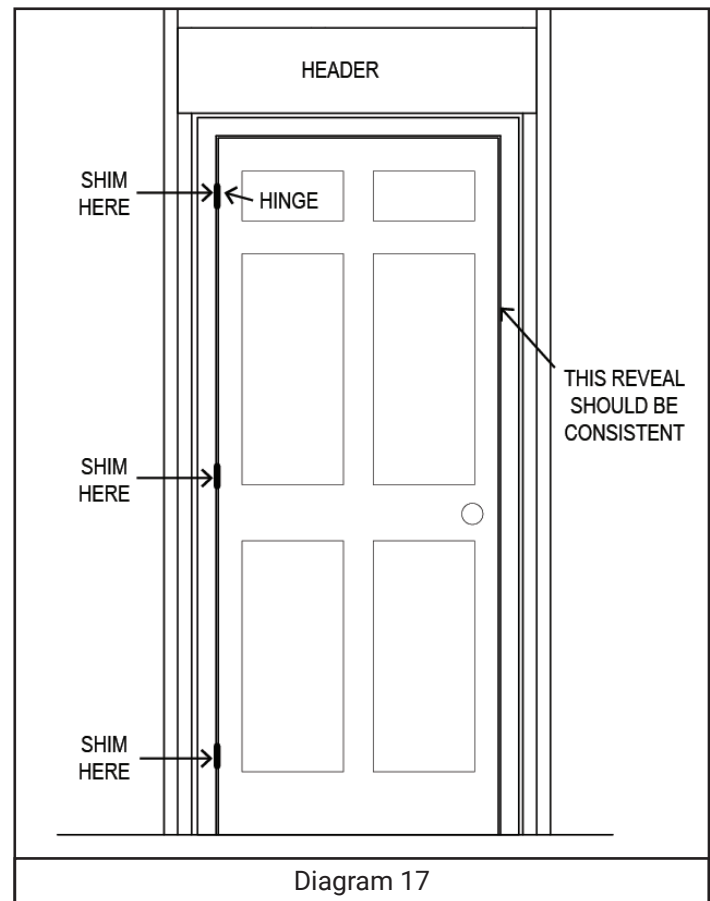
Hanging Doors

Door Swing

- Door swing is which way the door will swing when it opens into a space
- To determine swing:
 - Determine what is in the room or area that you should consider. For example, you would want to install a bedroom door to swing towards a perpendicular wall instead of the field of the room. You also don't want the open door to block any light switches
 - Stand with your back to where the hinges will be
 - Move whichever arm is on the "door side" the direction that the door will swing
 - If your right arm was used, then the door is a right-hand swing (and vice versa for left)

Exterior Doors

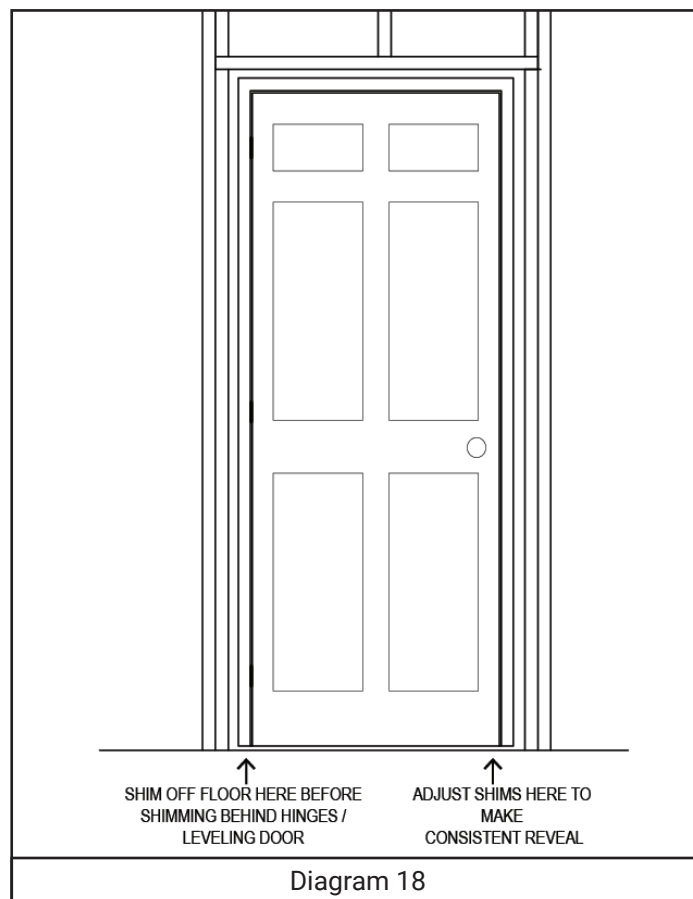
- Exterior doors installed should be pre-hung doors
- Most common exterior doors are 36" wide, 6'8" tall, and 1 3/4" thick
- Installation
 - Test fit the door into the opening
 - Cover all four sides of the opening with flashing tape to protect the framing. Like diagram 13, except in the case of a door a piece will go across the header as well.
 - Add a generous bead of caulk under the sill and on the wall on the sides/top where it will be covered by the brick molding around the door. This provides an air seal
 - Move the door into place
 - Add shims behind the hinges until the door is plumb
 - When door is plumb, remove one screw from each hinge and replace with a 3" screw that attaches into stud
 - Close the door and look at the gap/reveal
 - This gap should be the same all the way around the door
 - Add shims on the side opposite the hinges until the gap is the same all the way around the door
 - On the side opposite the hinges, pull back the weather stripping
 - Attach with 3" screws behind the weather stripping
 - 3 screws should be installed (roughly same heights as the hinges)
- Add window/door spray foam (not regular spray foam) to fill the gap between the door and framing
- Install exterior lockset according to manufacturer's instructions



Walls, Windows & Doors

Interior Doors

- Interior doors should be pre-hung
- Standard size interior doors are 36" or 32" wide, 6'8" tall, and 1 3/8" thick
- There should be a minimum 3/4" clearance underneath interior doors
- Installation
 - Move the door into place
 - Sit the bottom of the door on top of a couple shims to lift it off the frame
 - This is a greater concern if finished flooring will be installed after the door is hung, this creates space for it
 - Add shims behind the hinges until the door is plumb
 - When door is plumb, remove one screw from each hinge and replace with a 3" screw that attaches into stud
 - Close the door and look at the gap/reveal around the door
 - This gap should be the same all the way around the door
 - Adjust this gap by adding/removing shims underneath the jamb opposite the hinge side
 - Adjust until the gap is consistent
 - Attach door frame into stud with 12d finishing nails or screws
 - Attach into side that will be covered by door when it is closed
 - Pre-drill holes so that the wood does not split
 - Use a nail punch to sink the nails just below the surface
 - Cover nail holes with caulk
- Install interior lockset according to manufacturer's instructions



Walls, Windows & Doors

Special Considerations (ADA Accessibility)

In some homes there may be a need to widen a door to meet ADA requirements for wheelchairs and other medical equipment. In these cases, doors may need to be widened to 32" between the door frame and door face when the door is open 90 degrees. This may require re-framing the wall. Thresholds in these homes should not be higher than ½ inch. Door height of 80 inches.

When finishing doors the handles should be operable with one hand and between 34" and 48" from the bottom of the door. This can be achieved by using a levered handle instead of a rounded knob

Doors should not require more than 5 pounds of force to open and doors with closures should close from 90 degrees to 12 degrees in not less than 5 seconds and spring doors should close completely from 70 degrees in no less than 1.5 seconds.

Consider the specific needs of those living in the home you're working in. Each individual may have specific needs that can be addressed to make sure they can move easily throughout the home.

Installing Doorknobs and Handles

To finish a door installation, the hardware such as stops and knobs should be installed. Most doorknobs and stops will have instructions included and these should be followed when installing.

If a previous doorknob will be reused, be sure to keep all the screws and other hardware together in a Ziploc bag.

- Remove the doorknob from the old door by removing the screws from the knob baseplate
- Slide the doorknob pieces apart and remove from the door
- Unscrew the latch from the door and remove.
- Insert the latch into the thin side of the new door. Be sure that the curved side is facing the door frame
- Insert the knob with the turning mechanism and screw pins through the appropriate holes in the latch.
- Attach the knob with the screw holes to the pins using the attachment screws (finding the threaded pins for the screws is the hardest part).
- Install the strike plate onto the door frame
- Test that the door opens and shuts correctly and adjust as needed

Walls, Windows & Doors

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Roofs

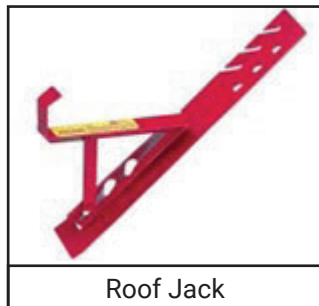
Why Roofs? Roof repair and covering keep the living area dry. Moisture from roof leaks can lead to structural damage and allow mold to grow and compromise air quality in the living space.

Section Contents:

- Roof Structure 96
 - Roof Framing. 96
 - Roof Decking. 101
- Roof Venting 103
- Roof Covering. 106
 - Metal Roofing 106
 - SBS Roofing 121

Safety

- ASP does not work on roofs of 2 story homes
- Any roof with eaves more than 12' high, peak more that 20' high, or with a pitch greater than 4:12 should not be worked on without approval from a construction consultant and/or the HRC
- When possible, look in the attic space before beginning a roof project to assess roof decking and framing from underneath.
- Roof jacks should be installed while working on roofs with a pitch greater than 4:12, with HRC approval.
 - Screw into rafters with 2 1/2 or 3 in. deck screws
 - 2x6s fit into the "j" portion to stop falls



Roofs

- Wasps, bees, bats etc. can live in attic spaces
 - Have wasp spray on hand if opening decking into attic space
 - Be prepared to contact an exterminator if bats are present
- Before adding/changing to roof structure significantly, check the floor system (band joist,) load-bearing walls, and foundation to ensure that the new weight can be adequately supported
- Wet roofs are extremely slick - do not work on roofs if they are wet
 - Allow dew to dry before working in the mornings
 - If raining, have interior work or other back-up projects ready to work on
- Sawdust, shingle debris, mud or any other matter can make the roof surface slick
 - Use a push broom to clean off roof surface if it gets slippery
- Mark weak areas with bright spray paint so they can be avoided
- For anyone working on the ground below, they should wear hard hats and use caution
- Ladders
 - Extension ladders should extend 3' above the roofline
 - Set up the ladder so that both feet are firmly on the ground, dig out one side with shovel or hammer claws if needed
 - Have a spotter to hold the ladder when in use
 - Set up ladder so when your feet are at the base and you hold your arms straight out, they just touch the sides of the ladder
 - If possible, install bracing into decking or fascia to help hold ladder in place
- Roof work is hot, ensure appropriate measures are being taken to prevent heat injuries
 - Adjust work time out on site for groups to take advantage of cooler morning weather
 - Make sure groups have shade (collapsible tents or tarps, lumber, and rope to make a shady area if there isn't shade on site.
 - During very hot weeks provide sports drink mix to help hydration

Roof Structure Project Planning

- If possible, getting into the attic space to look at rafters and ceiling joists
- What type of material will be best suited for the home (i.e. Metal on a gable roof, or SBS on a mobile home/flat pitch roof.
- What difficulties are present
 - Are there overhanging trees
 - Is there a good place for ladder placement
 - Can roofing materials be carried or passed to the roof area safely.
- How is the roof vented (gable vents, turbine vents, ridge vent, etc.) and will it need additional or new ventilation
- If there is damage to rafters or ceiling joists, can it be repaired from the attic space

Measurements Needed

- Height from ground to peak and ground to eaves
- Pitch of the roof (could be measured or done with pitch finder app)
- Current ceiling joist span
- Current rafter span

Roofs

Quality Control

- When repairing a rafter, ensure the scab extends at least two feet beyond the damaged area in both directions.
- Ensure the rafter repair is connected to the ridge beam with the appropriate hanger and fasteners.
- Ensure the edges of the decking fall on rafters
- New decking being used in a patch should be the same thickness as the surrounding decking
- Decking is securely attached and screws have not missed rafters.

Common Mistakes

- Decking patches miss rafters
- Decking patches are too small (only extend across one rafter bay instead of two)
- New decking is too thin or too thick and causes bumps or dips in the decking surface
- Rafter scabs are not fastened properly so that the scabs are not flush with the top (Roof decking side) of the rafter

After Work is Complete Quality Control Check

- Decking surface patch is as level as possible between new and old surfaces
- All new decking is secured to rafters
- All ceiling and/or after repairs are in line with the originals
- Same size lumber should be used for scabs on ceiling joists and rafters.

Roof Structure

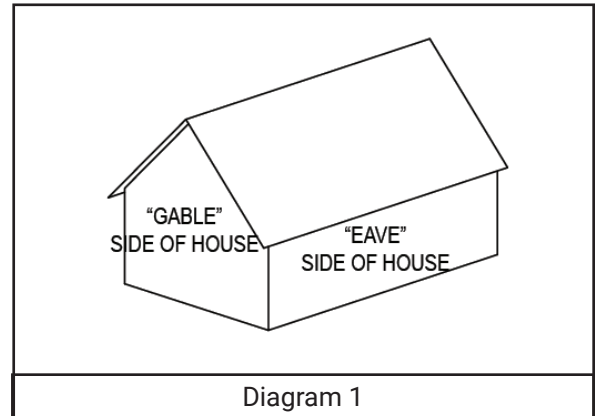
Roof Framing

Plans for any roof structure repair or re-pitch should be made with Construction Consultant and/or HRC. These repairs may include lifting a portion of the pitched roof back in line with the rest of the roof (in the event of a broken rafter) and need closer supervision for repairs).

Gable/Rake/Eave

Ceiling Joists (See Diagram 2)

- Size of lumber required is listed in the span chart below
- Rest on top of load bearing walls and run perpendicular to the ridge of the roof
- Depending on the size of the rafters, the ceiling joists may be angled so that they do not interfere with the slope of the roof
- Spacing for ceiling joists is typically 16" or 24" on center
- Ceiling joists may be spliced over interior load bearing walls

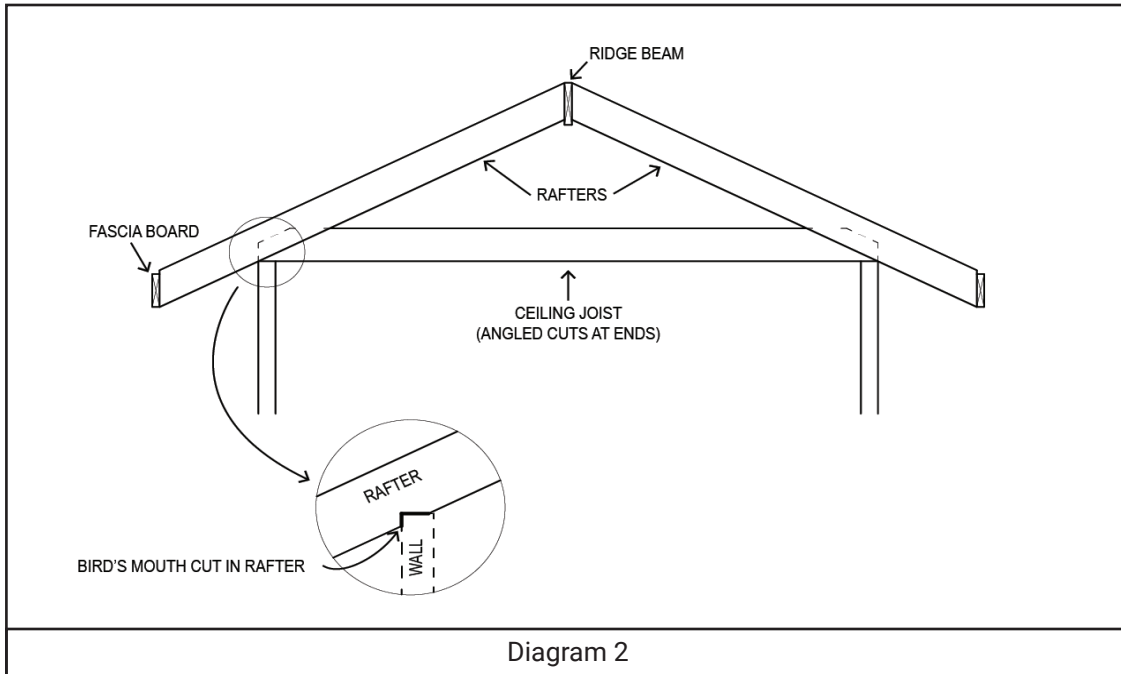


Ceiling Joist Span Chart			
		Span for Southern Pine #2	
Joist Size	Spacing (On center)	Limited Attic Storage	No Attic Storage
2x4	16"	8'	10'9"
	24"	6'7"	9'3"
2x6	16"	12'	16'11"
	24"	9'10"	13'11"
2x8	16"	15'3"	21'7"
	24"	12'6"	17'7"
2x10	16"	18'1'	25'7"
	24"	14'9"	20'11"

Ceiling Joist Repair

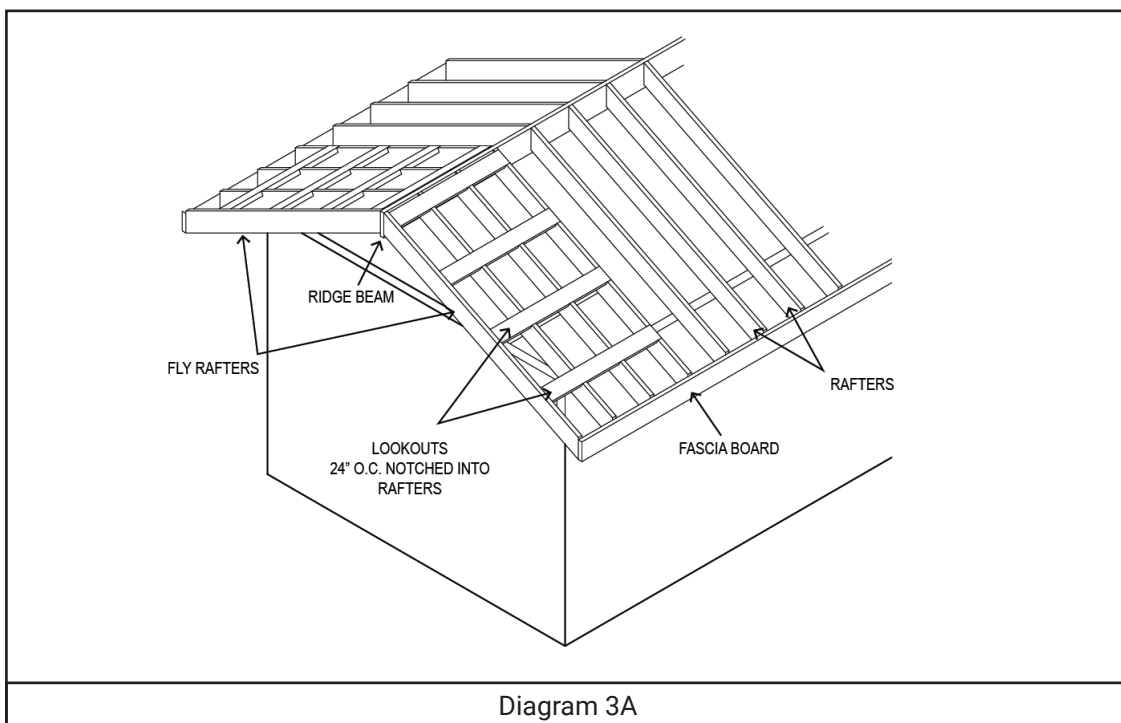
Ceiling joists can be repaired similarly to floor joists with scabs and sisters. Additional Safety precautions should be observed when working on ceiling joists such as wearing hard hats when working from below. If a ceiling joist is damaged but the ceiling below is not, and access from the attic space is possible it can be repaired from the attic by Adults and Older Youth Volunteers. Detailed instructions for Scabbing and Sistering Joists can be found in the flooring section starting on page 47.

Roofs



Rafter (See Diagrams 2 and 3)

- Size of lumber required is listed in the span chart below
- Run from ridge to eave and rest on the top plate of exterior walls
- Rafters may have a bird's mouth cut where they rest on top of the wall (See Diagram 2) or they may be attached with hurricane ties
- Spacing for rafters is typically 16" or 24" on center
- Where the rafter meets the ridge and the tail of the rafter that overhangs the wall should both be cut plumb



Roofs

Rafter Span Chart (Ceiling attached to rafters, ground snow load 30 psf. Southern Pine #2)		
Rafter Size	Spacing (On center)	Span for Southern Pine
2x6	16"	10'
	24"	8'2"
2x8	16"	12'8"
	24"	10'4"
2x10	16"	15'1'
	24"	12'3"

Rafter Repair

Rafter repair may need to be discussed with your CC or the HRC if there is a significant low area in the roof line due to broken or damaged rafters. For these repairs the rafter may need to be lifted back closer to its original position and a CC or the HRC can give helpful information on how to do this properly before installing scabs. For detailed information on Scabbing, see the Flooring Chapter on page 47.

Ridge Beam (See Diagrams 2 and 3A)

- Should be one dimensional lumber size larger than rafters
- May extend past exterior walls on gable sides of home to support fly rafters

Fly Rafter (See Diagram 3A)

- Furthest outside rafter on the gable ends of a roof that creates overhang
- Can be supported by "lookouts" which are notched into the tops of previous rafters to support this fly rafter or may be supported by blocking between this and the previous rafter
 - To build a "Lookout to support the fly rafter, measure up the two rafters closest to the Gable End at 24" on center and mark the placement of the lookouts.
 - Using a speed square or scrap piece of 2x6, mark where the edges of each lookout will be when notched.
 - Set a circular saw depth to 1.5" and notch rafters as you would a 6x6 post.

Fascia Board (See Diagrams 2 and 3A)

- On the gable ends the fly rafter is the fascia board/sub-fascia
- On the eave ends a fascia board covers the ends of the rafters
- This is what soffit is attached to
- The material may be 2x or 1x
- White wood should be used and painted or covered with soffit and metal fascia

Roofs

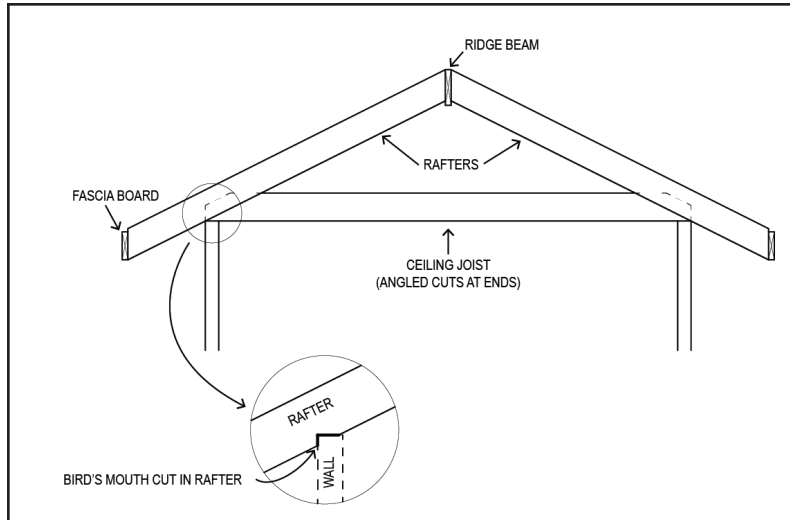


Diagram 2

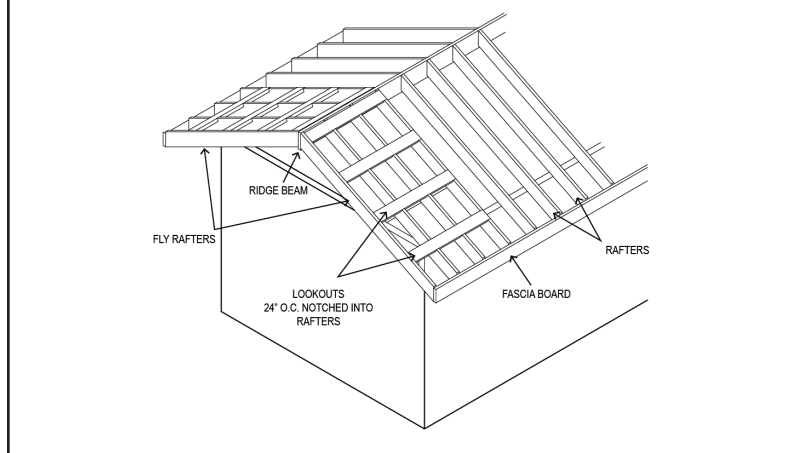


Diagram 3A

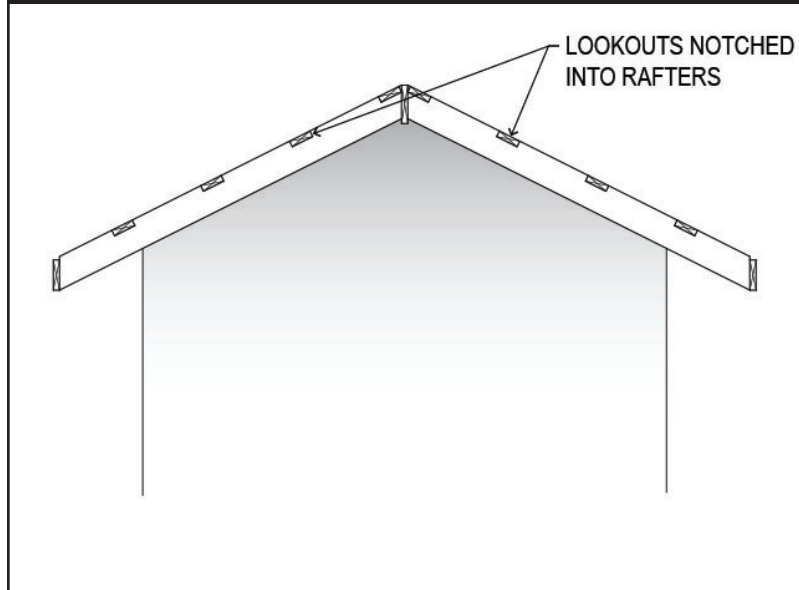
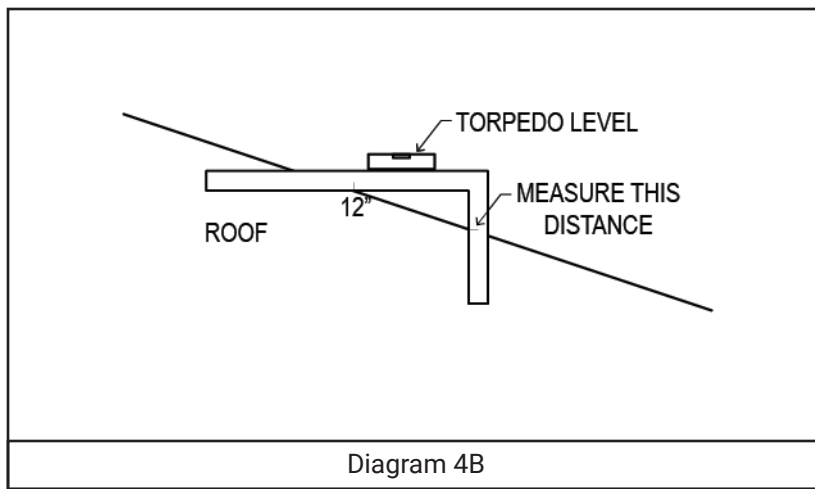
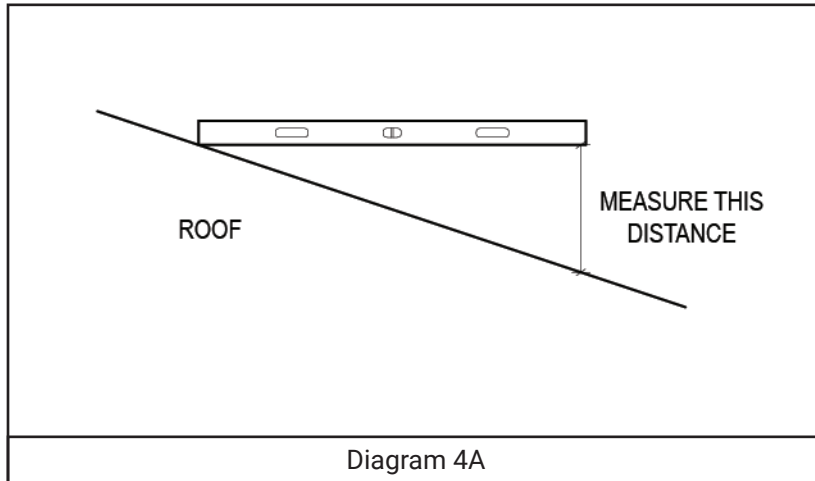


Diagram 3B

Roofs

Pitch

- The pitch of the roof is the measurement of its slope (rise/run)
- For roofs, the pitch is typically referred to by how many feet the roof drops over a 12' span, so a roof that drops 3' over a 12' distance would have a 3:12 pitch
- A pitch can be determined by holding a level with one end touching the roof and then measuring down to the roof (See Diagram 4)
- Convert the fraction so that the denominator is 12'
- For example, if the level used is a 4' level and the distance between the bottom of the level and the roof is 1' the rise/run is 1'/4'. Multiply both the rise and run by 3 (this makes the denominator 12') and the result is 3'/12' meaning the rise of the roof is 3' for every 12' of length. The pitch is a 3:12.
- There is also the PitchFactor app for phones that can be used to find pitch
- A Framing Square and Torpedo Level can also be used by holding the square with the 12" measure on the high point of the gable, leveling the square with the level, and reading the measure where the gable intersects the Square.



Roofs

Roof Decking

Roof decking is the solid surface of the roof that sits on the rafters. Typically, new roof decking installed will be 4'x8' sheets of $\frac{1}{2}$ " OSB. Older roofs may have decking that is a 1x material that will be $\frac{3}{4}$ " thick rather than $\frac{1}{2}$ " thick.

New Decking Installation (See Diagram 5)

- Plan layout of OSB
 - Each sheet should cover at least 2 bays and 3 rafters
 - Avoid using small pieces of OSB because there is greater strength when there are less seams
 - Seams should be staggered by at least 2 rafter widths
- Install OSB
 - Measure 48" up from the outside of the fascia board on each gable end of the roof and snap a chalk line across the rafters
 - This mark indicates the top of the first row of decking
 - OSB will run perpendicular to the rafters
 - Each 4' edge of the OSB should land on a rafter
 - Attach the OSB with 2" screws or 8d ring shank nails every 8"
 - Place H-clips on upper edge of OSB in every bay before installing the second row of OSB (See Diagram 6)
 - H-clips add stability by providing edge support to decking and allow for expansion of OSB
 - For the second row of OSB:
 - Stagger the short seams by at least 2 joist widths
 - Slide pieces into the H-clips
 - Cut out holes for vents/etc., start the hole with a wide drill bit and cut to shape with jigsaw or a hole saw
 - Continue installing OSB in rows and following the same process until a full row will no longer fit
 - For the last row, cut the OSB to width with the upper edge falling 2" short of the true ridge, this will allow for venting

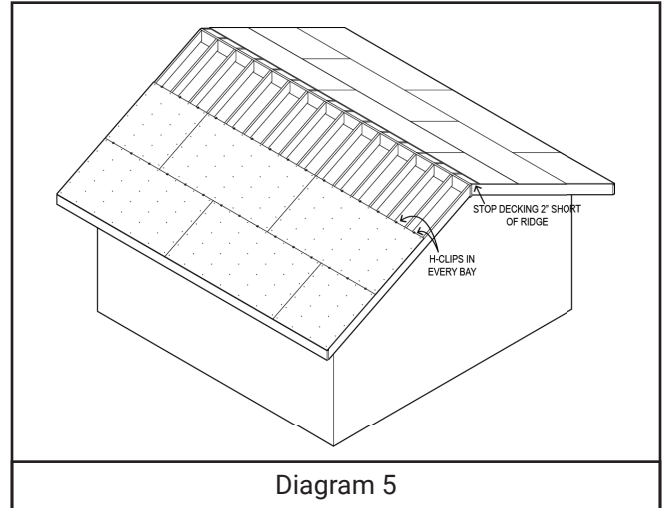


Diagram 5

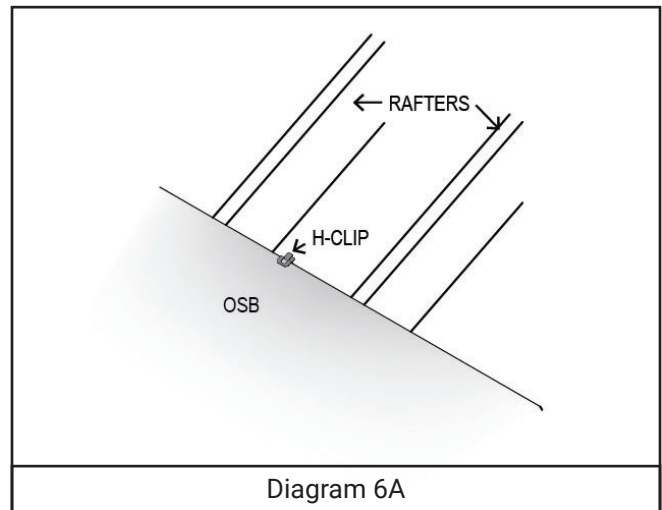


Diagram 6A

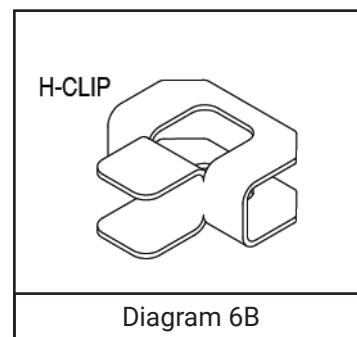


Diagram 6B

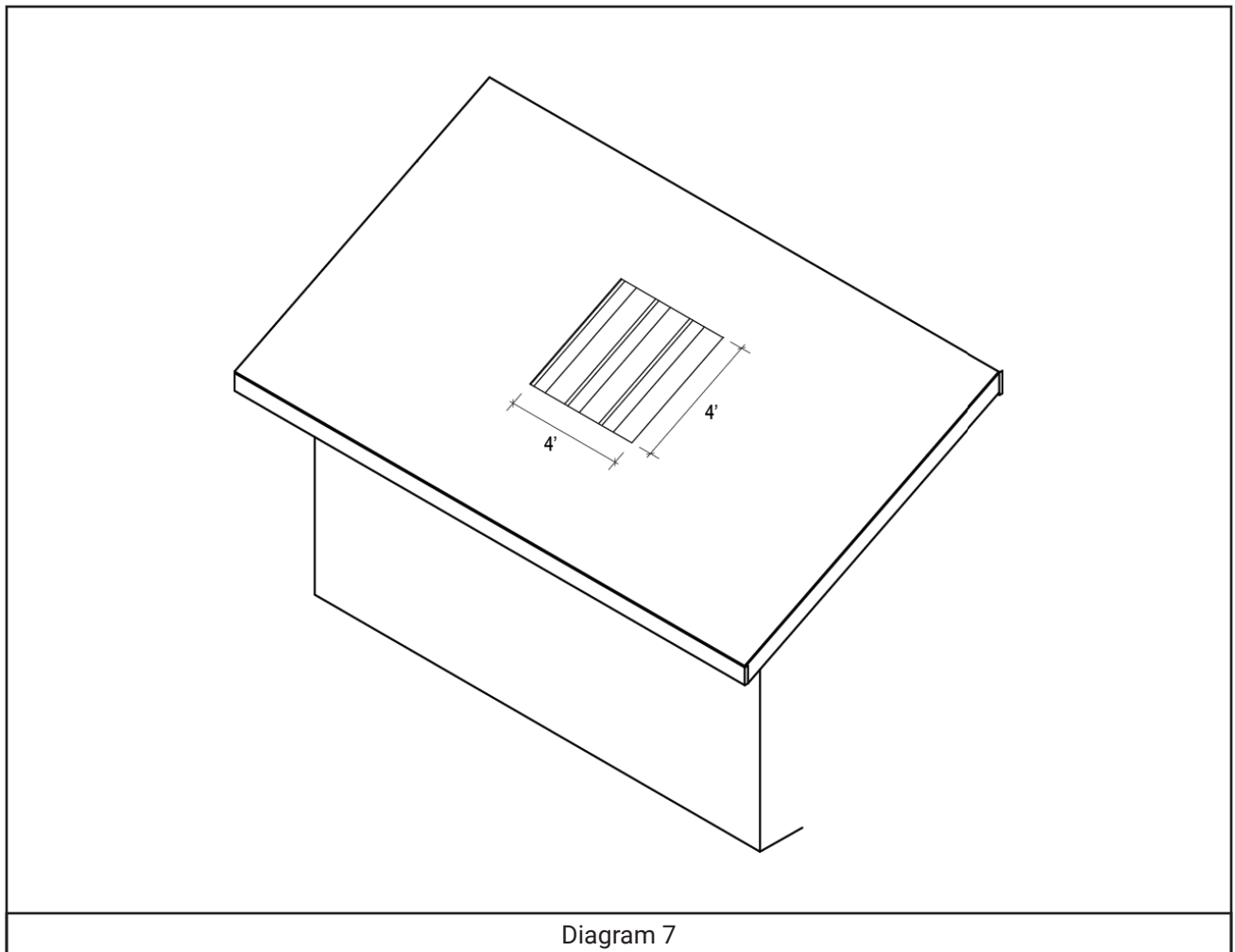
Roofs

Decking Repair (See Diagram 7)

To create solid patches with fewer seams, the minimum area that should be replaced at any time is a half sheet of OSB.

The material being used to patch should be the same thickness as the material on the roof

- Mark the area to be removed
 - Look at the fasteners through the existing decking to locate the rafters
 - Use a framing square to make the area marked is square and a chalk line to transfer the lines
 - Plan the replacement piece so that two edges will fall on top of rafters
- Set the depth of a circular saw to the thickness of the decking material and plunge cut into the decking to cut out the damaged piece
 - Before cutting, pull nails that will interfere with the cut to preserve the saw blade
- If needed, add nailers or blocking to the rafters that will support the edges of the piece
 - Nailers/blocking should be installed with 3" screws
- Cut the replacement piece of OSB to size
 - Dry-fit the new piece to make sure it fits in the space well
 - Attach the piece of OSB with 2" screws or 8d ring shank nails every 12"



Roofs

Roof Venting

Adequate venting of a roof is important because it allows hot air to escape, cooling the house in the summer and reduces moisture build up in the attic that leads to issues with air quality and mold.

There is venting that allows air to flow into the attic space (Intake Vents) and venting that allows air to flow out (Exhaust Vents), both of which need to be incorporated into a roof system.

Intake Vents

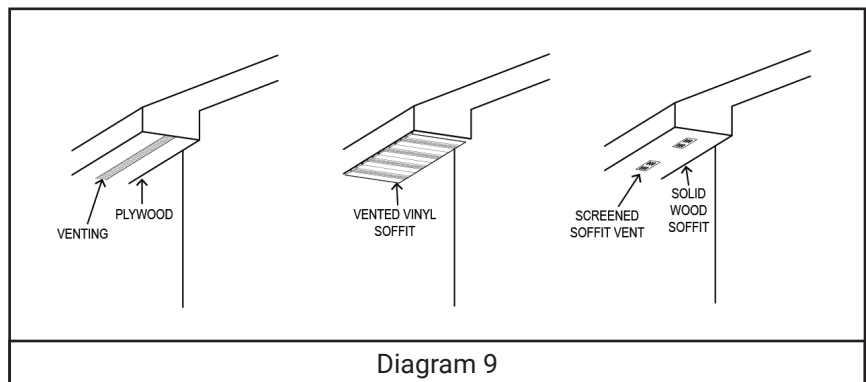
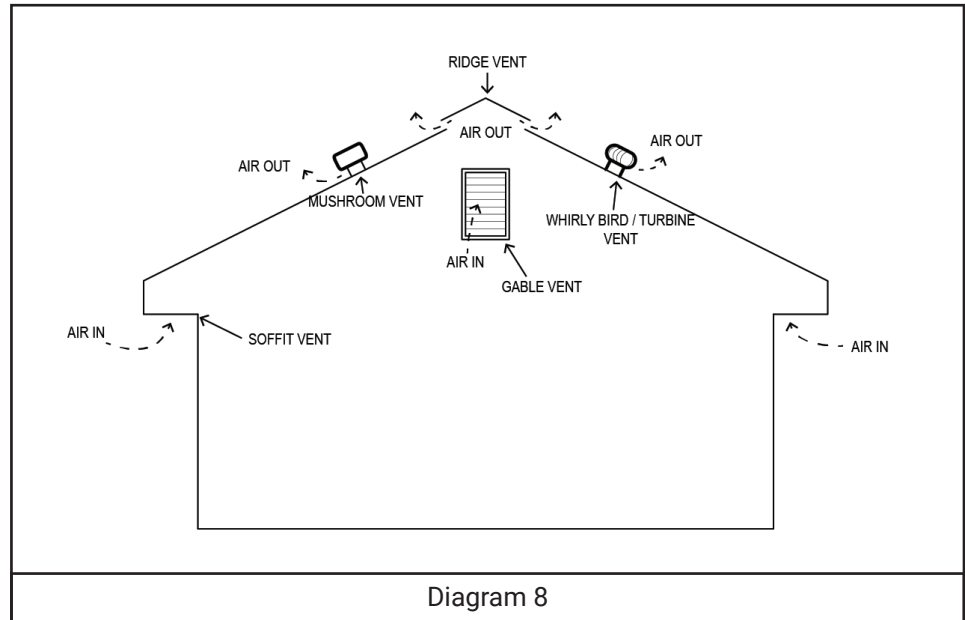
Ideally a home will have both soffit and gable vents.

- Soffit Vents

- The soffit of a home is underneath the overhang of the roof
- Soffit is only vented at the eave of the home and is unvented on gable sides (See Diagram 8)
- Soffit venting is only effective if there is open

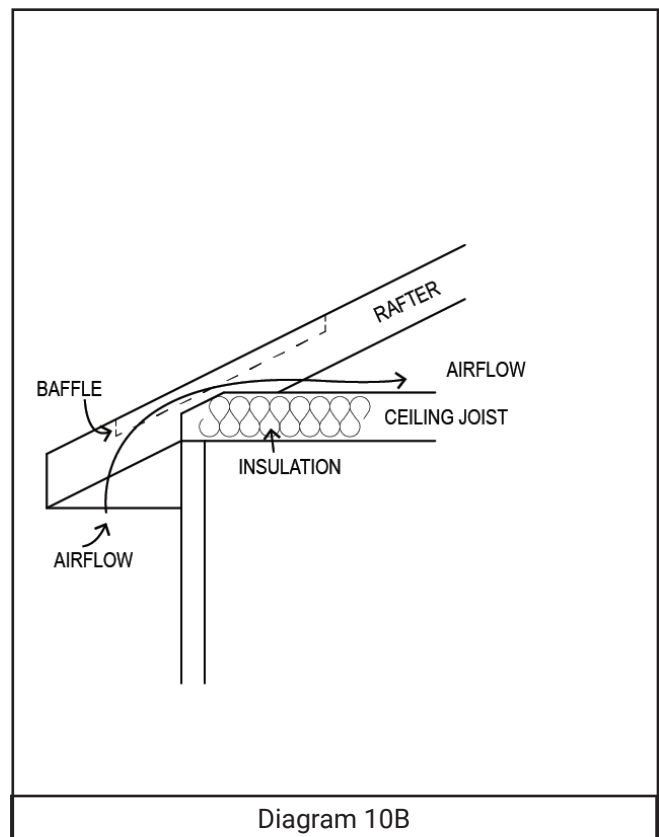
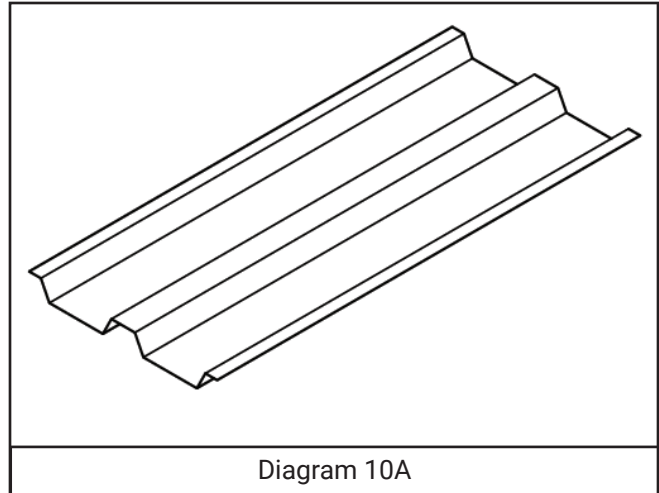
space over the top of the wall into the attic, sometimes this space has been closed off (in which case, gable vents should be considered) (V is cut off in diagram (9A))

- There are a variety of different types of soffit vents (See Diagram 9)
- Installation instructions for vinyl soffit are on page 146 of the manual
- If solid wood soffit is installed, venting can be added to it
 - Screened soffit vents come in many sizes, the most readily available among suppliers are rectangle “screened soffit vents” usually 4”x16”
 - Cut holes in the soffit using a circular saw or jigsaw
 - Be careful and use safety glasses when cutting overhead
 - Add a bead of caulk around the hole before placing the soffit vent
 - Install the soffit vents with short exterior screws
 - There are also some small, round, screened soffit vents that can be installed by drilling holes with a hole saw and inserting the vents, these may be difficult to find

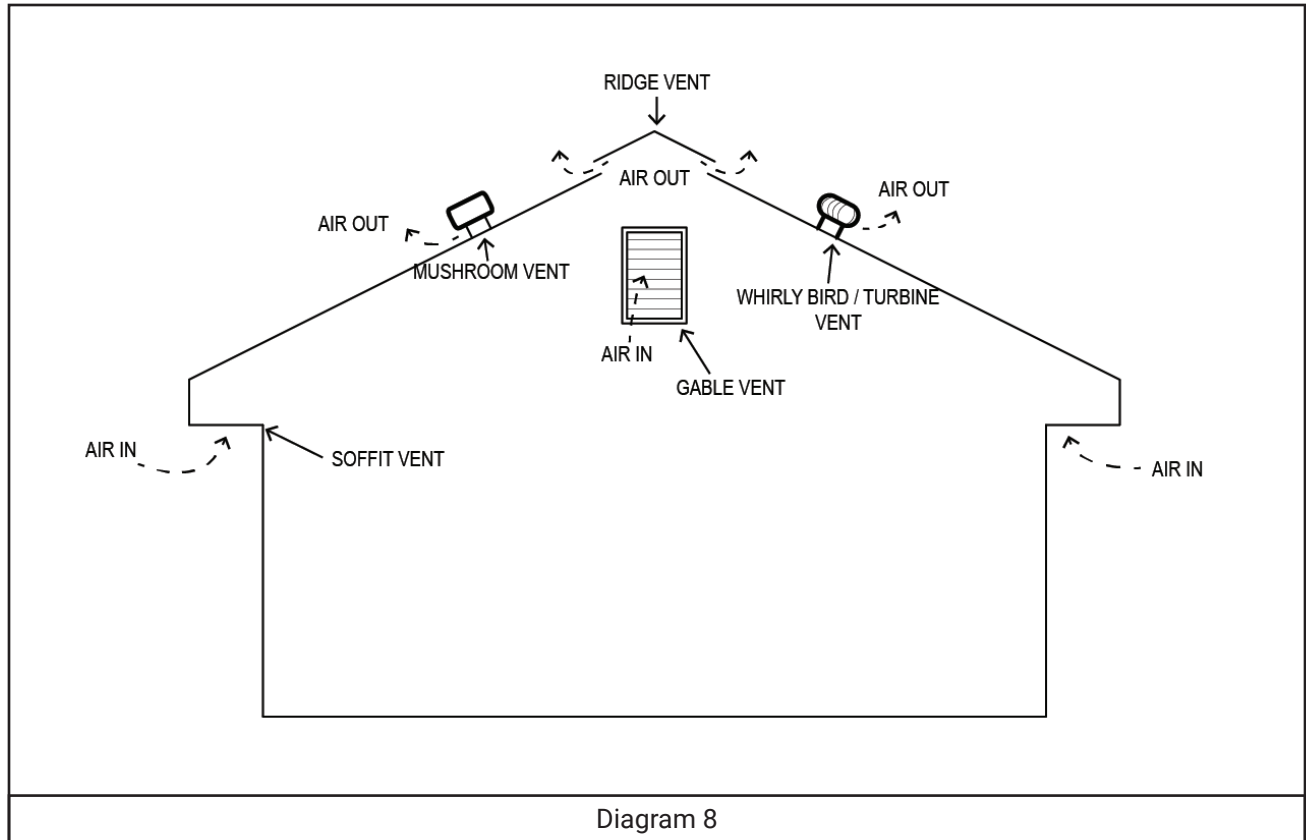


Roofs

- Baffles (See Diagram 10)
 - Baffles are Styrofoam channels, attached to the bottom of the roof decking over the exterior wall that allow air to move from the soffit area to the attic
 - Baffles should be installed if insulation interferes with the flow of air from soffit to attic
 - Baffles should extend from soffit about 3' into the attic
 - Attach baffles with staples
 - Install a baffle in every bay between rafters
 - Baffles can be used with any type of soffit
- Gable Vents (See Diagram 8, facing page)
 - Placed on gable walls at a height that they open into the attic space
 - There should be a gable vent on both sides of the home, directly across from one another
 - There are many different types of gable vents. The type of siding may dictate which gable vent should be used.
 - To install gable vents:
 - Plan how big of a gable vent you need. Typically, a 12"-18" rectangular vent is adequate
 - If you will be installing vinyl siding on the home, there are gable vents framed with j-channel that should be used
 - Cut holes for the vent in the siding/ sheathing
 - Caulk around the edge of the opening to create a seal when the vent is installed
 - Screw the vent into place with exterior wood screws



Roofs



Exhaust Vents (See Diagram 8)

- **Ridge Vents**
 - Ridge venting is typically a part of roof covering (metal roofing ridge allows for venting and a ridge vent can be installed with shingles, but not all shingle roofs have ridge venting)
 - Decking should be cut back 2" from the true ridge to allow for air movement (See Diagram 5)
 - If the ridge is adequately vented and new roofing is being installed, whirlybird/turbine and mushroom vents may be removed from the roof
- **Whirlybird/Turbine Vents**
 - These vents spin as hot air flows out of the attic
 - These vents should not be installed new, but they may be found on older homes
 - If ridge venting is installed along with new roofing, decking should be patched, and these vents can be removed
 - These vents are generally more expensive
- **Mushroom Vents**
 - Allow air to flow from the attic, while capped to keep moisture out
 - These vents can be installed if ridge venting is not available
 - A hole should be cut in the decking the size of the hole in the vent
 - Install the vent with the flange over the lower course of roofing and under the upper course to allow water to shed
 - Apply roofing tar on the bottom of the flange and tack the vent into place with roofing nails, cover nail heads with tar

Metal Roofing

Safety

- See page 93 for general roof safety guidelines and tips
- Metal roofing is extremely sharp- wear gloves when working with or moving metal
- If cutting metal with power tools, wear eye protection, hearing protection, and gloves
- Use caution when passing panels of metal up to the roof, make sure there are enough hands to pass and receive
- Sunglasses/hat can help reduce glare from Metal on a bright day and increase visibility
- Wear shoes with a good grip, tennis shoes may be a better choice than boots
- If the ground is muddy, avoid shoes getting muddy or bring a pair to swap into because mud on the roof can make the working surface slippery
- Do not walk on materials that are not fastened down (Metal or synthetic underlayment) as they can slip easily
- Use caution around any power lines or weather heads that might be nearby

Metal Roof Project Planning

- What is the pitch of the roof? (Roofs with pitch greater than 4:12 should not be worked on without approval)
- What is the height of the peak? (Roofs with peak height greater than 20' should not be worked on without approval)
- Order Metal well in advance. Include trim pieces, screws, and pipe boots in the order
- Most Metal manufacturers will cut Metal to right dimension if adequate drawing, measurements, and pictures are provided
- How many existing layers of roofing are present? Can the Metal overlay the existing roof covering or will existing roofing need to be removed first?
- Will tarping the roof be necessary overnight?
- Will purlins and/or underlayment be needed? Will you be using foam?
- How many ladders will be needed on site?
- Where is the safest place to get on and off the roof?
- How many vents/obstacles will you have to work around? Will any need to be removed or will any need to be extended? What is the source of venting? Will a heat-resistant pipe boot need to be ordered?
- Where will Metal be stored? Should be kept out of sight so that it is not stolen
- Can the Metal be delivered directly to the jobsite?
- Will the metal intersect with a section of roof that is less than a 2:12 pitch?
- Call the power company to move a weather head or lines that may be in the way of Metal installation or pose a risk to volunteers on the roof.
- Will any permits or inspections be necessary for the roof project?

Measurements Needed

- Length from eave to ridge on each surface
 - Panels of Metal will shift to sit 2" below the true ridge and overhang 2" at the eave
 - If this length is longer than 16 ft., HRC approval is needed for longer panels, or two overlapping panels should be used
- Length from gable to gable, or valley/transition, on each surface
 - Panels of metal are usually 38" and each panel covers 3' after overlap

Roofs

- Are there any vents on the roof?
 - Diameter of vents
 - Can Metal slide over the top of the vent? If not, a piece will be measured from 2" below the eave to 12" past the pipe and another piece that runs from 2" below the ridge to 12" below the pipe
- Length needed for any trim piece (valley, transition, rake, ridge, etc.)
 - Make sure the necessary overlaps are accounted for
- Square footage of roof for synthetic underlayment, if needed
- Dimensions of roof for purlins along edges and every 2' in the field

Quality Control

- Installation order
 - Ice and water shield (in valley, if applicable)
 - Synthetic underlayment
 - Purlins
 - Drip edge
 - Valley pieces
 - Sheets of Metal
 - Pipe Boots
 - Rake trim
 - Ridge cap
- Make sure purlins are installed properly along edge of roof, 2" down from ridge and along valleys in order to support Metal edges.
- Make sure purlins are installed around vents to support pipe boots.
- Make sure that neoprene screw heads are properly driven
- Check screw pattern:
 - Screws should only be placed into the flat sections of the roof
- Is the overlap of the Metal correct across the roof?
 - The edge with the smaller rib should be towards the starting gable side with the edge that has the larger rib and tab should be towards the field
 - Small rib overlaps large rib
- Make sure metal is set 2" below the ridge and there is a 2" overhang at the eave
- Make sure that the first piece of Metal is square to ridge/string set 2" below ridge
- Make sure all screws are going into wood below the Metal
- Make sure all pieces are overlapped correctly with the bottom piece being installed first

Common Mistakes

- Incorrect installation order
- Purlins not adequately secured into rafters
- Screws missing purlins, and not left in place and caulked
- Screws installed incorrectly (overdriven, underdriven, or at an angle)
- Incorrect screw pattern or placement
- Small rib facing the wrong way
- Top of Metal starting at true ridge, leaving no overhang over the drip edge along the eave
- First piece made square to the rake/edge of roof, not ridge

Roofs

After Work is Complete Quality Control Check

- Trim pieces that have been installed should be overlapped correctly
- Double check screws to make sure none are over or under driven
- Make sure that any screws that missed wood are sealed well
- Necessary pipe boots are installed

Metal Roofing Material List

Quantity	Item	Purpose / Notes
	Metal	
	Metal Panels	
	Valley Flashing	If applicable
	Rake Trim	
	Ridge Cap	
	Transition Flashing	If applicable
	Drip Edge	
	Ice and Water Shield	If applicable
	Purlins	If applicable, typically sold in 8' lengths
	Synthetic Underlayment	If applicable, typically sold in 1000SF rolls.
	Button Cap nails, Roof nails, or staples	For fastening synthetic underlayment
	Neoprene Screws	For fastening metal panels and trim.
	Pipe boots	For all penetrations through the roof
	Roof Nails or Lath screws	For valley flashing and top of transition flashing
	Silicone Caulk	For caulking any screws that miss purlins, etc. (oftentimes the metal manufacturer will sell a sealant that matches the color of the roof, or at least is designed to be used with the metal)
	3" Screws or 16d Nails	For attaching purlins into rafters
	2x6x12 White Wood	Bearing surface for roof jacks

Recommended Tools

Safety:

- Glasses
- Gloves
- Ear Plugs
- Hard Hats
- Wasp Spray
- Roof Jacks

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc.)
- Ladders
- Sawhorses
- Extension Cords/Splitters
- Caulk Gun
- String
- Metal Snips

Power Tools:

- Electric Metal Shears
- Circular Saw
 - Metal Blade
- Miter Saw
- Drills/Impact Drivers
- T-25 Driver to match deck screws
- ⅛" Metal Drill Bits to pre-drill Metal
- Hex Driver for Neoprenes (typically ¼" or 5/16")
- Hole Saw (correct size for drilling vent holes in Metal)

Metal Roof Installation Instructions

Roof Preparation

- Metal roofing should be installed over purlins to provide some airflow and allow for any moisture between the metal and roof to dry. If the original roofing material is not going to be removed, purlins should be installed over that original layer so that Metal can fasten to the purlins. If purlins are being installed over a solid surface (like an old shingle roof) a synthetic underlayment should be installed before the purlins.
- Ice and Water Shield (Only applicable if metal is being installed on bare decking, not to be used over existing shingles) Only applicable if metal is not being installed on a roof with existing shingles) Install per Diagram 11 (facing page).
 - Ice and Water Shield should be installed in all valleys before synthetic underlayment
 - This is an adhesive material that comes in a roll
 - Run from the eave to the peak
 - Do not step on this material until the backing is removed and it is stuck into place
 - Remove backing and stick piece down, trim excess even with eave and ridge
- Synthetic Underlayment is installed on roofs with existing shingle roof covering, or over bar decking (See Diagram 11, facing page)
 - Start at the lower end of the roof
 - Roll out and fasten with roofing or button cap nails. The Underlayment is usually marked everywhere it should be fastened.
 - Start the next row and overlap at least 2", there should be a designated overlap line on the material
 - Work up to the peak of the roof and trim just short of the peak, this will be left open for venting
 - Extra can be left over the ridge temporarily to help keep the roof watertight
- Valleys
 - Run an additional piece of underlayment in the valley that runs from the eave to the peak (over ice and water shield, if used)
 - When the regular courses intersect with the valley, overlap the valley at least 6"
 - Do not fasten the synthetic underlayment within 6" of the valley on either side
- **Do not step on the rolled-out material until it is fastened down**
- **Underlayment can be slicker than shingles or bare decking, especially in wet or dusty conditions. Be careful moving around and setting tools down on the synthetic underlayment.**

Roofs

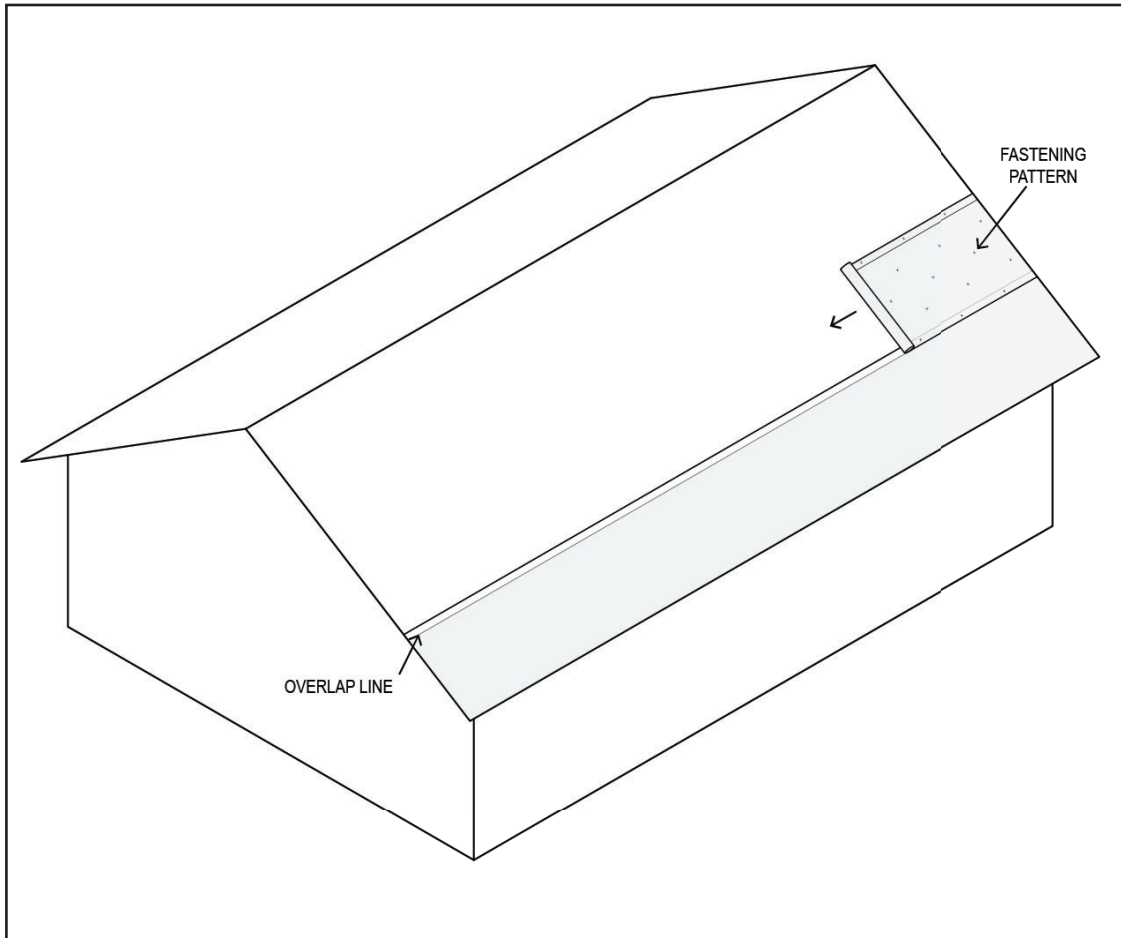


Diagram 11A

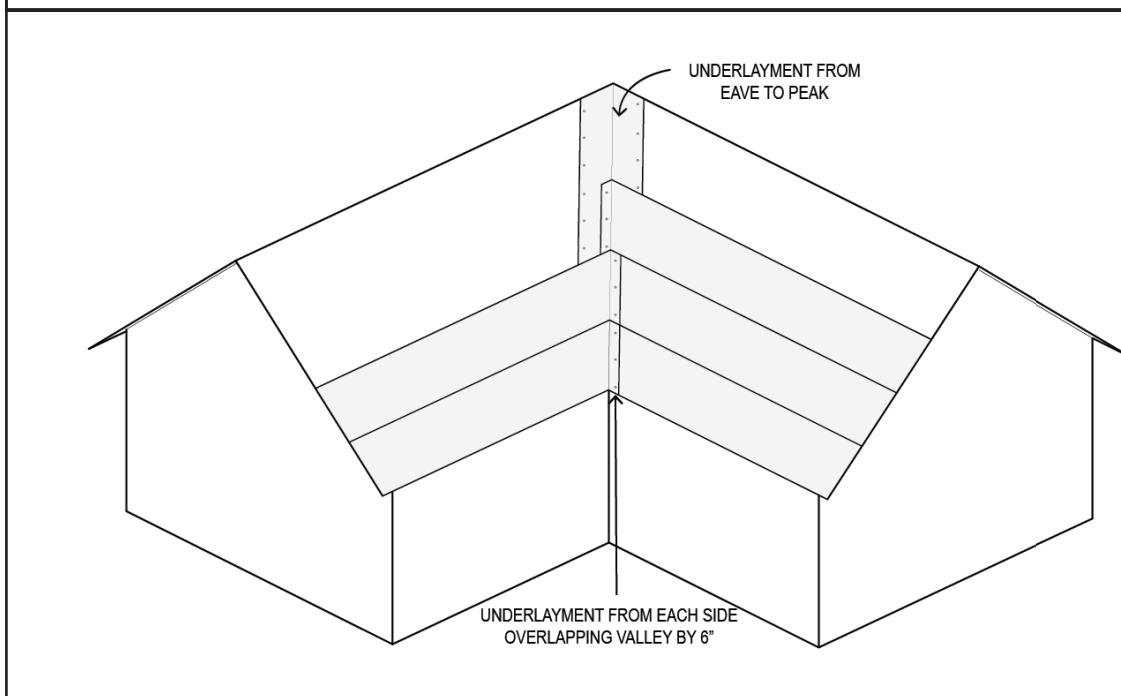
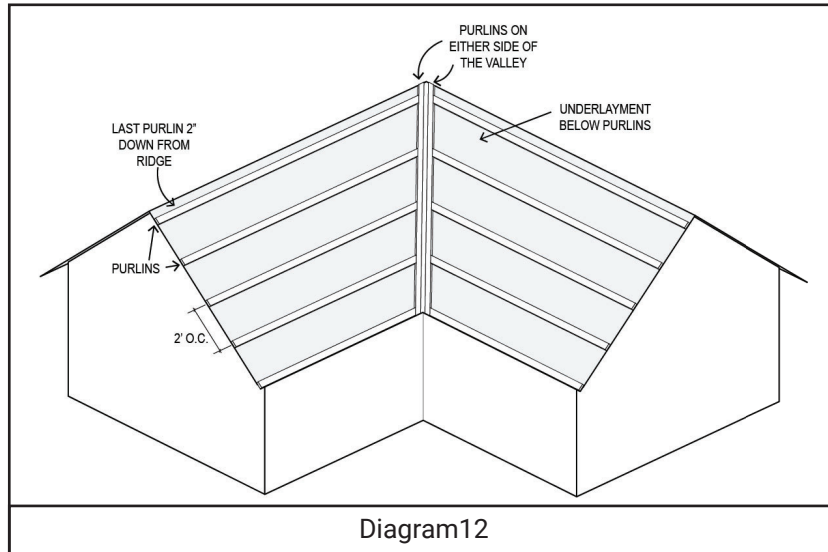
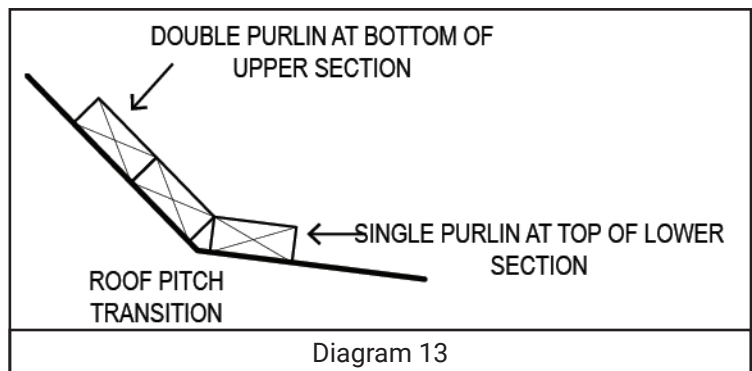


Diagram 11B

Roofs



- Purlins (See Diagram 12)
 - Purlins are typically 1x4 material that run perpendicular to the rafters/trusses and act as an attachment surface for metal roofing
 - Whether purlins are installed over bare rafters or over existing roofing, they are installed the same way
 - If installing over existing roofing, make sure that purlins are being fastened into the rafters. To find rafters on a roof with exposed decking look for nail heads. On roofs that do not have exposed decking start at a gabled end and measure over 16" and drill a pilot hole to see if the rafter is there. If the rafter is not there measure 24" from the gable end and repeat the pilot hole to find a rafter. If the roof has a ridge vent you may be able to see the ends of rafters.
 - Start at the eave of the roof
 - Fasten purlin into rafter with 3" screws or 16d nails, 2 into each rafter
 - Make sure that ends of purlins land on a rafter, even for an overlay
 - Install the next rows of purlins at 2' on center, working up the roof
 - Rows of purlins should be parallel to one another
 - Install the last row of purlins 2" down from the true ridge of the roof
 - Valleys
 - Install a purlin up either side of the valley, the valley piece of metal will attach directly to these purlins
 - Determine the distance from the valley based on the valley flashing piece (varies among suppliers)
 - Transitions (See Diagram 13)
 - If there is a change of pitch in the roof, install purlins at both sides of that transition
 - There should be two purlins at the bottom of the upper section of the roof
 - These will receive the transition flashing when Metal is being installed



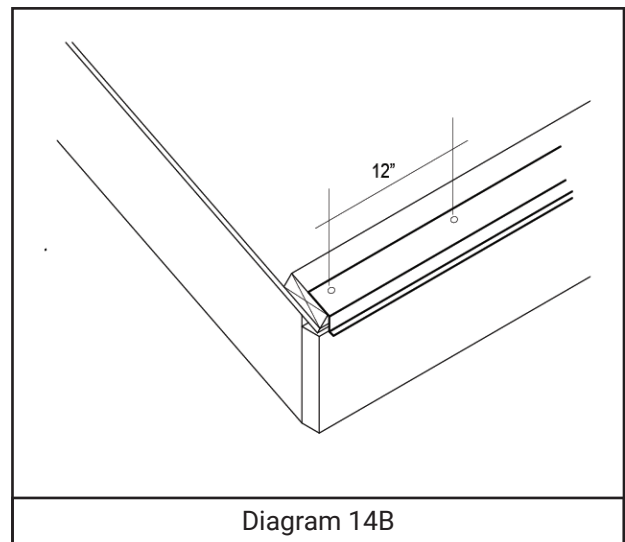
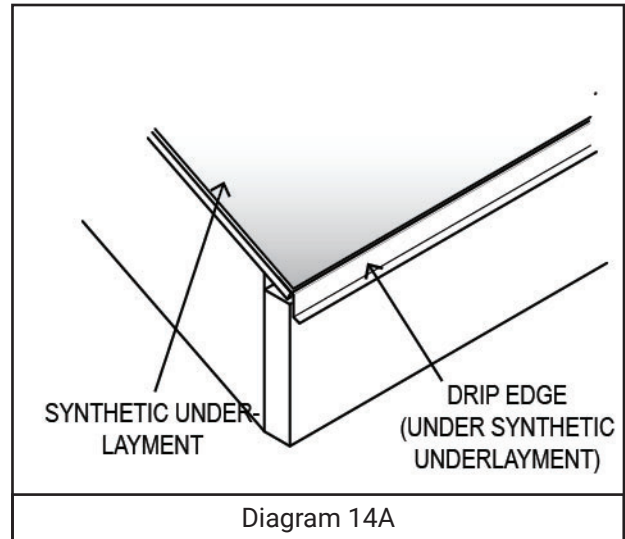
Roofs

Order of operations for metal installation is:

- Drip edge
- Valley pieces
- Sheets of Metal
 - Lower courses of Metal
 - Transition flashing
 - Rake trim for lower courses
 - Upper courses of Metal
- Rake trim
- Ridge cap

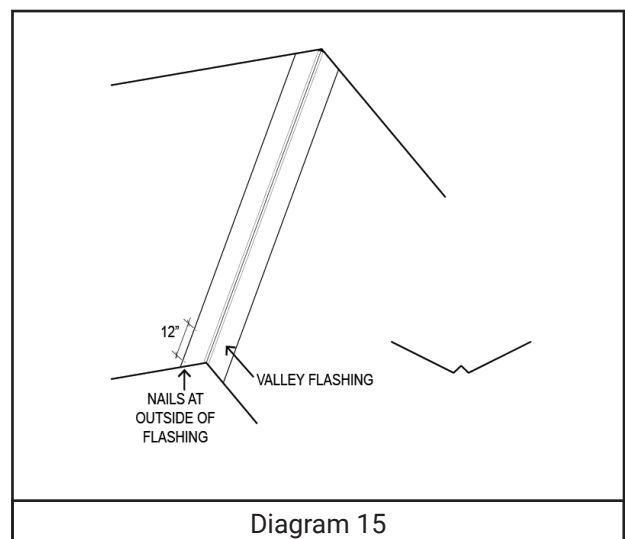
Drip Edge (Sometimes called gutter flashing or gutter apron)

- Drip edge will only be installed only on eave edges for metal roofing
- If there are no purlins, drip edge should be tucked underneath synthetic underlayment (See Diagram 14A)
- If there are purlins, drip edge should be installed on top of the purlins that run along the eave (See Diagram 14B)
- If gutters are present the drip edge should overlap the edge of the gutter
- Fasten drip edge with roofing nails every 12"
- Overlap pieces by 2"-4"



Valley Flashing (See Diagram 15)

- Run pieces from eave to ridge
 - Lower pieces will be under higher pieces
- Use Metal snips to trim the bottom of the piece to match the edge of the eave, and trim the top to match the ridge
- Allow valley to overhang the drip edge by 1"
- If overlap is needed, overlap by minimum of 6"
- Attach every 12" at the very edge of the valley using roofing nails or lathe screws.



Metal Panel Installation

- Cutting pieces of Metal
 - Metal can be cut with Metal snips, electric Metal snips, or a grinder with a metal cutting blade
 - When cutting metal make sure that leather gloves, safety glasses, and ear protection are all worn
 - Edges will be extremely sharp, and metal will be hot
 - Notches that need to be cut in Metal can be cut with Metal snips or with a jigsaw with a metal cutting blade
 - Most of the Metal should come already cut to length, however in some cases pieces will have to be cut
 - The last piece will likely have to be cut to a narrower width
 - Pieces of Metal in valleys will have to be cut to match the valley angle.
 - Pieces around vents will have to be cut
 - If possible, cut pieces so that the cut edge will be hidden by ridge cap/transition pieces/etc. because the cut edges rust more easily
- Run a string along the top of the roof
 - The string will run 2" below and parallel to the ridge
 - Tie off to temporary nails/screws at each end
 - Make the string tight
 - This marks where the top of the sheets of Metal will line up
- Put the first piece of Metal in place (See Diagram 16A, facing page)
 - The smaller rib will go on the gable side and the larger rib with the tab will face the field (See Diagram 17)
 - Line the top of the piece up with the string, making it square to the ridge
 - If the roof is not square:
 - See dashed line in Diagram 16A that shows potential out of square roof
 - Test the rake trim to see if it will cover the first rib of the piece, despite how the roof is out of square
 - If the rake trim fits over the first rib, despite the discrepancy, install the Metal where it is
 - If the roof is extremely out of square, this first piece may need to be trimmed at an angle, so that the rake trim can still be installed later (See Diagram 16B, facing page)
- Metal should be set 2" below the ridge and overhang the drip edge by 2" (See Diagram 16A) Overlap (See Diagram 17)
 - The following pieces of Metal will be installed with their smaller rib overlapping the tabbed rib of the previous piece

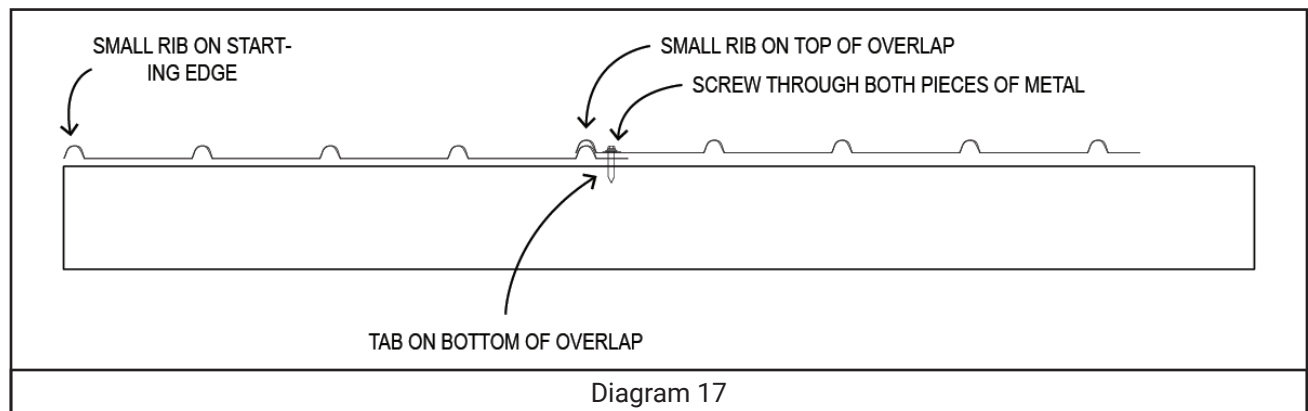
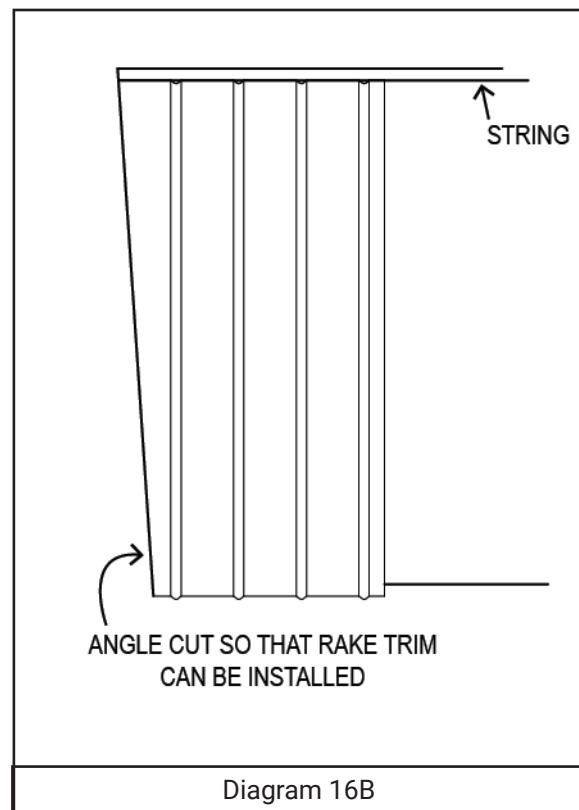
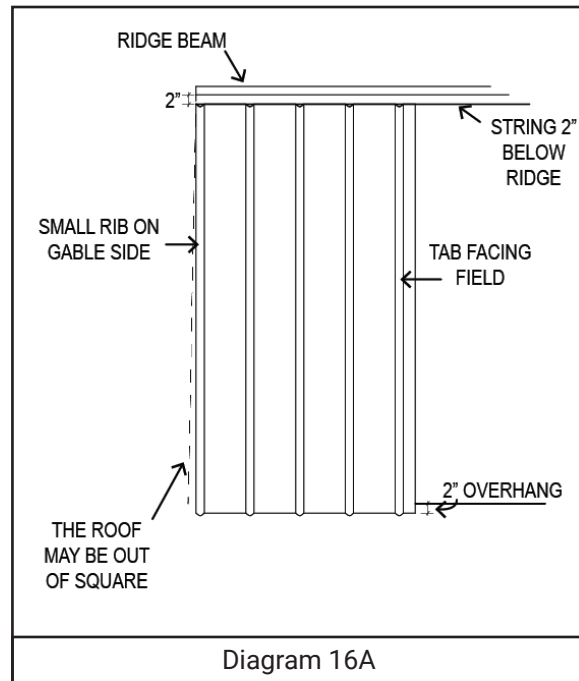


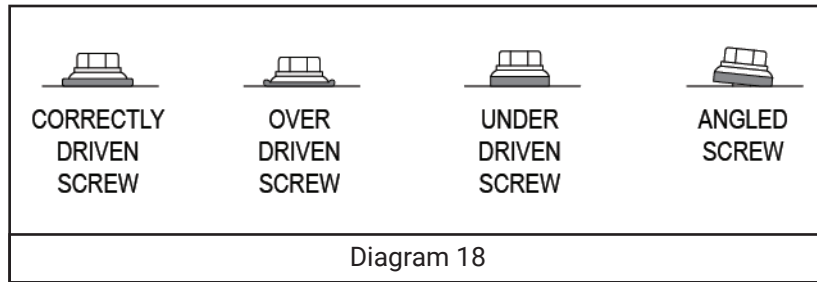
Diagram 17

Roofs

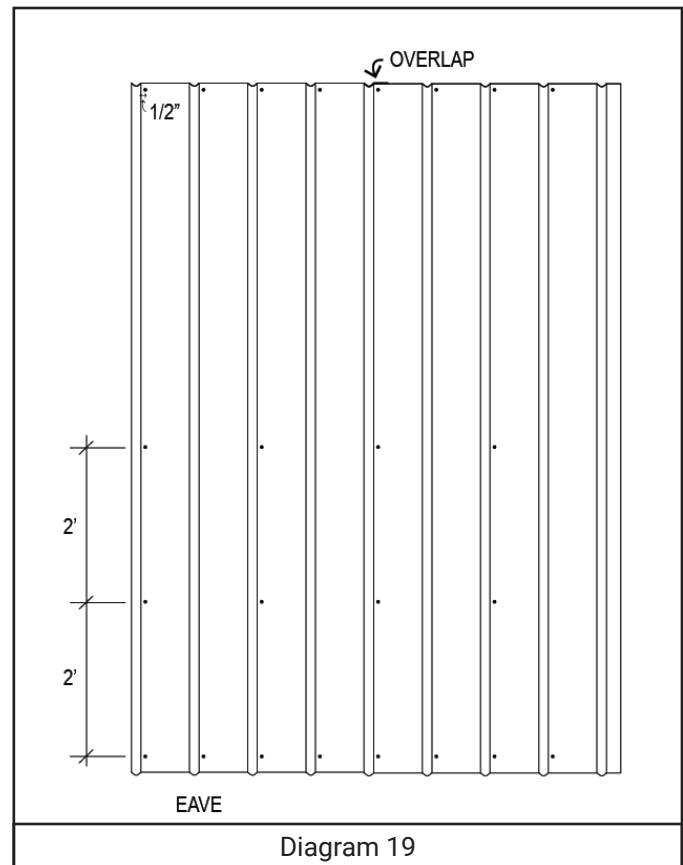


Roofs

- Fastening sheets (See Diagram 18 and 19)
 - Self-tapping Neoprene screws are used to fasten Metal (See Diagram 18)
 - Do not overdrive the screws, screws are overdriven if the neoprene gasket squishes out from under the screw head and splits, this will cause the gasket to fail and leak
 - Do not underdrive the screws, screws are underdriven if there is no change in the shape of the gasket at all
 - Make sure screws go in straight, if they go in at an angle the gasket won't seal properly
 - Neoprene gasket should expand slightly past its original shape



- Screws will be on the flat surface, about $\frac{1}{2}$ " from the edge of the rib
- The row of screws along the eave and the row along the ridge will have a different fastening pattern than those in the field
 - For ridge and eave, there will be a screw beside each rib
- The rows of screws in the field:
 - Spacing for rows will be 24", landing on each purlin
 - There will be a screw beside the small rib and the third rib
- The next piece will overlap the first, with the small rib of the second piece over the larger tabbed rib of the first piece
- Square and fasten pieces in the same manner, working across the roof
- If a screw misses the purlin or if a screw is overdriven and spins in place, leave the screw in place and apply silicone caulk around the screw head
- The last piece of Metal on each surface of the roof will have to be cut to the remaining width
 - Measure the piece at both the top and bottom, in case the roof is not square
 - Cut the piece to fit on the ground and then test for fit on the roof
 - Install any fasteners that fit within the regular fastening pattern
 - The edge of this piece will be fastened when the rake trim is installed over top of the metal



Roofs

- Metal in valleys (See Diagram 20)
 - Pieces of Metal that are installed at valleys will have to be cut at an angle
 - Measure from 2" below the ridge (the string line) to 3" from the center of the valley, measure over in the field 3' (width of a piece of Metal) and make the measurement again from 2" below the ridge to 3" from the center of the ridge
 - Transfer these measurements onto the piece of Metal and cut the angle
 - Fastening along the angle, use the same pattern as is used for the eaves or ridge
 - Screws will go through both the sheet of Metal and the valley flashing
 - Make sure that the screw is going into wood
- Transitions (See Diagram 21)
 - If there is a change in the pitch of the roof, install the lower course first
 - Rake trim should also be installed on this lower section before the transition flashing is installed (See instructions below)
 - Install the transition flashing piece
 - Along the top of the piece, attach with roofing nails every 12" to purlins
 - Along the bottom put a neoprene screw through the transition piece into each rib of the Metal
 - Overlap pieces by 6"
 - Install the course of Metal above the transition, letting pieces
 - terminate 1" above the bend in the transition piece
 - For transitions between a mobile home and an existing covered porch the new metal should extend onto the porch roof at least 1 purlin beyond where the home and porch meet.

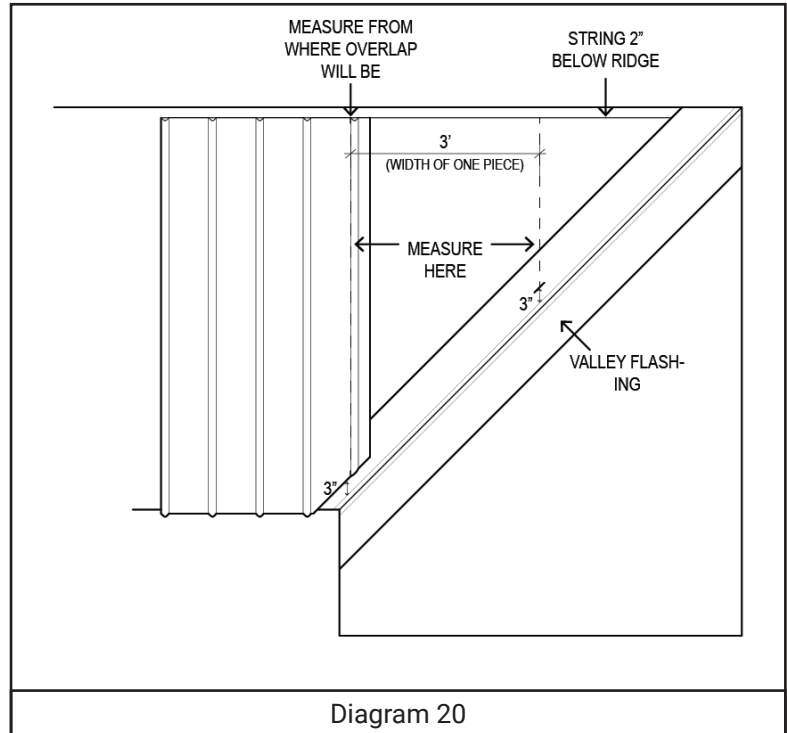


Diagram 20

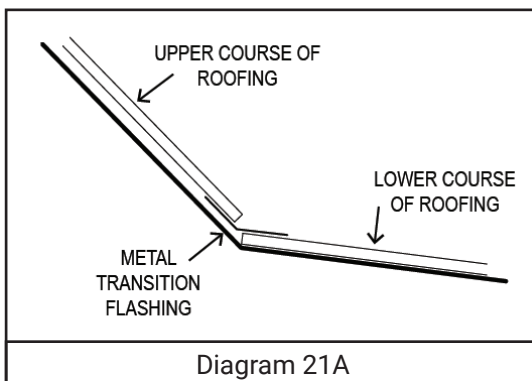


Diagram 21A

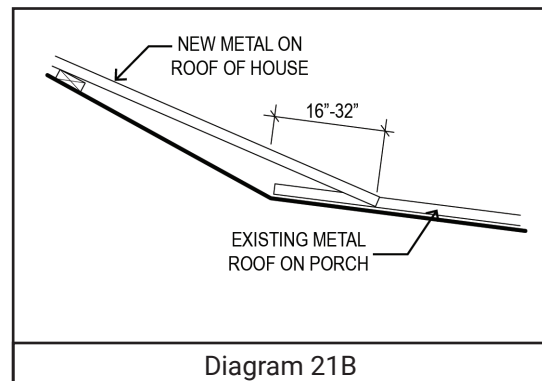


Diagram 21B

Roofs

- Vent Pipes

- If possible, cut a hole in Metal so that the piece can be installed over the pipe (A metal cutting hole saw will be needed. See Diagram 22A)
 - Allow, for about $\frac{1}{2}$ " of space around the pipe
 - Measure and mark where the hole will be in the Metal
 - Drill a starting hole and then cut to size with a jigsaw with a metal cutting blade or use a metal cutting hole saw
 - Install boot
 - Make sure the boot is flexible, not rigid so that it can be worked to match the profile of the roofing
 - Apply a generous bead of roof sealant to bottom of boot
 - Install the boot over the pipe and fasten every 2" around the base with neoprene screws
 - Don't work in a circle around the boot, but alternate sides as you install
- If the Metal is not able to be lifted over the vent, a two-piece system will be used around the pipe (See Diagram 22B)
 - There are boots designed to wrap around a pipe when it cannot be slid over (See Diagram 22C)
 - Cut a "U" the width of the pipe out of the top of the lower piece, allowing the center of the pipe to be 12" into the piece
 - Add purlin support
 - Add a 3' section where the top of the lower piece will land and where the bottom of the upper piece will land
 - This ensures that the lower piece will have something to rest on and that there will be something to fasten the bottom of the upper piece to
 - Install the lower piece (leave screws out of the top 2' of this piece as they would interfere with the overlap)
 - Install pipe boot
 - Apply a generous bead of roof sealant (Lexel or similar brand) to the bottom of the boot
 - Attach with a screw in each lower corner for now
 - Cut an upside down "U" out of the bottom of the upper piece, allowing the center of the pipe to be 12" into the piece
 - This "U" will be bigger as it is fitting overtop of and around the boot
 - Install the upper piece
 - Fasten with the normal fastening pattern
 - Add additional screws at the bottom of the upper piece as you would at the eave
 - Fasten around the remainder of the boot with neoprene screws every 2", alternating sides

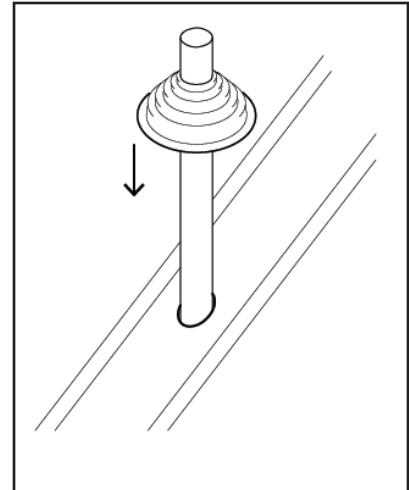


Diagram 22A

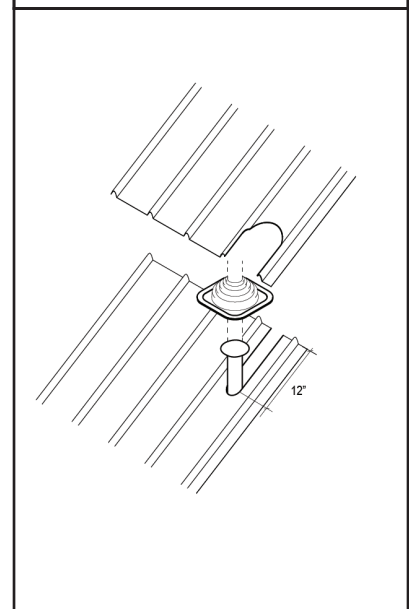


Diagram 22B

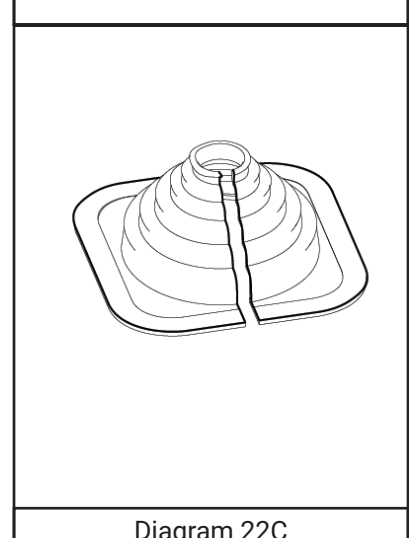


Diagram 22C

Roofs

Rake Trim (See Diagram 23)

- Rake trim is installed on the gable sides of the roof and cover the long edges of the Metal
- If multiple pieces are needed, start at the eave and work towards the ridge and overlap pieces by 6"
- If rake trim does not overlap a rib in the Metal, add a bead of roof sealant on the bottom tab that will rest on the roof before installing
- Fasten through tab with neoprene screws every 24", making sure that screws go into purlins
- Cut pieces plumb at the ridge
- Also fasten into the fascia board through the tab every 24" with neoprene screws

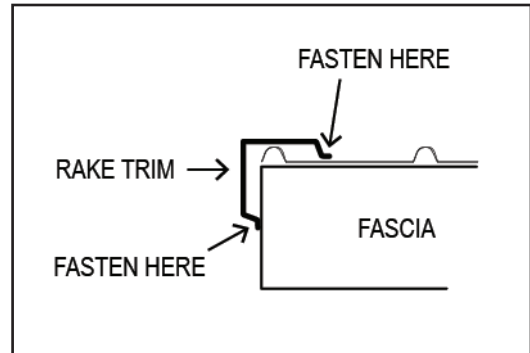


Diagram 23A

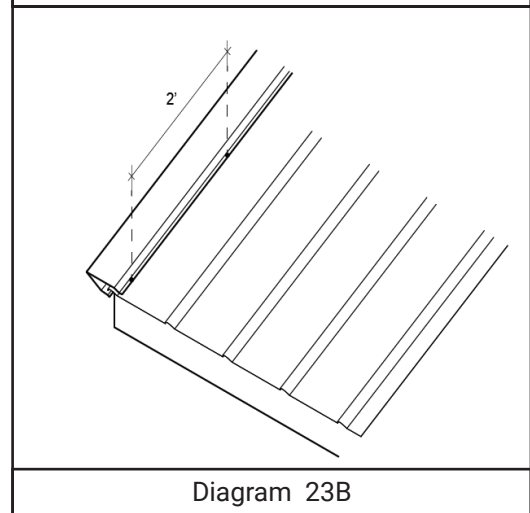


Diagram 23B

Ridge Cap (See Diagram 24)

- Ridge Cap will be installed to cover the ridge of the roof and allow venting
- Fasten with neoprene screws through the tab and into the rib of the sheets of Metal
- Screw into every other rib
- Longer screws may be required to go through the rib and into the purlin
- Overlap pieces by 12"
- If the decking runs all the way up to the ridge, it can be cut back 2" on either side to allow air to move
 - This is done prior to laying purlins.
 - Measure down 2" from the Ridge Peak on both sides and chalk a line across the length of the roof.
 - Set a circular saw to the depth of the Roof decking material (typically ½" OSB)
 - Cut along the Chalked line on both sides of the roof.
 - This vent can be covered with the ridge cap if roofing must be stopped due to weather.

