IMPORTANT

PLEASE READ BEFORE YOU START ERECTION!

All details, recommendations and suggestions in this manual are general guidelines only and are not meant to be all-inclusive. Erectors should follow industry-accepted installation practices with regard to all areas not specifically discussed in this manual. This erection manual is intended only as a supplement to the erection drawings that are furnished with each HOME. **For specific details on your HOME always refer to your Erection Drawings**.

Metal Building Manufacturers Association (MBMA)
1300 Sumner Avenue
Cleveland, OH 44115-2851
Phone: 216-241-7333
Web-Site: www.mbma.com

Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210
Phone: 202-693-1999
Web Site: www.osha.gov

INTRODUCTION

This manual is not designed to teach novices how to erect a steel home. It is intended as a guide for experienced building contractors and professional erectors.

We manufacture high quality, pre-engineered steel home packages. Quality erection is essential to complete the structure to the satisfaction of the customer.

This manual has been prepared to help guide the erection process by presenting techniques that are believed to be the most representative of good erection practices in the steel home industry. By necessity, these procedures and methods are general in nature. The erector should always use proven and safe erection methods.

This erection manual is intended only as a supplement to the erection drawings that are furnished with each home. The erection drawings show the customer's particular home as engineered and fabricated according to his local building code requirements. **The Home erection drawings will always govern with regard to construction details and specific home parts.** Contact your customer/technical service representatives to discuss any matters not addressed.

The information contained in this manual is believed to be reliable; however, the seller disclaims any responsibility for damages that may result from the use of this manual since the actual erection operations and conditions are beyond the seller's control.

It is emphasized that we are only a manufacturer of Steel Homes and components and are not engaged in the erection of building products. Opinions expressed in this manual about erection practices are intended only as a guide to assembling the components to create a home. The experience, expertise, and skill of the erection crews as well as the equipment for handling materials will determine the quality and safety of the erection and the ultimate customer satisfaction with the completed home.

The **MBMA's** "**CODE OF STANDARD PRACTICE**" shall govern with respect to the fabrication tolerances, erection methods, and all fieldwork associated with the project in question.

The erector should familiarize himself with contents of this document!

TABLE OF CONTENTS

IMPORTANT NOTICE:
Safety First

SECTION 1: GETTING TO KNOW YOUR ERECTION PLANS 2
How to read Your Anchor Bolt Setting Plan
Anchor Bolt Plans
Rigid Frame Cross Section
Roof Framing Plan
Endwall Framing Elevation
Sidewall Framing Elevations
Dormer Details
Connection Details
Assembly Details

SECTION 2: FOUNDATION AND HOME ANCHORAGE 12
General Foundation Information
Foundation Checking Information
Anchor Bolt Settings

SECTION 3: PRE-ERECTION 14
Access to Site
Unloading and Inventory
Handling and storing Structural Components
Handling and storing of Siding, Roof Panels, and Trim
Location of House Parts

SECTION 4: ERECTION OF STRUCTURAL STEEL 22
Structural Framing Precautions
Efficient Erection
General Information
Some Recommended Tools
Lifting Cables and Spreader Bars
Cable Tension and Hook Height
Raising Rigid Frames
Connection Bolts
Bolt Tighting Procedures
Joints subject to Tension Loads
Typical Framing Connection Details
Completing and Plumbing the First Bay
Erecting the Endwalls
Insulation of Cable Bracing

SECTION 5: ROOF INSTALLATION 35
Roof Insulation
Preparing the Eave
Roof Sheeting
PBR Panel
Roof Fasteners
Fastener Insulation
Butyl Tape
Fastener layout
Safety Note! Caution!! May be Slick
Safety Precautions for Roofing
Installation of First Roof Panel
Sealing the Side Lap
Sealing the Eave
Roof Sheeting Sequence
Installation of Final Panel
Ridge Flashing Detail
Installation of Wind Bracing

SECTION 6: WALL FRAMING 48
Installation of Wind Bracing
Window & Door Framing

SECTION 7: FLOOR JOIST SYSTEM 50

SECTION 8: ERECTION SEQUENCE 51
Quick Start Guide

SECTION 9: APPENDIX 59
OSHA safety Standards for Steel Erections: Final Rule

IMPORTANT NOTICE!!!

Read and understand this page before proceeding with any further reading.

We have a commitment to manufacture quality HOME components that are designed to meet the structural requirements of the home. However, the safety commitment and job site practices of the erector are beyond our control.

We therefore urgently recommended that safe working conditions and accident prevention practices be the top priority on the job site and that local, state and federal safety and health standards always be followed to help ensure worker safety. These points cannot be stressed too strongly.

Safety is a joint responsibility of all parties present on the site, including owners, architects, engineers, contractors, subcontractors, and employees of all the above. All should be watchful to avoid hazards which might cause injury or damage to property.

We recommend that the job foreman or other authority conducts daily meetings to emphasize safe practices. Everyone on the site should know the location of first aid kits and be familiar with the procedures to be followed in an emergency.

Workers should be required to wear appropriate clothing and use proper equipment, including hard hats, rubber-soled boots, gloves, eye protection, and safety harnesses when working on the roof. Work should stop for inclement weather when personnel are at risk due to high winds, lightning, precipitation, etc.

This manual should be interpreted and administered with sound judgment consistent with good safety practices. Its information is to be given to all workers on the job site. Where any doubt exists as to the language or direction of this manual, do not take risks, “play it safe”.

Safety First!

SECTION 1: GETTING TO KNOW YOUR ERECTION PLANS

After placing your order, you will receive one or more sets of erection plans marked "**For Construction"** (which may also be referred to as "**drawings**," "**plans**," or "**construction plans**"). The set will consist of a cover page and as many as 30 individual drawings which illustrate different sections of the home. These drawings are precise representations of the particular parts and assemblies of the home that has been manufactured for you, and they are intended as the definitive guide for properly constructing it. The drawings take precedence over everything else. For example, this manual offers general advice on constructing steel-framed homes and includes numerous illustrations and diagrams to help you recognize various parts and understand certain principles. However, only the erection plans illustrate your home, and you should study them carefully and follow them exactly.

Before receiving your final plans, you may also have obtained preliminary or even sample drawing sets. These may be marked "**NOT FOR CONSTRUCTION**" or "**SAMPLE**." It is extremely important that you do not plan or begin any construction based on preliminary plans. The final approved set will be marked "**FOR CONSTRUCTION.**" These are the only drawings that should be used to design a foundation or to make decisions about the construction of the home.

The cover page (first page) of each set of drawings will contain some important information. It will provide an index or table of contents for the entire set. It will have a set of specifications that describes the properties of some of the materials and that details the authorities and standards on which the design is based. It will list the home code and the specific design loads for which the home is engineered, including the wind load, roof load, collateral load, etc. It will also list some of the builder's responsibilities according to the terms of the sale and the standard practices of steel frame construction.

The following pages of this section provide several examples of drawings that are included in a set of erection plans. Once again, these are typical examples only and are not meant to represent a particular home.

HOW TO READ YOUR ANCHOR BOLT SETTING PLAN:

The most important thing you can do to make your erection go smoothly is to make sure your foundation is square and level and that your anchor bolts are in the exact right location. **When your foundation is right and your anchor bolts are right, your steel will bolt together easier.** That's because most parts of your red iron framing have bolt holes designed to line up with bolt holes on other parts of your red iron framing.

In order for these holes to line up with each other, so that you can get a bolt through them, your slab needs to be level. If it's not level, then one column can be higher than another column and that would make the rafters push the other column outward.

Your slab needs to be square. That means the diagonal measurements from the corners of your slab to the other corners are equal. For more information on a square and level foundation, please see page 3 of your erection manual.

Your main anchor bolt plan is on sheet F1. Enlarged details of this plan are shown on sheets F2 and F3. Sheet F1 also shows a reaction schedule. These reactions give your foundation engineer information about the loads the structure will exert on your foundation. They show downward, outward and inward loads of the columns, among other things. The loads are expressed in kips. One kip is equal to 1000 pounds.

The overall dimensions of your home will be shown on page F1. We do not show the thickness of your slab or how big your footings and piers need to be. That is determined by your local foundation engineer and HOME codes. In many areas, a 12" perimeter footing is suggested along with a 2'x2' pier under the I-Beam columns. Your specific soil conditions or local codes may require something else, so check that out before you do anything.

On sheet F1, you will see the locations of all your columns. Each column shown on this page has a 'BP' letter by it, such as BP-A or BP-K or BP-AA. This 'BP' letter refers to a larger detail that is shown on sheet F2 or F3. 'BP' stands for base plate .

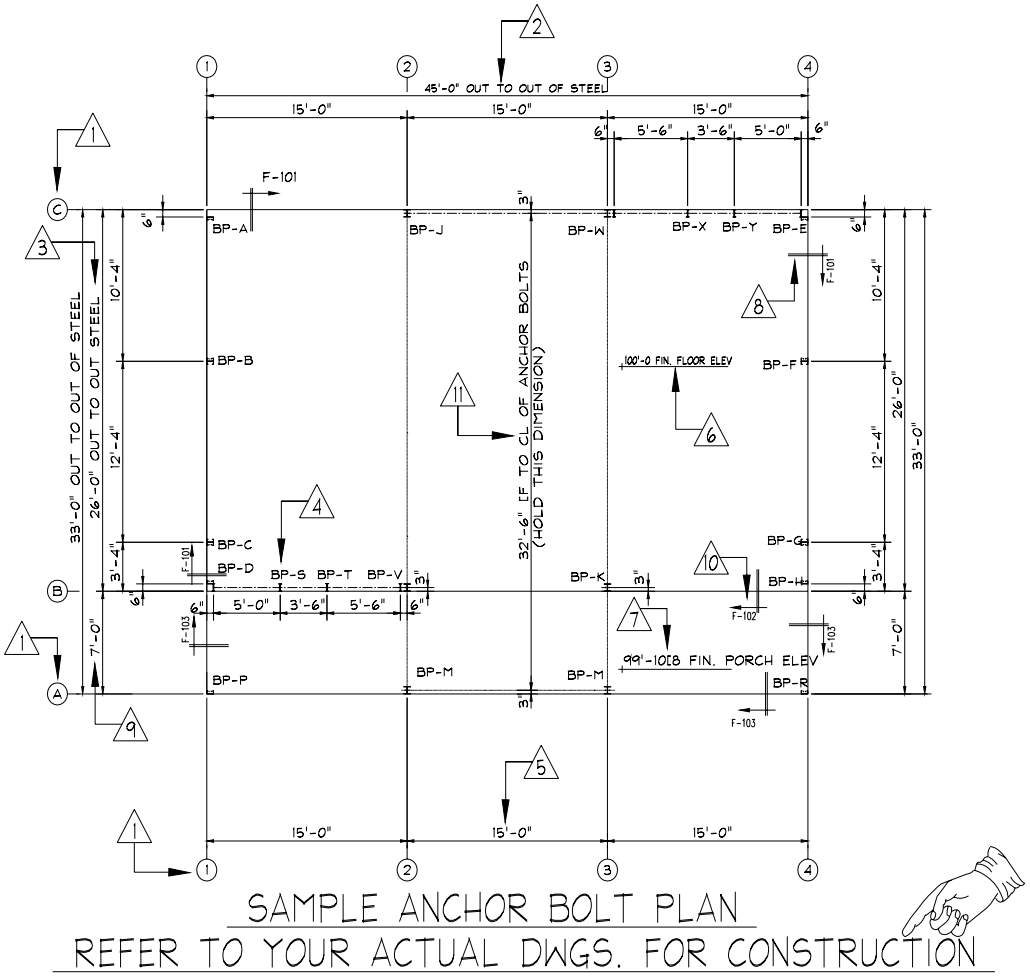
When you see a column marked BP-A on page F1, look for the larger detail of BP-A on sheet F2. This larger detail will show the shape of the column and its exact location on your foundation. The detail also shows the exact location of each anchor bolt. When you see the words 'steel line' that usually means the edge of your foundation.

Page F1 will show the elevation of each column. Some columns will be lower than others if they are on a porch. The baseline elevation shown for most columns is 100'-0". If a porch column is an 1 ½" lower than the main home columns, your plan would show an elevation of 99'-10 ½".

Most erection problems are caused by the slabs not being level or square or the anchor bolts being just a little bit off. A common mistake is to install the anchor bolts 3" from the front steel line and then 3" from the back steel line. Most slabs are not perfect enough to do this. **You should measure in from one side to install anchor bolts, then measure across the slab using the dimension provided. In other words, use one side as the control point for all measurements.**

When your anchor bolts are in the exact right location, your steel will bolt together easier.

ANCHOR BOLT PLANS



SAMPLE ANCHOR BOLT PLAN

REFER TO YOUR ACTUAL DWGS. FOR CONSTRUCTION

The anchor bolt plans will be used by the foundation engineer to design a suitable foundation for the home and to properly set the anchor bolts when the concrete is poured.

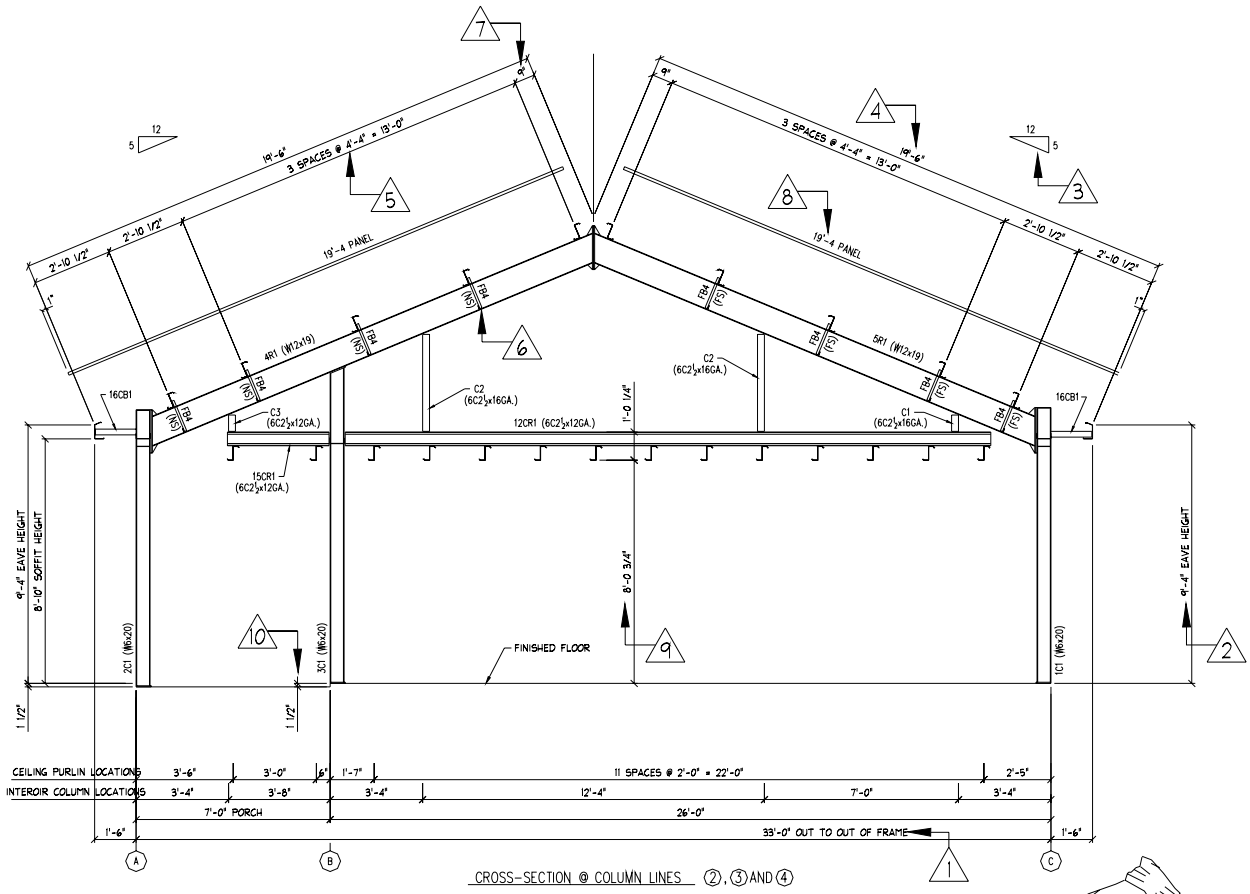
The plans include a table of "reactions" which informs the engineer of the potential stresses imposed by tyhe frames on the foundation.

When designing a foundation, be sure to use the data from the anchor bolt plans marked "FOR CONSTRUCTION" and not from any preliminary drawing.

This sample anchor bolt drawing above contains the following details and information.

1. Column lines.
2. Home length from out to out of steel.
3. Home width from out to out of steel.
4. Column baseplate (anchor bolt) locations.
5. Bay spacing from column centerline to column centerline.
6. Relative elevation of finished floor.
7. Relative elevation of porch.
8. Section view of edge of slab.
9. Porch length out to out of steel.
10. Porch drop (1 1/2") from finished floor line.
11. Centerline to centerline distance between anchor bolts.

RIGID FRAME CROSS SECTION

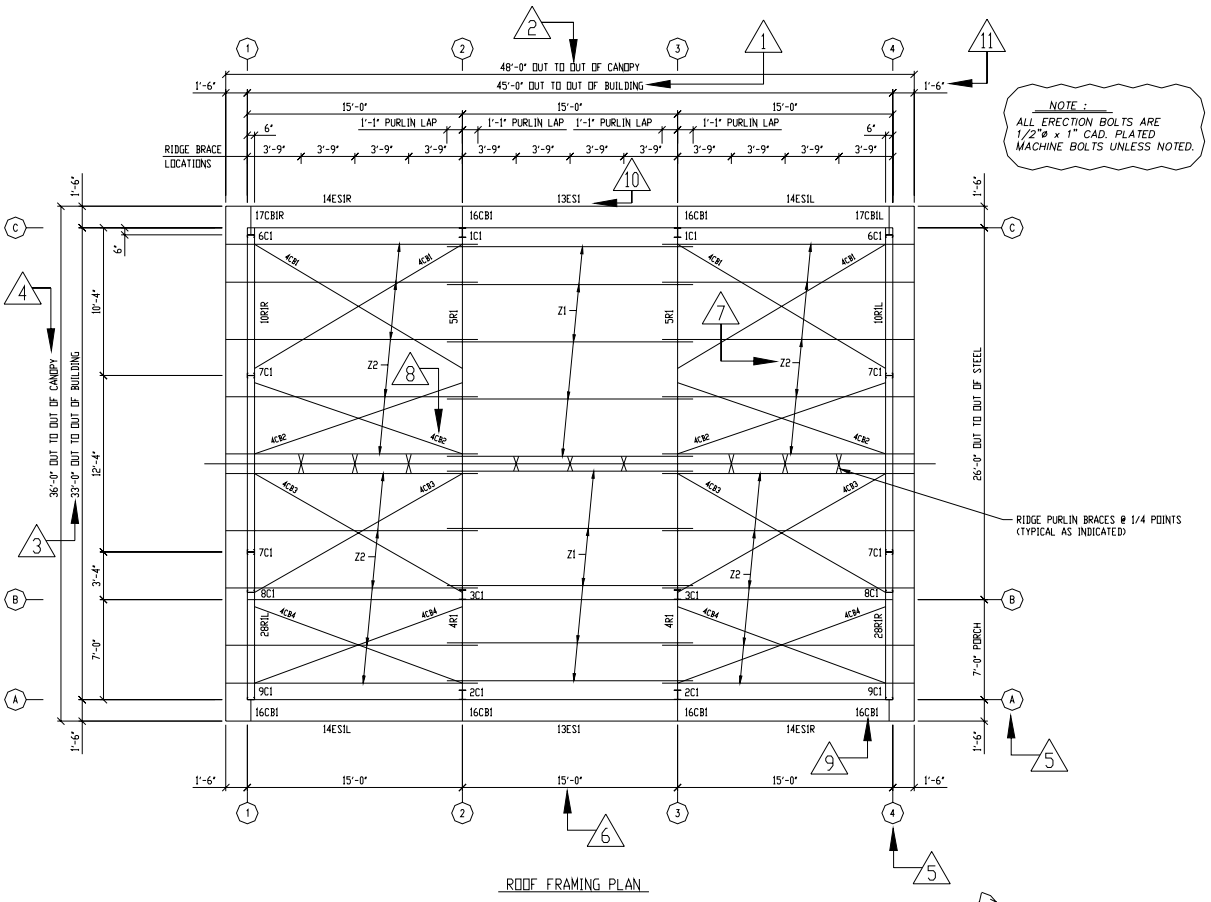


SAMPLE RIGID FRAME CROSS SECTION
REFER TO YOUR ACTUAL DWGS. FOR CONSTRUCTION

The typical rigid frame cross section shows the column and rafter arrangement, the purlin and frame brace locations, the inside clearances and the layout of sidewall panels and roof panels. The example drawing above illustrates a typical frame cross section and includes the following details and information:

1. Home width (feet and inches) dimension is out to out of frame.
2. Home eave height (feet and inches); dimension measured from finished floor to top flange of canopy strut.
3. Bevel of roof slope.
4. Slope dimension from centerline of ridge to out of canopy strut measured along slope of roof (feet and inches).
5. Purlin spacing (feet and inches).
6. Flange brace location.
7. Roof panel end lap dimensions measured from purlin web line (inches).
8. Roof panel length.
9. Ceiling height measured from top of finished floor to bottom of ceiling joist.
10. Porch drop ($1\frac{1}{2}$") from finished floor.

ROOF FRAMING PLAN

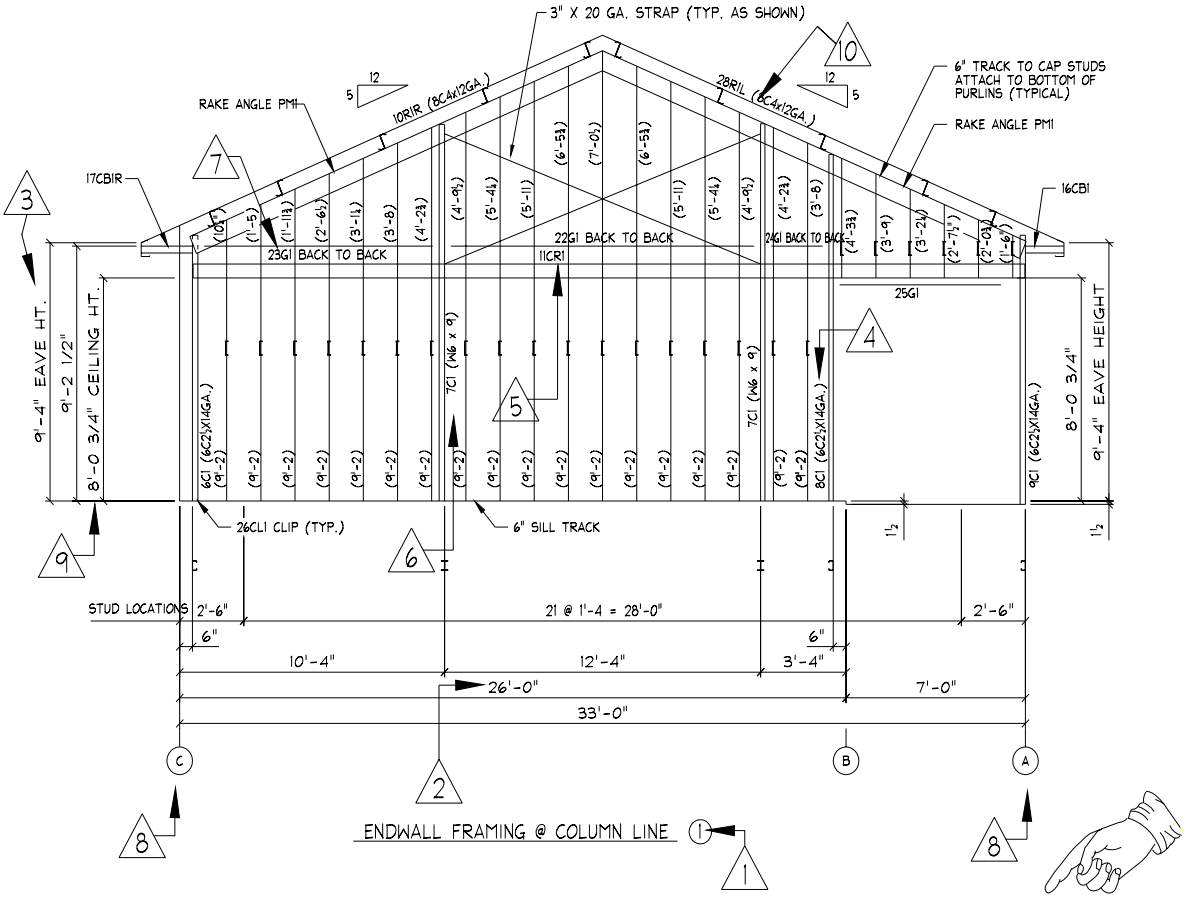


SAMPLE ROOF FRAMING PLAN
REFER TO YOUR ACTUAL DWGS. FOR CONSTRUCTION

The roof framing plan shows the arrangement of the endwall columns, rafters, and eave struts and purlins with their respective piece marks. The sample illustration above is typical of this type elevation and includes the following details and information:

1. Building length shown out to out of steel line.
2. Roof length shown out to out of purlins.
3. Building width shown out to out of the steel line.
4. Roof width shown out to out of canopy.
5. Column line designations.
6. Sidewall bay spacing measured from the centerline to the centerline of frames.
7. Purlin piece mark.
8. Roof wind bracing piece mark.
9. Canopy strut piece mark.
10. Eave strut piece mark.
11. Eave overhang measured from end of roof purlins to end of frame line.

ENDWALL FRAMING ELEVATION



SAMPLE ENDWALL FRAMING ELEVATION
REFER TO YOUR ACTUAL DWGS. FOR CONSTRUCTION

The endwall framing elevation shows the arrangement of the endwall columns, rafters, and girts with their respective piece marks. The sample illustration above is typical of this type elevation and includes the following details and information:

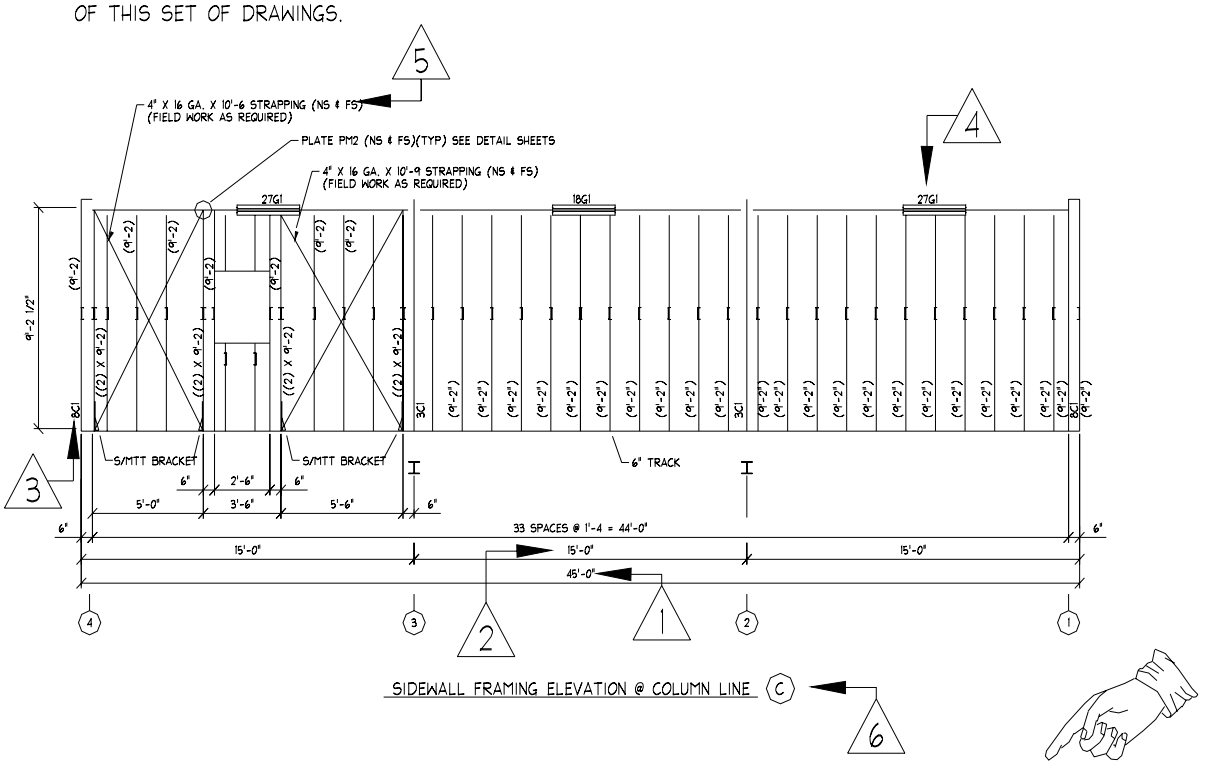
1. Endwall framing elevation designation by frame line number.
2. Width of home measured out to out of steel line.
3. Home eave height (feet and inches) measured from top of finished floor to top flange of eave strut.
4. Corner column piece mark.
5. Endwall rafter piece mark.
6. Endwall interior column piece mark.
7. Endwall girt piece mark.
8. Endwall column line designation (letter).
9. Ceiling height from top of finished floor to bottom of ceiling joist.
10. Main rafter piece mark.
11. The sidewall bay spacing which is measured from the centerline of frames.

