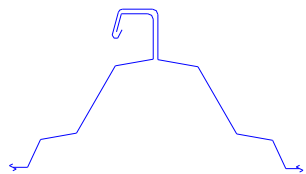
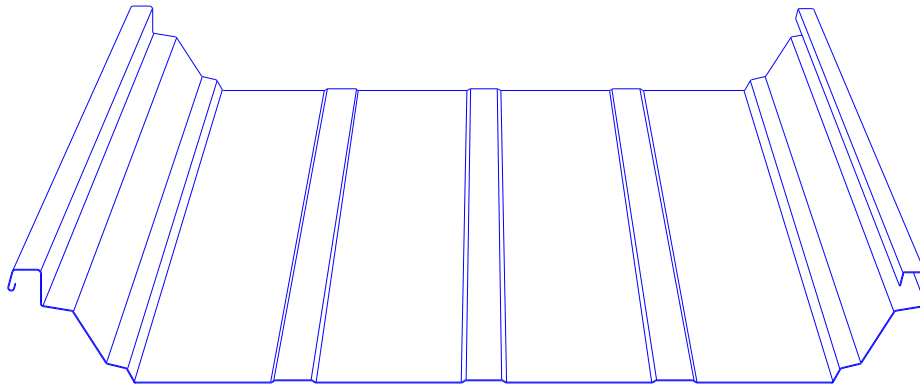
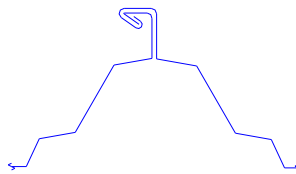


# ZL-24<sup>®</sup> ZONAL LOCK<sup>®</sup>

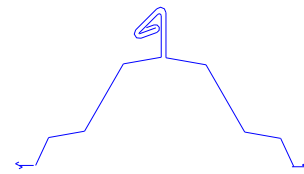
## Standing Seam Roof System ERECTION GUIDE



**ROLL-AND-LOCK**



**TRIPLE-LOCK**



**QUADRI-LOCK**

**BEHLEN<sup>®</sup>**  
4025 E. 23rd St. • Box 569  
Columbus, Nebraska 68601



Motorized Seamer Rental: [www.qualityroofseameers.com](http://www.qualityroofseameers.com)

NOTE: See back side of cover for latest changes to this manual.

TECH. INFORMATION 55067 6/01/06  
Rev. 12/5/17

**NOTE:** If pink sheets are included in this manual, refer to them for latest revisions.

LATEST CHANGES		BY: SR	DATE: 12/5/17
PAGE	CHANGE		
36	Revised downspout information		
88,91	Revised screw to attach the sign		

### **IMPORTANT NOTICE**

Read this erection guide completely prior to starting the installation of the ZL-24® standing seam roof system.

If there is a conflict between the project erection drawings and this guide, the project erection drawings will take precedence.

Due to the process of continuous improvement, the products and procedures in this erection guide are subject to change without notice.

Clarification concerning the roof installation should be directed to the Building Manufacturer Customer Service Manager.

#### **CONTACT:**

Behlen Mfg. Co.  
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## **1 GENERAL**

### **1.1 PURPOSE OF THE INSTALLATION GUIDE**

This installation guide is provided to customers and their erectors as the recommended procedure for the correct assembly of the ZL-24® standing seam roof system, here after referred to as the standing seam roof system.

This guide is intended to be used in conjunction with the project's erection drawings to help plan and organize the installation of the Standing Seam Roof System. The erection drawings identify the applicable roof conditions and govern specific part arrangements. The instructions will help you identify parts, establish the installation sequence, demonstrate correct assembly, and point out any areas or procedures requiring special emphasis or attention.

This installation guide applies to the standard Standing Seam Roof System. Custom roof conditions, including custom details and instructions, will be covered by the erection drawings. In case of conflict between this installation guide and the erection drawings, the erection drawings will have precedence.

### **1.2 CUSTOMER'S RESPONSIBILITY**

The customer is responsible for proper installation of the roof in accordance with the erection drawings and this installation guide, and in accordance with good engineering and construction practices.

The customer must take the responsibility for selecting a competent erector, insist that the work be performed by qualified and experienced standing seam metal roof installers, and insist that the erector take time to study and understand this guide, then assure that the erector correctly follows the guide's instructions.

The building manufacturer does not guarantee and is not liable for the quality of erection. The building manufacturer is not responsible for building defects that may be attributed to improper erection or the negligence of other parties.

Clarification concerning the roof installation should be directed to the building manufacturer's customer service manager.

## **2 SAFE ROOF INSTALLATION**

### **2.1 ERECTOR'S RESPONSIBILITY**

The erector of the roof system is responsible for the safe execution of this installation guide. These instructions are intended to describe the sequence and proper placement of parts. They are not intended to prescribe comprehensive safety procedures.

If the erector cannot safely assemble the roof in accordance with these instructions, it is the responsibility of the erector to stop the work and contact building manufacturer to determine alternate assembly procedures.

### **2.2 OSHA**

The Occupational Safety and Health Act (OSHA) has promulgated many regulations applicable to the installation of this or any other roof system. These regulations, identified as Part 1926, Safety and Health Regulations for Construction, are available from any government bookstore. The objective of the OSHA standards is to protect the worker from injury or illness. These OSHA regulations should be recognized as job site requirements and be fully complied with.

Failure to do so may result in substantial fines in the event of an OSHA inspection. Safe installation practices may be further defined and made mandatory by state or local ordinances.

Maintaining good housekeeping on the jobsite is recognized as being important to both OSHA compliance and to successful job completion.





## 2.3 WALKING AND WORKING ON ROOF PANELS

### A. PLACING PANELS ON THE STRUCTURE

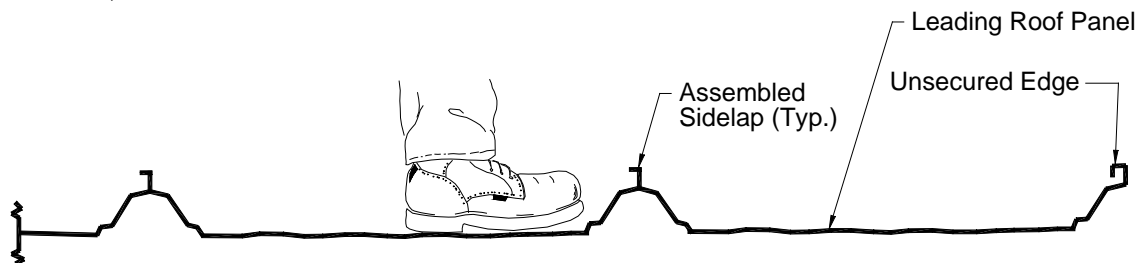
Do not place bundles of panels on the roof structure without first verifying the structure will safely support the concentrated weight of the panels and the weight of the installation crew. Some roof structures may not be designed to support the weight of a full panel bundle without additional structure support.

### B. WALKING ON ROOF PANELS

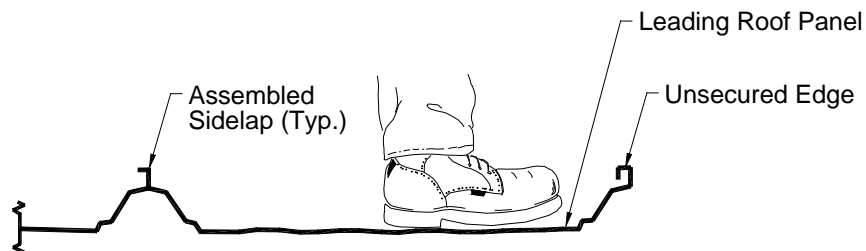
Do not use a roof panel as a working platform. An unsecured panel could collapse under the weight of a person standing between purlins or at the panel end.

Do not walk on the last installed panel run, as the unsecured edge could collapse under a person's weight. When installing clips or making endlap connections, etc., stand where the roof structural will support your weight.

An approved and safe walking platform should be used in high traffic areas to prevent the roof panel from being deformed, scratched, or scuffed.



**CORRECT**  
Step ONLY on secured roof panels.



**CAUTION - INCORRECT**  
DO NOT step on leading (unsecured) roof panel.

Foot traffic on the roof panels can cause permanent distortion of the panel surface. This distortion causes or contributes to visible oil-canning. This is especially critical for roofs with stand-off, because the panels may not have uniform solid support to help resist the foot traffic damage.

On roofs where minimum visible oil-canning is a critical requirement, the roof erection must be conducted in a manner that eliminates floor traffic on the roof panels. In all other cases, foot traffic should be minimized and must be limited to only those areas where the panel surface has solid support, such as directly over a joist or spacer block, etc.

### C. SAFETY EQUIPMENT

The use of safety equipment for the roof panel installation is recommended at all times during the installation process. However, when using lanyards, ensure that the clasp, belt hooks and wire cables are covered in such a manner that they will not scratch the panel surface if accidentally dragged along the panel. All workers should be tied-off to the rigid frames, do not use the purlins to tie-off.

### D. CREW SIZE

The length of the individual roof panels should be considered when determining the crew size. It is recommended that under normal conditions, there be one person for every ten feet of panel length, plus one.

### E. PANEL OVERHANG

Do not stand on the end of unsupported (cantilevered) panels at the eave or ridge. Standing on the cantilever portion may result in panel collapse.



## **F. POINT LOADS**

When properly supported by the structurals, panels are designed to support uniform loads, which are evenly distributed over the panel surfaces. Point loads that occur in small or concentrated areas, such as heavy equipment, ladder or platform feet, etc., may cause panel deformation or even panel collapse.

## **G. SLICK SURFACES**

Panel surfaces and structural steel surfaces are hard, smooth, and nonabsorbent, which causes these surfaces to be very slick when wet or covered with snow or ice. Even blowing sand or heavy dust can make these surfaces difficult to walk on without slipping.

Unpainted panel surfaces are often coated with oil to accommodate the panel-fabrication process. Although designed to wash away or evaporate during normal weather, the oil on new panels can be extremely slick, especially during periods of light rain or dew.

Caution must be exercised to prevent slipping and falling onto the roof surface or even sliding off the roof. Non-slip footwear is a necessity and non-slip working platforms are recommended.

## **H. ELECTRICAL CONDUCTANCE**

Metal panels are excellent electrical conductors. A common cause of injury is the contact of metal panels with power lines during handling and installation. The location of all power lines must be noted and, if possible, flagged. The installation process must be routed to avoid accidental contact with all power lines and high voltage services and equipment. All tools and power cords must be properly insulated and grounded and the use of approved ground fault circuit breakers is recommended.

## **I. FALSE SECURITY OF INSULATION**

Blanket and board insulation blocks the installer's view of the ground below the roof. Serious injury can occur when the installer gets a false sense of security because he cannot see the ground and steps through the insulation.

## **J. SHARP EDGES**

Some edges of panels and flashing are razor sharp and can cause severe cuts if proper protective hand gear is not worn. Be careful not to injure others while moving panels and flashing.

## **2.4 HANDLING ROOF MATERIALS IN STRONG WINDS**

Do not attempt to move panels in strong winds. Wind pressure can easily cause a man to lose balance and fall. Strong wind uplift on a panel can lift the weight of the man carrying the panel.

Loose, wind borne panels are very dangerous and can cause severe injury and damage.

Secure stacks of panels with banding or tie-downs, so wind will not blow the panels off the roof. Clamp individual unsecured panels to the roof structurals. Clamp or block panel bundles and accessory crates to prevent them from sliding down the roof slope.



## 3 CHECKING THE STRUCTURE

### 3.1 COMPLETED AND BRACED

Before placing materials and workers on the roof structure to start roof installation, it must be confirmed that the structure is designed to accommodate the material and erection loads as well as the appropriate live loads and wind uplift loads.

It also must be determined that the structure is complete and structurally sound with all structural connections and bracing in place and secure.

### 3.2 LATERAL STABILITY

The sliding clip method of attaching the roof panels to the roof structurals provides only limited lateral stability and diaphragm bracing to the roof structurals.

Before placing materials on the roof and starting the roof installation, confirm that the necessary roof bracing is in place and secured.

### 3.3 ALIGNMENT

Prior to installation, roof structurals should be checked for overall dimensions and evenness of plane. The roof structurals should also be checked to verify the roof system could be installed without interference. Also, roof structurals nearest the panel endlaps, ridge or high eave should be checked for correct location to properly accommodate the roof components.

#### A. TOLERANCES

To assure the roof system's correct fit-up and designed weather tightness, the structure must be aligned within the following tolerances:

**Out of Square** — The roof system can only accommodate 1/4" of sawtooth of the roof panel ends at the eave, ridge and panel splices. This means the allowable out of square of the rake line relative to the eave line and ridge line is 1/4" for each 40' of rake run.

**Structure Width and Eave Straightness** — The roof system is designed to accommodate  $\pm 2"$  of overall structure width error, or  $\pm 1"$  of eave straightness error at each eave.

To assure that the accumulation of the structure width error and eave straightness error does not exceed the roof system's tolerance, the structure width should be measured from eave line to eave line at each rake, at the first frame line from each rake and at each point where there is a significant error or change in eave straightness (this usually occurs at a frame line or at a wind column).

**Structure Length and Rake Straightness** — The roof system is designed to accommodate  $\pm 2"$  of overall structure length error, or  $\pm 1"$  of rake straightness error at each rake.

To assure that the accumulation of structure length error and rake straightness error does not exceed the roof system's tolerance, the structure length should be measured from rake line to rake line at each eave, at the ridge and at each point where there is a significant error or change in rake straightness (this usually occurs at an end rafter splice).

#### B. MEASURING

Structure length and width may be measured with a steel measuring tape from the face of the eave or rake member to the face of the opposite eave or rake member. The measuring tape must be parallel to the relative eave or rake line and must be stretched taut.

Eave and rake straightness may be determined by measuring deviations from a string line, which is stretched taut along the eave or rake line.

#### C. AESTHETIC ACCEPTANCE

Although these structure alignment tolerances will allow for reasonable roof component fit-up and ease of installation, the extremes of these tolerances may be aesthetically objectionable and should be confirmed with the customer before starting the roof installation.



## D. CORRECTIONS

Any structure alignment error, which exceeds the above stated tolerances, must be corrected before roof installation can begin. If it is decided that the structure alignment errors cannot be corrected, alternate roof details may have to be developed. The alternate details may require additional materials, modified parts (with additional cost, fabrication and delivery time) and additional installation time. The building manufacturer cannot assure the performance of such alternate details.

## 4 RECEIVING AND HANDLING ROOF MATERIALS

### 4.1 MATERIAL INVENTORY

Your material is carefully inspected and crated before leaving the plant and accepted by the transportation company as being complete and in satisfactory condition. It is the carrier's responsibility to deliver the shipment intact. It is the consignee's responsibility to inspect the shipment for damages and shortages when it is delivered.

Conducting a material inventory at the time of delivery is essential. By conducting the materials inventory, the erector is able to identify any material shortage or damage and avoid stopping installation later because of such shortage or damage.

It is imperative that any shortages or damage of the delivered materials be noted at once and clearly marked on the bill of lading before signature of acceptance. Notify the building manufacturer immediately of any conflicts. The building manufacturer will not be responsible for shortages or damages unless they are noted on the bill of lading.

In the case of packaged components (such as clips, fasteners and sealants, etc.), the quantities are marked on their container and should be checked against the bill of materials. The building manufacturer **must be notified of any shortages or concealed damage within 15 days of delivery.**

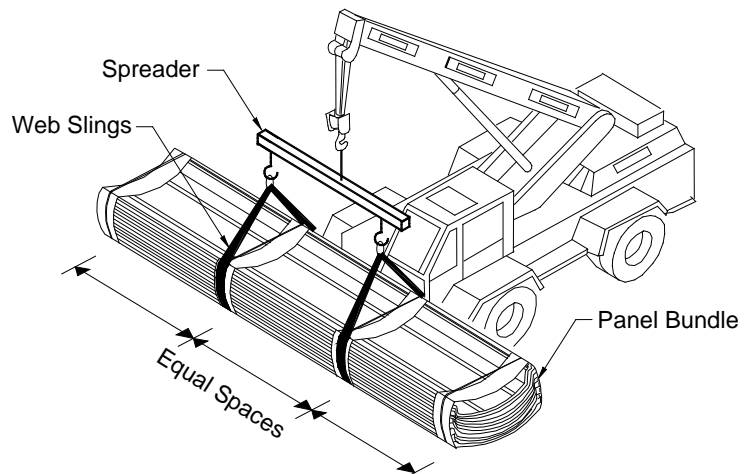
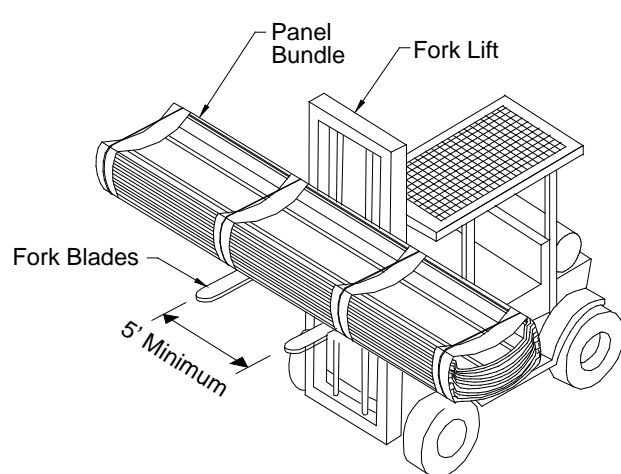
### 4.2 EQUIPMENT FOR UNLOADING AND LIFTING

Hoisting equipment is necessary to unload and position the panels and accessory crates for site storage and installation. The equipment must have sufficient capacity and reach to place the material where it is required for efficient installation.

Slings will be required to minimize panel damage. The recommended slings are nylon straps of 6" minimum width and of sufficient length to accommodate the panel bundle girth.

A spreader bar will be required for the longer panel crates to assure correct sling spacing and uniform lifting. The spreader bar must be large enough to handle the maximum panel bundle weight and length.

A forklift is handy for unloading and placing shorter panel and accessory crates.





## 4.3 LIFTING ROOF PANEL BUNDLES

Under normal conditions, panel crates less than 44' long can be lifted with two slings spaced at third points. Panel crates longer than 44' can be lifted with three slings located at quarter points using a spreader bar to achieve correct sling spacing for uniform lift.

Slings should be located at the banding locations. Loads should always be checked for secure hook-up, proper balance, and lift clearance. Tag lines should be used if necessary to control the load during lifting, especially if operating in the wind.

Panel crates less than 15' long may be lifted with a forklift only if the forks are spread at least 5' apart and blocking is used to prevent panel damage by the forks.

The number of panels in a typical bundle will be 20. The table below gives approximate weights of various panel lifts.

PANEL LENGTH	TOTAL WEIGHT OF 20 PANEL BUNDLE	PANEL LENGTH	TOTAL WEIGHT OF 20 PANEL BUNDLE
10'	544	35'	1889
15'	813	40'	2154
20'	1089	44'	2419
24'	1301	50'	2658
30'	1623	52'	2806

Banding on panel bundles must be left intact until all lifting is complete. Lift one bundle at a time.

## 4.4 FIELD STORAGE OF ROOF MATERIAL

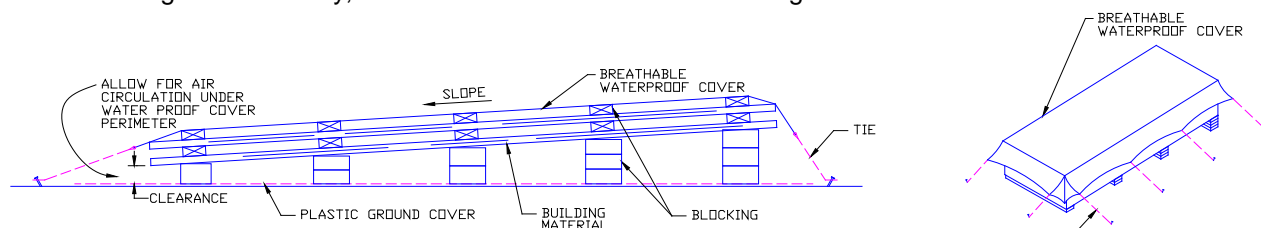
Upon acceptance of the shipment, the customer or his representative is responsible for proper handling storage and security of the roof materials. The building manufacturer is not liable for damage or loss of materials at the job site.

Outside job site storage of all building components should be limited to a short duration just prior to erection and when site conditions are favorable. Warehouse storage should be used when adverse field conditions or long-term storage is anticipated.

Coated steel panels are subject to corrosion and discoloration if moisture becomes entrapped between panels. Inspect panels for entrapped moisture upon arrival at the job site and properly protect and store them in order to prevent accumulation of moisture between panels.

In addition to moisture due to rainfall, moisture can also form between panels due to condensation. When panels are not expected to be immediately installed, inside storage is recommended.

When outside storage is necessary, store in accordance with the following criteria:



- Store panels in a protected area, out of standing water and drifting snow, etc.
- When panels are stored on the ground, use a plastic ground cover to minimize condensation of moisture from the ground onto the panels.
- Raise the bundles off the plastic ground cover to prevent contact with water puddles, and allow for air circulation over, under, and through the bundles to resist creation of and promote the evaporation of any condensed moisture.
- Provide sufficient blocking to raise and support the bundles to prevent excessive bowing.
- Slope panels for drainage of moisture from the panels.
- Cover panels with a breathable waterproof cover, allowing for air circulation (do not wrap cover under panel bundles or restrict air movement).
- Inspect panels daily for moisture accumulation.
- If panel bundles contain moisture, the panels must be dried and restacked. Use care in restacking to not damage panels.
- Secure opened or restacked panel bundles to prevent damage.



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When moving panel bundles, take extreme caution to prevent damage to the panel edges. Support uncrated panels at each end and at 6' spaces.

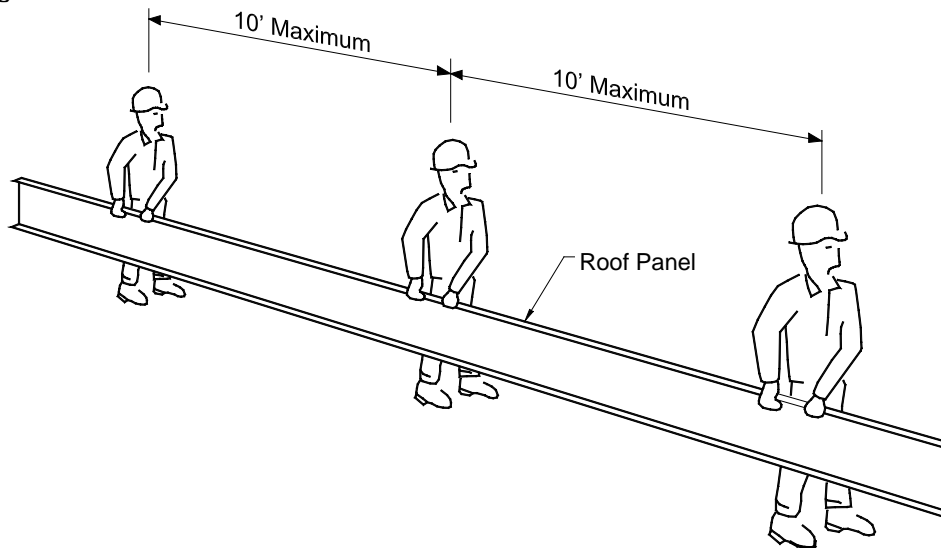
Secure all bundles or loose panels on the roof to the roof structurals at the end of each workday. On steep roofs, take provisions to prevent panels and panel crates from sliding off the roof. Be sure to set panel bundles on the roof in the proper direction for the installation sequence.

Store trim and accessories in a secure area and protected from damage, weather, and theft. Store fasteners, sealants, closures, etc. out of the weather and protected from contamination.

## 4.5 HANDLING INDIVIDUAL ROOF PANELS

To lift individual panels, lift one side of the panel by the seam letting it hang naturally to prevent buckling. Pick-up points should not be more than 10' apart. Do not pick-up panels by the ends only, or in a flat position.

If the individual panels are to be lifted to the roof by hand line, the common method is to use the vice grip "C" clamps. Position the clamps on the flat of the panel, as close as possible to one edge so the panel is lifted in a vertical position. The jaws of the vice grips must be padded to prevent damage to the panel surface. Space clamps, uniformly no more than 10' apart and the hand lines must be pulled in unison so that uneven lifting does not buckle the panel. Be sure the clamps are tight on the panel and the line is secure to prevent dropping the panel, which can result in personal injury and property damage.



## 4.6 HANDLING LONG TRIM

When removing long trim from the shipping crate and during installation, take care to prevent damage caused by buckling. Lift with two or more people, do not pick trim up by ends.

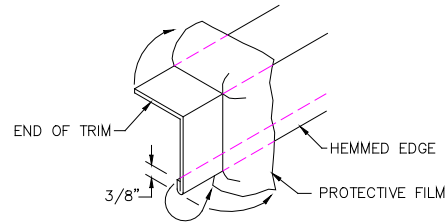


## 4.7 PROTECTIVE FILM REMOVAL

Trim components have a protective film on the colored surface that must be removed prior to installation. Prolonged exposure (more than 3 weeks) to rain and/or sunlight will adversely affect the protective film making removal difficult.

### REMOVAL INSTRUCTIONS

When film is being removed from trim having a hem along its edge, the film should be peeled off along the entire end. This includes the 3/8" hemmed area, on the back side. Pull the entire film strip at a constant rate. Do **NOT** try to rip the film off as it will tend to tear at the hemmed edge and corners leaving a strip that will have to be removed separately.



## 5 ROOF INSTALLATION BASICS

### 5.1 PROPER TOOLS

Before starting paneling, be sure that the proper equipment and tools are on hand. The tools must be in good operating condition and operators should adhere to safety precautions at all times.

Improperly operating tools, too few tools, inadequate power source, or other equipment deficiencies slow down the installation process. The cost of inefficient working is usually greater than the cost of providing good equipment.

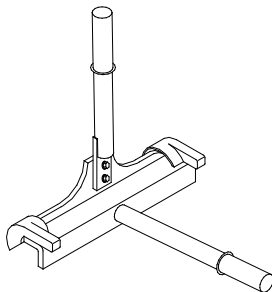
### 5.2 EQUIPMENT LIST

The following tools and equipment should be considered for efficient installation of the standing seam roof system. Actual tools and equipment required may vary due to variations in building type and construction.

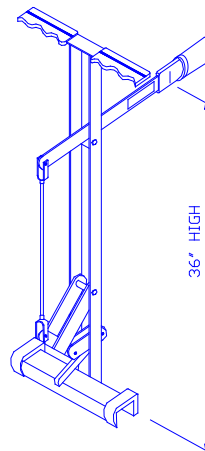
This list should not be interpreted as a limitation to your inventory of installation equipment. Tools (A thru D) are specifically designed for the standing seam panel and are available from the building manufacturer.

#### A. MANUAL SEAMING TOOLS

Either tool can be used to form the panel seam to a Triple-Lock profile at: Panel clips, Endlaps and panel ends at eaves and ridge lines.



HAND SEAMER TOOL 3518052



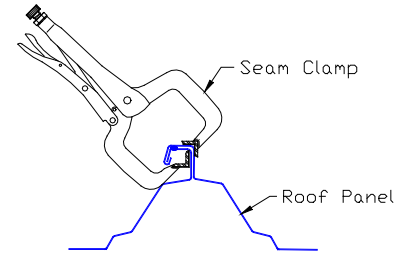
STAND-UP SEAMER 255139



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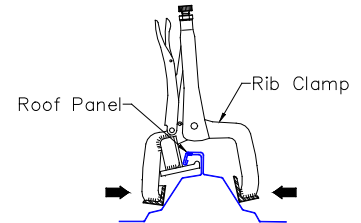
## B. SEAM CLAMP (Part No. 255133)

Used to compress tape mastic at panel endlaps. Minimum of (2) required.



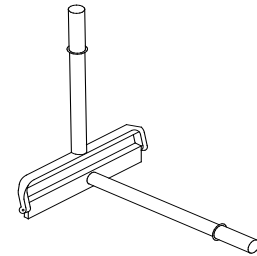
## C. RIB CLAMP (Part No. 255135)

Used to correct roof panel coverage by squeezing ribs together to provide a consistent coverage with a minimum of (4) required.



## D. QUADRI-LOCK SEAMING TOOL (Part No. 3518053)

Used to form the panel seam to a Quadri-Lock profile.



## E. MOTORIZED SEAMING MACHINE

For motorized seaming machine rental information refer to page 115 in this manual.

## F. OTHER TOOLS AND EQUIPMENT

Screw Guns — Designed for use with self-drilling screws

Socket Extensions — 6" extension for screw gun

Hex Socket Heads — 5/16" magnetic

Drill Motor — 1/4" capacity

Drill Bits — Assortment

Sheet Metal Cutter — or power shears or nibbler

"C" Clamps — vise grip type

Sheet Metal Shears — left and right cut

Hack Saw — with metal cutting blade

Steel Measuring Tape — 12', 50', 100'

Nylon String Lines

Chalk Line

Brooms

Marking Pen

Caulk Guns — for 1/10 gallon sealant tubes

Power Source and Extension Cords — capable of handling the total equipment requirements, including 20-amp seamer machine, without power drop due to extension cord length.





## 5.3 SEALANTS

### A. TEMPERATURE EFFECTS

Temperature extremes must be considered during installation of the roof due to the sensitivity of sealants. The recommended installation temperature range is 20° F to 120° F. At colder temperatures, the sealant stiffens resulting in loss of adhesion and compressibility. At hotter temperatures, the sealant becomes too soft for practical handling. On cold but sunny days, the panel's surface may become warm enough to accept the application of a heated sealant even though the air temperature is below 20° F.

When overnight temperatures fall below freezing, the sealant should be stored in a heated room so it will be warm enough to use the following day. On hot days, the sealant cartons should be stored off the roof in a cool and shaded area. While on the roof, sealant rolls should be kept shaded until actual use.

In very cold weather, it is recommended that the fasteners be tightened slowly and only tight enough that the sealant is in full contact with the panel or flashing. Then on the next sunny day, complete the tightening process after the sun warms the panel and flashing surfaces.

### B. CONTAMINATION

To assure proper adhesion and sealing, the sealant must have complete contact with adjoining surfaces. Contaminants such as water, oil, dirt and dust prevent such contact. The panel and flashing surfaces must be dry and thoroughly cleaned of all contaminants. Before applying tape sealant, the sealant should be checked for contaminants. If the sealant surfaces are contaminated, it must not be used.

During cool weather, condensation or light mist can accumulate on the panel and flashing surface and not be easily noticed. It is recommended that sealants always be kept under protective cover and that the panel and flashing surfaces be wiped dry immediately before installation.

Tape sealant is provided with a protective paper to reduce contamination. Incomplete removal of the protective paper will prevent the sealant's adhesion to the panel or flashing surfaces. Always check that the protective paper is completely removed. Do not remove the protective paper until immediately before the panel or flashing is installed over the sealant.

### C. COMPRESSION

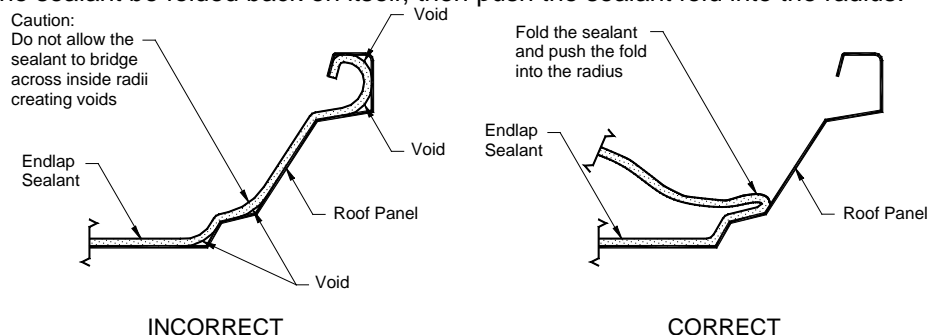
To assure proper adhesion and seal, the tape sealant must be compressed between the panel and flashing surfaces with firm and uniform pressure. In most cases, the required pressure is applied by the clamping action of screws pulling the adjoining surfaces together. However, the tape sealant's resistance to pressure becomes greater in cold weather.

During cold weather, the fasteners must be tightened slowly to allow the sealant time to compress. If the fasteners are tightened too fast, the fastener may strip out before the sealant compresses adequately, or the panel or flash may deform in the immediate area of the fastener, leaving the rest of the sealant insufficiently compressed.

### D. INSIDE CORNERS

An inside radius, such as where the panel flat meets a rib, is usually the most critical area to seal. A common mistake for the installer, is to bridge the sealant across the inside radius.

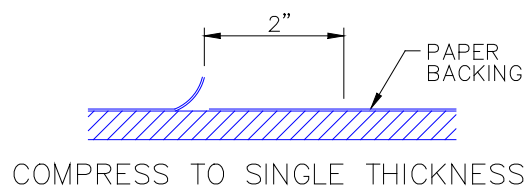
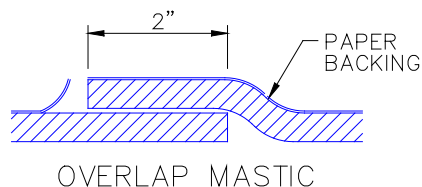
When the lapping panel or flashing is pushed into place, the bridged sealant is stretched and thinned. The sealant may then be too thin to adequately seal this critical area. When tape sealant is applied at an inside radius, it is recommended that the sealant be folded back on itself, then push the sealant fold into the radius.





## E. LAPS

Splice mastic with a 2" overlap. Press lapped tape mastic strips firmly together to form a single thickness.



## 5.4 FASTENERS

### A. SCREW GUN

Use torque control screw guns for driving self-drilling screws. 1800 RPM screw gun speed is necessary to attain efficient drilling speeds. High tool amperage (4 to 7 AMP) is required to achieve the proper torque for secure fastening.

### B. SOCKETS

Use good quality magnetic sockets. Good fitting sockets reduce wobble and stripping of the screw heads, especially the zinc-die cast heads. They also minimize objectionable paint chipping and scuffing on colored screws and minimize damage to the protective coating on unpainted screws. See Section 5.7 for additional information on socket types.

Magnetic sockets collect drill shavings, which will build up and eventually prevent the socket from seating properly on the screw heads. One method of removing the drill shavings is to roll up a ball of tape sealant and push the socket into the sealant.

When the socket is removed from the sealant, most of the drill shavings will remain embedded in the sealant thereby cleaning the socket. This process should be repeated as often as needed to keep the socket clear of drill shavings.

### C. SOCKET EXTENSION

A 4" or 6" socket extension is recommended for installing the panel clip screws. With the extension the screw can be driven straight down without tilting the screw gun to clear the panel or clip. Since socket extensions are slow to wear out, it is usually more cost effective to purchase socket extensions and good quality sockets rather than purchase sockets with built-in extensions.

## 5.5 INSTALLATION OF FASTENERS

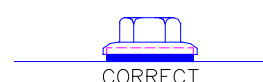
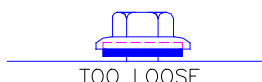
Before starting the screw, the materials to be joined must be pressed together with foot or hand pressure. The pressure must be maintained until the screw has drilled through all the materials and the threads have engaged.

Most self-drilling screws require 20 pounds of pressure to maintain the drilling action and to start the thread cutting action. Also, applying such pressure before starting the screw gun will usually prevent tip walking or wandering. If too little pressure is applied, the drill point may not cut into the metal and the point will heat up and become dull. If the pressure is too heavy, the bottom material may be deflected away, causing a standoff condition, or the drill tip may be broken or split. Screws must be held perpendicular to the panel or flashing surface during starting and driving.

For proper seating of the fastener-sealing washer, the panel or flashing surface must be clean and drill shavings must be removed from under washers before seating. The fastener must be driven perpendicular to the panel surface so that the washer can seat level without warping or cupping.

Do not over drive screws. Over driving can strip the threads and/or damage the sealing washer. Use screw gun with torque control set to function properly for the combination of fastener size, hole size and material thickness.

The fastener should be driven tight enough to uniformly compress the washer but not so tight that the washer splits or rolls out from under its metal dome. The recommended procedure is to tighten the fastener until the sealing washer just starts to visually bulge from under the metal dome.





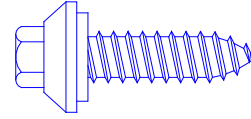
## Behlen ZL-24® Roof System Installation Guide

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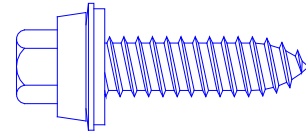
As a good installation practice, all roof installers should carry approved oversized screws. Upon stripping or breaking a screw, the screw must be immediately removed and replaced with the appropriate oversized screw. Do not defer the screw replacement to be remembered and fixed later, or to be found by the clean-up crew. The majority of such screws will be overlooked until the customer complains of leakage.

The following fastener replacement should be used on “over-turned” fasteners.

OVER-TURNED      ②⑤ #17 x 1” self-tapping screw (3228126)

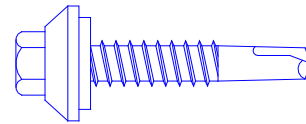


REPLACED BY      11/32” x 1 1/4” self-tapping screw (Not supplied by Mfg.)

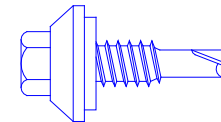


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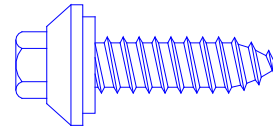
OVER-TURNED      ⑤ 1/4” x 1 1/4” self-drilling screw (3228105)



OVER-TURNED      ⑫ 1/4” x 3/4” self-drilling screw (3228103)

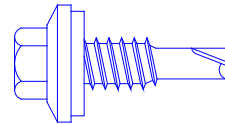


REPLACED BY      ②⑤ #17 x 1” self-tapping screw (3228126)

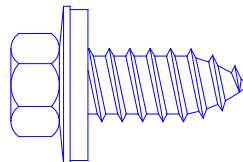


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OVER-TURNED      ② 1/4” x 3/4” self-drilling screw (3228100)



REPLACED BY      #17 x 3/4” self-tapping screw (3228108)





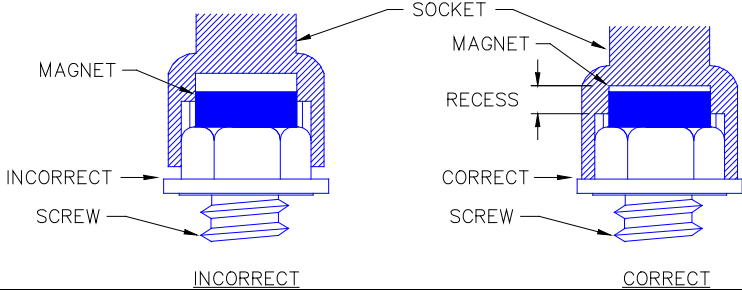
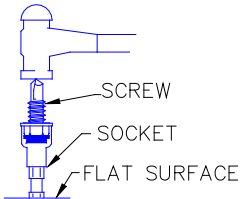
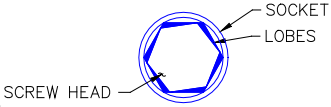
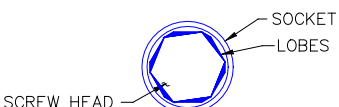
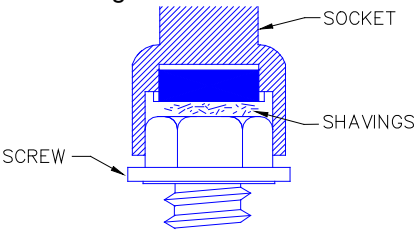
## 5.6 TROUBLE SHOOTING GUIDE

The following information is designed to assist you in correcting problems that may be encountered while installing the self-drilling screws. Listed below are some potential problems, causes and solutions.

If no solution to the problem can be found in the field, contact:

The building manufacturer or Atlas Bolt & Screw Technical Services (800) 321-6977

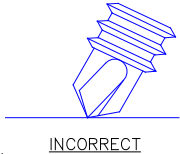
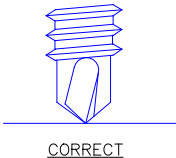
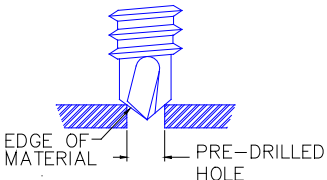
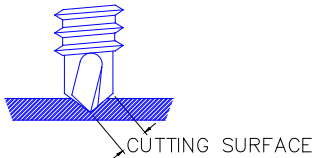
### 1. PROBLEM: Rounding off hex head.

CAUSE	SOLUTION
<p>Improper socket to hex contact.</p> 	<p>Set the proper magnet depth by using a screw and hammer to drive the magnet further into the recess of the socket.</p> 
<p>Improper engagement of socket to hex head.</p> 	<p>Replace socket with new one which has the new "lobe design" which provides a positive grip while contacting less surface to protect painted heads. Available from building manufacturer.</p> 
<p>Build-up of metal shavings in socket.</p> 	<p>Use a small plug of tape mastic to remove metal shavings.</p>
<p>Socket is worn causing screw to wobble.</p>	<p>Replace socket with new one.</p>
<p>Socket size does not fit approximately to screw head.</p>	<p>Check whether a 5/16" hex or 3/8" hex is being used.</p>



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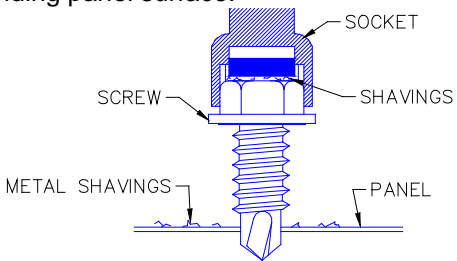
## 2. PROBLEM: Burning off or rounding of drill point.

CAUSE	SOLUTION
Forcing screw in by applying too much pressure. Not keeping fastener perpendicular to surface being drilled.	Allow the drill point to do work. Reposition screw/screw gun into a vertical position.
	
Incorrect drill point of material thickness being drilled.	Check the size/part number of screw being used with erection information supplied with job.
Improper speed (RPM) of screw gun.	Use 1800 RPM screw gun for best results.
Installing a self-drilling screw into a pre-drilled hole. The cutting surface of the screw will be blunted by the edge of the material.	Allow the screw point to drill hole with entire drill point cutting surface.
	

## 3. PROBLEM: Head separation (Head popping off)

CAUSE	SOLUTION
Incorrect application for screw. Stitch screw used in structural application.	Check the size/part number of screw being used with erection information supplied with job.
Over-torquing the screw.	Use depth sensing nose piece to allow proper seating of fastener.

## 4. PROBLEM: Head shavings on panel, causing red rust and corrosion.

CAUSE	SOLUTION
Steel body screws become magnetized by magnetic socket insert, metal shavings attach to screw and spin onto panel.	Remove build-up of metal shavings in socket so that metal chips will come off the panel and adhere to the socket when screw gun is withdrawn.
The act of installing screws causes metal shavings to lay on surrounding panel surface.	Blow off loose shavings or use soft cloth to gently wipe off shavings from panel surface.
	



## 5.7 TECHNICAL ASSISTANCE

The information (below) is recommendations from the building manufacturers' supplier of its fasteners.



### STOP . . . PLEASE READ

#### RECOMMENDED INSTALLATION FOR SELF-DRILLING TAPPING FASTENERS TO INSURE FASTENER PERFORMANCE

\* Apply with 1800 RPM electric screw gun.