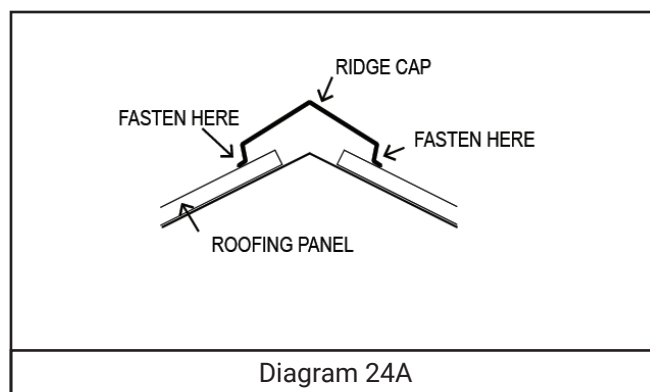


Diagram 24A

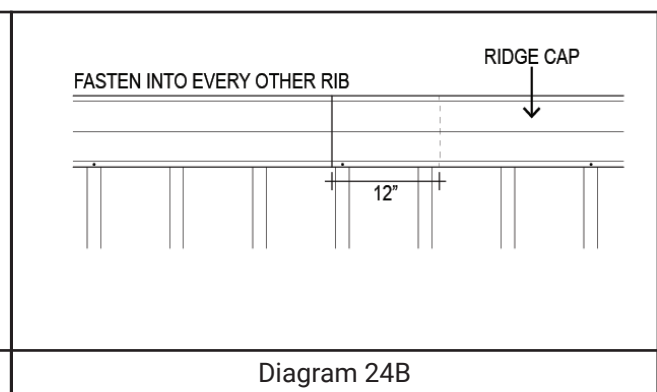
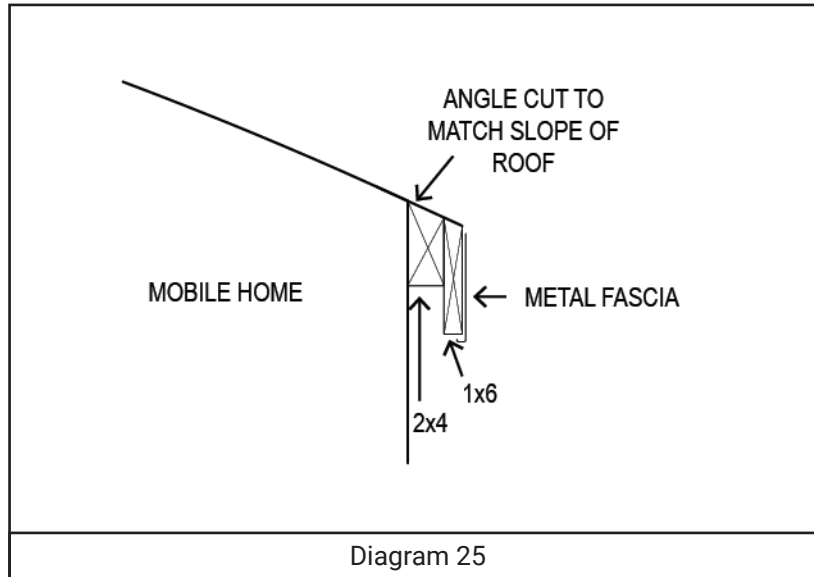


Diagram 24B

Roofs

Ridge Cap Continued: (See Diagram 25)

- It is best practice to cut and bend the ridge cap down so that the gap between the ridge cap and rake trim is closed off from weather and critters.
- To do this cut away 2 1/2" of the screw flange and the adjacent corner
- Cut a 2 1/2" slit at the peak of the ridge cap
- This will allow the top of the ridge cap to be bent down and close off the roof nicely.
- Cutting a plumb cut in the outside tab will provide a nice and finished look. (See Diagram 25)



Roofs

SBS Roofing

Safety

- See general roof safety guidelines and tips on page 93.
- When working on a mobile home roof, use scraps of ½" OSB to distribute weight and do not stand directly on the mobile home roof
- Minimize the number of people working on the roof (no more than 2 people per side of the roof).
- Use caution when lifting or moving SBS rolls as they are heavy and may require two people.

SBS Roof Project Planning

- What is the pitch of the roof? SBS should not be installed on Gabled Roofs with a pitch of 2:12 or greater. If it is Installed on pitches 1.5:12 pitch or greater the SBS will need to be back nailed.
- Is the roof safe for volunteers to be working on?
- Will you use a one piece or two-piece system?
- Does the home have gutters? Will they need to be removed, or can you work with them there?
- Does an overhang need to be installed?
- Are there any changes in the profile of the roof that will require alterations to how the SBS is installed?
- Is the product being installed on decking or a mobile home roof? (Instructions are different for each)
- For decked roofs
 - Will a synthetic underlayment be needed (required over existing decking, not required on new decking)
 - Is drip edge needed?
- Make sure the roof is swept and kept clean each day
- Where will SBS be stored? Should be kept upright and not in direct sunlight
- How many ladders will be needed on site? Where is the safest place to get on and off the roof?
- How many existing layers of roofing are present? If SBS roofing is already present, discuss with HRC and/or construction consultant
- Call the power company to move a weather head or lines that may be in the way of Metal installation or pose a risk to volunteers on the roof.
- Will any permits or inspections be necessary for the roof project?
- Make sure there are minimal dents in a mobile home roof so water cannot stand on the new material. Work with HRC and/or construction consultant

Measurements Needed

- Surface area of the roof (for primer, SBS, synthetic underlayment)
 - SBS is typically 3' wide and roll is 100sq ft
- Perimeter of the roof for the termination bar
- Number of vents and the diameter of each

Quality Control

- Clean roof of any debris
- Has an appropriate Primer been applied (if needed)
- Make sure rollers are being used to adhere SBS and get rid of wrinkles

Roofs

- Make sure additional squares of SBS are installed over roof vents with the slit running down the slope of the roof
- Are all overlaps correct? Check that all overlaps of pieces are flat, no bubbles or buckles
- Make sure termination bar is installed with the correct profile – drip edge out
- Make sure SBS overhangs 6-8 inches on gable sides and 3-4 inches on eave sides
- Make sure that neoprene screws holding termination bar in place are hitting wood/top plate of wall
- Make sure plastic film is removed from all exposed tar seams
- Prevent the need to walk or stand on newly installed SBS.

Common Mistakes

- Roof not swept well before priming
- Nail heads or other obstructions penetrating SBS
- SBS not rolled adequately, material not adhered to roof
- SBS did not overlap correctly across the roof.
- Circle around vent not cut tight enough, large gap left and overlapping piece not installed
- Termination bar installed backwards
- Little to no overhang of SBS
- Screws holding termination bar not hitting anything solid, just spinning
- Plastic film left on seams
- Granules on new SBS are damaged due to people walking or standing

After Work is Complete Quality Control Check

- All vents have an extra square of SBS on them
- All pip boots have been installed
- Termination bars are installed correctly
- Tar has been applied to any exposed SBS seams around vents.
- SBS is flat to the surface and adhered well
- The extra SBS that extends past the termination bar been cut off to create a clean edge

SBS Roofing Material List

Quantity	Item	Purpose / Notes
Built Out Overhang (If applicable)		
	1x6x__	Added overhang around mobile home eave
	2x4x__	Added overhang around mobile home eave
	3 1/2" or 4" Screws	To attach overhang
	Metal or Vinyl Fascia	To go over 1x6
	White Aluminum Fascia Nails	To attach fascia

Roofs

Quantity	Item	Purpose / Notes
SBS		
	SBS Roofing	
	Termination Bar	To secure edges of mobile home roof
	Water Based Primer	For coating mobile home roofs before SBS is installed
	Neoprene Screws	To attach termination bar
	Roofing Caulk/Tar	
	½" OSB	For weight distribution
	Ice and Water Shield	If applicable
	Synthetic Underlay-ment	If applicable
	Valley Flashing	If applicable

Recommended Tools

Safety:

- Gloves
- Hardhats

Painting (mobile home roofs only):

- Rollers
- Roller Covers
- Roller extension poles
- Paint trays
- Paint tray liners
- Rags

Power Tools:

- Drills/Impact Drivers
 - Hex Drivers for Neoprene Screws (¼" or 5/16", typically)
 - T-25 Drivers to match deck screws (for building overhang)
- Circular Saw (for building overhang)
- Table Saw (for building overhang)

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc.)
- Ladders
- Sawhorses
- Caulk Gun
- Metal snips
- SBS rollers
- Saw with metal cutting blade (to cut termination bar)
- Utility knives with hook blades

SBS Installation Instructions

SBS is a rubberized, self-adhering rolled roofing product designed for flat, arching, and low sloping roofs.

Working with SBS

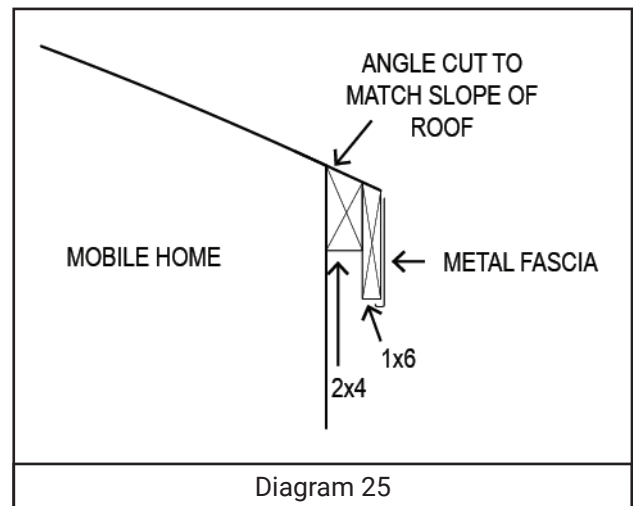
- There are two different systems for SBS installation on mobile home roofs, the One-Piece System and the Two-Piece System
 - The one-piece system can be slightly more difficult because the size of the pieces
 - Which system is used depends mostly on the comfort level of the volunteers working with the SBS product
- Do not fold or bend SBS material, that can cause damage to it and make it susceptible to leaking
- When the weather is particularly hot
 - SBS can be difficult to work with as it gets very sticky
 - Do not step on SBS or set things on the SBS while working, this will cause damage to SBS
- Avoid walking on SBS after it is installed
- Be careful when working with and placing SBS, once it is in place it cannot be adjusted
- SBS will only adhere to clean surfaces such as new OSB (old OSB needs Primer) or a primed metal mobile home roof, SBS will not adhere to any dirty or granulated surfaces such as old decking or tar paper
- Store SBS Vertically standing on one end.
- SBS should not be installed on roofs with a pitch greater than 1.5:12 (metal roofing is better for gable roof mobile homes)

SBS on Mobile Homes with Bow Truss Roofs

Avoid standing directly on the mobile home roof. Pieces of ½" OSB can be used to sit on the roof and work from to distribute the weight. Make sure these pieces span at least 2 of the mobile home trusses. Limit the number of people working on the roof to 2 on each side.

Preparation

- Sweep the roof clean
- Prime the roof with a water-based primer (an elastomeric such as Koolseal or APOC reflective roof coating)
 - This creates a clean and compatible surface for the SBS to adhere to
 - Most of this painting can be done with rollers from ladders
 - Be cautious not to let primer run down walls of the home
 - Allow to dry overnight before starting SBS installation



Roofs

Build Overhang (If applicable)

- The purpose of building an overhang is to prevent water from running down the wall and over windows
- Remove gutters if necessary
 - If these are rigid and hard to remove, they can be cut flush with the wall using a reciprocating saw with a metal cutting blade
- Install a 2x4 around the top edge of the wall (See Diagram 25)
 - Before installing, cut the top of the 2x4 at an angle that will match the line of the roof using a table saw
 - Fasten with 3 1/2" screws into the top plate of the wall or ends of trusses
 - Fasten every 12"-18"
- Install a 1x6 on the outside of the 2x4 (See Diagram 25)
 - Like the 2x4, cut the top of the board at an angle that will match the roof
 - Install with 4" screws into the 2x4
 - Fasten every 12"-18" with one screw over the other
- Short ends of the mobile home:
 - If the roof is flat, continue the 2x4 and 1x6 all the way around the roof
 - If the roof is sloped with a defined ridge, install the 2x4 and 1x6 at those angles
 - If the roof is rounded, cut 2x4 and 1x6 at multiple angles to match as closely as possible to the profile of the roof (See Diagram 26)
 - If there is a built-in overhang on the short ends of the mobile home, the 2x4/1x6 do not need to be installed on that side (See Diagram 27)
- Install metal fascia covering over the 1x6 (See Diagram 25)
 - Attach with white aluminum trim nails every 18"-24" one over the other
 - On eaves, start at one side and work towards the other, overlapping pieces 4"
 - Make tabs and fold around corners to keep water out

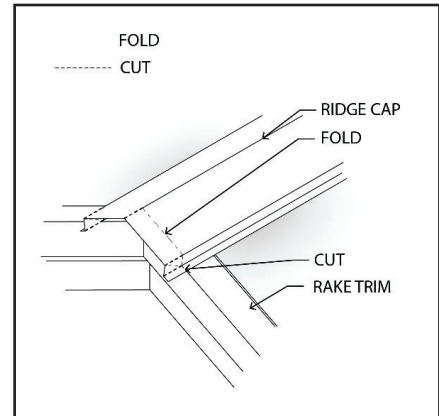


Diagram 26A

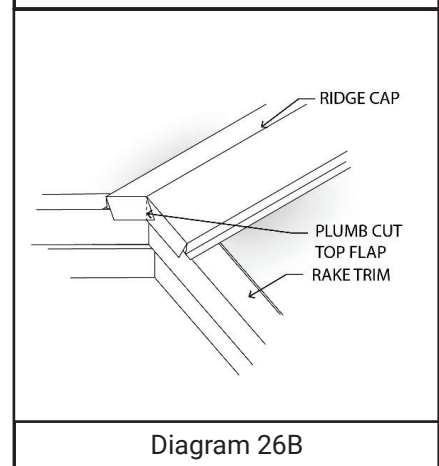


Diagram 26B

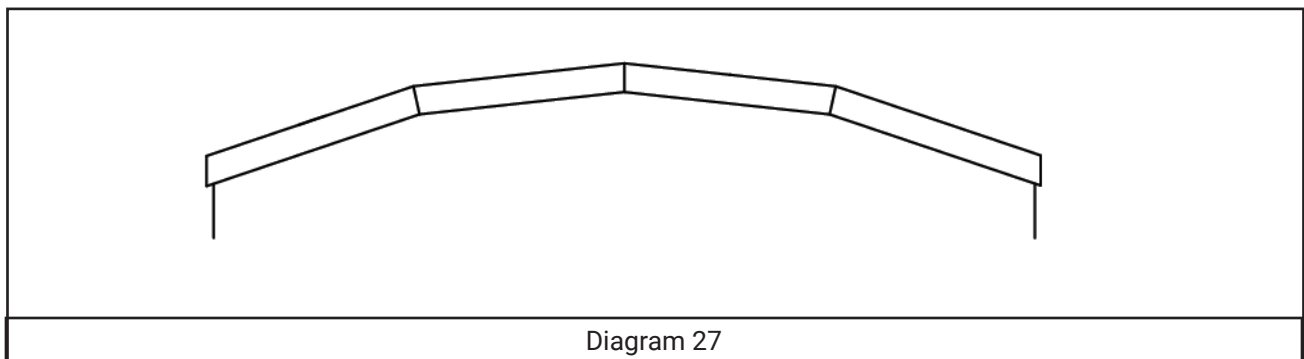


Diagram 27

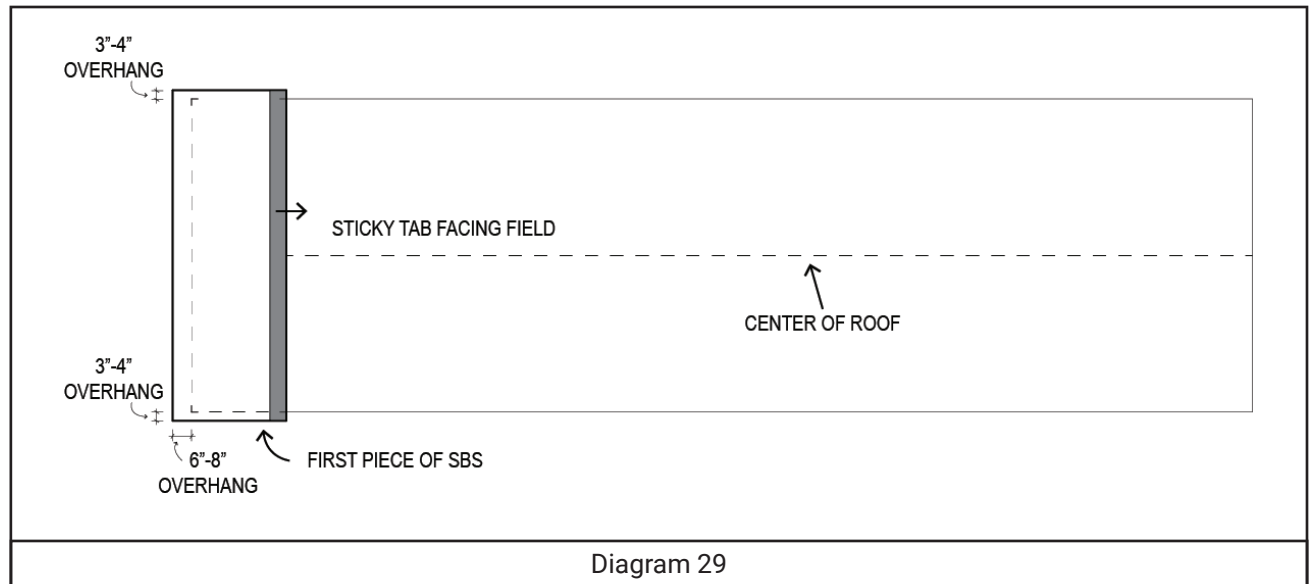
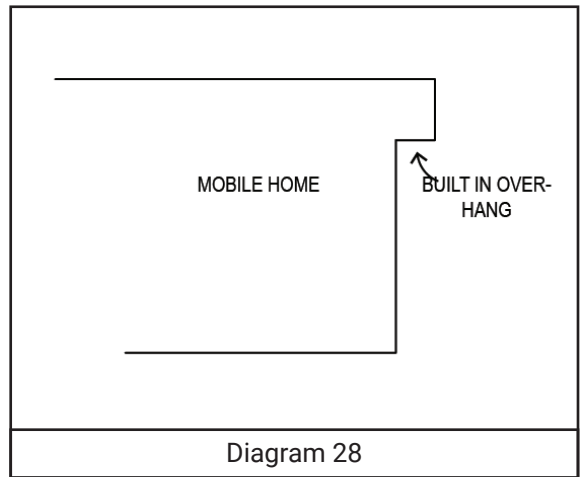
One Piece System for Bow Truss/Arched Roofs:

Cut Pieces

- Measure the needed length, pieces will run down the wall 3"-4"
- Pieces can be cut a little long and then trimmed after installation
- Pieces should be cut on the ground using a hook blade
- Pieces can be rolled up and easily carried up to the roof

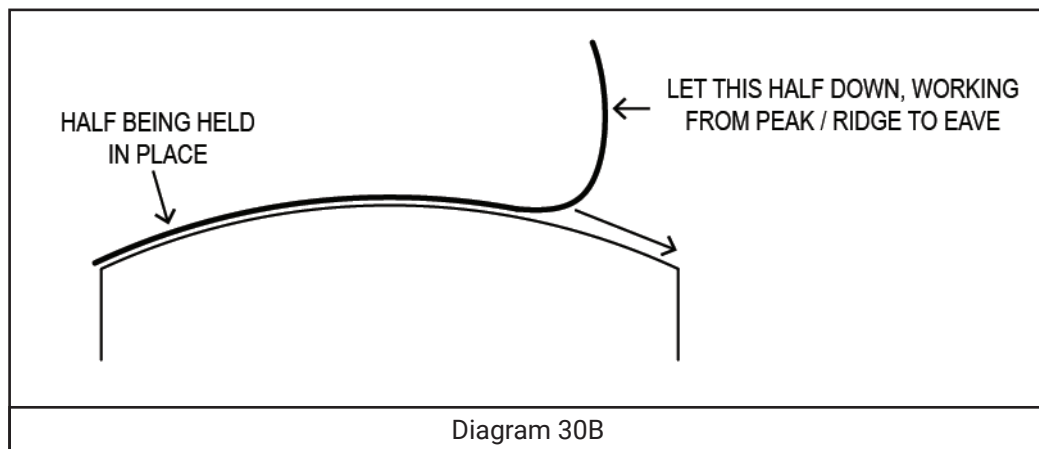
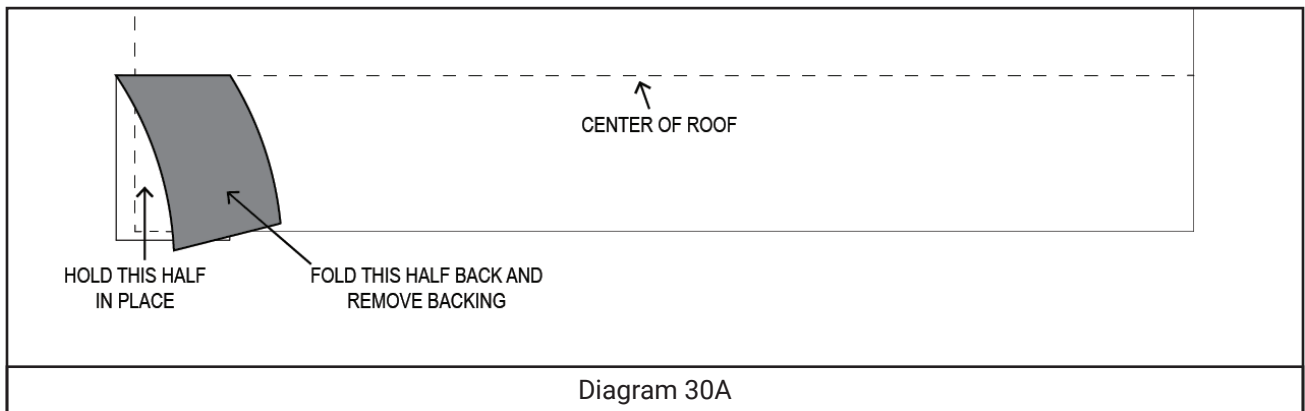
Install Pieces (See Diagram 28)

- Position the first piece with the sticky tab facing the field
- Allow 6"-8" to overhang the short side of the mobile home
- Make sure that there is even overhang on each end
- Stick the first piece down (See Diagram 29)
 - Hold the piece in place on one side of the roof
 - Fold the other half of the piece back, exposing the backing
 - Remove the backing on this half, while still holding the other half in place
 - Let the piece down, working from the peak of the roof towards the eave of the mobile home
 - Then, fold the other half back, remove the backing, and let it down to the roof, working from the peak to the eave



Roofs

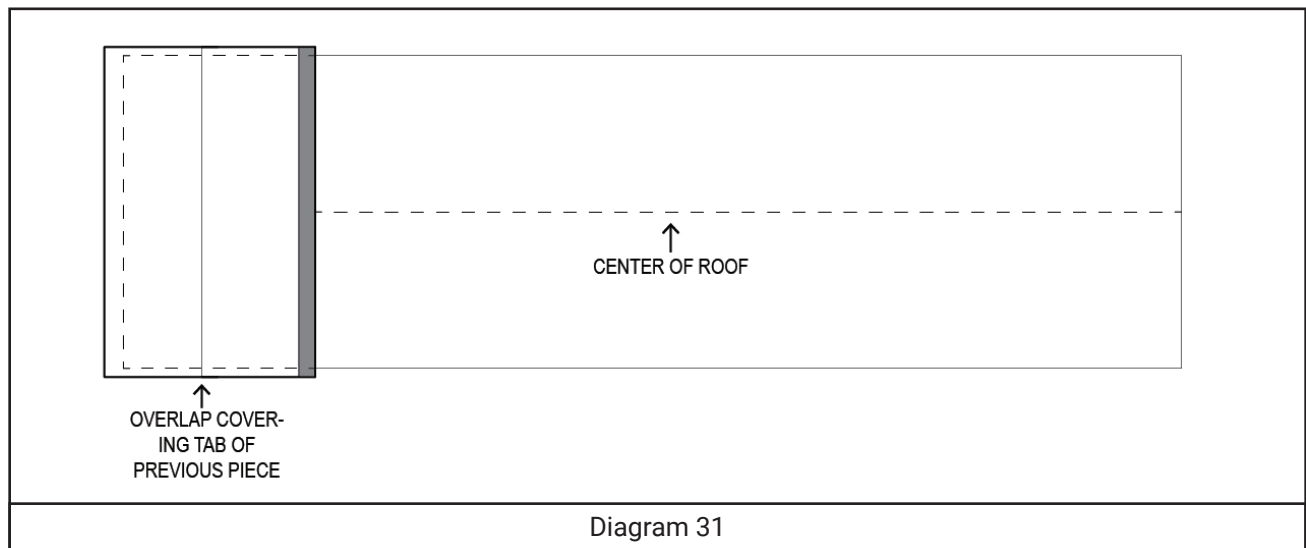
- Using a roller, go over the entire piece applying pressure to help the SBS adhere to the roof
 - Work from the overlap side towards the field
- Get the next piece into position
 - The next piece should cover the sticky tab of the previous piece (See Diagram 30)
 - Do not remove the plastic from the overlap tab on the first piece yet
 - Repeat the same process of holding half of the piece, folding back the other half, and removing the backing (See Diagram 29)
 - At this point, also remove the plastic from the overlap tab on this half of the roof
 - Let the piece down, working from the peak of the roof towards the eave of the mobile home
 - Repeat this process on the other side of the roof
- Repeat this process down the length of the roof
- Roll all pieces with roller applying pressure to help pieces adhere
- Follow instructions for vents and termination bar installation listed below



Two Piece System for Bow Truss/Arched Roofs:

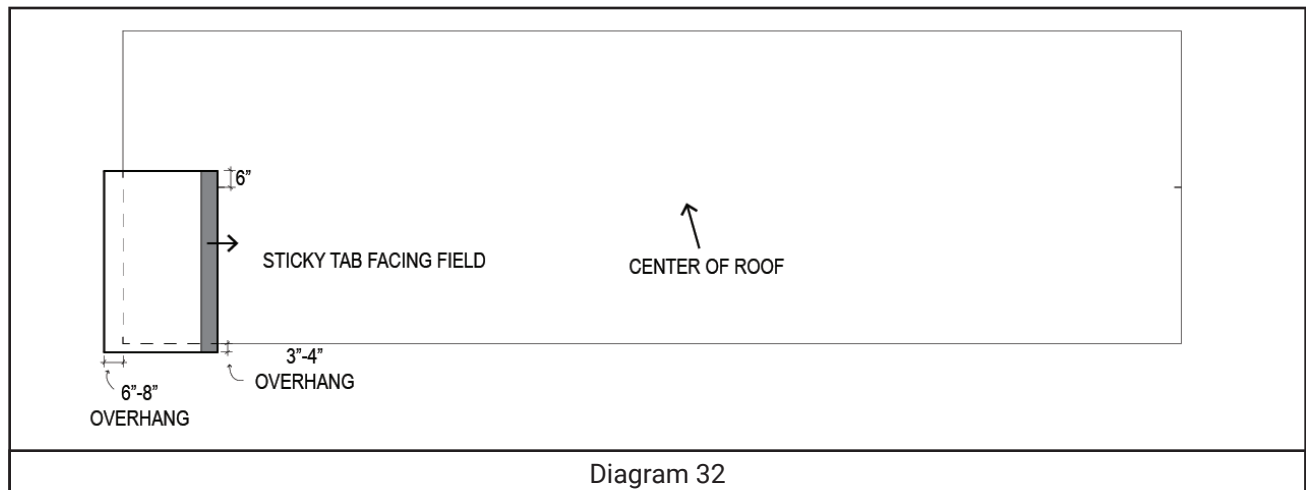
Cut Pieces

- Pieces will run 3"-4" down the wall and over the ridge 6"
- A chalk line can be snapped to show the ridge
 - This is helpful on rounded roofs where the ridge is not easy to determine
- Pieces can be cut a little long and then trimmed after installation
- Pieces should be cut on the ground using a hook blade
- Pieces can be rolled up and easily carried up to the roof



Install Pieces (See Diagram 31)

- All pieces on one side of the roof will be on the bottom of the overlap, and should be installed first
- Position the first piece with the sticky tab facing the field
- Allow 6"-8" to overhang the short side of the mobile home
- Make sure that there is 3"-4" of overhang at the eave and that the piece overlaps the ridge 6"



Roofs

- Stick the first piece down (See Diagram 32)
 - Hold the piece in place on one half (lengthwise)
 - Fold the other half of the piece back, exposing the backing
 - Remove the backing on this half, while still holding the other half in place
 - Let the piece down, working from the middle of the piece to the edge of the piece
 - Then, fold the other half back, remove the backing, and let it down to the roof, working from the middle to the edge
- Using a roller, go over the entire piece applying pressure to help the SBS adhere to the roof, working from overlap side to the field
- Get the next piece into position (on the same side of the roof)
 - The next piece should cover the sticky tab of the previous piece (See Diagram 33)
 - Do not remove the plastic from the overlap tab on the first piece yet
 - Repeat the same process of holding half of the piece, folding back the other half, and removing the backing (See Diagram 32)
 - At this point, also remove the plastic from the overlap tab
 - Let the piece down, working from the middle of the piece to the edge
 - Repeat this process on the other half of the piece
- Repeat this process down the length of the roof
- Roll all pieces pressure to adhere

with roller applying
help seal pieces

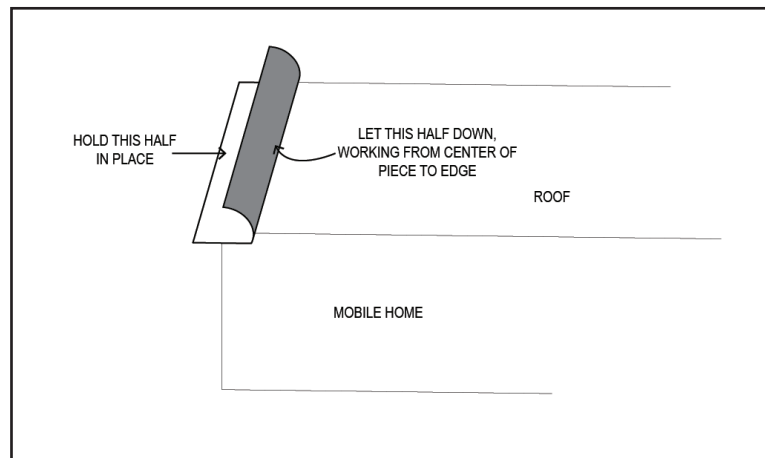


Diagram 33A

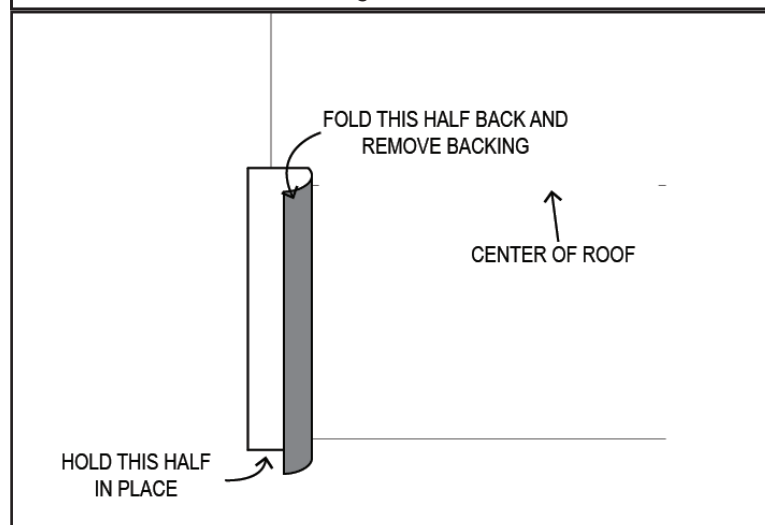
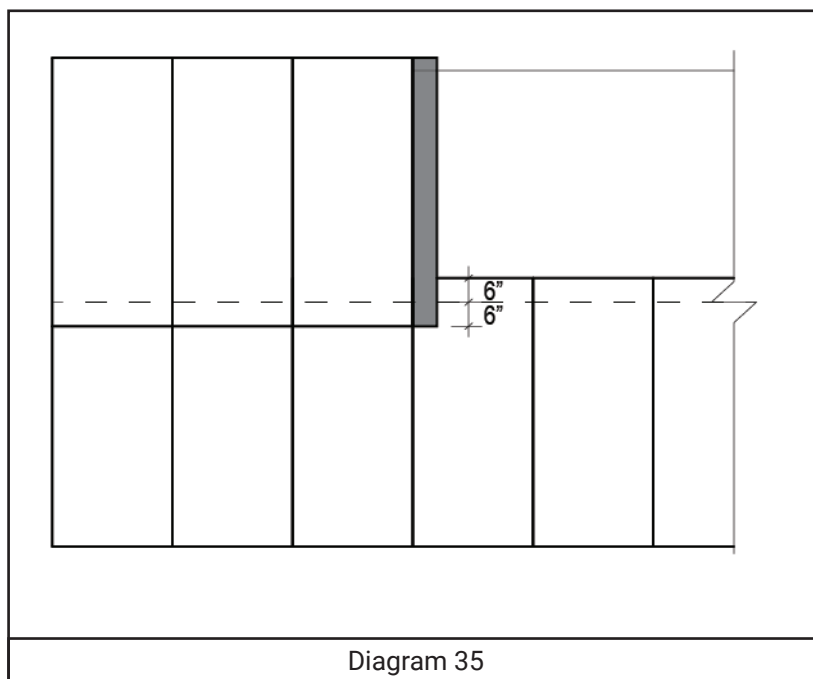
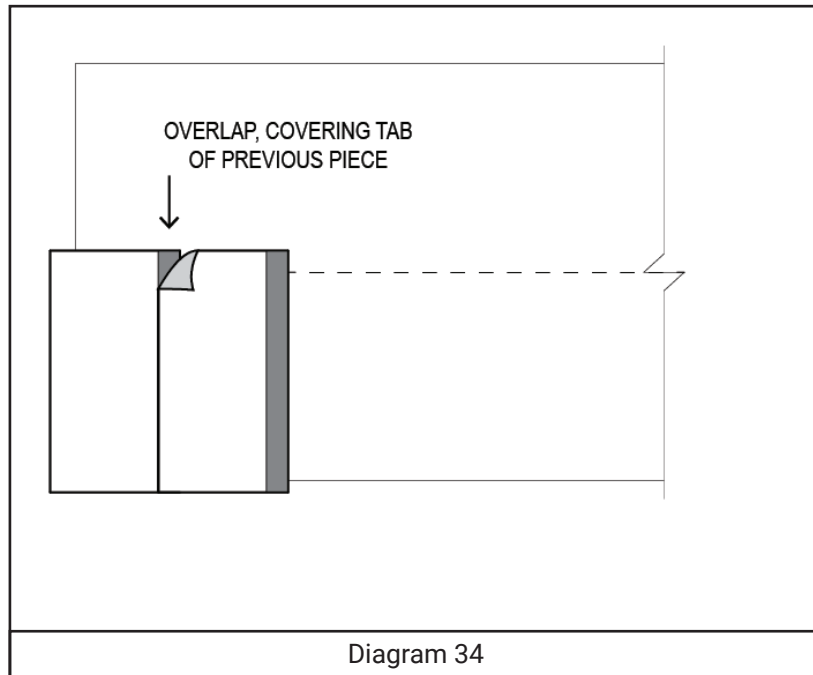


Diagram 33B

Roofs

- The same process will be followed on the other half of the roof (See Diagram 34)
 - Once 3-4 pieces are installed on the first side of the roof, installation can begin on the second side of the roof
- Follow instructions for vents and termination bar installation listed below



Roofs

Vent Pipes

- If possible, cut a hole in the SBS so that it can slide down over the vent pipe
 - Add roof tar around the bottom of the vent
 - Install a roofing boot over the vent
 - Apply a generous bead of roofing tar to around the bottom of the vent
 - Install the boot over the pipe and fasten every 2" around the base with neoprene screws
 - Don't work in a circle around the boot, but alternate sides as you install
 - Cover screw heads with roofing tar
- If boot cannot slide over the top of the vent pipe, cut the hole in the appropriate place and then cut a relief cut to the closest of the long edges (See Diagram 37)
 - The piece can then be worked around the vent pipe
 - Make sure that the hole is tight (within $\frac{1}{4}$ ") around the pipe
 - Dry fit pieces before installing
 - Use scraps or cardboard to make a template if needed
 - After this piece is installed, apply generous bead of roof tar around the vent and along the relief cut
 - If a relief cut was used:
 - Cut a square of SBS that extends past the vent 12" on each side
 - Cut a hole for the vent in the middle of this piece and a relief cut to one edge
 - Dry fit this piece before installing
 - Remove backing and apply a generous bead of roof tar to the perimeter of the sticky side of the patch
 - Put the patch in place around the vent pipe with the relief cut on the downhill side of the pipe
 - Use roller to help piece adhere
 - Apply roof tar around the pipe on top of this square and down the relief cut seam

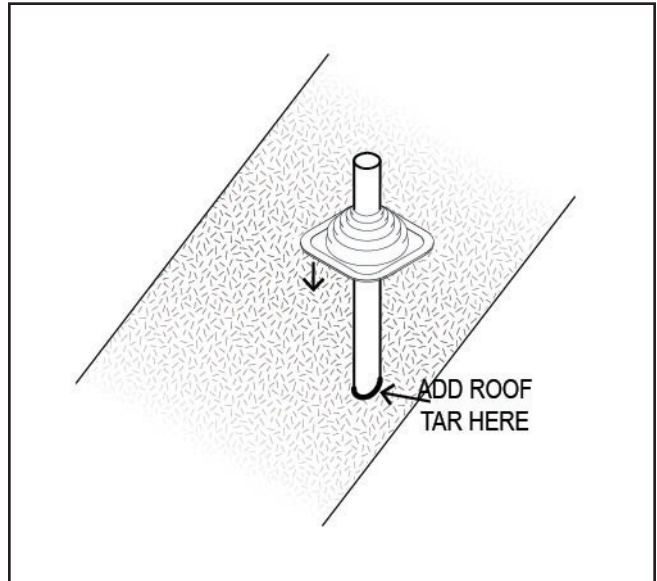


Diagram 36

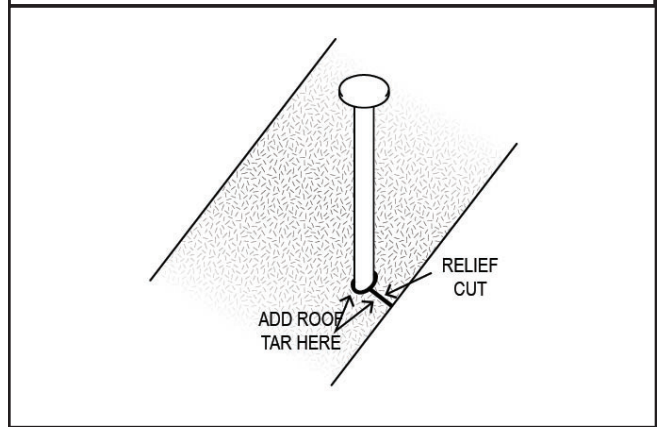


Diagram 37A

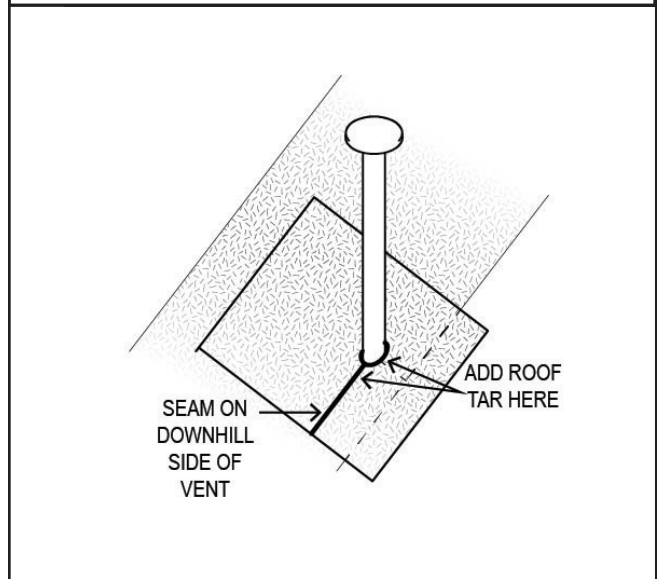
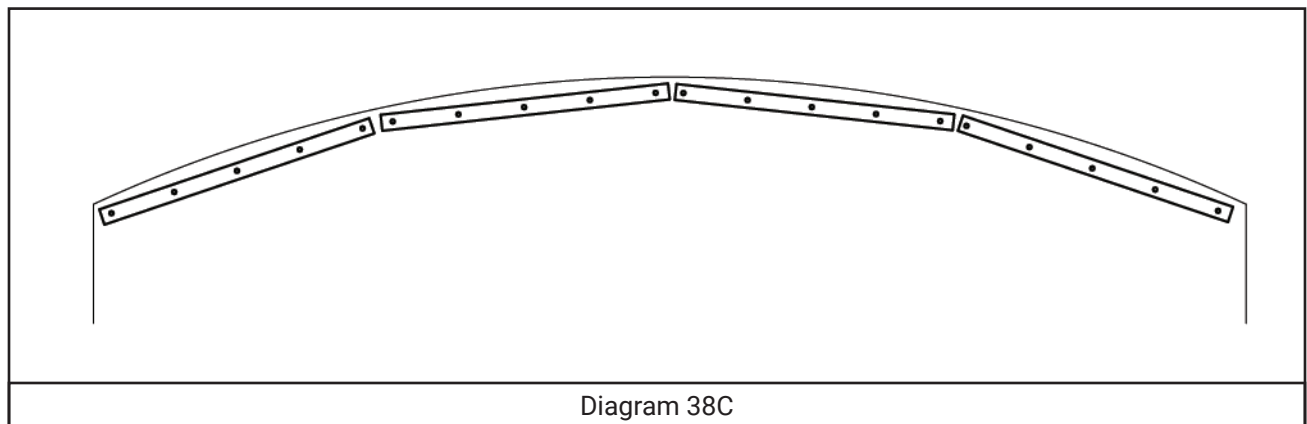
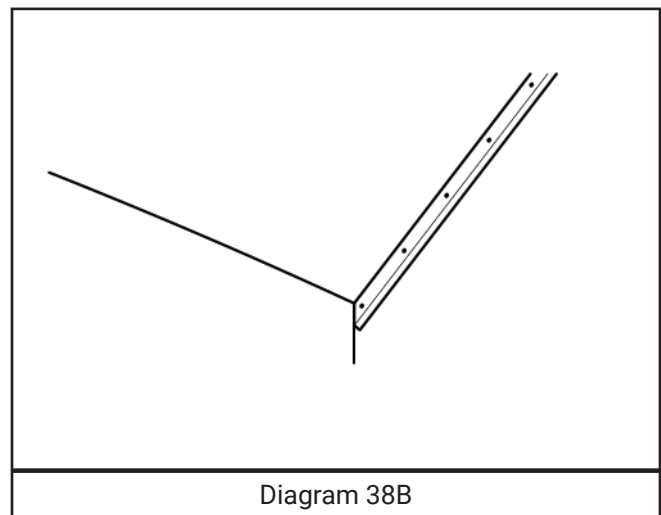
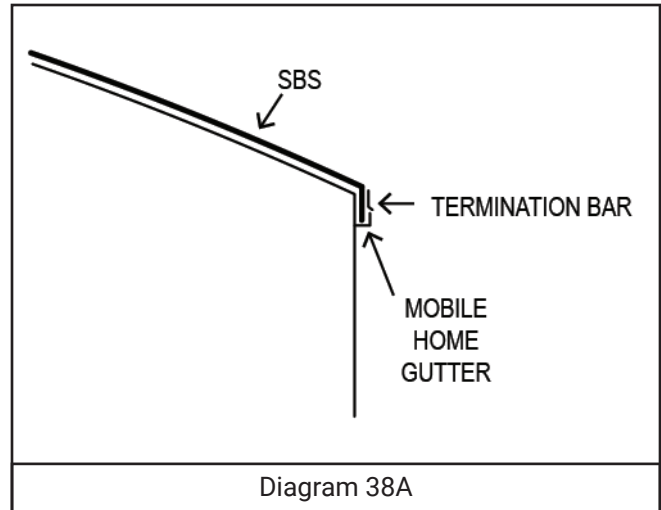


Diagram 37B

Termination Bar

- Termination bar is installed around the top of the mobile home walls to hold down the edges of
- the SBS
- Mobile home gutters
 - If possible, let SBS terminate into the gutter
 - If not, gutters can be removed or pounded down
- If the termination bar comes with a drip edge it should be installed facing out
- Placement of termination bar:
 - If an overhang has been built, the termination bar will be fastened directly into that
 - If no overhang has been built, place the termination bar so that screws are going into the top plate of the wall
- Apply a bead of roofing sealant to the back of the termination bar before putting it into place
- Fill every hole with a neoprene screw
 - Be careful not to overdrive screws and strip the wood
- Termination bar can be cut to length using a metal hacksaw
- On the short ends of rounded roof mobile homes,
- cut smaller sections to match profile (See Diagram 38C)
- Trim the SBS that remains below the termination bar. This should be done soon after the termination bar is installed



Roofs

SBS on Gabled Mobile Home, Flat, or Low-Pitched Roofs

SBS can be installed directly over new OSB decking. If SBS is to be installed over old decking, a synthetic underlayment must be installed or an appropriate primer applied so that the SBS will adhere to the surface well. If the roof pitch is 1.5:12 or greater the SBS material should be nailed down. For gabled mobile home roofs, consider whether metal or SBS material is more readily available in your area as you decide which to use.

Synthetic Underlayment (if applicable) (See Diagram 11)

- Drip edge should be installed across the low eave(s) before synthetic underlayment, see instructions below
- If there are valleys in the roof, ice and water shield and a strip of synthetic underlayment should be installed in the valley before synthetic underlayment on the rest of the roof, instructions below in "Valley" section (page 110)
- Sweep the roof well before installing synthetic underlayment
- Start at the lower end of the roof
- Roll out and fasten with roofing nails (staples or button caps should not be used because they can damage the SBS material)
 - Fasten with the pattern designated on the material
 - Additionally, fasten every 4"-6" around the perimeter of the underlayment
 - The SBS will adhere to the synthetic underlayment, so it is important for that to be fastened well
- Start the next row and overlap at least 2", there should be a designated overlap line on the material
- Work up to the peak of the roof and trim
- Do not step on the rolled-out material until it is fastened down, it is incredibly slick
- Be careful moving around and setting tools down on the synthetic underlayment

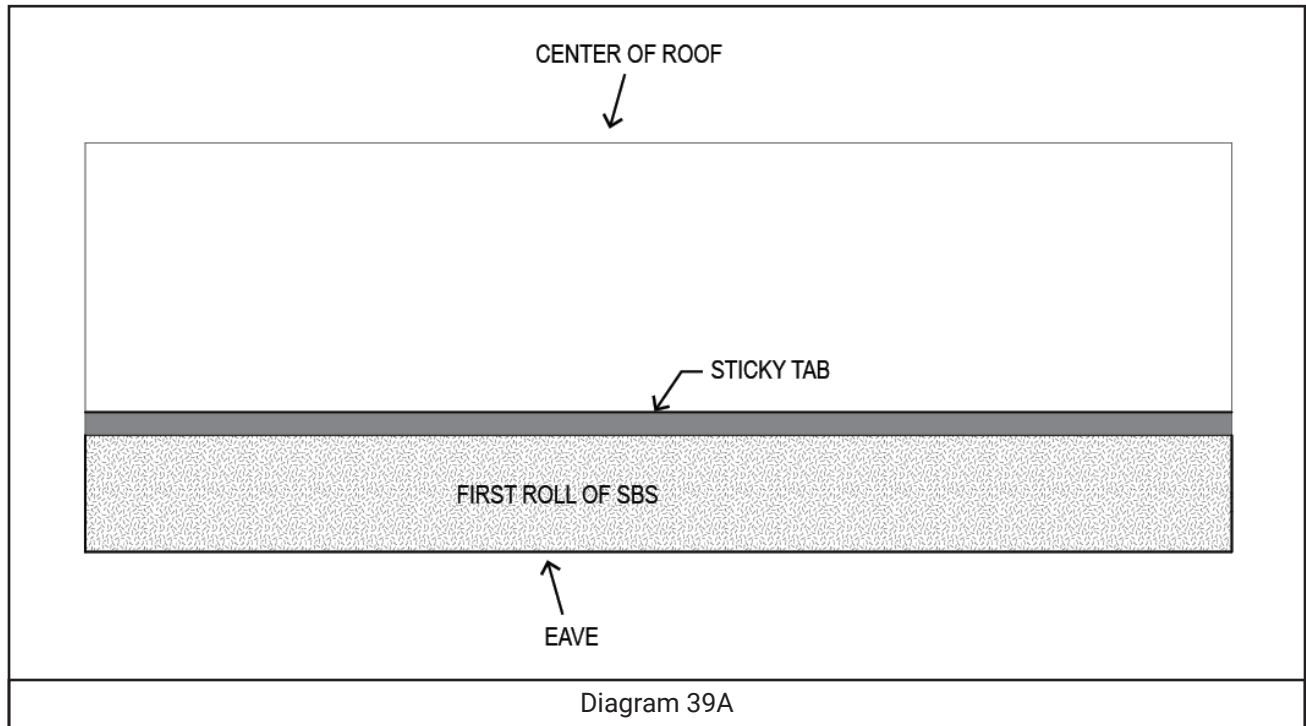
Cutting Pieces of SBS

- Pieces will run from one gable edge to the other, even with the drip edge
- Pieces should be cut on the ground using a hook blade
- Pieces can be rolled up and easily carried up to the roof

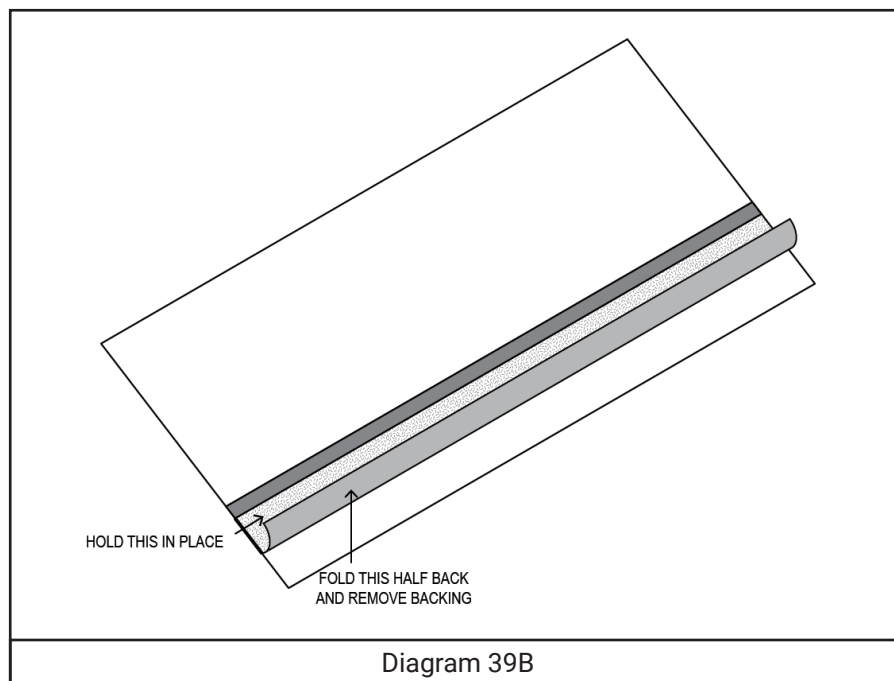
Roofs

Installing Pieces

- Position the first piece with the sticky tab facing up the roof and the other edge even with the drip edge along the eave (See Diagram 39A)

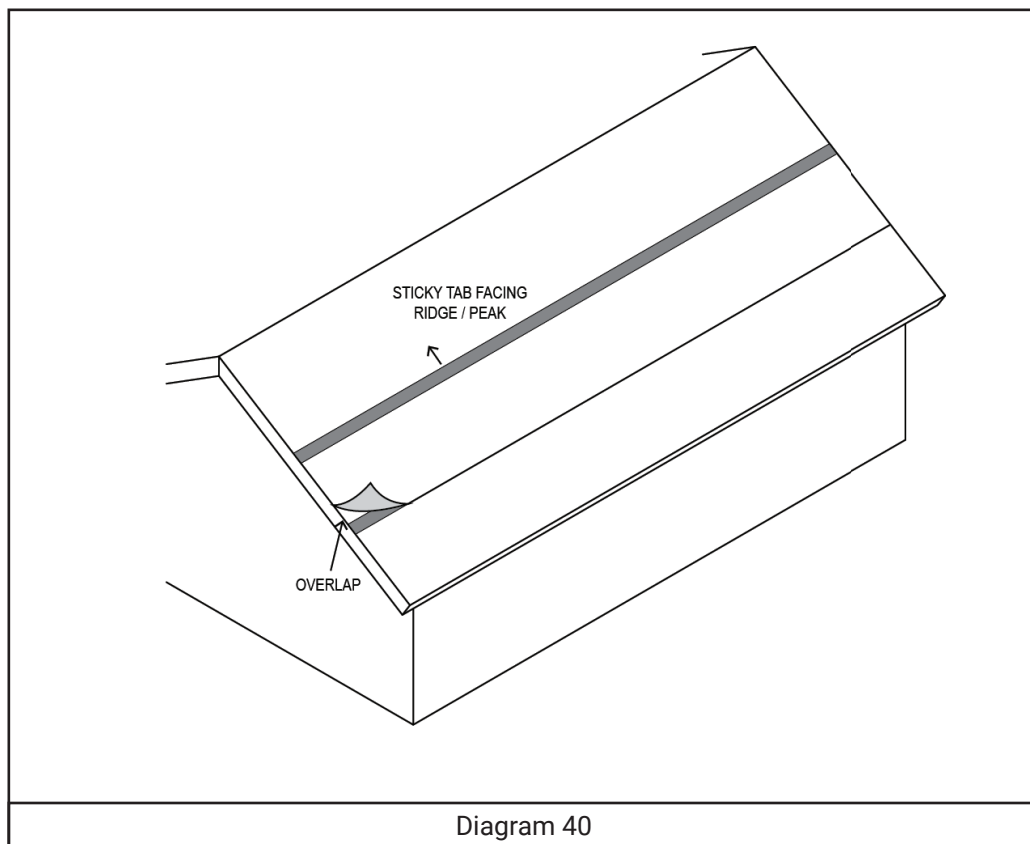


- Install the first piece down (See Diagram 39B)
- Hold the piece in place along its top half
- Fold the bottom half of the piece up, exposing the backing
- Remove the backing on this half, while still holding the upper half in place



Roofs

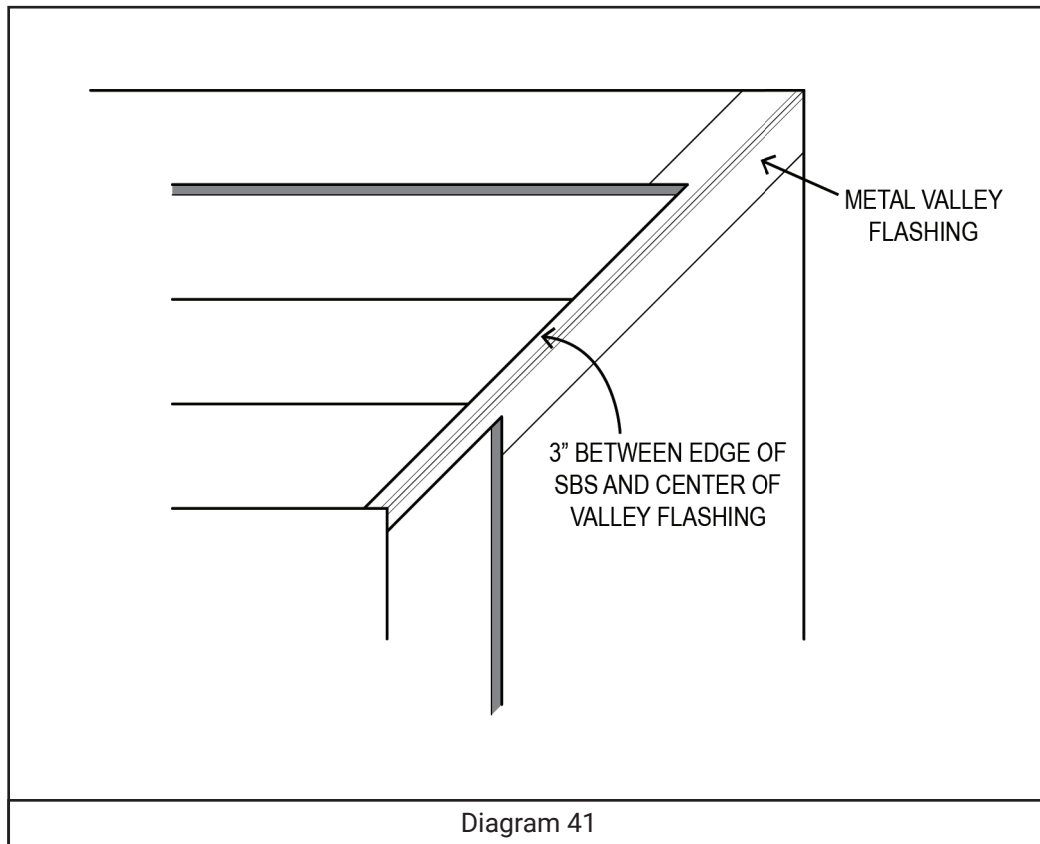
- Let the piece down, working from the middle of the piece towards the eave
- Then, fold the upper half back, remove the backing, and let it down to the roof, working from the middle of the piece towards the ridge/peak
- Using a roller, go over the entire piece applying pressure to help the SBS adhere to the roof, working from eave to ridge
- Nail in place at every 12" along the sticky tab if the roof pitch is 1 .5:12 or greater
- Get the next piece into position (See Diagram 39)
 - The next piece should cover the sticky tab of the previous piece
 - Do not remove the plastic from the overlap tab on the first piece yet
 - Repeat the same process of holding the upper half of the piece, folding back the lower half, and removing the backing
 - At this point, also remove the plastic from the overlap tab on the lower piece
 - Let the piece down, working from the middle of the piece towards the eave
 - Then, fold the upper half back, remove the backing, and let it down to the roof, working from the middle of the piece towards the ridge/peak
 - Nail in place at every 12" if 1.5:12 pitch or greater
- Repeat this process until the peak or ridge is reached
- Roll all pieces with roller applying pressure to help pieces adhere, working from eave to ridge
- If the roof is a shed roof, cut the last piece to the remaining width of the roof
- If the roof has a ridge, trim the last piece so that 6" overlaps the ridge and repeat this process for the opposite side of the roof
- Use full length pieces from gable to gable if possible
 - If overlaps must be made, overlap pieces by 12"
 - Add roof tar where edges of top piece will rest on bottom piece



Roofs

Valleys

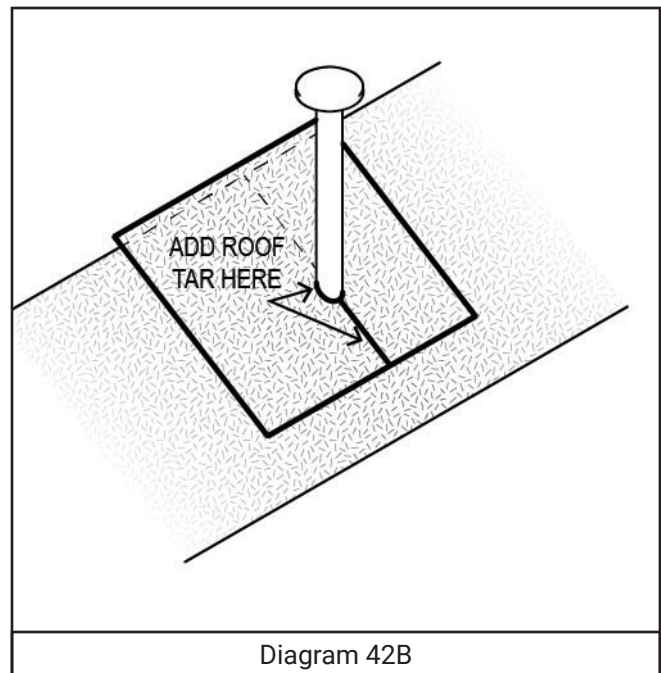
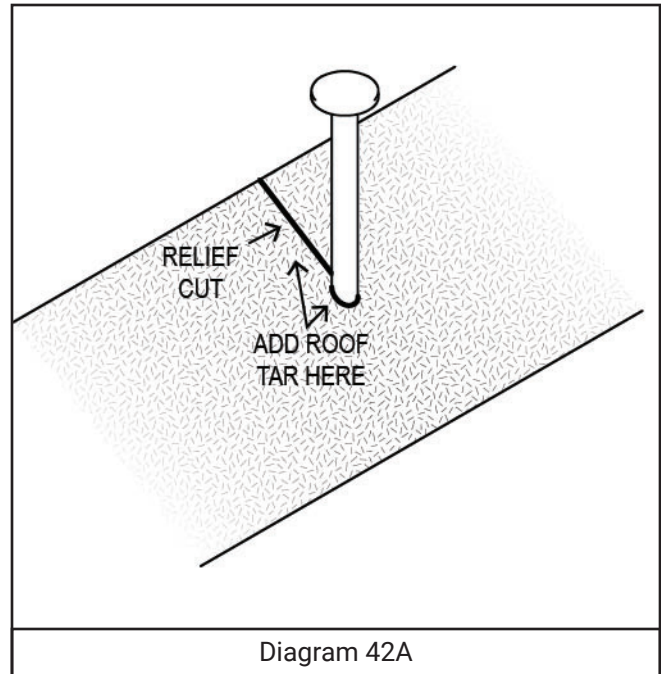
- Install Ice and Water Shield
 - Ice and Water Shield should be installed in all valleys before synthetic underlayment
 - This is an adhesive material that comes in a roll
 - Run from the eave to the peak
 - Do not step on this material until the backing is removed and it is stuck into place
 - Remove backing and stick piece down, trim excess even with eave and ridge
- Lay a strip of synthetic underlayment from eave to ridge, fastening only along the long edges using roofing nails (See Diagram 11)
- Synthetic underlayment from each surface of the roof creating the valley should overlap the valley at least 6", do not fasten any closer than 6" from the center of the valley
- Install metal valley flashing (See page 113/Diagram 15)
 - Run pieces from eave to ridge
 - Use Metal snips to trim the bottom of the piece to match the edge of the eave, and trim the top to match the ridge
 - Allow valley to overhang the drip edge by 1"
 - If overlap is needed, overlap by minimum of 6"
 - Attach every 12" at the very edge of the valley flashing using roofing nails
- Pieces of SBS terminating in the valley should be trimmed 3" short of the middle of the valley and rolled down well to adhere to the valley flashing (See Diagram 41)



Roofs

Vent Pipes

- If possible, cut a hole in the SBS so that it can slide down over the vent pipe (See Diagram 35)
 - Add roofing tar around the vent pipe
 - Install a roofing boot over the vent pipe
 - Apply a generous bead of Roofing Tar all the way around the bottom of the boot
 - Install the boot over the pipe and fasten every 2" around the base with neoprene screws
 - Don't work in a circle around the boot, but alternate sides as you install
 - Apply roof tar to each screw head
- If the piece cannot slide over the top of the vent pipe, cut the hole in the appropriate place and then cut a relief cut towards the long edge on the upper side of the roof (See Diagram 41)
 - The piece can then be worked around the vent pipe
- Make sure that the hole is tight (within ¼") around the pipe
- Dry fit pieces before installing
- Use scraps or cardboard to make a template if needed
- After this piece is installed, apply generous bead of roof tar around the vent and along the relief cut
- If a relief cut was used:
 - Cut a square of SBS that extends past the vent at least 12" on each side and will cover the entire relief cut
 - Cut a hole for the vent in this piece and a relief cut that will be below the pipe
 - Dry fit this piece before installing
 - Remove backing and apply a generous bead of roof tar to the perimeter of the sticky side of the patch
 - Put the patch in place around the vent pipe with the relief cut below the pipe
 - Roll piece with roller to help it adhere
 - Apply roof tar around the vent on top of this square and down the cut seam



Roofs

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Soffit & Siding

Why Siding? Siding acts as a skin on the outside of the house that helps protect it from water and helps to insulate the home.

Section Contents:

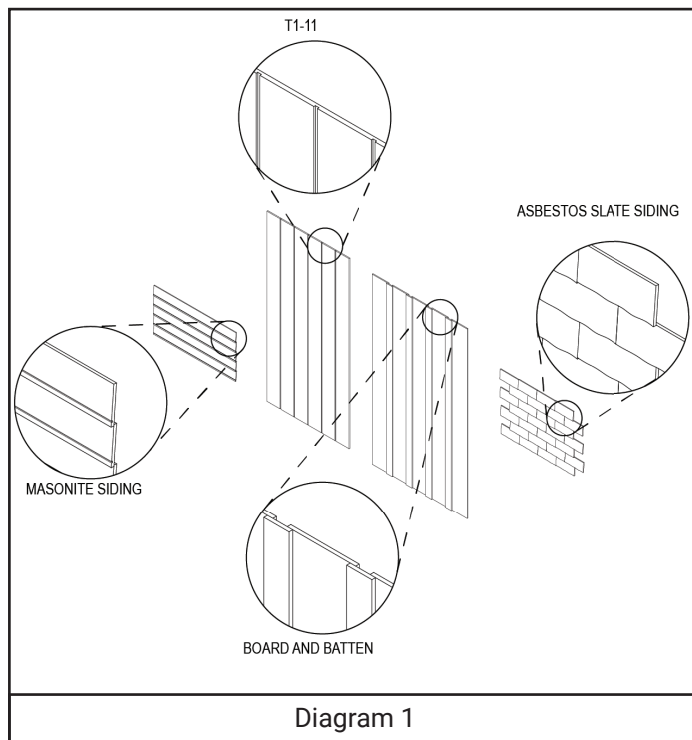
- Housewrap. 146
- Vinyl Soffit 146
- Vinyl Siding 151

Hazardous Siding:

Types of Siding:

Painted - Any siding painted before 1978 likely contains lead. Do not work on a house containing lead-based paint without consulting your construction consultant or Home Repair Coordinator. Lead based paint should not be scraped or sanded under any circumstances.

Asbestos - Working with siding containing asbestos can be dangerous. Asbestos siding is most dangerous when cut with a saw or broken into small pieces. Do not do any work on a house with asbestos siding without consulting your construction consultant or Home Repair Coordinator. Vinyl siding cannot be placed over asbestos siding with volunteers.



Soffit & Siding

Safety

- Maximum height of siding projects should not exceed 12' on the eaves and 20' at the peak without approval from HRC/CC.
- Be cautious when removing existing siding (bees/bats/etc. may live behind siding)
- Edges of vinyl can be very sharp, make sure gloves are available
- Make sure ladders are sturdy and secure
- All vinyl should be cut with snips, no power saws should be used
- There will most likely be various obstructions on the side of a home; Electrical boxes, weather head, telephone and cable/internet boxes, light fixtures, etc. Be careful around any obstructions you may find and contact any power companies if necessary.

Siding Project Planning

- Does the height of the walls that need siding exceed the 12' maximum for eaves and 20' on the peak?
 - If it does, talk with your CC and HRC for approval.
 - Will you be installing siding over existing siding or onto new sheathing?
 - If existing siding is vinyl, you will remove it before new installation.
 - If existing siding is other material, will you need to install vertical purlins to create level surfaces for new vinyl installation?
- Will you be installing siding into wood or metal?
 - Wood should utilize nails and metal should utilize lathe screws.
- How many ladders will be needed at a time?
- Is the site safe for volunteers using ladders?
- How will the siding work with the soffit/how will it finish at the top?
 - If there is not soffit installed on the home, it should be installed before the vinyl siding
- Is the bottom/starting point for the siding level? Will the bottom line of j-channel need to be stepped up or down at all?
- Will you be able to use starter strip, or will you use J Channel to terminate at the bottom of each wall?
- What kind of obstacles will you be working around? (Service panel, cable boxes, etc.)
 - Will you need mounting blocks for them?
- Discuss colors of siding with the homeowner.
- If you are installing foam insulation during this process, make sure to account for using double J-Channel or wide J-Channel.

Measurements Needed

- Measure perimeter of house and heights of walls (surface area to be sided)
- Measure the width of the overhang (for soffit)
- How many inside/outside corners?
- How many doors/windows? How much j-channel will be needed for each one?

Soffit & Siding

Quality Control

- Make sure there is housewrap up before siding/soffit
- Make sure the j-channel or starter strip along the bottom is level.
- Make sure corner posts are installed correctly and before other trim
- Ensure J-Channel is installed and overlapped correctly around windows/doors to allow for proper drainage
- Make sure weep holes were drilled into J Channel if used on the bottom run
- Mitered corners of J-Channel are tight
- If using a double J-Channel system, it is overlapped and installed correctly
- Make sure the seams in the siding have appropriate overlaps with factory edge on the outside
- Make sure siding seams are overlapped by 1 ½"
- Are the nails too tight/ does the siding have room to expand/contract?
- Make sure rows of siding are locking together
- Make sure each row of siding is level
- Make sure that pieces are fitting into the j-channel/trim
- Make sure seams are staggered
- Overlapping seams should face the same direction so that they are either hidden when looking from the front of the house or the overlaps are placed so the wind doesn't catch the edges.

Common Mistakes

- Fastening the j-channel at both ends and working towards the middle, creating waves
- J-Channel and rows of siding are not level
- Starting at both sides and working toward the middle, making overlaps not all in the same direction
- J- Channel is not installed and overlapped correctly around windows/doors
- Siding just butted together with no overlaps
- Nails too tight or at the edges of nail slots, preventing expansion/contraction
- Not testing that the pieces are interlocked and continuing to install pieces (all above will have to be removed to correct)
- Gaps too big around corners of windows/doors
- Siding not lining up around the tops of windows/doors
- Working up instead of across the wall

After Work is Complete Quality Control Check

- Ensure that overlaps are done correctly
- Siding needs to be terminated into the correct trim piece at the top
- Leftover siding is left for homeowners later in case of damage.
- Dirt has been cleaned off of the siding
- Seams are caulked around windows and doors
- All fallen nails and debris has been cleaned up around the worksite.

Group Leader Tips

- There are a lot of things to remember while working on vinyl siding. Consider copying these reminders and keeping someone in charge of quality control.
 - Work from one side of the house to the other. Do not start from both sides of a wall.
 - Minimum 1 ½" overlap between pieces of siding
 - Attach every 12"-18" with roofing nails or lathe screws
 - Do not pound nails tight or fully drive screws, leave a nickel's width behind them for expansion/ contraction
 - Make sure that nails are in the middle of the nailing slots
 - Make sure that pieces are interlocking by tugging out on the bottom of them
 - Stagger the seams between rows of siding by a minimum of 2'
 - No pieces shorter than 2' should be used (unless the space is smaller than that)
- Work as an assembly line around the house
 - Once housewrap is installed on one side, volunteers can start cutting and taping, then starting to install Vinyl trim (J-channel, starter strip, corner pieces) while others continue housewrap.
 - Once all the trim is installed on one wall, the siding can start on that wall and the trim crew can move on to the next wall
- When installing siding or soffit, designate who is cutting and who is installing
 - Have the person installing, measure ahead so that whoever is cutting can have the next piece ready
- Measurements should be communicated clearly.
 - Always account for the factory edge and overlap.

Recommended Vinyl Soffit and Siding Tools

Safety:

- Gloves
- Glasses

Other (Housewrap Only):

- Staple gun
- utility knives
- ladders
- hammers

Other (Soffit Only):

- Circular Saw - for cutting pieces for bird box Extension cord
- Drill
 - 1/8" drill bit - pre-drilling for bird box
 - T-25 Driver to match screws for building birdbox

Other (Siding Only):

- Snap Lock Punch Siding Tool - used to make tabs in pieces for the top row
- Vinyl Siding "Hook" Tool - Used to help lock siding into place in tight spots or to remove a piece
- Drill
 - Phillips Driver to match Lath Screws
 - 1/8" drill bit - weep holes in bottom run of J-channel

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc.)
- 4' Level
- Torpedo Level
- Tin Snips
- String line/String level
- Chalk Line
- Caulk Gun
- Ladders
- Sawhorses

Siding Materials Lists

Housewrap Materials		
Quantity	Item	Purpose / Notes
	Roll(s) Housewrap	Generally come in 100' rolls
3-4	Rosss housewrap tape	To seal seams and around windows/doors
2-4 boxes	Staples	Coordinate the correct type of staples to staple gun
	Button Cap Nails	Can be used in place of staples/staple gun
Vinyl Soffit Materials		
Quantity	Item	Purpose / Notes
	2x8 or 2x10 F	Angled piece of bird box, length for each corner is the same as the size of the eave overhang
	2x4 or 2x6 F	Makes corner with angled piece to create bird box, length for each corner is the size of the gable overhang plus one foot
	F-Channel	<i>Length needed (in feet)/12' (length of one piece) = # of pieces needed</i> (can replace with J-channel if siding is not being installed with soffit)
	Solid Soffit	For non-vented areas, typically gable sides
	Vented Soffit	For areas vented to the attic space, typically eaves For both solid/vented: <ul style="list-style-type: none"> <i>Width of overhang (in feet) x Length needed (in feet) = Area</i> <i>Area x 1.1 = Added 10% for error</i> <i>Area/12 SF (Size of one piece) = # of pieces</i>
	Metal/Vinyl Fascia	Size should coordinate to the size of the fascia board, length of pieces vary among suppliers <i>Length needed/length of one piece = # pieces</i>
1 Piece	J-Channel	To catch soffit where gable ends intersect with bird Boxes (See Diagram 6B)
	Roofing Nails	1 ¼" - 2" length, to attach f-channel to wall and soffit pieces to fascia
	White Aluminum Trim Nails	For attaching metal fascia and holding first pieces of soffit into place
	3" Deck Screws	Constructing the bird boxes

Soffit & Siding

Vinyl Siding Materials		
Quantity	Item	Purpose / Notes
	Outside Vinyl Corner Posts	
	Inside Vinyl Corner Posts	
	J-Channel	Across the bottom and top of each wall, around all windows/doors/etc. <ul style="list-style-type: none"> $\text{Length needed (in feet)} / 12' \text{ (length of one piece)} = \text{number of pieces needed}$
	Utility Trim/P-Channel	Across the top of the wall on eave sides of home <ul style="list-style-type: none"> <i>Same equation as J-channel</i>
	Siding	<ul style="list-style-type: none"> $\text{Length of wall (in feet)} \times \text{Height of wall (in feet)} = \text{Area}$ $\text{Add together area for each wall} = \text{Total Area}$ $\text{Total Area} \times 1.1 = \text{Added 10\% for error}$ $(\text{Area} + 10\% \text{ error}) / 100 \text{ SF} = \text{Squares Siding}$ <p>Vinyl Siding is ordered by the "Square" (1 Square = 100 SF), number of squares in a box will vary with supplier</p>
	Roofing nails or Lath screws	1 ¼" - 2" length, used to attach all vinyl trim and hang pieces of siding
	White Aluminum Trim Nails	To hold pieces in place through weep holes under windows/across the top of the wall
	White Flashing	If needed to work around lights/boxes/etc.
	Mounting Blocks	For hoses/dryer vents/etc. (as applicable)
	Exterior Silicone Caulk	Seams around windows /doors

Housewrap Instructions

Housewrap is a weather barrier layer installed before siding, intended to protect the walls from moisture.

- Housewrap should be installed with the words facing out, it is designed to weep water out
- Install with staples or button cap nails, attach every 18" - 24"
- Depending on the working area, housewrap can be installed two ways
 - Hold the roll up vertically and unroll it along the wall, attaching it as you go
 - Measuring and cutting pieces and then attaching them
 - This sometimes works better when the area is high off the ground and work is being done from ladders
- Make housewrap as flat to the wall as possible, pulling it tight to avoid bubbles
- If multiple courses are needed, install the course on the bottom first, so that when the top piece is installed, water would be flowing to the outside of the housewrap
- Wherever there is a seam, overlap pieces by 1'-2'
 - All seams should be taped with housewrap tape
 - Lower courses should always be behind upper courses
- Cut housewrap back from windows/doors/etc. 1"-2"
 - Tape around these edges, installing the tape on the bottom first, then the sides, and then across the top
 - Let all pieces of tape extend several inches past the corner of the window
- Housewrap can hang down lower than necessary and then can be trimmed after siding is installed

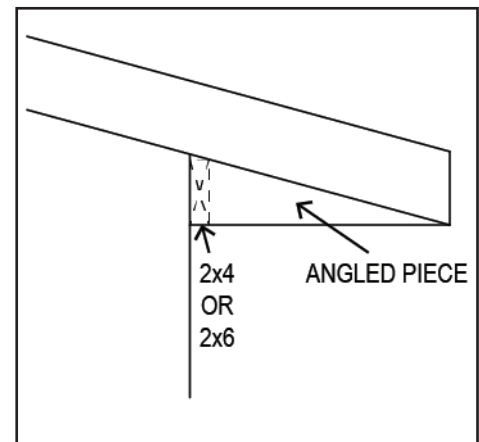


Diagram 2A

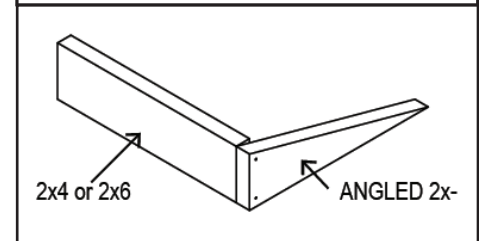


Diagram 2B

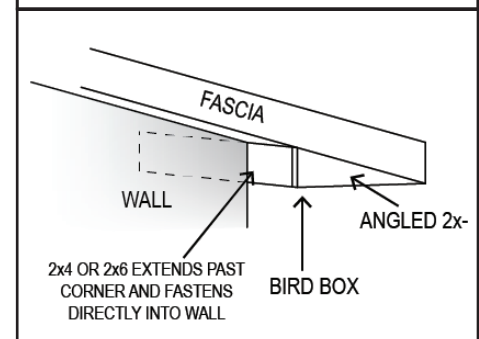


Diagram 2C

Vinyl Soffit Instructions

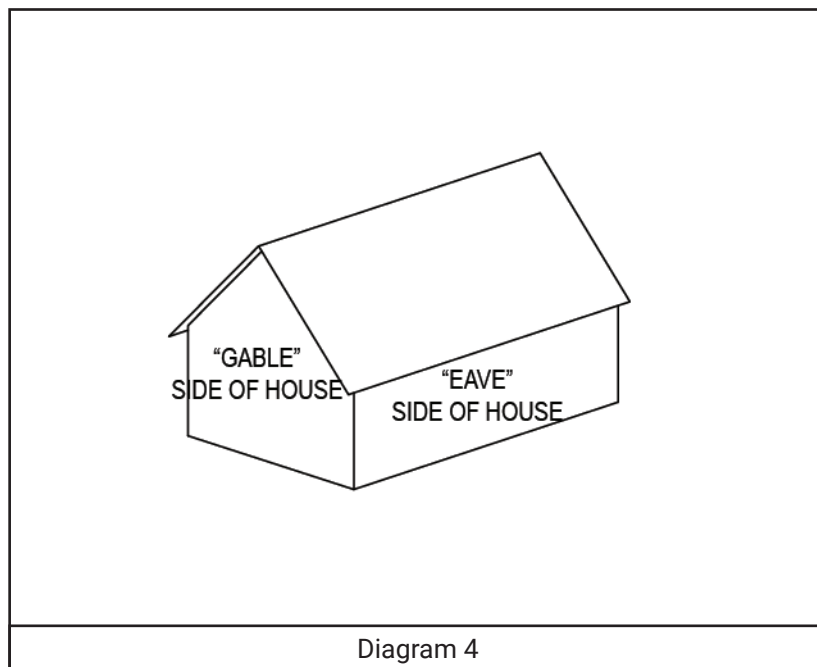
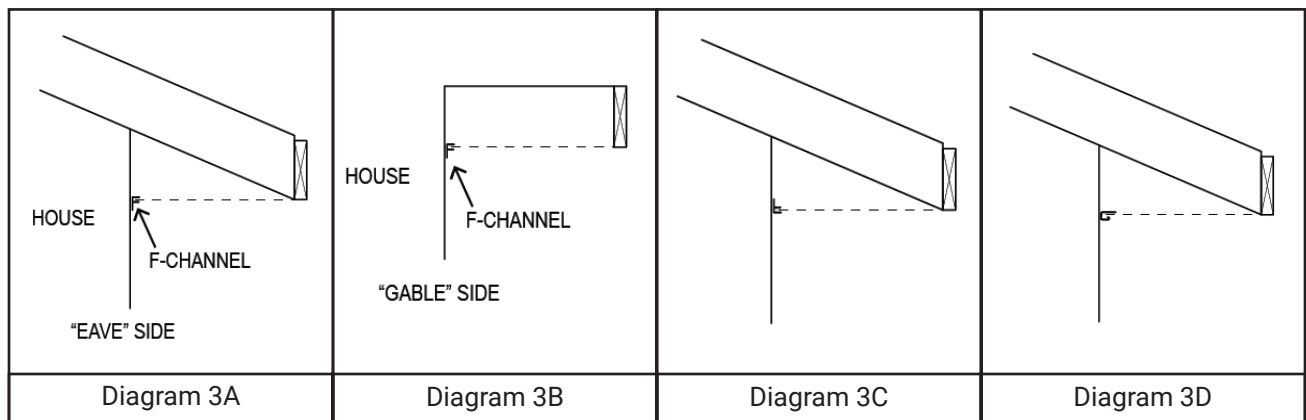
Bird Boxes/Corners (See Diagram 2)

- The corners of the house may require extra framing before vinyl soffit can be installed
- Determine the slope of the roof. This angle will be transferred onto 2x8 or 2x10 material, depending on the slope of the roof
 - Measure how long this piece will need to be (matching the overhang) and cut it accordingly
- This angled piece will make a corner with a 2x4 or 2x6, (depending on the available space) that will extend to the wall and be attached directly to the wall
- Assemble these two pieces before installing
- Pre-drill through the skinny section of the angle before screwing it up into the fascia board so that it doesn't split
- Install the bird box

Soffit & Siding

F-Channel (Or J-Channel, see second bullet to determine)

- Install f-channel along the wall of the house, with nailing tab down (See Diagram 3A and 3B)
 - The first piece will start at the corner of the house
 - Make sure that the opening of the f-channel is level with the bottom of the fascia board
 - Attach with roofing nails (1 ¼"-2") every 12"
 - Follow the same process for both eave and gable sides of the home (See Diagram 4)
- If soffit is to be installed without vinyl siding, this piece of f-channel should either be installed upside down or replaced with j-channel (attached through the back with short exterior screws) so that the nailing flange does not show after soffit is installed (See Diagram 3C and 3D)



Soffit & Siding

Install Soffit Pieces

- Determine vented or solid pieces
 - Solid soffit should be used where there is no venting to the attic, generally the gable (angled) sides of the roof
 - Vented soffit should be used where there is venting to the attic, generally the eave (flat) sides of the roof
- Measure from the inside of the f-channel to the outside of the fascia board and subtract $\frac{1}{4}$ " from this measurement
- **Measure each piece individually**, expect fluctuation in measurements of older houses
 - Do not mass produce soffit pieces without measuring first, they may not fit
- Make sure pieces are marked square and cut pieces to length using tin snips (See Diagram 5)
- **Pieces will be cut off of 12' sections of soffit and run perpendicular to the wall, interlocking with one another** (See Diagram 5 and 6)

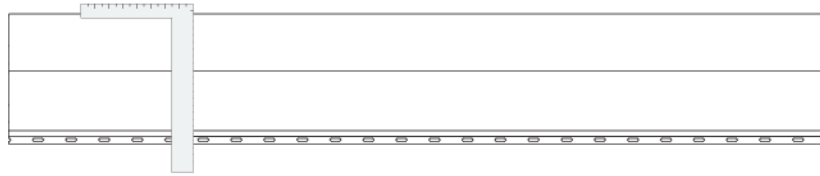


Diagram 5

- The first piece(s): (See Diagram 6)
 - The first piece in a run should be installed with the non-flange side on the starting edge and the nailing flange towards the field
 - On the eave sides the first piece(s) that are below the birdbox will be tacked in with white trim nails in each corner (See Diagram 6A)
 - The first piece on the gable side will require a piece of j-channel to catch the edge that intersects the bird box (See Diagram 6B)

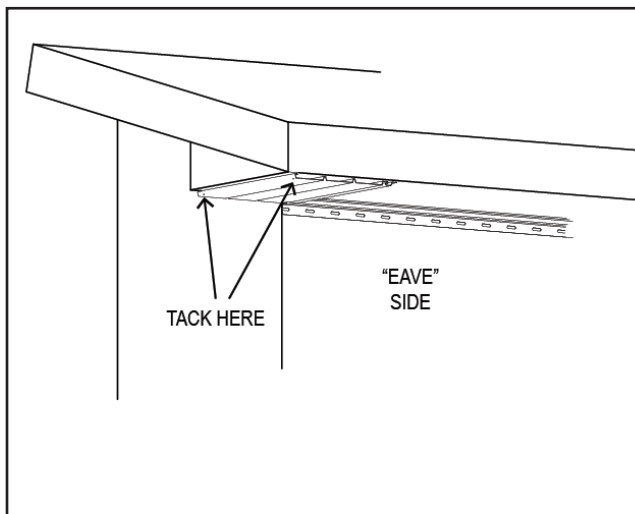


Diagram 6A

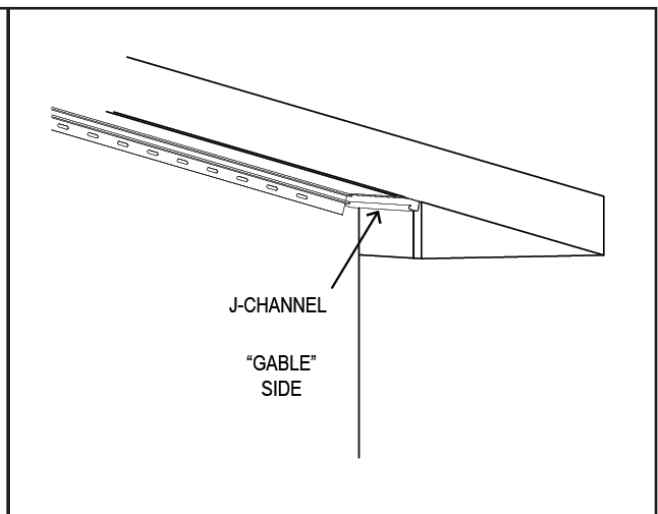
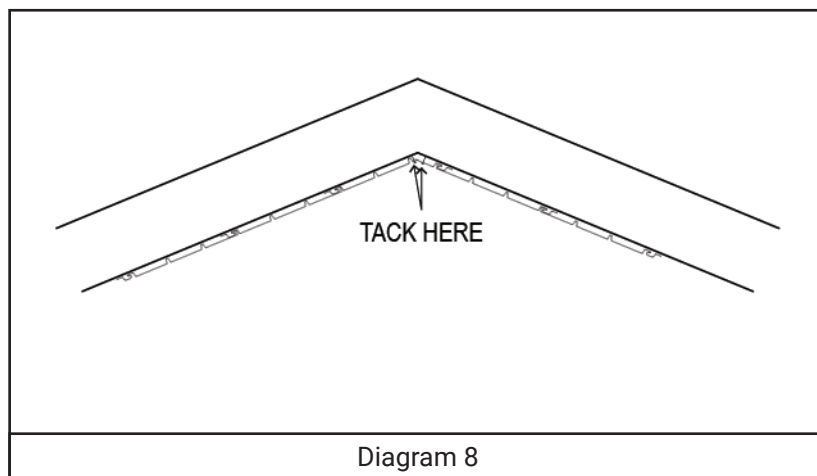
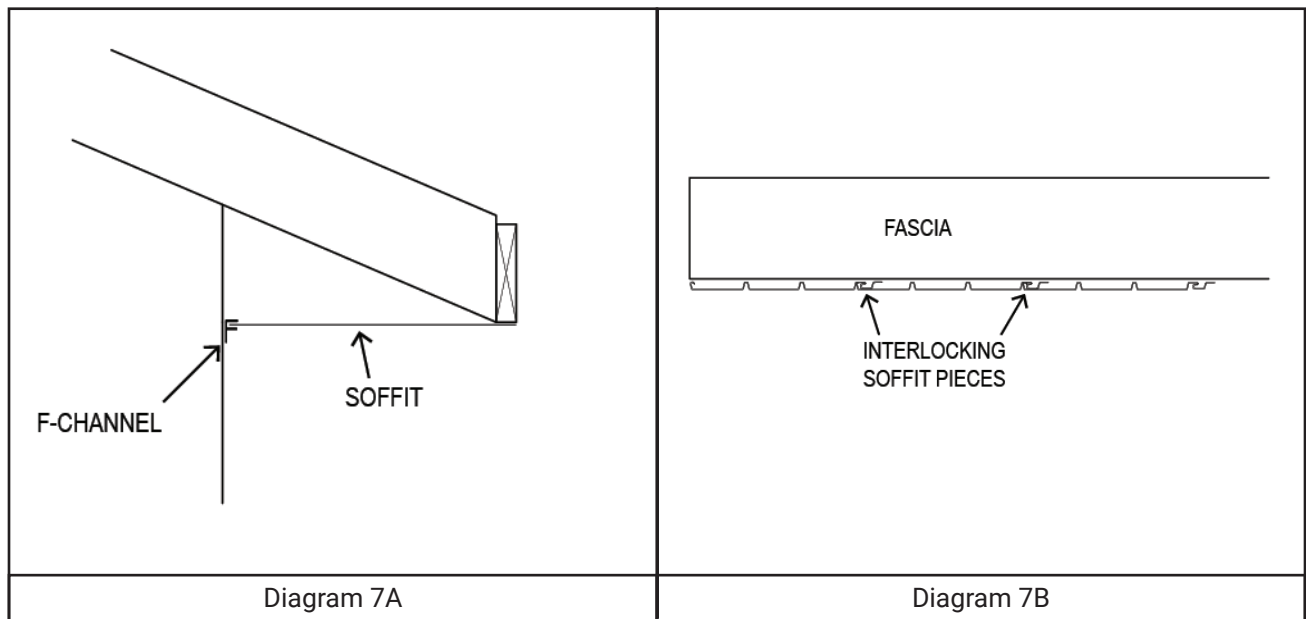


Diagram 6B

Soffit & Siding

- For the next pieces, insert one end into the f-channel and attach the other (through the nailing flange) with a roofing nail to the bottom of the fascia board (See Diagram 7)
- Snap the next piece of soffit to the first (See Diagram 7B)
 - Fully insert pieces into the f-channel and pull taught before attaching to the fascia
 - Pieces should not stick out beyond the fascia board
- For gable sides, start at one side and work up to the ridge, at the ridge bend the piece so that it will fit into the f-channel and tack into the fascia board with white trim nails on both sides of the ridge to help hold its shape, continue working down the other side and have the last piece terminate into a piece of j-channel (See Diagram 8)



Soffit & Siding

Metal Fascia

- Metal fascia should fit snug underneath the soffit pieces to hold them in place and slide underneath the drip edge (See Diagram 9A)
- Attach with white aluminum trim nails every 18"-24" one over the other
 - Make sure lower nails are high enough to go into wood
- On eaves, start at one side and work towards the other, overlapping pieces about 4"
- On gables, start at the bottom on both sides and work towards the ridge, overlapping pieces at the ridge
 - The piece on the top of the ridge overlap should be cut plumb
- Make tabs for corners to keep water out (See Diagram 9B)
- To cover the Bird Box with Metal Fascia (Diagram 10), cut the piece of fascia metal longer than the eave of the roof and bend it around the eve corner to the gable end and then bend it a second time on the back of the Bird Box (Diagram 10 A). After this is done, run the gable end fascia metal down to the edge of the eave covering the Original Bird box Fascia Metal (Diagram 10B). A Framing or Speed Square can be used to help bend the metal.

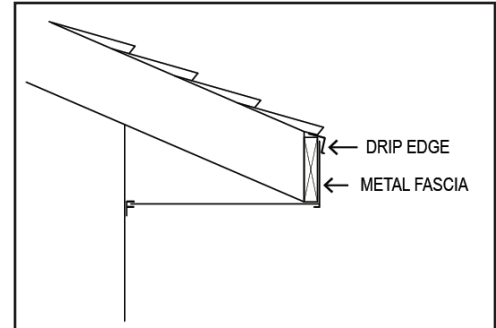


Diagram 9A

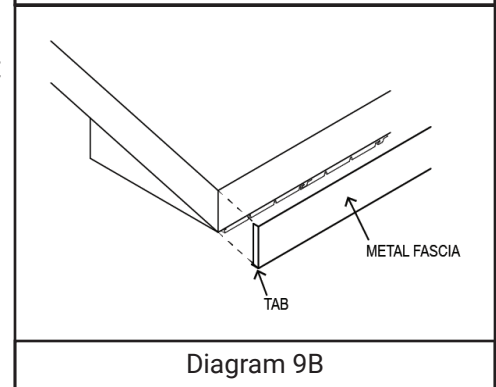


Diagram 9B

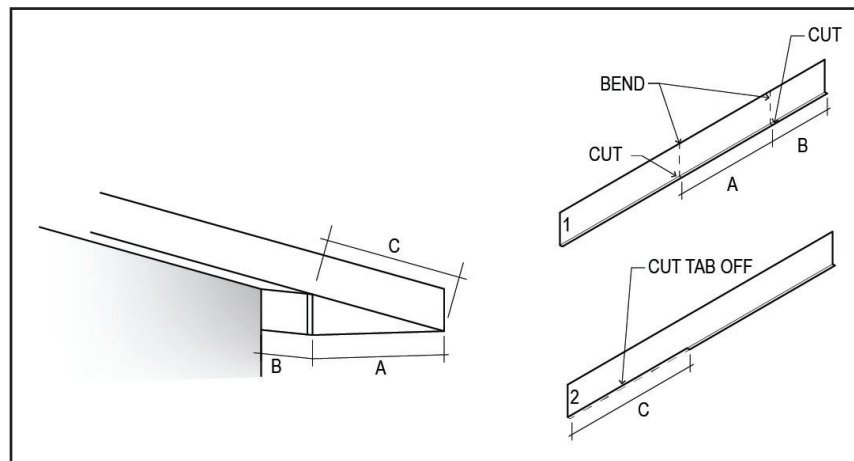


Diagram 10A

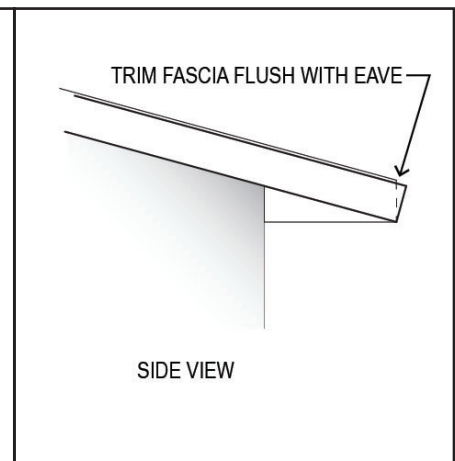


Diagram 10B

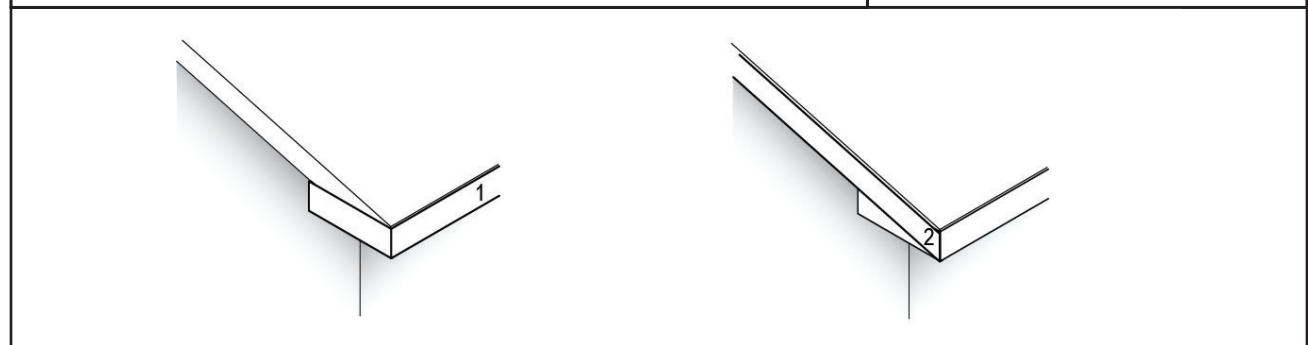
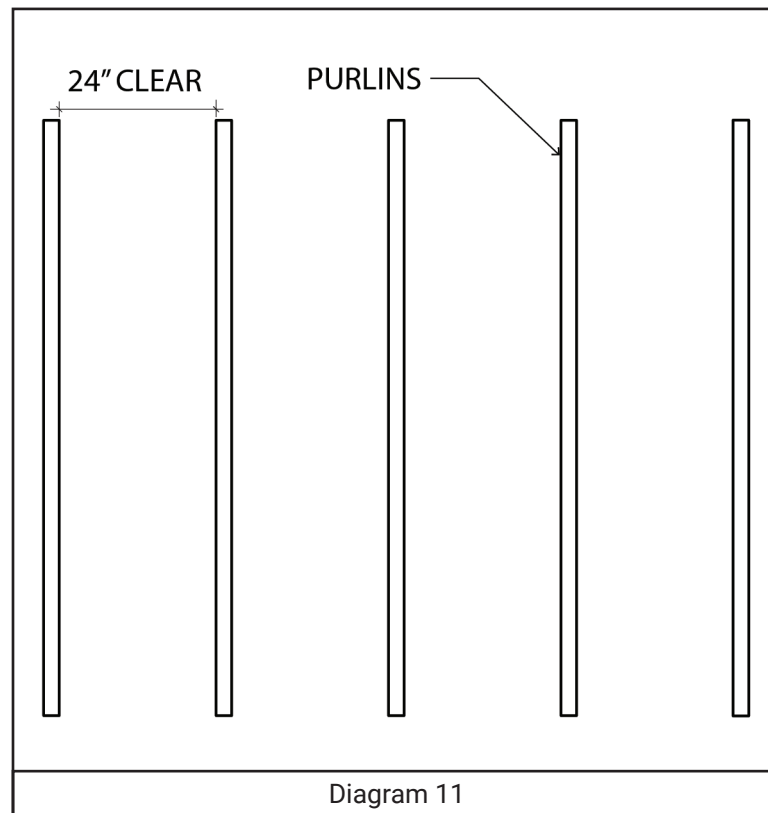


Diagram 10C

Soffit & Siding

Vinyl Siding Instructions

- Housewrap and vinyl soffit should both be installed before vinyl siding
- Corner posts and J-channel trim will be installed before siding to hold the edges of the siding
- On homes with lap siding, vertical nailers may be needed to make a level surface along the wall to appropriately install vinyl siding. When attaching vertical nailers to siding, determine what is under the siding if possible. If the siding is attached to a box frame house the length of screws used to attach nailers needs to be shorter so that they don't poke through too far into the inside of the home.
- Types of siding that may require Vertical nailers:
 - Wooden lap siding has deep laps that may require these vertical nailers
 - For homes that studs are difficult or seemingly impossible to find vertical nailers may be used. These vertical nailers must be securely attached to the wooden sheathing
 - Occasionally we install insulation and siding on a block house. Vertical nailers can be used in this situation
 - Nailers should be installed 16" apart so that proper screw placement for J-channel and siding can be used
 - Install nailers with two 2 1/2" deck screws every 16" up the wall. (Use lathe screws if attaching to metal and tap cons if attaching to concrete)
 - Frame the outside of doors and windows with nailers.