SIDEWALL FRAMING ELEVATION

NOTES:

1) THE SIDEWALL STRAP BRACING MAY BE RELOCATED, TO AVOID INTERFERENCE WITH WINDOWS AND DOORS, BUT MUST REMAIN ON THE SAME SIDEWALL. THE DOUBLE STUDS, SMTT BRACKETS, PM2 PLATES AND $\frac{5}{8}$"ø ANCHOR BOLTS ARE INTEGRAL PARTS OF THE BRACING AND MUST MOVE WITH THE STRAPPING.

2) ENDWALL AND SIDEWALL STRAP BRACING MUST BE INSTALLED TO THE INSIDE AND OUTSIDE OF THE STUDS AS SHOWN IN THE DETAILS ON THE DETAIL SHEETS OF THIS SET OF DRAWINGS.

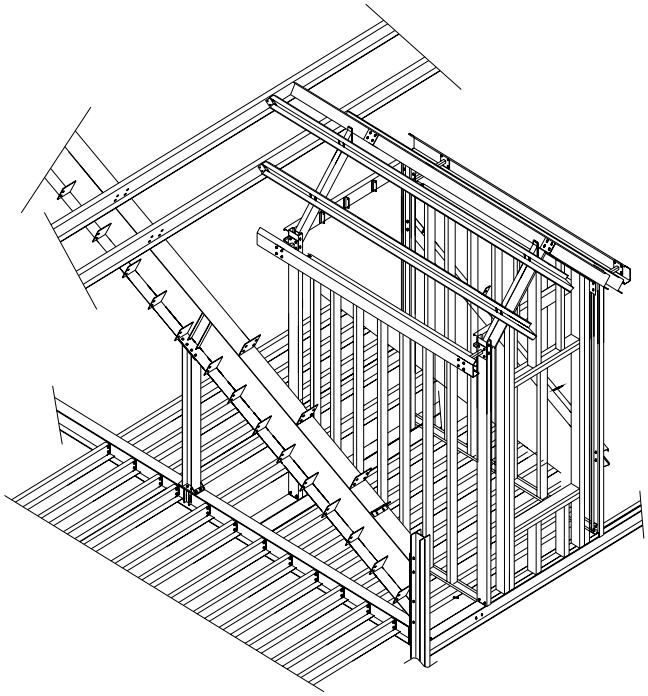


SAMPLE SIDEWALL FRAMING ELEVATION
REFER TO YOUR ACTUAL DWGS. FOR CONSTRUCTION

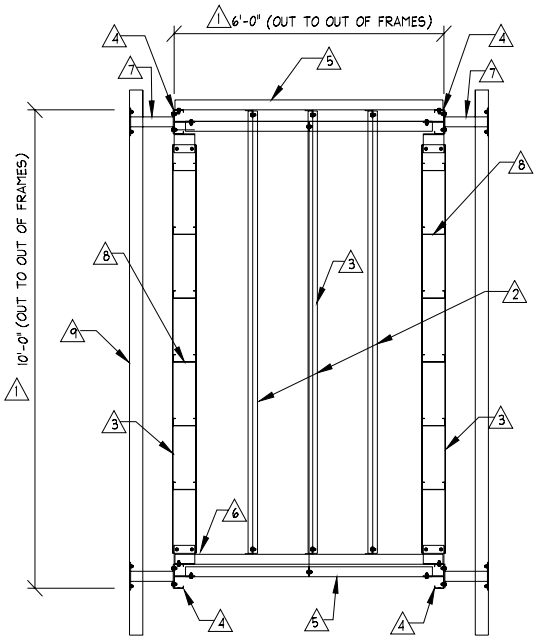
The endwall framing elevation shows the arrangement of the endwall columns, rafters, and girts with their respective piece marks. The sample illustration above is typical of this type elevation and includes the following details and information:

1. The home length. Which is measured from the out to out of the steel line.
2. The sidewall bay spacing. Which is measured from the centerlines of the frames.
3. The sidewall column piece mark.
4. The sidewall girt piece mark.
5. The sidewall bracing.
6. The sidewall column line designation.

DORMER DETAILS



ISOMETRIC VIEW



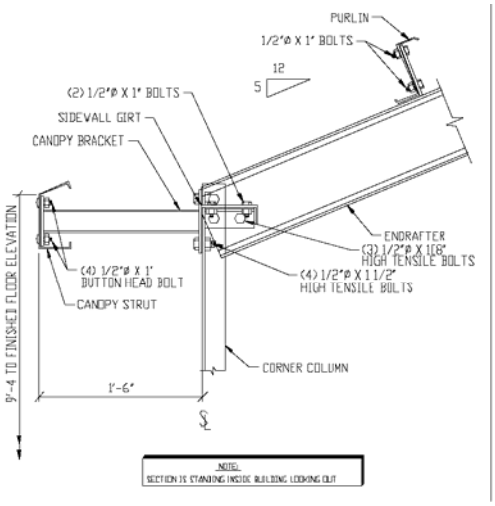
DORMER

NOTE: DORMER SHOWN IS A TYPICAL 6'-0" MODEL. PLEASE REFER TO ERECTION DRAWINGS FOR DETAIL OF SPECIFIC APPLICATION.

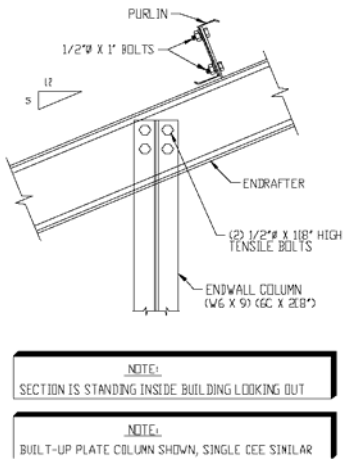
1. OUT TO OUT DIMENSION OF DORMER FRAMES
2. CEILING JOIST
3. GIRT (FOR ATTACHING SIDEWALL STUDS)
4. MAIN DORMER COLUMN
5. MAIN DORMER RAFTERS
6. DORMER CEILING RAFTERS
7. CANOPY BRACKET (FOR ATTACHING EAVE STRUTS)
8. EXTERIOR STUDS
9. EAVE STRUT

CONNECTION DETAILS

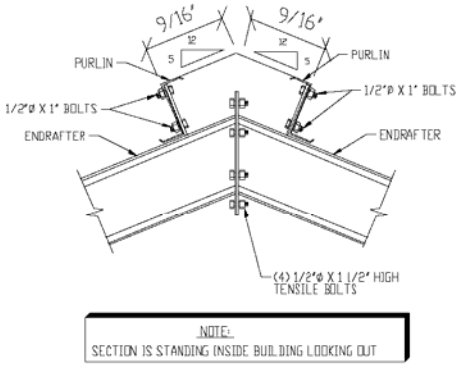
Each set of drawings will include detail sections that illustrate various connections and component assemblies used in the design of the particular home model described by the drawings. Below are some typical examples of connection details.



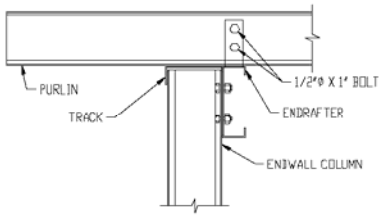
STANDARD SECTION @ ENDWALL EAVE



STANDARD SECTION @ ENDWALL CONNECTION



STANDARD SECTION @ RIDGE ENDWALL



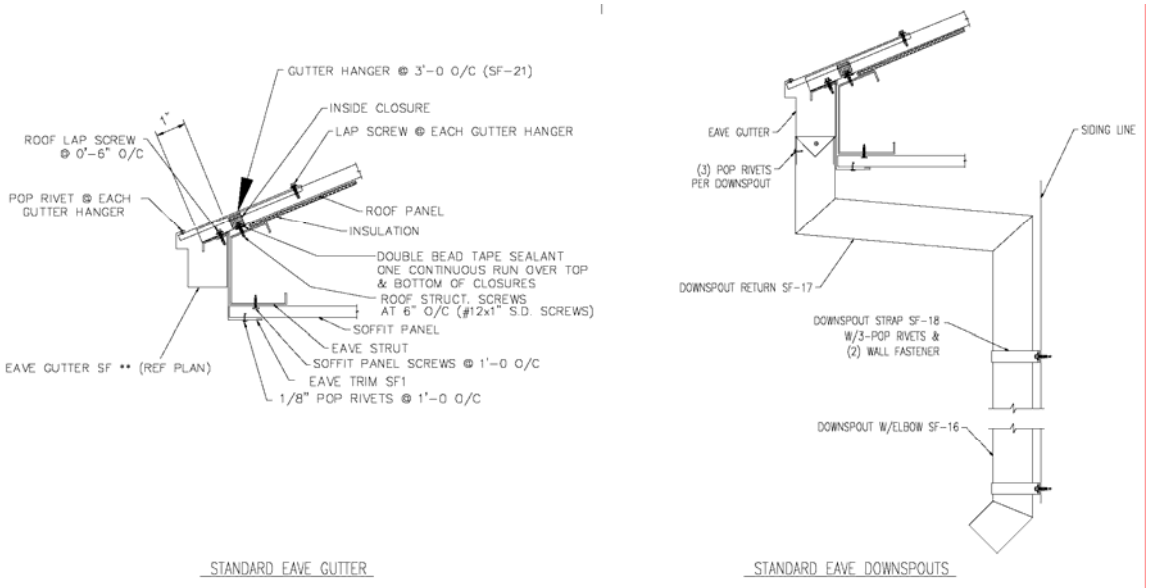
STANDARD SECTION THRU ENDWALL

NOTE! Details can be viewed on erection plans! **SAFETY FIRST!**

ASSEMBLY DETAILS

In addition to connection details, the drawings for certain home models may include diagrams of unusual or complex component assemblies. For example, many people choose our optional gutter and downspout system for their home. Below is an example of the details for this type of assembly:

Eave Gutter and Downspouts



NOTE! Details can be viewed on erection plans! **SAFETY FIRST!**

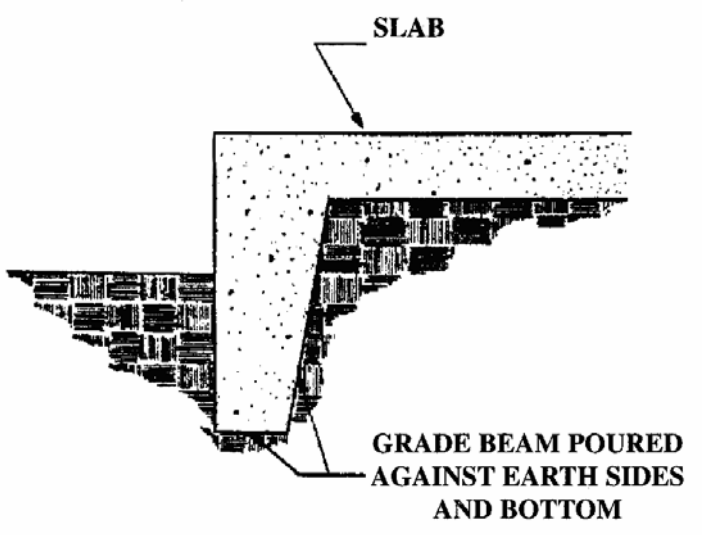
SECTION 2: FOUNDATION AND HOME ANCHORAGE

GENERAL FOUNDATION INFORMATION

We recommend that all home foundations, including pier sizes, grade beams and floor slabs, be designed by an experienced local foundation engineer. This engineer can also recommend excavation procedures, drainage practices, form work, reinforcing steel requirements and concrete proportioning. This will assure proper designs, expedite the work and reduce costs.

Proper construction techniques should be adhered to in the foundation work. The bottoms of all elevations should be level and smooth, and care should be taken to prevent cave-ins when utilizing the walls of the excavations for concrete forms. Strict adherence to OSHA and other local codes or laws governing "**shoring of excavation to prevent accidental cave-ins**" is critical. Where the ground surface is not level, the bottoms of the foundation should be in steps coinciding with the piers. Fill areas should be properly compacted to prevent settling cracks. Footing should extend below any fill material.

Care should be taken to obtain a good finish on the floor slab and to maintain the correct elevation throughout the slab. Pouring the slab in alternate sections "**checker board fashion**" can minimize shrinkage cracks. The outer corners of the foundation walls and piers should be sharply formed with straight lines and level tops. This will allow neat seating and good alignment of the base track.



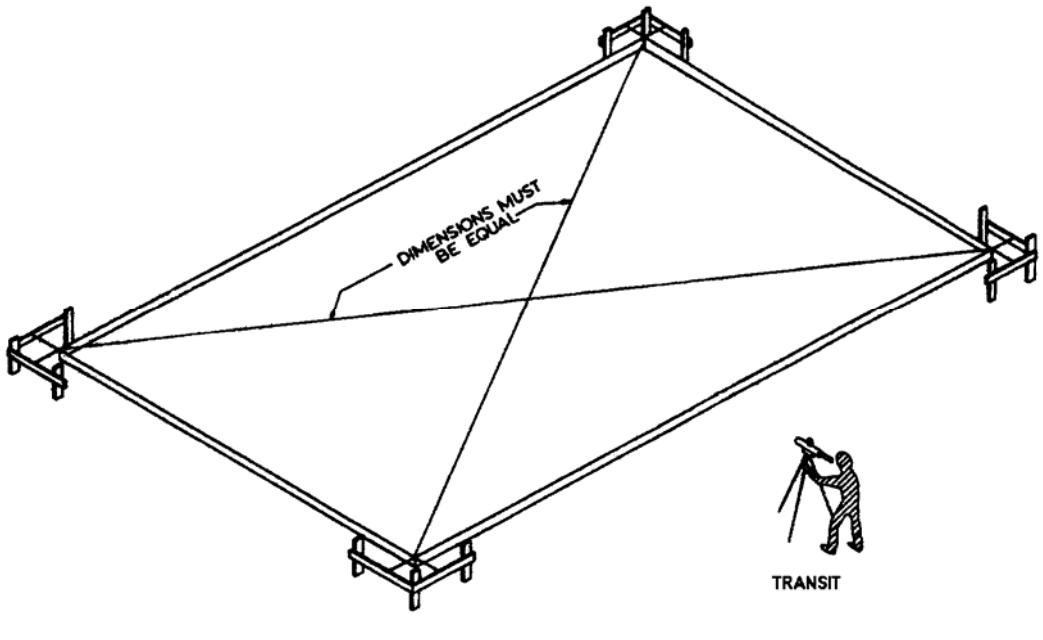
FOUNDATION CHECKING PROCEDURES

The importance of accurate foundation construction and anchor bolt settings cannot be over-emphasized. Foundation errors and miss-location of anchor bolts are among the most frequent and troublesome errors made in steel construction. The following procedures and methods should help to minimize these costly errors and delays.

1. To determine that the foundation is square, measure diagonal dimensions to be sure they are of equal length.

2. To determine that the foundation is level, set up a transit or level and use a level rod to obtain the elevation at all columns and posts.

3. Carefully check the location of all anchor bolts against the anchor bolt plan. All dimensions must be identical to assure proper start-up.



ANCHOR BOLT SETTINGS

It is extremely important that anchor bolts be placed accurately in accordance with the anchor bolt setting plan. When designing a foundation, be sure to use the data from the anchor bolt plans marked "**FOR CONSTRUCTION**" and not from any preliminary drawings. All anchor bolts should be held in place with a template or similar means, so that they will remain plumb and in the correct location during placing of the concrete. A final check should be made after the completion of the concrete work and prior to the steel erection. This will allow any necessary corrections to be made before the costly erection labor and equipment arrives.

SECTION 3: PRE-ERECTION

ACCESS TO SITE

The vehicle transporting your home parts must be able to gain access to the home site from the adjacent highway or road. Most homes will be delivered via standard 48 foot trailer. If the route to the job site requires travel across a non-paved surface, the driver will determine if he is able to safely travel that route. The decision to leave the paved roadways will be left solely to the discretion of the driver.

You should consider the route or routes the truck can take well before it arrives. Ensure that the truck or trucks have room to enter and exit the site. Check for obstructions both overhead and along the roadway, removing them as necessary. Be sure the roadway can support heavy wheel loads, and reinforce it with gravel or planking as needed.

Make sure there is enough room on the job site to physically perform the tasks required to erect the home. Installing sheeting and trim can become very difficult and expensive when the site is crowded.

Make sure that public utility equipment like buried gas lines and power cables or overhead wires do not create work hazards. Notify your utility company if necessary.
Be sure that you will have needed power, gas, and water on the job site.
We urge you to develop a comprehensive safety awareness program in advance and to familiarize the work force with the unique conditions of the site, the home materials, and the appropriate "Safe Work" practices you will follow.

UNLOADING AND INVENTORY

Your materials will arrive in one or more shipments. The structural components as well as the roofing panels (if purchased) will arrive together on one or more trucks. Additional materials -- like siding, insulation, and fasteners -- may arrive in separate shipments within a day or so of the main delivery.

NOTE! The plant loads the trucks to maximize trailer weight and ensure safety. We cannot vary our loading order to meet customer requests; however, when needed, we can reduce the maximum bundle weight for a slight additional charge.

You will be given specific delivery dates well in advance. We do everything we can to make sure materials arrive on schedule, but occasionally raw material shortages, equipment failure, truck difficulties, road conditions, bad weather, or other circumstances beyond our control may create delays. We cannot be responsible for equipment rentals, labor costs, or other expenses caused by delays.

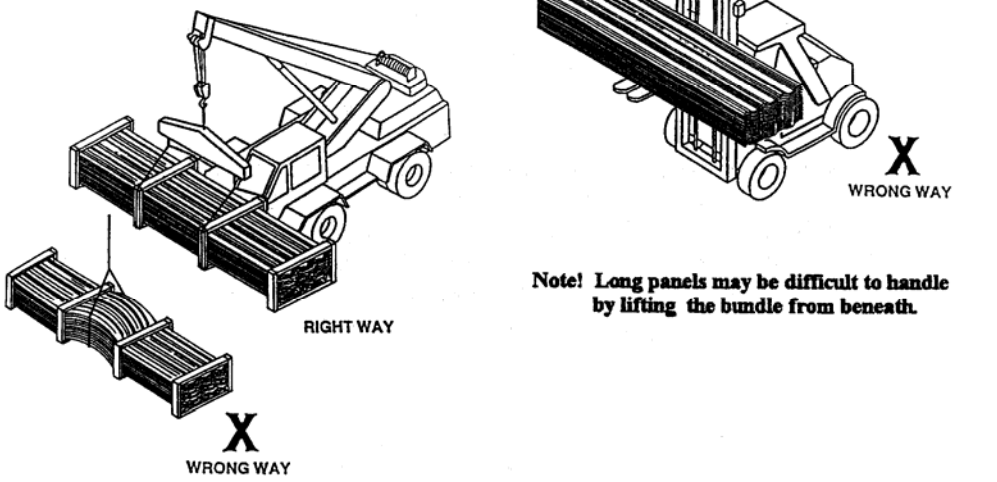
It is important to plan ahead for the careful, safe and orderly storage of all materials, especially when space is restricted. If you can determine in advance how to place components in the order you will erect them, you can spare yourself the trouble and expense of handling the same materials several times. Set procedures are not possible in all cases, but special attention should be given to the following items.

1. **Place offloaded materials in a convenient order**
Minimize, lifting, moving, and rehandling materials by storing them as near as possible to where they will be used.

2. **Use a ramp to protect the slab from damage**
If materials are to be laid on the slab, minimize the chance that the truck will strike and damage it by using a suitable ramp. Make sure that all workers are aware of hazards presented by materials stored on the slab.

3. **Schedule lifting equipment**
You will need some type of lifting equipment to unload and erect your home. When deciding on suitable equipment, consult your drawings and materials list to determine the dimensions and weights of the home components, evaluate your job site, and consider the boom length, lifting capacity, and maneuverability of the equipment.

You can minimize your costs by using the same lifting equipment to unload and erect structural parts. Plan ahead to combine unloading with erection. Start erecting columns and rafters as soon as the truck is unloaded.



4. <u>Beware of overhead power lines</u>
Overhead power lines are a constant source of danger. Extreme care must be used in locating and using lifting equipment to avoid contact with power lines.

5. <u>Supervise</u>
With a larger crew, unloading perhaps goes most smoothly when one person schedules, directs, and plans ahead without getting sidetracked by assisting with specific tasks**.**

6. <u>Inventory your materials</u>
When shipments are received in the field, two inspections are necessary:

a. When items, boxes, crates bundles, or other large components are received and unloaded from the carrier, they should be checked off from the BILL OF MATERIALS. Each item has a part number that also appears on the material list. (If you did not receive a material list, call the Seller.)

If during the inspection, some items are found to be damaged or missing, a report should be filed with the carrier immediately at the site on the BILL OF LADING. When containers show evidence of damage, they should be immediately opened and their

contents inspected. Panel bundles should always be opened and inspected for white or black rust.

NOTE: YOU MUST NOTE ANY MISSING ITEMS OR DAMAGE ON THE BILL OF LADING. THIS IS OUR ONLY DOCUMENTATION OF THE CONDITION OF THE LOAD UPON ARRIVAL, SO IT IS VERY IMPORTANT TO NOTE DAMAGES OR SHORTAGES AT THE TIME OF DELIVERY BEFORE THE DRIVER LEAVES. FAILURE TO MARK ANY DAMAGED OR SHORT ITEMS WILL RESULT IN REPLACEMENT PARTS BEING SHIPPED PREPAID BY YOU.

b. **You have 5 days to report hidden damages or shortages to items delivered in sealed bundles, crates, cartons, boxes, etc. Sealed containers must be opened, their contents checked, and discrepancies reported within this time period.**

If during this second inspection, damaged items or shortages are found, a written claim must be sent to the Seller post marked no later than five (5) days after delivery.

Unless these two important inspections are made and any reports or claims are filed in time, settlements become very difficult, and usually all parties suffer a loss. When filing claims with the Seller, the claim should indicate the item(s) in question, the actual quantity received, the quantity that should have been received, and the quantity that is damaged. The claims should also contain any other pertinent information like invoice and job numbers, names, telephone numbers, consignors, and consignees.

NOTE: BECAUSE THEFT, MISPLACEMENT AND OTHER MISHAPS CAN OCCUR ON JOB SITES, NEITHER THE CARRIER NOR THE SELLER CAN ACCEPT RESPONSIBILITY FOR DAMAGED OR MISSING MATERIALS NOT REPORTED WITHIN THE SPECIFIED PERIODS -- INVENTORY YOUR HOME WHEN IT ARRIVES.

HANDLING AND STORING STRUCTURAL COMPONENTS

Inspect all shipments prior to releasing the tie-downs for loads that may have shifted during shipment! REMEMBER, SAFETY FIRST!

Blocking under the columns and rafters protects the splice plates and the slab from damage during the unloading process. It also facilitates the placing of slings or cables around the members for later lifting and allows members to be bolted together into sub-assemblies while on the ground. Extra care should always be exercised in the unloading operation to prevent injuries from handling the steel and to prevent damage to materials and the concrete slab.

If water is allowed to remain for extended periods in bundles of primed parts such as girts, purlins, etc., the pigment will fade and the paint will gradually soften reducing its bond to the steel. Therefore, upon receipt of a job, all bundles of primed parts should be elevated at an angle to allow any trapped water to drain away and permit air circulation for drying. Puddles of water should not be allowed to collect and remain on columns or rafters for the same reason.

All primer should be touched up as required before erection!

HANDLING AND STORING OF SIDING, ROOF PANELS AND TRIM

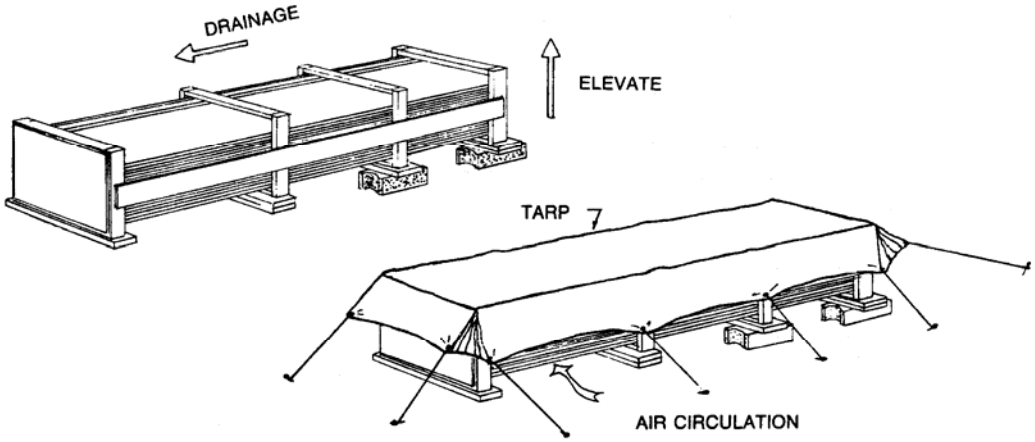
Our siding and roof panels, including color coated, galvalume and galvanized panels, provide excellent service under widely varied conditions. All unloading and erection personnel should fully understand that **these panels are quality merchandise, which merit cautious care and handling.**

Under no circumstances should panels be handled roughly. Packages of panels should be lifted off the truck, with extreme care taken to ensure that no damage occurs to ends of panels or to the side ribs. The packages should be stored sufficiently high off the high to allow air circulation underneath the packages. This protects against ground moisture and deters people from walking on the packages. One end of the bundle should always be elevated to encourage drainage in case of rain.

Stacked metals are subject to localized discoloration or stain when water is trapped between their closely nested surfaces. This discoloration is often called wet storage stain. We exercise extreme caution during fabricating and shipping operations to ensure that all panel stock is kept dry. However, in humid climates condensation can form between the stacked panels, and of course rain during or after shipment can introduce moisture as well.

Wet storage stain is usually superficial and has little effect on the appearance or service life of the panels as long as it is not permitted to remain on the panels. However, moisture in contact with the surface of the panels over an extended period can severely

attack the finish and reduce the effective service life. Therefore, it is imperative that **all panels be inspected for moisture upon receipt of the order.** If moisture is present, dry the panels at once and store in a dry, warm place.



Use wood blocking to elevate and slope the panels in a manner that will allow moisture to drain. Wood blocking placed between bundles will provide additional air circulation. Cover the stacked bundles with a tarp or plastic cover leaving enough opening at the bottom for air to circulate.

Caution!

Galvanized materials can be damaged by white rust from prolonged periods of contact with moisture while stacked together. This is not covered by warranty. If there is evidence of moisture during unloading, the panels should be separated, dried, and stored out of the weather to prevent permanent discoloration. Never install any material if its quality is in question!