\* Drive socket size must fit appropriately to fastener head.

Socket Types:

1. **Super Star Socket** - Used for long-life non-magnetic screw heads. Can be used with carbon screw to avoid drill chips collecting on magnetic sockets.

Building manufacturers Part No. - 1/4" (3518045) 5/16" (3518046) 3/8" (3518047)

2. **Non-magnetic** - Used by erectors on roofing applications, mainly to avoid drill chips collecting in sockets.  
Special Order - 1/4" 5/16" 3/8"

Drilling/Driving fastener must be held perpendicular to the fastening surface.

Self-Drilling fasteners should not be forced in. Allow the drill point to do the work.

#### - CAUTION -

Over-torquing may result in fastener separation/failure (head popping off).

Care should be exercised during installation.

Torque of 30-60 in. lbs. Based on fastener size and application.

*FOR APPLICATION SUPPORT, CONTACT:*  
**ATLAS BOLT & SCREW TECHNICAL SERVICES (800) 321-6977**

\* 1800 RPM screw guns and sockets are available at your local tool house or from:

**Dynamic Fasteners 1-800-821-5448**



## 5.8 FIELD CUTTING PANELS AND FLASHINGS

### A. ABRASIVE SAW PROBLEMS

Abrasive saws (circular saws with friction disks) are not recommended for cutting roof panels or flashing. Abrasive saws create high heat that may burn away the protective cladding from the panel edge, causing the edge to rust.

Also, abrasive saw dust contains fine, hot steel particles, which accumulate on panel and flashing surfaces where they rust and can cause staining and rusting of those surfaces.

Rust caused by abrasive saw damage or abrasive dust particles may be excluded from warranty claims.

### B. SHEARING METHODS

It is recommended that panels and flashing be cut with shears to provide a clean, undamaged cut. On shear cut edges, the protective cladding extends to the edge of the cut and is often wiped over the edge to further protect the base metal. Whenever possible, fit the material so that the factory cut edge is exposed and the field cut edge is covered.

When field cutting complex shapes, it is usually easier to cut out a 1" wide strip using both left and right hand shears. The 1" cutout provides clearance to smoothly cut the flats and the clearance to work the shears around tight corners.

When making repetitive cuts (such as cutting panels at a hip condition) it is recommended that a template be made from a piece of drop-off panel or flash to provide fast and accurate marking of the field cut. When using panel material for the template, cut off the top portion of the panel ribs so that the template is easily laid onto the panel being marked.

### C. MARKING PANELS

Avoid marking the panels for cutting, etc., in a manner that will leave visible markings stains, etc., on the finished roof surface. Use chalk or felt tip ink markers. **Do not use graphite (lead) pencils on unpainted panel surfaces**, the graphite can cause rusting of the surface.

### D. CLEANING METAL CHIPS FROM PANELS

The act of installing self-drilling screws can produce hot metal chips on painted or bare panel surfaces that can literally melt into the panel coating causing them to become adhered to the panel. If these panels are not cleaned immediately, the potential for red rust to deface the panel is almost certain. Blow off loose shavings or use soft cloth to gently wipe off shavings from panel.

## 5.9 PROTECT ROOF PANELS FROM TRACKING

Construction sites generate steel particles on the ground which the construction crew can track on to the roof surface thru foot traffic. The panel surface can become scratched or marred when the soles of shoes grind soil on steel debris into the panel surface causing steel debris rust staining. One solution is for roofing worker not to switch to the ground and back, workers on the ground should send up all materials needed rather than the roof crew retrieving them. Prevention of steel debris staining is the responsibility of the installer clean all debris off the panels.



## 5.10 TOUCH-UP PAINT

If scratches occur during handling and installation of painted trim, roofing and siding, it may be desirable to use touch-up paint to repair the blemishes. Surface scratches which are not obvious from a distance of six feet are generally best left untouched, since normal soiling and weathering will mask them.

Touch-up paint should be used sparingly and only to cover up areas where paint has been removed.

Areas to be touched up should be wiped with mineral spirits to remove dirt, wax and other contaminants then lightly sanded by using a 3M sanding block (medium grit) to roughen the painted surface adjacent to the scratched area before colored touch-up paint is applied.

Aerosol or spray applications are not recommended for blemish or scratch repairs. The best tool for this type of repair is a small brush.

Use the method below for obtaining touch-up paint:

### METHOD

Buy touch-up paint locally from a Sherwin-Williams store by using the formulas below.

The material is made in Metalatex Acrylic Semi-gloss coating. Products are in gallon formulas.

<b>ANTIQUE BRONZE (AZ)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 W1-WHITE - 40 1 1 L1-BLUE - 11 - 1 N1-RAW UMBER 6 53 - - R3-MAGENTA - 22 1 1  ONE GALLON ULTRADEEP B42T00104 884199993	<b>ASH GRAY (GY)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 B1-BLACK - 46 1 - R2-MAROON - 5 - 1 Y3-DEEP GOLD - 29 - 1  ONE GALLON EXTRA WHITE B42W00111 640518783	<b>CHARCOAL (CK)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 W1-WHITE - 16 - 1 B1-BLACK 6 37 1 - R2-MAROON - 17 1 - Y3-DEEP GOLD - 56 1 1  ONE GALLON DEEP B42W00113 640518809	<b>COLONIAL RED (CR)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 W1-WHITE - 37 - - B1-BLACK - 58 - - R2-MAROON 2 13 1 1 R3-MAGENTA 4 18 1 1  ONE GALLON ULTRADEEP B42T00104 884199993
<b>LIGHTSTONE (LS)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 B1-BLACK - 15 - 1 R2-MAROON - 1 - - Y3-DEEP GOLD - 31 - -  ONE GALLON EXTRA WHITE B42W00111 640518783	<b>NATURAL EVERGREEN (NG)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 W1-WHITE - 10 1 1 L1-BLUE 8 3 1 1 R2-MAROON - 23 - - Y3-DEEP GOLD 4 25 1 1  ONE GALLON ULTRADEEP B42T00104 884199993	<b>PATRICIAN BRONZE (ZK)</b> CUSTOM MANUAL MATCH CCE COLORANT OZ 32 64 128 B1-BLACK 6 1 - 1 R2-MAROON - 15 - 1 R3-MAGENTA - 22 1 1 Y3-DEEP GOLD 2 24 - -  ONE GALLON ULTRADEEP B42T00104 884199993	<b>POLAR WHITE (PW)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 B1-BLACK - 8 - - Y3-DEEP GOLD - 2 1 1  ONE GALLON EXTRA WHITE B42W00111 640518783
<b>REGAL BLUE (RU)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 W1-WHITE - 48 1 - B1-BLACK - 42 - 1 L1-BLUE 4 52 - 1 R3-MAGENTA - 48 1 -  ONE GALLON ULTRADEEP B42T00104 884199993	<b>REGAL WHITE (WK)</b> CUSTOM MANUAL MATCH CCE COLORANT OZ 32 64 128 B1-BLACK - 3 1 1 Y3-DEEP GOLD - - 1 -  ONE GALLON EXTRAWHITE B42W00111 640518783	<b>ROMAN BLUE (HB)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 W1-WHITE - 12 - - L1-BLUE 4 11 - - N1-RAW UMBER 4 25 1 1 R3-MAGENTA 2 15 - 1  ONE GALLON DEEP B42W00113 640518809	<b>SAHARA TAN (HT)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 B1-BLACK - 31 1 1 R2-MAROON - 15 1 - Y3-DEEP GOLD 2 62 - -  ONE GALLON EXTRA WHITE B42W00111 640518783
<b>SURREY BEIGE (BG)</b> CUSTOM SHER-COLOR MATCH CCE COLORANT OZ 32 64 128 B1-BLACK - 38 1 - R2-MAROON - 9 1 1 Y3-DEEP GOLD 2 32 - 1  ONE GALLON EXTRA WHITE B42W00111 640518783	<b>ULTRA BRITE RED (UB)</b> CUSTOM MANUAL MATCH CCE COLORANT OZ 32 64 128 W1-WHITE - 17 - - R2-MAROON - 34 1 - R3-MAGENTA 2 14 1 1 R4-NEW RED 8 61 - 1  ONE GALLON ULTRADEEP B42T00104 884199993		

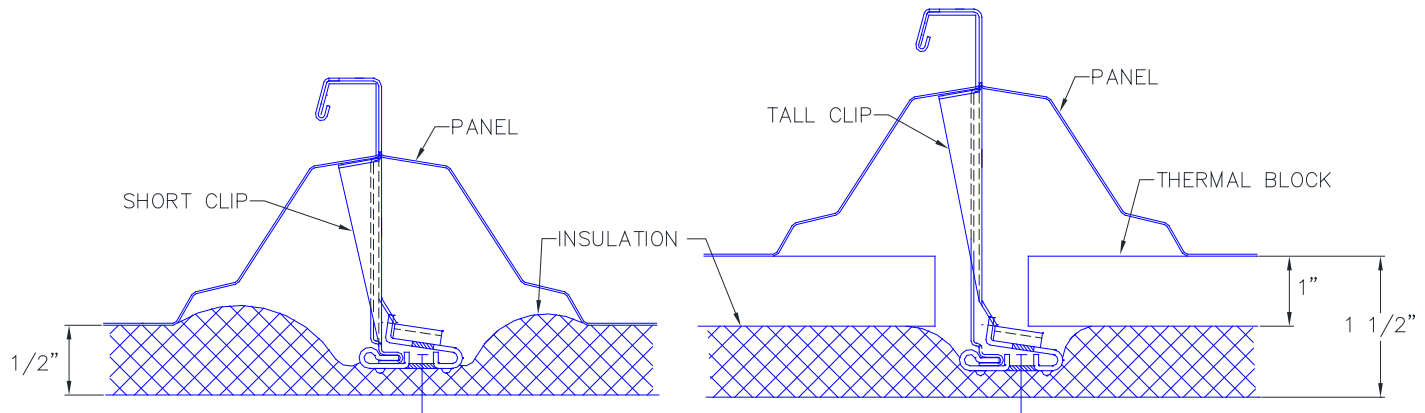




## 5.11 INSULATION AND THERMAL BLOCK COMBINATIONS

The building manufacturer recommends that insulation be used in all standing seam roof applications to avoid problems with condensation and to provide a buffer between the panel and the purlins to eliminate noise and possible damage due to metal-to-metal contact, plus reducing panel modularity problems during installation.

Two clip heights are available (short and tall) with each clip accommodating a range of blanket insulation thicknesses with the (tall) clip also accommodating 3/4" thick thermal blocks.



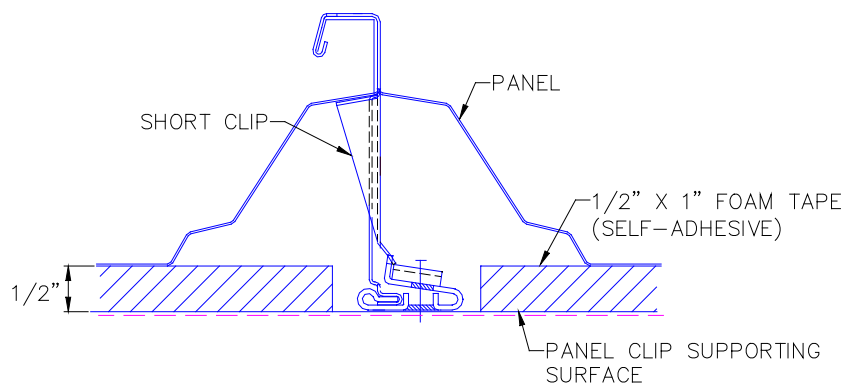
SHORT CLIP MPS602

TALL CLIP MPS603

The building manufacturer recommends that the standing seam roof system be installed with a minimum 1 1/2" blanket insulation between the panel and the panel bearing surface (purlin, bar joist, etc...). Below is a chart with various insulation thicknesses and thermal block combinations.

PANEL CLIP		STAND-OFF HEIGHT	INSULATING MATERIAL BETWEEN PANEL AND BEARING SURFACE
HGHT.	NO.		
SHORT	MPS602	1/2"	1 1/2" Min. - 4" Max. Blanket - No Thermal Block
TALL	MPS603	1 1/2"	4" Min. - 6" Max. Blanket - 1" Thermal Block

The building manufacturer can supply a 1/2" x 1" self-adhesive foam tape for limited applications such as (canopies, etc.) when included as part of the building order. Used only with the "short" panel clip.

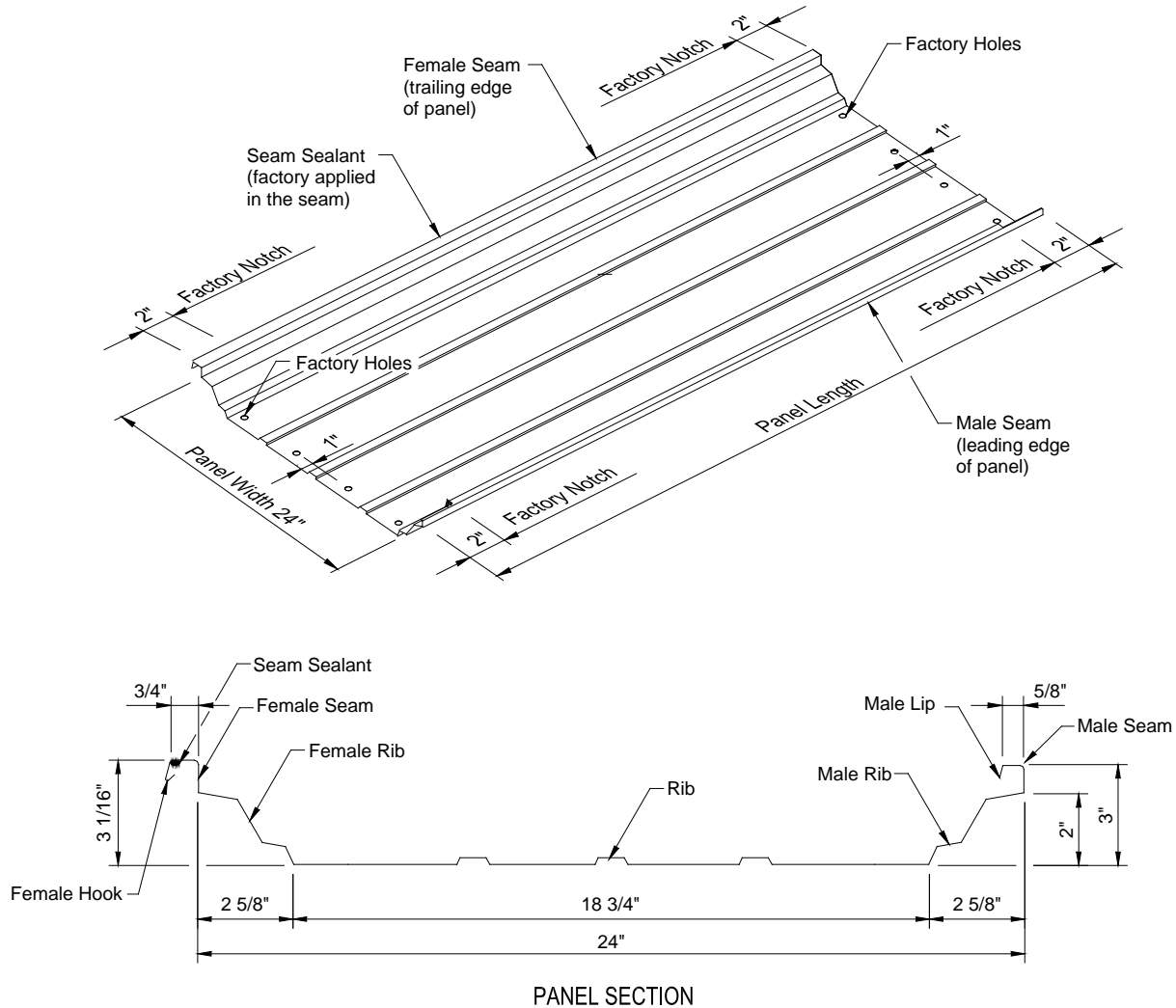




## 6 ROOF PANEL LAYOUT

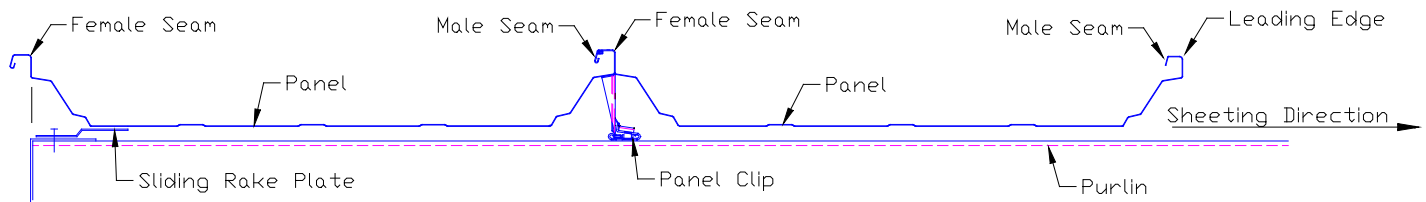
### 6.1 PANEL DESCRIPTION AND NOMENCLATURE

Throughout the manual, references to the panel will be made using the terms shown below. The three minor ribs are standard on all panels, they may not be shown in all details for the sake of clarity.



### 6.2 SHEETING DIRECTION AND MODULARITY

Although the roof system is designed so it can be installed in either direction (left to right or right to left), there may be roof conditions which require a specific sheeting direction. Check the erection drawings to determine if a specific sheeting direction is required. Throughout these instructions the roof sheeting installation will be shown with a (left to right) sheeting direction.

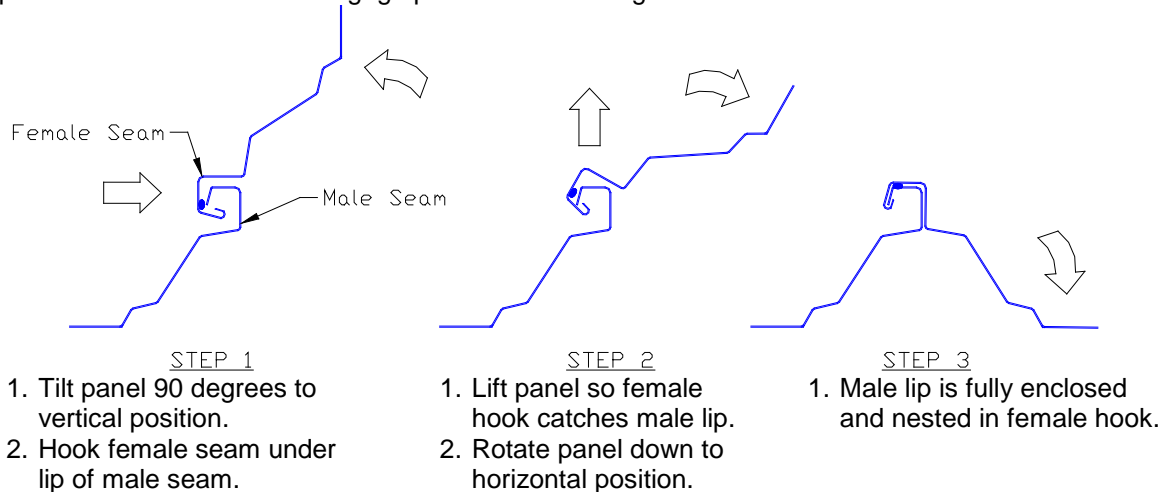


The leading edge of the roof panel is the edge towards the sheeting direction. On the roof panel, the male seam is always the leading edge. Before loading the panels onto the roof structurals, orient the panels so that the male seam is the leading edge.

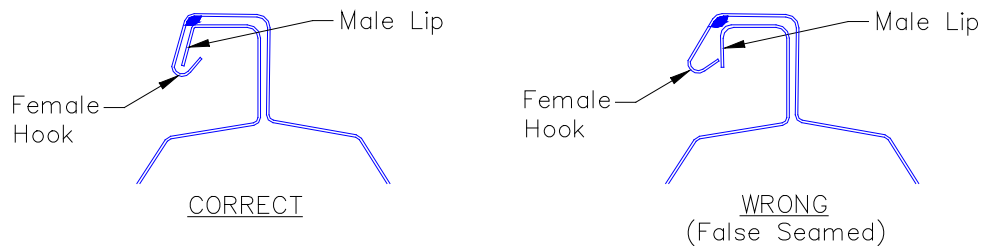


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A three step process should be used to engage panel seams during erection.



**CAUTION** A false seam may occur where the female lip does not hook the roof panels male lip. False seamed roof panels cannot provide their designed loads and maintain the weather tightness resistance.



The recommended installation sequence is to complete each panel run from eave to ridge before starting the next panel run.

To maintain roof panel modularity, it is necessary to install "end dams" in the previous panel run. If end dams are not installed in the previous panel run it will be difficult to hold modularity and may require a significant amount of field rework when installing end dams later on.

This sequence will help ensure straight runs and allow the insulation to be installed immediately ahead of each panel run.

During installation of the roof, considerations must be made for maintaining panel modularity so that the roof panel sidelap and seam can be properly assembled, the proper roof coverage can be obtained, and the standard perimeter parts will fit properly without necessity of field modifications or reordering of parts, etc.

**Caution:** Failure to maintain panel coverage width within the specified tolerance can cause faulty roof panel seams which can result in seaming difficulty or in severe cases reduction in roof performance specifications.

The panels must be held to the width dimension of the panel as designated on the erection drawings within a 1/8" width tolerance per panel. The accumulated coverage (start panel to finish panel) tolerance is determined by the ability to keep the panels parallel and to correctly fit and assemble the finish rake condition.

If the roof has conditions such as fixed location penetrations, parapets, fire walls, etc., the accumulated panel coverage may require tighter tolerances for proper fit-up and weather tightness of the roof.

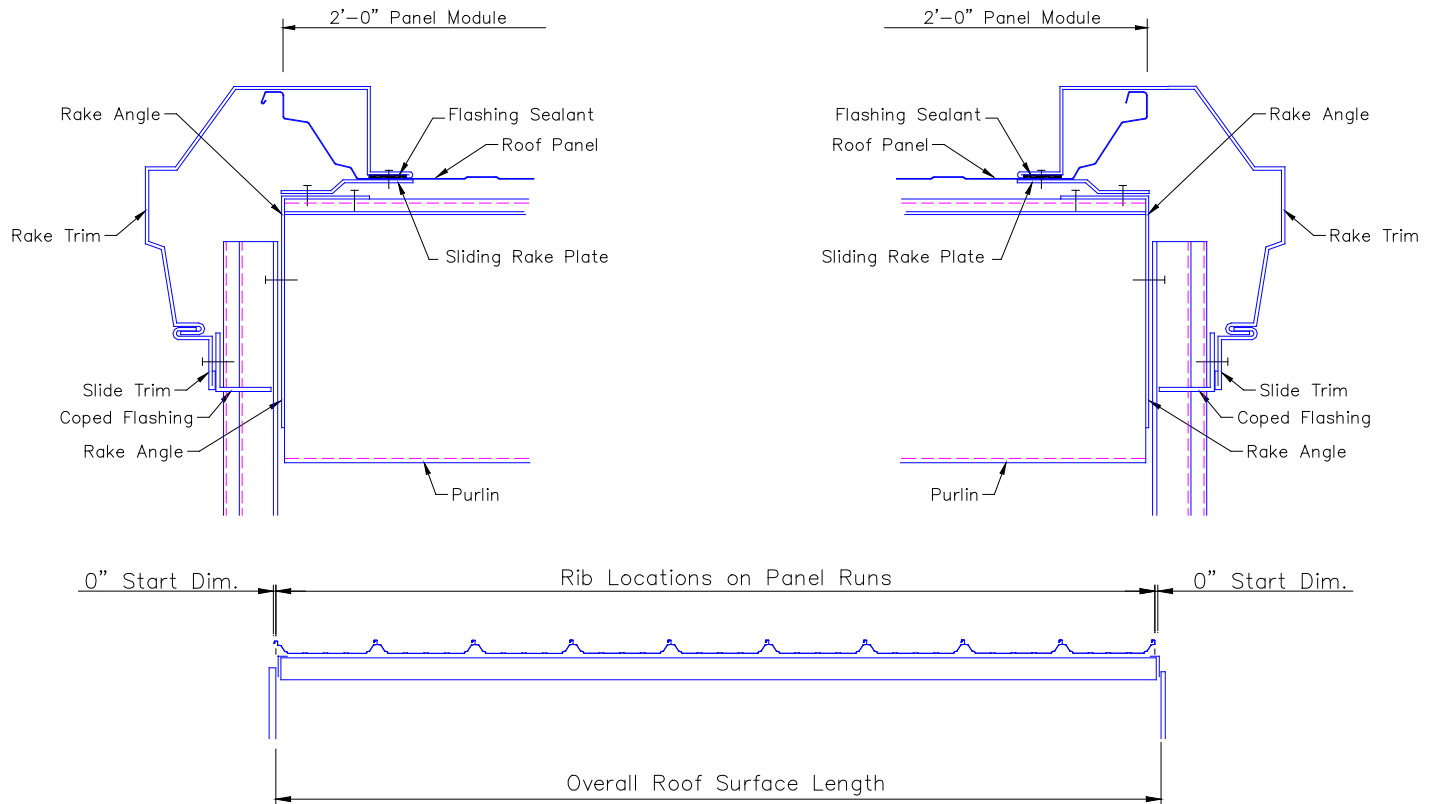


## 6.3 PANEL LAYOUT, START DIMENSIONS AND CHECKING FOR COVERAGE

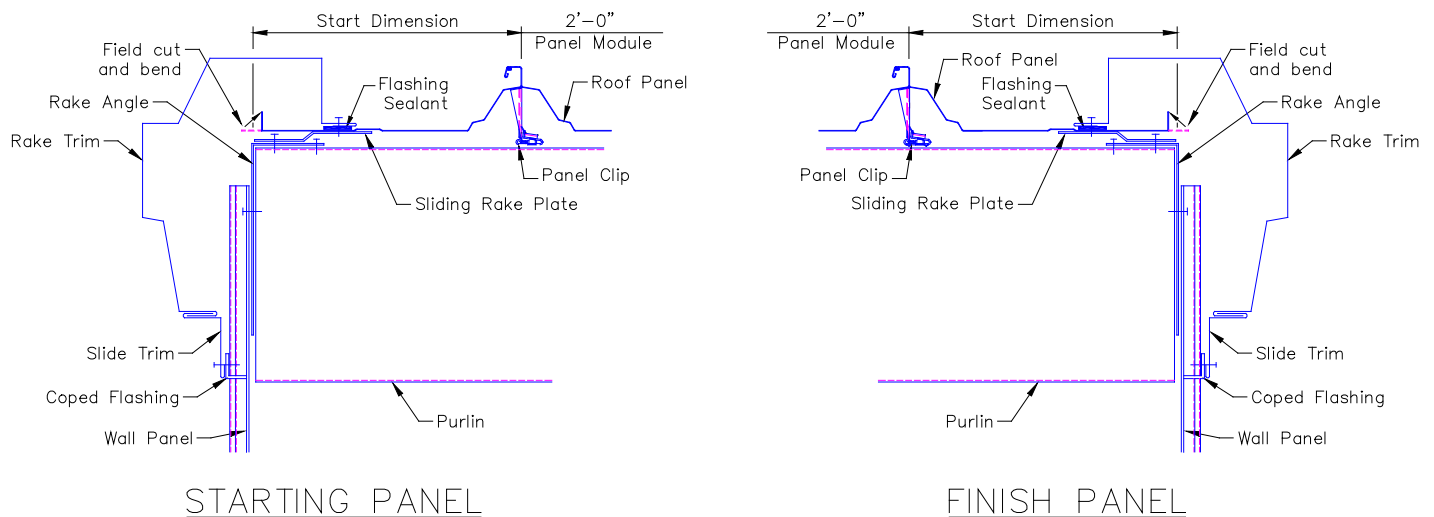
Recommended for all roofs, but a must for large or complex roofs, is to make a layout of the actual structure (field measured as described in section 3.3) so that the roof panel start and stop dimensions can be laid out to accommodate any structural misalignments.

Unless noted otherwise on the erection drawings the location of the roof panels along the roof surface will be based on the following.

- A. Buildings whose roof surface length is some multiple of 2'-0" will have the start panel seam and the finish panel seam located with a 0" START DIMENSION.



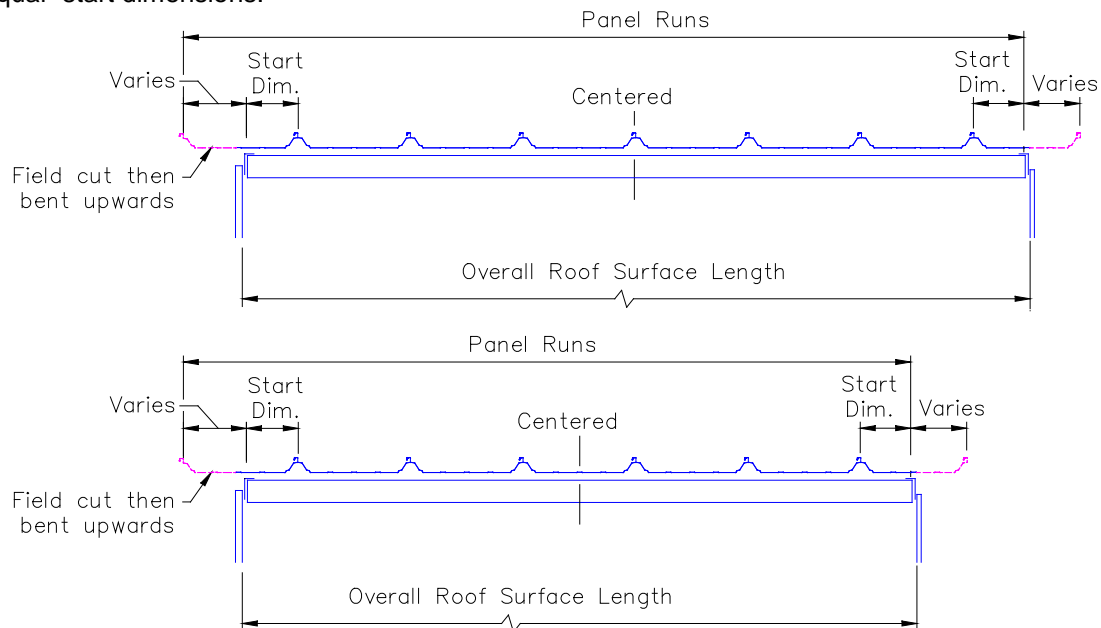
- B. Buildings whose roof surface length is "NOT" a multiple of 2'-0" can have equal START DIMENSIONS on each end.





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Equal “start dimensions” are based on “centering” the panels on the overall roof surface length “as shown below” requiring the field cutting of the starting and finishing panels. Always check the erection drawings as some jobs may require “Unequal” start dimensions.



When the optimal start and finish dimensions are determined, a string line should be set to precisely locate the leading edge of the start panel. After the start panel is secured and engaged with the next panel, the start panel seam will be the reference line for checking accumulated panel coverage.

Panel coverage is always checked at the eave, ridge, and end splices so that non-parallel seam (or dogleg) conditions can be detected and corrected before they become objectionable. The coverage check should be done with a measuring tape held taut and measured to the same side of the seam and always parallel to the eave to prevent any measuring error.

Every four to six panel runs should be checked for panel modularity. This will assure that the panels are maintaining a straight line and proper coverage is being maintained. If the panels are off module, they should be corrected by equal adjustments of the next four to six panel runs.

## 6.4 APPEARANCE CONSIDERATIONS

Although the above stated coverage tolerance will provide for reasonable ease of installation and water tightness, such visible conditions as non-parallel panel seams, dogleg of the panel seam at the end splices, non-parallel finish panel width, and mismatch of panel seams across the ridge, may be objectionable and should be confirmed with the customer before continuing roof installation.



## 7 INSPECTION OF ROOF ASSEMBLY DURING INSTALLATION

### 7.1 IMPORTANCE OF INSPECTION

During the roof installation, all areas of the roof system assembly must be frequently inspected to ensure the correct assembly in accordance with the erection drawings and this installation guide.

Failure to assemble the roof system correctly will result in roof performance problems that may require costly corrective work, roof replacement and performance and damage claims etc. Also, incorrect installation may void the performance and material warranties.

### 7.2 INSPECTION LIST

#### A. ERECTION DRAWINGS

Check that the erection drawings are available at the job site and have been reviewed for difference with the actual job conditions and differences with the installation guide. Also, confirm that the drawings are the latest issue with the latest revisions and additions.

#### B. ROOF LAYOUTS

Check that the roof start and finish dimensions have been correctly determined based on the erection drawings and the actual structural conditions.

#### C. BEFORE INSTALLING ROOF PANELS

Check that the structural misalignments were corrected in accordance with Section 3.0 of this installation guide.

Check that the correct eave and rake plates and eave trim are in place before installing the roof panels.

Check that the roof panel elevation provided by the panel clip height and insulation system matches the eave and rake plate elevation.

#### D. PANEL LENGTH

Check that the installed roof panels have the correct overhang at the eave and endlaps and have the correct hold back at the ridge or high eave, in accordance with the erection drawing.

#### E. EAVE SEAL

Check that the eave sealant is in the correct position on top of the eave trim and that the corrugation closure and eave pigtail sealant are correctly placed. Check that the eave fasteners penetrate the center of the eave sealant and into the eave plate. Check that the fasteners are not loose or stripped.

Check that the eave sealant is in complete contact with the roof panel and eave trim without any voids or gaps. Confirm that the roof panel and eave trim are clean and dry during installation and that the sealant is not wet or otherwise contaminated.

#### F. ENDLAP SEAL

Check that the roof panel endlaps are correctly assembled and that the lapping panels are tightly nested without visible gaps.

Check that the sealant is in the correct position and is in complete contact with the lapped panels without any voids or gaps, especially at the radius between the panel flat and the vertical legs of the panel. Confirm that the panels are clean and dry during installation and that the sealant is not wet or otherwise contaminated.

Check that the pigtail sealant is in the correct position and seals the endlap seam notches.

Check that the endlap fasteners penetrate through the center of the sealant and into the back-up channel. Check that the fasteners are not loose or stripped.

Check that the endlap assembly is not bowed down causing water ponding and debris accumulations.



## **G. RIDGE SEAL**

Check that the end dam assembly is correctly assembled.

Check that the sealant is in the correct position and is in complete contact with the end dam and the roof panel without any voids or gaps. Confirm that the end dams and roof panels are clean and dry during installation and the sealant is not wet or contaminated.

Check that the end dam fasteners penetrate through the center of the sealant and into the back-up plate. Check that the fasteners are not loose or stripped.

Check that the tube sealant is installed along the back of the end dam as necessary to seal any voids around the panel seam area.

## **H. RAKE SEAL**

Check that the rake trim is correctly assembled with the rake trim splices correctly oriented for downhill watershed.

If there are roof panel endlaps, check that the endlap sealant contacts the rake trim sealant or that a pigtail sealant is applied for that purpose.

Check that the sealant is in the correct position above the roof panel.

Check that the rake trim sets fully on the sealant and that the sealant is in complete contact with the roof panel and the trim without any voids or gaps. Confirm that the roof panel and trim are clean and dry during installation and that the sealant was not wet or contaminated.

Check that the rake trim fasteners penetrate the center of the sealant and into the rake plate. Check that the fasteners are not loose or stripped.

## **I. PANEL CLIP ATTACHMENT**

Check that the panel clips are correctly fitted to the panel without any distortion or damage of the clip tab. On panel clips, check that the clip tab is centered on the clip base between the centering tabs.

Check that the clips are located along each panel sidelap at each roof structural or at the locations specified on the erection drawings.

Check that the panel clip fasteners are of the type, size, length, finish and quantity-per-clip as specified on the erection drawings.

Check that the panel clip fasteners are not loose or stripped. In the case of multi-layered construction, verify that the fasteners penetrated and engaged the specified structural member.

## **J. SIDELAP**

Check that the panel sidelaps are on module (held to within the 1/8" panel width tolerance) and are assembled so that the male and female panel edges and panel clips are properly nested together prior to seaming.

Check that the full length of each sidelap seam is correctly seamed.

Check that the factory installed sidelap sealant is in the correct position without voids or interruptions and is not damaged, wet or otherwise contaminated.

Check that the panel coverage tolerance does not exceed 1/8" per panel and that the accumulated coverage will allow proper fit and assembly of the end dams and finish rake condition and any other critical fit conditions such as penetrations, parapets, etc.



## **K. FLASHING AND PENETRATIONS**

Check that all flashing (including penetrations) are correctly assembled and tightly fitted. Check that the required sealants are correctly positioned and in complete contact with the adjoining surfaces without voids or interruptions. Confirm that the sealants and adjoining surfaces are clean and dry during installation.

Check that the flashing splices are correctly lapped, sealed and fastened.

Check that the flashing is sufficiently pitched to shed water and eliminate ponding areas, especially at the critical splices, endlaps and corners.

Check that the fasteners are of the specified type, size, length, finish and spacing. Check that the fasteners are not loose or stripped. Check that the sealing washers are in full contact with the flashing surface and not distorted, split or otherwise damaged.

Along the rakes, high eave transitions, fixed penetrations, etc., check that the flashing is not constrained and will allow for the roof's expansion/contraction movement.

## **L. SURFACE CONDITIONS**

Damaged roof system surfaces are subject to corrosion and performance problems and may void the material and performance warranties.

Check that the panel and flashing surfaces are not being subjected to abusive conditions such as: careless handling of panels and flashing, excessive roof traffic, abrasive or contaminated footwear, rough handling of materials, tools and equipment, or contact with abrasive materials or residue, etc.

Check that the panel and flashing surfaces are not being subjected to exposed metal objects and materials left on the roof such as: tools, material drop-off, fasteners, wire, staples, drill and nibbler chips, saw and file particles, etc. In the process of rusting, these materials will absorb the panel's protective coating, thus leaving the panels exposed to rusting.

Check that the panels and flashing are not being subjected to long term wet conditions such as: standing water, consistent sources of steam, mist, spray, dripping or runoff, wet debris, wet insulation or other moisture holding material.

Check that the panels and flashing are not subjected to direct contact or runoff from corrosive materials such as: copper pipes and flashing, uncured cement, treated lumber anti-icing chemicals, strong solvents or other corrosive materials.

Check that graphite pencils were not used to mark on unpainted surfaces. The graphite marks can cause rusting.

Check that the roof materials are not subjected to damaging heat such as: cutting torches, abrasive saws, etc.

## **M. UNSPECIFIED MATERIALS**

Use of the wrong materials may cause installation and performance problems and may void the performance and material warranties.

Check that all installed roof system materials, especially sealants and fasteners, are only those which are provided or specified by the building manufacturer for your specific project and are used only as specified on the erection drawings and this installation guide.

## **8 STANDARD PARTS**

### **8.1 GENERAL**

The following details provide a basic description and graphic illustrations of the standard roof assembly parts. The purpose of these details is to assist the erector in the correct selection and identification of parts.

Because of the many variations in conditions, it is important that you review the job conditions to identify the specific parts required for your job.

Review the erection drawings for any special parts or parts which are different from the standard parts shown in these details. If differences exist, the erection drawings will have preference.

For proper fit-up, sealing and fastening, and to help ensure the roof assembly's weathertightness, structural capability, durability and appearance, the correct parts must be used. Do not use parts other than those specified on the erection drawings.

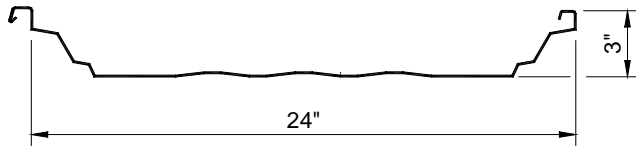




## 8.2 ROOF COMPONENTS, EAVE AND RAKE PLATES

### ROOF PANEL (24" wide panel)

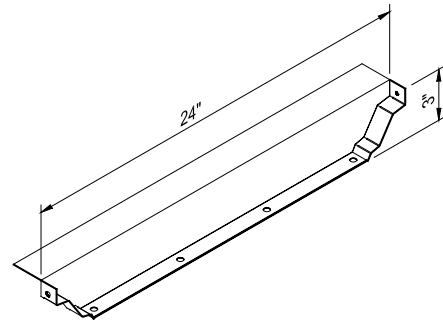
- 24 gauge precoated or galvalume material
- Roof color
- 3 Ribs
- Factory notched for endlap
- Factory punched holes



Part No. RS\_\_\_\_\_  
(Specify length and finish)

### END DAM (for 24" wide panel)

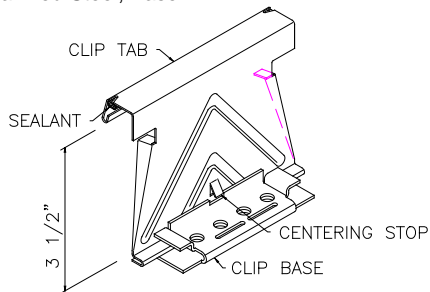
- 24 gauge precoated or galvalume material
- Roof color
- Factory punched holes



Part No. MT323

### FLOATING CLIP (for 1/2" stand-off)

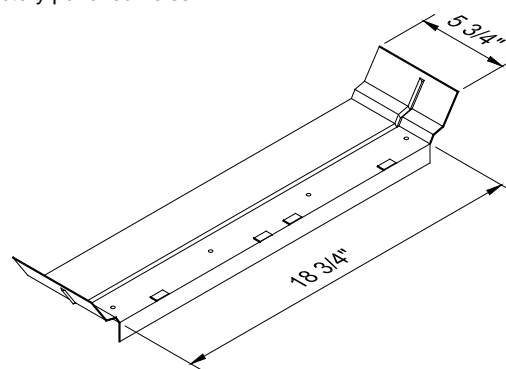
- 20 ga. Galvanized Steel, Tab
- 16 ga. Galvanized Steel, Base



Part No. MPS602

### ENDLAP BACK-UP PLATE (for 24" panel)

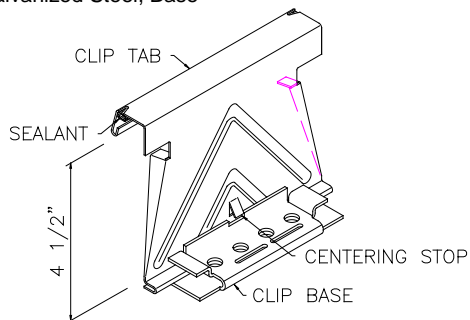
- 16 gauge Galvalume Steel
- Factory punched holes



Part No. MP262

### FLOATING CLIP (for 1 1/2" stand-off)

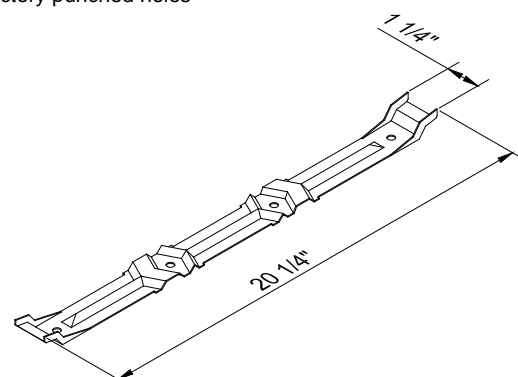
- 20 ga. Galvanized Steel, Tab
- 16 ga. Galvanized Steel, Base



Part No. MPS603

### ENDLAP CINCH STRAP (Optional)

- 20 gauge Stainless Steel
- Factory punched holes

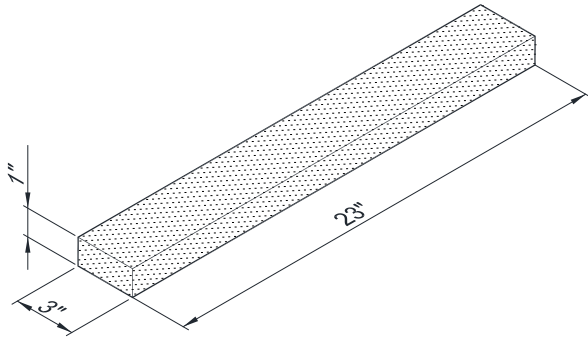


Part No. 3018192



## THERMAL BLOCK (for 24" wide panel)

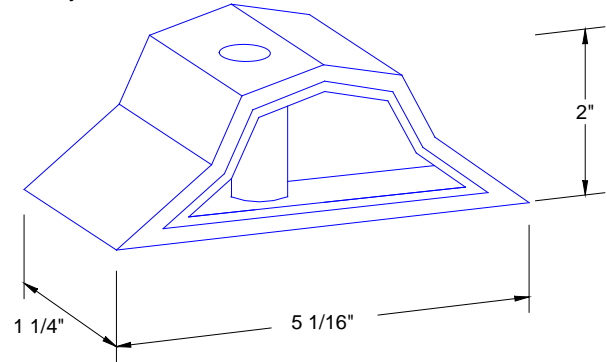
- Extruded Polystyrene Foam
- 1" Thick



Part No. 2308027

## CORRUGATION CLOSURE

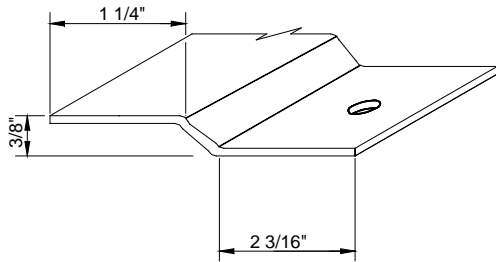
- High Density Polyethylene
- Black Finish
- Factory hole



Part No. 2958373

## EAVE PLATE (for 1/2" stand-off)

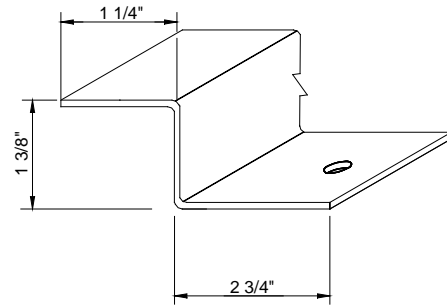
- 16 ga., 55 ksi Primed Steel
- 12'-0" length
- Factory punched holes at 12" ctrs.