Soffit & Siding

Vinyl Trim

- It is good practice to install all trim in one area before starting to install siding
- Corner posts should be installed before J-channel at the base/top of the wall
- Corner Posts
 - There are specific pieces for outside corners (See Diagram 12) and inside corners (See Diagram 13)
 - Butt corner piece up to soffit and allow to run down 3" below the starting line for the siding
 - Attach corner piece with 1¼" - 2" roofing nails (when attaching to wood) or lathe screws (when attaching to metal) through the nailing flange every 12"-18"

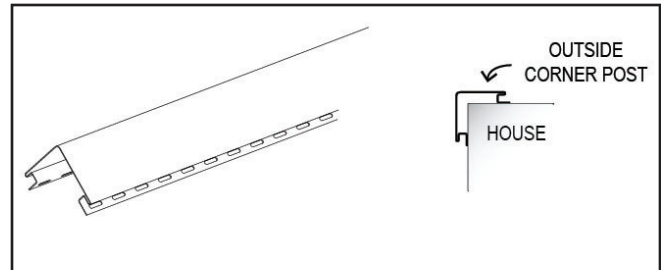


Diagram 12

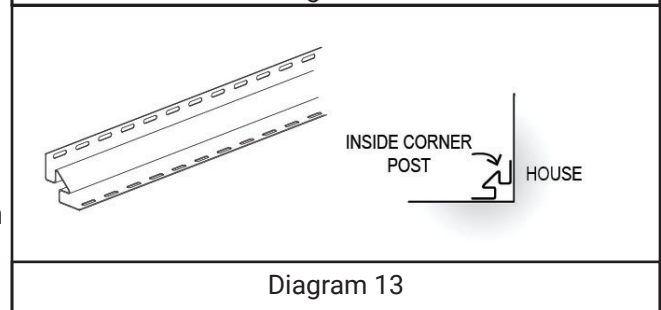


Diagram 13

J-Channel Basics:

- To cut J-channel, snip the front and back using tin snips, bend the piece to be able to cut the middle (See Diagram 14)
- All J-channel should be installed with roofing nails or lathe screws every 8"-12"
- Butt Joint (See Diagram 15) is used to join pieces of J-Channel together for long runs. A tab on the front face of the J-Channel is slid behind the front of the adjacent piece of J-channel.

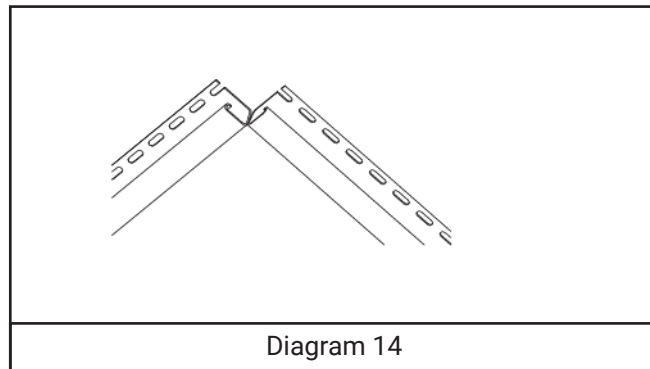


Diagram 14

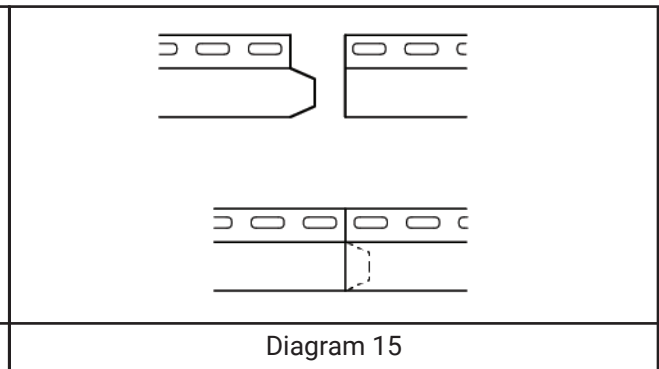


Diagram 15

J-Channel Corners

- Top Outside Corner (See Diagram 16)
 - For the top piece of J-channel
 - Cut a piece of J-channel the width of the window frame + twice the width of the front of J-channel that is being used. This can vary depending on J-channel. Typically, your cut will be 1 1/2" to 2" wider than the window frame.
 - Mark and cut a line at 45° from the top outside corners on the front of the J-channel. This cut will create a false miter. (See Diagram 16-A)
 - Cut a slit in the bottom of the J-channel adjacent to the back. Bend the tab created down 90°. This tab will tuck into side J-Channel (See Diagram 16-B and 16-C)
 - Install piece loosely until all pieces are installed
 - For the side piece of J-channel
 - Cut a piece of J-channel the height of the window frame + twice the height of the top and bottom of J-channel that is being used. Typically, your cut will be 1 1/2" to 2" taller than the height of the window frame.
 - At the top cut a notch out of the bottom of the piece of J-channel (See Diagram 16-B)
 - At the bottom cut a tab in the bottom and bend it up 90° (See Diagram 17-B, next page)
 - Tuck the tab from the top piece (already installed) into the opening created by the notch at the top of the side piece. Be sure the face of the J-channel is tucked behind the miter cut.
 - Do this for both sides and install pieces loosely until all pieces are installed

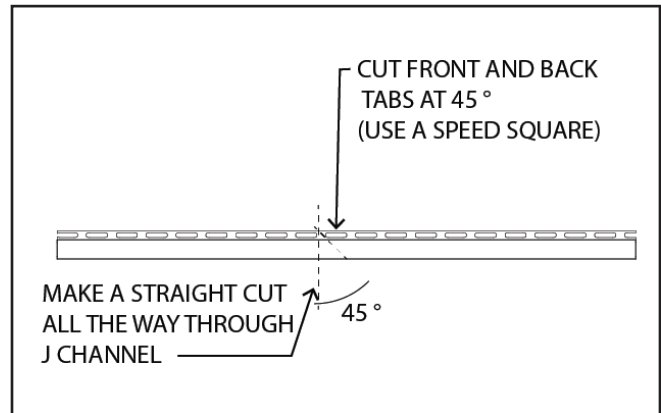


Diagram 16A

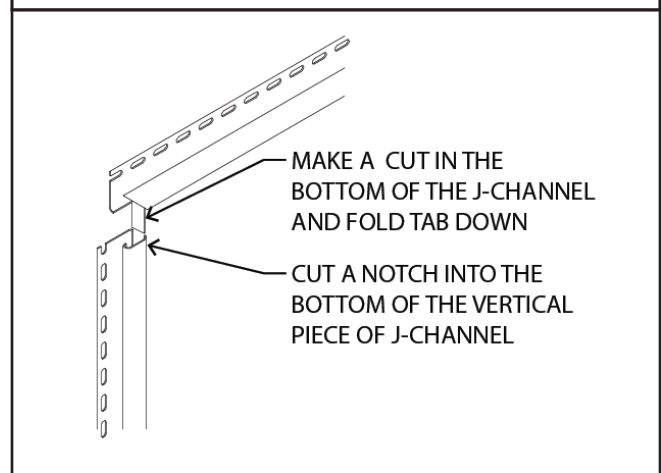


Diagram 16B

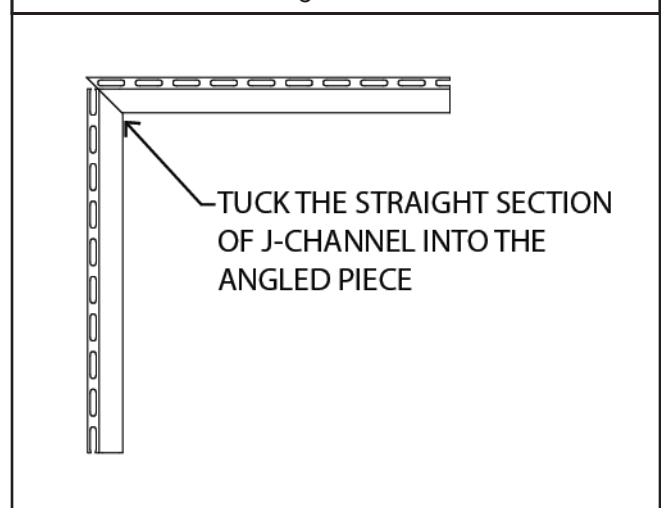
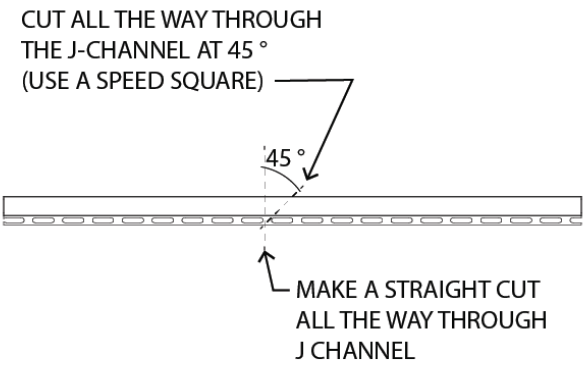
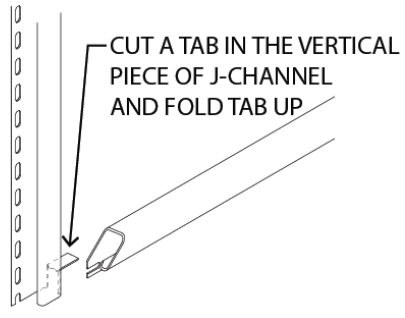
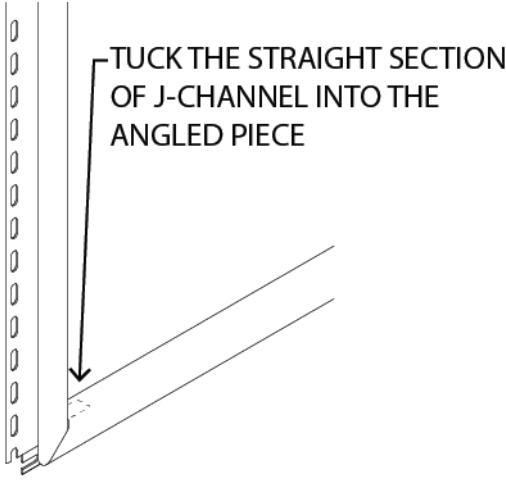
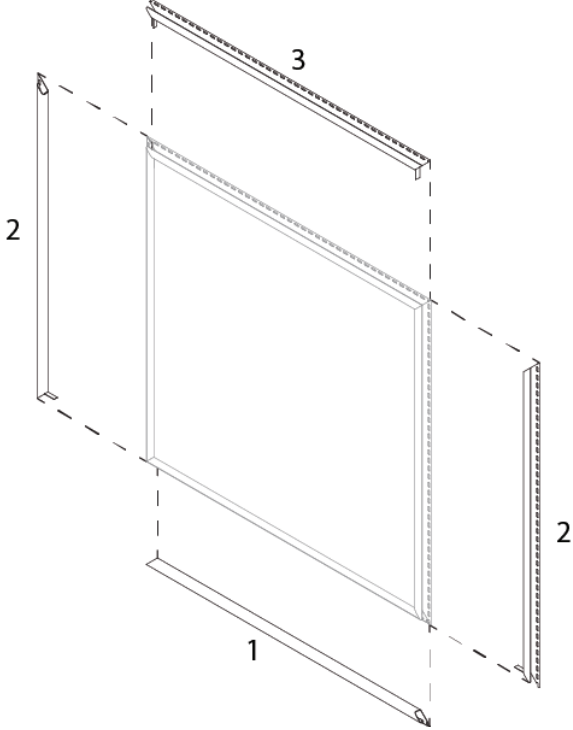


Diagram 16C

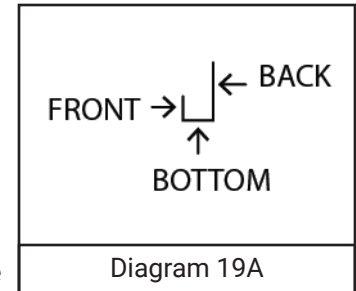
Soffit & Siding

- Bottom Outside Corner (See Diagram 17) Used at bottom corners of windows (see diagram 18), doors, etc.
 - For the bottom piece of J-channel
 - Cut a piece of J-channel the width of the window frame + twice the width of the front of J-channel that is being used.
 - Mark and cut a 45° line from the bottom outside corners to create the false miter on the bottom of the window. Cut all the way through J-channel. (See Diagram 17-A)
 - The tabs from both side pieces should tuck into the notches on each side, again be sure that the front tab of the side piece is tucked behind the mitered cut on the bottom piece. (See Diagram 17-C)

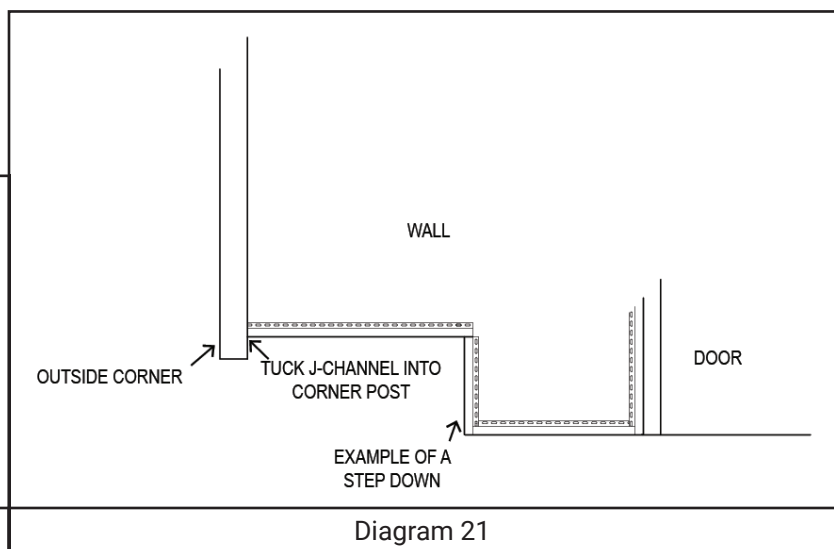
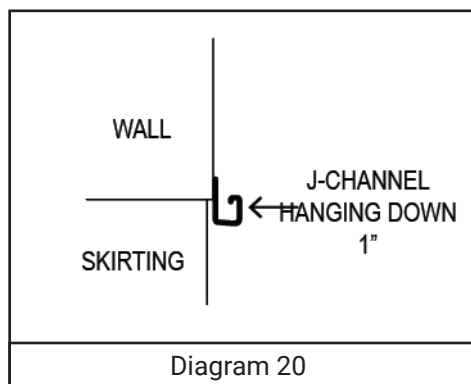
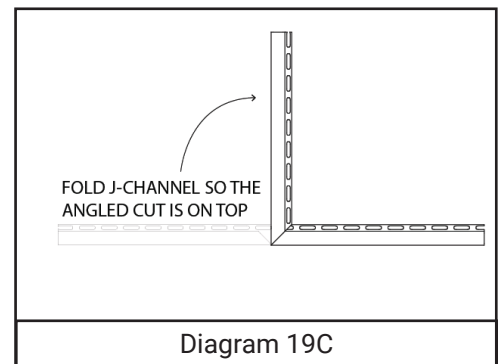
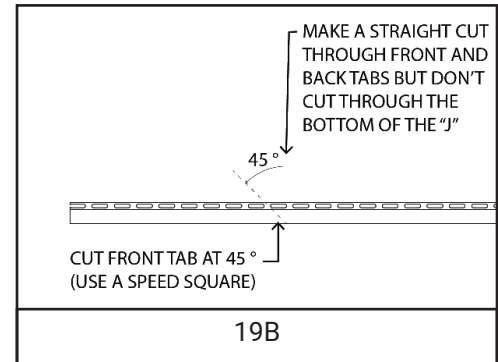
	
Diagram 17A	Diagram 17B
	
Diagram 17C	Diagram 18

Soffit & Siding

- Inside Corner (See Diagram 19)
 - Measure and mark where the inside corner is located on the house
 - Make a straight cut through the front and back of J-Channel, but not the bottom (See Diagram 19-B)
 - Use a speed square to mark and cut a 45° line into the cut previously made
 - The J-Channel is then folded to create the corner. Be sure to have the angle cut on the outside. (See Diagram 19-C)



- J-Channel along bottom of wall:
 - Use a line level and chalk line to make a mark that will indicate the top of the J-channel
 - J-channel
 - Allow for the J-channel to hang down 1" over the sheathing (See Diagram 20)
 - Where applicable, the J-channel can be tucked into the channel of the inside/outside corner posts (See Diagram 21)
 - Butt together pieces of J-channel as needed (See Diagram 15)
 - Drill 1/8" holes every 1'-2' in the bottom to allow water to drain out of the J-channel
 - If there is dramatic change in the base of the wall, the bottom J-channel can be stepped up or down using top outside corners (See Diagram 16 and 21)
 - *Starter strip can be used instead of J channel along the bottom edge and should be attached every 6-8".
 - Install starter strip by running a string with a line level across the home where the top of the starter strip will be.
 - Chalk a line or use the string to install the Starter strip to make sure it is level across the home. Double check it with a 4ft or 6ft level after installation



Soffit & Siding

- J-channel tips and tricks
 - Using the false miter method, especially on outside corners is a great way to have a clean and finished look. The tabs created are vital to keeping water going around the window instead of in the window.
 - Getting a good measurement on J-channel can be difficult
 - Having a flat workstation can help with this
 - You may find it easier to hold shorter sections of J-channel in place to mark where the cuts should be
 - J-channel is very flexible. Take care that it is being nailed tightly against adjacent surface.
 - Chalking a line to follow when installing J-channel or starter strip is an easy way to ensure it is level and straight.
- J-channel across the top of the wall
 - This J-channel will be installed upside down to receive the top of the vinyl siding (See Diagram 22)
 - The J-channel will sit tight against the soffit on both gable sides and eave sides of the house
 - Like the J-channel at the base of the wall, the ends can be tucked into the corner pieces
 - Butt ends together as needed (See Diagram 15)

Working Around Obstacles

- Working around electric service panels, hose bibs, electric outlets, light fixtures, and other obstacles are normal parts of siding installation
- There will likely be an electric service panel on every house, trim around those like you would a window
 - Slide the siding behind the conduit that comes out of the top, if possible, if there is not then run J-channel on both sides of the conduit
- There are special mounting blocks for the following (these have J-channel built in around them)
 - Hose Bibs, these come apart and snap back together around the hose bib
 - Dryer Vents, these simply replace existing dryer vent covers
 - Outlets and Light Fixtures
 - These require removing the outlet/light and should only be done by someone with approval from the staff (otherwise see below for how to J-channel around these)
- If needed (or mounting blocks are not available) a combination of flashing and j-channel can be used to work around some of these obstacles (See Diagram 23)
 - White metal or vinyl flashing can be slid behind light fixtures/outlets/mounted cable boxes and attached with white aluminum trim nails. (Be careful when using metal flashing around electrical wiring)
 - Overlaps can be made, if necessary, with the flashing
 - Install J-channel around these areas as you would around a window

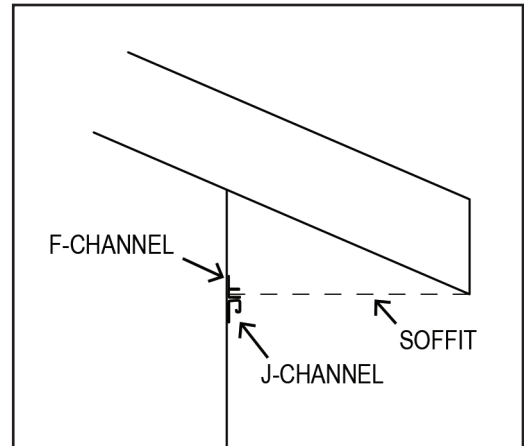


Diagram 22

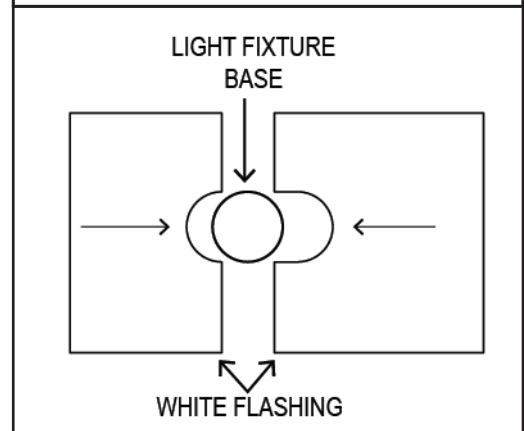


Diagram 23A

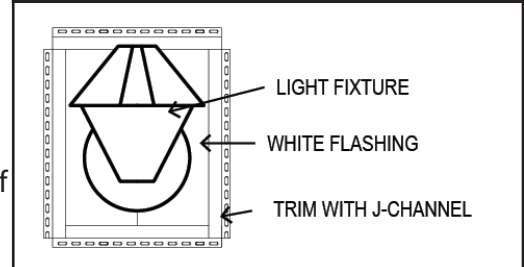


Diagram 23B

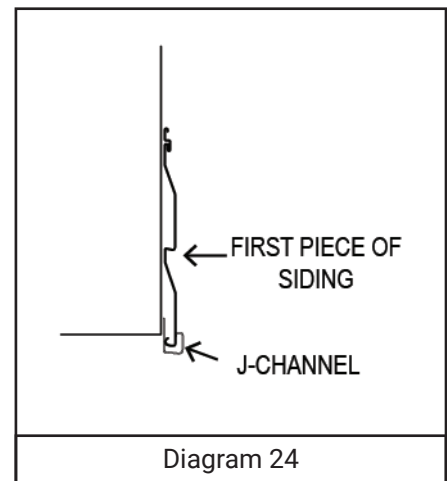
Soffit & Siding

- Many times, cable/internet boxes can be opened and removed and then reattached on top of the new siding
- Sometimes the best option will also be cutting notches for small obstacles in the siding itself and then sealing with silicone caulk
 - For example, if there is a cable that enters the house, cut a slit and small hole in the siding and work it around the cable, after the piece is installed add silicone caulk both around the cable and down the slit

Siding

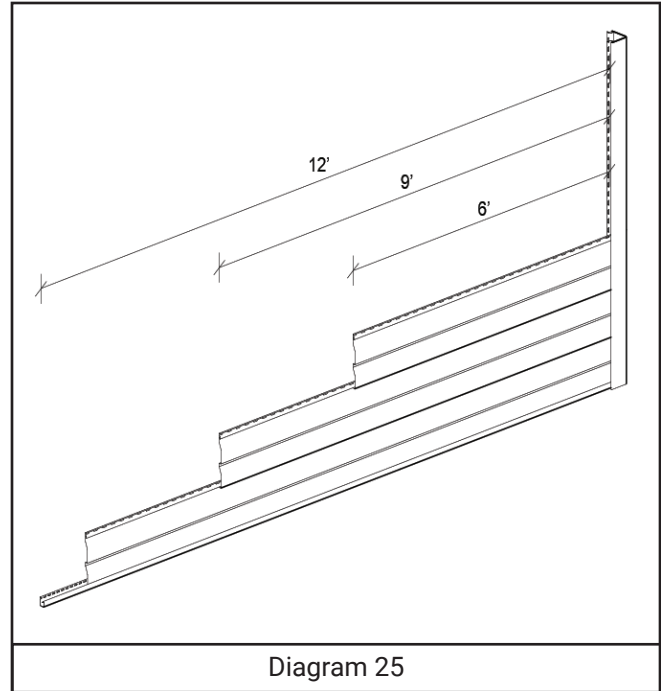
Each siding manufacturer may have slightly different specifications for nailing pattern, minimum piece length and other details. Consult the manufacturers. Consult the siding directions for more specifics.

- Pieces of siding will be installed working from one side of the house to the other
 - Do not work from both ends and meet in the middle, this will cause issues with overlap
 - For each individual wall, pick the corner from where the house will be seen most often and then start siding installation at the opposite corner of that wall (so, for the side of a house start siding installation at the back corner of the wall and work towards the front corner of the wall)
- Overlaps
 - The minimum overlap for pieces is 1 ½"
 - **A factory edge should always be on the outside of the overlap, a cut edge should never be exposed**
 - Each side on the house will use the "factory rights" or "factory lefts" depending on which direction you are working
 - For example, if working from the back to the front on the right side of a house all the pieces installed with visible overlaps will be showing the factory right side of a piece, or "factory rights." Therefore, all the scraps/ cut pieces created will have "factory left" edges and should be saved because they may likely be used on the opposite side.
- Installing the first row
 - The pieces in the first row will sit into the
 - J-channel that has been installed along the bottom of the wall (See Diagram 24)
 - The ends of pieces will fit into the track of the corner posts/j-channel around doors
 - Pieces of siding should be cut and installed ¼" short of fitting all the way into the track to allow for expansion/contraction
 - Double check that the top of the piece is level
 - Attach the first piece
 - Attach every 12"-18" with roofing nails
 - If there is not sheathing behind the siding, nails must be driven into studs
 - **Do not pound nails in tight**, leave a nickel width behind each nail head so that the siding can expand and contract
 - Put nails in the middle of the nailing slots
 - Overlap the minimum 1 ½" and continue working across the side of the house

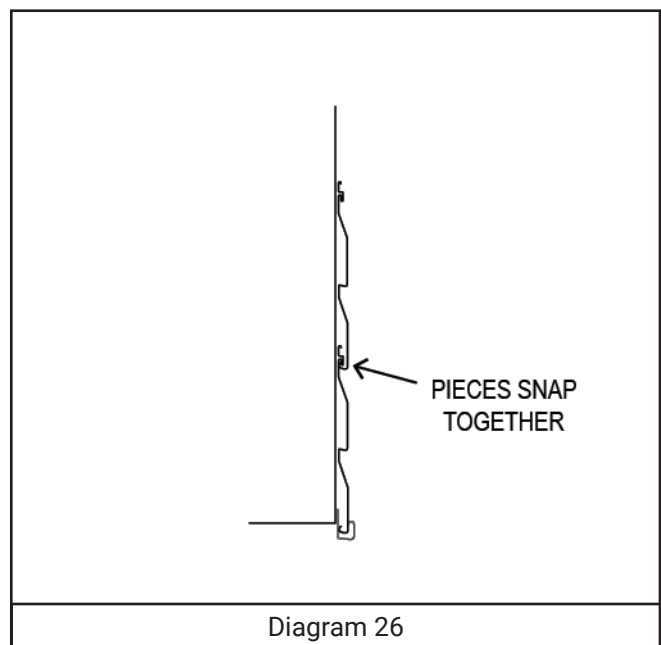


Soffit & Siding

- Pieces shorter than 2' should not be used
 - If the remaining space in a row to be filled is less than 2', trim the length of first piece in the row to ensure that the last piece in the row will be at least 2'
 - Trim off the side that will be on the bottom of an overlap
- Stagger the seams (See Diagram 25)
 - Seams should not stack on top of each other because then siding loses its ability to shed water
 - A good rule of thumb is to start the first row with a full 12' piece, the second with a piece around 9', the third with a piece around 6', and then repeat this pattern
 - The minimum space between seams in succeeding rows is 2' (sticking to the 12', 9', 6' pattern mentioned above helps prevent any issues with this)

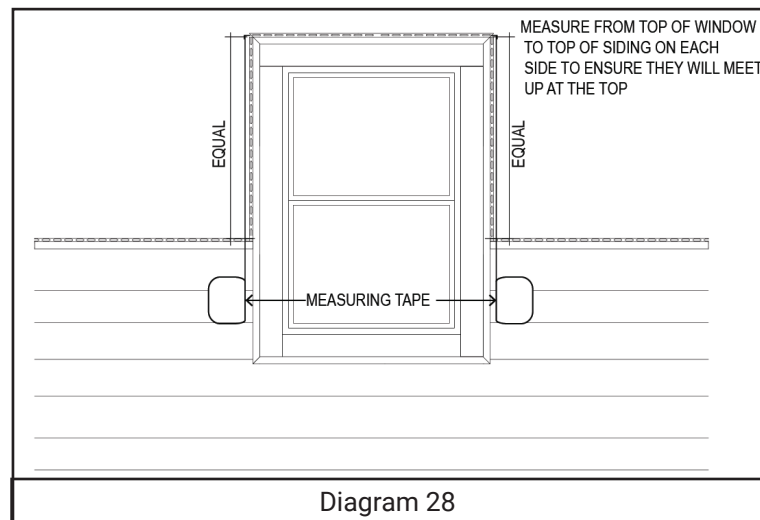
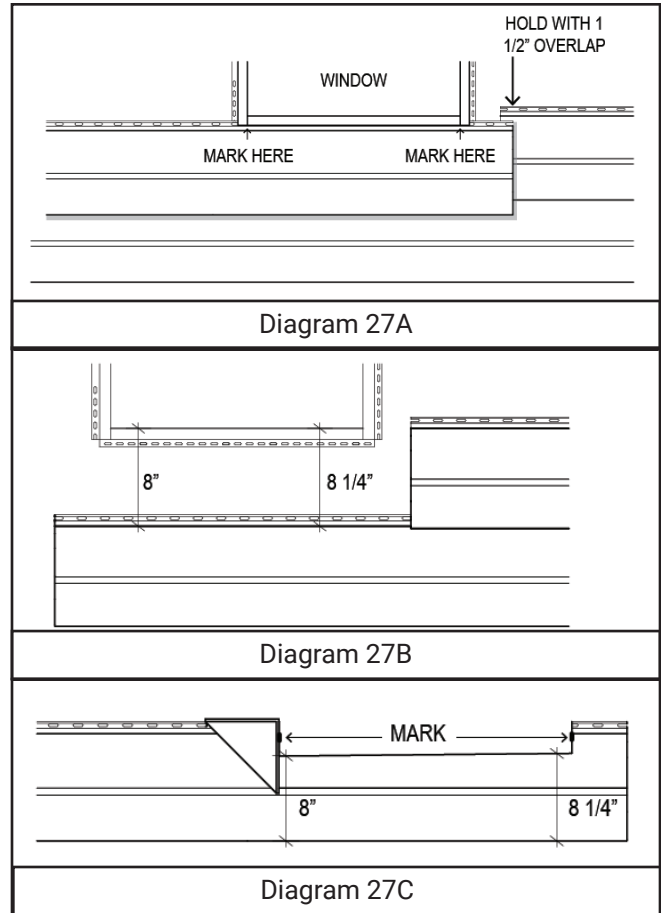


- Installing pieces after the first row
 - The pieces lock together (See Diagram 26)
 - Check at both ends and the middle by pulling out on the bottom of the piece to make sure that it is locked in before attaching
 - Put gentle, consistent, upward pressure on the bottom of the piece while fastening
 - Check every piece after installation to make sure that it is snapped together, if you find one later that has not been snapped in correctly, the only way to correct the issue is to remove all the pieces above it so that it can be snapped in correctly.
 - Installing each subsequent piece is the same as the first row. Remember these steps:
 - Work from one side of the house to the other
 - Full pieces should be used whenever possible. Cut pieces should only be used at the two ends of a run
 - Minimum 1 ½" overlap
 - Attach every 12"-18" with roofing nails
 - Do not pound nails tight, leave a nickel's width space behind them for expansion/contraction
 - Put nails in the middle of the nailing slots
 - Make sure that pieces are interlocking by tugging out on the bottom of them
 - Stagger the seams by a minimum of 2'
 - No pieces shorter than 2' should be used (unless the space to fill is smaller than that)



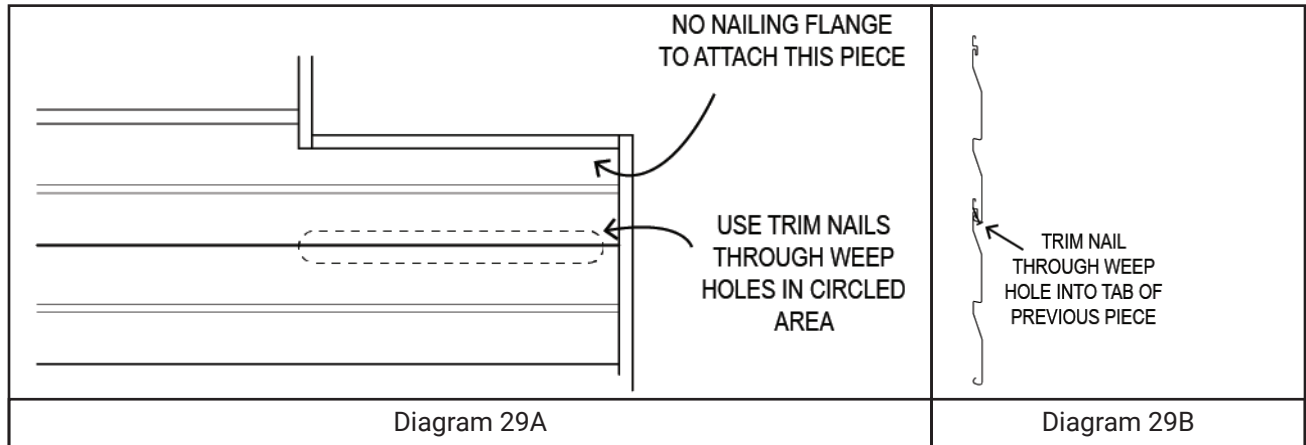
Soffit & Siding

- Cutting siding to fit around obstacles
 - All the edges of siding should be hidden by J-channel/trim that they are fitting into
 - A method for cutting notches: (See Diagram 27)
 - Hold the piece into place where it will fall side to side and slide it up into the J-channel
 - Make marks at where the cuts should be so they will fall $\frac{1}{4}$ " from the inside of the J-channel on the sides
- Measure carefully from the bottom of the locking tab of the previous piece to the inside of the J-channel under the window (measure both sides, there is no guarantee that the window is square) (See Diagram 27B)
- Transfer the measurements onto the piece (See Diagram 27C)
- When installing siding around windows it's a good idea to measure down from each side of the window to current course of siding to make sure the measurements are the same.
- Siding can be stretched when installing and after a couple of rows it's easy to
- become slightly higher or lower on each side of the window. This makes running the piece above the window difficult or impossible.
- Measuring as you work your way up the window will ensure the top piece can lock in on both sides of the window.
- There should not be a seam in siding pieces directly above a door or window
- This is tempting as it could make the notches easier, but it allows water to move into these places more easily
- Careful measuring can also be used to make notches around doors/windows

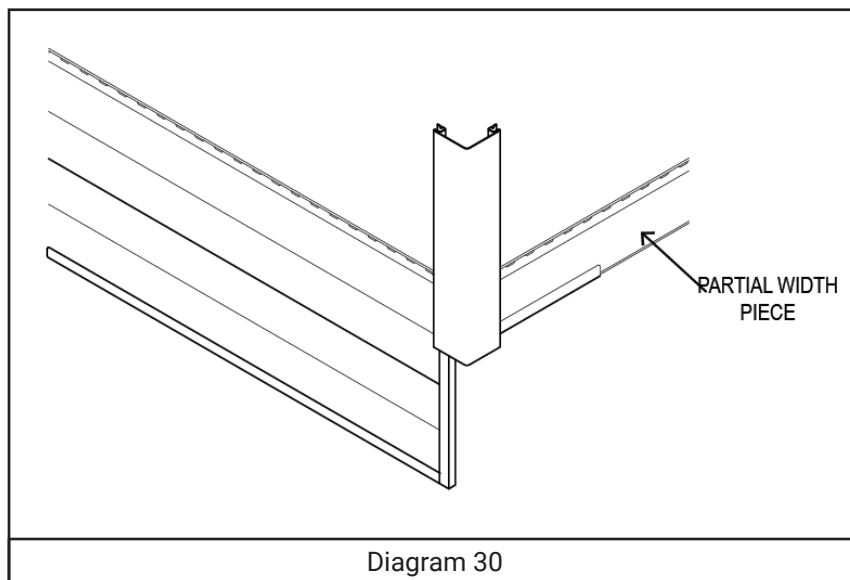


Soffit & Siding

In any situation where you must cut a notch that leaves a piece with no nailing flange where it terminates, use white trim nails through the weep holes in the bottom of the piece to help hold it into place (See Diagram 29)

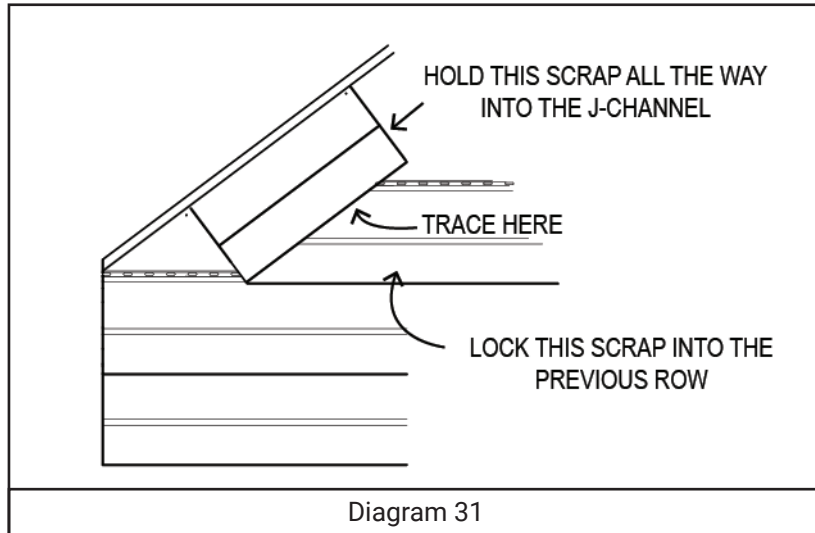


- Matching the profile of siding around the house (See Diagram 30)
 - If there is a situation where the siding to be installed on two intersecting sides of house that start at different levels, the first row on one of those sides can be trimmed so that the profiles of the siding line up at the corner
 - A Level and Speed Square can be used to make a mark where the top nailing flange should be on the wall after the turn.
 - Hold a level on the top of the flange and let it extend past the corner piece.
 - Once it is level hold your square at the bottom of the level on the adjacent wall and mark where the top of the siding flange is located.
 - Use scrap pieces and test until you get the right height for the pieces to be trimmed
 - Upon a successful test make a mark at this level across the next side of the house.
 - Take measurements at multiple locations from the line to the bottom of the j-channel in case there are any changes in how much a piece of siding needs to be cut.
 - When installing these partial width pieces, make sure they sit down into the J-channel and that they are level when they are installed



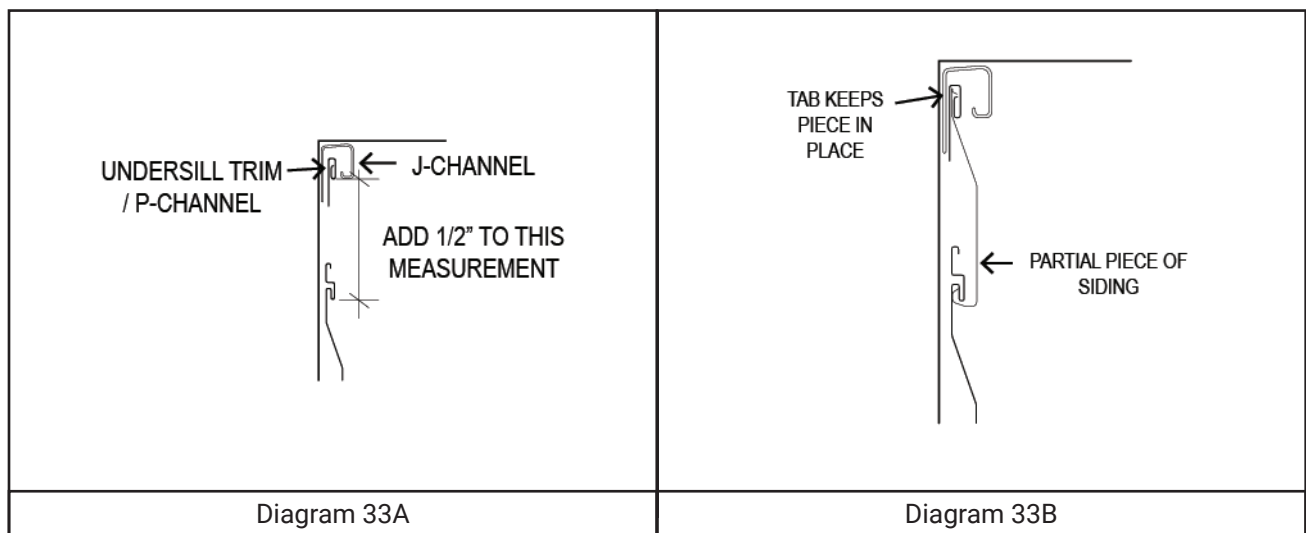
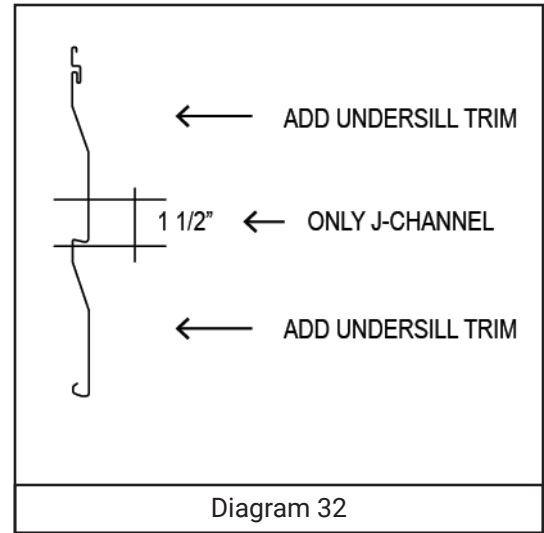
Soffit & Siding

- Finding angles of siding (See Diagram 31)
 - If you are working on the gable side of the house, make a template for the angle of the roof that can be used to transfer that angle onto each piece to be cut
 - To do this use two pieces of scrap, lock one on to the previous row, and hold the other into the angled j-channel, trace the bottom of this piece



Soffit & Siding

- Terminating siding at the top of the eave wall
 - Depending on how much of a piece of siding will be left there may need to be under sill trim (or p-channel) installed
 - If the top piece will be cut within an 1 ½" over the middle ridge of the piece, the cuts should be made across the width of the siding, and it will be stuck into the
 - J-channel that is at the top of the wall (See Diagram 32)
 - White trim nails should be used through the weep holes in the bottom of this last row of pieces to help hold them into place (See Diagram 29B)
 - If the last piece is cut below the middle ridge or more than 1 ½" over the middle ridge under sill trim/p-channel should be installed in the J-channel along the top of the wall, attach every 12"-18" with roofing nails (See Diagram 32)
 - The height of the last run of siding should be measured from the bottom of the nailing flange of the last run of siding to the bottom of where the siding will enter the under-sill trim/p-channel and add ½" (See Diagram 33-A)
 - Cut the siding width wise and test fit it into the under-sill trim
 - Once you see that the piece will fit, use a snap-lock-punch tool to make tabs in the top of the piece
 - Make sure that the tabs are towards the outside of the piece
 - Insert the piece into the under-sill trim making sure that it locks with the previous piece and that the tabs insert far enough into the under-sill trim to hold the piece into place (See Diagram 33-B)





Insulation, Vapor Barrier & Air Sealing

Section Contents:

- Insulation 163
 - Types of Insulation. 165
 - R Value. 165
- Fiberglass Insulation Instructions . 166
- Vapor Barrier 169
- Air Sealing 170

Insulation

Why insulation? Insulation reduces heat loss from the home in the winter and reduces heat gain in the summer, reducing heating and cooling costs.

Safety

- Wear long sleeves, gloves, glasses, and dust masks while working with insulation
- When insulating in an attic space, work on scrap OSB to keep weight distributed across ceiling joists
- Make sure staple guns are against wood when fastening, do not test in air
- While working in crawl spaces or attics, watch out for water leaks/critters/etc. By keeping an eye out for leaks you can help find potential causes of future issues. And watching for critters can prevent injuries and illness (wear masks especially in attics in case of rodent/bat droppings.)

Insulation Project Planning

- Will insulation be protected once it is installed? Are there any plumbing leaks that need to be addressed before insulation is installed? Are there any leaks or any gaps in the underpinning (crawl space insulation) or soffit (attic insulation)? Address those issues as well
- Is crawl space/attic space safe for volunteers to work in? Are there signs of animals? If so, does it look like pest control is needed before volunteer work begins?
- Make sure to use appropriate R-value of insulation for area being insulated (See page 165)
- Make sure volunteers will have adequate light to work - shop lights/flashlights
- Make sure volunteers have long sleeves, glasses, gloves, and masks

Measurements Needed

- Square footage of area to be insulated
- Size of rafters/floor joists/studs where insulation will be installed
- Spacing of rafters/floor joists/studs

Quality Control

- Make sure paper faces the conditioned area - “paper to the people”
- Is the insulation touching the surface it is intended to insulate? (but not compressed)
- For floor insulation, make sure there is some additional support that holds the insulation up (strips of house wrap/mesh/etc.)

Common Mistakes

- Insulation installed paper down from in the crawl space because it is easier
- Insulation does not have supports when installed from underneath or behind and will likely not touch the surface that is supposed to be insulated

After Work is Complete Quality Control Check

- Is insulation installed with paper to the insulated space, “paper to the people”?
- Is the insulation held in place well?

Insulation Material List

Quantity	Item	Purpose / Notes
___SF	Fiberglass Batt Insulation	Determine: <ul style="list-style-type: none">○ Faced or Unfaced Insulation○ Width of insulation (based on spacing of joists/studs)○ R-value of insulation
	Housewrap	To hold insulation into place from underneath if needed
	Staples	To hold insulation into place, coordinate size to staple gun

Recommended Tools

Safety

- Glasses
- Gloves
- Dust Masks
- Long Sleeves
- Tyvek Suits - can be used if working in crawl space or attic if needed

General

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc.)
- Utility Knife - to cut insulation and housewrap
- 2x4 or Straight Edge - to cut insulation
- Saw Horses
- Staple Gun
- Drop Lights and Flashlights if needed
- Ladder (if applicable)

Insulation, Vapor Barrier & Air Sealing

Types of Insulation

- Roll Insulation
 - Can be faced (paper on one side) or unfaced (no paper)
 - Typically, pieces are 8' long
 - Comes in different R-values depending on where it will be used (floors, walls, etc.)
 - Packaged in rolls by square footage
 - Comes in different widths for walls, floors, and ceilings that are built on 16" and 24" centers
 - This is the easiest to install and most used insulation
 - Installation instructions below
- Cellulose/"Blown In" Insulation
 - Loose insulation material, blown into place using a mechanical blower
 - Most used in attics
 - Has highest R-value per inch of thickness
 - Mechanical blower can be rented and instructions followed for installation
 - Avoid covering up venting and add baffles if needed (See page 104)
 - Allow a 3" gap around any heat producing obstruction (chimneys, wood stove stacks, etc.)
- Expanded Polystyrene Foam (EPS)
 - Come in 4'x8' sheets at different thicknesses
 - Often white with a reflective silver foil facing
 - Seams of foam sheets should be sealed with tape
 - Appropriate for insulating walls
 - Installation instructions for this type is included in the HUG System Section
- Extruded Polystyrene Foam (XPS)
 - Come in 4'x8' sheets at different thicknesses
 - Often blue or pink
 - Seams of foam sheets should be sealed with tape
 - Appropriate for insulating walls and roofs
 - Installation instructions for this type is included in the HUG System Section

R-Value

- The R-value is the resistance value of a material to the flow of heat
- The higher the R-value, the better insulator the material is
- R-Value requirements depend on the Climate Zone the work is being done. Be sure to confirm with the local building department.
 - Floors: R-19 up to R-30
 - Walls: R-13 up to R-20
 - Ceilings: R-30 up to R-49

Material	R-Value	Thickness
Fiberglass Batt Insulation	R-11	3.5"
	R-13	3.5"
	R-15	3.5"
	R-19	5.5"
	R-21	5.5"
	R-30	8.5"
	R-38	12"
Drywall	R-.45	½"
Plywood	R-.65	½"
Concrete Block	R-1.1	8"
Asphalt Shingles	R-.15	⅛"

Fiberglass Installation Instructions:

Working with fiberglass:

- Safety
 - If fiberglass comes in contact with skin, it can cause itching
 - Fiberglass should not be inhaled
 - Wear gloves, long sleeves/pants, dust masks, and safety glasses when working with fiberglass
 - After working with fiberglass, take a cold shower (hot water can open pores and can make skin more irritated)
- Material Care
 - Insulation should be stored in an area so that it will not get wet
 - If material does get wet, it cannot be used
 - Do not install material if it is wet, moisture can transfer to structure and cause rot
 - Avoid compressing the material, as the R-value decreases when the material is compressed

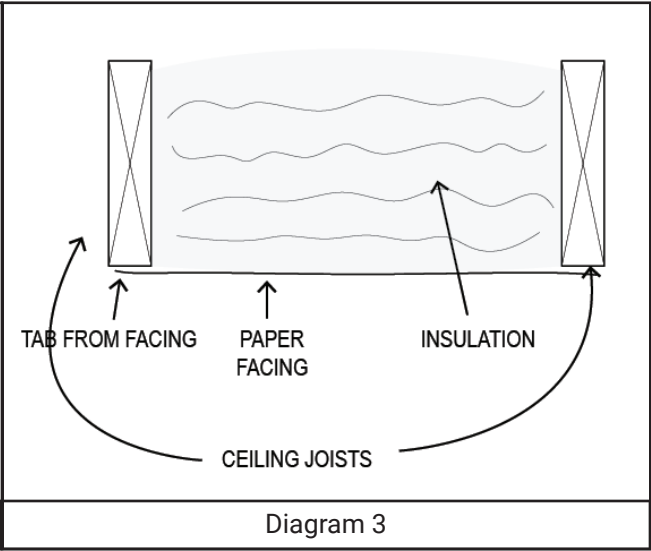
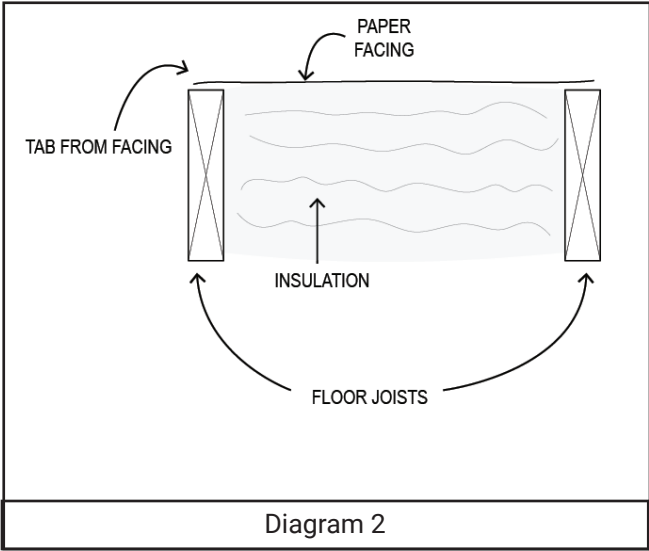
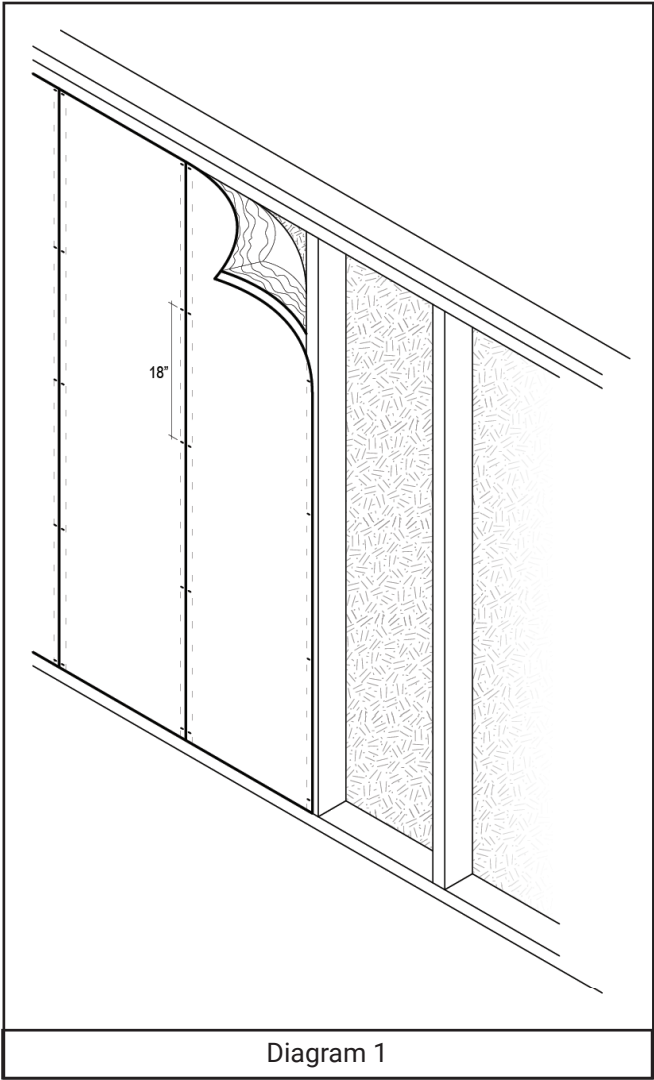
Installation

- Determine if using faced or unfaced insulation (see sections below)
- Pieces of insulation should be installed so that they will be in contact on 5 sides
- For example, pieces of insulation in floors should be touching joists on two sides, band joists on two sides, and the subfloor
- In runs longer than 8', pieces should butt against one another
- Cutting fiberglass
 - Hold a 2x4 scrap or straight edge across the insulation
 - Make cuts with a utility knife until through the material
- For electrical boxes/plumbing vents/ductwork/etc., cut tightly around the shape to reduce air flow
- Avoid compressing the material as that causes it to lose effectiveness
- Specifics for installation of faced and unfaced fiberglass insulation below

Faced/Roll Insulation

- Faced insulation has a paper "facing" on one side
- Faced insulation applications
 - In walls (See Diagram 1)
 - When working on the floor system from the top, so that the tabs can be folded out and stapled to top of floor joists (See Diagram 2)
 - Can be used in ceilings when installing from below so that tabs can be folded out and stapled to the bottom of the ceiling joists/rafters (unfaced can also be used in this application, see the next section) (See Diagram 3)
- Insulation should be installed with the paper facing towards the insulated area
 - "Paper to the people"
- Insulation should be put into place and tabs on paper facing unfolded to cover the face of the framing member
 - Attach with staples every 18" through paper tab into stud/joist
 - Paper facing tabs should overlap one another from adjacent pieces

Insulation, Vapor Barrier & Air Sealing



Unfaced Insulation

- Unfaced insulation has no paper facing on either side
- Unfaced insulation applications
 - When installing in floors from underneath (See Diagram 4)
 - In attic space (See Diagram 5)
- Floors from underneath:
 - Strips of house wrap should be cut (about 4"-6" wide and slightly longer than joist spacing), these will be used to hold insulation in place
 - Strips should be stapled perpendicular to the joists
 - Install strips every 18"
 - Strips should be tight enough that the insulation is touching the subfloor, but is not compressed
- Attic space
 - From underneath (before drywall)
 - Run strips of drywall tape or strips of housewrap perpendicular to the ceiling joists every 24" on center, tacking it with staples
 - Lay pieces of insulation above the tape
 - From above (after ceiling drywall)
 - Lay pieces of insulation in bays directly on top of drywall
 - If working in the attic space, bring flashlights/work lights if needed
 - Sit scrap OSB set across ceiling joists for a working surface, rather than balancing on ceiling joists
 - Be cautious of putting any weight on top of ceiling drywall
 - For any chimney or other heat producing obstruction in the attic space, allow a 3" gap from the insulation

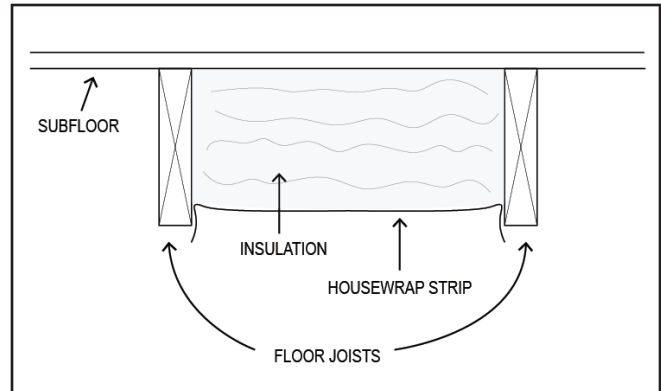


Diagram 4A

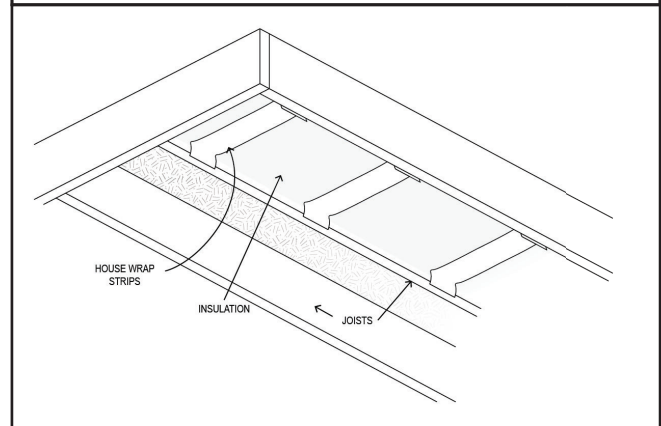


Diagram 4B

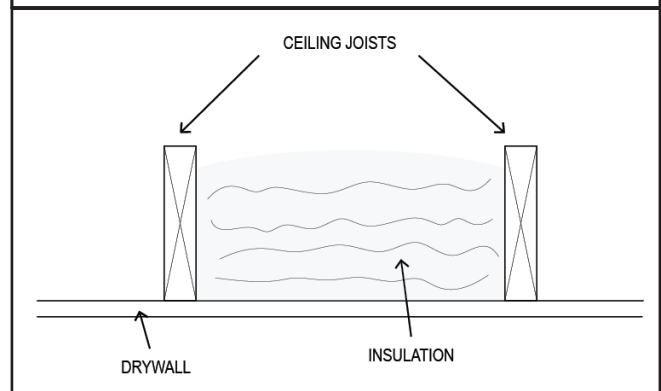


Diagram 5

Insulation, Vapor Barrier & Air Sealing

Vapor Barrier

A vapor barrier is a protective layer intended to keep moisture from penetrating a certain area. Vapor barriers should be installed under homes to keep moisture out of the crawl space. Accumulated moisture in the crawl space can lead to poor air quality in the home, structural rot, mold, etc.

Preparation

- Clean out the crawl space, removing debris or stored items
- Address any standing water

Lay Plastic Sheets

- 6 mm plastic (minimum thickness) should be rolled out to cover the entire floor of the crawl space
- Plastic should be installed on the ground and NOT against the joists.
- Plastic should extend 6" up the walls/underpinning and all piers
- Overlap seams by 3"

Seal Edges with Tape

- Use a moisture resistant tape (house wrap tape works well)
- Tape all overlap seams
- Tape the edges of the plastic to the wall/skirting/piers

Vapor Barrier Material List

Quantity	Item	Purpose / Notes
___SF	6mm plastic (minimum)	Square footage of crawl space floor
	Housewrap tape	To tape seams of vapor barrier

Recommended Tools

Safety

- Glasses
- Gloves
- Dust Masks
- Tyvek Suits - can be used if working in crawl space

General

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc.)
- Utility Knife - to cut insulation and housewrap
- Drop Lights and Flashlights if needed

Air Sealing

Air sealing is the process of reducing voids that lead to drafts/heat loss, creating a continuous building envelope. This can lead to energy savings and reduced heating/cooling costs.

Framing/Sheathing

- If a wall is open and exposed while work is being done, caulk can be added along the intersection of the bottom plate of the wall and the subfloor to prevent air movement
- Seams of sheathing for walls can be sealed with mastic or caulk if they do not land on studs
- Penetrations through framing or sheathing should be sealed
 - Plumbing/electric lines that run through walls or floor should be sealed with a fire rated caulk or fire rated spray foam insulation (should be used if gap is too large for caulk)

Drywall

- Seams and corners of drywall need to be taped/mudded to prevent air penetration
 - If a molding/trim is used where the ceiling and wall meet, it needs to be caulked to air seal
- All penetrations through drywall should be sealed with tape/mud or caulk
 - Plumbing lines should be caulked

Rigid Foam

- Rigid foam board can be installed on the outside of wall sheathing to add both insulating and air sealing qualities
- All seams of foam should be taped to prevent air movement
- This method is used in ASP's "Hug System" (see page 310)

Drywall

Why drywall? Drywall is used to help create ceilings and interior walls, drywall also adds fire resistance and air seals the insulated space.

Section Contents:

- Drywall Preparation 175
- Hanging Drywall 175
- Cutting Drywall 176
- Ceiling Drywall 178
- Wall Drywall 179
- Cornerbead 179
- Taping 180
- Mudding 180
- Sanding 184
- Patching 184

Safety

- Have multiple people in place when moving drywall, drywall is heavy and fragile. Carry the sheets of drywall vertically so it doesn't break under its own weight
- Wear dust masks and glasses when sanding drywall mud and be sure to section off areas of the home to prevent dust spread to the homeowner.
- Use ladder safety from page 16
- Mark wires/pipes/etc. in wall/ceiling before concealing with drywall to prevent hitting them with a screw.

Drywall Project Planning

- Make sure there is a storage space where material will stay dry.
- If drywall is moisture damaged and needs to be replaced, will there be framing or insulation behind damaged drywall that also needs repair?
- Is the source of drywall damage addressed? Leaky windows/ac units/roofs?
- What kind of outlets/vents/fixtures will you have to work around?
- Provide materials for T-braces and make sure there are ladders if needed
- Will the existing trim/baseboard need to be removed? Will it be replaced?

Drywall

- Will any permits/inspections be needed before drywall is hung?
- Is blocking needed in place before hanging drywall, for grab bars or other fixtures?
- Is there enough work available to keep everyone busy while the mud dries?
- Is there enough space in the room to occupy members of the work crew?
- Will drywall be finished flat or textured?
- Where is the source of water to clean tools?
- Make sure studs are plumb to each other so that drywall can be installed properly across the room.
- Make sure any preexisting nails or screws have been removed from studs before new drywall installation.
- Where in the home is this drywall repair happening? Will you need to utilize moisture resistant drywall?

Measurements Needed

- Surface area where drywall will be installed
- Thickness of existing drywall if matching
- Number of corner bead pieces needed for outside corners?
- Spacing of ceiling and wall joists

Quality Control

- Are the edges of drywall falling on studs?
- Make sure ceiling drywall is hung perpendicular to ceiling joists
- Are screw heads below the face of the drywall?
- Is drywall fastened adequately? (Every 8" on ceiling, 12" on wall)
- Make sure mud dries completely between coats
- Make sure tape is flat (no bubbles/bumps)
- Are appropriately sized knives being used for each coat? (6", 10", 12")
- Make sure coats of mud are thin
- Make sure mud is sanded well after last coat
- Make sure tools are cleaned and dried thoroughly between each coat
- Make sure sheets of drywall have factory tapered edges that run flush to each other.
- Brown backing is installed towards the wall

Common Mistakes

- Additional blocking not added for edges of drywall in corners
- Screw heads not countersunk and sticking out above surface
- Screw heads are overdriven and the paper of the drywall is broken.
- Not enough screws into ceiling joists
- Rushing to get needed number of mud coats
- Air bubbles in tape because tape not flattened out with knife
- Knives being used for all coats are too small
- Unnecessary sanding because coats of mud are too thick
- Seams are still visible
- Tools washed off but not dried will rust quickly
- Drywall sheets are installed with cut edges meeting a tapered factory edge creating issues for mudding and taping.
- Drywall is installed with brown backing towards the room

Drywall

After Work is Complete Quality Control Check

- Wipe off all dust from drywall and vacuum/sweep before painting
- Is drywall smooth and sanded well?
- Will baseboard/trim be installed as well?

Material Information

- Drywall comes in 4'x8' and 4'x12' sheets
 - 4'x8' pieces are much easier to work with and transport
- Thickness of sheets ranges from 1/4" to 5/8"
- Material should be stored inside and cannot get wet.
- "Green/Blue Board" is a moisture resistant drywall that should be used in areas that will be exposed to moisture (around showers, sink backsplashes etc.)
- 5/8" Drywall is recommended for ceilings joists spaced 24" OC.

Drywall Material List

Quantity	Item	Purpose / Notes
____SF	Drywall	Determine thickness needed
____	Corner Bead	For outside corners of drywall
	Drywall Nails	For attaching corner bead
	Drywall Mud	Pre-mixed is a more user-friendly product for less experienced volunteers
	Drywall Tape	
	2x4 White Wood	For blocking/nailers and T-braces as needed
	Drywall Screws	
	Sanding Screen	
	3" Screws	For installing blocking/making T-braces if needed

Recommended Tools

Safety:

- Glasses
- Gloves
- Dust Masks

General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc) Utility Knives + extra blades
- Saw Horses
- Extension Cords/Splitters
- Ladders
- T-Square
- Chalk Line
- Shop Vac
- Broom and Dustpan
- Drop Cloths/Plastic - to cover furniture and to build a barrier to prevent dust from entering other areas of the house
- Tin Snips - to cut corner bead
- Fan - to help drying time
- Rags

Drywall Tools:

- Mud Trays
- Mud Knives (4" or 5", 6", 10", and 12")
- Corner Knife Tool
- Keyhole Saw or Oscillating Multi Tool
- Sanding Screen
- Sanding Blocks
- Drywall Rasp

Power Tools:

- Drill/Impact Driver
 - Dimpler Bits
 - Phillips Drivers
 - T-25 Driver to match deck screws for blocking
- Circular Saw/Miter Saw - to cut blocking if needed

Drywall Installation Instructions

Preparation

- Needed inspections should be completed (framing/plumbing/electric/insulation)
- Nailers should be added if needed in corners so that vertical edges of drywall have something to attach to
- Scan studs/ceiling joists, remove any nails/screws that will interfere with the drywall. A good way to do this is to run a hammer down the length of the joist. If it hits a nail, it can be driven in, or screws can be removed.
- Check if the ceiling/walls are square. If not, know that pieces may have to be cut at slight angles to accommodate.

Creating a barrier Instructions:

Preventing dust from entering the rest of the home is good customer service especially if someone in the home has breathing problems.

Instructions for a 2-layer entry barrier

- *Using painters' tape, tape a "frame on the walls surrounding the door.*
- *Make sure the plastic extends at least 3" beyond the doorway (including the casing). The bottom of the plastic should lay on the floor and can be loosely taped into place*
- *Begin by taping plastic sheeting to the door latch side of the doorway*
- *As you begin taping across the top of the door put a piece of tape at around 2/3rds across the top and make an "S" overlapping the plastic at least 12" over itself and then finish taping the top (this prevents the plastic being too tight)*
- *Cut the plastic vertically and tape to the hinge side of the wall*
- *Smooth out the "S" in the plastic and tape a vertical line (using 2" painters or masking tape) with perpendicular lines at the top and bottom making a capital "I" (the "I" should extend from about 6" below the top to 6" above the bottom of the door)*
- *Using scissors or great care and a utility knife make a cut in the middle of the vertical line of tape to the horizontal lines (the tape will prevent the plastic from tearing*
- *Cut a second sheet of plastic to the same 3" larger than the door opening and tape it into place on the inside of the room being worked on to create a flap.*
- *At the bottom roll a deck spindle or scrap piece of 2x4 into the bottom of the flap and tape it in place, to give it some weight and keep the flap from passing through the entry and exit.*

Hanging Drywall

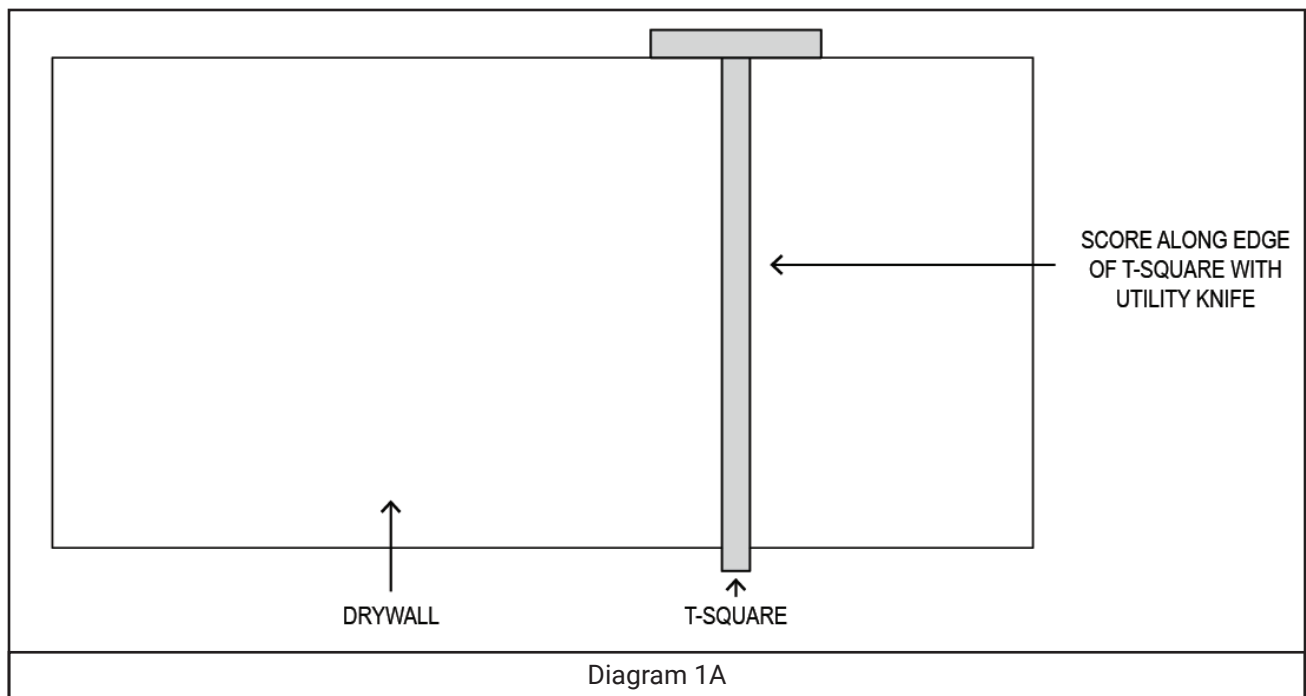
- The side of the drywall with the brown paper face is the back and should be installed facing the joists/studs
- When hanging drywall, work from the top down
 - Ceiling drywall should be hung before wall drywall
 - Top course of wall drywall should be hung before bottom course
- Seams of drywall should be staggered
- Factory edges should meet other factory edges and cut edges should face corners or be placed at the bottom of the walls.
- Keep seams tight as pieces are installed
- Fastening
 - 1 5/8" drywall screws should be used
 - Drills with an adjustable torque setting should be used if possible. These will help prevent

Drywall

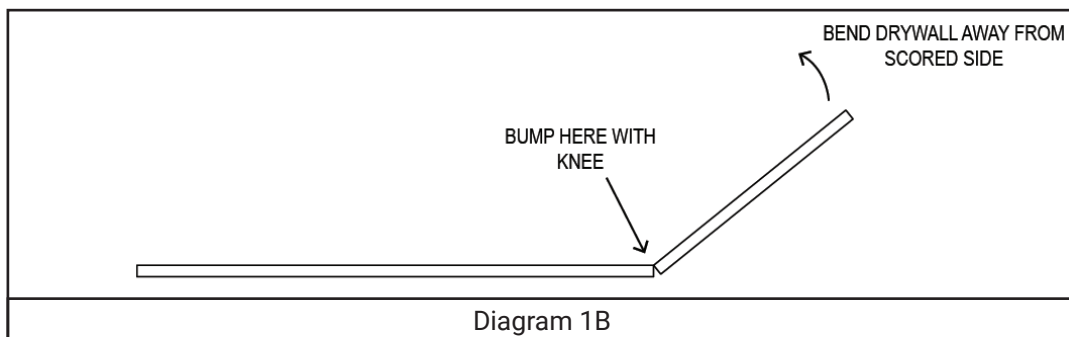
- breaking the drywall or over driving the screws
- Screw head should create a slight dimple and recess slightly below the surface of the drywall
- Drywall Dimpler Bits can be used to control screw depth
- Avoid attaching right at the edge of a piece, this will break the drywall
 - If drywall does break, leave the screw in place (so long as the screw head is below the surface) and add another screw close by
- Specifics of ceiling and wall drywall below

Cutting Drywall

- Cutting across the full piece
 - Use a utility knife and a straight edge, usually a T-square, to make sure the cut is straight (See Diagram 1A)

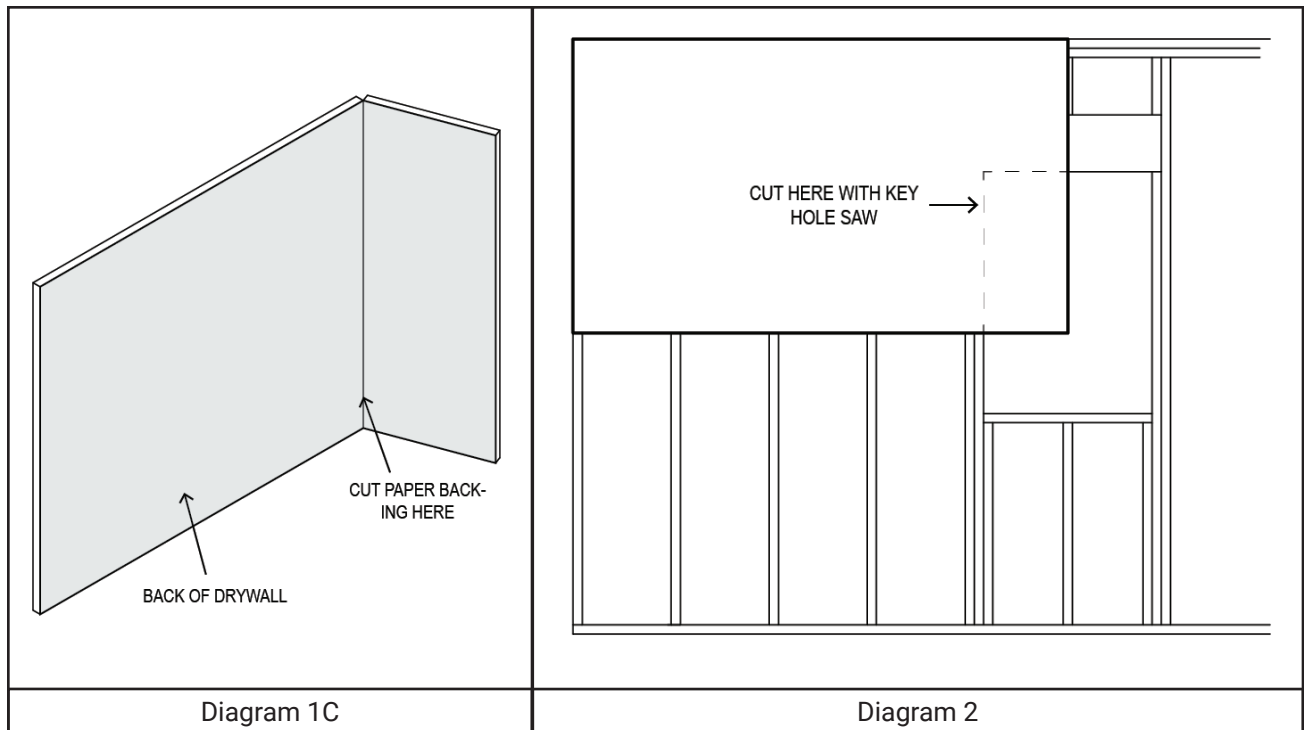


- Score front of drywall, running utility knife blade along the straight edge
- Sharply bend the drywall away from the scored side and it should snap (See Diagram 1B)
 - Can stand the piece up on the long edge and bump it with a knee on the opposite side of the score line
- Use the utility knife to cut the paper along the back (See Diagram 1C, facing page)



Drywall

- Cutting small penetrations
 - For plumbing pipes or other round penetrations, use a drill bit or hole saw attachment on a drill to make a clean hole
 - For electrical boxes or other small penetrations, measure and mark area to be cut out
 - Use a keyhole saw (also called drywall saw), or oscillating multitool to make the cut
 - Short, fast strokes back and forth with a keyhole saw work best if an oscillating tool is not available
 - Brace piece well when using a keyhole saw, cuts are difficult if piece moves back and forth
- Windows/Doors
 - Rather than measure for windows or doors, pieces can be installed over them and then they can be trimmed (See Diagram 2)
 - Cut the portion over the window frame with a keyhole saw or oscillating tool, keeping blade against the framing
- If a piece is cut slightly too long a drywall rasp should be used to shave the piece down, small trim cuts are difficult to make with the score and snap method or with a keyhole saw



Drywall

Ceiling Drywall (See Diagram 4)

- On ceilings, drywall will run perpendicular to the ceiling joists
 - Short edges of drywall should fall on ceiling joists
- ½" drywall should be used on ceilings with joist spacing of 16" OC and 5/8" drywall should be used with 24" OC joist spacing.
- Mark the locations of the ceiling joists on the wall so that they are easy to locate once the piece is in place (tape can be used if walls are finished)
- Build T-braces to help hold the piece in place while it is being fastened (See Diagram 3)
- Have someone ready with screws and drill
- before piece is lifted into place because holding the drywall overhead is difficult
- Attach every 8" along each ceiling joist
- Light fixtures should be removed if possible, or loosened (cut power off at breaker box before making any changes with light fixture)
- For overhead light boxes, measure and mark where these will go and cut before installing
 - Carefully transfer measurements so that piece will be in the correct orientation, it is easy to mark the reverse image since the piece will be hanging upside down

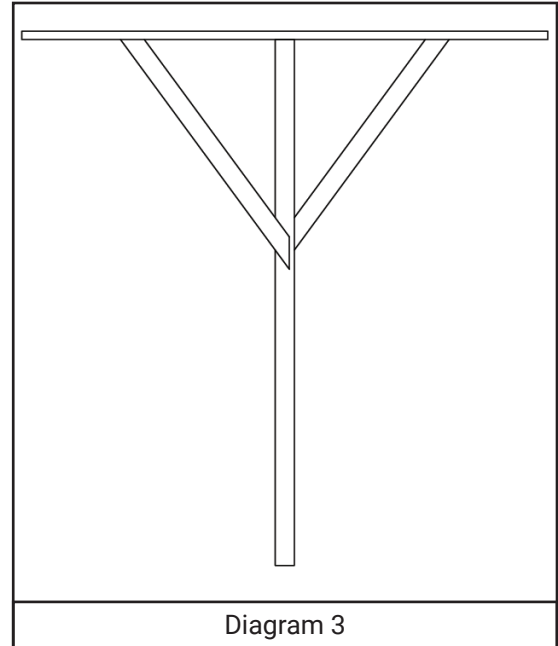


Diagram 3

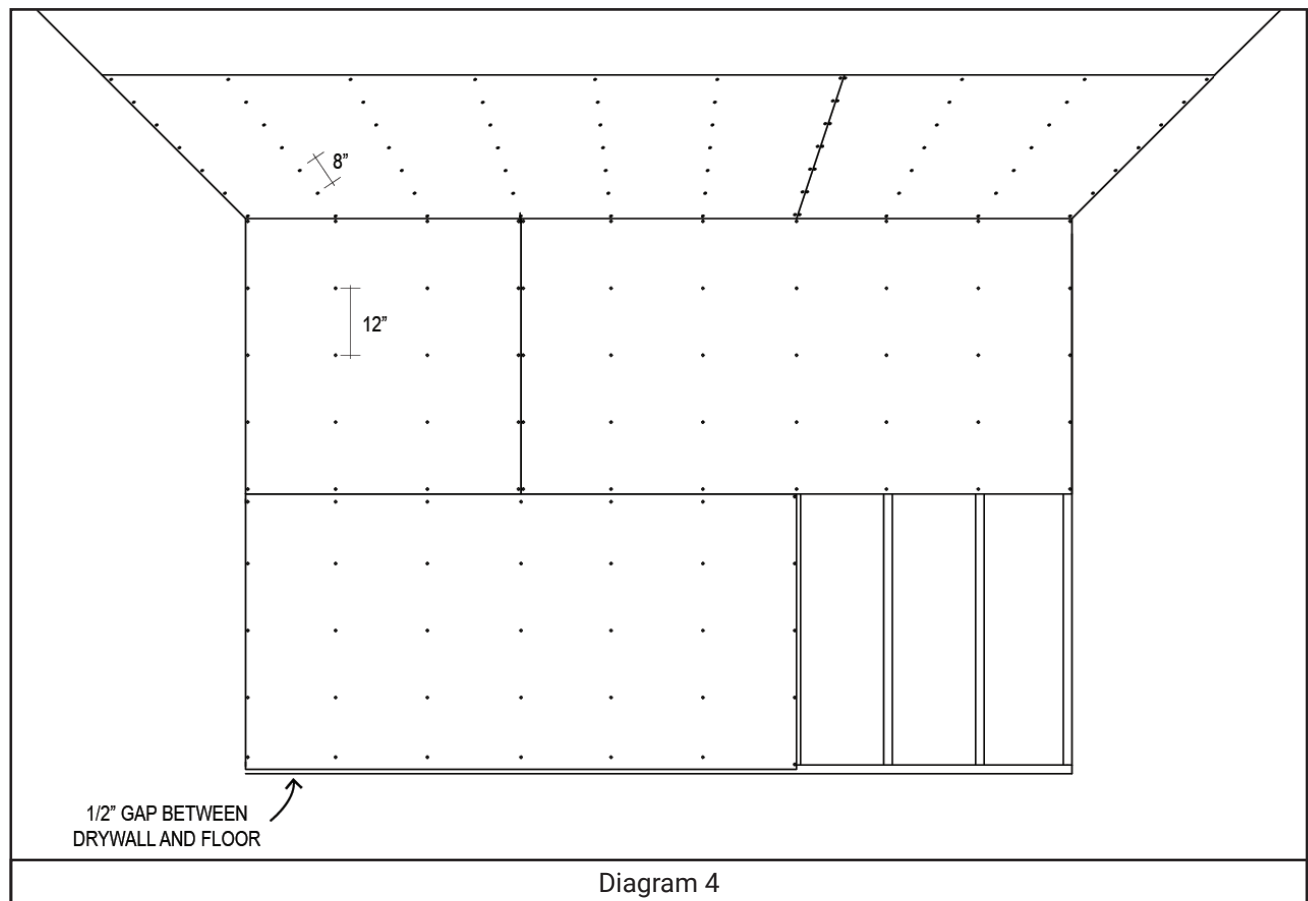


Diagram 4

Drywall

Wall Drywall (See Diagram 4)

- On walls, drywall can be hung vertically or horizontally
 - Horizontal is ideal because it requires less time on a ladder
 - Vertical edges of drywall should fall on studs
 - For walls that are less than 4' wide, pieces can be run vertically so that there is no seam in that wall
- ½" drywall should be used on walls (unless matching an existing thickness for a patch)
- Top courses should be hung first, then lower courses
- Mark on the ceiling and/or floor where the studs are so that they are easy to find when covered with new drywall
- Measure, mark, and cut out for electrical boxes/plumbing/ etc. before piece is installed
- The bottom of the bottom course should be at least ½" off the ground
 - Put the flat end of prybar under drywall, put block under the center of prybar, and apply pressure with foot to lift the drywall and make a tight seam at the top of the piece
 - Can do this at both ends of piece of drywall
- Fasten every 12" along studs

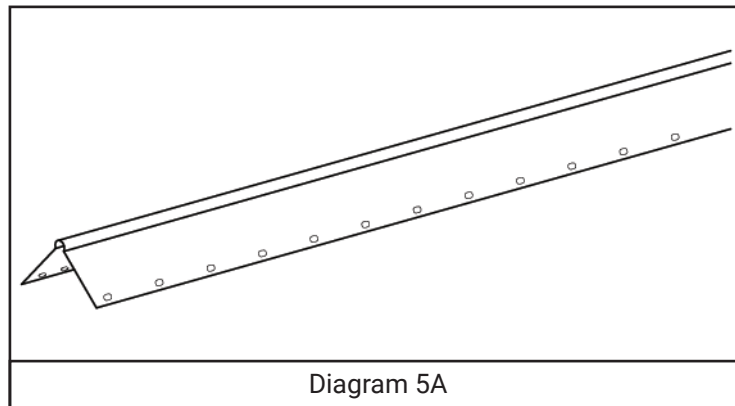


Diagram 5A

Corner Bead (See Diagram 5)

- Corner bead should be installed over outside corners
- Corner bead is typically vinyl or metal material and can be cut to length using tin snips
- Attach corner bead every 6" using drywall nails (not screws - the heads protrude and make it difficult to finish)

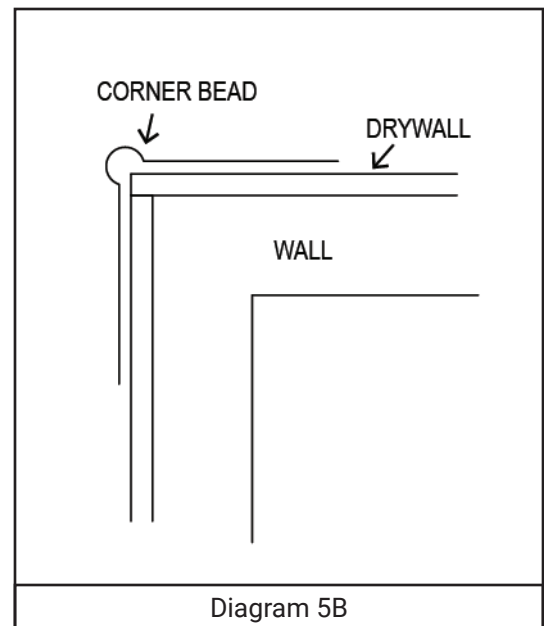


Diagram 5B

Drywall

Taping

There are two types of drywall tape

- Paper tape
 - Most commonly used tape
 - Installed with mud, paper tape is not adhesive
 - Pre-creased for easy installation in inside corners
 - Always used for inside corners (including joint of wall and ceiling)
 - Applied with first coat of mud
- Mesh tape
 - Adheres directly to the wall/ceiling
 - Not used for inside corners
 - Applied before first coat of mud

Drywall Mudding

- Specific directions for each coat of mud are below
- Vacuum/sweep area well before starting to use mud and between coats/sanding
 - Loose particles that get into mud or onto the drywall surface make it difficult to finish mud
- Put mud into a tray to work with it more easily
- After mud has been removed from the original container, it should not be put back into the container
 - Work with small amounts of mud at a time to avoid waste
- Add a small amount of water to the mud and mix it
 - Consistency should be like mayonnaise
- After putting mud onto the knife, knock the mud off each corner before applying to the wall (See Diagram 6)
- Close mud container when it is not being used to prevent drying out
- When applying mud to the drywall, start with the knife perpendicular to the drywall, as it is fully loaded, and then start to tilt it more parallel to the drywall as mud is moved from knife to drywall (See Diagram 7)
- The lighter the coats of mud and the less excess that is spread onto the wall, the less sanding will be required

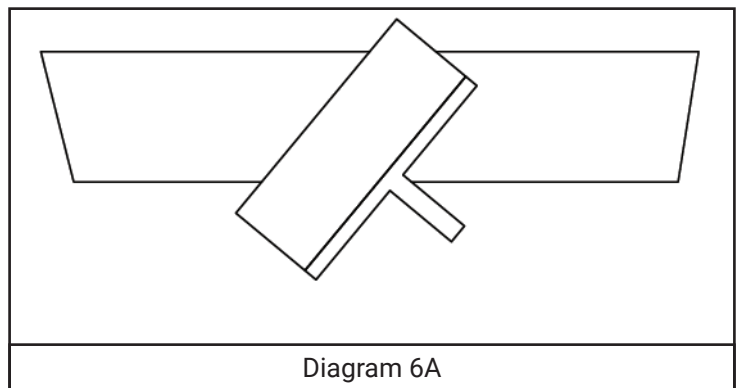


Diagram 6A

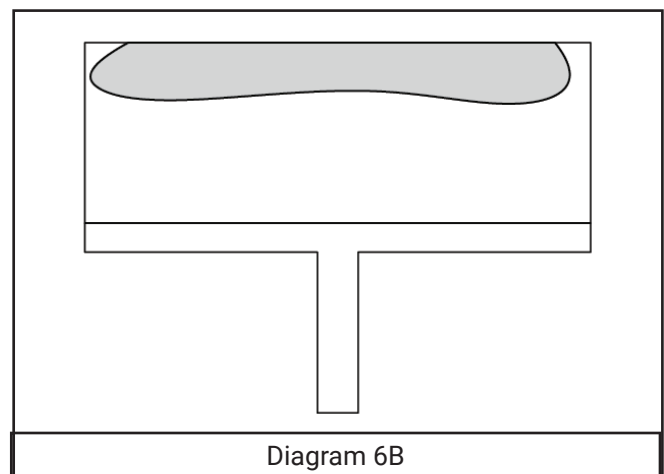


Diagram 6B

Drywall

Mud Over Screw Holes

- Using a drywall knife, check the screw heads in the room to make sure that they are sunken far enough below the surface
 - Run the drywall knife over each screw head, if the knife contacts the screw head, it needs to be sunken further in
- First Coat
 - First coat should be applied during the tape coat of drywall seams (see below)
 - Apply mud to screw holes using a 4" or 5" knife
 - Clean off knife on mud tray and use clean knife to scrape off any excess mud
 - Less excess mud at this stage will result in less sanding
 - After mud dries, scrape off any excess mud with a clean knife
- Second coat
 - Second coat should be applied during the skim coat of drywall seams (see below)
 - Repeat process used for first coat
- Sand mud over screw holes while sanding the rest of the room (after all coats of mud are completed)

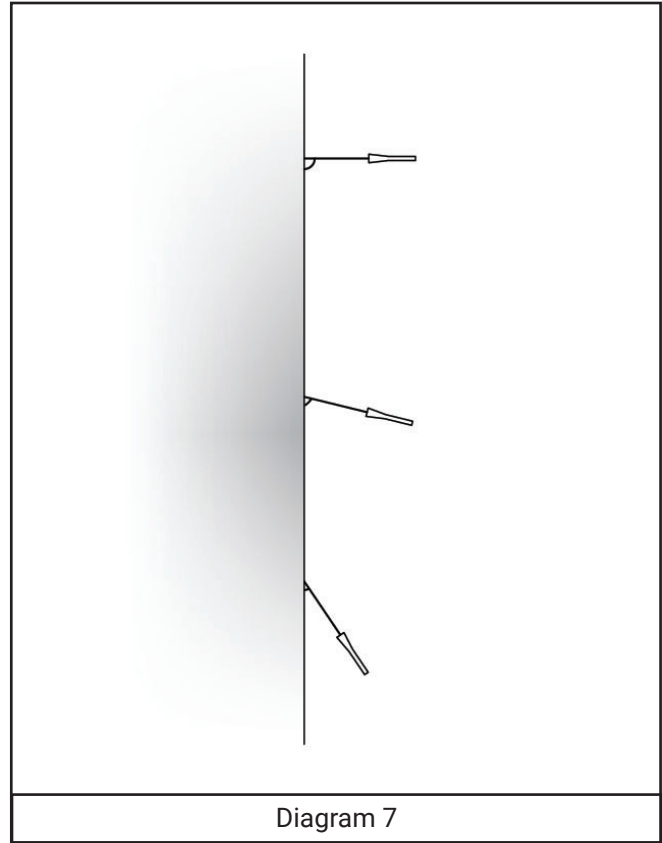
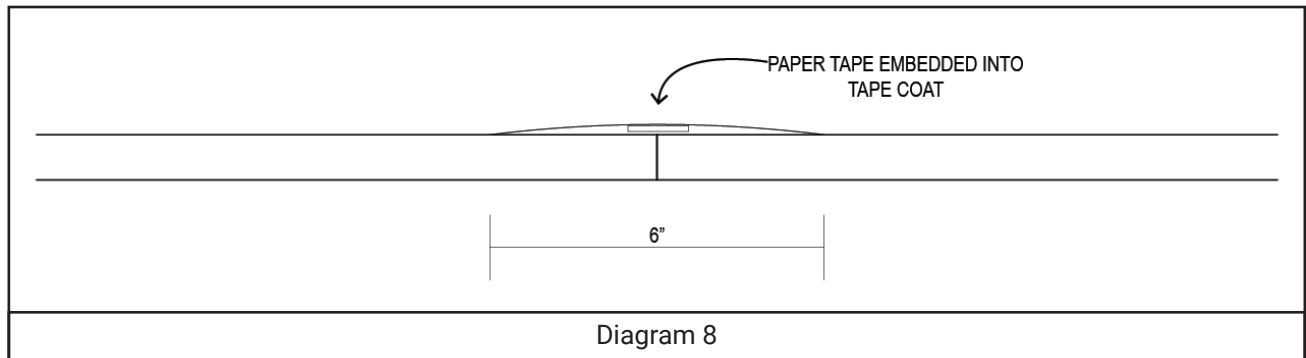


Diagram 7

Drywall

Tape Coat of Mud

- Using paper tape
 - Use a 6" knife
 - Apply a coat of mud to the drywall, using method listed above (See Diagram 7)
 - Lay paper tape overtop of the mud, centered on the joint of the two drywall pieces
 - Clean knife off and use it to flatten out tape
 - Clean knife between each stroke
 - Flatten tape to remove all bubbles/air pockets
 - Tape should be slightly embedded into the mud so that they mud and tape create an even surface (See Diagram 8)
 - Allow mud to dry overnight

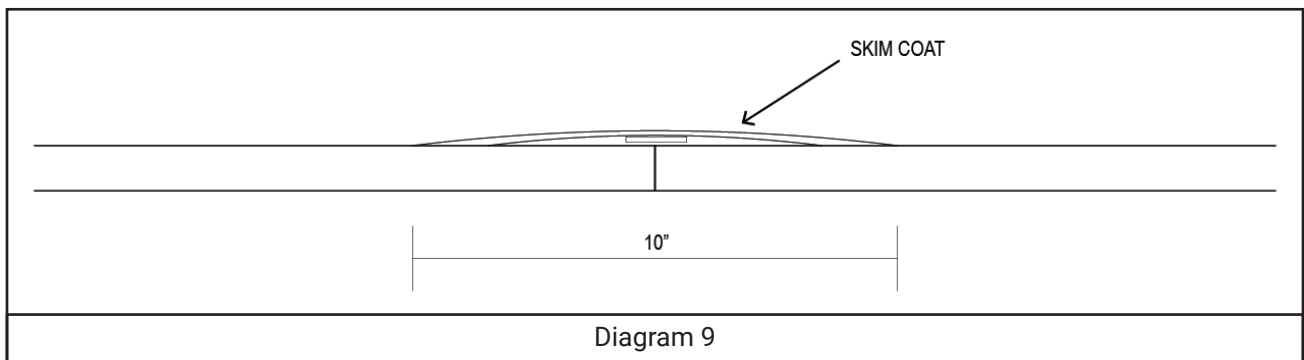


- Using mesh tape
 - Apply adhesive mesh tape to wall before applying any mud
 - Apply a thin coat of mud over top of the tape
 - The tape should still be seen through the mud
 - Allow to dry overnight
- After mud is mostly dry, use a wider knife, running it over the joint to knock off any ridges or excess of mud (this may have to wait until overnight)
- Inside Corners
 - Always use paper tape on inside corners
 - Apply a thin coat of mud to each side of the corner, using a 6" knife
 - Cut tape to length and pre-crease
 - Press the tape into the mud in the corner
 - After tape is in place, run a clean drywall knife down each side to embed the tape into the mud and work out any air pockets
 - Allow mud to dry overnight
- Outside Corners
 - Apply a thin coat of mud to each side of the corner
 - Run knife from top to bottom, holding at a 45° angle
 - One edge of the knife should rest on the outside of the corner bead and the other on the drywall
 - Scrape off any excess mud and clean any mud left on the ridge of the corner bead
 - Allow mud to dry overnight

Drywall

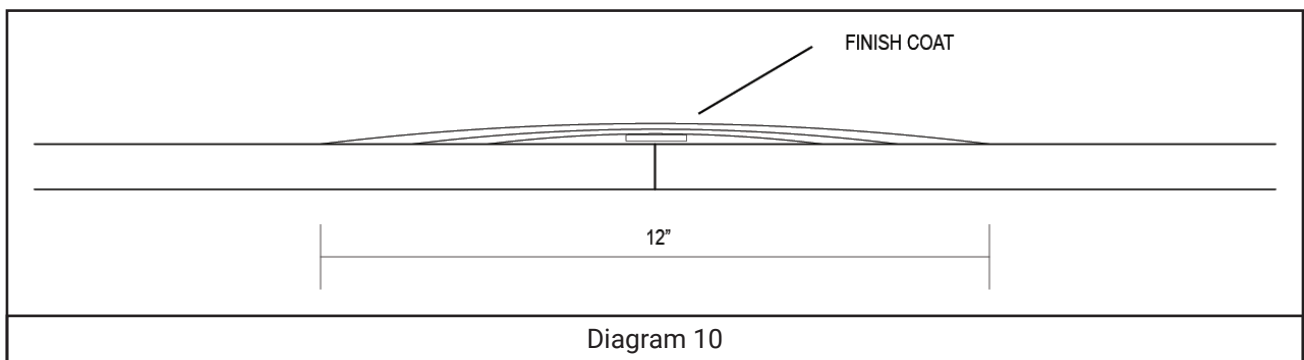
Skim Coat of Mud (See Diagram 9)

- Allow tape coat to dry completely before applying skim coat
- Scrape off any excess mud/ridges with a clean, wide knife before beginning the skim coat
- Skim coat will be the same regardless of what type of tape was used
- Use a 10" knife
- Apply a thin coat of mud
 - Tape should no longer be seen through this coat of mud
- Skim coat should be applied to both inside and outside corners
 - Inside corners can be completed using an inside corner tool (knife with a bend in it to apply mud to both sides at a time) if this tool is not available, mud one side of inside corner and let it dry before mudding the other side
- Allow mud to dry overnight
- Scrape off any excess mud/ridges with a clean, wide knife



Finish Coat of Mud (See Diagram 10)

- Allow skim coat to dry completely before applying finish coat
- Scrape off any excess mud/ridges with a clean, wide knife before beginning the finish coat
- Finish coat will be the same regardless of what type of tape was used
- Use a 12" knife
- Apply a thin coat of mud, as flat as possible
- Allow mud to dry overnight



Drywall

Sanding

- Allow finish coat to dry completely before sanding
- Dust masks and eye protection should be worn while sanding
- 100 grit drywall sanding screens should be used
- Dried mud should be sanded where there are high spots, to make the wall flat
- Over-sanding can result in low spots and even damage the tape that is air sealing the wall

Textured Drywall Finishing

- Adding texture to drywall is an alternative way to complete drywall finishing and hides mistakes better than traditionally finished drywall
 - Drywall texture is most traditionally added only on the ceiling but can be added on walls
- Taping and sanding should still be completed as described above
- Rollers, sponges, or texture brushes can be used to create texture on the ceiling
 - Mud should be mixed with water to make it easier to work with
 - Mud should be mayonnaise consistency
 - Practice texture on a drywall scrap before applying to the ceiling
 - To use rollers for texture, mix mud with water and use a nappy roller to simply roll the mud evenly onto the drywall
 - To use sponges or brushes, mix mud with water and dip the sponge/brush into the mud and apply it to the drywall making an evenly spread texture/pattern across the drywall
- Textured drywall will require a longer time to dry depending on how thick mud is applied

Patching a Hole in Drywall

- Square off the area around the hole using a framing square and level
- Cut a piece of drywall for a patch that is at least 2 inches larger (on two sides) than the hole.
- Measure in 1 inch on all four sides and score the BROWN BACKING PAPER break as you would a sheet when hanging drywall and peel the drywall material off the front paper.
- Test fit the patch and trim as needed
- Using a small amount of mud on each paper flap, fit the patch in place, and cover the entire patch with mud.
- Follow previous mudding instructions for finishing



Kitchens & Bathrooms

Kitchens

Why Kitchens? A kitchen is an important room in a home and is utilized multiple times a day. Families who are without a kitchen will need some way to get food and eating out each day of work can be unfeasible economically for some families.