NOTE! Remove **PLASTIC FILM** off all roof and trim before exposure to sunlight! Sunlight will bake the film on and make it hard to get off. **SAFETY FIRST!**

Care should always be taken when walking on panels. Use safety lines and nets when necessary! Panels are slippery. Oil or wax applied to the roof and siding panels for protection against weather damage will make them very slippery. Wipe dry any oil that has puddled from bundles stored on a slope. Dew, frost, or other forms of moisture greatly increase the slickness of the panels. Always assume panel surface is slick and act accordingly. **THINK SAFETY!**

When handling or uncrating the panels, **lift, rather than slide, them apart**. Burred edges may scratch the coated surfaces when sheets are slid over one another. Never allow panels to be walked on while on the ground. Rough and improper handling of a panel is inexcusable and a prime example of poor job supervision.

NOTE! Use gloves when handling metal panels to prevent hand injuries. Be aware of the dangers of handling panels on a windy day. A large panel can catch enough wind to cause serious injury or death, even at ground level! **SAFETY FIRST!**

LOCATION OF HOME PARTS

As previously emphasized, a great amount of time and trouble can be saved if the home parts are unloaded at the home site according to a pre-arranged plan. Proper location and handling of components will eliminate unnecessary handling.

Columns and rafters should be placed on blocking near the position where they will be installed.

Endwall columns and rafters are usually laid out at each end of the slab with the columns near their respective anchor bolts.

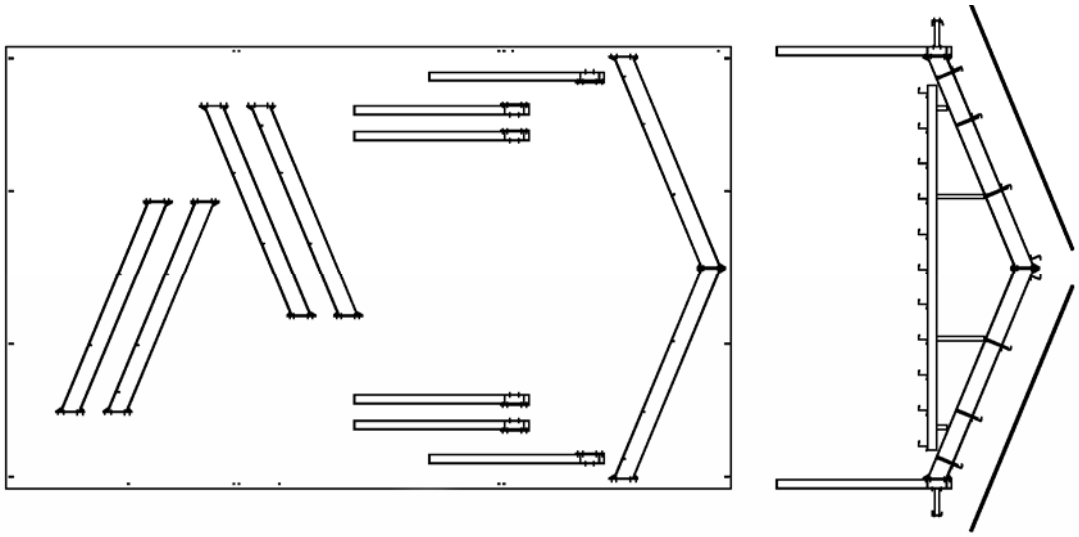
NOTE! An access area through the center of the home should be left for erection equipment.

Hardware packages should be located together, usually along one sidewall near the center of the home. This will minimize walking distances to other parts of the slab area.

Purlins and studs, depending on the number of bundles, are usually stored near the sidewalls, clear of other packages or parts.

Sheeting and siding packages are usually located along one or both sidewalls off the ground and sloping to one end to encourage drainage in case of rain.

Accessories are usually unloaded on a corner of the slab or near one end of the home to keep them out of the way as much as possible from the active area during steel erection.



NOTE! Steps must be taken to protect the entire job site from vandalism and pilferage.

SECTION 4: ERECTION OF STRUCTURAL STEEL

STRUCTURAL FRAMING PRECAUTIONS

Responsible personnel, experienced in rigging and handling steel members in a safe manner, should complete the layout, assembly and erection of steel. Improper handling can easily result in injury, delays and unexpected added costs. This is particularly true when raising assembly rafters for wide homes.

As Specified by MBMA guideline, the "correction for minor misfits" is a normal part of erection." Contact the manufacturer before making any modifications; however, they should be prepared to make minor adjustments as needed.

EFFICIENT ERECTION

Construction will be more efficient when the following conditions are met during he erection of a steel home:

- When safety practices are discussed and initiated in advance of any work procedure.
- When the overall work of erecting the home is divided into individual jobs, and when each job is assigned (in proper sequence) to teams consisting of from two to seven workers each.
- When individuals are properly trained and told what to do in advance so they don't waste time standing around waiting for instructions.
- When home parts are properly laid out according to advance planning so as to avoid lost time in repetitive handling or in searching for specific for specific items.
- When as many parts as can be raised in a single lift are bolted together on sub-assemblies on the ground where assembly work is faster and safer, thereby requiring fewer lifts and fewer connections to be made in the air.
- When erection of the steel framework starts at one end and continues bay by bay to the other end of the home.
- When the first bay is completed, the individual frames are erected and tied together by skeleton purlins, and the fill-in purlins are installed after the costly lifting equipment has been released.
- When tools of the proper kind, in good, safe condition, are available in sufficient quantity.

GENERAL INFORMATION

Many methods and procedures are in use for erecting steel structures. The techniques of raising frames vary from erecting small clear spans and endwall frames in units to erecting the large clear spans and modular frames in sections. The erecting methods used depend strictly on the type of structure, the available equipment, the experience level of the crews, and the individual job conditions.

The variation in these factors precludes the establishment of a firm or specific set of erection rules and procedures. Consequently, the erector to fit individual conditions and requirements must tailor the erection operation. However, there are certain erection practices, pertaining to structural members, which are in general use and have proven sound over the years. Descriptions of these follow:

Erectors are cautious not to cut primary members (rigid frame columns, rafters, end bearing frame rafters, interior columns). These are the primary support members for the frame and are designed as such. Any cutting of these members may affect the structural stability. A representative of the manufacturer should be consulted prior to attempting alterations of those members.

NOTE! Do not install any material if its quality is in question. The manufaturer will not be responsible for costs incurred associated with the installation and/or removal of the same.

NOTE! In no case should erection be started on green concrete "uncured concrete". Anchor bolts may pull loose, concrete spall (chip out along edges) may occur and equipment may crush or crack slab. Normal Portland Cement concrete should cure at least seven (7) days before the structural columns are erected. Special circumstances may require even longer curing periods; consult the foundation engineer on foundation questions.

SOME RECOMMENDED TOOLS

.

Hand Tools	Quantity
Belts w/bolt bags	4-6
Bridge reamer, 9/16”, 11/16”, 13/16”, 15/16”	1 each
Brush, wire	1
“C” clamps (6”, 9”, & 12”)	4-10
Can, oil	1
Caulking gun, open barrel	2-6
Chalk line, 100’ long and chalk	2
Channel locks	2
Come-a-long, 1 ton	2
Drift pin (barrel pin, bull pin)	2-5
Extension cord,	2-3
Extension cord, #12-3, 25’ long	1
Fire extinguisher, #10	2
First aid kit	1
Gloves, pr.	10
Goggles, safety	10
Ground fault interrupter (circuit breaker)	1
Hammers	
Hand Lines (rope), ½”-5/8” dia., 60’ long w/hooks	4-7
Hard hats	5-11
Ladders	
Load binders	3
Plumb bob	1-2
Pop rivet gun (manual or electric)	2-3
Saws, carpenters, hand	1
Saws, hack w/blade	4
Saw horses	2
Scaffold, section w/wheels	1-4
Shear, portable panel	2
Slings, nylon, 4” wide, 10’-12’ long	5
Snips, aviation (2 r/h, 2 l/h, straight cut)	1
Spirit level 4’ long	2
Spreader	4
Square, framing	1-2
Square, tri	1-5
Tape measure – 12’ to 16’ long	1
Tape measure – 100’ long	5

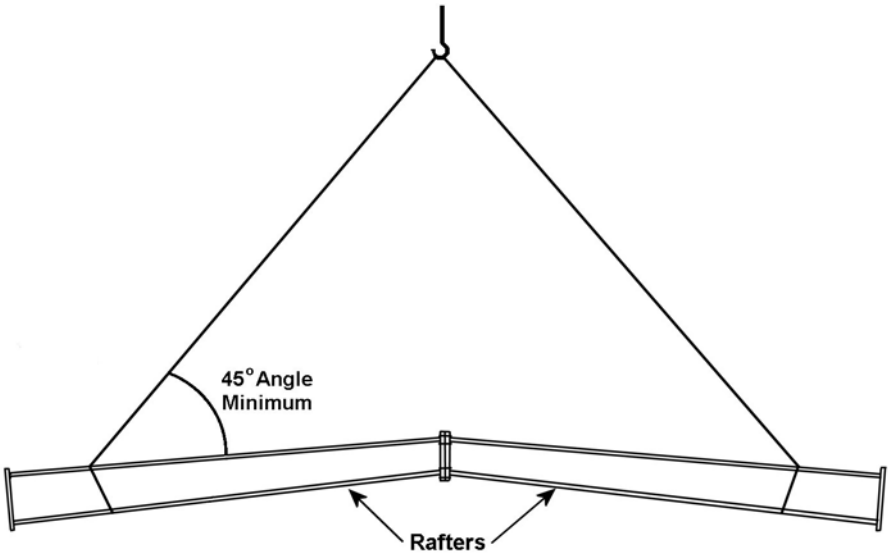
Power Tools

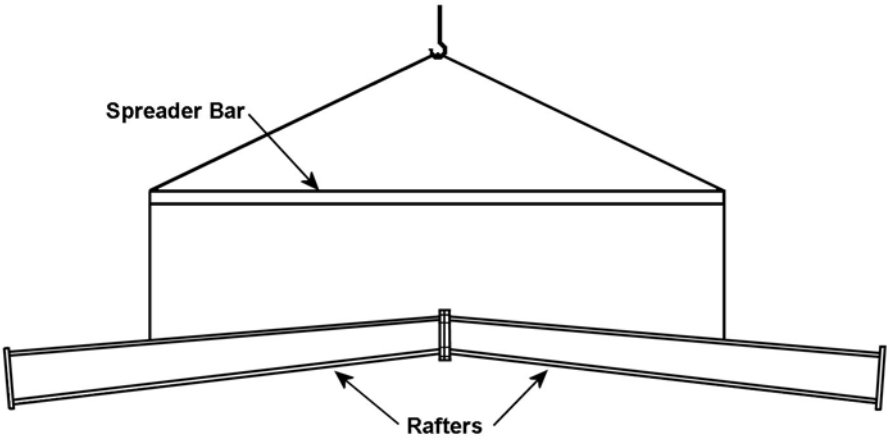
Cutting torch w/100’ hose, bottle cart, w/fire extinguisher	1
Hammer drill	1
7-1/2” heavy-duty skill saw	1
Screw guns and Drill	
Welding hood with spare lens	1
Portable Mig Welder oe equal	1

NOTE! This list is far from comprehensive. Erectors will need several basic items not mentioned here, and they may require other more specialized tools depending on the circumstances.

LIFTING CABLES AND SPREADER BARS

In all instances, the length of the lifting cables should be such that the angle between the rafter and the lifting cables is **no less than 45 degrees.** To reduce the severe compression stresses at the ridge of the rafters which are created by the angle of lifting cables, a spreader bar is recommended, which allows the lifting cables to be parallel to each other.

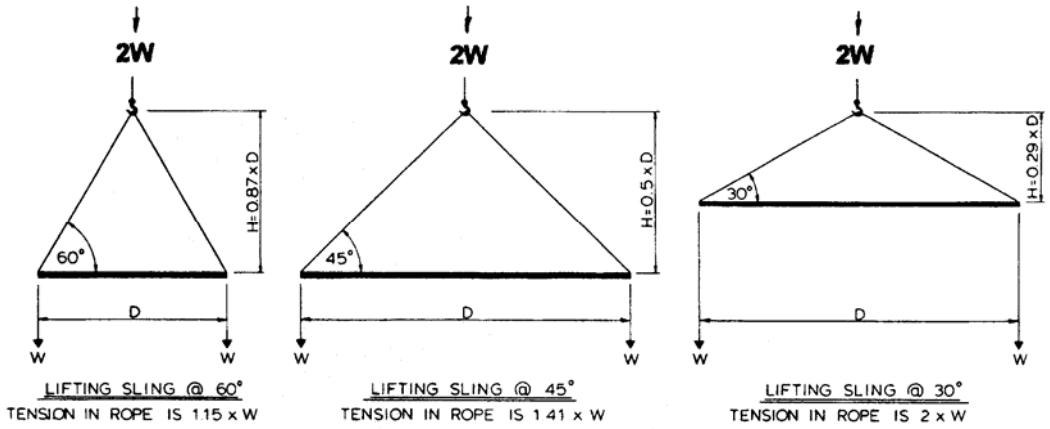




NOTE! Stay well in the clear of loads being moved by the lifting device. Hands and feet should be kept clear of moving loads and never stand under a load being lifted. Remember, **SAFETY FIRST!**

CABLE TENSION AND HOOK HEIGHT

Tension and hook height for lifting weights at various angles are shown below. Notice how the cable tension increases as the lifting angle is decreased. When tension in the cable increases, the compressive load, or buckling load, also increases. Slings with low lifting angles should therefore be avoided both to protect the cable and to prevent buckling the rafter beam.



SAFETY NOTE! Check wire rope for broken strands, broken wires and kinks. Replace damaged, unsafe rope immediately. Always use equipment with an adequate safety margin over the lifted load. **SAFETY FIRST!**

RAISING RIGID FRAMES

The intermediate or interior frames nearest the weight bearing endwall are usually erected first. This bay usually contains the diagonal bracing. The proper completion and plumbing of this first bay, as will be discussed later, is extremely important to the successful completion of the erection.

Although several methods are used to erect rigid frames, the best approach is to erect the columns first, tie them together with the sidewall girts and tighten the anchor bolts. On small spans and short eave heights, columns can often be set in place by hand without the use of hoisting equipment. **Temporary bracing should always be installed as soon as sections are lifted in place.**

NOTE! The anchor bolt tension may need to be adjusted to seat the rafter.

NOTE! Each worker should be trained to use the safest and most productive erection techniques. **SAFETY FIRST!**

After the columns have been erected, the ground-assembled rafter is hoisted into place and connected to the columns. The size of the rafter, which can be safely handled, depends on the equipment available and the experience of the erection foreman. **Generally, make as many connections on the ground as possible.**
The flange brace should be bolted to the rafter prior to raising in order to save time. **The hoisting equipment should never be released from the rafter until the frame is adequately braced so it cannot buckle or tip.**

Rigid frames, especially free ends or cantilevered sections **should never be left "for the day" in an unsupported, unbraced or unguyed condition.** Such practice has resulted in total loss of considerable amounts of erected steel because of wind

NOTE! Stay well in the clear of loads being moved by any type of lifting equipment or supported by temporary bracing. **SAFETY FIRST!**

.

CONNECTION BOLTS

Bolts used to make connections in secondary framing members such as the purlins are usually ½" diameter, ASTM designation A307. All primary framing connections are made with ASTM A325 bolts, usually 1/2" 5/8", 3/4", 7/8", and 1" diameters. The size and grade of the bolt are marked on the erection drawings.

NOTE! Each worker should be trained to use the safest and most productive erection techniques. **SAFETY FIRST!**

BOLT TIGHTENING PROCEDURES

A325 BOLTS

BOLT SIZE INCHES	W INCHES	SPECIFIED MINIMUM FASTENER TENSION KIPS (1000 LBS.)	SPECIFIED NUT ROTATION	
			BOLT LENGTH <=4 DIAMETERS	BOLT LENGTH >4 DIAMETERS
½	⅞	12	⅓ TURN	½ TURN
⅝	1 1/16	19		
¾	1¼	28		
⅞	1 1/16	39		
1	1⅛	51		
1¼	2	71		

JOINTS NOT SUBJECT TO TENSION LOADS

JOINTS NOT SUBJECT TO TENSION LOADS need only be tightened to the snug tight condition, defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.

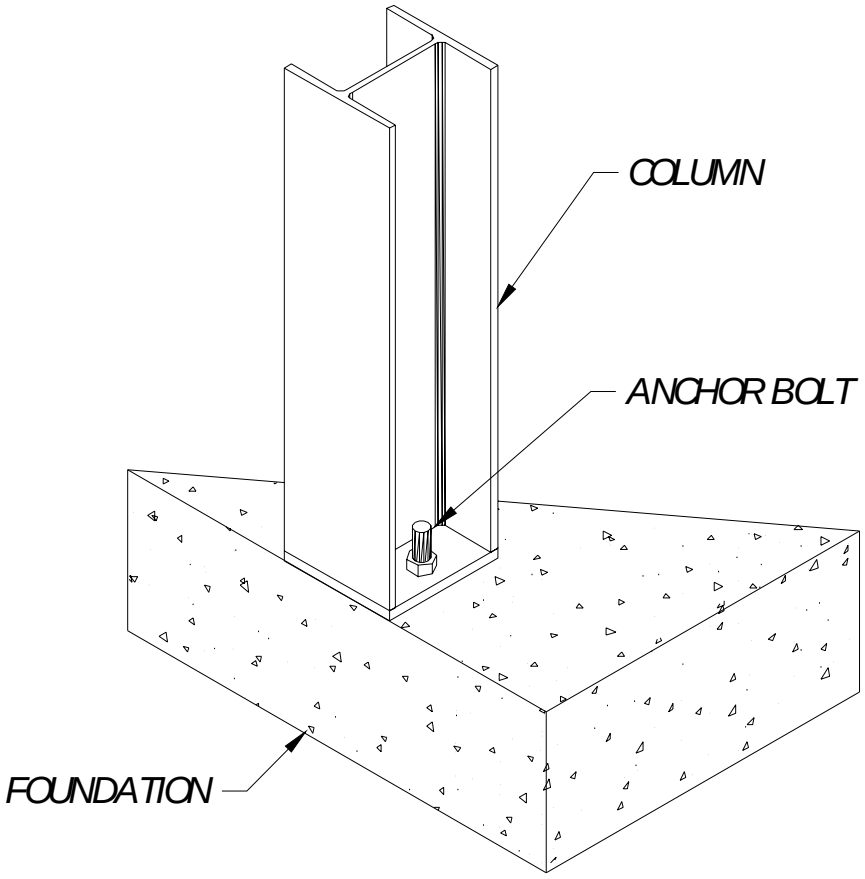
Two tightening procedures are specified for A325 bolts in joints subject to tension loads, **Turn-of-the-nut method** and **direct tension indicator.**

Turn-of-the-nut method - To use turn-of-the-nut method to gauge tension, first bring enough bolts to a "snug tight" condition to ensure that the parts of the joints are brought into good contact with each other. Next, place bolts in all remaining bolt holes and bring to "snug tight." Then additionally tighten all bolts per the above table, progressing from the bolts nearest the web to the free edges. During this operation there should be no rotation of the part not turned by the wrench.

Direct tension indicator - Tightening by this means is permitted provided it can be demonstrated, by an accurate direct measurement procedure, that the bolts have been tightened to the specified tension.

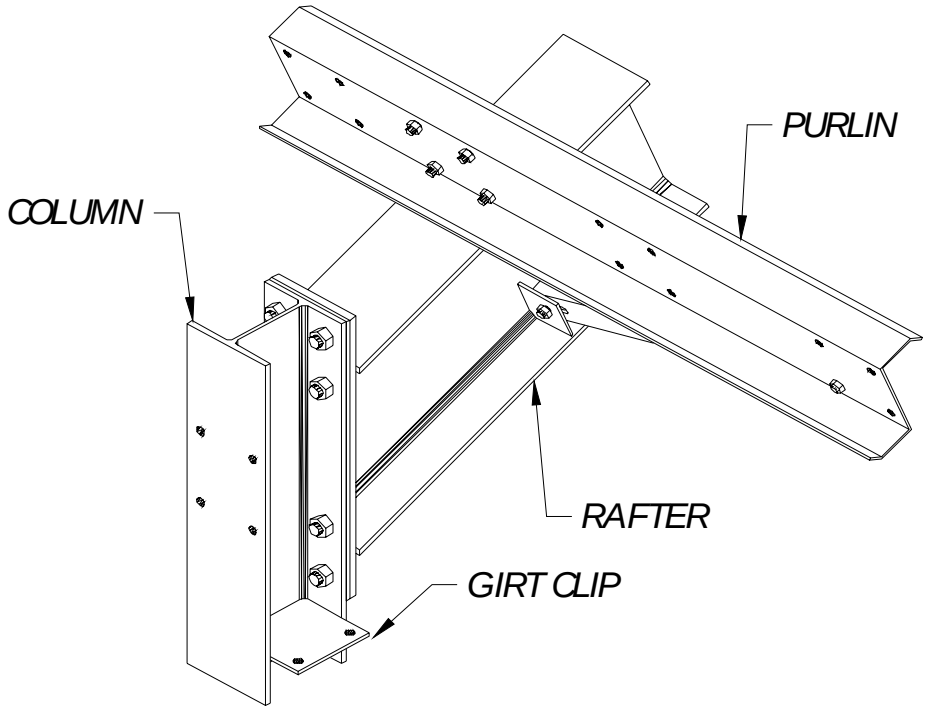
Consult latest edition of the AISC Manual of Steel Construction for more complete instructions for installing structural bolts.

TYPICAL FRAMING CONNECTION DETAILS

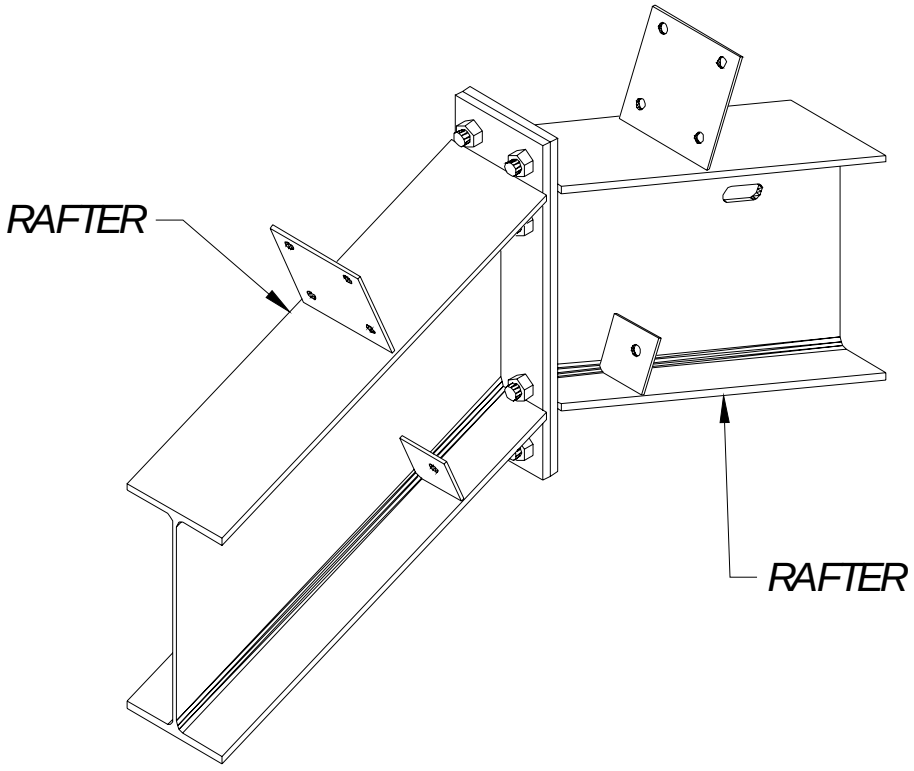


EXTERIOR COLUMN TO FOUNDATION

TYPICAL FRAMING CONNECTION DETAILS



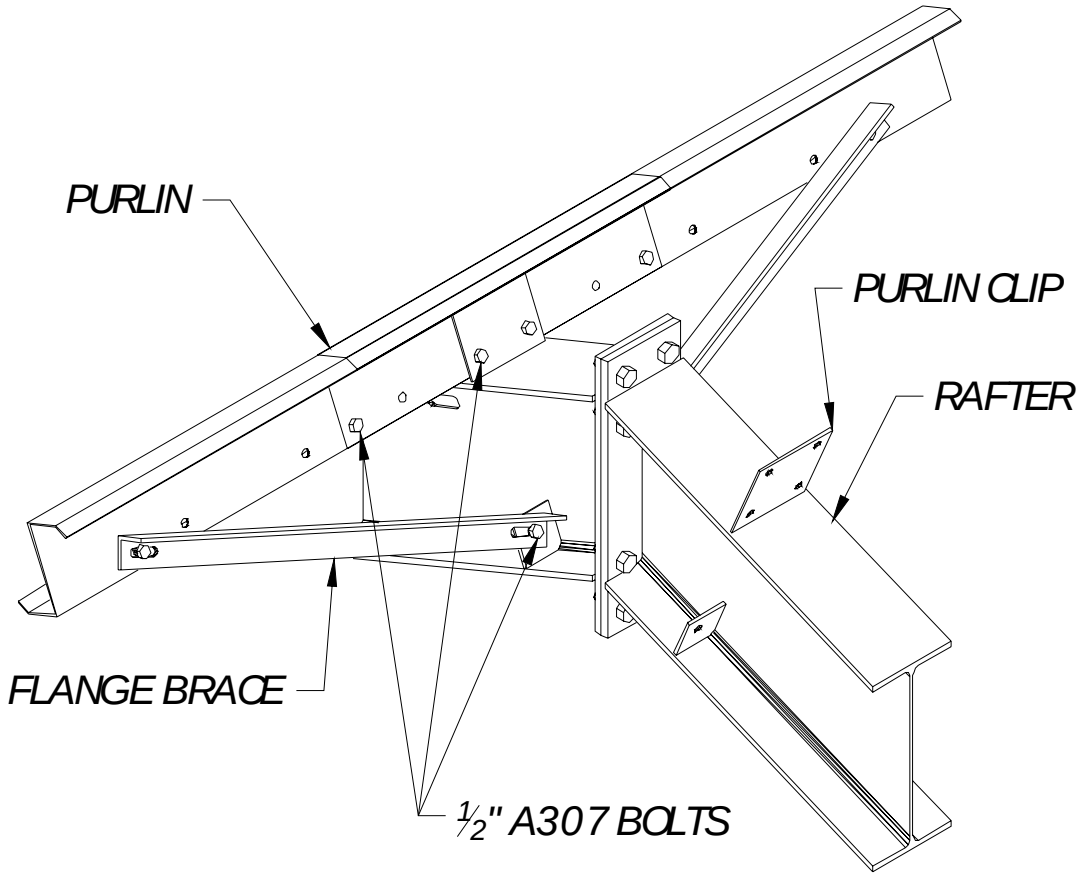
COLUMN TO RAFTER AT KNEE



RAFTER AT RIDGE

TYPICAL FRAMING CONNECTION DETAILS

We use several connection systems to attach purlins to frames. Two of the more common connections appear below:



FLANGE BRACE TO PURLIN

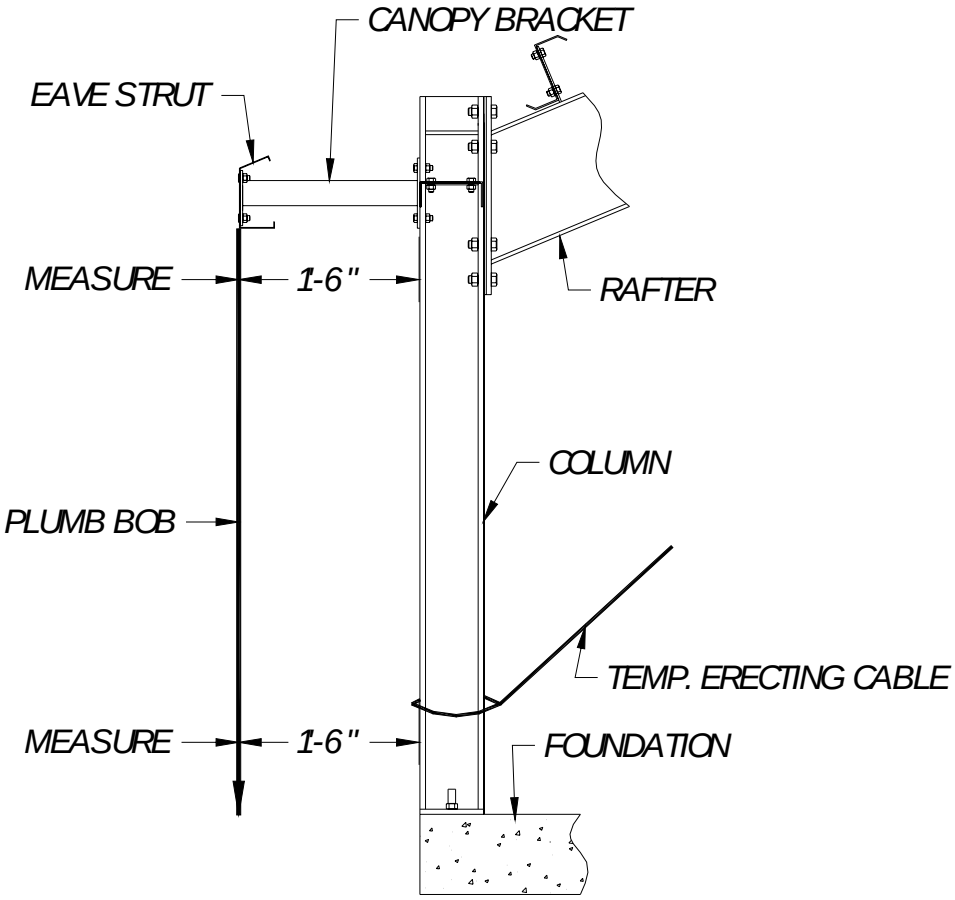
NOTE! Bolts shown here are required to be tightened to snug tight condition on round holes only.