Part No. MP254

## EAVE PLATE (for 1 1/2" stand-off)

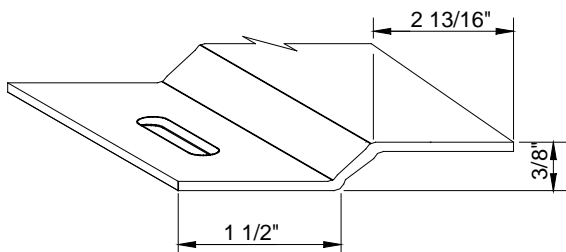
- 16 ga., 55 ksi Primed Steel
- 12'-0" length
- Factory punched holes at 12" ctrs.



Part No. MP255

## SLIDING RAKE PLATE (for 1/2" stand-off)

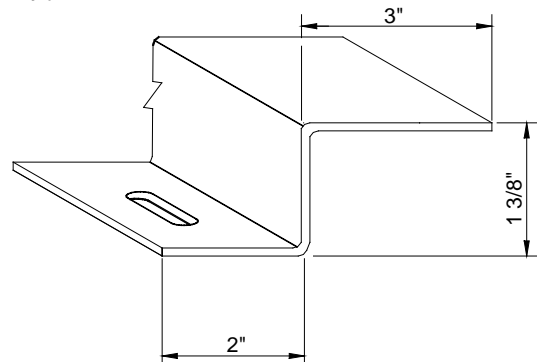
- 16 ga., 55 ksi Primed Steel
- 12'-0" length
- Factory punched slots at 24" ctrs.



Part No. MP260

## SLIDING RAKE PLATE (for 1 1/2" stand-off)

- 16 ga., 55 ksi Primed Steel
- 12'-0" length
- Factory punched slots at 24" ctrs.



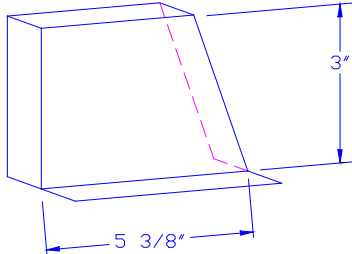
Part No. MP261



## 8.3 ROOF TRIMS

### END CAP

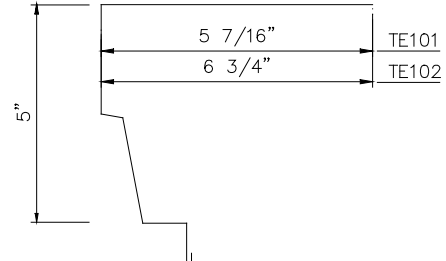
- 26 gauge precoated material
- Trim color
- At low eave corners



Part No. TR68 (RH Shown) TR69 (LH)

### EAVE TRIM

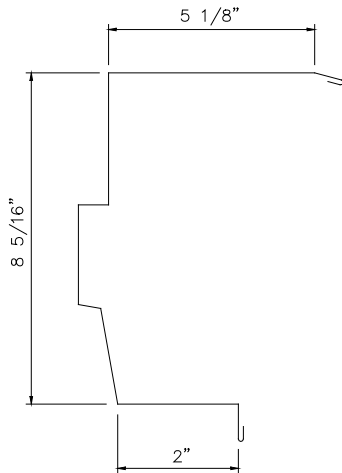
- 26 gauge precoated material
- Trim color
- Length 20'-6"
- Bent two at a time



Part No. TE101-20 Roof Slope 1 1/2:12 or Less  
Part No. TE102-20 Roof Slope 1 9/16 thru 4:12

### HIGH EAVE TRIM

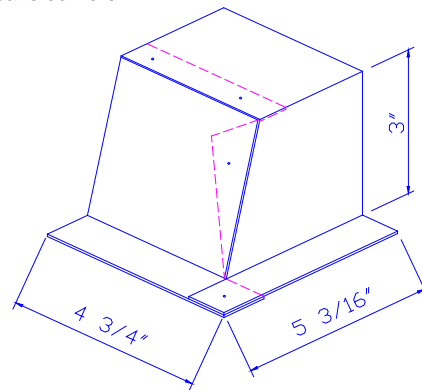
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE98-20 Roof slope 2 1/2:12 or less

### CORNER BOX CAP

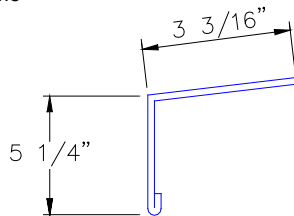
- 26 gauge precoated material
- Trim color
- At high eave corners



Part No. TR75 (R.H. Shown) TR76 (L.H.)

### EAVE FLASHING

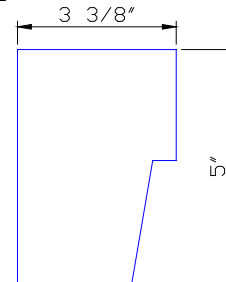
- 26 gauge precoated material
- Trim color
- Length 20'-6"
- Bent two at a time



Part No. TE99-20 Roof Slope 1 1/2:12 or Less  
Part No. TE100-20 Roof Slope 1 9/16 thru 4:12

### BIRD STOP

- 26 gauge precoated material
- Trim color
- At ends of eave flashing run
- Roof slopes to 4:12



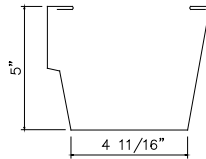
Part No. TE51-1 (RH shown) TE54-1 (LH)



## 8.4 GUTTER COMPONENTS

### STANDARD GUTTER

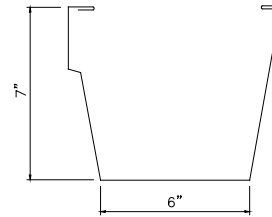
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE11-20 Roof slope 3:12 or less

### HIGH CAPACITY GUTTER

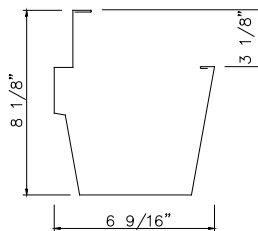
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE25-20 Roof slope 3:12 or less

### RIB CONCEALING GUTTER

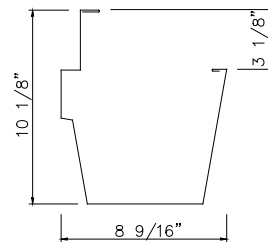
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE92-20 Roof slope 3:12 or less

### RIB CONCEALING (HIGH CAPACITY) GUTTER

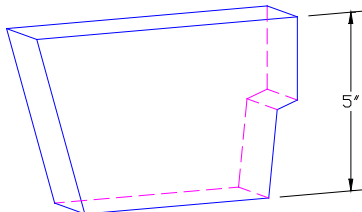
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE94-20 Roof Slope 3:12 or less

### GUTTER END CAP

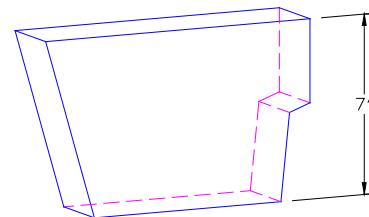
- 26 gauge precoated material
- Trim color
- Used at ends of standard gutter and rib concealing gutter (above)



Part No. TE68 (Left Hand) TE69 (Right Hand)

### GUTTER END CAP

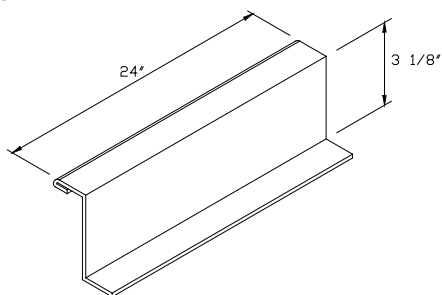
- 26 gauge precoated material
- Trim color
- Used at ends of high capacity gutter and rib concealing high capacity gutter (above)



Part No. TE72 (Left Hand) TE73 (Right Hand)

### RIB CONCEALING CORNER TRIM

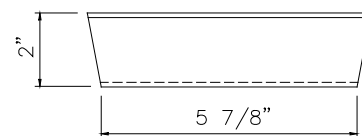
- 26 gauge steel
- Precoated or Galvalume Finish
- Trim color



Part No. TE96

### GUTTER STOP

- 26 gauge precoated material
- Trim color
- Used at ends of high capacity gutter and rib concealing high capacity gutter (above)



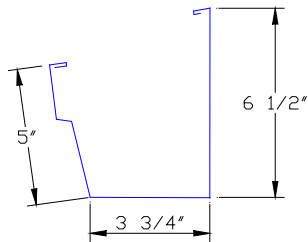
Part No. TE27



## 8.5 GUTTER COMPONENTS

### STANDARD GUTTER

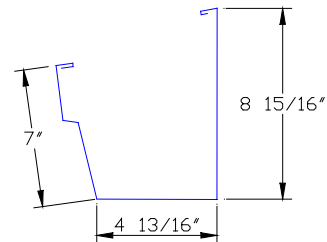
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE10-20 Roof slope 3 1/16":12 to 4:12

### HIGH CAPACITY GUTTER

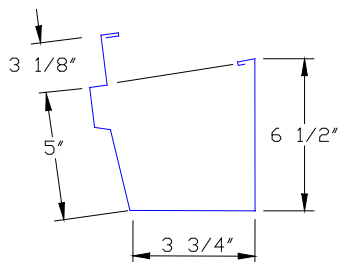
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE64-20 Roof Slope 3 1/16":12 to 4:12

### RIB CONCEALING GUTTER

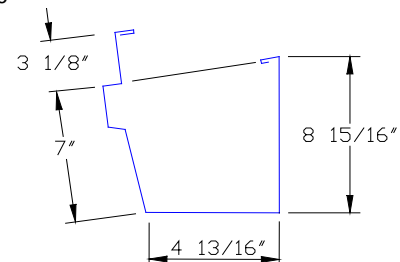
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE93-20 Roof slope 3 1/16":12 to 4:12

### RIB CONCEALING (HIGH CAPACITY) GUTTER

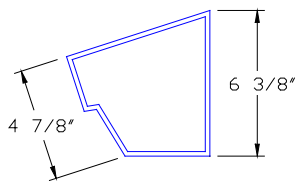
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TE95-20 Roof slope 3 1/16":12 to 4:12

### GUTTER END CAP

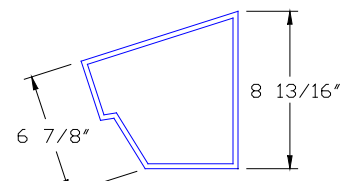
- 26 gauge precoated material
- Trim color
- Used at ends of standard gutter and rib concealing gutter (above)



Part No. TE70 (left-hand) shown TE71 (right-hand) similar

### GUTTER END CAP

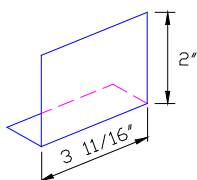
- 26 gauge precoated material
- Trim color
- Used at ends of standard gutter and rib concealing gutter (above)



Part No. TE74 (left-hand) shown TE75 (right-hand) similar

### GUTTER STOP

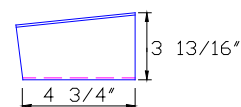
- 26 gauge precoated material
- Trim color
- Used at ends of standard gutter and rib concealing gutter (above)



Part No. TE8

### GUTTER STOP

- 26 gauge precoated material
- Trim color
- Used at ends of high capacity gutter and rib concealing high capacity gutter (above)



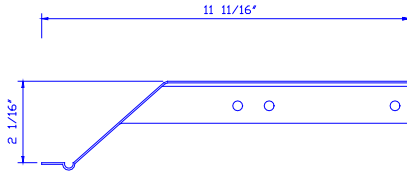
Part No. TE29 (right-hand) shown TE28 (left-hand) similar



## 8.6 RAKE TRIM AND DOWNSPOUT COMPONENTS

### GUTTER HANGER

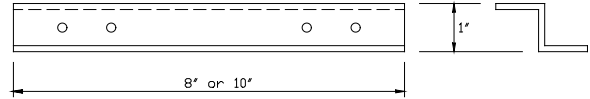
- 18 gauge galvanized or painted
- Roof color



Part No. MS32

### GUTTER HANGER

- 18 gauge galvanized or painted
- Roof color

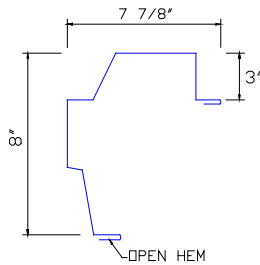


Part No. MZ31 (8" long)

Part No. MZ33 (10" long) used with High Capacity

### RAKE TRIM

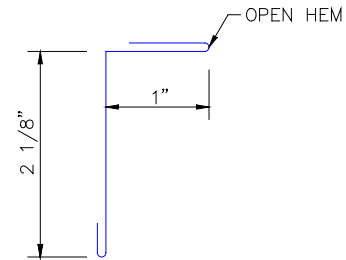
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TR67-20

### SLIDE TRIM

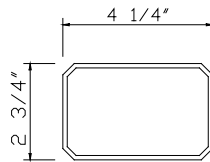
- 26 gauge precoated material
- Trim color
- Length 20'-6"



Part No. TR66-20

### 4" DOWNSPOUT

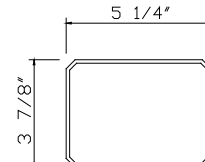
- 29 gauge precoated material
- Polar White color
- 10 ft. long



Part No. TM6

### 5" DOWNSPOUT

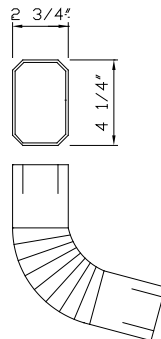
- 26 gauge precoated material
- Downspout color
- 10 ft. long



Part No. TM86

### 4" ELBOW

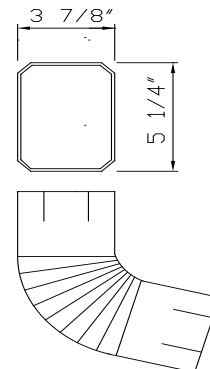
- 29 gauge precoated material
- Polar White color
- Type "A"
- 75 Degrees



Part No. TM7

### 5" ELBOW

- 26 gauge precoated material
- Type "A"
- 75 Degrees



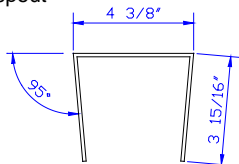
Part No. TM87



## 8.7 CORNER BOXES AND RIDGE COMPONENTS

### DOWNSPOUT STRAP

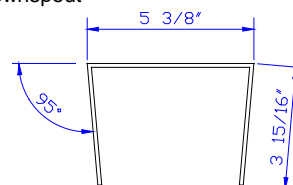
- 26 gauge precoated material
- Used with 4" downspout



Part No. MS19

### DOWNSPOUT STRAP

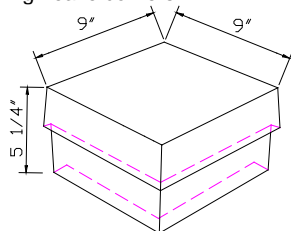
- 26 gauge precoated material
- Used with 5" downspout



Part No. MS26

### OUTSIDE CORNER BOX

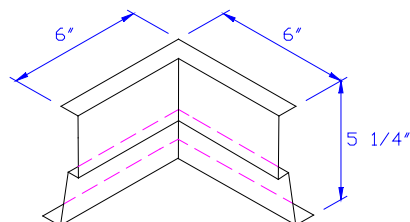
- 26 gauge precoated material
- Trim color
- At low eave and high eave corners



Part No. TE13

### INSIDE CORNER BOX

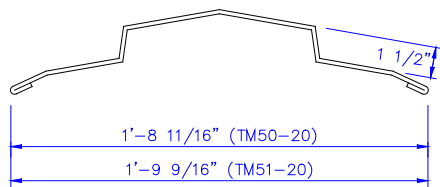
- 26 gauge precoated material
- Trim color



Part No. TE14

### RIDGE CAP (see NOTE below)

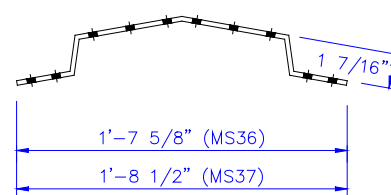
- 26 gauge precoated or galvalume
- Roof color
- Roof slope 4:12 or less



Part No. TM50-20 Roof slope 2:12 or less  
Part No. TM51-20 Roof slope 2 1/16:12 thru 4:12

### PEAK CINCH STRAP (see NOTE below)

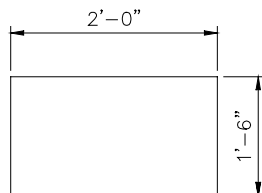
- 16 gauge galvanized steel
- Roof slope 4:12 or less
- 1" width



Part No. MS36 Roof slope 2:12 or less  
Part No. MS37 Roof slope 2 1/16:12 thru 4:12

### FLEXIBLE MEMBRANE (see NOTE below)

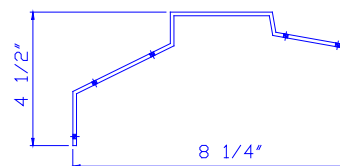
- Black EPDM Material
- 0.045" Thick



Part No. TM54

### CINCH PLATE

- 16 gauge galvanized steel
- 1" width



Part No. MS40

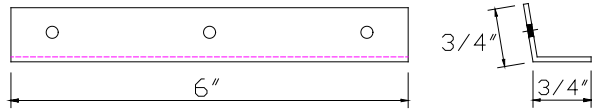
Note: When 10 ft. ridge ventilators are used, see Section 11.1.1 for part replacement.



## 8.8 TRIM AT ENDWALL PEAK

### CINCH STRAP (See NOTE below)

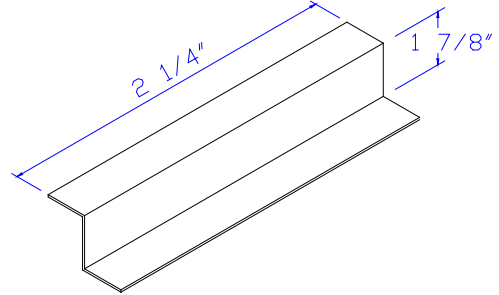
- 16 gauge galvanized steel



Part No. MS34

### PEAK FLASHING ZEE

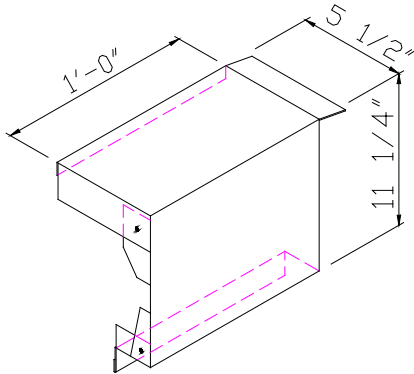
- 22 gauge galvalume steel



Part No. MZ32

### LH PEAK FLASHING (see NOTE below)

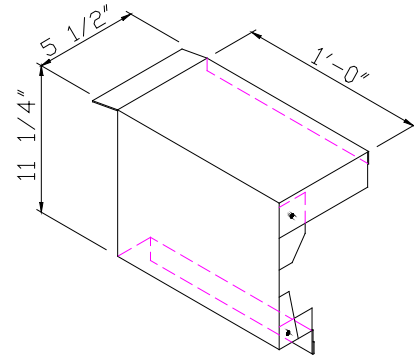
- 26 gauge precoated material
- Trim color



Part No. TR70

### RH PEAK FLASHING (see NOTE below)

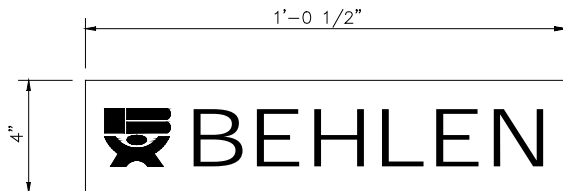
- 26 gauge precoated material
- Trim color



Part No. TR71

### SIGN

- 26 gauge precoated material
- Trim color



Part No. TR22

Note: When 10 ft. ridge ventilators are used, see Section 11.1.1 for part replacement.



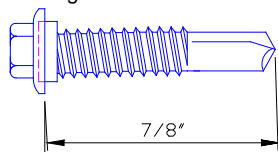


## 8.9 FASTENERS

Fasteners will be identified by a "label" or circle with a numerical number inside of it. These labels and numbers will correspond to the ID number in the FASTENER SCHEDULE in the job erection drawings.

### ② SCREW 1/4 x 3/4 FL-TP SD WW

- Self-drilling screw with a flat-top under cut 5/16" hex head and EPDM sealing washer
- Stitch screw for attaching eave and rake trims to wall surfaces.

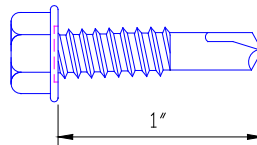


Part No. (Plated) 3228100

Part No. (Colored) 3228100\_\_ (code)

### ③ SCREW 12 x 1 HWH SD NW

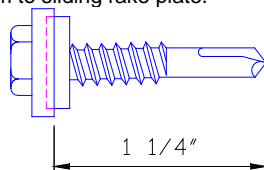
- Self-drilling screw with a 5/16" hex head and no washer
- Rake angle to purlin fastener



Part No. 3228084

### ⑤ SCREW 1/4 x 1 1/4 LG-LF SD WW

- Self-drilling screw with a long-life 5/16" hex head with EPDM sealing washer
- Structural screw for attaching roof panel to eave plates.
- Attaching rake trim to sliding rake plate.

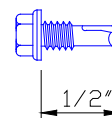


Part No. (Plated) 3228105

Part No. (Colored) 3228105\_\_ (code)

### ⑥ SCREW 8 x 1/2 HWH SD NW

- Self-drilling screw with a 1/4" hex head and no washer.
- Roof trim endlap fastener

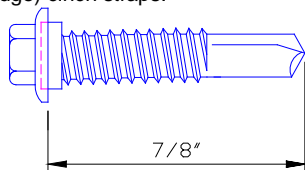


Part No. (Plated) 3228099

Part No. (Colored) 3228099\_\_ (code)

### ⑫ SCREW 1/4 x 3/4 LG-LF SD WW

- Self-drilling screw with a long-life 5/16" hex head with EPDM sealing washer
- Stitch screw for attaching ridge caps to end dams, ridge cap endlaps and (ridge) cinch straps.

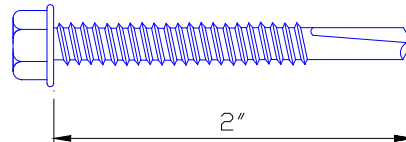


Part No. (Plated) 3228103

Part No. (Colored) 3228103\_\_ (code)

### SCREW 12 x 2 HWH SD #5 PT NW

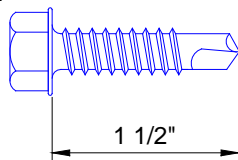
- Self-drilling screw with a 5/16" hex head with #5 drill point and no washer
- Panel clip fastener to bar joist



Part No. 3228133

### ⑳ SCREW 1/4 x 1 1/2 HWH SD NW

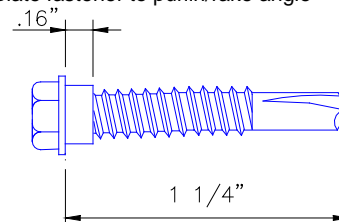
- Self-drilling screw with a 5/16" hex head and no washer
- Panel clip fastener
- Eave plate fastener



Part No. 3228122

### ㉓ SCREW 1/4 x 1 1/4 HWH SHOULDER SD NW

- Self-drilling screw with a 5/16" hex head with shoulder and no washer
- Sliding rake plate fastener to purlin/rake angle

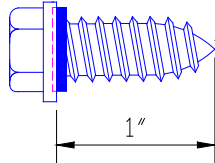


Part No. 3228124



## ②5 SCREW 17 x 1 LG-LF ST WW

- Self-tapping screw with a long-life 5/16" hex head with EPDM sealing washer
- Panel endlap fastener
- End dam to panel fastener



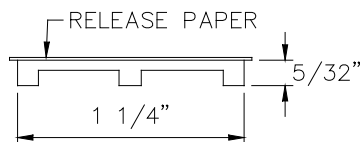
Part No. (Plated) 3228126

Part No. (Colored) 3228126\_\_ (code)

## 8.10 MASTICS

### FLASHING SEALANT

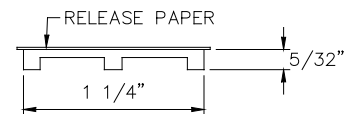
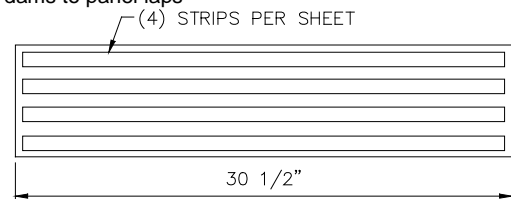
- SEALER 5/32 x 1 1/4 x 30' ROLL
- Along low eave lines
- Along endwall rake trim to panel lap
- Ridge cap to end dam laps
- Any pigtails that are required.



Part No. 3209430

### ENDLAP SEALANT

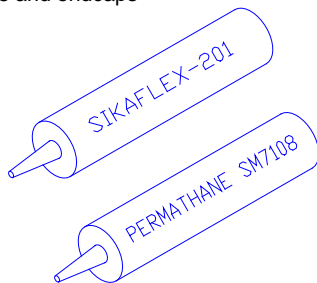
- SEALER 5/32 x 1 1/4 x 30 1/2" PAD
- Roof panel endlaps
- End dams to panel laps



Part No. 3209420

### GUN GRADE MASTIC

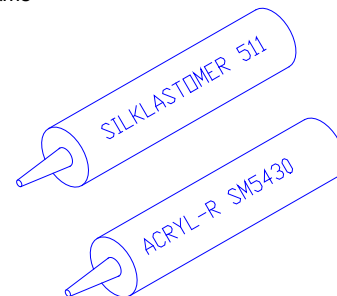
- Skinning urethane caulk
- Perimeter roof trim endlaps
- At corner boxes and endcaps



Part No. 3288023

### GUN GRADE MASTIC

- Non-skinning butyl caulk
- At panel endlaps
- Along end dams

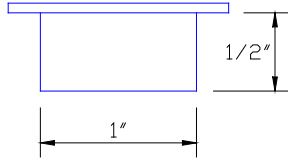


Part No. 3288028



## ADHESIVE BACK 1/2 X 1 WEATHERSTRIPPING

- A resilient foam tape (25 ft. roll) to fill void between panel flat and clip supporting surface when no blanket insulation is used.
- Installing skylight in roof surface



Part No. 3939050

## 9 ROOF INSTALLATION DETAILS

### 9.1 GENERAL

The purpose of this information is to instruct the erector in correct and efficient assembly of the roof system. The following details provide graphic illustration of the roof assembly steps for the following building types and/or conditions.

- A. Gabled and single sloped buildings
- B. Low eave and rakes of lean-to building
- C. Gutters for roof slopes of 4" to 12" or less
- D. Roof accessories

Because of the many variations in conditions, it is important that you review the job to identify and isolate the specific installation details required for your job.

Review the erection drawings for differences with these details. If differences exist, the erection drawings have precedence.

These details are arranged in a step-by-step sequence. Following this sequence ensures correct assembly and ensures that the part to be worked on will be readily accessible for the next assembly step.

Do not shortcut these assembly steps without careful consideration of the possibility of incorrect or omitted assembly and the resulting corrective rework.

To minimize confusion, the details are always oriented so that the view is from eave to ridge, with the starting rake at the left and finish rake at the right. Refer to the erection drawings to determine the required sheeting direction and rake conditions.

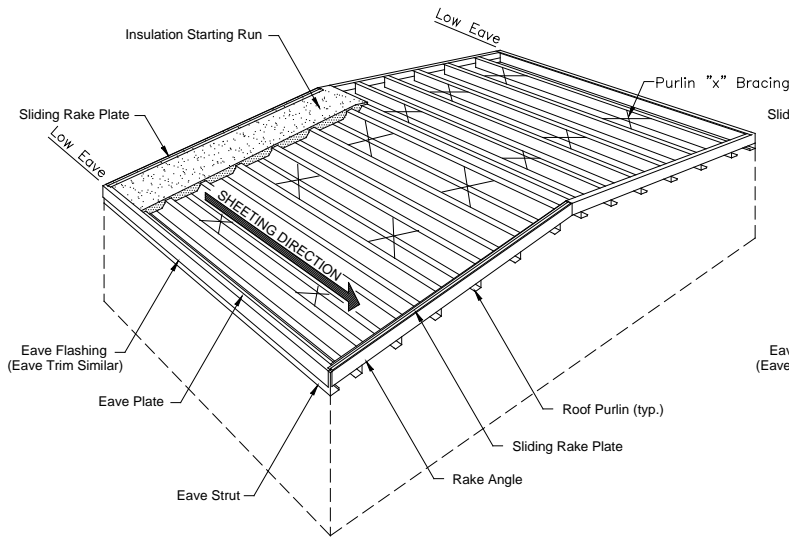
To help ensure weather tightness, the details emphasize proper fit-up, sealing and fastening. It is most important that only the specified sealants and fasteners be used for each condition and that they are installed correctly as shown on these details and the erection drawings.

Be sure that these critical instructions are reviewed often and the roof assembly is checked at each assembly step.

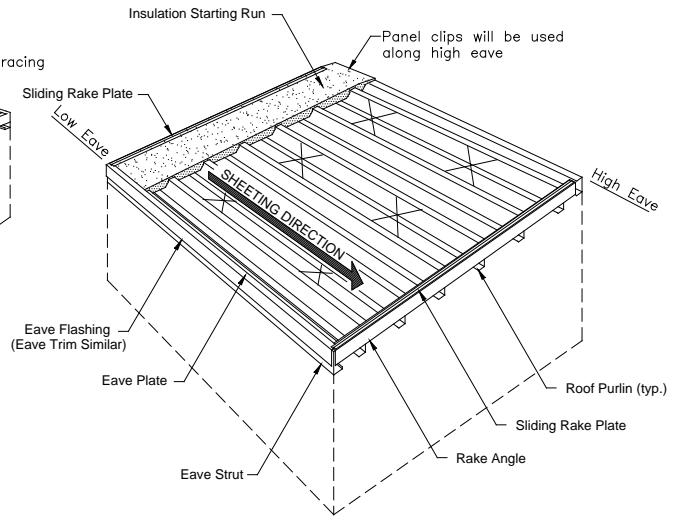


## 9.2 PREPARATION FOR ROOF PANEL INSTALLATION

### 9.2.1 ORIENTATION VIEW



GABLED BLDG.



SINGLE SLOPE BLDG.

The details in this section will show the installation of the sliding rake plate along the endwall rake, and along the low eave the eave plate, eave flashing, eave trim and the first run of insulation. These are parts that must be installed before the roof panel insulation can begin.

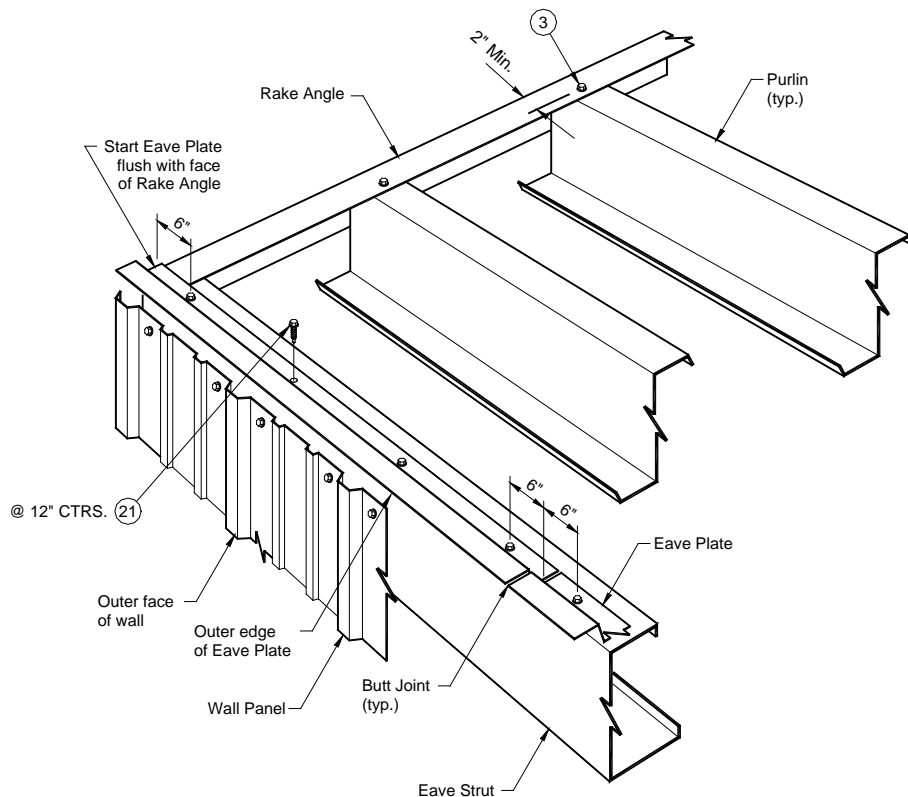
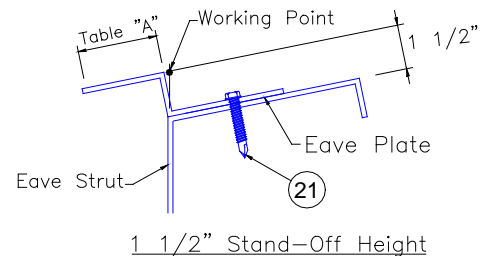
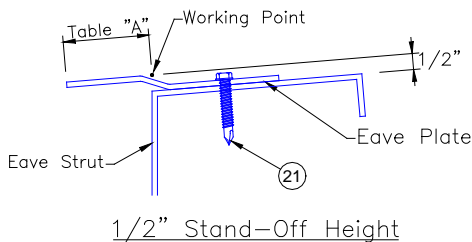
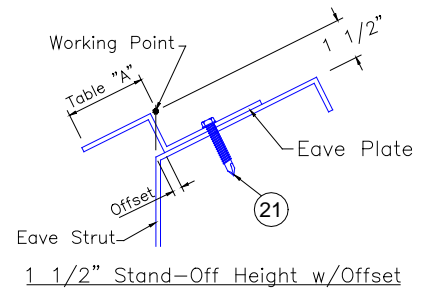
This view shows the roof system oriented for a left-to-right sheeting direction. For right-to-left sheeting, reverse the parts orientation.

Sliding rake plates are required at both ends of building. Refer to the erection drawings for the required rake conditions.



## 9.2.2 INSTALL EAVE PLATE

ROOF SLOPE	TABLE A DIMENSION		OFFSET
	1/2" STAND-OFF	1 1/2" STAND-OFF	
1/4:12	1 1/4	1 5/16	0
1/2:12	1 1/4	1 5/16	0
3/4:12	1 5/16	1 3/8	0
1:12	1 5/16	1 3/8	0
2:12	1 5/16	1 1/2	1/16
3:12	1 3/8	1 5/8	1/8
4:12	1 7/16	1 3/4	3/16
OTHERS	SEE PLANS		



The eave plate provides a solid attachment surface for the low eave end of the roof panel. Eave plates should never be placed at the high eave on single slope buildings.

Use applicable dimension from TABLE A to locate the eave plate in relationship to the eave strut. See erection plans for positioning of eave plates on roof slopes greater than 4" to 12".

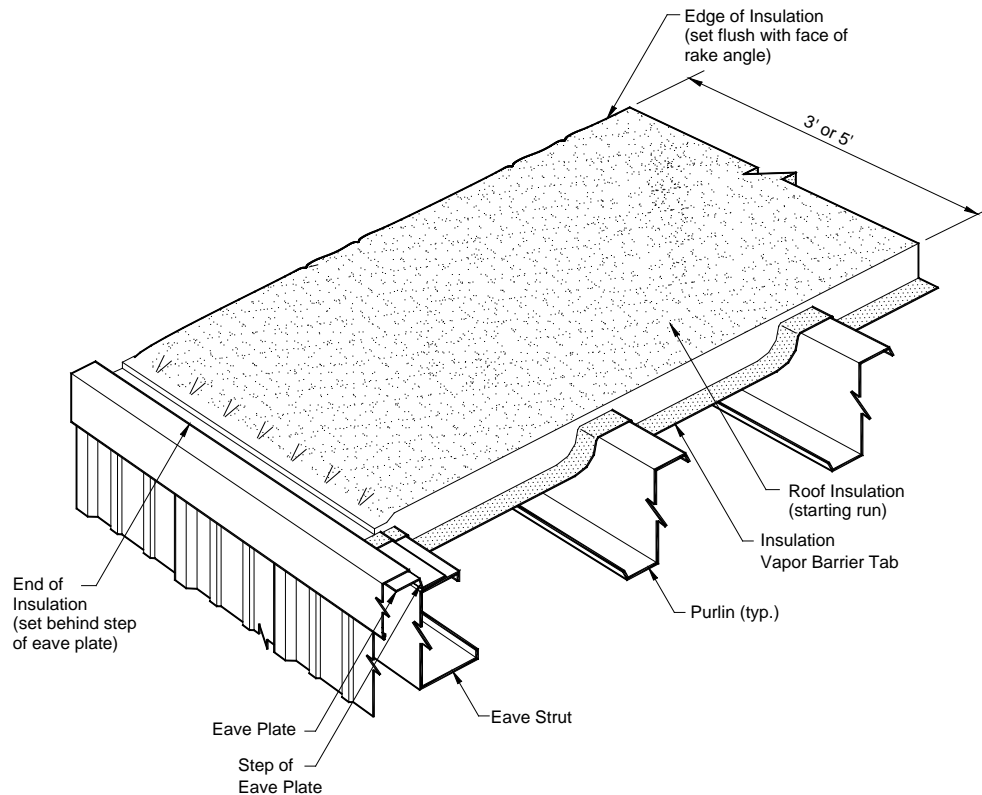
The eave plate must be installed before the roof insulation is placed over the structurals. Use ②① Self drilling Screws at 12" centers to attach eave plate to eave strut.

Before installing the eave plate, check that the eave strut members are in a straight alignment from rake to rake. Shim the eave plate as necessary to provide a level roof line.

Install the starting and finish ends of the eave plates flush with outer face of rake angle.



## 9.2.3 INSTALL FIRST RUN OF INSULATION



Refer to the erection drawings to determine the specific insulation required for the project. In all cases refer to the insulation manufacturer's instructions for proper insulation installation and vapor seal assembly. This detail shows fiberglass blanket insulation, which is the most commonly used insulation for metal standing seam roofs.

The leading edge of each insulation run should extend approx. 12" beyond the leading edge of the roof panel. This will allow for easy assembly of the vapor barrier seal between insulation runs.

With four foot or six foot wide insulation, the first run should be installed to only cover three feet or five feet respectively. The extra foot of width can be cut or lapped over the rake.

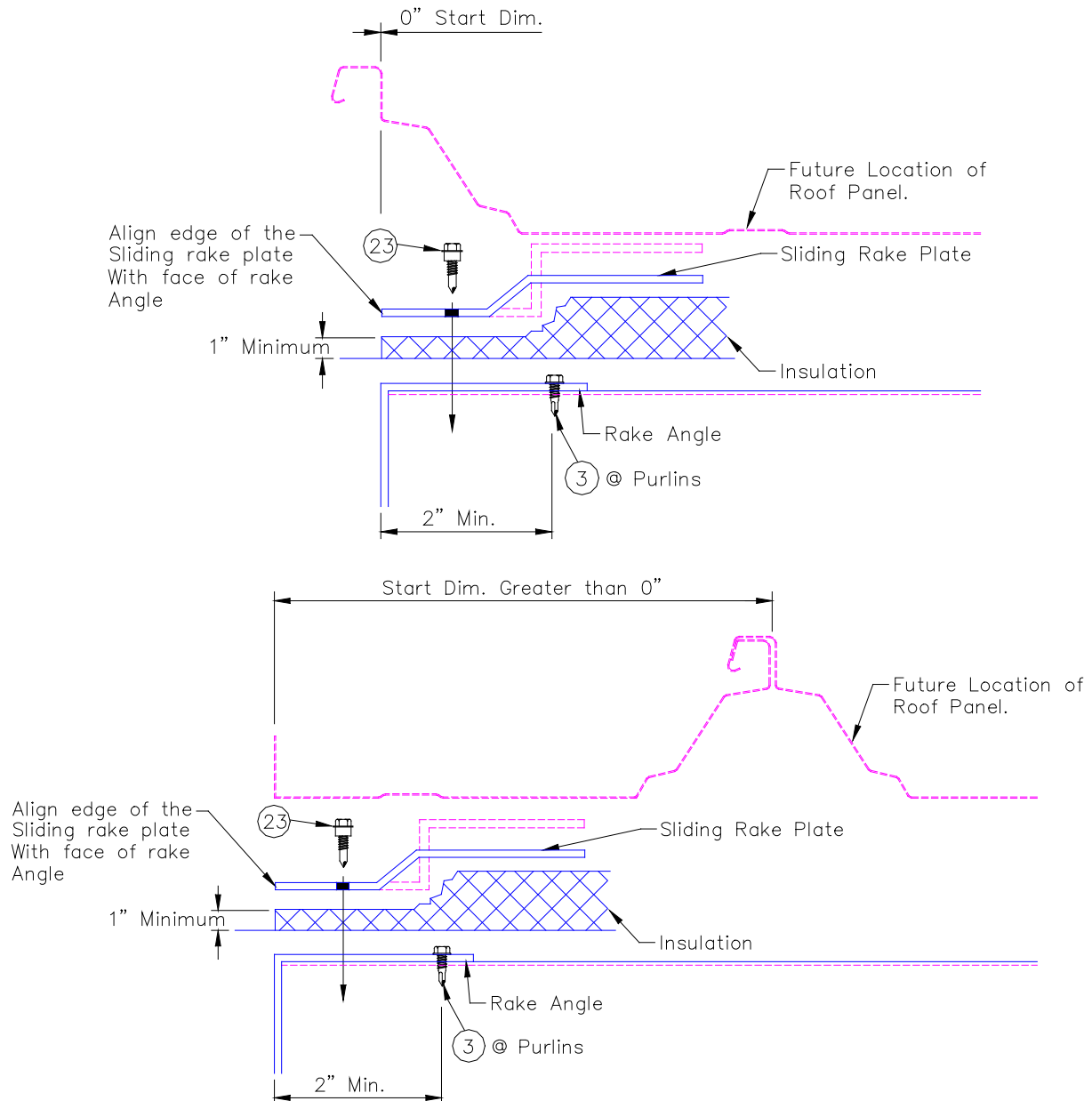
It is important to cut back insulation to 1" thick at the rake prior to installing the sliding rake plate on top. This will give the roof a chance to move, and also will hold down the insulation during installation.

