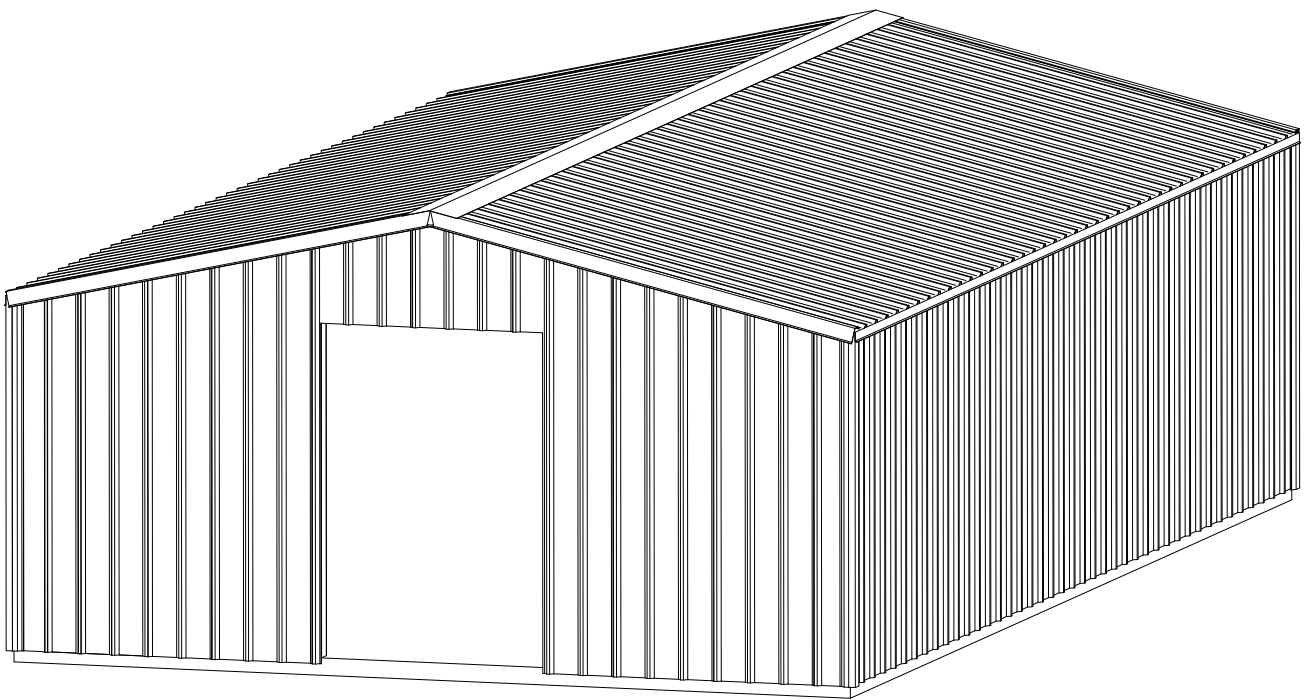




# **Instruction Manual for Installing Cold Formed Steel Buildings**

## **Gable Buildings**



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## **Gable Buildings**

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## Proper Use of Manual

**Before beginning construction of the building, read the following notifications and notices to understand how this manual is to be used.**

This manual is a reference source, with information on how to construct a typical Cold Formed Steel Buildin. It is not a set of specific instructions for your building. There are no specific measurements or comprehensive component lists in this manual. For specific measurements and components for your building, please see the engineering plans.

**Please be aware of the following:**

- This manual is to be used for reference only, and the information contained in it is not specific to your building.
- For information specific to your building, please consult the engineering plans.
- This manual must be used in conjunction with the engineering plans.
- All measurements are to be taken from the accompanying plans and specifications.
- The engineer's plans override any information in this manual.
- This is not a work safety manual, so it is of utmost importance to follow all safety recommendations of OSHA (Occupational Safety and Health Administration).

**Note:**

- Please adhere to all local building department requirements.
- Do not work on the building in damp conditions and do not walk on roof sheeting in damp or frosty conditions.
- If you are employing a tradesman to erect your building for you, check with the governing authority to see if he needs to be licensed. Also verify that all insurances for both the tradesman and his employees are current.

**This manual is to be read in conjunction with:**

### **1. Engineering plans**

The engineering plans contain the foundation plan, all elevations and all connection details specific to your building. The primary purpose of the engineering plans is for obtaining permits for your building. All installation and construction requirements on the engineering plan must followed to ensure that the building complies with all applicable building codes.

### **2. Construction Package**

The construction package is for reference only, and meant to supplement the engineering plans. It provides more detailed information on where components of your building are to be installed. For example, there will be anchor bolt layouts, sheeting layouts, girt layouts,



and more. All markings on the construction package will correspond with the Usage and Piece Marks columns on the supplied building order.

### **3. Building order**

The building order is a list of all ordered components of the building. Please consult the building order as soon as possible after delivery to ensure all necessary components have been received and to ensure the timely replacement of missing parts.



## Description of Engineering Plans

The engineering plans consist of the following sections:

### 1. Foundation plan

Typically located on sheet 1 of the engineering plans and labeled as 1/1, this displays the foundation of the building and many components in relation to the foundation. Items indicated on the plan include doors and windows (which can be referenced from the above Door and Window Schedule), sidewall/endwall columns and x-bracing.

### 2. Sidewall exterior elevations

Typically located on sheet 1, with the front elevation labeled as 2/1 and the back elevation labeled as 3/1, these display the view of the sidewalls as shown from the outside of the building. Items indicated on the elevations include wall girts, roof purlins, x-bracing and vertical bracing.

### 3. Endwall interior elevations

Typically located on sheet 1, with the left interior elevation labeled as view 5/1 and the right interior elevation labeled as 4/1, these display the view of the endwalls as shown from the interior of the building. Items indicated on the elevations include wall girts, roof purlins, columns, rafters, endwall columns, x-bracing and flybracing.

### 4. Mezzanine plan (if applicable)

Because this doesn't exist on every building, its location on the Engineering plans is variable from building to building. This plan shows the layout of the mezzanine. Items indicated on the plan are mezzanine joists, mezzanine girders and columns.

### 5. Connection details

These details are typically shown on sheet 2. They consist of all the connections necessary for the construction of the building and are referenced from the plans and elevations on sheet 1.

### 6. Slab detail

Typically located on sheet 2, this shows the construction of the building foundation slab.

### 7. Member and material schedule

Typically located on sheet 2, this lists materials and members used in the construction of the building. It is referenced throughout the Engineering Plans, as well as this manual.

### 8. General structural notes

These are general engineering notes, listing various requirements for the construction of the building.



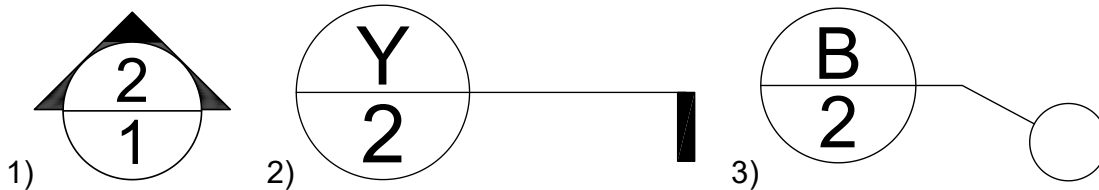
### 9. Interior cross section at frame (if applicable)

This section view, typically located on sheet 2, gives a cross section of the building at the typical portal frame and displays the construction and layout of the columns, rafters and knee and apex braces, among other things.

### 10. Section and detail callouts

Various views and details are referenced on the engineering plans through section and detail callouts. Below, you can see 3 of the most typical. Note that typically the top number is the detail or view number while the bottom number is the sheet number.

- 1) **Elevation callout.** Located on the foundation plan these callouts reference an elevation that is from the perspective of the position of the callout in the direction of the arrow. The 2 over 1 means that the callout is referencing view 2 on sheet 1.
- 2) **Cross section callout.** This references a cross section through the section line protruding from the callout. The detail will display this cross section in the direction the flag points. This specific callout references detail Y on sheet 2.
- 3) **Detail callout.** This callout references a detail elsewhere on the plans which gives a more detailed view of the area referenced. This callout specific references detail B on sheet 2.





## **Construction of Building**

### **General Construction Notes**

- 1. It is recommended that as much assembly of building components is completed while the components are on the ground as opposed to in the air. An example of this would be measuring and coping knee braces before columns are installed, or installing all necessary clips or brackets to a column before raising and installing the column.**
- 2. Before drilling holes in concrete, ensure that location to drill is 100% correct. If incorrect, building construction may need to be delayed**
- 3. The exact makeup of a bolt assembly can vary by building. Note that although washers are illustrated as part of a bolt assembly, the bolts supplied may instead have a flanged head and nut (washer/head or washer/nut combined). For exact makeup of the bolt assembly, please refer to the building order.**
- 4. When installing trim, keep in mind how water will run. Trim should be installed so water will not flow into the building during normal flow.**
- 5. Framing tek screws have various diameters and lengths. Make sure that when installing framing tek screws, correct screw size, type and number per connection are used, per the engineering drawings and building order. If you have been provided with screws of various length and self drilling tip size, the correct use of screws should be listed on the building order. If not, longer screws that can drill through more material should be saved for those connections that require drilling through a significant amount of steel.**
- 6. When installing all screws that include rubber washers, such as wall and roof screws, care must be taken to tighten these screws the proper amount. If screws are tightened too much or too little, they will not seal properly. Screws should be tightened so that washer has been compressed, but not to such a degree that the washer becomes deformed. If washer becomes deformed, a screw with a fresh washer will need to be re-installed.**
- 7. Depending on the manufacture location and manufacturers capabilities some connections in the construction may be either screwed or bolted. The engineering plans will specify the required method.**





## Step 1 – Building Set-up

Before beginning construction of your building, please complete the following.

### 1. “Check-in” building immediately after receiving shipment from supplier.

Immediately after receiving your steel delivery from supplier, unpack and make sure that all parts have arrived as specified on the building order, which should be provided by your building seller. Note that the building order lists materials from all vendors. Please check delivery against the appropriate vendor section of the building order. If order is not as it should be, please contact building seller immediately. If there is a mistake on the order, supplier will correct order only if notified within 7 days of delivery. If customer fails to check-in building and notify building seller within these 7 days, any extra costs incurred will be the responsibility of the customer.

After “checking in” your building, you may need to store your materials for a length of time before beginning construction. When your steel arrives, it is important to do the following:

- Store the steel so there is adequate airflow over it while it is waiting to be used in the construction.
- Any water that finds its way onto the steel should be removed and the steel dried as soon as possible.

Failing to do this can result in the first stages of corrosion commonly referred to as storage stain. Note that the above tips are not the only storage precautions that you may need to take. Please consult all manufacturer’s storage instructions. If you are concerned about your storage situation you should contact the building seller or supplier and discuss this with them.

### 2. Assemble necessary tools.

To construct your building, ACT recommends that you acquire the following tools:

- Sharpie markers
- Carpenters pencil
- Pencils and paper
- Tape measures
- Chalk line with extra chalk
- String line
- 4’ level
- Builders square or angle square
- Safety glasses
- Right-cutting and left-cutting sheet metal snips
- 3/4” or larger hammer drill w/ SDS-compatible chuck
- 1/2” and 5/8” Powers “wedge-bits” drill bits
- Impact wrench
- (4) 6” C-clamp vice grips
- Spud wrench or bull pin
- Tek screw gun



- Electric drill
- Nibbler or Sawzall
- Angle grinder
- Circular saw or chop saw with necessary steel cutting blades
- Multigrips or pliers
- Rivet gun
- 10-lb sledge hammer
- Caulking gun
- Silicone caulking
- Air puffer
- 1/4" and 5/16" magnetic hex nut drivers
- 1/2," 5/8," 3/4," and 15/16" bolt sockets
- Utility knife
- Two-sided tape
- Wrenches
- Ropes
- (2) 8'-12' step ladders
- (1) 22'-28' extension ladder
- Power and extension cords
- Electric shears
- Material lift

The following tools are optional, but are recommended for ease of installation:

- Fork lift
- Scaffolding
- Scissor lift
- Boom lift
- Crane with a minimum 70' boom reach (professional contractors only)

Note that other tools may speed the process of building installation. The above tools are merely the minimum needed to install your building. If you have any questions regarding tools, such as recommended brands, please contact your building seller.

### **3. Check that the building foundation complies with engineering plans.**

If your building uses a foundation slab, then ensure:

- a) The slab is level.
- b) The slab is diagonally square. (See Glossary.)
- c) The slab is the exact size as your building will be.

If your building uses pier footings, ensure piers are of correct depth, square and clear of any loose soil.

### **4. Clean and clear slab.**

Completely clean slab, making sure it is clear of all dirt and/or debris as well as any other obstructions.



### **5. Set out the location of all columns and all anchor bolts.**

First, set chalk lines on both the sidewall and the endwall of the building. Note that this chalk line will be set in from the edge of the slab the size of the wall girts. Thus, if you have 4" sidewall girts, the chalk line on the sidewall will be set in 4 inches. Note that the size of the sidewall and endwall girts can be different. Please check the engineering plans for specific size of sidewall and endwall girts.

Also, chalk out the center line of your bays. Bay spacing is found on the engineering plans.

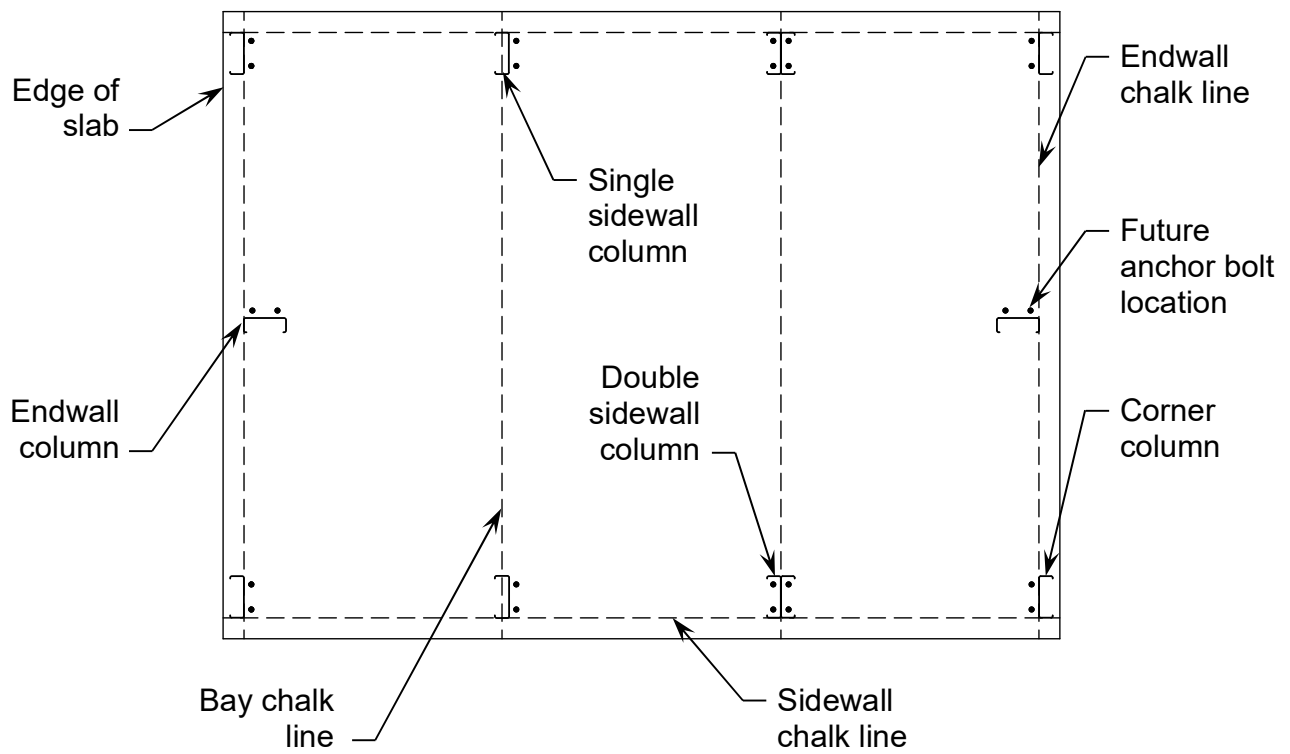
After chalking lines on slab, mark out the locations of your columns. Note that the edge of the single- and double-sidewall columns are set on the edge of the sidewall chalk line, and these columns are centered on the bay chalk lines. The same is true of the endwall columns being set on the edge of the endwall chalk line. Note, however, that the corner columns are set in off the sidewall, with the edge of the column lining up to the edge of the sidewall chalk line. They also may be set in off the endwall, as the back of the corner column will line up with the back of the endwall girt chalk line. When the endwall girts are 6" or larger, the corner column will be set in from the edge of the slab. This is illustrated on the following page.

Note that the corner columns will always consist of a single column. Your interior sidewall columns will either be all single columns or all double columns. This is not illustrated on the following page, and both single and double columns are shown to illustrate both instances.

Note that it is imperative that the lines are chalked. All columns must line up exactly. Using chalk lines ensures this will occur, even if slab is not completely square. However, slab must be diagonally square to ensure all columns line up correctly.

Once complete setting out the location of your columns, mark out the locations of your anchor bolts holes. The exact location of the holes will vary based on your sidewall and endwall column types. The exact location of your anchor bolts can be determined by used the Bolt Setout plan, which can be provided by your building seller. Note that bolts for a single CEE assembly will fall outside the CEE, while bolts for a double CEE assembly will be contained in the CEE.

It is imperative that the bolt locations are marked out in exactly the right location. If bolts holes are drilled in the wrong location, building construction will need to be delayed until the concrete slab is fixed.





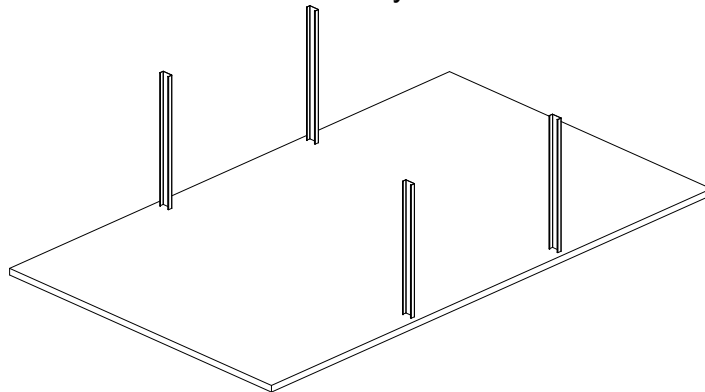
## Step 2 – Installation of Framing

Note that the following section is to be used in conjunction with Appendix B, which contains specific instructions for installing all framing components described below. For example, all specific instructions on installing haunch brackets are found in the haunch bracket installation section of Appendix B. Please refer to Appendix B as you proceed through the instructions below. For information on installing door and window framing, please refer to Appendix A.

To begin erection of the building, you should start by constructing the framing on a bay that contains x-bracing and has no window or door openings. Preferably, you should start on an interior bay. Note that the descriptions and illustrations below are for a building with single columns and rafters. Please see engineering plans for any questions on your specific building components.

### 1. Stand and anchor columns on interior bay with x-bracing.

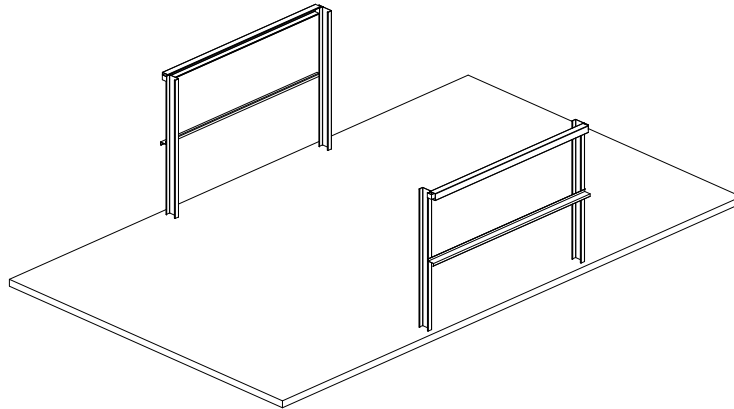
First connect the haunch brackets and any necessary mezzanine brackets to the column CEEs. Then, stand up columns and set anchor bolts in pre-drilled and cleaned holes, attaching the columns to the foundation according to locations laid out on engineering plans. Attach any needed column stiffeners to your columns at this time.



### 2. Add sidewall girts and eave purlins and temporarily brace wall bay.

Connect the columns with wall girts and eave purlins. Before securing, make sure that all columns are plumb (truly vertical). Then temporarily brace the bay to make sure the columns stay plumb. Pro Tip! Use ratchet strapping to temporarily “x-brace” the bay until final x-bracing is installed in step 5.

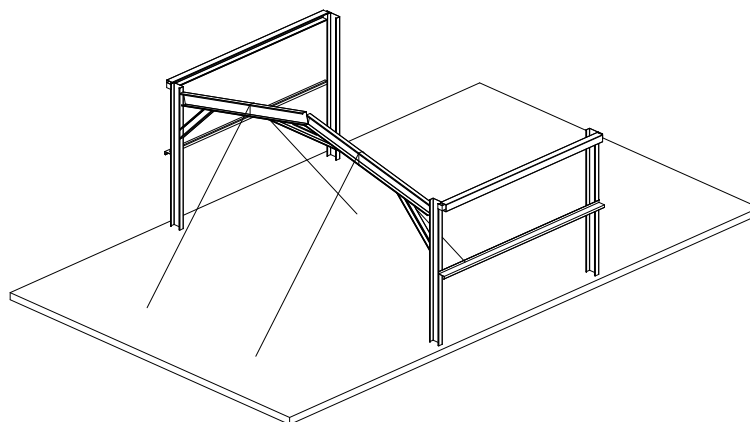
When installing girts in this first bay, ensure that the attaching flange of the girt is connected to the columns, with the attaching flange connected so it is pointing upward. Note that if LGSi sections are to be used for the wall girts, it is important that the wider flange is connected to the rafter. Each LGSi should have one flange slightly wider than the other so that girts will more easily interlock, and they must be installed in this manner. For more information, please see wall girt installation section in Appendix B. (*Illustration on next page*)



### 3. Add first rafter with apex brace.

Connect two rafter CEEs together using the apex bracket. Raise the rafter into place and connect to the columns. (See haunch connection section.) Secure connected rafter with rope so that rafter will stay plumb and level. Before tightening rafter bolts, make sure that distance from edge of rafter to edge of rafter equals the distance from the edge of column to edge of column. If this is not precise, columns will be pushed out of plumb when rafter is installed.

Install knee and apex braces as directed on the engineering plans.



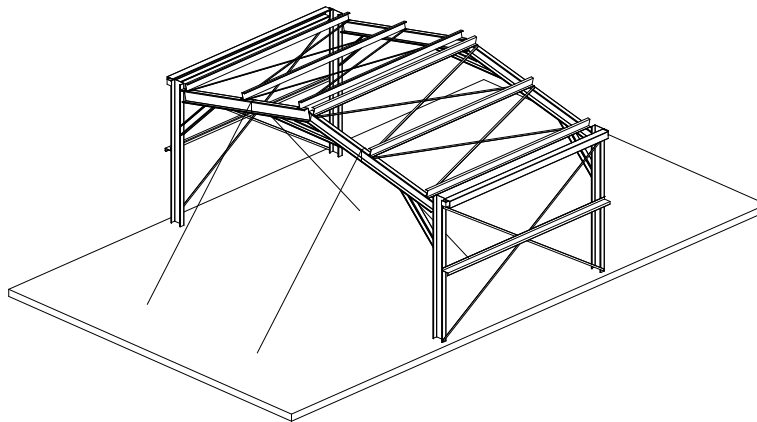
### 4. Add second rafter with apex brace and stabilize with roof purlins.

Install the second rafter. After stabilizing rafter and making sure that rafter is plumb and level, connect to first rafter using roof purlins. Install all purlins for that bay, at spacing and location specified in the engineering plans.

Ensure that the attaching flange of the purlins is connected to the rafter in this first bay with the long flange pointing downhill. If LGSI sections are being used for the purlins, note that it is important that the wider flange is connected to the rafter. LGSI sections are made to interlock for easier installation, and they must be installed in this manner. For more information, please see roof purlin installation section in Appendix B.

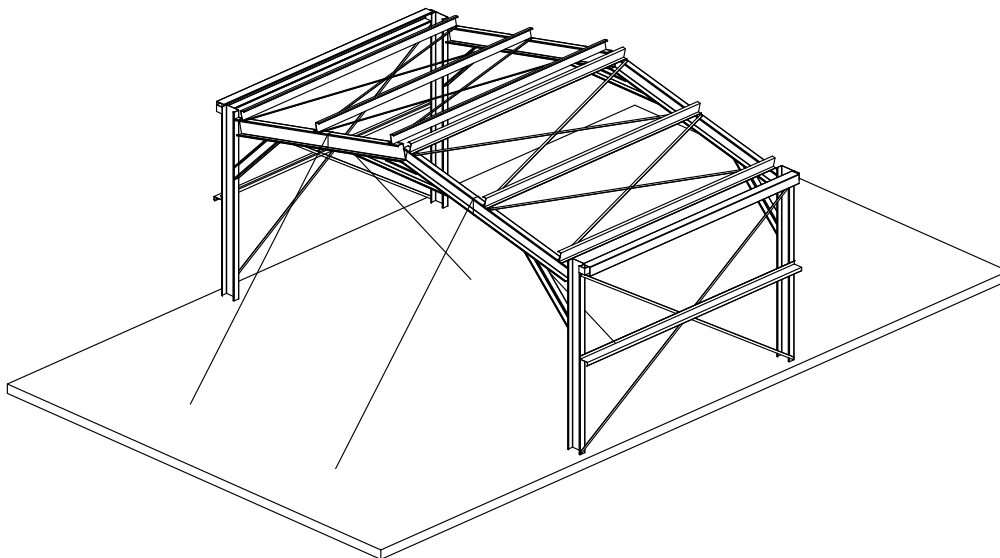


Install knee and apex braces. Exact location specified on engineering plans.



### **5. Install x-bracing.**

After ensuring all columns, rafters, girts, and purlins are level and plumb, install x-bracing per the engineering plans. Ensure that x-bracing is snug, but not overly tightened. The x-bracing must be tight enough to prevent movement, but must not be so tight as to pull the columns and rafters out of level.



### **6. Install mezzanine components in constructed bay, if applicable.**

If your building has a mezzanine, it can be installed at any point after this step in the previously constructed bays. Earlier installation can provide greater stability to your building components during construction, and will ensure building compliance with the engineering plans. Please refer to Appendix B of this manual for instructions on installing mezzanine components.



### **7. Construct the remaining interior bays and complete all framing.**

Following the instructions outlined above, install the necessary columns, rafters, mezzanine components, girts, purlins, and x-bracing for the remaining interior bays. Remember to ensure that all components are level and plumb.

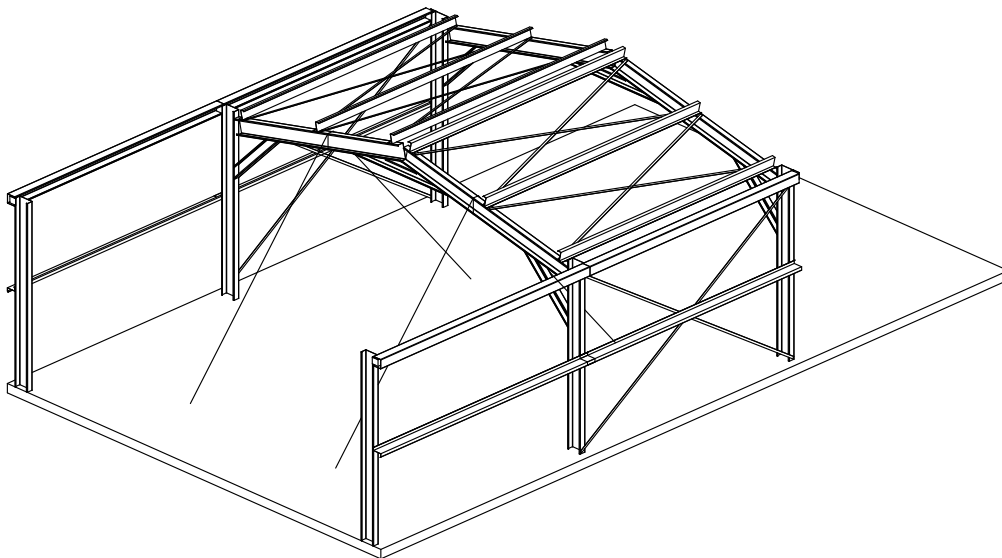
After installing all columns, rafters, girts, and purlins, install all flybracing per the engineering plans.

Note that not all bays will have all the same components. Please refer to the engineering plans for exact number and location of all components.

Also note that certain bays require door framing to be installed in place of wall girts. Please refer to the engineering plans for location. Also see Appendix A for instructions on how to install door and window framing.

### **8. Install corner columns.**

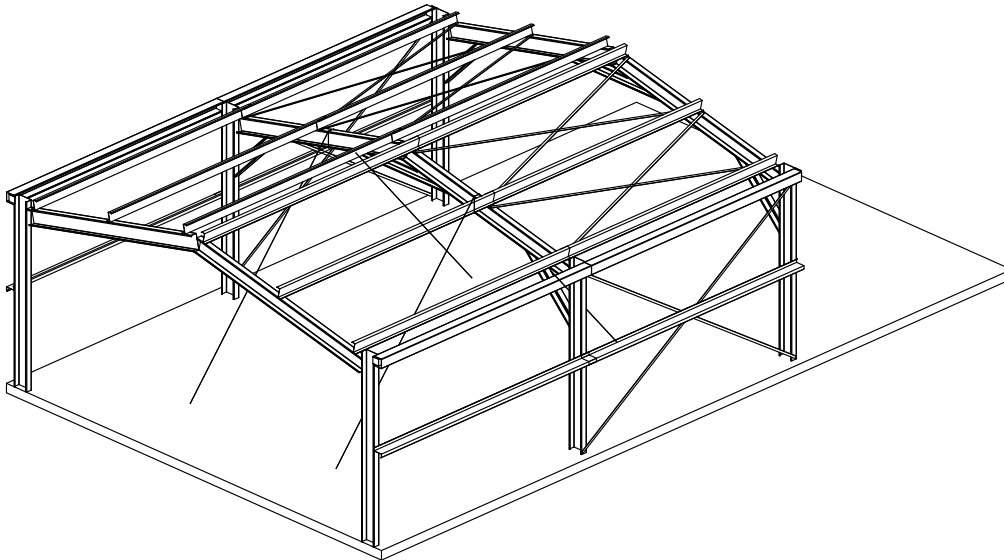
Stand up corner columns and drill and set anchor bolts. Then, after making sure columns are level and plumb, connect to sidewall column by installing eave purlins, wall girts and door framing per engineering plans.





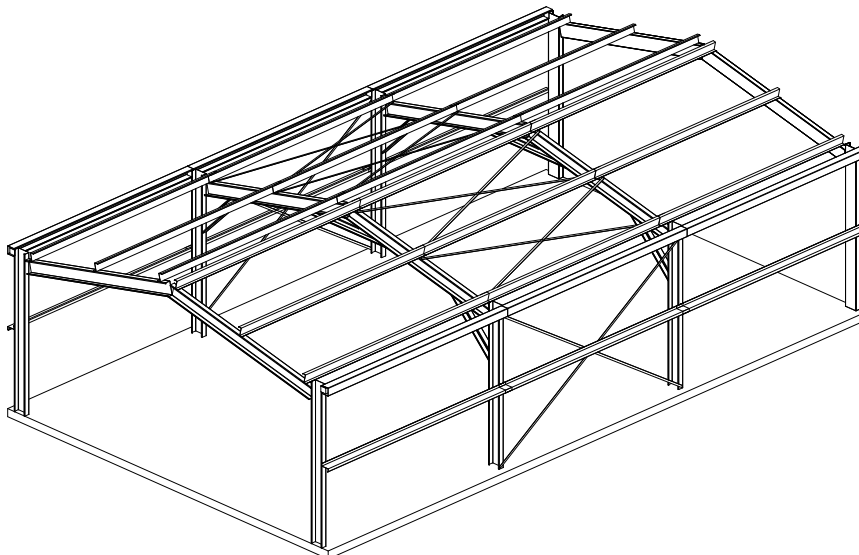
**9. Install end rafters.**

Install end rafter. After making ensuring it is level and plumb, connect to interior rafters by installing roof purlins for that bay.

**10. Install corner columns and end rafters on opposite end.**

Using the method described above (in 7 and 8), install the remaining corner columns and end rafters, ensuring that they are installed level and plumb.

You may also remove rope ties at this time.

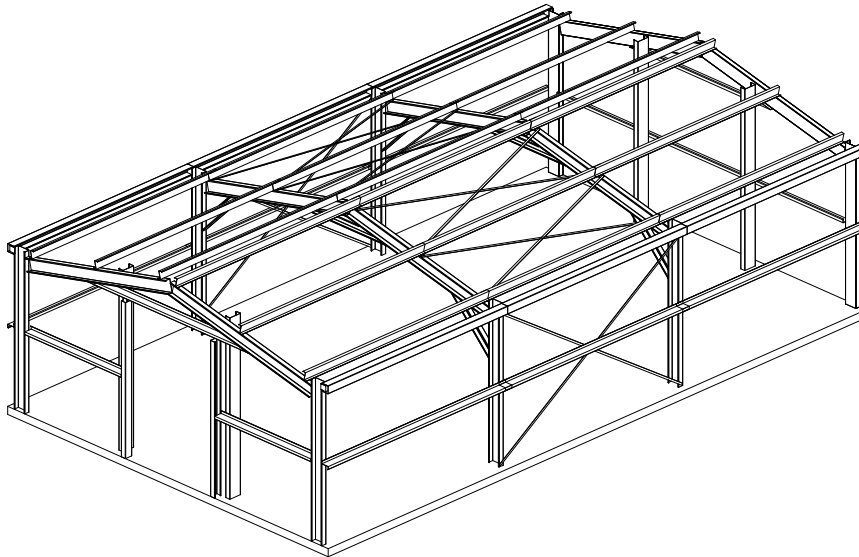


**11. Complete framing of endwalls.**

Install the endwall columns. Location and number are located on engineering plans.

Install all endwall mezzanine components, wall girts, door framing and flybracing per engineering plans.

Ensure all framing components are plumb and level.

**12. Install any base angle, corner angle and rake angle provided in building kit.**

After completing all framing, install any base angle, corner angle and rake angle that is in your building kit. For installation of base angle, corner angle and rake angle please see Appendix B.

**Alternate framing method:**

If you possess the equipment, it can be easier to construct the buildings portal frames (which consist of columns, rafters, and all applicable knee and apex braces) on the ground and tip up or raise the portal frame all at once. However, because of the weight of these members, this process often requires heavy equipment such as a fork lift or a crane. Do not attempt this without adequate equipment and without taking ample safety precautions.



### **Step 3 – Installation of Siding and Trim**

Note that the following section is to be used in conjunction with Appendix C, which contains specific instructions for installing all trim components described below. For example, all specific instructions on installing wall sheeting are found in the wall sheeting section of Appendix C. Please refer to Appendix C as you proceed through the instructions below.

Note that trim will vary greatly with each building based on the building options selected. Please see your order to ascertain what trim will be on your building. Note that this manual provides instructions for basic types of trim and siding ordered by ACT's ordering system. You may or may not have all of the components described below. If you have additional questions, please contact your building seller.

#### **1. Install windows.**

Install all windows per manufacturers' instructions.

#### **2. Install trim around doors and windows.**

Install necessary head/jamb cover, which is installed only on the overhead door jambs and header. After installing head/jamb cover, install head/jamb trim. Note that head/jamb trim is installed on all three sides of doors and all four sides of windows.

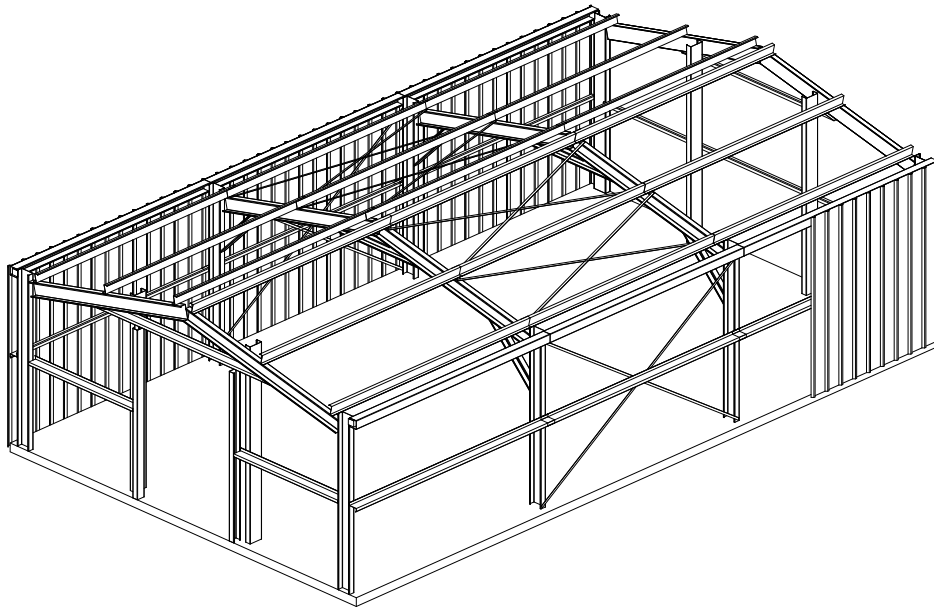
#### **3. Install base trim**

If your building kit includes base trim, install that before proceeding with installation of wall sheeting.

#### **4. Install sidewall sheeting, insulation, and closure strips.**

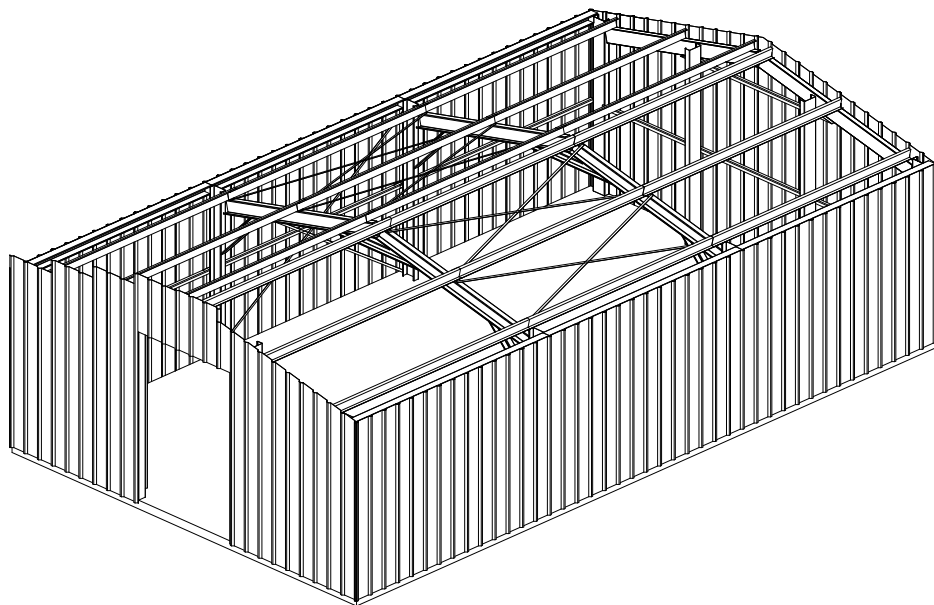
After completing any base trim, install insulation, sidewall sheets and closure strips. For instructions on this process, please see the Wall Sheeting Installation section in Appendix C. Note that the sidewall sheets should extend about 1" below the edge of the slab and extend to just below the eave purlin. Also note that the sheeting should start at the back side of the building so that when you look at the building, the sheeting laps do not stand out. Note that sheeting will have to be trimmed around doors and windows.

*(Illustration on next page)*



**5. Install endwall sheeting, insulation and closure strips.**

After sidewall sheets are installed, install endwall sheets. These are installed in the roughly same manner as sidewall sheets. However, after sheets are attached, these sheets will need to be trimmed to match the roof slope.



**6. Install corner trim.**

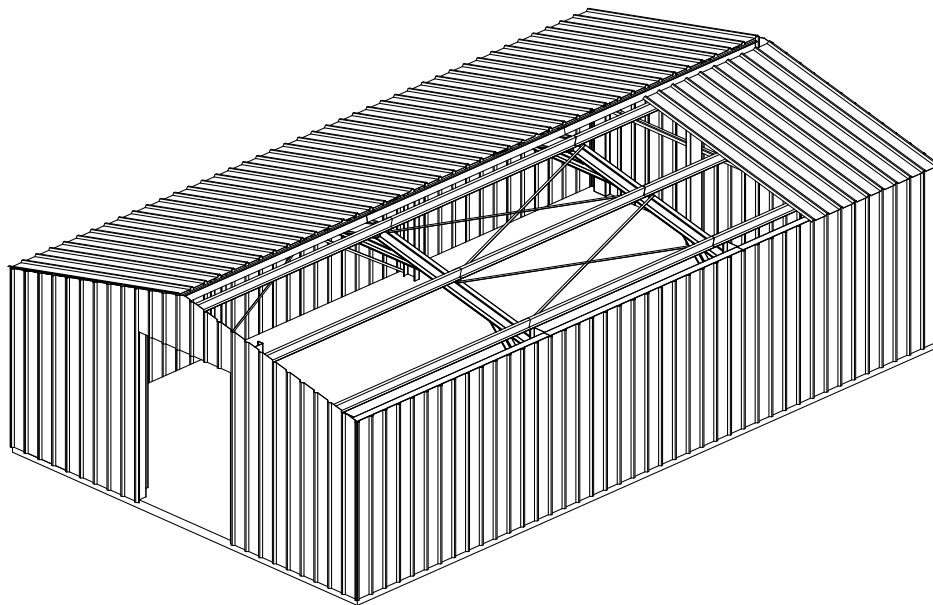
Install corner trim on all building corners after all wall sheathing is complete.

**7. Install eave trim or box gutters.**

After installing all corner trim, install eave trim or box gutters if provided in building kit.

**8. Install roof sheeting, skylights, insulation and closure strips.**

Install roof insulation, closure strips, roof sheets and skylights. It is best to roof one side of the roof and then sheet the opposite side only after the first side is entirely sheathed. Also, sheeting should start at the side opposite the direction of the prevailing winds.

**9. Install rake trim.**

Install rake trim at the tops of all endwalls.

**10. Install ridge cap and closure strips.**

Install ridge cap along the ridge of the building, installing any provided outside closure strips.

**11. Install sculptured gutters.**

After installing all other trim and sheathing, install sculptured gutters.

**12. Install gutter downspouts.**

After gutters are installed, install gutter downspouts.

**13. Install all doors.**

After installing all sheathing and trim, install all doors per manufacturers' instructions.



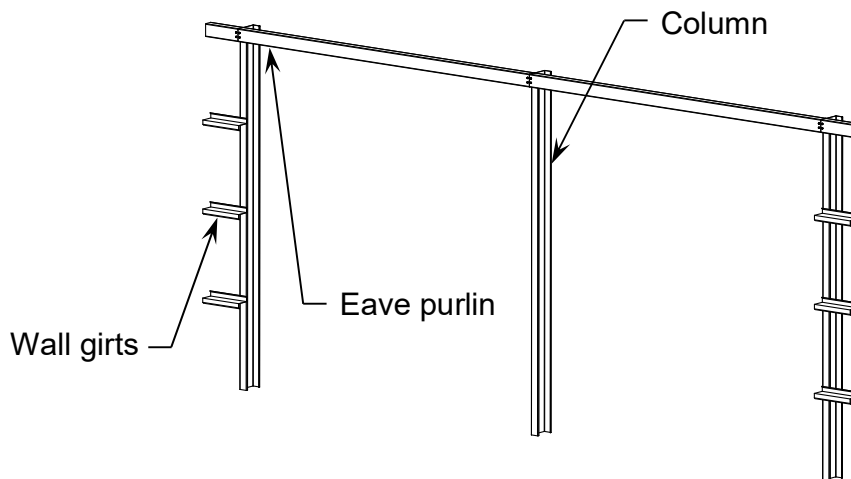
## Appendix A – Door and Window Framing

Last updated 5/6/2020

### 1. First complete all previous framing for bay.

Install all applicable columns, rafters, and/or eave purlins for the bay in which you are going to install framing. Ensure that all components are plumb and level before continuing with door framing.

Note that the illustration below depicts two sidewall bays side by side, each of which has doors. In this typical illustration, wall girts from surrounding bays are also shown. On your building, components will vary depending on bay location and whether door is being installed on the sidewall or endwall. Please see engineering plans for exact details and location of framing components.



### 2. Install header girt and bottom girt (if installing window).

If installing a door, start by installing header girt, which is simply a wall girt to which the door jamb connects. For specific instructions on installing wall girts please see Appendix B. Exact location can be found on engineering plans and the girt layout of the construction package.

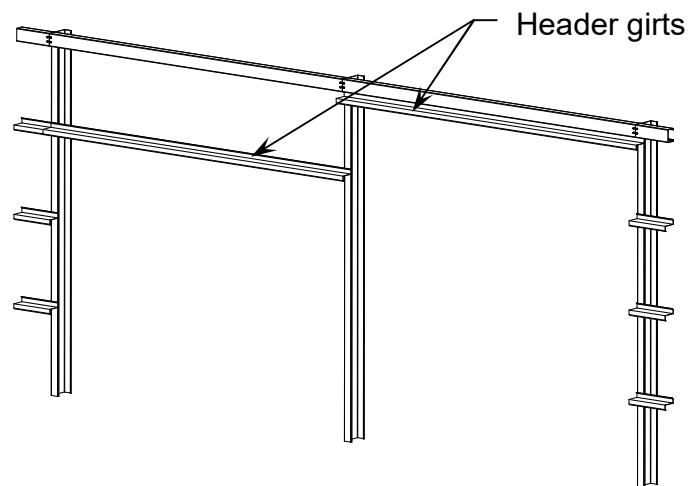
Note that in most cases, doors jambs will extend from the slab to the next wall girt above where the top of the door will be. However, per engineering plans, door jambs cannot be connected to the eave purlin. In some cases, the top of the door will be above the highest wall girt. To ensure that the door jamb does not connect to the eave purlin, an extra wall girt must be added in the bay just below the eave purlin. For a typical illustration of this, please see the illustration on the following page.

Note that some header girts are to be installed as double header girts (as specified on the door schedule, located on the engineering plans). A double header girt simply consists



of installing two interlocked LGSI or ZEE sections together where there would normally only be a single LGSI or ZEE.

If installing a window, install header girt and, if necessary, also install a bottom girt, the wall girt to which the window jamb connects on its bottom end. If two wall girts cannot span the entire bay due to window size, both header girt and bottom girt need to be installed as double girts. Also, install all wall girts that are to be installed above the header girt and below the bottom girt. For exact details on installation of wall girts, see wall girts section in Appendix B.