COMPLETING AND PLUMBING THE FIRST BAY

After the first intermediate or interior frames have been set, We recommend that all purlins, girts, and canopy struts be installed in the braced bay and then that the entire bay be plumbed, aligned and braced before proceeding further. **If the home is designed without cable bracing, the erector is responsible for providing temporary erection bracing.**

When this bay is properly and accurately plumbed and braced, the remaining members will usually remain plumb, and few adjustments, if any, will be necessary.

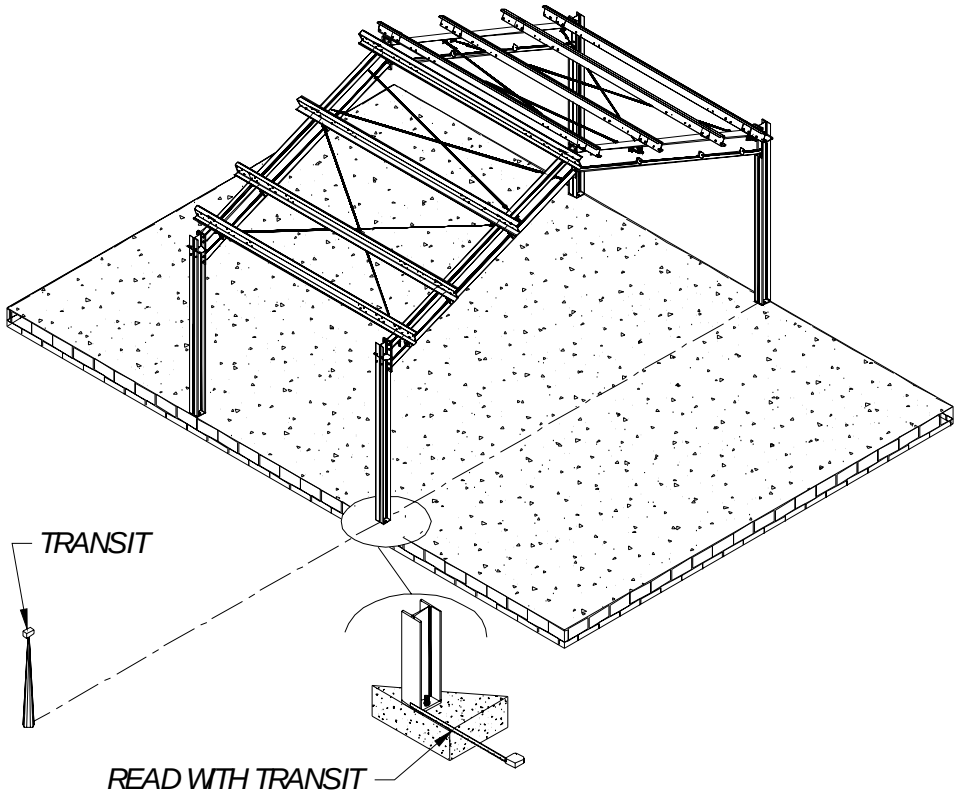
Plumb the frame with a plumb bob or transit, not a spirit level. To measure lateral plumb, hang the plumb bob from the top of the column down the outside flange as shown below. Adjust plumbing cables to obtain equal tape measurements at top of column.



NOTE! Use OSHA approved tie off, netting or rails when working on roof areas and adhere to all OSHA safety rules. **SAFETY FIRST!**

To plumb the braced bay lengthwise using a transit, sight in the transit parallel to the base of the frame columns by using a position a few inches from the frame line (See sketch). Make sure the transit is level. Check the frame by reading the tape through the transit. First bring the columns into plumb, then the rafters, by adjusting diagonal bracing. Take all measurements from centerline of flange. Take a measurement at the base of the columns and adjust the bracing to correct the transit reading at the rafter measuring location. Once the frame is plumb, all connection bolts and anchor bolts should be tightened.

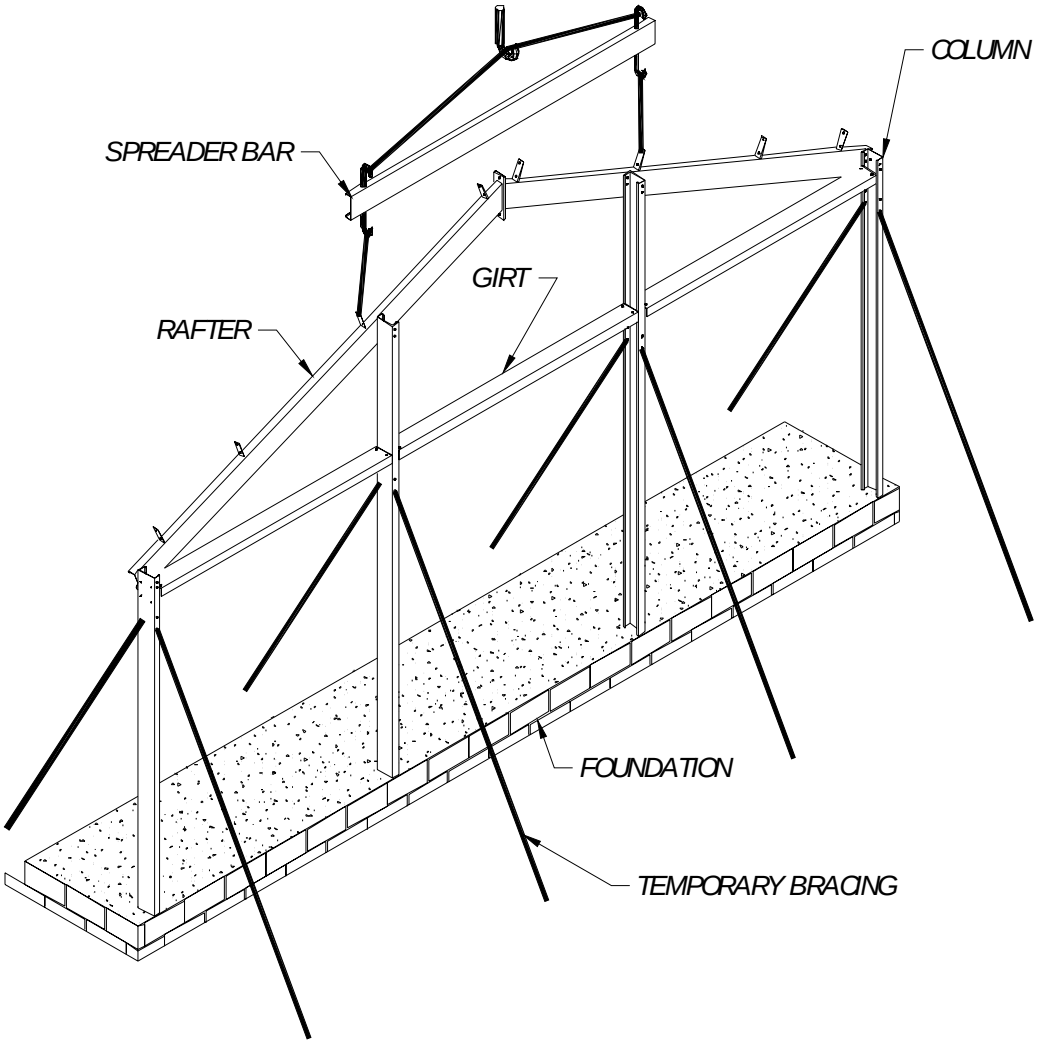
To plumb the braced bay without a transit, run a chalk line from out of flange to out of flange of columns on the foundation (per drawing). Drop plumb bob(s) from rafter flange(s) and square the frame using the rod bracing for leverage.



NOTE! Each worker should be trained to use the safest and most productive erection techniques. **SAFETY FIRST!**

ERECTING THE ENDWALLS

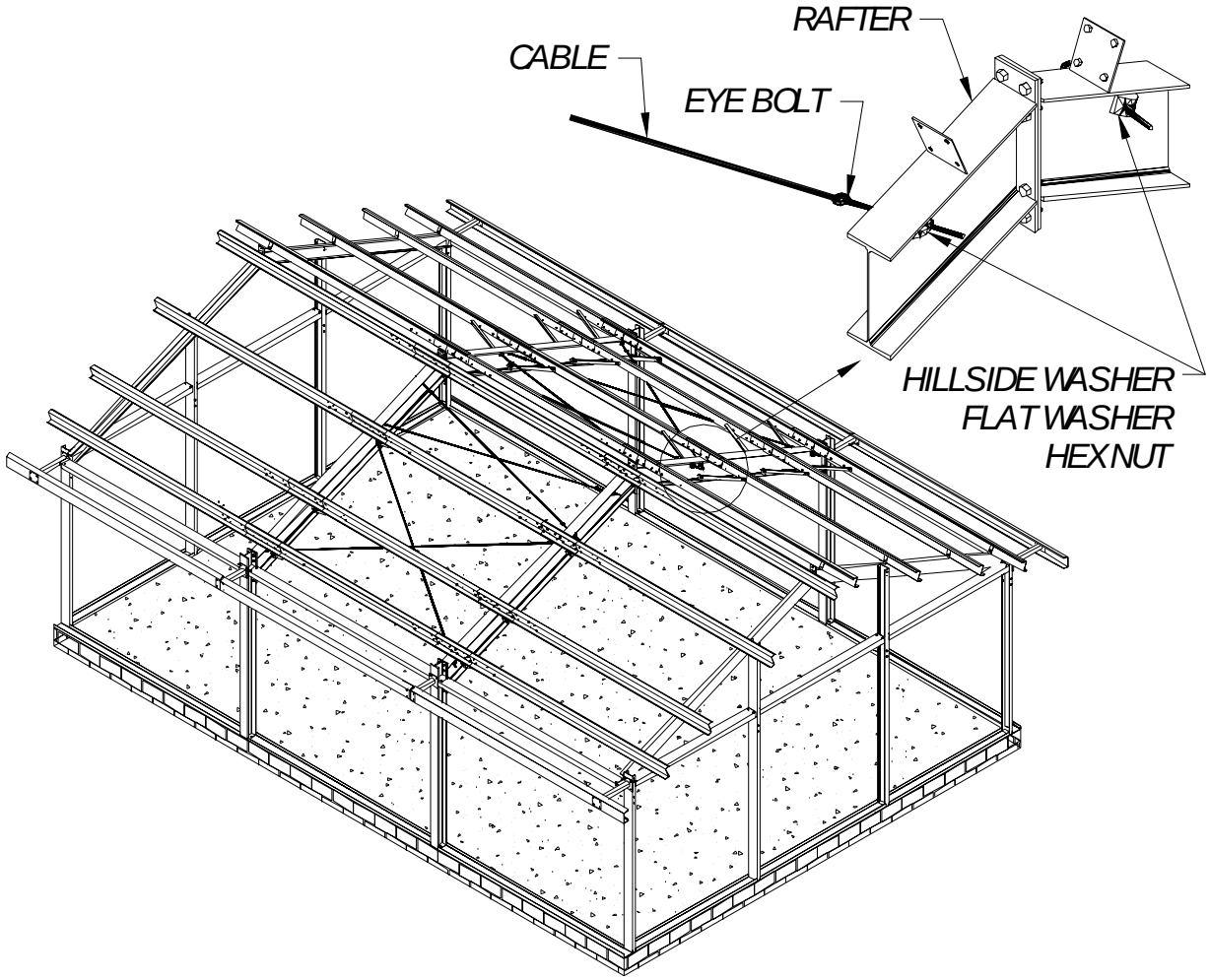
Endwalls that span 50 feet or less may be raised into position and set on the anchor bolts as a unit. All rafters, column girts, door headers, doorjambs, clips, etc., should be assembled on the ground with the bolts left finger tight. **A spreader bar should be used to raise the endwall frame.** Because the column and beam frames are relatively flexible, be careful not to bend or twist them by incorrectly placing the lifting cables or by roughly or carelessly lifting the members.



NOTE! Stay clear of all moving loads. Make certain all framing is properly braced or guyed before lifting lines are removed. Follow all OSHA regulations! **SAFETY FIRST!**

INSTALLATION OF THE CABLE BRACING

Cable bracing in steel homes can be critical! It may provide necessary support for wind loads or other longitudinal loads. However, diagonal bracing is not needed for some smaller home models, and the erection plans will indicate whether it is called for in the design. **Care should be taken, however, not to over tighten and bend structural members.** The workmen should watch the structural members carefully while tightening the bracing. When there is no diagonal bracing (and sometimes even when there is), additional temporary bracing should be used to stabilize the structure during erection. It is the erector's responsibility to determine if temporary bracing is necessary and to supply it when it is needed.



NOTE! Workers should always use gloves when working on metal frames and sheeting. Always follow all OSHA safety recommendations. **SAFETY FIRST!**

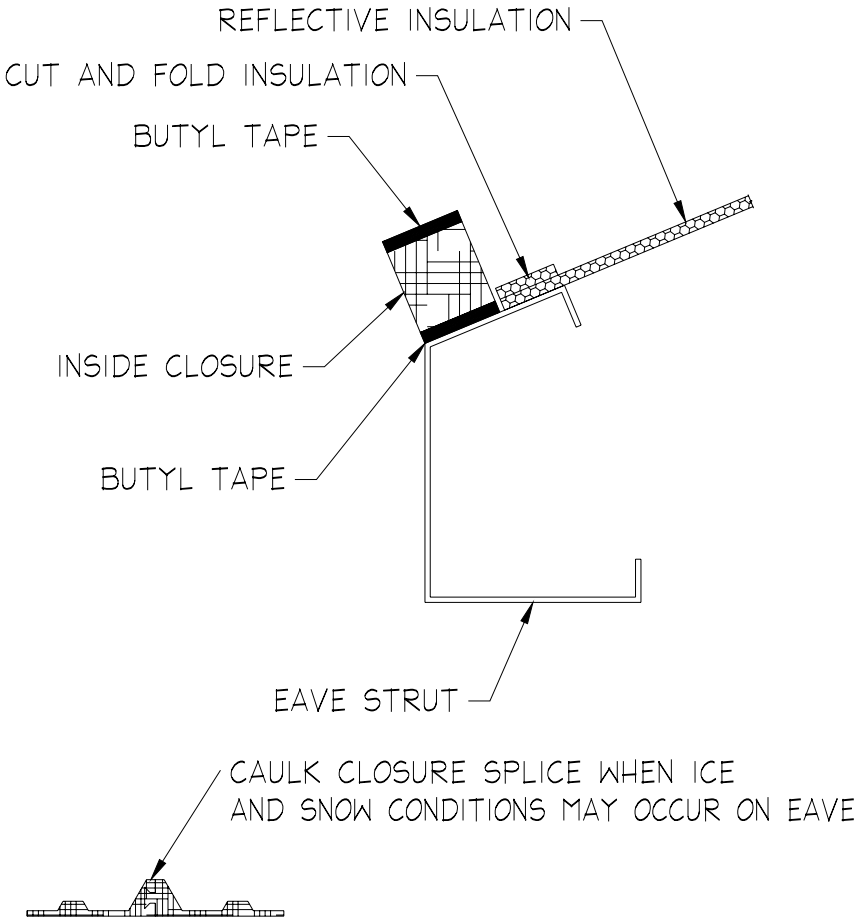
SECTION 5: ROOF INSTALLATION

ROOF INSULATION

Pre cut roof insulation to reach from eave to eave allowing approximately 2 feet of additional length to facilitate handling. Hold insulation at one sidewall and roll out insulation across the purlins. **Stretch the insulation to provide a tight and smooth inside surface.** Weights clamped to each end can be used to hold insulation taut.

NOTE! Insulation has no load bearing strength. Stand or walk on approved scaffold or walk boards. Follow all OSHA recommended safety instructions regarding safety harnesses and/or nets to protect from falls! **SAFETY FIRST!**

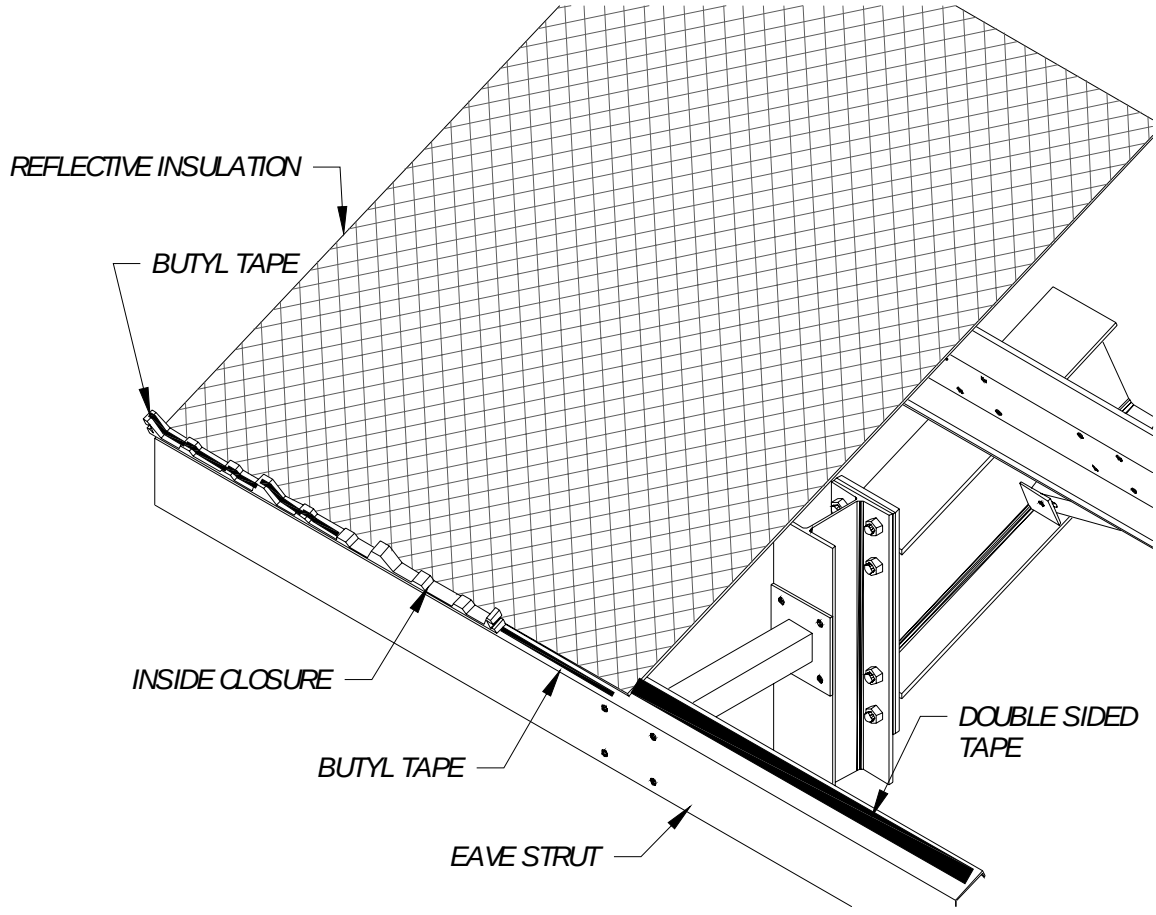
A four-foot starter roll of insulation is recommended to maintain the insulation joint ahead of the sheeting edge. Seal insulation side lap joints with adhesives or fold and staple. The proper sequence is to install the roof sheets in conjunction with the insulation.



PREPARING THE EAVE

After installing the first run of insulation, prepare the eave for the first roof panel by applying tape sealant along the eave outside of the insulation while leaving release paper in place. Sealant must be applied in a straight line and without voids. **Do not stretch the Butyl Tape.** Use a knife to cut if necessary. Cut an inside closure strip as shown and place starter piece on top of the butyl tape (removing protective paper from the tape only as required). Align the major rib of the closure to the starting closure and apply along the top of the eave butyl tape. If roof is subject to ice and snow build-up, the splice in the closure strip must be caulked to insure that it's weatherproof.

Along the top of the closures that have been placed along the eave, ***apply a second run of Butyl Tape***. **Prior to removing paper backing,** check and mark for proper alignment of the first roof panel. Continue Butyl Tape and closure run along eave in preparation for the next roof panel.

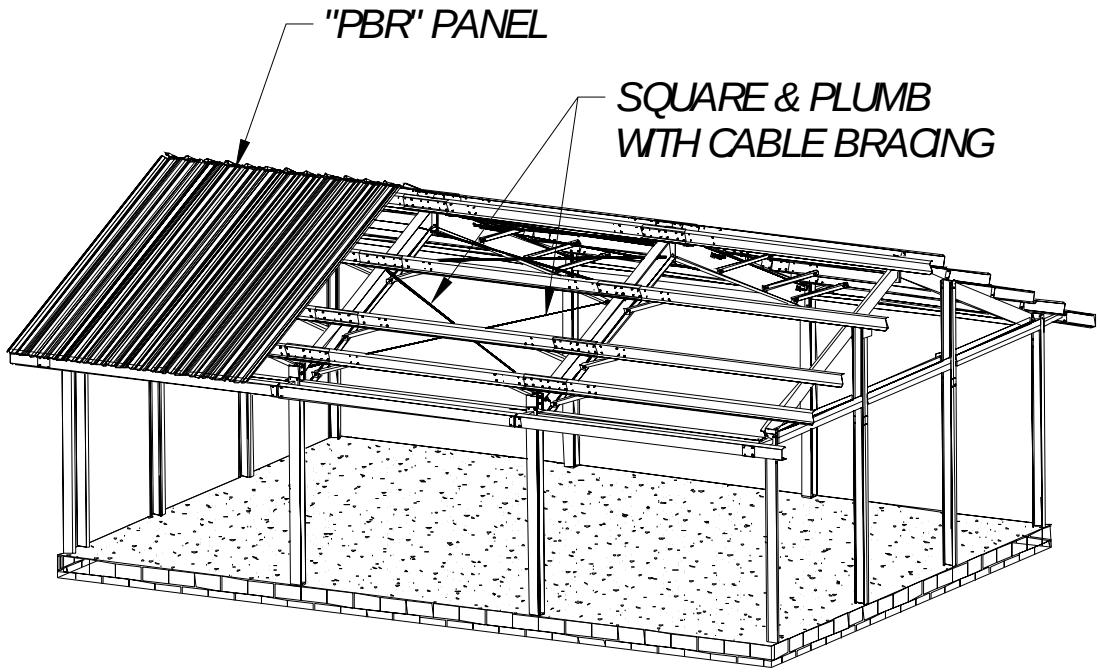


NOTE! Insulation has no load bearing strength. Stand or walk only on approved scaffolding or walk boards. **SAFETY FIRST!**

ROOF SHEETING

All the primary and secondary framing should be erected, plumbed and the bolts properly tightened before the sheeting of the home is started.

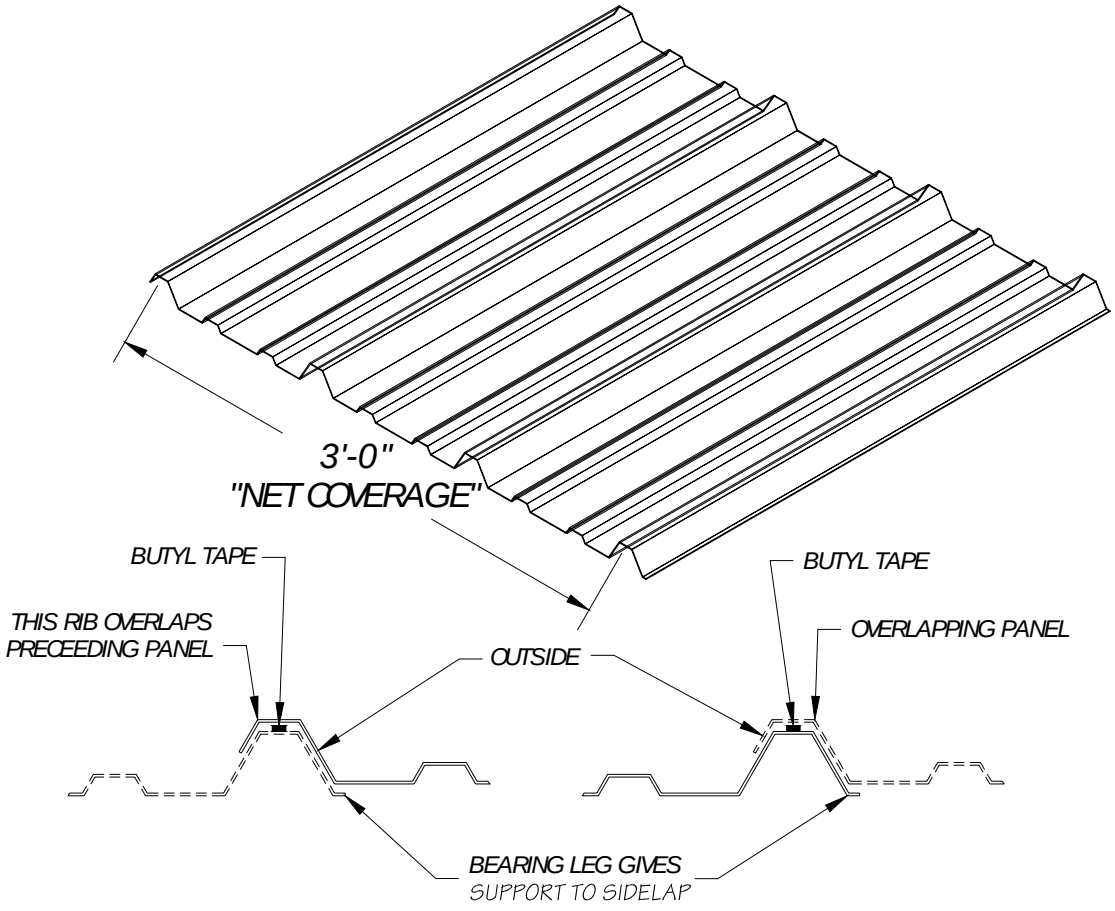
Our roof panels are quality merchandise and should be handled with care. When unpacking and separating panels, always lift them up and apart; never slide one panel over another. When lifting panels, support long panels to prevent buckling.