Kitchen Section Contents

- Demo and Layout 188
- Cabinets 189
- Countertops 190
- Sink and Backsplash 192

Safety: Kitchens

- During demolition of the current kitchen, be wary of sharp objects like nails or screws in removed materials
- Be careful of weak spots in the floor that may be uncovered when appliances or cabinets are moved
- Masks should be always worn due to dust and potential pest contaminants
- (Due to the availability of food and moisture, the kitchen is a common place for pests such as mice and insects. These pests can carry airborne pathogens and wearing a mask is the best way to prevent these.)
- While removing old materials be careful swinging hammers and prybars so no one is hit.
- Some materials that are removed will be heavy, be sure to use teamwork to lift heavier items.
- **If the power outlet for the Stove/Oven/Range (220V) is damaged when the appliance is moved or needs to be moved to improve the kitchen layout, STOP WORK AND CONTACT AN ELECTRICIAN TO REPAIR OR MOVE THE OUTLET.**

Kitchen Project Planning

- A good, estimated timeline for a complete kitchen remodel/repair for unskilled volunteers is at minimum 3 to 4 weeks for average volunteers. When we are working in these rooms, we need to be mindful and have a good estimate time frame for when work will be completed.

-

Quality Control

- Cabinets are laid out to fill the required space without gaps
- Cabinets are attached to wall studs or blocking, specifically upper cabinets
- Joints between cabinet sections are flush on the outside
- Tops of the cabinet sections are level (they may not be flush, but this will be covered with the countertop)
- All drawers open
- Countertop is level
- Countertops have been secured to the cabinets through the attachment points
- Kitchen sink is attached to the countertop with fasteners
- Joints where the sink and countertop and the countertop and backsplash meet have been caulked.
- New backsplash material is securely fastened
- Kick plates are installed

Common Mistakes

- Screws used to attach cabinets to the wall do not hit studs or solid wood
- Countertops are not attached securely (loose) or have been over tightened (the plastic attachment point has broken).
- Cabinet doors or Drawers open into an appliance, wall, or other cabinet
- The hole cut for the sink is too large and has large gaps.
- Not installing the “finishing touches” like kickplates, backsplash, and cabinet/drawer pulls
- Cabinet/drawer pulls not installed level, plumb, or in line with the other pulls

After Work is Complete Quality Control Check

- All visible parts of cabinets are painted, stained, or finished
- Cabinet doors open and close smoothly without hitting an adjacent appliance
- Cabinet/drawer pulls are installed (if applicable)

Kitchens & Bathrooms

Kitchen Materials

If volunteers are doing any floor system, floor covering, wall, etc. repairs, be sure to check the materials and instructions in those sections.

- Upper Cabinets
- Lower Cabinets
- Countertops
- Kitchen sink (see Plumbing for those materials and instructions)
- Toe kicks
- Cabinet door and drawer pulls
- Interior screws (1 ½, 2, and 2 ½ in lengths)
- Interior trim screws (2 and 2 ½ in.)
- Countertop joining bolts
- Backsplash material
- Depending on the purchased cabinets, Stain or Paint

Recommended Tools

- Circular Saw
- Sawhorses
- Impact Drivers
- Drills
- Various Drill and Driver bits (star, Philips, and 1/8 drill specifically)
- Reciprocating Saw
- Standard hand tools
- Pry bars
- Contractor bags

Safety Items

- Safety Glasses
- Gloves
- Masks
- Long sleeved shirts
- Some materials that are removed will be heavy, be sure to use teamwork to lift heavier items.

Kitchen Instructions

The average size of a kitchen in the US is between 100 and 250 square feet depending on the total square footage of the home. Mobile Homes and homes that are around 1500 sq. ft. or less (ASP typical project homes) have 100 sq. ft. Kitchens.

Beginning Work

- Before starting work on a Kitchen project, be sure to have a plan for how work will progress. Kitchens are very important and need to be completed in a timely manner so the homeowner can have a place to prepare meals.
- Begin working on the Kitchen by removing all the old or damaged materials that need to be removed. As things like cabinets and countertops are removed, make sure they are stacked neatly in an easily accessible area outside so they can be removed from site to the dump efficiently.
- Once damaged materials are removed address any repairs to the floor system and walls (see *Floor System on page 35 and Walls on page 69*)
- While any repairs to the floor system and walls are being done, take measurements for the new cabinets, both upper and lower. (If drywall is being replaced, be sure to subtract ½" to 1" from the cabinet length (depending on if it is wall to wall) to account for the thickness of the drywall.)
- Use the measurements to draw a sketch of the kitchen layout and draw in the locations of the various cabinets. It may be helpful to make two drawings, one for the uppers and one for the lowers. For the lower cabinet layout sketch start with the Sink Cabinet.
- Mark the location of any studs in pencil in the space that will be between the Upper and Lower Cabinets. If new drywall is being installed blocking can be added for the cabinets to be attached to.
 - Cabinets are purchased in sections of various widths depending on the type of cabinet orientation it is (see cabinet types and photos)
 - Standard cabinet depths (front of cabinet to the wall) are 12" for uppers and 24" for lowers. Heights for lowers are typically 33"-34".
 - When laying out cabinets (without wall repairs) it is a good idea to locate and mark studs to attach the cabinets to the wall. If repairs are being made to the walls, then blocking can be added where the cabinets are desired.
 - Be sure to talk with the homeowner about where they would like the upper cabinets as well as considering their physical abilities. Upper cabinets can be installed all the way up to the ceiling or not. This will also be determined by the height of the purchased uppers.
 - Common Types of Cabinets needed in Kitchens
 - Lowers
 - Kitchen sink Cabinet (the widest cabinet section most designed for a double basin kitchen sink)
 - Double Cabinet (a cabinet with two doors)
 - Double Cabinet with drawers (a cabinet with two doors and two drawers above the doors)
 - Single Cabinet (cabinet with one door, these are available in multiple widths)
 - Single Cabinet with drawer (cabinet with one door and one drawer above the door, available in multiple widths)
 - Three Drawer Cabinet (cabinet with three drawers)
 - Corner Cabinet (goes in the corner of the kitchen and can have either fixed shelves or a Lazy Susan inside.

Kitchens & Bathrooms

- Cabinet with a corner blank (this will be a cabinet that has a “blank,” no door or access, on one end that is placed next to an appliance)
- Uppers
 - Corner Cabinet
 - Double Door Cabinet
 - Single Door Cabinet
 - Above Appliance Cabinet (These are typically double door cabinets and are shorter in height than other upper cabinets. They are designed to install above refrigerators and stoves)
- There are also some less common styles you may want to consider such as Triple Door cabinets. Be sure to pick cabinet units based on the dimensions of the Kitchen.

Installing Cabinets

Begin with the Upper Cabinets. This allows for them to be held in place easier while someone is attaching them to studs. IF repairs are done to the walls where drywall is removed, blocking can be added to give more attachment points for cabinets. To add blocking, measure up to the height of the attachment points of the cabinet (both upper and lower).

Upper Cabinets

- Begin by measuring up the wall from the floor to the desired height of the Upper Cabinets and mark this height.
 - The standard height between the countertop and the cabinets is 18 inches.
 - When measuring this distance make sure to add the thickness of the countertop to the cabinet height.
 - If desired, you can draw the outline of each cabinet in position on the wall so you know where each one goes.
- Using a 4 ft or longer level extend this mark across the area where the cabinets will be installed. (This method will ensure the cabinets will be at the same level even if the floors are not level)
- Have two people lift a cabinet into place to test the location and fit and temporarily attach with two 2 ½ in cabinet screws.
 - Repeat with the next cabinet
- After each new installation check that the cabinets are plumb and level.
 - Also check the look of the cabinets in the space to make sure they work in the space.
 - Check the swing of the doors to make sure nothing is blocking them
- If everything looks and fits well, attach the cabinets to the wall permanently using screws.
 - Be sure that screws are going into studs (they don't just spin when mostly driven)
- Join the individual cabinets together using 2-2 ½ in trim screws through the door framing
 - Be sure to predrill the holes to avoid splitting the cabinet material.
 - Install one screw at the top and one at the bottom.

Lower Cabinets

- Start with the Sink Cabinet.
 - This has to be done because of the plumbing lines.
 - Kitchen Sinks are usually centered, installed under a window.
 - If any plumbing lines come through the floor, holes will need to be drilled through the cabinet base using a hole saw (if there are shut off valves these holes will need to be large enough for them to pass through)
 - Two people can then lift the cabinet over the plumbing lines while a third feeds the lines through the holes. (if shut off valves are not present, turn off the water and install them after the cabinet per the plumbing instructions)
 - Secure the Cabinet to the wall, into studs, using 2 ½ in screws.
 - From the Sink Cabinet work out on each side making sure the top of each cabinet is flush with the top of the cabinet next to it.
 - Shims will be needed at the wall and floor to ensure a plumb and level installation. Attach all cabinets with the same screws to studs or blocking (if blocking was installed prior to the new drywall)
 - Join each cabinet together with trim screws through the door framing using 2-2 ½ in trim screws
 - Be sure to predrill the holes to avoid splitting the cabinet material
- Once base cabinets are installed a toe kick is needed across the bottoms to complete the installation

Installing Countertops

When purchasing countertops for the kitchen, be sure to allow for a ½ to 1 inch overhang if the cabinets and countertops are not going from wall to wall. Take into consideration how countertop sections will join. Try to use as little sections as needed. Corners should come pre mitered

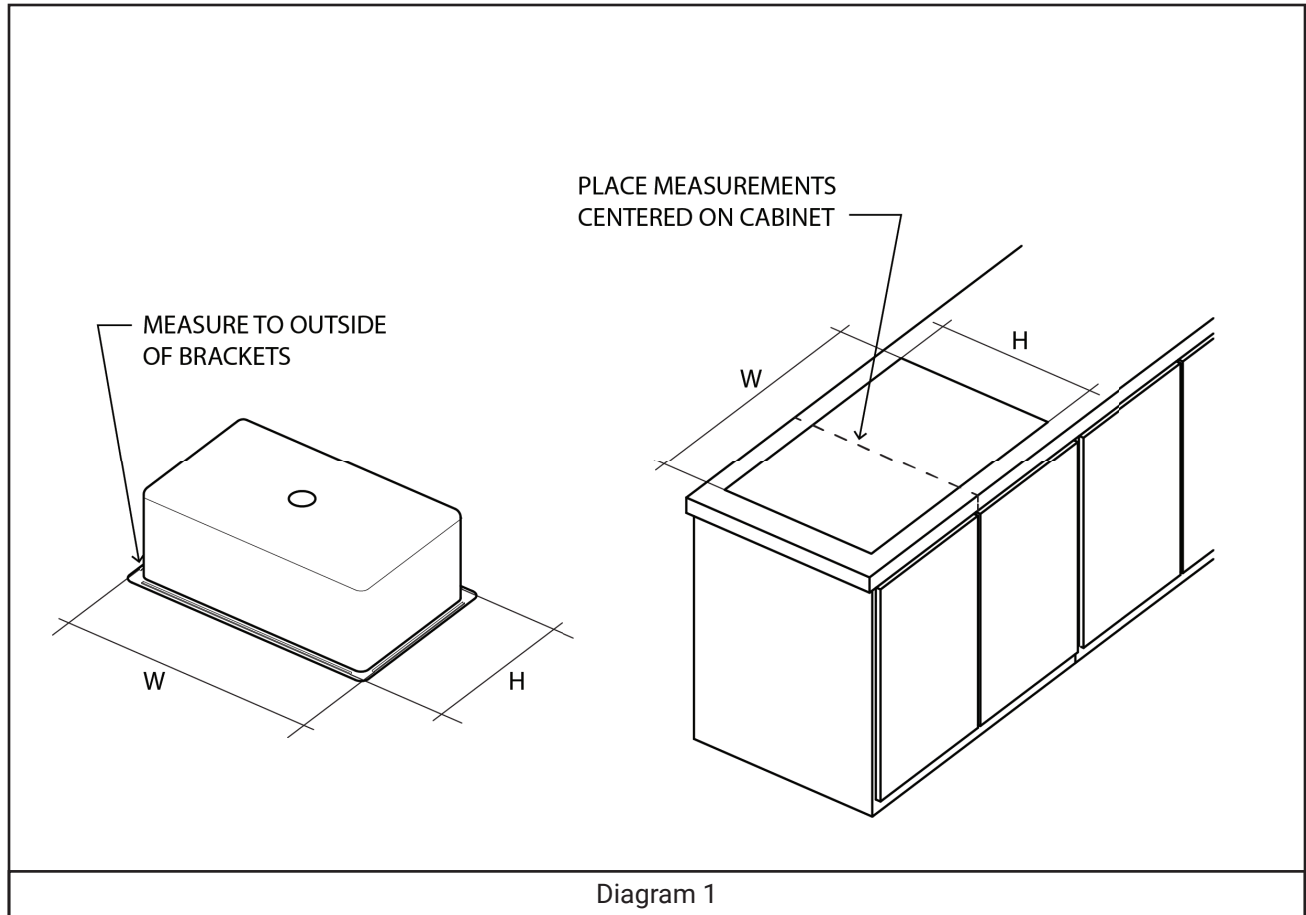
Countertops are heavy, and when the hole is cut for the kitchen sink is cut, they can break easily. Use teamwork to carry and set the countertops in place.

If edges are exposed on Formica Counter tops be sure to get the matching end cap kit.

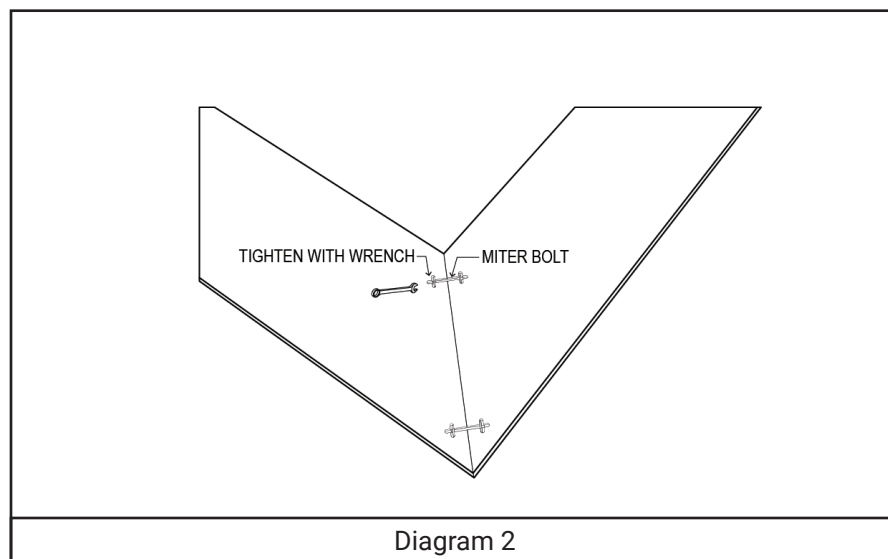
Beginning Countertop installation

- Start with the section of the countertop where the kitchen sink will be.
- Turn the sink over and measure the widest point on the basin and add ¼ inch to each side to ensure it will fit once the hole is cut. Test fit the sink after the hole is cut. If the hole is too small expand the hole by ¼ inch on one or two sides at a time to not cut the hole too big.
 - To mark the position of the sink on the countertop, measure the distance from one edge of the countertop to the edge of the sink. Measure the distance from the sink lip to the sink basin and add that to the distance from the countertop edge to the sink edge lip.
 - New sinks often come with a template on the box
- Once the sink hole is cut to size and the sink fits, carry the countertop into the kitchen with at least two people and set it into position on top of the cabinets.
- Measure any overhang that is present to make sure it is the correct ½ to 1 inch (potentially on both sides).
- Set countertop sections in place and check the fitment of the overhang (if present) and the position of the miter joint in the corner (if present).

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- Once the countertops are in the proper place with the correct overhangs, join the countertop sections together using the miter joint bolt kit. (Diagram 1)
 - Position countertop sections so the notches for the bolts can be placed
 - Insert the miter bolts into each notch and tighten the nuts by hand until they are hand tight. Repeat for each bolt.
 - Using a wrench or a ratchet and socket, tighten the bolts until they are snug, and the countertop sections are tight together.

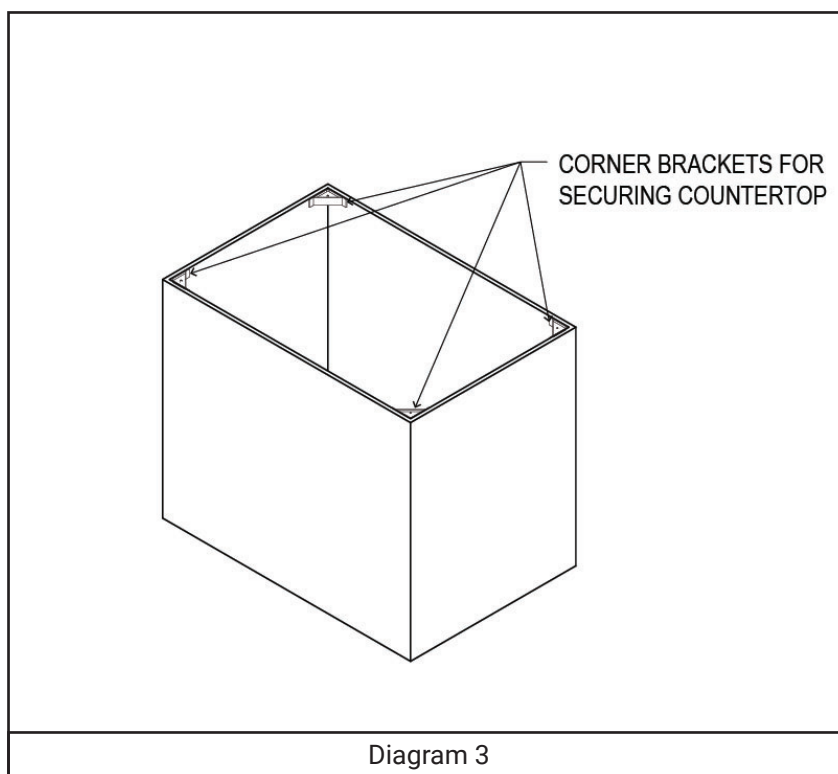


Kitchens & Bathrooms

A few things to look for when joining the sections:

When inserting the bolts have someone make sure the top of the countertop where the joint it remains flush. This is easier if the corner cabinet does not have a Lazy Susan because the bolts can be installed from inside the cabinet. If the corner cabinet has a Lazy Susan and no access to the countertop from inside the cabinet at least 2 to 4 volunteers or more will be needed to hold the countertop sections together while another volunteer tightens these bolts. This can be done on the kitchen floor or outside, but the countertop will need to be carefully carried and put into place. Use as many volunteers as possible when carrying a joined countertop.

- Once the countertop is in place with the correct overhang, attach the countertop to the cabinets at each of the four corners and in the center of the countertop using the plastic attachment points or corner brackets that are usually included on the cabinets using 1 ½ inch cabinet screws (Diagram 2).
- To finish out the countertops, cover any exposed ends with end cap kit materials.



Sink and Backsplash

- When finishing a cabinet and countertop begin by installing the sink using the hardware provided with the sink (if it isn't it may need to be purchased). It is also necessary to use a bead of caulk under the sink lip that will be on top of the countertop to prevent water from getting trapped under this lip (Diagram 3).
- Once the sink is installed, caulk can be applied around where it meets the countertop (*To install the sink faucet and drain lines see the Plumbing Section on page 315*)

Kitchens & Bathrooms

- Backsplashes can be a variety of materials ranging from paneling to traditional tile. ASP does not use tile for a backsplash due to the difficulty and time needed for installation. The peel-and-stick vinyl or PVC tile backsplashes will give the look of traditional tile or metal and are recommended for longevity over paneling.
- To install the peel-and-stick backsplash, clean and dry the area where the backsplash will be installed. Any dust or moisture will hinder the adhesive from sticking.
- Cut each tile, if needed, to fit the area where it will be placed and peel the protective paper from the back. It is a good idea to test the fit before removing the paper.
- Stick the tile to the wall and check that it is level.
- Repeat until the backsplash is completed
- Finish by running a bead of caulk where the backsplash and countertop meet to prevent moisture from becoming trapped between the counters and wall.

Bathrooms

Why Bathrooms? Bathrooms are an important room in the house and are utilized multiple times a day. When bathrooms are being worked on, the family will need somewhere to use a toilet and bathe. For some one-bathroom houses, ASP may need to rent a Portable Toilet for the family and/or find a place for the family to shower as well.

Bathroom Section Contents:

- Vanity 196
- Vanity top and sink 197
- Tubs and Showers 197
- Medicine Cabinets 198

Safety: Bathrooms

- As with any demolition work, be careful of sharp objects and drywall dust. Bathrooms can be worse for dust and masks are a must because of the potential for mold as well as chemicals in drywall, paint, and other building materials.
- Be careful of weak spots in the floor. These will most commonly be around the toilet, shower/tub and vanity/sink drains where water and potential leaks can occur.
- Be careful when cutting into walls and the floor so you don't hit the water supply or drain lines.
- Use teamwork when lifting heavy items like toilets, tubs, vanities, showers, etc.

Bathroom Project Planning

- A good, estimated timeline for a complete bathroom remodel/repair for unskilled volunteers is at minimum 3 to 4 weeks for average volunteers. When we are working in these rooms, we need to be mindful and have a good estimate time frame for when work will be completed.
- It is very difficult for a full work crew to have a meaningful week of service with just a bathroom to work in, so plan accordingly

Quality Control

- The vanity is properly secured to wall studs or blocking
- The vanity top is secured to the vanity cabinet using construction adhesive
- Shower pan has the proper drop
- Shower surround panels are installed directly to studs and not drywall
- Medicine cabinet is attached to wall studs or blocking

Common Mistakes

- Toilet not tight enough (rocks) or too tight (base can be broken by over tightening)
- Vanity is not attached to wall studs or blocking
- Medicine cabinet is not attached to studs or blocking
- Shower surround is attached to drywall not the studs (drywall should not be behind the shower surround at all)
- The shower pan does not drop towards the drain.

After Work is Complete Quality Control Check

- Joints around the toilet, shower, and vanity that are prone to water intrusion have been caulked
- The toilet is level and secured to the floor (no rocking)

Kitchens & Bathrooms

Bathroom Materials

- Toilet
- Wax ring or other toilet gasket
- Plastic shims for leveling toilet
- Vanity and sink
- Shower/tub with surround
- Water Resistant OSB
- PVC trim
- Medicine cabinet
- Lighting
- Caulk

Recommended Tools

When planning work on a Bathroom, make sure that the family has either a second working bathroom that can be used while work is progressing, or that a portable toilet is rented during work. If a portable toilet is rented be sure to have it picked up from the worksite after the Bathroom is completed.

See Construction Manual Chapters on Floor Systems and Flooring for materials lists and instructions that will be needed if floor repairs are needed.

*See Construction Manual Chapters on Walls and Drywall for wall repair materials lists and instructions if wall repairs are needed. **DO NOT INSTALL ANY DRYWALL BEHIND A TUB OR SHOWER.***

For hooking up plumbing fixtures such as toilets, sinks, and tub/showers see the Plumbing Chapter for materials list and instructions.

See Electrical Chapter for materials list and instructions for lights and fans.

Materials

- Vanity and sink
- Tub or shower pan
- Shower surround
- Medicine cabinet

Tools

- Drills and Impact drivers
- Bits
- Standard hand tools
- Panhead screws (1-1 ½ inch)
- Cabinet screws (1 ½-2 inch)
- Trim Screws (1 ½ inch)
- Oscillating Multitool
- Hole saw
- Tape measure
- Caulk guns
- Kitchen and bathroom caulk

Safety Items

- Masks
- Safety glasses
- Gloves

Beginning Bathroom Work

- Measure the size of the bathroom including the height of the room so you can lay out where things will go, especially if the bathroom is being enlarged to be made more accessible.
- If it looks like any plumbing lines will need to be moved, contact plumbers to get estimates for this work. Volunteers can hook up fixtures and drains but they cannot move or install new lines.
- If the bathroom is being enlarged, lay out where the toilet, vanity and sink, and tub/shower will go and plan construction of any new walls accordingly.
- If the bathroom remains the same and only repairs are being made with new fixtures being installed. Measure the area of the tub/shower so one as close to the original size can be purchased
- Consider the original layout of the bathroom and how much space there is and purchase new fixtures to make the best use of the available space.

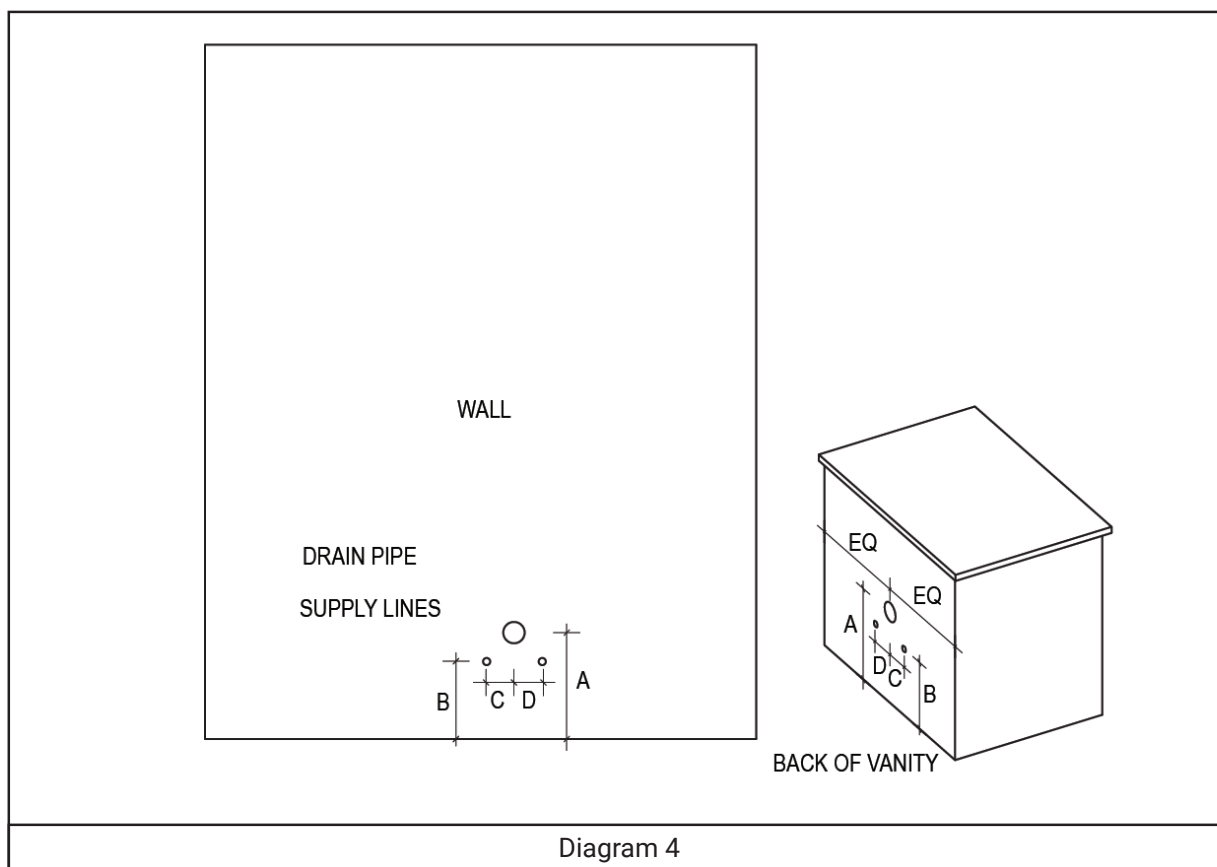
For Toilet installation see the Chapter on Plumbing

Vanity Installation

Depending on the vanity purchased it may have the sink and faucet included. If not, it will need to be purchased separately.

- Begin by locating the wall studs in the area where the vanity will be against the wall and mark them at the top of the vanity.
- Separate the sink top (if included) and place the vanity cabinet where it will be located. Holes for the plumbing will have to be cut using a hole saw either through the back of the vanity (some will not have a back) or through the vanity bottom. Cut holes large enough for the sink shutoff valves to pass through.
 - To locate where to cut the holes in the vanity back, push the vanity as close to the lines as possible and mark the top with a pencil. Move the vanity back out and cut using the mark at the top of the hole saw.
 - To locate where to cut the holes in the bottom of the vanity (Diagram 4, facing page):
 - Measure the distance from each supply line and the drain line to the wall.
 - Center the vanity as close as possible to the lines and the desired final position and push the vanity as close to the lines as possible.
 - With the vanity as close to the lines as possible (touching a line is best) measure from the outside of one side of the vanity to the closest line (line touching the vanity).
 - Using the measures from the line touching the back of the vanity and the wall to line measure mark the placement of the first hole, a rough drawing is fine.
 - Measure from the first hole placement to the closest side of the second line and place a mark then measure from the back of the vanity to the wall measurement and draw that hole placement.
 - Repeat previous step for the third hole.
 - Using a hole saw (typically a 1 ½ inch and a 2 ¼ inch) cut the holes for the lines. If the supply line valves are larger than 1 ½ inch use the appropriate size.

Kitchens & Bathrooms



- After the holes are cut, use teamwork to move or lift the vanity into place and feed the lines through the appropriate holes.
- Once the drain and supply lines have been passed through the vanity and it is against the wall make sure it is level and attach it to the wall, into studs, using 1 ½ or 2-inch cabinet screws.

Installing the Vanity top and sink

Most vanity tops will already have the sink as part of it but it not the same procedures as with a kitchen sink installation can be used.

- Place a bead of high quality Construction Adhesive around the top of the vanity.
- Lift (use teamwork if needed) the vanity top and place it on top of the vanity
- Measure the overhang on both sides to make sure they are equal. If there are no overhangs, make sure both sides are flush with the vanity cabinet.
- After the Construction Adhesive has set, follow the instructions in the Plumbing section for connecting the plumbing.

Installing a tub or shower pan

The most difficult part of this installation is the drain. See the Plumbing Section for detailed Instructions.

- Test fit the new shower pan in the space where it will be installed. If needed, take measurements and build a wall to house the plumbing. Also plan for an access door to the shower/tub plumbing to help with future repairs when needed.
- Install shower drain and set it into place using the instructions in the Plumbing section.
- Attach shower pan to studs using panhead or drywall screws. For fiberglass shower pans, it is necessary to pre-drill the holes to prevent the pan flange from breaking.

Installing the shower surround

- Depending on the style of shower surround that has been purchased, you may need to start with the long wall panel. Test fit this panel first then the non-plumbing panel, and finally the plumbing panel.
 - During the test fit of the plumbing panel, the placement of holes needed for the shower diverter, tub faucet, and shower nozzle can be marked on the back of the panel to be cut with the appropriate hole saw.
- Once all the panels have been test fit, they can be assembled and screwed into studs using Panhead or drywall screws. Predrilling holes can help prevent the shower surround flange from breaking.
- Before installing the Plumbing wall panel, predrill a pilot hole using the marks made during the test fitting and then moving to the shower side and finish on the side that will be exposed to the shower. (Drilling the holes from the shower side rather than the wall side will ensure a smoother hole.)
 - If there is not an access panel where the plumbing can be connected after the shower surround be sure to connect the plumbing supply lines before permanently installing this panel.

Medicine Cabinet Installation

Decide whether a medicine cabinet will be mounted on top of the drywall or between studs inside the drywall.

If a medicine cabinet is being mounted on top of Drywall it should be mounted by screwing into studs or using drywall anchors that will support the appropriate weight.

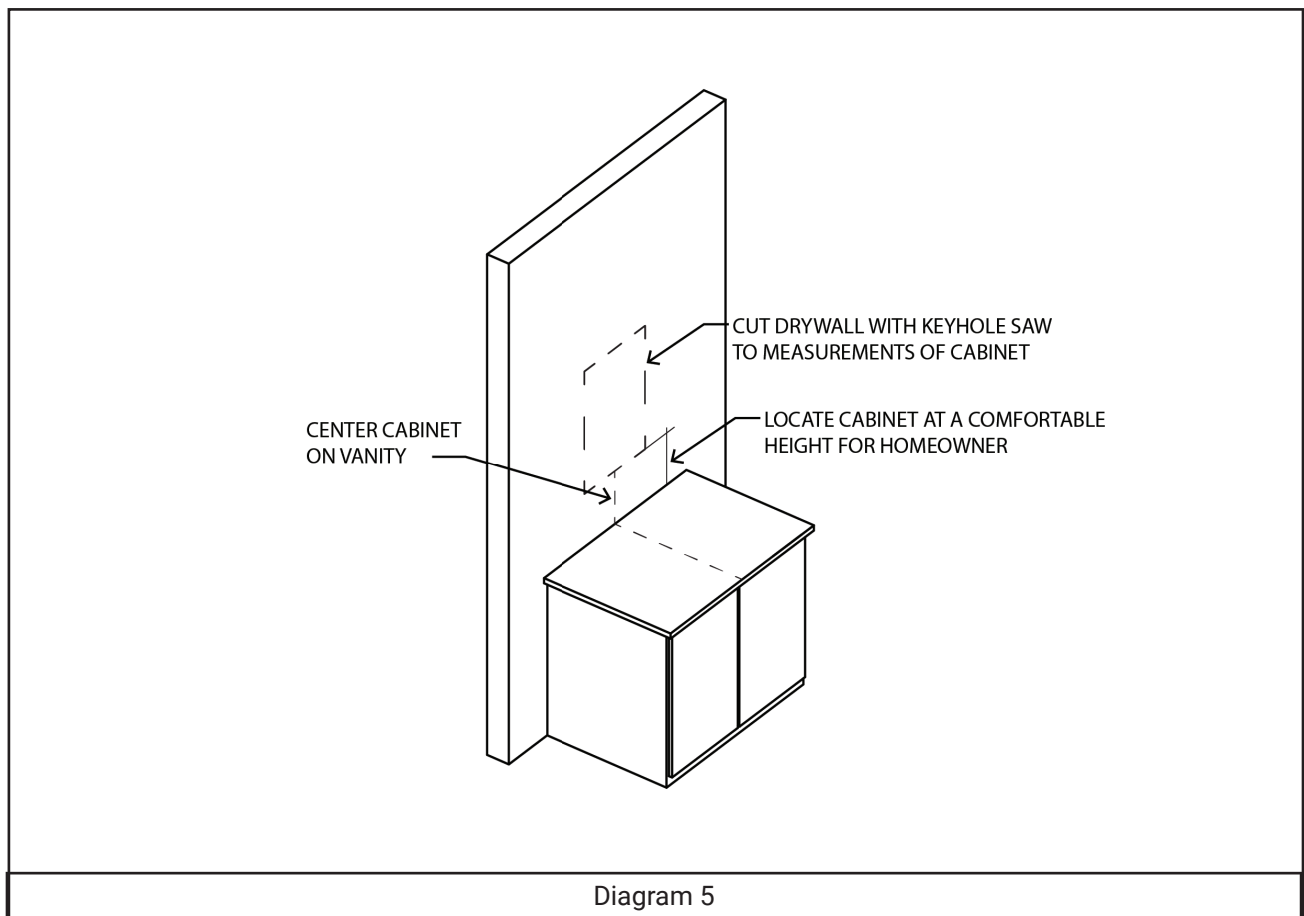
- Begin by making sure there will be at least 3 inches of space between the medicine cabinet/mirror and the sink/vanity, and the top is at least 72 inches from the floor (Diagram 5, facing page).
 - If the medicine cabinet is being installed between studs within the wall mark the area of drywall to be cut out for the cabinet and cut.
 - Slide the cabinet into the cut hole
 - Level the cabinet in the space and use screws to attach the cabinet to the sides of the studs.
- If the medicine cabinet is being installed without cutting into the wall space, locate at least one stud and use one screw to attach the cabinet to the wall.
- Level the cabinet and use a 1/8 in drill bit to drill through the cabinet where it will be mounted to the wall in the void space.
- Drill pilot holes for the anchor placement and remove the cabinet from the wall
- Drill the appropriately sized hole for the anchors that will be used and install the anchors
- Lift the cabinet into place and reattach using the first screw and then installing screws through the anchor holes and finally a second screw into the stud.

Finishing up

- Use PVC 1x trim boards or other PVC trim pieces (¼ round, etc.) to trim around the shower/tub and surround.
- Run a bead of caulk around the seams between the trim, and surround, pan, and floor.
- Use ¼ round to cover the seam between the shower pan and the floor coverings.
- Run a bead of caulk between the vanity top and wall seam.

Special Considerations for bathrooms:

- If the drywall is removed from around the shower/tub area install the shower/tub and surround before hanging drywall so the shower/tub surround flanges are covered by the drywall.
- Check the locations of any holes that need to be drilled to make sure they are in the correct places before drilling. Fiberglass shower surrounds can be repaired but it is difficult and will need to be done by the HRC or someone with Autobody experience.
- When demoing drywall, primarily in Stick Built homes, be careful in the walls around the sink and vanity. Older medicine cabinets had a slot in them where used razor blades could be disposed of and, when used, the walls can have these lying on the bottom plate of the wall.



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Paint & Trim

Why paint? Painting provides a cleanable surface, which helps create better air quality. Paint also protects surfaces from moisture and can have a positive effect on mood. A fresh coat of paint can be good for more than just the home.

Section Contents:

• Painting/Priming	202
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Painting/Priming

Safety

- Any paint from before 1978 likely contains lead and CAN NOT be scraped/ sanded. If there is a concern about Lead Paint in homes built up to 1985 a test can be performed to confirm that it is not lead-based paint. This is due to paint companies liquidating their stock of lead-based paint before the law went into effect in 1978.
 - If volunteers will be working around Lead Paint they will need to be supervised by someone who has been certified in Lead Paint Renovation, Repair, and Painting
- If there are pets or kids on the worksite block off work area or keep paint out of reach
- Use ladder safety on page 16
- Wear safety glasses when rolling paint onto ceilings
- A 2-layer plastic barrier can be used to help prevent paint fumes from moving to other areas of a home. This could be helpful if a family member in the home has breathing problems.

Painting Project Planning

- Do walls/ceilings need any repair before painting?
- Will a primer be needed?
- What color and sheen of paint will be appropriate? Let the homeowner be involved in choosing the color
- Plan to paint window/door trim/baseboard as well.
- Clean the surface before painting
- Plan where furniture/belongings will be during the painting process, provide adequate drop cloths to cover anything that cannot be removed from the area
- How many ladders will be needed?
- Where is a good water source for cleaning brushes?
- If there are multiple types of paint (for ceilings/walls/trim/etc.) label what each is for
- Will the paint cover the stains or does the drywall need to be replaced?
- Is the painted area sufficiently ventilated while working and while drying?

Measurements Needed

- Surface area to be primed/painted (Perimeter of Room X Ceiling Height = Surface Area)

Quality Control

- Make sure paint is mixed well
- Are there any drips in the paint?
- Is paint spread evenly on the surface?
- Make sure edges around doors and the top/bottom of the wall are cut in with a brush, not a roller
- If brushes/rollers are not being used during a break – make sure they are cleaned or wrapped in plastic to keep them from drying out

Common Mistakes

- Paint not mixed and color not the same across room
- Paint from roller not distributed well, visible difference in texture
- Brushes dry out/get tacky while left sitting out during breaks

After Work is Complete Quality Control Check

- Is another coat needed?
- Do any surrounding surfaces need to be cleaned? Windows/trim/etc.
- Is all tape removed and outlet covers/switch plates back in place?
- Leave some leftover paint with the homeowner for touch ups

Priming/Painting Material List

Quantity	Item	Purpose / Notes
	Primer/Paint	Account for how many coats of paint/primer should be needed for the area to be painted
	Paint Tape	
	Paint Tray Liners	

Recommended Tools

Safety:

- Glasses - should be worn when rolling overhead

General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc.)
- Ladders
- Buckets or Hose - for cleaning out

Paint Tools:

- Paint Brushes (1½" - 3")
- Paint Cups
- Stir Sticks
- Drop Cloths/Plastic/Housewrap
- Rollers
- Roller Covers
- Paint Trays
- Rags
- Cleaner

Priming and Painting

Paint Information

- Paint is either interior or exterior, do not use exterior paint on interior surfaces and vice versa
- Paint can be latex based, or oil based
 - Latex based paint should be used whenever possible, it dries quickly, cleans up with water, and has less odor
 - Oil based paint is more durable but takes longer to dry (up to 2 days), requires paint thinner for clean-up (which can be difficult and hazardous), and has a strong odor
- 1 gallon of paint will typically cover approximately 350 sq. ft.
- Paint has different sheens, meaning how much gloss is in the paint
 - Higher sheens should be used in areas that will have more traffic, need to be cleaned more often, or experience more moisture
 - Different sheens and applications:
 - Flat: Ceilings
 - Eggshell: Bedrooms, Living Rooms
 - Satin: Kids Rooms, Kitchens, Laundry Rooms, Hallways
 - Semi-Gloss: Baseboard/Trim, Doors, Cabinets

Room Preparation

- Items in room
 - Coordinate with homeowners about items in room
 - Move items away from walls, out of the room if possible
 - Cover anything that cannot be removed, make sure that it is covered before painting begins
- Drop cloth
 - Make sure a drop cloth or plastic is put down to protect the flooring from paint drips (if new floor coverings are being installed, painting can be done prior to the floor coverings and not use drop cloths)
 - Plastic or drop cloths can easily be cut to size and taped to the baseboard to prevent a gap between the drop cloth and wall
 - Use a drop cloth or paper to make a path between the work area and the outside of the home to prevent tracks in the event anyone steps in paint, either on the floor or drop cloth.
- Remove outlet covers/switch plates/etc.
 - Place all pieces and screws in a certain location so that they can be replaced when the work is complete
 - If switch plates and outlet covers are damaged, replace them. If it is in the budget, replace all the covers to make sure they all match.

Surface Preparation

- All surfaces should be cleaned before they are painted
 - Drywall should be wiped down with a slightly damp rag
 - Metal surfaces, paneling, or other water-resistant surfaces can be cleaned with wet rags and a basic cleaning solution
 - Allow all surfaces to dry completely before priming/painting
- Sweep/vacuum away any particles/dust close to the painting area that could get into the paint
- Fix any imperfections in the surface before painting
 - Any holes in drywall should be patched with mud/putty and allowed to dry
 - Any cracks in siding should be caulked and allowed to dry

Paint & Trim

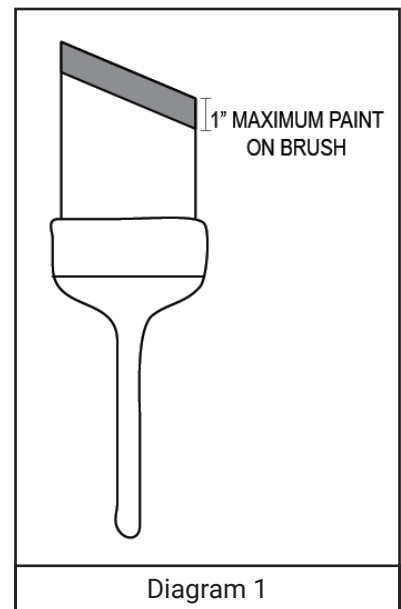
- For paint that is flaky on surface to be repainted
 - If the paint is older than 1978 it likely contains lead and should not be scraped or sanded, work with staff/construction consultant/Home Repair Coordinator to find an alternate solution
 - If flaky paint does not contain lead, scrape it with a paint scraper or wire brush to knock all the loose pieces off
 - All existing paint does not need to be removed, but there should be a flat, clean surface before priming/painting

Taping

- Taping is an important and tedious job that should occur before priming/painting begins
- Taping is done to protect adjacent surfaces that should not get paint on them
- If tape does not stick well, the area may not be clean
- Tape should be used on baseboard/trim, on ceilings, and any other adjoining surface that is not to be painted
 - Make sure that the tape is covering the surface that needs to be protected and not intruding on the area that is to be painted
- Tape should be pressed down well
- Do not remove tape until the primer/paint has dried completely
 - Use a utility knife and be careful when removing tape. Latex based paints tend to peel off with the tape.

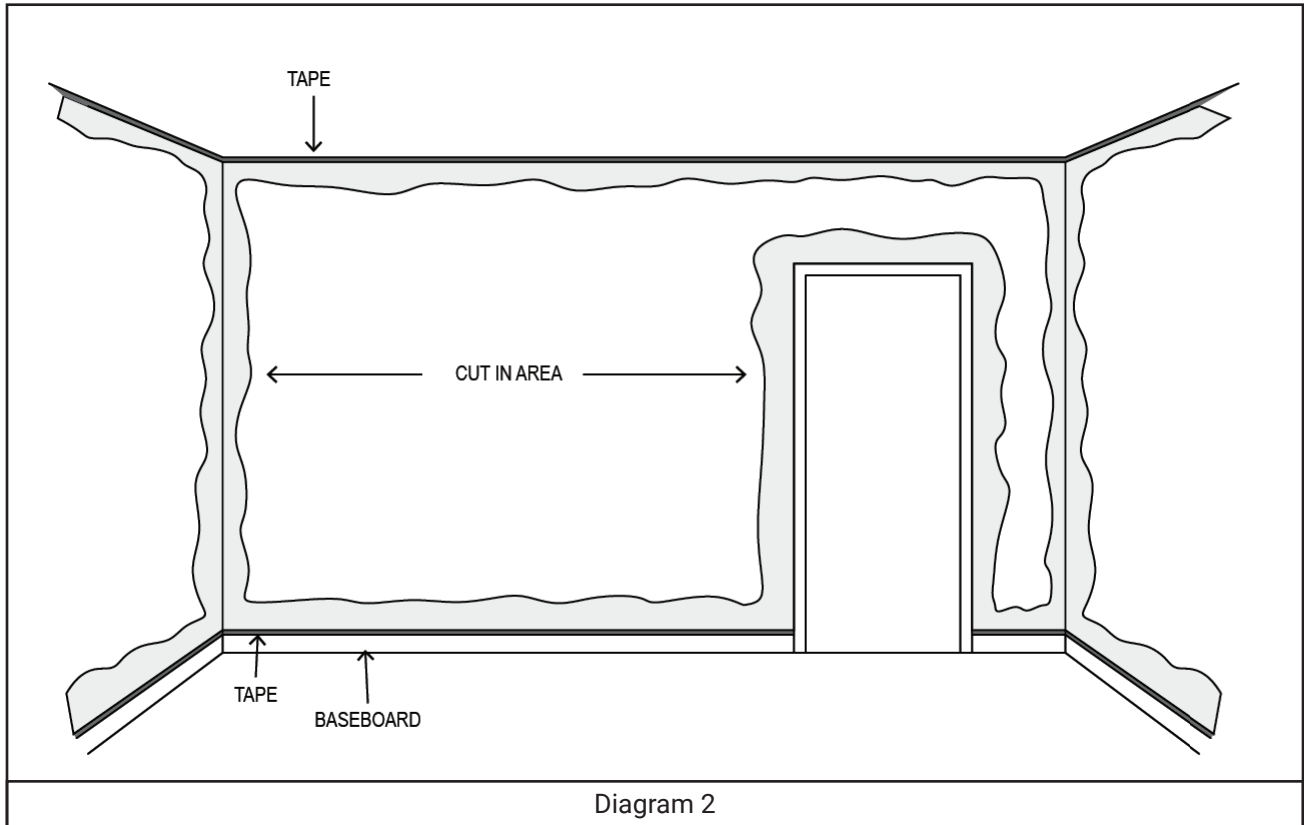
Paint Brush Technique and Care

- Hold the paintbrush like a pencil for more control over where paint goes
- Dip only ½" - 1" of the end of the bristles into the paint at any time (See Diagram 1)
 - If paint gets any higher up on your brush it will gum up the paintbrush, dry and become messy and difficult to clean
- A paint brush should not sit with paint in it for more than 5 minutes
 - If you are taking a break or doing something else for a while, the paint brush can be set in clean water during that time
 - When you come back to the paintbrush, dry it out as much as possible with a cloth before beginning to use it again
 - If you are done with the paintbrush, wash it out immediately
 - The sooner the paintbrush is washed out the easier it will be to clean
 - Paint brushes should always be cleaned thoroughly, this is not a fast process
 - Clean until no more color comes out of the bristles under running water, even as you spread the bristles apart
 - A clean wire brush or paint brush/roller cleaning tool can be used to comb the bristles of the paint brush and work paint out of them

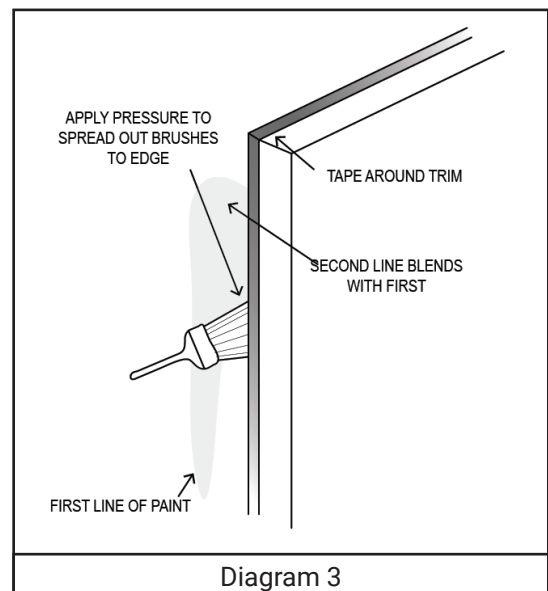


Cutting In

- All borders of the surface being painted should be painted with a brush (See Diagram 2)
 - The cut in area should be about 6"-8"
 - Corners of adjoining walls, the top and bottom of walls, around windows and doors are all areas that should be cut in
 - If painting a ceiling, the perimeter of the wall touching ceiling and light fixtures should be taped



- A smaller, angled brush (1 ½" or 2") is good for cutting in
- Dip no more than 1" of the paint brush into the paint at any time
- Run a line of paint onto the wall about 1" away from the edge, go back to the top of that line and run the brush down, applying enough pressure to spread out the bristles and let them run directly down that edge (See Diagram 3)
 - Go back and smooth out the extra paint with the paint brush so that no bumps are left in the paint
 - This method works best in 2'-3' increments



Roller Technique and Care

- Paint trays should not contain so much paint that there is not space to even out the paint on the roller using the ramp on the tray
- To load paint onto the roller:
 - Dip the roller ½" into the tray
 - Roll up and down the ramp on the roller tray to distribute paint evenly
 - Repeat this several times until the roller is covered with paint, but not dripping
 - If a roller throws paint off as it rolls against the wall, it is overloaded
- To apply paint to surface: (See Diagram 4)
 - Start 6" from a corner and 12" above the floor
 - Roll up towards the ceiling at an angle away from the corner, applying little pressure
 - Stop a few inches shy of the ceiling, and roll straight down to distribute the paint rolled on by the first stroke
 - Repeat this process until most of the paint is off the roller, then go back over the painted area with a mostly empty roller to distribute paint more evenly
 - Work across the wall in this manner
 - Periodically, go back over the painted area with a mostly empty roller, using the same strokes with light pressure to even out any roller marks
 - With a mostly empty roller, run the roller horizontally across the top and bottom of the wall to even out strokes made that overlap the cut in area
 - In Diagram 4, the smaller arrows show the passes already made with the roller and the larger arrows show the continuing path to follow with the roller

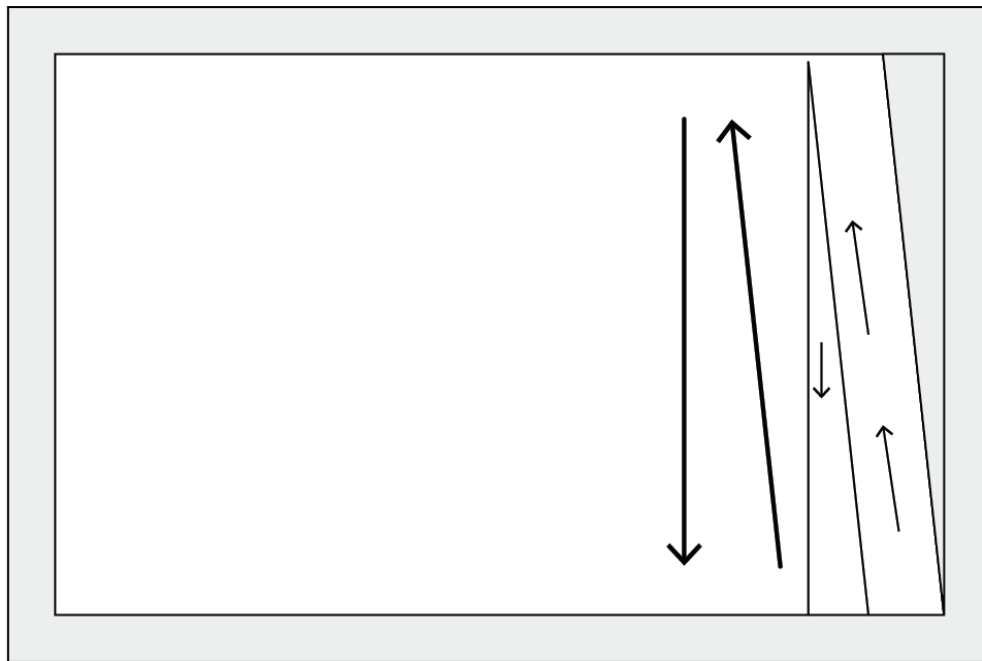


Diagram 4

Paint & Trim

- The roller cover can be sealed in a plastic bag and saved so that it does not dry out between coats of paint
- Roller covers should be washed thoroughly after use
 - Scrapers can be used to squeeze excess paint out
 - Clean in running water or in buckets of water, swapping out for clean water occasionally
 - Clean until water runs clear out of roller
 - Before beginning cleanup of brushes and rollers at the work site ask the homeowner if you can and find a place away from the home where they can be cleaned.
- For paint disposal, paint in trays or cups can be poured back into the can and reused.
 - When the job has been completed, unopened and open cans can be left with the homeowner (if they want them) for touch up and repainting in the future.
 - If the homeowner does not want the extra paint, check with your local dump and follow their guidelines for how it should be disposed of. Unopened cans can be used on another project, especially if it is a common neutral color (white, beige, or gray)

Painting Trim

- Trim should be painted before installation if possible
- Pre-primed trim only needs to be painted, trim that is not pre-primed needs to be primed and painted
- Small rollers can be used to paint baseboard/1x4
- If painting must be done after trim is installed, tape both the floor and the wall

Trim/Moulding

Why trim? Trim covers and protects the edges of the flooring, helps air seal around exterior doors, and helps provide a finished product.

Safety

- Wear eye protection while cutting with a miter saw

Trim Project Planning

- What type of trim will be used?
- Can trim be painted outside before it is installed?
- Wall painting should be done before trim is installed
- Purchase all trim needed for a project at once so that you are not mixing styles or sizes when a product runs out.

Measurements Needed

- What lengths of trim will be needed?
- Will quarter round or base shoe be needed to cover the gap around the flooring?

Quality Control

- Are corners mitered?
- Is trim spliced correctly over long walls of the room?
- Are holes pre-drilled before finish nails are installed?
- Are nails going into studs of the wall?
- Make sure nail heads are countersunk below surface (using nail punch) and filled in with putty
- Make sure touch up paint work is done after trim is installed.

Common Mistakes

- Corners just butted together (this is only correct for 1x4)
- Pieces of trim butted straight together over long walls (not spliced at angles)
- Nails installed without pre-drilling causing trim to split
- Nails only going into drywall
- Nail heads just hammered flat to surface and no nail punch used
- Touch up paint is missed, and marks are left on the trim.

After Work is Complete Quality Control Check

- Is trim caulked and painted?
- Does the baseboard cover the edges of flooring?
- Is trim fastened well (into studs)?
- Are fastener holes filled with caulk or putty?

Trim Material List

Quantity	Item	Purpose / Notes
	Trim	Baseboard, casing, etc.
	6d Finish Nails	
	Trim screws	if not using finish nails
	Caulk	Acrylic, Latex paintable

Recommended Tools

Safety:

- Glasses
- Power Tools:
- Miter Saw
- Drill
 - Drill Bit to pre-drill for finish nails

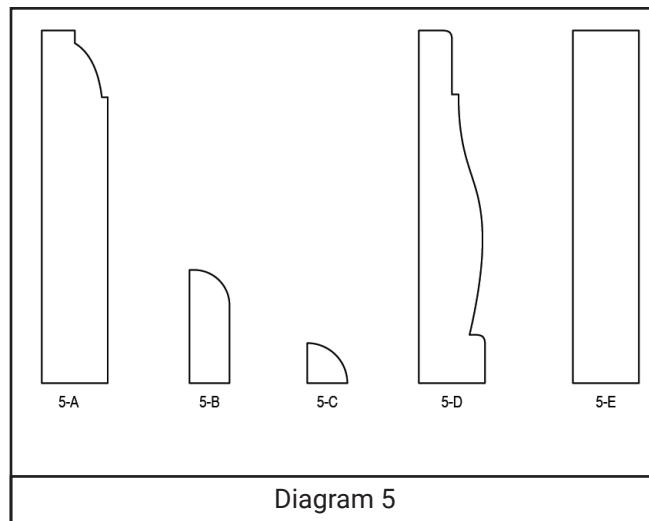
General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc)
- Step Ladders - for tops of doors/windows or ceiling trim
- Nail Punch
- Saw Horses
- Extension Cords
- Caulk Gun
- Drill
 - T-10 bit for Trim Screws

Paint & Trim

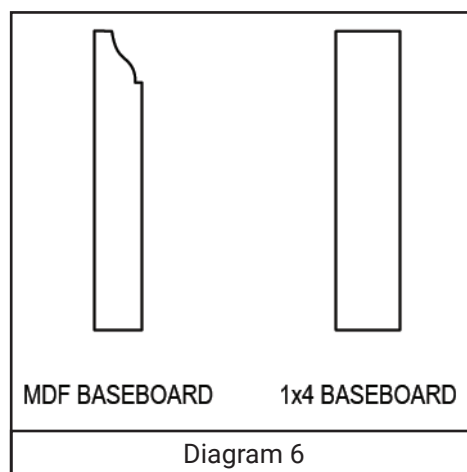
Types of Trim

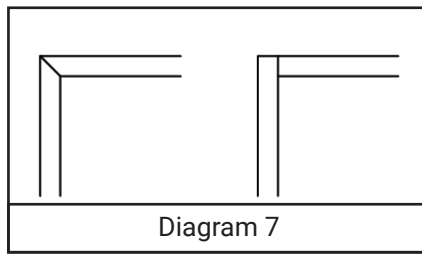
- Baseboard (5-A)
- Base Shoe (5-B)
- Quarter Round (5-C)
- Door and Window Casing (5-D)
- 1x4 (5-E)



Preparation and Working with Trim

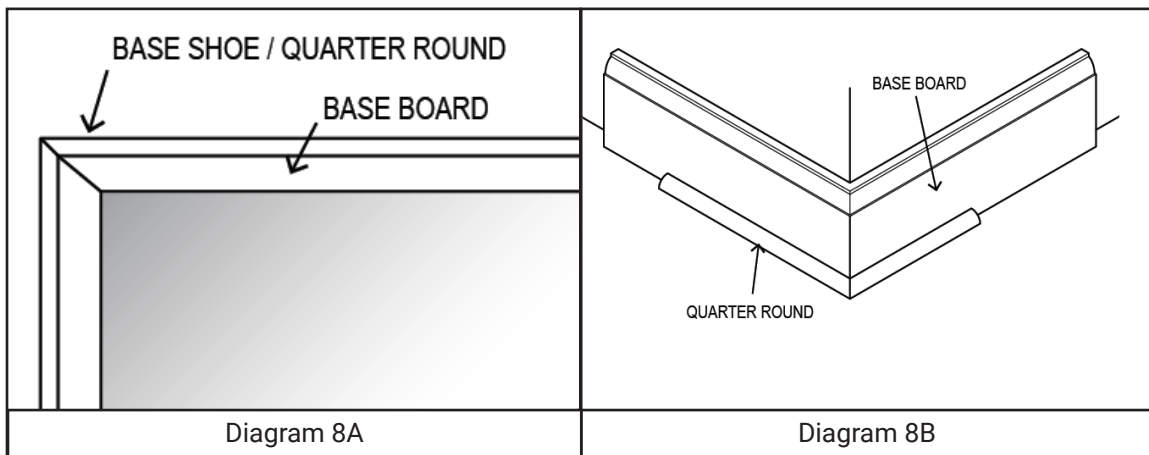
- Trim can be primed/painted before it is installed and then touched up after installation
- Mark the studs on the wall (paint tape can be used for this)
- Baseboard should be attached with finishing nails or trim screws in to wall studs
- All trim should be cut with a miter saw and corners should be mitered whenever possible.
- Door Casing should be installed before baseboard as it will run all the way to the floor, baseboard will then butt into that
- Baseboard can be either 3.25 MDF Baseboard or 1x4 material. Baseboard will be installed around the base of the wall to protect and cover the edge of flooring. (Diagram 6)



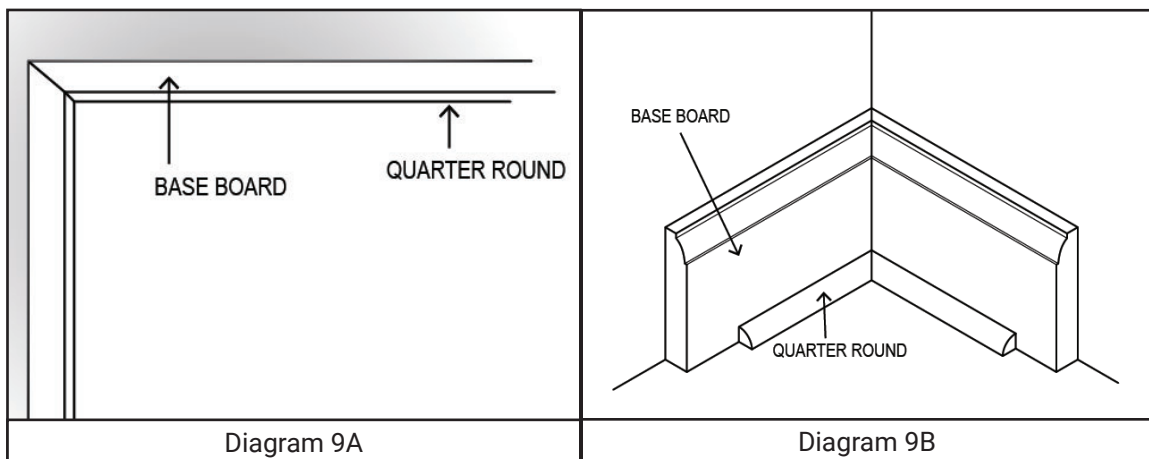


Corners (Baseboard, 1x4, Ceiling Molding, Base Shoe, Quarter Round)

- The same methods will be used for baseboard (base or 1x4) and 1x4 ceiling molding
- Mitered Corners (see Diagram 7)
 - For baseboard, base shoe, or quarter round all corners should be mitered using a finish saw blade (more teeth means a smoother cut for the corners) so that the profiles of the trim meet at the corner
 - If possible, cut the angle on one end of the piece and hold it in place, then make the mark for the cut at the opposite end (this eliminates error from using a tape measure)
 - Outside corners: (See Diagram 8)
 - The joint where two pieces come together may need to be greater than 45° if the corner is not completely true

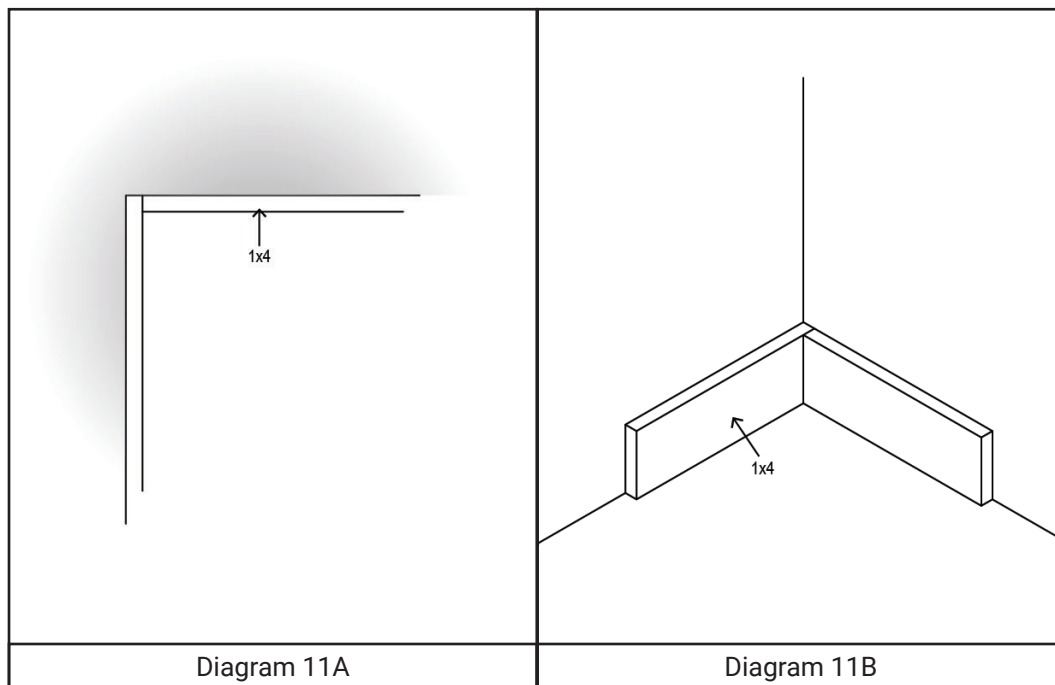
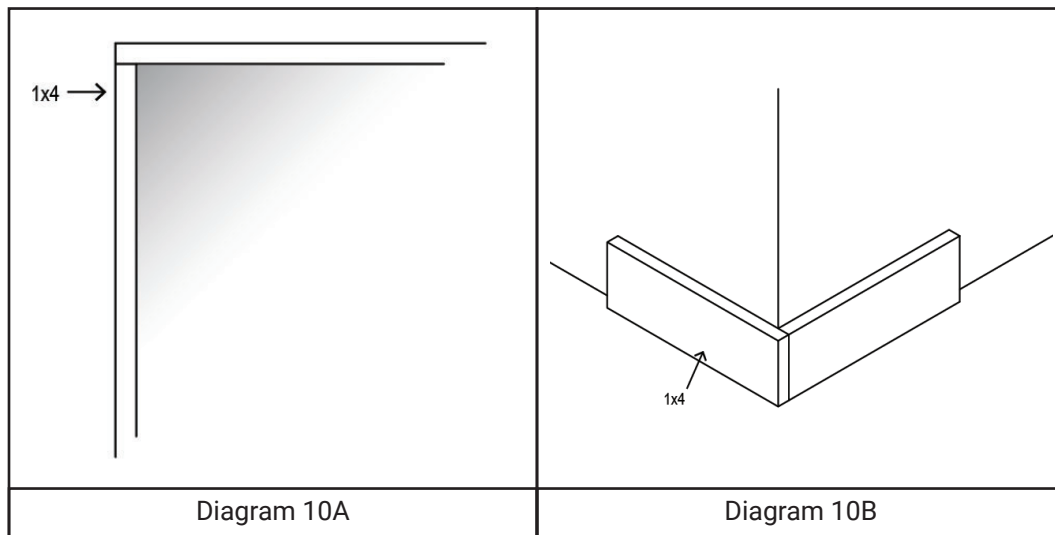


- Scraps can be used to practice and determine needed angles
- Inside Corners: (See Diagram 9)
 - Where the two pieces come together, a 45° should be cut on the end of both pieces



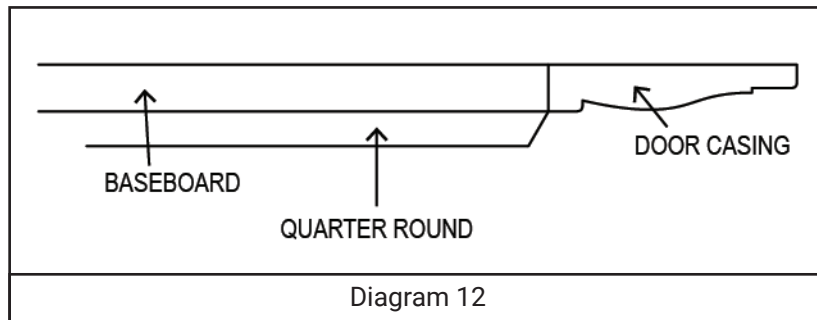
Paint & Trim

- Non-Mitered Corners
 - If 1x4 material is used for baseboard, it does not have to be mitered
 - Outside Corners: (See Diagram 10)
 - The piece coming from one side should run even with the corner of the wall
 - The piece coming from the other side should run to even with the outside of the first piece of 1x4
 - Inside Corners: (See Diagram 11)
 - The piece coming from one side will run all the way into the corner
 - The piece coming from the other side will run directly into the first piece



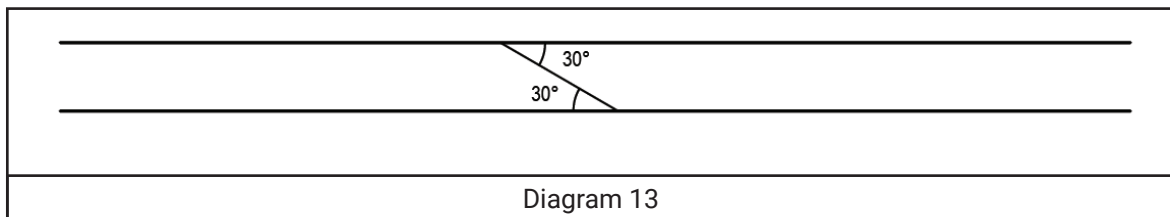
Base Shoe and Quarter Round

- Base shoe or quarter round can be installed over baseboard
- Base shoe and quarter round protect the bottom of the baseboard
- Base shoe or quarter round can also be installed to cover the edges of the flooring if the baseboard is not wide enough to do so
- Where base shoe or quarter round meets door casing, base shoe/quarter round will extend past the width door casing
 - At these points, cut the base shoe or quarter should be cut at 22.5° (See Diagram 12)



Splices (See Diagram 13)

- A splice is where two pieces of trim will come together over a long wall
- Try and use long/full pieces to avoid splices
 - Some splices will be inevitable because of the size of the room
- Splices should occur over a stud
- Cut a 30° splice into each piece so they will fit tightly together
- If 1x4s are using the ends can butt straight together, without the angled splice, but should still meet over a stud



Paint & Trim

Fastening Pieces

- 6d finishing nails or trim screws (typically require a T-10 bit) should be used to install trim
- Holes should be pre-drilled using a 7/64 drill bit before nailing to prevent splitting
 - Drill bits this small will break easily, do not apply a lot of pressure on drill or bend the bit
 - Use a drill bit slightly smaller than the diameter of the finish nail
- Hammer nail until the head is almost flush, then use a nail punch to finish setting the nail to just below the surface of the trim (See Diagram 14)
- Baseboard or 1x4 should be fastened into the studs of the wall (See Diagram 14)
 - Do not nail into the floor
- Base Shoe/Quarter Round should be fastened into the baseboard

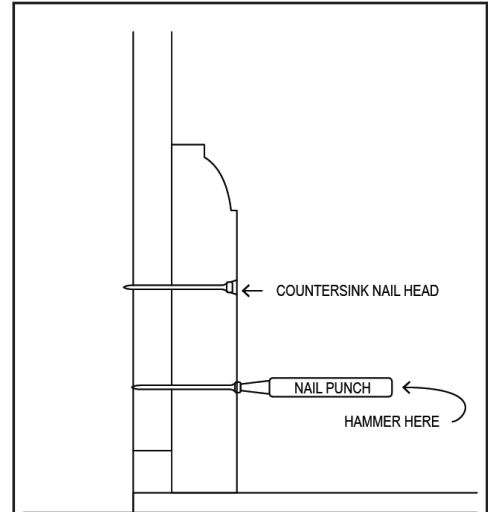


Diagram 14

Casing (Doors) (See Diagram 15)

- Pieces of door casing will be installed around the perimeter of the door, leaving a small reveal of the door jamb
- At the top corners of the door, pieces will be cut at 45° to make mitered corners
- The Thin part of the casing goes closest to the door and the thick side towards the wall (see Diagram 16)
- Install the top piece, then the two side pieces
- Side pieces will run all the way down to the floor covering
- Fasten using the same procedure as Baseboards

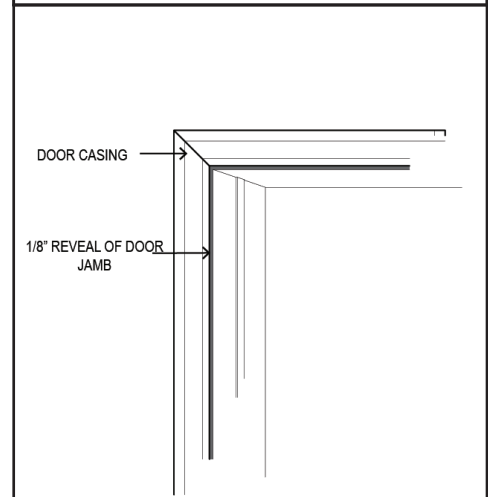


Diagram 15

Casing (Windows)

- Pieces of drywall or 1x material will be used to finish the inside of the rough opening for a window
- Casing should be used around the perimeter of the window
- The Thin part of the casing goes closest to the door and the thick side towards the wall
- All pieces will be cut at 45° to make mitered corners
- Start with the top piece and work down when installing
- Fasten using the same procedures as Baseboards

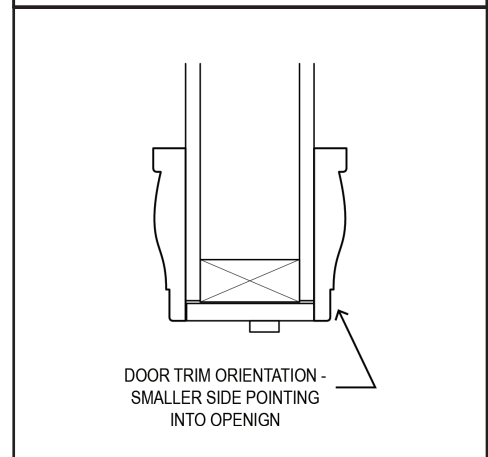


Diagram 16

Casing and/or Trim Special Considerations:

There are some special situations where a door or window casing may need to be modified to go around Light switches and Outlets. To do this, an Oscillating Multitool is the best tool to use following these instructions.

- Begin by cutting the casing pieces to the correct length with the 45-degree angle where it connects with the other piece(s) of casing.
- Hold the piece in place and use a pencil to mark both edges of the switch or outlet (with the cover in place).
- Using a Speed Square, extend the marks for the edges of the outlet about halfway across the casing piece
- Measure the distance from the edge of the door/window opening to the edge of the cover then mark this distance from the THIN side of the casing to the thick side on each of the cover edge lines.
- Using a handsaw or oscillating multitool, cut out the area that needs to go around the switch/outlet cover.
- Check the fit and adjust the notch as needed.
- *If the cut looks like it could compromise the integrity of the casing piece, or the homeowner doesn't want the casing cut, the outlet cover can also be trimmed as long as the cover still covers the switch/outlet and electrical box.*

Caulking (See Diagram 17)

- White, acrylic, paintable latex caulk should be used for caulking trim
- Cut $\frac{1}{4}$ " off the tip of the caulk gun with the built in tool on the handle or with a utility knife
- Use the poking tool or a long nail to pierce the seal of the tube
- Where to caulk:
 - Seams between wall and baseboard/casing
 - Seams between baseboard and base shoe/quarter round
 - Corner joints of all trim
 - Divots from nails/screws
- How to caulk:
 - Hold the caulk gun at a 45°, with the top of the cut tip in the intersections where the caulk will be applied
 - Apply light and consistent pressure to the handle while moving the caulk gun across the seam
 - If needed smooth out the seam using your finger, clean finger off on a rag as caulk builds up on it
- Use wet rags to clean up any drips or wipe off tip of caulk gun as needed
- Add a small amount of caulk to all divots created by countersinking nail/screw heads to make them invisible
- After caulk dries, any imperfections can be touched up with the original baseboard paint
- Put a long nail or screw in the tip of the caulk to seal it when done caulking

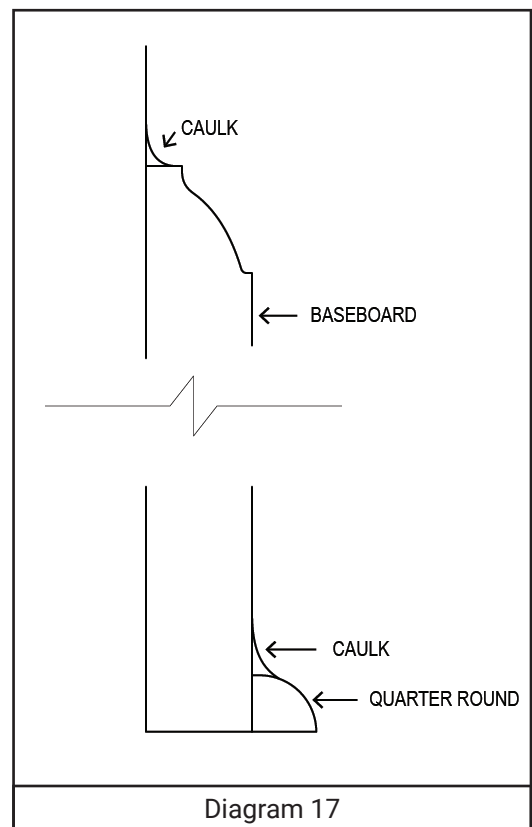


Diagram 17



Drainage Ditches

Why drainage ditches? Drainage ditches help re-route water that normally accumulates around the foundation of the home. They help reduce moisture build up (that can cause mold and rot) under and at the base of the home. There are two basic types of drainage ditches.

- **Surface Drainage.** Typically, a shallow ditch filled with gravel to allow a pathway for surface water to drain away from home. These are the most typical ditches we use to redirect water.
- **Subsurface Drainage.** Also referred to as a French drain. Subsurface drains are placed beneath the top layer of soil to remove excess water at the root level. Subsurface drains are often deeper and require drainage pipes, filter fabric, in addition to gravel.

Positive drainage is created by making a slope that runs away from the house.

- Positive drainage is a lower maintenance alternative to gutters, which can cause damage if they are not cleaned out regularly or installed incorrectly
- Moving soil with hand tools can adjust grade to provide drainage. It is recommended to have a minimum of 6 inches of fall within the first 10 feet of a home.

If this is not possible due to the location of the home, other methods to provide drainage must be used.

Drainage Ditches

Safety

- Be cautious of underground utilities while digging. Call Dig Safe prior to any digging. This can take up to a week to get marked properly so be sure to call ahead.
- When working closely together, be careful while swinging pickaxes/dig bars
- Gravel can be heavy, do not over lift. Use a wheelbarrow whenever you can.
- Straw can be used to make the walking surface less slick if needed

Drainage Ditch Project Planning

- Where will the ditch be? Where will water be diverted to?
- Is it surface water or ground water that needs to be diverted?
- Are there any underground utilities in the area that the ditch will go to?
- Where will you drop off gravel when it is delivered?
- How much gravel will be needed? Should you get it delivered?
- Make sure there are enough digging tools and wheelbarrows available
- Will there be enough work to keep people busy while waiting for gravel deliveries?

Measurements Needed

- Length of ditch
- Width and depth of ditch

Quality Control

- Check the slope of the ditch
- Check that the ditch is at least 6" deep and 12" wide for a surface drainage ditch (Should be at least 10" for a subsurface drainage ditch)

Common Mistakes

- The ditch is not sloping enough to drain water
- Filter fabric not wrapped complete around gravel

After Work is Complete Quality Control Check

- Has there been grass seed and straw applied to disturbed dirt?
- Is the ditch diverting water away from the house? Make sure that water is not directed towards anywhere that it could cause damage
- Make sure ditch is full and slightly mounded with gravel
- Make sure that any landscape fabric used is trimmed to meet the top of the gravel.

Drainage Ditches

Drainage Ditch Material List

Quantity	Item	Purpose / Notes
	#57 Gravel	Ordered by the ton <ul style="list-style-type: none">○ <i>Depth (in feet) X Width(in feet) X Length(in feet) = Cubic Feet</i>○ <i>Cubic Feet/27 (# of Cubic Feet in a Cubic Yard) = Cubic Yards</i>○ <i>Cubic Yards x 1.4 = Tons Needed</i>
	Membrane	Landscape Fabric for lining ditch
	2x4x10 F	To build frame that measures slope
	3" Screws	To build above frame
	*Corrugated Pipe	*If drainage calls for subsurface drain

Recommended Tools

Safety:

- Glasses
- Gloves
- Landscape Fabric for lining ditch

General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc.)
- Utility Knives
- Saw Horses
- Extension Cords
- Level (2' or 4')
- T-25 drivers to match screws

Power Tools: (for building frame)

- Circular Saw/Miter Saw
- Drill/ Impact Driver

Digging Tools:

- Spade Shovels
- Flat Shovels
- Hoes
- Digging Bar
- Pickaxe
- Wheelbarrow
- Buckets

Drainage Ditch Instructions

Plan Ditch (See Diagram 1)

- Plan the path of the ditch before starting to dig
- The ditch should run perpendicular to the water flow, to catch and reroute water running downhill
- Determine the end point of the ditch
 - The ditch should not route water into someone else's yard
 - The ditch should end somewhere that it will not create additional water running across a driveway/walkway/yard
- The ditch must be at least 2' away from the foundation of the home
- Use marking paint to show the path of the ditch
- Designate where the highest point of the ditch will be

Dig Ditch

- The minimum slope of the drainage ditch is a 1" drop for every 10' of length
 - To measure this, build a frame out of a 5' 2x4 piece at the top and legs on either end with one leg $\frac{1}{2}$ " longer than the other (See Diagram 2)
 - A $\frac{1}{2}$ " drop over 5' gives the required 1" drop over 10'
 - A level can be placed on top of the frame, when the frame is level that means the ditch is at the correct slope
- The minimum size of a surface ditch is 12" wide and 6" deep (See Diagram 3)
- The minimum size of a subsurface ditch is 12" wide and 8" deep (See Diagram 3)
 - The ditch can be larger
 - The ditch will be deeper in some cases to meet the slope requirements
- Pile excess dirt from the ditch on the downhill side of the ditch (See Diagram 3)

Fill Ditch

- When the ditch is completed:
 - Surface ditch:
 - Fill ditch with gravel (See Diagram 3)
 - #57 stone should be used
 - Gravel should fill the entire ditch and be slightly mounded so that dirt does not collect on top of the gravel
 - Spread grass seed and straw on disturbed portions of yard.
 - Subsurface ditch or French Drain: (See Diagram 4)
 - Lay filter fabric across ditch with enough excess to fold back over top after ditch is filled with gravel
 - Place roughly 2-3" of gravel in bottom of ditch on top of filter paper
 - Place corrugated pipe in ditch being sure that it maintains at least 1" of drop for every 10' of pipe.
 - Once pipe is in ditch, cover and fill ditch roughly 2" to the top with gravel
 - Wrap filter fabric over top of gravel, hold in place with landscaping staples
 - Fill the remainder of ditch with excavated dirt. Spread grass seed and straw to encourage new grass growth.

Drainage Ditches

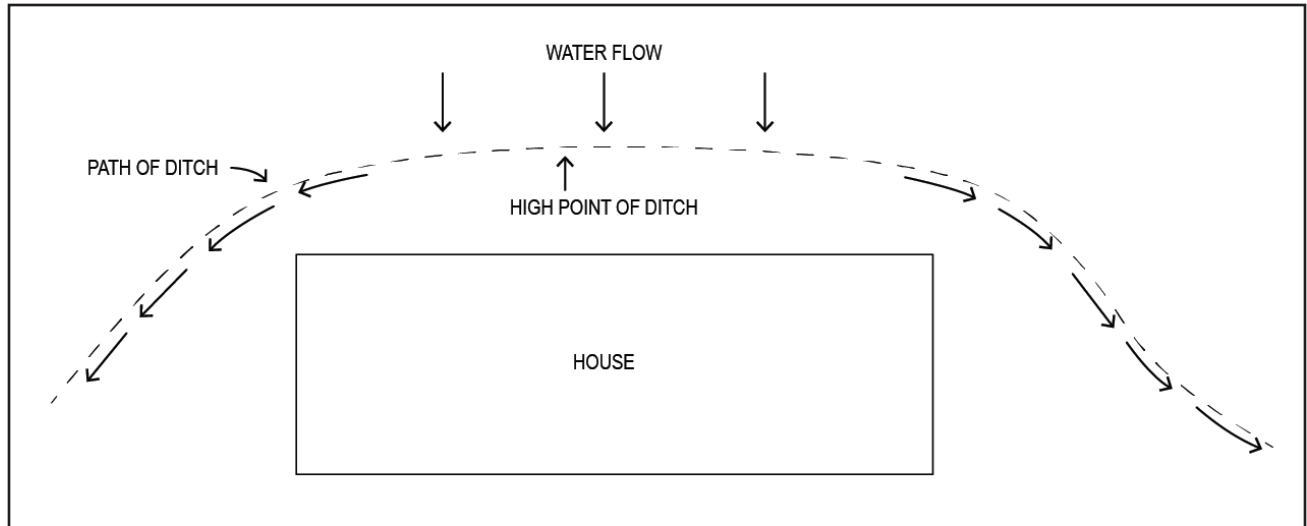


Diagram 1

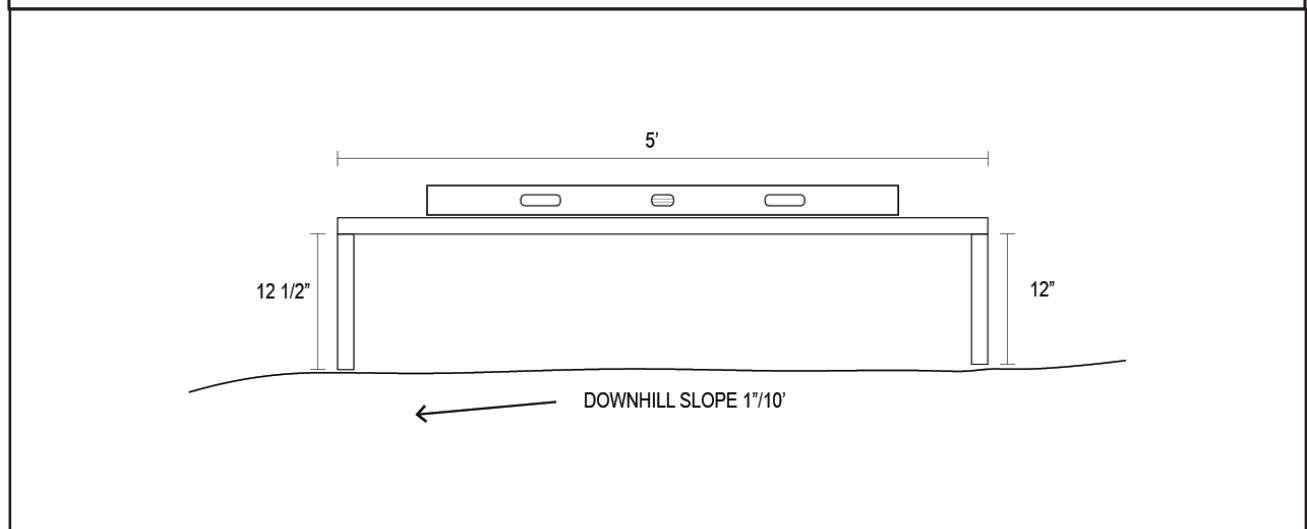


Diagram 2

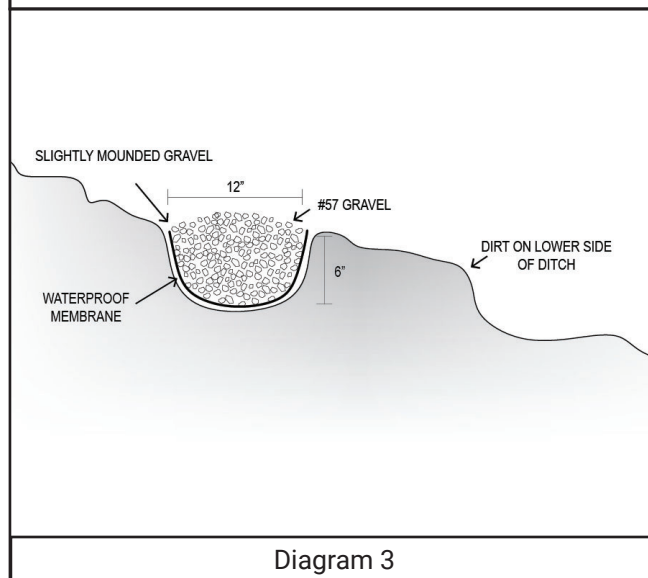


Diagram 3

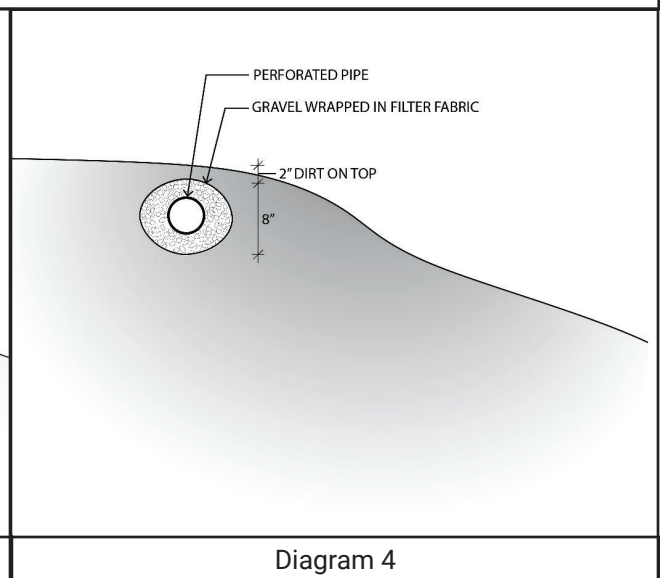


Diagram 4

Drainage Ditches

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Underpinning

Why underpinning? Underpinning protects the crawlspace by providing insulation to the water lines below, keeping animals out, protecting insulation, and rerouting water/drainage that would otherwise be under the home.