### 3. Install door jambs.

If door jambs are CEE sections, before installing jambs, install wall girt clips to door jamb, which will be used to install wall girts after door framing is installed. Clips are installed at same height as wall girts. Exact location of clips and wall girts can be found on engineering plans. If Channel will be used for door jambs, girt clips will not be required. The type of door jamb required for each opening will be noted on your engineering plans. See part 5 (“Install Remaining Wall Girts”) of this appendix for more information on installing girt clips if necessary.

Next, mark the location of the door jambs and the exact location of the anchor bolt. Note that the door jambs will be installed with their web side towards the opening with the flanges of the CEE or Channel pointing away from the opening.

The distance between the webs of the two jambs is the rough opening width of the door, which is found on the engineering plans. Note that the rough opening width can vary from the nominal width of the door to be installed. Please consult any instructions that come from your door manufacturer as well as the engineering plans to establish the exact opening width between door jambs. The door jamb must also be installed against the edge of the slab.

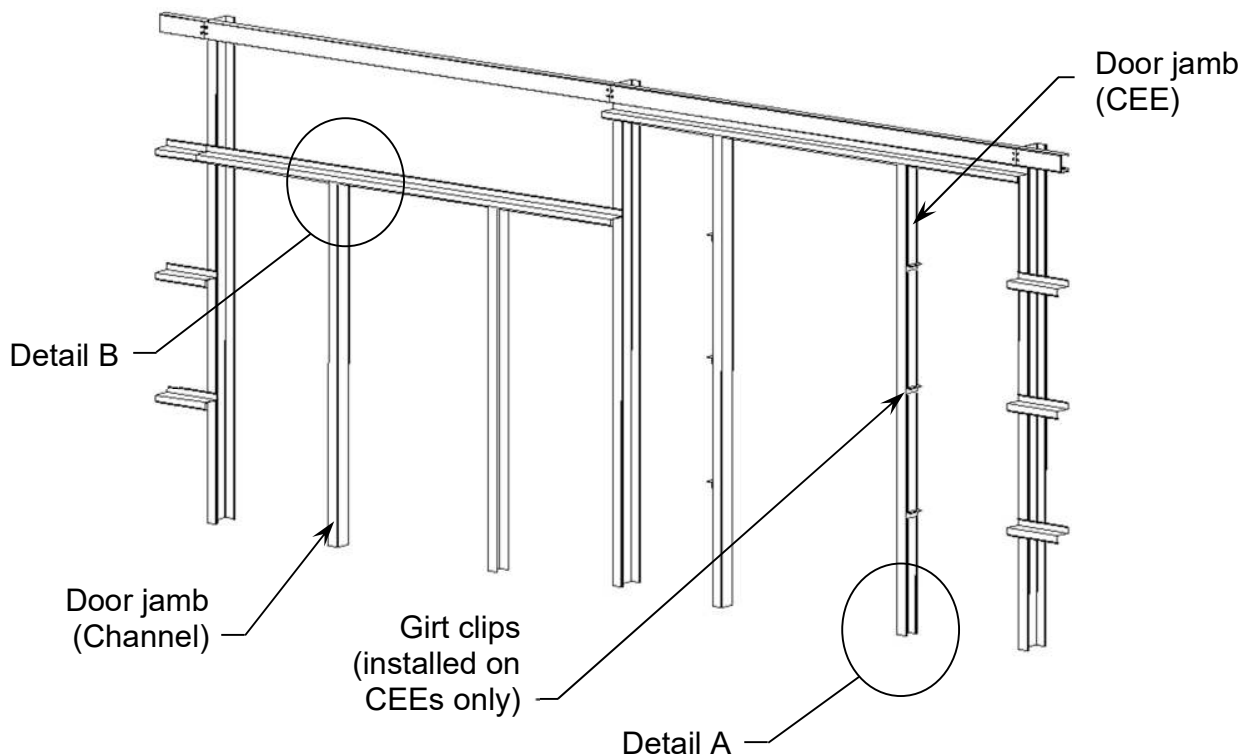


## Appendix A – 3

After exact locations are determined, drill the anchor bolt hole. Note that when installing a “wedge-bolt” anchor to secure the base of the door jamb to the slab, a hole must first be drilled through the correct sized girt clip and into the concrete. Note that you must drill the hole in the concrete with a suitable “wedge-bit” the correct size for the bolt (if unsure check with the bolt manufacturer. This bolt hole should be 1” deeper than the bolt is long so the bolt securely attaches to the slab. Before inserting the bolt, clear the hole of concrete dust by using compressed air. If no water is present in the hole, using an air puffer to clean the hole of dust will suffice.

Once the bolt hole is drilled, install the door jamb anchor clip to the slab. This must be installed before the door jamb due to size constraints. Before tightening anchor clip, ensure that it is perpendicular to the slab edge and that the upper leg of the clip is toward the opening. Then, install the door jambs, fitting the door jamb into place and connecting the installed anchor clip and the header girt. Note that the anchor clip must attach to the web of the door jamb. For detailed typical views on these connections, please see Detail A and Detail B on the following page. For exact installation details, please see the engineering plans. Before securing door jambs, ensure that both door jambs are plumb when they are installed.

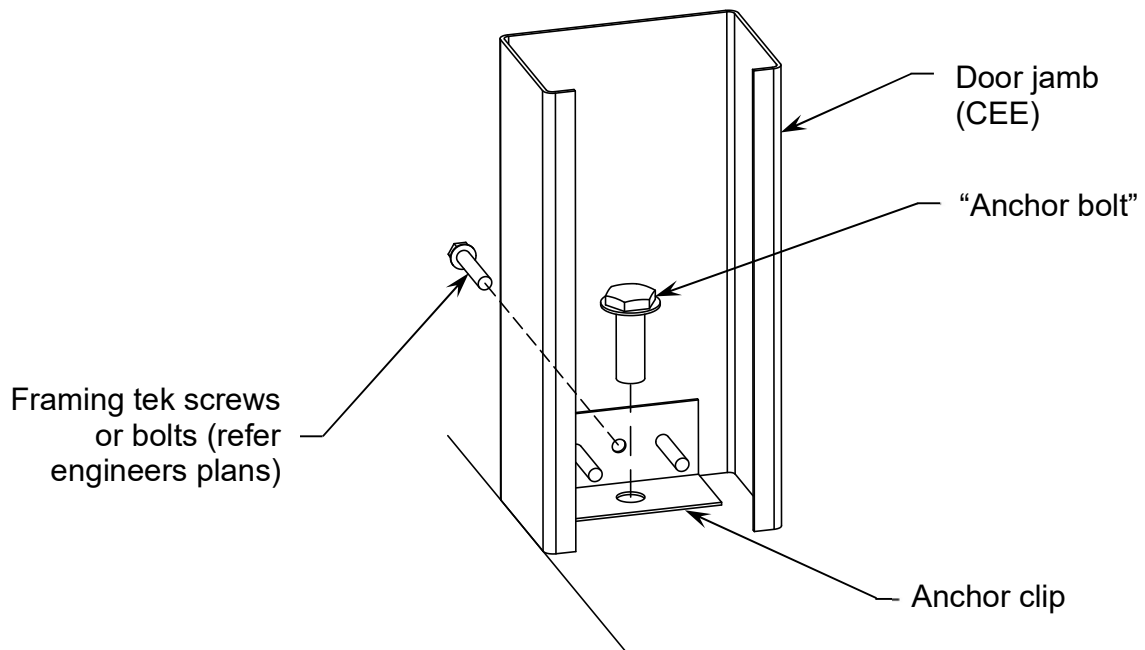
Also note that it is recommended that the stiffener lip of the header girt be bent out where the door jamb meets the header so that the door jamb is plumb. This bend is illustrated in Detail B on the following page.



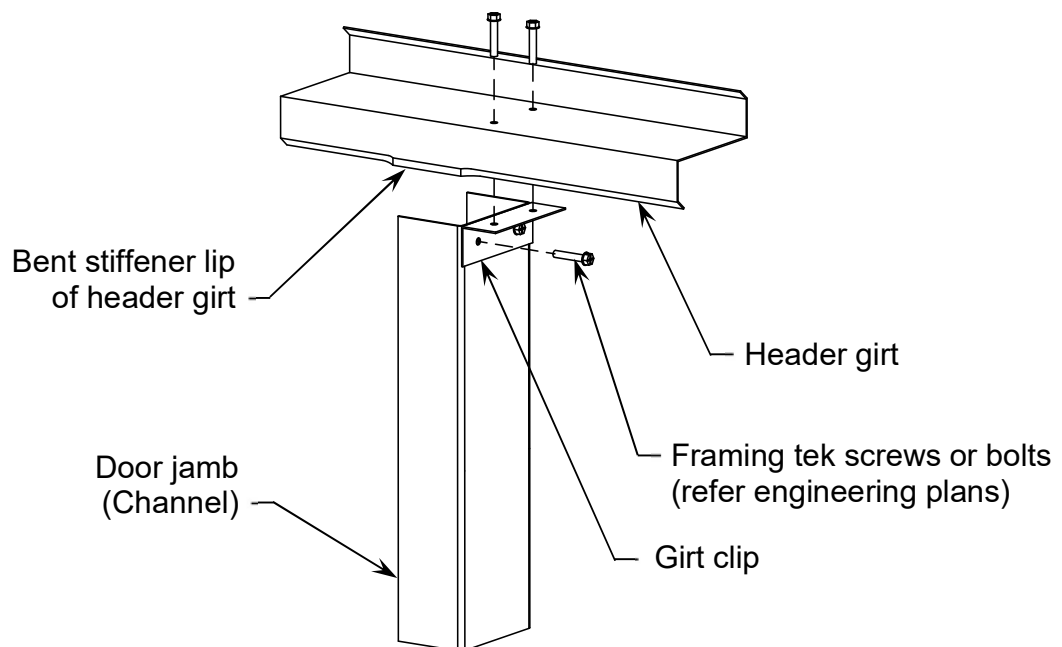




**Detail A**

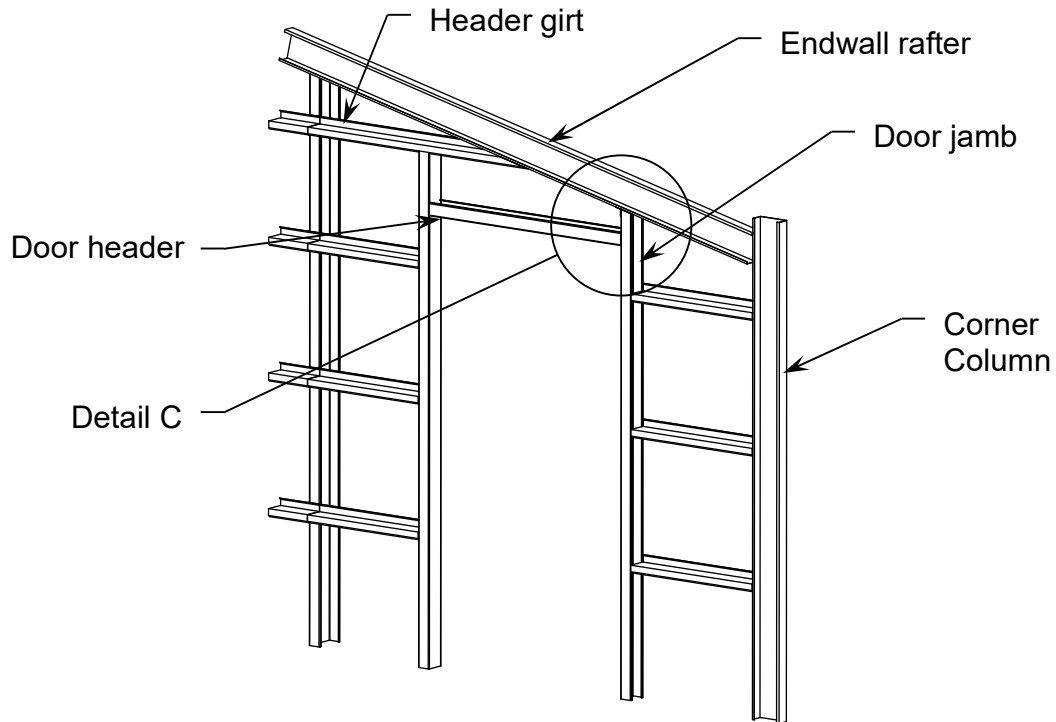


**Detail B**

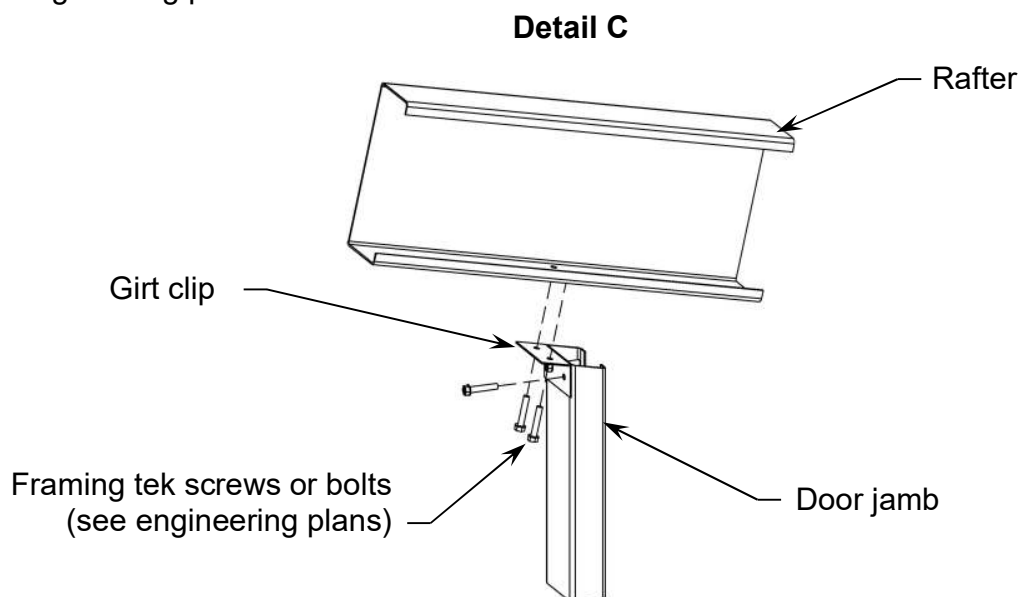




The only variation in the installation of the door jamb will occur in some instances where door framing is installed on the endwall. In some cases, the door jamb has no header girt to attach to and must attach directly to the endwall rafter. This is illustrated below.

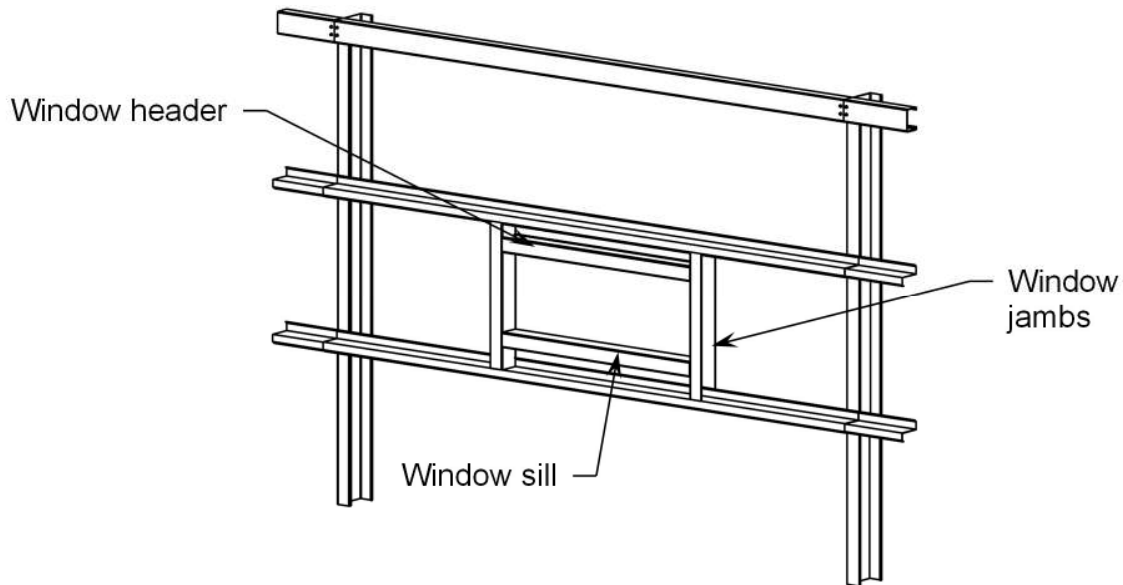


When this is the case, the door jamb will be installed as shown below in Detail C. Note that the top of the door jamb will need to be coped to fit the bottom of the rafter, and the correct sized girt clip that connects the door jamb to the rafter will need to be bent to fit as well. Note that the door jamb base will be installed as shown and described above, as per engineering plans.





When installing jambs for a window opening, the procedure is almost exactly the same. However, in some cases the jamb will extend all the way down to the slab, while in others the jamb will connect to a lower girt. The latter method is illustrated below. In this case, the jamb connects to the lower girt in the exact same method as it is connected to the header girt. This connection is shown in Detail B on page Appendix A – 4. For exact details on your door and window jambs, please see the engineering plans.



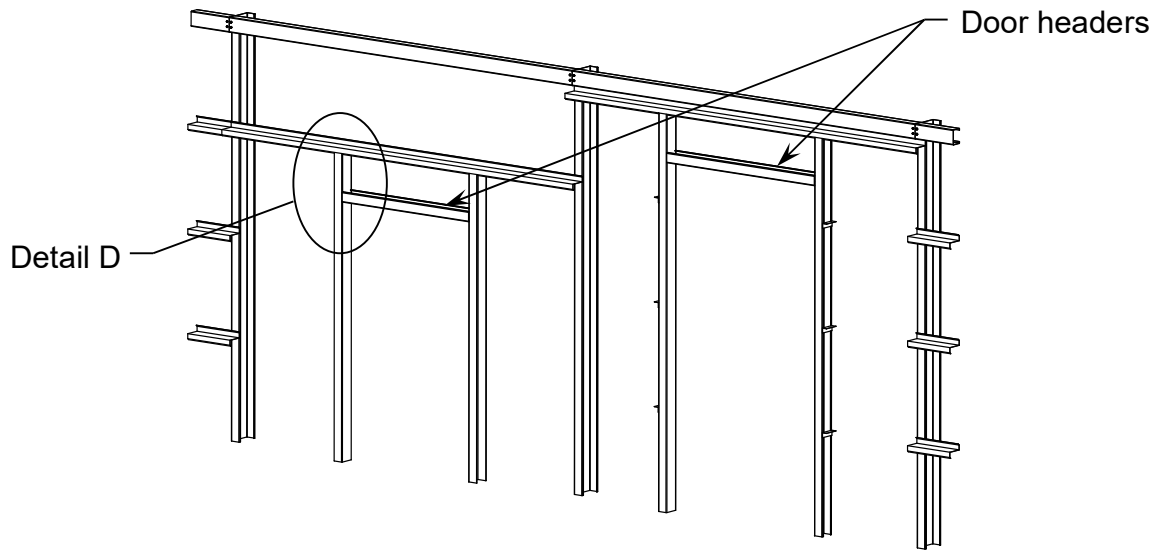
#### **4. Install door header and window sill (if installing window).**

After installing the door jambs, install the door header. This will be installed using girt clips and framing tek screws or bolts. Please see the Detail D below and the engineering plans for exact details on installing door header.

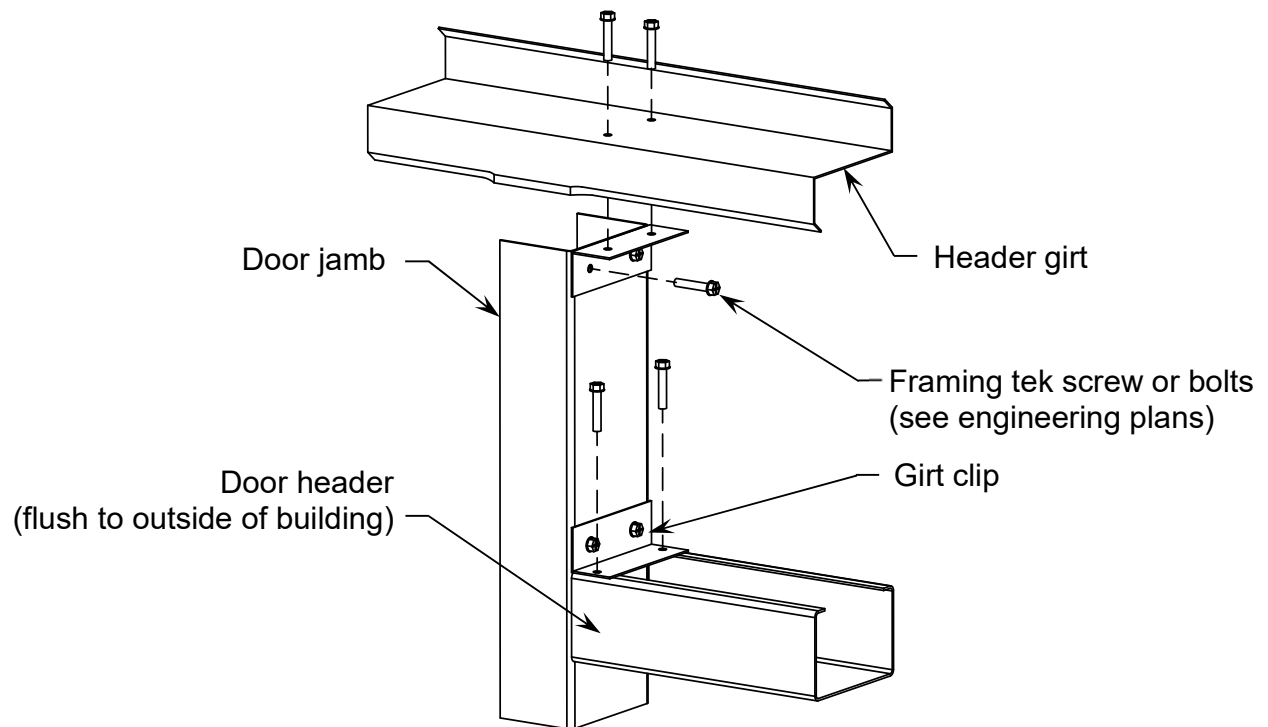
Before securing a header, make sure it is installed at the correct height. The engineering plans note the rough opening height, and the header should be installed at the height noted on the engineering plans. Note that the rough opening height can vary from the nominal height of the door to be installed. Please consult any instructions that come from your door manufacturer as well as the engineering plans to establish the exact height of the opening header and sill.

If installing a window, you will need to install not only a window header but also a window sill. This is exactly like the header except it is installed at the bottom of where the window will be. This is illustrated on the two previous pages. Note that the installation of the window sill is exactly the same as the window header, except upside down.

Please see the following page for illustrations of the installation of the door headers.



**Detail D**

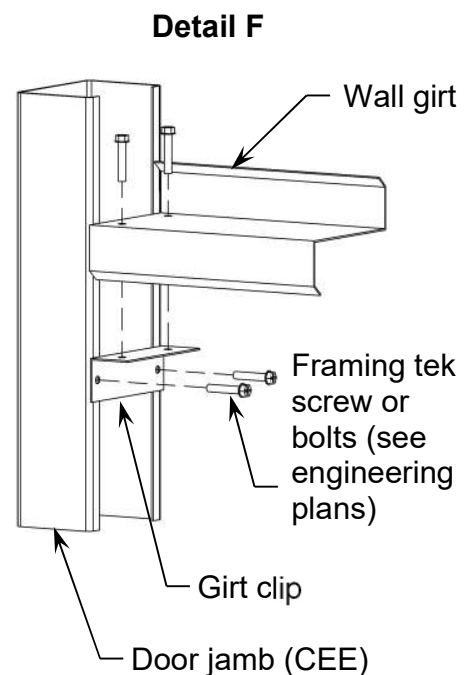
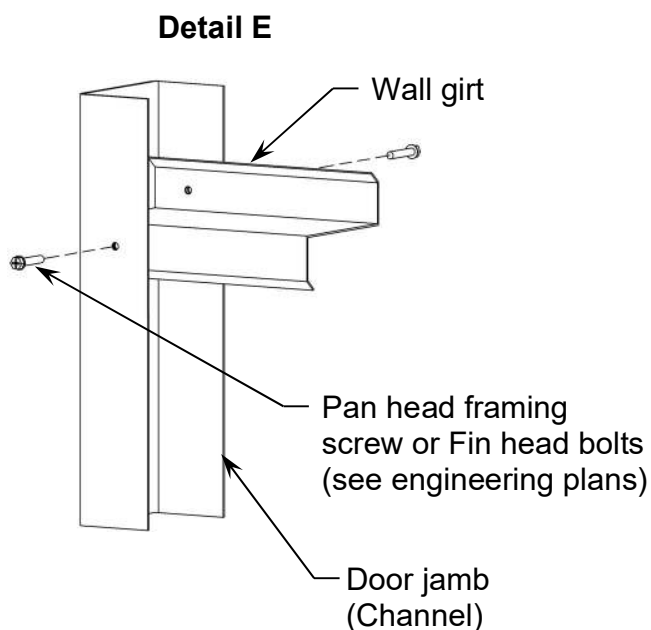
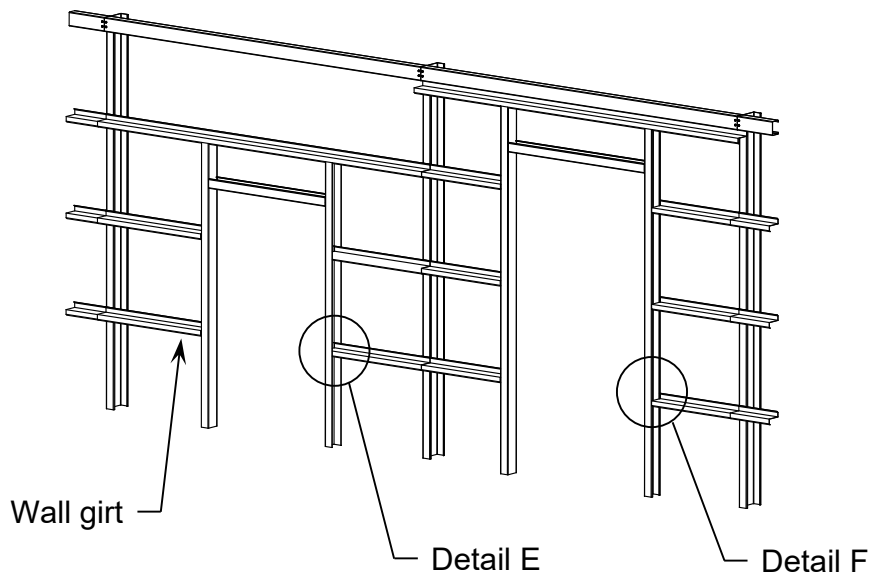




## 5. Install remaining wall girts.

Once you are done with the door jambs and headers, install all remaining wall girts. Note that if the door jambs are Channels, you will use Detail E to install the wall girts to the door jambs. If CEE Section is used for the door jambs, you will use Detail F. The material used in your building will be noted on the engineering plans.

In Detail E, the wall girts will fit inside the door jamb flanges, and the flanges of the wall girts will attach directly to the flanges of the door jamb. In Detail F, you will install the wall girts to the previously installed girt clips that attach to the stiffener lips of the door jambs. For further information on installation of wall girts, see wall girts section in Appendix B.





## Appendix B – Framing Component Installation

Last updated 12/3/2020

### Apex Brace Installation

Refer to apex connection detail on the engineering plans for the location of the apex brace. Refer to the member and material schedule on the engineering plans for size, gauge and type of apex brace and number of bolts or screws necessary to install the apex brace.

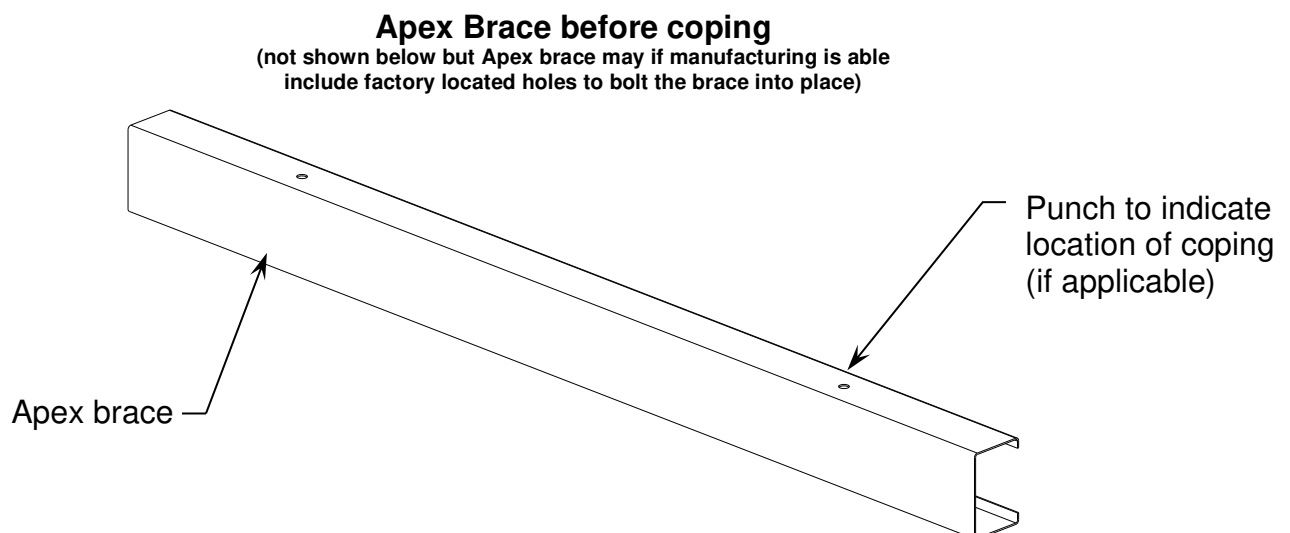
To install an apex brace you must first cope the flanges of the apex brace CEE section. In some building configurations, punches will be made on the flanges of the apex brace to indicate the sections to be coped. If your apex braces come with these punches, the flanges can be coped up to and including the punch. If punches are not present, you will have to calculate the exact locations to cope the flanges, using the information found on the engineering plans.

If you are installing the apex braces using framing bolts, holes will have either been factory punched or need to be pre-drilled onsite before installation, per engineering plans.

Once the CEE section is coped, you will attach it to the rafters with bolts or screws, which are specified on the member and material schedule on the engineering plans.

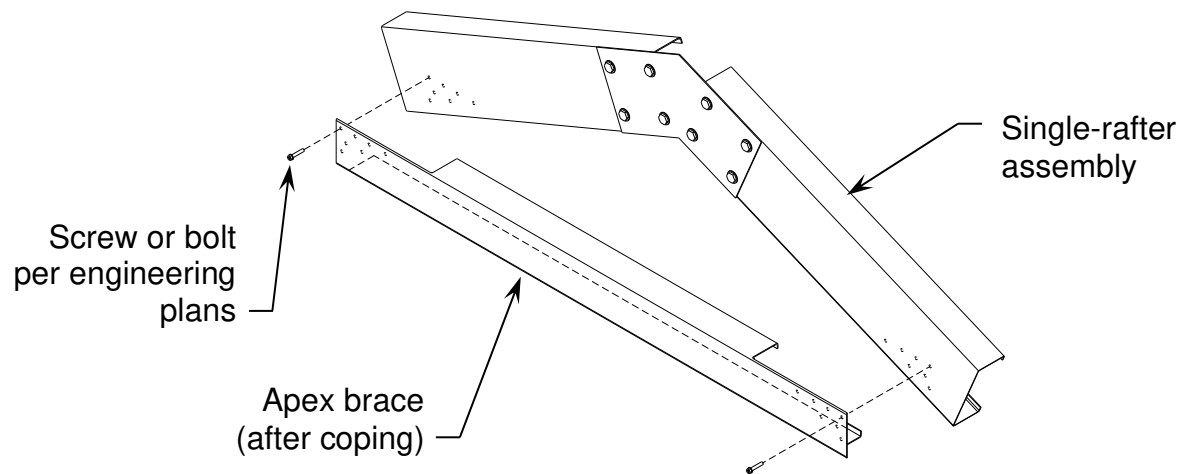
Note that if your building has a gambrel-style roof pitch, each portal frame will have three separate apex brace assemblies. See apex connection detail on the engineering plans for further instructions.

Please see the illustrations below and on the next page as a reference for attaching the apex brace to the rafters. Note that the exact location, number and type of the bolts or screws are specified on the engineering plans but are not represented on the illustrations.

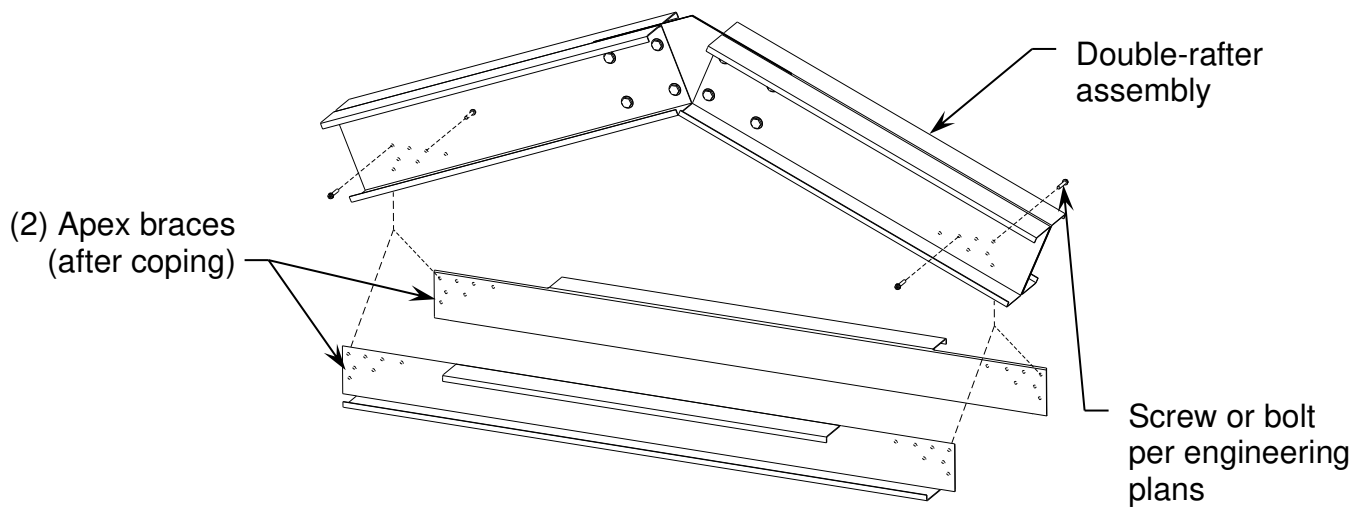




### Single-rafter apex brace assembly



### Double-rafter apex brace assembly



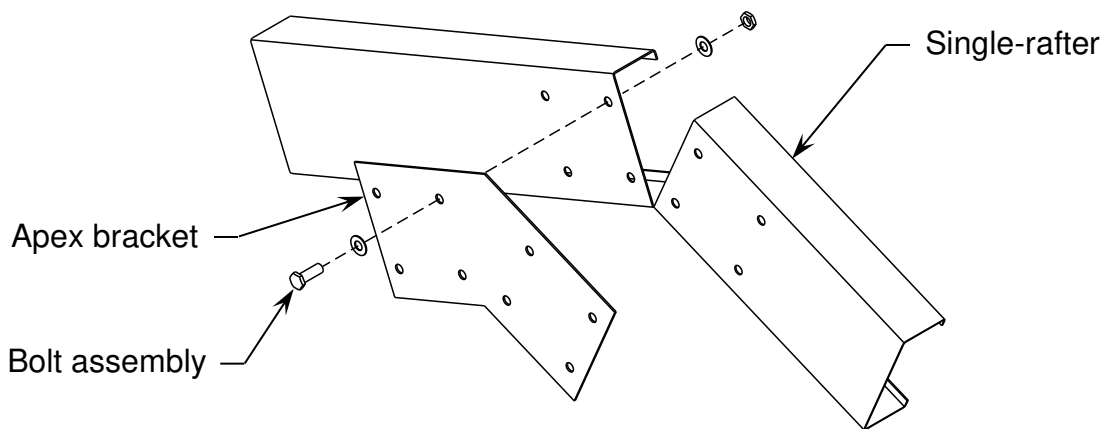


## Apex Bracket Installation

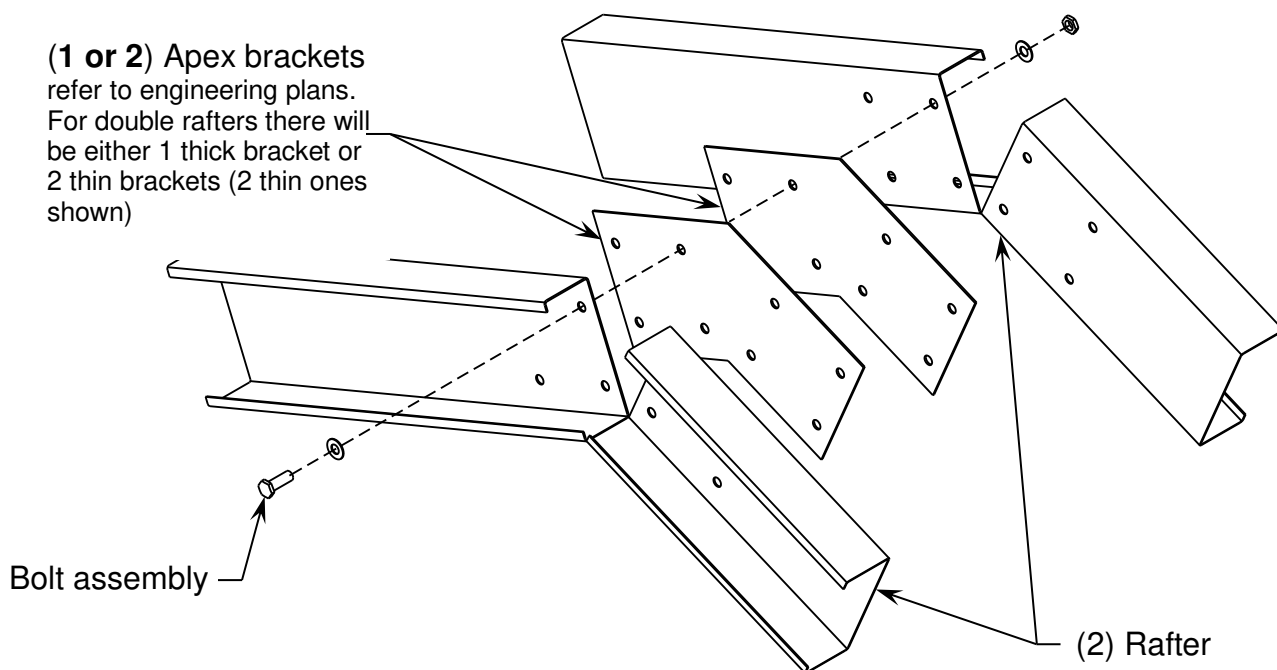
Connect rafters to apex bracket with bolts. Please see engineering plans for number and type of apex brackets and see the member and material schedule on the engineering plans for number and type of rafters.

Note that if your building has a gambrel-style roof pitch, each portal frame will have three rafter-to-apex bracket connections, one at the roof apex and two connecting the rafters to the lower rafters. See apex connection detail on the engineering plans for further instructions. Please see the illustrations below for reference.

### Single-rafter to apex bracket assembly



### Double-rafter to apex bracket assembly







## Base Angle Installation

If you have base angle on your building, it will be on your building order and will be indicated on the foundation plan of the engineering plans.

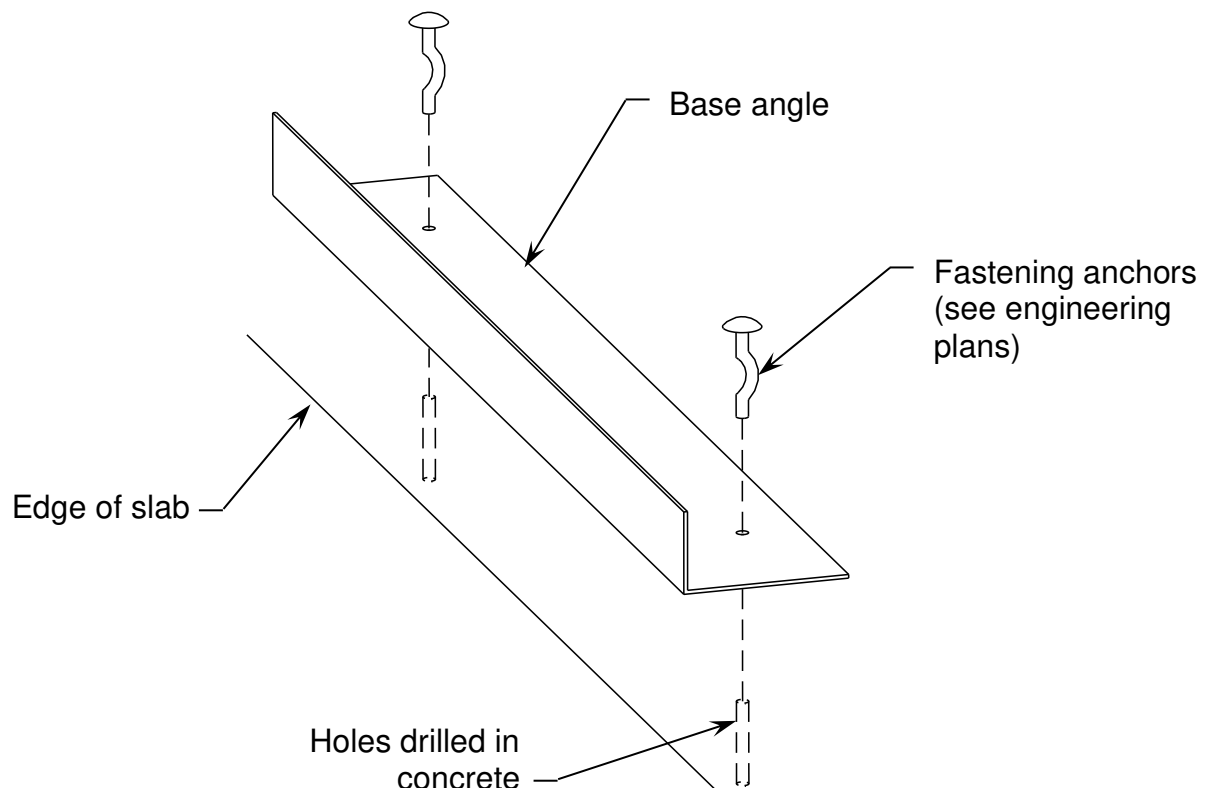
Base angle is installed to the slab using the fastening anchors and spacings as shown on the engineering plans. If not factory produced then there may be a requirement to drill holes in the base angle to take the fastening anchors.

Before continuing, roll mastic can be applied to the bottom of the base angle. This will fully seal the space between the base angle on the concrete slab and also hold base angle in place during the rest of the installation process.

When ready, line up edge of base angle to edge of slab. Drill a hole in the concrete  $\frac{1}{4}$ " in size and at least 1" deep through the already-created holes in the base angle. Clear the hole of any concrete dust. Then use a sledgehammer to install the fastening anchors, force them into the drilled hole.

Note that the base angle will be installed around the entire slab, except when a column or door jamb impedes the installation of the base angle. Please see the foundation plan on the engineering plans for fastening anchors spacing and locations.

Please see the illustration below as a reference on the installation of the base angle. Also refer to the foundation plan on the engineering plans for exact requirements on base angle installation.





## Column Base Installation

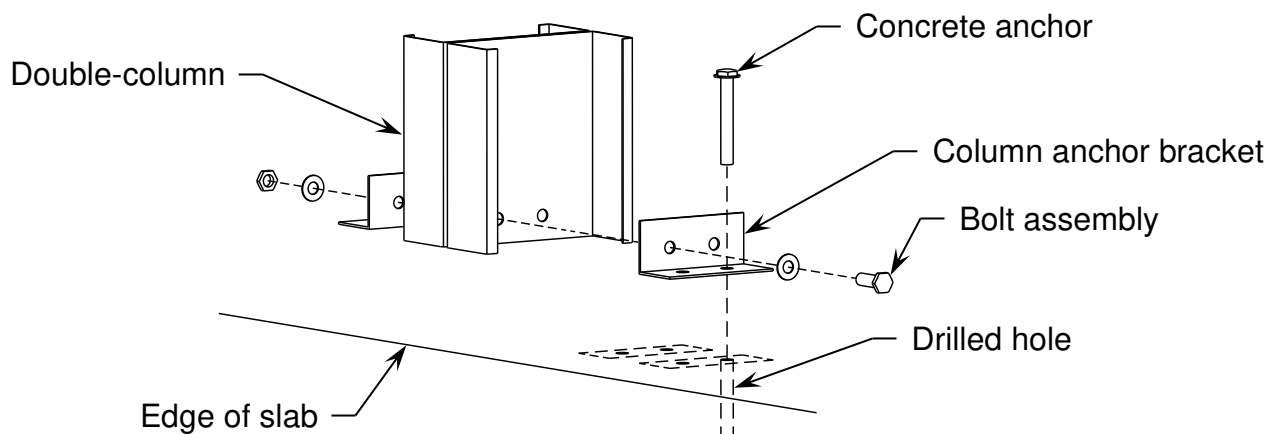
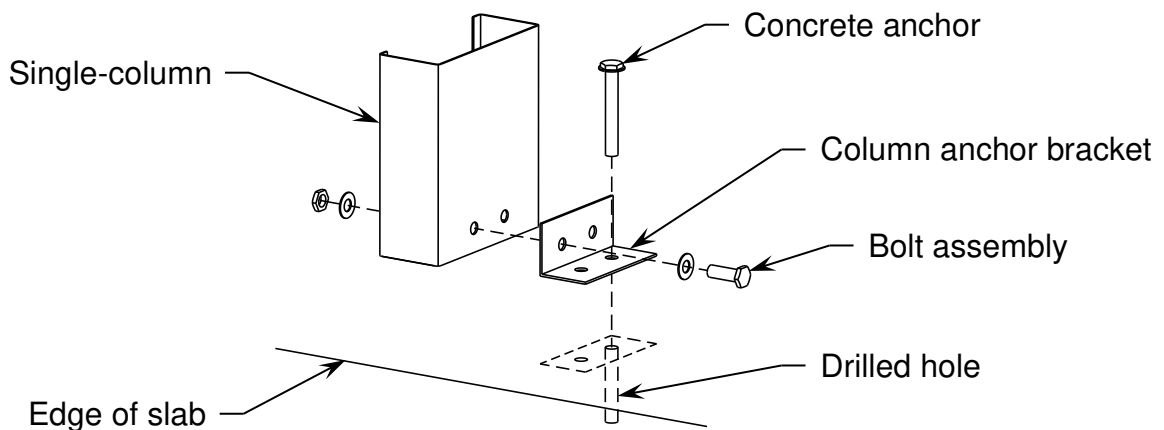
Columns are attached to the foundation of your building using column anchor brackets and concrete anchors. These concrete anchors can require specific drill bits, or special inspection during installation. Please refer to the member and materials schedule of the engineering plans for these requirements before continuing.