NOTE! Workers should always use gloves when lifting sheets and follow all OSHA safety recommendations. **SAFETY FIRST!**

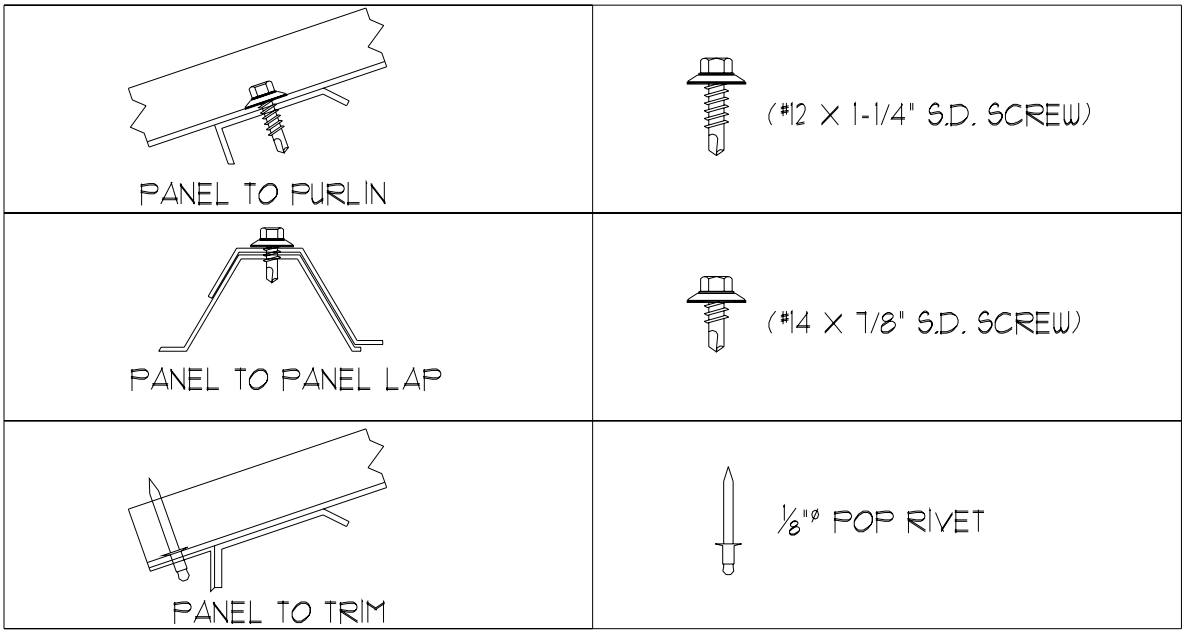
PBR PANEL

The "PBR" panels are designed for roof applications. This deluxe profile incorporates an extra support leg so that each leading edge overlaps the next panel, adding to its stability and making it easier to install. Sheeting can be started from either end of the home; however, by applying the sheets toward the direction of the prevailing view the overlap line on the side of every third rib will be less visible. Where heavy prevailing winds occur, **place the edge to be lapped into the wind!**



DANGER! Do not step on major ribs, the side or edge end of a "PBR" panel. Always follow OSHA safety recommendations. **SAFETY FIRST!**

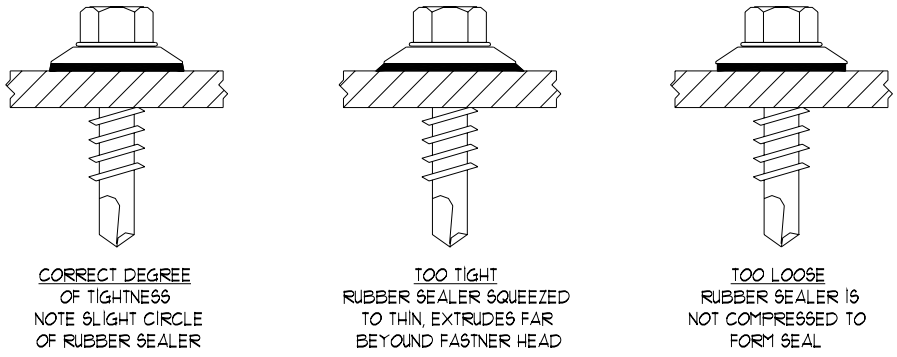
ROOF FASTENERS



FASTENER INSTALLATION

Correct fastener installation is one of the most critical steps when installing roof panels. Drive the fastener in until it is tight and the washer is firmly seated. **Do not overdrive fasteners**. A **slight** extrusion of neoprene around the washer is a good visual tightness check.

Always use the proper tool to install fasteners. A fastener driver (screw gun) with an RPM of 1700-2000 should be used for self-drilling screws. A 500-600 RPM fastener driver should be used for self-tapping screws. Discard worn sockets, these can cause the fastener to wobble during installation.

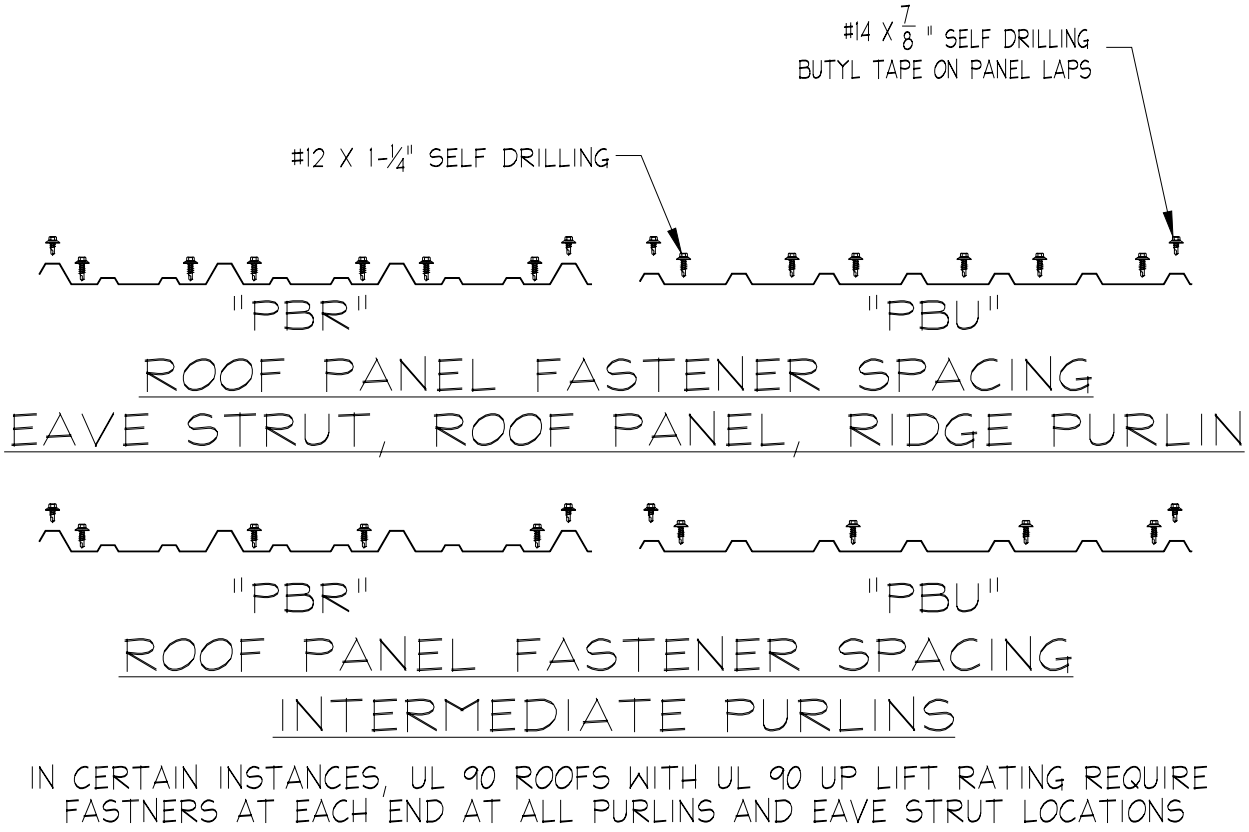


NOTE! Always remove metal filing from surface of panels at the end of each work period. **Rusting filings can destroy the paint finish and void any warranty**.

BUTYL TAPE

Proper Butyl Tape application is critical to the weather tightness of a home. **Butyl tape should not be stretched when installed**. Apply only to clean, dry surfaces. Keep only enough butyl tape on the roof that can be installed in a day. Store remaining butyl tape in a cool dry place. After butyl tape has been applied, keep protective paper in place until panel is ready to be installed.

FASTENER LAYOUT



NOTE! Wipe oil and other slippery substances from roof panels. Do not step on rib of panel, near a crease in the panel, near a side edge within five feet of the end of unsecured panel. Use OSHA approved tie off, netting or rails when working on roof. Insulation has no load bearing strength. Maintain body weight on approved scaffold or walk boards. **SAFETY FIRST!**

SAFETY NOTE! CAUTION!! PANELS MAY BE SLICK

Because of the demands of the manufacturing process, oil has been applied to the coil stock to protect the coil as well as the finished panel during manufacturing, shipping and storage. **Metal panels must be wiped clean prior to panel installation.**

NOTE Always wear rubber sole work boots! When on the roof, use OSHA approved protection devices such as safety lines, safety nets or catch platforms.

UNSECURED PANELS MAY SLIP IF STEPPED ON!

Employees should be continuously warned to never step on a single unsecured roof panel or on a stack of roof panels lying unattached on the purlins.

Secure each end of the panel with clamps or appropriate fasteners and place walk boards of adequate size and strength in the flat of any panels not fully secured to the purlins and supported by panels on each side. Walk boards should run the full length of the panel and be fastened together with rope run through holes drilled near the end of each board.

Cut a groove in the bottom of each board so that the board will lie flat and not tip back and forth because of the rope.

Daily meetings describing safe work procedures, use of hard hats, rubber sole shoes for roof work, proper equipment for handling material and protection devices are recommended. **SAFETY FIRST!**

SAFETY PRECAUTIONS FOR ROOFING WORK

We recommend that erection crews be continuously trained and retrained in safe and productive work practices. Working on the roof requires proper training, correct equipment and constant alertness to minimize the danger of falls. Hard hats should be worn on the job site to prevent injury from falling objects. Safe work practices for erection task should be carefully reviewed with erection crews prior to beginning each job.

Panels May Collapse If Not Properly Secured

Roof panels must be completely attached to the purlins and to panels on either side before they can be a safe walking surface.

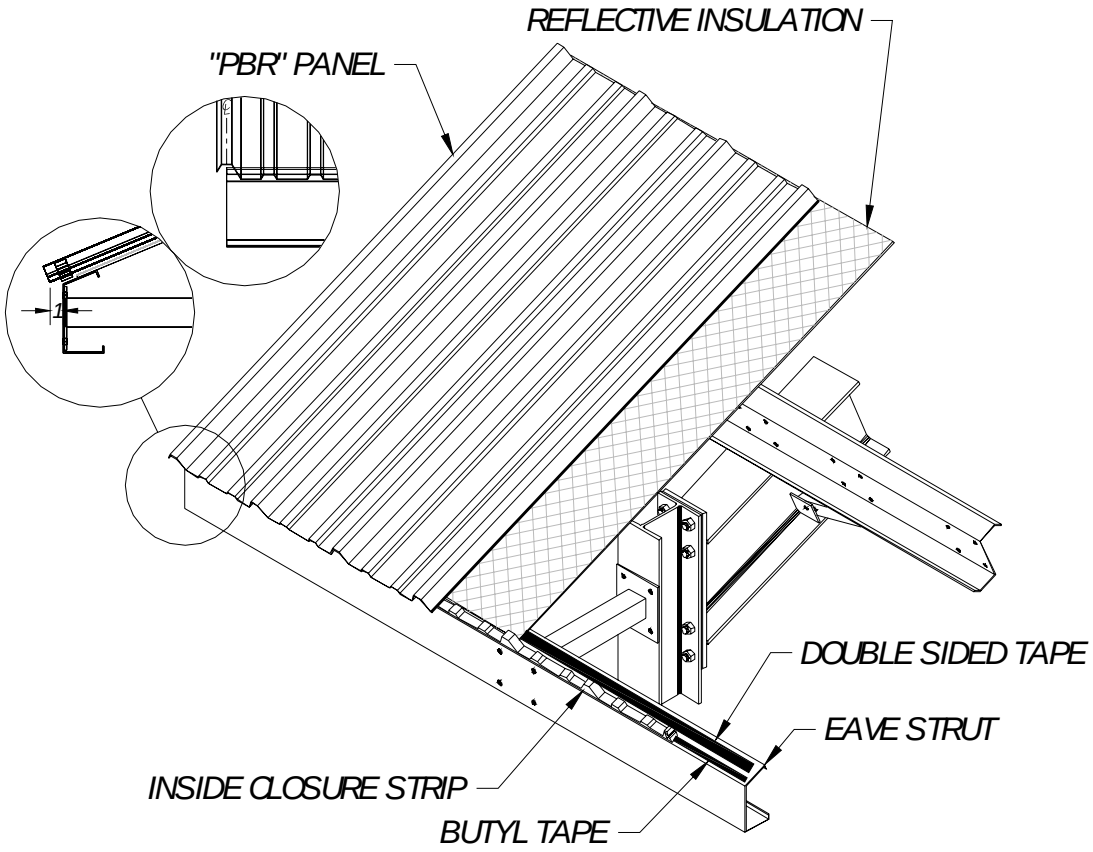
Partially attached or unattached panels should never be walked on!

DO NOT:
Step on a rib at the edge of panel
Step near the crease in rib at the edge of panel.
Step within 5 feet of the edge of an unsecured panel.

A single roof panel must never be used as a work platform. An OSHA approved runway should be used for work platforms! (Consult OSHA Safety and Health Regulations for the Construction Industry).**SAFETY FIRST!**

INSTALLATION OF FIRST ROOF PANEL

Once the eave is prepared, the first roof panel may be installed. Check the erection drawings to determine the roof overhang at the eave. Set the roof panel in place over the inside closure (after removing the paper from the mastic) ensuring the major ribs of the panel nest properly with the inside closure. Align the panel to the structure with appropriate fasteners. If the HOME requires more than one panel per run, do not install fasteners until the overlapped panel is installed.



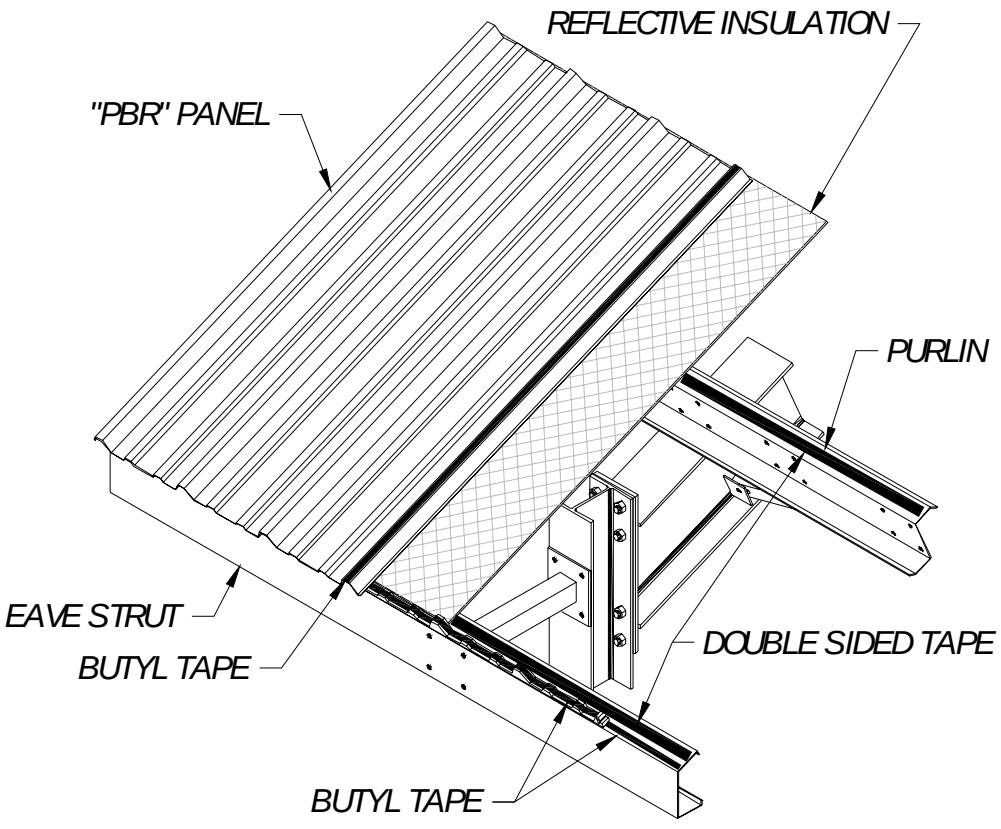
NOTE! Do not walk on unsecured panels. Wipe oil and other slippery substances from roof panels. **SAFETY FIRST!**

SEALING THE SIDELAP

Apply the sidelap tape sealant to the weather side edge of the lower panel's major rib as shown. The tape sealant should only be applied to clean, dry surfaces. With the release paper in place, press firmly along the length of the sealant to insure proper adhesion. In removing the protective paper from the tape sealant, care should be taken not to pull the tape sealant away from the panel. Install the adjoining panel, positioning the overlapping rib with care. At the center of rib drill clearance holes in the overlapping panel, drill 1/8" pilot holes for the lap fasteners. Stitch the lap with the No. 14 self-drilling fasteners supplied with the job. **Never allow the sealant to be placed in other locations.**

SEALING THE EAVE

Butyl Tape location at the eave is critical. To ensure a weather tight seal, the sidelap sealant must extend down from the top of the rib to the sealant on the eave closure. The sealant extension must splice into the eave butyl tape.

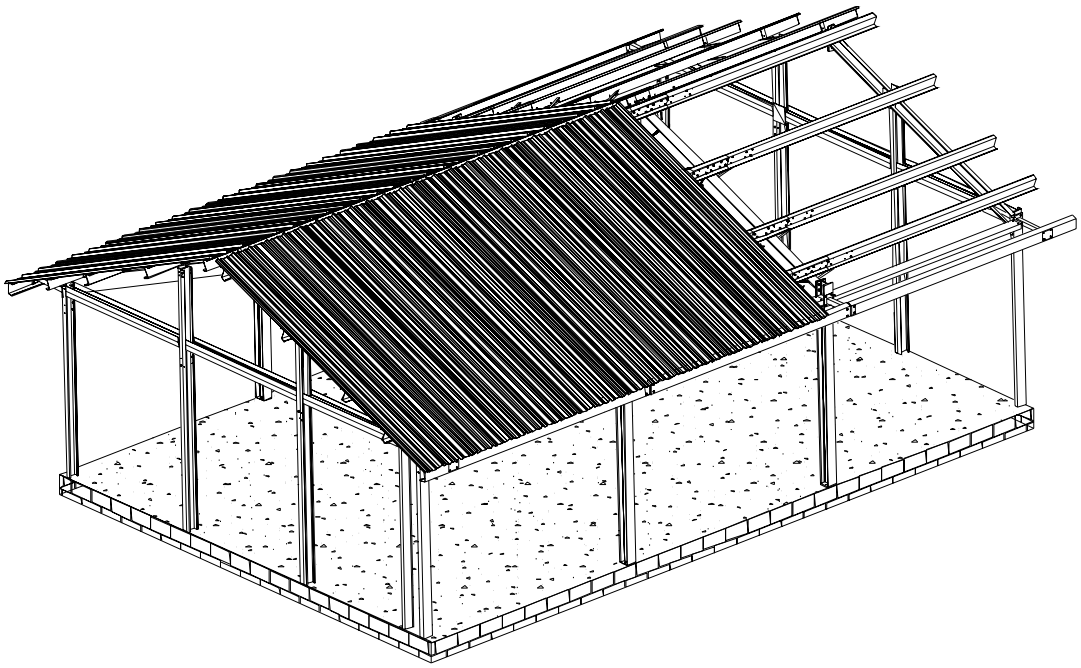


NOTE! Use OSHA approved eye protection when operating a drill. Sweep up all drill shavings from panels at end of each work period to minimize surface rust damage to panel finish. **SAFETY FIRST!**

ROOF SHEETING SEQUENCE

It is recommended that both sides of the ridge of the structure be sheeted simultaneously. This will keep the insulation covered for the maximum amount of time and the panel ribs properly aligned for the ridge panel. Check for proper coverage as the sheeting progresses. **Note panel-sheeting sequence below!**

With the first panel run installed and secured and the side-lap sealant applied, the second panel run may be started. Prepare the eave with an inside closure and tape sealant as shown previously. Position the panel so that the overlapping ribs will nest properly. Be sure to check for proper overhang and panel coverage. Stitch the major ribs of the two panels together, and fasten the panel to the purlins.



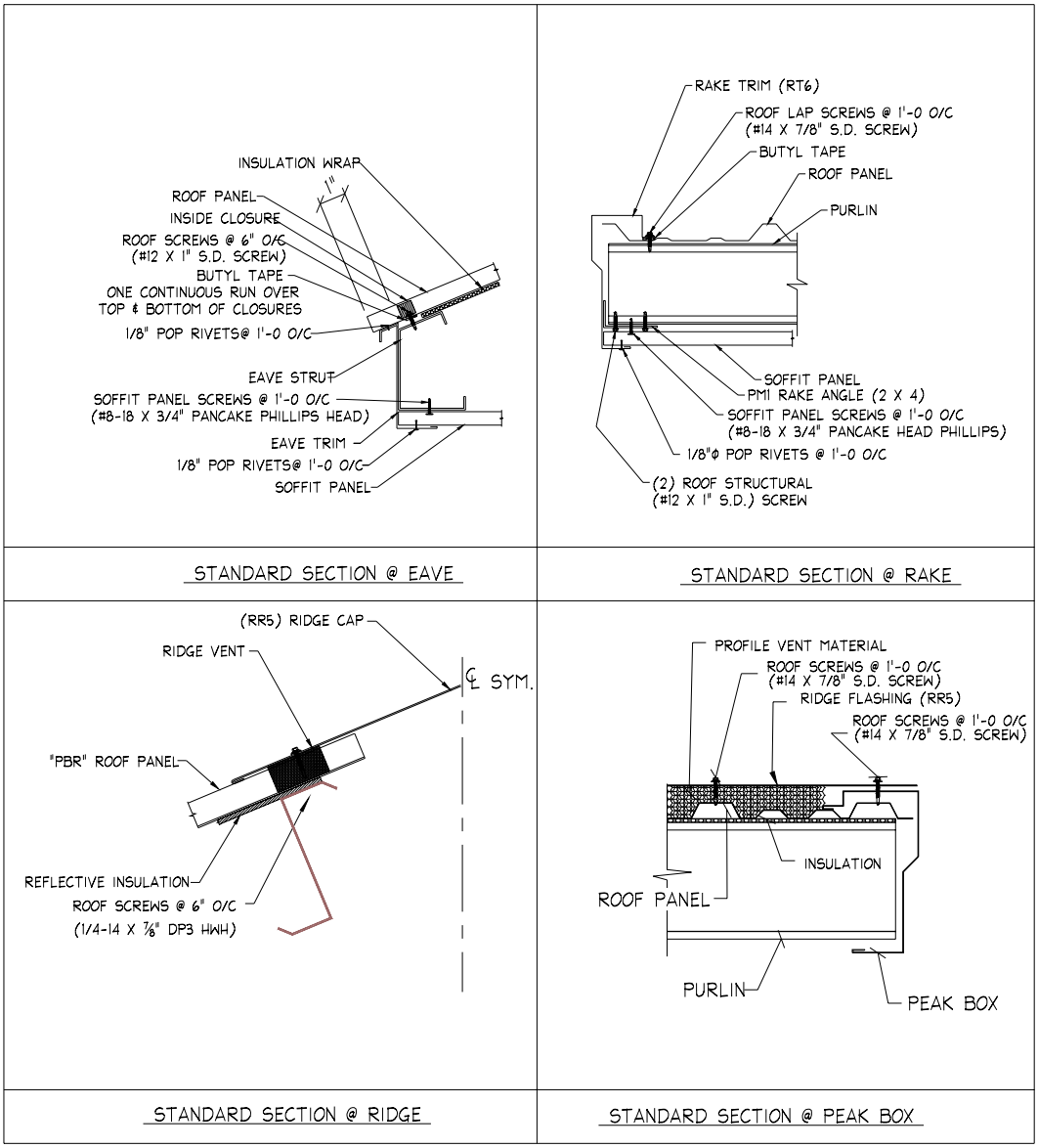
NOTE! Workers should maintain a constant awareness of their location in relation in relation to the roof edge at all times. Follow all OSHA recommended safety suggestions. **SAFETY FIRST!**

INSTALLATION OF FINAL PANEL

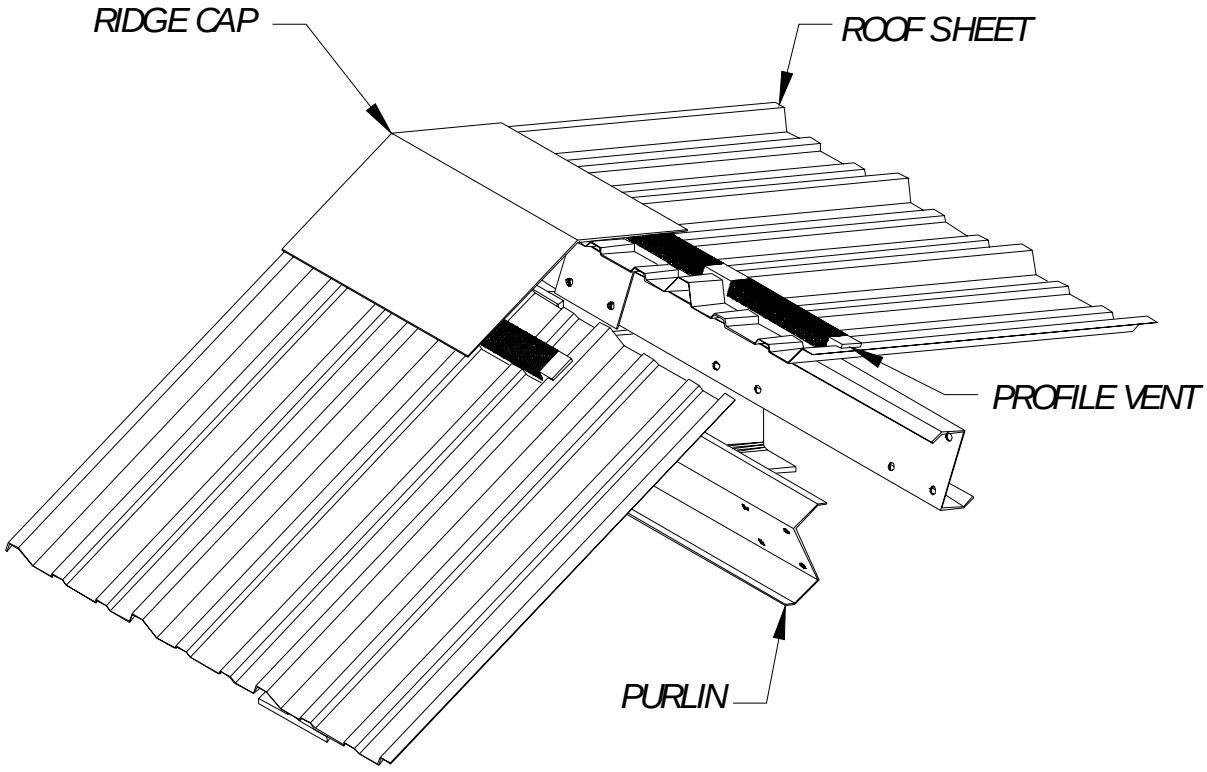
Although many erectors will back lap the last roof panel (to match panel coverage with the home's length) is routinely done. This installation method can compromise the integrity of the roof by trapping moisture between the panels. This moisture could eventually lead to rust and metal failure. **We recommend field cutting the final panel lengthwise** to create the desired width to finish off the home. ***The cut edge of the panel should always be installed on the outside edge, not the lap edge.*** The narrow panel should be handled with care, and foot traffic avoided until the final panel is completely installed.