Use two rows of double-faced tape along the top of the eave strut and eave plate to hold the insulation in place until the roof panel is installed.

In all cases, do not extend the end of the insulation onto the high flange of the eave plate.



## 9.2.4 SLIDING RAKE PLATE POSITIONED FOR RAKE TRIM



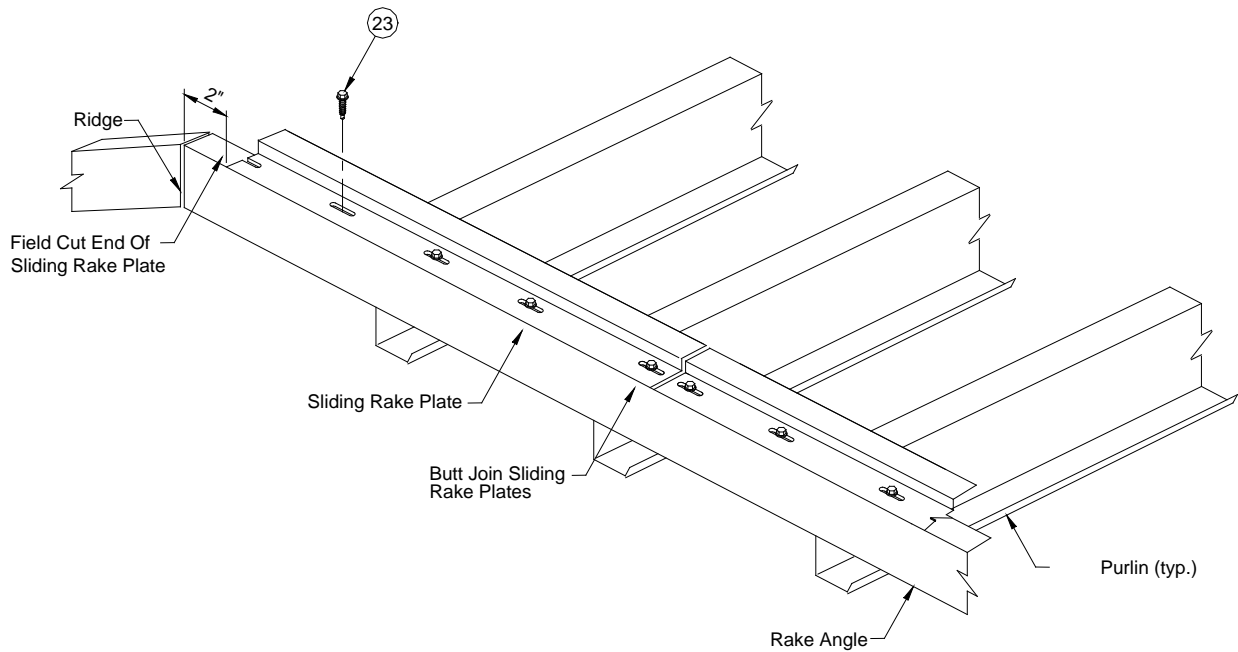
The position of the sliding rake plate will be located the same for roofs with or without a roof panel start dimension.

The rake angle is installed with ③ self-drilling screws at each purlin and eave strut prior to installing sliding rake plate.

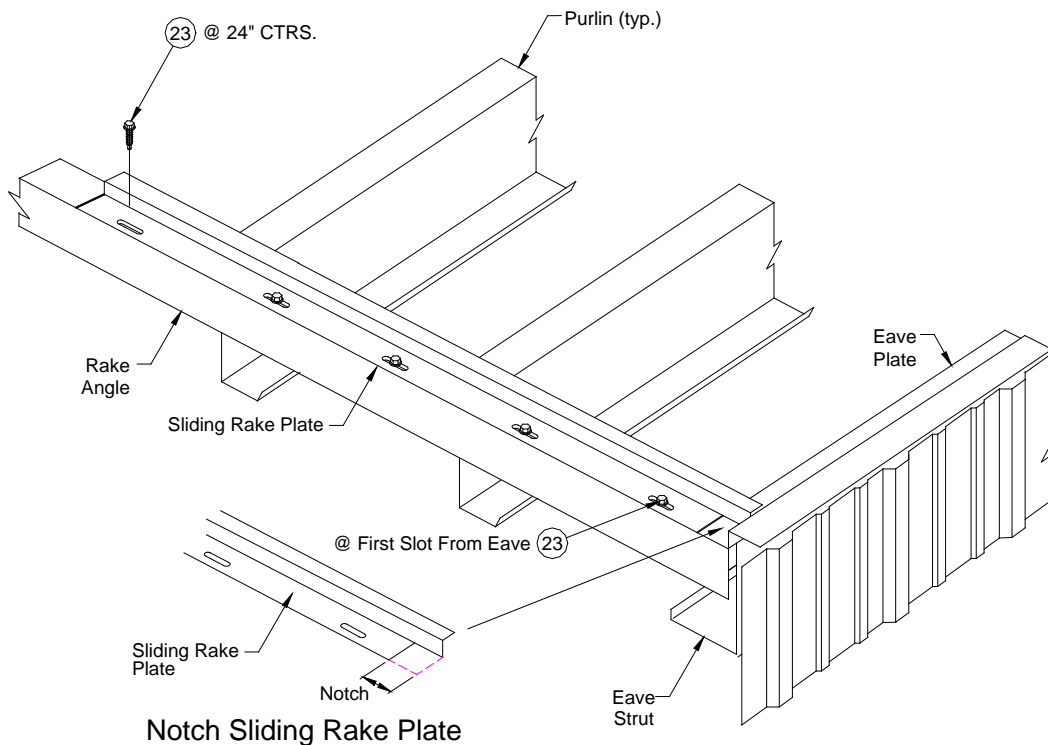
The sliding rake plate is attached to the rake angle with a ②③ self-drilling “shoulder” screw in the center of the slot at 24” centers.



## 9.2.5 START SLIDING RAKE PLATE INSTALLATION



### SPLICING AND ENDING



### Notch Sliding Rake Plate

### Start At Eave

For clarity of detail, insulation is not shown

It is important that the sliding rake plate is installed in a straight line and parallel to the rake line.

If the rake angles have been installed straight and true, the edge of the rake angle can be used to align the sliding rake plate.

If the rake angle is not true and square, a chalk line should be used to guide the installation of the sliding rake plate.





# Behlen ZL-24® Roof System Installation Guide

Start the end of the sliding rake plate flush with the inside edge of the eave plate.

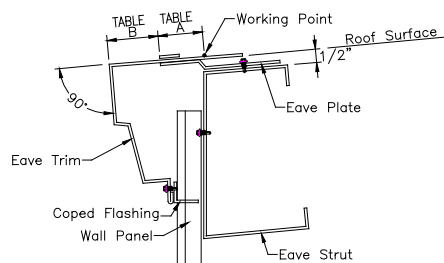
Secure the starting end of the sliding rake plate with a ③ self-drilling shoulder screw in the sliding rake plate's first slot. To allow for expansion/contraction movement, secure the rest of the sliding rake plate run to the rake angle with screws spaced as shown. Install the shoulder fasteners in the center of the slots.

Butt join the ends of the sliding rake plates. Install the shoulder fasteners in the slots on either side of the butt joints.

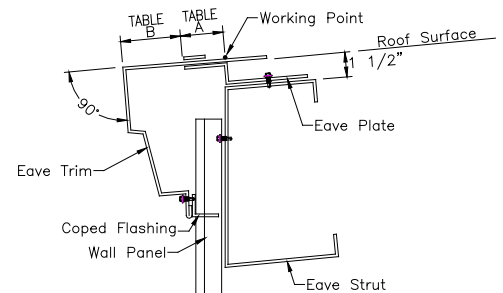
Field cut the last sliding rake plate two inches (2") from the ridge line or high eave line.

## 9.2.6 INSTALLING EAVE TRIM

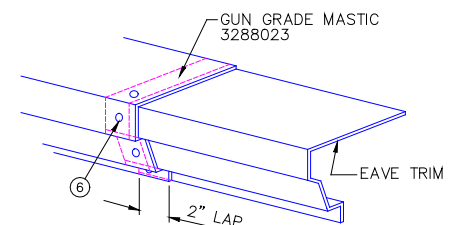
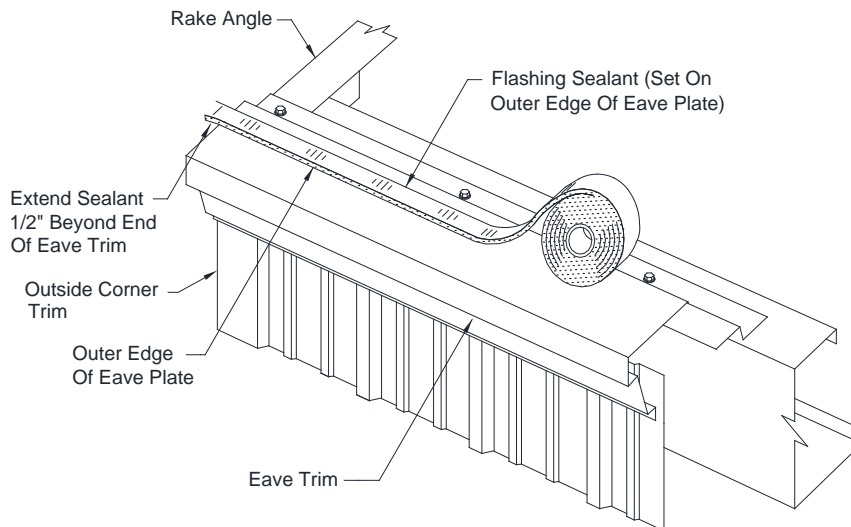
ROOF SLOPE	TABLE B DIMENSION	
	1/2" STAND-OFF	1 1/2" STAND-OFF
1/4:12	2 3/8	2 5/16
1/2:12	2 7/16	2 3/8
3/4:12	2 1/2	2 7/16
1:12	2 5/8	2 9/16
2:12	3 1/16	2 7/8
3:12	3 7/16	3 3/16
4:12	3 13/16	3 1/2
OTHERS	SEE PLANS	



1/2" STAND-OFF HEIGHT



1 1/2" STAND-OFF HEIGHT



EAVE TRIM END LAP

## STARTING EAVE TRIM

For clarity of details, insulation is not shown.

Place the upper leg of the eave trim over the eave plate as shown and position, using dimensions in Table B. See erection plans for positioning eave trim on roof slopes greater than 4" to 12". Using these dimensions will keep the front face of the eave trim 90 degrees to the roof surface, assuring that the outside corner boxes will fit properly at the corners. Align the end of the eave trim with the face of the outside corner trim. The eave trim provides a water seal between the roof panel and the wall panel. Temporarily hold the eave trim in place with several ③ self-drilling screws. These screws should be removed prior to the placement of the roof panel.



# Behlen ZL-24® Roof System Installation Guide

Position the bottom edge of the eave trim along a caulk line. Insert coped flashing between eave trim and wall panel, then secure the trim to the wall panel, see Wall Erection Guide for spacing.

Install and align all other eave trim sections in the same manner allowing a minimum 2" lap. Each lap will contain (4) ⑥ trim screws and gun grade mastic.

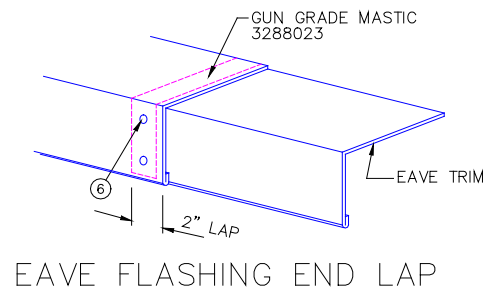
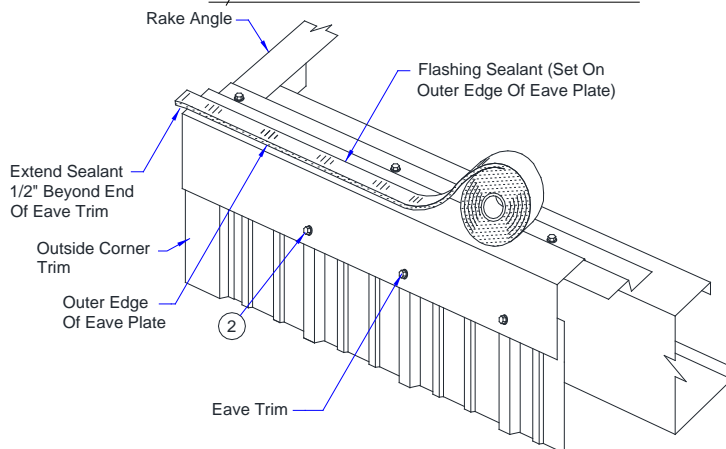
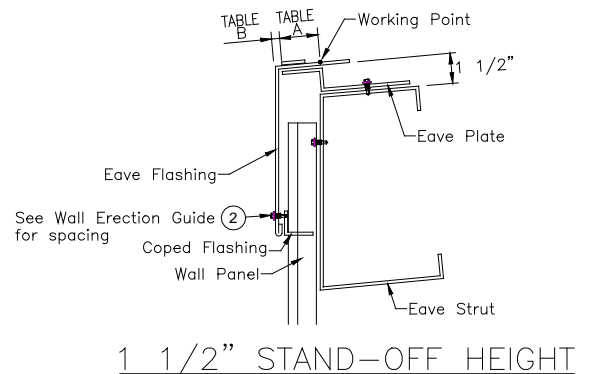
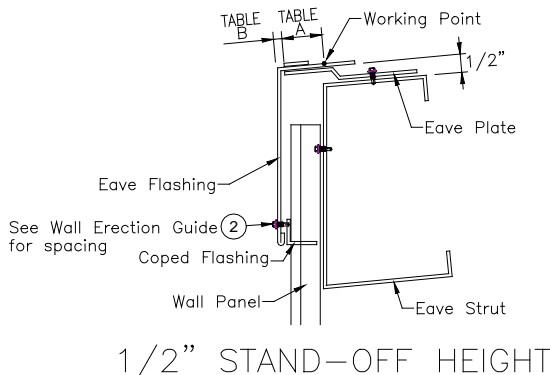
Apply a continuous strip of flashing sealant along the top edge of the eave flashing.  
Align the outer edge of the sealant flush with the outer edge of the eave plate.

Do not remove the paper backing from the sealant at this time.

Until the roof panels are installed, the eave sealant is vulnerable to damage from foot traffic or dragging material over the eave. Do not step on or otherwise damage the sealant.

## 9.2.7 INSTALLING EAVE FLASHING

TABLE B		
ROOF SLOPE	DIMENSION	
	1/2" STAND-OFF	1 1/2" STAND-OFF
1/4:12	1/4	1/4
1/2:12	1/4	3/16
3/4:12	1/4	3/16
1:12	3/16	1/8
2:12	3/16	1/16
3:12	3/16	1/16
4:12	1/8	0
OTHERS	SEE PLANS	



### STARTING EAVE FLASHING

For clarity of details, insulation is not shown.



# Behlen ZL-24® Roof System Installation Guide

Place the upper leg of the eave flashing over the eave plate as shown and position, using dimensions in Table B. See Erection plans for positioning eave flashing on roof slopes greater than 4" to 12. Align the end of the eave flashing with the face of the outside corner trim. The eave flashing provides a water seal between the roof panel and the wall panels. Temporarily hold the eave flashing in place with several ③ self-drilling screws. These screws should be removed prior to the placement of the roof panel.

Position the bottom edge of the eave flashing along a caulk line. Insert coped flashing between eave flashing and wall panel, then secure the trim to the wall panel, see Wall Erection Guide for spacing.

Install and align all other eave flashing sections in the same manner allowing a minimum 2" lap. Each lap will contain (2) ⑥ trim screws and gun grade mastic.

Apply a continuous strip of flashing sealant along the top edge of the eave flashing.

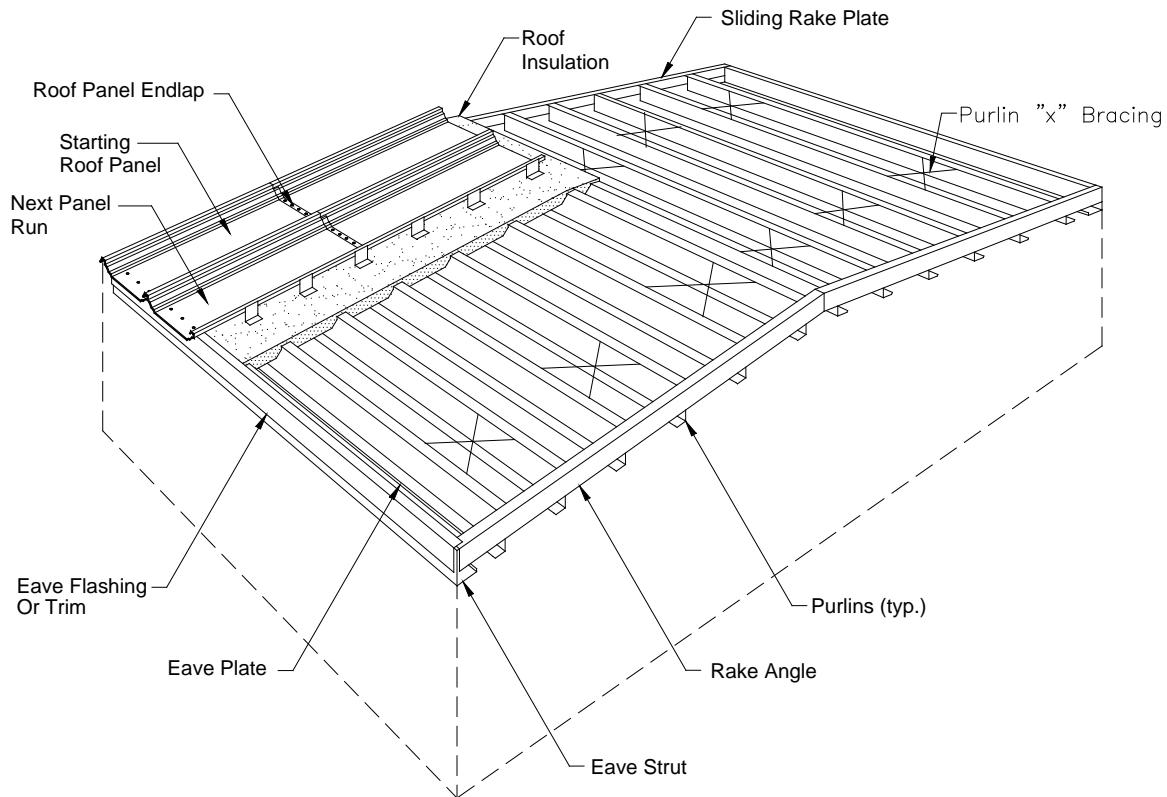
Align the outer edge of the sealant flush with the outer edge of the eave plate.

Do not remove the paper backing from the sealant at this time.

Until the roof panels are installed, the eave sealant is vulnerable to damage from foot traffic or dragging material over the eave. Do not step on or otherwise damage the sealant.

## 9.3 ROOF PANEL INSTALLATION

### 9.3.1 ORIENTATION VIEW



The details in this section show installation of the starting and subsequent roof panels.

The roof panel endlap details are shown as an integral part of the roof panel installation. If the project does not require roof panel endlaps, the endlap details are clearly identified and can be disregarded.

The (optional) cinch straps will be shown at the eave line and at the panel endlaps. If the project does not require cinch straps that information can be disregarded.

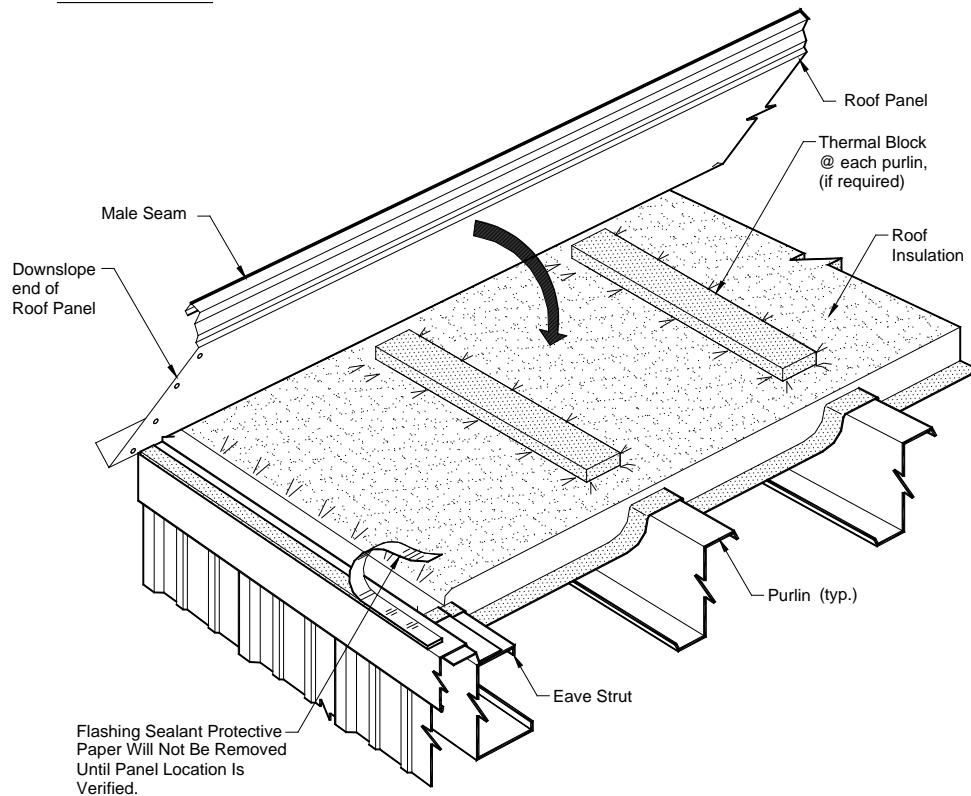
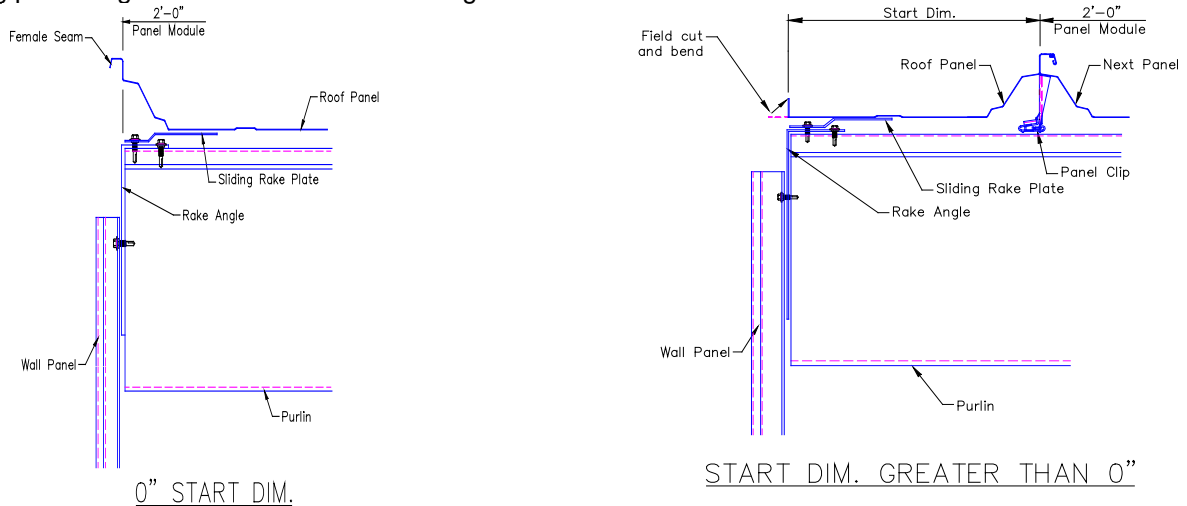
Installation of the last panel run is shown in Section 9.9.1.



## 9.3.2 FIRST ROOF PANEL PLACEMENT

The position of the first panel in relationship to the endwall rake angle is critical. Check the erection set of plans for possible "START DIMENSION" and if field cutting of the first panel is required. If the panel is to be field cut, allow for a minimum 1" bent-up leg along the cut edge.

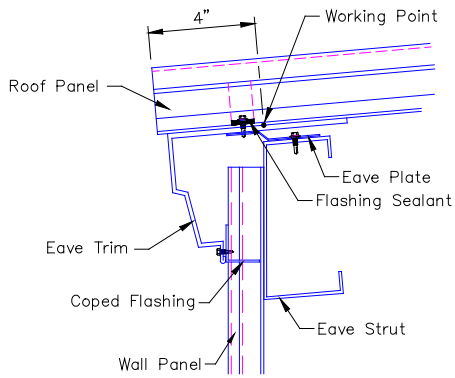
The starting panel edge should match the outer edge of the rake.



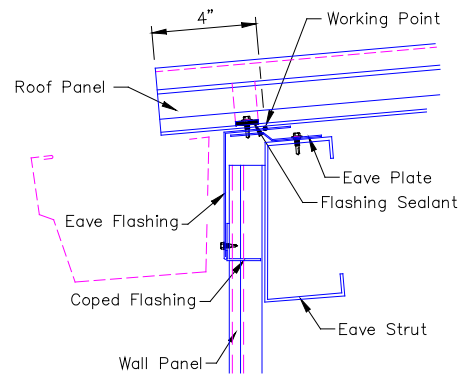
If thermal blocks are required, place the blocks on top of the insulation directly over the roof structurals. On some roof slopes it may be advantageous to use a spray-on adhesive on the thermal block to keep it positioned over the roof structural until the panel is installed. Thermal blocks are not required at the eave strut.

Position the roof panel along the rake line and the end of the panel 4" beyond the eave strut unless another dimension is specified on the erection drawings.

Rotate the panel down to rest on the thermal blocks or insulation.



PANEL OVERHANG WITH  
EAVE TRIM

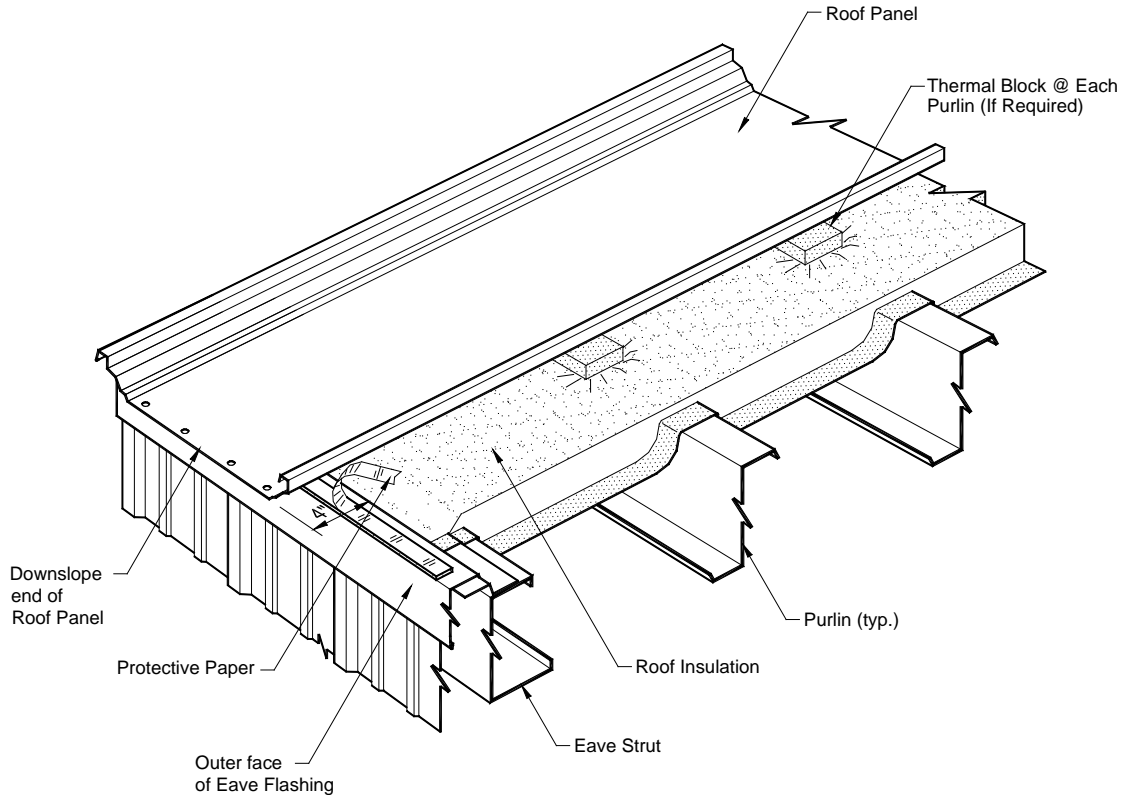


PANEL OVERHANG WITH  
GUTTER

The roof panel's eave overhang dimension is critical as it establishes the location of endlaps and ridge cover attachment points.

Verify that the roof panel's overhang dimension is correct and verify that the roof panel is aligned parallel to the rake line.

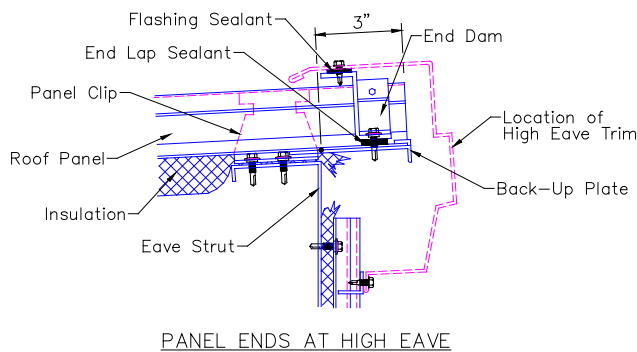
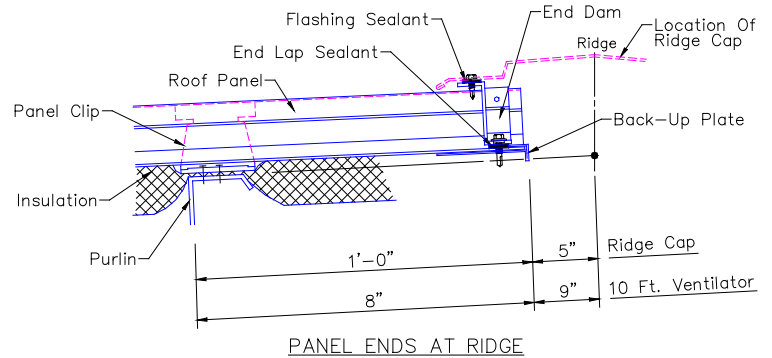
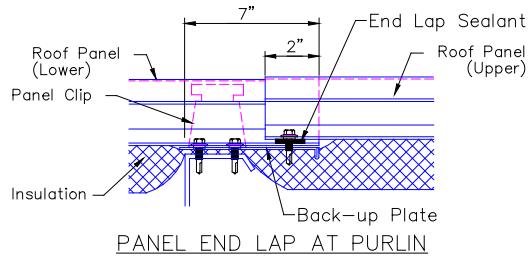
Raise the leading corner of the panel and remove the protective paper from the flashing sealant.



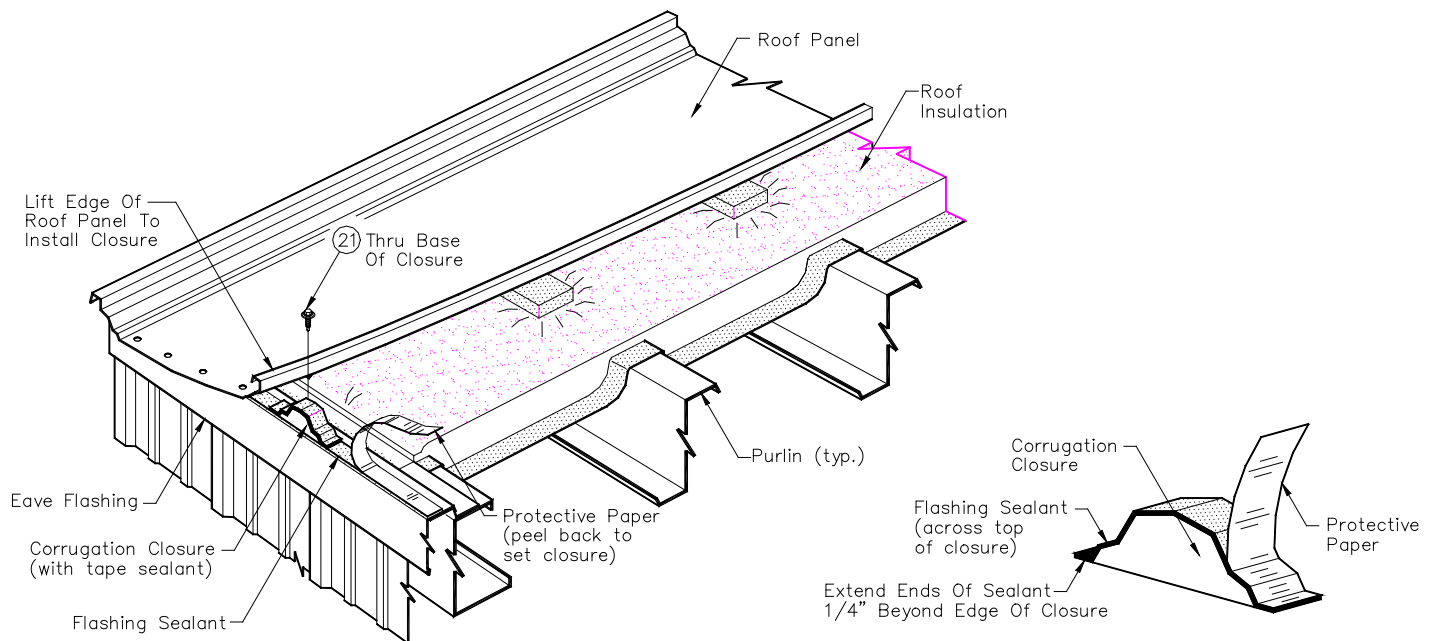


## 9.3.3 PANEL OVERHANG VERIFICATION

Before attaching the roof panel to the eave plate measure the panel overhang at the purlin on the upslope end and verify that it is in the correct position.

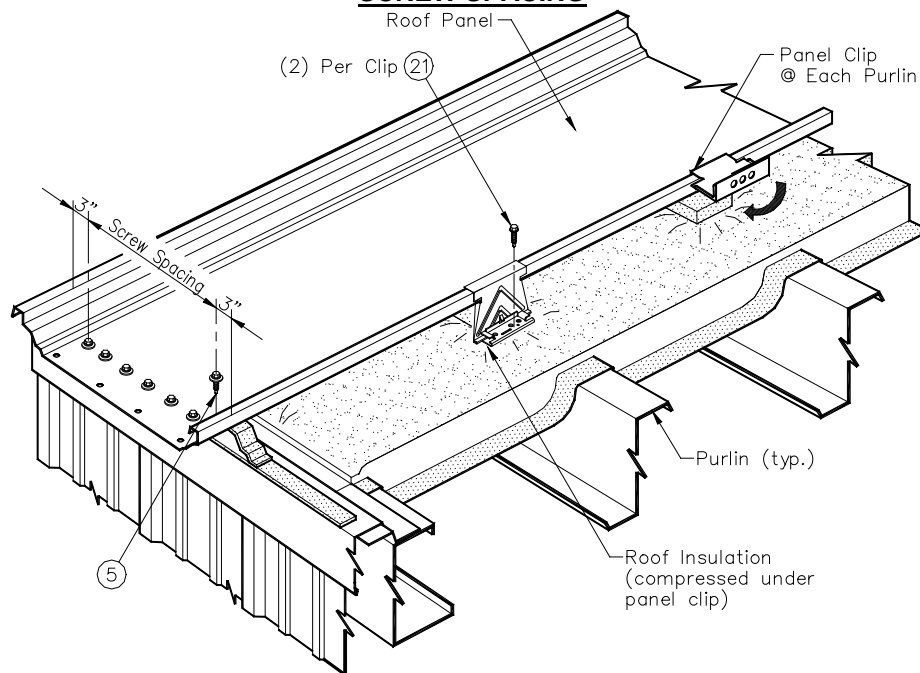
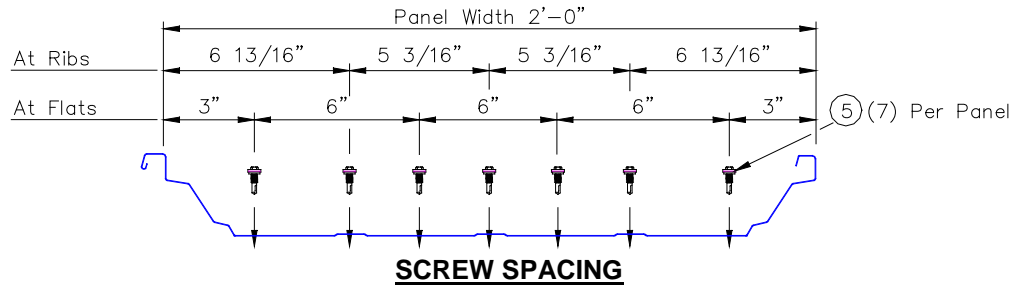


## 9.3.4 INSTALL CORRUGATION CLOSURE



Pick up the corner of the roof panel and peel back the protective paper from the flashing sealant as shown to clear the corrugation closure. Place the closure into the panel corrugation on top of the flashing sealant. Make certain closure is directly over the eave plate.

Fasten the closure to the eave plate with a ②1 Self Drilling Screw installed through the hole in the base of the closure. Prepare the corrugation closures by applying flashing sealant along the top surfaces as shown in the above illustration. Remove the protective paper.

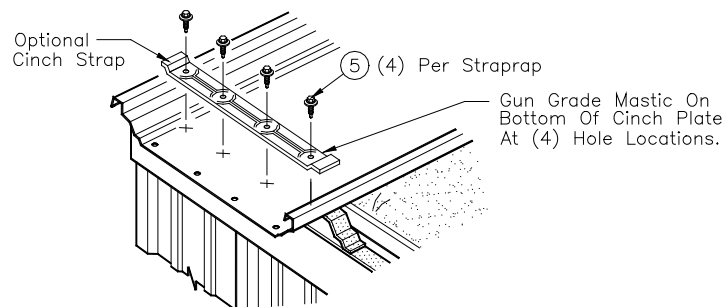


**CAUTION: Do not scrape off the clip's sealant assembling to the roof panel.**

Before fastening the roof panel to the eave plate and fastening the leading edge of the panel with the panel clips, check that the panel coverage is correct and the leading edge of the panel is straight and parallel to the rake line.

Fasten the eave end of the panel with (7) (5) self-drilling screws as shown above unless the (optional) cinch strap is used, then see below.

Position the fasteners to penetrate through the center of the sealant, through the eave flashing and into the eave plate.



If the (optional) cinch strap is used apply gun grade mastic to the bottom of the cinch strap at the hole locations, then position the strap so that the fasteners will penetrate through the center of the sealant, eave trim and into the eave plate.

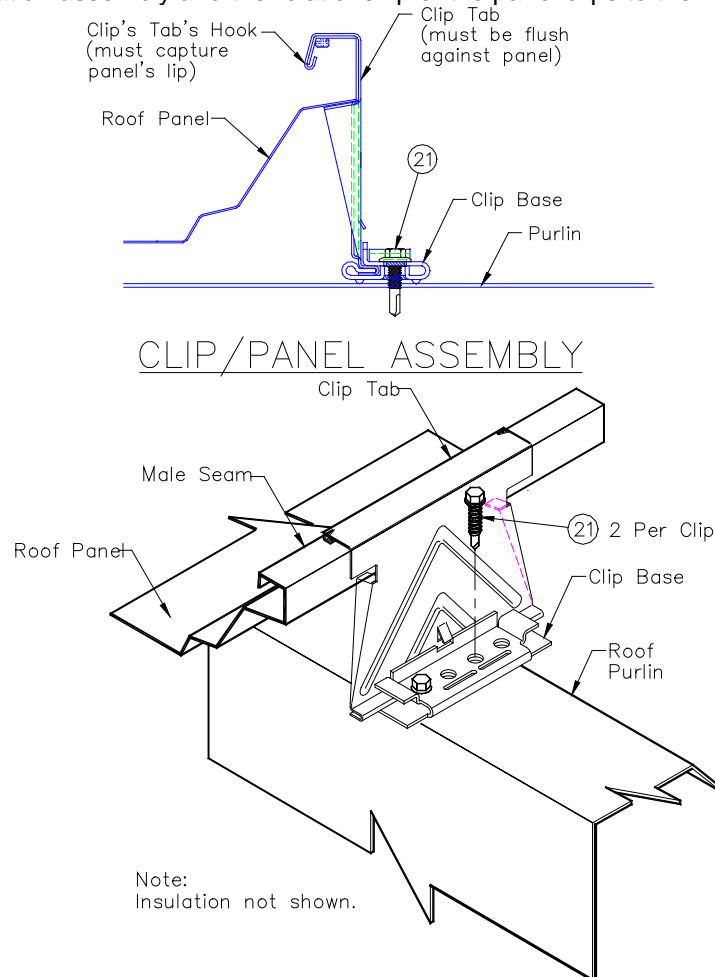


## 9.3.5 ATTACHING PANEL CLIP

Install roof panel clips to the leading edge of the roof panel at each roof purlin. Panel clips are not required at the low eave strut but will be used at the high eave strut on single slope building.

To install the clips, tilt the clip so that its tab can be hooked over the edge of the roof panel's male seam. Position the clip's base so that the clip fasteners can be installed through the holes in the base and into the roof purlin, then rotate the clip down into the vertical position.