Section Contents:

- Framing 229
- Vinyl Trim 234
- Access Doors 235
- Vinyl Pieces 236
- Venting 237
- Mobile home hitches 238

Safety

- Wear thick leather gloves, safety glasses, and ear protection when cutting rebar or metal with a power saw/grinder
- Both vinyl and metal are very sharp - use gloves while working with these materials
- Avoid putting rebar stakes through utilities/lines that may be underground, call Dig Safe (811) and look at where power poles and water meters are located.
- Be aware of any bees/snakes/other critters that could be under the home
- Look for leaks in plumbing lines or unresolved grey/black water underneath a home that may need to be addressed before closing in a space.
- Look for falling insulation that may need repair either before or after underpinning.
- Wear face masks when working under any home.

Underpinning

Underpinning Project Planning

- Is the band joist, rim joist or ends of common joist needing repairs before underpinning is attached?
- Are there any obstacles around the home? How will you work around those? (AC/furnace units, gas tanks, porches, etc.)
- Where will access doors be needed?
 - Will they interfere with future projects? (ramps/porches/additions)
 - Aim to construct access doors directly next to water shut offs under the home.
- How tall will the underpinning be? Will any additional framing be required?
- Provide a method for cutting rebar or purchase precut rebar.
- Will the crawl space be insulated? It may be easier to insulate before the underpinning limits access
- Color of tin or vinyl the homeowner wants and will match the home? (if applicable)

Measurements Needed

- Measure perimeter of home and height off the ground at all corners
- Measure height at locations of access doors
- How many inside/outside corners are needed?
- Measuring for metal underpinning:
 - Metal sheets will be 3' wide, lay a tape measure across the ground and take vertical measurements at 3' increments (if there is a slope, measure higher side)
 - Add 3"-4" of height to each piece that will stick into trench in front of base plate
 - Consider getting a few extra pieces of metal in case of any mis-cuts around hitches/other obstacles
 - Keep a detailed diagram showing where each piece goes during installation

Quality Control

- Make sure top plate is set back 1 ½"
- Make sure that the bottom plate is installed directly below top plate
- Make sure the bottom plate is secured adequately with rebar
- Make sure vertical studs are installed every 4' and that they are plumb (if applicable)
- Make sure vinyl pieces lock together
- Make sure vinyl pieces are plumb as they are being installed
- Measure each vinyl piece individually (vertically)
- Make sure proper venting is installed.
- Fasten vinyl pieces through the nail flange into framing members.
- If the height of underpinning exceeds 36", make sure additional framing is installed

Common Mistakes

- Underpinning sticking out further than siding
- Plumb bob not used to set bottom plate
- Pieces inserted into the J-channel at the top but not snapped into each other
- Pieces at a visible angle
- Pieces cut too short and not 2"-3" stuck into the ground
- No venting
- Additional framing not installed for underpinning that exceeds 36" tall
- Vinyl pieces have been face screwed into framing members.
- No access door

Underpinning

After Work is Complete Quality Control Check

- Is there positive drainage away from the underpinning?
- Is there adequate venting?
- Are pieces fastened well?
- Are tops of corner pieces covered/flushed well?
- Are crawl space doors installed and sealed well?
- Are access doors covered with vinyl or sealed with exterior paint?

Group Leader Tips

- Someone can start cutting rebar into 1' sections while others can start on the top plate
- Once the first several feet of top plate are installed, other volunteers can follow by installing the bottom plate
- After several feet of the top/bottom plate are installed, vertical members can be installed
- After sections of the vertical framing members are installed, vinyl corners and J-channel can be installed (if using vinyl)
- Vinyl sheets can be installed after the initial vinyl trim is started
- Create an assembly line around the house so that teams can specialize in one task

Underpinning

Underpinning Materials Lists

Quantity	Item	Purpose / Notes
	2x4x ____ PT	Bottom Plate, Vertical members for each corner, other vertical members (as applicable)
	2x4x ____ F	Top Plate (2x4 can come in any length) Perimeter of home (in feet)/ length of lumber = # of pieces Horizontal members (as applicable), access door materials
	½" (#4 Rebar)	For anchoring bottom plate to the ground. 1' of rebar is needed for every 6' of bottom plate. <ul style="list-style-type: none"> ○ <i>Perimeter (in feet)/6' = # pieces of rebar needed</i> ○ <i># rebar needed/10' (typical selling length of rebar) = # of 10 pieces</i> Add a few extra pieces of rebar to account for extra
	3" Screws	Used to attach top plate and vertical framing
For Vinyl Underpinning		
Quantity	Item	Purpose / Notes
	J-Channel	Perimeter of home plus any needed for access door trim, hitches, etc., comes in 12' lengths
	Outside Vinyl Corners	Come in 10' lengths
	Inside Vinyl Corners	Come in 10' lengths
	Solid (non-vented) Soffit	Used for the majority of the underpinning Sheets are 1' wide and 12' long
	Vented Soffit	Used for venting at specific locations Sheets are 1' wide and 12' long <ul style="list-style-type: none"> ○ <i>Height x length = surface area</i> ○ <i>Add all sides to find total surface area</i> ○ <i>Total surface area x 1.1 = Added 10% for error</i> ○ <i>(Total surface area + 10% error)/12 (SF in each piece) = # of pieces needed</i>
	Roofing Nails	Used to attach vinyl trim and underpinning sheets
	White Aluminum Trim Nails	For attaching partial pieces at corners/access doors

Underpinning

Access Door Material		
Quantity	Item	Purpose / Notes
	½" Plywood	To cover the frame
	1 ½" Exterior Screws	To fasten the plywood to door frame
	Exterior Primer/ Paint Or get vinyl/J- channel or metal to cover access door with	To paint access door
	Exterior Hinges	
	Latch for Access Door	

Recommended Tools

Safety:

- Gloves (Sturdy/leather for working with metal)
- Glasses
- Ear Plugs

Power Tools:

- Miter Saw
- Drills/Impact Drivers
 - T-25 Driver to match deck screws
 - ½" Wood Drill Bit to pre-drill for rebar pieces
 - ⅛" Drill Bits - to pre-drill for metal sheets/venting (they dull quickly so 4-5 would be useful)
 - ½" Metal Drill Bit for pilot holes for jigsaw cut outs (metal only)
- Circular Saw
 - Metal Blade to cut rebar
- (or) Angle Grinder - with metal cutting blade to cut rebar
- Jigsaw
 - Metal blade to notch around hitch/other obstacles (metal only)

Digging Tools:

- Pick Axe - to dig trench around bottom plate
- Shovel - to level out ground as needed and create positive drainage

General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc.)
- Sawhorses
- Extension Cords/Splitters
- Tin Snips
- Level
- Heavy Hammer - to pound in rebar
- Plumb Bob
- Framing Square

Underpinning

Instructions for Vinyl Underpinning

Prepare for Underpinning Installation

- Remove any old underpinning and any other items around the base of the home
- There needs to be a flat surface to attach the top plate to, if necessary, trim back the chip board that is holding up the insulation about 4-5"

Install the 2x4 Top Plate

- The top plate will be installed with the 3 ½" side of the 2x4 against the floor joists (See Diagram 1)
- The outside edge of the top plate will rest 1 ½" back from the edge of the band joist (See Diagram 1)
- Attach to the floor joists with 3" screws

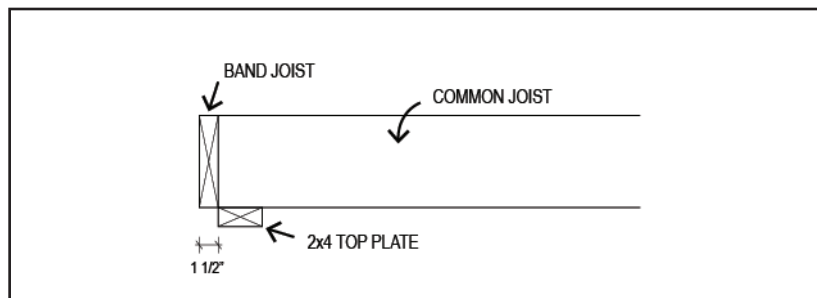


Diagram 1A

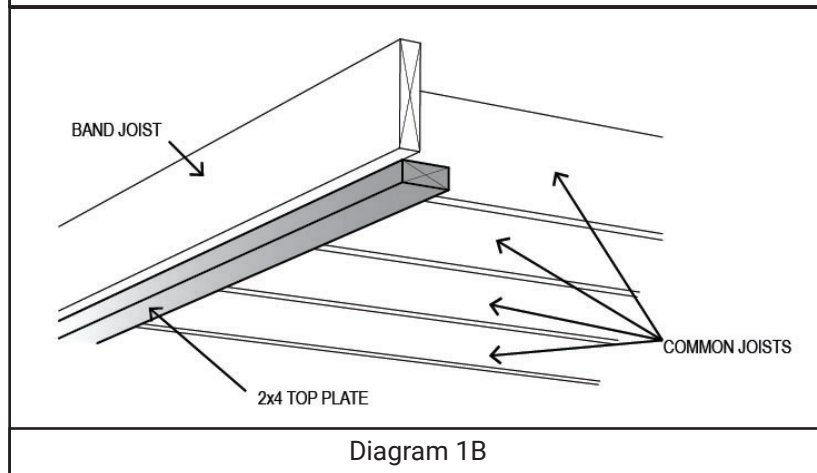


Diagram 1B

- Make sure that pieces of top plate meet on a floor joist so that there is something adequate for them to be attached to (See Diagram 2)

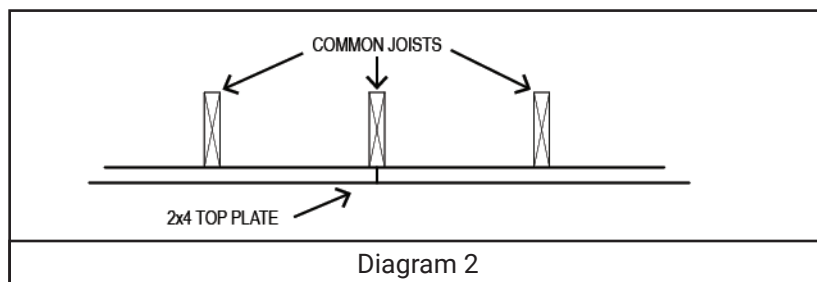
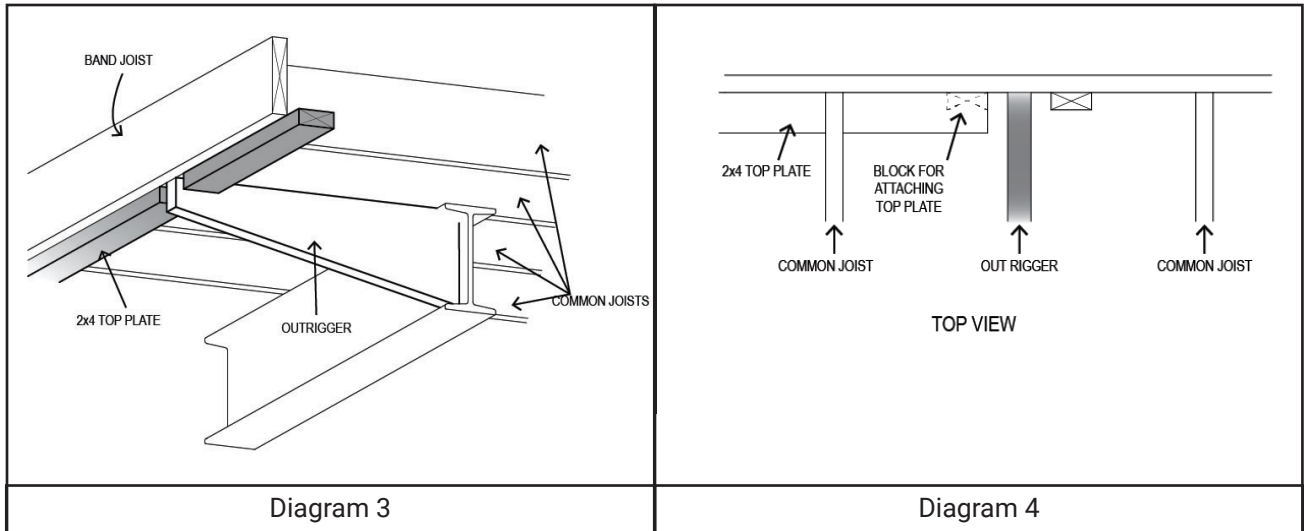


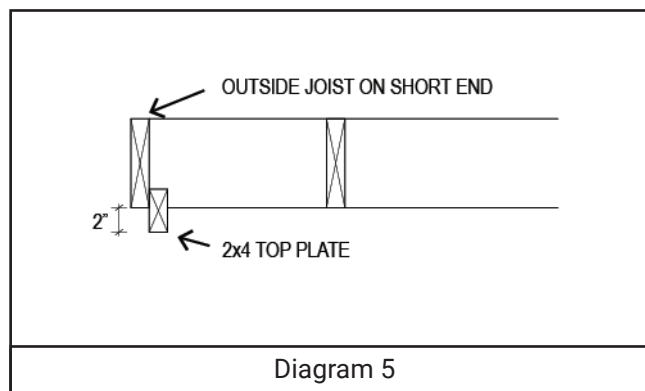
Diagram 2

Underpinning

- On the long sides of mobile homes there will likely be outriggers (metal supports from the main beam) that interrupt the ability to continuously run the top plate
 - When these are encountered, run the top plate to either side of the outrigger and install a block attached to inside of band joist, level with the bottom of the band joist, to attach the top plate to if necessary (See Diagram 3 and 4)



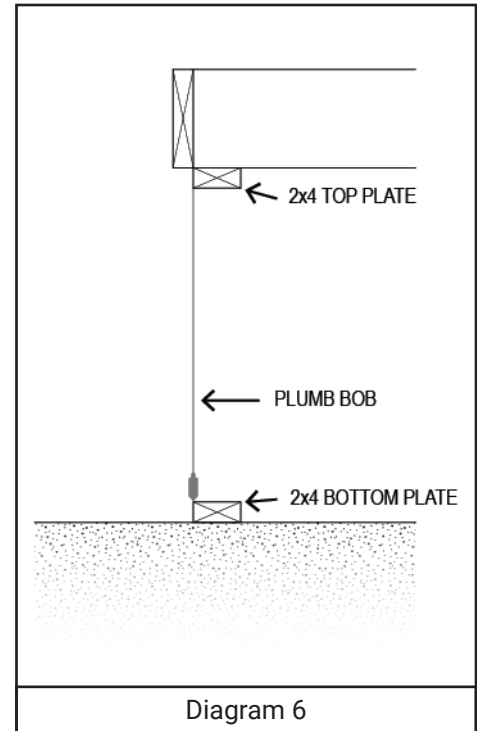
- The metal cross member across short ends of a mobile home may also make installing the top plate difficult. If there is not space for the 2x4 top plate to rest on the 3 1/2" side, it can be turned on edge or 2x2 material could be used for the top plate instead. If 2x2 material is used, make sure to pre-drill with an 1/8" bit before screwing into place.
 - If there is nothing to attach the top plate to on the short sides of a mobile home (or rim joist side of a house), the top plate can be installed behind and below the level of the rim joist (See Diagram 5)
- In some situations the J-Channel will need to be installed directly into the metal cross member or directly to rim joist.



Underpinning

Install Bottom Plate

- Cut 12" pieces of 1/2" rebar that will be used to anchor the bottom plate into place, (precut rebar is best if it is available)
 - Use a circular saw or an angle grinder with a metal cutting blade
 - Wear leather gloves, ear and eye protection, and DO NOT TOUCH the pieces directly after cutting, they will be hot
- Drill 1/2" holes in base plates every 6' or at each end of pieces shorter than 6"
 - When planning for rebar placement be cautious of any underground utilities and allow a 3' clearance from them with the rebar
- Use a plumb bob from the outside surface of the top plate to determine where the bottom plate will rest (See Diagram 6)
 - When bottom plate is directly under the top plate, hold in place and pound in the pieces of rebar (heavier hammers will be better for this)



Underpinning

Install Vertical Framing Members

- Vertical framing members will be 2x4 material
- Determine needed vertical framing members
 - If the space between the top and bottom plate is under 36" there should be vertical members every 4' (See Diagram 7A)
 - If the space is between 36" and 60" there should be vertical members every 4' and a center brace that runs mid-height inside the vertical members (See Diagram 7B)
 - To install measure the distance between the vertical supports and cut to each space's length
 - Toe-screw into the vertical supports
 - If installing galvanized flashing near the ground, add a lower cross member about 6"-10" above the bottom plate to screw the flashing and j-channel to.
 - If the space is over 60" there should be vertical members every 4' and two horizontal braces, evenly spaced and running perpendicular in between vertical members
- Mark location of the vertical members on the top plate
 - From the corner, the center of each vertical member will be at 4', 8', 12', 16', etc... (See Diagram 7)
- Read section on access doors on pages 235 and plan for those during vertical framing member installation
- Measure between the top and bottom plate to get the length for each vertical member
- Turn vertical members so that the wider side faces out (See Diagram 7)

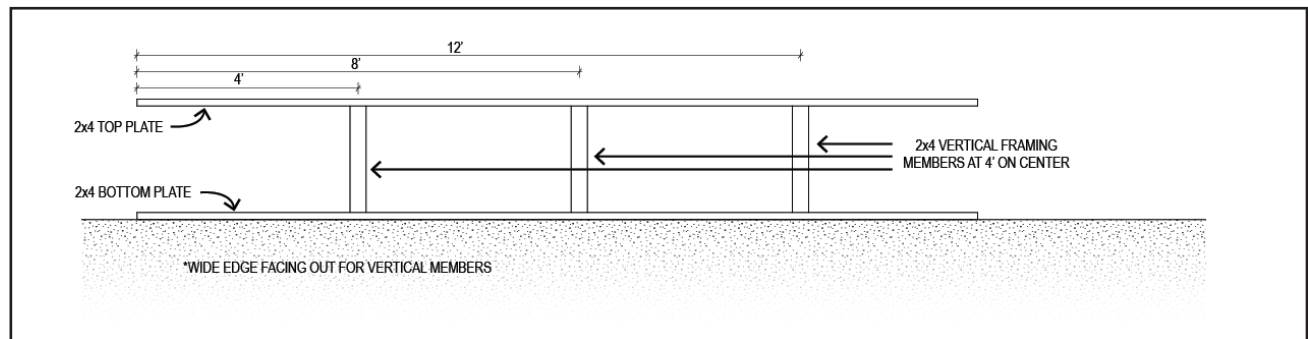


Diagram 7A

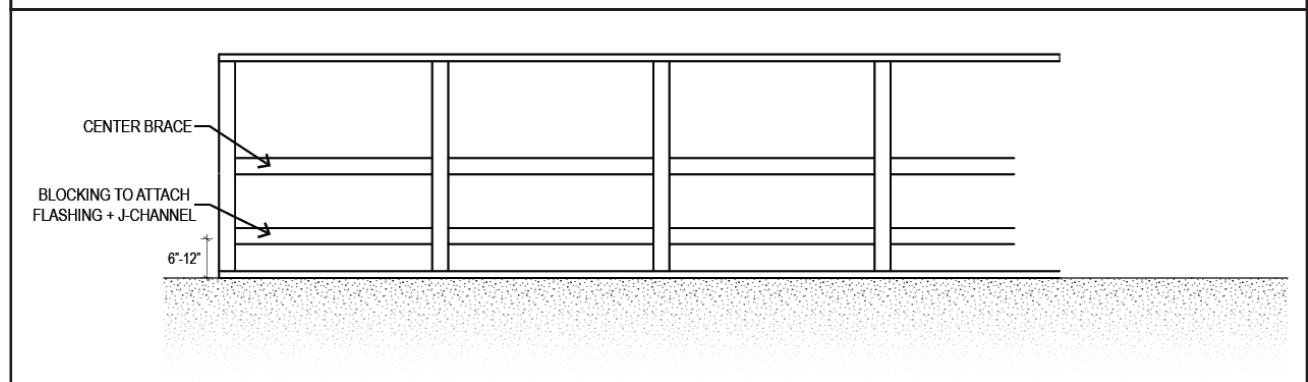
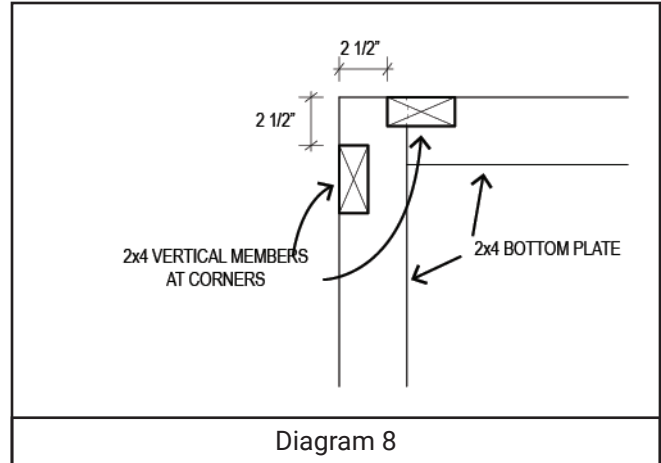


Diagram 7B

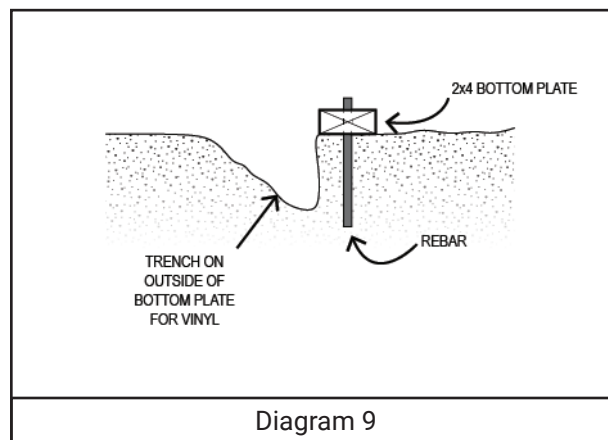
Underpinning

- Fasten at the top plate and then use level to make sure member is plumb before fastening to bottom plate
 - Toe-screw members into place with 3" deck screws
 - Pre-drilling with a $\frac{1}{8}$ " bit can make toe-screwing easier
- At each corner, install vertical members $2\frac{1}{2}$ " away from the true corner (See Diagram 8), corner piece dimensions may vary depending on distributor
 - Look ahead at corner pieces and Diagram 10



Trench Around Bottom Plate

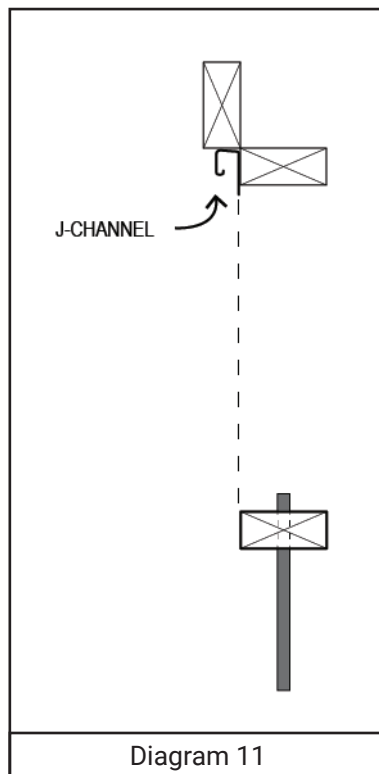
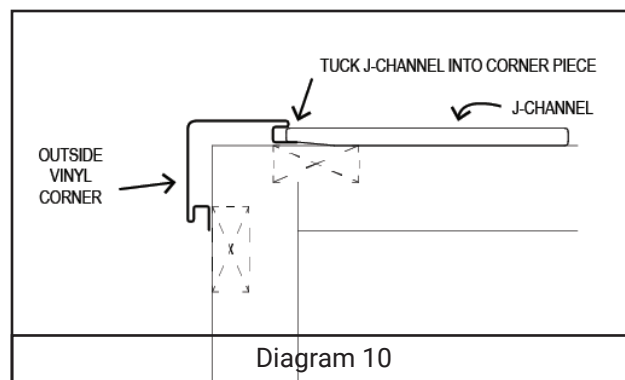
- After framing is complete, make a trench 4-6" inches into the dirt in front of the bottom plate (See Diagram 9)
 - Make sure the trench goes straight down from the bottom plate so that the vinyl will not bend when installed



Underpinning

Install Vinyl Trim

- Install vinyl corner pieces
 - These pieces will run from the top of the top plate to several inches into the trench, attach to the corner vertical members with roofing nails through the nailing tabs every 12"-18" (See Diagram 10)
- Install J-channel
 - J-channel will run only across the top plate, with the opening facing down (See Diagram 11)
 - Tuck the J-channel into the outside corner piece, then attach every 12-18" to the top plate with roofing nails (See Diagram 10 & 11)
 - Make sure to push up on J-channel when installing so that it does not sag
 - Start at one end of J-channel and work to the other to avoid sagging
 - If outriggers interfere, measure and cut pieces to rest between them



Underpinning

Access Doors

Access doors should be located near water/utility shut offs and other places the homeowners may need to be able to get to easily.

- The height of the door will depend on the height of the underpinning at that location, but should be 2 ½' - 3' wide
- Install vertical framing members to create opening for access doors
- Build a frame for door using 3" deck screws that will leave a slight gap all the way around when the door is in the opening (See Diagram 12)
 - Test fit before installing diagonal members
 - Install diagonal members in frame
 - To find angle, lay the wood across the frame and trace the needed angle
- Cover the door with either ½" plywood painted with exterior paint or trim with J-channel and use pieces of underpinning on door frame (See page 142-144 of vinyl siding section for instructions on installing J-channel around door)
- Attach door to frame using exterior hinges and make sure it swings conveniently
- Install latch and make sure that the door opens/closes well
- Install J-channel on either side of the opening for the access doors to catch the edges of the vinyl pieces (Shown in left side of Diagram 12)
 - Trim these vinyl pieces the same as pieces at the end of a row
 - Tack these partial pieces through the interlocking tab into the nailing flange of the previous piece using white aluminum trim nails

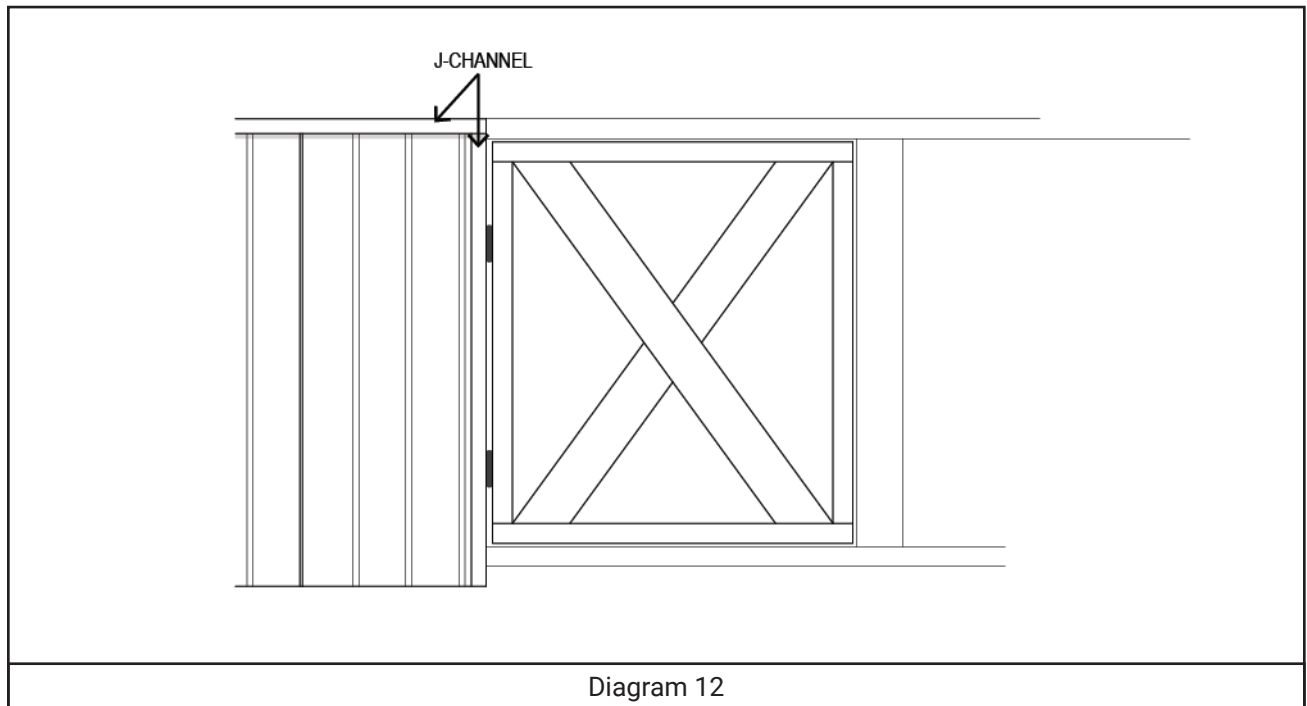


Diagram 12

Underpinning

Install Vinyl Pieces

- The underpinning pieces will be cut to length (from 12' pieces) and be installed vertically, interlocking with one another
- Soffit material can be used for underpinning, most of the material will be solid, some will be vented
 - See below on venting before starting to install vinyl pieces
- Measure from inside the top of the J-channel to about 3" below bottom of the base plate
 - Use framing square to make square marks
 - Use tin snips to cut vinyl pieces to length
 - Measure each piece individually
- Insert the non-tab side of the first piece of underpinning into the track of the corner piece, push up to the top of the J-channel (See Diagram 13 and 14)
- Attach at the top, check for plumb, then attach at the bottom with roofing nails
- After the first piece, each piece will lock together vertically
- Attach each piece at the top and bottom with roofing nails, and attach every fourth piece to the vertical members through nailing flange
- At the end of a side of the house, if the remaining piece to be installed is less than the full width of a normal piece, cut it lengthwise to the appropriate width
 - Make sure to measure from the non-tab side so the partial piece will still interlock
 - All partial pieces should terminate into a corner piece or J-channel
 - Tack these partial pieces through the interlocking tab into the nailing flange of the previous piece using white aluminum trim nails

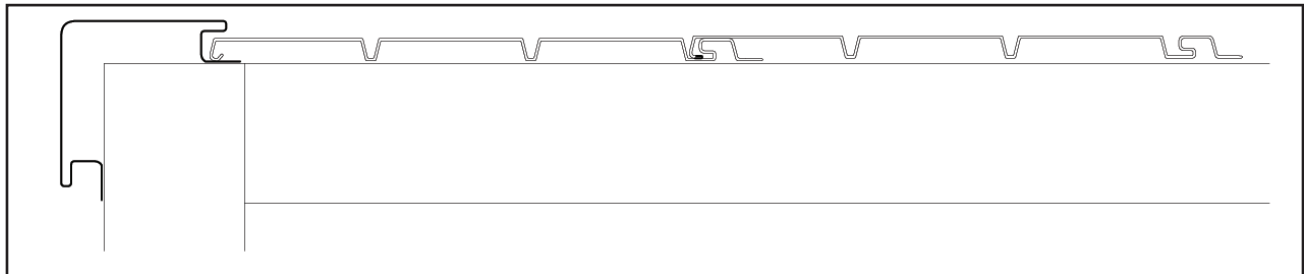


Diagram 13

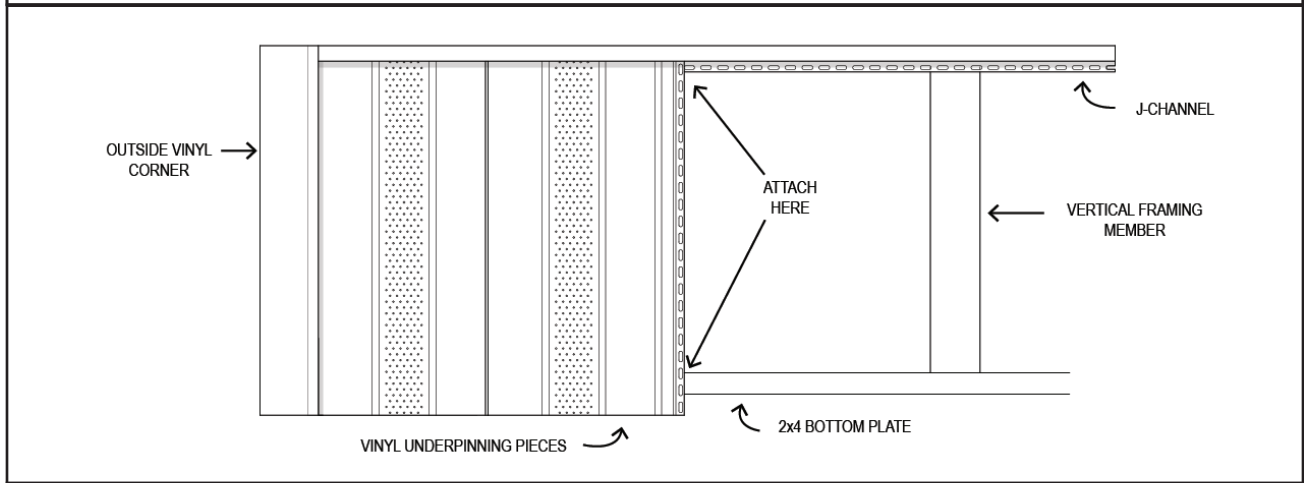


Diagram 14

Underpinning

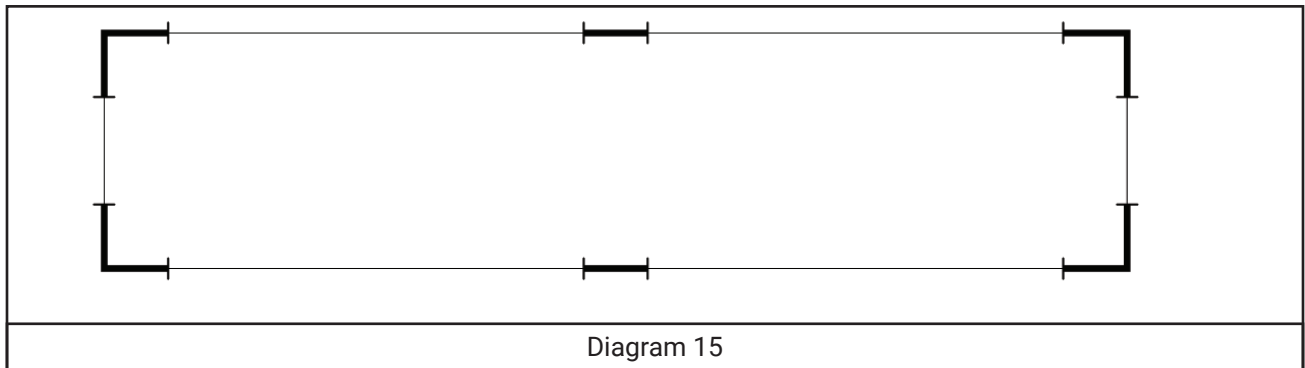
Special Consideration:

If the Underpinning being replaced was damaged by a weed eater. Metal flashing can be used at the bottom. (Will need to account for more j-channel will be needed for flashing installation)

- To install metal flashing add a lower horizontal member between the vertical supports between 8" and 12" above the bottom plate depending on the width of the flashing
- Attach the metal flashing to the horizontal member using pan head screws
- Install j-channel to the cross member above the bottom plate making sure to cover the screws.
- Vinyl soffit pieces will then be installed in the top and bottom j-channels and attached with roofing nails or panhead screws.

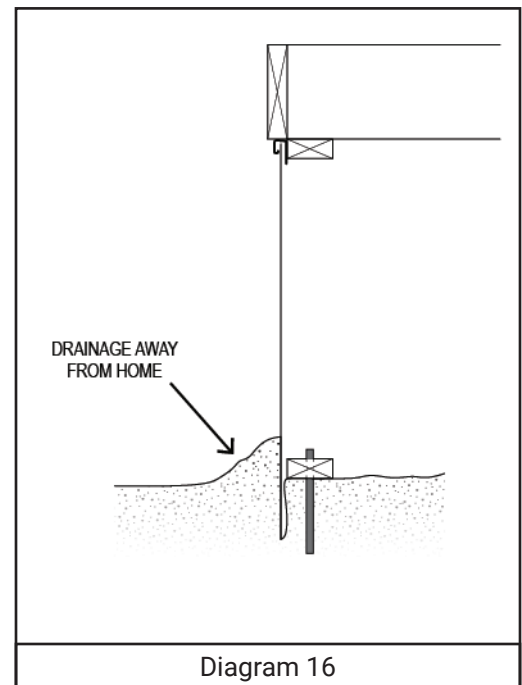
Venting

- Vented pieces of underpinning must be installed at all corners and halfway on long sides of the home
 - The vented vinyl pieces will interlock the same way as the non-vented, they will just be used in certain locations
 - At each highlighted section in Diagram 15, there should be 3 pieces of vented vinyl underpinning (3 pieces on each side of corner)



After Vinyl Installation

- After vinyl pieces are installed, push the dirt back up against the bottom of the vinyl so that it slopes away from the house, creating positive drainage (See Diagram 16)



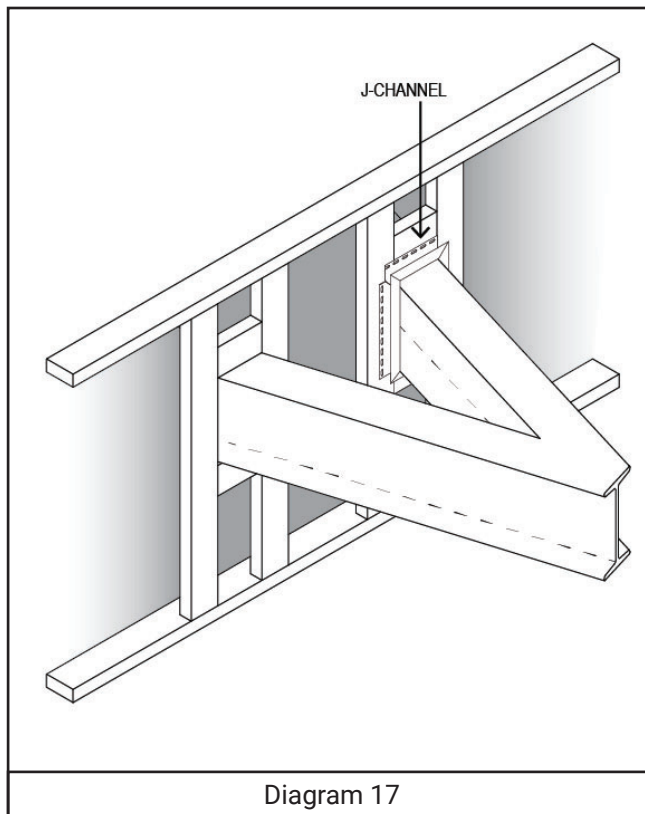
Underpinning

Mobile Home Hitches

- Diagram 17 illustrates how to install framing for underpinning around hitches
- The right side of the hitch in Diagram 17 shows J-channel installed to the framing around the hitch
- Follow instructions for how to install the J-channel (explained in the vinyl siding section of the manual)
- Similarly to how the vinyl underpinning fits into the J-channel along the top plate, it should be measured and cut to fit into the track around the hitch
 - For more information reference the vinyl siding section on pages 157 and use the same principles

Crawl Space Venting Information

Crawl space ventilation is important because it allows outside air to circulate within the crawl space. This is important because the outside air helps prevent moisture accumulation, which can cause rot to the floor system/foundation.



For every 150 SF of surface area of the crawl space, there should be at least 1 SF of venting.

For example, if a single wide is 60' x 14', the crawl space area is 840 SF. (840/150 = 5.6) Therefore, there must be at minimum 5.6 SF of crawl space venting.

If there is a home that has underpinning installed, but it is not vented there are several ways to add ventilation:

(Vents should be installed towards the top of the underpinning)

- For metal or vinyl underpinning, a grid of holes can be drilled (See above in Metal Underpinning)
 - $\frac{1}{8}$ " is the maximum size that the ventilation holes can be
- Holes can be cut and pre-made vents installed
 - For this method use sheet metal or neoprene screws
 - Make sure to silicone caulk around the hole for the vent before installing
 - Wipe off excess caulk after vent is installed
 - A typical vent for this would be 8"x16" and galvanized
 - These can be cut with tin snips to fit between the ribs in the tin if necessary
- For vinyl underpinning that is not vented, it may be possible to replace several pieces with vented vinyl pieces, but make sure you can match the width of the existing pieces



Porches

Why Porches? For safety, stairs and porches must have handrails and must be sturdy. Homes should have two exits available for use in case of emergencies. Additionally, porches can provide outdoor living space and are favorite parts of the home for many homeowners.

Section Contents:

• Frame	245
• Posts.	246
• Notched 6x6s	249
• Joists	250
• Decking	252
• Diagonal Bracing.	254
• Stairs.	254
• Handrails	260

Safety

- Wear gloves when removing debris/old structures
- Make sure to bend down or remove any nails sticking out of debris lumber
- Wear safety glasses when cutting or working near someone cutting with power tools
- Communicate with homeowner/block off entrance if needed
- Put up temporary rails overnight if needed for homeowner to have accessibility to home
- Set up a cutting station facing away from the work area with plenty of space to maneuver
- Cover any holes that have been dug overnight

Porch Project Planning

- While you are working on the porch, does the family have another way in and out of the house?
- Are any utilities - water/electricity in the area where the ramp will go? Call Dig Safe
- Are there any underground utilities - water/electric in the area where the porch will go?
- Where will the stairs come off the porch?
 - This should be convenient to the way the door swings and to the natural walking path if possible
- Will any permits/inspections be needed?

Porches

- What size will the porch be? ASP builds a standard 5'x5' or 6'x10'
- All porch material will be pressure treated lumber
- Be aware that when a porch is removed from the home it may expose more work such as Band, Rim, or Common joist repair, wall framing repair, siding repair, etc.
- Does local building code have any specific porch requirements? (6x6 instead of 4x4 posts, kick plates on stairs, graspable handrails)

Measurements Needed

- Measure the height to the bottom of the door from the ground - determines the length of posts and stringer length
- Determine which posts to use
 - If porch will be under 8' high use 4x4 posts
 - If porch will be over 8' high use 6x6 posts (porches of this height must be approved by construction consultant or Home Repair Coordinator)
 - Check the local building codes, as some places require 6x6 posts regardless of height

Group Leader Tips

- Some volunteers can split cap blocks while others are digging
- Once the exterior frame is put together
 - Some people can start pre-cutting deck boards to length while others install common joists
 - Some can start working on stairs (laying out and cutting stringers) while joists/decking are installed
 - The stair assembly can be largely put together separate from the porch
 - Once one stringer is cut out - you can use it to mark where the holes for the posts at the bottom of the stairs will go and start digging those
 - Once the stair assembly is put together, someone can pre-cut the treads for the stairs
- Posts can be cut to height and top and bottom rails installed after the frame is put together - just make sure to account for the 1" of the decking if it is not installed yet
- Spindles can be pre-drilled in bulk somewhere to the side - just make a sample so that the screws will be sure to hit the rails

After Work is Complete Quality Control Check

- Make sure that all deck boards that were notched for posts are supported underneath
- Make sure finished handrail height is 36"
- Make sure the first step is down, not out and that the steps are 36" wide
- Make sure that the tops of the spindles and posts are covered by the 2x4 cap board at top of the handrail
- Make sure to sand all handrails

Porches

Quality Control

Posts/Frame

- Make sure a hole is dug for the post that will be used for the top of the stair handrails
- Make sure posts at top of stairs are 36" wide from inside to inside of the posts
- Make sure framing is dropped 1 ¼" below bottom of door frame to allow space for deck boards
- Make sure joists are parallel to the house so that the deck boards will be perpendicular
- Make sure additional framing member is installed against the inside of the 2 posts closest to the house - attached to the posts with LedgerLOKs
- Make sure frame is attached to posts with LedgerLOKs
- If porch is over 30" tall make sure diagonal bracing is installed
- Make sure posts are left long until measuring for handrails
- **DO NOT cut posts until the porch is finished and work begins on the handrails.**

Decking

- Make sure decking does not interfere with door opening
- Make sure deck boards are crowned
- Add blocks below where notches are made in deck boards around posts

Steps

- Make sure first step is down, not a step out
- Make sure rise/run is consistent
- Make sure stringers are square to the porch

Handrails

- Make sure bottom and top rail are flush to the inside of the posts around the porch
- Make sure finished handrail height is 36"
- Make sure spacing of spindles is 3 ½"
 - Make sure to pre-drill holes for spindle

Common Mistakes

Posts/Frame

- Hole is forgotten until frame is set, difficult to dig around frame
- Posts set 36" outside to outside and stairs end up too narrow
- Framing butted up to the bottom of the door frame, no space for deck boards
- This framing member is forgotten and there are only deck screws holding the back of the frame to the posts
- Diagonal bracing forgotten altogether
- Posts cut flush to framing
- Posts are cut too short for the handrails to be an adequate height.

Decking

- Adequate space not left for deck boards
- Blocking forgotten and boards weak around posts

Stairs

- Ledger board is forgotten, and stairs are attached to frame making the first step out, not down
- Rise and run are inconsistent

Handrails

- Bumpers are attached to the inside of the posts, not between the posts
- Posts cut off at 36", making finished handrail height too high
- Posts cut off too short and the handrail is lower than 36"
- Pre-drill step skipped, spindles splitting
- Spindles installed upside down

Porch Materials List

5'x5' Porch (Stair material not included - see below)		
Quantity	Item	Purpose / Notes
5	4x4x__ PT (or 6x6)	Posts within frame
4	2x6x10 PT	Exterior frame, common joists
2	2x4x8 PT	Blocking, temporary supports, cross piece for
		bottom of stairs
6	12' Deck Boards	Walking surface over joists
2	2x4x12 PT	Diagonal bracing
3	2x4x10 PT	Top/bottom rail and cap around frame
30	Pre-cut spindles	For rails around landings

6'x10' Porch (Stair/Handrail material not included - see below)		
Quantity	Item	Purpose / Notes
7	4x4x__ PT (or 6x6)	Posts within frame
6	2x6x10 PT	2 long exterior frame members, common joists
1	2x6x12 PT	Cut in half for short sides of frame
2	2x4x8 PT	Blocking, temporary supports, cross piece for bottom of stairs
11	12' Deck Boards	Cut in half for walking surface over joists
2 (or 3)	2x4x12 PT	Diagonal Bracing (Add third for diagonal bracing on center posts if porch is over 4' high)

6'x10' Handrails (if steps coming off of 10' side of porch)		
Quantity	Item	Purpose / Notes
5	2x2x12 PT	Top/bottom rail and cap around framing
45	Pre-cut spindles	2 long exterior frame members, common joists

6'x10' Handrails (if steps coming off of 10' side of porch)		
Quantity	Item	Purpose / Notes
3	2x4x10 PT	Top/bottom rail and cap on the 10' side
3	2x4x12 PT	Top/bottom rail full 6' side, top/bottom rail and cap in small section beside steps
1	2x4x8 PT	Cap on the full 6' side
45	Pre-cut spindles	For rails around porch

Porches

Stair Material (for both 5'x5' and 6'x10')		
Quantity	Item	Purpose / Notes
	2x12x__ PT	<i>The length of piece needed for each step is one foot for each step plus one foot</i>
1	2x10x10 PT	Cross pieces for top and bottom of stairs, ledger board to hang stairs
	2x4x__ PT	Top/bottom rail and cap for handrails on stairs, (6 lengths of 2x4 the same as the required length for the stringer)
1	4x4x12 PT	Cut in half for posts at bottom of stair handrails
	2x6x__ PT or 2x12x__ PT	Stair treads, 2 pieces of 2x6 or 1 piece of 2x12 38"-40" for each stair tread
	Pre-cut spindles	For stair rails, <i>horizontal distance between posts for top and bottom of stairs (in inches)/5" = # of spindles</i>

Other Materials/Fasteners		
Quantity	Item	Purpose / Notes
5'x5' Porch		
6	4" Solid Concrete Blocks	Base for steps, ½ in each post hole
30-35	LedgerLOKs	Attaching posts to frame, stairs to frame, ledgers to posts, posts to stairs
	2 ½" Deck Screws	To attach deck boards and spindles
	3" Deck Screws	For all other framing
	2x6 Joist Hangers	For common joists (not in contact with posts)
6'x10' Porch		
7	4" Solid Concrete Blocks	Base for steps, ½ in each post hole
45-50	LedgerLOKs	Attaching posts to frame, stairs to frame, ledgers to posts, posts to stairs
	2 ½" Deck Screws	To attach deck boards and spindles
	3" Deck Screws	For all other framing
6	2x6 Joist Hangers	For common joists (not in contact with posts)

Recommended Tools

Safety:

- Glasses
- Gloves
- Ear Plugs

Digging Tools:

- Post Hole Diggers
- Shovels
- Digging Bars or Sledge Hammer to break blocks

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc.)
- Sawhorses
- Extension Cords/Splitters
- Framing Square - for laying out stairs
- 4' Level
- Post Level
- Prybars - if deconstructing
- Marking Paint

Power Tools:

- Drills/Impact Drivers
 - (2-3) 1/8" Drill Bits - to pre-drill handrails and spindles
 - (3-4) T-25 Drivers for Deck Screws
 - 5/16" Hex Drivers or T-40 Driver coordinating to heads of LedgerLoks
- Miter Saw
- Jig Saw - for notching around posts/finishing cuts in stringers
 - Wood Blade
- Circular Saw - cut posts to handrail height Reciprocating Saw
 - Demo Blade
 - Wood Blade

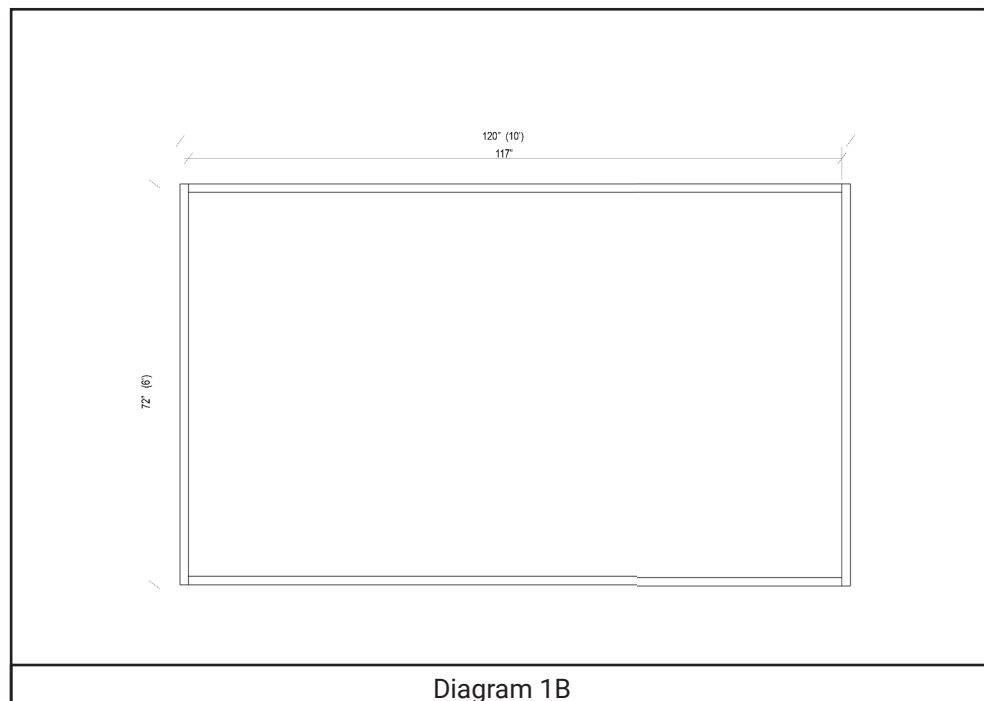
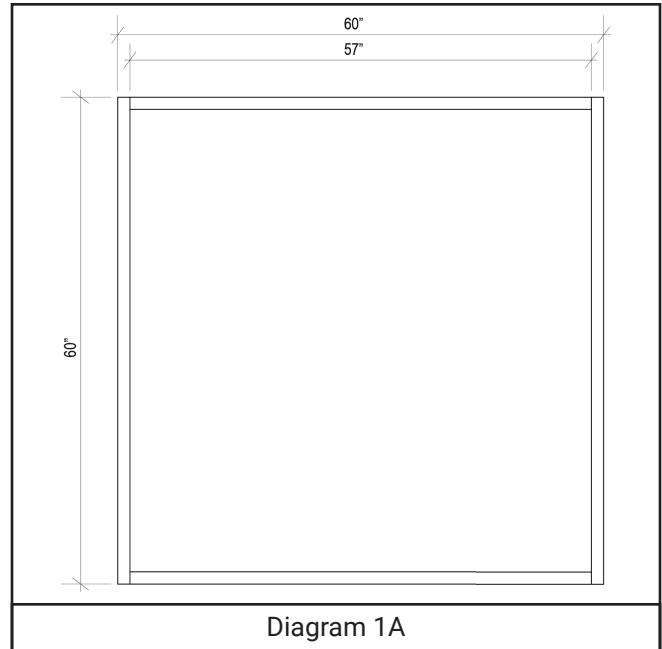
Porches

Porch Instructions

Two standard sized porches are 5'x5' and 6'x10'

Build Frame

- Build 5'x5' frame (See Diagram 1A)
 - From 2x6 cut two pieces 57" and two pieces 60"
 - Arrange these to form the outside perimeter of the frame at a finished 60"x60" (5'x5')
- Build 6'x10' frame (See Diagram 1B)
 - From 2x6 cut two pieces 72" and two pieces 117"
 - Arrange these to form the outside perimeter of the frame at a finished 72"x117" (6'x10')
- Use a framing square to make sure the corners are square and add some temporary diagonal bracing to keep the shape while the frame is moved
 - Arrange bracing so that it will not be in the way when it is held in place against the house and does not interfere with corner posts.
- Move frame to desired location for porch
 - Pay attention to which direction the door swings when placing frame so that homeowners will not be walking into porch rail

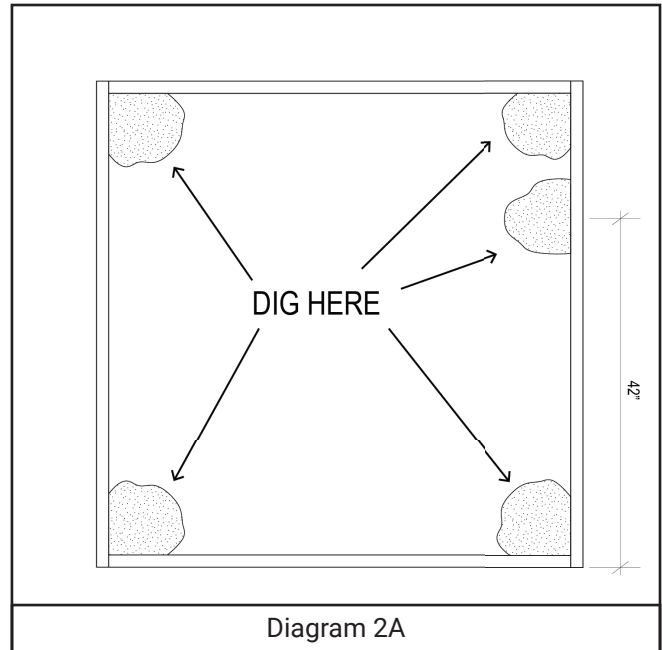


Porches

Install Posts and Frame

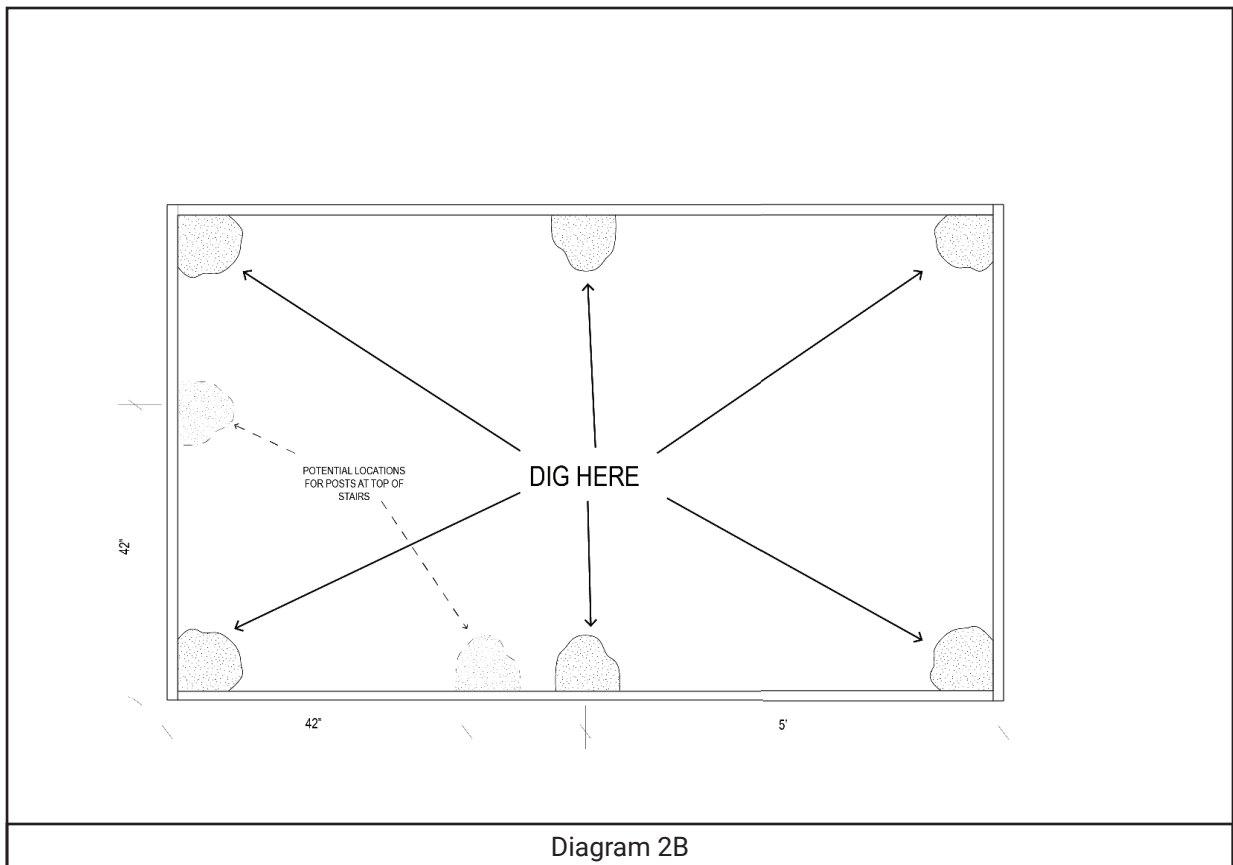
For 5'x5' (See Diagram 2A)

- Mark each corner on the ground, holes will be dug for posts at these marks (See Diagram 2A)
- There will be a 5th hole for the post at the top of the stairs
 - Measure over 42" from the corner that the stairs will be on to indicate where that hole will be
 - Stairs can come off front or either side
 - **IF BUILDING FOR A RAMP BE SURE TO SPACE POSTS 41 1/4" APART.**



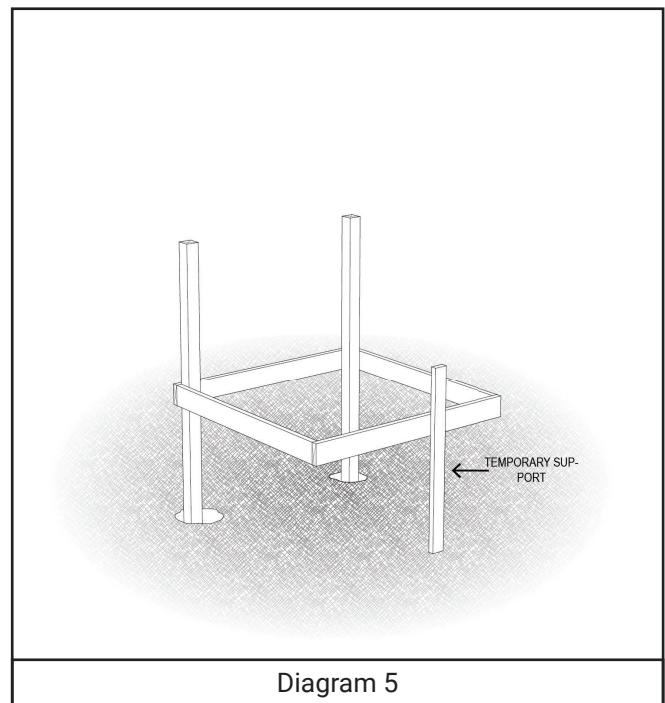
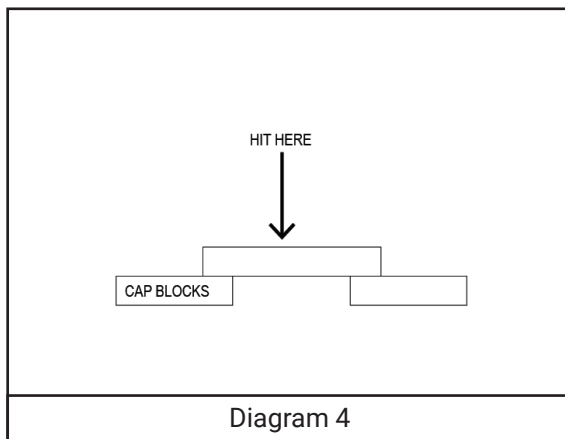
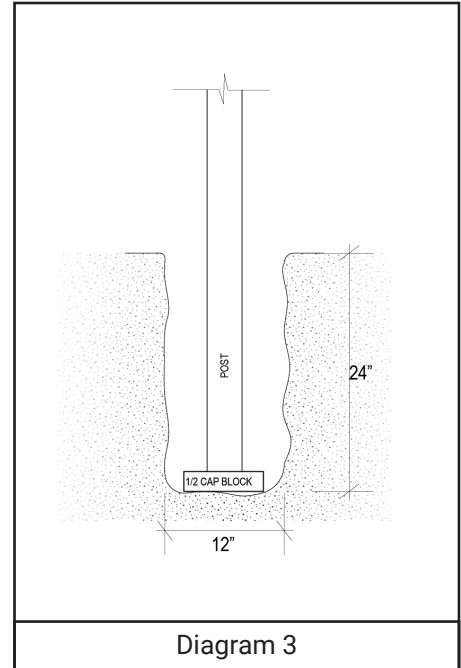
For 6'x10' (See Diagram 2B)

- Mark each corner on the ground and in the middle of the 10' sides, holes will be dug for posts at these marks
- There will be a 7th hole for the post at the top of the stairs
 - Measure over about 42" from the corner that the stairs will be on to indicate where this hole will be
 - Stairs can come off of front at each corner or either side



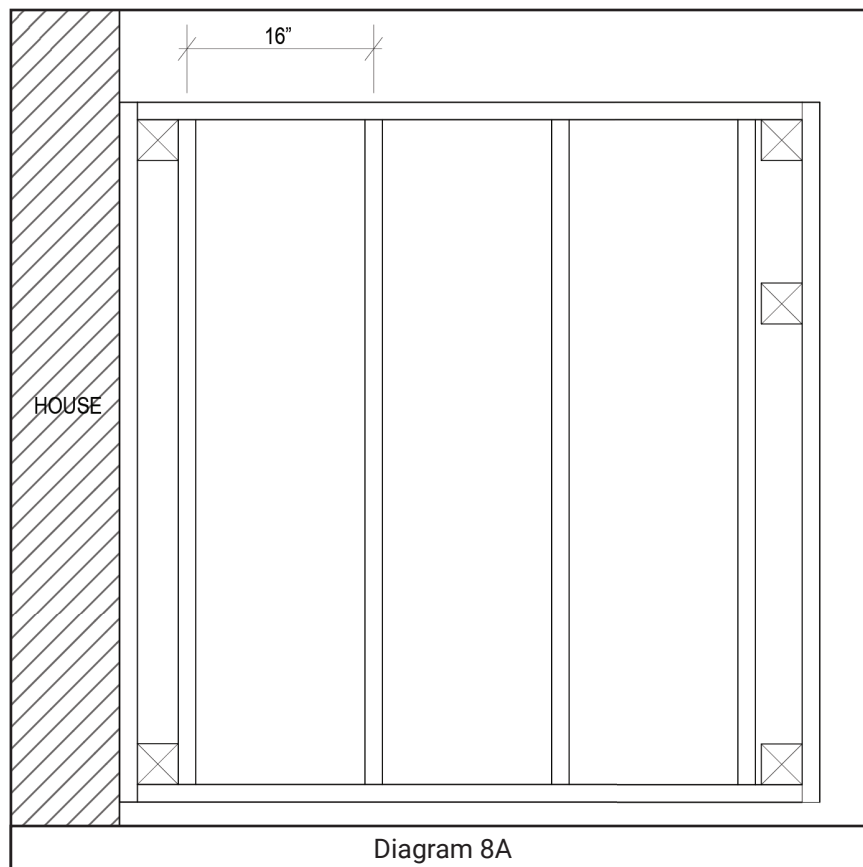
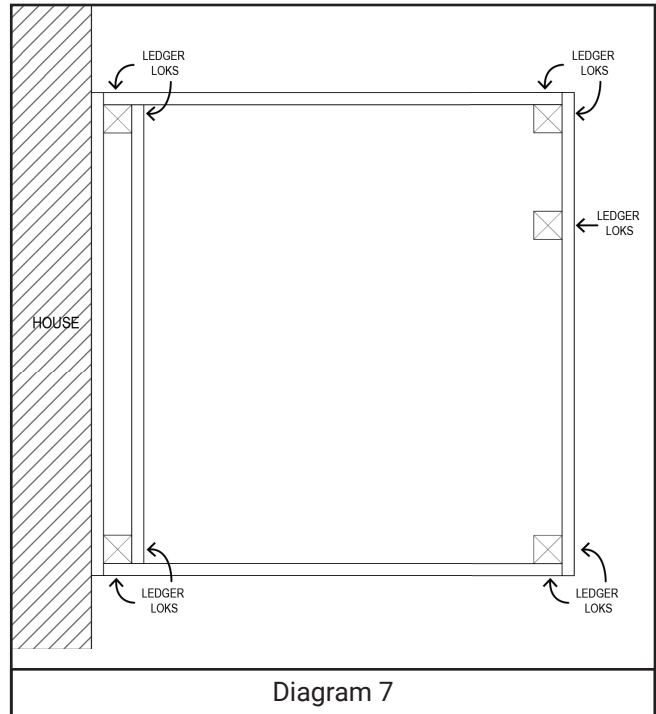
Porches

- Dig holes 12"x12"x24" (or 16"x16"x24" for 6x6 posts) (See Diagram 3)
- Tamp/pack dirt flat in bottom of hole with digging bar or sledge
- Place either a split cap block or 3" of dry sackrete in the bottom of each hole
- For cap blocks, split with digging bar or sledgehammer, place half of a cap block in each hole, and make block level (See Diagram 4)
 - Do not split all of the blocks - 2 will be needed whole for base of stairs
 - For sackrete, after pouring in 3", tamp down and make flat with sledge or digging bar
- Leaving the frame over holes, set the two (for 5'x5') or three (for 6'x10') posts in the holes touching the home and lift frame into place
 - Use a deck board as a spacer and leave a 1/4" - 1/2" gap between the door sill and the top of the decking
 - Make sure posts are plumb and the frame is level between the two posts (don't worry about level of frame perpendicular to the house right now)
 - Temporarily fasten with screws
 - Use a temporary support for the front of the frame (a 2x4 touching the ground and fastened to the frame works well, or two pieces for a 6'x10') (See Diagram 5)
 - Back fill holes and compact dirt several times in the process



Porches

- Set the additional posts (3 more for 5'x5' and 5 more for 6'x10')
 - Make sure they are plumb, temporarily attach with screws
 - Backfill holes and compact dirt (*see next page if notching 6x6s)
- **Do not cut off posts - they will be used for handrails**
 - For 6'x10' only, cut off the one post in the center of the long side against the house even with the top of the frame (See Diagram 8B, page 253)
- An additional 2x6 frame member should be installed in front of the rear posts for both 5'x5' and 6'x10' (See Diagram 7)
- Fasten frame to posts with 2 LedgerLOKs where each frame member intersects a post after double checking plumb/square

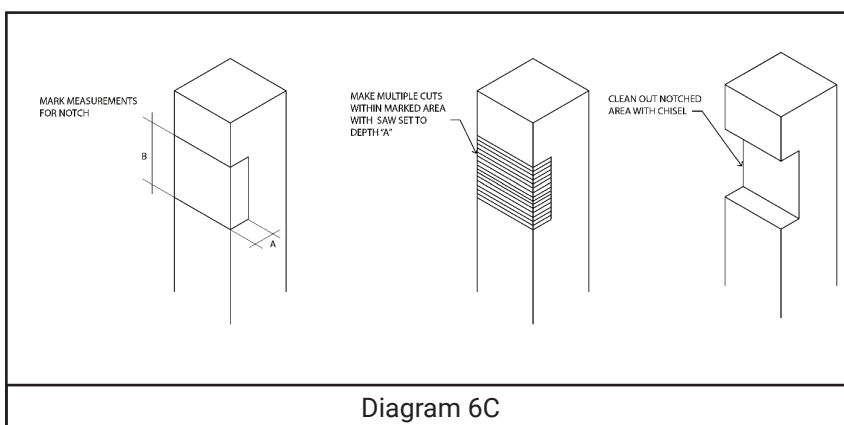
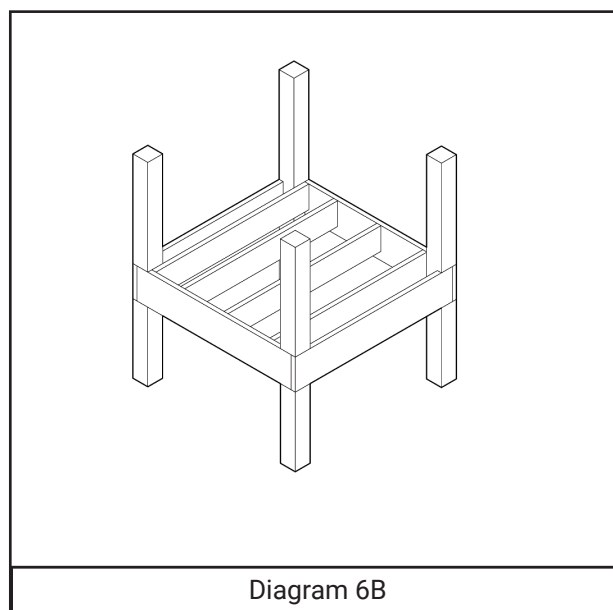
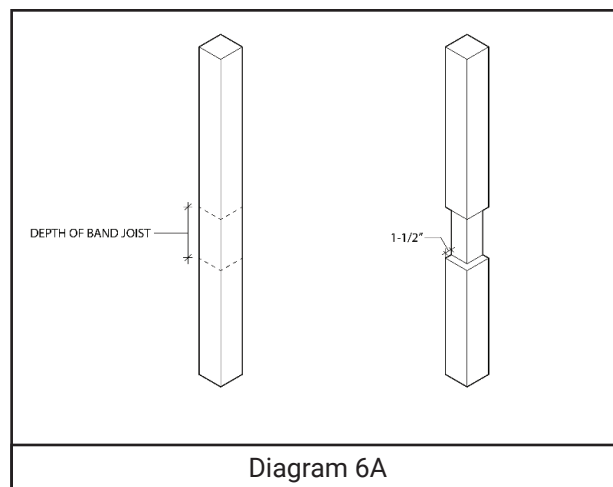


Porches

Special Consideration for using notched 6x6's

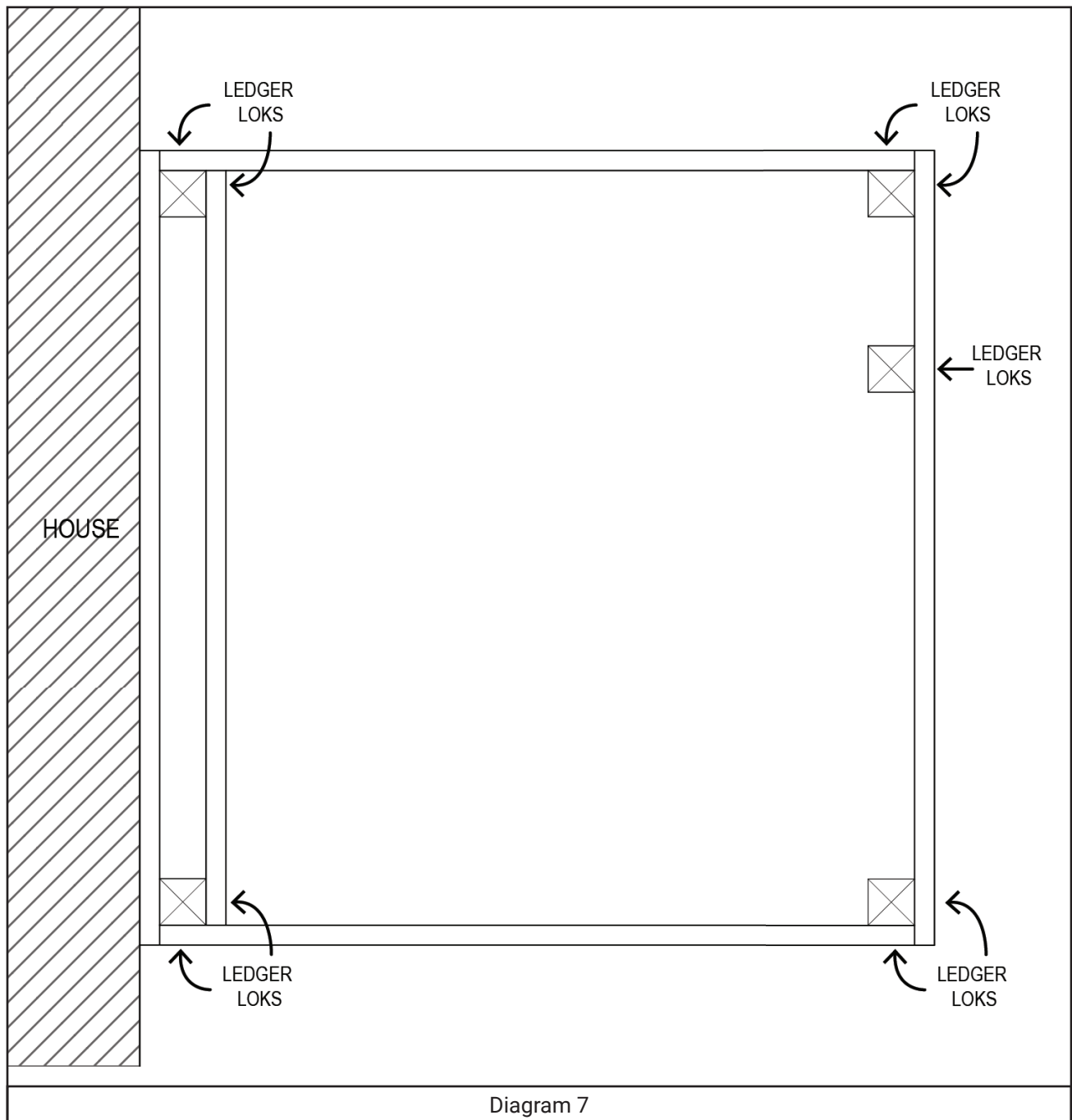
If working in a county that requires the frame of the deck to be supported by a notch in the 6x6 you can follow directions listed prior with some special considerations.

- It tends to be easier and look nicer to make the stairs the same width as the deck when using 6x6 posts. It takes away the need for the 5th post for the stairs on the deck but requires a fourth stair stringer.
- If working in loose soil, a level 4" concrete pad may be needed instead of cap blocks to ensure height of post remains consistent throughout process.
- When using the frame to mark and dig holes, remember the post will shift 1 1/2" after the notch is made.
- When leveling the frame additional braces may be required to hold the four posts plumb
- Once the frame is level and temporarily screwed into the posts, mark the top and bottom of the frame at the posts. These marks are where the notches will be located. (Mark specific post location on each post)
- Remove frame and posts. Move posts to a proper cut station and notch posts. Notching can be achieved by setting the depth of a circular saw at 1 1/2" or slightly deeper and making several passes. The chips left can be knocked away with a hammer and cleaned up with a reciprocating saw, oscillating multitool, or by hand with a chisel.
- This will create a notch for both frame (band and rim joist) to fit into and be supported by. Attach using county approved fasteners. (LedgerLOKs are accepted in most counties, but some like Jonesville will require carriage bolts)

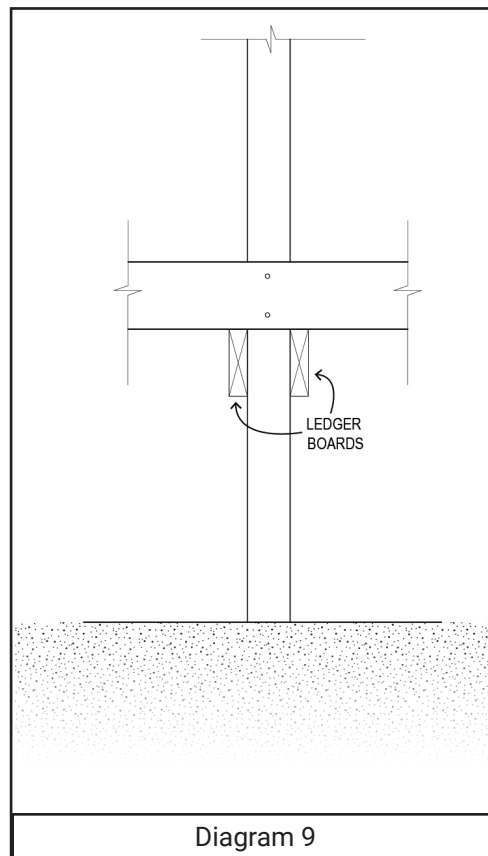
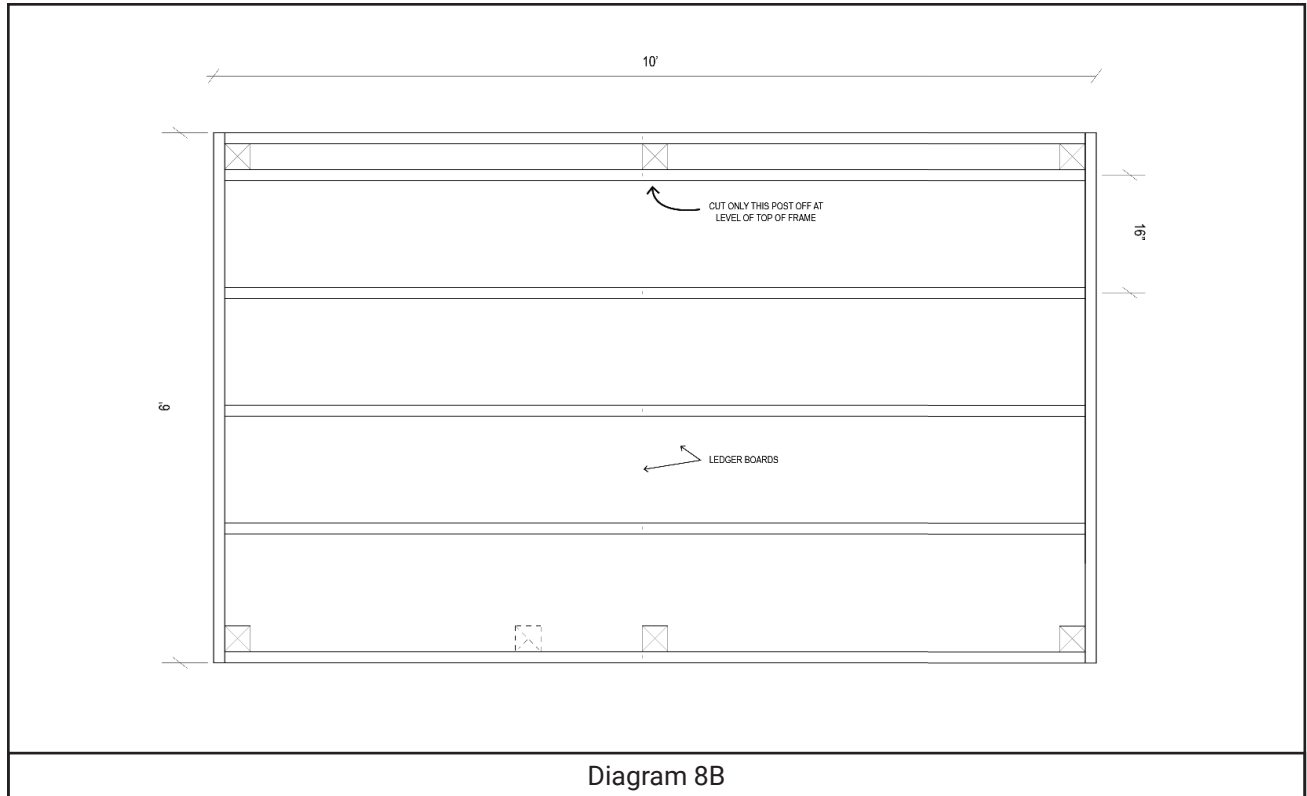


Porches

- Install common joists (See Diagram 7)
 - Joists should run parallel to the home
 - Install common joists every 16" on center
 - Measure and install each common joist with deck screws through the band joist
 - Once each joist is in place, add a 2x6 joist hanger using joist hanger nails in holes on the flat surface and through the diagonal holes (NEVER USE SCREWS unless they are specific Joist Hanger Screws)
- For 6'x10' only, install 2x6 ledger boards on both sides of the center posts running underneath the common joists (See Diagram 8B and 9, facing page)
 - Attach the ledger boards to the posts with LedgerLOKS



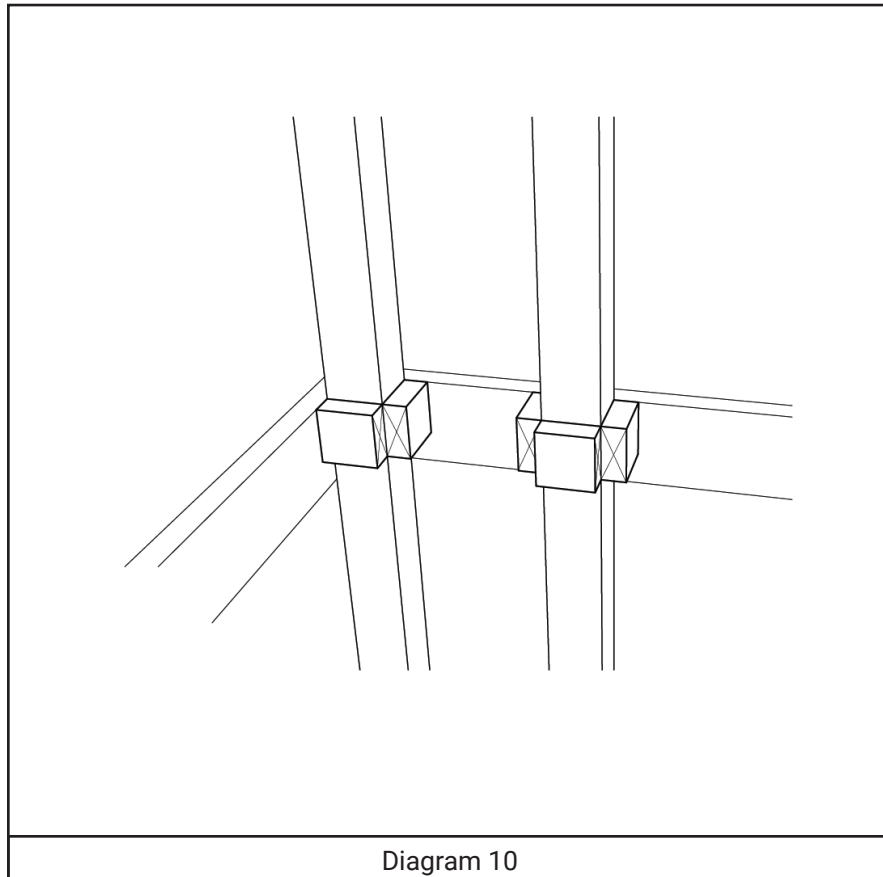
Porches



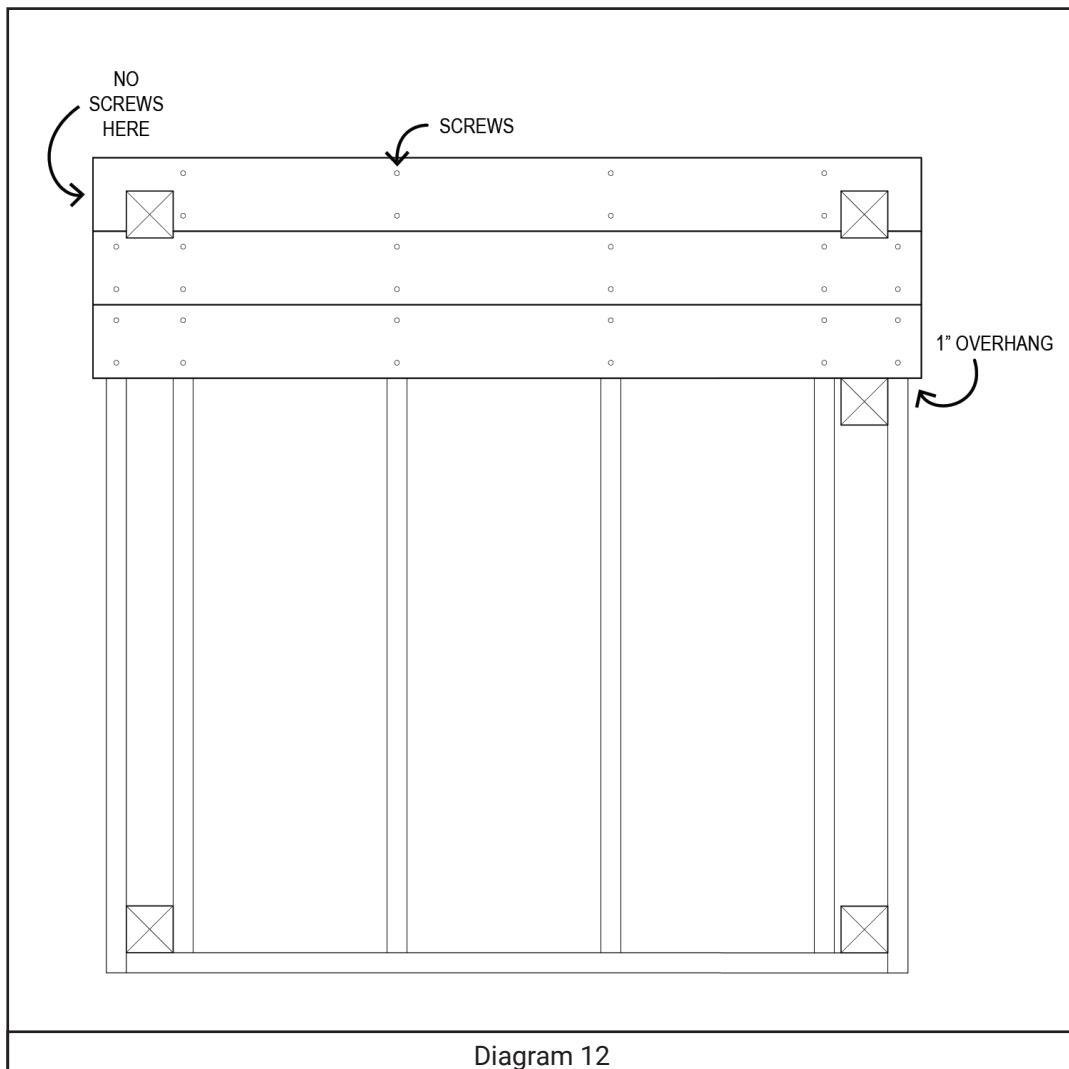
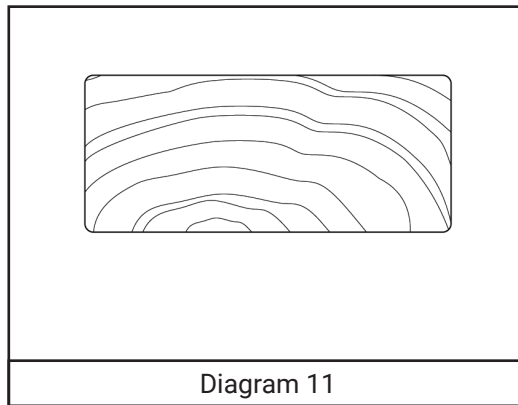
Porches

Install Decking

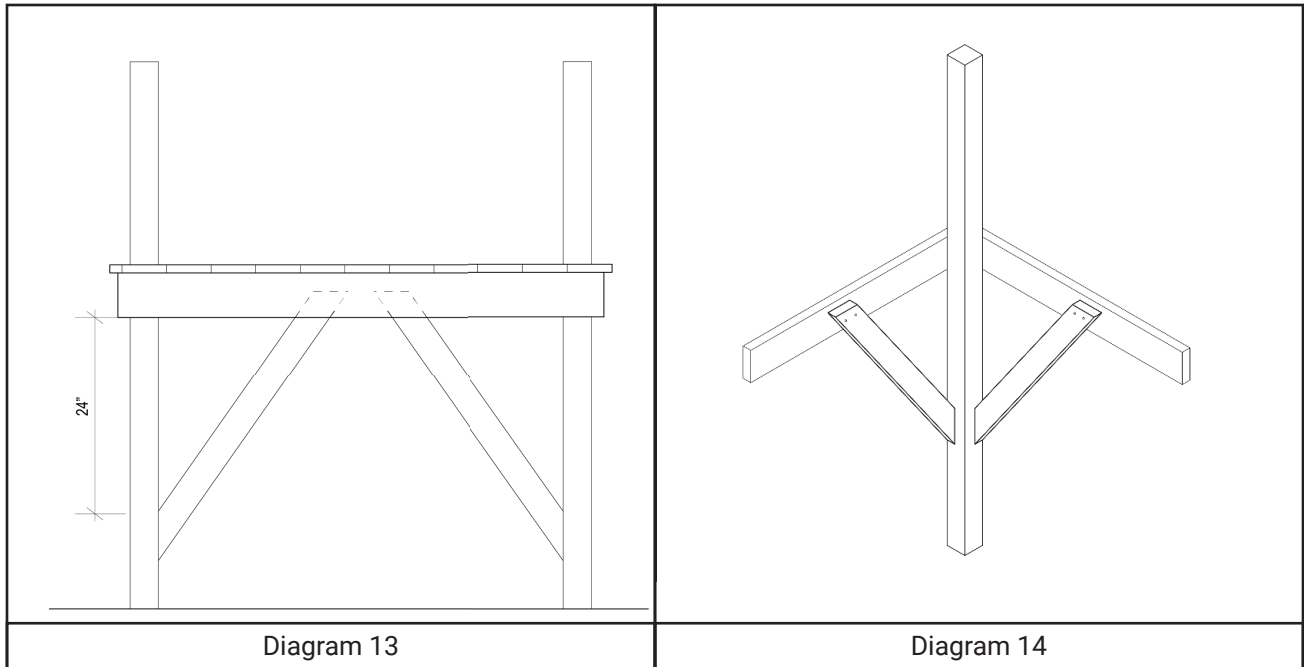
- Add blocks (cut from 2x4) at each post to provide a bearing surface for boards where they are notched around posts (See Diagram 10, facing page)
 - Make sure to pre-drill the holes in these small pieces with $\frac{1}{8}$ " drill bits to prevent them from splitting
- Decking will run perpendicular to the joists
- Allow for 1" overhang if you have boards that will let you to do that without excess waste. Otherwise you can have the boards cut flush against the size of the frame (this will be most common if utilizing 10' boards on a 5x5 porch).
- Crown boards when installing by looking at the end grain of the boards (this helps water to run off rather than staying in place on the wood) (See Diagram 11, facing page)
- Notch around posts using a jig saw, do not put screws into short sides of the notches (they will break easily) (See Diagram 12)
- Put two 2 $\frac{1}{2}$ " deck screws through the deck board into each joist about 1" in from the edge of the board. Predrilling these holes will help prevent the board from splitting (See Diagram 12)
- Do not leave any spaces between the boards, as the treated lumber dries out it will shrink, and small gaps will form to allow water to run between
- Notch around posts using a jig saw, do not put screws into short sides of the notches (they will break easily) (See Diagram 12)
- Put two 2 $\frac{1}{2}$ " deck screws through the deck board into each joist about 1" in from the edge of the board. Predrilling these holes will help prevent the board from splitting (See Diagram 12)
- Do not leave any spaces between the boards, as the treated lumber dries out it will shrink, and small gaps will form to allow water to run between



Porches



Porches



Diagonal Bracing

- Diagonal bracing is required for all porches that are 30" or higher (from ground to walking surface) to increase stability of the porch
- Each corner porch post (except the one for the top of the stairs) should have 2 diagonal braces attached to it
 - For 6'x10' porches higher than 4' off the ground, diagonal bracing should be added to the middle posts on the long sides
- Braces should be cut from 2x4 with 45° cuts on each end
 - Bottom of the brace will attach to the post 2' below the framing of the deck (See Diagram 13)
 - Bracing should attach flush with the outside of the post and behind the frame of the porch (See Diagram 14)
 - Attach with 3" deck screws through diagonal brace into post/frame starting the screws on the outside of the porch framing.

Stairs

- Cut stair stringers from 2x12 material
- There will be three identical stringers
- The rise of the steps should be 6"-7 ½" and the run/tread should be 10"-11" (10 ½" is recommended)
 - Determine the rise by dividing the overall height of the stairs by the number of stairs to be constructed (roughly 7" per step) – you can use an online stair calculator if needed
 - Consider a lower rise (around 6" if building for elderly homeowners or homeowners with mobility issues)
- If the ground is sloping take that into consideration when determining number of steps

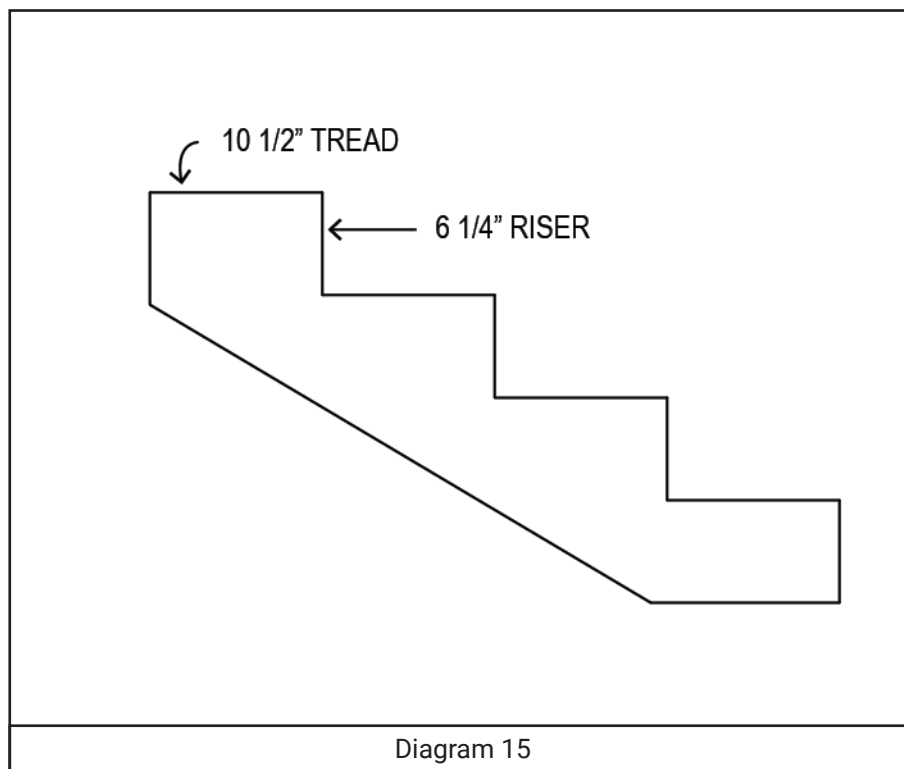
Porches

For example:(see Diagram 15)

If the top of the porch surface is 31" off of the ground, divide that height by a potential rise height until you get close to a whole number. $31/7 = 4.43$. $31/6 = 5.17$. $31/6 \frac{1}{4} = 4.96$. 4.96 will round up to 5. Therefore, there will be **5 "rises" of 6 $\frac{1}{4}$ "**. From the surface of the porch, the first step will be down (not out) and this will count as one of the five rises. Therefore, the stringer piece that is cut out will only have 4 rises. There will also be 4 treads (number of treads and rises always matches).