NOTE! SAFETY FIRST!

TRIM DETAILS



RIDGE FLASHING DETAIL

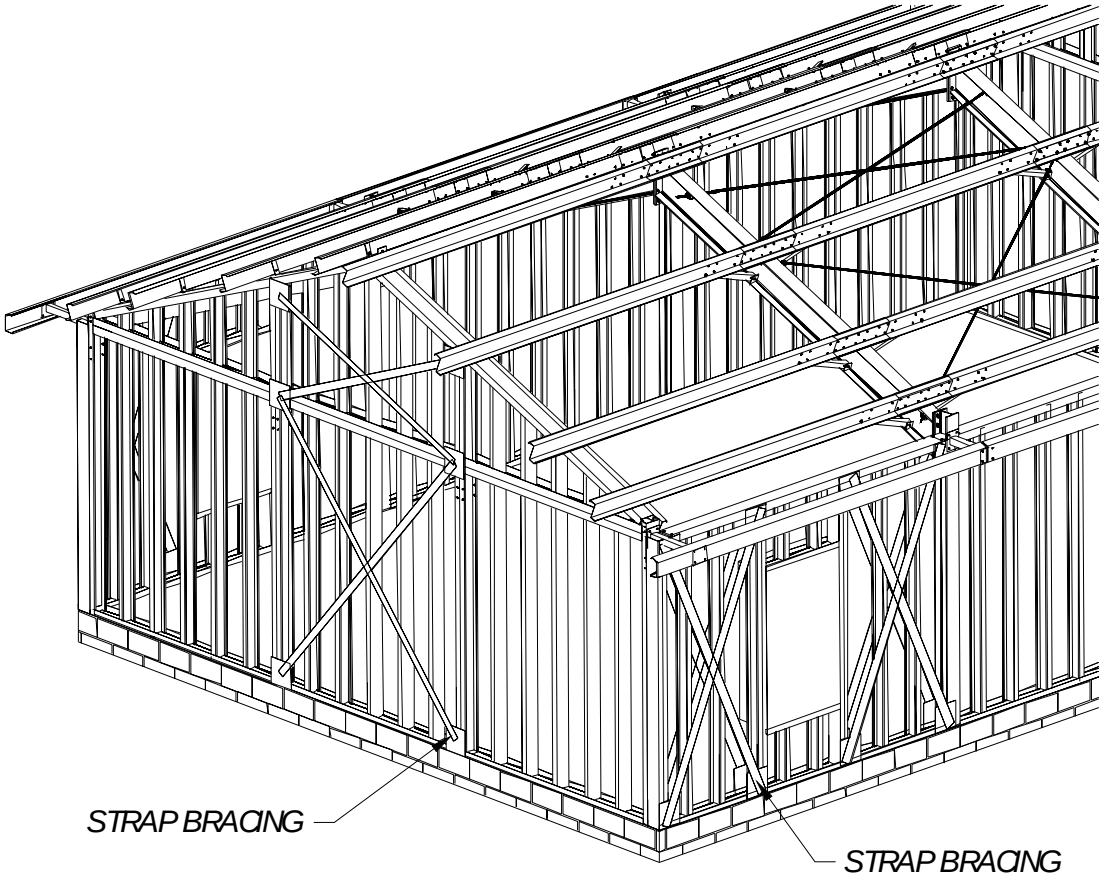


SECTION 6: WALL FRAMING

INSTALLATION OF WIND BRACING

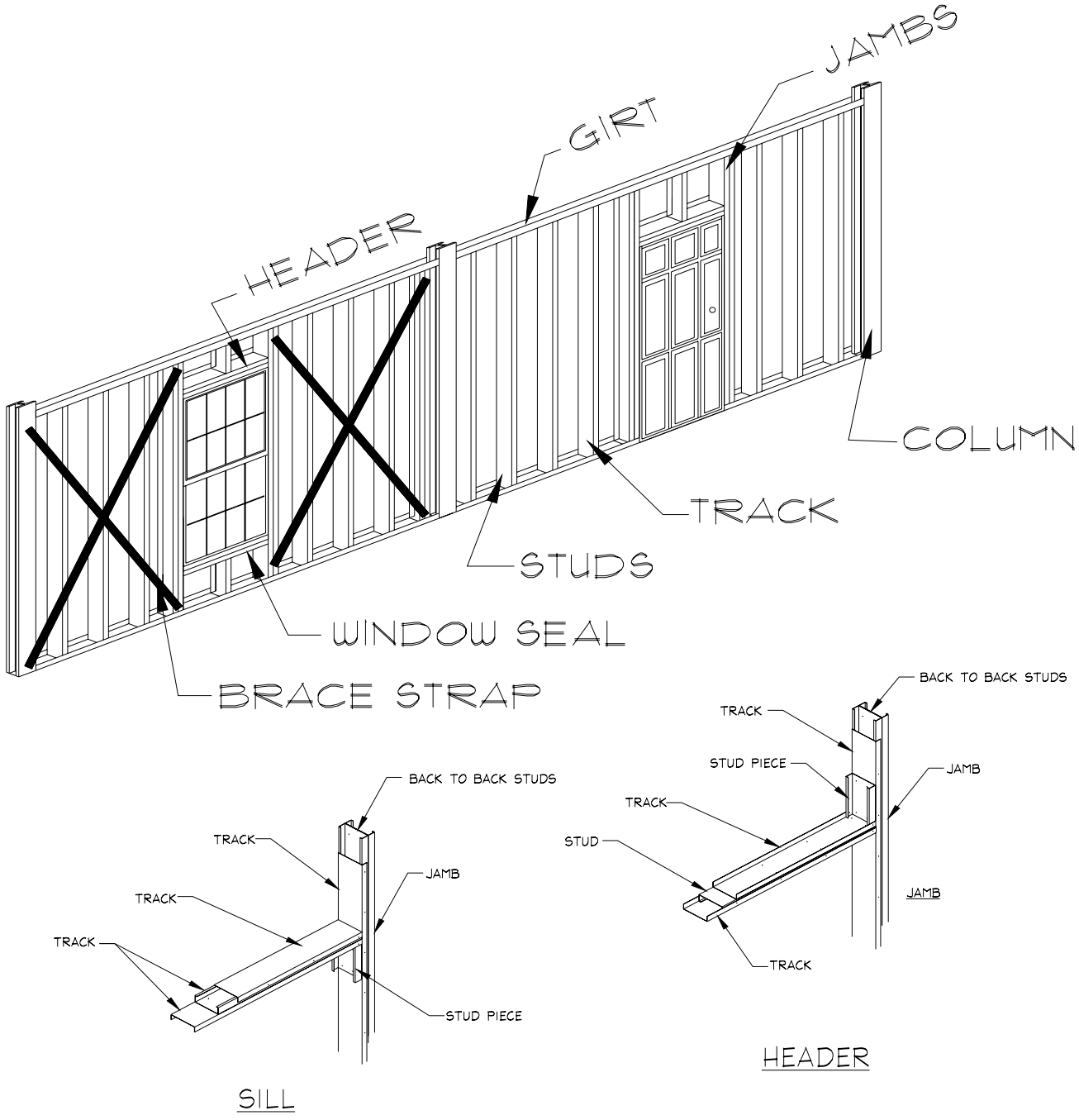
The wind bracing is usually strap material. It should be installed as shown on the erection drawing and should be tensioned so that the home will not sway or rock when the wind blows.

Occasionally the wind bracing of a home cannot be installed in the specific bay because of doors or other complications. Usually these can be moved to other bays without affecting the structural integrity of the home. However, before moving any wind bracing, check with the manufacturer. **Never modify your home's structure without written authorization from the manufacturer.**



NOTE! Follow all OSHA approved safety recommendations. **SAFETY FIRST!**

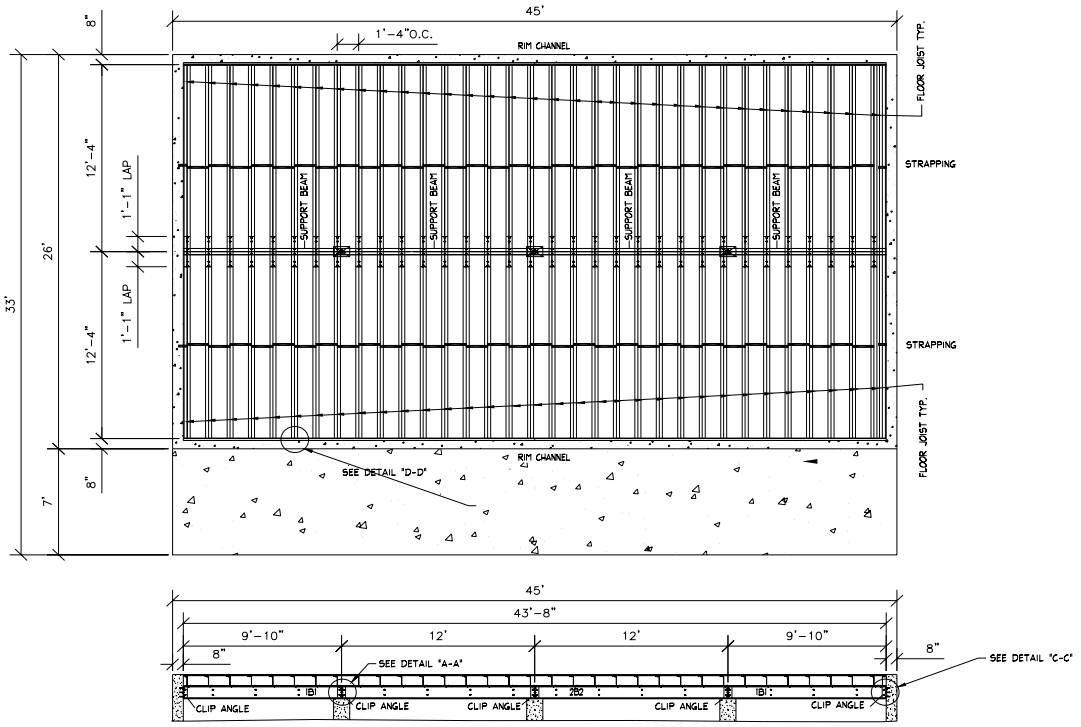
WALL FRAMING FOR WINDOWS AND DOORS



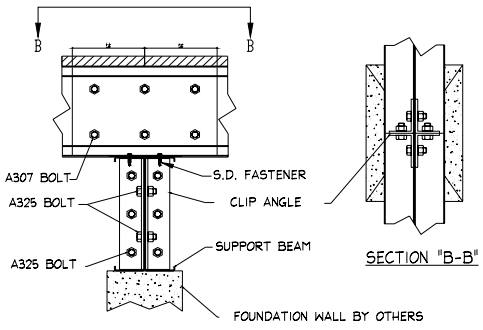
WINDOW & DOOR FRAMING

NOTE: ALL SCREW SPACING IS 1'-0" O.C.

SECTION 7: FLOOR JOIST SYSTEM

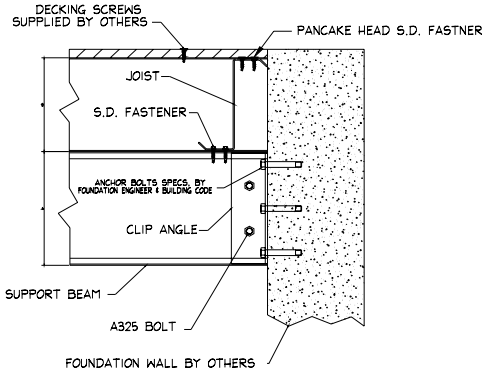


STANDARD FLOOR JOIST SYSTEM

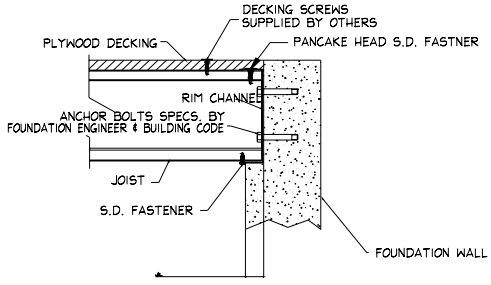


TYPICAL DETAIL "A-A"
AT PIER SUPPORTS ONLY

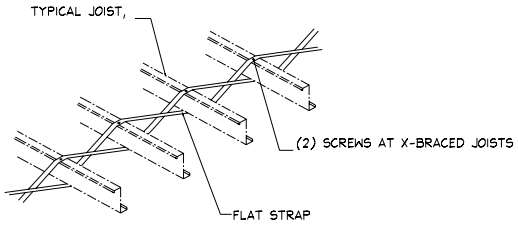
SECTION "B-B"



TYPICAL DETAIL "C-C"
AT BEAM END SUPPORT



TYPICAL DETAIL "D-D"
AT JOIST END SUPPORT

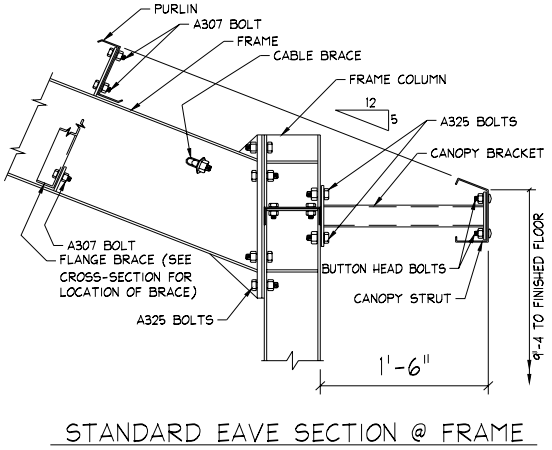


TYPICAL STRAPPING DETAIL

SECTION 8: ERECTION SEQUENCE

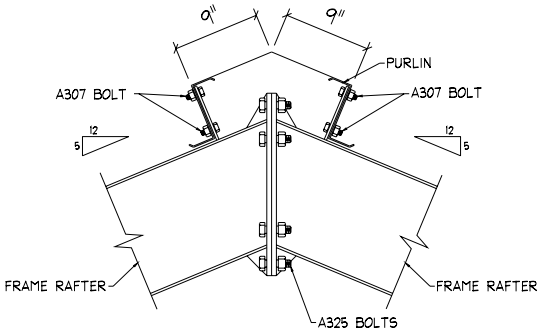
QUICK START GUIDE

1. Erect First Interior Frame



STANDARD EAVE SECTION @ FRAME

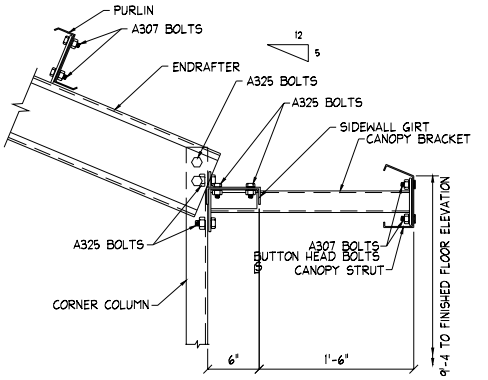
A. Bolt canopy brackets onto outside columns.
B. Stand and level all columns at that frame line onto anchor bolts and tighten nuts.
C. Raise rafters - bolt rafters onto columns and rafters together at peak.
D. Install temporary bracing.



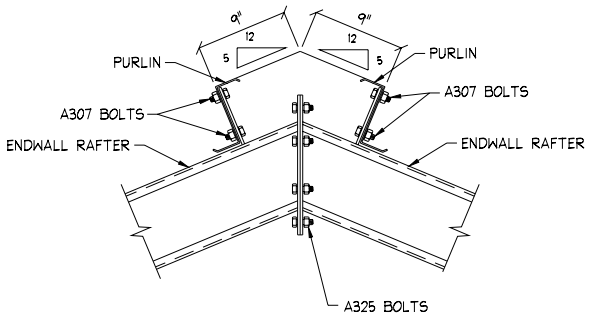
STANDARD SECTION @ RIDGE

2. Erect Endwall Frame

A. Bolt canopy brackets onto corner columns and clips onto the base of all endwall columns. (standard section at endwall eave)



STANDARD SECTION @ ENDWALL EAVE



STANDARD SECTION @ RIDGE ENDWALL

B. Stand and level all endwall columns onto anchor bolts and tighten nuts.
C. Install temporary bracing.
D. Raise rafters -bolt rafters onto columns and rafters together at peak. (standard section at ridge endwall)

3. Erect Next Interior Frames

A. Erect the frame like you did in step ‘1’ above.
B. Tie this frame to the previous frame like you did in step ‘3’ above.
C. Install temporary bracing.

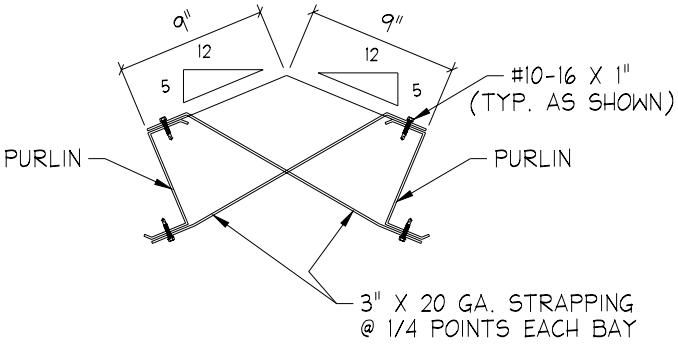
4. Tie Frames Together

A. Bolt roof purlins onto rafters .
B. Bolt canopy/eave strut onto canopy brackets.

C. Bolt sidewall girts onto clips at top of columns.
D. Install temporary bracing

5. Erect Remaining Endwall Frame
A. Erect the frame like you did in step '2' above.
B. Tie this frame to the previous frame like you did in step '3' above.
C. Install temporary bracing.
D. Screw 2" x 4" rake angle to bottom of purlins (STANDARD SECTION @ RAKE see your erection drawings)

6. Roof Bracing (STANDARD SECTION @ FRAME EAVE, RIDGE BRACING and ROOF FRAMING PLAN see your erection drawings)

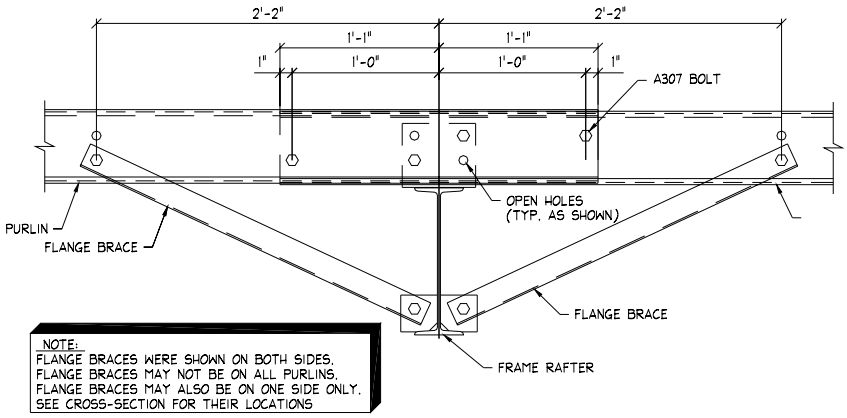


STANDARD SECTION @ RIDGE BRACING

A. Attach cable bracing.
B. Plumb structure using cable bracing.
C. Screw the 3” flat strapping at the top of one ridge purlin to the bottom of the opposite ridge purlin; do this 4 times in each bay.

7. Roof Flange Bracing (STANDARD SECTION THRU PULIN SPLICES and STANDARD SECTION @ FRAME EAVE see your erection drawings)

Note – these are also called ‘Sag Angles’ or ‘Purlin Braces’



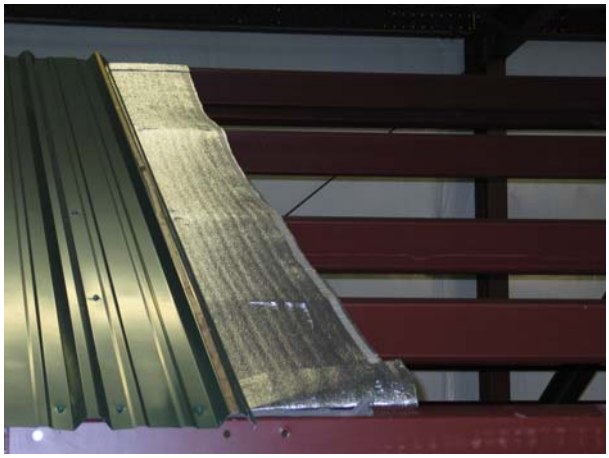
STANDARD FLANGE BRACE CONNECTION @ FRAME

A. Bolt all flange braces onto purlins and frames.

8. Install Roof Sheets and Insulation Wrap (ROOF SHEETING PLAN, STANDARD SECTION @ EAVE and RIDGE see your erection drawings)

Note - Fist roof sheet should be attached at furthest end from prevailing view; **in other words, if your driveway is on the right hand end of your home, start sheeting at the lefthand end, as this will hide the lap**

A. Roll insulation out over purlins and tape to eave and ridge with double stick tape. Only roll out one run at a time and install a roof sheet over this before rolling out next run.



B. Apply inside foam closure at eave with Butyl Tape double bead tape on top and bottom.
C. Level and attach first roof sheet using structural screws to screw to roof purlins and eave/canopy strut.
D. Apply Butyl tape along the edge of sheet, where the next panel laps.
E. Level and attach the next sheet and screw the structural screws to purlins and the lap screws to the previous sheet.
F. Repeat steps C and D above until you reach the end of roof, then do the other side.

9. Install Ridge Assembly (ROOF SHEETING PLAN and STANDARD SECTION @ RIDGE)

A. Pop rivet the Ridge Closure Trim 1 ¼" from the top edge of the roof sheet. The Ridge Closure Trim is 'C' shaped 2" x 2" x 2" and is colored on the inside.
B. Apply Butyl tape (double bead tape sealant) along top edge of panels – all the way down the ridge.
C. Install the outside closures on top of Butyl tape, fitting them snug against back of Ridge Closure Trim.
D. Apply Ridgemaster Vent material over ridge.
E. Screw Ridge Cap down on each side of ridge.

10. Roof Trim (STANDARD SECTION @ EAVE and RAKE see your erection drawings)
A. Install eave trim, rake (gable) trim, corner boxes and peak boxes.

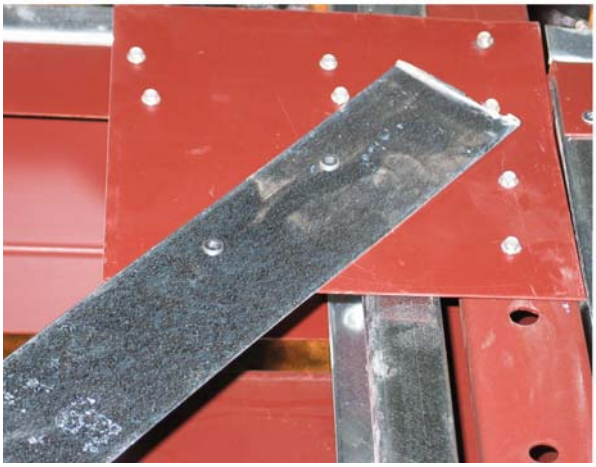
11. Build Exterior Stud Walls(STANDARD PLAN @ STANDARD CORNER, STANDARD SECTION @ BRACE CONNECTIONS, SIDEWALL SOFFIT, ENDWALL SOFFIT and SECTION "B" see your erection drawings)
A. Apply 2 beads of silicon caulk under the 6" track.

B. Place track on foundation and drill ¼" holes every 12" through track and into concrete using hammer drill. Hammer in wedge anchors.
C. Place studs in position into track at the bottom and into red iron girt at the top. Screw into place.
D. Frame windows and doors by using 6" track for headers and sills.

E. Install gable studs by using track at top of endwall girt and under the roof purlins.

12. Install Strap Bracing (STANDARD SECTION BRACE CONNECTIONS, SECTION "B" and SIDEWALL FRAMING ELEVATION see your erection drawings)

Note – the sidewall strap bracing is the 4" wide 16 gauge material. Most homes require one 11' wide 'X' of strapping ,or if you have a window or door placement issue, two 5'6" wide 'X's of strapping, inside one bay per sidewall. This means your 'X' has to be totally between two sidewall columns. Also, the strapping must be applied on both sides of the studs (inside and outside).



A. Anchor bolt the SMTT bracket to foundation at the bottom of each leg of the 'X'.
B. Attach the SMTT bracket to **two – back to back 16 gauge studs.**
C. Screw the PM2 16 gauge plate to these back to back 16 gauge studs at the top and bottom for each leg of the 'X'.
D. Screw the 4" wide 16 gauge flat strapping to the PM2 16 gauge plates – to form an 'X'. **Use screw pattern specified on detail 'Standard Section at Brace Detail' and 'Detail B'**
E. Screw 3" strapping in gable.

13. Apply Siding (SIDEWALL SHEETING ELEVATION, STANDARD SECTIONS @ PORCH, STANDARDS @ ENDWALL and SIDEWALL SOFFIT see your ertection drawings)

Note – Siding should be started at furthest end from prevailing view; **in other words, if your driveway is on the right end of your home, start siding at the left end, as this will hide the laps of the siding. Siding laps should be made at a stud.** For visual appearance, the staggering of laps should be well planned. At a minimum, two laps in a line vertically should be separated by at least two panels of siding.

Install windows and doors.
Apply siding 'J' channel around windows and doors, and all purpose trim at top of sidewalls and endwalls

Screw starter strip at base of studs.
Screw siding – paying careful attention to laps.

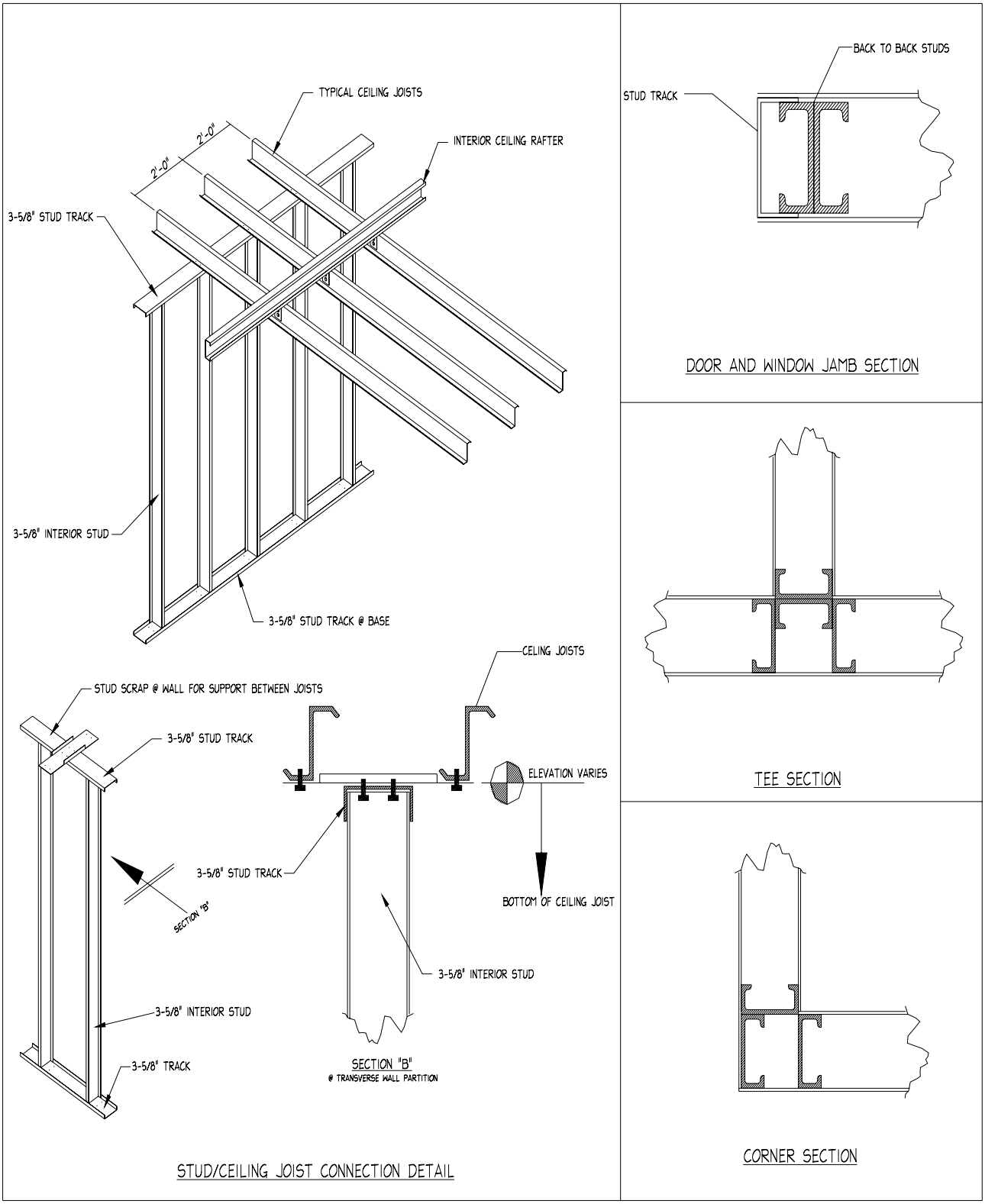
14. Install Soffit (STANDARD SECTION @ EAVE, RAKE, ENDWALL SOFFIT and SIDEWALL SOFFIT see your erection drawings)

A. Screw 2”x2” galvanized edge angle at top of studwall at eave and rake (gable).
B. Screw soffit ‘J’ channel to galvanized edge angle.
C. Screw soffit to bottom of canopy/eave strut and purlins.
15. Finish Interior

Note – since we have no interior load bearing walls, we recommend that the ceiling drywall be installed first, so as to save cutting and fitting ceiling drywall to individual rooms and closets. The length of your interior studs reflects this recommendation. Your ceiling joists are 24” on center, so most people use 5/8” drywall; be sure to check the recommended span for your drywall.