After ascertaining the exact location of the anchor bolts, drill the anchor bolt holes, using a rotary drill to drill holes in the concrete slab. Make sure that drilled hole is deep enough for concrete anchor to fit in the hole snugly. Once the hole is drilled, you must clear it of any remaining concrete dust by using compressed air. If no water is present in the hole, using an air puffer to clean the hole of dust will suffice.

Next, attach column anchor brackets to the bottom of the column using bolt assembly, tightening the bolt assemblies by hand. For exact information on the column anchor bracket and bolt type, see engineering plans.

Lastly, stand up column and install your concrete anchor through column anchor bracket to concrete slab. When complete tighten bolt assemblies with impact wrench. Please see the illustrations below as a reference for attaching the columns to the foundation.

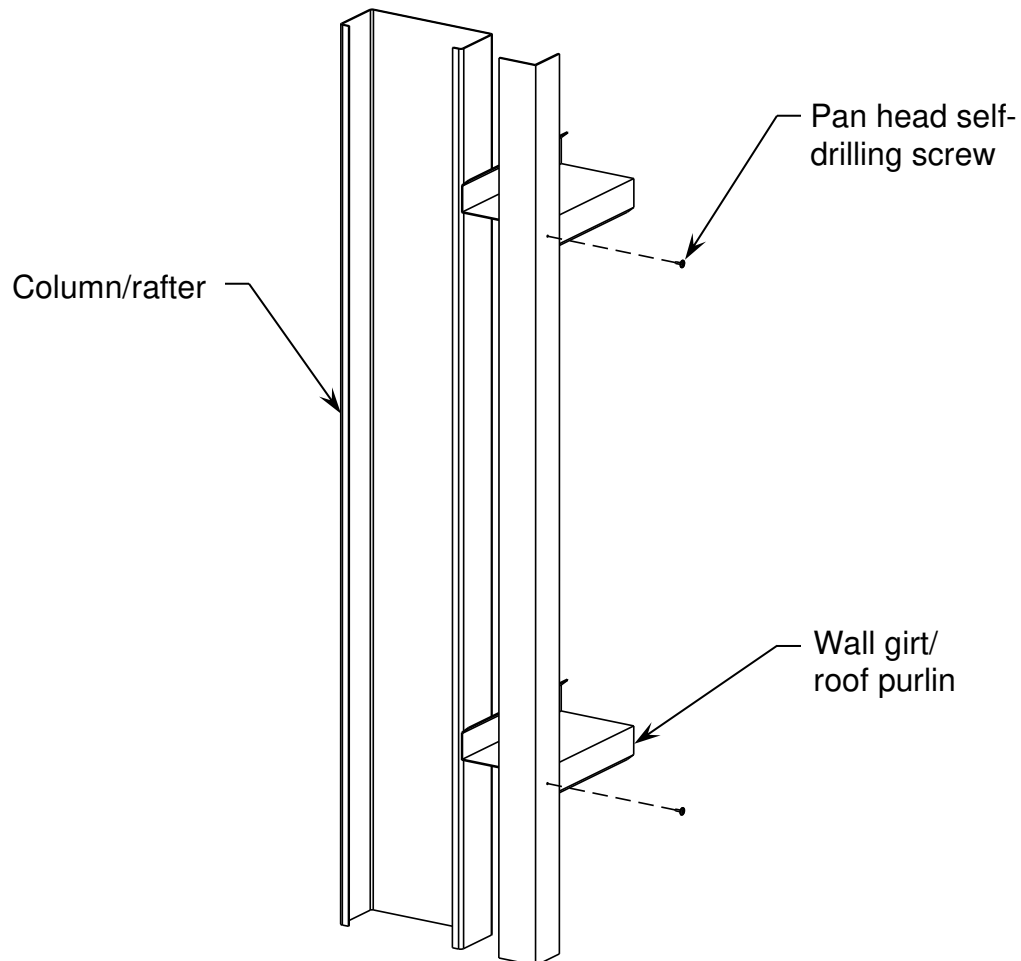
### Single-column base connection





## Corner and Rake Angle Installation

If corner and rake angle is provided in your building kit, it will be installed on the ends of all girts and purlins and will be attached using a pan head self-drilling screws. When installing at the ends of wall girts, corner angle should run from the edge of the slab to the eave of the building. When installing at the ends of purlins, rake angle should run from the eave to the apex of the building. Please see the illustration below as a reference for installing corner and rake angle.





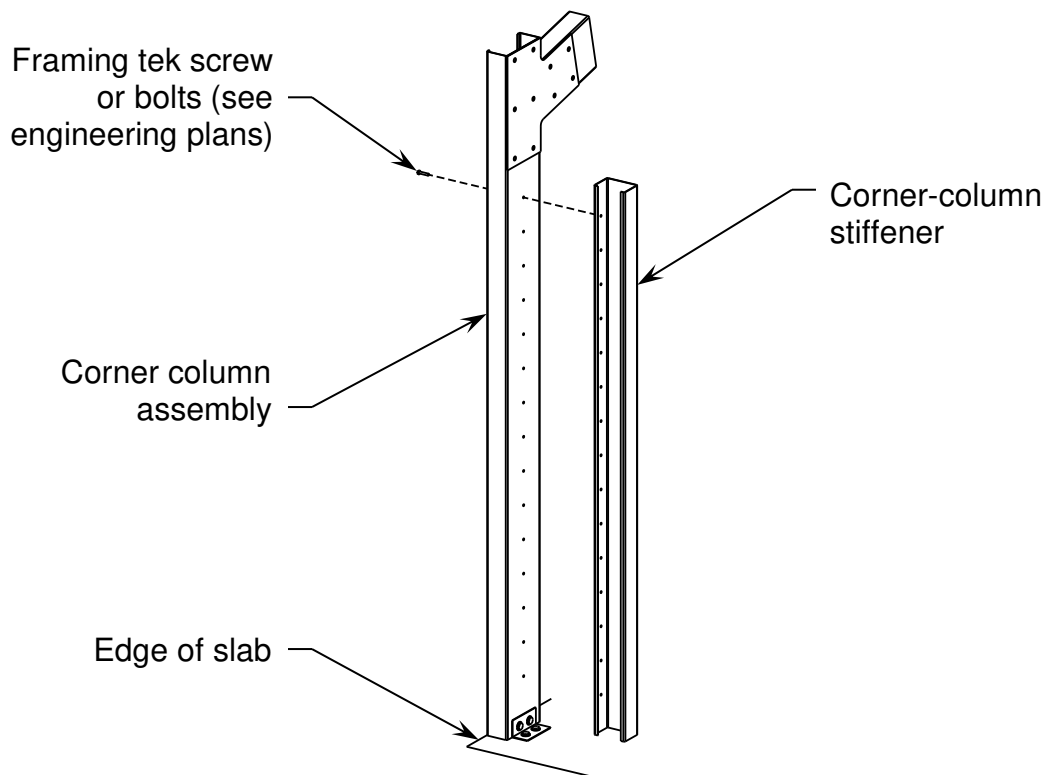
## Corner Column Stiffener Installation

In some cases, you will need to install a corner column stiffener (which is comprised of a CEE section) at specific corner columns. This will be indicated on your engineering plans. You will attach the stiffener to the corner column using framing tek screws or bolts. Note that corner column stiffener will run from top of column anchor bracket to bottom of the haunch bracket.

In some cases, other components, such as a mezzanine floor bracket, will need to be installed to a column that requires a corner column stiffener. In this case, both components will need to be installed, first installing the mezzanine bracket, and then installing the corner column stiffener to the column, over the mezzanine floor bracket. Note that corner column stiffeners will always need to run continuously from the column anchor bracket to the haunch bracket, regardless of other components to be installed.

The *only* case where corner column stiffeners should be coped or cut in any way is when the bolts at a mezzanine bracket on the corner column are 4" apart horizontally, and the corner column stiffener must fit between them. In this case, move the stiffener slightly off the center of the column so that the web of the stiffener is between the mezzanine bracket bolts. Then cope off the flange and stiffener lip of the corner column stiffener in two locations, where the bracket bolts would interfere with the corner column stiffener.

Please see the engineering plans for exact information on size, location and installation of corner column stiffener. See the illustrations below as an example of how to install the corner column stiffeners.





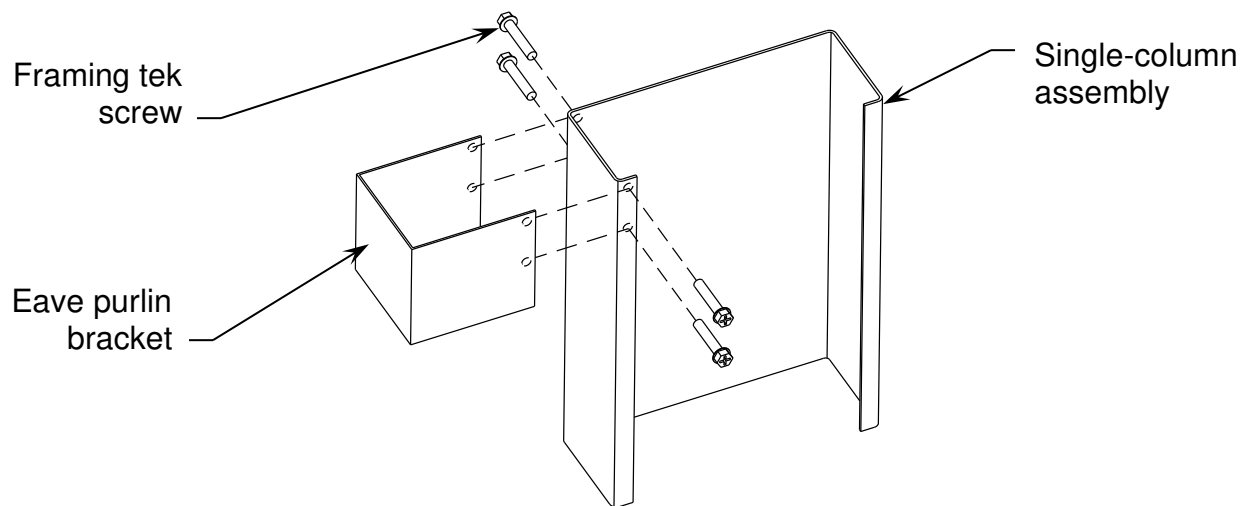
## Eave Purlin Bracket Installation

Connect eave purlin bracket to column using framing tek screws or bolts. Please see the illustrations below as a reference for attaching the eave purlin bracket to the columns. Check your engineering plans for eave purlin bracket method to use.

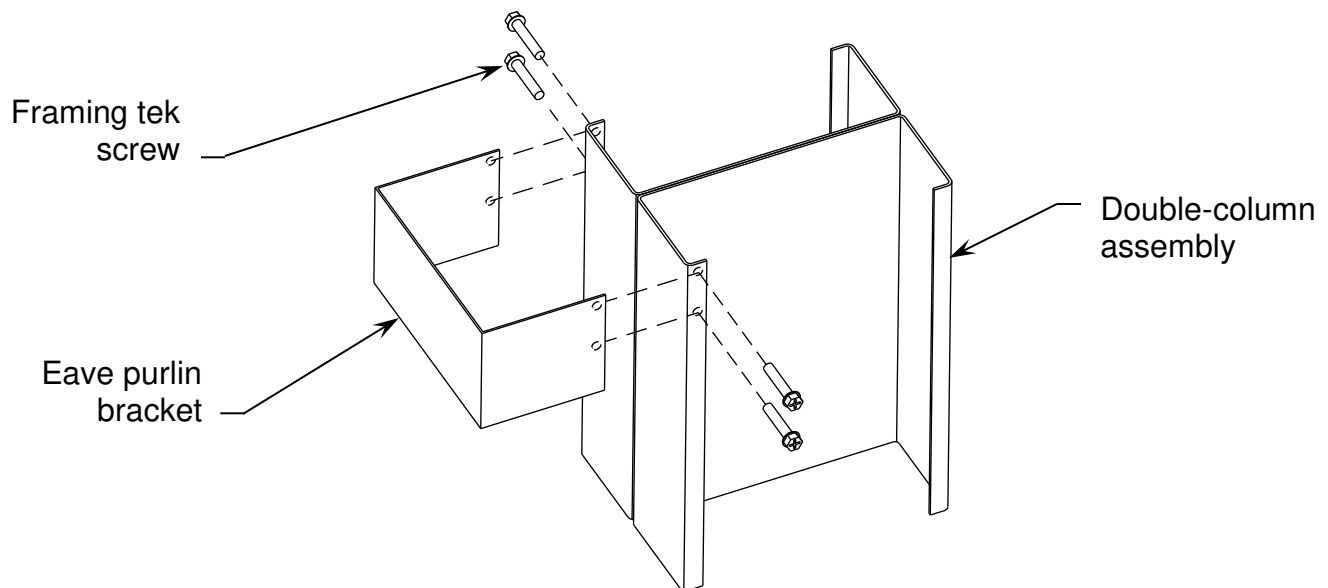
### Method 1 – Standard Bracket

For the standard eave purlin bracket assembly, the framing tek screws should be as far apart from each other as possible.

#### Standard eave purlin bracket to single-column assembly



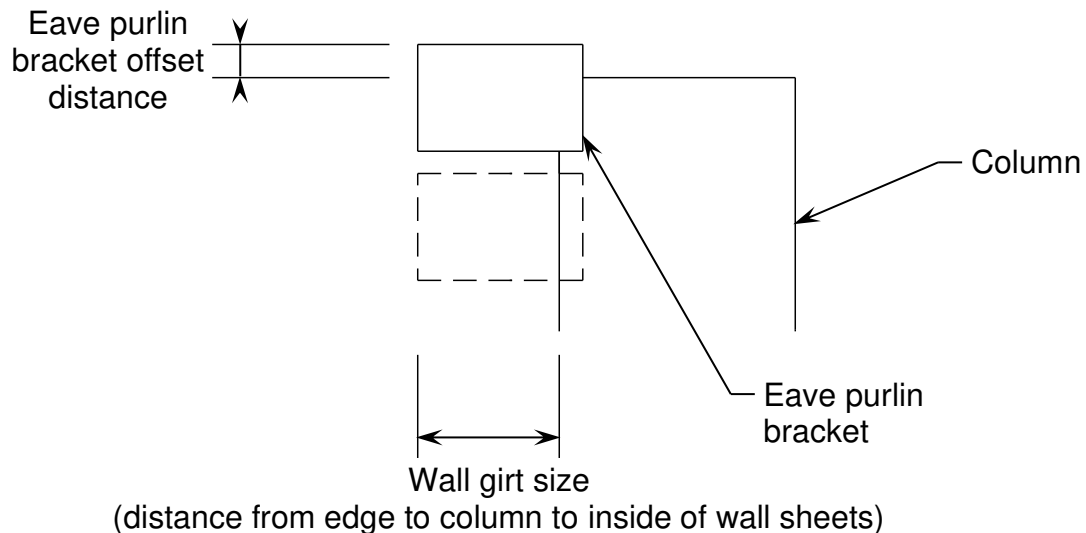
#### Standard eave purlin bracket to double-column assembly





Exact location of bracket will vary per building. The eave purlin bracket should be installed so that when the eave purlin is attached to the eave purlin bracket, the bottom lip of the eave purlin will align with the bottom of the eave purlin bracket. Thus, the distance between the top of the eave purlin bracket and the top of column varies per building. This distance is illustrated below and can be found in the table below. Also note that the eave purlin bracket will need to be installed so that the bracket will line up with the slab edge. Thus, the edge of the eave purlin will not always line up with the edge of the stiffener lip of the column CEE. This distance will need to be determined at time of construction.

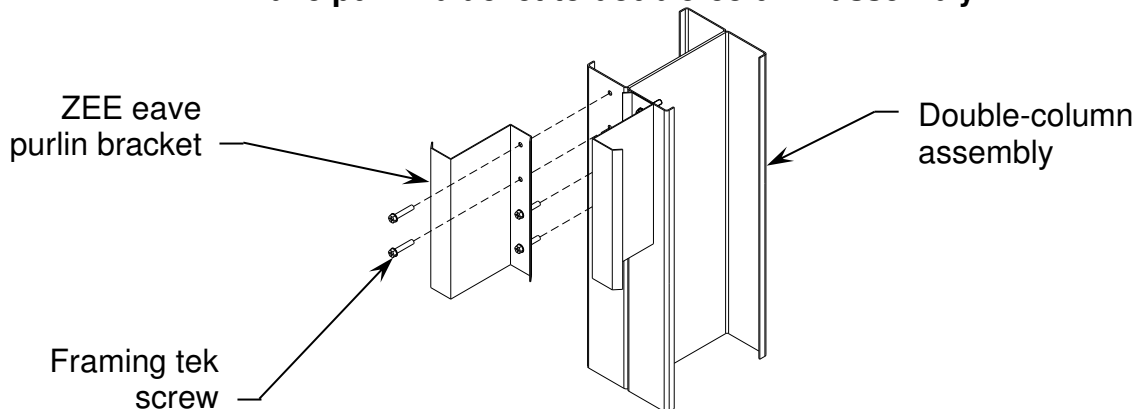
Please see below for an illustration of how the location of the eave purlin bracket can vary. The eave purlin bracket offset distance will be listed on your engineering plans.



## Method 2 – ZEE Eave Purlin Bracket

A ZEE Eave Purlin Bracket will be installed on all walls with girts that are 8" or larger on double-column assemblies. Simply install a short section of ZEE (exact length and bracket location will be listed on your engineering plans) to the front of the column.

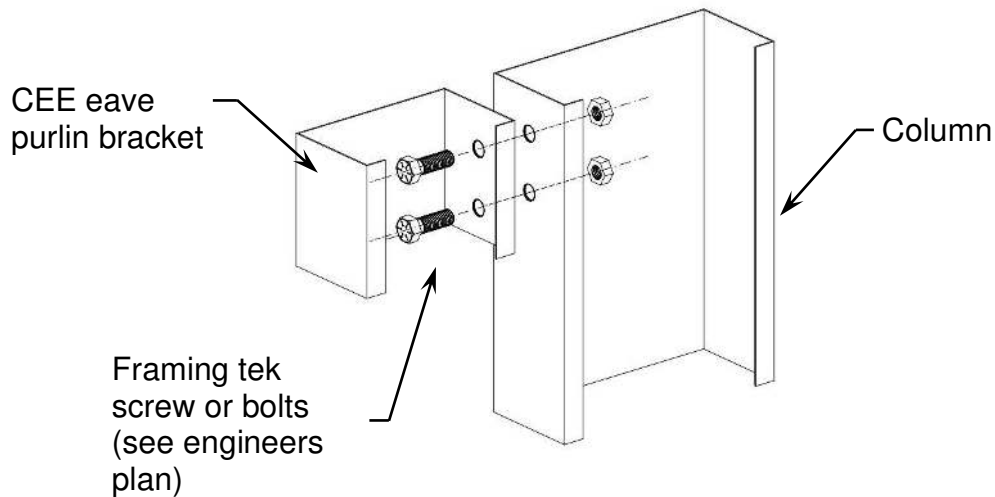
### ZEE Eave purlin bracket to double-column assembly



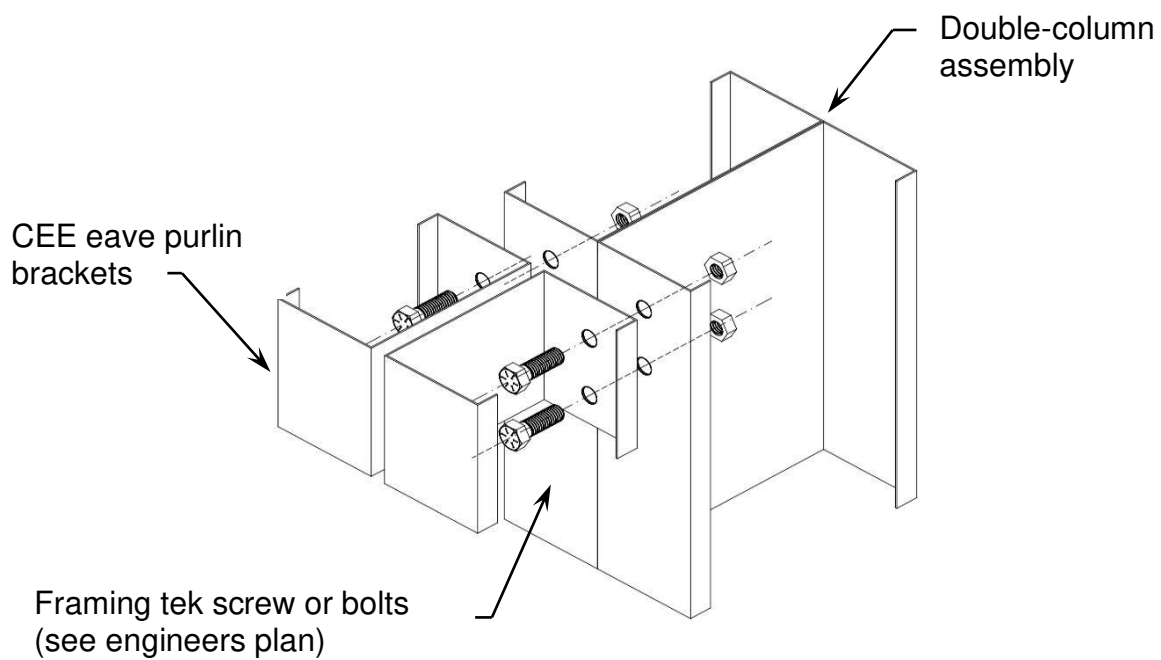
### Method 3 – CEE Eave Purlin Bracket

A CEE Eave Purlin Bracket will be installed to the outside column flange. Install a short section of CEE to the outside flange of the column using framing tek screws, or bolts (refer to the engineering plans for the location, size, and fastening type).

#### CEE Eave purlin bracket to single column



#### CEE Eave purlin bracket to double-column assembly





## Eave Purlin Installation

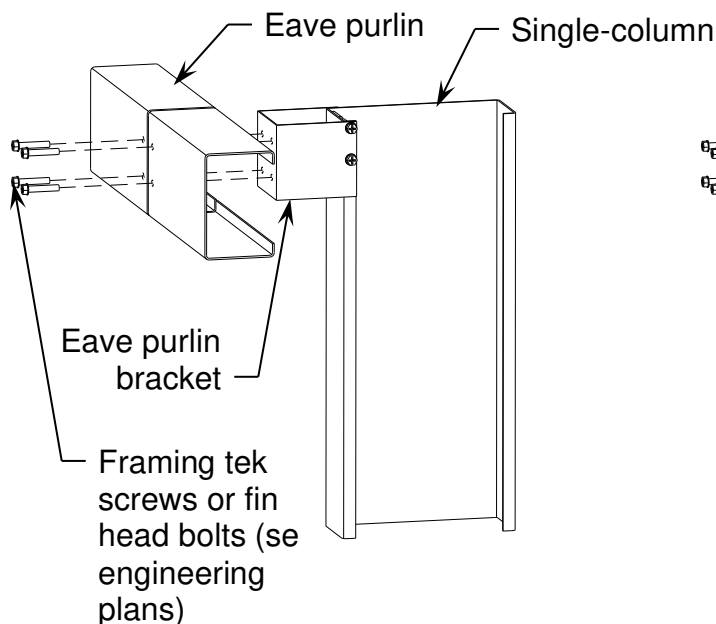
Connect eave purlin to eave purlin bracket using framing tek screws. Note that the exact location of the eave purlin bracket varies. For specifications on how eave purlin bracket must be placed, see “Eave Purlin Bracket Installation” section above. Do not install eave purlin until all conditions are met.

To install the eave purlin bracket, place the eave purlin so that the bottom stiffener lip is pushed up to touch the bottom of the eave purlin bracket and the front of the eave purlin is flush with the front of the eave purlin bracket. Then, install two framing tek screws from each eave purlin into the eave purlin bracket. Note that the eave purlin can be either a CEE Section or an Eave Strut.

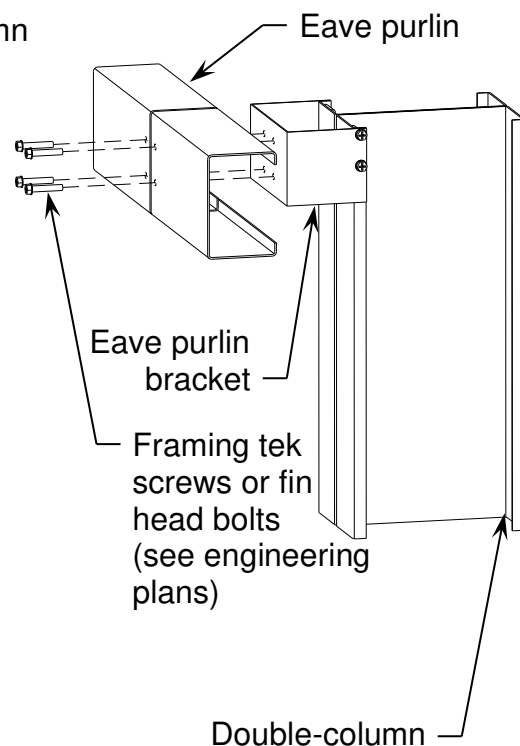
Note that when you install the eave purlin, when it connects to the eave purlin bracket on the corner column, the edge of the eave purlin must line up with the edge of the eave purlin bracket. When installing eave purlin on an interior sidewall column, eave purlin will fall in center of eave purlin bracket. Also, once the eave purlin is installed, the top of the eave purlin should align with the eave of the building.

Please see the illustrations below and on the following page as a reference for attaching the eave purlin to the eave purlin bracket.

### Eave purlin to single-column assembly



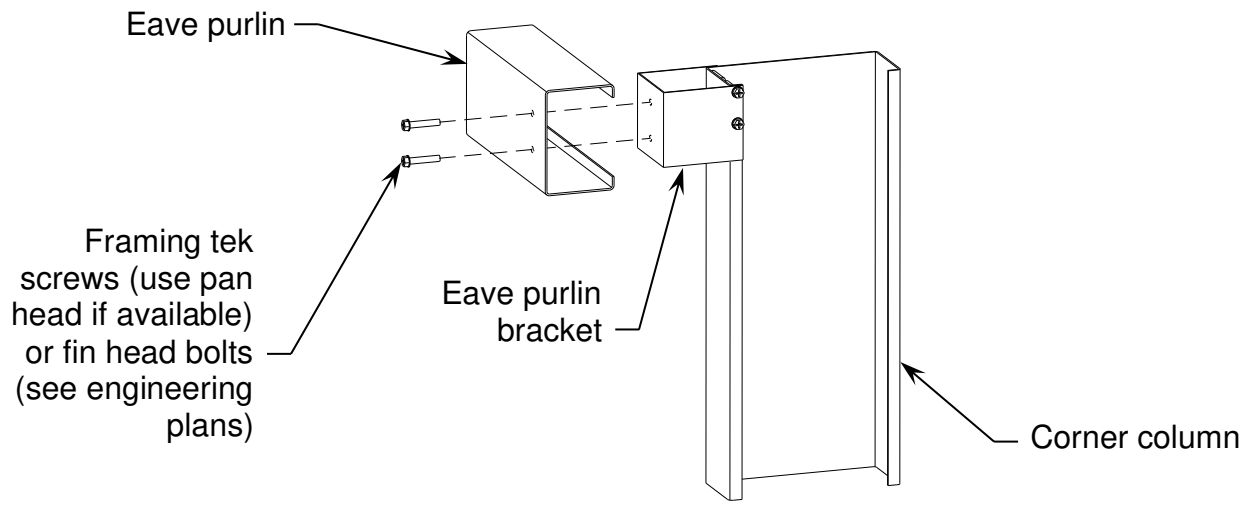
### Eave purlin to double-column assembly







### Eave purlin to corner-column assembly





## **Endwall Column Installation**

For installation of base of endwall columns, see “Column Base Installation” section earlier in appendix

After installing base of endwall column, top of endwall column will need to be attached to the rafter. Before securing top of endwall column, ensure that column is plumb.

When installing endwall columns, there are many variations that can occur. Before proceeding, ascertain whether endwall columns are single or double. This information can be found in the member and material schedule on the engineering plans.

The endwall column will attach directly to the rafter and will be installed using framing tek screws or bolts, as specified on engineering plans.

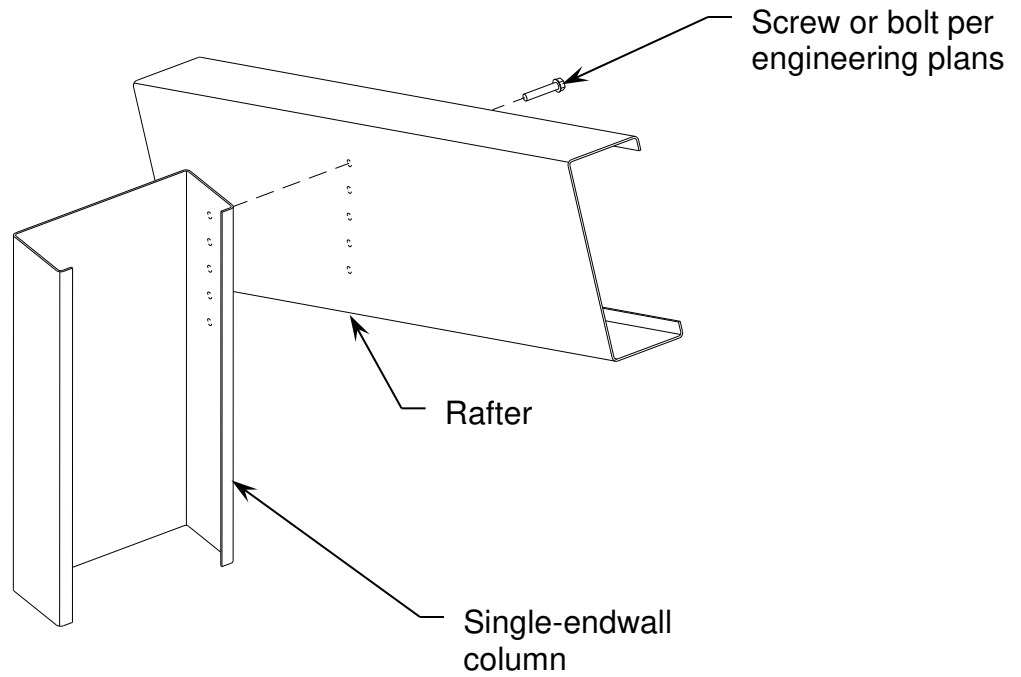
Because of this, if your building has 6” or larger endwall girts, the corner columns and endwall rafter in the endwall will be set in from the edge of the slab, so that the back of the endwall portal assembly will align with the back of the endwall girts. Please see the engineering plans for more information if you have endwall girts that are 6” or larger.

If an endwall column is being installed in the middle of the endwall, it will need to attach to the apex of the rafters. In this case, some of the bolts that connect the rafters and apex bracket together could impede the installation of the endwall column. If this is the case, it is permissible to remove two of the bolts of this connection, but only the bolts that are to the inside and toward the bottom of the rafter. This is shown in the illustrations on the following pages.

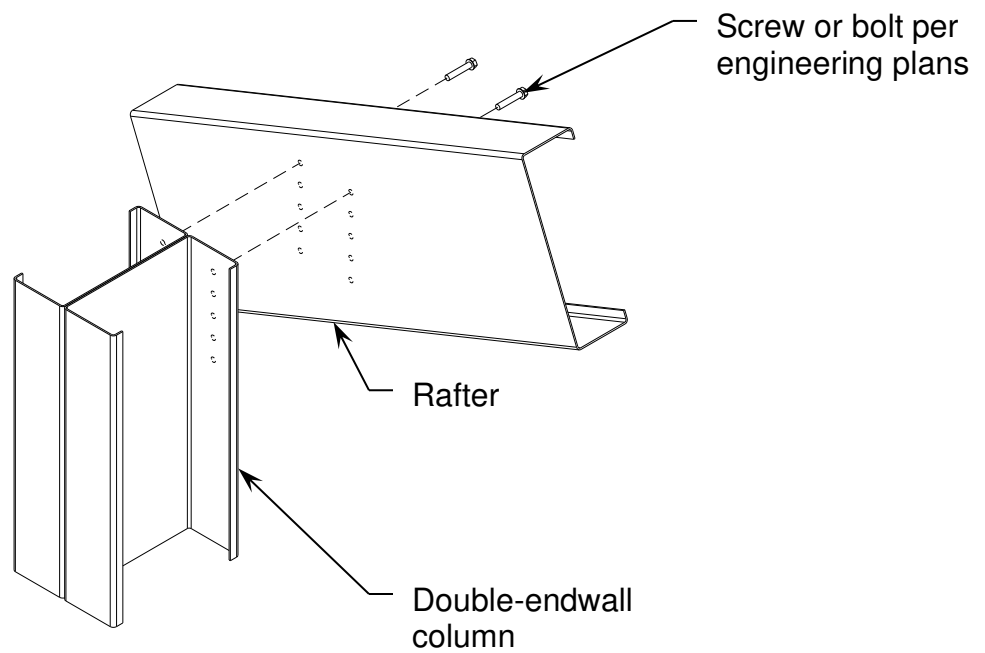
Please see the illustrations on the following pages as a reference for attaching the endwall columns to the rafters. For exact information on attaching the top of endwall columns to the rafter, please see the engineering plans.



### Single-endwall column to rafter assembly

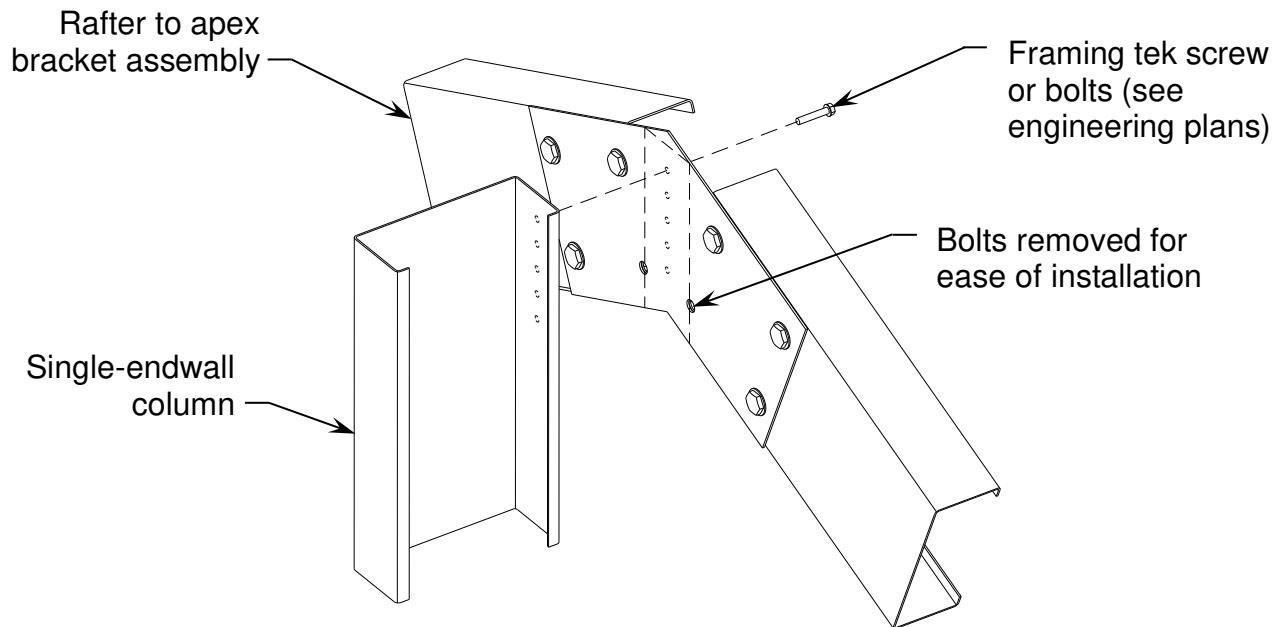


### Double-endwall column to rafter assembly

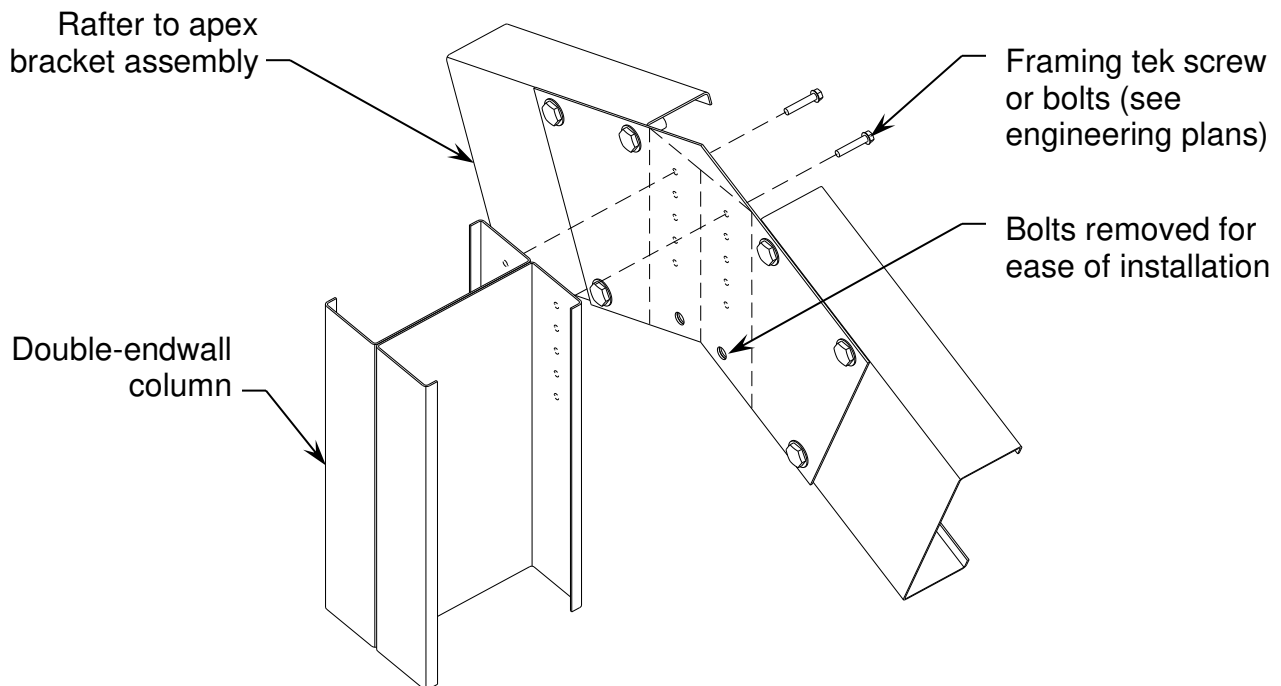




### Single-endwall column to rafter assembly installed at apex



### Double-endwall column to rafter assembly installed at apex





### Flybracing Installation

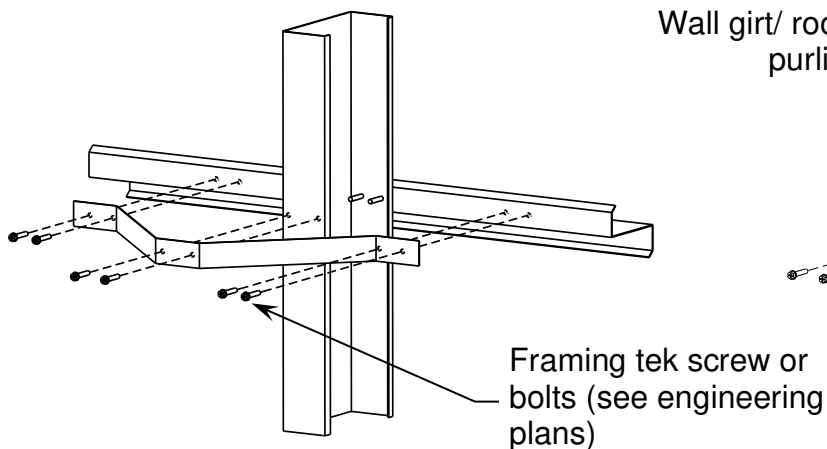
After installing columns and rafters, you may have to install flybracing. This is detailed and can be found on the engineering plans.

Flybracing is installed by attaching strapping (the exact type as used for x-bracing) to both the frame (either column or rafter) and the girt or purlin using framing tek screws or bolts.

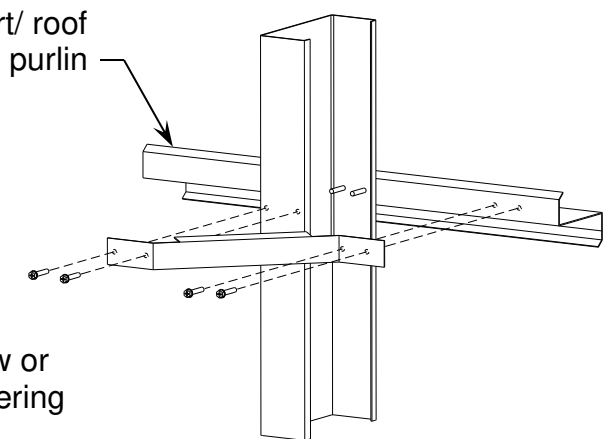
In some instances, flybracing can only be installed on one side of the girt/purlin. When this is the case, attach from the frame to the girt using a two legged member with a minimum of 1.5" legs. It is best to fashion this out of excess material since this item will not be found in your building order. Please see the details on the engineering plans for exact information on installing flybracing using this alternate method.

Please see the illustrations below as a reference for installing flybracing.

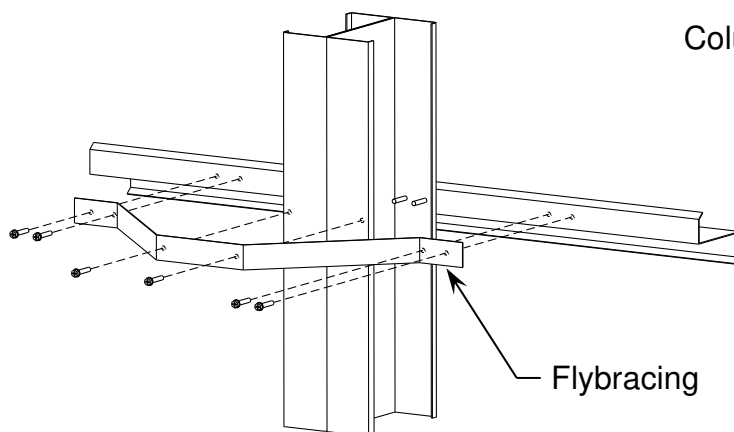
**Flybrace installation  
at single-frame**



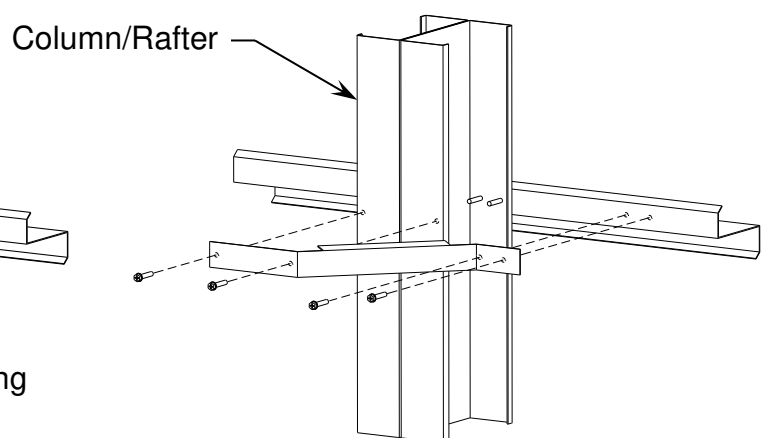
**Alternate flybrace installation  
at single-frame**



**Flybrace installation  
at double-frame**



**Alternate flybrace installation  
at double-frame**





## Girt (Sidewall and Endwall) Installation

Girts are installed on the sidewall and endwalls of your building and are connected to the sidewall and endwall columns. Each wall girt is connected from one column to the adjacent column using framing tek screws or bolts (see engineers plan). When overlapping girts, they *must* overlap at a sidewall or endwall column.

Installation of girts is different for those bays that have doors and windows. Please see Appendix A (Door and Window Installation section) for more information on this aspect of girt installation.

Note that for some buildings, LGSIs will be used to make up the wall girts. Please check your engineering plans or order to see if an LGSI or ZEE is to be used. An LGSI is nearly identical to a ZEE, but for an LGSI each flange will have a different width, so that one flange will be roughly  $\frac{1}{4}$ " wider than the other. This is so that the girts will interlock a bit easier. Thus, when installing LGSI wall girts, install them in such a manner that the first girt attached should have its wider flange (note that there may be a small triangle-shaped hole in the web of the LGSI, which points toward the wider flange) connected to the column. This will easily allow the next girt to be installed so that, if its narrower flange is connected, it will easily interlock with the other girt. When installing all wall girts, please keep this fact in mind.

Note that when installing wall girts, LGSIs or ZEEs can generally be installed with the outside flange of the girt pointing either up or down. Please refer to the engineering plans for any specific requirements.

**Pro tip:** When overlapping girts, per the engineering plans, only a 3" overlap of the girts is required, though the width of a single column is 4". Your girts should be ordered so that a 3" overlap is assumed at all single columns, and a 7" overlap is assumed at all double columns. When overlapping girts, a temporary tek screw or bolt can be installed at the inside edge of the first installed girt, within  $\frac{1}{2}$ " of the edge of the column. When the second girt is installed later, the previously installed screw or bolt will not interfere with the second girt, allowing for easy installation. Once the second girt is in place, the screws or bolts required by engineering plans can be installed. This method is illustrated in Detail A and Detail B below.

In some cases, endwall girts will need to attach directly to the rafter. When this occurs, bend out the upper stiffener lip of the endwall girt, so that it lays flush against the edge of the endwall rafter. Please see the instructions and illustrations below and on the following page (specifically Detail D) as a reference on how to install girts which connect directly to the rafter.