The completed stringer will look like this:

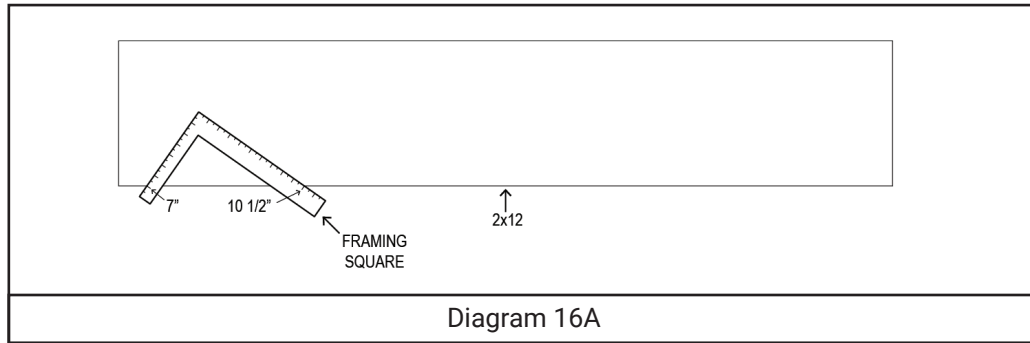
- Once the rise and run are determined - lay out the stringer



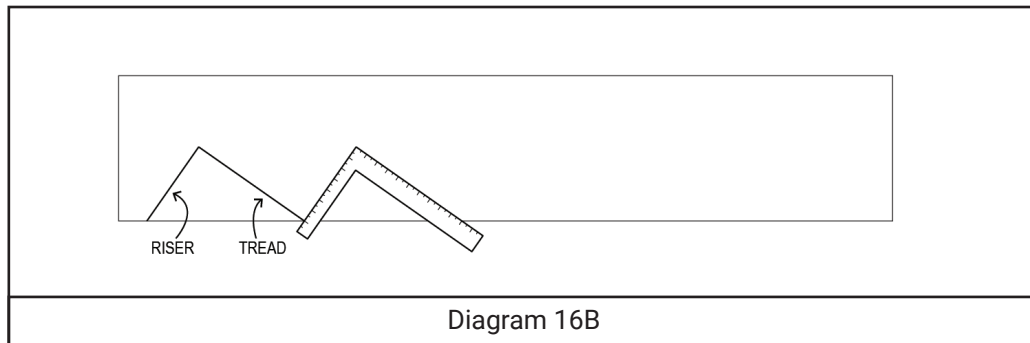
Porches

In Diagram 16, 7" rise and 10 1/2" treads are used as an example to create a stringer with four rises of 7", the four rises include the top step from the top of the stringer to porch surface (each porch will require a different stringer size)

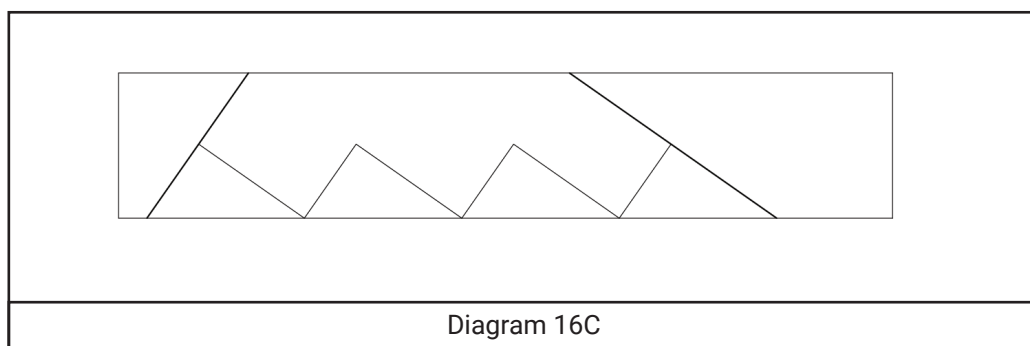
- Hold framing square on edge of 2x12 at riser and tread height and trace the outside of the framing square (See Diagram 16A)



- Continue tracing this profile until there are the appropriate number of risers and treads (See Diagram 16B)

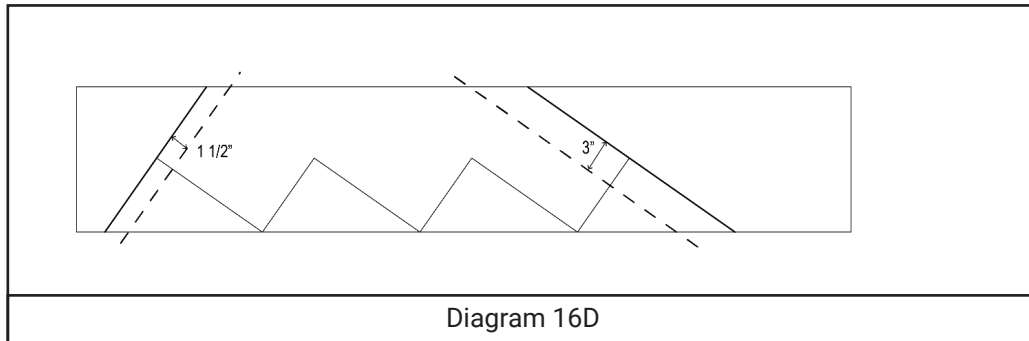


- Continue these lines at a 90-degree angle at the back of the top stair and the bottom of the first stair. (See Diagram 16C)

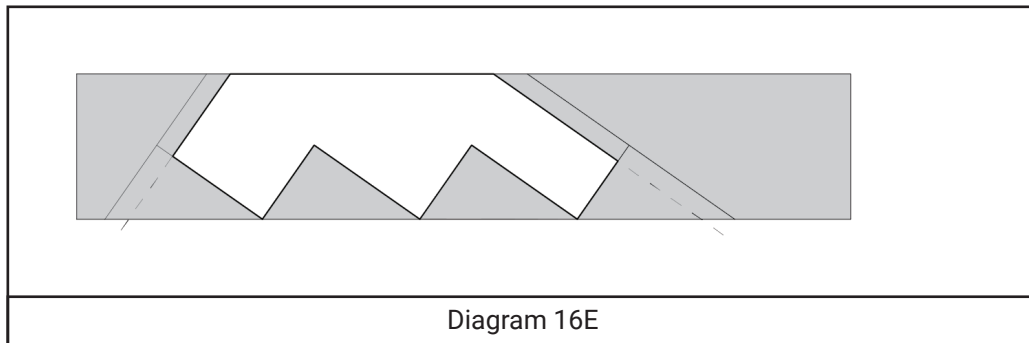


Porches

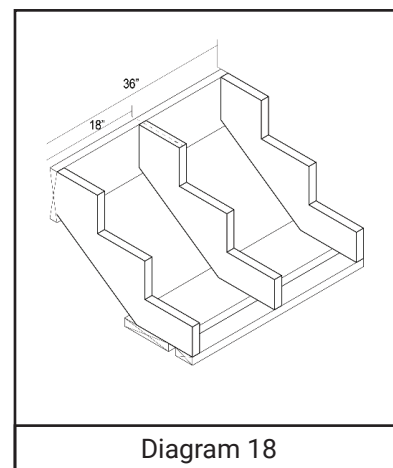
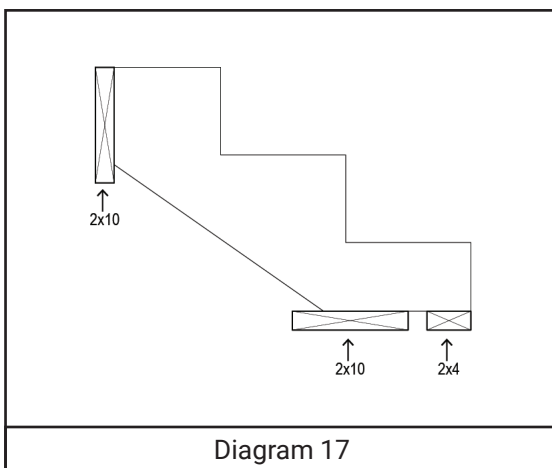
- Draw a parallel line that is $1\frac{1}{2}$ " to the inside of the line at the back of the top stair and a line 3" from the line on the bottom of first stair. (See Diagram 16D)



- Cut out stringer along darkened line, as in Diagram 16E
 - Make initial cuts on stringers with circular saw, do not cut past corner of where the right triangle shapes are being cut out or the stringer will be weakened
 - Finish corner of cut with hand saw or jigsaw

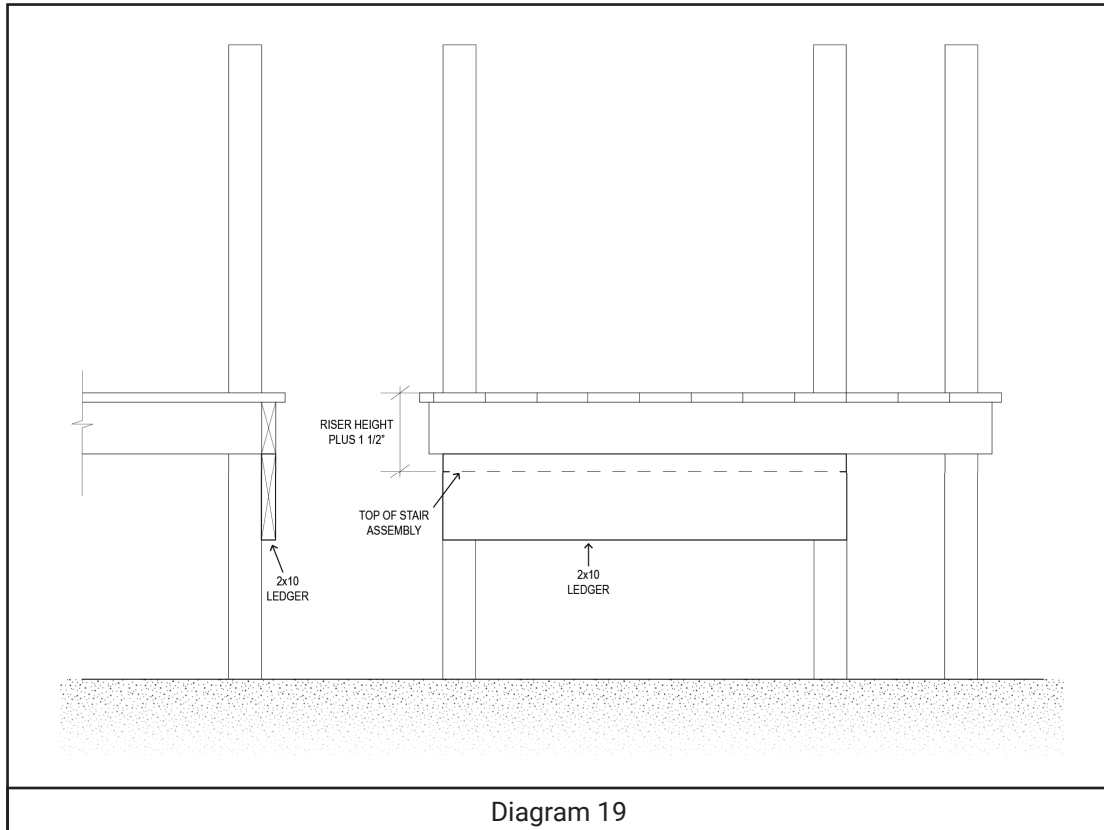


- Once one stringer is cut out, use that as a template and trace it for the two remaining stringers
- Assemble stair frame
 - Cut two pieces of 2x10 at 36" and one piece of 2x4 at 36"
 - The base of the stairs will sit on top of a 2x10 and 2x4 cross piece
 - A 2x10 cross piece will go across the back of the stringers (See Diagram 17 and 16)
 - The middle stringer should be in the center of both the top and bottom cross pieces
 - Fasten these pieces together making sure that they are square (See Diagram 18)



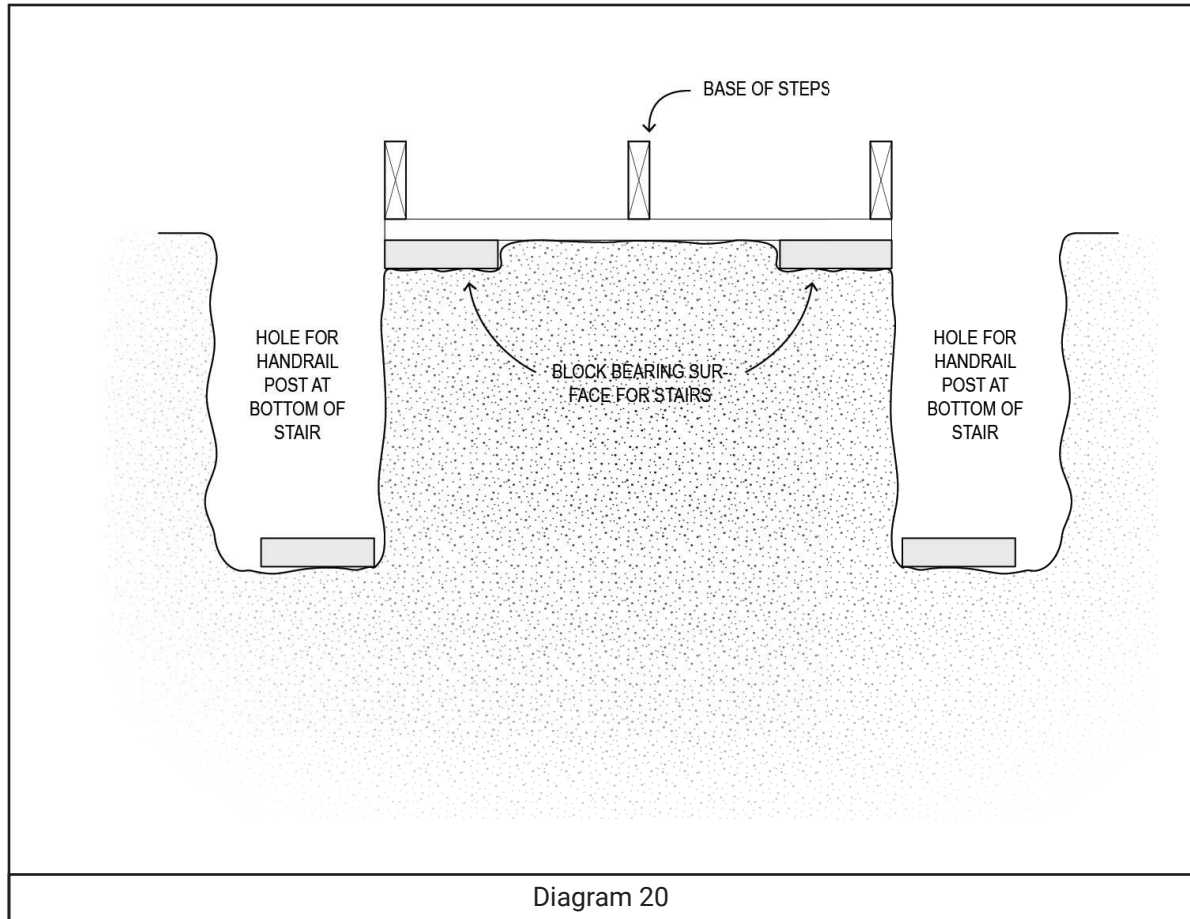
Porches

- Install Stairs
 - Across the two posts that act as the opening for the stairs, install a 2x10 that is cut to 43" using LedgerLOKs (See Diagram 19)
 - Measure down from the surface of the porch the height of the riser plus 1 ½"
 - For example, if the riser height is 6 ¼" (+ 1 ½"), measure down 7 ¾"
 - Transfer that line across the ledger board that was just installed using a level, this is where the top of the stair assembly will go (See Diagram 19)
 - **This first step will be down, not out**



- Hold the stair assembly in place, dig out ground at base of steps if necessary to make sure treads are level
- While stairs are held in place, mark the far corners of the bottom step to indicate where holes will be dug for the handrails
- Dig holes for handrail posts 12"x12"x24" and place either a ½ cap block or 3" of sackrete in the bottom
- Dig out a rectangular hole for a full cap block so that the bottom of the stairs rest on the flat surface of the cap block, make the two blocks level (these may have to be adjusted slightly by sitting the steps on them and making sure everything is level and the steps are in contact with both blocks) (See Diagram 20, facing page)

Porches



- Once the stair assembly is in place, fasten the stairs to the 2x10 ledger using 6 LedgerLOKs
- After stairs are attached, set posts at the bottom of the steps
 - Make sure posts are plumb in both directions and attach to bottom of stringers using 2 LedgerLOKs
 - Fill holes and tamp dirt
- Install 1x6 PT or deck boards as “Toe Kicks” on risers (Some local building code will require this.)
- Install decking on the stairs
 - Use either 2x6 or 2x12 as stair tread
 - Allow for a 1” overhang on each side

Porches

Handrails Around Porch Landing (Stair handrail instructions below)

- Cut the posts in the frame at $34\frac{1}{2}$ " above surface of decking boards using circular saw at maximum depth from each side (finishing with reciprocating saw if necessary, because of placement)
- Install bumpers/rails around frame
 - Top bumper will run flush with the tops and insides of the posts (See Diagram 21)
 - Bottom bumper will run flush with the inside of the posts and rest $3\frac{1}{2}$ " above the decking (sit on a 2x4 block while installing to get the right height) (See Diagram 21)
 - Measure each of these individually, make sure that they are snug
 - Pre-drill with $\frac{1}{8}$ " drill bit before toe-screwing the top and bottom rail into place (this will keep the wood from splintering)

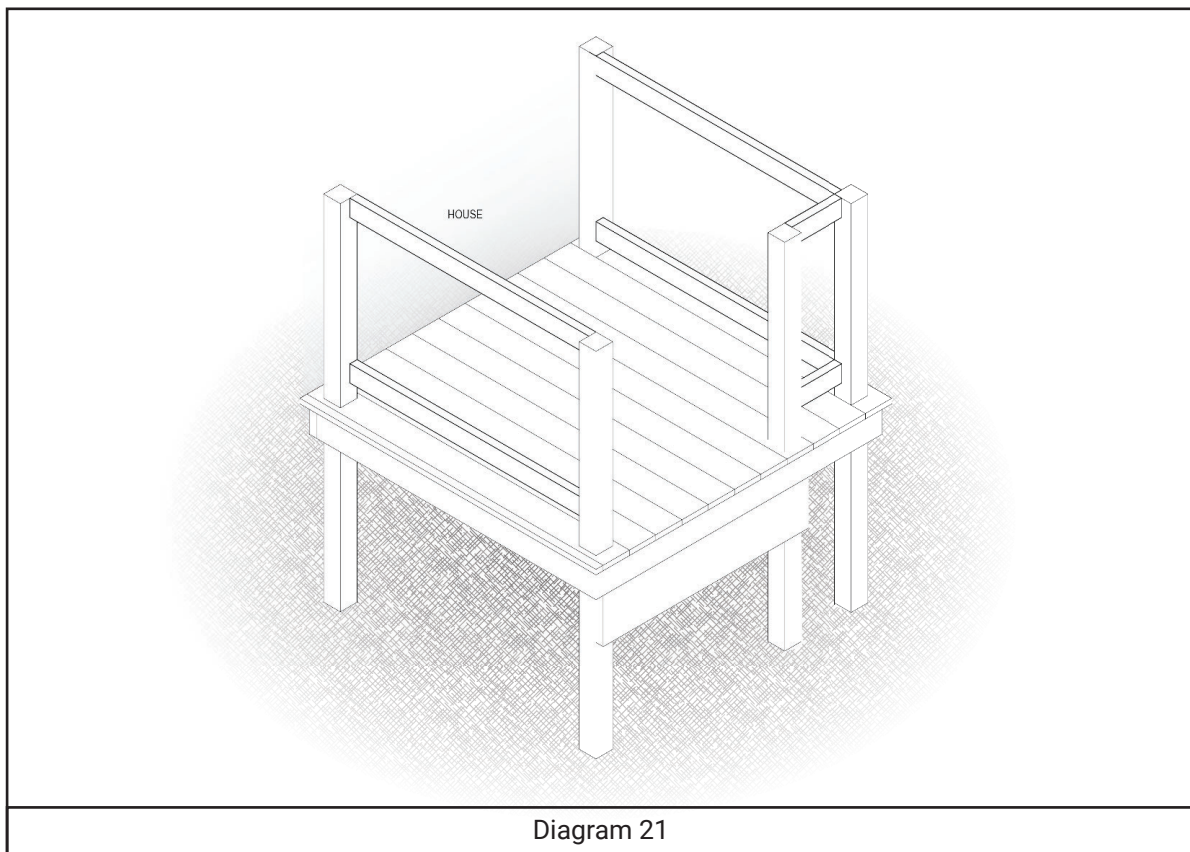
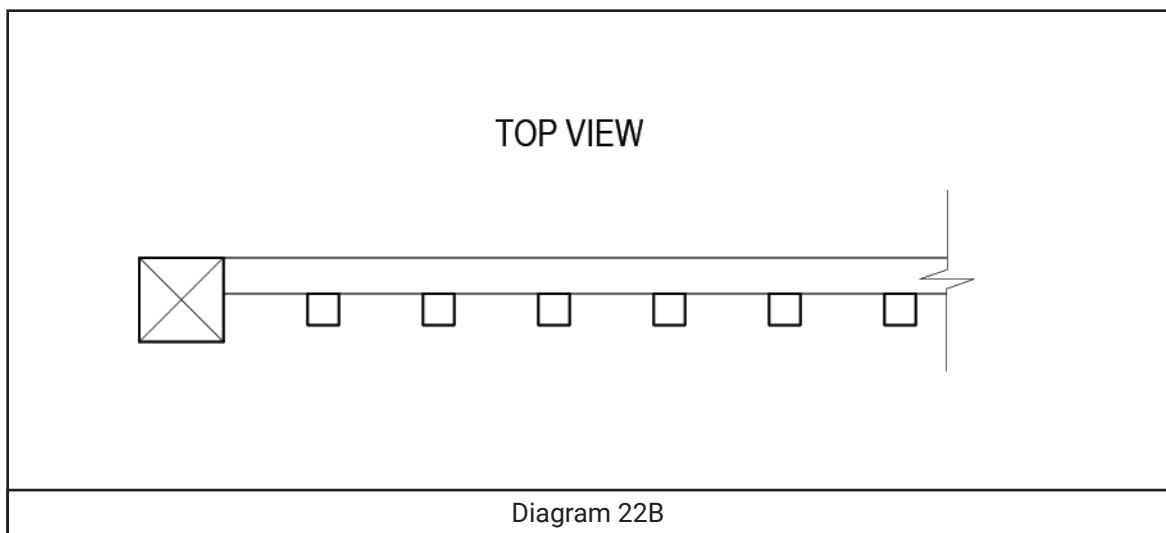
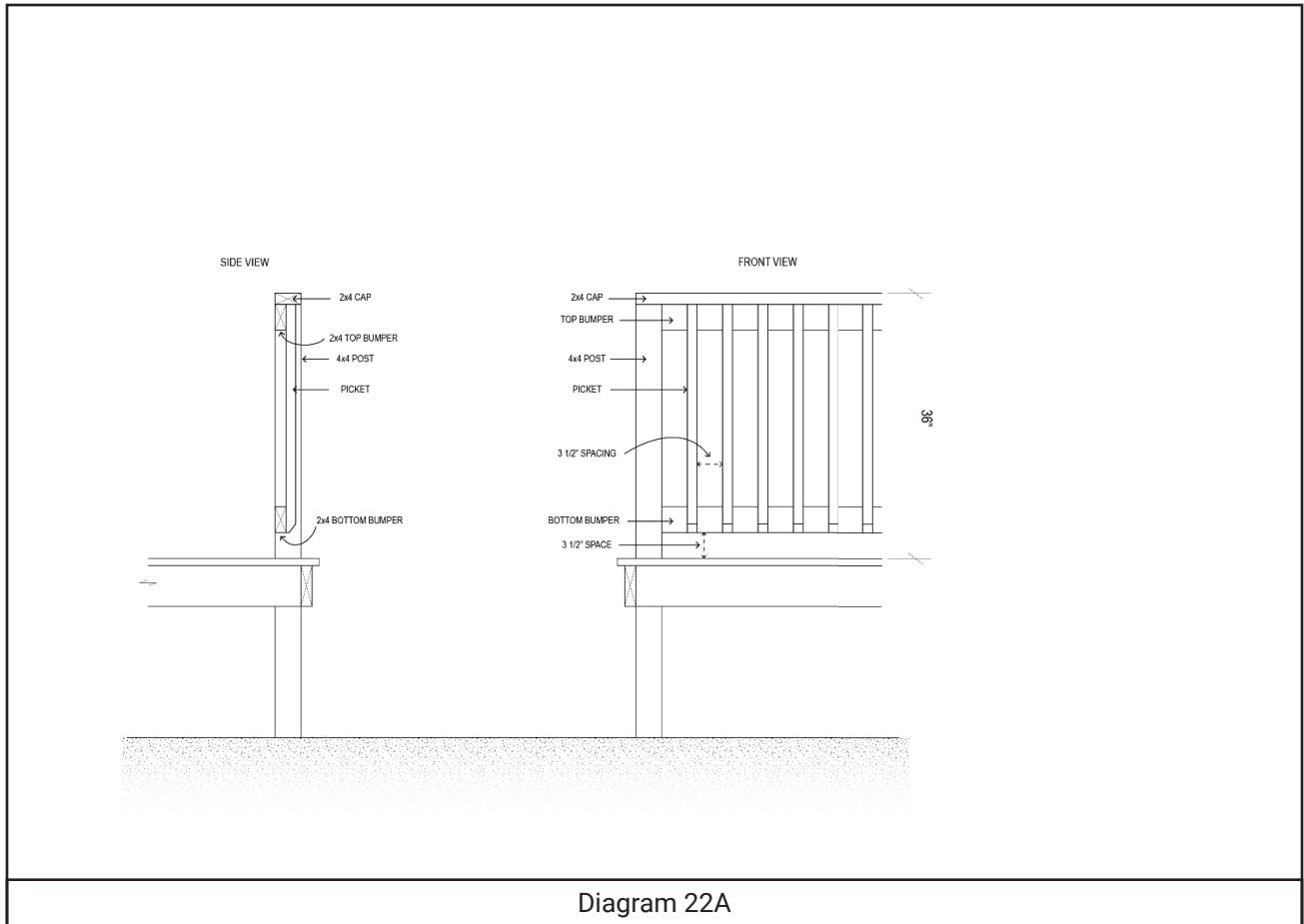


Diagram 21

- Use 2x4 as a cap that will sit flat on top of the top bumper and cover the tops of the 4x4 posts
 - Cut 45-degree angles where 2x4 caps come together at a corner
- Install spindles every $3\frac{1}{2}$ " with flat end at the top (2x4 width can be used at top and bottom as a spacing block) (See Diagram 22, facing page)
 - Cut spindles to length (measure from bottom of bottom rail to top of top rail)
 - Pre-drill holes in spindles with $\frac{1}{8}$ " drill bits, and install with $2\frac{1}{2}$ " screws
 - Start in the middle of each section between posts and work to either side, making sure the center spindle that is installed first is plumb

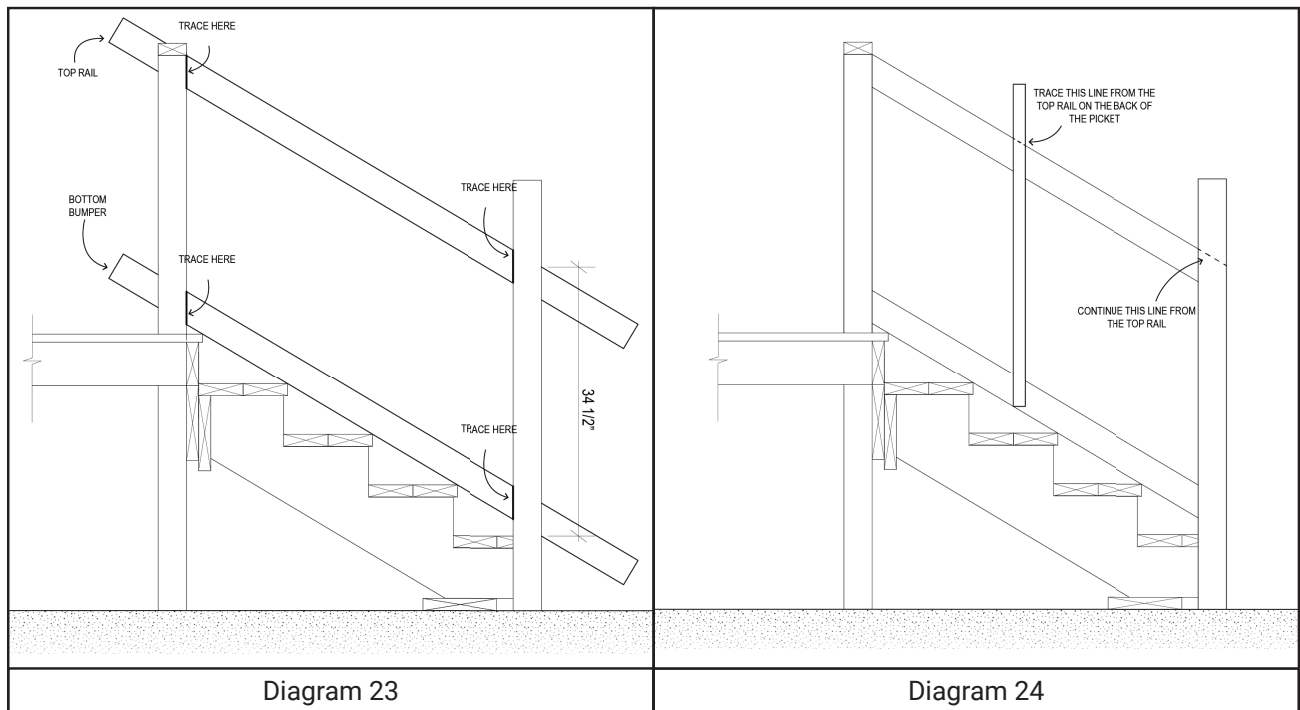
Porches



Porches

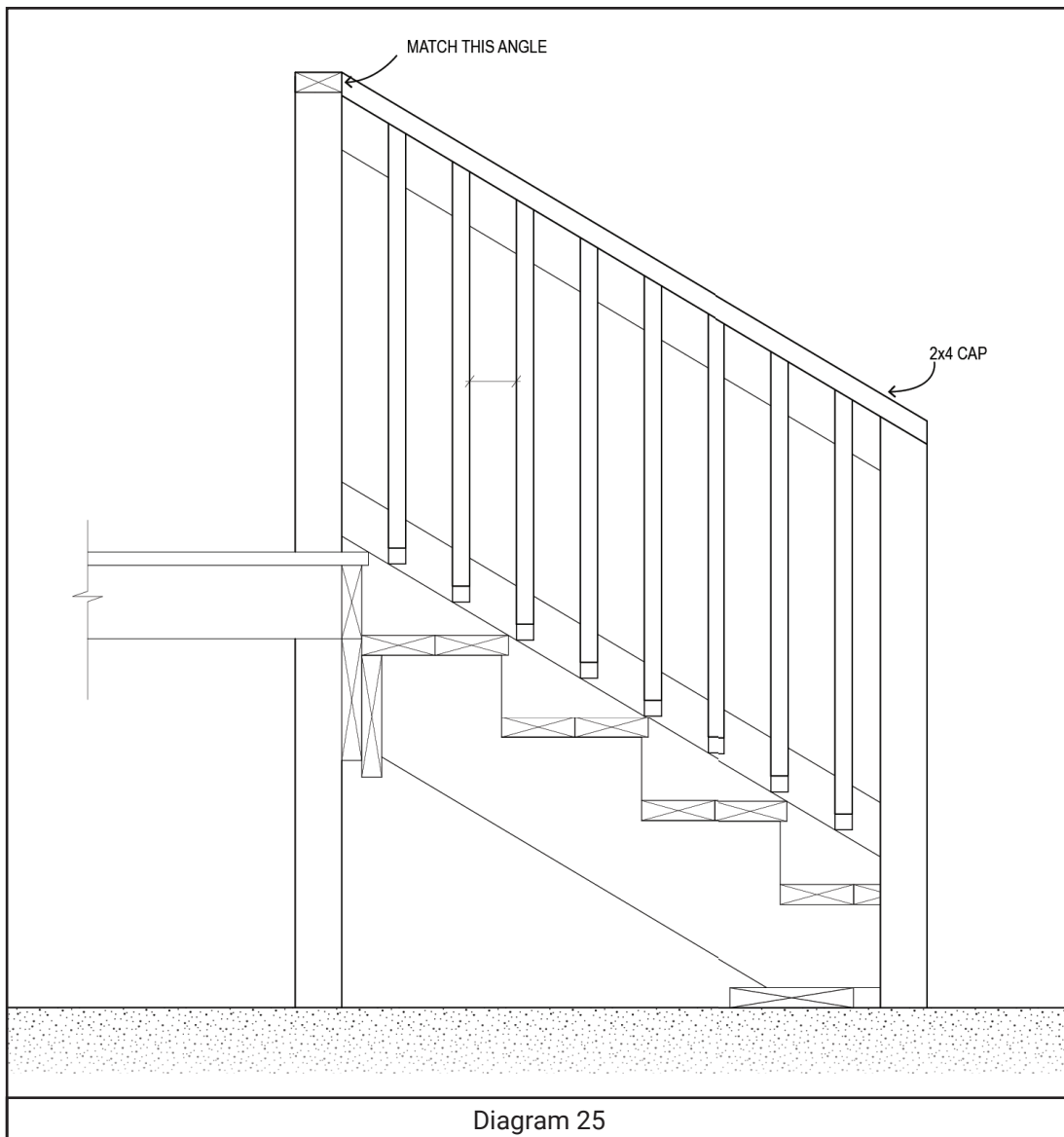
Handrails on Stairs

- Bottom bumper will rest on the nose of each step (See Diagram 23)
 - Hold bottom bumper in place and trace the angle created at the intersection of the bumper and the posts at the top and bottom of the stairs
 - The bumper will rest in between the two posts
 - Attach the bumper by toe-screwing into the posts
- The height of the top bumper should be 34 ½" above the nose of each step (See Diagram 23)
 - Measure to determine height and placement of top bumper and trace the angle created at the intersection of the 2x4 and the posts
- Cut posts at bottom of stairs to height
 - Continue the line of the top rail onto the posts using a straight edge at the bottom of the steps, cut these posts to height (See Diagram 24)
 - Make the initial cut with a circular saw set to maximum depth, finish cut with reciprocating saw
 - Have someone in place to catch the top piece of post as it is cut



Porches

- Install Spindles
 - Spindles will be spaced every 3 ½" (use width of a 2x4 block as a spacer)
 - Start in the middle of the stair bumpers and make sure the first spindle is plumb
 - Hold the spindle in place with the bottom of the spindle at the bottom of the bottom rail and trace where the cut should be at the top of the top rail (See Diagram 25)
 - Match the angle of the cut on the miter saw and cut to length
 - Pre-drill spindles with ⅛" drill bits and install with 2 ½" deck screws o 2x4 cap over handrails (See Diagram 25)
 - Match the angle cut to that of the top rail by tracing the angle and matching it on the miter saw
 - Cut piece slightly long initially, and cut to exact length once the correct angle is found
 - Allow for a small overhang at the bottom of the handrail
 - Attach with 3" screws into the top rail/bumper



Porches

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Ramps

Why Ramps? Ramps provide safe access to elderly and disabled homeowners and help them to have independence in their homes.

Section Contents:

- Ramp planning 272
- Ramp layouts 275
- Holes and Posts 278
- Framing and Runners 281
- Transition from ramp to ground. . . 286
- Decking 287
- Handrails 288
- Landing pad 293

Safety

- Wear gloves when removing debris/old structures
- Make sure to bend down or remove any nails sticking out of any debris lumber
- Wear safety glasses when cutting or working near someone cutting with power saw
- Communicate with homeowner/block off entrance if needed
- Put up temporary rails overnight if needed for homeowner to have accessibility
- Set up a cutting station facing away from the work area with plenty of space to maneuver boards

Ramp Project Planning

- Is there adequate space for a ramp?
- Ramp layout should be convenient to the way the door swings and natural pathway if possible.
- While the ramp is being built, will the family have another entrance/exit to the house?
- Are any utilities - water/electricity in the area where the ramp will go? Call 811, Dig Safe
- Should any other repairs be made to make the home safe and accessible for the family?
- Where will the ramp end?
- Will an initial landing/porch need to be built as well?
- Will you need to turn the ramp or have an extra landing to break up the length?

Ramps

- Will any permits/inspections be needed?
- Does the ground slope towards or away from the ramp area? This may affect the length
- All ramp material will be pressure treated lumber
- See additional ramp planning section below for ramp layout/design instructions

Measurements Needed

- Height off the ground - the ramp will drop 1" for every 12" of length
- Length of the ramp, number of the landings and turns that will be in the ramp

Ramps

Quality Control

- Are holes 16"x16"x 24"?
- Check for 41 ¼" space from the inside of one post to the inside of the other across the width of the ramp
- Check for 7'6" spacing from center of the post to center of the post going down the ramp
- Check for a consistent 1" drop for every 12" of ramp
- Make sure boards are crowned
- Check to make sure 2 LedgerOK are used everywhere a ledger, runner, or joist meets a post
- Make sure finished rail height is 36"
- Make sure that spacing for spindles is 3 ½" and that spindles are plumb
- Make sure that there is a 1 ½" graspable handrail at the top of the handrail on ramp sections and a bumper at the bottom – for both spindles and barn rails

Common Mistakes

- Holes not 16"x16" at the bottom
- Posts set too far apart so that ordered lumber for runners/rails will not reach
- Ramp is too steep
- LedgerLOK forgotten on outside runners
- Posts cut off at finished handrail height
- No smooth transition/concrete pad at the end of the ramp

After Work is Complete Quality Control Check

- If ramp does not end at a driveway/sidewalk pour a small concrete pad at the bottom of the ramp to help the homeowner transition onto and from the ramp
- Sand tops of handrails if needed
- Have other necessary handicap modifications made to the home?

Group Leader Tips

- Getting the layout done and posts set is the hard part because there are a lot of moving pieces. Hang in there!
- Some volunteers can split blocks while others are digging
- You can start digging holes for the second line of posts before the first is complete
- If there is a landing, once the first framing member for that is installed, some people can be installing the runners and ledgers for the first section of the ramp while others work on framing/joists for the landing
- Once the first section of runners is complete, decking can start to be installed at the top, even if all the framing hasn't been installed
- Some people can be pre-cutting decking while others are framing
- Handrails can be started at the top of the ramp once it is decked, while framing/decking are still happening at the bottom

Ramps

Ramp Material List

5'x5' Landing/Turn		
Quantity	Item	Purpose / Notes
5 or 4	4x4x__ PT (or 6x6)	Posts within frame, 5 for an initial landing, 4 if 5'x5' is a 90 degree turn, (2 additional posts will be in the frame but those will double with posts ordered with sections of ramp)
4	2x6x10 PT	Frame and common joists
2	2x4x8 PT	Blocking, temporary supports, bracing, miscellaneous, etc.
6	10' Deck Boards	Walking surface over joists

Spindle Handrails for 5'x5' Landing/Turn		
Quantity	Item	Purpose / Notes
3	2x4x10 PT	Top/bottom rails and cap around frame
30	Pre-cut spindles	For rails around landing
Barn Rails for 5'x5' Landing/Turn		
3	2x6x10 PT	Top, middle, and bottom rails/bumpers
2	2x4x10 PT	Cap for rails around landing

5'x8' Landing		
Quantity	Item	Purpose / Notes
4	4x4x__ PT (or 6x6)	Posts within frame (2 additional posts will be in the frame but those will double with posts ordered with sections of ramp)
4	2x6x10 PT	Short sides of frame and common joists
2	2x6x8 PT	Long sides of frame/band joists
12	8' Deck Boards	Walking surface over joists

Ramps

Spindle Handrails for 5'x8' Landing		
Quantity	Item	Purpose / Notes
3	2x4x10 PT	Top/bottom rail, and cap on short sides of landing
3	2x4x8 PT	Top/bottom rail, and cap on long side of landing
45	Pre-cut spindles	For rails around landing
Barn Rails for 5'x8' Landing		
3	2x6x10 PT	Top, middle, bottom rails/bumpers on short sides of landing
1	2x4x10 PT	Cap for rails on short sides of landing
3	2x6x8 PT	Top, middle, bottom rails/bumpers on long sides of landing
1	2x4x8 PT	Cap for rails on long side of landing
5' Intermediate Landing		
Quantity	Item	Purpose / Notes
2	4x4x__ PT (or 6x6)	Posts within frame (2 additional posts will be in the frame but those will double with posts ordered with sections of ramp)
2	2x6x10 PT	Runners/joists
4	12' Deck Boards	Or (6) 8' Deck Boards, walking surface over joists
Spindle Handrails for 5' Intermediate Landing		
Quantity	Item	Purpose / Notes
1	2x6x10 PT	Top rail on landing
2	2x4x10 PT	Bottom bumper, cap over spindles/posts
24	Pre-cut spindles	Rails on both sides of landing
Barn Rails for 5' Intermediate Landing		
3	2x6x10 PT	Top, middle, bottom rail/bumper on both sides of landing
Each 7'6" Section of Ramp		
Quantity	Item	Purpose / Notes
2	4x4x__ PT (or 6x6)	Posts within sections of ramp
4	2x6x8 PT	Runners and ledger boards
6	12' Deck Boards	Or (9) 8' Deck Boards, walking surface over runners

Ramps

Spindle Handrails for Each 7'6" Section of Ramp		
Quantity	Item	Purpose / Notes
1	2x6x8 PT	Top rail
2	2x4x8 PT	Bottom bumper, cap over spindles/posts
36	Pre-cut spindles	Rails on both sides of ramp section
Barn Rails for Each 7'6" Section of Ramp		
6	2x6x8 PT	Top, middle, bottom rail/bumper on both sides of ramp

Other Materials/Fasteners		
Quantity	Item	Purpose / Notes
	4" Solid Concrete Cap Blocks	Half a block for each post/hole (Or sackrete for each hole)
	LedgerLOKs	30 per each 5x5, 25 per each 5x8, 16 per 5' landing, 16 per each section of ramp
	2x6 Joist Hangers	6 per each 5x5, 10 per each 5x8, 2 per each 5' landing, 3 for each intersection of a landing/ramp
	Joist Hanger Nails	
	2 ½" Deck Screws	To attach deck boards and spindles

Landing Pad Materials (only use materials needed for the type of pad being constructed)

- Scrap 2x lumber to build frame/form and use as a concrete float
- Concrete (# of bags determined on the VOLUME of the landing area)
- For a larger concrete pad, a concrete float will be needed to smooth the concrete
- Wheelbarrow
- Shovels
- Hoes
- Concrete trowels and float (if available)
- 2" Pavers
- Sand

Recommended Tools

Safety:

- Glasses
- Gloves
- Ear Plugs

Digging Tools:

- Post Hole Diggers
- Shovels
- Digging Bars or Sledge Hammer to break blocks

General Tools:

- Basic Hand Tools (Tape measures, hammer, pencils, speed square, etc.) Saw Horses
- Extension Cords/Splitters
- Framing Square - for squaring layout line 4' Level
- Post Level String/String Level Spray/Marking Paint
- Stakes - for tying off layout string

Power Tools:

- Drills/Impact Drivers
 - (2-3) 1/8" Drill bits - to pre-drill handrails and spindles
 - (3-4) T-25 drivers for deck screws
 - 5/16 Hex bits or T-40 - coordinating to head of LedgerLOK Miter Saw
- Jig Saw - for notching around posts
 - Wood Blade
- Circular Saw - cut posts to handrail height Reciprocating Saw
 - Wood Blade

Ramps

Ramp Instructions

Ramp Planning

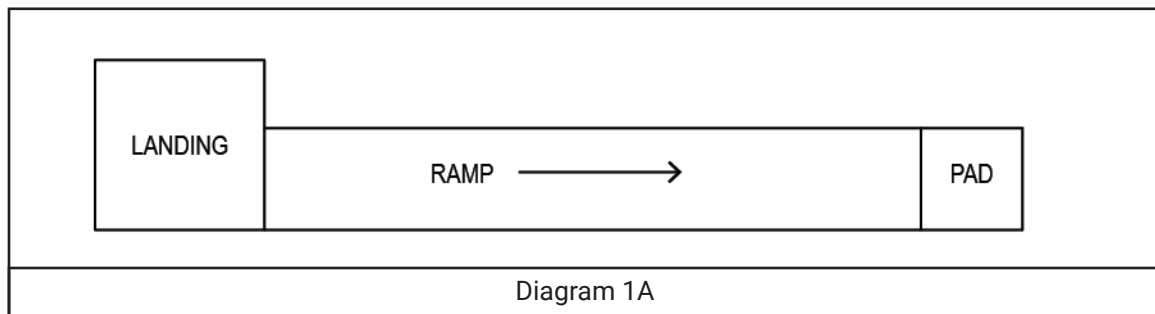
A ramp will drop 1" for every 12" in length. It is important to plan out the path of the ramp before construction so that the ramp will fit in the available space.

Consider where the ramp is ending with convenience to the homeowner, likely somewhere near the driveway. This will largely dictate the ramp's path.

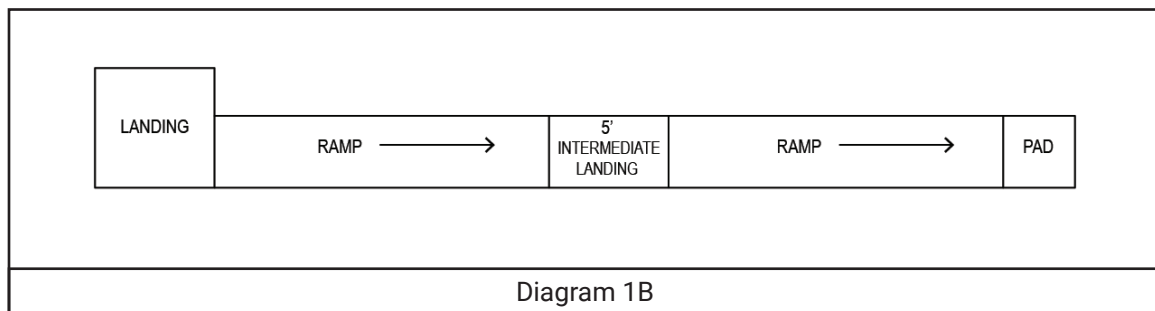
A ramp should always have a minimum 5'x5' landing at its beginning. This may be a porch or landing that is built as part of the ramp, or it may be something pre-existing. (Note the beginning "landings" in Diagram 1 may be something that already exists).

There are several possible layouts for ramps:

- A straight ramp with less than 30' of dropping surface (anything longer must have an intermediate landing)

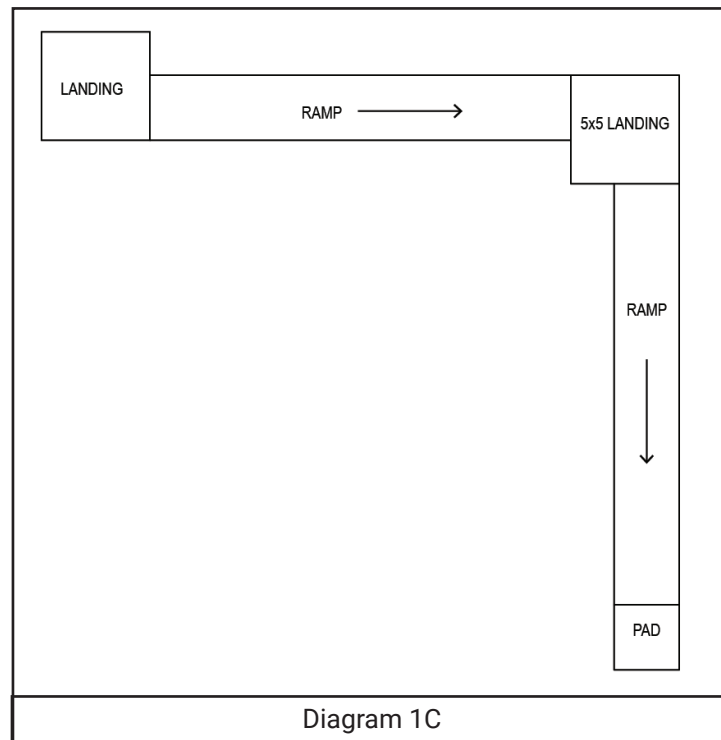


- A straight ramp with more than 30' of dropping surface with intermediate landing(s), intermediate landings are the same width as the ramp and 5' long

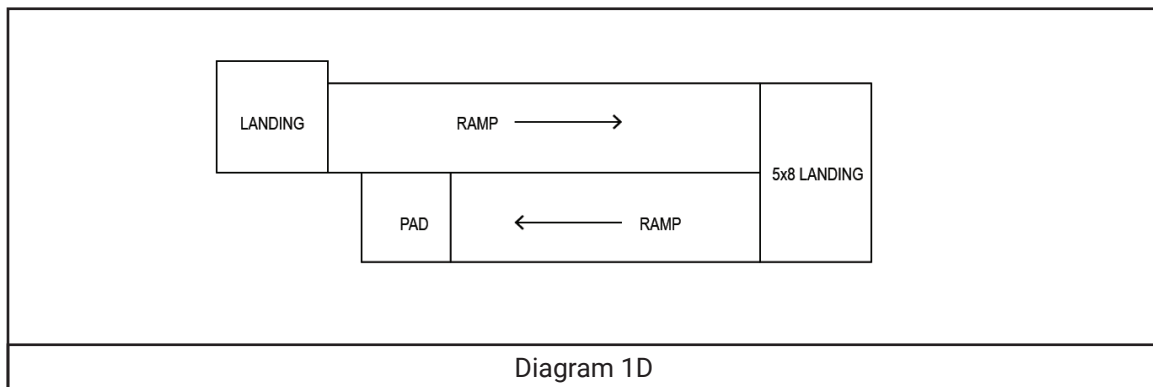


Ramps

- A ramp with a 90-degree turn, with a 5x5 landing at the turn



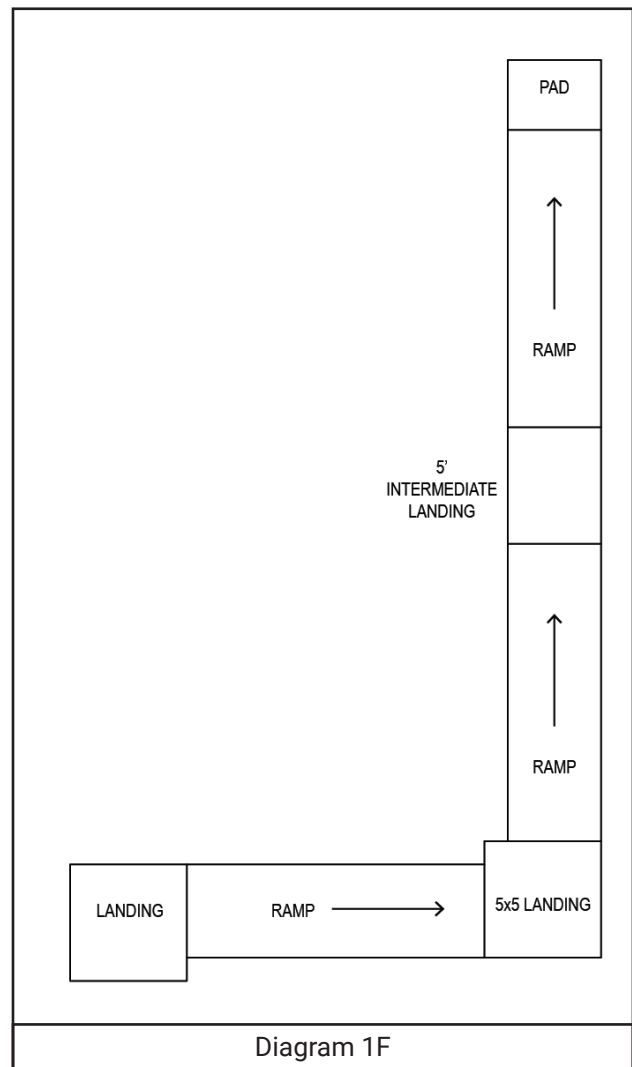
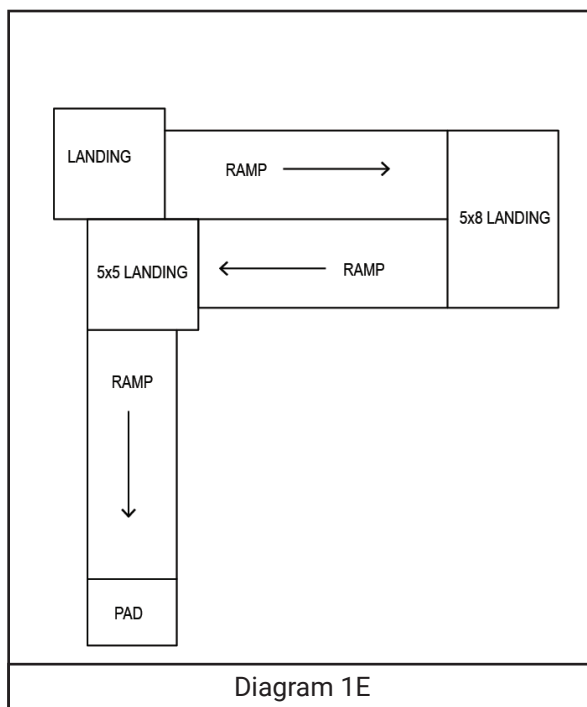
- A ramp with a 180-degree turn, with a 5x8 landing at the turn



Ramps

A ramp should be kept as simple as possible in the available space. Additional turns make the work more complex and costly, however, sometimes this is the only option for the space.

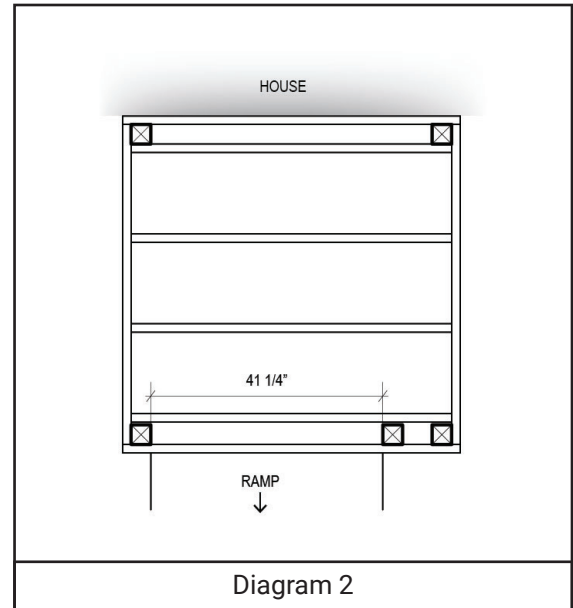
- Some additional ramp layout possibilities include (but are not limited to) a 180 degree and 90-degree turn (See Diagram 1E), or a 90 degree turn and an intermediate landing (See Diagram 1F)



Ramps

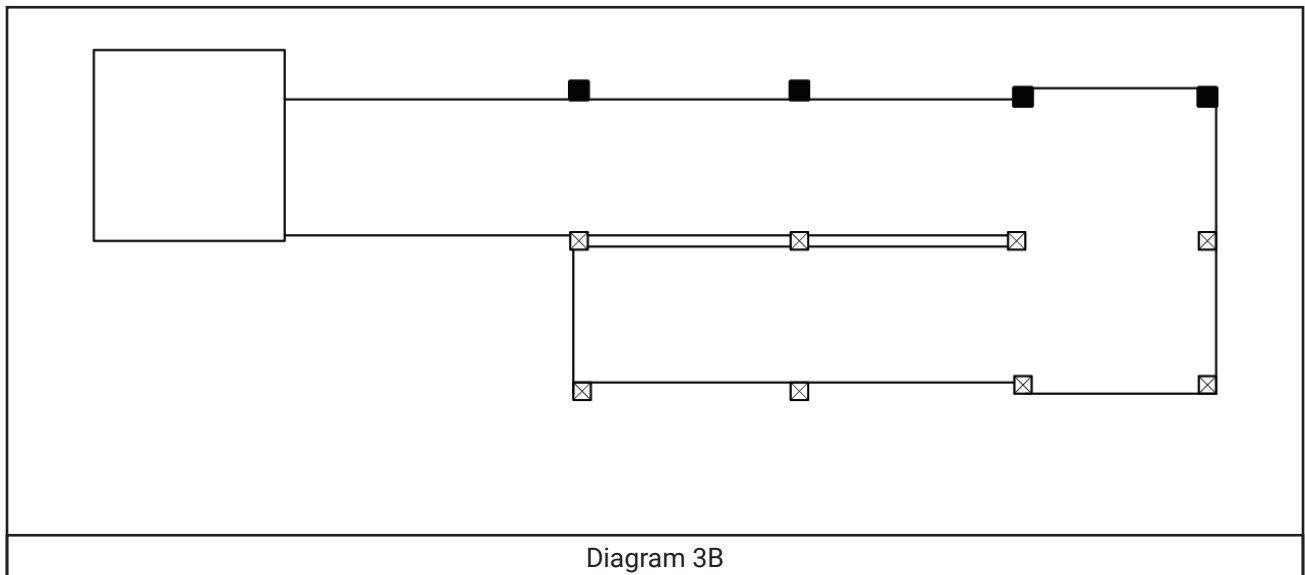
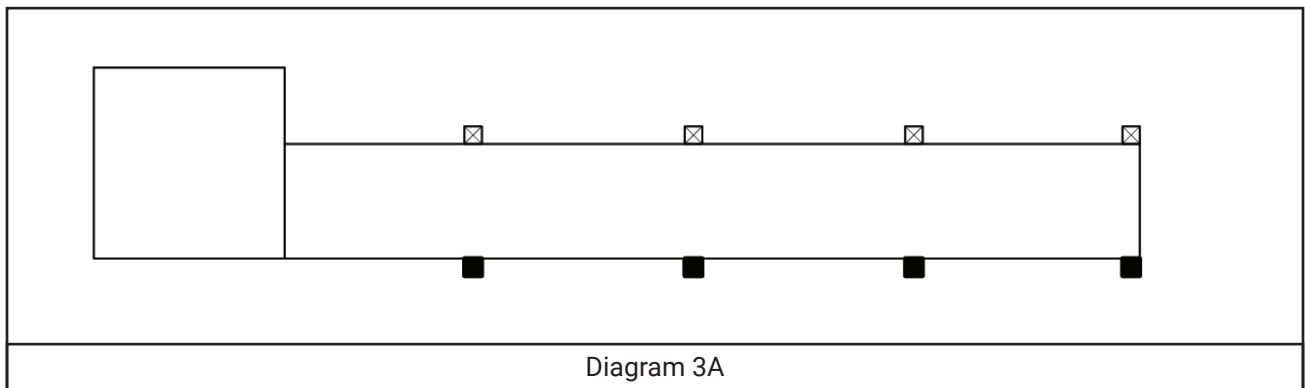
If there will be a 5'x5' landing or porch constructed at the top of the ramp, consult the porch section (See pages 225). Follow these instructions from beginning through handrails with the following change:

- An additional (5th) post will be installed for the ramp (as is with the stairs in the porch section), the space between these posts will be 41 1/4" across the width of the ramp (See Diagram 2)
- Common joists should be installed so that decking on landing is parallel to decking on ramp when it is added



Ramp Layout

- Posts will be installed in "lines"
 - All the posts in one line will be installed, then posts in the next line can be installed
 - The highlighted posts in Diagram 3A and B shows a "line" of posts



Ramps

- All posts up through the ones that make the first landing should be set, then the process will be repeated for the next section of ramp
- Determine the spacing of the posts
 - This will depend on the layout of each ramp
 - For dropping sections of ramp, the posts should be spaced 7'6" on center along each line
 - When using 8' lumber, by spacing 7'6" there is some forgiveness and if any spacing gets a little off the 8' lumber still fits in the given space
 - Posts would be centered at 7'6", 15', 22'6", 30' (as applicable to each ramp)
 - Posts that make up an intermediate landing, 5'x5' turn, or 5'x8' turn should be spaced 4' 5 1/2" on center (50" OC)
- For the first line of posts, from the landing that will act as a starting surface (or a section of ramp coming off an intermediate turn/landing):
 - Attach a string on the inside of the starting post (See Diagram 4)
 - Pull string in the direction of the drop of the ramp
 - Use a framing square to make sure that the string is square
 - Hold the framing square in place and move the string until it lines up with the edge of the framing square
 - Tie the string off to a stake that is driven into the ground
 - Make sure string remains square
- Mark where holes will go based on ramp plan
 - The string as shown in Diagram 4 indicates the inside of the line of posts
 - Use spray/marking paint to mark the center of each hole

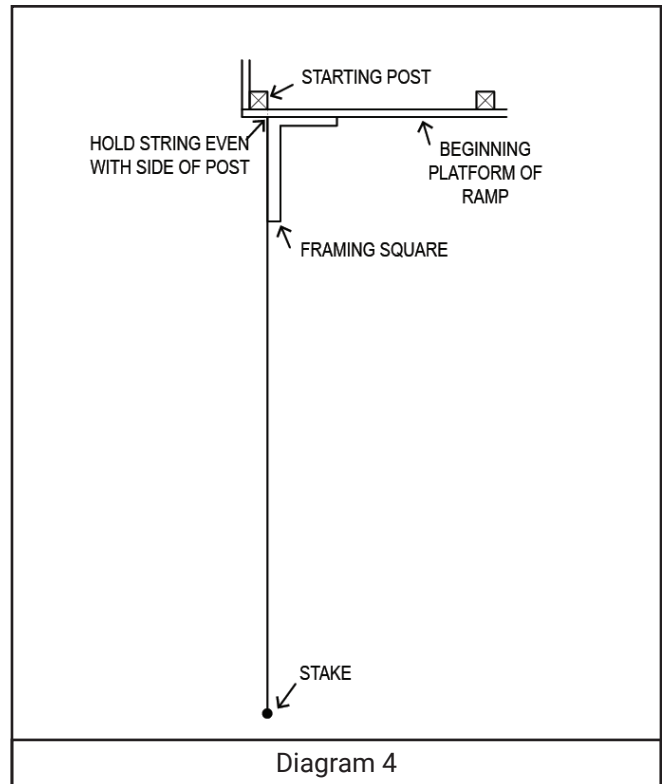
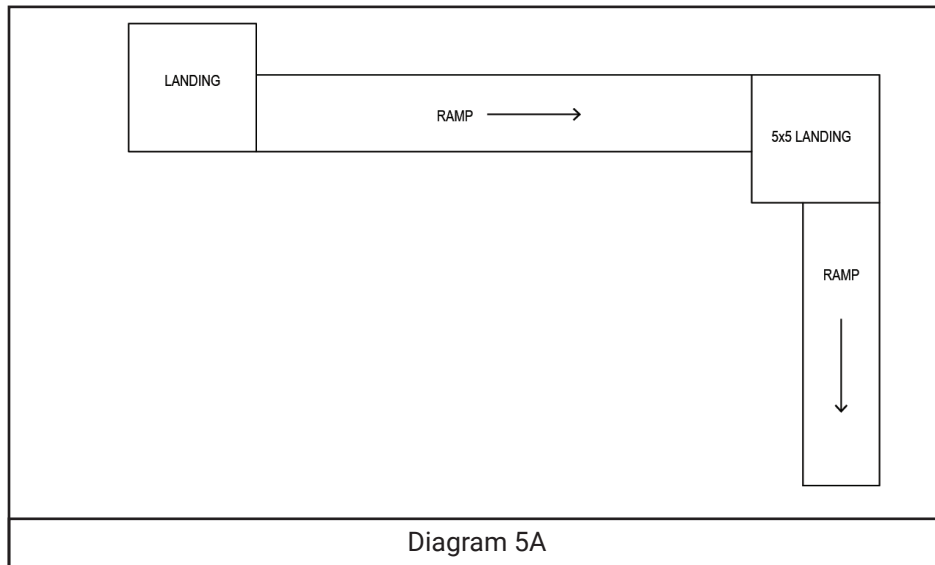


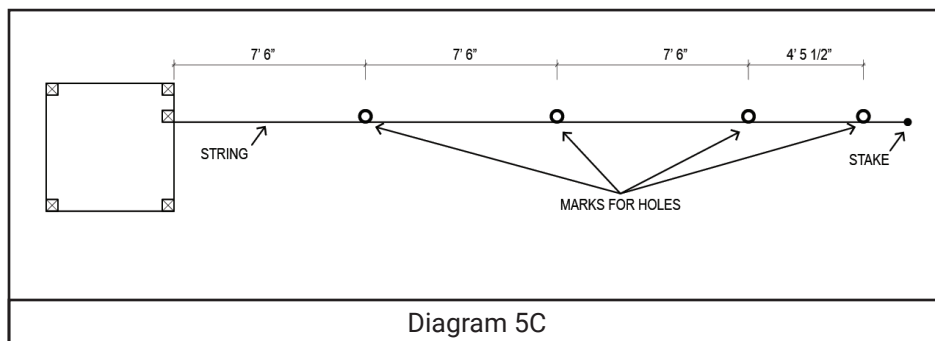
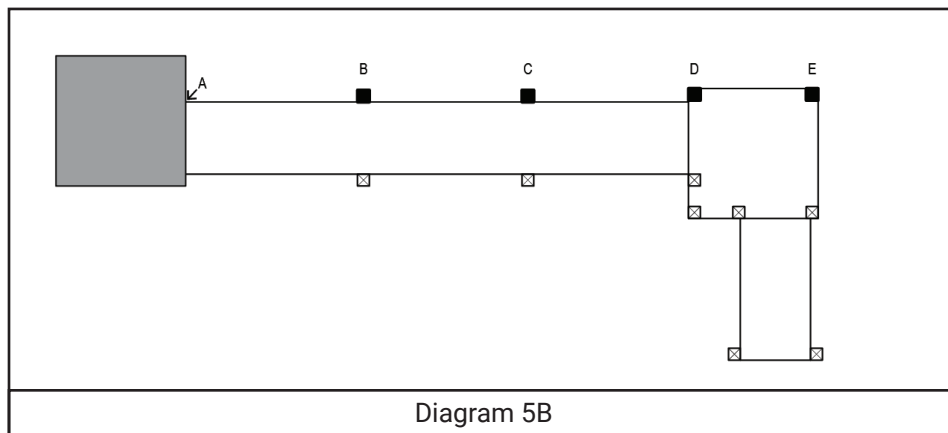
Diagram 4

Ramps

Example for marking post locations: Layout for ramp:



The highlighted posts in diagram 5-B below are the first line of posts that will be set. From point A to point D will be 22'6" long. (Points B, C, D, and E mark the center of each post). From point A to B will be 7'6", B to C will be 7'6", C to D will be 7'6", D to E will be 4'5 1/2". Therefore, spray paint marks will be made along the string (measuring from point A) at 7'6" (B), 15' (C), 22'6" (D), and 26'11 1/2" (E).



Ramps

Dig Holes and Set Posts

- Leave the stake in the ground, but temporarily remove string to dig holes
- The spray paint mark should indicate the center of the hole
- Holes will be dug 16"x16"x24"
 - Tamp the dirt in the bottom of the hole flat
- Place either a split cap block or 3" of dry sackrete in the bottom of each hole
 - For cap blocks, split with digging bar or sledgehammer, place half of a cap block in each hole, and make block level (See Diagram 7)
 - For sackrete, after pouring in 3", tamp down and make flat with sledge or digging bar

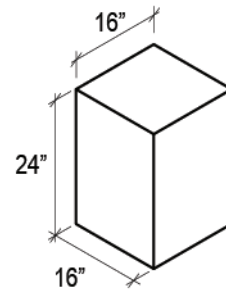


Diagram 6

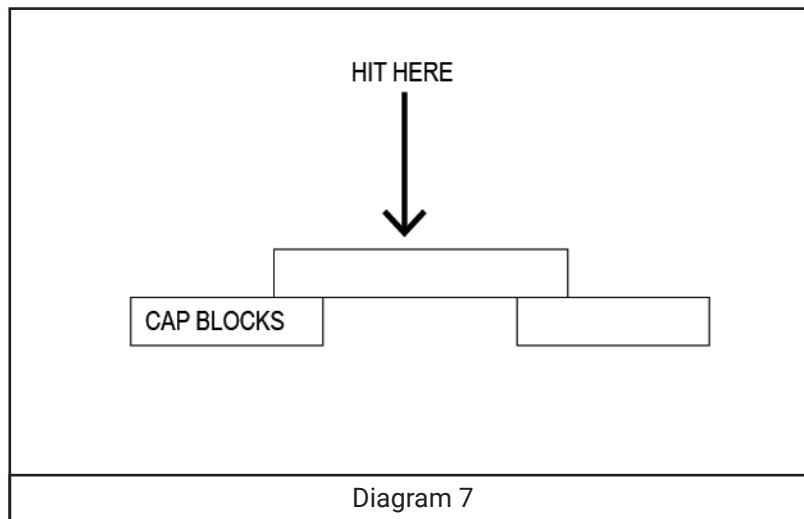


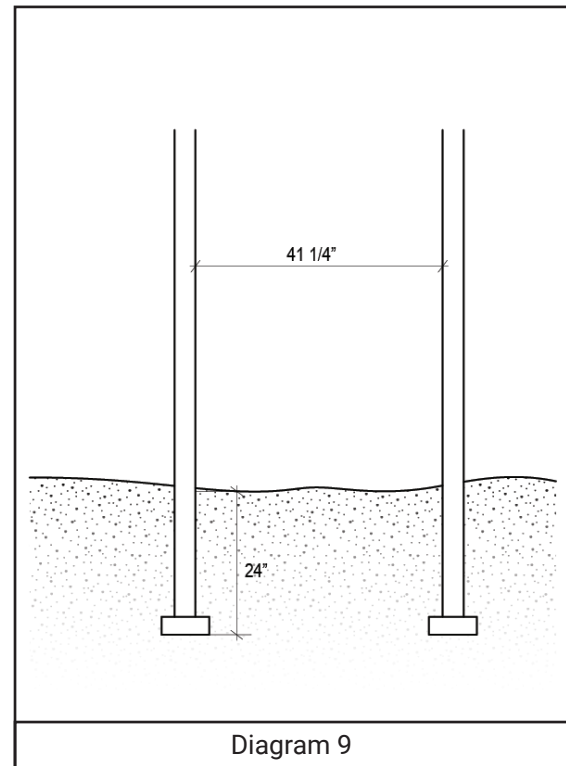
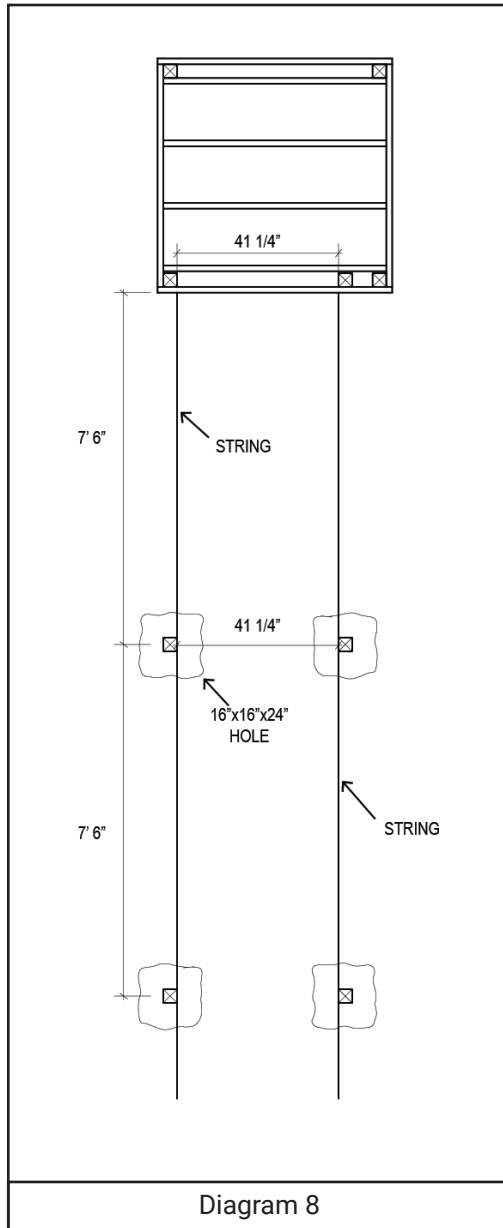
Diagram 7

- Post will sit directly on the cap block or sackrete
- After all holes in a line are dug, re-attach the string to the stake and double check for square to the landing
 - Make sure string is pulled tight
- Start by setting the first post in the line (The left side of Diagram 8 shows the first line of posts)
 - The post should be in place with one edge barely touching the string (do not let the post lean into the string so that it is no longer straight)
 - Make sure the post is on the correct side of the string, in line with the post from the landing/porch
 - Use a level (or post level) to make sure post is plumb in both directions
 - From the edge of the landing to the center of the first post should be 7'6"
 - **When the post is lined up with the string, plumb, and 7'6" from the landing, start to fill in the holes with dirt**
 - If the hole needs to be adjusted to meet these criteria, remove the post and widen the hole as needed

Ramps

- Fill holes with several inches of dirt at a time and tamp tightly
- Set the next post in line
 - Like the first, make sure that the post is lined up with the string, plumb, and at the correct distance from the center of the previous post
- Set remaining posts in line repeating this process
- As each post is set, step out towards the stake and look back down the line of posts
 - They should all disappear behind the one closest to you if they are lined up correctly

Ramps

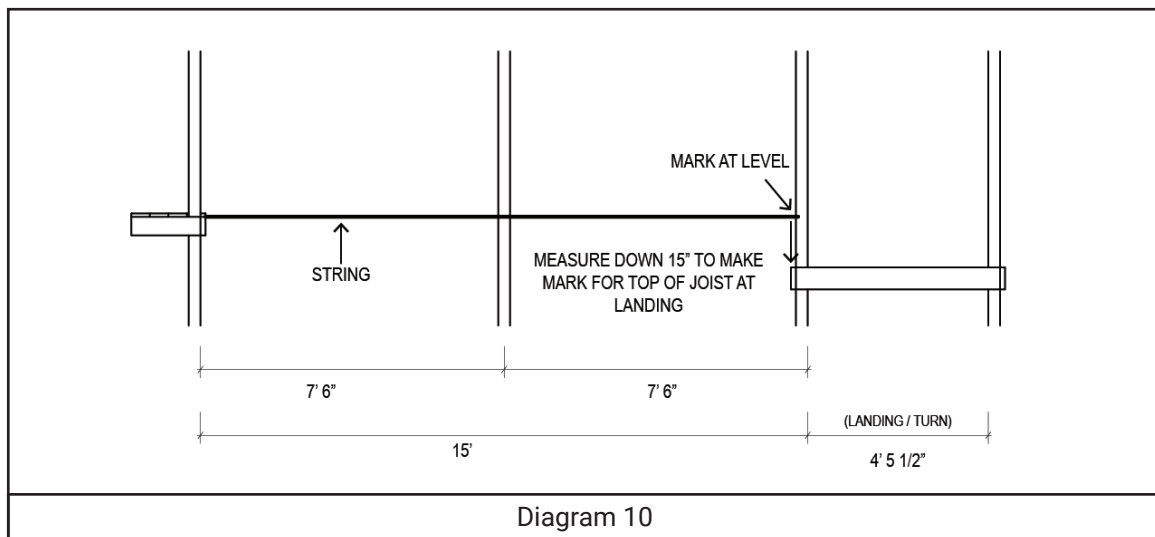


- Prepare the second line of posts (See Diagram 8 and 9)
 - For this line of posts, attach another string (lined up with the inside of the starting post) and square it, securing it to a stake as was done for the first line
 - The distance from the inside to inside of each set of posts moving down the ramp is 41 1/4"
 - Mark the holes, dig, and put in cap blocks or sackrete as done before
- Setting the second line of posts (See Diagram 8 and 9)
 - Follow the same process as for the first line of posts
 - **Additionally, make sure that as posts are set there is a 41 1/4" space from the inside of posts in the first line to the inside of posts in the second line**
 - Continue until all posts in line are set
- Follow the same procedure for any additional lines of posts that form a sloping portion of the ramp

Ramps

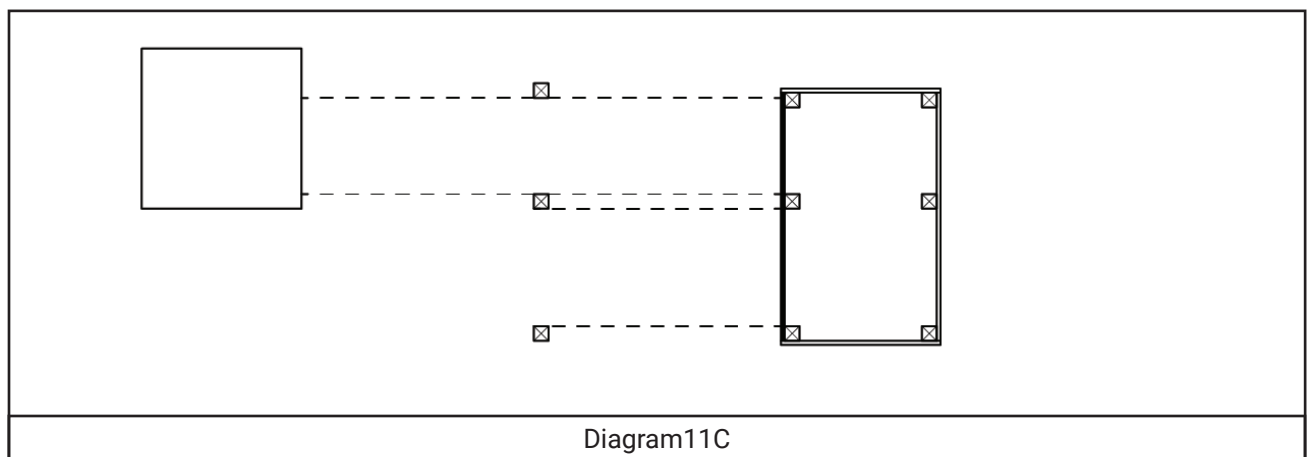
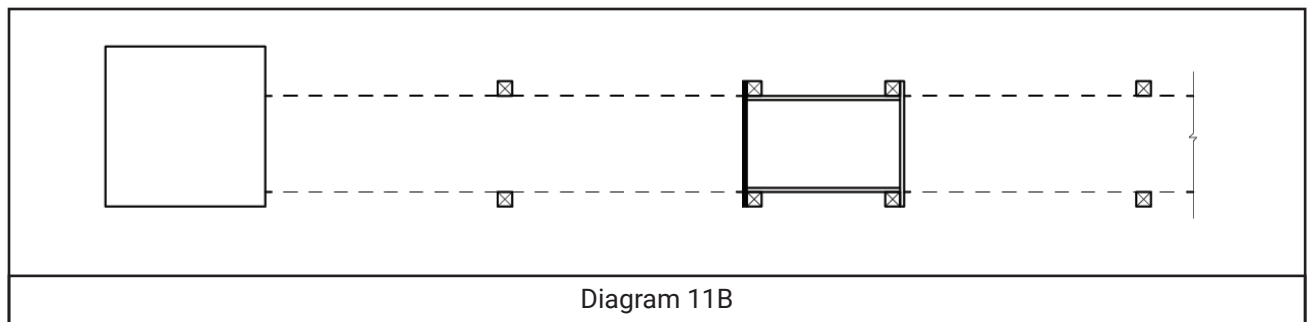
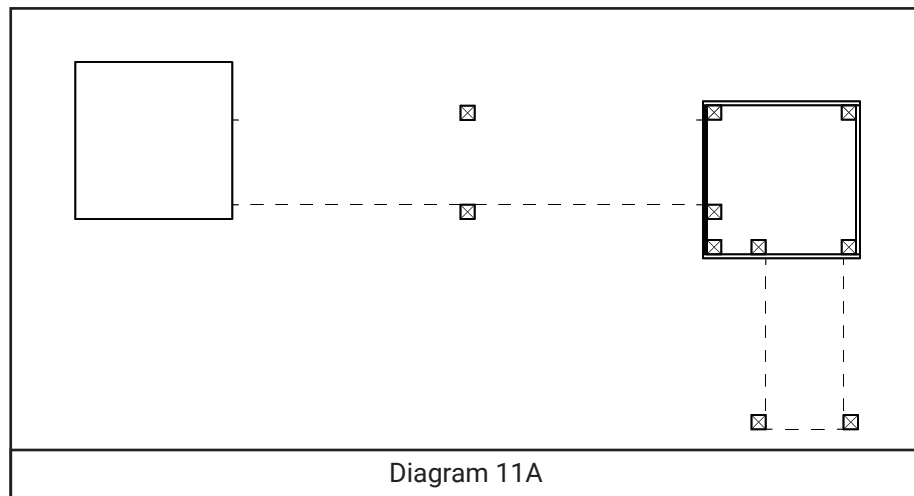
Landing Frame (if applicable):

- Starting at the top of the ramp the runner will drop 1' for 12' of length
- Use string and line level from the top of point where the first runner will start at the porch/landing
 - If initial landing is already decked, drop string 1" to account for the thickness of the decking that will be added on top of the runners, to ensure a smooth transition
- Run string to the first post in the landing/turn and mark at level
- Measure down from this level mark and make another mark at how many inches of drop there should be for this section of the ramp
 - **The number of inches dropped is equal to the distance in feet of the dropping section of the ramp**
- Diagram 10 demonstrates this process with two sections of ramp that are dropping over a 15' section



Ramps

- Repeat this process on the second line of posts
- Install a 2x6 across the posts at the bottom of the dropping section of ramp (and any others that make up this side of the landing/turn - See Diagram 11C) so that the top of the 2x6 lines up with these marks
 - Make sure this board is level
 - Attach board with 2 LedgerLOKs into each post
 - Diagram 11 shows the outside frame for a intermediate landing, 5'x5' turn, and 5'x8' turn, with the highlighted member being the first installed at the marks made using the string level
- Add additional framing members, using a level to carry them around the posts (See Diagram 11)
 - Where each 2x6 intersects a post, attach with 2 LedgerLOKs



Ramps

- Install the joists in the landing/turn (See Diagram 18, page 285 for common joist layout of each landing)
 - Install common joists every 16" on center
 - Measure and install each common joist with deck screws through the band joist
 - Make sure joists are flush with the frame at the top
 - Once each joist is in place, add a 2x6 joist hanger using joist hanger nails in holes on the flat surface and 2 ½" deck screws through the diagonal holes
- Add blocks (cut from 2x4) to each post in landing to provide a bearing surface for decking (See Diagram 12)
 - Make sure to pre-drill the holes in these small pieces to prevent them from splitting

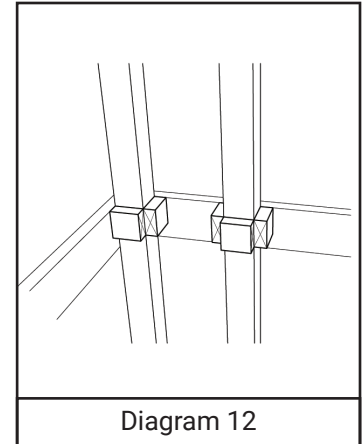


Diagram 12

Outside Runners:

- Runners are 2x6s that will act as joists on the dropping ramp
- Starting at the top of the ramp the runner will drop 1' for 12' of length
- The angle for where the runner meets a landing is 5°, cut both ends of runners at this angle
- Make sure runners are dropped 1" from the surface of the landing/porch so that when the decking is added the transition will be smooth (if tying into an existing landing)
- Runners will be installed on the inside of each line of posts (See Diagram 13)

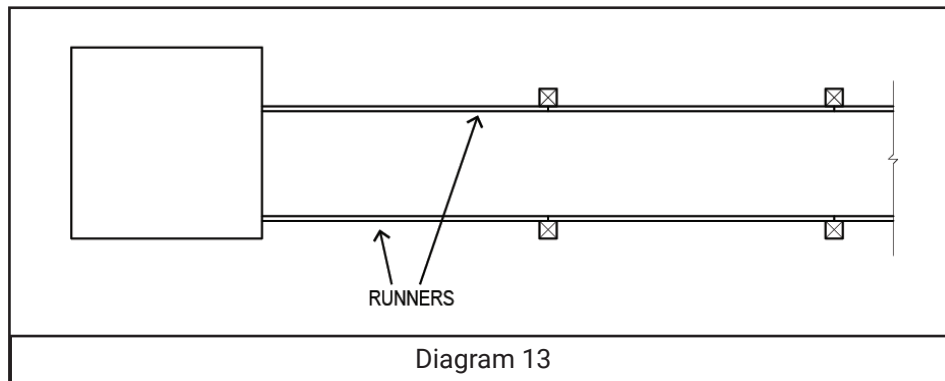


Diagram 13

- Check the slope of the runners as they are installed
 - A 2x4 block can be taped to a 4' level at 42" (See Diagram 14)
 - The 3 ½" to 42" ratio is the same as the required 1" to 12" for the slope of the ramp
 - With the level and 2x4 block sitting on top of the runner, the runner is at the correct slope when the level/block assembly reads level

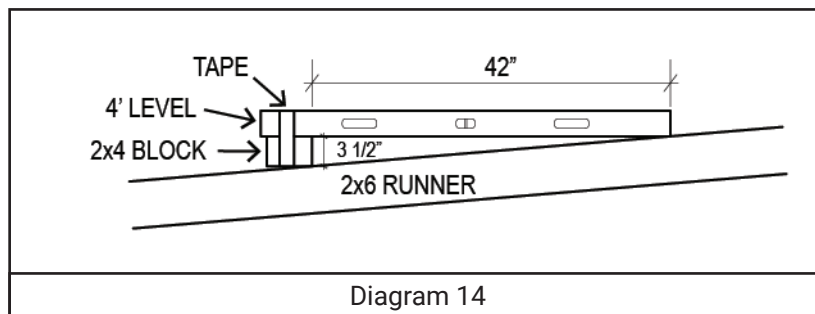
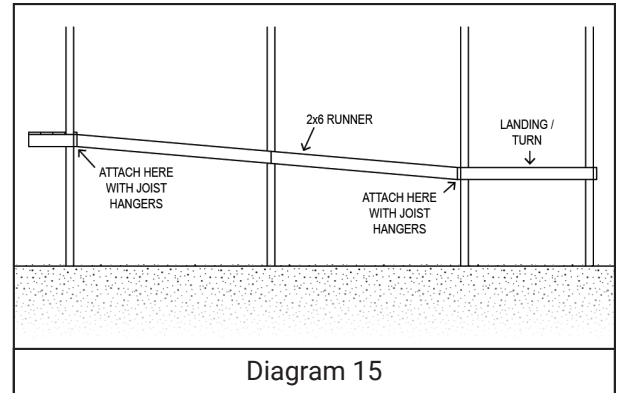


Diagram 14

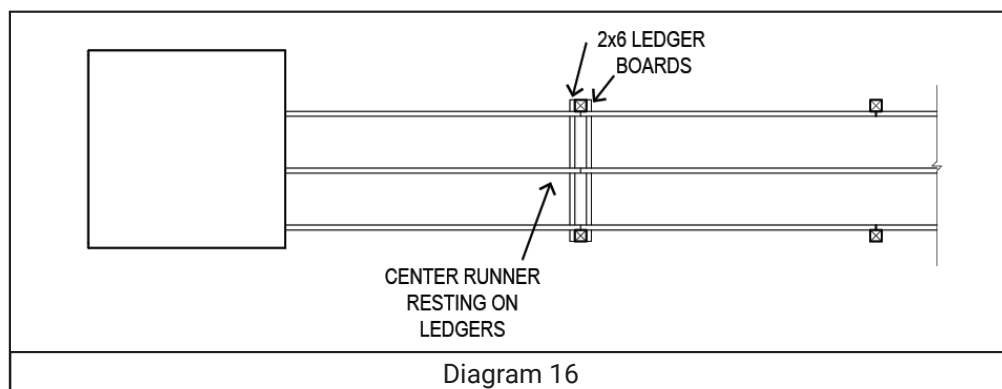
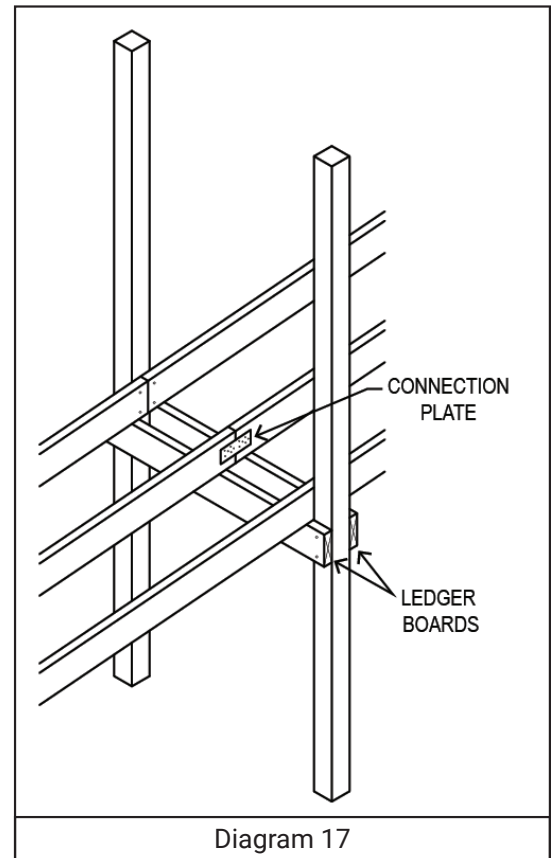
Ramps

- Where runners meet at posts, they should be butted together and flush to one another at the top
- Runners should be attached to each post with 2 LedgerLOKs but can be temporarily attached with screws until they are adjusted to the correct place
- Use joist hangers where runners meet landings
- Make sure that where the runners intersect with the landing that the runners are flush at the top
- Follow the same process for any additional sections of ramp



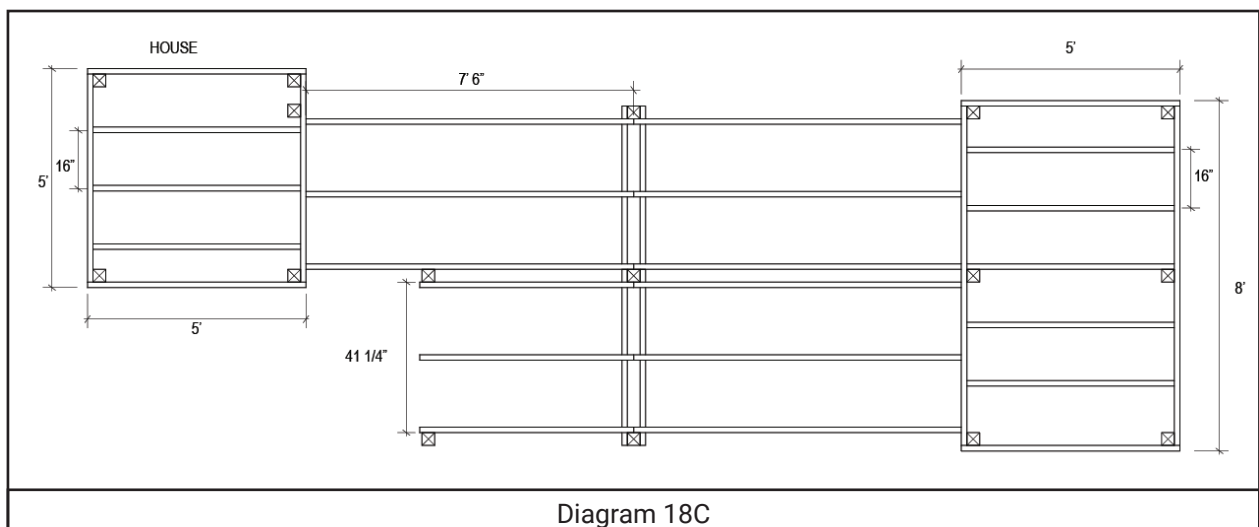
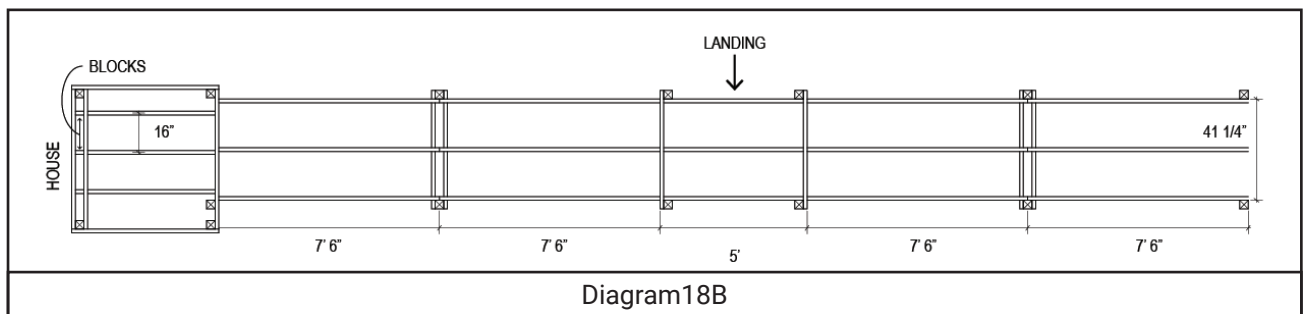
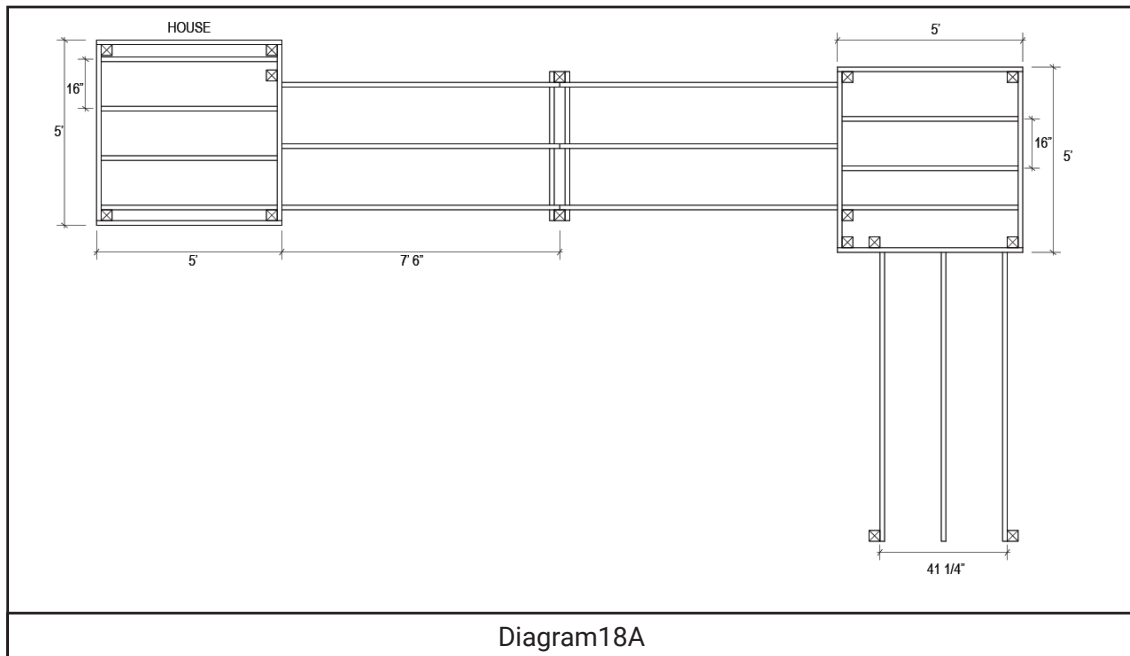
Ledger Boards and Center Runners

- Ledger boards are cut from 2x6s
- These will rest snugly underneath and perpendicular to the runners and connect pairs of posts together (See Diagram 16 and 17)
- Attach ledger boards to posts with 2 LedgerLOKs to each post
- A ledger board should be installed on both sides of each set of posts, butted up to the bottom of the runners
- Install center runners (See Diagram 16 and 17)
 - Cut both ends at 5°
 - Set on top of ledger boards and tack into place using screws
 - Make sure that the center runner is directly in the center of the opening
 - Attach the center runners to the Ledger boards by toe screwing and the ends together using a joining plate on each side (to attach use joist hanger nails in every hole **DO NOT USE SCREWS**).
 - Make sure that where sections of center runner butt together over ledger boards, the tops are flush



Ramps

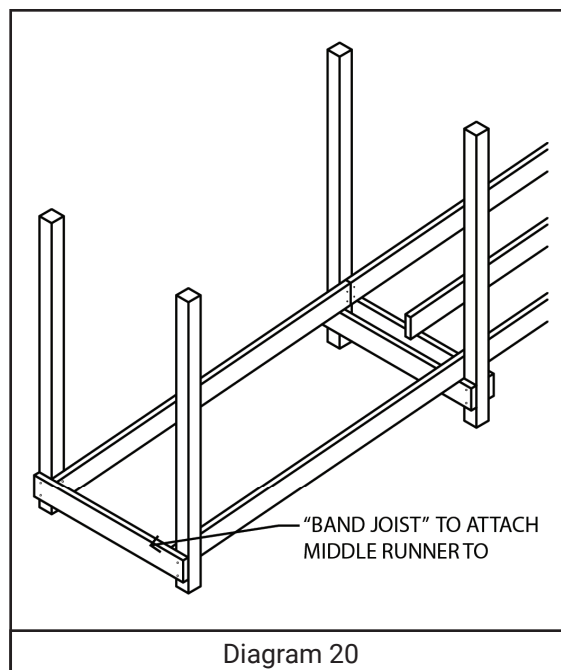
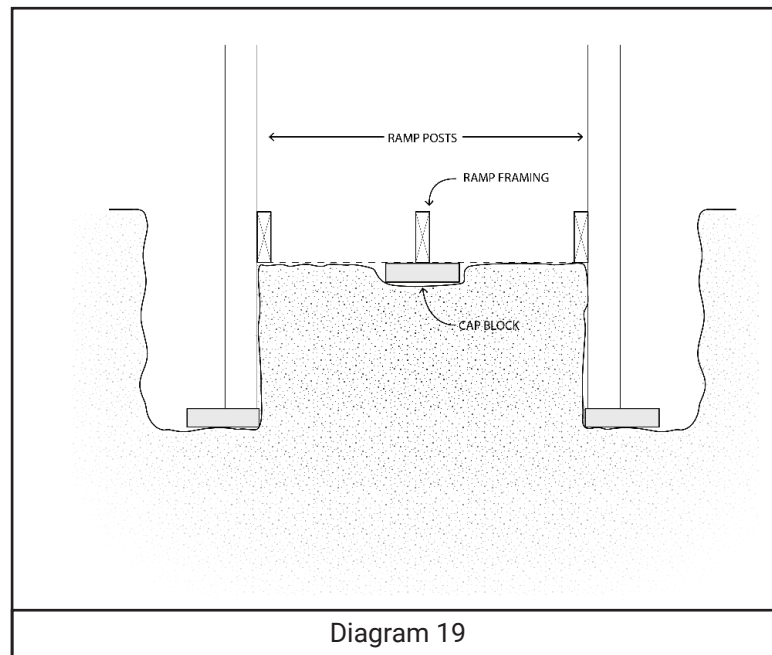
Diagram 18 A, B, and C illustrate several possibilities of framing for different ramp layouts. Other variations/combinations of these are possible.