When fiberglass roof insulation is used, the panel clips normally set on top of the insulation and the insulation is compressed between the clip's base and the top of the roof purlin. In all cases, refer to the erection drawings to determine the required insulation assembly and the relationship of the panel clips to the insulation.



**CAUTION:** Failure to enclose the male lip in the clip hook and failure to nest the clip flush against the panel clip can cause faulty seaming and objectionable seam appearance.

Panel clips are available as floating clips only and are available in different stand-off heights. Refer to the erection drawings to determine the type of clip required for each roof condition.

Check that the panel clip's tab is seated tightly around the roof panel's seam and that the panel clip's hook has captured the panel's lip.

Check that the clip's base is vertical and that the base is set square and firmly over the roof purlins.

Panel clip fastener type and quantity vary according to the roof structural material and roof load requirements. Refer to the erection drawings for the required type and quantity of panel clip fasteners.

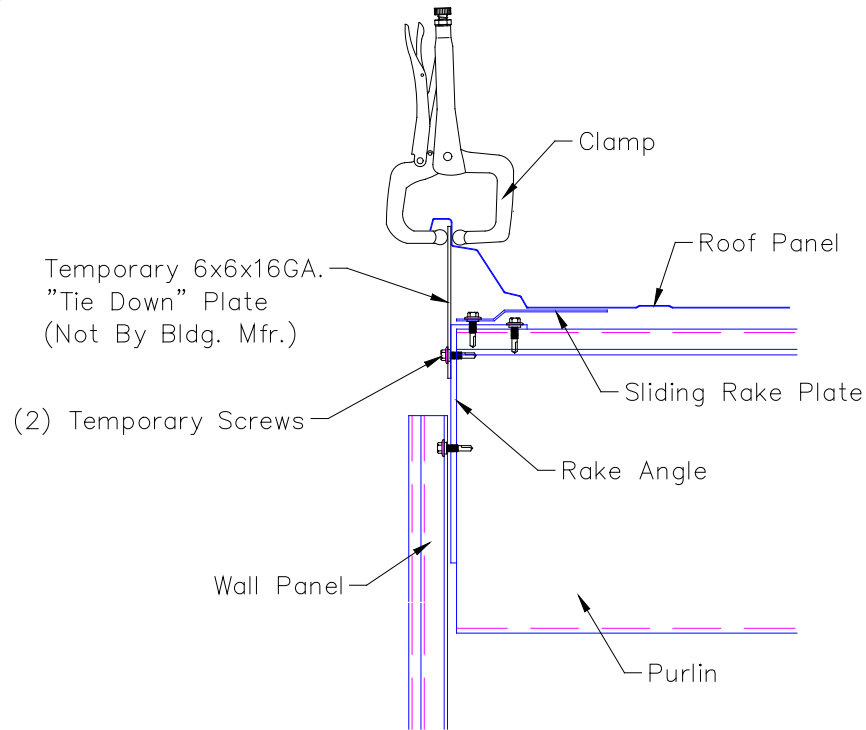
Check that the clip fasteners are equally spaced through the clip base holes and are securely engaged into roof purlin.



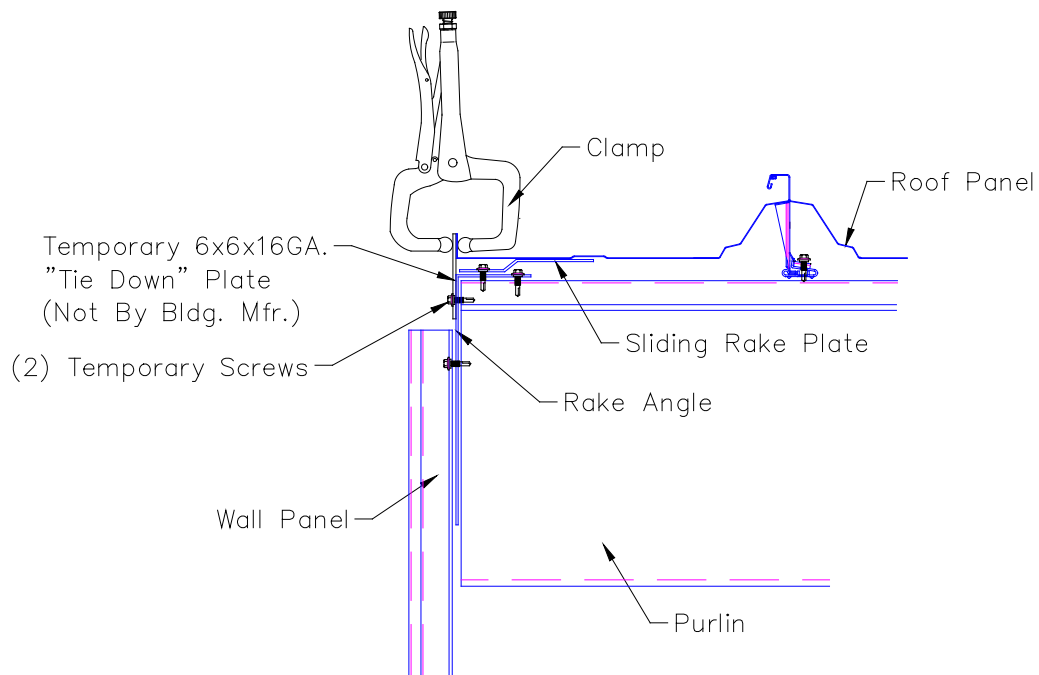


## 9.3.6 TEMPORARY ROOF PANEL TIE-DOWN

If the rake trim is to be installed later, the edge of the first panel run should be temporarily clamped to the rake angle. Any attachment along the rake must be removed when the rake trim is installed.



0" START DIMENSION

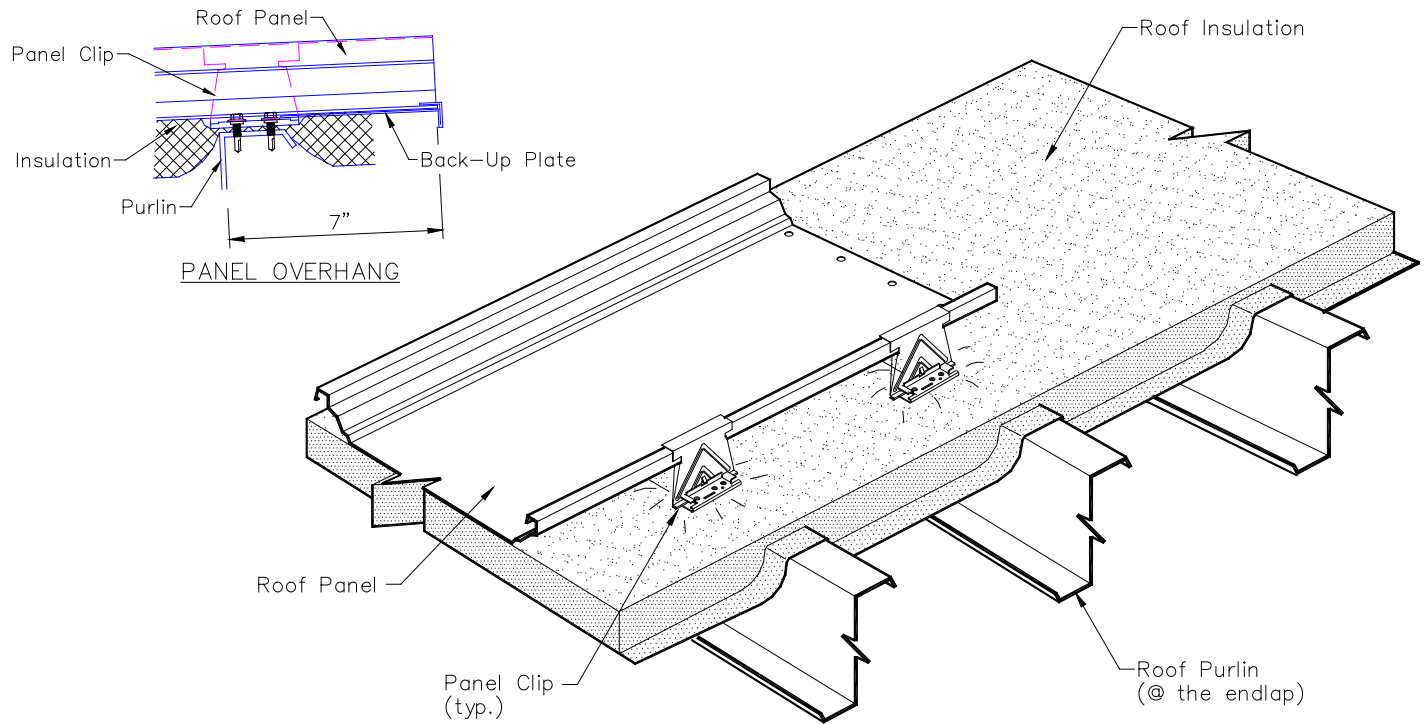


START DIMENSION GREATER THAN 0"



## 9.4 CONSTRUCTING ENDLAPS

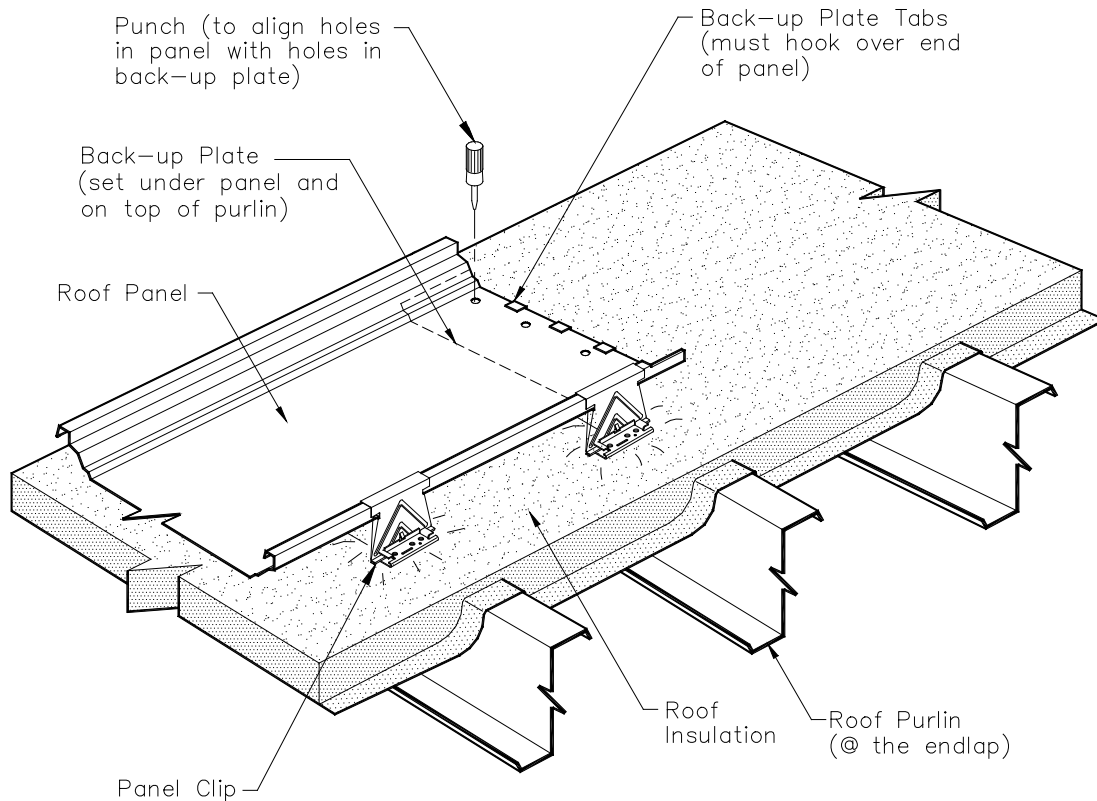
### 9.4.1 PANEL OVERHANG VERIFICATION



Verify that the roof panel overhang at the purlin line is 7". This dimension will assure that the back-up plate will set over the top of the purlin.



## 9.4.2 INSTALL BACK-UP PLATE



Slide the back-up plate under the roof panel, as shown.

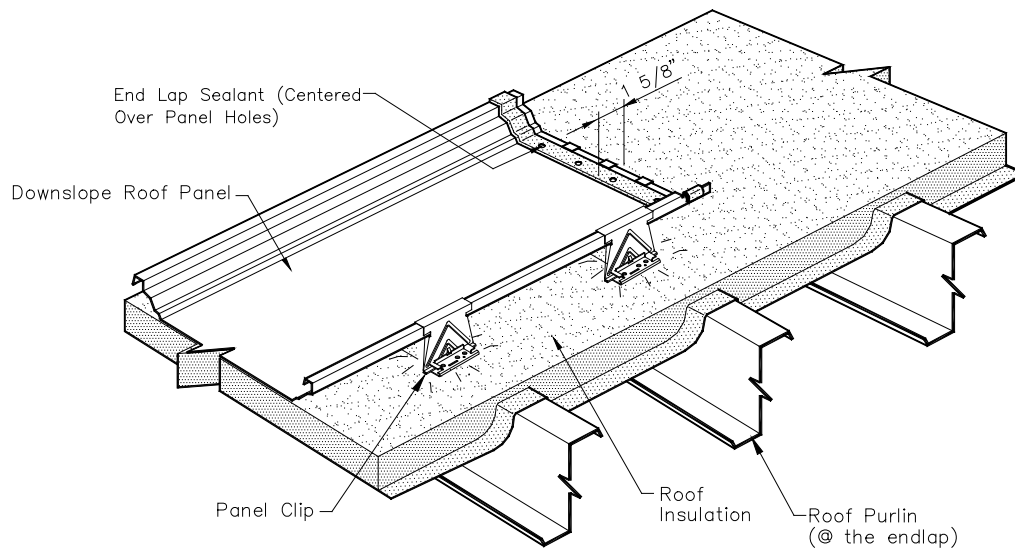
The back-up plate must be set over the top of the roof purlin. If thermal blocks are used, the back-up plate must be set over the thermal block.

The back-up plate's tabs must hook over the end of the roof panel.

Use punches to align the holes in the back-up plate with the factory punched holes in the roof panel.



## 9.4.3 INSTALL TAPE AND GUN GRADE MASTICS



The proper placing of the endlap sealant is critical to the weathertightness of the roof endlaps.

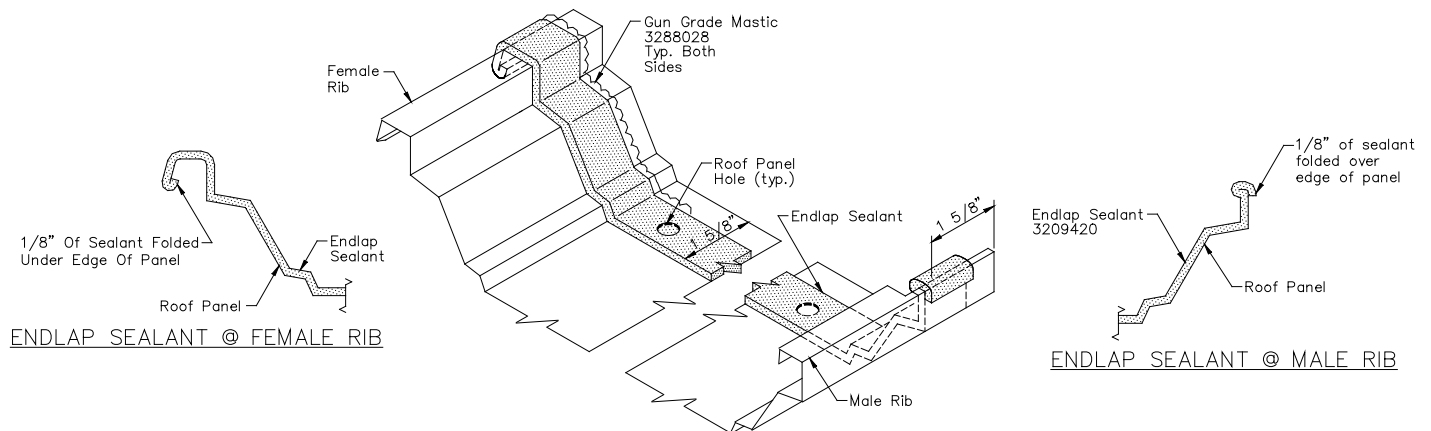
Before installing the endlap sealant, the roof panel's surface must be wiped clean and dry.

Position the sealant so that its downslope edge is uniformly 1 5/8" from the end of the panel. The sealant must be centered over the roof panel's factory punched holes.

Install a continuous strip of endlap sealant along the end of the roof panel, as shown.

Check that the sealant fully contacts the roof panel's surface and that it is completely fitted into the panel corners and around the seams.

The sealant's protective paper helps to retain the sealant's shape during installation and protects the sealant's surface from damage and contamination. Do not remove the protective paper until immediately before the installation of the up-slope roof panel. Specific endlap sealant details are shown below.



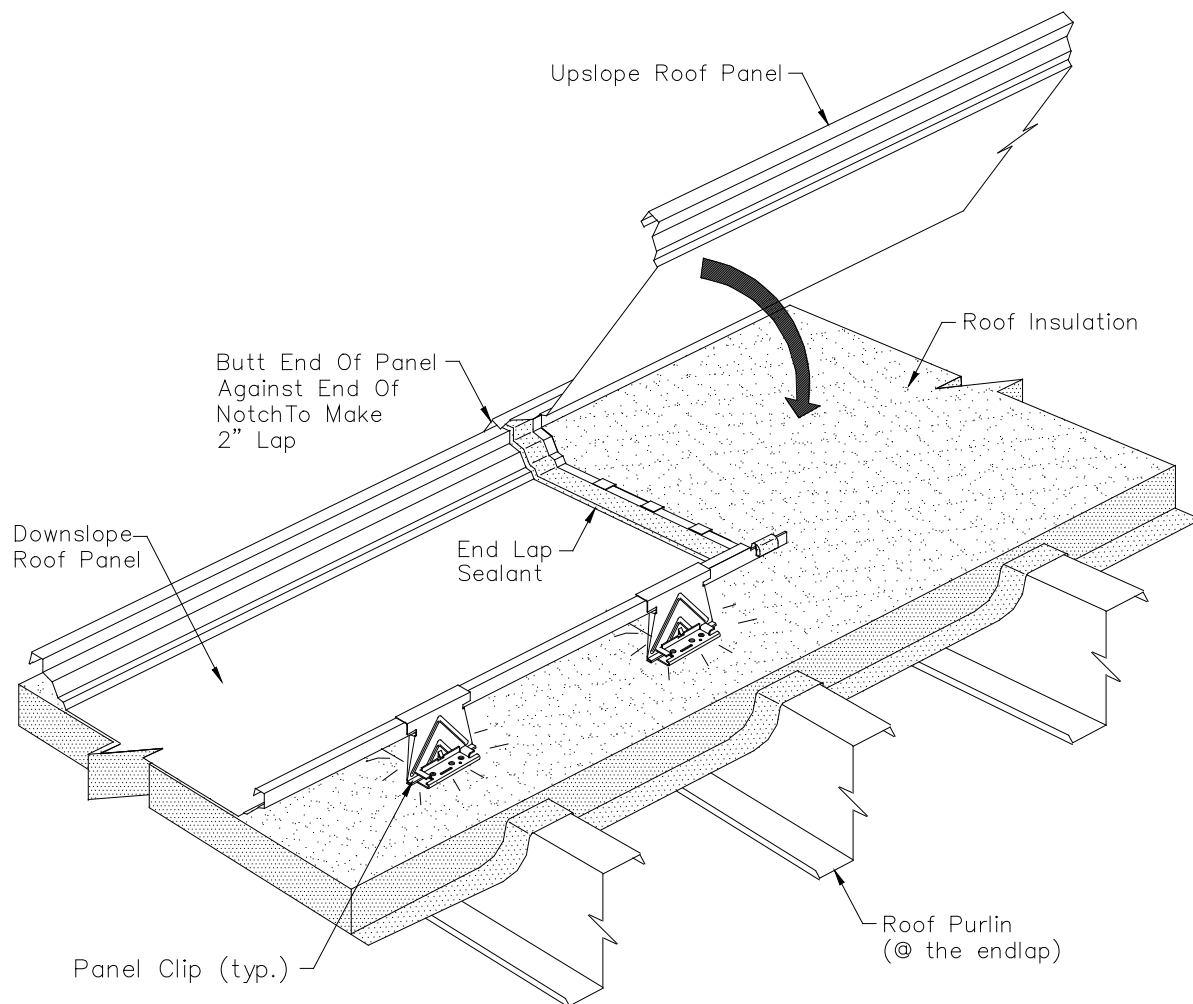
Use the 30 1/2" long pad of endlap sealant to fit around the roof panel seams as shown.

Check that the 1/8" ends of the sealant are correctly folded around the roof panel's edges. Excess sealant in the roof panel seams will cause difficult panel assembly. Remove any excess sealant.

After the sealant is correctly positioned, uniformly press the sealant against the roof panel's surface to assure adhesion. Do not use excess pressure which can thin the sealant.



## 9.4.4 UPSLOPE PANEL PLACEMENT



Wipe dry and clean the underside surface of the up-slope roof panel.

Remove the protective paper from the installed endlap sealant.

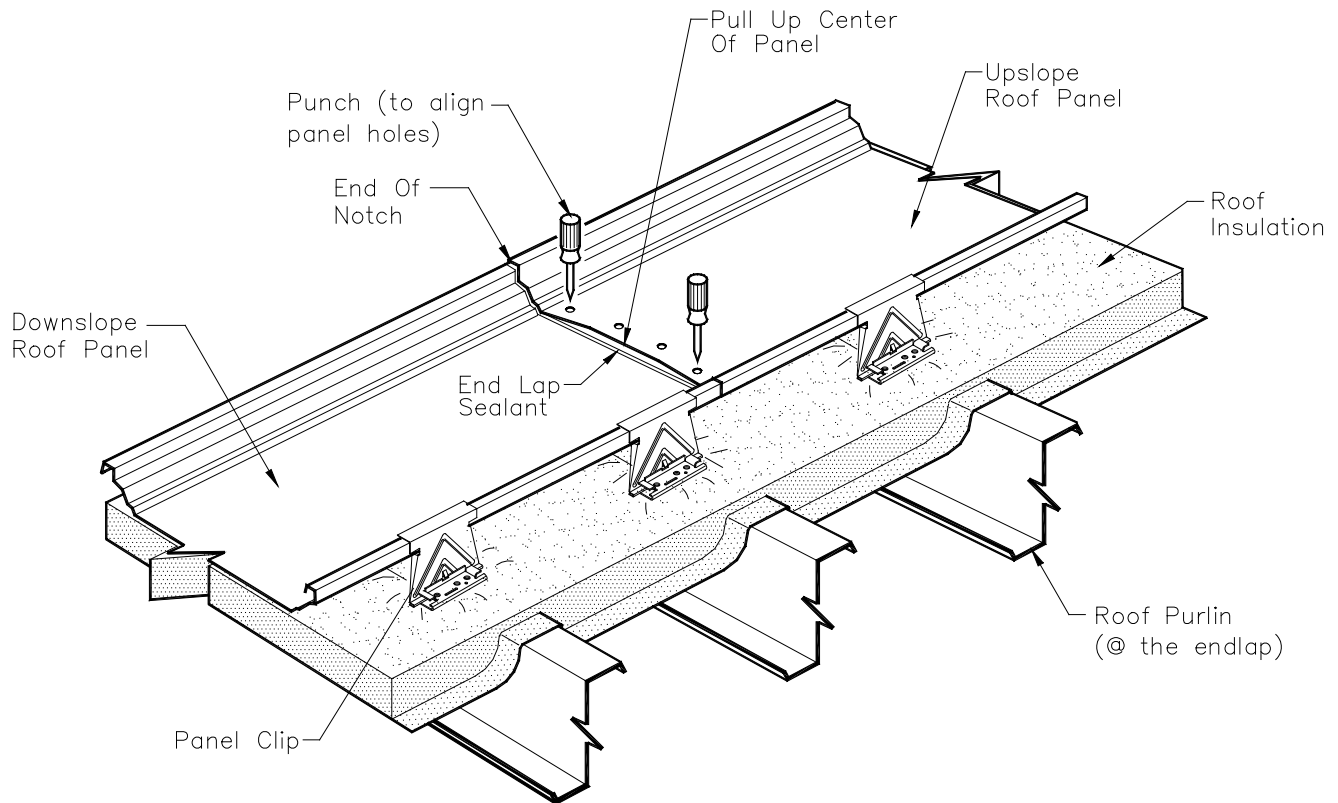
Position the end of the up-slope roof panel to make a 2" lap over the down-slope roof panel.

At the seams, the end of the up-slope roof panel should butt against the notch on the down-slope roof panel.

Check that the up-slope roof panel will correctly lap over the endlap sealant.



## 9.4.5 PANEL ALIGNMENT



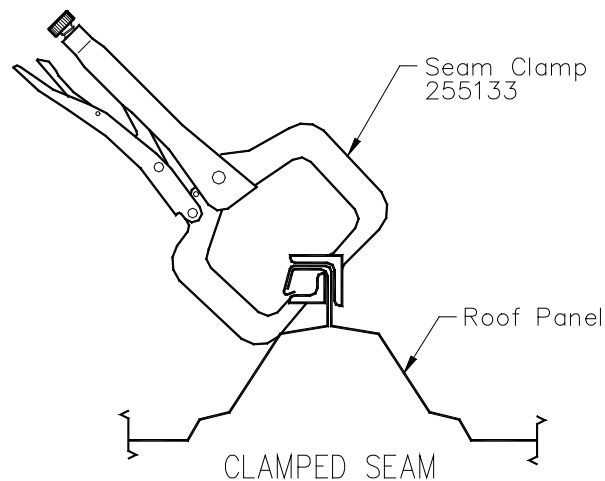
Lower the up-slope roof panel to lap onto the down-slope roof panel.

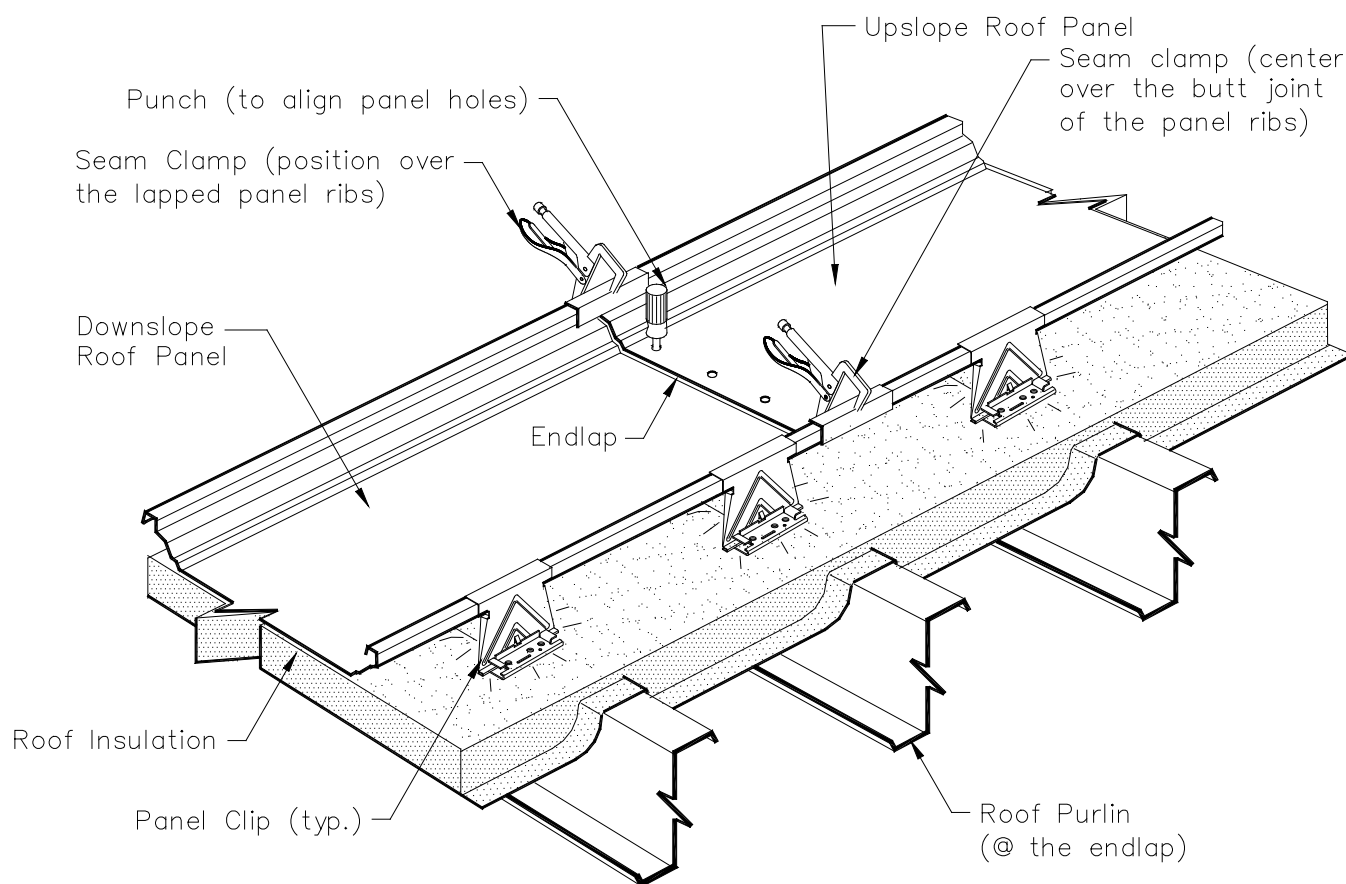
While lowering the up-slope roof panel, bow the end of the panel by pulling up on its center. This will allow the panel to more easily nest into the down-slope panel.

Use punches to align the factory punched holes of the lapping panels. The punch will have to penetrate through the endlap sealant and into the holes in the back-up plate. Do not disturb the position of the sealant while inserting and removing the punch.

Do not remove the punches from the roof panel holes until after the seam clamps have been installed.

## 9.4.6 CLAMP THE SEAMS





Use the seam clamps to draw the lapping panel seams together, as shown.

Check that the clamp jaws are correctly aligned to the seam before closing the clamp. Misaligned clamps can distort and damage the roof panel seams.

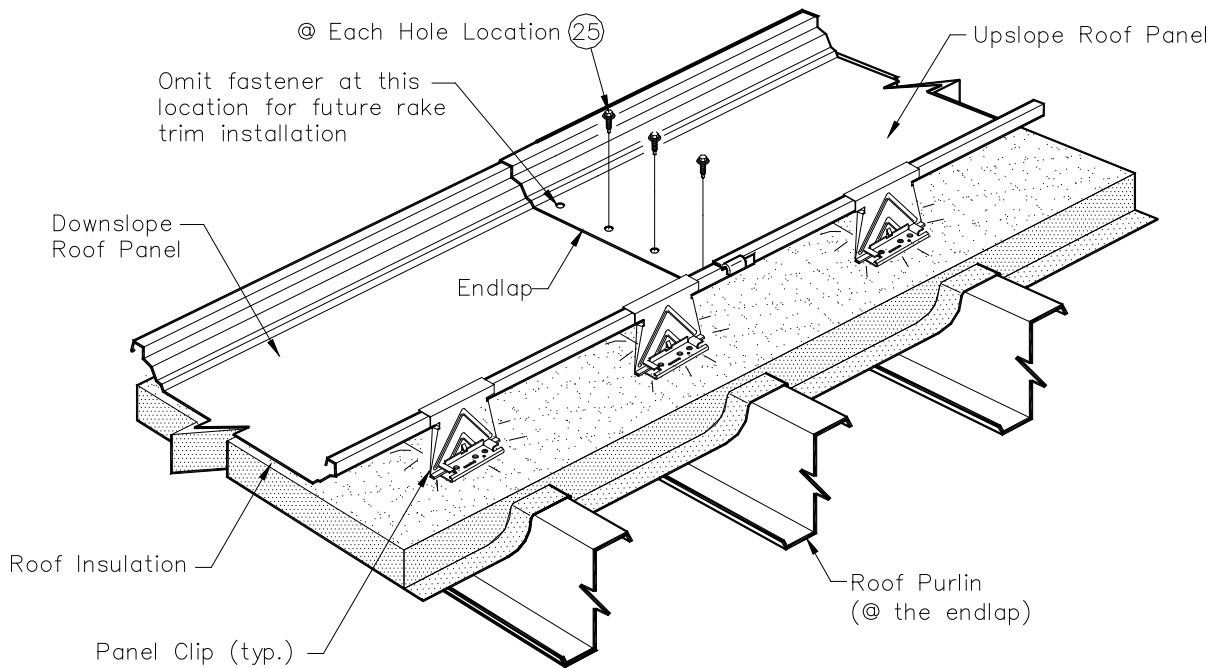
Slowly close the clamp to allow the sealant to flow between the lapped seams.

With the seam clamps installed, uniformly press down on the up-slope panel to close the panel lap and to assure adhesion to the endlap sealant.

Do not remove the seam clamps until after the fasteners have been installed in the endlap.

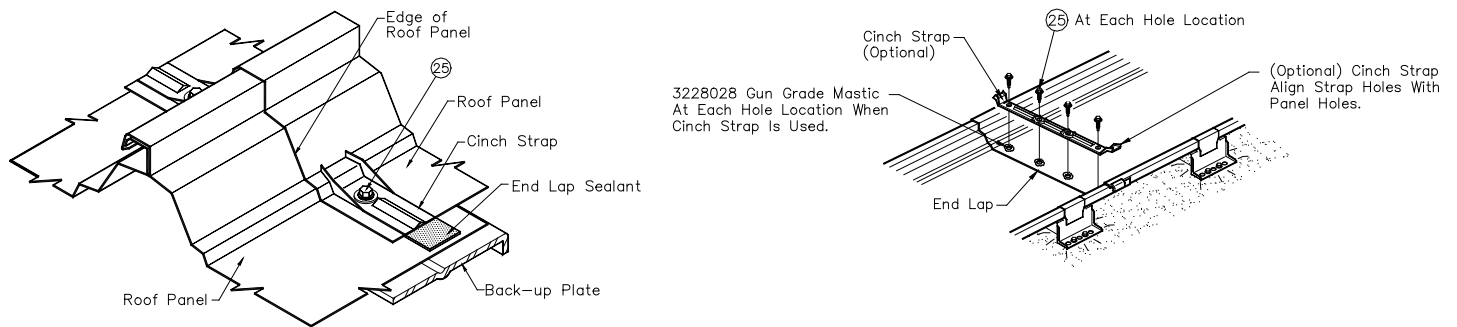


## 9.4.7 INSTALL ENDLAP FASTENERS



Install (4) (25) self-tapping screws in the factory punched holes in the panel. Check that fasteners penetrate through the center of the endlap sealant and are securely engaged into the back-up plate.

Should any of these fasteners, during installation, be “overturned” or “stripped-out” they should be replaced with an 11/32” x 1 1/4” self-tapping screw, see page 40. Leaving a stripped-out fastener will compromise the water tightness of the roof.



Refer to the erection drawings to determine if a (Optional) cinch strap is required.

If a cinch strap is required, carefully apply gun grade mastic to the bottom of the cinch strap at the hole locations, then position the cinch strap over the factory punched holes in the roof panel.

Use a punch to align the factory punched holes in the cinch strap, roof panels and back-up plate.

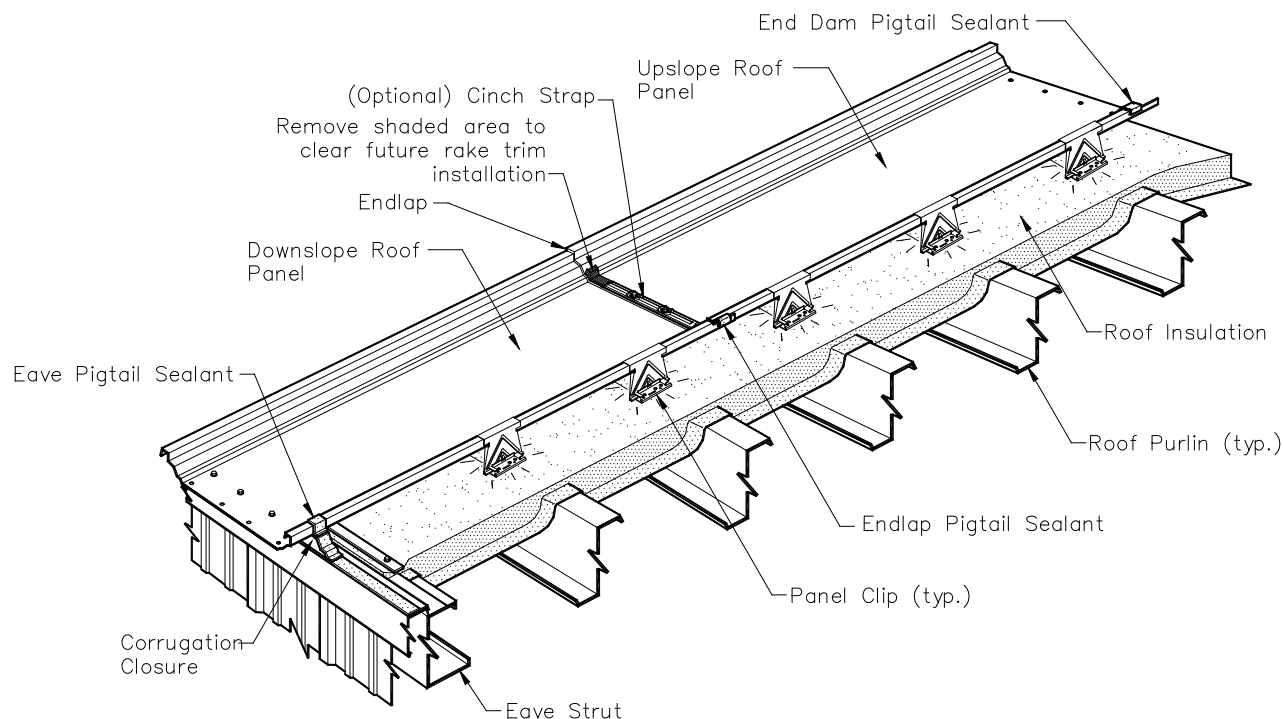
Install (25) self-tapping screws in the holes at each end of the cinch strap. Then install fasteners in the remaining holes.





## 9.5 PIGTAIL SEALANTS ALONG PANEL SEAM

### 9.5.1 LOCATION OF PIGTAILS

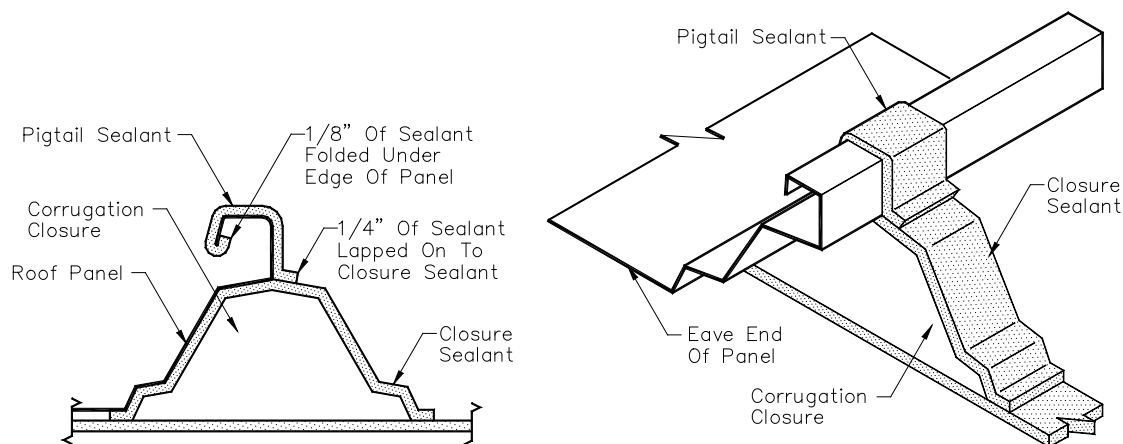


Pigtail sealants are strips or pieces of tape sealant, cut to the required length from rolls of flashing sealant.

The pigtail sealants must be correctly installed along the panel seam, before the next panel run can be installed.

Install the EAVE, ENDLAP and END DAM pigtails on the leading edge of the roof panel as shown.

### 9.5.2 PIGTAIL SEALANT AT EAVE



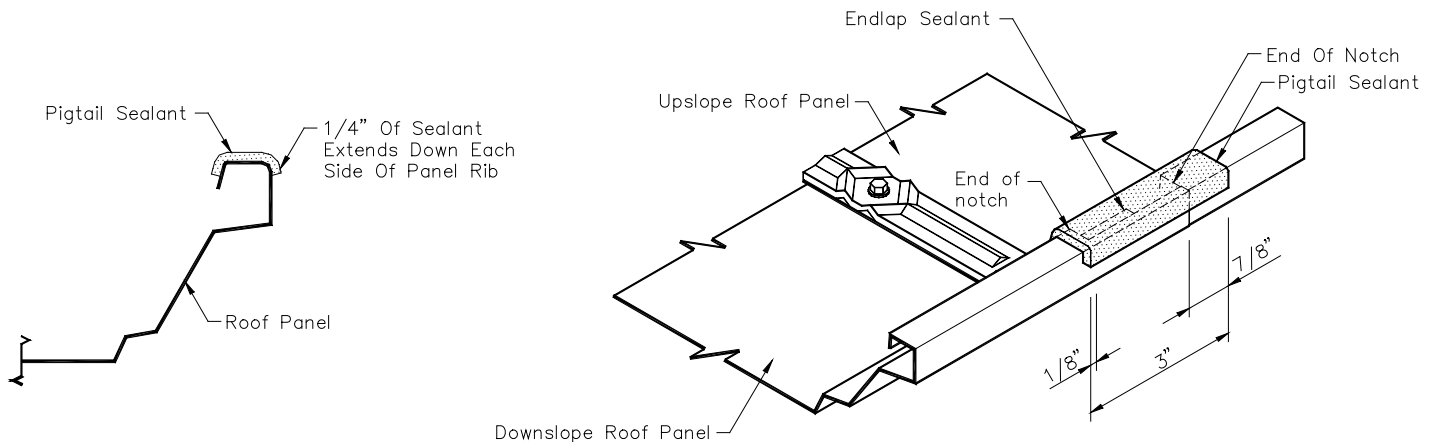
Cut the pigtail sealants to be fitted around the roof panel's seam as shown.

At the eave, lap 1/4" of the pigtail sealant onto the corrugation closure's sealant. Cut the other end of the pigtail sealant so 1/8" can be folded under the edge of the roof panel.

After the pigtail sealant is correctly placed, uniformly press the sealant against the panel's surface to assure adhesion.



## 9.5.3 PIGTAIL SEALANT AT ENDLAP



Cut the pigtail sealant to a 3" length and fit around the roof panel's seam as shown.