When installing endwall girts to a corner column or to an endwall rafter (as shown in Details C and D below), make sure that the back of the endwall girt aligns with the back of the column or rafter. If the endwall girts are 6" or larger, this will mean the corner columns and endwall rafters will be set in from the edge of the slab. For more information,



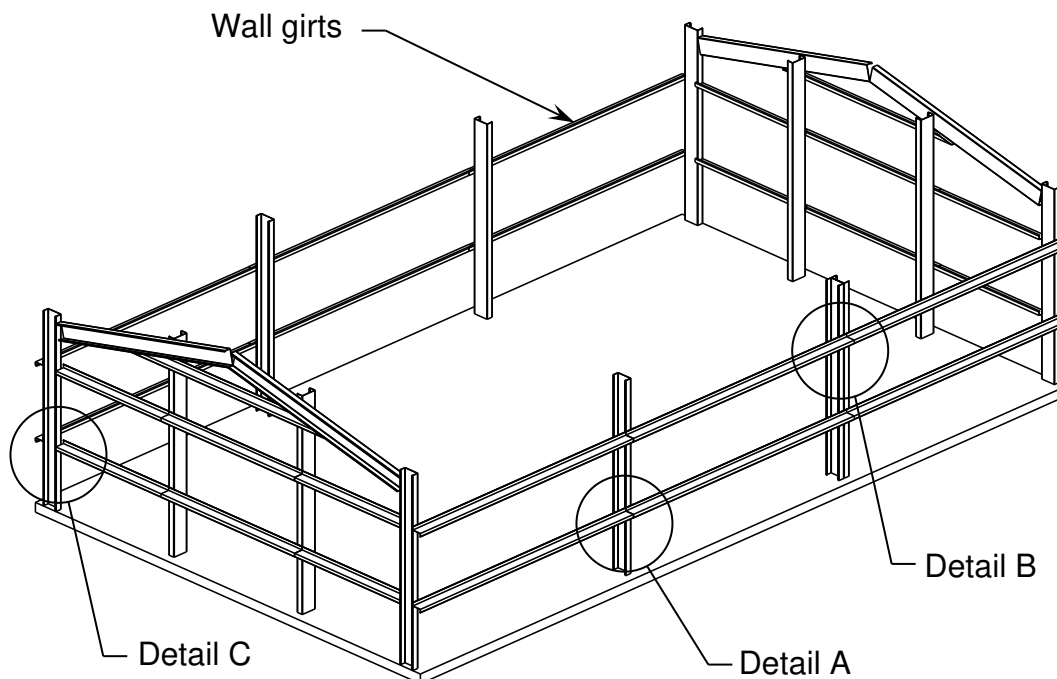
please see the engineering plans, or see the “Set out the location of all columns and all anchor bolts” section of the main installation manual.

Please see the details on the engineering plans for more information on installing wall girts and please see illustrations on the next two pages as a reference for installing wall girts. Note that in the illustrations, not all components are shown for clarity. Double and single-columns are shown, but your building will not have both double and single interior sidewall columns. Instead it will be one or the other.

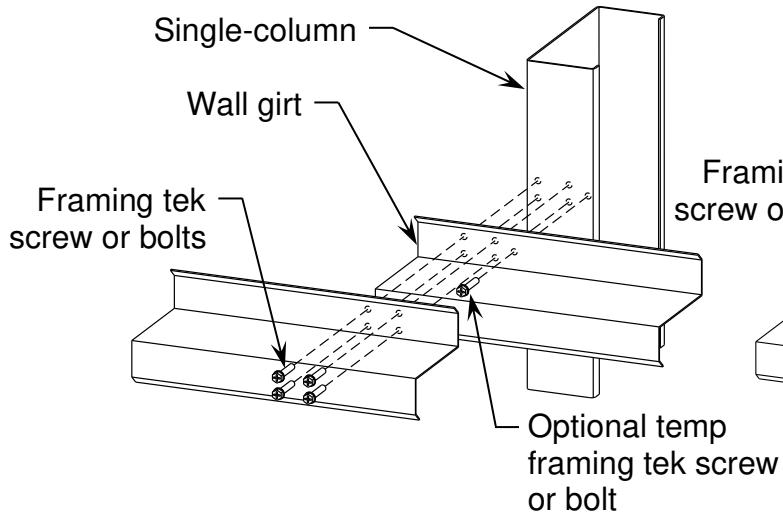
Note that though girts are graphically shown on the engineering plans, locations shown are not exact.

If you are installing base angle, install this first. If you are not installing base angle, you will need to install a bottom girt, which should be located as close to the slab as possible without touching the slab.

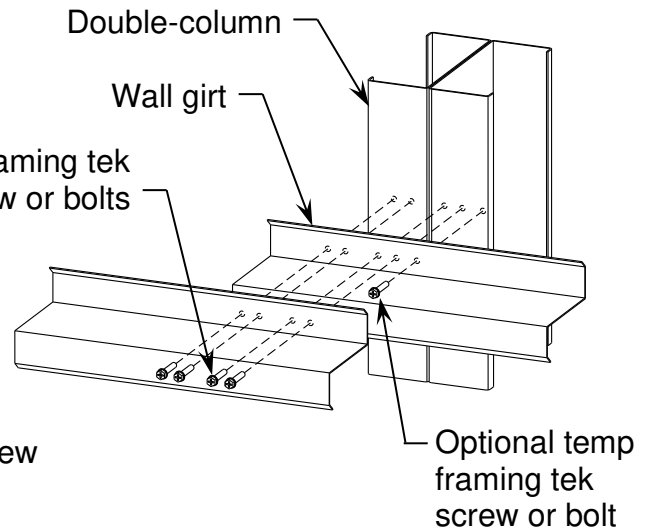
Locate the next girt with its web being the up the column the maximum girt spacing. Remember to that the girt flange connected to the column should be pointed upward. The subsequent girts should be located up the column from the initial girt at maximum girt spacing. Note that the final girt installed should be within the maximum girt spacing of the eave purlin. For the maximum girt spacing, please see the member and material schedule of the engineering plans. Note that there is both a sidewall girt spacing and an endwall girt spacing listed. Ensure that you use correct spacing for each wall.



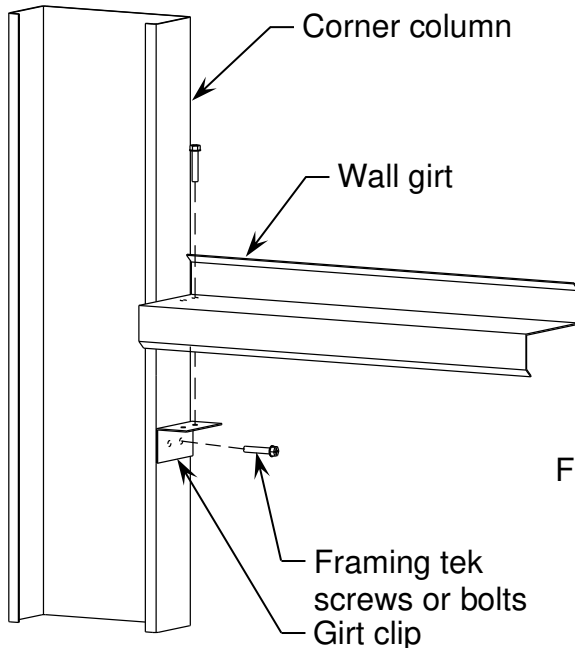
**Detail A**  
**Girt to single-column assembly**



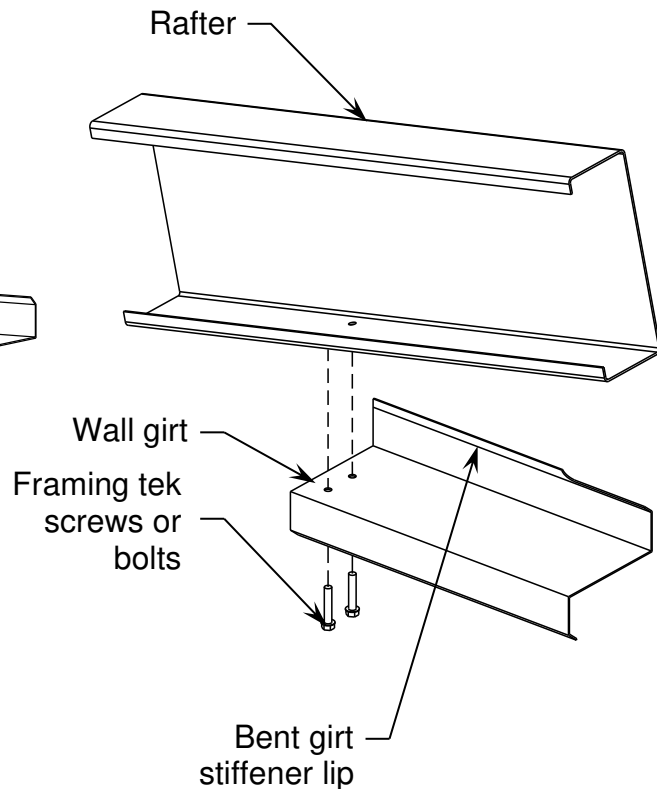
**Detail B**  
**Girt to double-column assembly**



**Detail C**  
**Endwall girt to column assembly**



**Detail D**  
**Endwall girt to rafter assembly**







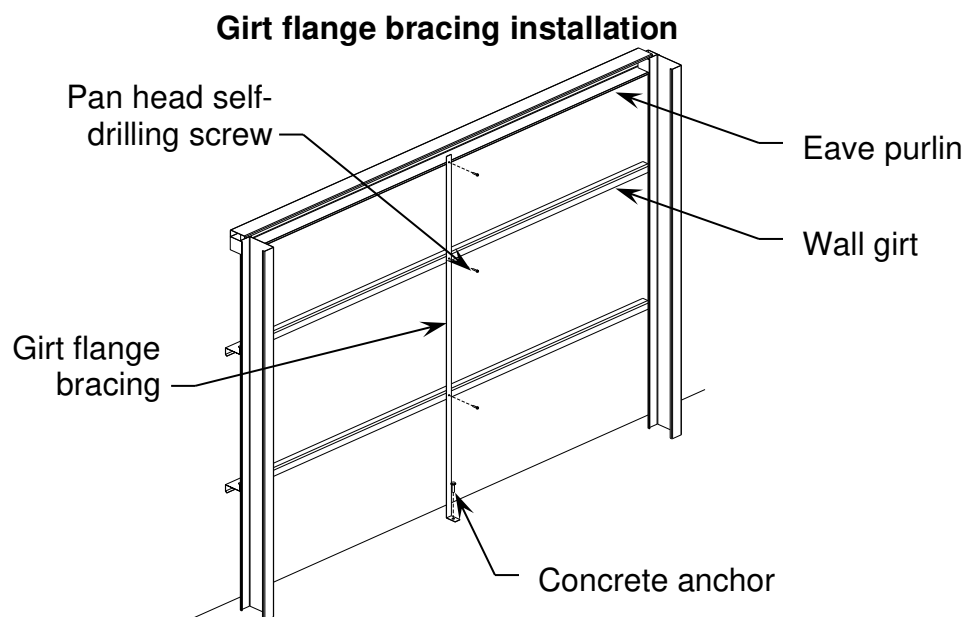
## Girt and Purlin Flange Bracing Installation

After installing all wall girts and roof purlins, you may have to install girt and purlin flange bracing. This is specified on the engineering plans. Please see number and location on the sidewall elevations.

If necessary for your building, you will need to use the strapping provided and install this using pan head framing screws to attach to the wall girts, roof purlins and eave purlins and a concrete anchor to attach to the foundation. Please see the column base installation section for more information on installing these anchor bolts.

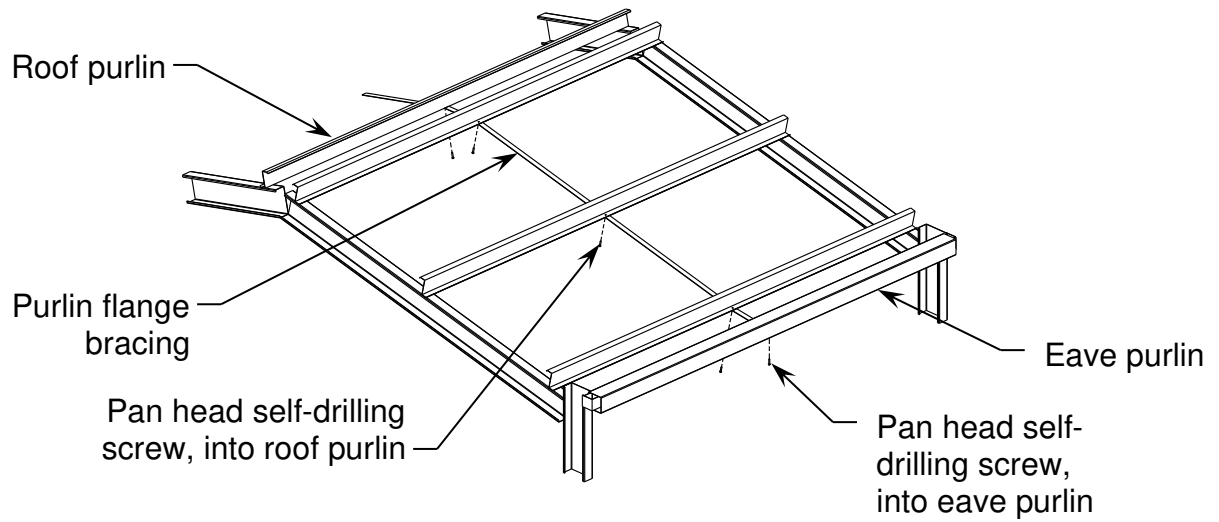
Please see the details on the engineering plans for information on strapping, screw and bolt types required as well as for specific installation instructions.

Please see the illustrations below and on the next page as a reference on how to install girt and purlin flange bracing.





### Purlin flange bracing installation





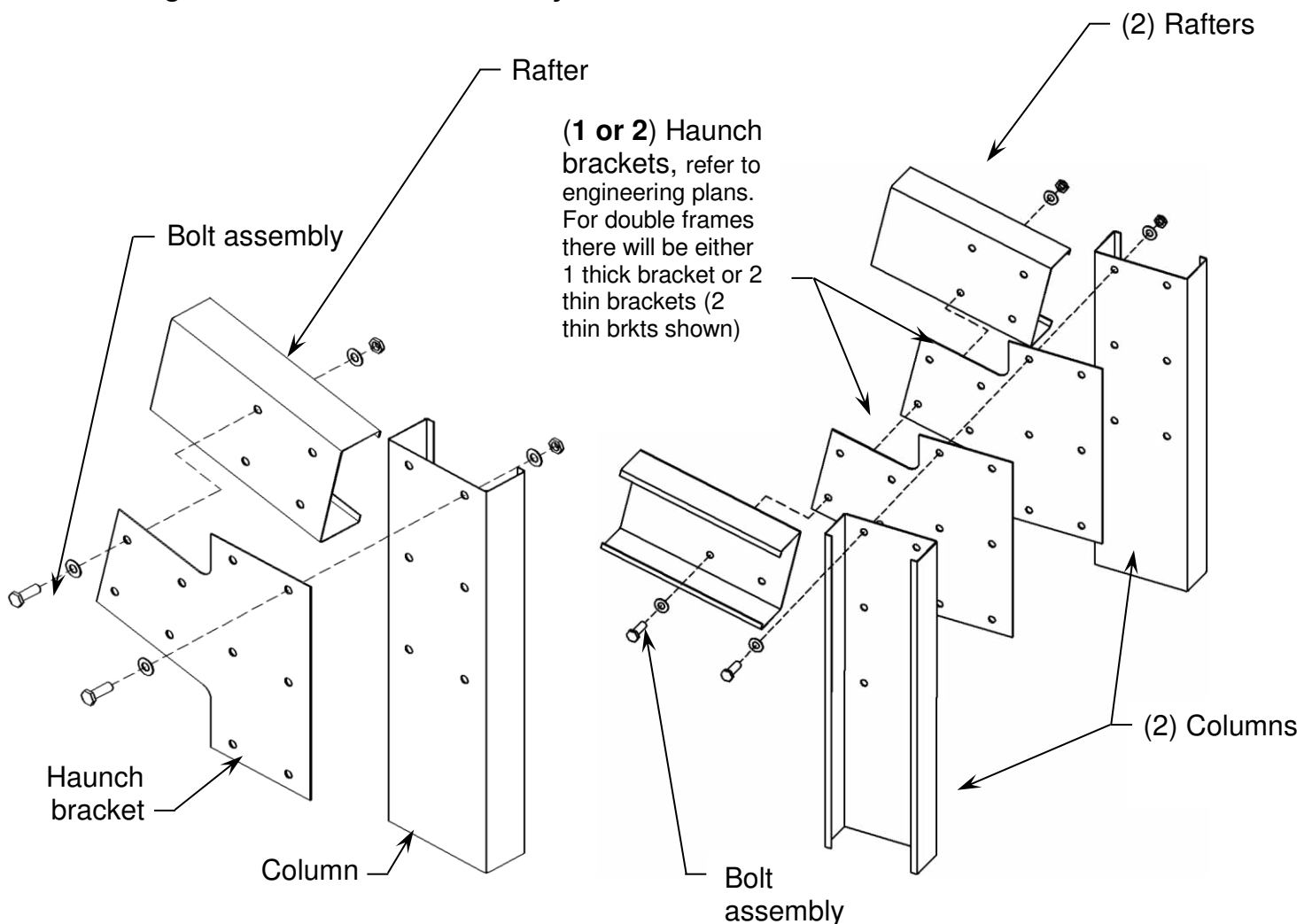
## Haunch Bracket Installation

Connect columns to rafters using the haunch bracket with bolts. Please see the details on the engineering plans for number, type, and shape of haunch brackets and see the member and material schedule for number and type of columns and rafters. Please see the illustrations below as a reference for attaching the columns to the rafters using haunch brackets.

Note that in some cases, not all holes in the haunch bracket will have a bolt installed, but will instead remain empty. Please see the engineering plans for the exact placement and number of installed bolts.

**Single-column to rafter assembly**

**Double-column to rafter assembly**





## Knee Brace Installation

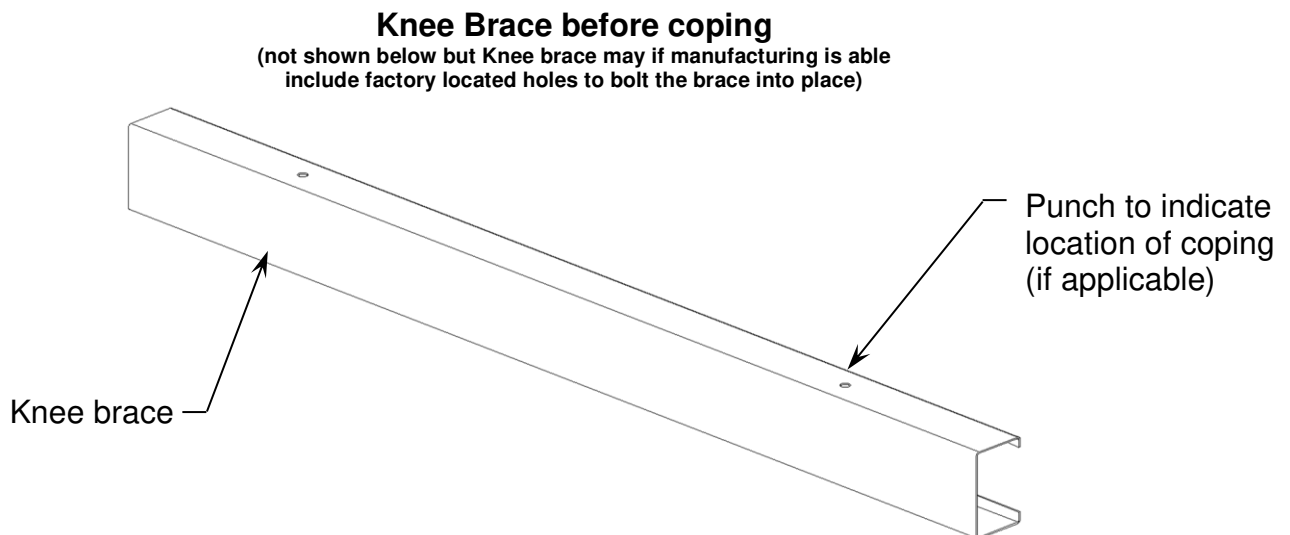
To install a knee brace you must first cope the flanges of the knee brace CEE section. In some building configurations, punches will be made on the flanges of the knee brace to indicate the sections to be coped. If your knee braces come with these punches, the flanges can be coped up to and including the punch. If punches are not present, you will have to calculate the exact locations to cope the flanges, using the information found on the engineering plans.

Once the CEE section is coped, you will attach it to the columns and rafters with bolts or screws, which are specified on the member and material schedule on the engineering plans.

If you are installing the haunch braces using framing bolts, holes will have either been factory punched or will need to be pre-drilled before installation, per engineering plans.

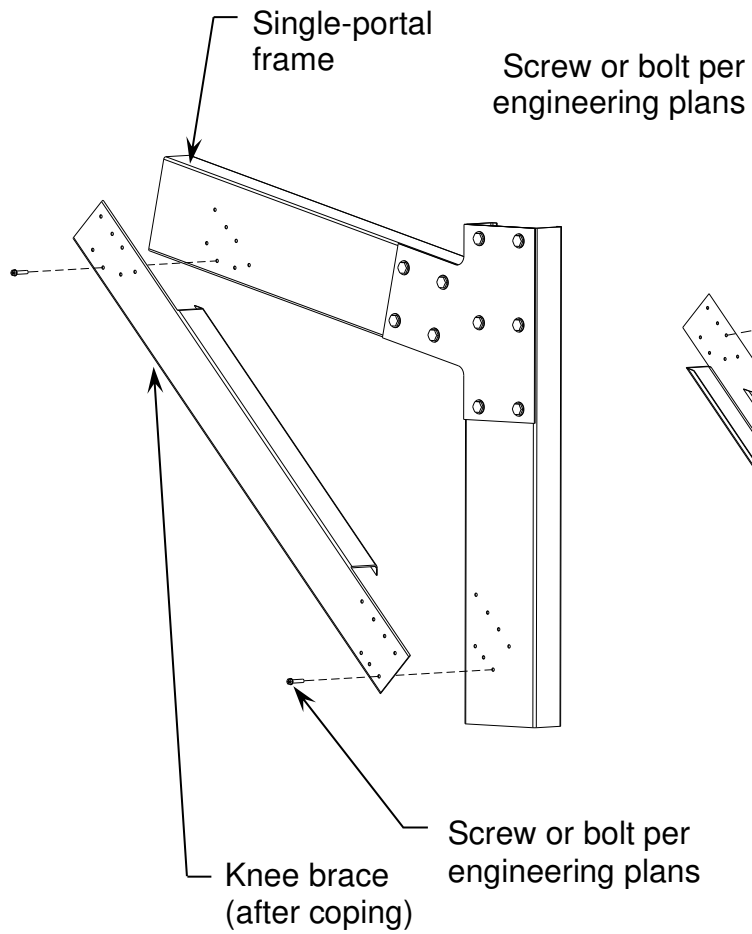
Refer to haunch connection detail on the engineering plans for the height of the bottom end of the knee brace relative to the foundation. Refer to the member and material schedule on the engineering plans for size, gauge and type of knee brace and number of bolts or screws necessary to install the knee brace.

Please see the illustrations below and on the following page as a reference for attaching the knee brace to the columns and rafters. Note that the exact location, number and type of the bolts or screws are specified on the engineering plans but are not represented on the illustrations below.

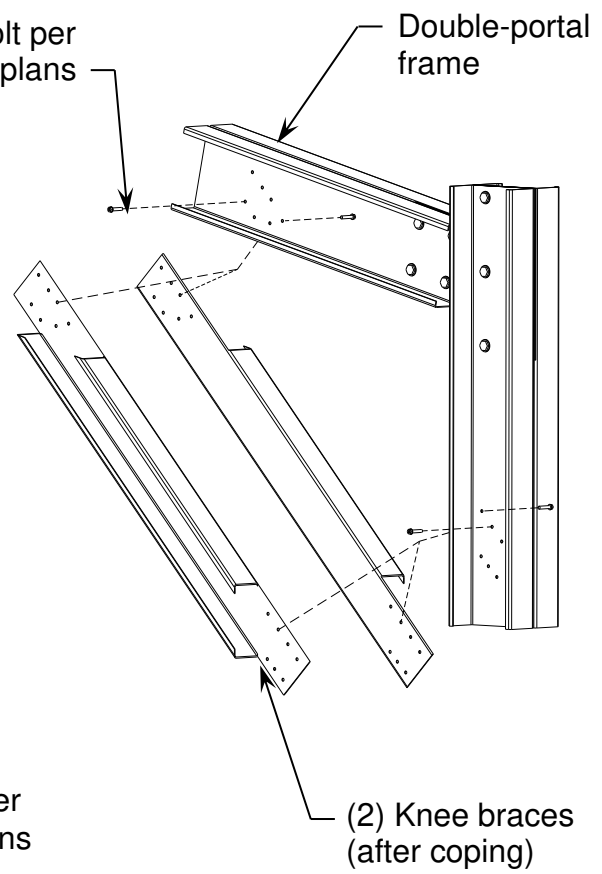




### Single-column knee brace assembly



### Double-column knee brace assembly





## Leanto Rafter Installation

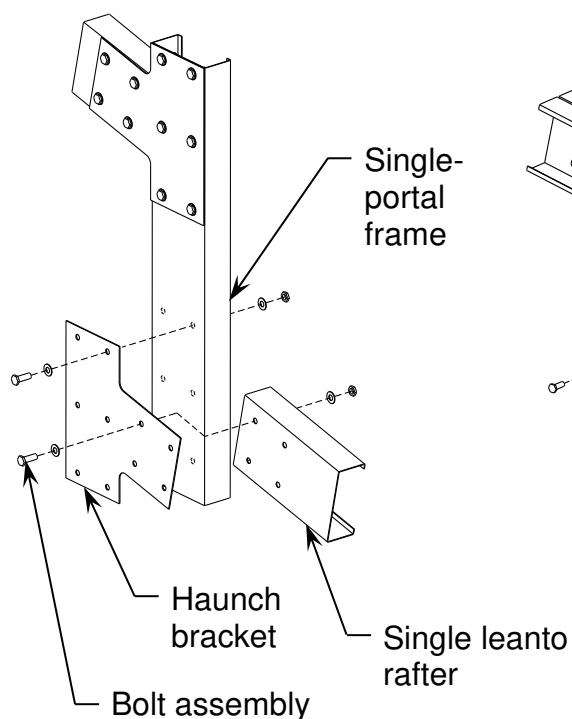
The leanto rafter is installed between the main building column and a leanto column. Installation can happen once the main building column is correctly installed, and after the leanto column is stood up and secured, with the haunch bracket properly installed at the top. In method 3 below, if applicable, wall sheeting must be installed as well.

Based on the configuration of your building, there are three possible installation methods. Typically, buildings with a leanto drop will use Method 1 described below, while buildings without a leanto drop will use Method 2. Buildings that have sheeting between the main building and leanto sections of the building can use method 3. Please refer to your engineering plans for the exactly method to be used on your building.

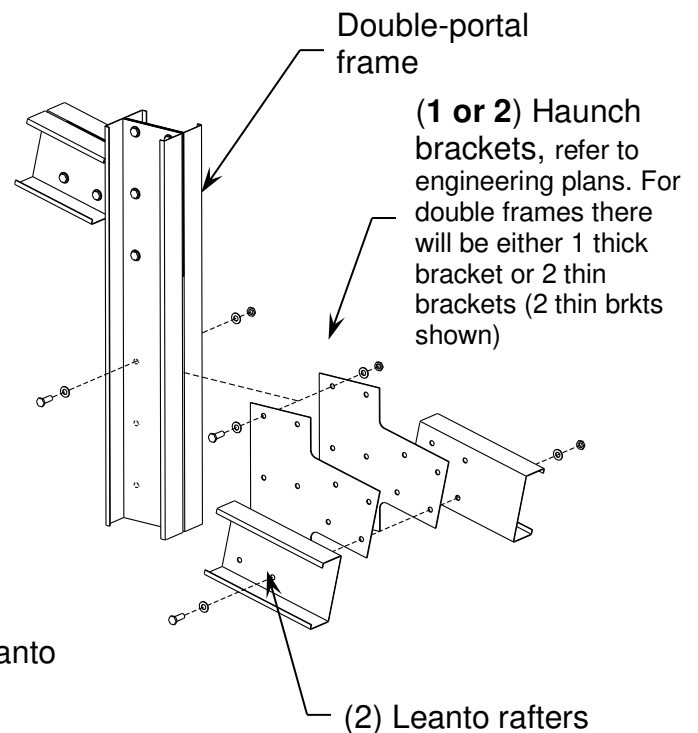
### Method 1

In this method, the top of the leanto rafter is secured using an upside down haunch bracket attached to the main building column. Once the main building column is installed, attach the upside down haunch bracket to the column with the bolts as required by the engineering plans. Once secured, the leanto rafter can be installed between the main building column and the leanto column.

**Leanto rafter to single-column assembly with drop**



**Leanto rafter to double-column assembly with drop**



## Method 2

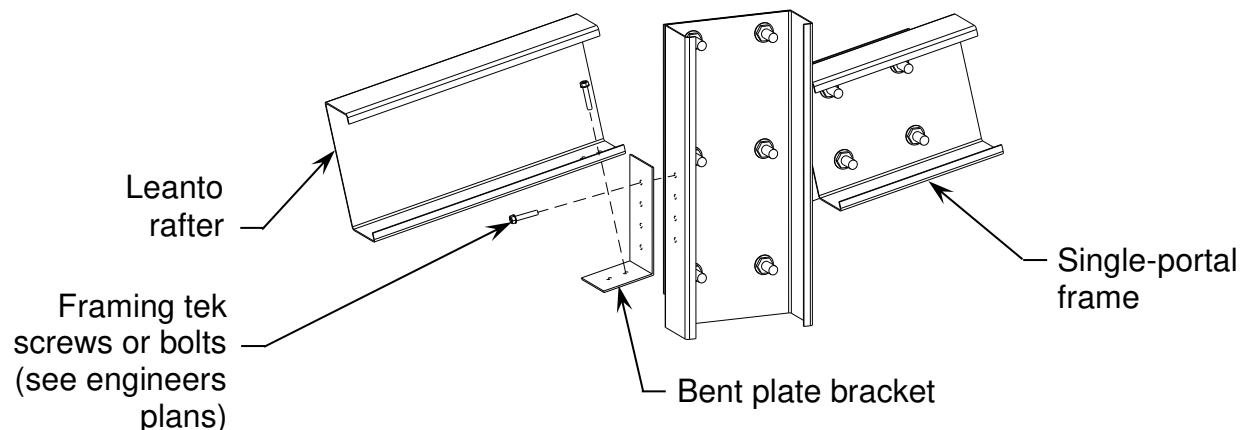
In this method, the top of the leanto rafter is secured using a bent plate bracket. Once the main building column is secured, attach the bent plate bracket to the column at the correct height using the framing tek screws or bolts as indicated on the engineering plans.

**Pro Tip:** Since the bent plate bracket will typically come with a 90 degree bend, it will need to be bent more on site to match the leanto roof pitch. To easily bend the bracket to the required angle, install the leanto rafter to the bent plate while the bracket is still at 90 degrees, so that the rafter is perpendicular to the column.

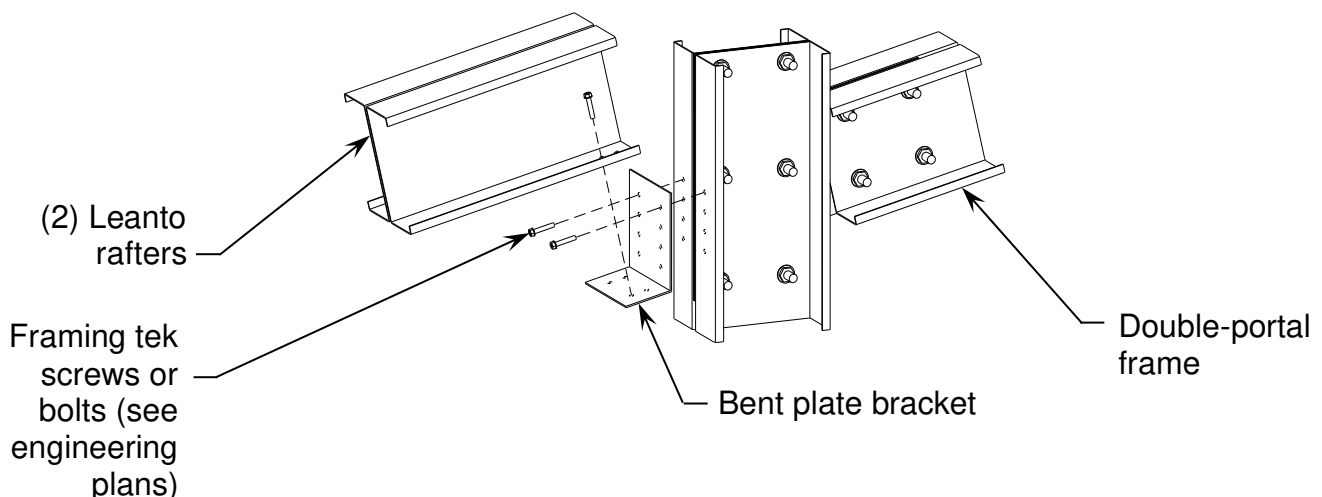
When this is done, the unsecured end of the rafter will now be above the leanto column. At this point, carefully lower the unattached end of the rafter to the correct height so it can attach to the leanto column. This will allow gravity and the weight of the rafter to bend the bent plate bracket to the angle required.

Once in place, secure the leanto rafter to the leanto column as indicated on the engineering plans, typically using bolts for a standard haunch connection.

### Leanto rafter to single-column assembly without drop



### Leanto rafter to double-column assembly without drop



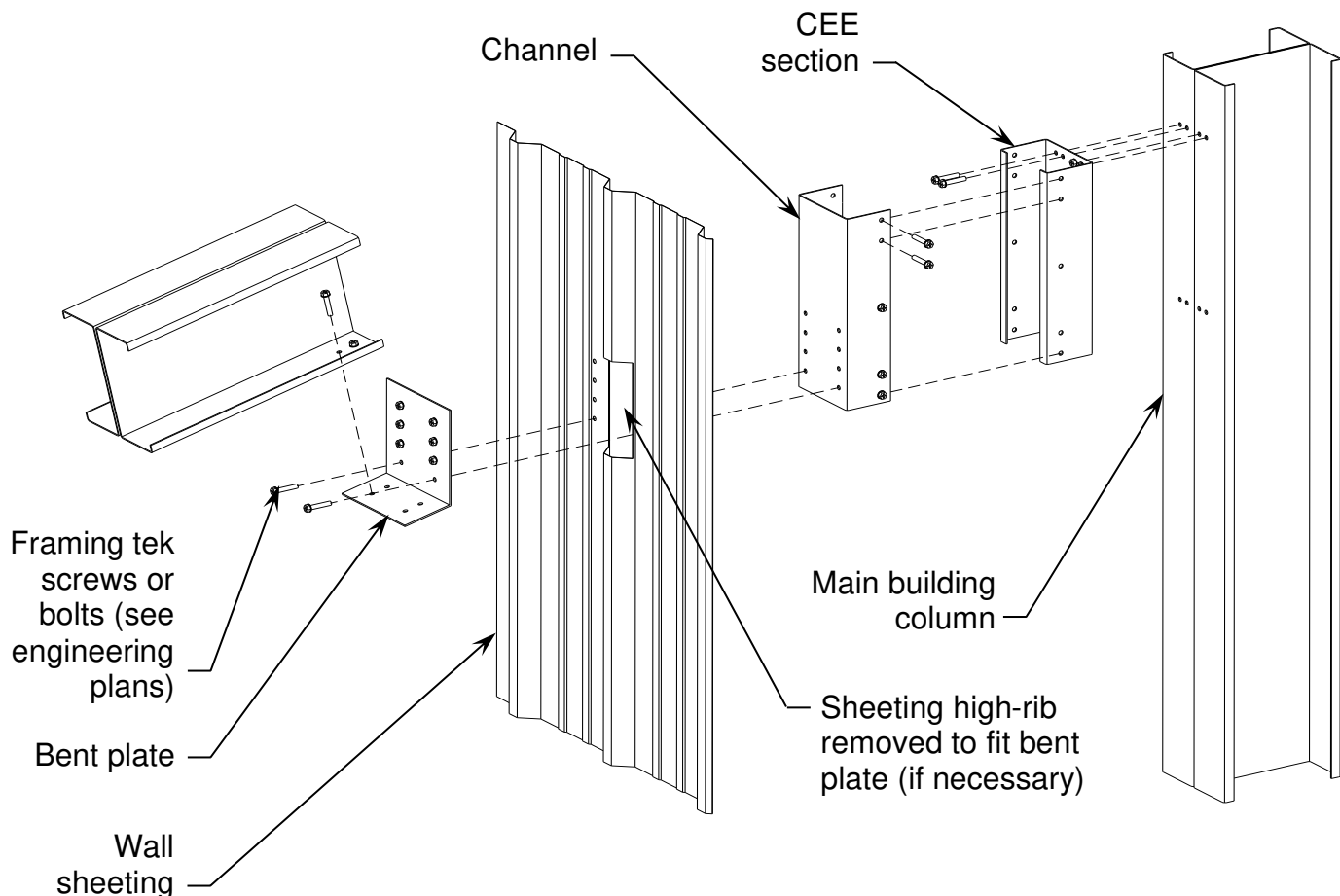
### Method 3

If buildings where sheeting exists between the main building and the leanto, a leanto rafter connector can be constructed so that the leanto rafter will appear to be installed directly to the wall sheeting.

In this method, a CEE section is installed to the main building column using framing tek screws. Then, a Channel is placed over the CEE section and secured using framing tek screws or bolts. The channel should be secured so that the overall size of the CEE/Channel connector matches the girt size in the wall.

Once this connector is installed, the wall sheeting can be installed. The wall sheeting should be flush to the face of the connector. Once the sheeting is installed, the bent plate (as shown in method 2) will be installed to the connector, through the installed wall sheeting. Note that when installing the bent plate if it conflicts with the sheeting high-ribs then that part of the high rib will need removed to allow the bent plate to sit flat against the wall sheeting.

#### Leanto rafter installation with leanto rafter connector







## Mezzanine Installation

When beginning mezzanine installation, mezzanine floor brackets must be installed at the same time as the haunch brackets. If this is not done, it will impede the installation of the mezzanine and slow building installation. Please see engineering plans for location of single- and double-mezzanine girders, and for number of brackets to be installed.

After installing mezzanine floor brackets, install the mezzanine girders. These and the floor brackets will be installed using bolts. Please see engineering plans for location of single- and double-mezzanine girders. Note that when installing double-mezzanine girders, you must install extra bolts to fasten the two girders together. Please see the engineering plans for location of these bolts.

After installing the mezzanine girder, install any necessary mezzanine knee braces which are indicated on the engineering plans. For instructions on installation, please see the knee brace installation section above. Installation procedures for knee braces and mezzanine knee braces are nearly identical. The only difference for installing mezzanine knee braces will be that the top end of the brace will attach to the mezzanine girder as opposed to the rafter.

Next, install any necessary mezzanine posts. The location of these is indicated on the engineering plans. Note that most mezzanine post installation consist of double 4" CEEs are placed with their fronts together, and held together by framing tek screws and small sections of strapping. This front-to-front installation is shown on a following page. However, some larger CEEs are installed back-to-back similar to standard columns. Please see the engineering plans for exact requirements and placement of the mezzanine posts.

The installation of the top and bottom of the mezzanine posts can vary by post size and engineering requirements. Posts 6" or larger may require the standard column base installation described earlier in this appendix. 4" posts will use framing tek screws and concrete anchors. The top of the mezzanine post will be attached to the mezzanine girder above using framing tek screws and clips. Note that in some cases, strapping will also be required. Please see the engineering plans for specific information on installation requirements for mezzanine posts.

After that, install mezzanine floor joists. Note that these are installed in a similar fashion as the wall girts and roof purlins, interlocking and connecting to the mezzanine girders with framing tek screws or bolts. For information on installing these, please see the wall girt or roof purlin section. For information on joist size and location, please see engineering plans.

After installing the joists, a mezzanine edge joist will need to be installed. This CEE section is installed directly to the sidewall column with framing tek screws or bolts. Once all joists are installed, you will need to install the edge angle along the outside edges of the mezzanine joists. To do this, place angle on edge of joist, and install pan-head

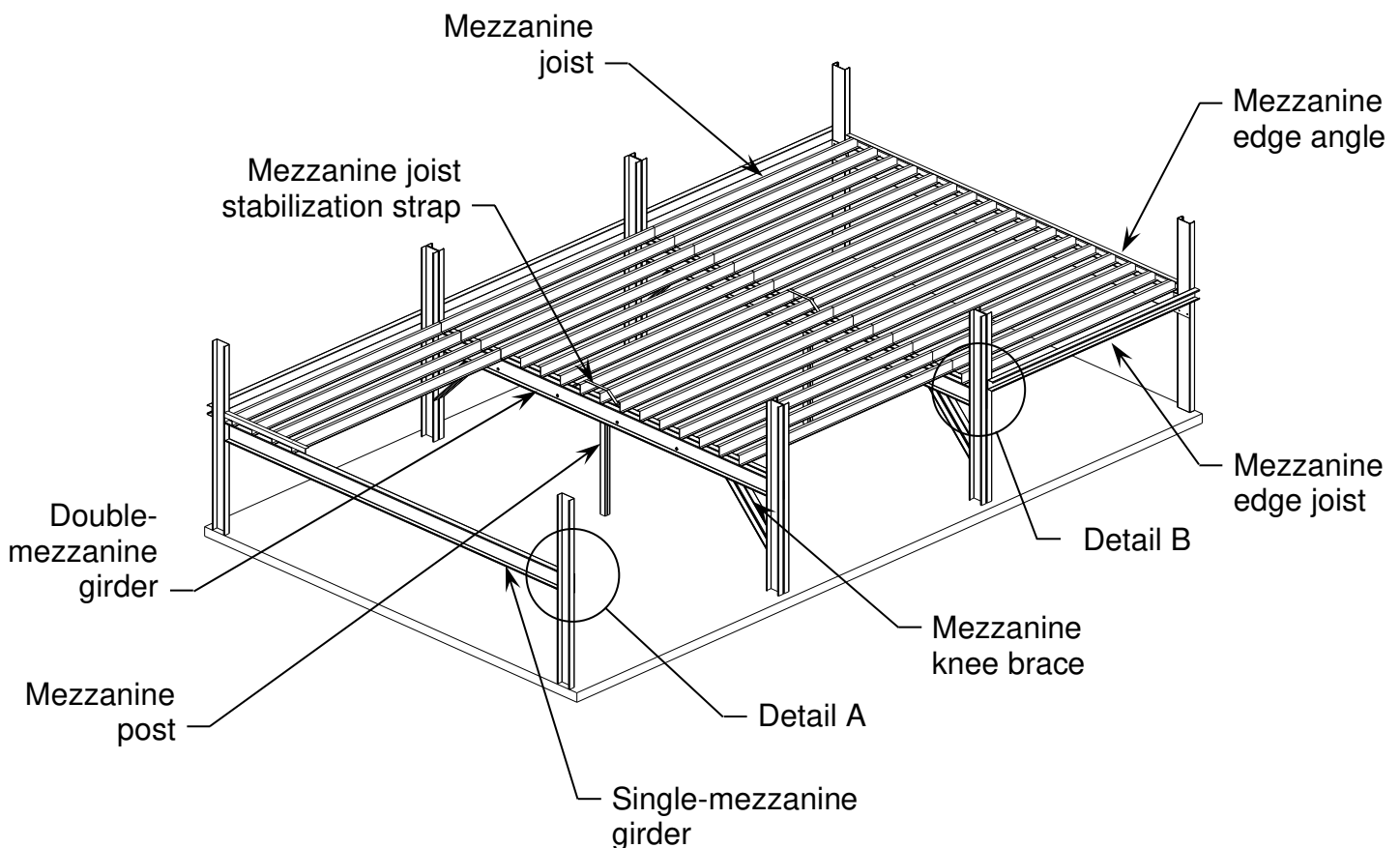


screws or fin head bolts at each intersection of edge angle and joists. For exact angle and fastener requirements, see the engineering plans.

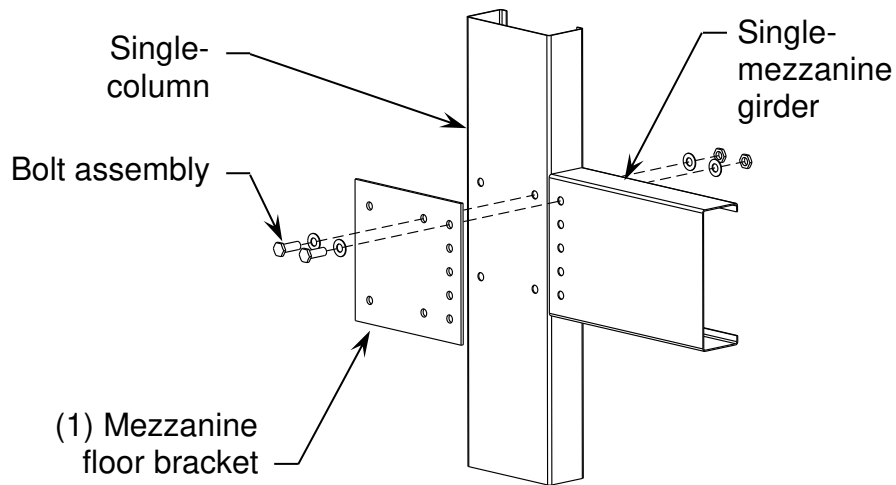
Also, you will need to stabilize the mezzanine joists, installing mezzanine joist stabilization strap in the center of all mezzanine girders not at the outer edges of the mezzanine joists. This strap will need to span at least two mezzanine joists, and will be installed using pan head screws or fin head bolts where the strap overlaps the mezzanine joists. For exact strap placement and requirements, as well as fastener requirements, please see the engineering plans.

If installing stairs in your building that would require an opening to be cut in your mezzanine, you will need to cut and reinforce the mezzanine joists. For more information on this, please see the engineering plans. Note that because of the custom engineering required for stairs, instructions for installation of stair opening and the stairs themselves are not provided in the manual. Please contact your building seller for information on installation of stairs.