A. Screw 2” x 2” galvanized edge angle to studs around the interior perimeter, at ceiling height, to act as drywall support where there is no red iron.
B. Screw ceiling drywall to 6” ceiling joists and edge angle.
C. Install interior track at floor and ceiling.
D. Build interior stud walls.

INTERIOR FRAMING DETAILS



SECTION 9: APPENDIX

Taken from Part IV., Department of Labor, Occupational Saftey and Health Administration, 29 CFR 1926, Safety Standards for Steel Erection: Final Rule

Subpart R -- Steel Erection

1926.750 Scope.
1926.751 Definitions.
1926.752 Site layout, site-specific erection plan and construction sequence.
1926.753 Hoisting and rigging.
1926.754 Structural steel assembly.
1926.755 Column anchorage.
1926.756 Beams and columns.
1926.757 Open web steel joists.
1926.758 Systems-engineered metal buildings.
1926.759 Falling object protection.
1926.760 Fall protection.
1926.761 Training.
APPENDIX A TO SUBPART R -- GUIDELINES FOR ESTABLISHING THE COMPONENTS OF A SITE-SPECIFIC ERECTION PLAN: NON-MANDATORY GUIDELINES FOR COMPLYING WITH § 1926.752(e)

APPENDIX B TO SUBPART R -- ACCEPTABLE TEST METHODS FOR TESTING SLIP-RESISTANCE OF WALKING/WORKING SURFACES: NON-MANDATORY GUIDELINES FOR COMPLYING WITH § 1926.754(c)(3)

APPENDIX C TO SUBPART R -- ILLUSTRATIONS OF BRIDGING TERMINUS POINTS: NON-MANDATORY GUIDLINES FOR COMPLYING WITH § 1926.757(a)(10) and § 1926.757(c)(5)

APPENDIX D TO SUBPART R -- ILLUSTRATION OF THE USE OF CONTROL LINES TO DEMARCATE CONTROLLED DECKING ZONES (CDZs): NON-MANDATORY GUIDELINES FOR COMPLYING WITH § 1926.760(c)(3)

APPENDIX E TO SUBPART R -- TRAINING: NON-MANDATORY GUIDELINES FOR COMPLYING WITH § 1926.761

APPENDIX F TO SUBPART R -- PERIMETER COLUMNS: NON-MANDATORY GUIDELINES FOR COMPLYING WITH § 1926.756(e) TO PROTECT THE UNPROTECTED SIDE OR EDGE OF A WALKING/WORKING SURFACE

APPENDIX G TO SUBPART R -- FALL PROTECTION SYSTEMS CRITERIA AND PRACTICES FROM § 1926.502: NON-MADATORY GUIDELINES FOR COMPLYING WITH § 1926.760(d)

APPENDIX H TO SUBPART R -- DOUBLE CONNECTIONS: ILLUSTRATION OF A CLIPPED END CONNECTION AND A STAGGERED CONNECTION: NON-MADATORY GUIDELINES FOR COMPLYING WITH § 1926.756(c)(1)

Subpart R -- Steel Erection

1926.750(a) This subpart sets forth requirements to protect employees from the hazards associated with steel erection activities involved in the construction, alteration, and/or repair of single and multi-story buildings, bridges, and other structures where steel erection occurs. The requirements of this subpart apply to employers engaged in steel erection unless otherwise specified. This subpart does not cover electrical transmission towers, communication and broadcast towers, or tanks.

Note to paragraph (a): Examples of structures where steel erection may occur include but are not limited to the following: Single and multi-story buildings; systems-engineered metal buildings; lift slab/tilt-up structures; energy exploration structures; energy production, transfer and storage structures and facilities; auditoriums; malls; amphitheaters; stadiums; power plants; mills; chemical process structures; bridges; trestles; overpasses; underpasses; viaducts; aqueducts; aerospace facilities and structures; radar and communication structures; light towers; signage; billboards; scoreboards; conveyor systems; conveyor supports and related framing; stairways; stair towers; fire escapes; draft curtains; fire containment structures; monorails; aerialways; catwalks; curtain walls; window walls; store fronts; elevator fronts; entrances; skylights; metal roofs; industrial structures; hi-bay structures; rail, marine and other transportation structures; sound barriers; water process and water containment structures; air and cable supported structures; space frames; geodesic domes; canopies; racks and rack support structures and frames; platforms; walkways; balconies; atriums; penthouses; car dumpers; stackers/reclaimers; cranes and craneways; bins; hoppers; ovens; furnaces; stacks; amusement park structures and rides; and artistic and monumental structures.

1926.750(b)(1) Steel erection activities include hoisting, laying out, placing, connecting, welding, burning, guying, bracing, bolting, plumbing and rigging structural steel, steel joists and metal buildings; installing metal decking, curtain walls, window walls, siding systems, miscellaneous metals, ornamental iron and similar materials; and moving point-to-point while performing these activities.

1926.750(b)(2) The following activities are covered by this subpart when they occur during and are a part of steel erection activities: rigging, hoisting, laying out, placing, connecting, guying, bracing, dismantling, burning, welding, bolting, grinding, sealing,

caulking, and all related activities for construction, alteration and/or repair of materials and assemblies such as structural steel; ferrous metals and alloys; non-ferrous metals and alloys; glass; plastics and synthetic composite materials; structural metal framing and related bracing and assemblies; anchoring devices; structural cabling; cable stays; permanent and temporary bents and towers; falsework for temporary supports of permanent steel members; stone and other non-precast concrete architectural materials mounted on steel frames; safety systems for steel erection; steel and metal joists; metal decking and raceway systems and accessories; metal roofing and accessories; metal siding; bridge flooring; cold formed steel framing; elevator beams; grillage; shelf racks; multi-purpose supports; crane rails and accessories; miscellaneous, architectural and ornamental metals and metal work; ladders; railings; handrails; fences and gates; gratings; trench covers; floor plates; castings; sheet metal fabrications; metal panels and panel wall systems; louvers; column covers; enclosures and pockets; stairs; perforated metals; ornamental iron work, expansion control including bridge expansion joint assemblies; slide bearings; hydraulic structures; fascias; soffit panels; penthouse enclosures; skylights; joint fillers; gaskets; sealants and seals; doors; windows; hardware; detention/security equipment and doors, windows and hardware; conveying systems; building specialties; building equipment; machinery and plant equipment, furnishings and special construction.

1926.750(c) The duties of controlling contractors under this subpart include, but are not limited to, the duties specified in Secs. 1926.752 (a) and (c), 1926.755(b)(2), 1926.759(b), and 1926.760(e).

1926.751 Definitions

Anchored bridging means that the steel joist bridging is connected to a bridging terminus point.

Bolted diagonal bridging means diagonal bridging that is bolted to a steel joist or joists.

Bridging clip means a device that is attached to the steel joist to allow the bolting of the bridging to the steel joist.

Bridging terminus point means a wall, a beam, tandem joists (with all bridging installed and a horizontal truss in the plane of the top chord) or other element at an end or intermediate point(s) of a line of bridging that provides an anchor point for the steel joist bridging.

Choker means a wire rope or synthetic fiber rigging assembly that is used to attach a load to a hoisting device.

Cold forming means the process of using press brakes, rolls, or other methods to shape steel into desired cross sections at room temperature.

Column means a load-carrying vertical member that is part of the primary skeletal framing system. Columns do not include posts.

Competent person (also defined in § 1926.32) means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Connector means an employee who, working with hoisting equipment, is placing and connecting structural members and/or components.

Constructibility means the ability to erect structural steel members in accordance with subpart R without having to alter the over-all structural design.

Construction load (for joist erection) means any load other than the weight of the employee(s), the joists and the bridging bundle.

Controlled Decking Zone (CDZ) means an area in which certain work (for example, initial installation and placement of metal decking) may take place without the use of guardrail systems, personal fall arrest systems, fall restraint systems, or safety net systems and where access to the zone is controlled.

Controlled load lowering means lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.

Controlling contractor means a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project -- its planning, quality and completion.

Critical lift means a lift that (1) exceeds 75 percent of the rated capacity of the crane or derrick, or (2) requires the use of more than one crane or derrick.

Decking hole means a gap or void more than 2 inches (5.1 cm) in its least dimension and less than 12 inches (30.5 cm) in its greatest dimension in a floor, roof or other walking/working surface. Pre-engineered holes in cellular decking (for wires, cables, etc.) are not included in this definition.

Derrick floor means an elevated floor of a building or structure that has been designated to receive hoisted pieces of steel prior to final placement.

Double connection means an attachment method where the connection point is intended for two pieces of steel which share common bolts on either side of a central piece.

Double connection seat means a structural attachment that, during the installation of a double connection, supports the first member while the second member is connected.

Erection bridging means the bolted diagonal bridging that is required to be installed prior to releasing the hoisting cables from the steel joists.

Fall restraint system means a fall protection system that prevents the user from falling any distance. The system is comprised of either a body belt or body harness, along with an anchorage, connectors and other necessary equipment. The other components typically include a lanyard, and may also include a lifeline and other devices.

Final interior perimeter means the perimeter of a large permanent open space within a building such as an atrium or courtyard. This does not include openings for stairways, elevator shafts, etc.

Girt (in systems-engineered metal buildings) means a "Z" or "C" shaped member formed from sheet steel spanning between primary framing and supporting wall material.

Headache ball means a weighted hook that is used to attach loads to the hoist load line of the crane.

Hoisting equipment means commercially manufactured lifting equipment designed to lift and position a load of known weight to a location at some known elevation and horizontal distance from the equipment's center of rotation. "Hoisting equipment" includes but is not limited to cranes, derricks, tower cranes, barge-mounted derricks or cranes, gin poles and gantry hoist systems. A "come-a-long" (a mechanical device, usually consisting of a chain or cable attached at each end, that is used to facilitate movement of materials through leverage) is not considered "hoisting equipment."

Leading edge means the unprotected side and edge of a floor, roof, or formwork for a floor or other walking/working surface (such as deck) which changes location as additional floor, roof, decking or formwork sections are placed, formed or constructed.

Metal decking means a commercially manufactured, structural grade, cold rolled metal panel formed into a series of parallel ribs; for this subpart, this includes metal floor and roof decks, standing seam metal roofs, other metal roof systems and other products such as bar gratings, checker plate, expanded metal panels, and similar products. After installation and proper fastening, these decking materials serve a combination of functions including, but not limited to: a structural element designed in combination with the structure to resist, distribute and transfer loads, stiffen the structure and provide a diaphragm action; a walking/working surface; a form for concrete slabs; a support for roofing systems; and a finished floor or roof.

Multiple lift rigging means a rigging assembly manufactured by wire rope rigging suppliers that facilitates the attachment of up to five independent loads to the hoist rigging of a crane.

Opening means a gap or void 12 inches (30.5 cm) or more in its least dimension in a floor, roof or other walking/working surface. For the purposes of this subpart, skylights and smoke domes that do not meet the strength requirements of § 1926.754(e)(3) shall be regarded as openings.

Permanent floor means a structurally completed floor at any level or elevation (including slab on grade).

Personal fall arrest system means a system used to arrest an employee in a fall from a working level. A personal fall arrest system consists of an anchorage, connectors, a body harness and may include a lanyard, deceleration device, lifeline, or suitable combination of these. The use of a body belt for fall arrest is prohibited.

Positioning device system means a body belt or body harness rigged to allow an employee to be supported on an elevated, vertical surface, such as a wall or column and work with both hands free while leaning.

Post means a structural member with a longitudinal axis that is essentially vertical, that: (1) weighs 300 pounds or less and is axially loaded (a load presses down on the top end), or (2) is not axially loaded, but is laterally restrained by the above member. Posts typically support stair landings, wall framing, mezzanines and other substructures.

Project structural engineer of record means the registered, licensed professional responsible for the design of structural steel framing and whose seal appears on the structural contract documents.

Purlin (in systems-engineered metal buildings) means a "Z" or "C" shaped member formed from sheet steel spanning between primary framing and supporting roof material.

Qualified person (also defined in § 1926.32) means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

Safety deck attachment means an initial attachment that is used to secure an initially placed sheet of decking to keep proper alignment and bearing with structural support members.

Shear connector means headed steel studs, steel bars, steel lugs, and similar devices which are attached to a structural member for the purpose of achieving composite action with concrete.

Steel erection means the construction, alteration or repair of steel buildings, bridges and other structures, including the installation of metal decking and all planking used during the process of erection.

Steel joist means an open web, secondary load-carrying member of 144 feet (43.9 m) or less, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses or cold-formed joists.

Steel joist girder means an open web, primary load-carrying member, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses.

Steel truss means an open web member designed of structural steel components by the project structural engineer of record. For the purposes of this subpart, a steel truss is considered equivalent to a solid web structural member.

Structural steel means a steel member, or a member made of a substitute material (such as, but not limited to, fiberglass, aluminum or composite members). These members include, but are not limited to, steel joists, joist girders, purlins, columns, beams, trusses, splices, seats, metal decking, girts, and all bridging, and cold formed metal framing which is integrated with the structural steel framing of a building.

Systems-engineered metal building means a metal, field-assembled building system consisting of framing, roof and wall coverings. Typically, many of these components are cold-formed shapes. These individual parts are fabricated in one or more manufacturing facilities and shipped to the job site for assembly into the final structure. The engineering design of the system is normally the responsibility of the systems-engineered metal building manufacturer.

Tank means a container for holding gases, liquids or solids.

Unprotected sides and edges means any side or edge (except at entrances to points of access) of a walking/working surface, for example a, floor, roof, ramp or runway, where there is no wall or guardrail system at least 39 inches (1.0 m) high.

1926.752 Site Layout

1926.752(a) Approval to begin steel erection. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the following written notifications:

1926.752(a)(1) The concrete in the footings, piers and walls and the mortar in the masonry piers and walls has attained, on the basis of an appropriate ASTM standard test method of field-cured samples, either 75 percent of the intended minimum compressive design strength or sufficient strength to support the loads imposed during steel erection.

1926.752(a)(2) Any repairs, replacements and modifications to the anchor bolts were conducted in accordance with § 1926.755(b).

1926.752(b) Commencement of steel erection. A steel erection contractor shall not erect steel unless it has received written notification that the concrete in the footings, piers and walls or the mortar in the masonry piers and walls has attained, on the basis of an appropriate ASTM standard test method of field-cured samples, either 75 percent of the intended minimum compressive design strength or sufficient strength to support the loads imposed during steel erection.

1926.752(c) Site layout. The controlling contractor shall ensure that the following is provided and maintained:

1926.752(c)(1) Adequate access roads into and through the site for the safe delivery and movement of derricks, cranes, trucks, other necessary equipment, and the material to be erected and means and methods for pedestrian and vehicular control. Exception: this requirement does not apply to roads outside of the construction site.

1926.752(c)(2) A firm, properly graded, drained area, readily accessible to the work with adequate space for the safe storage of materials and the safe operation of the erector's equipment.

1926.752(d) Pre-planning of overhead hoisting operations. All hoisting operations in steel erection shall be pre-planned to ensure that the requirements of § 1926.753(d) are met.

1926.752(e) Site-specific erection plan. Where employers elect, due to conditions specific to the site, to develop alternate means and methods that provide employee protection in accordance with § 1926.753(c)(5), § 1926.757(a)(4) or § 1926.757(e)(4), a site-specific erection plan shall be developed by a qualified person and be available at the work site. Guidelines for establishing a site-specific erection plan are contained in Appendix A to this subpart.

1926.753 Hoisting and Rigging

1926.753(a) All the provisions of § 1926.550 apply to hoisting and rigging with the exception of § 1926.550(g)(2).

1926.753(b) In addition, paragraphs (c) through (e) of this section apply regarding the hazards associated with hoisting and rigging.

1926.753(c) General.

1926.753(c)(1) Pre-shift visual inspection of cranes.

1926.753(c)(1)(i) Cranes being used in steel erection activities shall be visually inspected prior to each shift by a competent person; the inspection shall include observation for deficiencies during operation. At a minimum this inspection shall include the following:

1926.753(c)(1)(i)(A) All control mechanisms for maladjustments;

1926.753(c)(1)(i)(B) Control and drive mechanism for excessive wear of components and contamination by lubricants, water or other foreign matter;

1926.753(c)(1)(i)(C) Safety devices, including but not limited to boom angle indicators, boom stops, boom kick out devices, anti-two block devices, and load moment indicators where required;

1926.753(c)(1)(i)(D) Air, hydraulic, and other pressurized lines for deterioration or leakage, particularly those which flex in normal operation;

1926.753(c)(1)(i)(E) Hooks and latches for deformation, chemical damage, cracks, or wear;

1926.753(c)(1)(i)(F) Wire rope reeving for compliance with hoisting equipment manufacturer's specifications;

1926.753(c)(1)(i)(G) Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, or moisture accumulation;

1926.753(c)(1)(i)(H) Hydraulic system for proper fluid level;

1926.753(c)(1)(i)(I) Tires for proper inflation and condition;

1926.753(c)(1)(i)(J) Ground conditions around the hoisting equipment for proper support, including ground settling under and around outriggers, ground water accumulation, or similar conditions;

1926.753(c)(1)(i)(K) The hoisting equipment for level position; and

1926.753(c)(1)(i)(L) The hoisting equipment for level position after each move and setup.

1926.753(c)(1)(ii) If any deficiency is identified, an immediate determination shall be made by the competent person as to whether the deficiency constitutes a hazard.

1926.753(c)(1)(iii) If the deficiency is determined to constitute a hazard, the hoisting equipment shall be removed from service until the deficiency has been corrected.

1926.753(c)(1)(iv) The operator shall be responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator shall have the authority to stop and refuse to handle loads until safety has been assured.

1926.753(c)(2) A qualified rigger (a rigger who is also a qualified person) shall inspect the rigging prior to each shift in accordance with § 1926.251.

1926.753(c)(3) The headache ball, hook or load shall not be used to transport personnel except as provided in paragraph (c)(4) of this section.

1926.753(c)(4) Cranes or derricks may be used to hoist employees on a personnel platform when work under this subpart is being conducted, provided that all provisions of § 1926.550 (except for § 1926.550(g)(2)) are met.

1926.753(c)(5) Safety latches on hooks shall not be deactivated or made inoperable except:

1926.753(c)(5)(i) When a qualified rigger has determined that the hoisting and placing of purlins and single joists can be performed more safely by doing so; or

1926.753(c)(5)(ii) When equivalent protection is provided in a site-specific erection plan.

1926.753(d) Working under loads.

1926.753(d)(1) Routes for suspended loads shall be pre-planned to ensure that no employee is required to work directly below a suspended load except for:

1926.753(d)(1)(i) Employees engaged in the initial connection of the steel; or

1926.753(d)(1)(ii) Employees necessary for the hooking or unhooking of the load.

1926.753(d)(2) When working under suspended loads, the following criteria shall be met:

1926.753(d)(2)(i) Materials being hoisted shall be rigged to prevent unintentional displacement;

1926.753(d)(2)(ii) Hooks with self-closing safety latches or their equivalent shall be used to prevent components from slipping out of the hook; and

1926.753(d)(2)(iii) All loads shall be rigged by a qualified rigger

1926.753(e) Multiple lift rigging procedure.

1926.753(e)(1) A multiple lift shall only be performed if the following criteria are met:

1926.753(e)(1)(i) A multiple lift rigging assembly is used;

1926.753(e)(1)(ii) A maximum of five members are hoisted per lift;

1926.753(e)(1)(iii) Only beams and similar structural members are lifted; and

1926.753(e)(1)(iv) All employees engaged in the multiple lift have been trained in these procedures in accordance with § 1926.761(c)(1).

1926.753(e)(1)(v) No crane is permitted to be used for a multiple lift where such use is contrary to the manufacturer's specifications and limitations.

1926.753(e)(2) Components of the multiple lift rigging assembly shall be specifically designed and assembled with a maximum capacity for total assembly and for each individual attachment point. This capacity, certified by the manufacturer or a qualified rigger, shall be based on the manufacturer's specifications with a 5 to 1 safety factor for all components.

1926.753(e)(3) The total load shall not exceed:

1926.753(e)(3)(i) The rated capacity of the hoisting equipment specified in the hoisting equipment load charts;

1926.753(e)(3)(ii) The rigging capacity specified in the rigging rating chart.

1926.753(e)(4) The multiple lift rigging assembly shall be rigged with members:

1926.753(e)(4)(i) Attached at their center of gravity and maintained reasonably level;

1926.753(e)(4)(ii) Rigged from top down; and

1926.753(e)(4)(iii) Rigged at least 7 feet (2.1 m) apart.

1926.753(e)(5) The members on the multiple lift rigging assembly shall be set from the bottom up.

1926.753(e)(6) Controlled load lowering shall be used whenever the load is over the connectors.

1926.754 Structural Steel Assyembly

1926.754(a) Structural stability shall be maintained at all times during the erection process.

1926.754(b) The following additional requirements shall apply for multi-story structures:

1926.754(b)(1) The permanent floors shall be installed as the erection of structural members progresses, and there shall be not more than eight stories between the erection floor and the upper-most permanent floor, except where the structural integrity is maintained as a result of the design.

1926.754(b)(2) At no time shall there be more than four floors or 48 feet (14.6 m), whichever is less, of unfinished bolting or welding above the foundation or uppermost permanently secured floor, except where the structural integrity is maintained as a result of the design.

1926.754(b)(3) A fully planked or decked floor or nets shall be maintained within two stories or 30 feet (9.1 m), whichever is less, directly under any erection work being performed.

1926.754(c) Walking/working surfaces.

1926.754(c)(1) Shear connectors and other similar devices.

1926.754(c)(1)(i) Tripping hazards. Shear connectors (such as headed steel studs, steel bars or steel lugs), reinforcing bars, deformed anchors or threaded studs shall not be attached to the top flanges of beams, joists or beam attachments so that they project vertically from or horizontally across the top flange of the member until after the metal decking, or other walking/working surface, has been installed.

1926.754(c)(1)(ii) Installation of shear connectors on composite floors, roofs and bridge decks. When shear connectors are used in construction of composite floors, roofs and bridge decks, employees shall lay out and install the shear connectors after the metal decking has been installed, using the metal decking as a working platform. Shear connectors shall not be installed from within a controlled decking zone (CDZ), as specified in § 1926.760(c)(8).

1926.754(c)(2) **Slip resistance of metal decking**. [Reserved]

1926.754(c)(3) Slip resistance of skeletal structural steel. Workers shall not be permitted to walk the top surface of any structural steel member installed after July 18, 2006 that has been coated with paint or similar material unless documentation or certification that the coating has achieved a minimum average slip resistance of .50 when measured with an English XL tribometer or equivalent tester on a wetted surface at a testing laboratory is provided. Such documentation or certification shall be based on the appropriate ASTM standard test method conducted by a laboratory capable of performing the test. The results shall be available at the site and to the steel erector. (Appendix B to this subpart references appropriate ASTM standard test methods that may be used to comply with this paragraph (c)(3)).

1926.754(d) Plumbing-up.

1926.754(d)(1) When deemed necessary by a competent person, plumbing-up equipment shall be installed in conjunction with the steel erection process to ensure the stability of the structure.

1926.754(d)(2) When used, plumbing-up equipment shall be in place and properly installed before the structure is loaded with construction material such as loads of joists, bundles of decking or bundles of bridging.

1926.754(d)(3) Plumbing-up equipment shall be removed only with the approval of a competent person.

1926.754(e) Metal decking.

1926.754(e)(1) Hoisting, landing and placing of metal decking bundles.

1926.754(e)(1)(i) Bundle packaging and strapping shall not be used for hoisting unless specifically designed for that purpose.

1926.754(e)(1)(ii) If loose items such as dunnage, flashing, or other materials are placed on the top of metal decking bundles to be hoisted, such items shall be secured to the bundles.

1926.754(e)(1)(iii) Bundles of metal decking on joists shall be landed in accordance with § 1926.757(e)(4).

1926.754(e)(1)(iv) Metal decking bundles shall be landed on framing members so that enough support is provided to allow the bundles to be unbanded without dislodging the bundles from the supports.

1926.754(e)(1)(v) At the end of the shift or when environmental or jobsite conditions require, metal decking shall be secured against displacement.

1926.754(e)(2) Roof and floor holes and openings. Metal decking at roof and floor holes and openings shall be installed as follows:

1926.754(e)(2)(i) Framed metal deck openings shall have structural members turned down to allow continuous deck installation except where not allowed by structural design constraints or constructibility.

1926.754(e)(2)(ii) Roof and floor holes and openings shall be decked over. Where large size, configuration or other structural design does not allow openings to be decked over (such as elevator shafts, stair wells, etc.) employees shall be protected in accordance with § 1926.760(a)(1).

1926.754(e)(2)(iii) Metal decking holes and openings shall not be cut until immediately prior to being permanently filled with the equipment or structure needed or intended to fulfill its specific use and which meets the strength requirements of paragraph (e)(3) of this section, or shall be immediately covered.

1926.754(e)(3) Covering roof and floor openings.

1926.754(e)(3)(i) Covers for roof and floor openings shall be capable of supporting, without failure, twice the weight of the employees, equipment and materials that may be imposed on the cover at any one time.

1926.754(e)(3)(ii) All covers shall be secured when installed to prevent accidental displacement by the wind, equipment or employees.

1926.754(e)(3)(iii) All covers shall be painted with high-visibility paint or shall be marked with the word "HOLE" or "COVER" to provide warning of the hazard.

1926.754(e)(3)(iv) Smoke dome or skylight fixtures that have been installed, are not considered covers for the purpose of this section unless they meet the strength requirements of paragraph (e)(3)(i) of this section.

1926.754(e)(4) Decking gaps around columns. Wire mesh, exterior plywood, or equivalent, shall be installed around columns where planks or metal decking do not fit tightly. The materials used must be of sufficient strength to provide fall protection for personnel and prevent objects from falling through.

1926.754(e)(5) Installation of metal decking.

1926.754(e)(5)(i) Except as provided in § 1926.760(c), metal decking shall be laid tightly and immediately secured upon placement to prevent accidental movement or displacement.

1926.754(e)(5)(ii) During initial placement, metal decking panels shall be placed to ensure full support by structural members.