Ramps

Transition from ramp to ground:

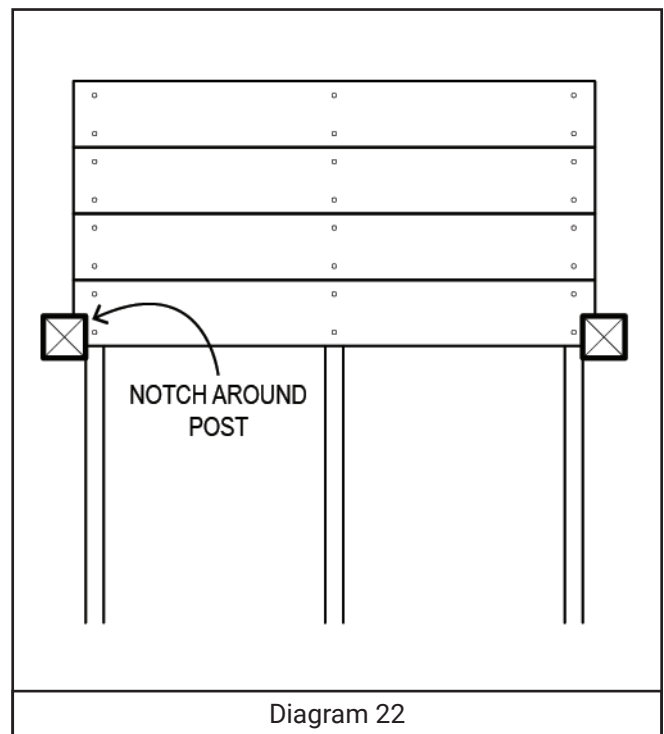
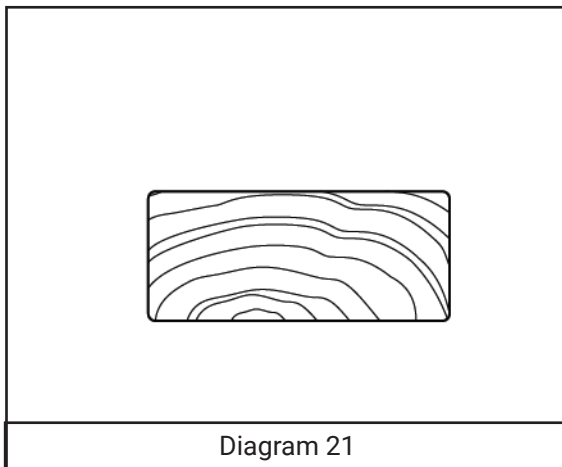
- When transitioning from ramp to ground, enough dirt will need to be removed so the ramp will maintain the proper slope for a smooth transition to ground level.
- In addition, post holes will be needed at the end of the ramp.
- Attach outside runners to posts and attach a 2x6 to the ends of the runners. This will act as a band joist to catch the middle runner.
- The middle runner should also be supported by a cap block.
- If ground contact lumber is available, it should be used for this section of the ramp since it is in contact with the ground.



Ramps

Decking

- Decking will run perpendicular to the runners/joists
- Allow for a 1" overhang of the decking on the ramp and landings
- Crown boards when installing by looking at the end grain of the boards (this helps water to run off rather than sitting on the wood) (See Diagram 21)
- Notch around posts using a jigsaw (See Diagram 22)
- Put two screws through the deck board into each runner about 1" in from the edge of the deck board (See Diagram 22)
- Do not leave any spaces between the boards, as the treated lumber dries out it will shrink, and small gaps will form to allow water to run between
- If the runners are not perfectly square, decking may need to be cheated in one direction (rather than lining up decking edges perfectly) so that decking still covers the outside runners
- As an alternative method, decking pieces can be pre-cut to 48" and installed with relatively even overhang on each side, after decking is installed a chalk line can be used to mark a 1" overhang and decking can be cut at that mark



Ramps

Railings

- There are two different methods of railings for ramps: barn rails and spindles
 - Spindles are required for any ramp 32" or higher off the ground
 - Barn rails can be used for any ramp less than 32" off the ground
- For 5'x5' and 5'x8' landings, the handrails will be different than those on the sections of ramp, for a 5' straight intermediate landing, the rails will be the same as the dropping sections of ramp

Spindle Railings (See Diagrams 23 and 24)

- Cut posts
 - On landings cut posts off flat at 34 ½" above the decking
 - For posts along the dropping section of the ramp, mark 33" above the decking on the first and last post (on the uphill side) and use a chalk line to transfer that line across all posts on the dropping section
 - Cut off posts at this angle using a circular saw at maximum depth and finishing cut with a reciprocating saw
 - Make sure someone is there to catch the top piece that is being cut off
 - Around landings refer to directions in "Porch" section on page 260
- For dropping sections of ramp:
 - Install a 2x4 bottom bumper
 - This will start at the inside of the first set of posts at the landing/porch
 - Cut both ends at 5°
 - Bumpers will run on the inside of the posts (like the runners)
 - This bumper will rest 3 ½" above the surface of the deck boards (use a 2x4 block for spacing)
 - Attach with 3" deck screws
 - Install a 2x6 top rail
 - Like the bottom bumper, this will start at the inside of the first set of posts at the landing/porch, cut both ends at 5°, run on the inside of the posts, attach with 3" deck screws
 - Install this 2x6 sticking 3" above the tops of the cut posts
 - Install 2x4 cap that will lay flat and cover the tops of the 4x4 posts, and eventually the ends of the spindles
 - If needed, install a block at the top and bottom for this cap to rest on (See Diagram 20)
 - Make sure that joints in this cap are over a post
 - Install spindles
 - Install every 3 ½" (2x4 width can be used at top and bottom as a spacing block)
 - Cut spindles to length (measure from bottom of bottom rail to bottom of 2x4 cap)
 - Top of the spindles can be cut at a 5° to match the slope of the top rail
 - Pre-drill holes in spindles with 1/8" drill bits, and install with 2 ½" screws
 - Start in the middle of each section of ramp and work to either side, making sure the center spindle that is installed first is plumb

Ramps

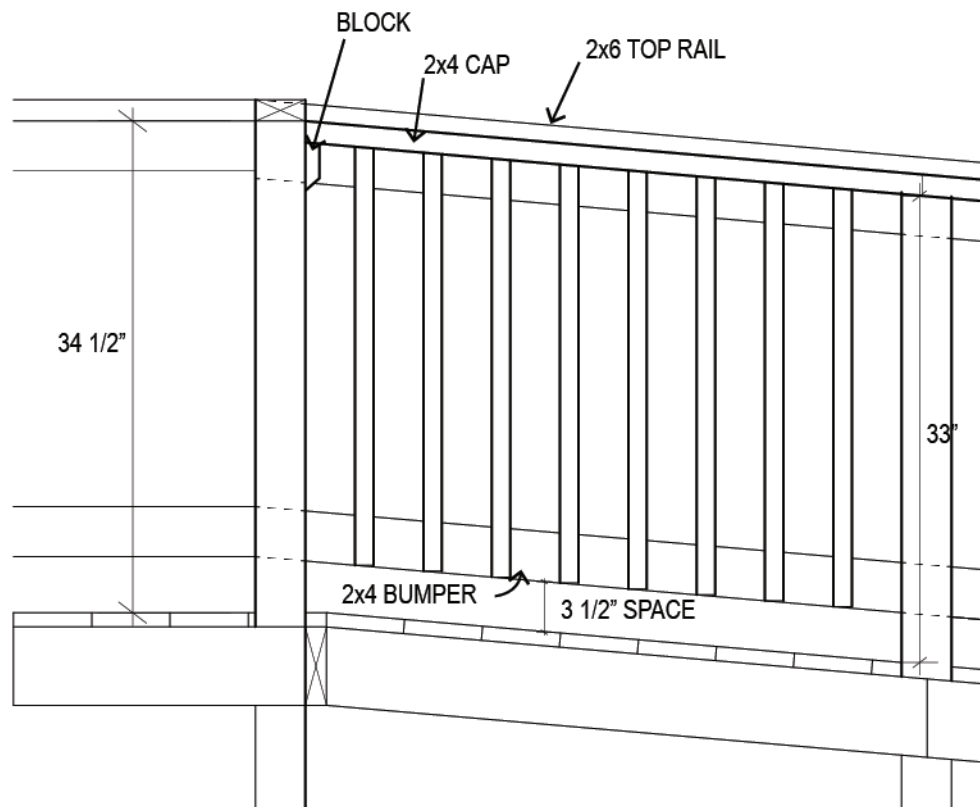


Diagram 23

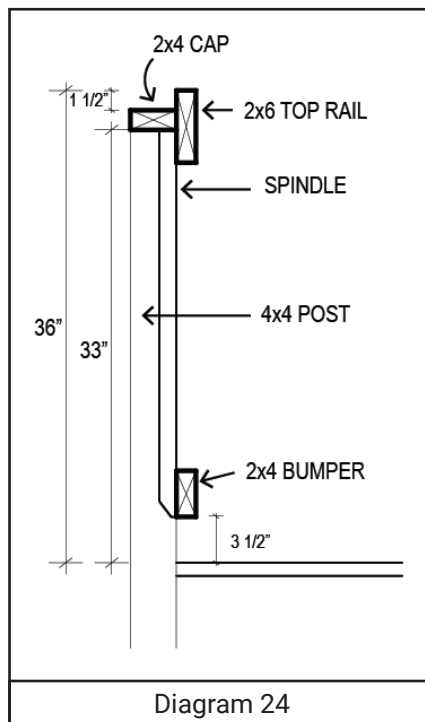
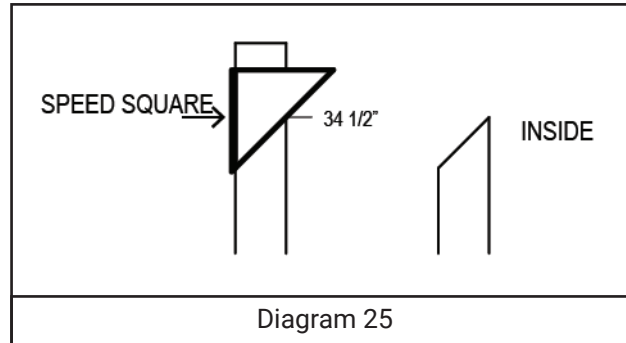


Diagram 24

Ramps

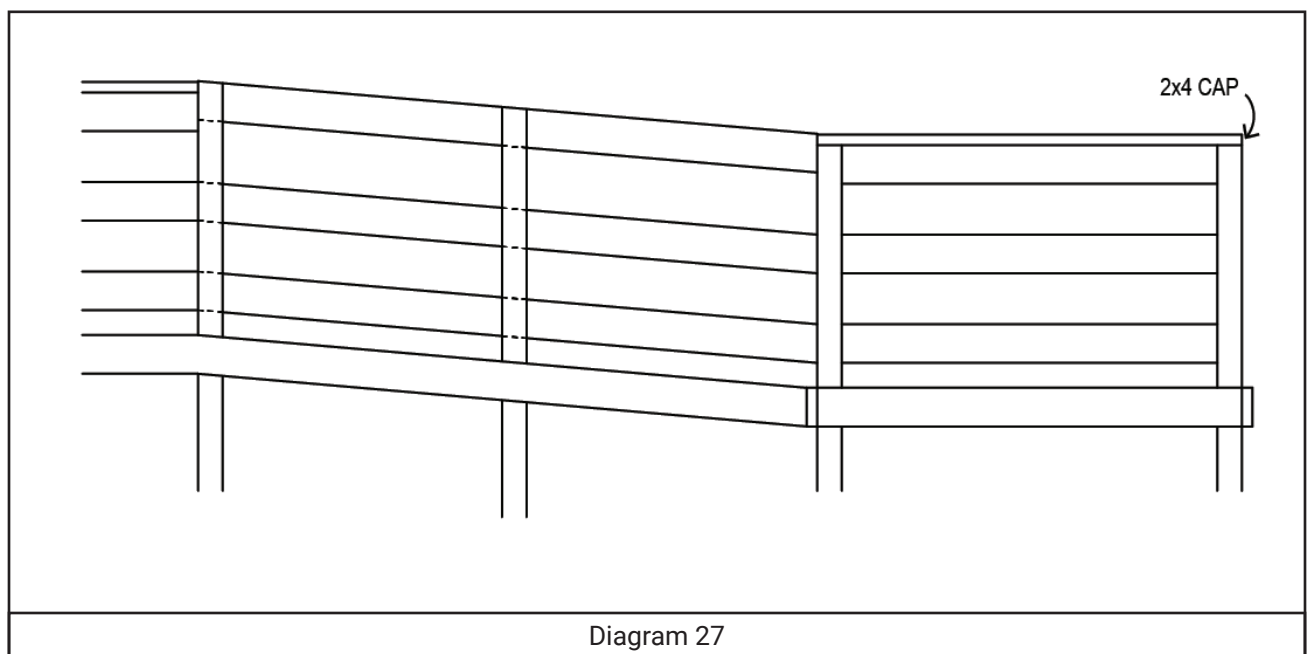
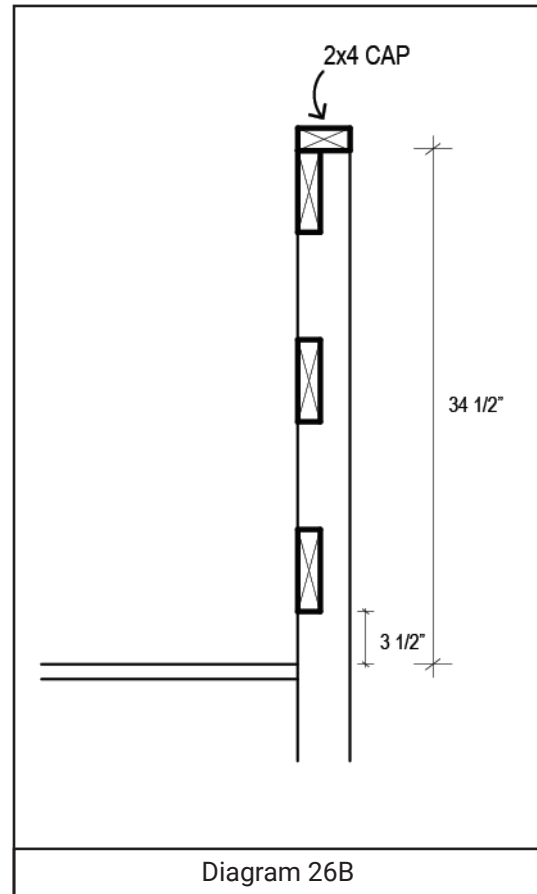
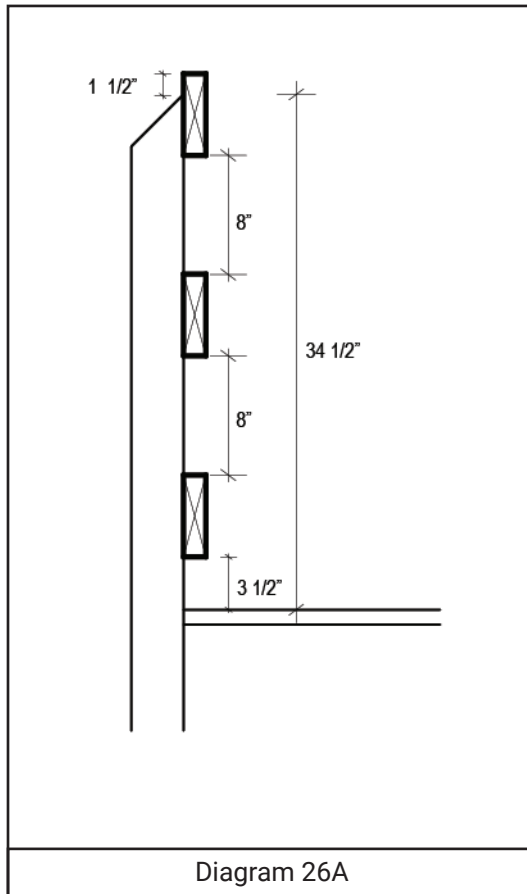
Barn Railings: (Check with local building codes whether Barn Railings can be made.)

- On landings, cut posts off flat at 34 ½" above the decking
- For posts along the dropping section of ramp, measure 34 ½" above the decking on the uphill side of each post
 - Transfer lines around post with speed square and cut post at a 45° angle (See Diagram 25 and 26A)
 - Can make the first pass of cut with a deeply set circular saw and finish with the reciprocating saw
 - Make sure someone is there to catch the top of the post as it is cut off



- Attach 2x6 handrails/bumpers down the ramp on the inside of the 4x4 posts using deck screws (See Diagram 26A and 27)
 - For top rail let 2x6 stick up 1 ½" above the tops of the posts
 - Install a 2x6 bottom rail 3 ½" above the decking (can use a 2x4 turned on edge as spacing)
 - Install an additional 2x6 between the top rail and bottom bumper
- Around landings (Diagram 26B and 27)
 - Install 2x6 rails (top, middle, and bottom) matching the height of those on the dropping sections of ramp
 - The top rail will not completely line up because of the additional 2x4 cap around the landing
 - These will be cut and installed between posts rather than on the insides (as shown in diagram 26B)
 - Install a flat 2x4 cap, covering the top of the posts
 - Cut 45° angles at landing corners

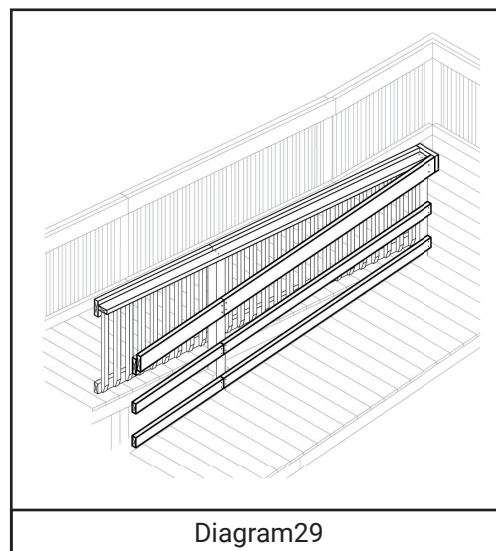
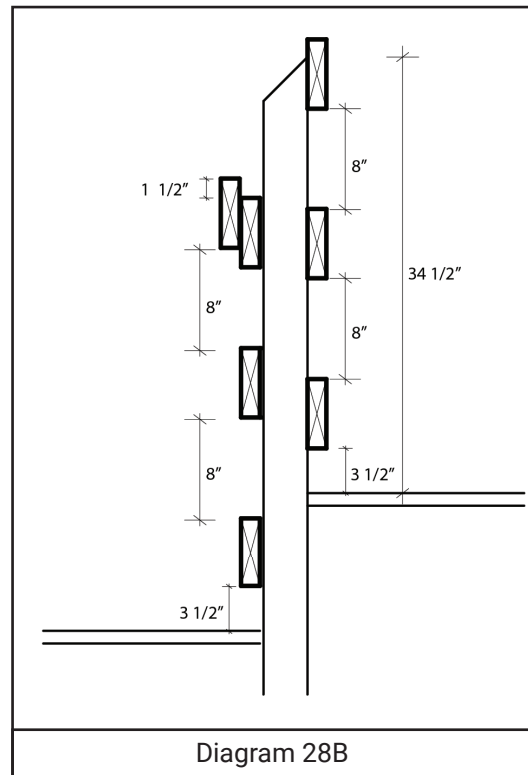
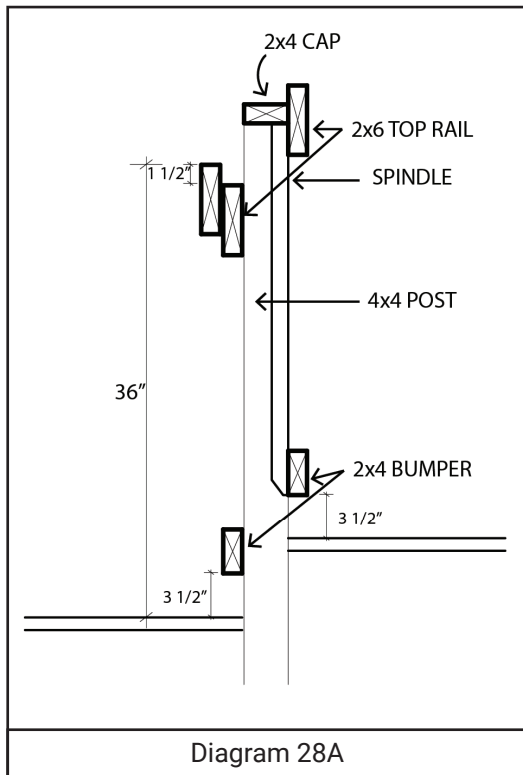
Ramps



Ramps

Railings for Ramps that turn 180 degrees

- An additional 2x6 top rail will be needed for both spindle and barn rail style ramps that turn 180 degrees.
- This additional 2x6 allows space for the top rail to be graspable on the lower sections of ramp.
- Posts spaced at 41 1/4" will allow for this while still maintaining minimum clearance of 36".



Ramps

Terminating a Ramp

There are times when a ramp will end in a space that can become a muddy area beside a driveway. This can be addressed in two ways. First, pavers and sand/concrete/mortar or other materials can be set up for a more decorative and potentially less expensive solution. Second, a concrete pad can be poured at the end of the ramp to give the homeowner a non-muddy area at the end of the ramp.

Paver Landing

When to build a Paver Landing:

- The area where the landing will be is on a hillside
- The area where the landing will be built does not regularly have standing water.
- It can be built without a full frame

Installation:

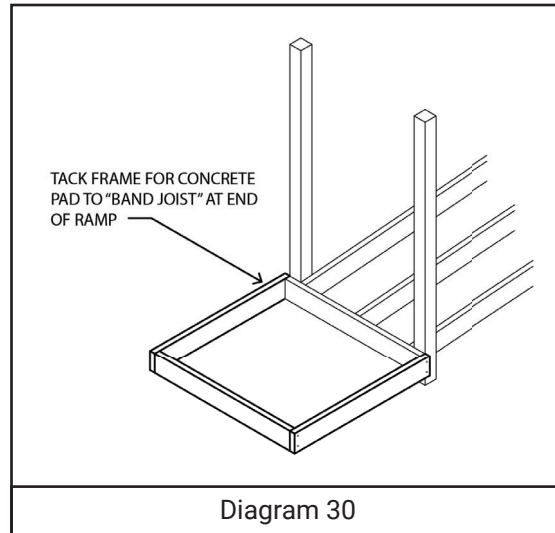
- Begin by digging down a level area the desired size of the landing
 - If the landing is on a hill and has a low side some sort of frame will be needed to prevent the landing from sliding down the hill (split pavers work well)
- Add a layer of gravel to the area where pavers will be placed to give a stronger foundation.
- Smooth out a thin layer of construction sand on top of the gravel to provide a smooth surface for the pavers to sit on
 - This will prevent pavers possibly breaking
- Layout the pavers on top of the sand starting closest to the ramp making sure the top of the pavers is flush with the top of the ramp (if they are a little high this is okay because the pad will compress overtime)
- Use more sand to fill any gaps between the pavers and sweep off the extra sand.

Concrete Pad

When to Choose a Concrete Pad:

- If the ramp ends in a level, low area that is prone to standing water
- If cost and the water needed to mix the concrete are available.
- If the volunteers are physically able to move the bags of concrete and all of the needed tools are available.

Ramps



Installation (See Diagram 30):

- Dig down the area at the end of the ramp to the desired dimensions of the landing pad.
 - This should go all the way to the termination of the ramp (2x6 placed at the end of the runners)
 - The top of the landing pad should be even with the top of the deck boards
 - The minimum thickness for a landing pad is 4" so the area at the end of the ramp may need to be filled in some to get the proper height.
- Build a concrete frame/form using 2x6 lumber (this will be removed so it doesn't matter if it is PT or Finished)
 - The inside area of the frame/form should be the full width of the ramp or wider and the length should extend past the muddy area.
 - Make sure the frame is square (cross bracing can be used)
- Mix concrete in a wheelbarrow
 - The consistency of the concrete should be about like a fast-food milkshake to allow for it to pour and spread well. The wetter or thinner the mix the longer it will take to cure.
- Pour the concrete into the frame/form and spread it evenly
 - Scrap pieces of 2x4 can be used as a concrete float to help smooth it out.
- Repeat mixing and pouring until the pad is at the proper height
- Smooth the top out using a concrete float or scrap pieces of 2x4.
 - Lightly move the board over the surface of the concrete to smooth out any lumps, bumps, and bubbles that are present.
 - Try to leave any rough areas near one edge of the pad
- Block off the area around the pad with caution tape and sawhorses so it doesn't get walked on
 - When volunteers arrive the next day, they can admire the animal footprints that showed up overnight.



Mobile Homes

Mobile homes are manufactured buildings that come out of a factory ready to live in (heat systems/plumbing/and electric included). Mobile homes are designed to be moved to a site, placed on piers or a continuous foundation, and hooked up to service facilities. Initially, mobile homes were not intended for long term/permanent use. Prior to 1978 there was little regulation on mobile home structure. Due to many manufacturers, mobile homes are constructed differently.

Section Contents:

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Mobile Homes

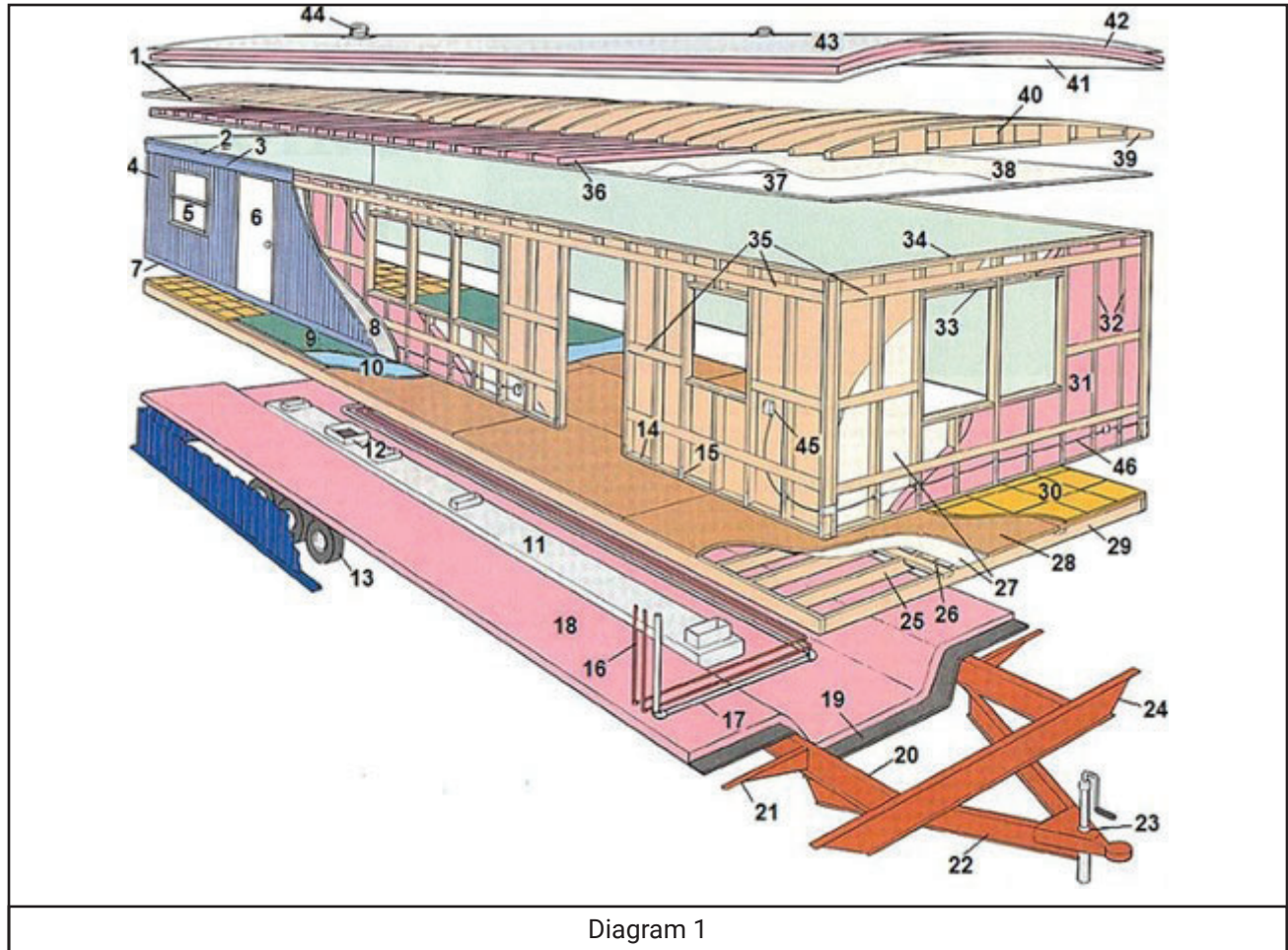


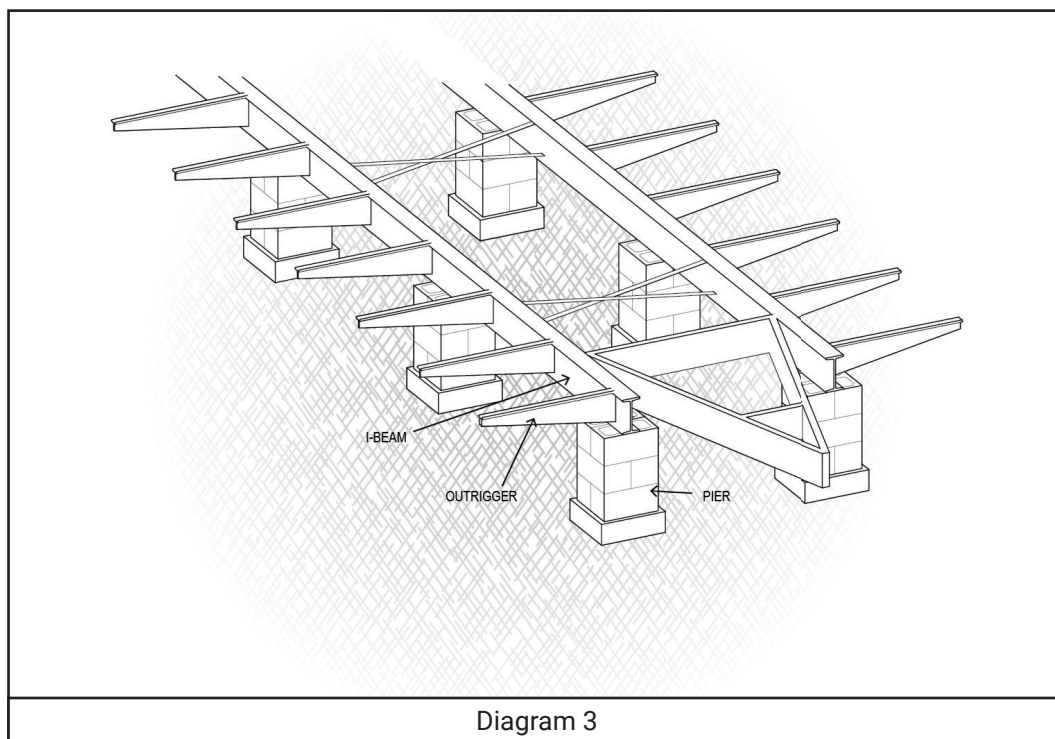
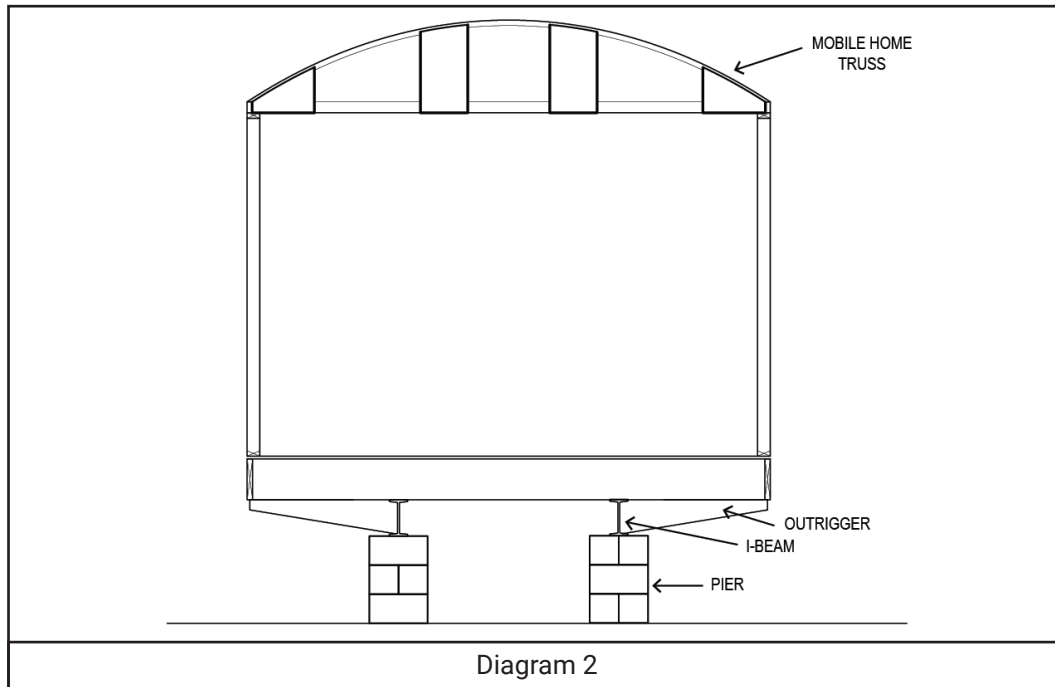
Diagram 1

- | | | |
|---------------------------|--------------------------------|---|
| 1. Truss | 22. A-Frame | 38. Second Roof Vapor Barrier |
| 2. J-Rail | 23. Hitch and Jack | 39. Truss Rafter |
| 3. Top Starter Panel | 24. Front Cross Member | 40. Tie Rail (Cross Rafter) |
| 4. Metal Siding | 25. Floor Joist | 41. First Roof Vapor Barrier |
| 5. Window | 26. Stringer/Bracing | 42. First Layer of Fiberglass Roof Insulation |
| 6. Exterior Door | 27. Vapor Barrier | 43. Galvanized Roof Steel |
| 7. Bottom Starter Panel | 28. Floor Underlayment | 44. Furnace Roof Stack |
| 8. Wall Sheathing | 28. Bottom Sill | 45. Electrical Outlet Box |
| 9. Carpet | 29. Vinyl Floor Covering | 46. Electrical Wires |
| 10. Carpet Pad | 30. Fiberglass Insulation | |
| 11. HVAC | 31. Studs | |
| 12. Furnace Base | 32. Header | |
| 13. Moving Gear | 33. Top Plate | |
| 14. Bottom Plate | 34. Belt Rails | |
| 15. Gusset | 35. Second Layer of Insulation | |
| 16. Water Supply Lines | 37. Ceiling Panels | |
| 17. Drain/Sewer Line | | |
| 18. Fiberglass Insulation | | |
| 19. Vapor Barrier | | |
| 20. I-Beam | | |
| 21. Outrigger | | |

Mobile Homes

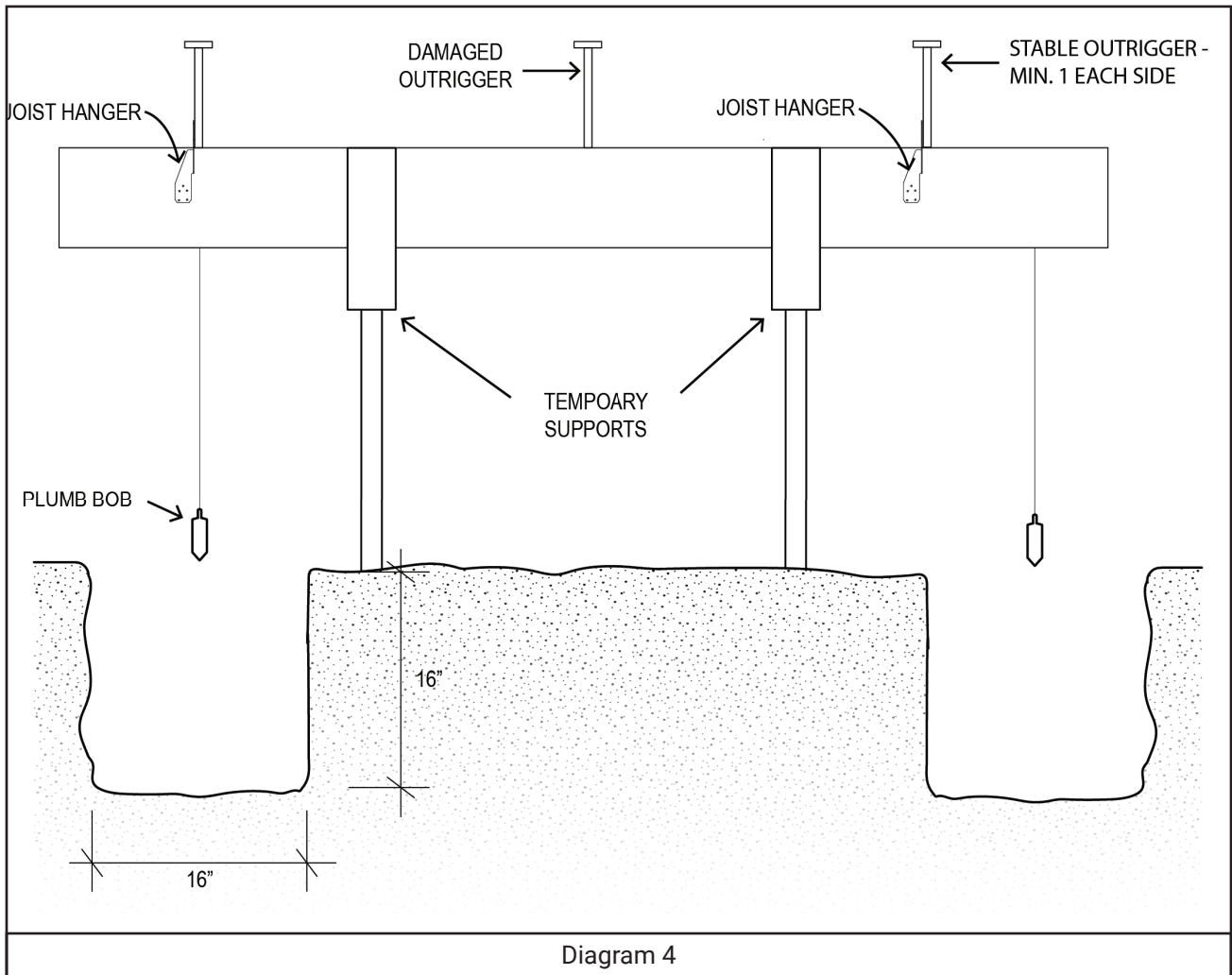
Foundations (See Diagram 2 and 3)

- I-beams run the full length of the mobile home and are the main support for the mobile home
 - I-beams should be supported every 8' with a pier
 - Piers are most likely concrete blocks
 - If any piers are compromised or missing, sonotubes should be installed (See pages 26-34 for information on sonotube installation)



Mobile Homes

- Outriggers: come off the I-beams perpendicularly and support the band joist and exterior wall
 - If outriggers are missing or damaged, the band joist/exterior wall can be supported by installing a 4x4 post under the band joist (see Diagram 4)
 - See instructions for post installation on pages 32, install as a post would be installed under a girder



- Tie Downs: come off the floor system and I-Beam and anchor to the ground.
 - They are installed to prevent floor system movement and create a permanent connection to the land.
 - On occasion these mobile home tie downs are on the exterior of the mobile home and run over the roof and siding. These over-the-top tie-downs should not be removed during a mobile home project.

Mobile Homes

Floors

- Structure:
 - Typically, mobile home floor joists will be 2x6s running perpendicular to the I-beams
 - I-beams
 - Joists could also be 2x4s
 - Joists could run parallel to the I-beams
 - Check underneath mobile home to look at structure before opening floors
- Floor framing sits directly on I-beams (See Diagram 2)
- If band joist repair is needed, wall/roof should be temporarily supported (See page 48)
- Subflooring is most often particle board
 - Particle board does not hold up to moisture and disintegrates quickly
 - If coming down to subfloor for repairs, it is good practice to replace all particle board with $\frac{3}{4}$ " OSB
 - Subfloor repair found on page 41

Walls

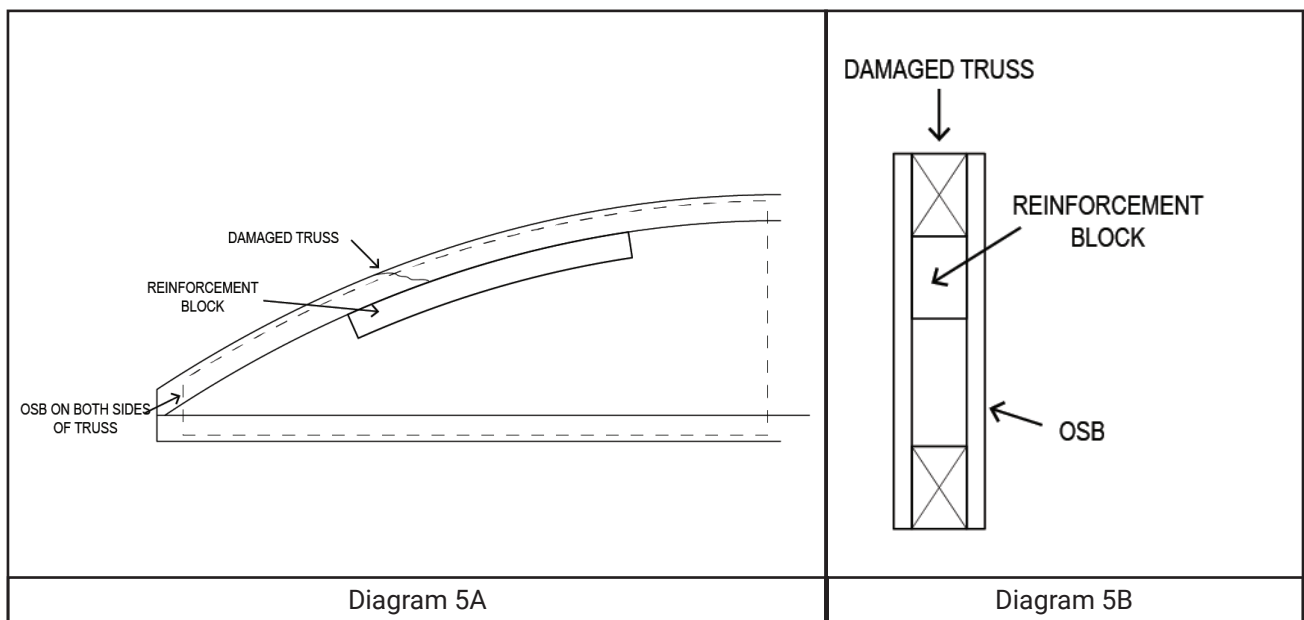
- Walls are likely not a full 2x4
 - 2x2s or 2x3s are common
 - If repairs are to be made to walls, 2x4s will likely have to be ripped down to the correct width with a table saw
 - Some suppliers do sell 2x2/2x3
- Exterior walls of the mobile home carry the weight of the roof trusses
- Mobile home siding
 - The metal siding of a mobile home provides lateral support and should not be removed unless alternate lateral support will be installed
 - Alternate lateral support methods could be sheathing or lateral 1x4s installed every 16" on center

Roofs

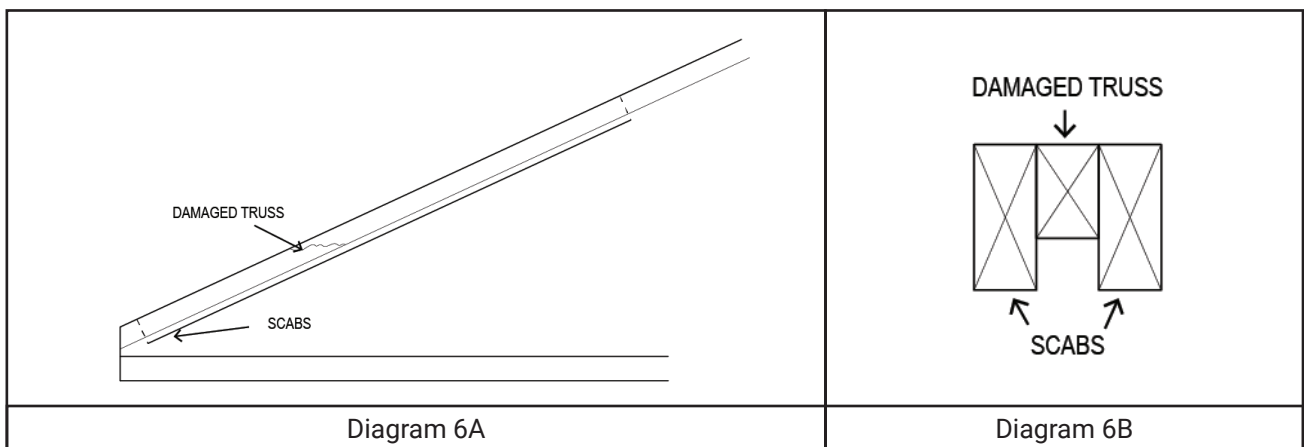
- Mobile home roof structure consists of trusses that sit on the exterior walls
 - Trusses are made of small lumber (typically 2x2 or smaller)
 - Trusses are not intended to carry much weight (about 20 lbs. per square foot or less depending on truss style) and are easily broken
 - If work must be done on a mobile home roof, OSB should be laid down on the roof (crossing at least 3 trusses) to distribute the weight of a person
- Thin metal roofing is screwed into the top of the trusses, there is no solid decking to the roof
- Roofing options for mobile home roofs
 - Use SBS on flat or bow truss roofs
 - For pitched roofs, SBS or Tin roof covering can be used (See page 93)

Truss Repair

- Truss repair will be done from inside the home, ceiling drywall will likely be damaged and need to be removed if truss repair is needed
- For rounded mobile home roofs, add a block underneath the broken place in the truss (See Diagram 5)
 - The block used should not be wider than the truss
 - Extend the block 1' past the crack on each side
 - Screws should go into but not through the top piece of the truss
 - OSB plates should be cut to cover the crack and the reinforcement block, down to the bottom member of the truss
 - OSB is represented by the dashed line in Diagram 5A
 - OSB should be added to both sides



- For flat or gable shaped mobile home roofs, scabs should be added to either side of the cracked truss (See Diagram 6)
 - Scab should extend 2' past the damaged area on both sides
 - A scab should be added on both sides of the truss if possible



Mobile Homes

Roof Repair (If there is a penetration in the metal skin of a mobile home roof)

- Locate leak and clean area with a plastic putty knife (removing chunks of roof coating)
- Cut a piece of metal flashing that will extend past the damaged area to the next truss on either side
- Run butyl tape or a bead of silicone caulk under the edge of the flashing
- Attach into the truss with roofing nails
- Run a strip of SBS that covers the patch and runs over the peak of the mobile home
 - Roll the SBS with a roller to help it adhere
- This should only be done in situations where there is one damaged area and the rest of the roof is in good condition, otherwise a roll roof covering replacement should be considered

Common Mobile Home Issues

- Rotten floor/wall under ac unit
 - This often happens because AC unit leaks and the window opening left by the AC unit is not sealed properly
 - Make sure that the AC unit slopes away from the home to drain properly
 - Unit can be supported by bracing on the outside if needed
 - Seal the open space left from the AC unit so that water cannot come in
 - Lauan cut to size can be used, paint outside to make waterproof
- Saggy vapor barrier underneath the home
 - If the vapor barrier under the home is sagging, the insulation may be sitting on top of that and not in contact with the floor, therefore not insulating
 - If the vapor barrier is sagging in one location, it could be an indication of a plumbing leak
 - Any new vapor barrier installed under a home should sit on the ground and not attach to the underside of the floor system.
- Water running into windows and exterior doors
 - Windows and doors can be caulked
 - Overhang can be installed with SBS roofing or shed roof system to keep water from running down the walls onto window/door frames
- Subflooring is often made from particle board instead of OSB
 - When this material gets wet, it will swell and eventually begin to come apart.
 - If there is carpet or other floor coverings, the disintegration of the subfloor may not be observable until the old floor covering is removed.
 - Particle board subflooring should be replaced with OSB of a similar thickness.
- Not enough insulation
 - If the vapor barrier is falling or the subfloor has been damaged by water, the insulation may need to be replaced or added to.
- Leaky windows and doors or windows with condensation
 - Mobile home windows are somewhat easier to replace than in stick-built homes.
 - If doors and windows need to be replaced, this needs to happen before HUGS or siding because the door and window mounting plates will be hidden behind the siding materials.

Mobile Homes

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HUG Systems

Why Hug Systems? The Hug System allows access to floor/wall repair from the outside of the home, adds significant insulation to the entire home, and provides both new roof covering and new siding/underpinning. The system reduces energy costs for the homeowner and creates a new, thorough building envelope. When considering a HUG for any home be sure that there is adequate time to complete all aspects of the HUG during the summer. ALL Mobile Home HUGs will include a new roof and underpinning that will tie into the siding system. HUGs done on a stick-built home may sometimes include a roof, but it might not tie into the siding.

Section Contents:

- Order of Operations 307
- Framing 307
- Overhang 308
- J-Channel 309
- Foam with Siding 310
- Flashing. 311
- Vinyl Siding 312
- Foam with Roof 312
- SBS 312
- Metal Roofing. 312

Safety

- Be aware of wires/plumbing that may run through walls that you are fastening into
- Be aware of and avoid any underground utilities that may interfere with framing around the bottom of the home
- Use ladder safety from page 16
- See project specific sections for additional safety information (siding, SBS, etc.)
- Watch out for any bees/critters under the home and in the soffit areas of stick-built homes.
- Look for any plumbing leaks under home before closing in crawl space

Hug System Project Planning

- What kind of obstacles will you have to work around? (porch roofs, cables, etc.)
- Locate where wires are likely to be and use shorter fasteners in these areas. (At the level of outlets, where switches are located)
- Is there adequate time to complete this entire project?
- How will the top of the hug system be terminated? Under the existing eave or will an overhang have to be added?
- What kind of roof material will be used on the HUG?
- Is the hug system going to cover the existing siding? Vertical nailers may be required.
- Will you need to remove existing vinyl siding?
- What color siding does the homeowner want?

Measurements Needed

- Dimensions of home
- Height from ground to eave at each corner or height from foundation to eave
- Height from ground to roof peak
- Number of windows/doors - how much J-channel will be needed to go around each one?

Quality Control

- Are nails for foam and siding going into studs? Should Lathe Screws be used in metal skin?
- Make sure foam terminates into J-Channel
- Ensure crawl space is vented
- Make sure there is an access door into the crawlspace
- Make sure overhang is securely fastened

Common Mistakes

- Seams of foam not taped
- Siding not level
- Nails missing studs, just fastening into metal siding
- Wrong fastener used
- Exposed foam around windows/doors
- Venting left out completely

See project specific sections for additional quality control/common mistake information

After Work is Complete Quality Control Check

- Is the transition from siding to roof smooth?
- Is J-channel around windows/door caulked?
- Is there venting to the crawlspace?
- See project specific sections for additional After Work Quality Control checkpoints

HUG Systems

Hug System Material List

Framing		
Quantity	Item	Purpose / Notes
	2x4x__ PT 2x4 can come in any length	Bottom plate: <i>Perimeter of home (in feet)/length of lumber = # of pieces</i> Vertical members for each corner, other vertical/horizontal members (as applicable), access door material
	½" (#4) Rebar	For anchoring bottom plate to the ground 1' of rebar is need for every 6' of base plate <ul style="list-style-type: none"> ○ <i>Perimeter (in feet)/6' = # of pieces of rebar</i> ○ <i># rebar needed/10' (typical selling length of rebar) = # of 10 pieces</i> Add a few extra pieces of rebar
	3" Screws *nailers may be required	Used to attach top plate and vertical framing Used in some applications
Access Door Material: (See Underpinning and Skirting Chapter)		
Foam Insulation Material		
Quantity	Item	Purpose / Notes
	½" Foam Board	for walls
	1" to 2" Rigid Foam Board To calculate needed foam	for roofs <i>SF of walls to be insulated/32 (SF in one piece) = # of pieces needed</i>
	J-channel	To catch edges of foam around doors/windows Linear feet needed/12 (feet in one piece) = # of pieces needed
	Housewrap Tape	To seal seams of foam
	1 1/2" lathe screws	For attaching foam and j-channel
	Window/Door Caulk	To caulk j-channel around windows/doors
	12" Galvanized Flashing	To install around base of home
Overhang Materials		
Quantity	Item	Purpose / Notes
	2x4x__ PT	For overhang that ties into the wall top plate
	1x6x__ PT	For overhang to act as Fascia Board
	3 1/2 – 4" Screws	To connect 2x4 an 1x6 lumber
	1x6 Metal Fascia	To cover 1x6 and provide surface for SBS
	White Aluminum Trim Nails	

Recommended Tools

Safety:

- Gloves (Sturdy/leather for working with metal)
- Glasses
- Ear Plugs

Power Tools:

- Table Saw
- Drills/Impact Drivers
 - T-25 Drivers to match deck screws
 - Philips bits for lathe screws
 - ½" Drill Bit to drill holes for rebar
- Circular Saw
 - Wood Blade
 - Metal Cutting Blade for cutting rebar
 - (or) Angle Grinder - with metal cutting blade to cut rebar
- Digging Tools:
- Shovel - to level out ground as needed and create positive drainage

General:

- Basic Hand Tools (Tape measures, hammers, pencils, speed square, etc.)
- Utility Knives - for cutting foam
- Sawhorses
- Extension Cords/Splitters Caulk
- Gun
- Tin Snips
- Level
- Heavy Hammer - to pound in rebar Plumb Bob
- Ladders

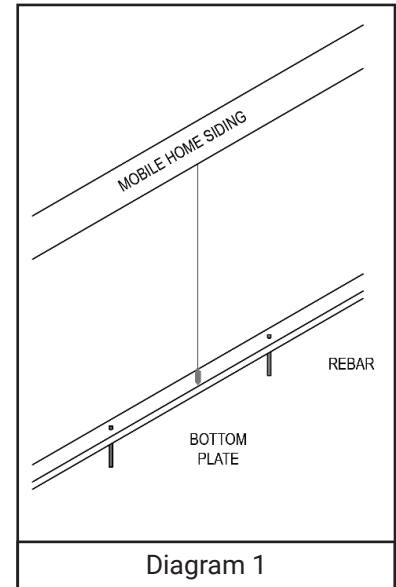
See Vinyl Siding section (page 151) for materials/recommended tools

See Roofing section (page 95) for materials/recommended tools (including material for the built-out overhang)

Hug System Instructions for Mobile Homes

Order of Operations: (See Diagrams 5 and 7 on pages 312, 313)

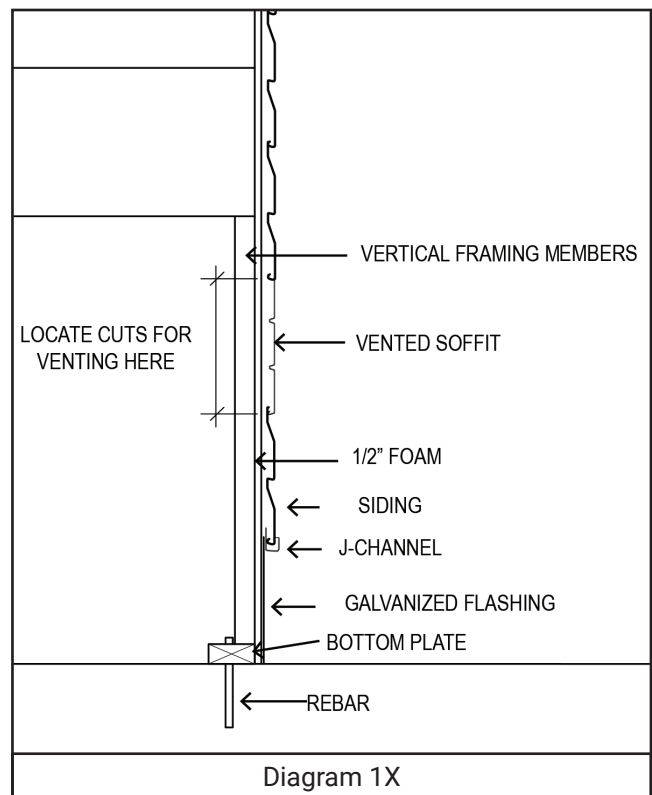
- Any needed band joist/wall repair (page 48)
- Framing around base of mobile home (page 308)
- Trim windows/doors with J-channel (to receive foam) (pages 308)
- Build out overhang around roof (page 308).
- Install metal fascia (page 150)
- Install SBS roofing, attach with termination bar (page 132)
- If installing Metal roofing or SBS on a Gable roof, install purlins with ridged foam (PolyISO) insulation between each.
 - Be sure to extend the metal 2 inches past the built-out overhang
- Install foam on walls (page 310)
 - Can start installing foam on roof at this time as well (page 312)
- Install flashing along bottom (page 311)
- Install vinyl trim and siding (after foam on walls) (page 151)



Framing Around Base of Mobile Home:

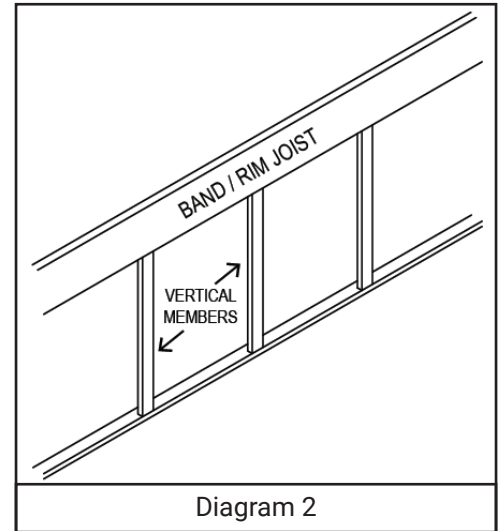
Hug systems on mobile homes combine the underpinning and siding into one unit. To do this, framing (much like underpinning framing) is needed to attach the foam, flashing, and siding too.

- Install Top and Bottom Plates (See Diagram 1)
 - Install Top Plate of Framing flush with the outside edge of the existing siding of the home.
 - Unlike with Underpinning Framing that sits back from the outside of the home wall this sits flush with the outside surface.
 - Prep bottom plates by drilling ½" holes in base plates every 6' or at each end of pieces shorter than 6'
 - When planning for rebar placement, be cautious of any underground utilities and allow a 3' clearance from them with the rebar
 - Use a plumb bob from the outside surface of the top plate to determine where the bottom plate will rest
 - When the outside edge of the bottom plate is flush with the outside edge, hold the bottom plate in place and pound 12" pieces of rebar in each hole drilled (heavier hammers will be better for this)



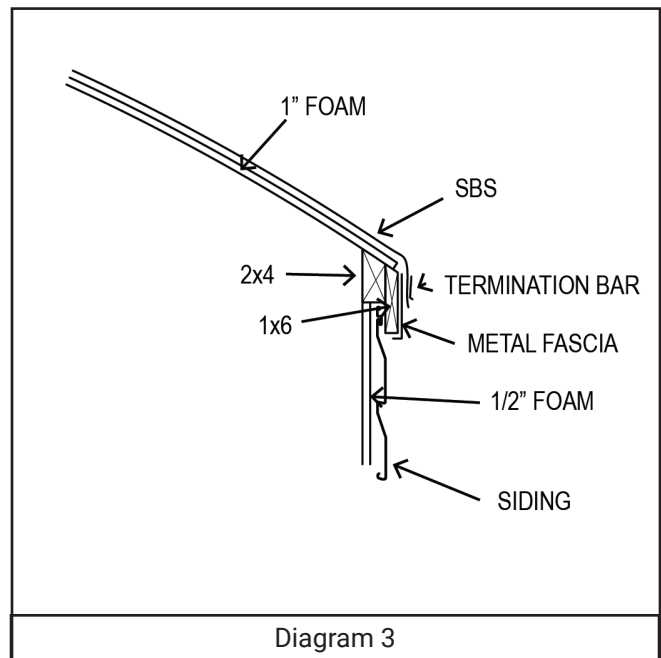
Install Vertical Framing Members and Locating Existing Wall Studs (See Diagram 2)

- Vertical framing member will be 2x4 material
- Vertical members should be installed directly below wall studs and no more than 16" apart.
 - Location of wall studs can be determined by pushing in on mobile home skin or driving short test screws to locate studs.
- Plan for access doors during vertical member installation, it should be near plumbing shutoff. It can be built as described in the underpinning sections using painted plywood as the door and vertical framing members as the jambs.
- Measure between the bottom of the band/rim joist and bottom plate for each individual member to get the length for each vertical member. Make sure the vertical framing is flush with the band/rim joists and/or top plate.
- Turn vertical members so that the wide side is facing out. The primary function of these members is to receive siding. Turning them, wide side out makes them easier to attach to.
- Fasten vertical members at the band/rim joist and then use level to make sure all members are plumb before fastening to bottom plate
 - Toe-screw members into place with 3" screws
- At each side of each corner, install vertical members 2 1/2" from the very corner



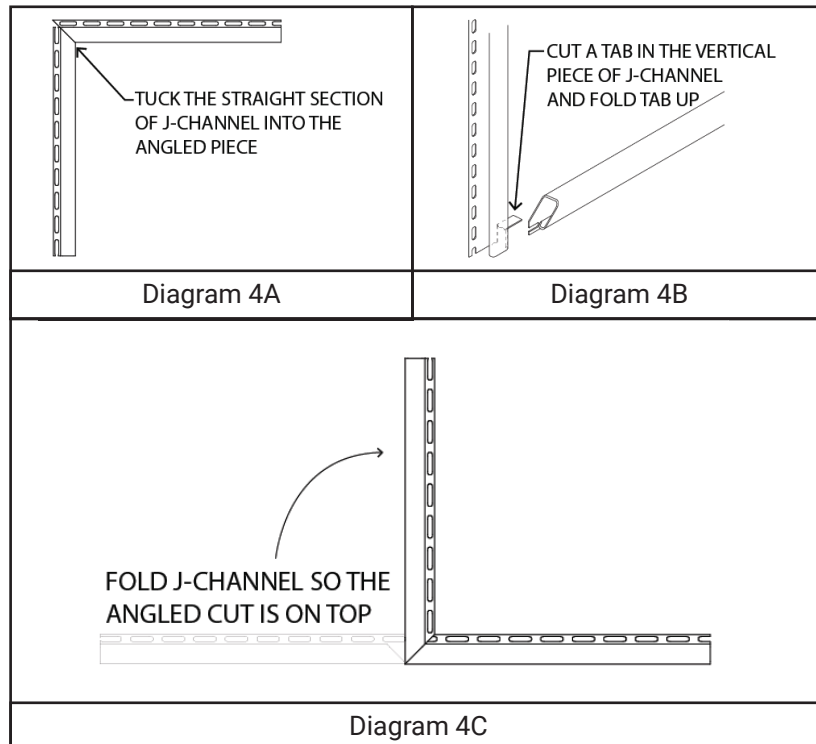
Build Out Overhang Purpose and Order of Operations

- The purpose of the built-out overhang is to prevent water from running down the wall and over windows
 - This also separates the wall and roof system so that they can be worked on at the same time
- Remove gutters if necessary
 - If these are rigid and hard to remove, they can be cut flush with the wall using a reciprocating saw with a metal cutting blade
- Install a treated 2x4 around the top edge of the wall
 - Before installing, cut the top of the 2x4 at an angle that will match the line of the roof using a table saw
 - Fasten with 3 1/2" to 4" screws into the top plate of the wall or ends of trusses
 - Fasten every 12"-18"
- Install a treated 1x6 on the outside of the 2x4 (See Diagram 3)
 - Like the 2x4, cut the top of the board at an angle that will match the roof
 - Install with 2" screws into the 2x4
 - Fasten every 12"-18" with one screw over the other



HUG Systems

- Short ends of the mobile home: (see page 308 and Diagram 3)
 - If the roof is flat, continue the 2x4 and 1x6 all the way around the roof
 - If the roof is sloped with a defined ridge, install the 2x4 and 1x6 at those angles
 - If the roof is rounded, cut 2x4 and 1x6 at multiple angles to match as closely as possible to the profile of the roof (See page 132, Diagram 38C)
 - If there is a built-in overhang on the short ends of the mobile home, the 2x4/1x6 do not need to be installed on that side (page 126, See Diagram 28)
- Install metal fascia covering over the 1x6 (See page 124, Diagram 25)
 - Attach with white aluminum trim nails every 18"-24" one over the other
 - On eaves, start at one side and work towards the other, overlapping pieces 4"
 - Make tabs for corners to keep water out



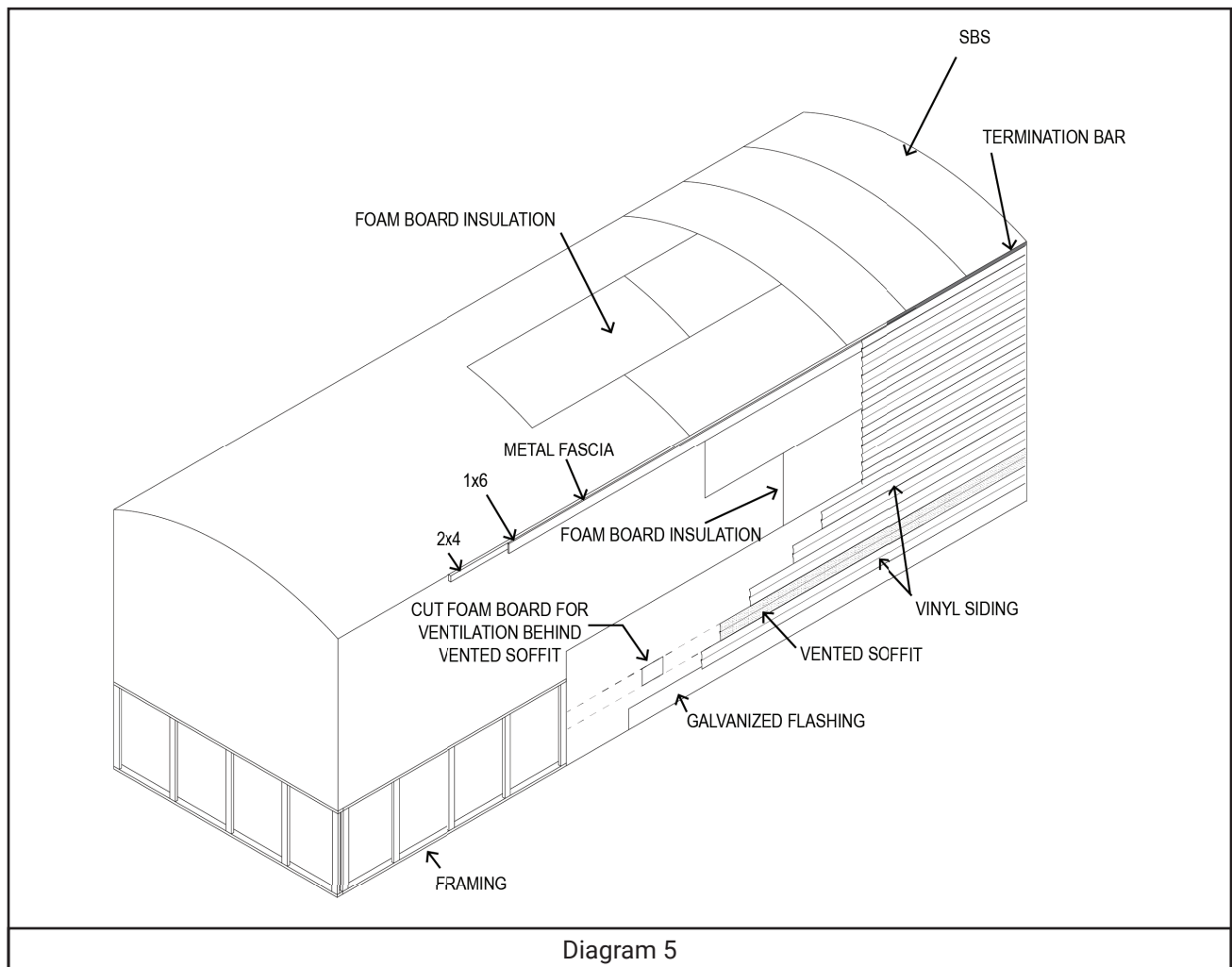
J-Channel Around Doors and Windows to Receive Foam (Diagram 4)

Windows and doors are the most vulnerable components of the hug system. Increasing the depth of siding often creates a ledge for water to enter below the window. The solution for this depends on the window, if there is window trim, if it's a window that is boarded up, etc. If replacement windows are allowed by the budget, replacing them with vinyl windows with a siding flange can alleviate this problem. If replacement windows are not accessible, take special care with the J-Channel around the windows especially. Any seams or gaps must be small enough to receive sealant (caulk).

- Windows/doors/other obstructions should be trimmed with J-channel that will hold the edges of the foam that will be installed
- Some counties may be able to source 1 1/2" J-channel. This can receive both foam and siding.
- The false miter method is a good way to make the J-Channel weather-tight
- Place J-channel around mobile home doors and windows so that they can still be removed in the future. (Place J-Channel adjacent to flange of window)
- See more detailed instructions for J-Channel installation on Page (152).

Foam Board Installation on Walls (See Diagrams 5 and 6)

- ½" foam should be used on the walls
- Sheets of foam will run horizontally
- The bottom of the first sheet should fall on the bottom plate
 - If needed, cut the bottom of the piece at an angle so that the top on the first row stays parallel to the mobile home
- Cut foam by scoring with a utility knife, then bend the two edges away from the cut and it should split at the score mark
- Sheets of foam should be attached with lathe screws (1 ½" - 3")
 - Make sure nails are fastening into studs
 - **IN AREAS WHERE THERE MAY BE WIRES BEHIND WALL, USE SHORT SCREWS**
- Transfer the locations of studs onto the foam board
 - These lines will be used to help locate studs for higher courses of foam and while installing siding
- Continue installing foam board in rows until a full piece will no longer fit
- Top course of foam
 - Run the foam up to the bottom of the 2x4 overhang that was installed around the edge of the roof
- Seal all seams of foam with house wrap tape



HUG Systems

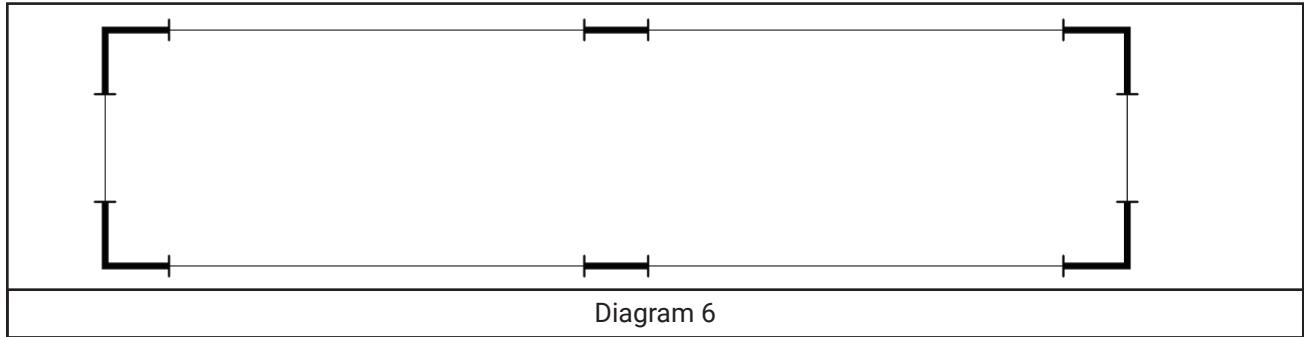


Diagram 6

Install flashing and Crawl Space Ventilation (See Diagram 6)

- Vent holes should be cut out of the foam prior to flashing and siding/vented soffit being installed. Vent holes should be cut into the foam at the corners and middle of the mobile home. (see Diagram 6)
 - Vent holes should be cut under the flooring of the mobile home. (See Diagram 7). Vent holes should be 18" wide by 10" high.
- 8-12" galvanized flashing is installed along the bottom of the wall over top of the foam. It should be installed with roofing nails every 12" on the top on bottom and should overlap or wrap around corners.
- It can follow grade and does not have to be level, but the bottom of flashing
- should contact the ground
- It will likely have to be cut to manipulate it to go up and then downhill. Overlap seems a minimum of 6"
- To help with this installation a lower horizontal cross member can be added to the framing. This will provide material for nails or screws to be driven into and hold the material.
 - To install metal flashing add a lower cross member between the vertical supports between 8 and 12 inches above the bottom plate depending on the width of the flashing
 - Attach the metal flashing to the bottom plate and the cross member using pan head screws
 - Install j-channel to the cross member above the cross member making sure to cover the flashing screws.
 - The first row of siding will then be installed in the bottom j-channels and attached with roofing nails or panhead screws to the vertical supports.
- Continue rows of siding until a continuous row of siding can be installed around the Crawl Space area.
- At approximately the 3rd row of siding, or the row that will fall directly under the floor, install a row of vented soffit all around the home. This will be used to help provide proper ventilation and air flow into the crawl space. Be sure vented holes have been cut prior to installing the vented soffit following the pattern in Diagram 6

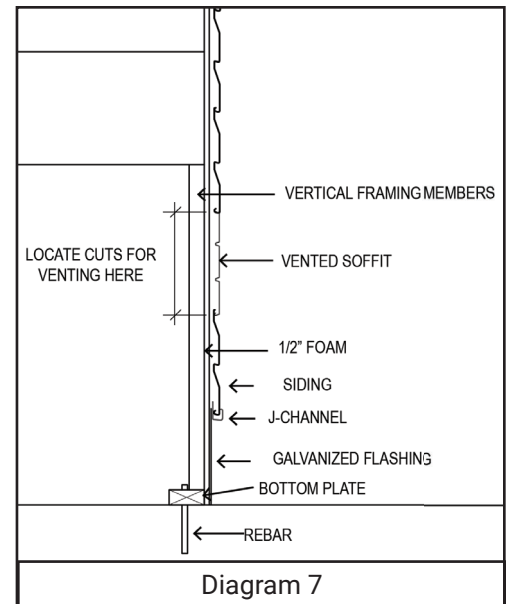


Diagram 7

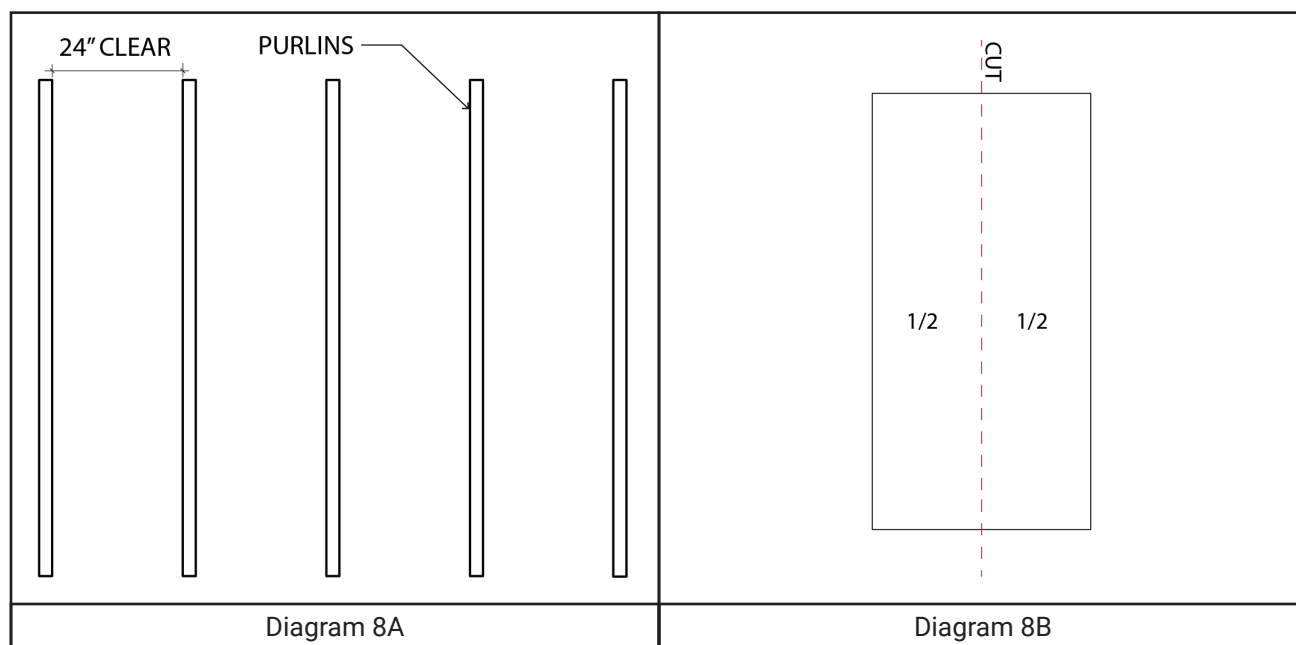
Installing Foam Board on Roof (See Diagram 5)

- **With SBS Roof Systems**
 - 1" POLYISOCYANURATE (ISO) needs to be used in conjunction with SBS to ensure the proper adhesion of the SBS.
 - Install foam using Lathe Screws not roofing nails (roofing nails won't be able to hold onto the metal of the roof)
 - Make sure the foam seams are staggered
 - If the Roof is Gabled with a 1.5/12 or Greater Pitch, Purlins will need to be installed so that the SBS can be nailed in place through the sticky strip on the Cap Sheet
 - Install SBS roofing (if applicable). See roofing chapter page 123 for detailed instructions
- **With Metal Roof Systems**
 - 1" RIGID FOAM (Extruded polystyrene foam) should be used on the roof
 - Sheets of foam will run perpendicular to the trusses of the roof
 - Sheets should start at the edge of the built-out overhang
 - Install purlins (Furring Strips) 18"-24" apart and lay foam between the purlins using wafer head screws
 - Attach foam with 2" wafer head screws (or 3" if using 2" foam) into the mobile home trusses
 - Some success has been had using Loctite Adhesive rather than screws to prevent holes in mobile home roof skin
 - Seal all seams of foam with house wrap tape
 - Install metal roofing (if applicable) see roofing chapter page 108 for detailed instructions
- **Install vinyl siding** see page 153 for detailed instructions

Hug System Instructions for overlaying lap siding:

The hug system can also be installed on stick-built homes that are in need of additional insulation and thermal barrier. Some lap siding has laps that are minor enough the foam itself is enough to flatten the wall appropriately to install vinyl siding. Sometimes this is not the case and vertical nailers are needed to install the vinyl siding in a flat, consistent plane. When attaching vertical nailers to siding, determine what is under the siding if possible. If the siding is attached to the side of a box frame house the length of screws used to attach nailers needs to be shorter so that they don't poke through the inside of the home.

- Wooden lap siding has deep laps that may require these vertical nailers
- For homes that studs are difficult or seemingly impossible to find vertical nailers may be used
- Occasionally we install siding on a block house. Vertical nailers can be used in this situation
- Nailers should be installed 24" apart so that half a piece of 48" wide foam fits between the nailers (See Diagram 8)
- Install nailers with two 2 1/2" deck screws every 16" up the wall. (Use lathe screws if attaching to metal and tap cons if attaching to concrete)
- Frame the outside of doors and windows with nailers.
- Place cut pieces of blue foam in between nailers and tape both sides to nailers using house wrap tape.
- Install corner posts
- Install J-Channel or starter strip across bottom of nailers, making sure that the foam and nailers will be concealed. Measuring down from the top and using a chalk line with a line level can help to ensure the j-channel or starter strip is level.
- J-channel is installed around windows and doors and attached to nailers. Take care to install tightly around frame and be sure to caulk any gaps with UV resistant caulk.
- Install J-Channel at top of wall for the top course of siding.
- Install siding as described in the Siding section. Roofing nails or lathe screws may be used. Take care that vinyl has room to expand and contract. (See page 153)



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Plumbing

Why Plumbing? Many homes we encounter may require minor or major plumbing upgrades for the safety of the home. Volunteers (adult or older youth under direct adult supervision) can be used for minor repairs such as installing toilets, shower/tubs and surrounds, faucets, sinks and vanities and other kitchen appliances. Major plumbing repairs should be done by a licensed plumber.

Section Contents:

- Setting a Toilet 320
- Installing a vanity and sink 322
- Installing a shower/tub diverter and lines . . . 322
- Shower and Sink drain lines 323
- Kitchen sink installation, supply and drain lines . 322

Safety

- Pipe cutters are sharp and can cause cuts
- ABS, PVC, and CPVC pipe gets brittle with age and can shatter when being cut with standard pipe cutters. Wear Safety Glasses.
- Fumes from drain lines are toxic. When removing toilets, sinks, etc. Use a rag or wad of paper towels to stop up the drain.
- Be sure that the water to the area you are working on is turned off, leaks can increase the homeowners' water bill and damage other areas of repair.
- Bathrooms can be tricky especially if there is only one in the home. A Port-a-John may be needed if there isn't a second bathroom, and it is going to take more than a day to complete the project. Never leave a family without a toilet overnight. Note that Port-a-Johns may not be available during summer holidays.

Plumbing Project Planning

- Before any plumbing repairs are completed, your PM and CC should be made aware of the situation.
- If a volunteer is a licensed plumber, check with the local inspection and code enforcement department to see if a state license is required for them to do inspected work.
 - In many of our counties, a license from any state is acceptable for larger projects like new supply or drain lines but others may require an in state license.
 - They should only need a permit if adding new fixtures (bathroom addition)
- Contact plumbers in counties during set up week to get an understanding of what they will work on and look for. It is very normal for a plumber to not work on mobile homes.
- If volunteers are licensed and feel comfortable making minor plumbing repairs, establish a plan to purchase the correct materials. (Bring them to hardware or collect specific links/visuals)
- Are the plumbing repairs connected to a bathroom or kitchen project that has been agreed upon with the homeowner?
- The whole crew cannot fit into the bathroom. What else can they work on?
- This is for a high skilled group leader.
- Starting a bathroom project easily grow into a larger project, so be prepared for what you are opening up.

Quality Control

- Make sure toilet flange is either sitting on the flooring or flush with the floorcoverings.
- Only use toilet wax rings once (after the toilet is set the first time with a wax ring, it cannot be taken up and reset.
- Be sure that all plumbing connections are fully connected and no leaks are present.
- Are the proper SharkBite fittings, and/or Glues used for the correct type of pipe that is present in the home
- Have threaded fittings had plumber's tape applied to the fitting threads.
- Are threaded fittings tight enough.
- Are all drain lines glued properly.

Common Mistakes

- Drain lines are not glued (many people think that because drain lines aren't pressurized they don't need glue but they do)
- SharkBite fittings are not fully in place
- Threaded fittings are not tight enough
- Shower diverters are attached to blocking in the walls
- Shower surrounds are installed over drywall instead of directly to studs or according to manufacturers directions.

Plumbing

Plumbing Materials:

- PEX (red, blue, or white), typically in $\frac{1}{2}$ in. and $\frac{3}{4}$ in. diameter, for supply lines



- Sink drain piping (look for specific drain lines for bathrooms and kitchens. These will typically be $1\frac{1}{2}$ in. polypropylene or $1\frac{1}{4}$ in. for bathroom sinks)



- PVC or ABS drain lines for main plumbing drain repairs (usually $1\frac{1}{2}$ ", 2", 3", or 4" pipes)



- Couplings
- T-junctions
- Long and short Elbows (90 and 45 degree)
- P-traps
- Shower or tub drain (tub overflow)



Plumbing

- A toilet flange repair ring (usually Steel, or brass)



- Toilet Gasket (these are traditionally wax, but it is recommended to use the Better than Wax rings because they can be reused. This is very good when a bathroom is going to be worked on multiple days in a row so that the toilet can be taken in and out every day as needed while work is going on). Always be sure to put the toilet back!



- Fernco rubber repair couplings



- Various couplings to connect sections of straight piping. SharkBite Press-on fittings are your best friend for supply lines but make sure they are for the correct type of pipe.



Plumbing

- Shop towels or rags to clean up water that spills
- All-purpose Cement and Primer (heavy duty) to glue drain lines



Recommended Tools:

- SharkBite Removal tool.



- Pipe cutters (for multiple types of pipes).



For Pex



For Copper

- A small bucket (approximately 1 gal or less) to catch leftover water in lines of the toilet tank.
- *A PEX crimp tool is amazing to have and provides a more secure connection for PEX water lines, but it is not necessary. It is only for skilled volunteers to use.*

Plumbing

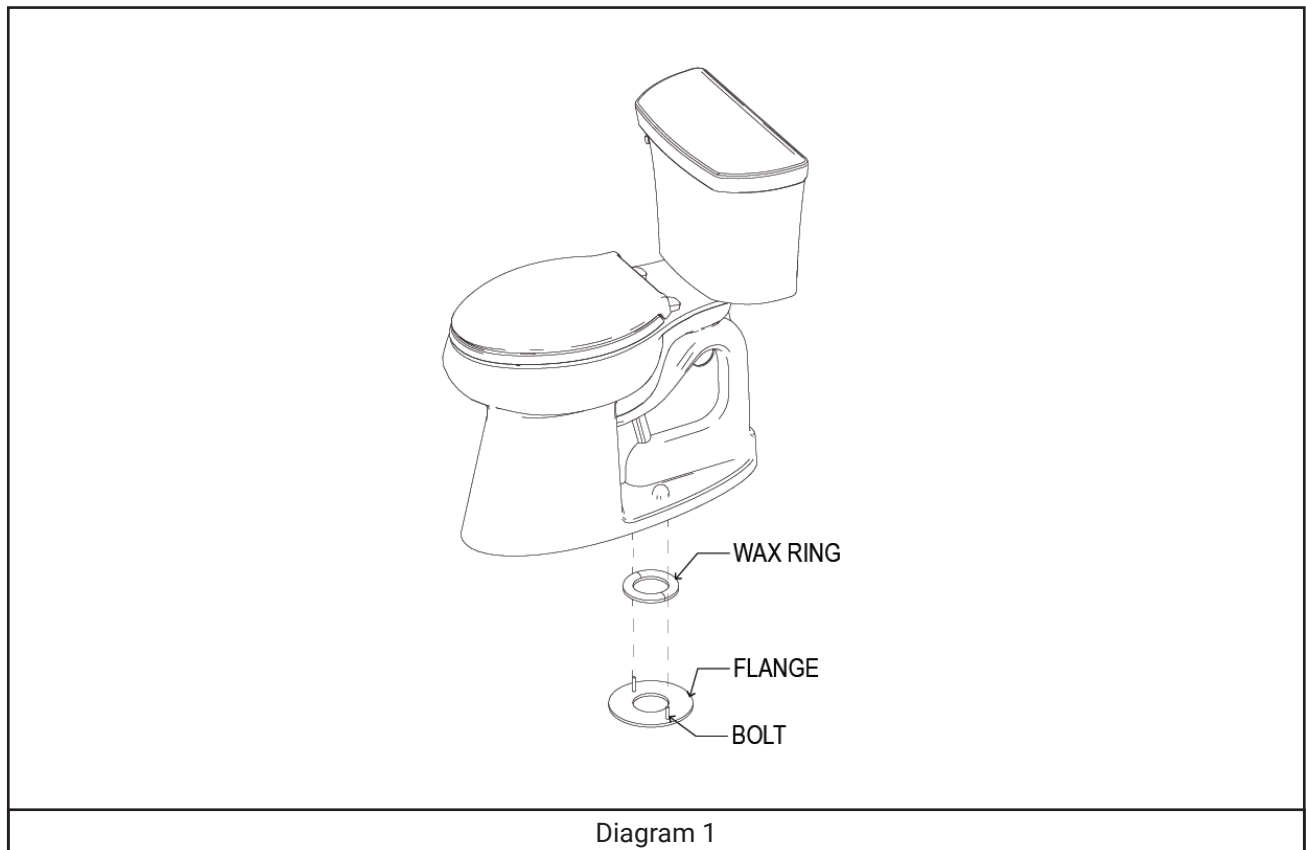
When Volunteers will do Plumbing Repair

In previous Summers, it has been recommended that volunteers should never do plumbing. While this remains true for running new or replacement supply and drain lines, or patching a main waterline into a home, often volunteers will be asked to set toilets and do other plumbing projects relating to Bathrooms and Kitchens and their supply and drain lines.

- When replacing floorcoverings (with or without Floor system repairs) in bathrooms
- When installing ADA toilets and showers
- When replacing Kitchen Cabinets

Setting a Toilet (Diagram 1)

When setting a toilet inspect the toilet flange for damage. If it is broken purchase a Flange Repair ring (see tools and materials section on page 318)



- Begin by turning off the water to the toilet (if there isn't a shutoff valve leading to the tank you will probably have to turn the water off at the main. Make sure the homeowner knows they will be without water)
 - If there is no valve one needs to be installed above the floor so it can be turned off in the future. (see next section)
- After the water supply is shut off, Flush the toilet and let as much water as you can drain from the tank.

Plumbing

- Use a shop vac with the filter removed, Liquil Lok, OR a large sponge to remove remaining water in the trap
 - If replacing the toilet tank or its insides, place a bucket under one side of the tank and loosen the screws attaching the tank to the bowl as well as the supply line from the tank. (The bucket will catch any residual water in the tank)
 - Place the toilet in a large trash bag when carrying out of the room, this prevents anything from dripping on the floors
- Remove the bolts attaching the bowl to the flange and team lift the toilet off the flange and carry it to where it will be stored (if reused) or to the dump pile (if it will be replaced). Remember to keep the toilet as level as possible.
- Inspect the condition of the toilet flange and determine if it is in good condition or needs repair. Use a plastic scraper to remove the old wax ring. After inspecting the flange use an appropriately sized wad of shop towels or a cloth rag to block the flange opening.
- Once any Floor System repairs and Floor Covering replacement are completed, replace the toilet by installing NEW flange bolts (included with the toilet gasket).
- Place a wax ring, or rubber alternative on the flange
- Carefully carry the toilet back into the bathroom and reinstall it onto the toilet flange. *Be careful when tightening the flange bolts as they can break the porcelain of the toilet if they are over tightened.* Tighten the bolts, going back and forth on each side and use a level.
- Reinstall the Toilet Tank (if removed). Make sure all gaskets are installed in the proper places to prevent leaks around the screws, between the tank and bowl, and at the supply line attachment point.
- Attach the supply line to tank and valve
- Turn water back on and check for leaks in the tank and where the toilet sits on the floor. Flush the toilet multiple times. (It is also a good idea to check under the house to make sure everything is draining properly).

Common Questions and issues

- Some people will ask about caulking around the toilet base where it sits on the floor. This is up to your discretion as an ASP Staff or Volunteer. Caulk in the area is a nice finishing touch and makes the bathroom look nice, but it also will seal in water from a leak in the toilet flange. This could cause damage to the floor system over time but there are some homeowners and inspectors that will insist on it being done. If you do caulk the toilet leave a gap at the back to allow water to escape
- Sometimes the flushing mechanism of a toilet will be the problem and can be replaced instead of replacing a whole toilet. If this is decided, then follow the included instructions with the repair kit and when purchasing the repair kit make sure to match the toilet brand.