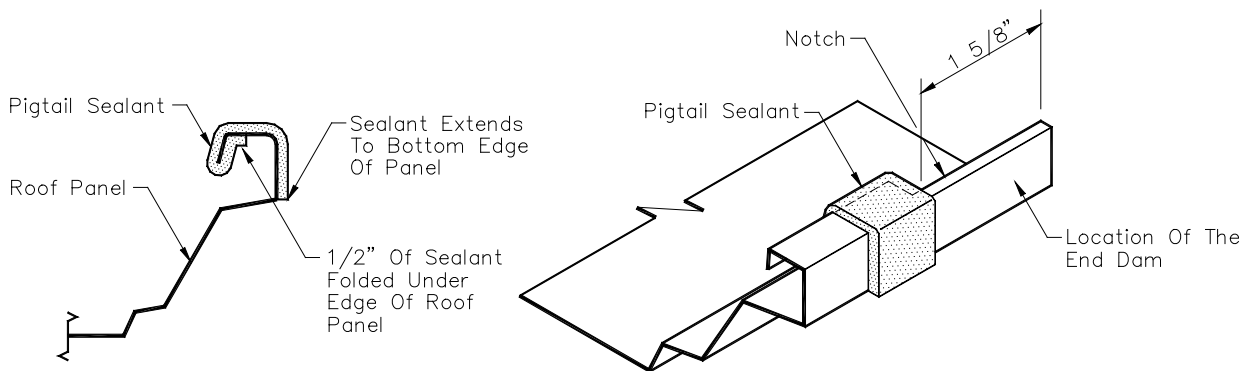
Position the pigtail sealant to lap 1/8" over the downslope end of the roof panel's notch.

Center the sealant over the roof panel's seam. Fold the edges of the sealant down over the sides of the seam.

Excess sealant in the seams will cause difficult roof panel assembly. Remove any excess sealant.

After the pigtail sealant is correctly placed, uniformly press the sealant against the panel's surface to assure adhesion.

## 9.5.4 PIGTAIL SEALANT AT END DAM



At the end dam location on ridges or high eave of single slope buildings, position the pigtail sealant so its edge is 1 5/8" from the end of the roof panel.

The sealant must lap over the edge of the roof panel's notch.

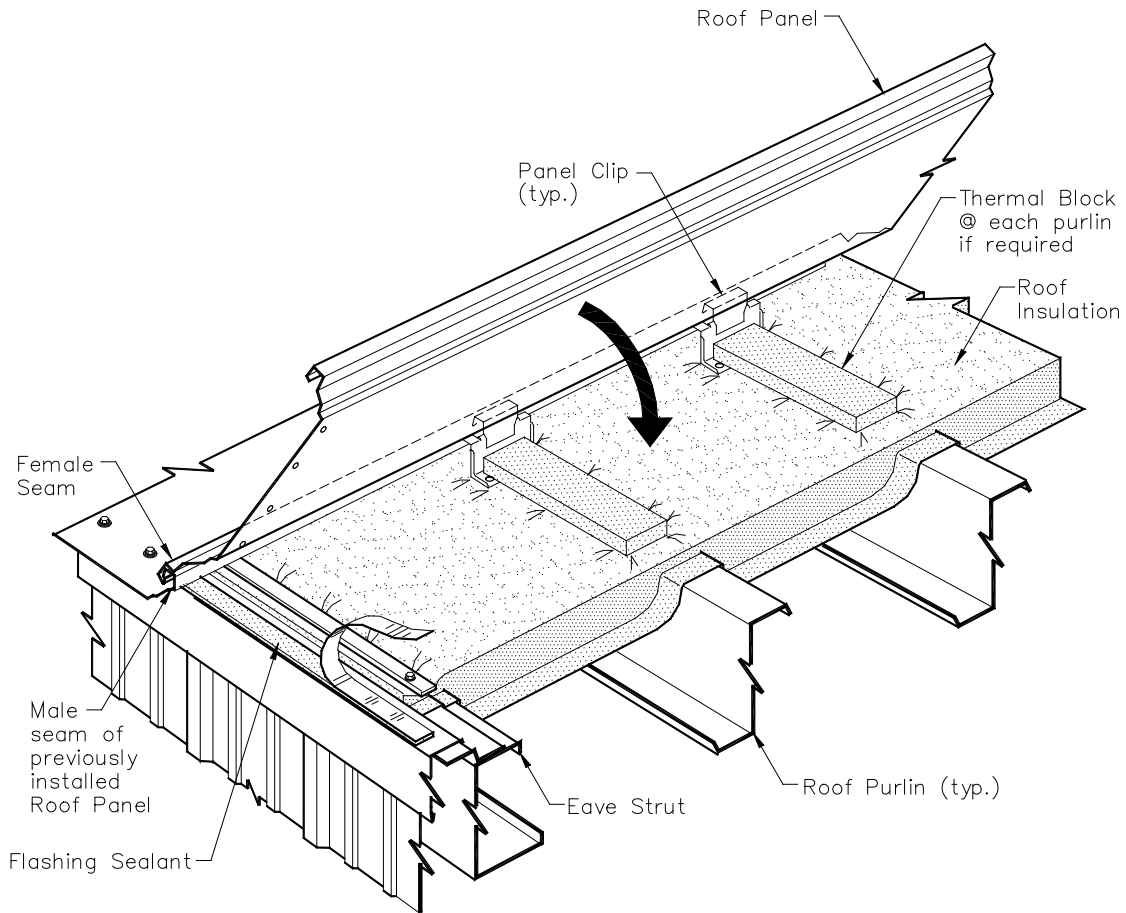
Fold 1/2" of the ridge pigtail sealant under the edge of the roof panel. Cut the other end of the sealant so it sets flush with the bottom edge of the roof panel's seam.

Excess sealant in the seams will cause difficult roof panel assembly. Remove any excess sealant.

After the pigtail sealant is correctly placed, uniformly press the sealant against the panel's surface to assure adhesion.



## 9.6 INSTALL NEXT PANEL RUN



Remove the protective paper from the flashing sealant. Remove only enough of the protective paper to allow installation of the next roof panel.

If required, place the thermal blocks on top of the insulation directly over the roof purlin. On some roof slopes it may be advantageous to use a spray-on adhesive on the thermal block to keep it positioned over the roof structurals until the panel is installed. Thermal blocks are not required at the eave strut.

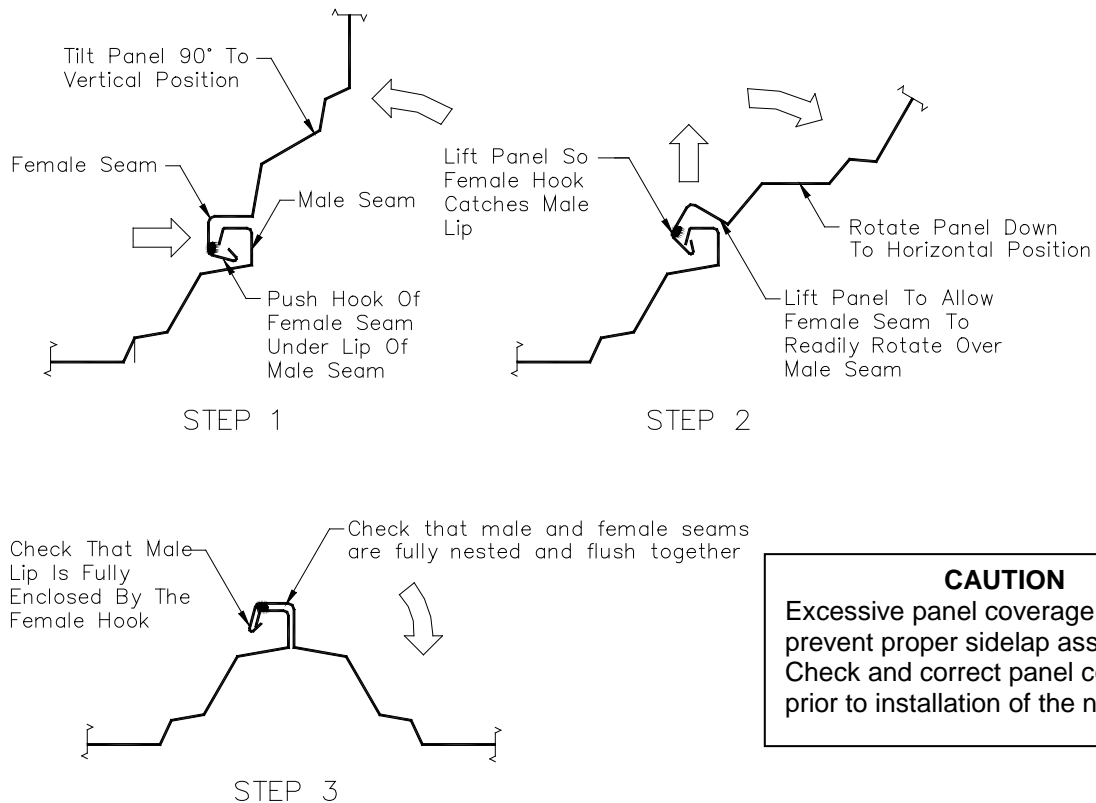
Position the trailing edge of the roof panel over the leading edge of the previously installed roof panel and position the end of the roof panel 4" beyond the eave strut unless another dimension is specified on the erection drawings.

Tilt the panel as shown so the female seam can be hooked over the male seam of the previous roof panel.

Specific roof panel sidelap assembly details are shown on the following page.



## 9.6.1 ENGAGING PANEL SIDELAP



**CAUTION**  
Excessive panel coverage width can prevent proper sidelap assembly. Check and correct panel coverage prior to installation of the next panel

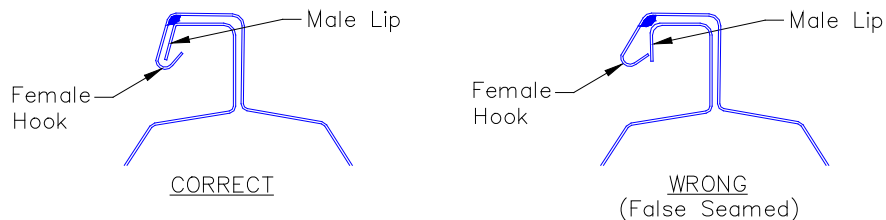
It is easier to hook the roof panel seams together if the roof panel is first tilted up to the vertical position.

With the roof panel in the vertical position, align its female seam to slide under the male seam of the previous roof panel.

With the female seam under the male seam, lift up the roof panel so the female seam's hook catches the lip of the male seam.

While continuing to lift up on the roof panel, rotate the panel down to rest on the insulation or spacer blocks.

Be careful not to scrape off the seam sealant during the sidelap assembly.

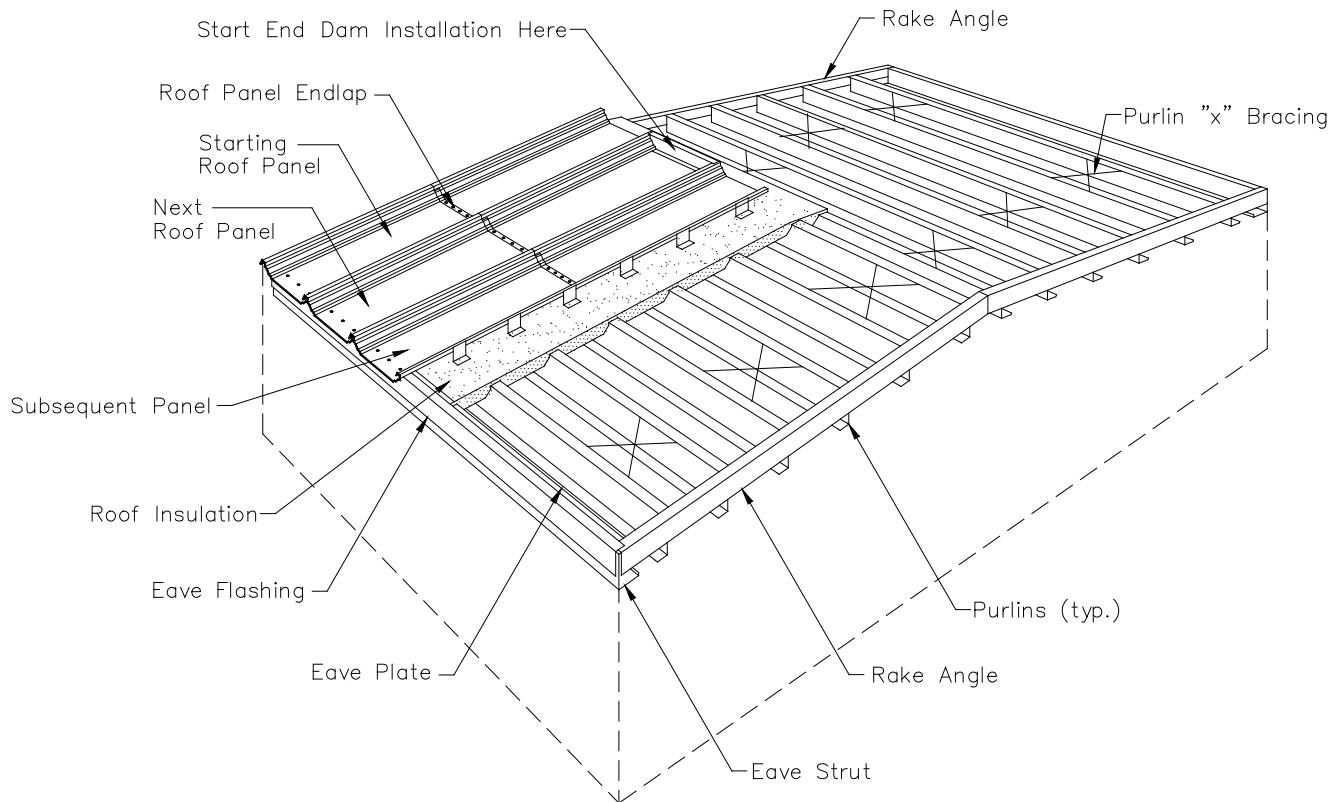


**CAUTION:** A false seam may occur where the female lip does not hook the roof panel's male lip. False seamed roof panels cannot provide their designed loads and maintain the weather tightness resistance. They must be reassembled before installing the next roof panel.



## 9.7 END DAM INSTALLATION

### 9.7.1 ORIENTATION VIEW



Metal end dams are used to close the ends of the roof panels at the ridge, high eave and high eave transition conditions. The details in this section will show roof panel preparation requirements and installation of the end dams.

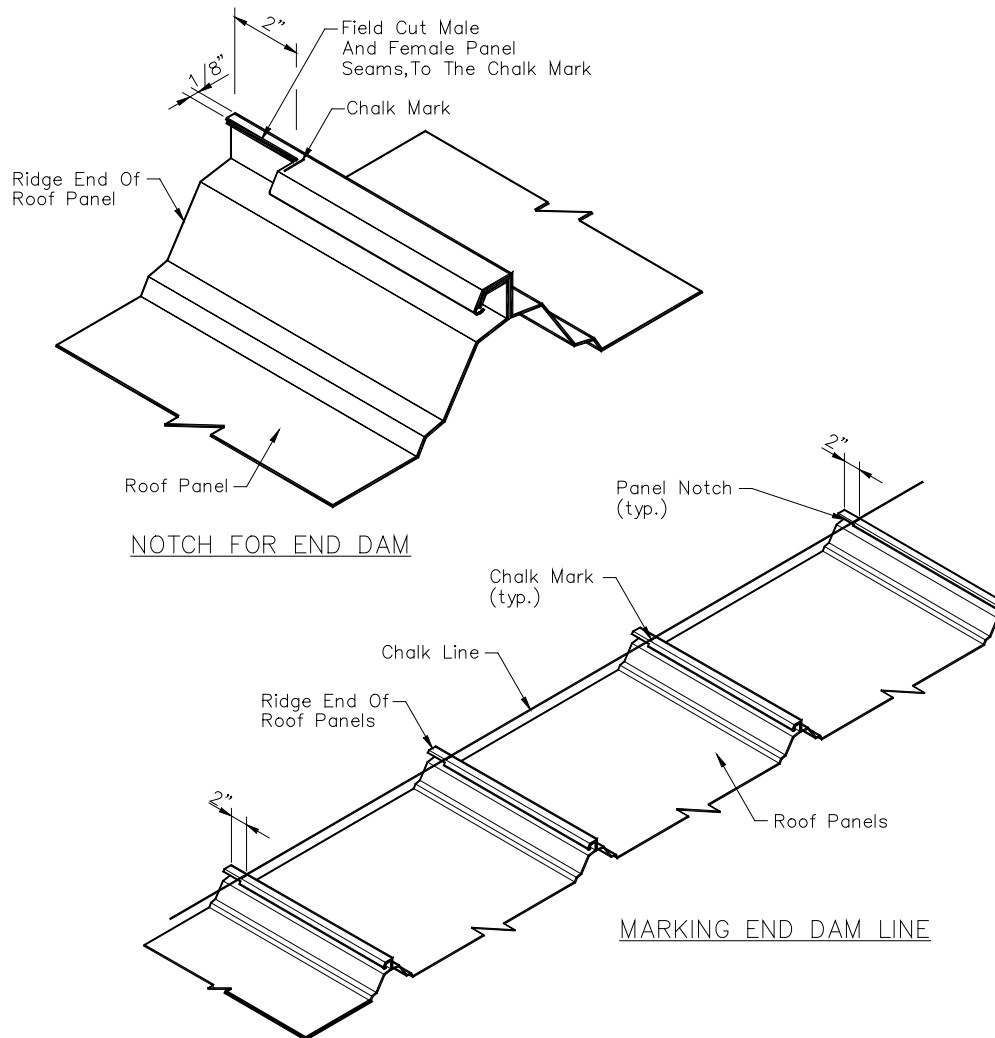
The end dam for the starting roof panel will ONLY be installed after the rake trim is installed.  
The end dam should be installed in a panel run AFTER the next panel run has been installed.

Installation of end dams as each panel run is completed helps to maintain the correct roof panel coverage at the ridge or high eave.

If the end dams are installed after all of the roof panels are in place, roof panel coverage errors may prevent proper installation of the end dams.



## 9.7.2 PREPARATION FOR END DAM INSTALLATION



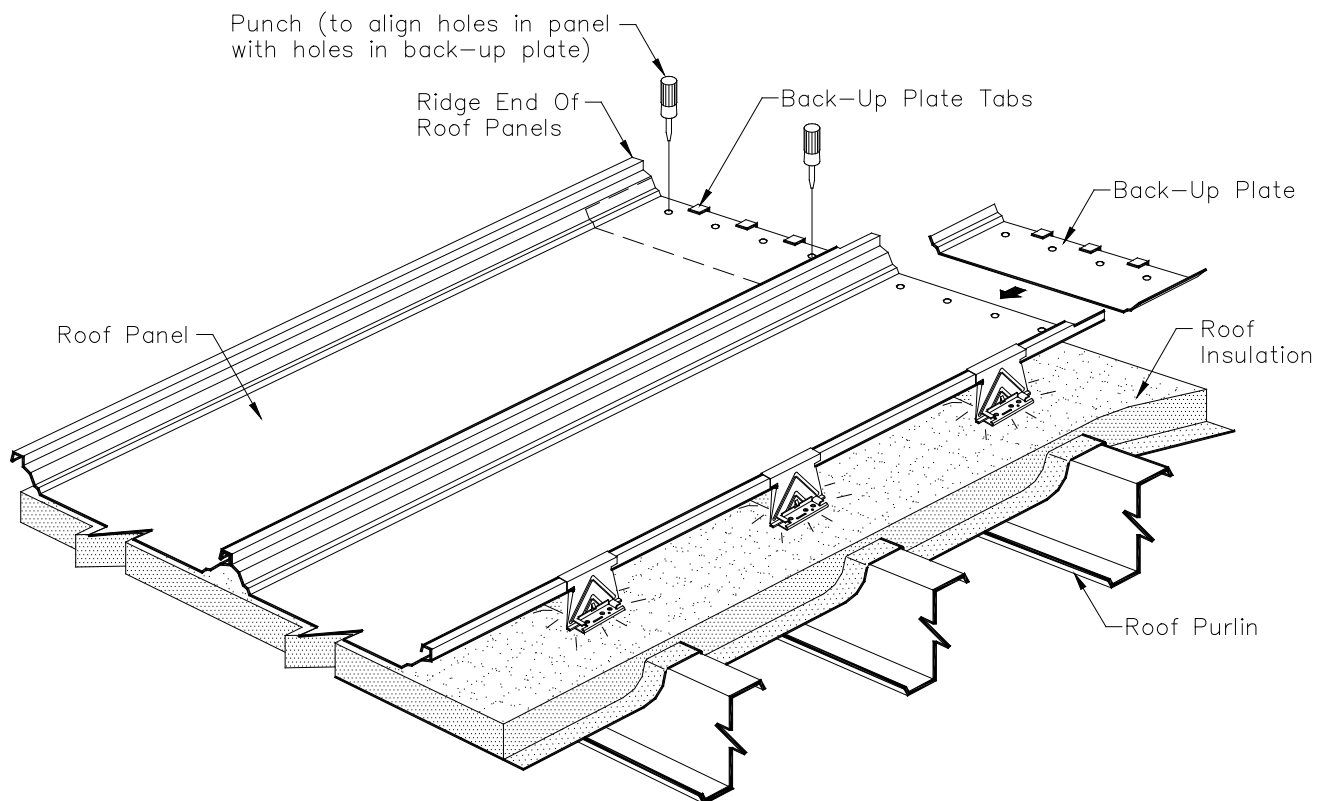
Verify that the roof panel overhang at the (ridge) purlin line is sufficient to complete the ridge or high eave trim detail. See "Panel Overhang Verification" in Section 9.3.3.

Check the alignment of the notches/end dams along the ridge line. If the notches/end dams are staggered more than 1/4", use a chalk line to establish a straight line. Position the chalk line so no notch extends below the line.

Using the end of the factory notch (or chalk marks) as a guide, field cut the additional notching in both male and female portions of the seam as shown.

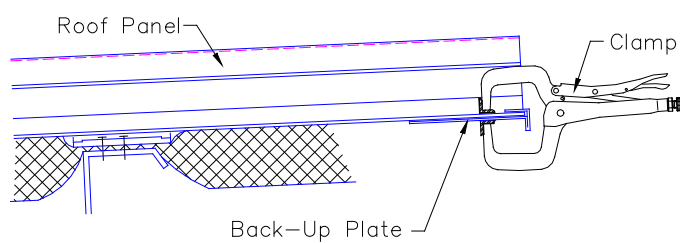


## 9.7.3 INSTALL BACK-UP PLATE



Slide the back-up plate under the roof panel as shown.

The back-up plate must be set over the top of the roof purlin. If thermal blocks are used, the back-up plate must be set over the thermal block.

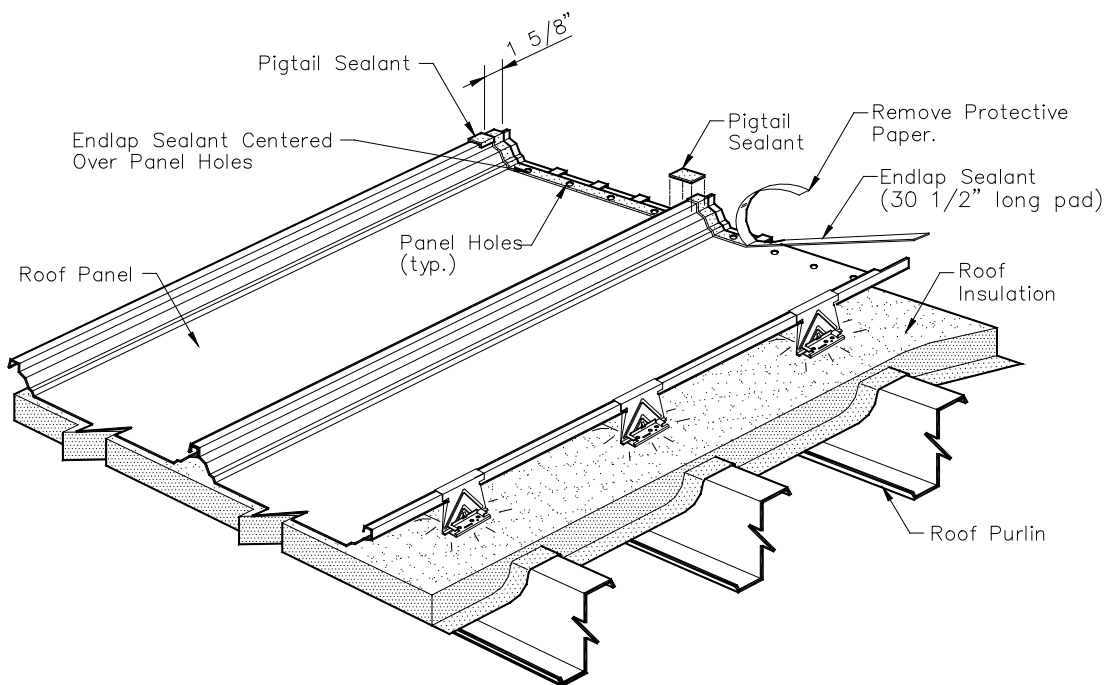


PANEL ENDS AT RIDGE

If the ridge purlin is located too far down slope for the back-up plate to rest on the purlin or thermal block, use a clamp to hold the back-up plate in position until after the fasteners are installed.



## 9.7.4 INSTALL TAPE AND GUN GRADE MASTICS



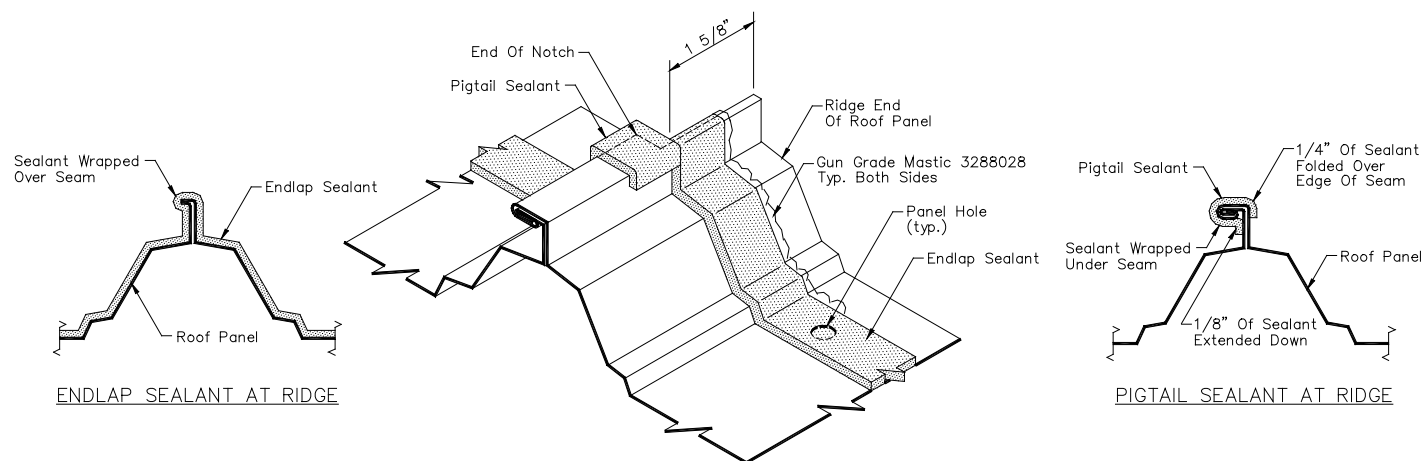
Before installing the endlap sealant, the roof panel's surface must be wiped clean and dry.

Install a continuous strip of endlap sealant along the end of the roof panel as shown.

Position the sealant so that its downslope edge is uniformly 1 5/8" from the end of the panel. The sealant must be centered over the roof panel's factory punched holes.

Check that the sealant fully contacts the roof panel's surface and that it is completely fitted into the panel corners and around the seams

Cut a strip of flashing sealant and install as the pigtail sealant as shown.



The correct installation of the ridge sealant is critical to the weather resistance of the roof system.

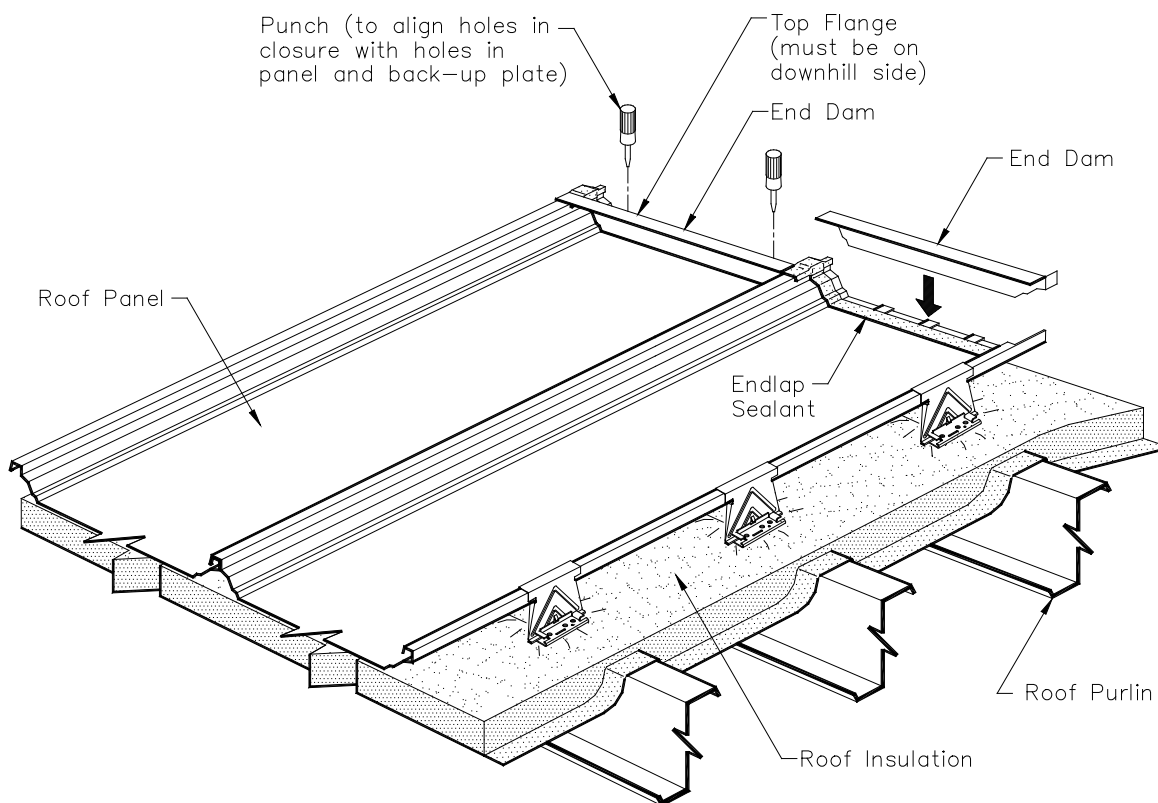
Be sure to verify that the sealant is installed as shown above before installing end dams.

After the sealant is correctly positioned, uniformly press the sealant against the roof panel's surface to assure adhesion. Do not use excess pressure, which can thin the sealant.





## 9.7.5 INSTALL END DAM



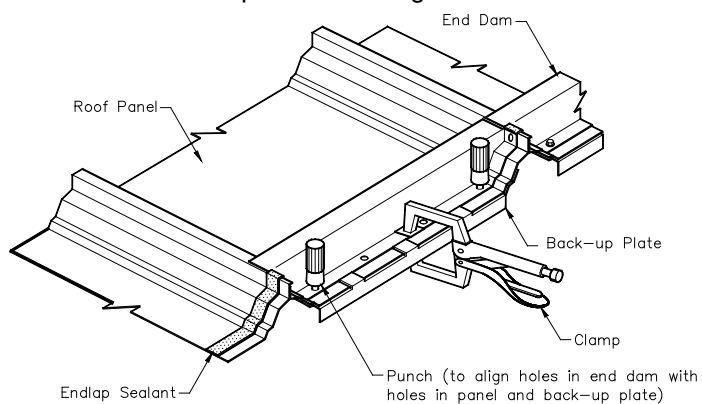
Wipe dry and clean the underside surface of the end dam flanges.

Remove the protective paper from the installed endlap sealant at the ridge.

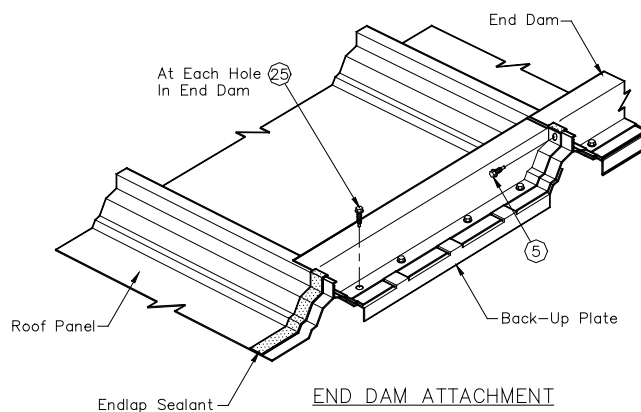
Position the end dam so its bottom flange is turned up-slope and its top flange is downslope.

Position the end dam's bottom flange directly over the endlap sealant and use punches to align the holes in the end dam with the factory punched holes in the roof panel and back-up plate.

Be careful not to displace or damage the sealant while installing the end dam and punches.



END DAM ALIGNMENT



END DAM ATTACHMENT



## Behlen ZL-24® Roof System Installation Guide

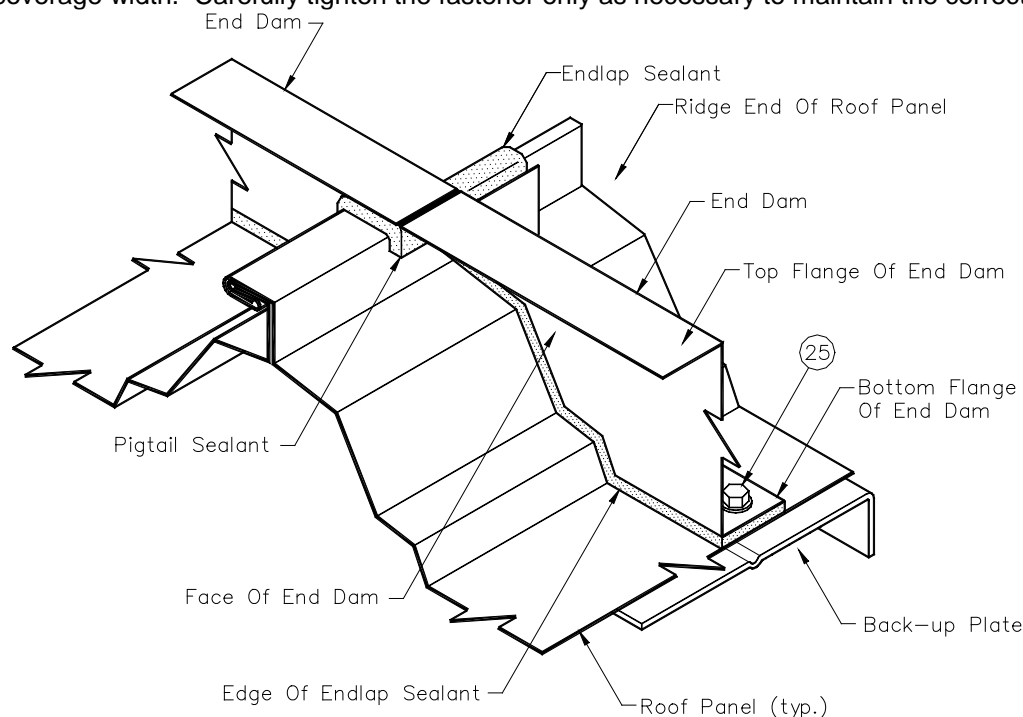
While the matching holes are aligned by the punches, uniformly press the end dam into the endlap sealant to assure adhesion. Use a clamp to hold the assembly together while installing the fasteners.

Install ②⑤ self-tapping screws through the holes in the end dam's bottom flange.

Check that the fasteners penetrate through the center of the endlap sealant and are securely engaged into the back-up plate.

Check that the face of the end dam is perpendicular to the roof panel and aligned with the previously installed end dams. If not, push the top of the end dam to the correct position.

Install a ⑤ self-drilling screw through the hole at the top of the end dam, through the roof panel seam and into the opposite end dam. Over tightening this fastener will squeeze the roof panel sidelap assembly together and may affect the roof panels coverage width. Carefully tighten the fastener only as necessary to maintain the correct panel width.



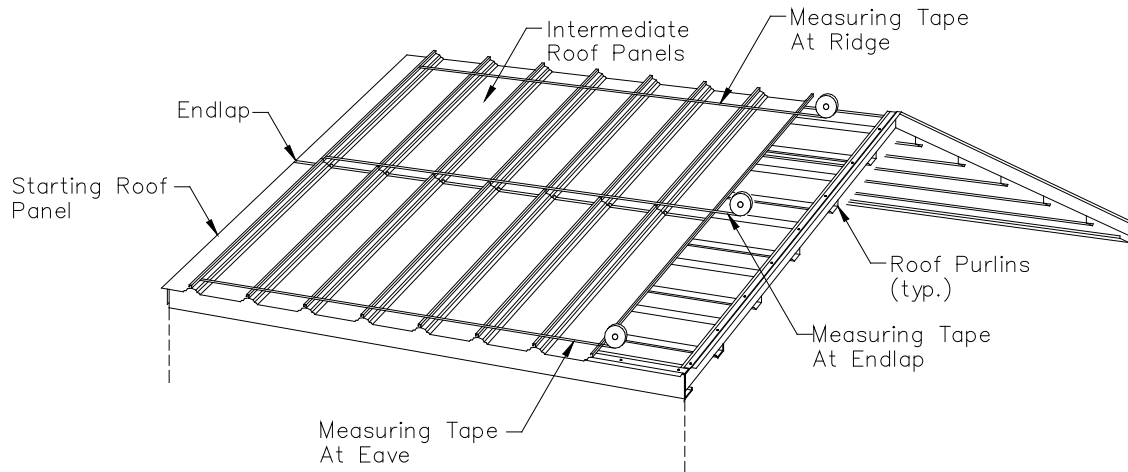
Verify that the end dam is correctly assembled as shown.

Check that there are no un-sealed voids between the roof panel and the end dam, especially in the critical areas around the roof panel ribs and seams.

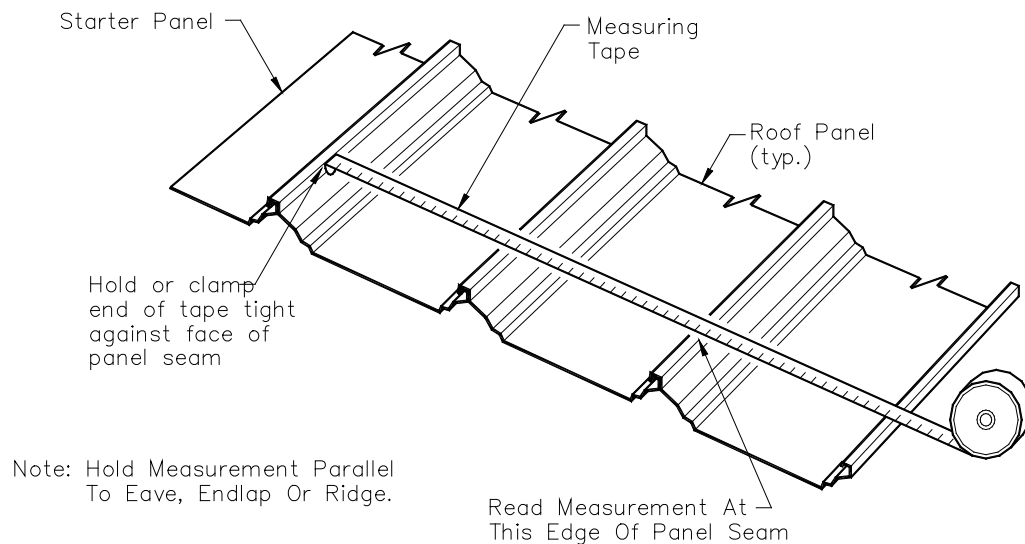


## 9.8 INSTALLING SUBSEQUENT PANEL RUNS

### 9.8.1 CHECKING PANEL COVERAGE



CHECKING PANEL COVERAGE



PANEL COVERAGE MEASUREMENT

**Caution:** To assure proper fit-up of the sidelap assembly, proper seaming, proper fit-up of closures, flashing, curbs, etc., it is important that each panel be held to within the 1/8" panel coverage tolerance and that overall coverage be checked frequently and any coverage error be corrected before it accumulates.

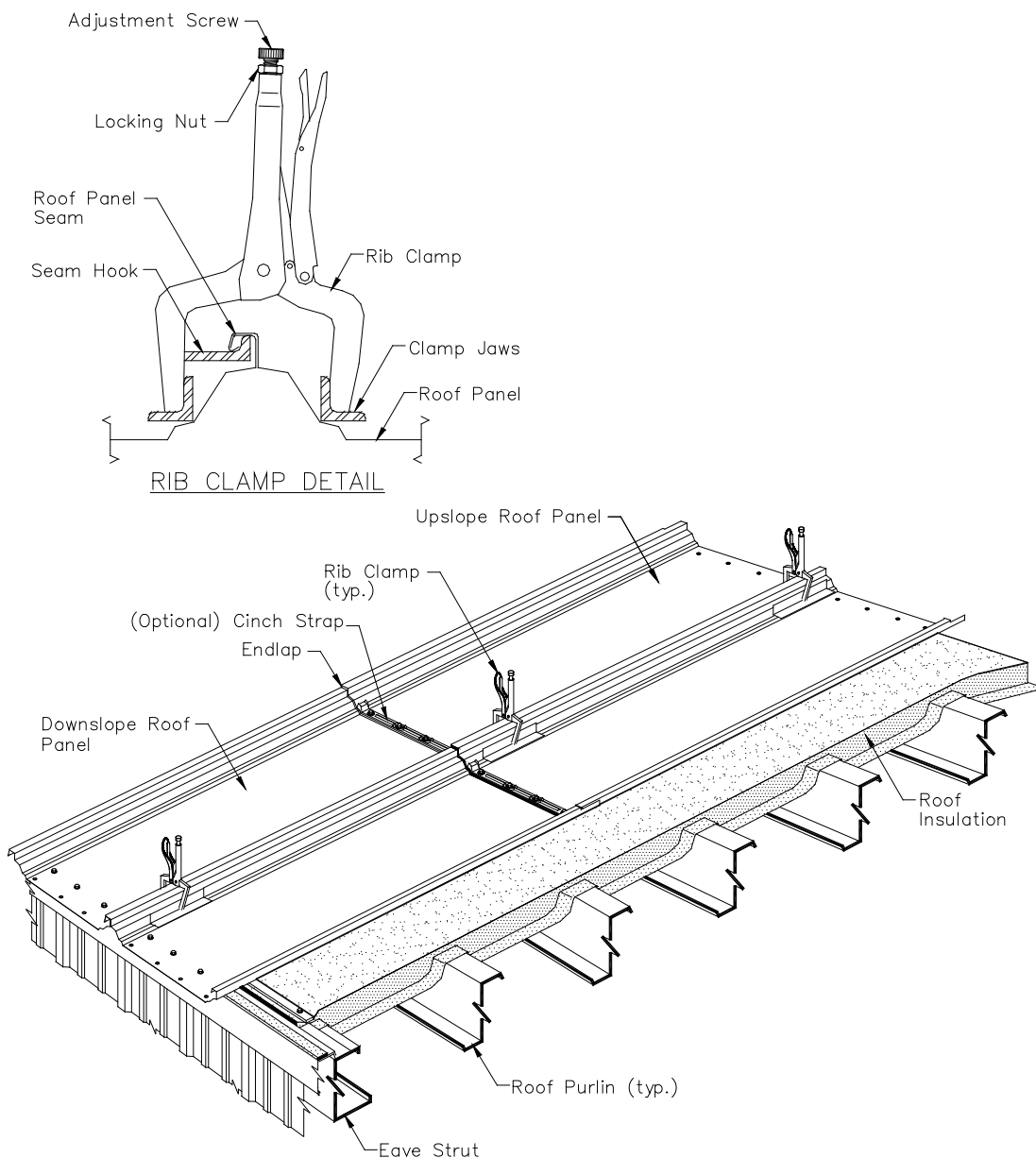
Coverage must be checked at the eave and ridge and at every endlap.