1926.754(e)(6) Derrick floors.

1926.754(e)(6)(i) A derrick floor shall be fully decked and/or planked and the steel member connections completed to support the intended floor loading.

1926.754(e)(6)(ii) Temporary loads placed on a derrick floor shall be distributed over the underlying support members so as to prevent local overloading of the deck material.

1926.755 Column Anchorage

1926.755(a) General requirements for erection stability.

1926.755(a)(1) All columns shall be anchored by a minimum of 4 anchor rods (anchor bolts).

1926.755(a)(2) Each column anchor rod (anchor bolt) assembly, including the column-to-base plate weld and the column foundation, shall be designed to resist a minimum

eccentric gravity load of 300 pounds (136.2 kg) located 18 inches (.46m) from the extreme outer face of the column in each direction at the top of the column shaft.

1926.755(a)(3) Columns shall be set on level finished floors, pre-grouted leveling plates, leveling nuts, or shim packs which are adequate to transfer the construction loads.

1926.755(a)(4) All columns shall be evaluated by a competent person to determine whether guying or bracing is needed; if guying or bracing is needed, it shall be installed.

1926.755(b) Repair, replacement or field modification of anchor rods (anchor bolts).

1926.755(b)(1) Anchor rods (anchor bolts) shall not be repaired, replaced or field-modified without the approval of the project structural engineer of record.

1926.755(b)(2) Prior to the erection of a column, the controlling contractor shall provide written notification to the steel erector if there has been any repair, replacement or modification of the anchor rods (anchor bolts) of that column.

1926.756 Beams & Columns

1926.756(a) General.

1926.756(a)(1) During the final placing of solid web structural members, the load shall not be released from the hoisting line until the members are secured with at least two bolts per connection, of the same size and strength as shown in the erection drawings, drawn up wrench-tight or the equivalent as specified by the project structural engineer of record, except as specified in paragraph (b) of this section.

1926.756(a)(2) A competent person shall determine if more than two bolts are necessary to ensure the stability of cantilevered members; if additional bolts are needed, they shall be installed.

1926.756(b) Diagonal bracing. Solid web structural members used as diagonal bracing shall be secured by at least one bolt per connection drawn up wrench-tight or the equivalent as specified by the project structural engineer of record.

1926.756(c)(1) Double connections at columns and/or at beam webs over a column. When two structural members on opposite sides of a column web, or a beam web over a column, are connected sharing common connection holes, at least one bolt with its wrench-tight nut shall remain connected to the first member unless a shop-attached or field-attached seat or equivalent connection device is supplied with the member to secure the first member and prevent the column from being displaced (See Appendix H to this subpart for examples of equivalent connection devices).

1926.756(c)(2) If a seat or equivalent device is used, the seat (or device) shall be designed to support the load during the double connection process. It shall be adequately

bolted or welded to both a supporting member and the first member before the nuts on the shared bolts are removed to make the double connection.

1926.756(d) Column splices. Each column splice shall be designed to resist a minimum eccentric gravity load of 300 pounds (136.2 kg) located 18 inches (.46 m) from the extreme outer face of the column in each direction at the top of the column shaft.

1926.756(e) Perimeter columns. Perimeter columns shall not be erected unless:

1926.756(e)(1) The perimeter columns extend a minimum of 48 inches (1.2 m) above the finished floor to permit installation of perimeter safety cables prior to erection of the next tier, except where constructibility does not allow (see Appendix F to this subpart);

1926.756(e)(2) The perimeter columns have holes or other devices in or attached to perimeter columns at 42-45 inches (107-114 cm) above the finished floor and the midpoint between the finished floor and the top cable to permit installation of perimeter safety cables required by § 1926.760(a)(2), except where constructibility does not allow. (See Appendix F to this subpart).

1926.758 Systems- Engineered Metal Buildings

1926.758(a) All of the requirements of this subpart apply to the erection of systems-engineered metal buildings except §§ 1926.755 (column anchorage) and 1926.757 (open web steel joists).

1926.758(b) Each structural column shall be anchored by a minimum of four anchor rods (anchor bolts).

1926.758(c) Rigid frames shall have 50 percent of their bolts or the number of bolts specified by the manufacturer (whichever is greater) installed and tightened on both sides of the web adjacent to each flange before the hoisting equipment is released.

1926.758(d) Construction loads shall not be placed on any structural steel framework unless such framework is safely bolted, welded or otherwise adequately secured.

1926.758(e) In girt and eave strut-to-frame connections, when girts or eave struts share common connection holes, at least one bolt with its wrench-tight nut shall remain connected to the first member unless a manufacturer-supplied, field-attached seat or similar connection device is present to secure the first member so that the girt or eave strut is always secured against displacement.

1926.758(f) Both ends of all steel joists or cold-formed joists shall be fully bolted and/or welded to the support structure before:

1926.758(f)(1) Releasing the hoisting cables;

1926.758(f)(2) Allowing an employee on the joists; or

1926.758(f)(3) Allowing any construction loads on the joists.

1926.758(g) Purlins and girts shall not be used as an anchorage point for a fall arrest system unless written approval is obtained from a qualified person.

1926.758(h) Purlins may only be used as a walking/working surface when installing safety systems, after all permanent bridging has been installed and fall protection is provided.

1926.758(i) Construction loads may be placed only within a zone that is within 8 feet (2.5 m) of the center-line of the primary support member.

1926.759 falling Object Protection.

1926.759(a) Securing loose items aloft. All materials, equipment, and tools, which are not in use while aloft, shall be secured against accidental displacement.

1926.759(b) Protection from falling objects other than materials being hoisted. The controlling contractor shall bar other construction processes below steel erection unless overhead protection for the employees below is provided.

1926.760 falling Object Protection.

1926.760(a) General requirements.

1926.760(a)(1) Except as provided by paragraph (a)(3) of this section, each employee engaged in a steel erection activity who is on a walking/working surface with an unprotected side or edge more than 15 feet (4.6 m) above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.

1926.760(a)(2) Perimeter safety cables. On multi-story structures, perimeter safety cables shall be installed at the final interior and exterior perimeters of the floors as soon as the metal decking has been installed.

1926.760(a)(3) Connectors and employees working in controlled decking zones shall be protected from fall hazards as provided in paragraphs (b) and (c) of this section, respectively.

1926.760(b) Connectors. Each connector shall:

1926.760(b)(1) Be protected in accordance with paragraph (a)(1) of this section from fall hazards of more than two stories or 30 feet (9.1 m) above a lower level, whichever is less;

1926.760(b)(2) Have completed connector training in accordance with § 1926.761; and

1926.760(b)(3) Be provided, at heights over 15 and up to 30 feet above a lower level, with a personal fall arrest system, positioning device system or fall restraint system and wear the equipment necessary to be able to be tied off; or be provided with other means of protection from fall hazards in accordance with paragraph (a)(1) of this section.

1926.760(c) Controlled Decking Zone (CDZ). A controlled decking zone may be established in that area of the structure over 15 and up to 30 feet above a lower level where metal decking is initially being installed and forms the leading edge of a work area. In each CDZ, the following shall apply:

1926.760(c)(1) Each employee working at the leading edge in a CDZ shall be protected from fall hazards of more than two stories or 30 feet (9.1 m), whichever is less.

1926.760(c)(2) Access to a CDZ shall be limited to only those employees engaged in leading edge work.

1926.760(c)(3) The boundaries of a CDZ shall be designated and clearly marked. The CDZ shall not be more than 90 feet (27.4 m) wide and 90 (27.4 m) feet deep from any leading edge. The CDZ shall be marked by the use of control lines or the equivalent. Examples of acceptable procedures for demarcating CDZ's can be found in Appendix D to this subpart.

1926.760(c)(4) Each employee working in a CDZ shall have completed CDZ training in accordance with § 1926.761.

1926.760(c)(5) Unsecured decking in a CDZ shall not exceed 3,000 square feet (914.4 m^2).

1926.760(c)(6) Safety deck attachments shall be performed in the CDZ from the leading edge back to the control line and shall have at least two attachments for each metal decking panel.

1926.760(c)(7) Final deck attachments and installation of shear connectors shall not be performed in the CDZ.

1926.760(d) Criteria for fall protection equipment.

1926.760(d)(1) Guardrail systems, safety net systems, personal fall arrest systems, positioning device systems and their components shall conform to the criteria in § 1926.502 (see Appendix G to this subpart).

1926.760(d)(2) Fall arrest system components shall be used in fall restraint systems and shall conform to the criteria in § 1926.502 (see Appendix G). Either body belts or body harnesses shall be used in fall restraint systems.

1926.760(d)(3) Perimeter safety cables shall meet the criteria for guardrail systems in § 1926.502 (see Appendix G).

1926.760(e) Custody of fall protection. Fall protection provided by the steel erector shall remain in the area where steel erection activity has been completed, to be used by other trades, only if the controlling contractor or its authorized representative:

1926.760(e)(1) Has directed the steel erector to leave the fall protection in place; and

1926.760(e)(2) Has inspected and accepted control and responsibility of the fall protection prior to authorizing persons other than steel erectors to work in the area.

1926.761 Training.

1926.761(a) Training personnel. Training required by this section shall be provided by a qualified person(s).

1926.761(b) Fall hazard training. The employer shall provide a training program for all employees exposed to fall hazards. The program shall include training and instruction in the following areas:

1926.761(b)(1) The recognition and identification of fall hazards in the work area;

1926.761(b)(2) The use and operation of guardrail systems (including perimeter safety cable systems), personal fall arrest systems, positioning device systems, fall restraint systems, safety net systems, and other protection to be used;

1926.761(b)(3) The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used;

1926.761(b)(4) The procedures to be followed to prevent falls to lower levels and through or into holes and openings in walking/working surfaces and walls; and

1926.761(b)(5) The fall protection requirements of this subpart.

1926.761(c) Special training programs. In addition to the training required in paragraphs (a) and (b) of this section, the employer shall provide special training to employees engaged in the following activities.

1926.761(c)(1) Multiple lift rigging procedure. The employer shall ensure that each employee who performs multiple lift rigging has been provided training in the following areas:

1926.761(c)(1)(i) The nature of the hazards associated with multiple lifts; and

1926.761(c)(1)(ii) The proper procedures and equipment to perform multiple lifts required by § 1926.753(e).

1926.761(c)(2) Connector procedures. The employer shall ensure that each connector has been provided training in the following areas:

1926.761(c)(2)(i) The nature of the hazards associated with connecting; and

1926.761(c)(2)(ii) The establishment, access, proper connecting techniques and work practices required by § 1926.756(c) and § 1926.760(b).

1926.761(c)(3) Controlled Decking Zone Procedures. Where CDZs are being used, the employer shall assure that each employee has been provided training in the following areas:

1926.761(c)(3)(i) The nature of the hazards associated with work within a controlled decking zone; and

1926.761(c)(3)(ii) The establishment, access, proper installation techniques and work practices required by § 1926.760(c) and § 1926.754(e).

Appendix A to Subpart R -- Guidelines for Establishing the Components of a Site-specific Erection Plan: Non-mandatory Guidelines for Complying with § 1926.752(e).

(a) General. This appendix serves as a guideline to assist employers who elect to develop a site-specific erection plan in accordance with § 1926.752(e) with alternate means and methods to provide employee protection in accordance with § 1926.752(e), § 1926.753(c)(5), § 1926.757(a)(4) and § 1926.757(e)(4).

(b) Development of a site-specific erection plan. Preconstruction conference(s) and site inspection(s) are held between the erector and the controlling contractor, and others such as the project engineer and fabricator before the start of steel erection. The purpose of such conference(s) is to develop and review the site-specific erection plan that will meet the requirements of this section.

(c) Components of a site-specific erection plan. In developing a site-specific erection plan, a steel erector considers the following elements:

(c)(1) The sequence of erection activity, developed in coordination with the controlling contractor, that includes the following:

(c)(1)(i) Material deliveries:

(c)(1)(ii) Material staging and storage; and

(c)(1)(iii) Coordination with other trades and construction activities.

(c)(2) A description of the crane and derrick selection and placement procedures, including the following:

(c)(2)(i) Site preparation;

(c)(2)(ii) Path for overhead loads; and

(c)(2)(iii) Critical lifts, including rigging supplies and equipment.

(c)(3) A description of steel erection activities and procedures, including the following:

(c)(3)(i) Stability considerations requiring temporary bracing and guying;

(c)(3)(ii) Erection bridging terminus point;

(c)(3)(iii) Anchor rod (anchor bolt) notifications regarding repair, replacement and modifications;

(c)(3)(iv) Columns and beams (including joists and purlins);

(c)(3)(v) Connections;

(c)(3)(vi) Decking; and

(c)(3)(vii) Ornamental and miscellaneous iron.

(c)(4) A description of the fall protection procedures that will be used to comply with § 1926.760.

(c)(5) A description of the procedures that will be used to comply with § 1926.759.

(c)(6) A description of the special procedures required for hazardous non-routine tasks.

(c)(7) A certification for each employee who has received training for performing steel erection operations as required by § 1926.761.

(c)(8) A list of the qualified and competent persons.

(c)(9) A description of the procedures that will be utilized in the event of rescue or emergency response.

(d) Other plan information. The plan:

(d)(1) Includes the identification of the site and project; and

(d)(2) Is signed and dated by the qualified person(s) responsible for its preparation and modification.

Appendix B to Subpart R -- Acceptable Test Methods for Testing Slip-Resistance of Walking/Working Surfaces (§ 1926.754(c)(3)). Non-Mandatory Guidelines for Complying With § 1926.754(c)(3).

The following references provide acceptable test methods for complying with the requirements of § 1926.754(c)(3).

- Standard Test Method for Using a Portable Inclineable Articulated Strut Slip Tester (PIAST)(ASTM F1677-96)
- Standard Test Method for Using a Variable Incidence Tribometer (VIT)(ASTM F1679-96)

Appendix D to Subpart R -- Illustration of the Use of Control Lines to Demarcate Controlled Decking Zones (CDZs): Non-mandatory Guidelines for Complying with § 1926.760(c)(3)

(1) When used to control access to areas where leading edge and initial securement of metal deck and other operations connected with leading edge work are taking place, the controlled decking zone (CDZ) is defined by a control line or by any other means that restricts access.

(1)(i) A control line for a CDZ is erected not less than 6 feet (1.8 m) nor more than 90 feet (27.4 m) from the leading edge.

(1)(ii) Control lines extend along the entire length of the unprotected or leading edge and are approximately parallel to the unprotected or leading edge.

(1)(iii) Control lines are connected on each side to a guardrail system, wall, stanchion or other suitable anchorage.

(2) Control lines consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:

(2)(i) Each line is rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1.0 m) from the walking/working surface and its highest point is not more than 45 inches (1.3 m) from the walking/working surface.

(2)(ii) Each line has a minimum breaking strength of 200 pounds (90.8 kg).

Appendix E to Subpart R -- Training: Non-mandatory Guidelines for Complying with § 1926.761

The training requirements of § 1926.761 will be deemed to have been met if employees have completed a training course on steel erection, including instruction in the provisions of this standard, that has been approved by the U.S. Department of Labor Bureau of Apprenticeship.

Appendix F to Subpart R -- Perimeter Columns: Non-Mandatory Guidelines for Complying with § 1926.756(e) To Protect the Unprotected Side or Edge of a Walking/Working Surface

In multi-story structures, when holes in the column web are used for perimeter safety cables, the column splice must be placed sufficiently high so as not to interfere with any attachments to the column necessary for the column splice. Column splices are recommended to be placed at every other or fourth levels as design allows. Column splices at third levels are detrimental to the erection process and should be avoided if possible.

Appendix G to Subpart R -- § 1926.502 (b)-(e) Fall Protection Systems Criteria and Practices

(b) "Guardrail systems." Guardrail systems and their use shall comply with the following provisions:

(b)(1) Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches (1.1 m) plus or minus 3 inches (8 cm) above the walking/working level. When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of this paragraph (§ 1926.502(b)).

Note: When employees are using stilts, the top edge height of the top rail, or equivalent member, shall be increased an amount equal to the height of the stilts.

(b)(2) Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches (53 cm) high.

(b)(2)(i) Midrails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.

(b)(2)(ii) Screens and mesh, when used, shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.

(b)(2)(iii) Intermediate members (such as balusters), when used between posts, shall be not more than 19 inches (48 cm) apart.

(b)(2)(iv) Other structural members (such as additional midrails and architectural panels) shall be installed such that there are no openings in the guardrail system that are more than 19 inches (.5 m) wide.

(b)(3) Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied within 2 inches (5.1 cm) of the top edge, in any outward or

downward direction, at any point along the top edge.

(b)(4) When the 200 pound (890 N) test load specified in paragraph (b)(3) of this section (§ 1926.502) is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches (1.0 m) above the walking/working level. Guardrail system components selected and constructed in accordance with the appendix B to subpart M of this part will be deemed to meet this requirement.

(b)(5) Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding, without failure, a force of at least 150 pounds (666 N) applied in any downward or outward direction at any point along the midrail or other member.

(b)(6) Guardrail systems shall be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

(b)(7) The ends of all top rails and midrails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.

(b)(8) Steel banding and plastic banding shall not be used as top rails or midrails.

(b)(9) Top rails and midrails shall be at least one-quarter inch (0.6 cm) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it shall be flagged at not more than 6-foot intervals with high-visibility material.

(b)(10) When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section shall be placed across the access opening between guardrail sections when hoisting operations are not taking place.

(b)(11) When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.

(b)(12) When guardrail systems are used around holes used for the passage of materials, the hole shall have not more than two sides provided with removable guardrail sections to allow the passage of materials. When the hole is not in use, it shall be closed over with a cover, or a guardrail system shall be provided along all unprotected sides or edges.

(b)(13) When guardrail systems are used around holes which are used as points of access (such as ladderways), they shall be provided with a gate, or be so offset that a person cannot walk directly into the hole.

(b)(14) Guardrail systems used on ramps and runways shall be erected along each unprotected side or edge.

(b)(15) Manila, plastic or synthetic rope being used for top rails or midrails shall be inspected as frequently as necessary to ensure that it continues to meet the strength

requirements of paragraph (b)(3) of this section (§ 1926.502).

(c) Safety net systems. Safety net systems and their use shall comply with the following provisions:

(c)(1) Safety nets shall be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 feet (9.1 m) below such level. When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed.

(c)(2) Safety nets shall extend outward from the outermost projection of the work surface as follows:

Vertical distance from working level to horizontal plane of net	Minimum required horizontal distance of outer edge of net from the edge of the working surface
Up to 5 feet	8 feet
More than 5 feet up to 10 feet	10 feet
More than 10 feet	13 feet

(c)(3) Safety nets shall be installed with sufficient clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the drop test specified in paragraph (4) of this section [§ 1926.502].

(c)(4) Safety nets and their installations shall be capable of absorbing an impact force equal to that produced by the drop test specified in paragraph (c)(4)(i) of this section [§ 1926.502].

(c)(4)(i) Except as provided in paragraph (c)(4)(ii) of this section (§ 1926.502), safety nets and safety net installations shall be drop-tested at the jobsite after initial installation and before being used as a fall protection system, whenever relocated, after major repair, and at 6-month intervals if left in one place. The drop-test shall consist of a 400 pound (180 kg) bag of sand 30+ or -2 inches (76+ or -5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level.

(c)(4)(ii) When the employer can demonstrate that it is unreasonable to perform the drop-test required by paragraph (c)(4)(i) of this section (§ 1926.502), the employer (or a designated competent person) shall certify that the net and net installation is in compliance with the provisions of paragraphs (c)(3) and (c)(4)(i) of this section (§ 1926.502) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with paragraph (c)(3) of this section (§ 1926.502) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the jobsite for

inspection.

(c)(5) Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration. Defective components shall be removed from service. Safety nets shall also be inspected after any occurrence which could affect the integrity of the safety net system.

(c)(6) Materials, scrap pieces, equipment, and tools which have fallen into the safety net shall be removed as soon as possible from the net and at least before the next work shift.

(c)(7) The maximum size of each safety net mesh opening shall not exceed 36 square inches (230 cm) nor be longer than 6 inches (15 cm) on any side, and the opening, measured center-to-center of mesh ropes or webbing, shall not be longer than 6 inches (15 cm). All mesh crossings shall be secured to prevent enlargement of the mesh opening.

(c)(8) Each safety net (or section of it) shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2 kN).

(c)(9) Connections between safety net panels shall be as strong as integral net components and shall be spaced not more than 6 inches (15 cm) apart.

(d) "Personal fall arrest systems." Personal fall arrest systems and their use shall comply with the provisions set forth below. Effective January 1, 1998, body belts are not acceptable as part of a personal fall arrest system.

Note: The use of a body belt in a positioning device system is acceptable and is regulated under paragraph (e) of this section (§ 1926.502).

(d)(1) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(d)(2) Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

(d)(3) Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds (22.2 kN).

(d)(4) Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(d)(5) Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. Effective January 1, 1998, only locking type snaphooks shall be used.

(d)(6) Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

(d)(6)(i) directly to webbing, rope or wire rope;

(d)(6)(ii) to each other;

(d)(6)(iii) to a dee-ring to which another snaphook or other connector is attached;

(d)(6)(iv) to a horizontal lifeline; or

(d)(6)(v) to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

(d)(7) On suspended scaffolds or similar work platforms with horizontal lifelines which may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline.

(d)(8) Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two.

(d)(9) Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds (22.2 kN).

(d)(10)(i) Except as provided in paragraph (d)(10)(ii) of this section [§ 1926.502], when vertical lifelines are used, each employee shall be attached to a separate lifeline.

(d)(10)(ii) During the construction of elevator shafts, two employees may be attached to the same lifeline in the hoistway, provided both employees are working atop a false car that is equipped with guardrails; the strength of the lifeline is 10,000 pounds [5,000 pounds per employee attached] (44.4 kN); and all other criteria specified in this paragraph for lifelines have been met.

(d)(11) Lifelines shall be protected against being cut or abraded.

(d)(12) Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(d)(13) Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(d)(14) Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.

(d)(15) Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (22.2 kN) per employee attached, or shall be designed, installed, and used as follows:

(d)(15)(i) as part of a complete personal fall arrest system which maintains a safety factor of at least two; and

(d)(15)(ii) under the supervision of a qualified person.

(d)(16) Personal fall arrest systems, when stopping a fall, shall:

(d)(16)(i) limit maximum arresting force on an employee to 900 pounds (4 kN) when used with a body belt;

(d)(16)(ii) limit maximum arresting force on an employee to 1,800 pounds (8 kN) when used with a body harness;

(d)(16)(iii) be rigged such that an employee can neither free fall more than 6 feet (1.8 m), nor contact any lower level;

(d)(16)(iv) bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 m); and,

(d)(16)(v) have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 m), or the free fall distance permitted by the system, whichever is less.

Note: If the personal fall arrest system meets the criteria and protocols contained in Appendix C to subpart M, and if the system is being used by an employee having a combined person and tool weight of less than 310 pounds (140 kg), the system will be considered to be in compliance with the provisions of paragraph (d)(16) of this section [§ 1926.502]. If the system is used by an employee having a combined tool and body weight of 310 pounds (140 kg) or more, then the employer must appropriately modify the criteria and protocols of the Appendix to provide proper protection for such heavier weights, or the system will not be deemed to be in compliance with the requirements of paragraph (d)(16) of this section (§ 1926.502).

(d)(17) The attachment point of the body belt shall be located in the center of the wearer's back. The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.

(d)(18) Body belts, harnesses, and components shall be used only for employee protection

(as part of a personal fall arrest system or positioning device system) and not to hoist materials.

(d)(19) Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.

(d)(20) The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves.

(d)(21) Personal fall arrest systems shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service.

(d)(22) Body belts shall be at least one and five-eighths ($1^{5/8}$) inches (4.1 cm) wide.

(d)(23) Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists except as specified in other subparts of this Part.

(d)(24) When a personal fall arrest system is used at hoist areas, it shall be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

(e) Positioning device systems. Positioning device systems and their use shall conform to the following provisions:

(e)(1) Positioning devices shall be rigged such that an employee cannot free fall more than 2 feet (.9 m).

(e)(2) Positioning devices shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kN), whichever is greater.

(e)(3) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(e)(4) Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of this system.

(e)(5) Connecting assemblies shall have a minimum tensile strength of 5,000 pounds (22.2 kN)

(e)(6) Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(e)(7) Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and

used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. As of January 1, 1998, only locking type snaphooks shall be used.

(e)(8) Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

(e)(8)(i) directly to webbing, rope or wire rope;

(e)(8)(ii) to each other;

(e)(8)(iii) to a dee-ring to which another snaphook or other connector is attached;

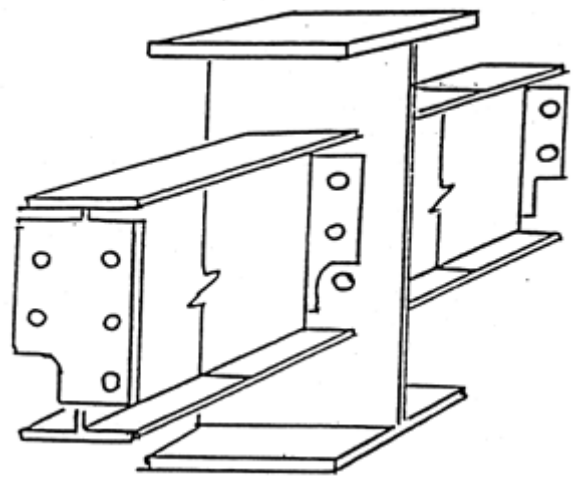
(e)(8)(iv) to a horizontal lifeline; or to depress the snaphook keeper and release itself.

(e)(8)(v) to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

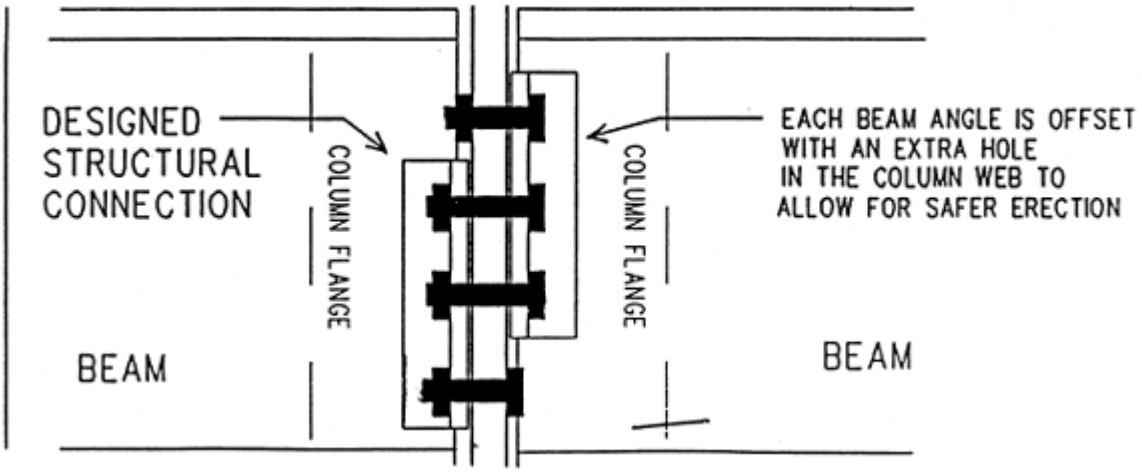
(e)(9) Positioning device systems shall be inspected prior to each use for wear, damage, and other deterioration, and defective components shall be removed from service.

(e)(10) Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

Appendix H to Subpart R -- Double Connections: Illustration of a Clipped End Connection and a Staggered Connection: Non-Mandatory Guidelines for Complying with §1926.756(c)(1).



Clipped end connections are connection material on the end of a structural member which has a notch at the bottom and/or top to allow the bolt(s) of the first member placed on the opposite side of the central member to remain in place. The notch(es) fits around the nut or bolt head of the opposing member to allow the second member to be bolted up without removing the bolt(s) holding the first member.



Staggered connections are connection material on a structural member in which all of the bolt holes in the common member web are not shared by the two incoming members in the final connection. The extra hole in the column web allows the erector to maintain at least a one bolt connection at all times while making the double connection.