Toilet Flange Repair using a Repair Ring

If the toilet flange is broken when the toilet is moved a metal repair ring can be used to repair the toilet rather than having a plumbing subcontract come and install new drain lines. Note: Repair rings can only be used if the broken flange is above the level of the floor, if the flange is broken closer to where it attaches to the main line contact a plumber to repair the main line.

- Clean the broken toilet flange as well as you can. Be sure to remove any broken sections of the flange. (be sure to wear a mask and gloves while working around this drain)
- Lay out the metal repair ring on top of the broken flange and use deck screws to attach it to the subfloor. When laying out the repair ring make sure the holes for the Johnny Bolts are in the proper orientation.
- If the flange is damaged and/or broken, then there is probably subfloor damage that needs to be addressed.

Installing a Water Supply Shutoff Valve

If there are not shutoff valves connected to the supply lines to a sink, shower/tub, or toilet, they should be installed so that water does not have to remain turned off to the entire house while work progresses.

- *If there are not shutoff valves connected to the supply lines to a sink, shower/tub, or toilet, they should be installed so that water does not have to remain turned off to the entire house while work progresses.*
 - Begin by identifying the type of supply line pipe that is present.
 - If the supply line is Copper, CPVC, PVC, Polybutylene, or PEX then SharkBite Press-on couplings can be used to install the new valves.
 - If the pipe is Polybutylene a special SharkBite designed for use with Polybutylene will be required
 - If it is pipe that can be worked on turn off the water to that area (possibly the entire home)
 - Cut the supply line as high above the floor as possible. A straight clean cut is required.
 - Using the Press-on valve, FIRMLY press the valve onto the water line supply (the fitting should click 2 times and feel as though the SharkBite is grabbing onto approximately ½ in of the pipe).
 - Reattach the Threaded supply lines from the valve to the faucet or toilet.
 - *Make sure the supply line is the correct size for the valve and fixture.* They should be ½ in or 3/8 in.
 - While observing the repair have someone turn the water back on and be ready to turn it off again if there are any leaks.
 - It is common for SharkBite fittings to not be properly attached to pipes the first time. If this happens, they will need to be pressed further onto pipes. If they leak, don't panic, just turn the water back off, wait for any built-up pressure in the line to go away, and press the pipe and coupling more firmly together.

Installing a Shower Diverter/Faucet

When installing a new shower to replace the tub, a new shower diverter/faucet will need to be installed. You will want to work with a skilled professional to get this installed.

Sink Faucet Installation (Bathroom Vanity or Kitchen)

New sink faucets will be installed the same way in both bathrooms and kitchens, and all will come with manufacturer's instructions for installation.

- Begin by emptying the cabinet so you can reach the supply lines and
- Turn off water to the sink at the shutoff valves (if there are none present, this is the time to install them)
- Once the water is off, disconnect the supply lines from the faucet and valves using an adjustable wrench.
- Locate the attachment nuts on the bottom of the faucet and unscrew them (most of these will be plastic and only hand tight if they are newer but if it is an older faucet, you may need to use an adjustable wrench or channel lock pliers.
- After the attachment nuts are removed the faucet should lift out of the sink holes.
 - Most sinks will have faucet mounting holes that are standard widths apart, be sure to measure these from inside the cabinet so the proper replacement can be purchased.
- Clean around the holes where the new faucet will be installed. We want to do this because the new faucet base may not be the same size as the old one and having a clean surface looks nice. It will be easier to clean without the faucet installed.
- Install the new faucet using the provided hardware in the faucet box (remember the plastic nuts that hold the faucet to the sink should only be tightened by hand unless otherwise stated in the instructions)
- Reconnect the water supply lines. It is always best to purchase new supply lines and be sure to check what length you will need.
 - Depending on the supply line instructions you may need to wrap the valve threads with plumbers' tape to help prevent leaks
- Turn water back on and check for leaks and operation of the faucet. Tighten nuts where there are any leaks and dry any drips with a shop towel.

Sink Drain Lines (Bathroom Vanities or Kitchen Sinks)

Sink drain lines will often be the most common place for leaks and should be replaced by a skilled volunteer. These are typically 1 ½ in or 1 ¼ in. Polypropylene lines that use plastic and/or rubber gaskets and threaded rings to hold the pipes together. The joints between pipes are typically only hand tightened. In some older sinks the drains may be made of thin metal so be careful and wear gloves while working with these to prevent cuts.

- Begin by removing items from the sink cabinet and place a bucket underneath the trap.
- While wearing nonslip gloves, carefully remove the old drain and note how it goes together and if it exits the room through the wall or floor.
 - Beginning at the lowest point, unscrew each section of drainpipe from each other.
 - Disconnect the stopper pull from the sink drain in bathroom vanities
 - Unscrew the drain from the sink basin. In kitchens the drain with the sink basket may not need to be removed.
- Most new sink drains can be purchased in kits that will fit the application. These will sometimes come with instructions but don't expect them. To install the new drain lines, start at the sink and begin by only hand tightening.
 - When installing a new sink basin drain in any sink, make sure you use the cardboard or paper gasket that looks like it would not be used.
 - Attach the sink stopper in bathroom vanities by inserting the stopper into the drain and then inserting the stopper lever in its hole in the drain (you will not be able to see this so it will have to be done by feel)

Plumbing

- Follow the rest of the drain piping down to where it connects into to wall or floor pipe. (a reducing coupling may be needed to connect the polypropylene pipe to PVC pipe)
- Use Teflon tape on plastic threads, to make tightening slip nut easier
- To seal drain to basin, use silicone on bathroom vanities (marble) and use plumbers putty on kitchen sinks (stainless steel)
- Once the drain is installed and all joints are hand tight, fill the sink with water and check for any leaks where the basin meets the drain.
- After checking the basin for leaks, then let water run through the drain to check for leaks in the pipe, p/s-traps, etc.



Shower Pan/Tub and Drain Installation

Installing a shower pan and drain is one of the most common and difficult plumbing installations that volunteers do. There will need to be people in the bathroom as well as in the crawl space or basement in order to install the drain. Most often a 3 or 4 piece tub surround is what is used for ASP. A 1 piece surround won't fit through the door. Be sure to check the installation instructions for what you purchase to make sure you are ordering the correct materials needed (i.e. glue to mount to plywood or studs). This is something that should be done by a skilled volunteer.

- Begin by carefully removing the existing tub/shower, surround, any damaged wall materials
 - Repair any damage to the Subfloor and Floor System (*Instructions in the Flooring Chapter page 53*)
 - If there are any damaged studs in the walls repair these per the *Walls Instructions on page 81*
- Once any repairs to the Floor System and Walls are completed the new shower pan or tub and drain can be installed.
 - When purchasing the new shower pan measure the area where it will be installed. Be sure to measure where the shower drain will need to be so the shower pan will have the correct drain location. They will either be left, right, or center drain. *If the available shower pans do not have a drain hole that will match the location of the floor drain hole you will need to cut the drain line and install a new p-trap. DO NOT CUT TOO MUCH OF THE PIPE. THE LESS NEW DRAIN LINE THAT NEEDS TO BE INSTALLED THE LESS LIKELY FOR THE SLOPE TO BECOME OFF.* Be sure to check and see if any floor joists interfere.
 - If the existing drain was cut, dry fit the new shower pan or tub and mark where the drain hole will need to be in the floor (do not cut the drain hole when installing the new flooring). Remove the shower or tub after fitting it and marking the drain hole. Check the marked area to make sure it is not in the middle of a floor joist, if it hits a joist a new plan will need to be made.
- Use a 2 ¼ or similar sized hole saw to cut the drain hole in the floor (this hole may need to be larger depending on the type of drain that is purchased).
- Once the drain hole is cut in the subfloor install the drain into the shower pan or tub. This will screw in and typically has a rubber gasket that will hold the down pipe to the drain when the screw is tightened (this may have to be done with someone under the home).
- Next, position the shower pan or tub in place and use the plastic installation clips to screw the pan or tub into every wall stud.
- Once the new pan/tub is in place, go under the home and connect all the drain lines (*instructions in the next section*).

Plumbing

- Add shower walls/surround according to the manufacturer's instructions. Typically they are glued with construction adhesive to plywood mounted to the studs.
- Caulk all seams.

Shower/Tub Drain Repair (Fernco) and Installation

Repair with Fernco

- Use 2 Ferncos and cut out damaged section
- If a drain line under a home is cracked and leaking the easiest way to repair, it is to use the proper size Fernco coupling. To install, cut a small section of the damaged pipe enough that the line can be moved to slide the coupling over one side and then back over the other side. Once the Fernco Coupling is in position with at least one inch of the pipe inside the hose clamps, tighten the hose clamps until they are tight on the pipe and the coupling cannot be moved on the pipe. Run water through the drain and check for leaks.

Connecting to an existing drain line with new pipe

- To install a new drain line for a shower or tub cut the existing drain line as close to the p-trap as you can (if more needs to be cut due to a repositioning of the drain you can cut that later).
- When making plumbing lines longer try to use the same pipe material (this helps with the look as well as if a specific cement is purchased or the only available).
- Once the shower pan/tub is installed and the downtube from the shower is through the floor, dry fit all the pieces that will connect to the main line cutting each individual piece as needed so they fit with minimal movement.
- Next take all new pipe sections apart and prime with "Purple" Primer and begin glueing the sections together (All-purpose Pipe Cement is recommended, especially if mixing pipe materials, because it can be used on most plastic pipe material). If joining new PVC or to Black ABS pipe use a Fernco Coupling as solvent welding (cementing/gluing) is not recommended.
- Allow a few hours for the glue to dry and then leak test the drain (if the shower is still under construction this can be done by pouring water down the drain with a bucket multiple times).
 - If there is a leak in a new drain line, cut out the joint and retry or use a Fernco coupling to fix the leak.

Special Considerations

Galvanized and copper pipe

- Many older stick-built homes may have plumbing that uses these pipe materials for their supply lines. Copper is a good material, but the joints must be “sweated” (soldered) on which makes it beyond the skill of most volunteers (some plumbers don’t like to do it anymore). Copper piping is also expensive, so it is usually found in higher end homes. Copper lines are not very likely to leak, unless it has been cracked due to freezing, but the valves and things they connect to can. If you find yourself working with copper pipe, use an appropriate SharkBite coupling and transition to PEX.
- Most older homes will have some kind of Galvanized Steel piping for waterlines. Galvanized pipe was used for main water lines (the water line coming into the home from the meter) and then it would transition to either copper, PVC, or another pipe material inside the home. A galvanized pipe is good for its strength but over time the interior of the pipes rusts and clogs reducing water pressure (think about plaque in blood vessels). This rust results in the pipe walls becoming thinner and eventually having pin hole leaks all along the pipe.
- When working with either galvanized pipe it is probably best to have a plumber do the repairs or contact the HRC or your CC to see if they are comfortable working with galvanized waterline. If it is a main line break, volunteers can dig the ditch the new main line will be laid into.

Other types of Drain lines and drain issues

- The most common types of pipe material for drain lines are PVC and ABS but depending on the age of the home and who installed the plumbing you may experience other pipe types. In older homes, built prior to the 1970s, you may find Cast Iron, Lead, or Terracotta Drain Lines. These offer their own challenges and may mean that a totally new drain system needs to be installed.
- Another issue that may arise when dealing with drain line leaks is that the lines were installed without the use of any glue. DIY plumbers will do this because they reason that since these lines are not under much pressure there is no need for glue. If you find this situation a plumber should be contacted to redo the drain lines.



Room Additions

Why room additions? Room additions can allow children's bedrooms to be separated by gender. Additionally, bathroom additions can be added if there are not adequate bathroom facilities or accessible bathroom facilities are needed.

ASP builds five standard sized room additions

- 8'x12' Single Bedroom Addition
- 8'x24' Double Bedroom Addition
- 8'x20' Bedroom and Bathroom Addition
- 8'x10' Accessible Bathroom Addition

Safety

- When opening any wall, cut slowly in case there are wires or plumbing lines in the wall
- Be aware of underground utilities where footings will go
- Reference individual project sections for more safety information

Room Addition Project Planning

- Check with the inspector about necessary permits and what parts of the project will need to have inspections completed
- Ensure that dimensions of planned room addition will fit in available space on property, considering both property lines, obstacles, and any required setbacks
- Identify subcontractors to work with.
- Locate Subcontractors before signing a room addition that way they are lined up when the addition is ready for them to begin work.
- Electricians should be used for all room additions and plumbers will be used for bathrooms/ kitchen/laundry.
- Check the breaker box in the home to ensure it will support the additional load?
- Check with the local Health Department to determine if existing septic will need any upgrades.
- Where will the room attach to the existing home? (Consider the following)
 - Ease of roof transition
 - Proximity to septic/electric lines/etc.
 - Property lines
 - Where will the door be cut to access the new room?

Room Additions

- Cannot come out of an existing bedroom unless a hallway is built as well
- Where will water for concrete mixing come from?
- See project specific sections for additional project planning information

The instructions and procedures in this section are the same for both mobile home and stick built home applications. The primary difference between the two different home types is that the entry to the Room Addition through the exterior wall will be thicker and need to be trimmed out. Unless the local building codes require a room addition to be on a continuous foundation (which will have to be subcontracted), They will be supported on the Footers and Piers per the instructions.

Measurements Needed

- Height from ground to top of existing floor system
 - Post height will change with the concrete footer that extends above ground
- See Project specific sections for more information on measurements needed for material ordering

Quality Control

- Holes for footings should be widened out at bottom
- Make sure all holes for footers are in the correct place before pouring concrete
- All concrete in each individual hole should be poured at one time
- Post connector should be inserted into the wet concrete
- Check outside wall height (minimum 84 ½")
- Check that window opening is 18" above floor
- Make sure that the transition from addition roof to existing roof is smooth
- Make sure roof venting is added
- Make sure adequate flashing is added between existing house and room addition walls
- Make sure flashing and a strip of SBS are installed before the 2x4/2x6 overhang

Common Mistakes

- Outside frame for floor system not used to mark holes, they are dug in the wrong place
- Concrete count not double checked before each hole, pour one partially full and then run out
- Walls built at height with full studs, not low enough to allow slope to roof
- If outside wall is too low, roof transitions may be rough
- Flashing forgotten and siding butted up to the existing wall, allowing water and air to move in easily
- 2x4 and 2x6 installed before flashing/SBS

See individual project sections for additional Quality Control/Common Mistakes checkpoints

After Work is Complete Quality Control Check

- Is the room attached to the home well and watertight?
- Is the doorway from the existing home into the new room trimmed well?
- Is there a smoke detector installed in each new bedroom?
- See specific project sections for After Work Quality Control Checks

Room Addition Instructions

Order of Operations:

- Build Floor Frame
- Determine Floor Height
- Holes For Footers
- Temporarily Set Floor Frame
- Pour Footers
- Install Piers
- Install Common Joists
- Install Subfloor
- Frame and Stand Walls
- Install Rafters
- Sheath Walls
- Flashing (from existing home to new addition)
- Build Out Overhang (on gable sides of roof)
- Install Fascia Board
- Deck Roof
- Install Metal Fascia on Gable Sides Only
- SBS Roof Covering
- House wrap
- Cut Door Opening between home and addition
- Install Window(s)
- Vinyl Soffit/Metal Fascia
- Vinyl Siding
- Subcontractor (electrician/plumber) come through at this point
- Insulate
- Underpinning
- Set shower/tub (if applicable, see product instructions)
- Drywall (Install and Finish)
- Install and Trim Interior Door
- Prime/Paint
- Install Finished Floor
- Set Light Fixtures/heaters/toilet/vanity
- Trim (Baseboard and Windows)

Room Additions

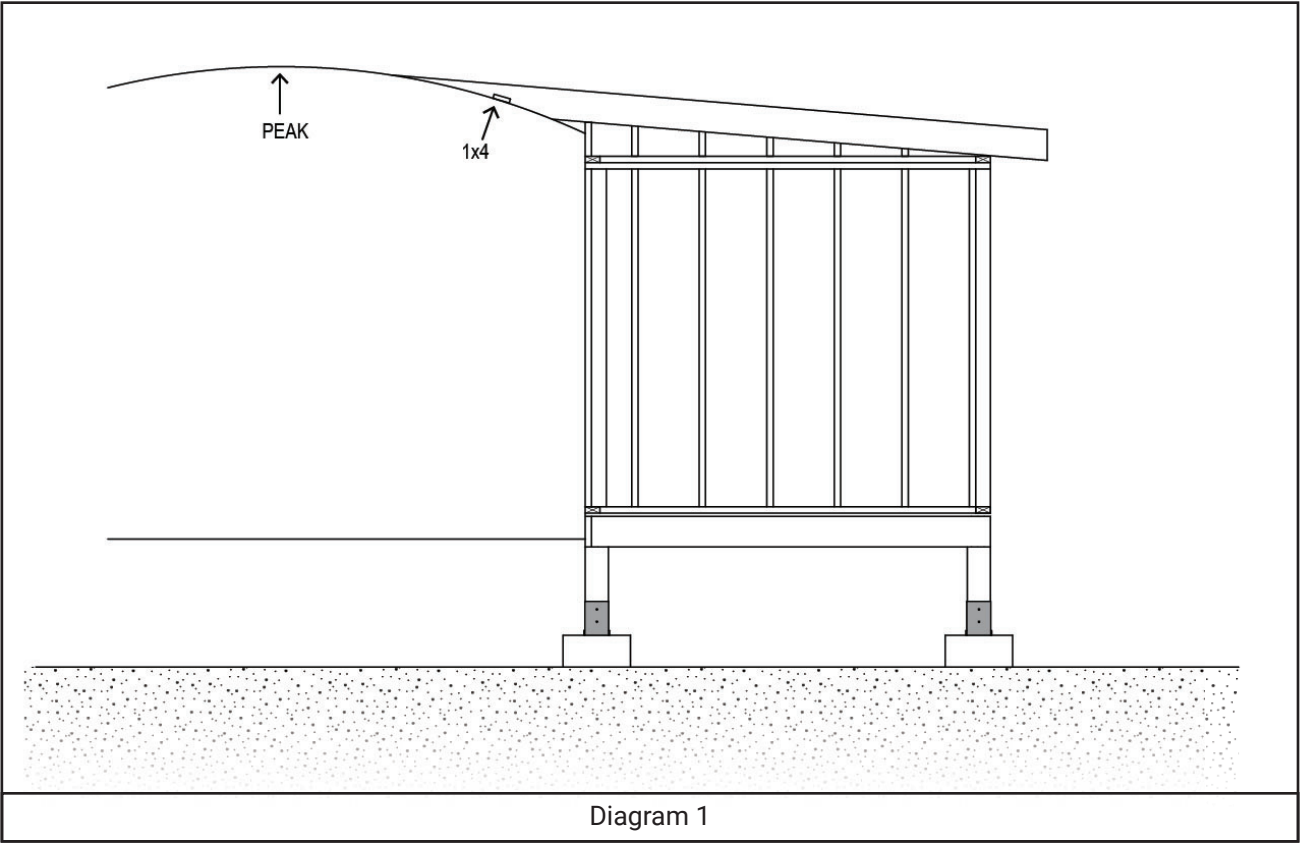
Room Addition Materials List						
		Quantities for:				
Item	Purpose:	8'x12' Bed- room	8'x24' Two Bed- room	8'x20' Bed- room and	8'x10' Acces- sible Bath- room	5'x5' Bath- room
2x8x8 * *If within 18" from grade PT is recommended	Common Joist and Double Rim Joist	12	12	12	12	12
2x8x8*	Double Band Joist	X	X	X	X	X
2x8x12*	Double Band Joist	4	4	4	4	4
2x8x10*	Double Band Joist	X	X	X	X	X
2x8x10*	Common Joist and Double Rim Joist	X	X	X	X	X
60lb bags Con- crete	Footers (10-12 bags per hole)	~ 60	~ 60	~ 60	~ 60	~ 60
2x8x12 WW	Boxes Over Footers	3	3	3	3	3
6x6x__ PT	Piers (depending on height of existing home)					
¾" OSB	Subfloor	3	3	3	3	3
2x4x8 WW	Top/Bottom Plate	6	6	6	6	6
2x4x12 WW	Top/Bottom Plate	6	6	6	6	6
2x4x10 WW	Top/Bottom Plate					
2x4 Studs		45-50	45-50	45-50	45-50	45-50
2x10x__ WW	Header Material (depending on width of window)					
1x4x8 WW	Ledger to receive rafters	2	2	2	2	2
2x8x16 WW	Rafters	10	10	10	10	10
2x8x12 WW	Rafters	X	X	X	X	X
7/16" OSB	Wall Sheathing, Roof Decking, Header Material	14	24	20	14	9
2x4x8 PT	Gable Side Overhang	4	4	4	4	3
1x6x8 PT	Gable Side Overhang	4	4	4	4	3
6x6 Post Brackets	Connect Piers to Footers	6	8	8	6	4

Room Additions

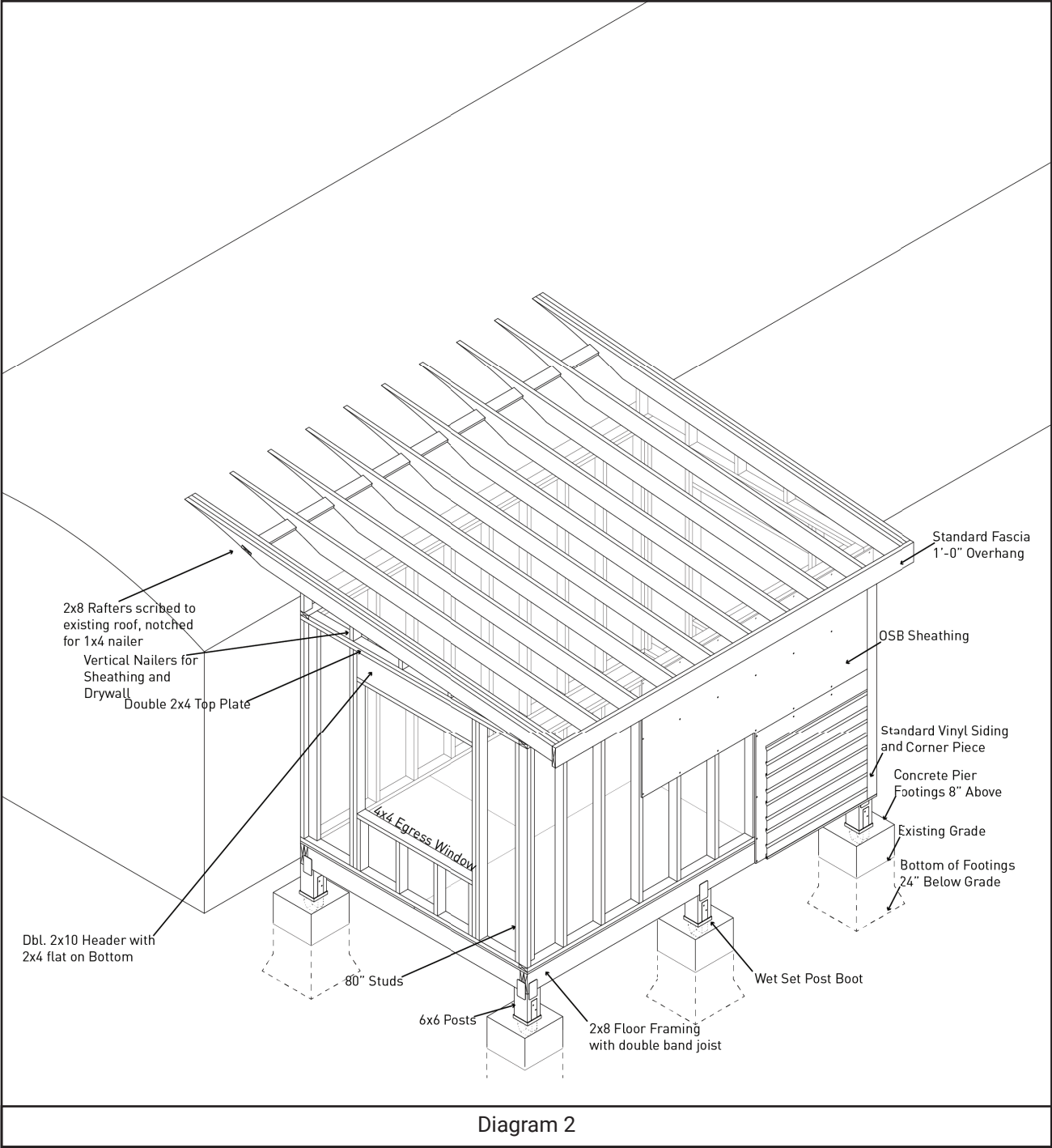
Room Addition Materials List						
		Quantities for:				
Item	Purpose:	8'x12' Bed-room	8'x24' Two Bed-room	8'x20' Bed-room and	8'x10' Accessible Bath-room	5'x5' Bath-room
¾" x 7" Galvanized Carriage Bolts/Washers/Nuts	Connect Piers to Floor System	20	24	24	20	
2x8 Joist Hangers		16	34	28	12	8
Hurricane Ties	Connect Rafters to Exterior Wall	10	19	16	9	5
Flashing	Between existing home/roof and new room/roof	40'	40'	40'	40'	40'
Pre-hung Interior Door		1	2	2	1	1
Window (Must be egress in bedrooms)		1	2	2	1	1
Toilet		X	X	1	1	1
Shower/Tub/Surround		X	X	1	1	1
Sink/Vanity		X	X	1	1	1

For additional materials see lists and recommended tools from specific sections (siding, roofing, drywall, etc.).

Reference Diagrams



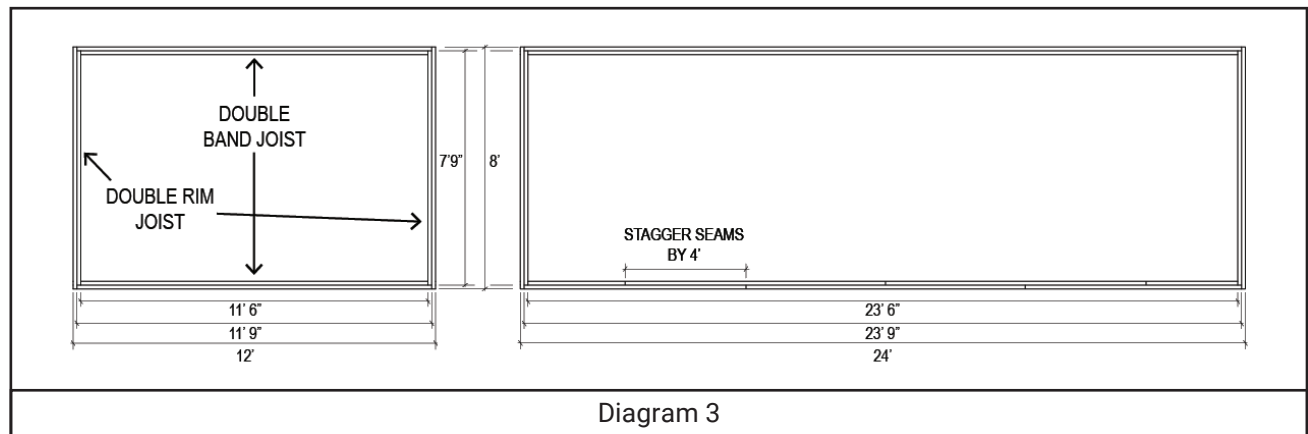
Room Additions



Room Additions

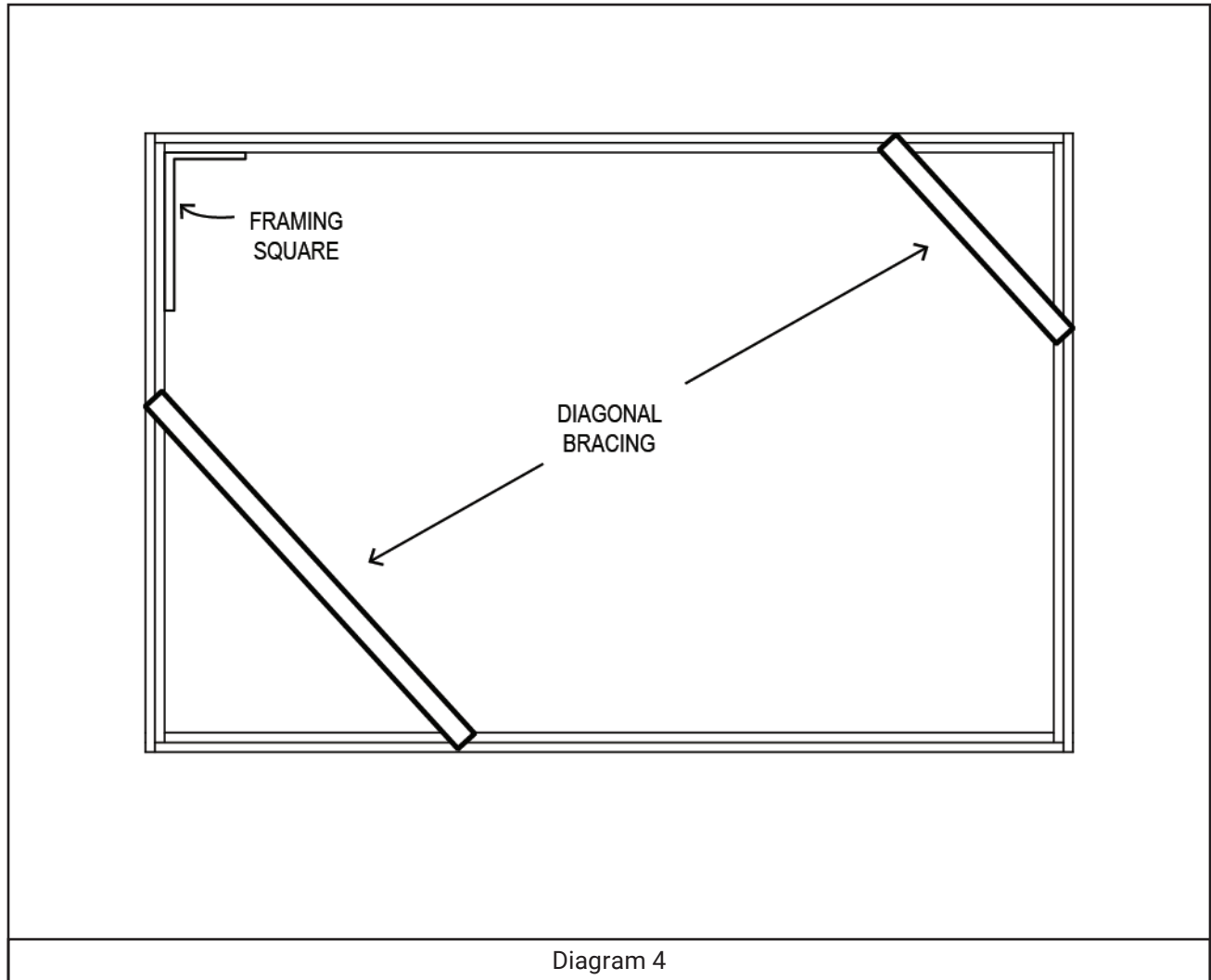
Build Floor Frame

- The finished dimensions of the outside of the frame should equal the dimensions of the planned room addition
- Build the outside perimeter of the frame, typically using 2x8 lumber (See Diagram 3)
 - Double band joist
 - Cut pieces for the outside band joist 3" short of the finished length of the room addition
 - Cut pieces for the inside band joist 6" short of the finished length of the room addition
 - Use full lengths of lumber, if possible, if necessary to use multiple pieces and stagger seams by 4'
 - Double rim joist
 - Cut pieces for the outside rim joist to the full width of the room addition
 - Cut pieces for the inside rim joist 3" short of the finished length of the room addition
 - Assemble the frame with 3" exterior screws, one over the other every 12"
 - Intersect corners as seen in Diagram 3 to create a frame with finished outside dimensions of the given room
- For example, if the room addition is 8' x 12' the length of pieces cut will be
 - Outside Band: 11'9"
 - Inside Band: 11'6"
 - Outside Rim: 8'
 - Inside Rim: 7'9"



- Adjust the frame to square and add temporary bracing to help keep its shape
 - Use framing square to adjust the corners
 - Place the bracing so that it will not interfere with the frame being put in place against the home

Room Additions



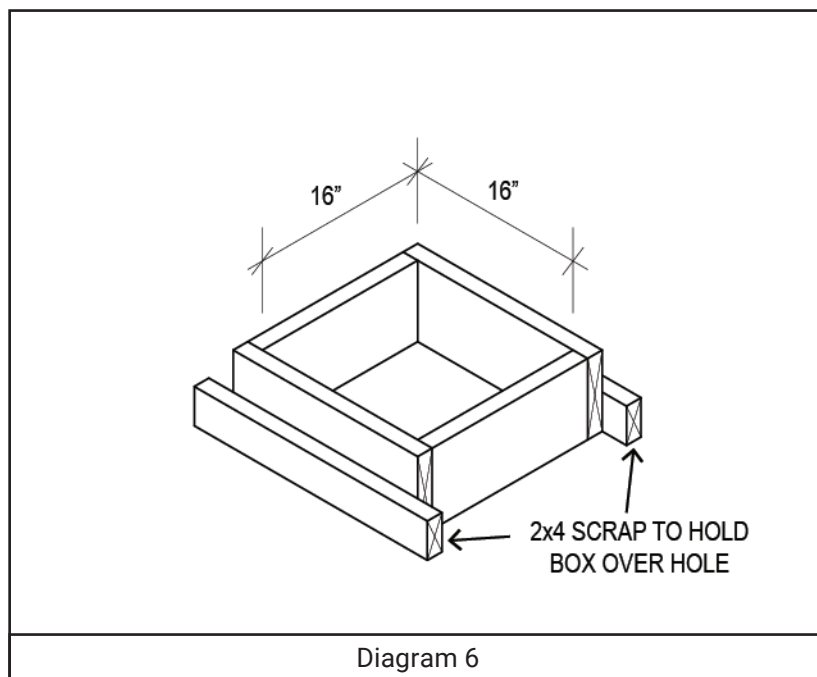
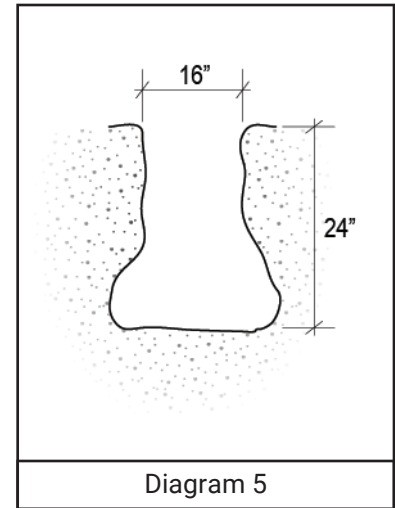
Determining Floor Height

- The top of the new floor system should align with the top of the existing floor system
- If the addition is to a house, remove a section of siding to determine where the top of the existing floor system is
- If the addition is to a mobile home, cut a slit in the skin of the mobile home up from the bottom that allows you to see the top of the band joist
- Make sure this slit is cut, or siding is removed in the space that the new door will be cut from the existing house to the new addition (cover with tape to water seal until room is in place)
- Make a mark on the outside of the siding/mobile home skin at the top of the floor joists
 - Transfer that line across the wall where the room addition will be using a level
 - This is the mark that will be used to line up the top of the addition's band joist against the home

Room Additions

Holes for Footers

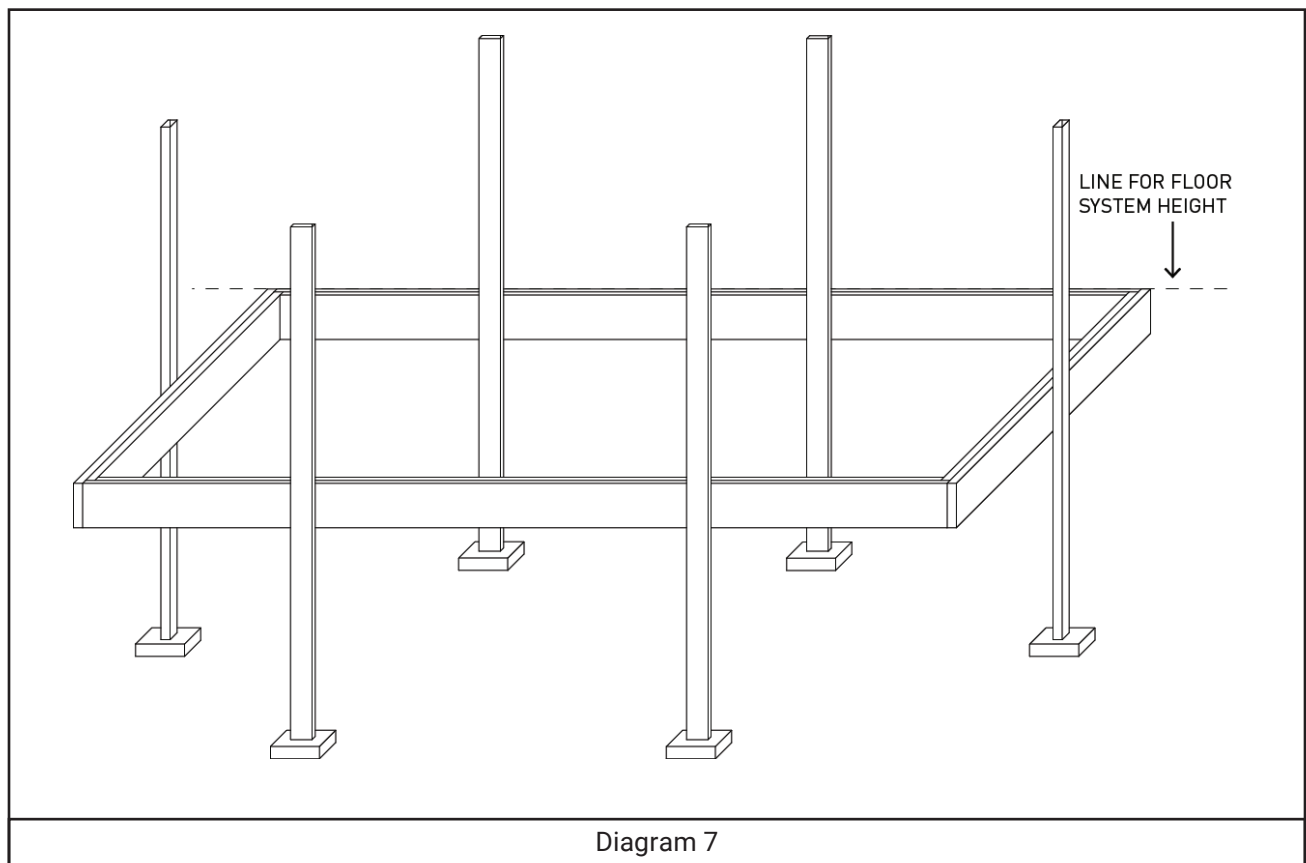
- Move the frame into its position (but sitting on the ground) and mark where the holes will be dug for the footers
 - Mark each corner
 - For any side over 8' there will also be intermediate piers
 - For 10' and 12' lengths there should be a pier in the middle of both long sides
 - For 20' lengths there should be two intermediate piers on each long side at 6'8" on center
 - For 24' lengths there should be two intermediate piers on each long side at 8' on center
- Dig holes at each mark (See Diagram 5)
 - Holes should be dug 16"x16"x24" deep
 - At the bottom of each hole, dig the bottom wider than the 16"x16" top
- Build boxes out of 2x8 material for each pier (See Diagram 6)
 - This will be temporary, so it does not need to be pressure treated
 - Open space created by box should be 16"x16"
 - Place these over each hole, they will allow the concrete to extend above the ground when poured
 - Make sure that the forms are in a nice straight line. Even though they are temporary the concrete will be permeant and will need to be framed around later
 - Attach a 2x4 scrap to two sides of the box that extend over the opening of the hole to hold the box in place if needed
 - These boxes must be level so that concrete poured to the top will also be level
 - Adjust ground underneath them if needed to make them level



Room Additions

Temporarily Set Floor Frame (See Diagram 7)

- Move frame into place over holes
- Align with mark for the top of band joist against the home
- Attach temporary 2x4 supports resting on cap blocks
 - Level and temporarily support the side against the home first
 - Then check level on the short sides and outside, and attach temporary supports across the front
 - Temporary supports should be roughly every 8' and attached with 3" screws
- The frame should be square itself and square to the house
- Check that all holes and boxes for footers are in place to receive posts that will sit directly under the floor frame
 - Adjust boxes/holes if needed



Room Additions

Pour Footers

- It is important that all concrete in a hole is poured at one time so that the concrete dries as one unit
 - As you mix and pour for the first hole, count the bags used and make sure that there is enough for the remaining holes, do not start pouring for a footer that there is not enough concrete to complete
 - Make sure the bracket is present; it needs to be set in place while concrete is wet
- Mix concrete in a wheelbarrow or pan using a garden or mixing hoe
 - Follow the instructions on the concrete packaging for water to concrete ratio
- Fill hole and box to the top of the 2x8
 - Level off the top using a trowel
- Set bracket in concrete (while the concrete is still wet)
 - Use a plumb bob from the frame to determine where the bracket should go (See Diagram 8)
If the brackets are not placed before the concrete sets, then expansion bolts and different post boots can be used.
 - It is important that the bracket be in place so that the pier that is installed between the frame and the bracket will be plumb
- Allow the concrete to cure/dry overnight before installing the piers

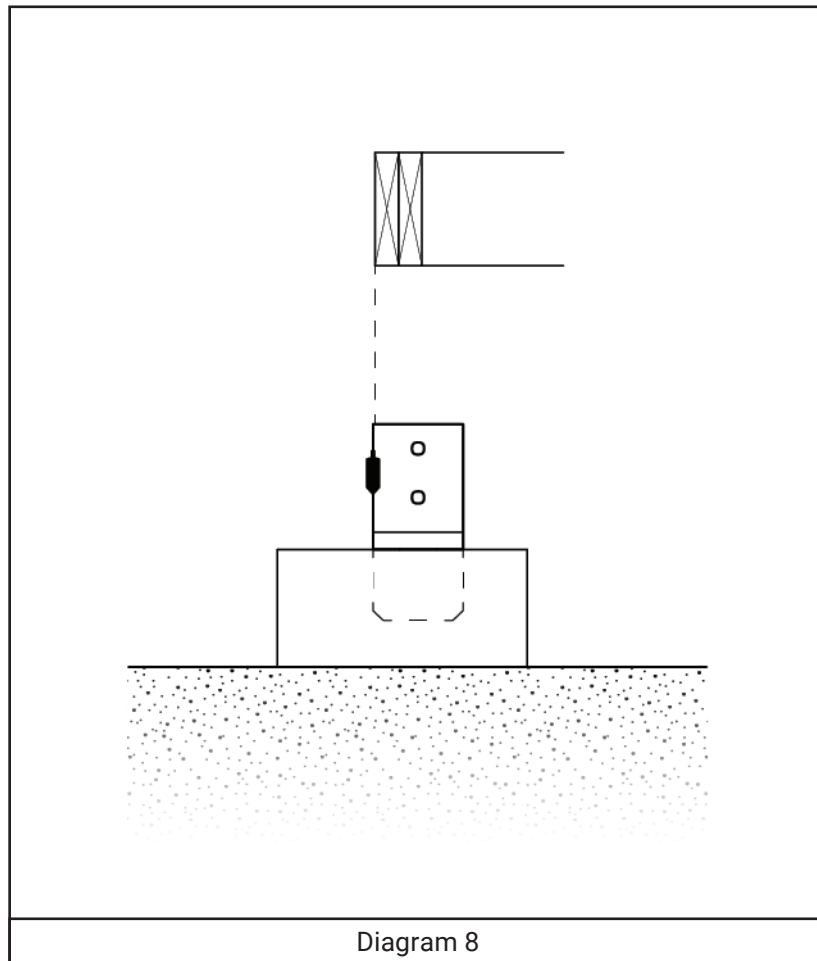


Diagram 8

Room Additions

Install Piers

- Double check that the temporary bracing has not moved and that the frame is both at the correct height and level
 - Adjust as needed
- Piers will be cut from 6x6 posts
- For each pier, measure from the top of the floor frame to where the 6x6 will sit in the bracket (See Diagram 9)
 - Cut 6x6 to this length using a circular saw set to maximum depth, rotating the post and making passes on all sides until cut is all the way through
- Cut notches so that the outside of the 6x6 is flush with the outside of the floor frame and the remainder extends up to the top of the floor frame
 - For piers in the corner, a 2 ½"x2 ½" piece will remain (See Diagrams 10A and 10B)
 - For intermediate piers, a 2 ½"x5 ½" piece will remain (See Diagrams 10C and 10D)
 - The height of the notches should match the height of the joists
 - To cut notches, plunge cut with a circular saw and complete cuts with a reciprocating saw or a hand saw
- Pre-drill holes and install lag screws from the outside of the frame into the notch that is extending up
 - Use 2 lag screws each time a post meets the frame (See Diagrams 10A and 10C)
 - Use ¾"x6 ½" galvanized lag screws

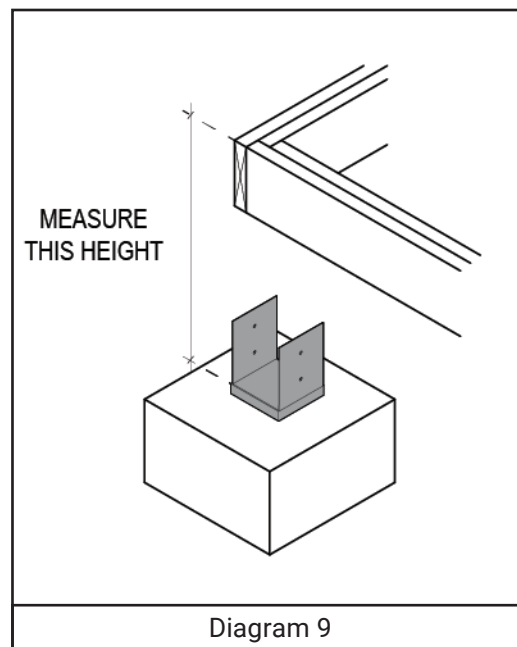
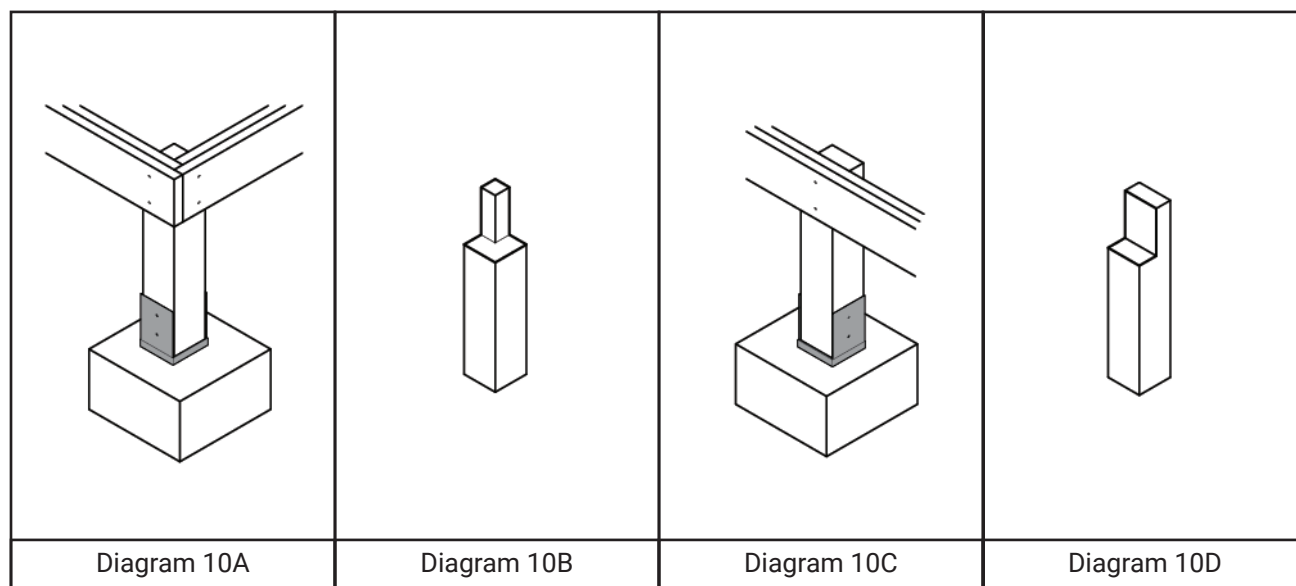


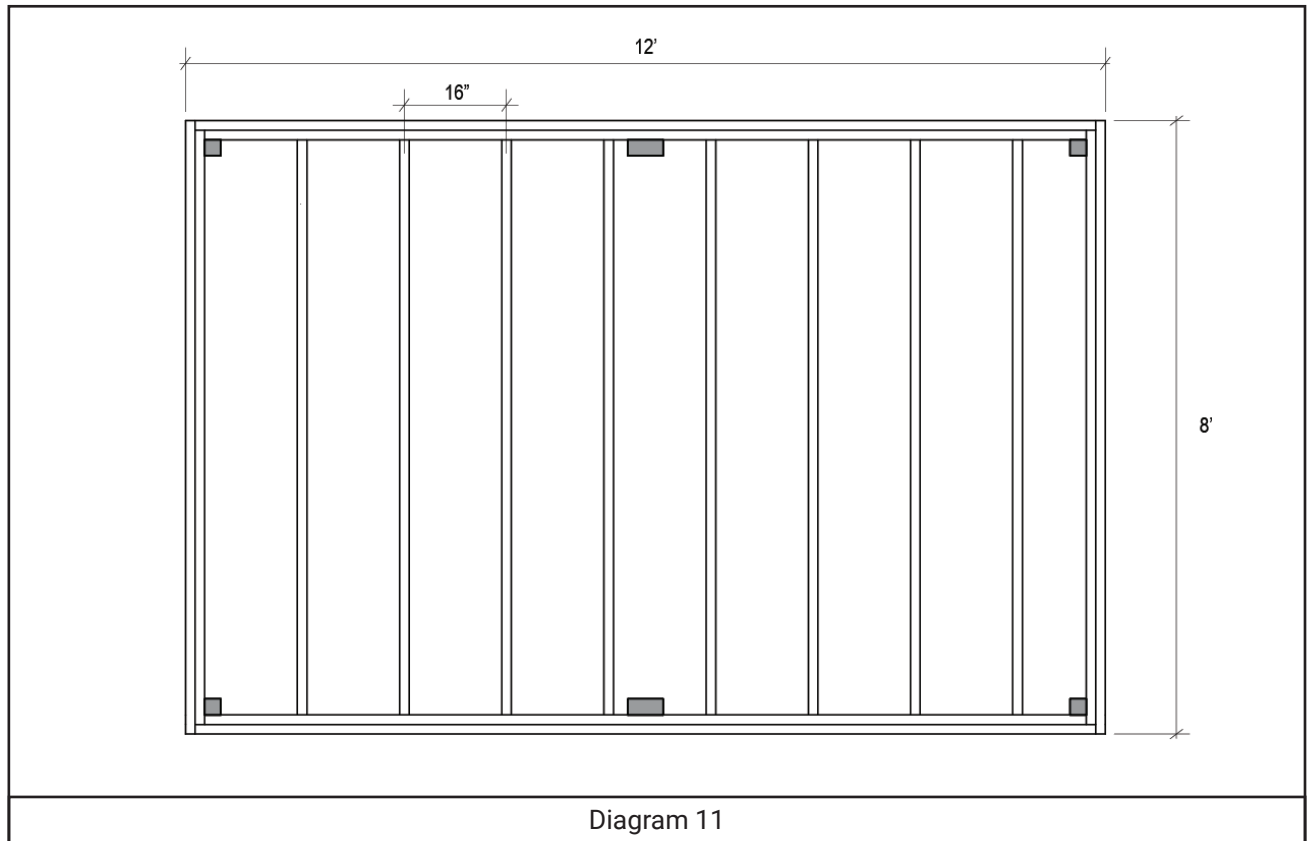
Diagram 9



Room Additions

Install Common Joists (See Diagram 11)

- Joists will run perpendicular to the band joist/perpendicular to the long sides of the addition
- Install common joists every 16" on center
- Crown each common joist, making sure that its natural arch is facing up
- Measure and install each common joist
 - Can toe-screw joist into place to hold it still or just hold it in place
- Add joist hangers on each end of joists
 - Use joist hanger nails in holes on the flat surface and 2 ½" deck screws through the diagonal holes



Room Additions

Install Subfloor

- See installation directions on page 45

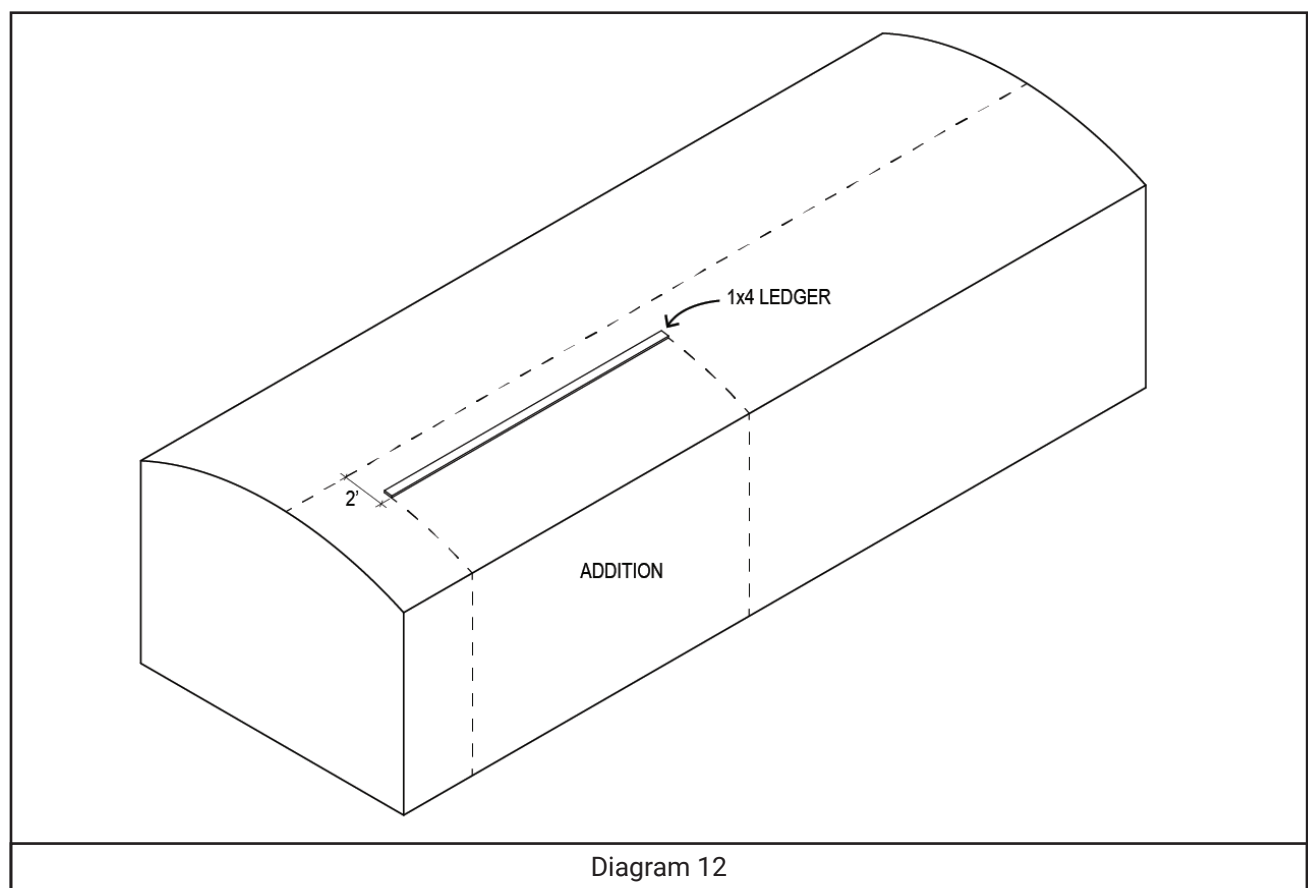
Frame and Stand Walls

- See building and standing instructions on page 65
- For room additions the required minimum height of the outside wall is 84 ½"
 - After the double top plate and the bottom plate, the minimum stud height is 80"
- The bottom of the window should be a minimum of 18" above the floor
- Wall height
 - For additions to mobile homes, all four walls should be built to the same height
 - For additions to homes with rafters under the eaves, the interior wall should be at a height to support the rafters and the other three should be at the same height
- Do not forget to frame interior door(s) and window(s)
- Consider the pitch of the roof and how the new roof will tie into the old when determining the wall height
 - For additions onto mobile homes, rafters will likely have to extend up onto the existing roof and be scribed and cut at an angle to match the slope of the existing roof
 - For houses, the rafters may either rest underneath the existing overhang or extend up onto the existing roof and create a transition from the existing roof (tin roofing and transition flashing can be used in this situation)
 - For additions on the gable side of a house, flashing will have to be installed under the existing siding where the new roof attaches to the side of the house

Room Additions

Install Rafters

- Roof over room addition will be a shed roof, with a single slope
- Determine the size of the rafters based on the span chart on page 90
 - Generally, 2x8s should be adequate
- Rafters for room additions to mobile homes
 - The rafters will run from just below the peak of the mobile home room to 12" past the exterior wall of the addition
 - Install a 1x4 ledger on the mobile home roof 2' below the peak to receive and distribute the weight of the rafters (See Diagram 12)
 - 1x4 should be fastened into the mobile home trusses with deck screws
 - Ends of 1x4 should end on trusses if possible (this may not be possible at each end)
 - 1x4 should be installed the width of the room addition



- Scribe the profile of the roof onto the rafter (See Diagram 13A, facing page)
 - Put the first rafter into place with a corner just below the peak of the mobile home roof and the other end sitting on a block that is on top of the outside wall, the block should be the same width as the rafters
 - Take an additional block the same size as the rafter and use it to trace the shape of the roof onto the rafter
- Cut the shape in the rafter from scribing using a jig saw if the line is curved or a circular saw if the line is straight

Room Additions

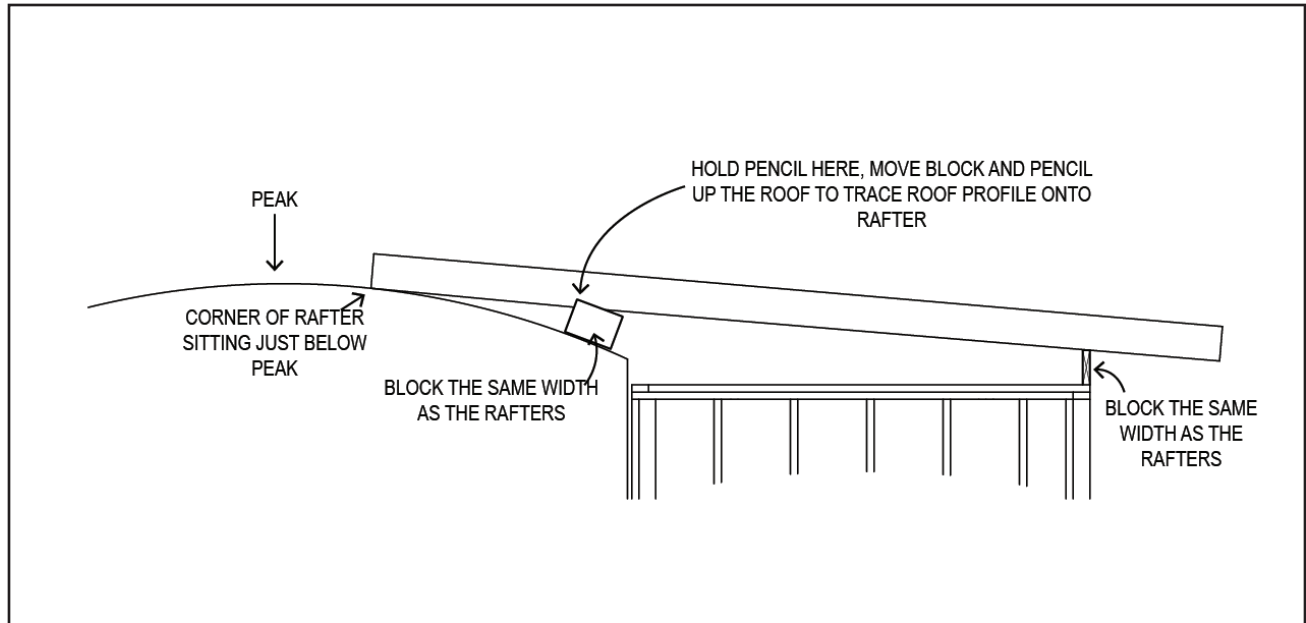


Diagram 13A

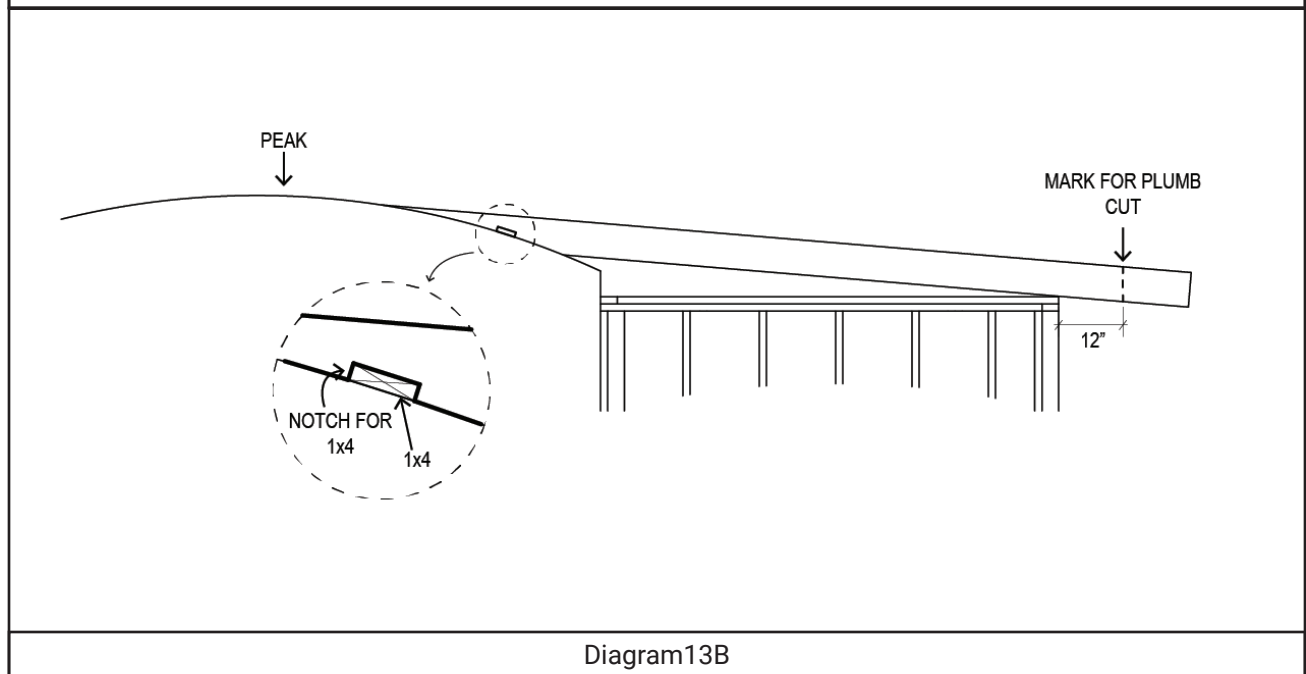
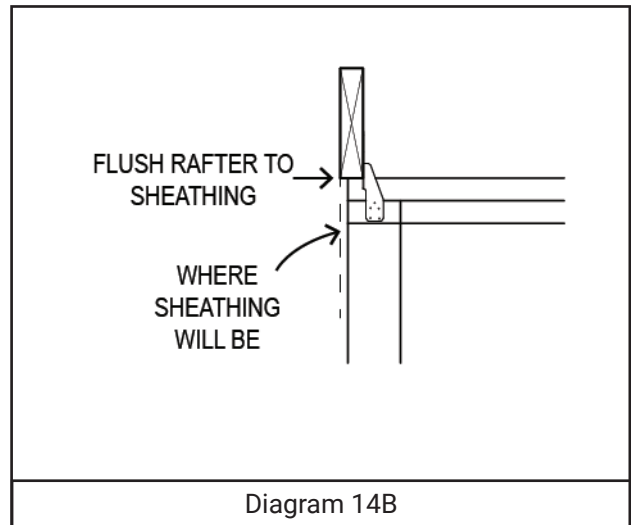
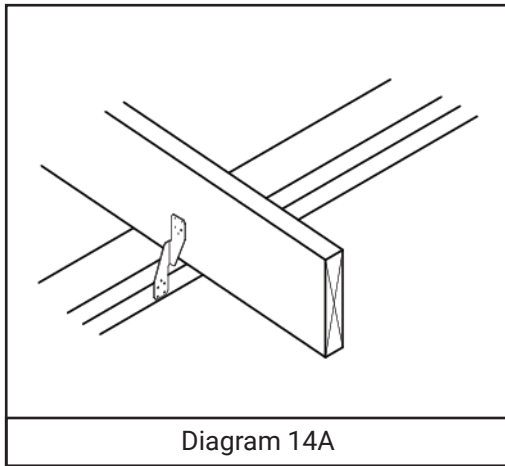


Diagram 13B

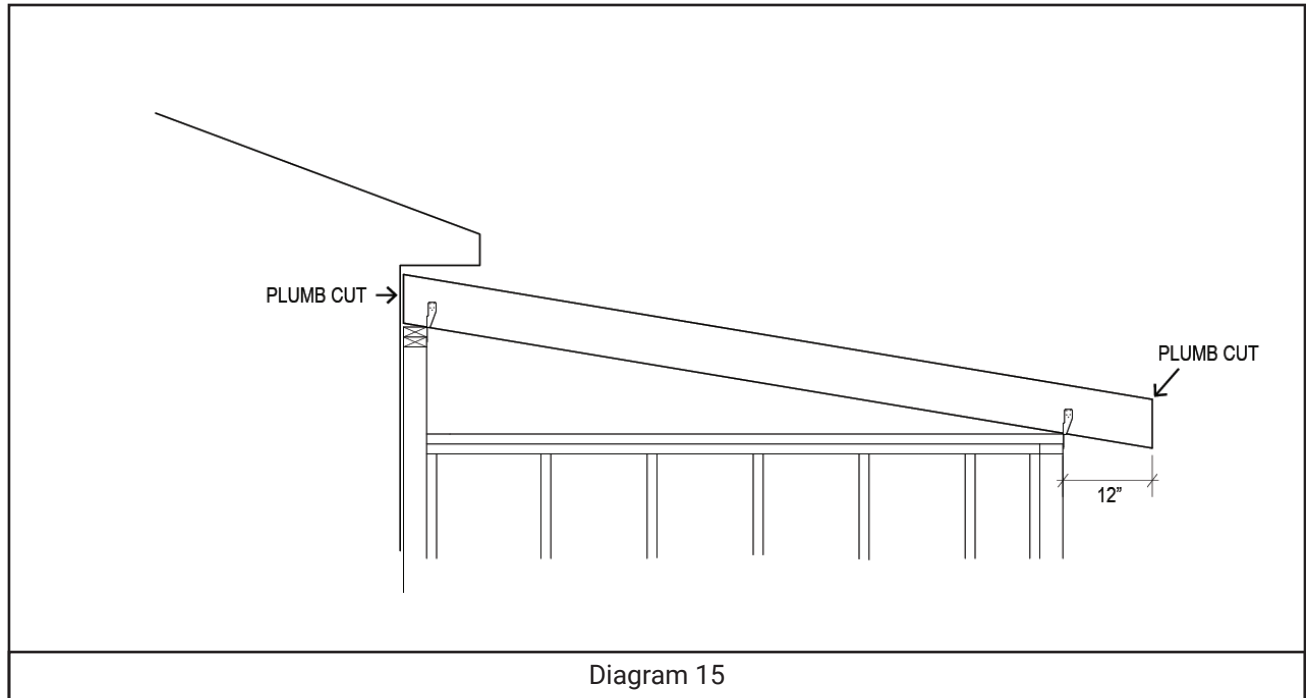
- Put the rafter into place with the small, cut end just below the peak and the other end resting directly on top of the exterior wall (See Diagram 13B)
 - Mark where the rafter sits on the 1x4 ledger
 - Notch out the shape of the 1x4 so that the cut profile of the rafter will sit directly on the mobile home roof
- After the notch is cut, put the rafter back into place and measure and mark a plumb, 12" overhang (See Diagram 13B)
- Make the plumb cut and use this rafter as a template to mark and cut the remainder of the rafters

Room Additions

- Install the rafters 16" on center
 - Where the rafters sit on top of the addition's exterior wall, they should be attached with hurricane straps, filling 3 holes in each face of the hurricane strap with joist hanger nails (See Diagram 14)
 - Blocks will be added that attach the rafters to the new interior wall of the room addition (instructions below)
 - Pre-drill and toe-screw through the rafter into the 1x4 ledger to hold the top of the rafters into place
- The outside rafters should be installed so that the outside of the rafter will be flush with the sheathing of the wall when installed (See Diagram 14B)



Room Additions

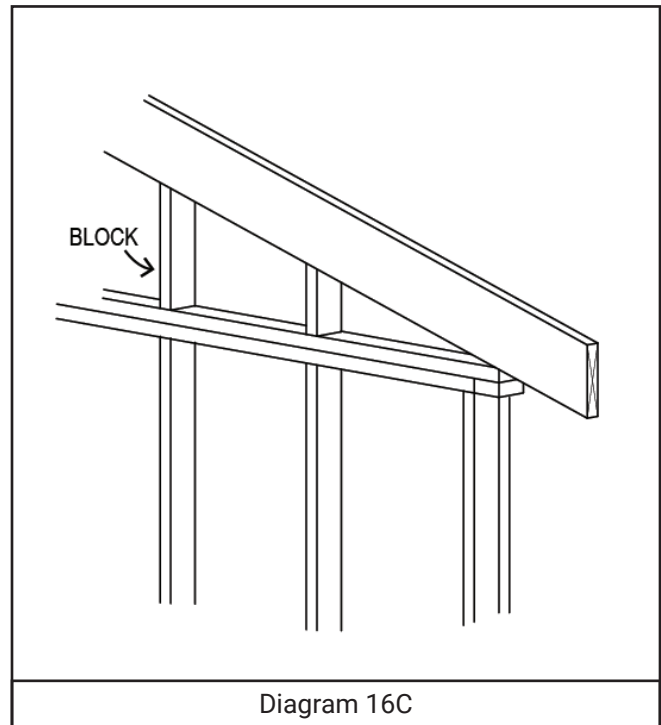
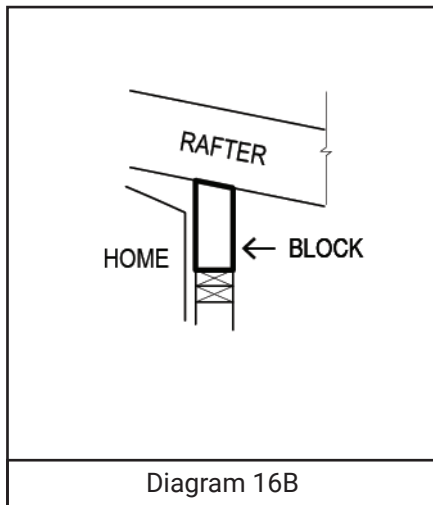
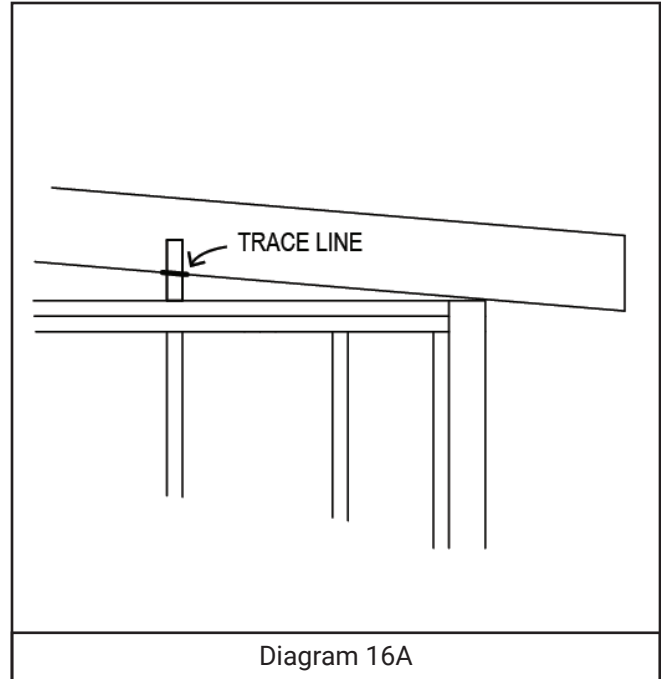


- Rafters to room additions on houses
 - If the rafters will be installed underneath the eave of the home: (See Diagram 15)
 - The rafters should rest on top of the interior wall that is built against the house and on top of the outside wall
 - Both ends of the rafter should be cut plumb
 - There should be a 12" overhang at the eave
 - Find the correct angles on one rafter and then use it as a template to mark and cut the additional rafters
 - Rafters should be installed 16" on center
 - Rafters should be fastened to both walls with hurricane ties, 3 joist hanger nails into each face of the hurricane tie
 - The two outside rafters should be installed to fall flush with the sheathing of the wall, account for this when installing rafters because the walls will not have been sheathed yet
 - If the rafters will extend up on to the roof, work with your construction consultant or HRC to plan for attaching the rafters to the existing roof

Room Additions

Sheath Walls

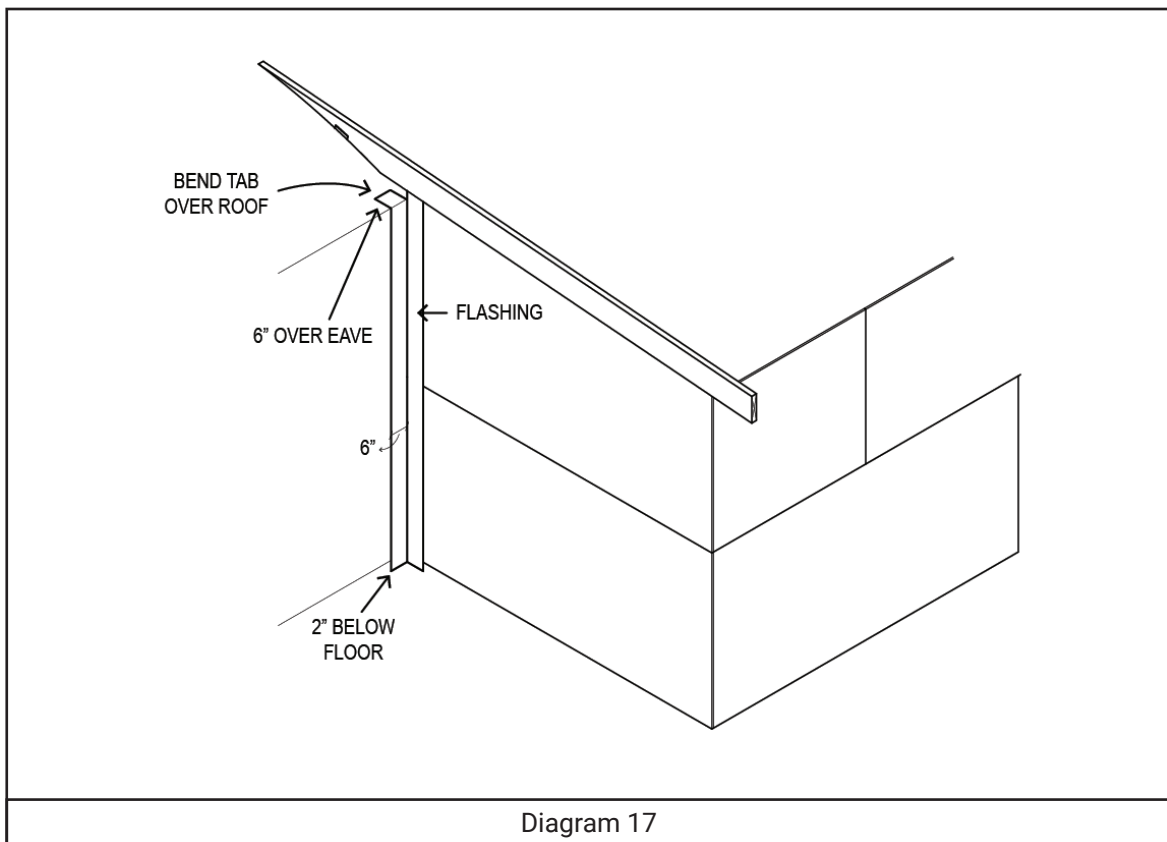
- Once the walls are sheathed, (until the room is dried in) the hole for the window will be the access to the inside of the room
- Blocks
 - Install blocks between the two side walls and the outside rafters
 - These will act as nailers for both sheathing and drywall
 - If there is space between the rafters and the interior wall, blocks should be added here too
 - To install (See Diagram 16)
 - Install over studs so that the spacing remains the same
 - Trace the angle onto the pieces and toe-screws into place
 - Find and cut angles with miter saw
- Detailed sheathing instructions can be found on page 73
- Carry sheathing from bottom of floor frame to bottom of outside rafter, top of sheathing will be cut at an angle



Room Additions

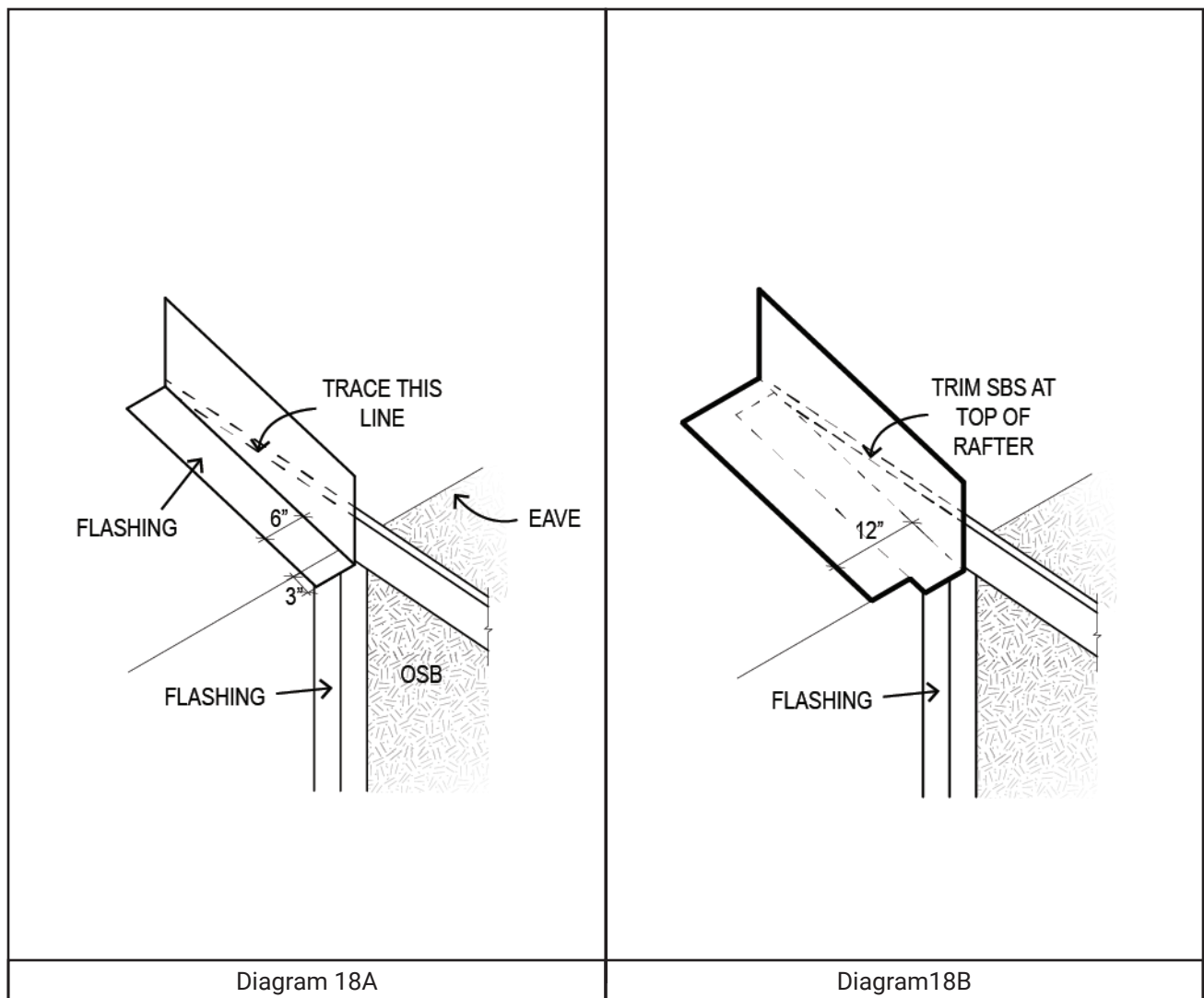
Install Flashing

- For additions to mobile homes, flashing needs to be installed where the walls and roofline of the addition meet the existing structure
- For additions to homes, flashing only needs to be installed where the new walls intersect the old
- Wall to wall connection (See Diagram 17)
 - Bend a piece of flashing that will extend from 2" below the bottom of the floor frame to 6" above the eave (for mobile homes) or extends up to the top of the rafter (for additions to homes with new roofline under existing overhang)
 - At least 6" needs to extend onto the existing siding
 - If there is a mobile home gutter, it needs to be cut 3"-4" away from the intersection of the walls and that 3"-4" section should be pounded down
 - Bend the flashing in half lengthwise using a straight edge to help create the corner
 - Cut 6" down the middle of the bend on one end, bend one tab down and out 90° (this tab will extend over the roof)
 - Apply a generous bead of silicone caulk to the back of the edge that will rest on the siding of the new structure
 - Put the flashing into place, bending the tab over the roof
 - Fasten to the existing wall with neoprene screws every 8" (or more often if needed to match profile of siding)
 - Fasten into the new sheathing every 12"-18" with roofing nails
 - Add another bead of silicone caulk at edge of flashing over existing siding after it is fastened
 - Do not fasten tab into the roof



Room Additions

- Roof to roof flashing (See Diagram 18)
 - Bend a piece of flashing lengthwise that will extend from the top of the addition rafters to 3" past the eave
 - At least 6" should extend out onto the roof
 - Use wide enough flashing that it will extend up the majority of the side of the rafter
 - Put this piece in place and trace where the flashing extends above the new roof
 - Cut this line using tin snips
 - Tack the flashing into the rafter every 12" using roofing nails, do not tack into the existing roof
 - A length of SBS roofing material should be cut that runs from the top of the rafter to 3" past the eave
 - The SBS will extend at least 12" out onto the roof and run up the side of rafter, covering the flashing
 - SBS should extend above the addition roof all the way to the eave, trim this excess off with a hook blade
 - Use the SBS roller, to roll the SBS onto mobile home roof, flashing, and rafter to help it adhere

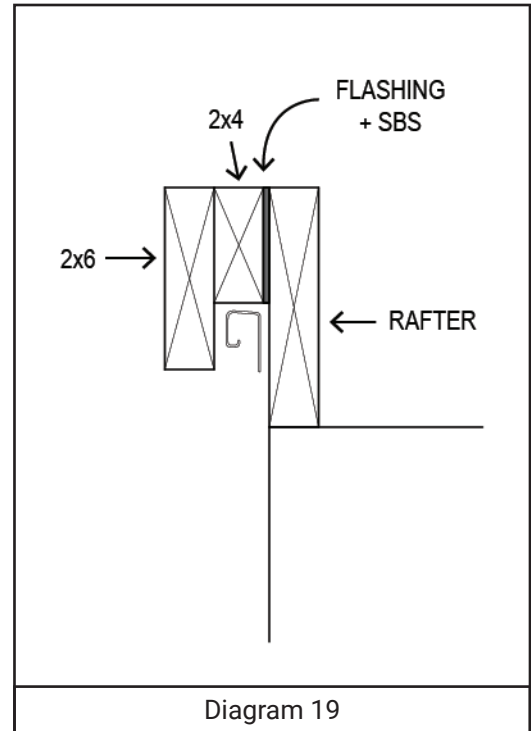


Room Additions

Build Out Overhang

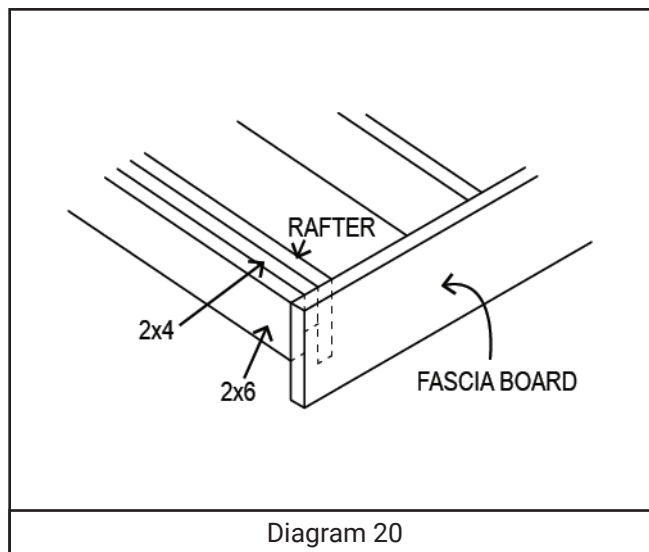
When not building a fly rafter on a stick built home. (See Diagram 19)

- An overhang will be built out on sloped sides of the room addition
- Install a pressure treated 2x4 on the outside of the exterior rafters
 - Cut to match profile of rafters at the top and the plumb cut at the bottom
 - Fasten into the rafter (over the SBS) with 3" screws
- Install a 2x6 on the outside of the 2x4
 - Cut to match profile of rafters at the top and the plumb cut at the bottom
 - Fasten into the 2x4 with 3" screws
- This creates an opening where the j-channel for the top of the siding will rest (j-channel won't be installed until later)



Install Fascia Board (See Diagram 20)

- For more detailed instructions see the Chapters on fascia and soffit.
- Install a 2x8 fascia board across the front of the rafter tails
 - This will cover the ends of the 2x6 and 2x4 overhangs that were just installed



Deck Roof

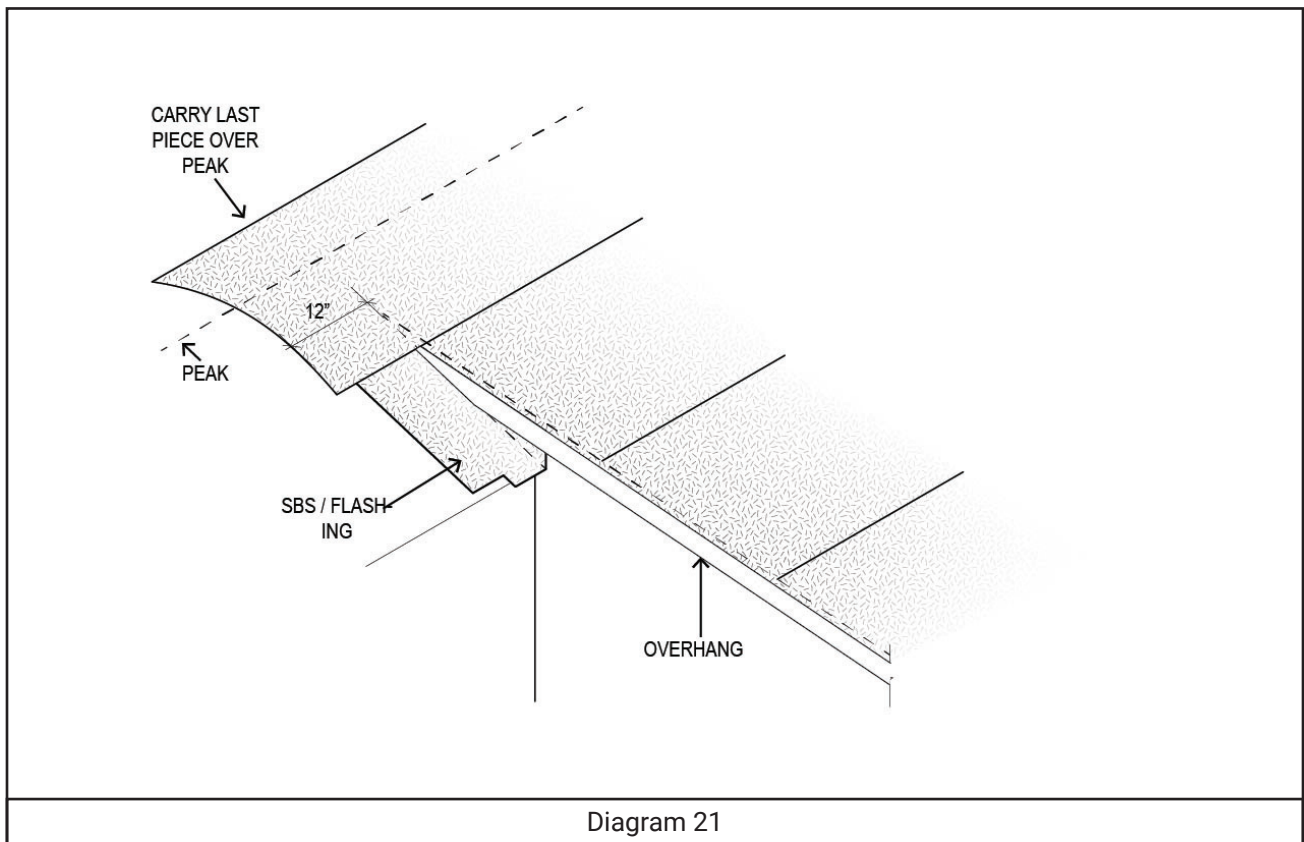
- Instructions for installing roof decking are on page 92
- If SBS roof covering will be used do not install H-clips
- Extend the OSB slightly past the end of the rafters at the top if that will help ease the transition

Install Metal Fascia on Gable Sides Only

- Attach metal fascia over the outside of the 2x6 on both angled sides of the roof
- Install with white aluminum trim nails attached every 18", one over the other

Roof Covering

- Instructions for SBS roof covering are on page 106
- Instructions for metal roof covering are on page 121
- If using SBS on an addition to a mobile home, leave excess on each edge to be attached underneath termination bar, but do not attach termination bar until metal fascia has been installed
 - Soffit across the eave side must be installed before metal fascia
 - SBS can be left overhanging temporarily and fastened down later
- Carry the last piece of SBS over the peak of the roof and extend 12" past the overhang on each end (See Diagram 21)



Room Additions

House wrap:

- See installation instructions on page 146

Cut Door Opening into Home

- If coming through an existing window, remove the window
- Cut away siding from the opening from the addition side and drywall away from the interior
- Remove interfering studs and re-frame opening as needed

Install Window:

- See installation instructions on page 85

Vinyl Soffit/Metal Fascia:

- See installation instructions for vinyl soffit and metal fascia on page 146
- The termination bar across the eave needs to be installed after the metal fascia is installed
- Vinyl Siding: Instructions for installing vinyl siding are on page 151
- On gable sides, j-channel will be installed into the gap of the overhang created by the 2x4 and 2x6 at the top of the wall
- Subcontractor(s) (Plumbing and Electric):
- This is the point in the room addition process that electricians and plumbers should come do the rough ins
- Do not complete the remaining items until the plumbing/electric is run because it will interfere with their ability to complete work
- Insulate:
- See installation instructions for insulation on page 166

Underpinning:

- See installation instructions for underpinning installation on page 229

Set Shower/Tub Base:

- See product installation instructions and/or detailed instructions on page 197

Drywall (Install and Finish):

- See instruction for drywall installation and finishing are on page 175

Room Additions

Install and Trim Interior Door (See Diagram 22)

- A pre-hung interior door will be used, the door will swing into the room
- Additional studs may need to be added to the wall of the existing house or mobile home to create the door frame
 - A header should be built and installed over this new doorway in the existing wall
- If the addition is to a mobile home, the door will likely be taller than the wall of the mobile home (which is okay, because the door will swing into the room)
 - This will require some extra trim at the top of the opening
- Install pre-hung door (detailed directions on page 90)
- 1x material can be ripped to width with a table saw and used to meet up to the pre-hung door frame, install 1x with finish nails (this can be done on both sides and the top if possible)
- Install door casing around the door inside the existing home

Prime/Paint:

- See instructions for priming/painting on page 204

Install Finished Floor:

- See installation instructions for finished flooring installation on page 62

Set Light fixtures/heaters/ toilet/vanity Trim:

- See installation instructions for trim on page 209
- Including baseboard and trim around windows

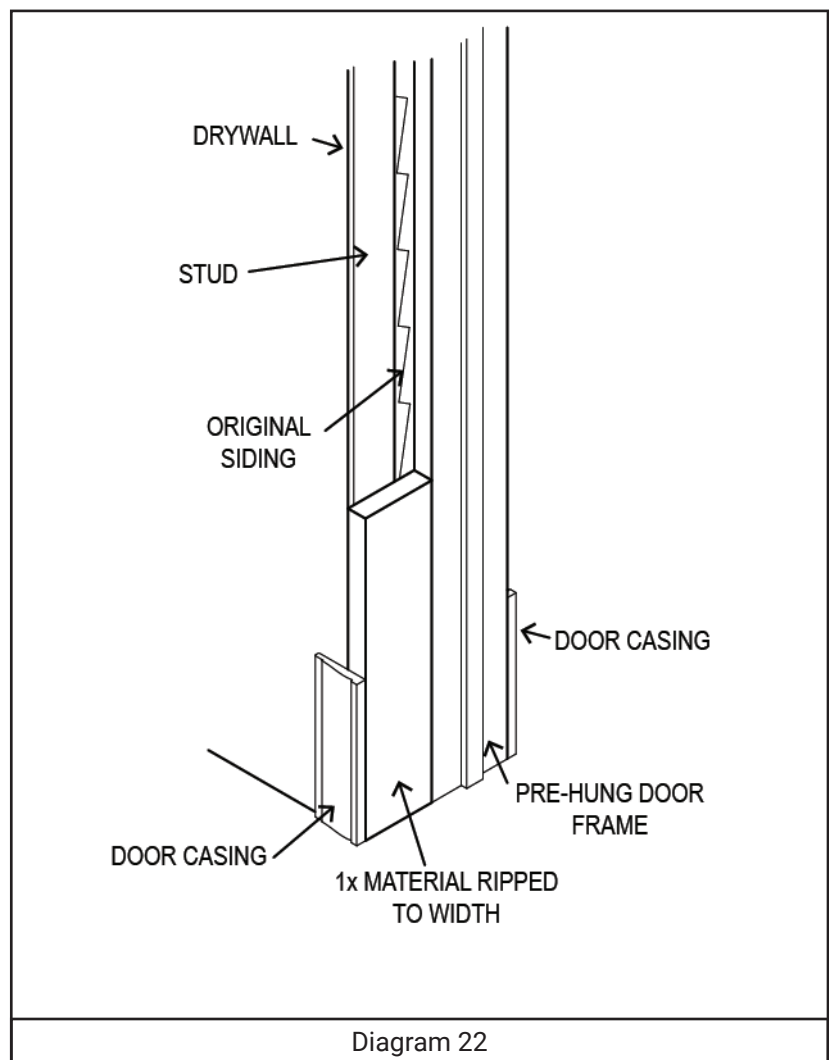


Diagram 22

Photo Credits

"0.152' x 6' Strong-Tie SDWC Truss Plate Structural Screw, Orange Zinc." *Fasteners Plus*, www.fastenersplus.com/0.152-x-6-Strong-Tie-SDWC-Truss-Plate-Structural-Screw-Orange-Zinc?quantity=1&package-quantity=25&gclid=Cj0KCQjw1-NBRC3ARIsAliFYOM2JEhlxylmfh1Z7UBhuVdC7IQMB-9iDxDGcM0_qp7w1KznagWd-D6YaAphWEALw_wcB.

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