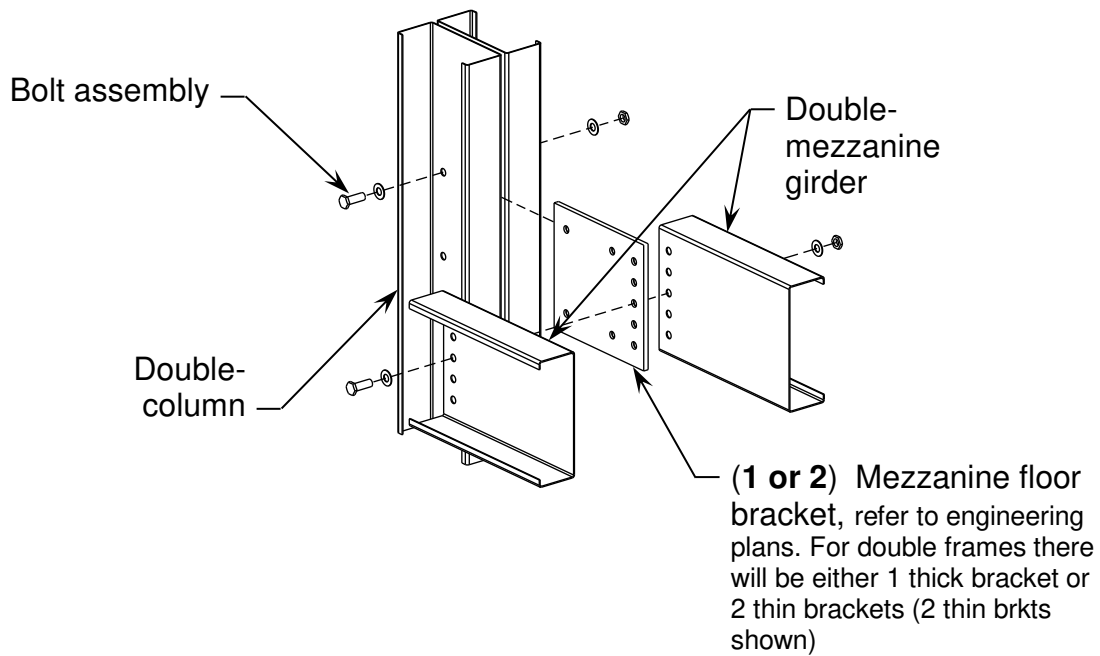
Please see the illustrations below and on the following pages as a reference for installing a mezzanine in your building. For reasons of clarity, not all components are shown.



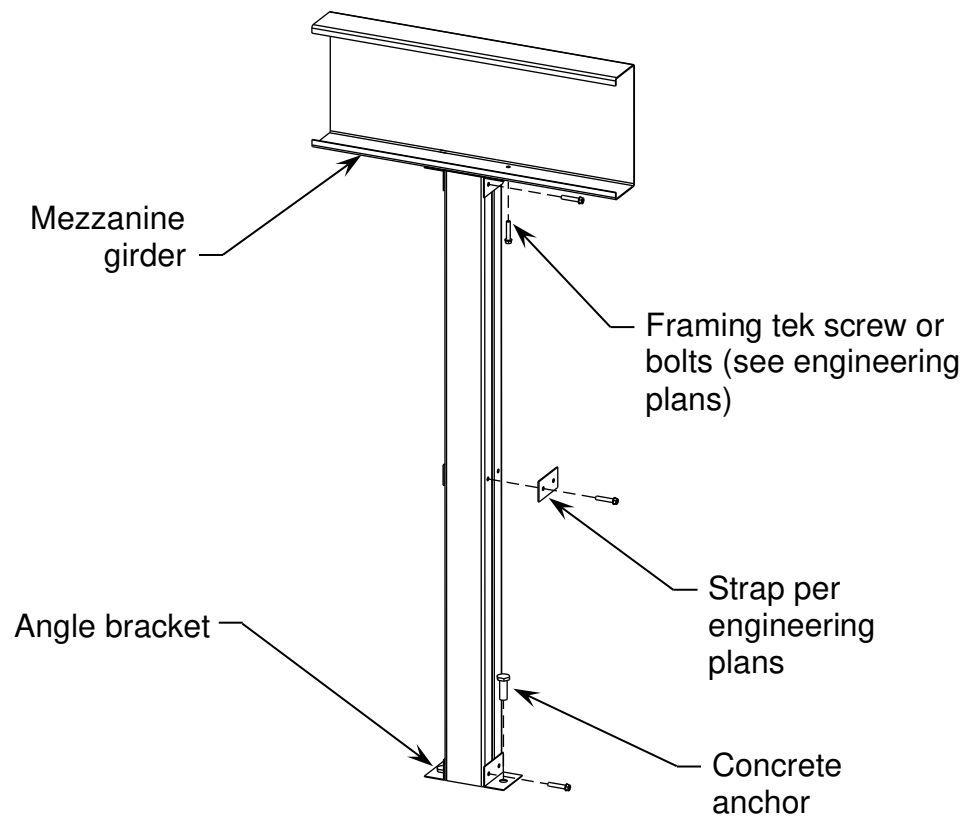
### Detail A



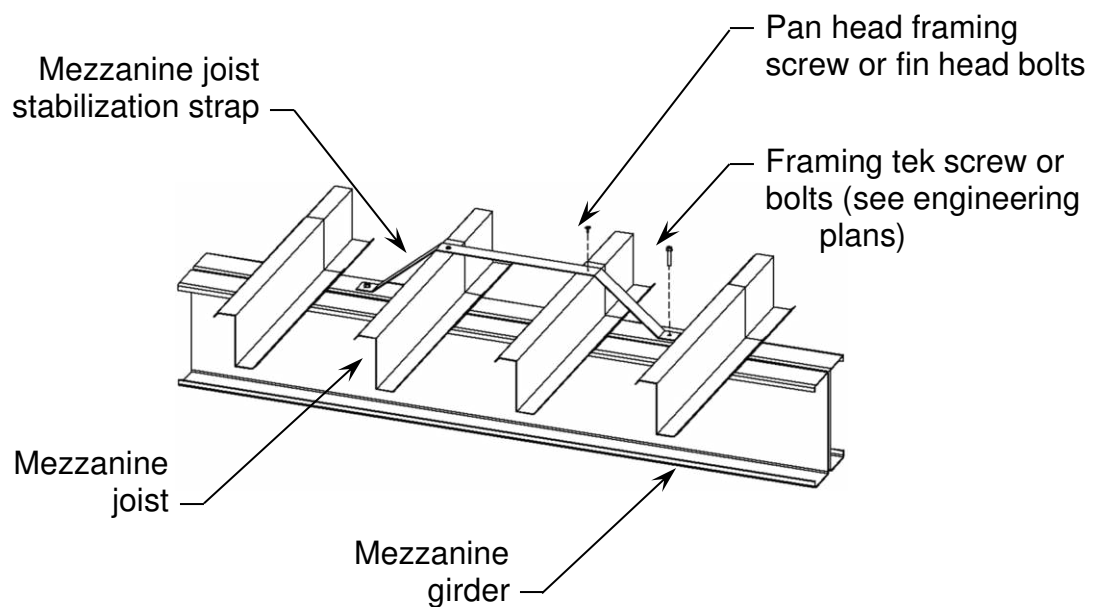
### Detail B



### Front-To-Front Mezzanine Post Installation

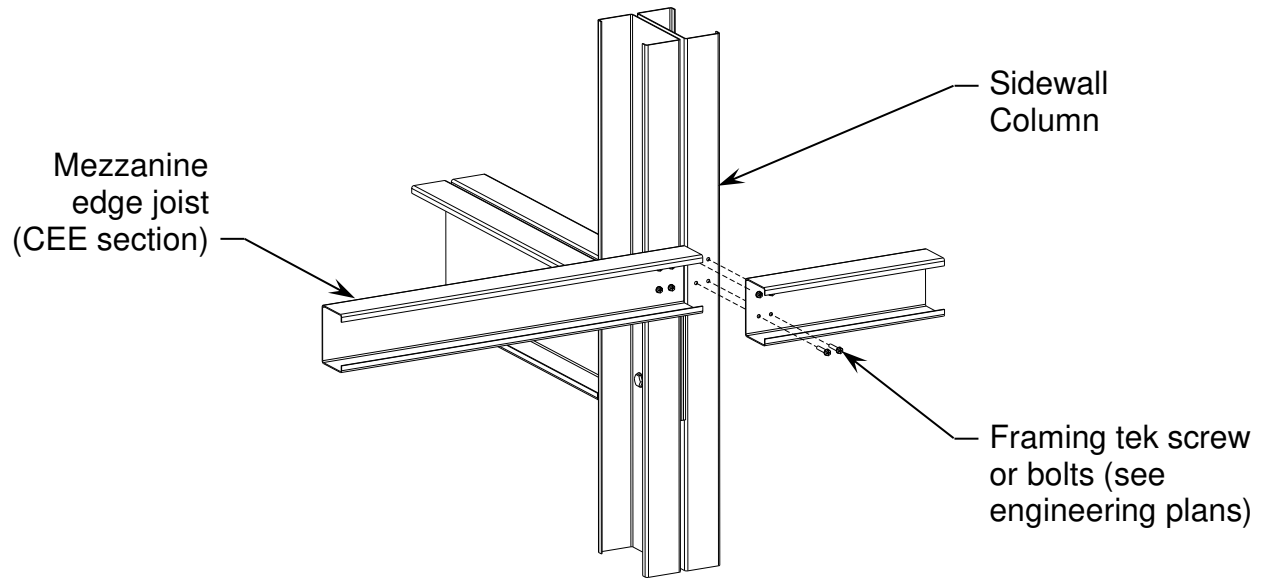


### Mezzanine Stabilization Strap Installation

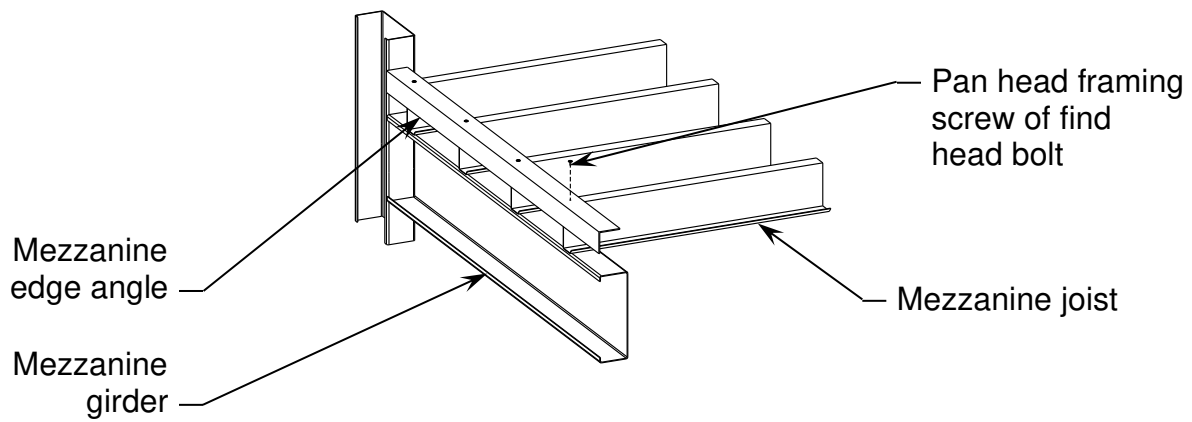




### Mezzanine Edge Joist Installation



### Mezzanine Edge Angle Installation



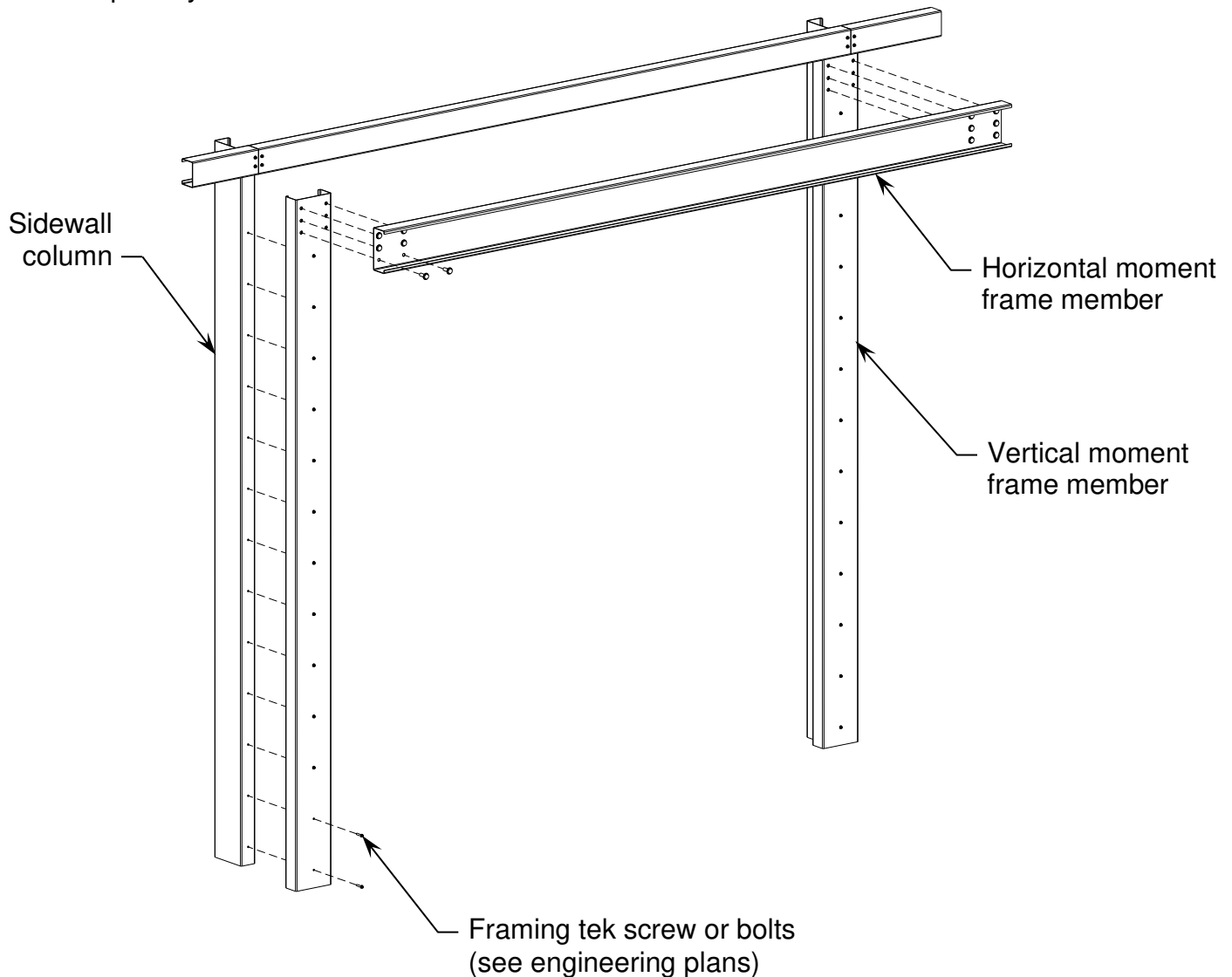


## Moment Frame Installation

A moment frame is a connection of vertical and horizontal members that are installed to the front of sidewall columns when x-bracing cannot be installed.

In a typical installation, the vertical members of the moment frame will be installed to the front of the sidewall columns using screws or bolts. Once properly installed, the horizontal member will be installed to the top of the vertical members using bolts. Note that bolt holes may need to be drilled on-site. Please see the engineering plans for required location and number of bolts, as well as for screw requirements.

The illustration below shows the installation of a moment frame that spans a single bay at an interior sidewall bay. Please see engineering plans for any alternate installations that may be required when installed next to a corner column or if a moment frame spans multiple bays.





## **Open Bay Installation**

If you have open bays in your building, those bays that are open will not typically contain any wall girts, with girts and sheeting from adjacent bays stopping at the edge of the columns for the open bay.

However, if your open bays have an open bay header, you will need to install open bay header girts to support your open bay header sheeting. If this is the case, an open bay header girt will be installed at the bottom edge of the open bay header, and, if the open bay header sheet is longer than the minimum required girt spacing for that specific wall, girts will need to be installed to support the open bay header sheet. Standard trim may be installed at the bottom and sides of the open bay header if necessary.

If an entire wall will consists of open bays, you will simply not install any of the wall girts for that entire wall unless directed otherwise on the engineering plans. Also note that if this is the case, you may be required to install moment frames. For location and installation instructions, please refer to the engineering plans.



## Purlin Installation

Purlins are installed on the top of rafters of your building. Each purlin is connected from one rafter to the adjacent rafter using framing tek screws or bolts. When overlapping purlins, they *must* overlap at a rafter.

Note that for some buildings, LGSIs will be used to make up the purlins. Please check your engineering plans or order to see if an LGSI or ZEE is to be used. An LGSI is nearly identical to a ZEE, but for an LGSI each flange will have a different length, so that one flange will be roughly  $\frac{1}{4}$ " wider than the other. This is so that the purlins will interlock a bit easier. Thus, when installing LGSI purlins, install them in such a manner that the first purlin attached should have its wider flange (note that there may be a small triangle-shaped hole in the web of the LGSI, which points toward the wider flange) connected to the column. This will easily allow the next purlin to be installed so that, if its narrower flange is connected, it will easily interlock with the other purlin. When installing all purlins, please keep this fact in mind.

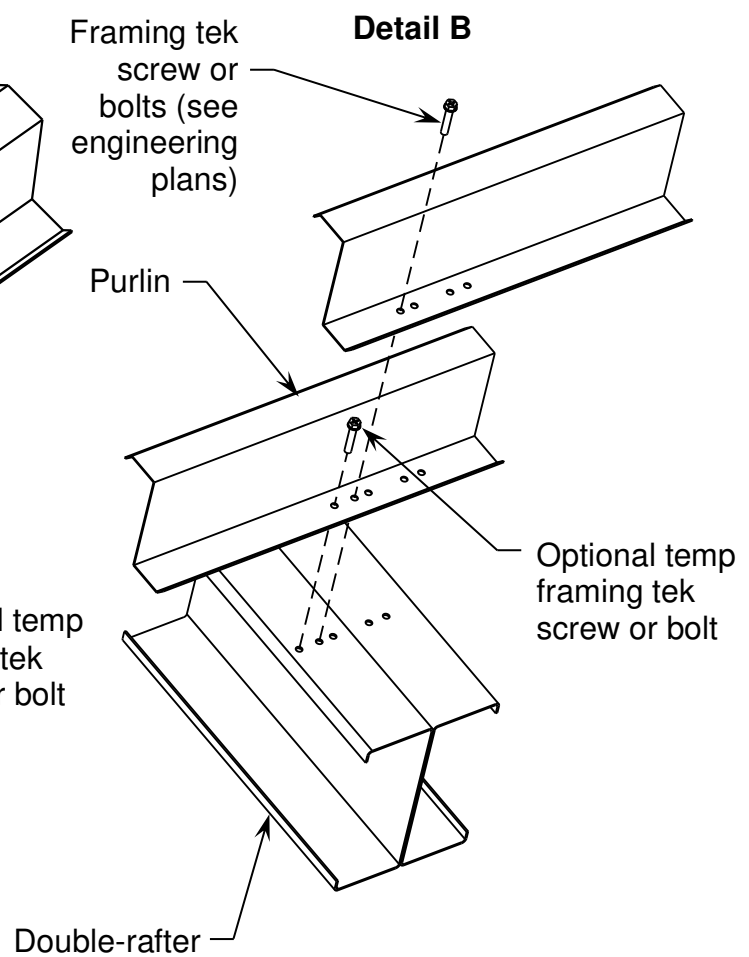
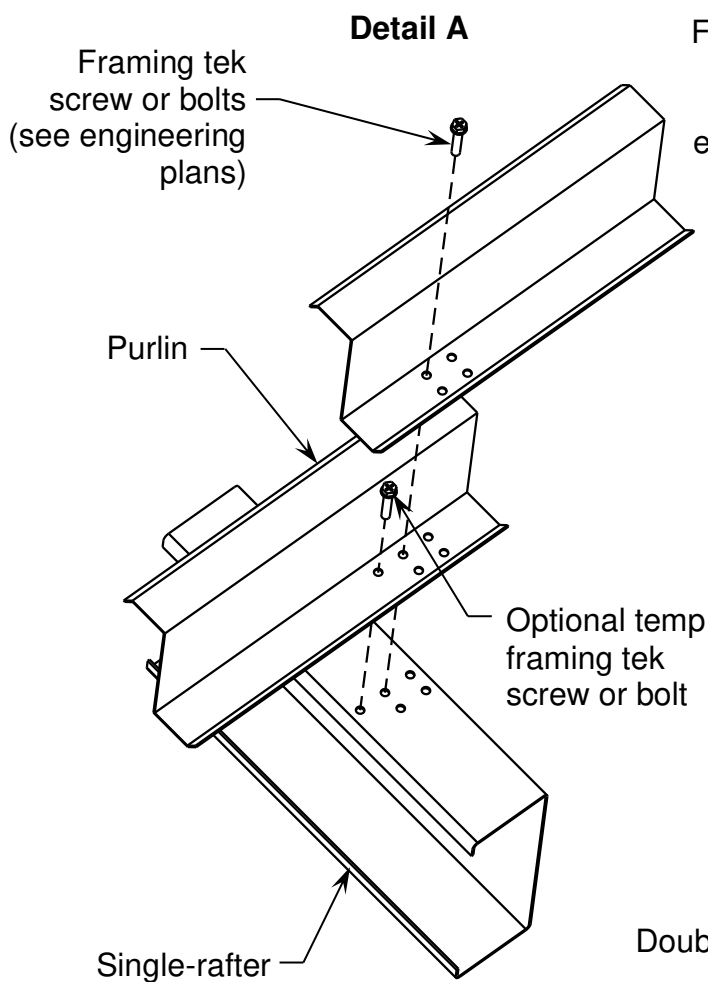
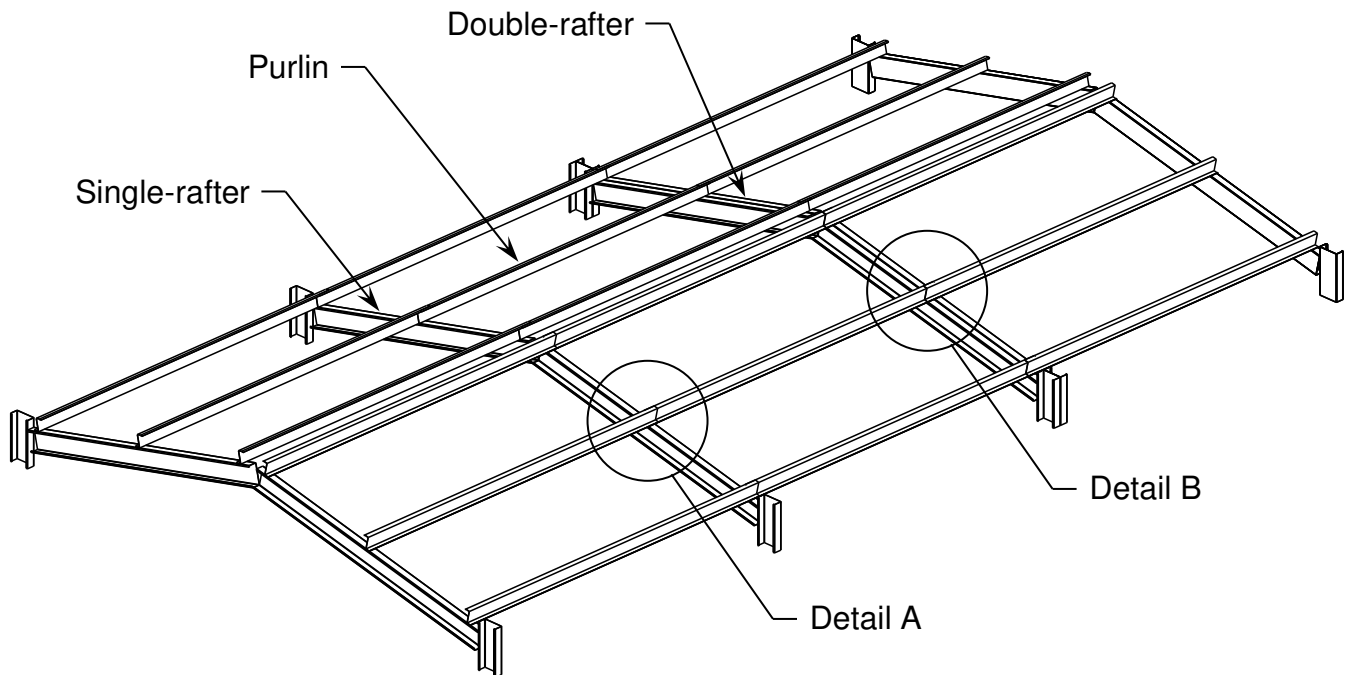
Also, when installing interior and top purlins, make sure the flange that is connected to the rafter points downhill. The lowest purlin on gambrel style roofs should be installed the opposite direction to limit the length of unsupported sheeting.

Please see the details on the engineering plans for more information on installing purlins and please see illustrations below and on the following page as a reference for installing purlins. Note that in the illustrations, not all components are shown for clarity and that double and single-rafters are shown, but your building may not have both double and single-rafters. Instead it will be one or the other.

**Pro tip:** When overlapping purlins, per the engineering plans, only a 3" overlap of the purlins is required, though the width of a single rafter is 4". Your purlins should be ordered so that a 3" overlap is assumed at all single rafters, and a 7" overlap is assumed at all double rafters. When overlapping purlins, a temporary tek screw or bolt can be installed at the inside edge of the first installed purlin, within  $\frac{1}{2}$ " of the edge of the rafter. When the second purlin is installed later, the previously installed screw will not interfere with the second purlin, allowing for easy installation. Once the second purlin is in place, screws or bolts as required by engineering plans can be installed. This method is illustrated in Detail A and Detail B below.

Note that though purlins are graphically shown on the engineering plans, locations shown are not exact. Locate the top purlin with its web being at the top end of the rafter (with the flange connected to the rafter pointed downhill). The subsequent purlins should be located downhill from the initial purlin at the maximum purlin spacing. Note that the final purlin installed should be within the maximum purlin spacing of the eave purlin. For the maximum purlin spacing, please see the member and material schedule of the engineering plans.





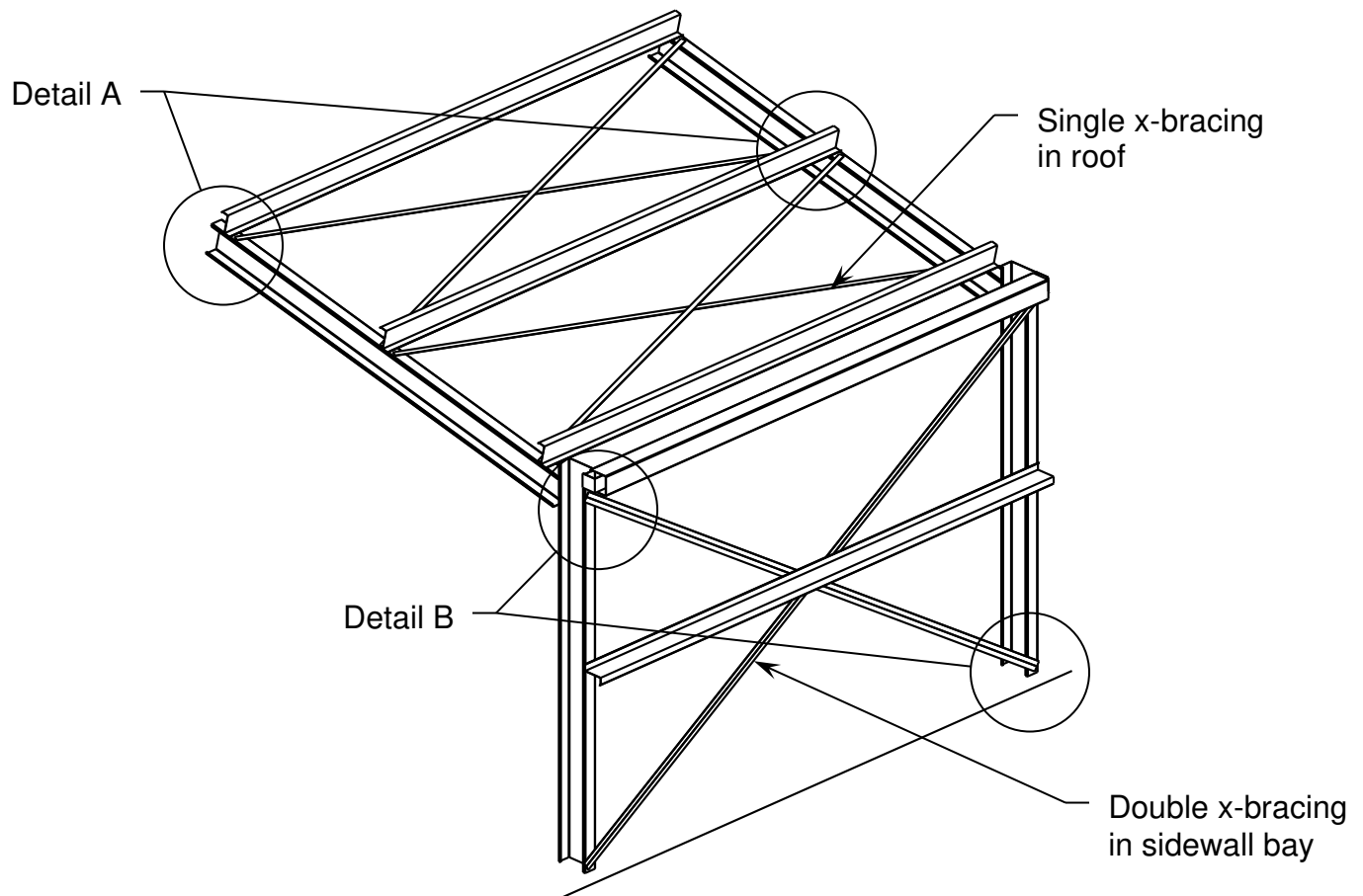


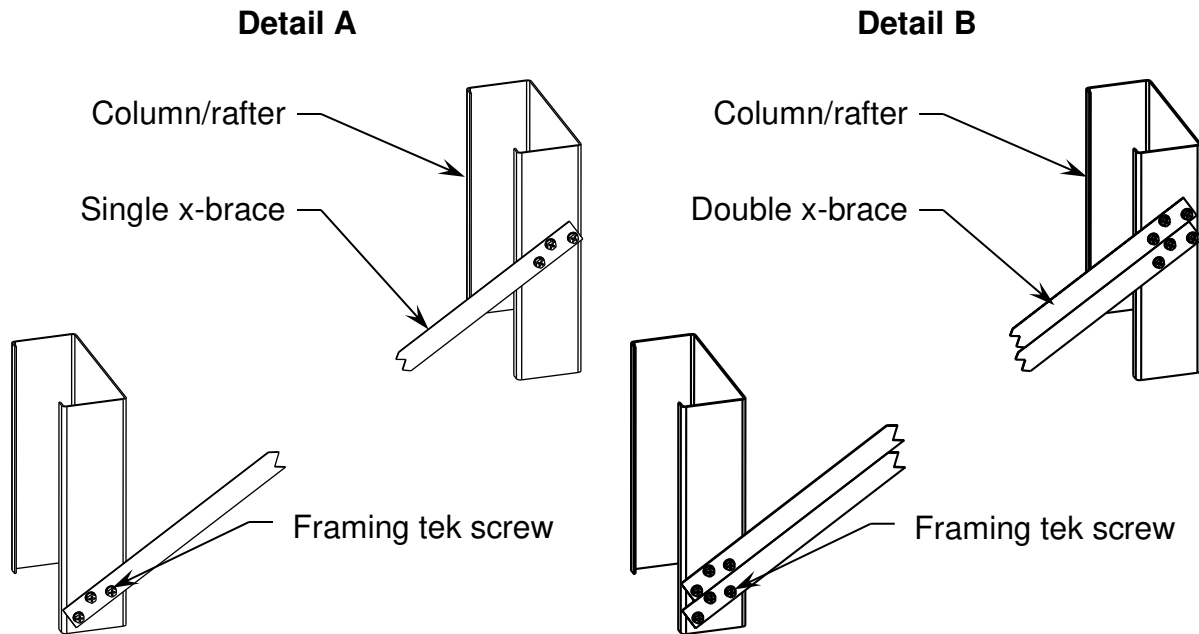
## X-Bracing Installation

After installing wall girts and roof purlins, you will need to install x-bracing on the walls and on the roof, respectively. For exact location and layout of the x-bracing, please see the engineering plans, specifically the foundation plan and all elevations. Note that the specific strapping type is specified in the member and material schedule on the engineering plans. Further installation instructions and requirements specific for your building are found in the details section of the engineering plans.

Note that when installing x-bracing, strapping needs to be within 2" from the top and bottom of column or rafter, per the engineering plans.

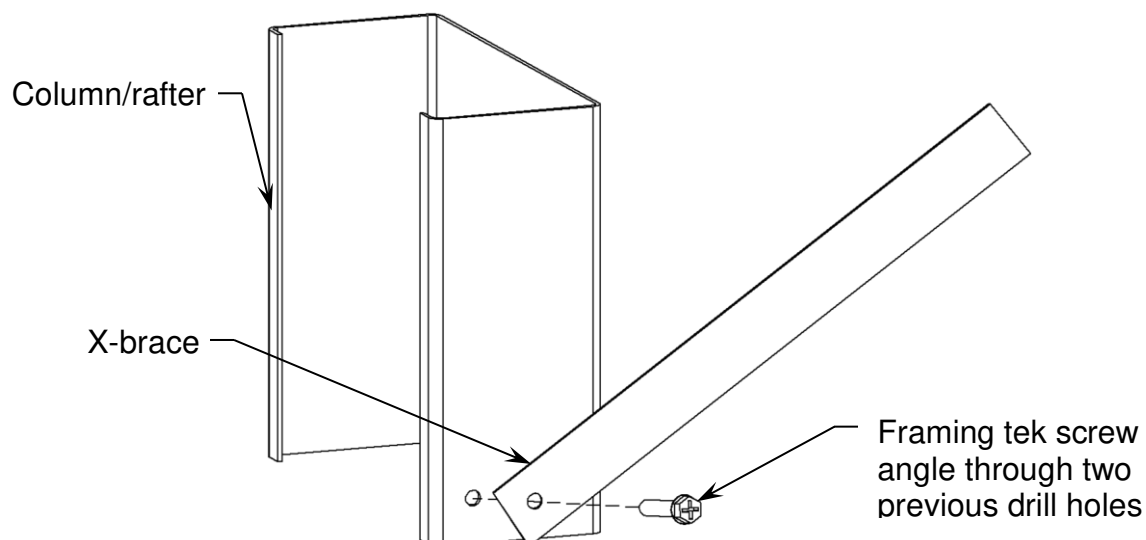
Please see the illustrations below and on the following page as a reference on installation of x-bracing. Note that the illustrations do not show endwall x-bracing. However, installation is similar to the installation of x-bracing on the sidewall. Also note that double x-bracing is shown on the sidewall, while single x-bracing is shown on the roof. This is for reference only. Please refer to the member schedule on sheet 2 of your engineering plans for x-bracing requirements.





When installing x-brace, it is imperative that it be snug. However, you must not overtighten it. Overtightening will pull your columns out of plumb. Please keep this in mind while installing.

To get your x-bracing tight, first attach one end of the strap (in most cases the higher end) using a single screw, so the strap is attached to one column or rafter but is still able to pivot. Then pull the strap manually as tight as you can and clamp into place. Drill a hole through the strap **ONLY** using a framing tek screw. Do not drill into the column or rafter. Instead, using the hole you have just drilled, trace the hole on the column. Then, unclamp and reposition strap so you can drill a hole in the column. Drill this hole about  $\frac{1}{4}$ " past where your previous mark was. Then, after both holes are drilled, angle a framing tek screw through both holes, as illustrated below. This process should tighten your x-brace, but not overtighten it. If it is not snug enough, or is overtightened and pulls columns or rafters out of plumb, remove and re-install the x-brace.





## Appendix C – Trim Component Installation

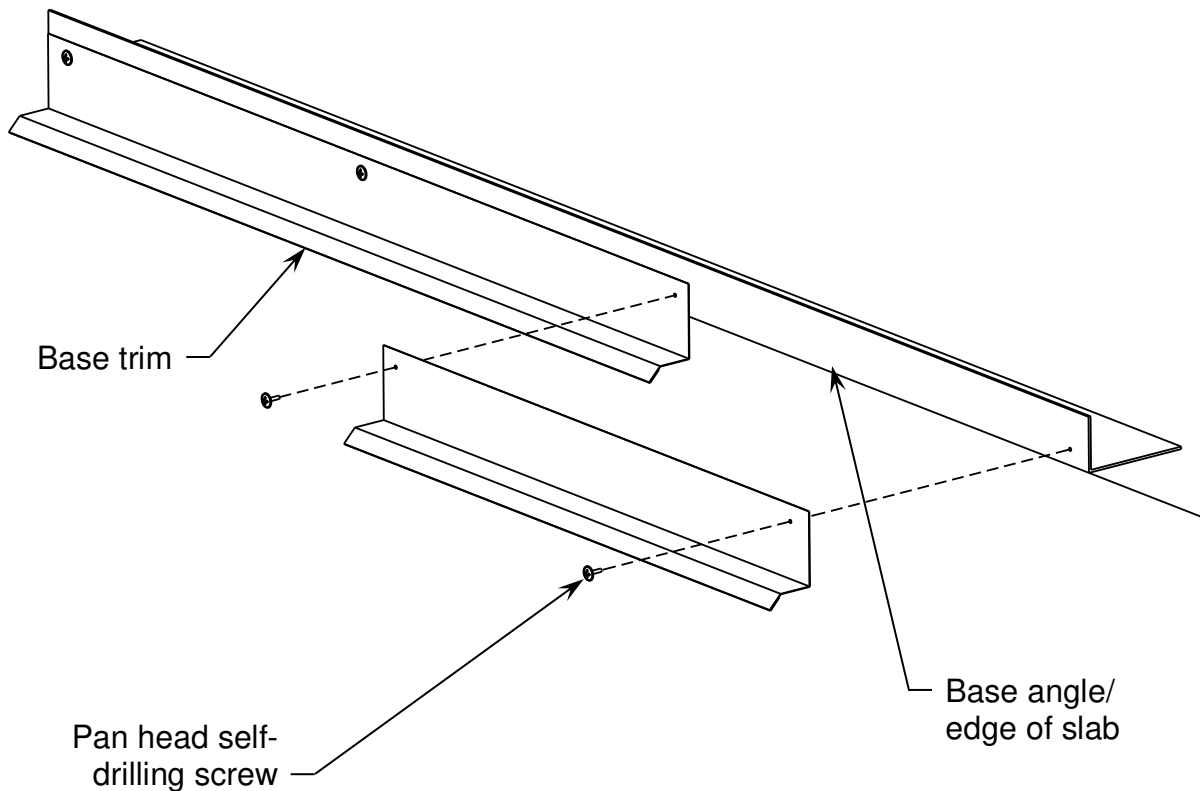
Last updated 1/8/2019

### Base Trim

Base trim, if it comes with your building kit, is installed at the bottom of all wall sheeting at the edge of the slab.

To install base trim, align the trim so that the bottom leg of the trim falls below the edge of the slab the desired amount, and then attach the trim to the lowest available framing member using pan head framing screws installed every 24". In the detail below, base trim is installed to base angle, though a bottom girt could be used instead.

Take care that the base trim is level, or your wall sheeting may not install correctly.

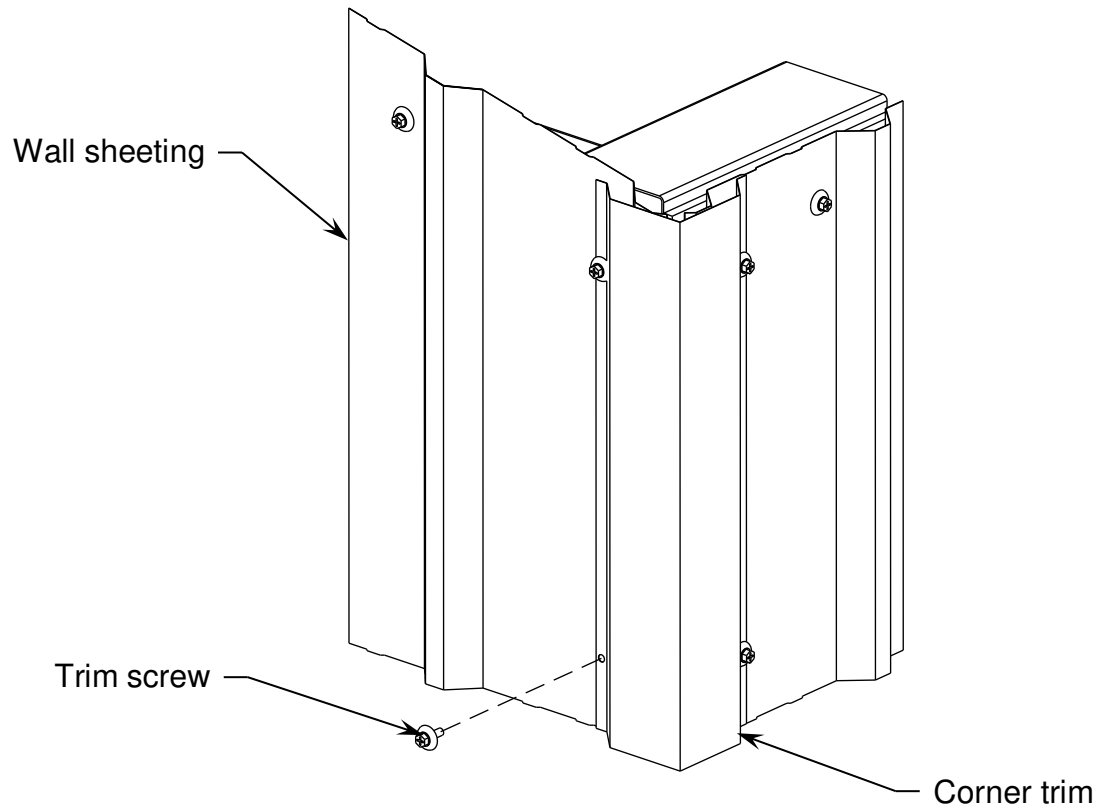




## Corner Trim Installation

Corner trim is installed at all four corners of the building and runs from the bottom of the wall sheets to the top of the sidewall sheets. Corner trim is attached to the wall sheets using trim screws through the edge of the trim into the wall sheets. Note that in some cases more than one piece will be needed to span the entire length of the sidewall sheet. When this is case, simply install the bottom piece of corner trim first and then overlap and install other pieces above that. If corner trim must be cut to fit, use metal snips.

Please see the illustration below as a reference on how to install corner trim.





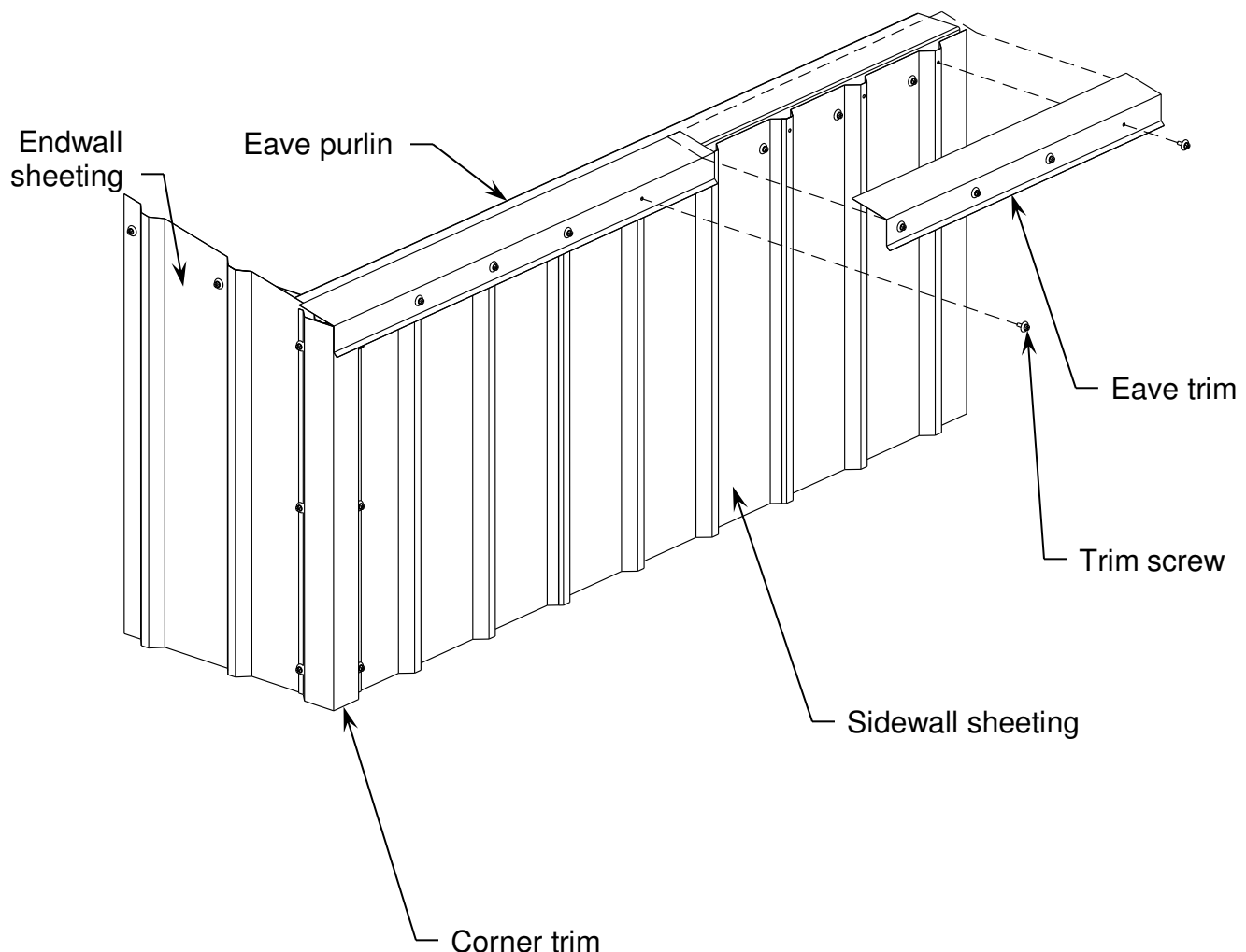
## Eave Trim Installation

Eave Trim is installed along the top of the sidewall sheets. It is connected to the face of the sidewall sheets at every high rib using trim screws. Eave trim will run the entire length of the sidewall, from the edge of the corner trim to the opposite edge. Simply overlap eave trim pieces to span this distance, trimming any pieces as necessary using metal snips.

Note that pan head screws can be installed from the top of the eave trim into the eave purlin during installation, to hold the eave trim in place during roof sheeting installation. These can be installed every 48". These screws are not shown in the illustration below.

Note that if you have a gambrel-style roof, eave trim will be installed at the top of the lower section of roof sheeting, and will be installed in a similar manner as described above, attaching eave trim to the lower section of roof sheeting using trim screws.

Please see the illustration below as a reference for installing eave trim.