To avoid accumulation error, the coverage measurement should always be from the rake line or the starting roof panel's seam.

To avoid measurement error, the measuring tape must be free and taut and must be parallel to the eave line or ridge line.



## 9.8.2 ADJUSTING PANEL COVERAGE



The most common coverage error is the spreading of the roof panels, especially at the panel ends. This can cause excess panel coverage along the eave, endlaps and ridge.

To correct excess roof panel coverage, use rib clamps to squeeze together the panel ribs as shown.

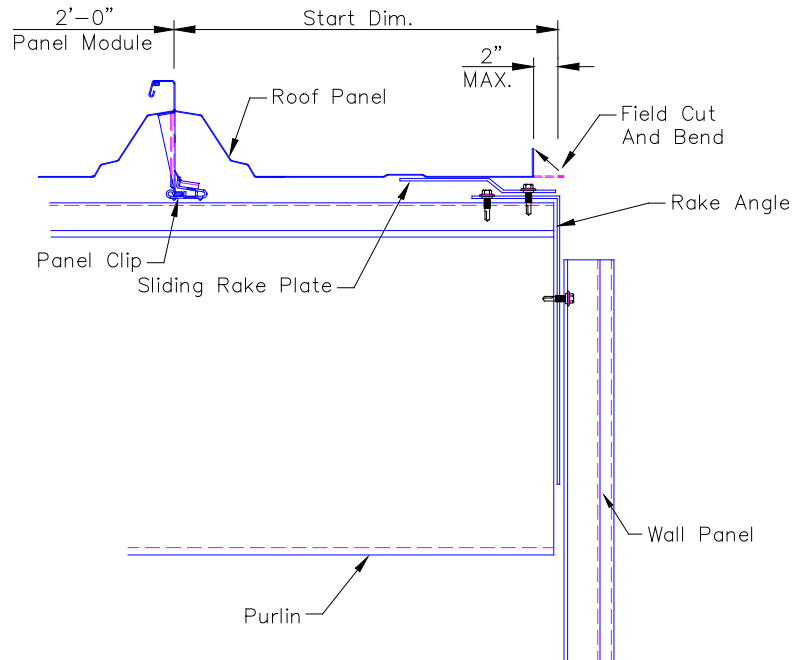
The rib clamps can be adjusted and locked so that they will squeeze the panel ribs to provide a consistent coverage width.

If excessive coverage has accumulated over several panel runs, do not try to correct all of the error at one time. Corrected roof panel coverage must not be greater than 1/8" per panel. Correct accumulated coverage error by making the correction over several panel runs.

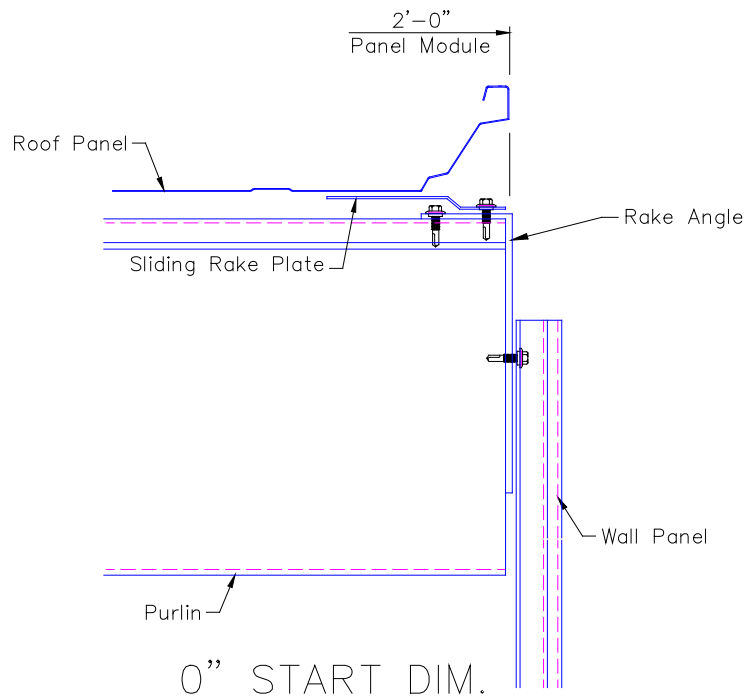


## 9.9 TERMINATION PANEL INSTALLATION

### 9.9.1 INSTALL LAST PANEL RUN



START DIM. GREATER THAN 0"



0" START DIM.

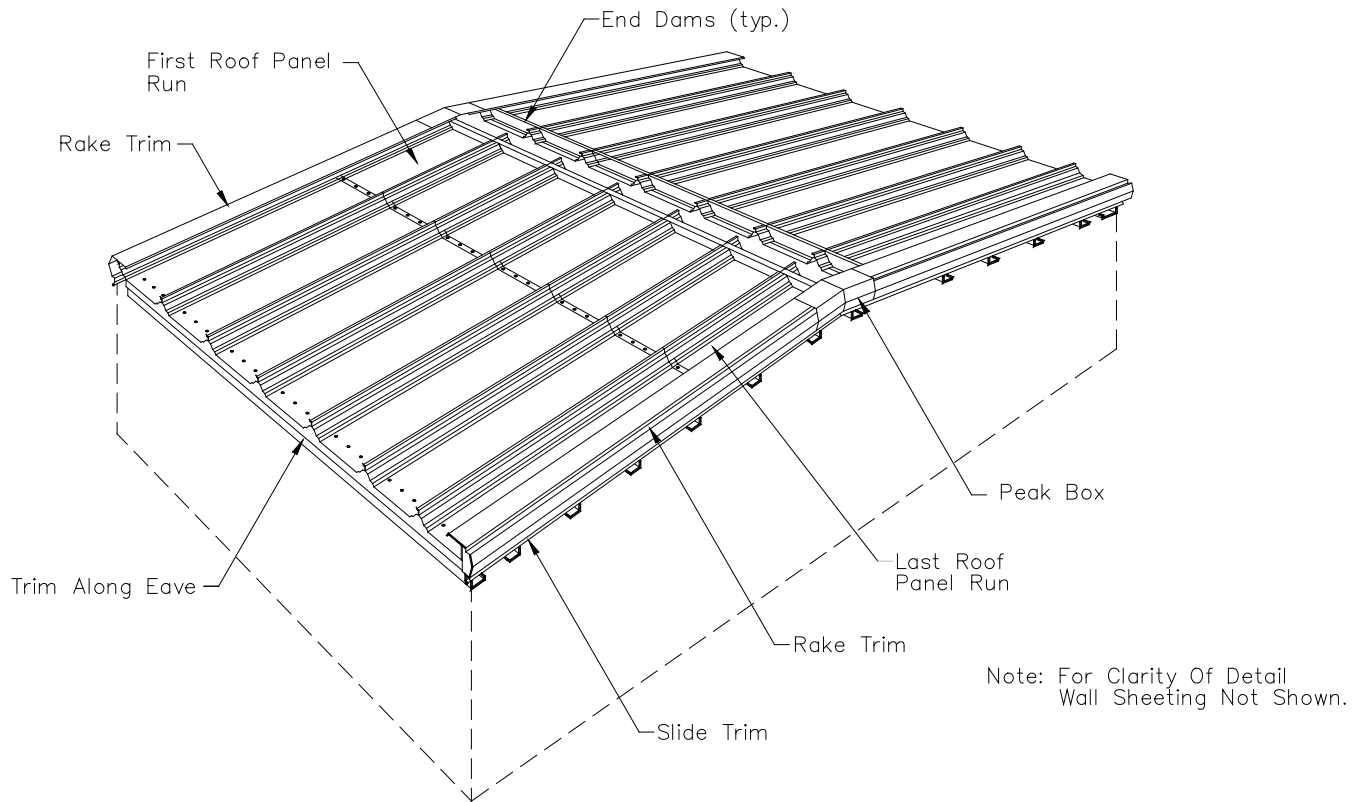
The position of the last panel in relationship to the endwall rake angle is critical. Check the erection set of plans for possible "START DIMENSION" and if field cutting of the last panel is required. If the panel is to be field cut, allow for a minimum 1" bent-up leg along the cut edge.

The last panel edge should not extend beyond the outer edge of the rake and no more than 2" short of the rake.



## 9.10 RAKE TRIM INSTALLATION

### 9.10.1 ORIENTATION VIEW

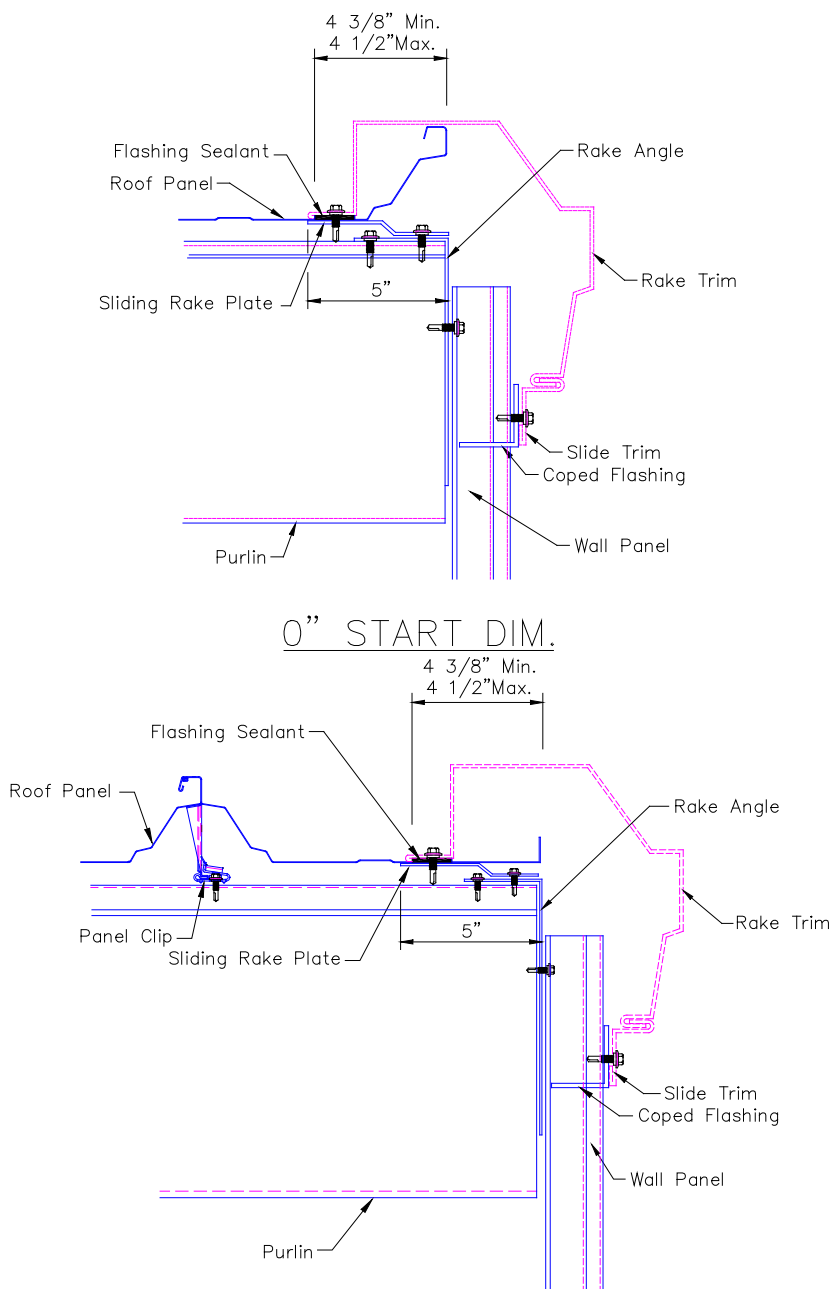


The details in this section show installation of rake trim along the last panel run, having a 0" start dimension.

This information can be applied to rake trim along the first panel run at the other endwall and/or roof panel runs with a start dimension greater than 0".



## 9.10.2 INSTALL FLASHING SEALANT ALONG RAKE



### START DIM. GREATER THAN 0"

Prior to installing flashing sealant along the endwall rake, wipe the top surface of the roof panel clean and dry. The flashing sealant must be positioned directly over the sliding rake plate's top flange. Lay out the sealant location on the panel's top surface with a chalk line.

Position the edge of the sealant on the chalk line. Start and finish the ends of the sealant flush with the ends of the roof panel.

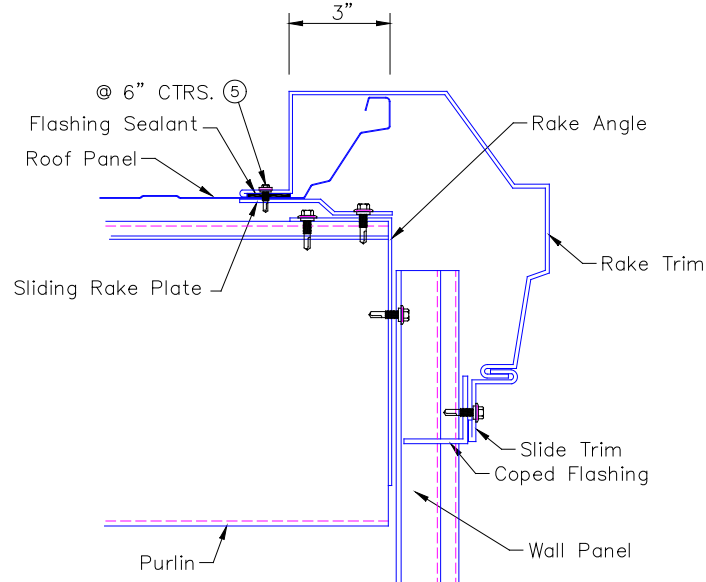
Check the entire length of the sealant to assure that it is correctly positioned and that there are no voids or thinned areas.

After the sealant has been correctly installed, lightly press the sealant against the roof panel to assure adhesion. Do not use excess pressure which can thin the sealant.



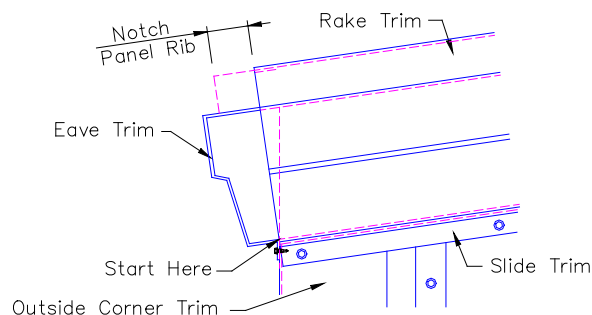
## 9.10.3 START RAKE TRIM AT EAVE

Prior to installing the first section of rake trim, position the rake trim at the corner, as shown below, to determine if and how much of the major rib on the panel extends beyond the end of the rake trim. Field notch or remove the **MAJOR RIB** on the panel so that the end cap can be installed later.

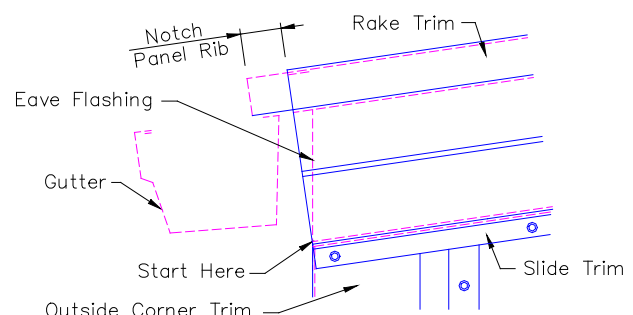


Remove protective paper from flashing sealant and position lip on the rake trim over the sealant as shown above.

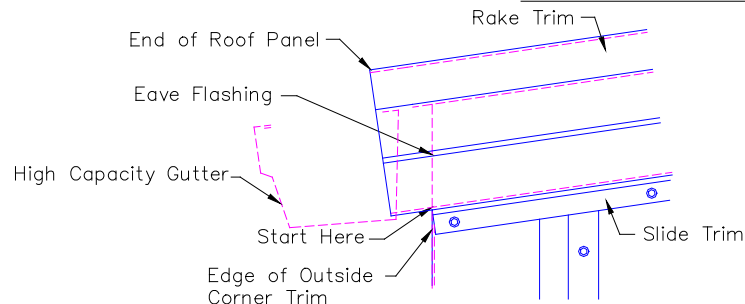
Start the downslope end of the rake trim and slide trim at the edge of the outside corner trim when eave trim or standard size gutter is used along the sidewall eave. When high capacity gutter is used along the sidewall eave, the rake trim should start at the end of the roof panel and the slide trim should start at the edge of the outside corner trim.



SIDEWALL WITH EAVE TRIM



SIDEWALL WITH STANDARD SIZE GUTTER



EAVE FLASHING AND HIGH CAPACITY GUTTER ON SIDEWALL

Check that the rake trim is properly aligned with the face of the wall panel.

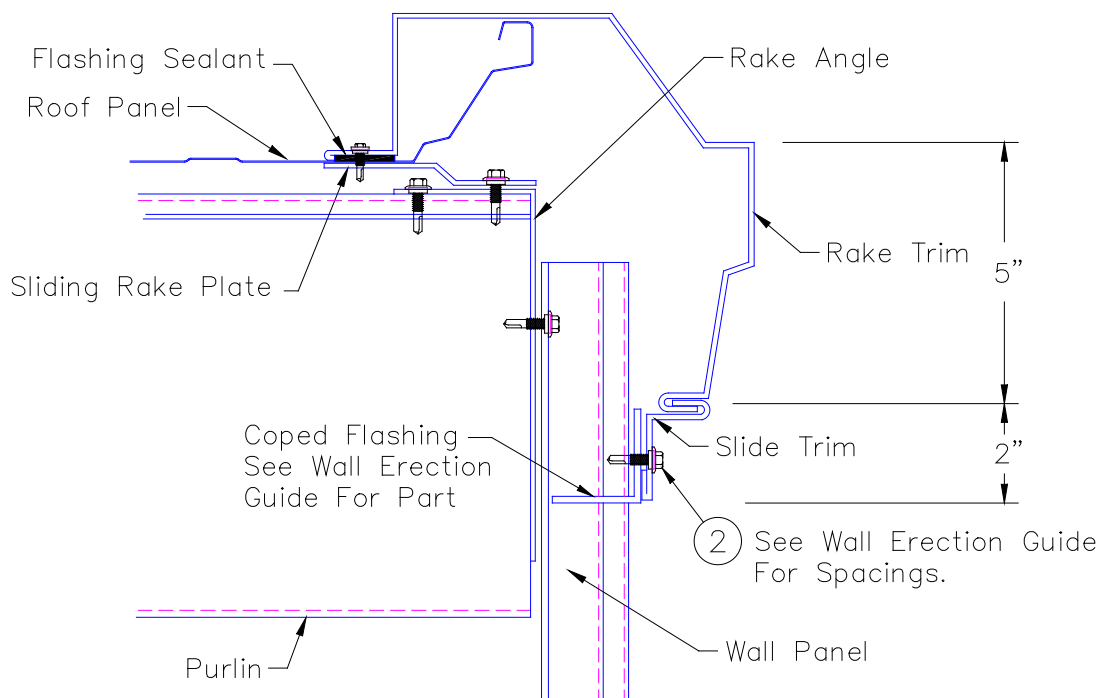
Fasten the rake trim to the roof panel/sliding rake plate with self-drilling screws at 6" centers. **BE SURE FASTENERS DO NOT PENETRATE THE ROOF PURLINS**, must clear roof members by 2".

Check that the fasteners penetrate the center of the sealant and securely engage the panel/sliding rake plate.





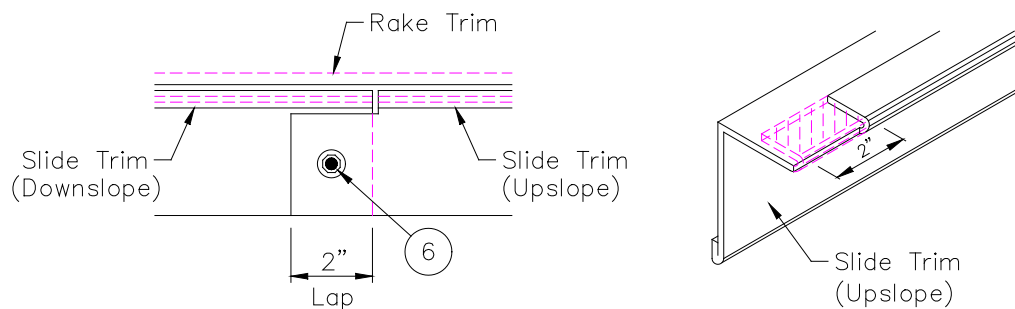
## 9.10.4 INSTALL SLIDE TRIM



After installing rake trim to roof panel, install the slide trim starting at the edge of the outside corner trim and running continuous along the bottom edge of the rake trim as shown above.

Position the coped flashing behind the slide trim before installing ② self-drilling screws. The slide trim will allow for the roof to expand and contract.

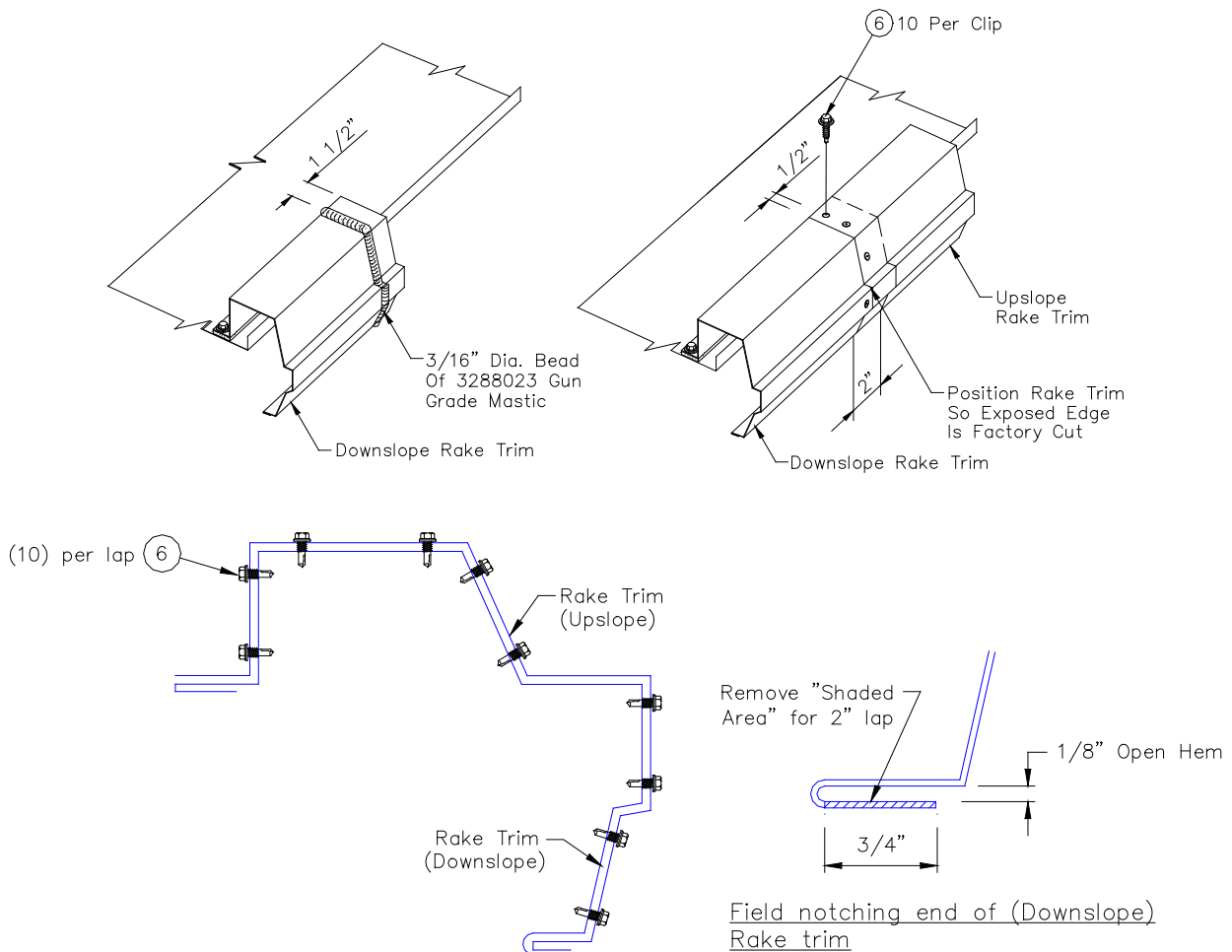
In all cases, the bottom edge of the rake trim/slide trim must be installed straight and parallel to the roof line.



Lap ends of slide trim by field notching 2" and secure with ⑥ trim screw.



## 9.10.5 RAKE TRIM ENDLAP

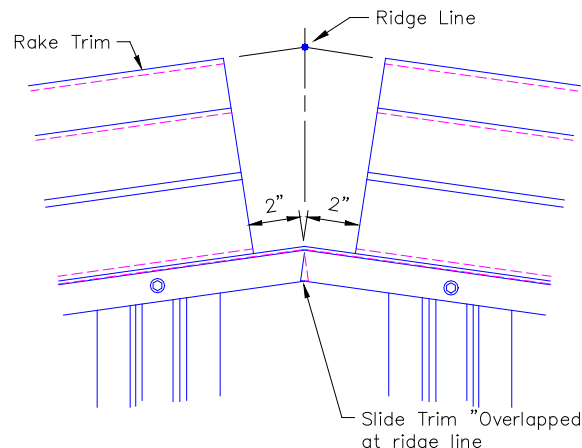


Install the rake trim from eave to ridge to provide for watershed at the splices.

Lap ends of rake trims 2" use bead of gun grade mastic and (10) ⑥ trim screws to secure endlap.

Field notch end of downslope rake trim for 2" lap.

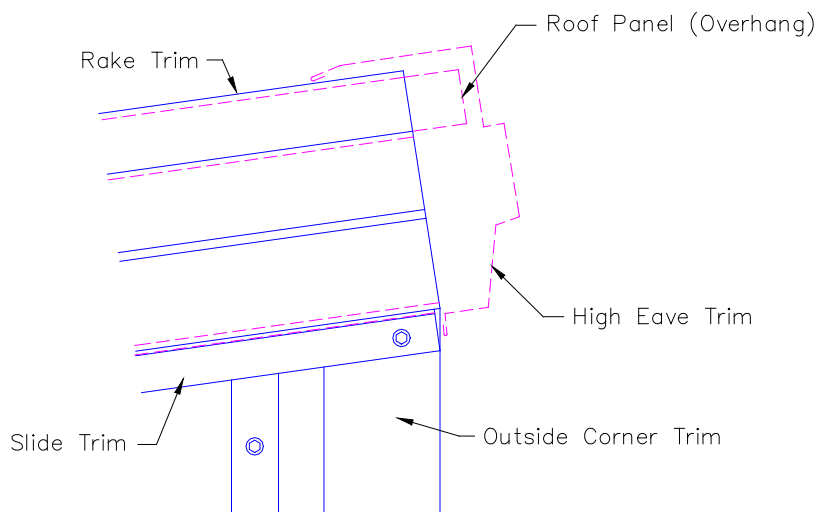
## 9.10.6 ENDING RAKE TRIM AT RIDGE



When installing rake trims on a building, trims will start "flush" with the outside edge of corner trims and stop "short" of the ridge line by 2" to allow for roof expansion.



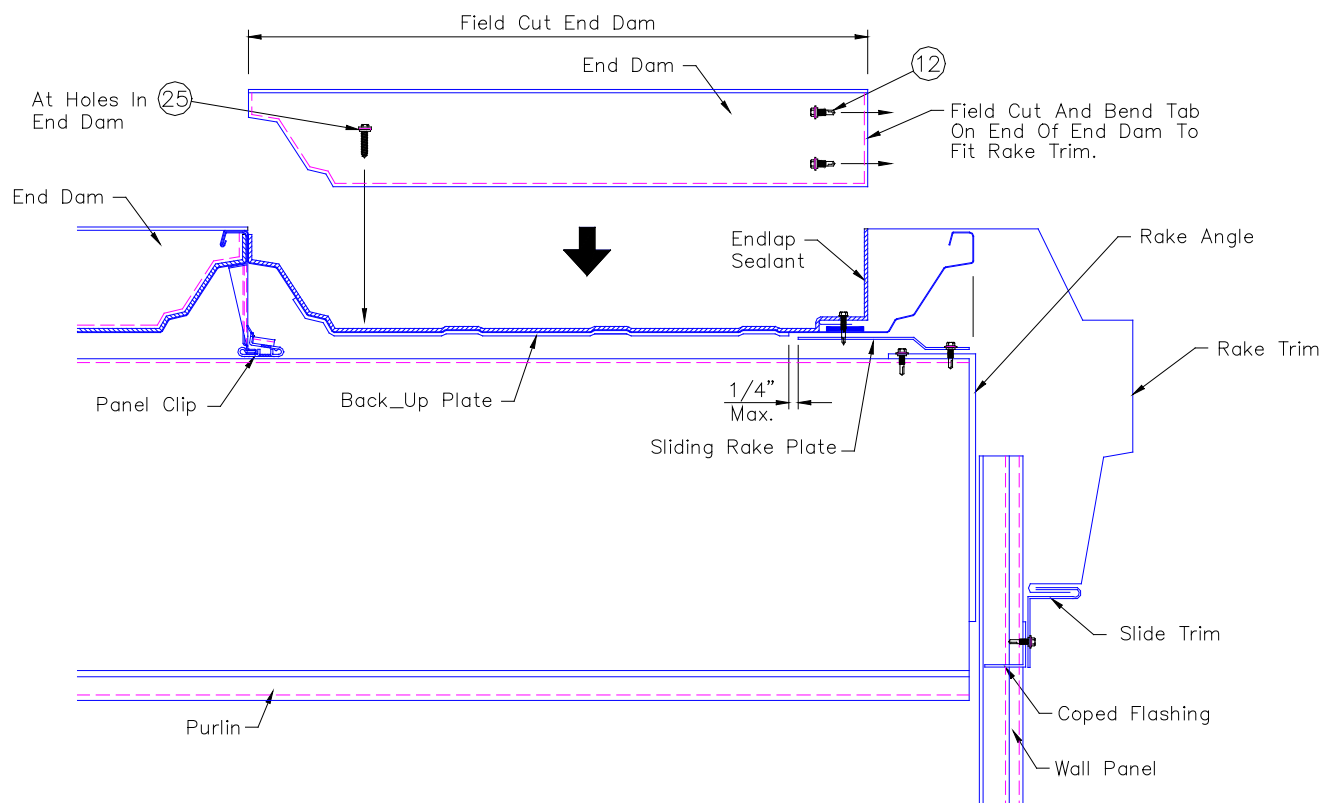
## 9.10.7 ENDING RAKE AT HIGH EAVE



On single slope buildings, the rake trim will stop at the edge of the outside corner trim at the high eave line.

## 9.10.8 TERMINATION OF END DAMS AT RAKE

Once the rake trim is installed at the ridge line or high eave, the end dam and back-up plate can be installed.



The back-up plate must be field modified to clear the sliding rake plate.

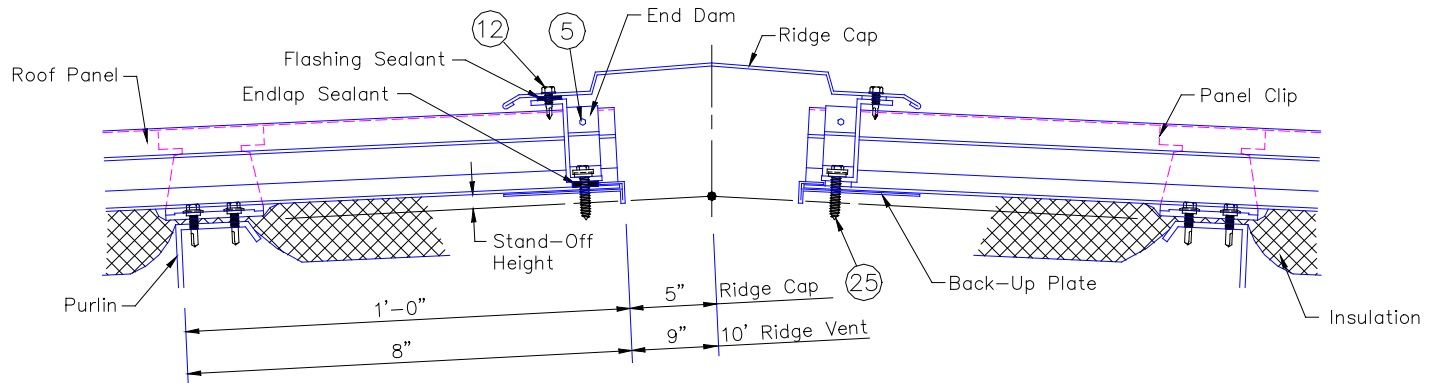
Install the endlap sealant to extend up the face of the rake as shown.

An end dam must be field modified to fit between the roof panel rib and the rake trim.



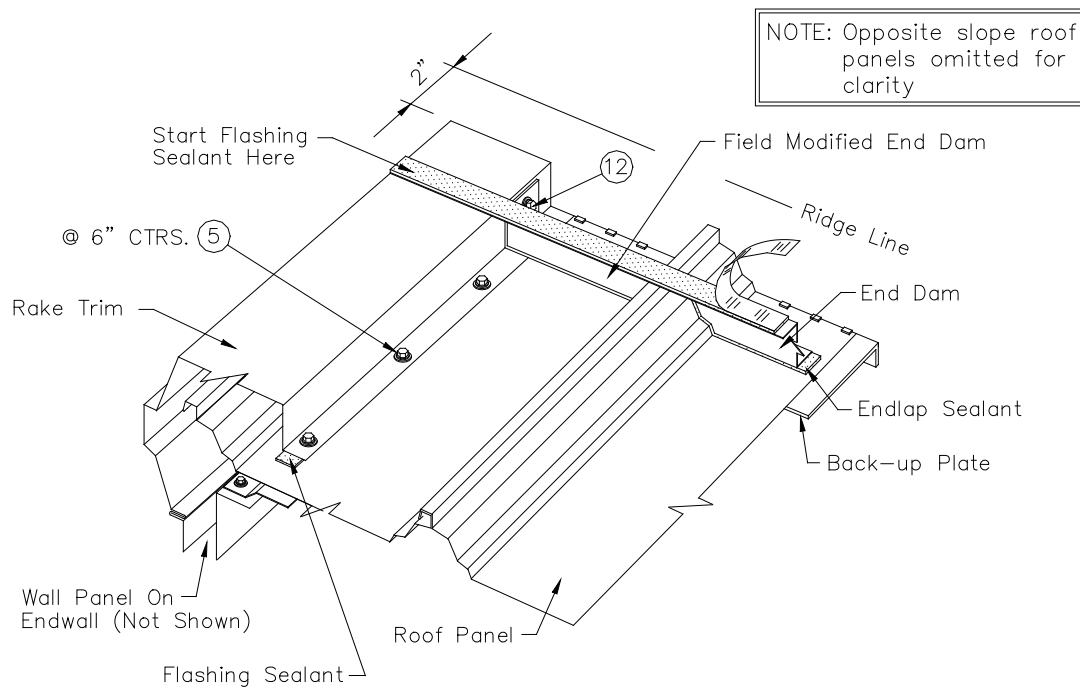
## 9.11 RIDGE CAP INSTALLATION

### 9.11.1 RIDGE PANEL OVERHANG VERIFICATION



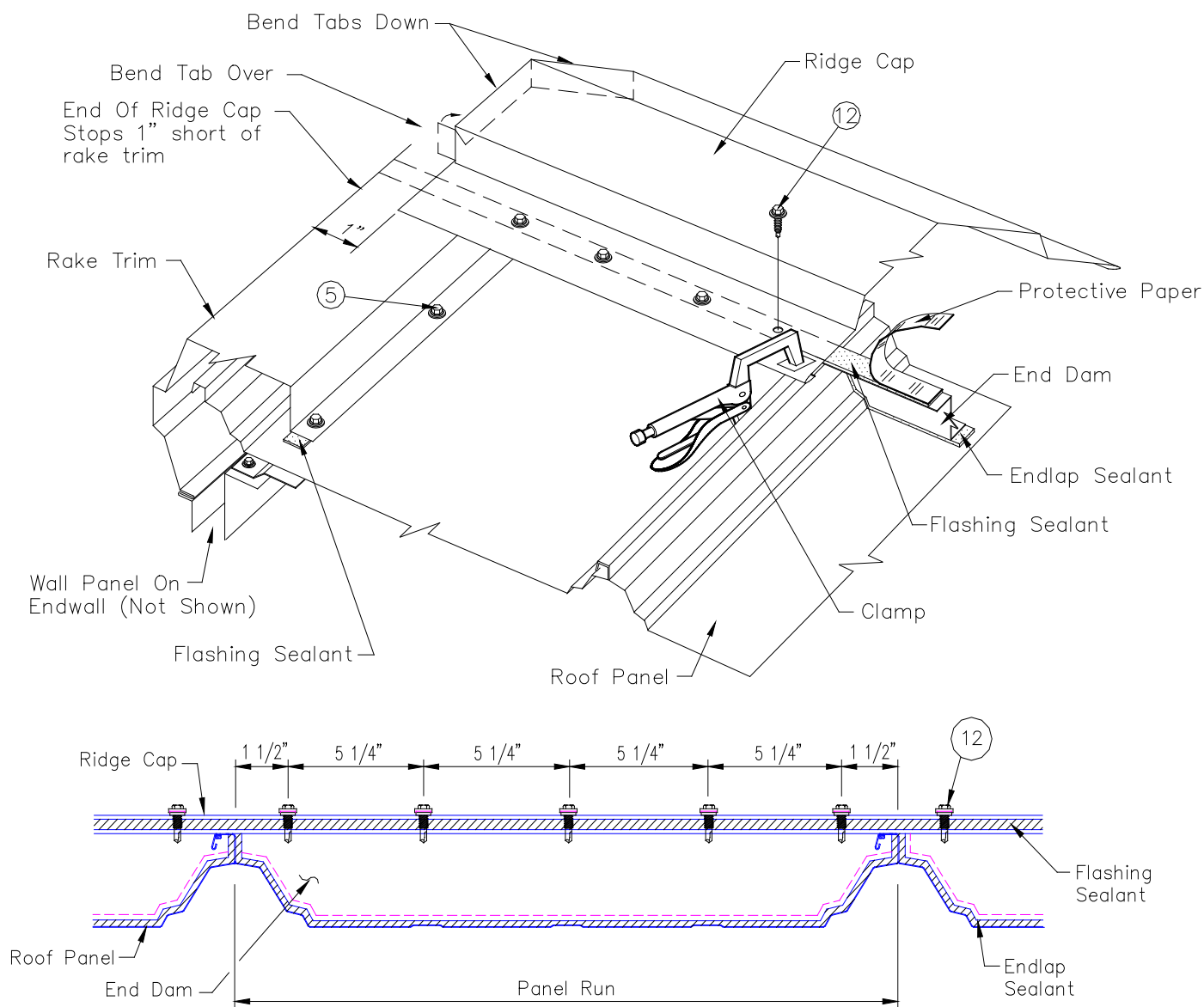
Verify that the roof panel overhang at the ridge represents the building conditions being erected.

### 9.11.2 STARTING AT RAKE



Assure rake trim is held back 2" from the centerline/ridgeline on both sides.

Apply tape sealant as shown in detail (above) on both sides of ridge.



## SCREW PATTERN

Install the ridge cap to span across the opposing end dams run as shown.

Bend tabs at the end of the ridge cap before attaching the membrane. Cut slits 1" long at 5 locations and field bend down tabs to form smooth edge for membrane to rest against.

Position the end of the ridge cap 1" short of the rake trim.

Align the center of the ridge cap over the ridge centerline. Use a string line to assure a straight ridge cap installation.

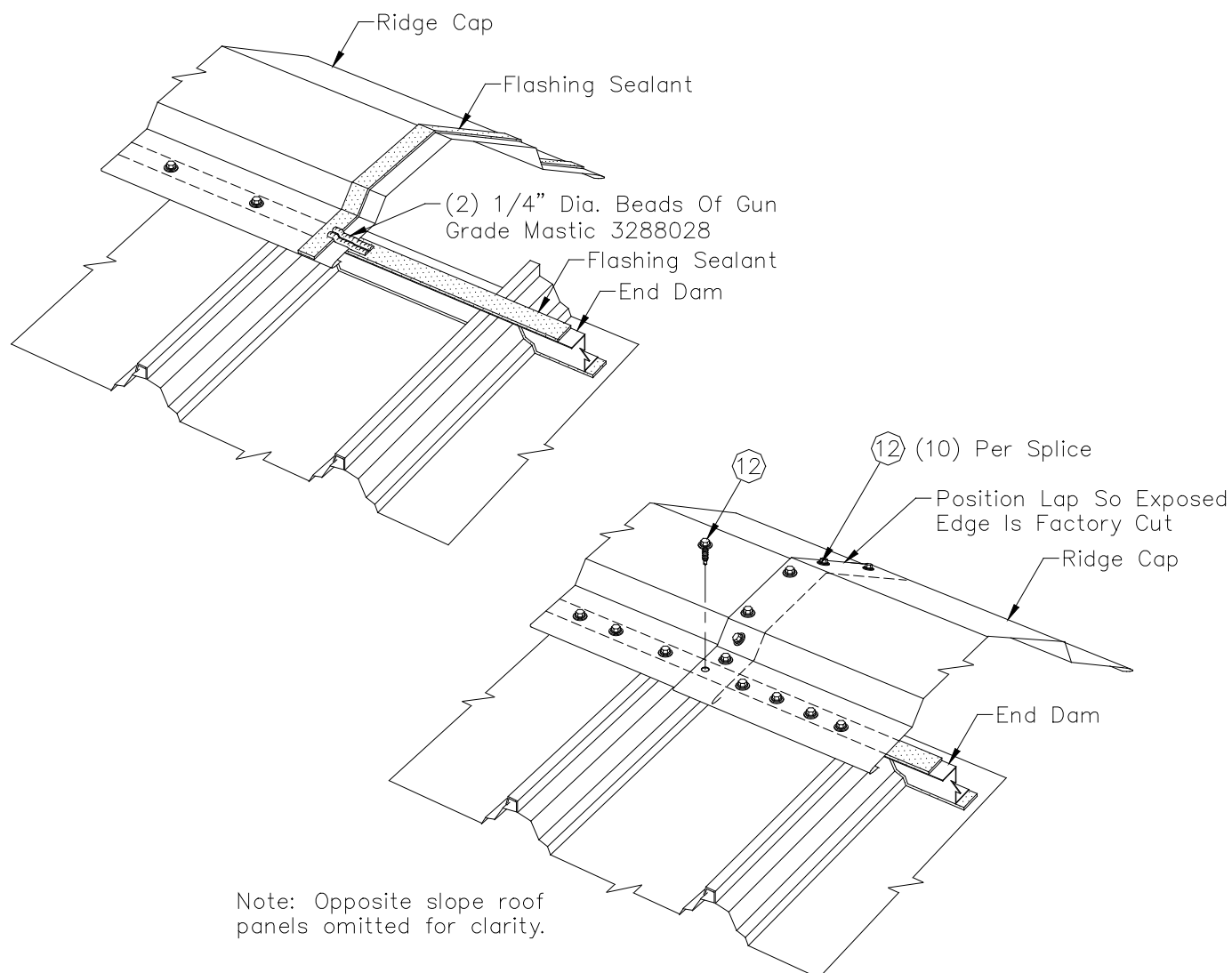
Fasten the ridge cap to the end dams with ⑫ self-drilling screw spaced as shown. Check that the fasteners penetrate the center of the sealant and securely engage the end dams.