## Box-style (Pre-Hung) Gutter Installation

*Note: Gutters are not designed for use in snow areas and will need additional support to withstand the snow loads if used.*

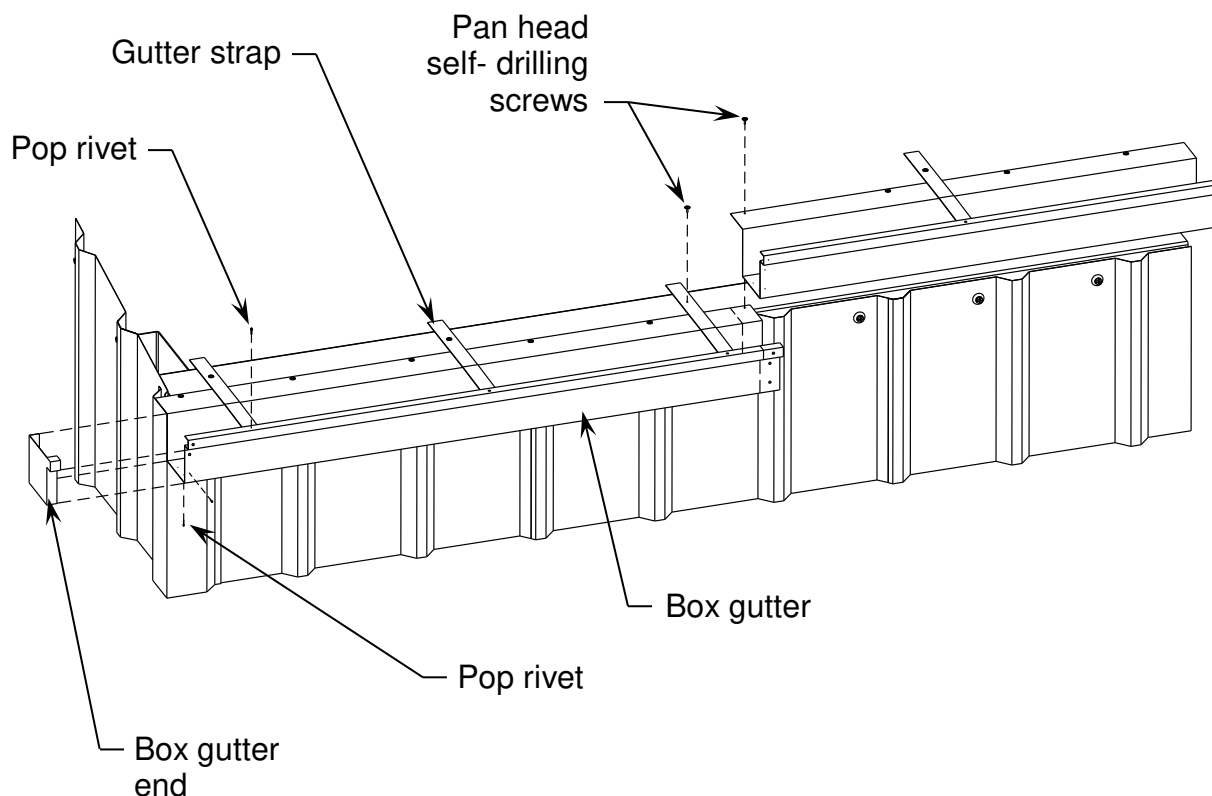
Box gutters are installed along the top of the sidewall sheets. They will need to be installed before installing the roof sheets. They are connected on the top to the eave purlin using pan head self-drilling screws. These screws should be installed every 48". Gutter strap will need to be installed every 24" as well. This connects at one end to the eave purlin and connects to the edge of the gutter. Note that gutter strap will be connected to the eave purlin using pan head self-drilling screws and will connect to the gutter using pop rivets.

Gutters will run the entire length of the sidewall, from the edge of the corner trim to the opposite edge. You will need to be fit gutters together to run the necessary distance, trimming any pieces as necessary using metal snips.

After installing all gutters, gutter pieces will need to be sealed together using silicone caulking (to prevent leakage) and secured using pop rivets. To install a pop rivet, first drill a hole the size of your pop rivet through both materials. Then, insert pop rivet through both holes and set pop the rivet using a rivet gun.

Note that the box gutter end will be installed, at the end of the entire length of gutter in the same manner. It will fit just inside the end of the gutter. It will need to be set, sealed with silicone caulking and secured using pop rivets.

Please see the illustration below as a reference for installing box gutters.





## **Sculptured-style (Post-Hung) Gutter Installation**

*Note: Gutters are not designed for use in snow areas and will need additional support to withstand the snow loads if used.*

Sculptured gutters are installed along the top of the sidewall sheets and just under the edge of the roof sheets. They will need to be installed after installing the roof sheets.

First, one edge of the gutter will be attached to the roof sheets by installing trim screws adjacent to every high rib through the roof sheet and into the gutter's inside lip.

Next, install the gutter hanger. This hanger, which fits over the high rib of the roof sheets, is attached using a trim screw, and it will extend from the roof sheet to the far edge of the sculptured gutter. (This will cause gutter hanger to extend into the gutter.) Note that gutter hangers will need to be installed per manufacturer's recommendation, typically every 24" or 36". In most cases, this will be at every other high rib of the roof sheeting; however, this can vary depending on roof sheeting type.

After installing gutter hanger, connect outer lip of gutter to gutter hanger using trim screws.

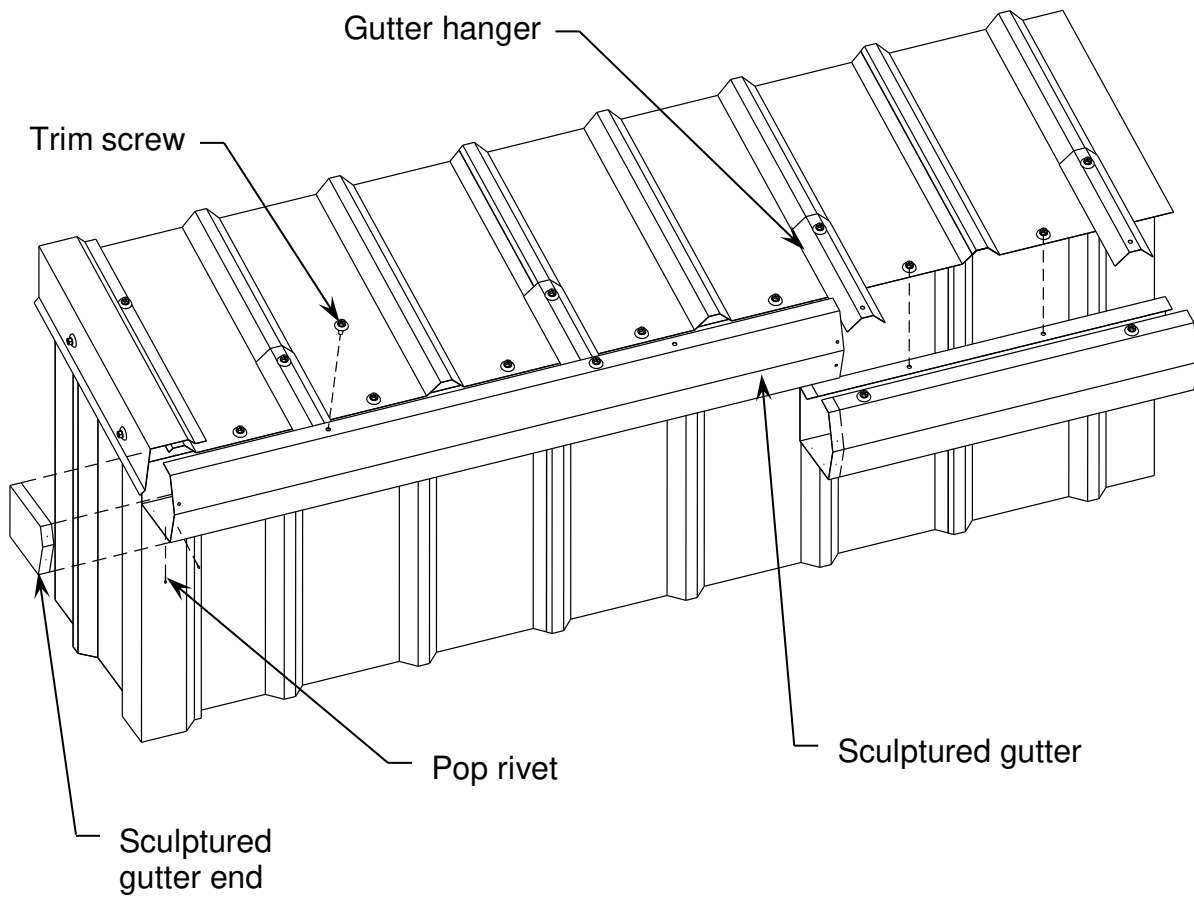
Gutters will run the entire length of the sidewall, from the edge of the corner trim to the opposite edge. You will need to be fit gutters together to run the necessary distance, trimming any pieces as necessary using metal snips.

After installing all gutters, gutter pieces will need to be sealed together using silicone caulking (to prevent leakage) and secured using pop rivets. To install a pop rivet, first drill a hole the size of your pop rivet through both materials. Then, insert pop rivet through both holes and set pop rivet using a rivet gun.

Note that the sculptured gutter end will be installed, at the end of the entire length of gutter, in the same manner. It will fit just inside the end of the gutter. It will need to be set, sealed with silicone caulking and secured using pop rivets.

Please see the illustration on the following page as a reference for installing sculptured gutters.







## Gutter Downspout Installation

After installing the gutters, you will need to install gutter downspouts. Gutter downspouts are connected to the gutter using pop rivets and are connected to the wall sheets using gutter downspout brackets.

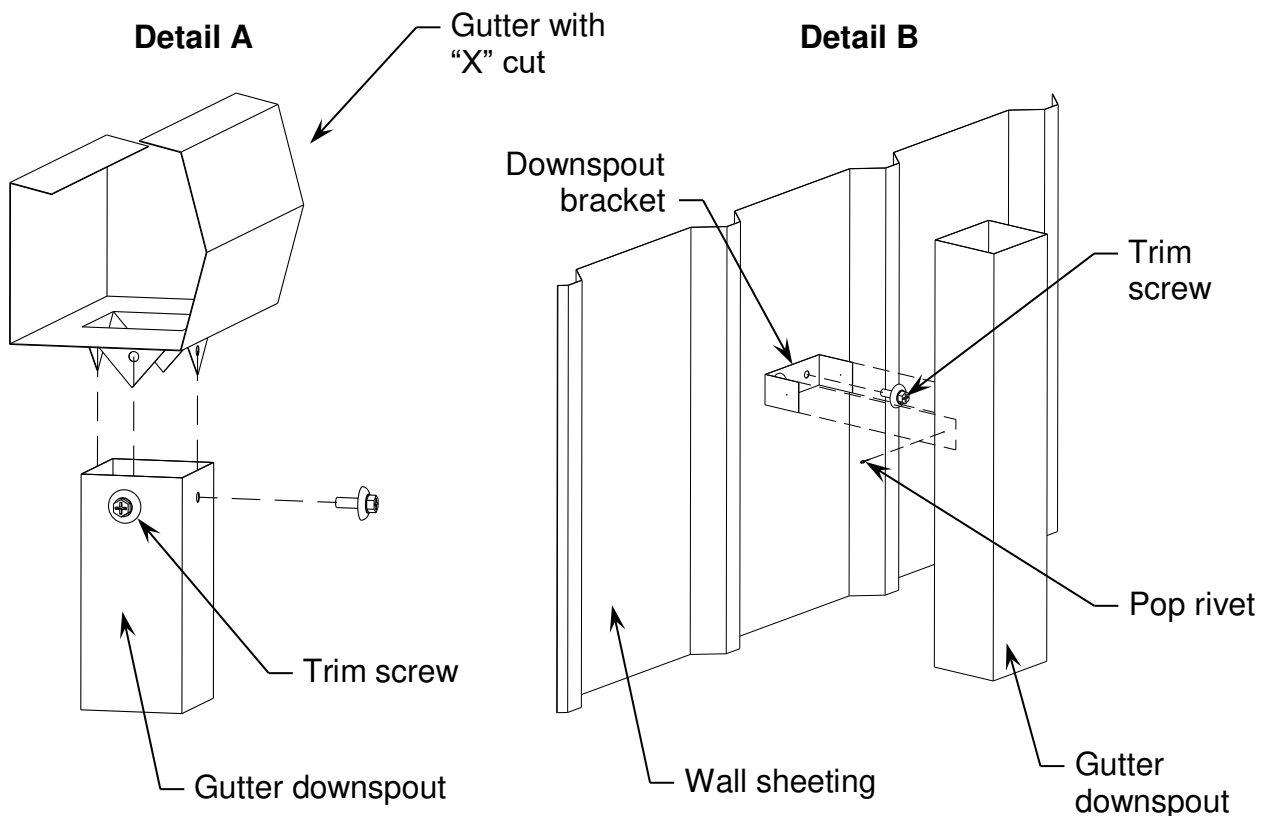
Start by cutting an “X” in the gutter itself in the shape of the gutter downspout. Make sure that this opening will be positioned in the middle of the trough of the wall sheeting in the middle of two high ribs. You can use the gutter downspout to trace the outline before cutting. After an X is cut, fold down all four tabs, and connect the downspout to the tabs using trim screws. This is illustrated in Detail A below.

Next, attach the downspout to the wall sheeting. First, cut a downspout strap in half and fold into a u-shaped bracket. Attach this bracket using two trim screws to the wall sheeting in the middle of the trough of the wall sheeting between two high ribs. Then attach the downspout to bracket using pop rivets. Before securing, ensure that gutter downspout is plumb. This is illustrated in Detail B below.

If a single piece of downspout does not run the entire length of the sidewall, splice together two pieces of downspout and install an extra bracket.

If necessary, use silicone caulking to seal any gaps in gutter and gutter downspout.

Please see the illustrations below as a reference for installing gutter downspouts.



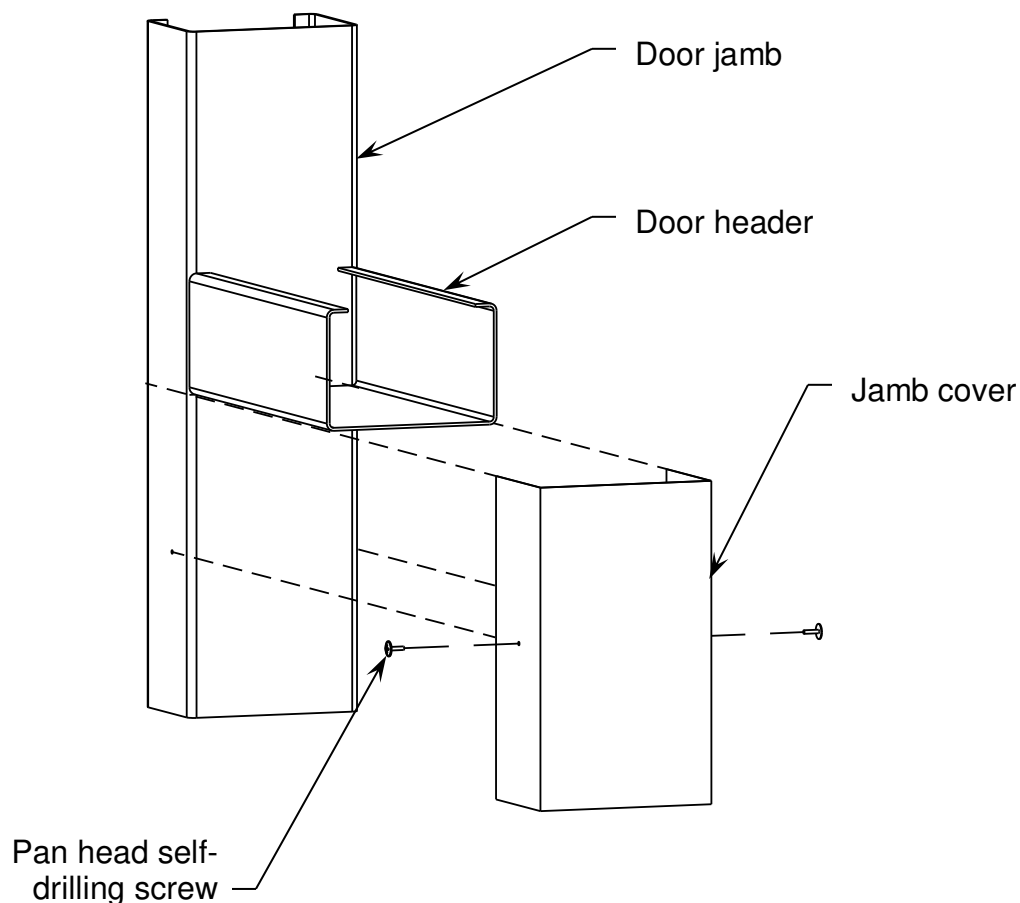


## Head/Jamb Cover Installation

Head/jamb cover is installed on the door jambs and headers of rollup and sectional doors. This piece of trim simply wraps the jamb in your trim color. The head/jamb cover is installed using pan head self-drilling screws on both the front and back of the door jambs and door header. Head/jamb cover will run from the slab to the bottom of the door header and run the length of the door header.

Note that the head/jamb cover will need to be cut to length using metal snips. If a single piece of trim is not long to span the needed distance, simply overlap two pieces of trim to span the necessary distance.

Please see the illustration below as a reference for installing the jamb cover. Head cover is installed in the same manner, except is installed over the door header instead of the door jamb.





## Head/Jamb Trim Installation

Head/jamb trim is installed around the edge of all doors and windows. It is installed using a pan head self-drilling screw, connecting the head/jamb trim to the door jambs, header and sill (if installing around window). Note that all head/jamb trim will need to be cut to length. This can be done using metal snips. If you require a length more than the stock length of head/jamb trim, you will need to splice together two different pieces, install as needed and caulk using silicone caulking to prevent water leakage around door.

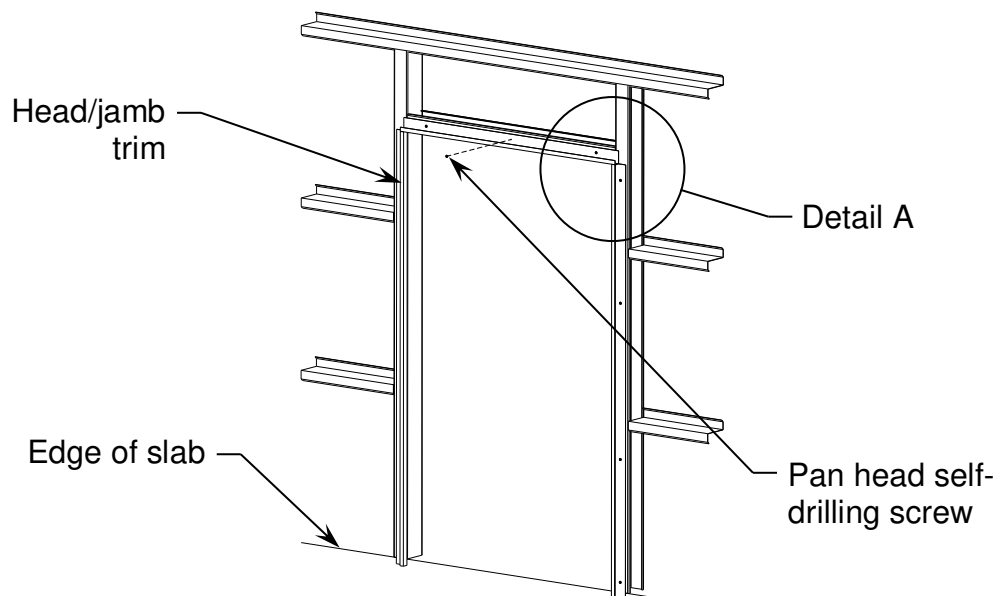
When installing the top section of head/jamb trim, the length of the piece should be cut to 2" longer than the length of the door header, so that there is a 1" overlap on each side.

When installing the side sections of head/jamb trim around doors, the pieces will need to be cut so that they run from the bottom edge of the door header to the bottom of the wall sheets (typically 1" below the edge of the slab).

When installing the side sections of head/jamb trim around windows, the pieces will need to be cut so that they run from the bottom edge of the window header to 1" past the bottom of the window sill.

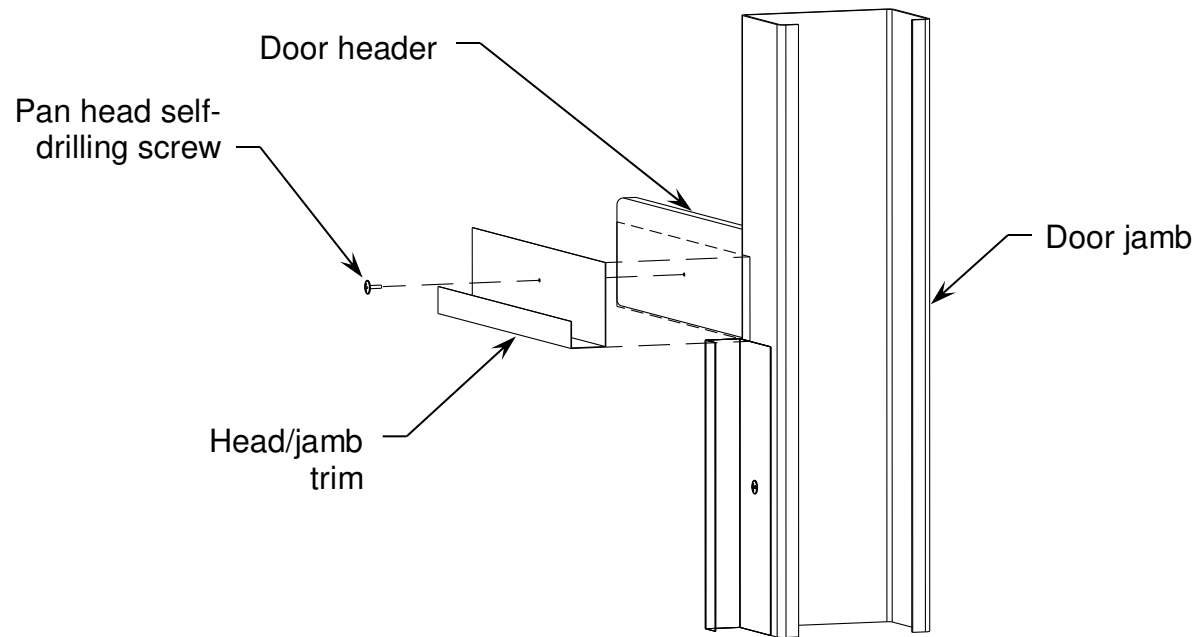
When installing the bottom section of head/jamb trim around windows, the piece will need to be cut to be the same length as the window header and window sill.

Please see the illustrations below and on the following page as a reference for installing head/jamb trim. Note that an overview for installing head/jamb trim around a window is not shown. However, it is similar to installing around a door, except with an extra piece of head/jamb trim on the bottom. Detail B below shows the installation of the bottom piece of head/jamb trim.

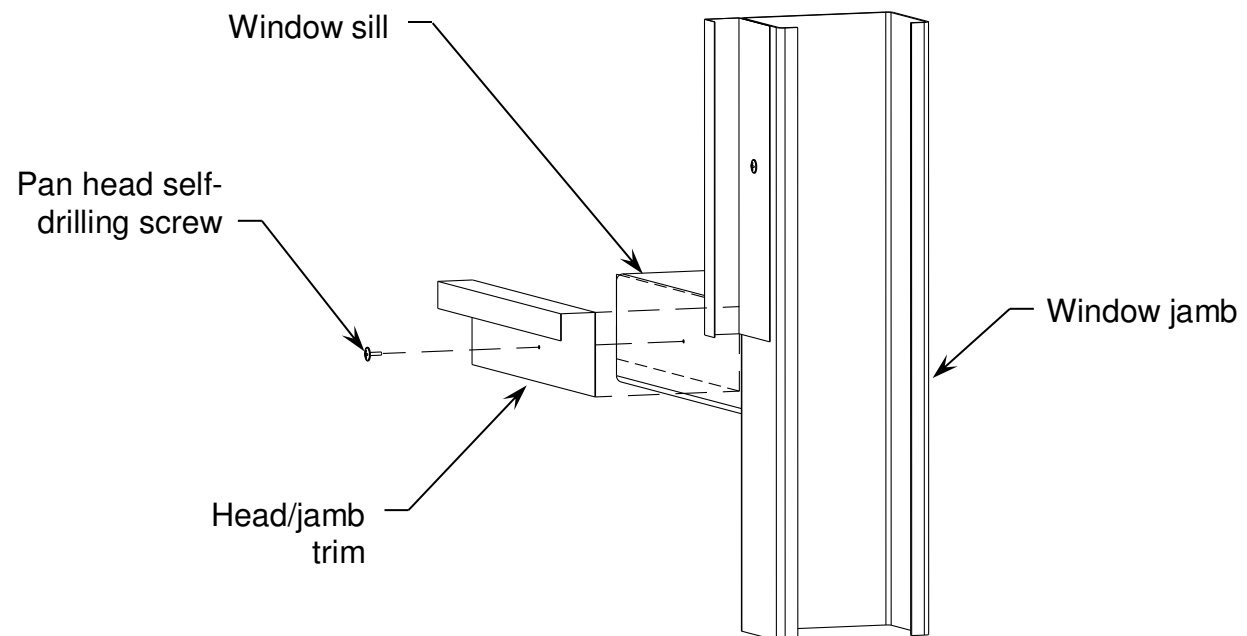




**Detail A**



**Detail B**





## Pitch Break Trim Installation

Pitch break trim is installed at the top of the leanto roof sheeting, where the leanto roof meets the main building, and runs the entire length of the leanto. Simply overlap pitch break trim pieces to span this distance, trimming any pieces as necessary using metal snips.

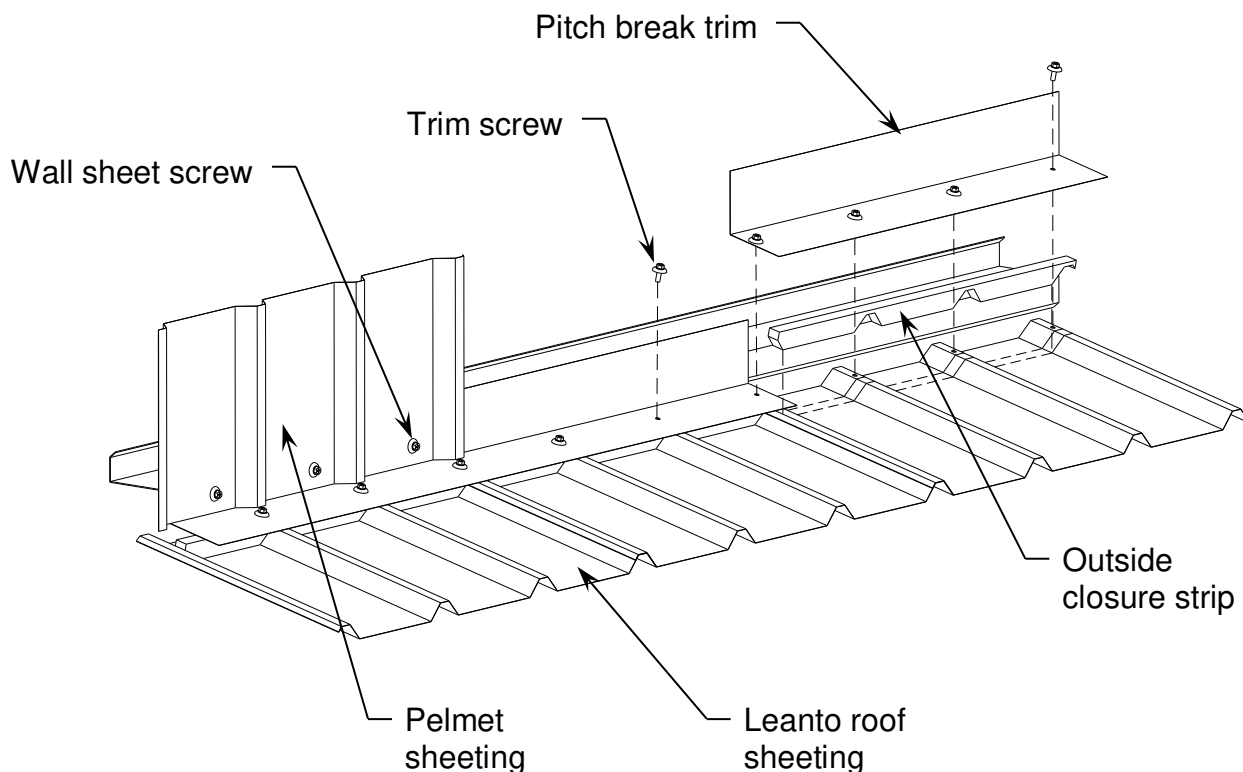
If your building kit comes with outside closure strips, they should be installed prior to installation of pitch break trim. To install, attach closure strip to the leanto roof sheets, just below the top end of the leanto roof sheets. These will be installed along the entire length of the leanto. To attach, remove the protective strip from the back of the closure strip, place and stick in desired location.

If your building comes with inside closure strips for the pelmet sheeting, closure strips will be installed on the top section of the pitch break trim, underneath the pelmet sheeting.

Note that pelmet sheeting will be attached above the pitch break trim and will often have insulation and inside closure strips, just as normal wall sheeting attaches to the bottom of the building.

Pitch break trim is installed using trim screws attached to every high rib on the leanto roof sheets.

Please see the illustration below as a reference for installing pitch break trim.



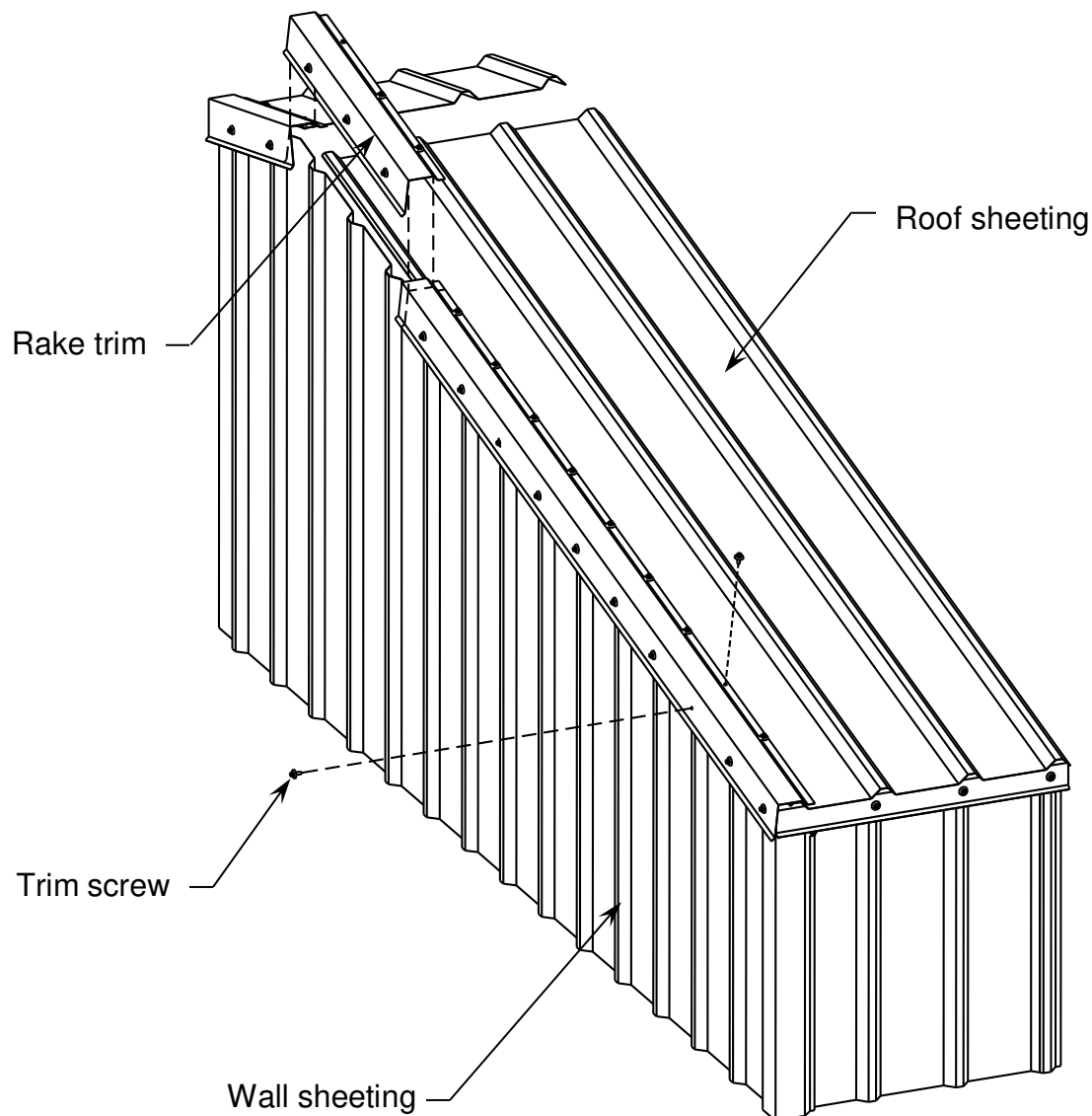


## Rake Trim Installation

Rake trim is installed at the top of the endwall sheets on both sides of the building. It is connected on the top to the roof sheets using trim screws (which are installed from the lip of the rake trim into the trough of the roof sheets, as shown below) and to the face of the endwall sheets at every high rib using trim screws. Rake trim will run the entire length of the end, from the end of one roof sheet to the apex and back down the opposite side. Simply overlap rake trim pieces to span this distance, trimming any pieces as necessary using metal snips.

Note that you will have either normal or sculptured rake trim. Though normal rake trim is illustrated below, sculptured trim is installed identically with screws in the same locations. Please see building order for specific trim type.

Please see the illustration below as a reference for installing rake trim.





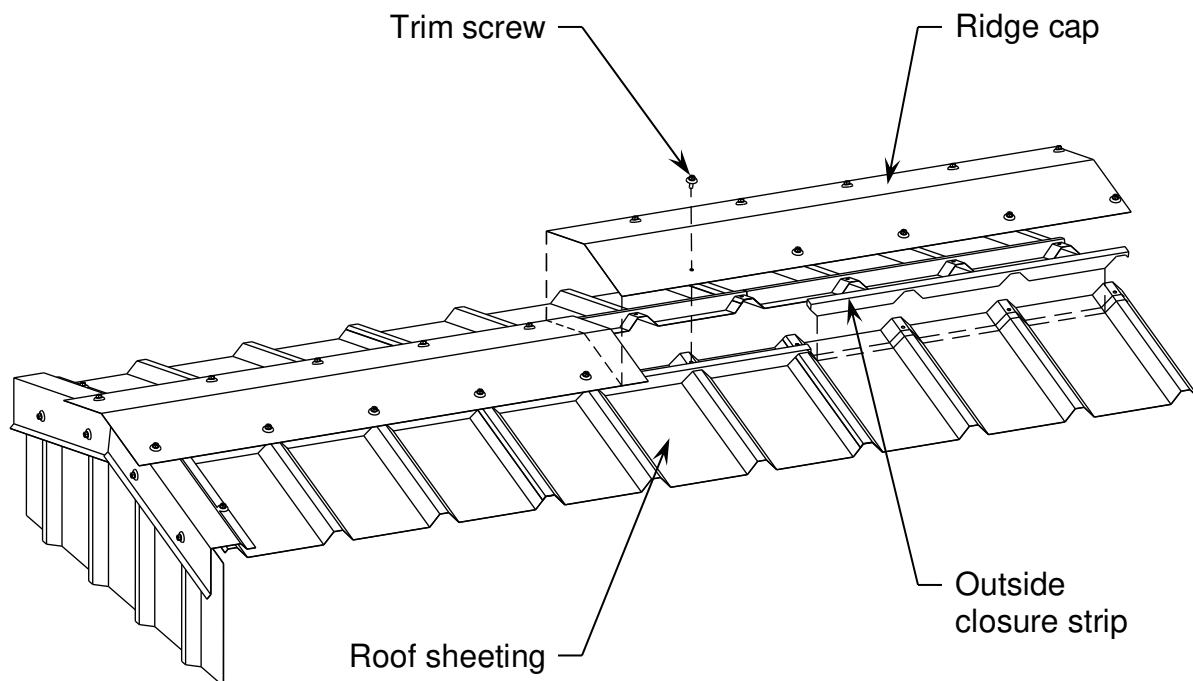
## Ridge Cap and Closure Strip Installation

Ridge cap runs along the ridge of the building. Ridge cap is installed from one endwall to the other and usually sticks over the rake trim 1-3", depending on builder preference. Simply overlap rake trim pieces to span this distance, trimming any pieces as necessary using metal snips.

If your building kit comes with outside closure strips (either normal or vented), they should be installed prior to installation of ridge cap. To install, attach closure strip to the roof sheets just below the top end of the roof sheets. These will be installed along the entire length of the building. To attach, remove the protective strip from the back of the closure strip, place and stick in desired location.

Ridge cap is installed using trim screws attached to every high rib in the roof sheets.

Please see the illustration below as a reference for installing ridge cap.







## **Roof Sheeting, Skylight, Insulation and Closure Strip Installation**

*This section applies to the installation of Classic Rib, PBR, and IC-72 roof sheeting. If installing another type of roof sheeting panel, such as Vertical Seam sheeting, please refer to manufacturer's installation instructions.*

When installing roof sheeting, insulation and inside closure strips you should begin on the side opposite the direction of the prevailing wind. Thus, if the prevailing wind comes from the east, roof sheeting should begin on the west side of the building.

If you have insulation, it will need to be installed before installing roof sheets or inside closure strips. Insulation is installed between the roof purlins and the roof sheets.

For instructions on installation of insulation, please see manufacturer's instructions, which are supplied with the insulation.

If you are installing a vented ridge cap, install insulation from the eave purlin to the highest roof purlin on each side of the roof. Thus, there will be no insulation between the two highest roof purlins. If not installing a vented ridge cap, install insulation from each eave purlin to either of the highest roof purlins. Thus, the insulation from one side will run over the apex to the roof purlin. This will ensure that insulation covers the entire roof.

After installing the first insulation sheet, it is recommended that you install your first roof sheet and inside closure strip, if applicable. Continue this process until entire roof sheeting is complete. Note that because insulation sheets and roof sheets have different widths, there will be a different number of insulation sheets and roof sheets installed on the roof of the building. Please take this into account when installing insulation and roof sheeting.

Before installing roof sheet, place inside closure strip on the eave purlin (if you have insulation, this will be placed on the insulation) in a location where roof sheet will be placed. To attach, remove the protective strip from the back of the strip, place and stick in desired location.

Note that first roof sheet should begin at the edge of the endwall. Also, you will notice that one edge of the roof sheet has a longer lap than the other side. The side with the short lap will be installed so that it lines up with the edge of the endwall. Note that this will allow the sheets to easily overlap. For exact information on sheet overlap, see roof sheeting detail on engineering plans.

Roof sheets are installed using roof sheeting screws. These screws are installed at high ribs at every roof purlin and at the eave purlin. Note that the screws will be installed at every high rib or every other high rib, per the engineering plans.

At the top purlin, if roof screws will be covered up by the ridge cap (within 10" or 5-1/2" of apex depending on ridge cap size), do not install this line of screws on the high rib.



Instead, install these adjacent to the high rib, using wall screws instead of roof screws. This process for installation is illustrated below. When installing screws, it is recommended that a straight edge or chalk line is used, so all screw lines are even.

If your building is in an area of high wind and you are using closure strips, you may want to install extra roof screws at the eave purlin in the middle of the each sheeting pan, to provide extra support for the roof sheet. However, although this will ensure the closure strips will not ever become dislodged, this method will increase the chances of water leakage in the pan of the roof sheet.

Before installing a roof sheet, it is recommended that you tie a string between the apexes at each endwall. This will be your guiding line for installing your roof sheets, so that the top of your roofs sheets are even. When this happens, the bottom of your sheets should come out even as well. Note that if you try to line up the sheets by the bottom edge, this can lead to the sheets themselves being uneven above as sheets have a tendency to shift. Note that when you line up your roof sheets near the apex of your building, roof sheets will not run entirely up to the apex. Instead, they will be 5-7" short of the apex, to allow for any venting. Note that this gap will be covered by ridge capping. Also, when installing roof sheets, they will run past the edge of the wall and/or eave trim. This distance will vary by preference, but is usually 1-3". If you are installing gutters, make this distance 1".

When you are done installing all sheets on one side of the roof, it is likely that your last sheet will need to be cut so it does not stick past the edge of the building. This can be cut using metal snips or electric shears. The sheet should be cut so edge of sheet lines up with building corner.

Note that skylights are installed similarly to roof sheets. However, skylight sheets may not span from the eave to the apex of the roof. Instead, skylights will run from the apex of building and extend as far as length of skylight sheet allows. A shorter section of roof sheeting will need to be installed below this skylight sheet, from skylight sheet to the eave. Note that installation will be similar to normal roof sheets, with roof screws at high ribs installing to roof purlins. Note that a skylight sheet and a roof sheet installed below must overlap on a roof purlin, attaching both skylight and roof sheet to that purlin using roof screws.

As you sheet the roof, you can install the skylight in place of the roof sheet, or, if the skylight does not span the entire length of the roof, you can install the skylight after all other roof sheets are installed.

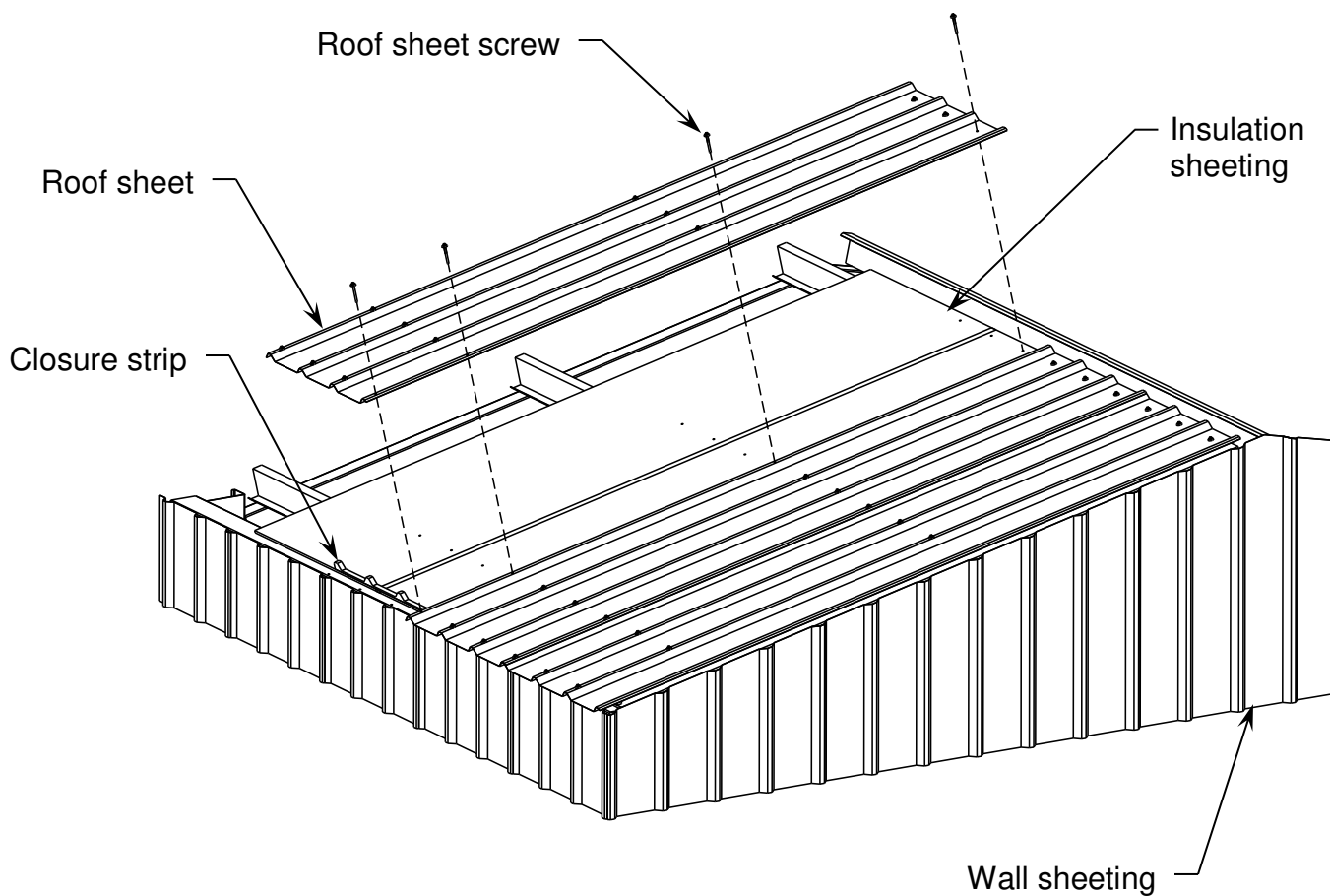
When installing skylights, make sure that the skylight sheet overlaps on top of the sheet that will be installed below it, so rain water will not leak into the building. Make sure to take care when installing skylight screws, to prevent splintering of skylight. Roll mastic or caulking is recommended to be used around the edge of the skylight to fully seal the skylight sheet to the normal roof sheets.



If installing roof sheets on the building with leantos that have a drop from the main building roof to the leanto roof, leanto roof sheeting will run from the edge of the main building to just past the edge of the leanto. If there is no drop, roof sheets will need to run from the apex of the building to just past the edge of the leanto. Installation procedures are the same as described above.

Please see the illustration below as a reference for installing roof sheets.

For exact information on installation of roof sheets, including screw locations and sheet overlap, please see the engineering plans.





## Wainscot Installation

Wainscoting allows your building to have a transition from one color of wall sheeting to another at a height of your choosing. When you have wainscot on your building, please follow the steps below to ensure

Note that you will need to reference the sections on girt installation and wall sheeting installation. Insulation and closure strips are not shown in the illustration in this section.

Please see the illustrations on the following page as a reference for installing wainscot.

### **Step 1: Install wainscot girt**

When installing girt in the building, make sure to install a girt at the wainscot height. The web of the girt should fall exactly at the height of the wainscot. Make sure that the outside flange of the girt points downwards.

### **Step 2: Install angle on top of wainscot girt.**

After the girt is installed, attach a standard angle to the top of the girt. Attach with framing screws every 48”.

### **Step 3: Install sheeting below.**

Per standard wall sheeting instructions, install the section of sheeting below the wainscot girt. The bottom of the sheeting will attach to the base angle or bottom girt, and the top end of the sheeting will attach to the flange of the wainscot girt. Make sure that all insulation and closure strips are installed properly before installing the sheeting.

### **Step 4: Place wainscot trim.**

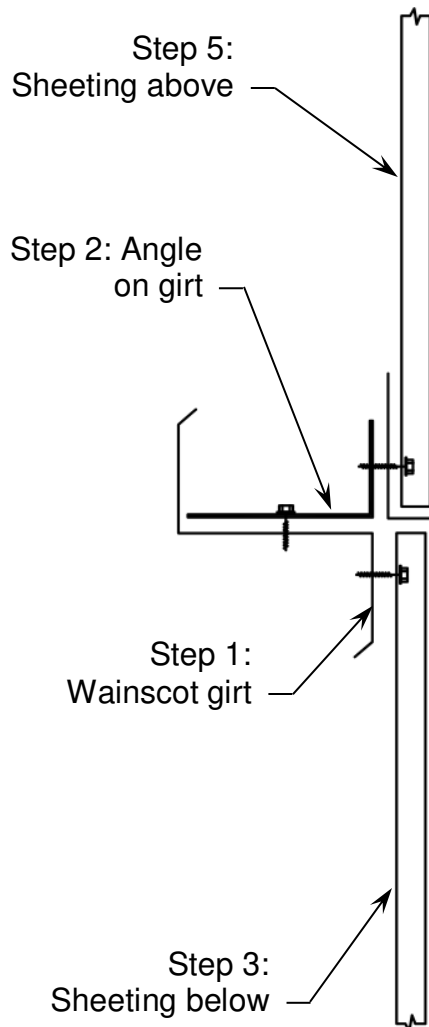
Place wainscot trim at the transition point between the girt. This does not need to be secured yet, but the trim can be temporarily secured with tape, mastic, or a pancake head screw.

### **Step 5: Install sheeting above.**

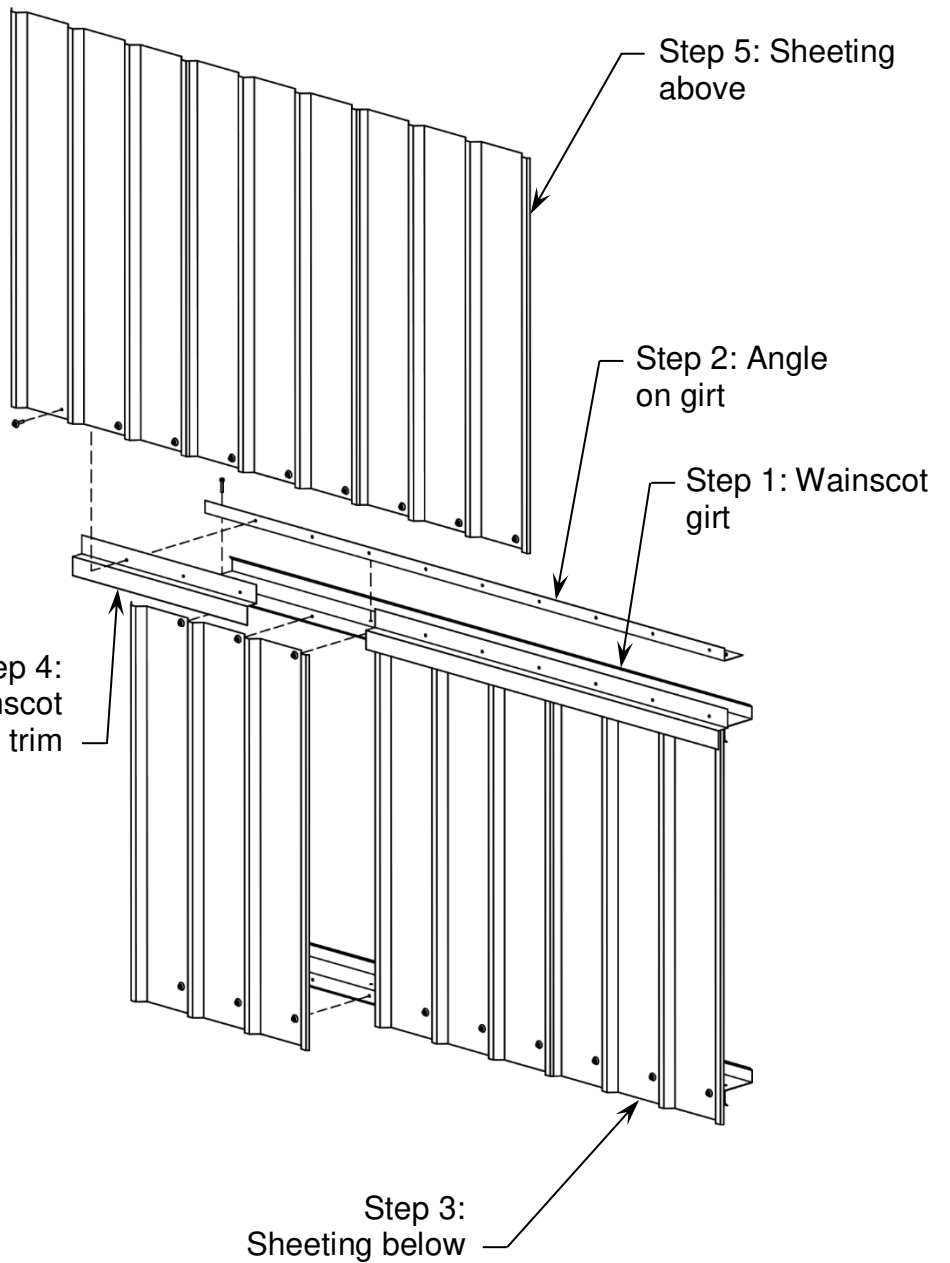
Per standard wall sheeting instructions, install the section of sheeting above the wainscot girt. The bottom of the sheeting will attach the sheeting and wainscot trim to the angle on top of the wainscot girt. Make sure that all insulation and closure strips are installed properly before installing the sheeting.



**Profile View**



**3D View**





## **Wall Sheeting, Insulation and Closure Strip Installation**

When installing wall sheeting, insulation and inside closure strips you should begin from the back side of the building. This will make sheeting laps less obvious.

If you have insulation, it will need to be installed before installing wall sheets or inside closure strips. Insulation is installed between the wall girts and the wall sheets.

For instructions on installation of insulation, please see manufacturer's instructions, which are supplied with the insulation.

After installing the first insulation sheet, it is recommended that you install your first wall sheet and inside closure strip, if applicable. Continue this process until entire wall sheeting is complete. Note that because insulation sheets and wall sheets have different widths, there will be a different number of insulation sheets and wall sheets installed on the wall of the building. Please take this into account when installing insulation and wall sheeting.

Before installing wall sheet, place inside closure strip on side of slab or base trim (if you have insulation, this will be placed on the insulation) in a location where the wall sheet will be placed. To attach, remove the protective strip from the back of the strip, place and stick in desired location.

Wall sheets will run from 1" below the edge of slab to just below the top of the eave purlin (allowing for pitch of roof sheet).

Note that first sidewall sheet should begin at the corner of the building. Also, you will notice that one edge of the sidewall sheet has a longer lap than the other side. The side with the short lap will be installed so that it lines up with the corner. Note that this will allow the sheets to easily overlap. For exact information on sheet overlap, see wall sheeting detail on engineering plans.

Wall sheets are installed using wall sheeting screws. These screws are installed adjacent to the sheeting high rib at every wall girt, at door and window headers and sills and at the eave purlin. Note that the screws will be installed adjacent to every high rib or every other high rib, per the engineering plans.

This process for installation is illustrated below. Before attaching a sheet, use a level to make sure the sheet is plumb. Also, when installing screws, it is recommended that a straight edge be used, so all screw lines are level.

When you are done installing all sheets on one sidewall, it is likely that your last sheet will need to be cut so it does not stick past the edge of the building. It is best to cut this before installing. Use metal snips or electric shears and cut so edge of sheet lines up with building corner.



When installing wall sheets around doors, insulation and walls sheets must be cut to fit around these doors. This can be done with a nibbler or sawzall. Before installing, measure and cut sheet to fit around door or window. Once cut, door can be installed, and it will fit into already-installed head/jamb trim. This is illustrated below.

Please see the illustrations on the following page as a reference for installing sidewall sheets. Note that though not illustrated, installation of endwall sheets is similar to installation of sidewall sheets. However, when installing endwall sheets, install sheets and attach screws adjacent to every high rib and at every wall girt just as with the sidewall sheets. However, instead of attaching at eave purlin, screws will be installed adjacent to every high rib and into the stiffener lip of the columns and rafters. If corner and rake angle is installed, screws can be installed here instead of the stiffener lips.

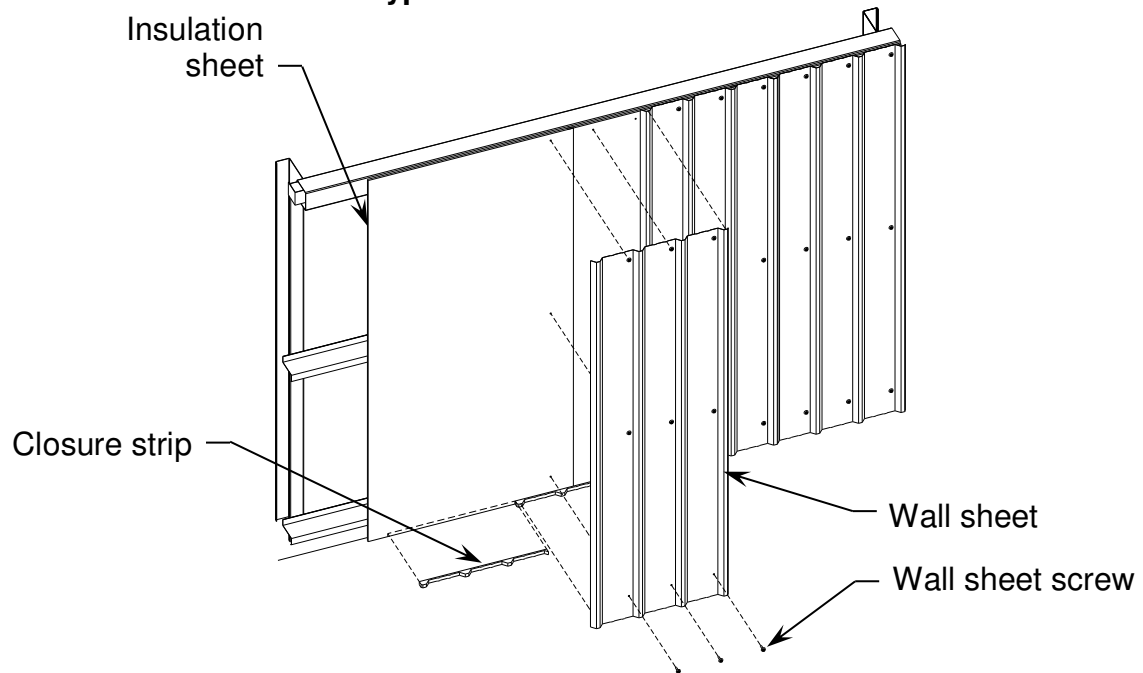
Also note that after sheets are attached, tops of insulation and endwall sheets will need to be trimmed to match the roof slope.

When installing wall sheeting on leantos, leanto sidewall sheets are installed just as normal sidewall sheets. Endwall sheets are installed the same as well, though endwall sheets will need to be trimmed to match the roof slope for the main building and the leantos and must match any drop in the leanto roof from the main building.

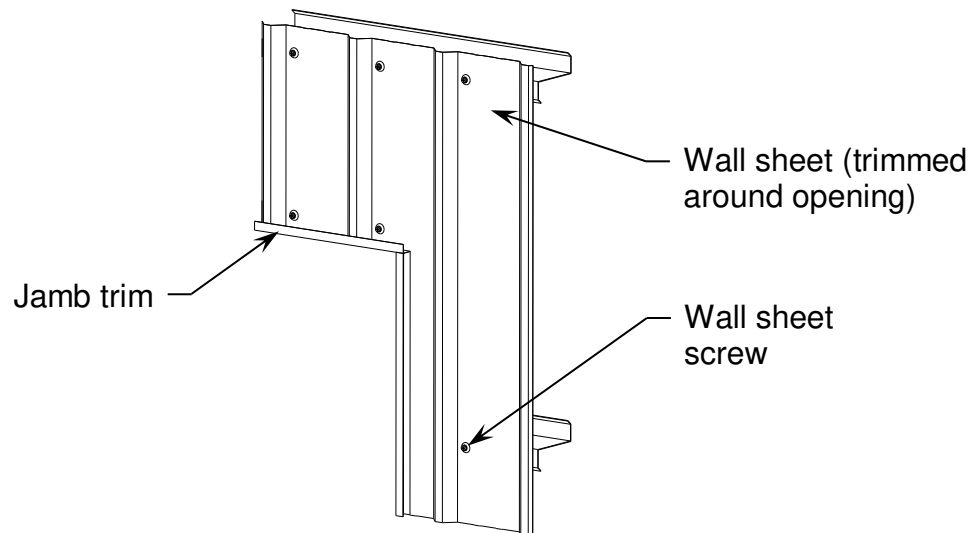
Note that pelmet sheeting is installed exactly like normal sidewall sheeting, except it runs from the eave purlin of the main building to the top of the pitch break trim and leanto roof sheeting. For more information, see Pitch break Trim Installation section.

For exact information on installation of wall sheets, including screw locations and sheet overlap, please see the engineering plans.

### Typical wall sheet installation



### Wall sheet installation around openings





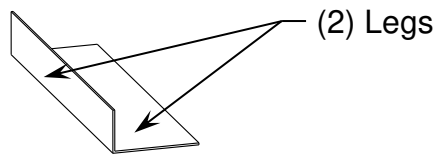


## Appendix D – Glossary

Last updated 5/31/2017

### Angle

A piece of material that, in profile view, is L-shaped and is made of galvanized steel. Angles consist of two legs that can be the same or differing size. Angle will typically need to be cut to length in the field.



### Angle Bracket

Similar to the above angle, but will come cut to a specific length and possibly pre-punched. These are typically used to install girts or the base of the column to the concrete.

### Apex

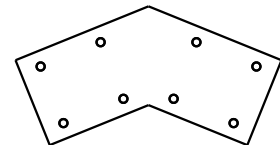
The peak, or highest point, of the building. The apex height is measured from the inside of the intersection of the roof sheets.

### Apex Brace

One or two CEE sections that are installed just under the apex of interior portal frames, connected to the rafter. Note that apex braces will need to be coped before installing. The exact size of apex brace can be found on the building order.

### Apex Bracket

A plate used to connect both rafters to form the apex of the building. It is roughly  $\frac{1}{8}$ " thick and is made of galvanized steel. The size of the plate varies depending on the size of the column. A typical apex bracket is illustrated to the right.



### Base Angle

A piece of framing material that is installed on the edge of the slab. Typically this piece is a 4" x 2" angle, and comes in 20' stock lengths.

### Base Trim

A piece of trim that is installed at the bottom of the wall sheeting.

### Bay

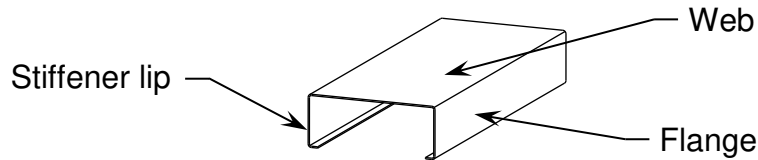
A term used to describe the space between two portal frames.

### Bolt Assembly

A connection that consists of a bolt, two washers and a nut.

**CEE Section**

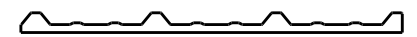
A framing component that is shaped like a “C”. Most framing components are made of CEE sections of various shapes and sizes. A CEE section consists of a web, two flanges and two stiffener lips, as illustrated below.

**Channel Material**

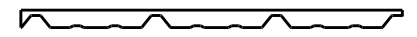
Framing material that is similar to a CEE section, except without the stiffener lip. Channel material is made of galvanized steel.

**Closure Strips**

Foam strips that fit on or under roof sheets to seal building. Closure strips will either be “universal” or “formed.” Universal closure strips come in lengths of 50’ and will fit any sheeting type while formed strips will fit a single sheet and be sheeting specific. Note that there are formed closure strips for both the inside and outside of the sheeting. Inside closure strips fit behind/under roof and wall sheeting, while outside closure strips fit on top of roof and wall sheeting. Formed closure strips are illustrated to the right.



Formed Inside Closure Strip



Formed Outside Closure Strip

**Column**

One or two CEE sections which are installed vertically and provide the basis for the walls of the building.

**Column Anchor Bracket**

An angle that is used to connect the columns to the concrete slab. Column anchor brackets have various length and leg size, depending on the size of the column.

**Column Stiffener**

Channel material that is installed over a column.

**Cope**

To cut or remove a portion of framing material so as to make the material easy to install.

**Corner Angle**

An angle, typically 4” x 2,” that is installed on the corner of the building at the end of sidewall girts to ease the installation of endwall sheets.



### **Corner Column**

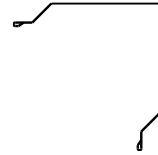
A column that is installed at the corner of the main building or leanto. This consists of a single CEE section. Note that if a leanto is installed, the main building will have a corner column even though this column will not be at the corner of the slab. There will also be a leanto corner column.

### **Corner Column Stiffener**

A CEE section that is attached to a corner column to add stiffness to the column. This is typically used on an American Barn style building where the sidewall bay is open.

### **Corner Trim**

A piece of trim that is installed on the corner of the building, to cover the gap between sidewall and endwall sheets. Each leg of corner trim is roughly 5" long. The profile of corner trim is illustrated to the right.



### **Diagonally Square**

A rectangular area is said to be diagonally square if the lengths of each diagonal leg are exactly the same. If an area is diagonally square, it is guaranteed that all corners are 90 degree angles.

### **Door/Window Jamb**

A CEE section or Channel that composes the vertical framing around a door or window.

### **Door/Window Header**

A CEE section that composes the framing above a door or window. This piece fits between the jambs.

### **Double Column/Rafter**

A column or rafter that consists of two CEE sections back to back.

### **Eave Height**

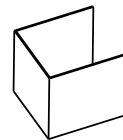
The nominal height of your building, measured from the top of the concrete slab to the intersection of the inside of the roof sheets and wall sheets.

### **Eave Purlin**

A CEE section or Eave Strut that runs the length of the sidewall at the top of the sidewall columns.

### **Eave Purlin Bracket**

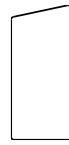
A bracket that connects to the top of sidewall columns and is used to install the eave purlin. An eave purlin bracket attached to a single column will be 4" wide, while an eave purlin bracket attached to a double column will be 8" wide. A typical eave purlin bracket is illustrated to the right.





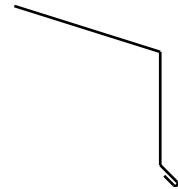
### **Eave Strut**

This item is shaped like a CEE Section. However, it will have one or two sloped flanges, often to match the roof pitch of a building.



### **Eave Trim**

Trim that runs along the top of sidewall sheets, the entire length of the sidewall. Each leg of eave trim is roughly 3" long. The profile of eave trim is illustrated to the right.



### **Endwall Column**

A column that is installed on the endwall and connects perpendicular to rafters either directly or using an endwall column bracket. This consists of one or two CEE sections.

### **Flange**

An element of CEE, LGSI, and ZEE sections.

### **Flybracing**

A section of strapping or a two-legged member that braces the endwall columns to the girts on the endwall.

### **Framing Tek Screw**

A self-drilling screw used to install framing components. These screws are the same color as galvanized steel.

### **Framing**

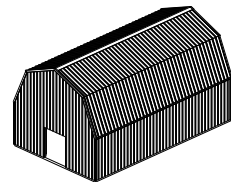
The components of the building that make up the structural frame of the building. Framing members are made of galvanized steel.

### **Galvanized Steel**

Steel that is coated with rust-resistant zinc and has a shiny silver appearance. All of the framing material is composed of galvanized steel.

### **Gambrel**

A type of roof style that has two different roof pitches. A typical building with a gambrel roof is illustrated to the right. A single-portal frame for a gambrel roof will consist of four rafters instead of the normal two.



### **Girt**

A ZEE section that is installed from one column to an adjacent column horizontally to help create the wall of the building.

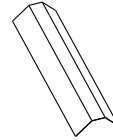
### **Girt Flange Bracing**

Strapping that runs vertically on the inside of wall girts to prevent the shifting of the wall girts.



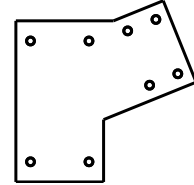
### **Gutter Strap**

A piece of trim used to secure gutters. A typical gutter hanger is 12" long and is illustrated to the right.



### **Haunch Bracket**

A plate used to connect columns and rafters. Exact size and shape of the plate varies depending on the size of the column and pitch of the roof. Note that for gambrel-style roofs, due to the steep roof slope, an apex bracket is used as a haunch bracket. A typical haunch bracket is illustrated to the right.



### **Header Girt**

The girt to which a door jamb connects. This consists of an LGSI or ZEE section.

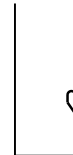
### **Head/Jamb Cover**

Trim that wraps around door jambs of drive doors to cover the galvanized steel jambs. The profile of head/jamb cover is illustrated to the right. The width of the head/jamb cover will be the same width as the door or window jambs.



### **Head/Jamb Trim**

Trim that is shaped like a "J," installed on the front of door and window jambs and headers to give the transition from sheeting to opening a clean look. Head/jamb trim is typically 3" tall and 1-1/2" wide. The profile of head/jamb trim is illustrated to the right.



### **Interior Bay**

A bay which is between two other bays.

### **Knee Brace**

One or two CEE sections that are installed between the column and the rafter. Note that knee braces will need to be coped before installing.

### **Leanto**

A structure connected to the main building that has its own framing, which connects to the framing of the main building. Note that leantos can be enclosed like the main building or they can be open, making it more of an awning than a building. Also, the space between the main building and leanto can be open, or have wall sheeting as a barrier.

### **Level**

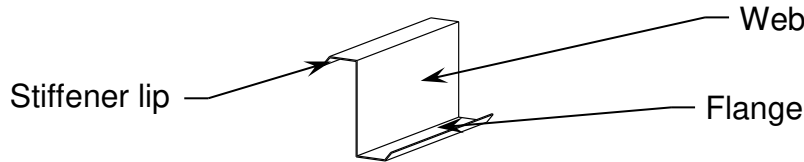
The same height at all places; parallel to the ground.

### **LGSI Section**

A framing component that is shaped like a "Z." An LGSI section consists of a web, two flanges and two stiffener lips, as illustrated below. Note that this component is very similar to a ZEE section, however, for LGSI sections, one flange will be roughly 1/4" wider than



the other. This will allow the material to easily interlock, for ease of installation of girts and purlins. Note that there may be a small triangle-shaped hole in the web of the LGSI, which points toward the wider flange.

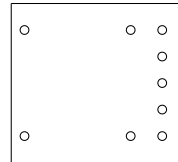


### **Mezzanine**

A second floor that can span the length of the building or only specific bays.

### **Mezzanine Bracket**

A plate used to connect columns and mezzanine girders. This is roughly  $\frac{1}{8}$ " thick and is made of galvanized steel. Exact size and shape of the plate varies depending on the size of the column. A typical mezzanine bracket is illustrated to the right.



### **Mezzanine Girder**

One or two CEE sections installed between sidewall columns which provide the main support for the mezzanine.

### **Mezzanine Joist**

LGSI or ZEE sections installed on the mezzanine girders that make up the floor of the mezzanine.

### **Mezzanine Post**

Two CEE sections connected together into posts that are installed under the mezzanine girders to provide further support for the mezzanine.

### **Mushroom Head Spikes**

Spikes used to attach base angle to the concrete slab.

### **Nibbler**

A tool used for trimming wall and roof sheets that can be found at your local hardware store.

### **Open Bay**

A bay which has no girts or siding installed.

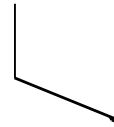
### **Pan Head Self-Drilling Screw**

A self-drilling screw which has a non-obtrusive head once installed. These screws are the same color as galvanized steel.



### **Pitch Break Trim**

Trim that connects to the pelmet sheeting and leanto roof sheeting to cover the gap between these sheets. Each leg of pitch break trim is roughly 3-5" long. The profile of pitch break trim is illustrated to the right.



### **Pelmet**

The area on the sidewall of a main building that is above the leanto while still being below the eave of the building. This area will only exist on buildings that have a leanto that has a drop from the eave of the main building to the roof of the leanto.

### **Plumb**

Truly vertical.

### **Portal Frame**

A section of framing consisting of columns, rafters and any knee and apex braces.

### **Powers “Wedge-Bolt” Anchor**

An anchor bolt which is installed into a pre-drilled hole in the concrete slab.

### **Powers “Wedge-Bit”**

A special drill bit that drills correct hole sizes for the insertion of Powers “wedge-bolt” anchors in concrete.

### **Purlin**

An LGSI or ZEE section that is installed from one rafter to an adjacent rafter horizontally to help create the roof of the building.

### **Purlin Flange Bracing**

Strapping that runs on the inside of roof purlins to prevent excess movement.

### **Rafter**

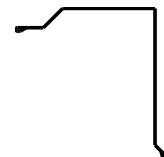
One or two CEE sections which are installed to provide the basis for the roof of the building. A rafter will connect to the column on its lower end and an opposite rafter on its upper end, which creates the apex of the building.

### **Rake Angle**

An angle, typically 4" x 2," that is installed on the endwall edges of the roof purlins, to ease the installation of endwall sheets.

### **Rake Trim**

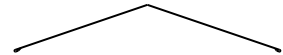
Trim that runs along the top of endwall sheets the entire length of the endwall. The profile of typical rake trim is illustrated to the right. Note that some buildings will have sculptured rake trim, which will have a slightly different profile.





### **Ridge Cap**

Trim that is installed at the apex of the building on top of the roof sheets. The profile of typical ridge cap is illustrated to the right. Note that the exact shape of the ridge cap may vary, but in all cases, will cover the apex of the building.



### **Roof Sheet**

Sheeting material that makes up the roof of the building.

### **Roof Sheet Screw**

A self-drilling screw which is made to drill through the high ribs of the roof sheets and into the roof purlins. It is painted on its head to match the roof sheet color.

### **Sawzall**

A tool used for cutting wall or roof sheets that can be found at your local hardware store.

### **Sheeting**

Components that make up the walls or roof of the building. Sheeting will be painted on one side.

### **Sidewall Column**

A column that is installed on the sidewall, is part of a portal frame and connects to rafters with haunch bracket(s). This consists of one or two CEE sections.

### **Single Column/Rafter**

A column or rafter that consists of a single CEE section.

### **Skylight**

A roof sheet that is made of fiberglass or polycarbonate.

### **Stiffener Lip**

An element of CEE, LGSI, and ZEE sections.

### **Strapping**

Material that typically comes 1-½" to 2" wide and in rolls of varying length. This is usually less than ⅛" thick and is made of galvanized steel. Strapping is used in x-bracing and girt and purlin flange bracing.

### **Trim**

Material that covers the edges of the building, effectively finishing it out. This is made of a similar material as the sheeting. Typically all pieces have the same color though this can vary by building.



**Trim Screw (or Stitch Screw)**

A short self-drilling screw that is made to attach trim pieces to sheeting material. Note that these screws will not be able to drill through framing components. Trim screws are painted on the head to match the color of the trim pieces.

**Two-Legged member**

A framing component with only two legs. An example of this would be a 2" x 2" angle bracket.

**Wall Sheet**

Sheeting material that makes up the wall of the building.

**Wall Sheet Screw**

A self-drilling screw which is made to drill through the trough of the wall sheets and into the wall girts. It is painted on its head to match the wall sheet color.

**Web**

An element of CEE, LGSI, and ZEE sections.

**Window Sill**

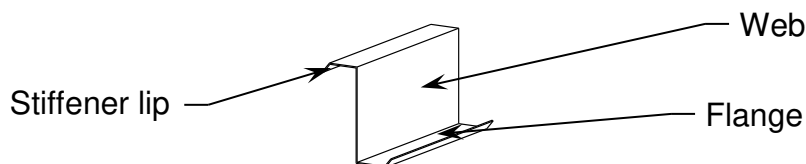
A CEE section that composes the framing below a window. This piece fits between the jambs.

**X-Bracing**

Strapping that connects rafters and columns to provide stiffness to bays.

**ZEE Section**

A framing component that is shaped like a "Z." A ZEE section consists of a web, two flanges and two stiffener lips, as illustrated below. Note that for LGSI sections, which are very similar to ZEE sections, one flange will be wider than the other, to allow the material to easily interlock.





## Appendix E – Overhang Installation

Last updated 5/6/2020

### Overhang Framing Installation

#### 1. Install columns, rafters, and outriggers using a typical haunch bracket

This step follows the same steps to the instructions found in Appendix B/Haunch Bracket Installation with additional steps to create an Overhang.

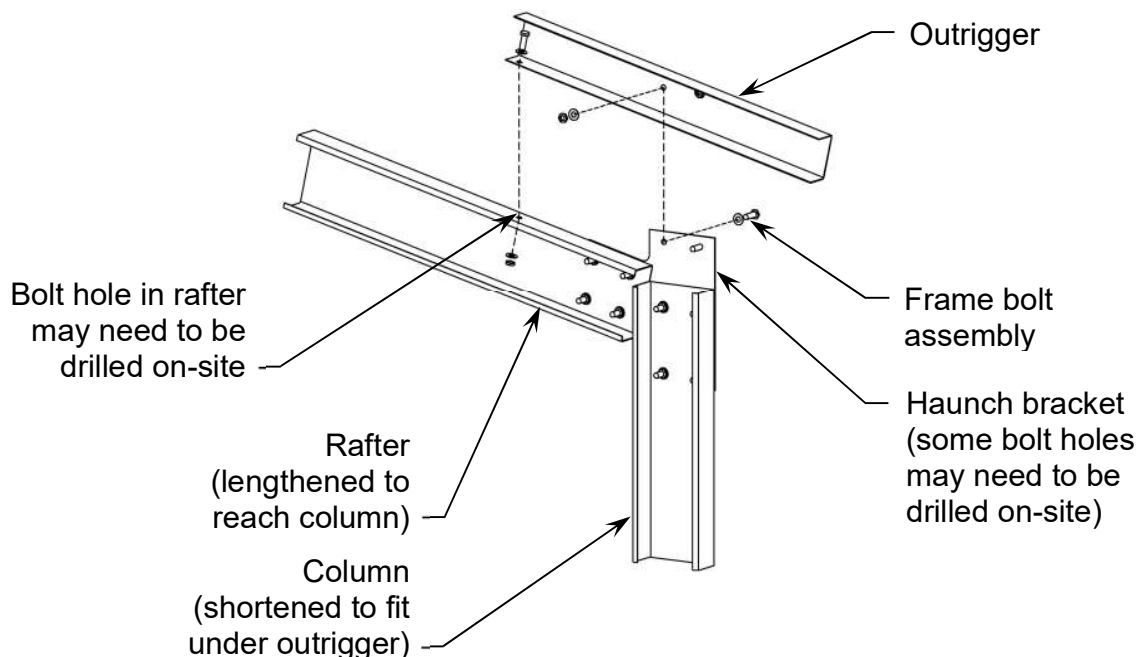
The main differences are:

- the installation of the outrigger.
- the column will be shorter and sit lower on the haunch bracket.

When installed the haunch bracket will stand above the column. The column-to-haunch bracket connection requires four bolts as illustrated below. The column will always be supplied with 4 holes however in some building configurations the bracket may not come with the required number of bolt holes. If this is the case, attach the haunch bracket to the column using bolts through the 2 holes that already align. Then drill the other two holes through the haunch bracket using the existing spare holes in the column.

Once the column and rafter are installed, the outrigger can be installed to the rafter and haunch bracket. On the bottom end, it will need to attach to the haunch bracket with frame bolts. On the top end, it will attach to the top of the rafter. Note that the hole in the rafter (shown below) may need to be drilled on-site. Please see the engineering plans for exact attachment requirements.

The illustration below shows the outrigger installation for a single rafter. On a double-rafter, two outriggers will be installed, one on each rafter.



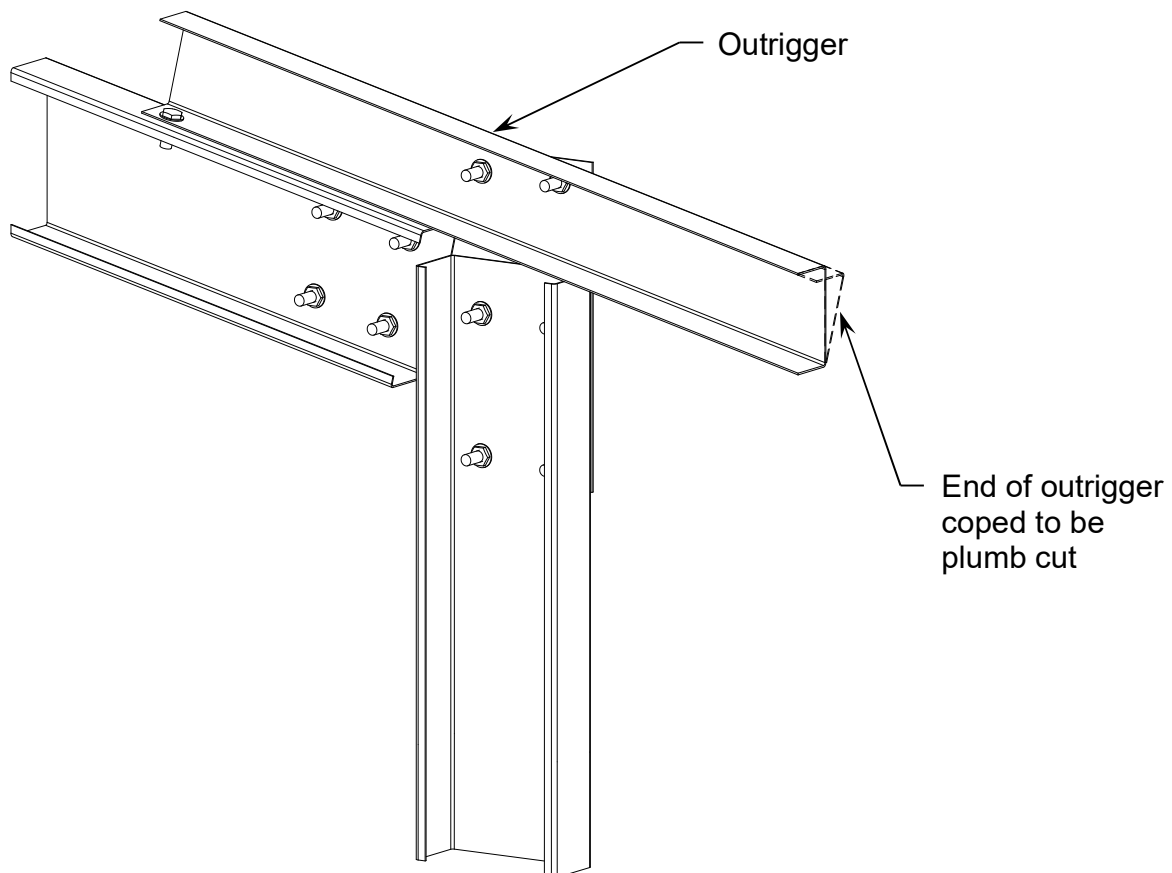


## 2. Plumb cut ends of outriggers, if necessary

In some cases, outriggers will be sent out longer than the nominal overhang length. This is to ensure that connection between outrigger and overhang eave purlin meets all engineering requirements. This situation will most often occur on 4:12 or steeper roof pitches where a vertical face is required on the overhang.

In these cases, the end of the outrigger will need to be coped on the end so that the end is plumb cut. The length of the outrigger should come be ordered to a length where you will simply need to cut straight up from the bottom corner of the overhang.

Please check your building order to see if your outriggers will need to be coped. This will be noted in the Usage column of your order, with the text “End to be plumb cut”, and the piece mark on the outrigger will be marked with a “\_PC” at the end of the mark.



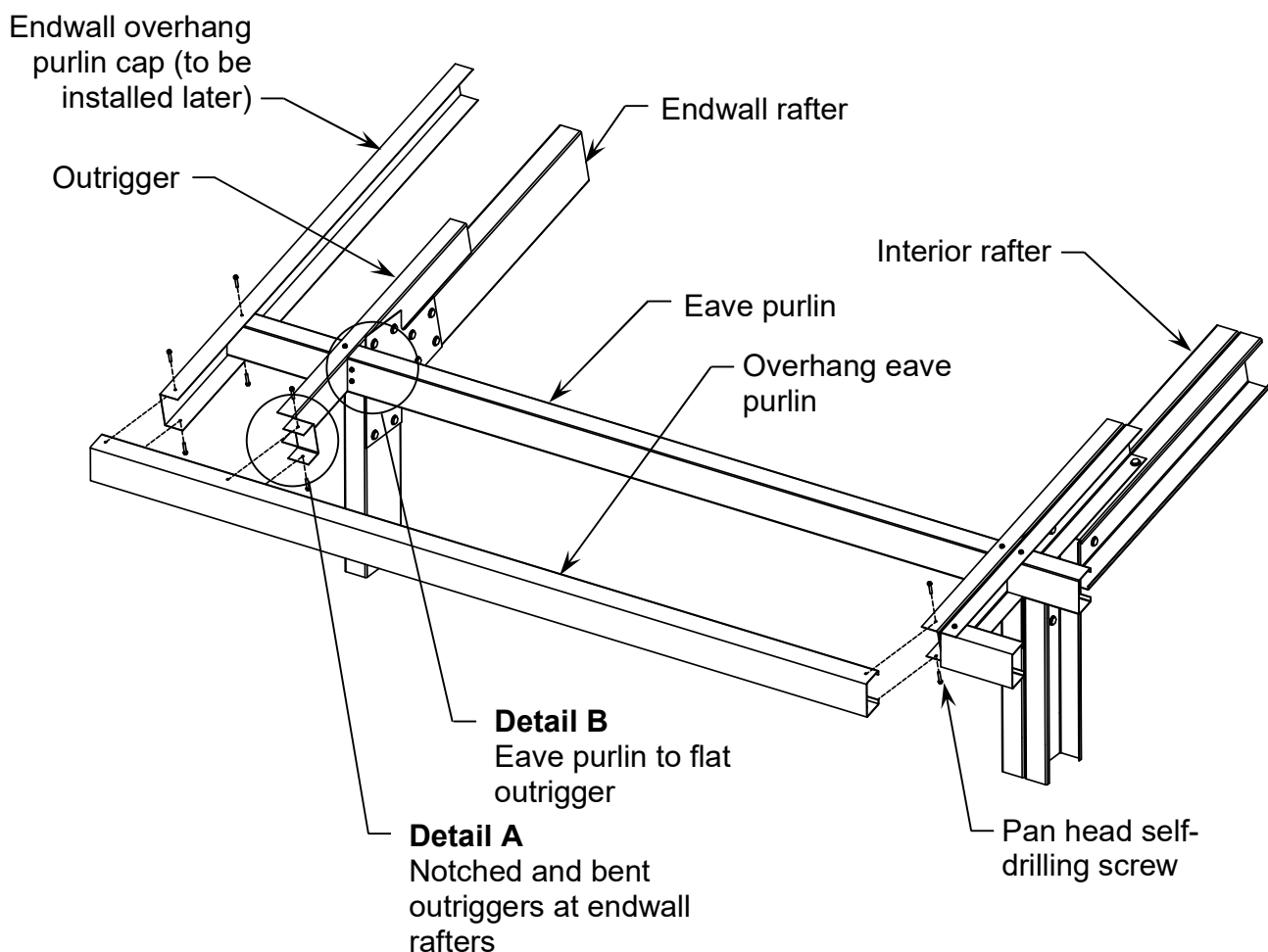


### 3. Install eave purlins between outriggers

After installing all the outriggers you can install the eave purlins between the outriggers. Each sidewall with an overhang will have two eave purlins per bay, an eave purlin that is installed at the top of the wall sheeting, and an overhang eave purlin, that is installed at the end of the outrigger, which is shown in the illustration below.

Eave purlins are installed between the outriggers, from the web of one outrigger to the other. Channel material is used as the outrigger, so the eave purlins should fit into the channel, and then be attached using pan head screws.

On some buildings with large sidewall overhangs, a roof purlin may fall in the outrigger area. This is not shown in the illustration below. If this is required on your building, it will be indicated on your order, in the Usage column with the note “Purlin in Outrigger.” Those purlins will need to be installed to the outrigger in the same manner as the eave purlins.

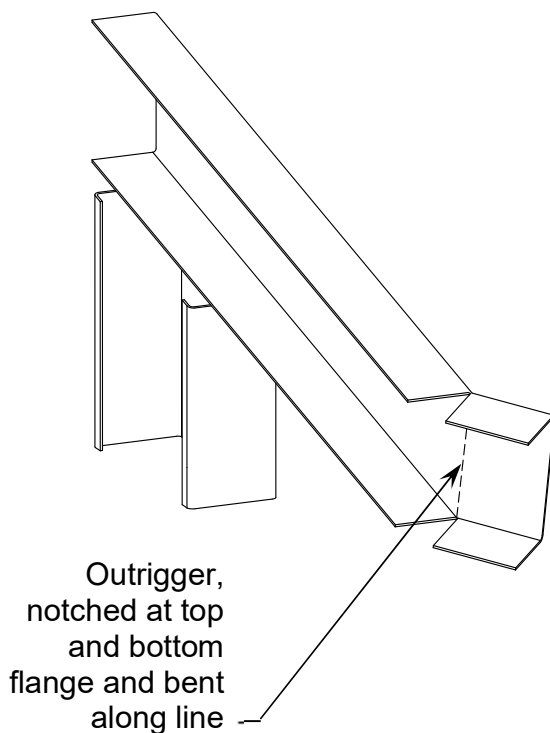




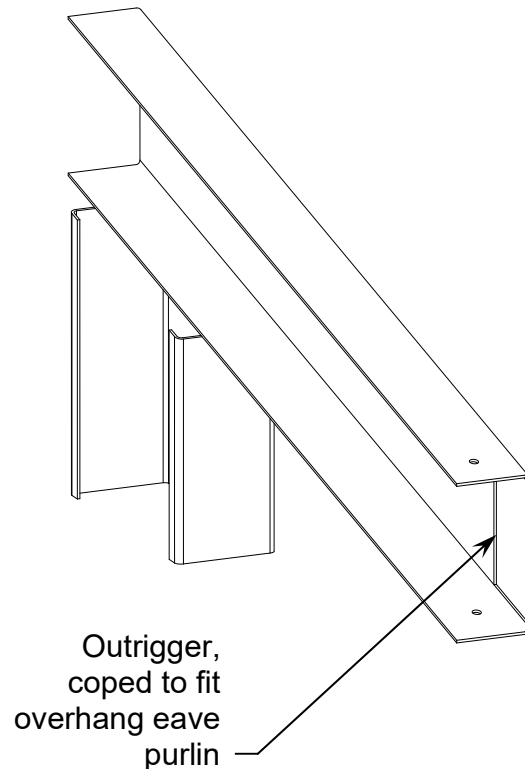
The illustration on the previous page displays not only the typical eave purlin installation, but the installation of an eave purlin when an endwall overhang is also present. Notice how the typical eave purlin is cut at the outrigger at the endwall rafter, but the overhang eave purlin runs all the way to the endwall overhang purlin cap. When an endwall overhang is present, the last outrigger must be notched and bent into position (as shown in Detail A) before installation of the eave purlin.

Note that in some cases an alternate installation must be used. If you were required to plumb cut your purlins in step 2, you will need to use the alternate detail A. In the alternate installation, the outrigger will be ordered longer than normal and will then need to be coped on site as shown in the illustration below.

**Detail A  
(standard)**



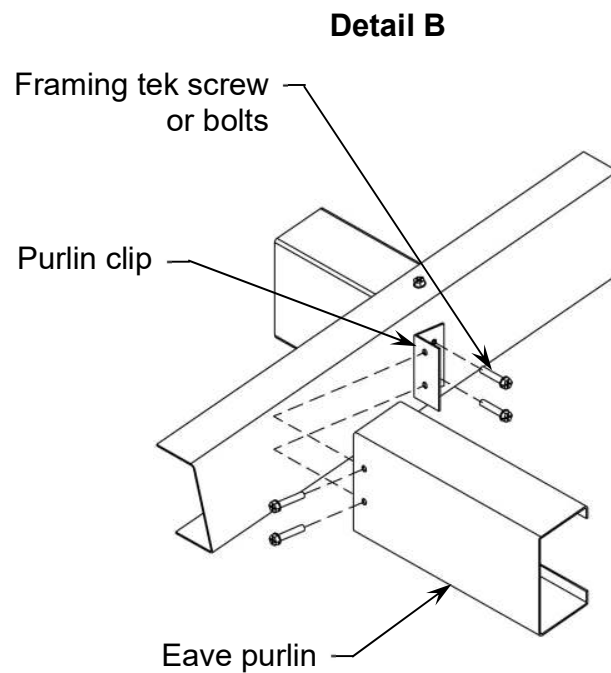
**Detail A  
(alternate)**





When installing the overhang eave purlin, the flanges of the outrigger and the flange of the eave purlin must adequately overlap. Please refer to the engineering plans for required overlap, and follow any extra steps required.

In some cases the eave purlins will fit to the flat side of the outrigger. In these cases, purlin clips and framing tek screws will need to be used, as shown in Detail B. For exact details on installation requirements, please refer to your engineering plans.



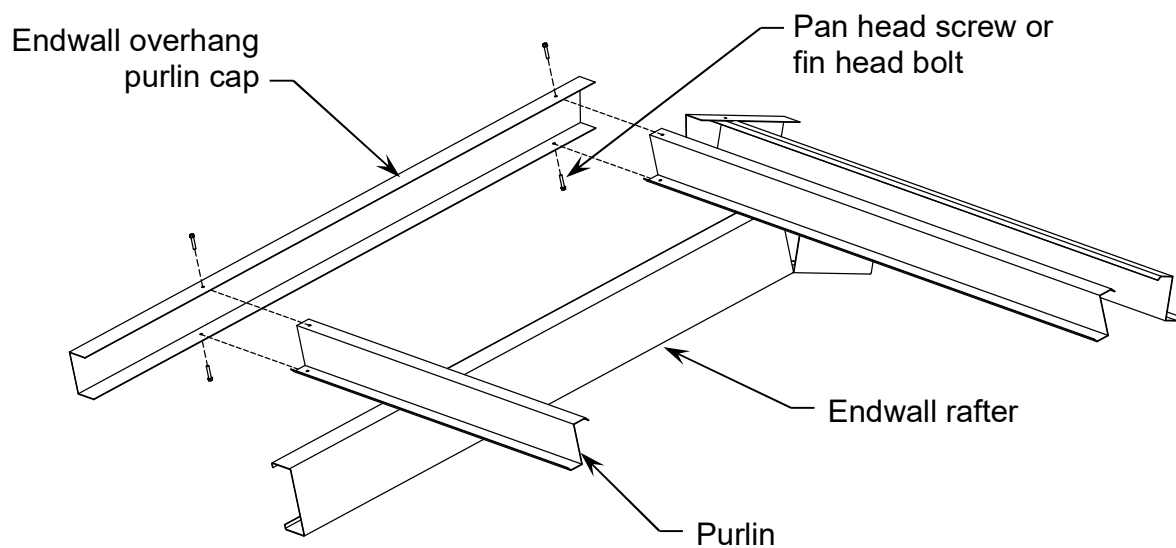


#### 4. Install Endwall Overhang Purlin Cap

At this point, you should have your eave purlins and typical purlins installed. If installing an endwall overhang, the purlins will extend past the edge of the building by the size of the overhang.

After the purlins are installed, the endwall overhang eave purlin cap (which is also shown above) will need to be installed. Simply slide the cap over the ends of the purlins, and secure with one pan head screw into the top and bottom flanges.

Please see the illustration below for an example of the purlins extending past the edge of the endwall, and the cap installed over the ends of the purlins.

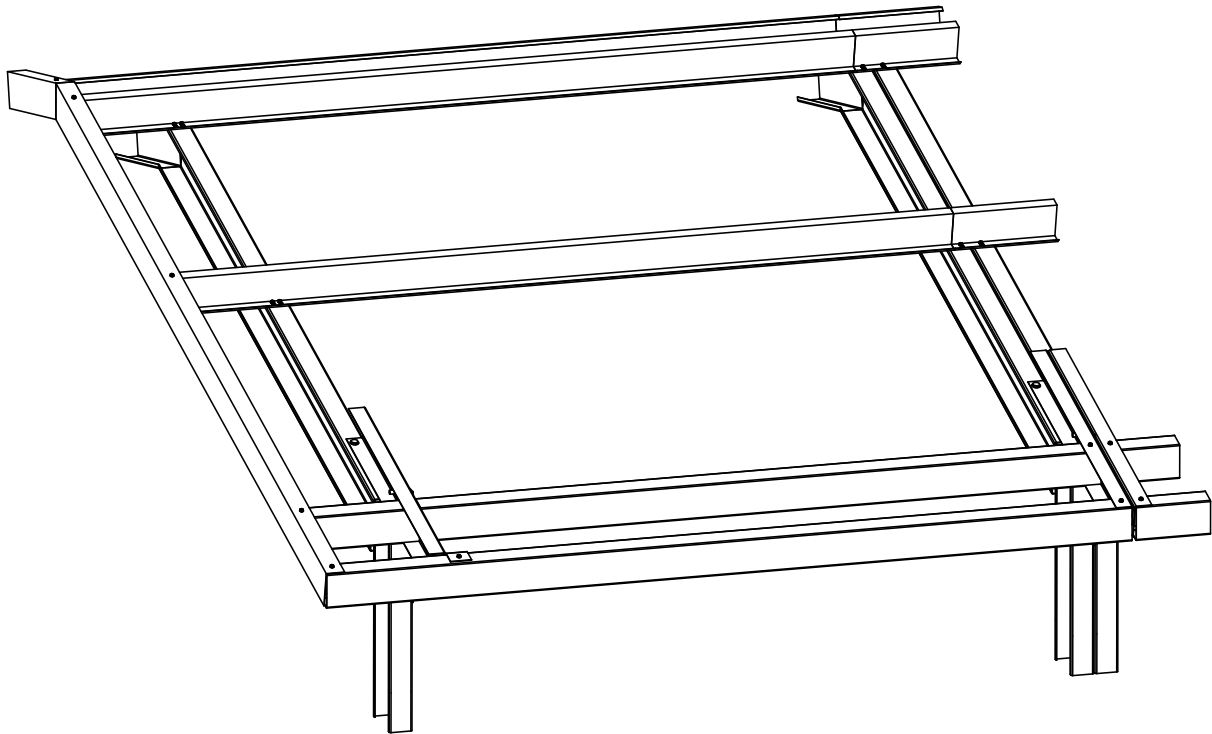




## 5. Completion of overhang framing

Once the eave purlins, purlins, and endwall overhang purlin cap are installed, the framing portion of overhang will be complete.

Below is an illustration of the completed overhang framing when both a sidewall and endwall overhang exist on the building.





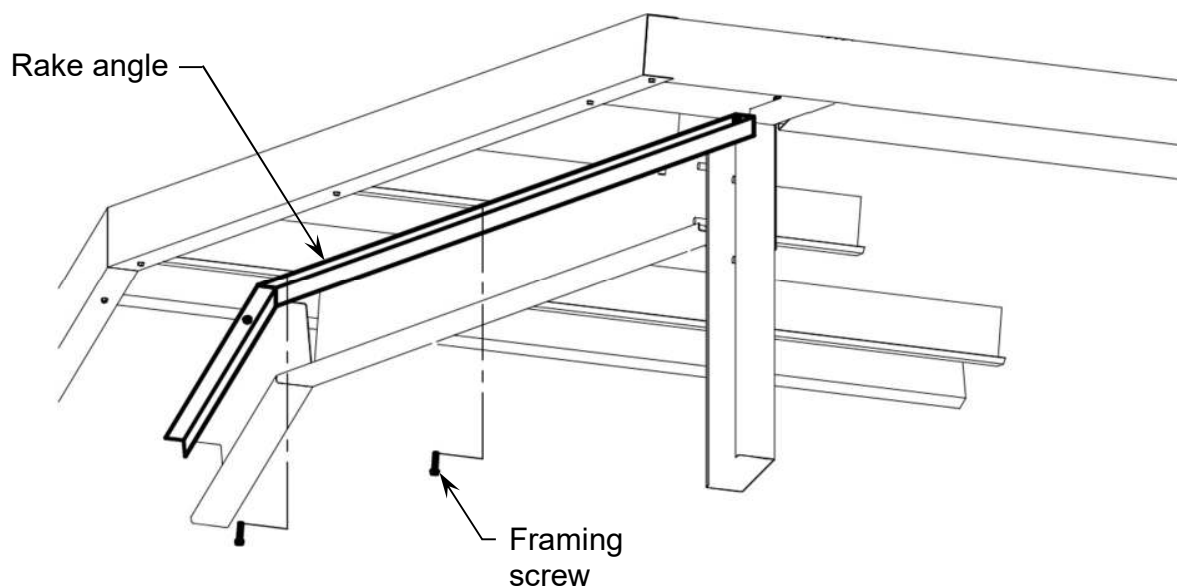


## Overhang Trim Installation

### 1. Install rake angle

On the underside of the purlins, install the rake angle. The vertical leg of the rake angle should align with the outside edge of the endwall girts (not shown in the illustration below), so that the wall sheet can later attach to that leg.

The short leg of the angle will attach to the underside of the purlins. At each location where the angle crosses the purlin, connect with a standard framing screw.

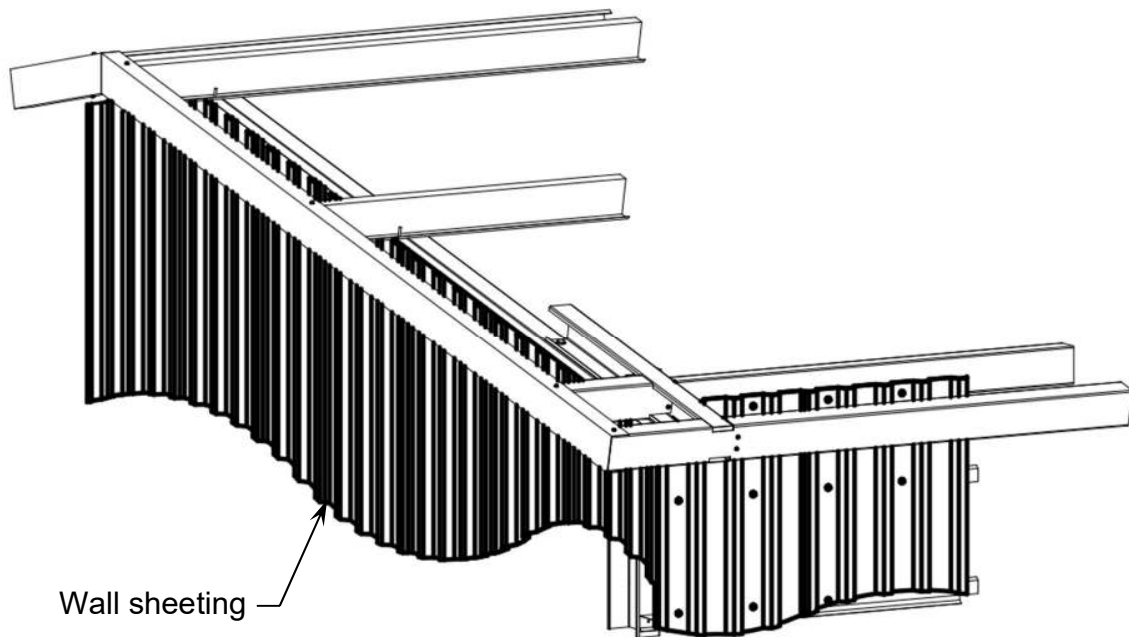




## 2. Install wall sheathing and insulation

Install all wall sheathing and installation per standard installation instructions, found in Appendix C. As with a standard installation, when installing sheathing under an overhang, sidewall sheathing will install at the top to the eave purlin. The endwall sheathing will attach to the rake angle.

Note that sidewall sheathing will need to be trimmed around the outriggers to install correctly.





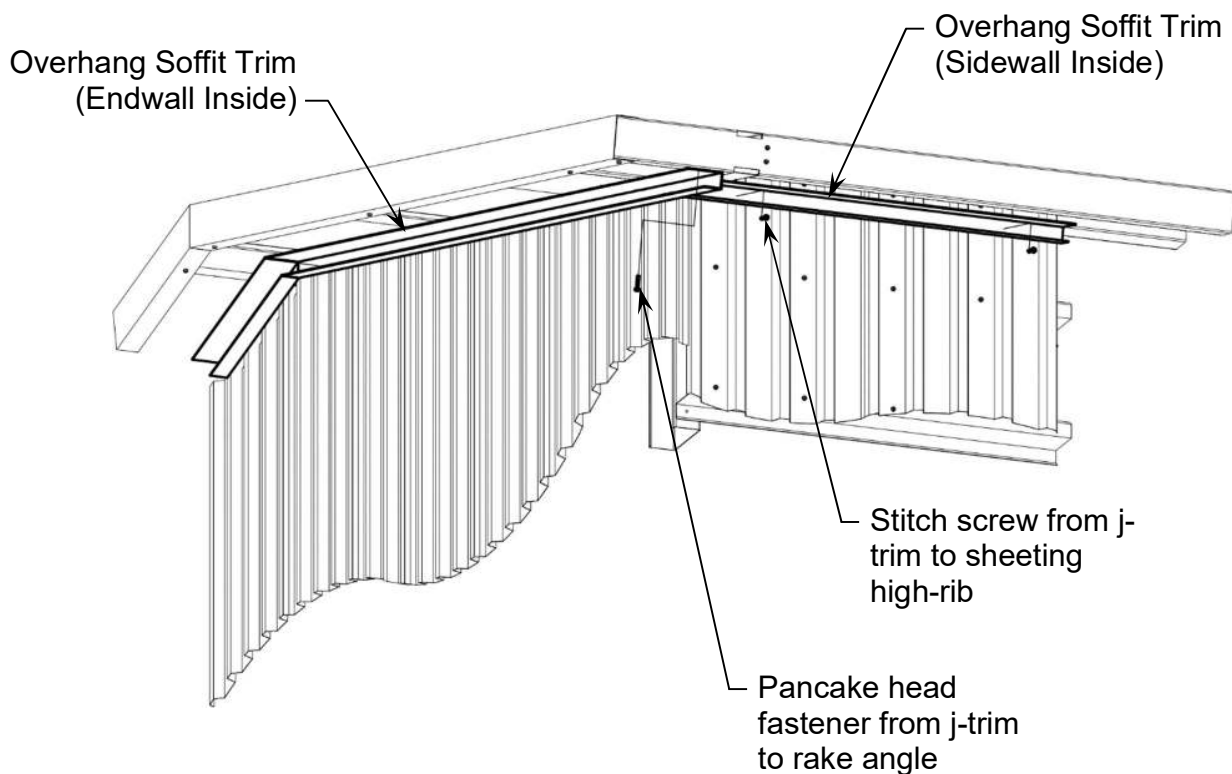
### 3. Install j-trim at underside of purlins

J-trim will then be installed at the top of the wall sheeting, and will eventually accept the overhang soffit material. This material will be listed on your order with the usage “Overhang Soffit Trim (Sidewall Inside)” and “Overhang Soffit Trim (Endwall Inside)”.

On the sidewall, j-trim will be installed to the high-rib with a stitch screw every 24". A pancake head screw can also be installed from the j-trim leg every time that it crosses the bottom of the outrigger.

On the endwall, a pancake head screw will be installed from the j-trim into the rake angle at every location where a purlin exists.

Note that is you are installing wall closure strips, they will be installed between the j-trim and the wall sheeting.

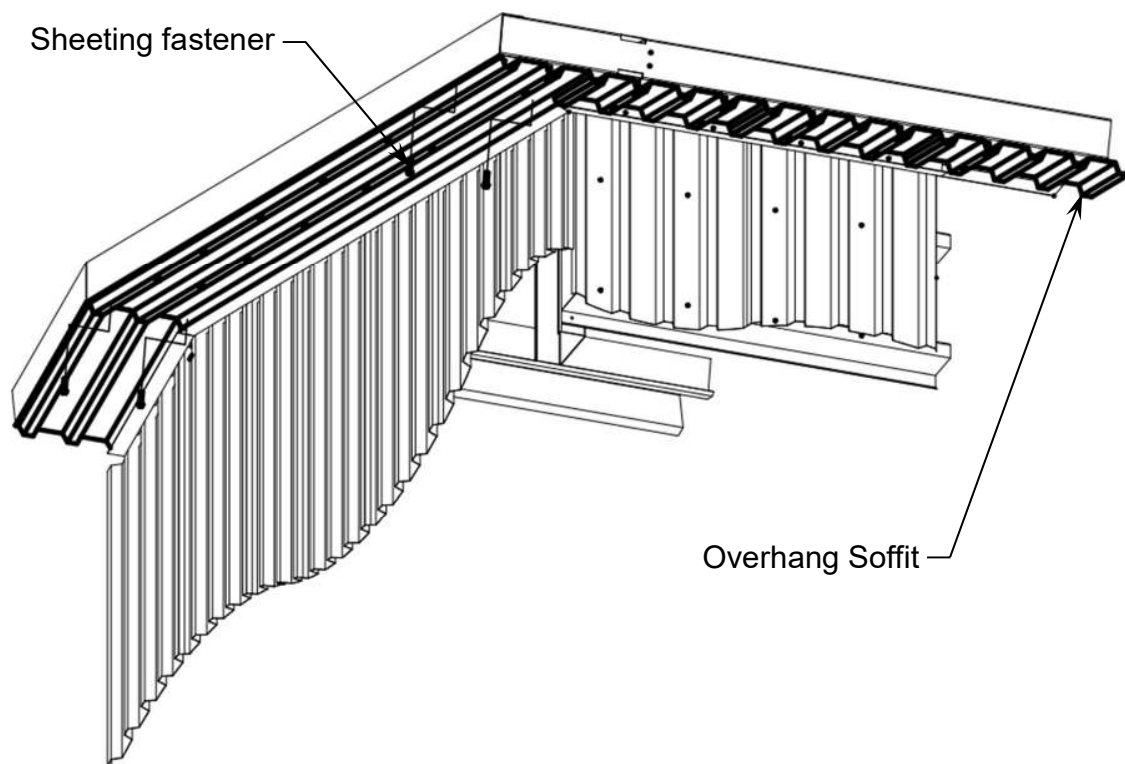




#### 4. Install soffit material

For sidewall soffit, insert the top end of the soffit into the existing j-trim and secure the bottom side of the soffit using sheeting screws at the underside of the overhang eave purlin.

For endwall soffit, secure the soffit to the underside of the purlins. Screws will be installed near high ribs at the same frequency as for wall sheeting.



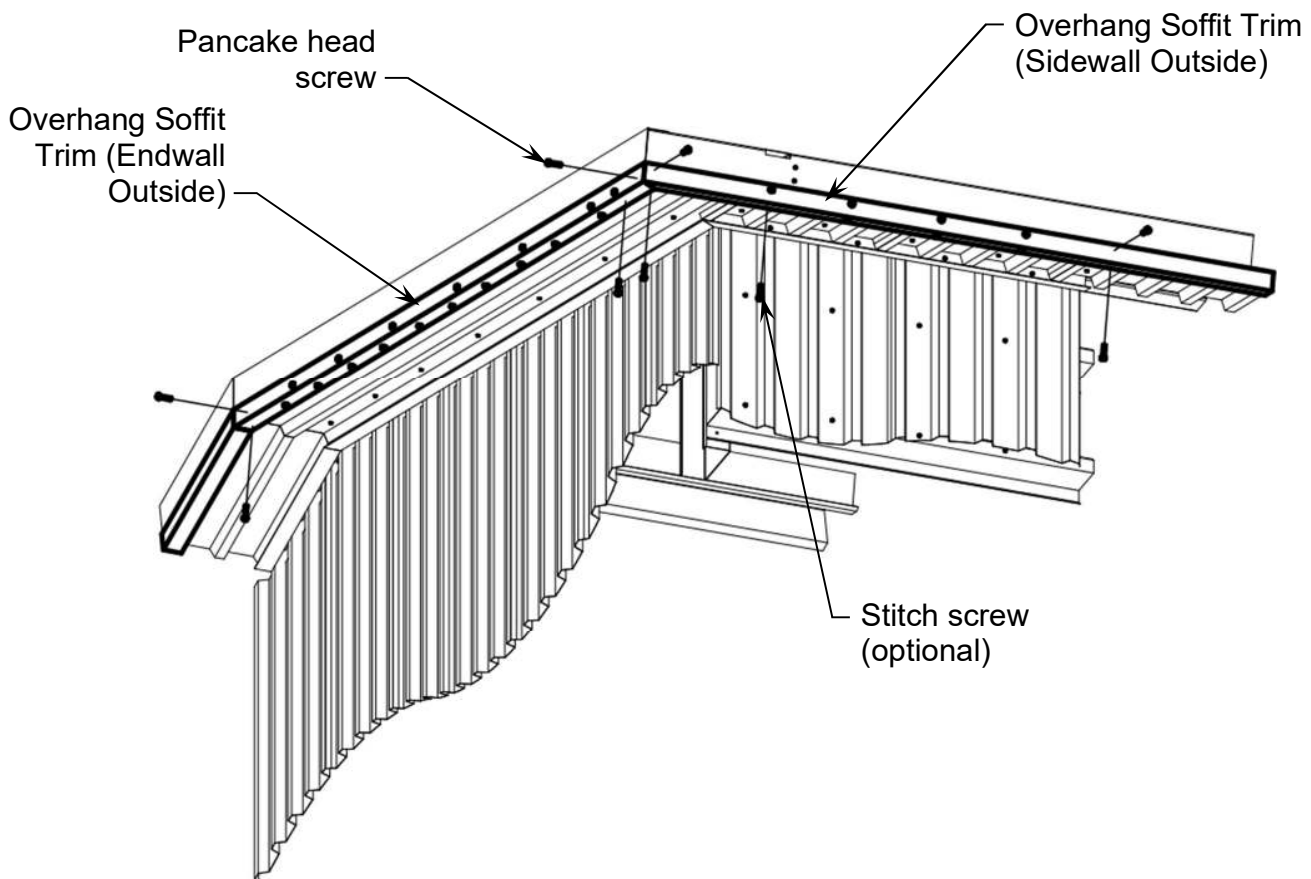


## 5. Install outside bottom soffit trim

On the bottom outside edge of the overhang, trim will need to be installed. This trim will be noted with the usage “Overhang Soffit Trim (Sidewall Outside)” and “Overhang Soffit Trim (Endwall Outside)” on your order. If the sidewall overhang has a vertical face, the bend angles for these trims will be different.

Trim will be secured to the front of the overhang eave purlin or the face of the endwall overhang cap using pancake head screws installed every 48”.

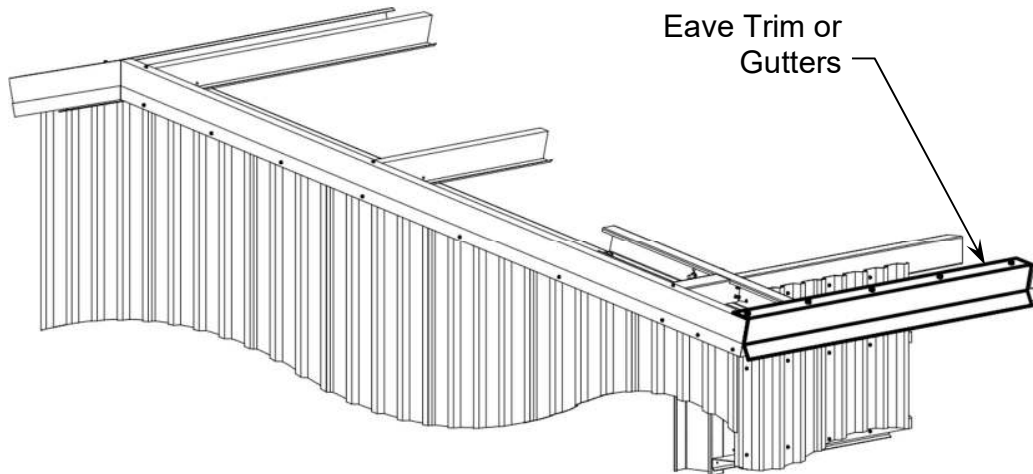
Optional stitch screws can be used to secure the bottom leg of the trim to the soffit material.





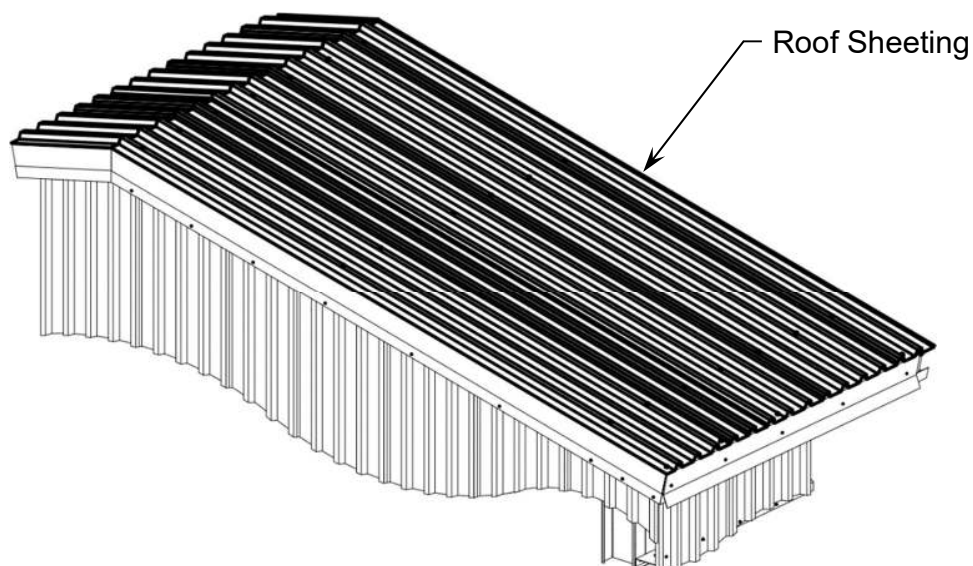
## 6. Install eave trim or box-style gutters

Install eave trim per standard instructions, found in Appendix C. If a gutter is in use, check how it is installed. Gutters that attach to the eave purlin will need to be installed at this point, while gutters that attach to the roof or wall sheathing will be installed after all other sheathing and trim.



## 7. Install roof sheathing and insulation

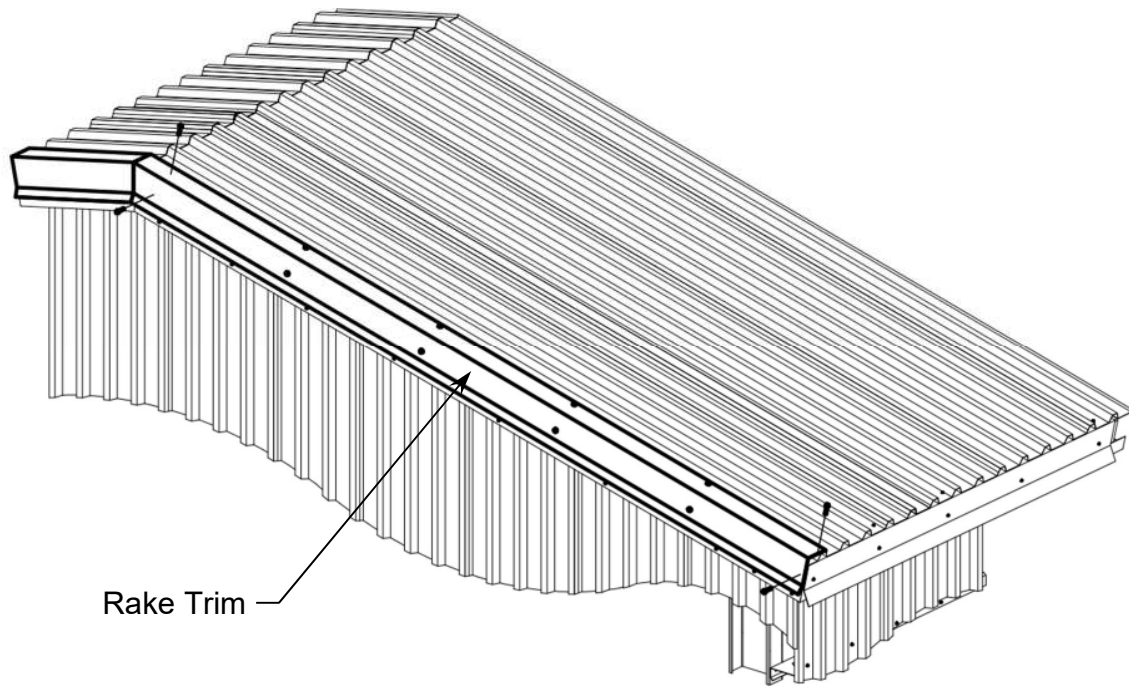
Install roof sheathing per standard instructions, found in Appendix C.

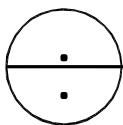
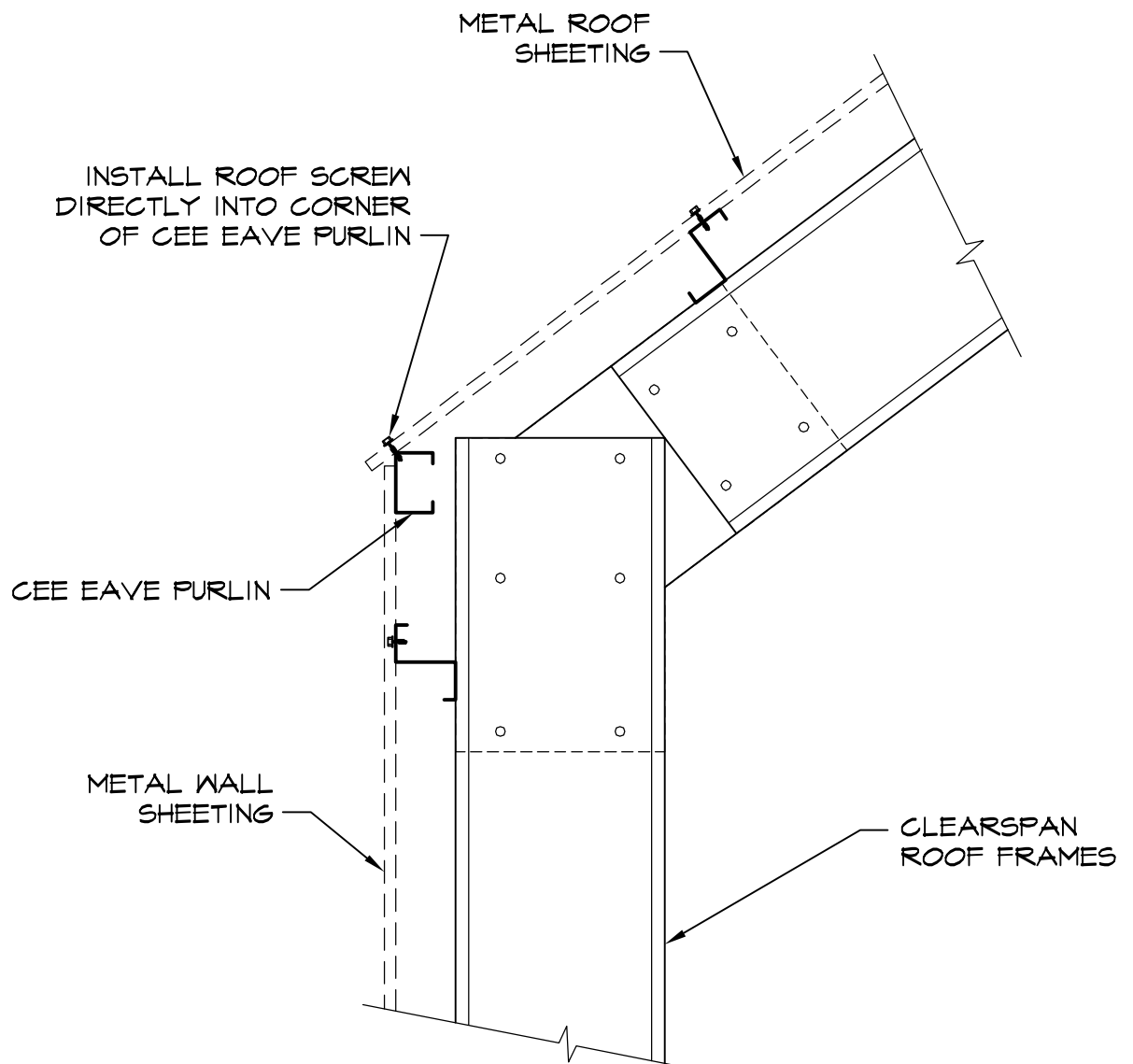




## 8. Install rake trim

Install rake trim per standard instructions, found in Appendix C.

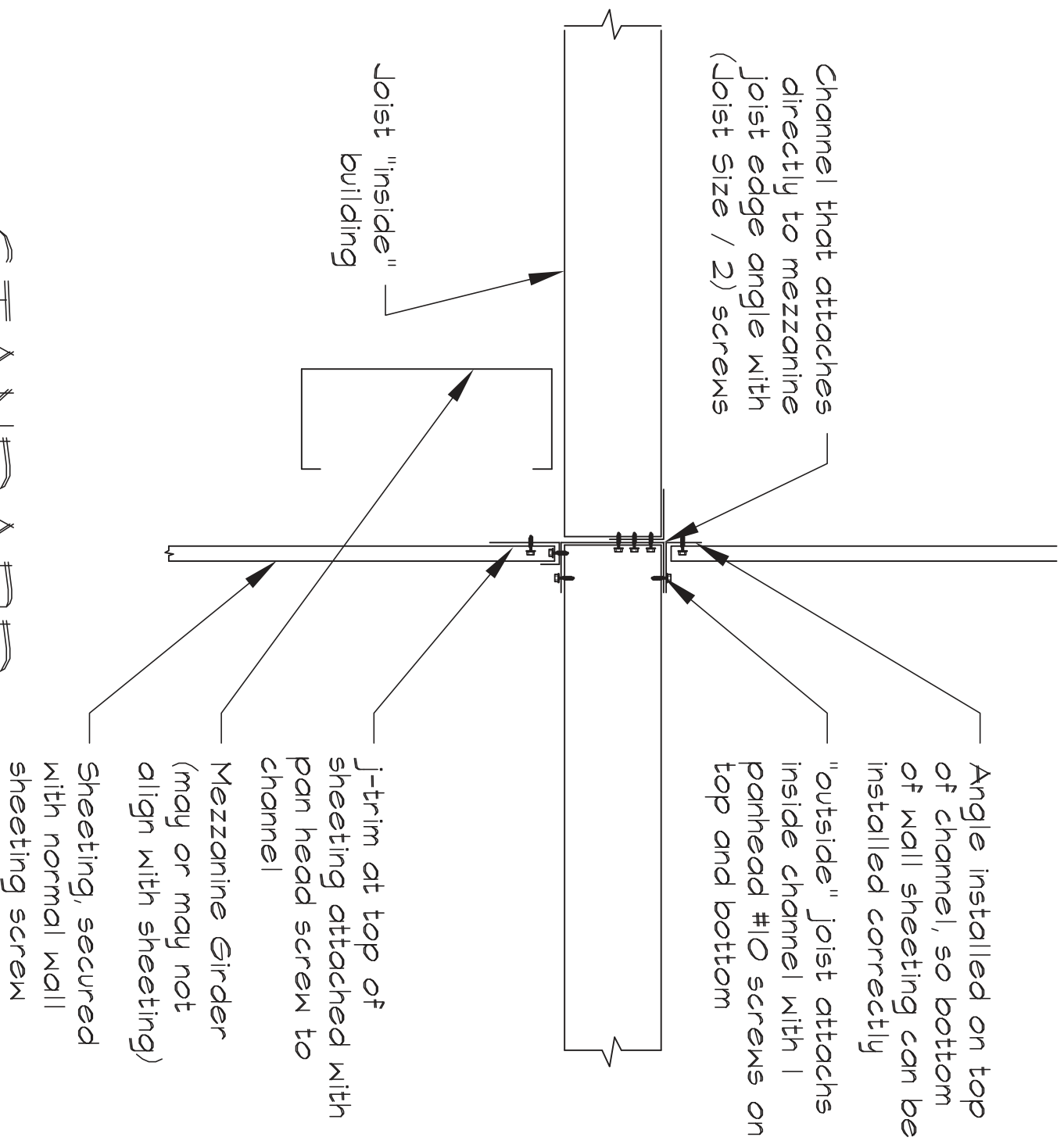




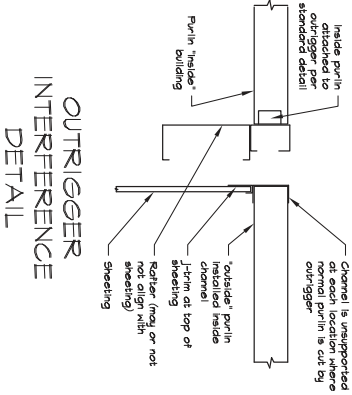
## ROOF SCREW TO CEE EAVE PURLIN

SCALE: 1" = 1'-0"

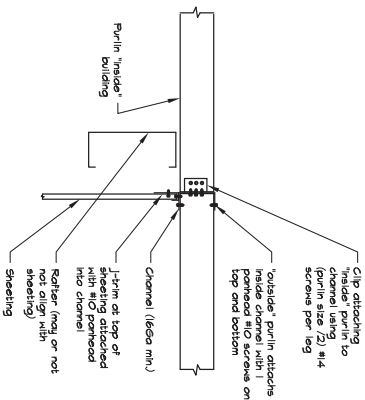




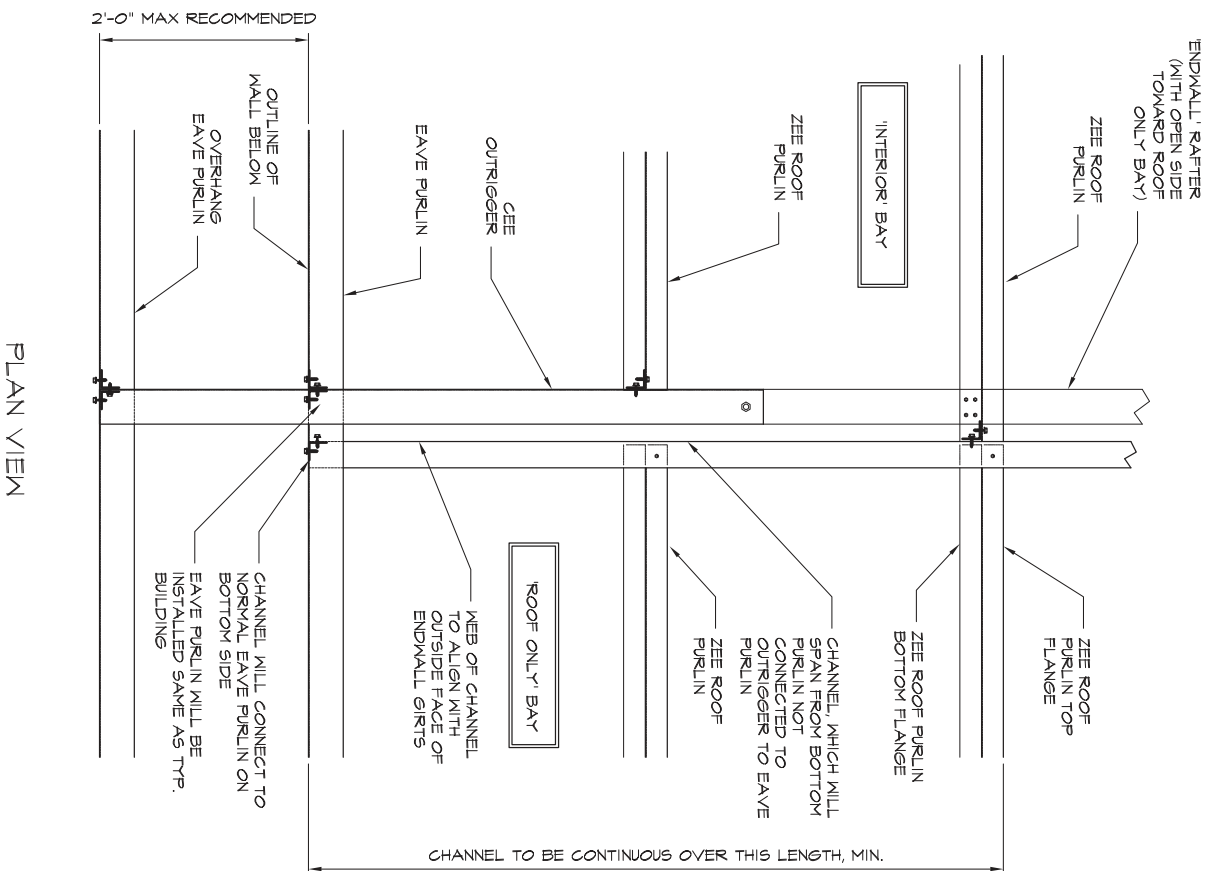
# STANDARD DETAIL



OUTRIGGER  
INTERFERENCE  
DETAIL



STANDARD  
DETAIL



PLAN VIEW



## STORAGE STAIN

TBP 2005.9

### WHAT IS STORAGE STAIN?

Metallic coated steel products, such as hot-dip galvanized and GALVALUME<sup>®1</sup> Coated Sheet Steel, owe much of their excellent corrosion resistance properties to a protective oxide which is formed and replenished when their surfaces are exposed to freely circulating air. However, if the same surfaces are exposed to moisture for prolonged periods of time, in the absence of freely circulating air, white or black corrosion products begin to develop. Such conditions can occur when moisture is trapped between the laps of a coil of hot-dip galvanized or GALVALUME<sup>®</sup> Coated Sheet Steel. The same conditions can also occur when moisture is trapped between the stacks or bundles of improperly stored formed panels at a construction site. The ensuing white, black or intermediate gray corrosion products are commonly referred to as storage stain.

Figure 1 shows an example of a black storage stain on a roof panel. Figure 2 shows an example of white rust storage stain on a hot-dip galvanized coil. Staining can also occur when moisture permeates between a strippable film and the metal coating. This unique "worm tracking" pattern is a combination of black and white corrosion product as shown in Figure 3.

Once the storage stain is formed, it is very difficult to remove. It is not only aesthetically unappealing, it can also indicate permanent damage to the integrity of the products depending on the amount of time the product has been stored under the improper conditions. The only practical option is to prevent storage stain from occurring in the first place.



Figure 1. Black storage stain on a GALVALUME<sup>®</sup> roof panel.



Figure 2. White rust on the surface and sidewall of a galvanized coil.



Figure 3. Stain on a GALVALUME<sup>®</sup> roof panel under strippable coating.

### PREVENTING OF STORAGE STAIN IN COILS

To prevent storage stain, manufacturers of galvanized and GALVALUME<sup>®</sup> Coated Sheet Steel use two basic principles: prevent water from penetrating the laps of coils, and reduce the corrosive effect of moisture should it penetrate the coil laps.

<sup>1</sup> GALVALUME<sup>®</sup> is an internationally registered trademark of BIEC International, Inc. and some of its licensed producers

Moisture is prevented from damaging the surfaces of coated steels in coil form by a variety of methods including:

### **1. Passivation Treatment**

A chemical treatment is applied to the surface of coated steel products, which chemically reduces the reactivity of the coated surface with moisture. Such treatments significantly extend the storage life of coated steel products when they are stored under adverse conditions, but it cannot indefinitely prevent the occurrence of storage stain. In addition, the passivation treatments cannot always be used if the product is to be subsequently painted.

### **2. Oiling**

The application of oil to the surface of coated products during manufacture prior to coiling is also effective in reducing moisture penetration. Two types of oils are used: slushing oils and vanishing oils. These oils generally also contain corrosion inhibitors, which can slow the effects of moisture during storage. They also provide lubrication during subsequent forming operations. Vanishing oils are often used for construction products since they are designed to evaporate during manufacturing.

### **3. Edge Sealers**

These are more viscous oils or greases applied to the side-walls of steel products after coiling to prevent moisture from entering between the coil laps.

### **4. Packaging**

Coils are wrapped in tear resistant, waterproof paper wrapping for transportation and storage. The papers often contain vapor phase corrosion inhibitors (VPI), which are volatile at ambient temperatures and are slowly released from the paper, and then penetrate the laps of the enclosed coil along with any water vapor that might also be present and reduce its corrosive effect.

### **5. Storage**

If the temperature of a steel coil is lower than the dew point of the surrounding air, water from the surrounding air will condense on the surfaces of the coil. This is a condition known as “sweating”. The mass of a steel coil is capable of condensing large quantities of water under such conditions. This water can penetrate the laps either by capillary action or by high humidity air penetrating the laps and subsequently condensing water on surfaces between coil laps.

Therefore, it is important to store coils of coated steel products in controlled environments so that the dew point of the ambient air is always below the temperature of the coils being stored.

## **STORAGE AND HANDLING OF FORMED PANELS**

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Formed panels are normally stacked and bundled for shipment and storage. This also introduces conditions for storage stain if sufficient care is not taken in the packaging and storage of these bundles.

Paper wrapping should be used to protect the bundles of material from dirt and moisture. Plastic or other non-breathing material should not be used for wrapping bundles because these materials prevent air passage and tend to trap moisture in the bundle. The top wrapping sheet of each bundle should lap **over** the bottom paper, to prevent rainwater from entering the bundle (see Figure 4). All panel bundles should be accompanied by a tag or other listing that clearly describes each bundle’s contents.

Each bundle should be inspected upon receipt, and any damage, corrosion or wet material must be noted on the delivery documents. Wet material should be dried according to the panel manufacturer's instructions. Panels and accessories should not be stored in a wet condition.

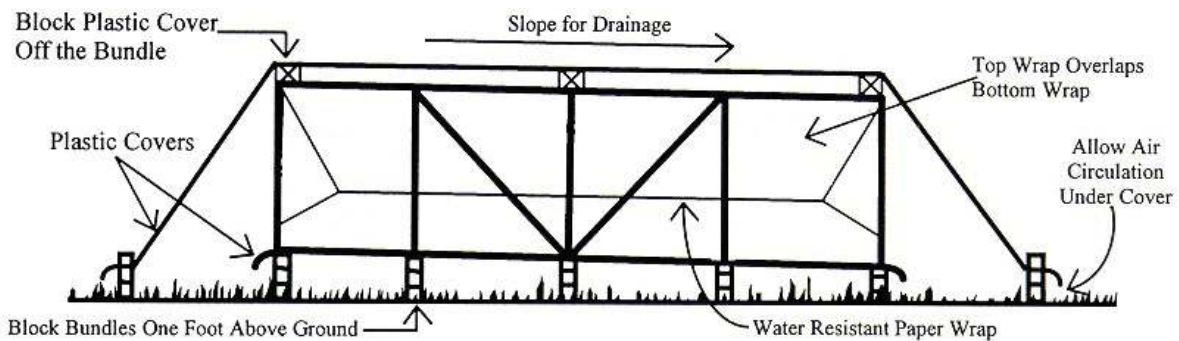


Figure 4. Proper Storage of Building Panel Bundles at Job Site

## STORAGE AT THE JOB SITE

It is recommended that panel bundles be stored under a roof whenever possible. If panel bundles are stored outside, the following list of requirements should be adhered to:

1. The storage area should be reasonably level, and should be located to minimize handling of bundles during the construction process.
2. When storing on bare ground, place a plastic ground cover under the bundles to minimize condensation on the panels.
3. Store bundles at least 12 inches above ground level to allow air circulation beneath the bundle, and to prevent rising water from entering the bundle.
4. Elevate one end of the bundle slightly to permit runoff of moisture from the top of the bundle or from between nested panels. Water-resistant paper will not provide long-term resistance to moisture penetration from puddled water on top of the bundle. A waterproof cover should be placed over the bundles, with allowance for air circulation under the cover (see Figure 4).
5. Inspect stored bundles daily and repair any tears or punctures in the water-resistant wrapping with a compatible waterproof tape.
6. Re-cover opened bundles at the end of each day to prevent entry of moisture.

## SUMMARY

1. Storage stains are white or black corrosion products formed while the hot dip galvanized or GALVALUME® Coated Sheet Steel is in a coil form or in a tight stack.
2. Long term exposure to water or moisture in an oxygen deprived environment can cause storage stain.

3. The most common sources of storage stain are when the steel is in a coil or a bundle of panels. Any time a portion of the steel is exposed to moisture and deprived of oxygen, storage stain can occur.
4. Storage stain should be prevented because it is very difficult to remove without affecting the appearance and/or the performance of the products.
5. Passivation treatments (chemical treatments) can be used to resist storage stain. However, the chemical treatment should not be used on the galvanized products that would be subsequently painted.
6. Oils may be applied to prevent water from reaching the metal surface, thus retarding the appearance of storage stain.
7. To prevent stain while the steel is in a coil, several steps can be taken:
  - Use a climate controlled storage area
  - Wrap in VPI paper
  - Use edge sealers
  - Use First-In, First-Out inventory control
8. To prevent storage stain in a bundle of stacked panels, take the following steps:
  - If possible, store under a roof until use
  - Keep the bundle 1 foot off the ground
  - Slope the bundle
  - Cover the bundle
  - Keep a plastic sheet under the bundle
  - Allow air circulation around the bundle
  - Inspect the bundle daily for rips or tears
  - Re-cover partially used bundles
  - Use a conveniently located, level storage area

#### **DISCLAIMER**

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For further assistance on the use of steel building panels or related topics  
contact U. S. Steel Construction Sales Group:

U. S. Steel Construction Sales  
6200 E. J. Oliver Boulevard  
Room 106  
Fairfield, AL 35064  
1-800-633-8226 or 1-888-243-6851  
Ext. 2683

[ConstructionGroup@uss.com](mailto:ConstructionGroup@uss.com)