**Important: To provide watershed, the ridge cap must have a positive pitch, even during roof panel contraction.**

To increase the ridge cap's pitch, first fasten only one edge of the ridge cap, then push on the opposite edge of the ridge cap to deflect its center upward. Hold it in position with clamps while fastening the outer edges. Avoid making contact with the tape mastic before pushing, then set in place.



## 9.11.3 RIDGE CAP ENDLAP



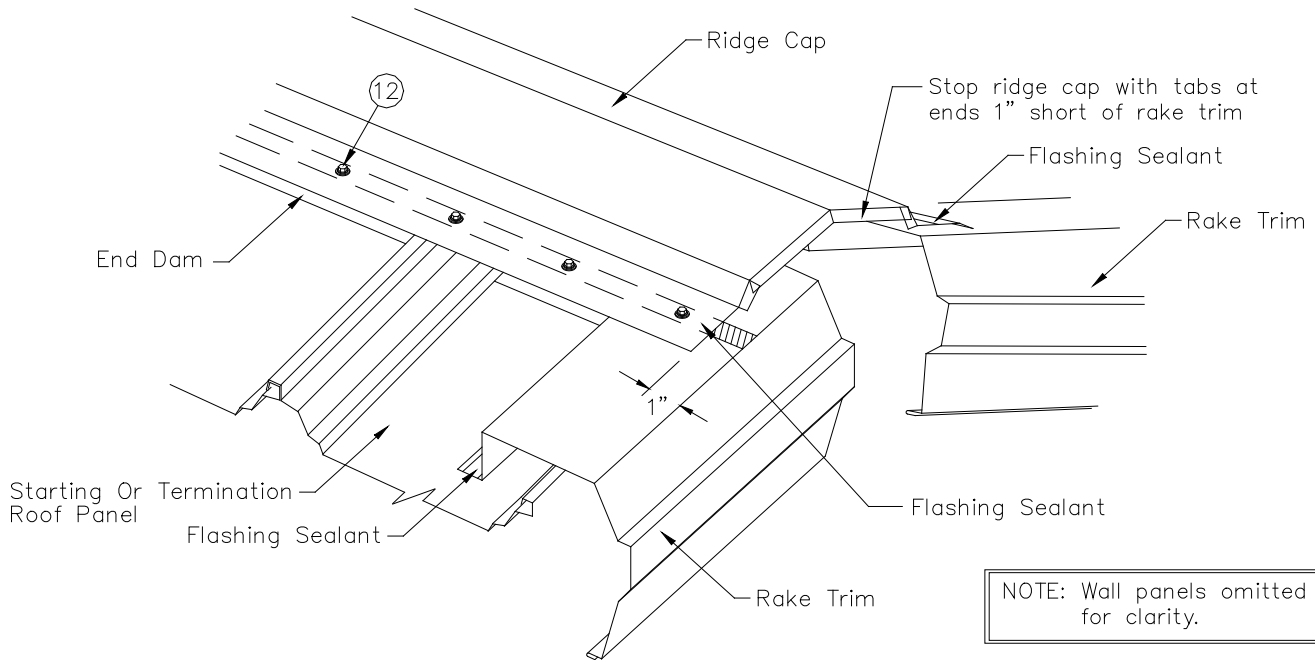
Assemble the ridge cap splices with tape sealant and ⑫ self-drilling screws as shown.

**Important:** The splice fasteners must be installed carefully to avoid downward deflection and buckling of the ridge cover ends.

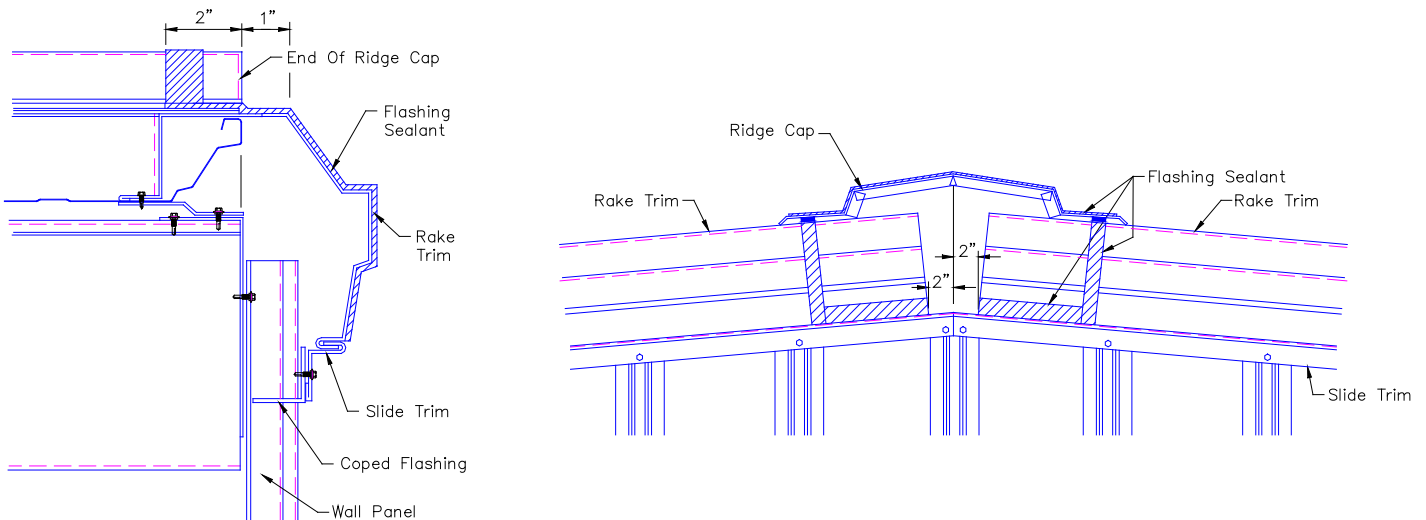


## 9.12 TERMINATION OF RIDGE AT RAKE

### 9.12.1 INSTALLING TAPE SEALANT



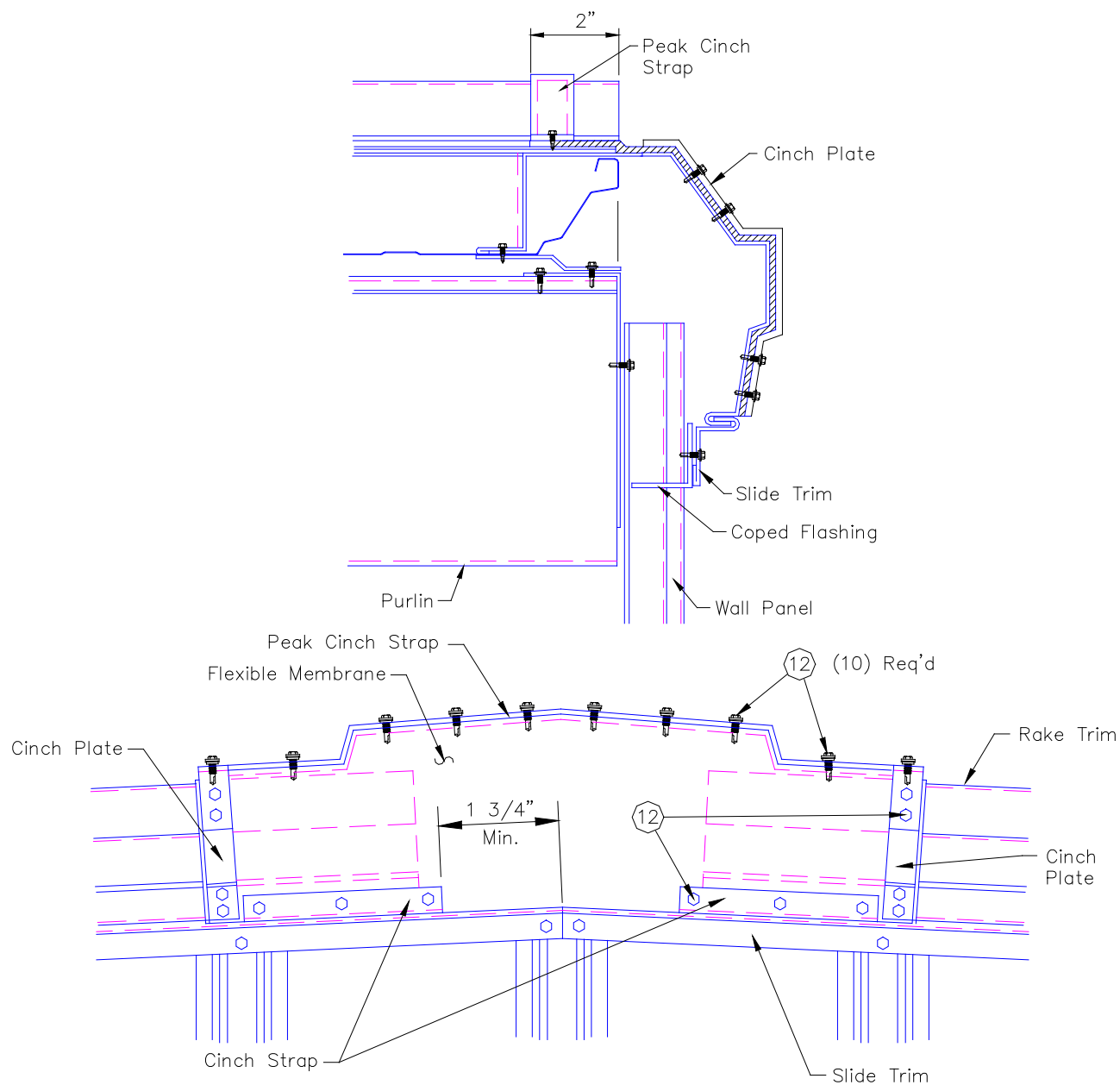
Assure that the rake trim is held back 2" from center of peak on both sides and that the 1" tabs have been bent down on the end of the ridge cap.



Apply flashing sealant across the ridge cap, then downwards along the front face of the rake trim then along the lower edge of the trim as shown above.



## 9.12.2 POSITION AND SECURE FLEXIBLE MEMBRANE

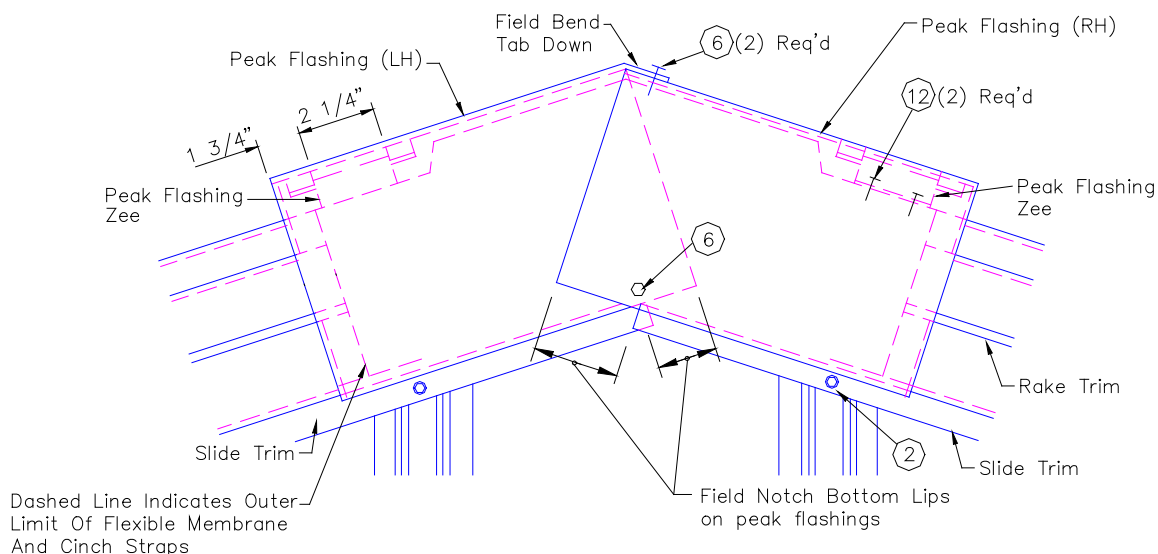
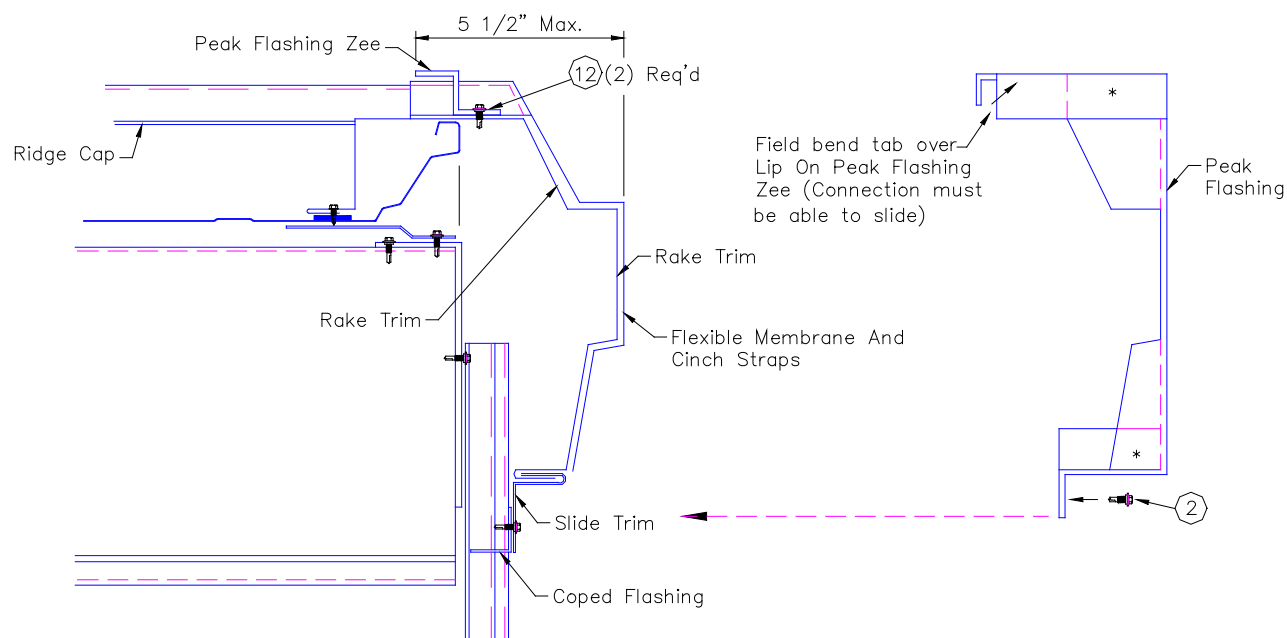


Position flexible membrane over the lines of flashing sealant and secure with cinch straps. Start with a peak cinch strap across the ridge, then (2) cinch plates at the sides and then (2) cinch strap across the bottom. Use ⑫ self-drilling screws.





## 9.12.3 INSTALL PEAK FLASHINGS



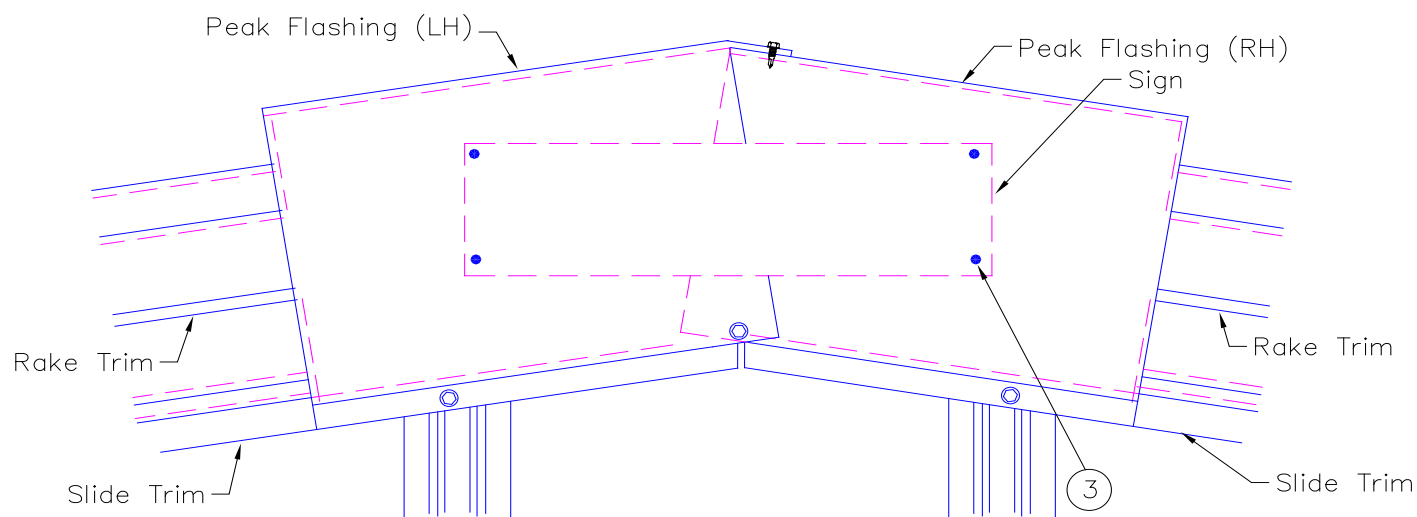
Position the (LH) and (RH) peak flashings over the flexible membrane by bending the tab along the top of the flashing over the peak flashing zeos and installing ② self-drilling screws through the bottom of the peak flashings into the slide trim.

Field notching the bottom lips on the peak flashing is required. The length is dependent on the magnitude of the roof slope.

After the peak flashings are clamped to the peak flashings and secured with screws in the front, field bend downwards the tab on the top and secure with (2) ⑥ trim screws.



## 9.12.4 INSTALL SIGN

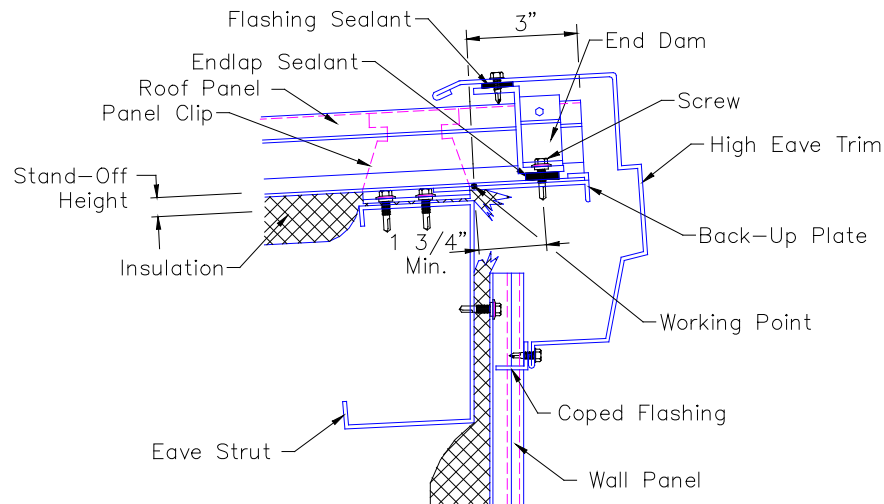


Install the sign to the peak flashing with (4) ③ structural screws.



## 9.13 HIGH EAVE TRIM INSTALLATION

### 9.13.1 PANEL OVERHANG VERIFICATION



#### PANEL ENDS AT HIGH EAVE

The high eave roof panel overhang dimension is critical as it will assure that the back-up plate/end dam location will be sufficient for attachment of the high eave trim and that the screws will not come in contact with the eave strut when thermal expansion and contraction of the roof surface occurs.

### 9.13.2 PREPARATION FOR END DAM INSTALLATION

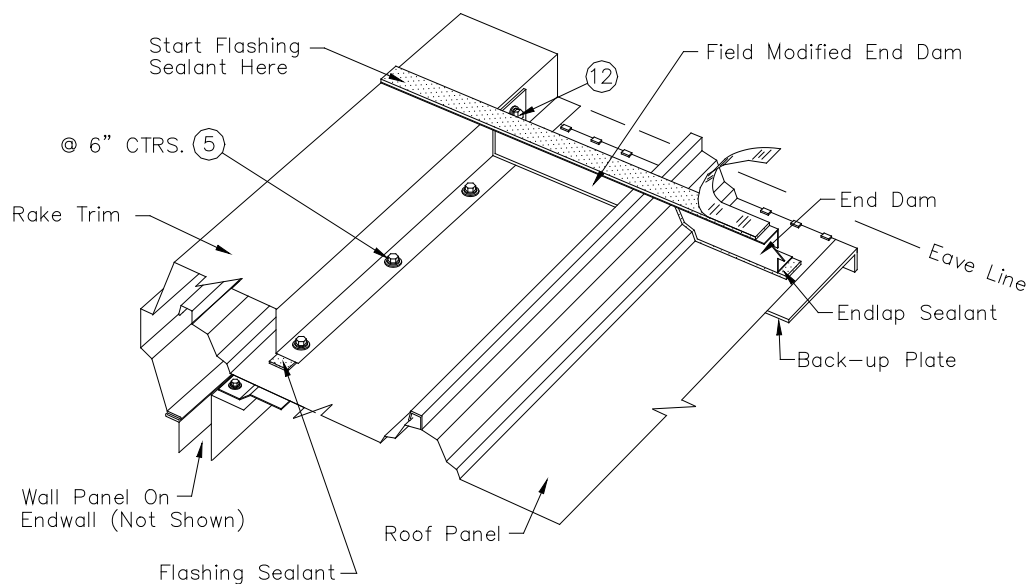
See Section 9.7.2 for information on preparing the end of the panel for end dam installation.

### 9.13.3 INSTALL BACK-UP PLATES AND END DAMS

See Section 9.7.3 for information on installation of back-up plates.

See Sections 9.7.4, 9.7.5 and 9.10.8 for information on installation of end dams.

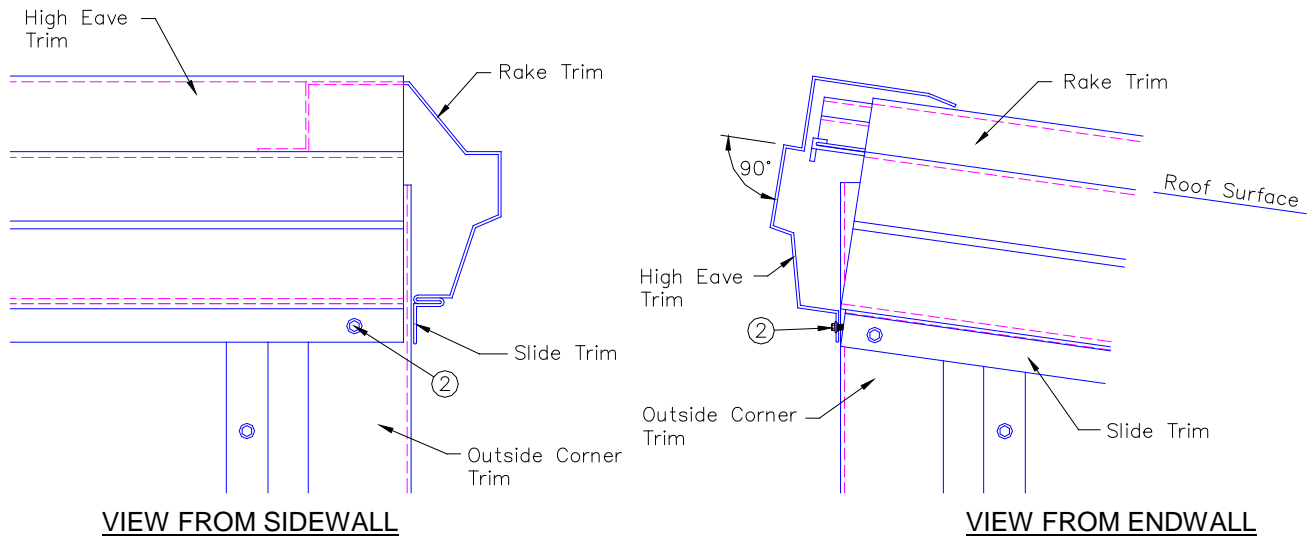
### 9.13.4 POSITION HIGH EAVE TRIM AT CORNER



Apply flashing sealant as shown (above) along end dam lips.



## Behlen ZL-24® Roof System Installation Guide

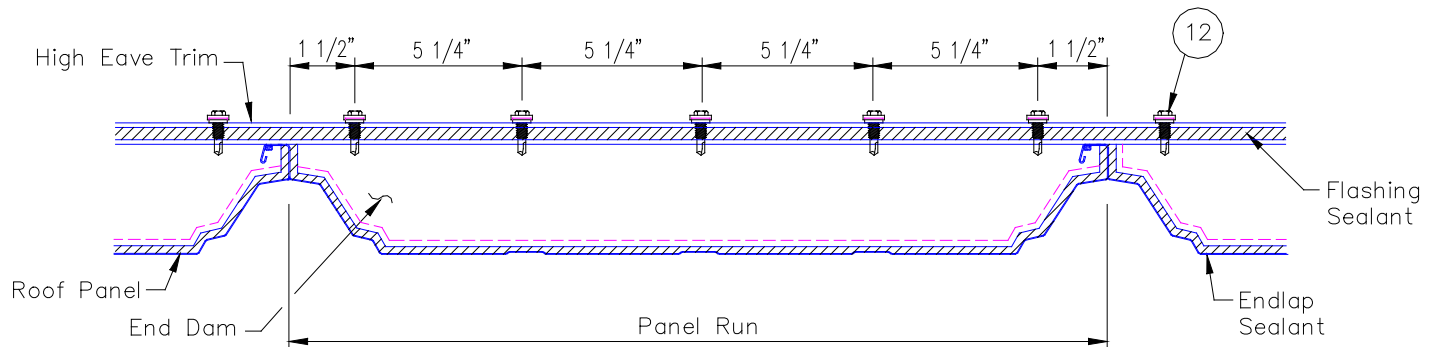


Place the top leg of the high eave trim over the flashing sealant along the lips on the end dams and position the front face of the high eave trim so that it is 90 degrees to the roof surface. This will assure that the outside corner boxes will fit properly at the corners.

Position the bottom edge of the high eave flashing along the sidewall, insert the coped flashings between the trim and wall surface, then secure with ② self-drilling screws, see Wall Erection Guide for spacing.

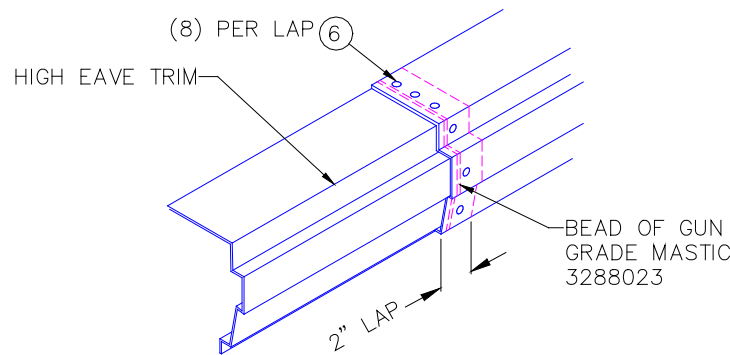


## 9.13.5 ATTACHING HIGH EAVE TRIM TO END DAMS



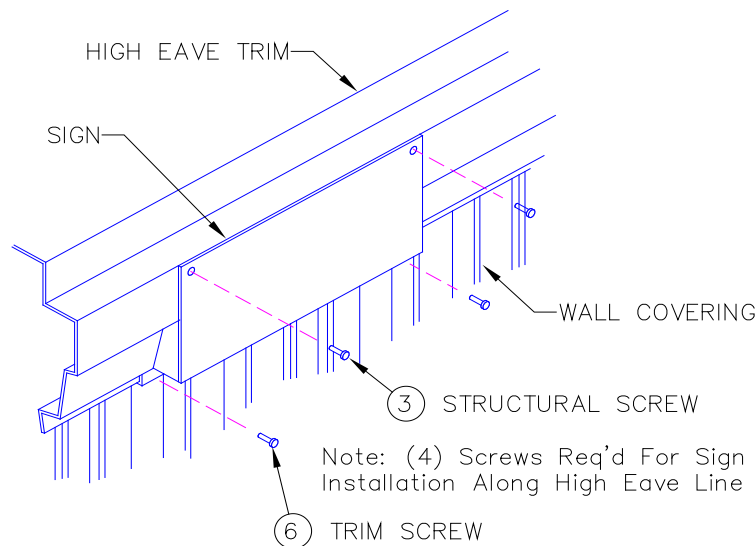
Fasten the high eave trim to the end dams with ⑫ self-drilling screws spaced as shown above. Check that the fasteners penetrate the center of the sealant and securely engage the end dam.

## 9.13.6 HIGH EAVE TRIM ENDLAPS



Install all high eave trims as previously described allowing a minimum 2" lap. Each endlap will contain gun grade mastic and (8) ⑥ trim screws.

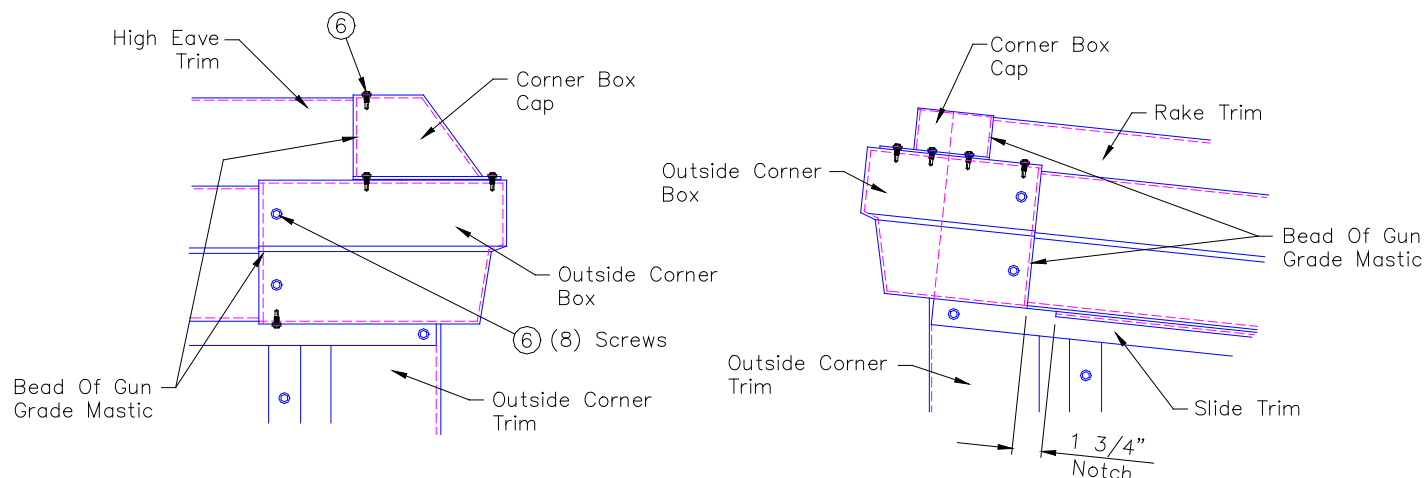
## 9.13.7 ATTACHING SIGN



Use (2) ⑥ trim screws and (2) ③ structural screws to install sign along the high eave line.



## 9.13.8 FINISHING HIGH EAVE TRIM TO RAKE AT CORNER



Field notch top of slide trim to allow for thermal expansion and contraction of the rake trim/outside corner box.

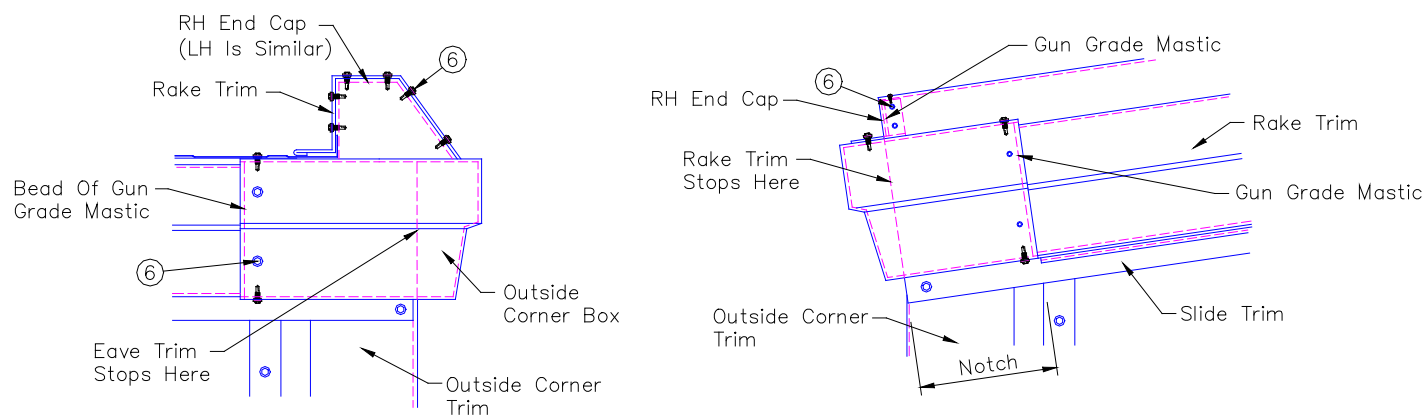
Field cut the top of the outside corner box to fit corner.

Install outside corner box using (8) (6) trim screws and gun grade mastic 3288023 along the front and top surfaces.

Install the corner box cap using (9) (6) trim screws and gun grade mastic 3288023 around the perimeter of the cap.

## 9.14 LOW EAVE TO RAKE, CORNER TRIMS

### 9.14.1 EAVE TRIM TO RAKE



After the eave trim and rake trim are installed at the corner, the outside corner box and either the (RH) or (LH) end cap will be used to finish the corner.

Field notch or remove any portion of the roof panel and extends beyond the end of the rake trim. Field notch the slide trim to clear the bottom lip of the outside corner box.

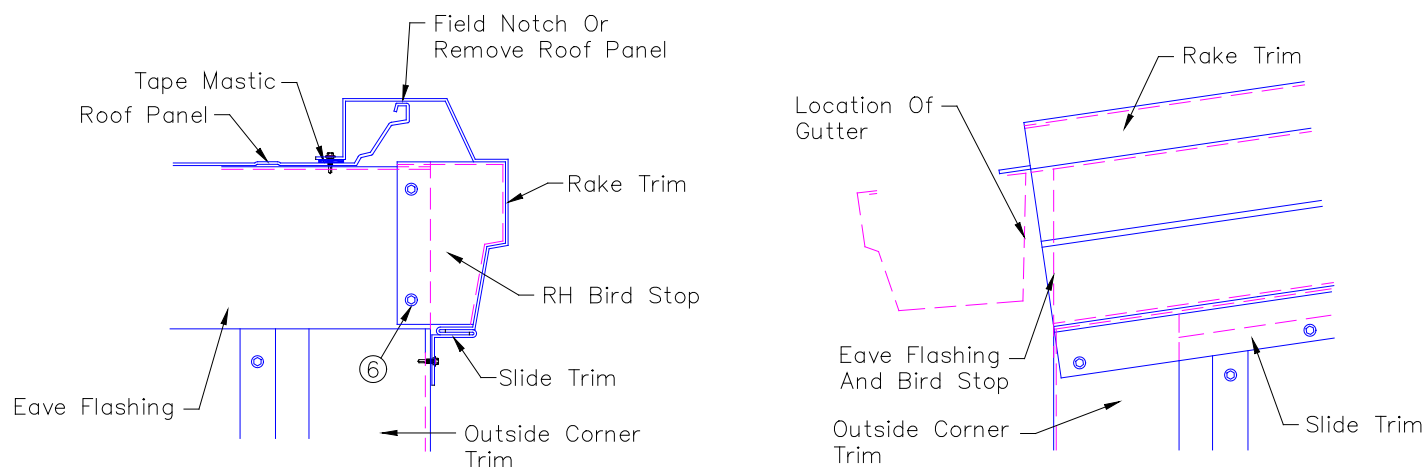
Field cut the top of the outside corner box to fit corner.

Install outside corner box using (8) (6) trim screws and gun grade mastic 3288023 along the front and top surfaces.

Install the (RH) or when applicable (LH) end cap with (9) (6) trim screws and gun grade mastic 3288023 around the perimeter of the end cap.



## 9.14.2 EAVE FLASHING TO RAKE



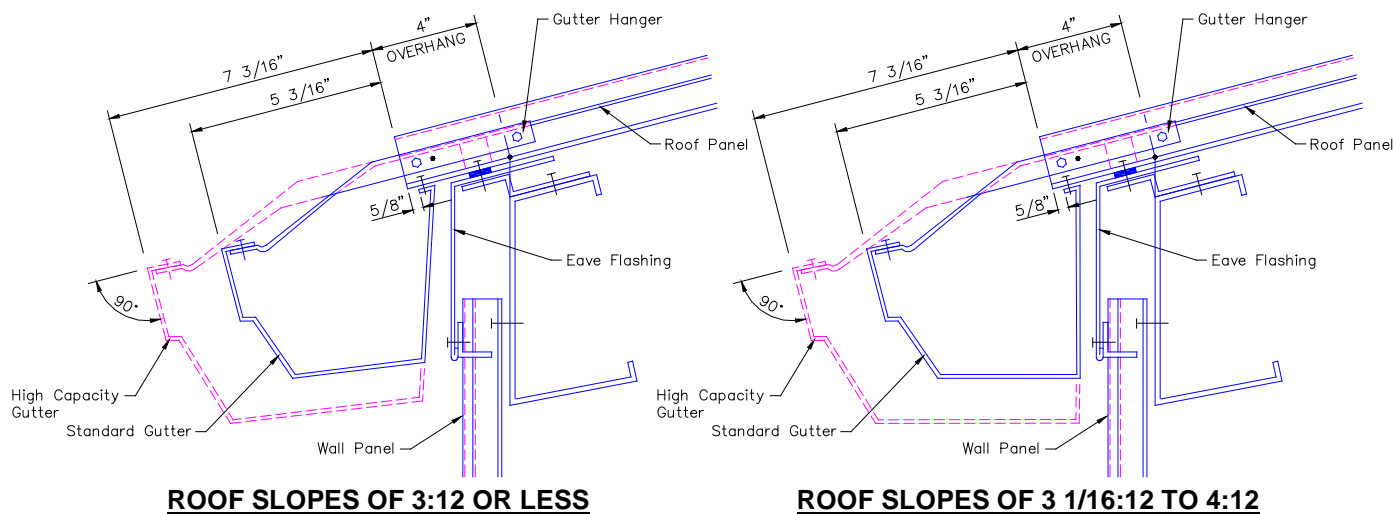
Where the eave flashing stops at the edge of the outside corner trim a (RH) or when applicable (LH) bird stop will be used to flash to the back side of the rake trim.

Attach the bird stop with (2) ⑥ trim screws.

The end cap and outside corner box used at this eave to rake intersection will be installed when the gutter is in position, which is described elsewhere in this guide.

## 9.15 STANDARD AND HIGH CAPACITY GUTTER INSTALLATION

### 9.15.1 PANEL OVERHANG VERIFICATION



**ROOF SLOPES OF 3:12 OR LESS**

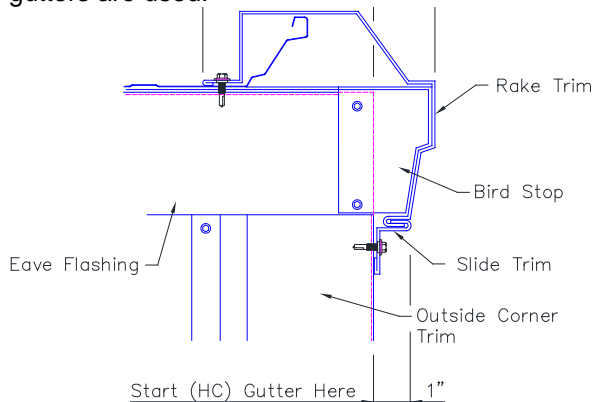
**ROOF SLOPES OF 3 1/16:12 TO 4:12**

Verify that the roof panel overhang at the eave is 4". This dimension will assure that the back lip on the gutter can be attached to the roof panel through the four hole locations, that are 1" in from the end of the panel.

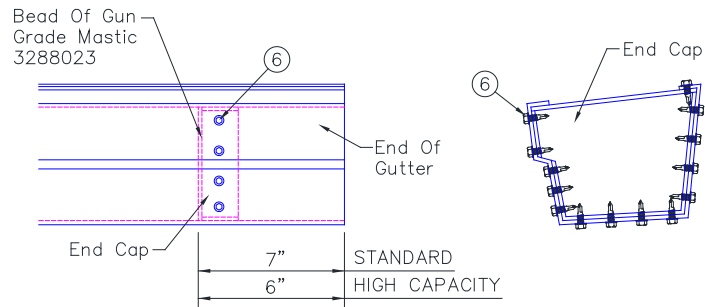


## 9.15.2 INSTALL GUTTER END CAP

The location of the end cap from the end of the gutter is dependent on whether STANDARD or HIGH CAPACITY gutters are used.



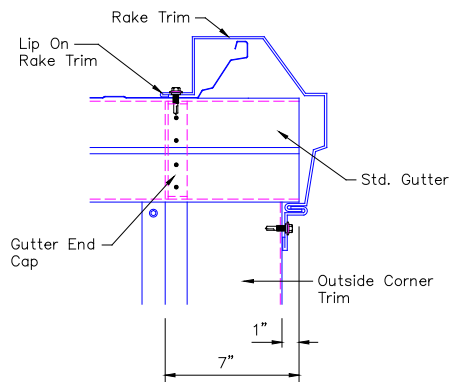
**STARTING LOCATION**



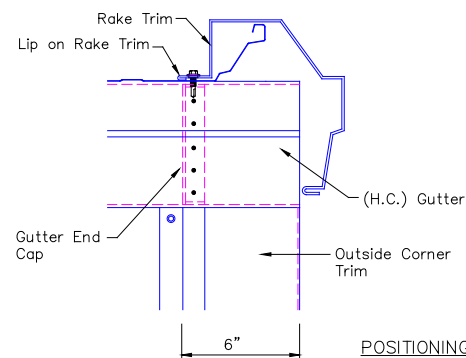
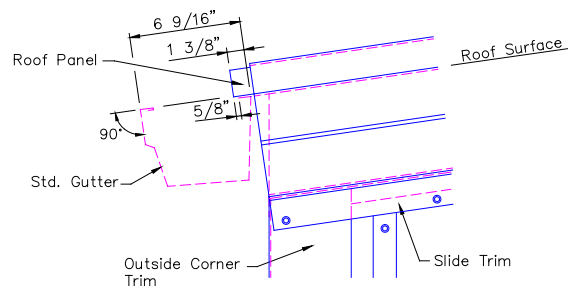
**END CAP LOCATION**

Assemble the gutter end cap using gun grade mastic 3288023 and (14) ⑥ trim screws.

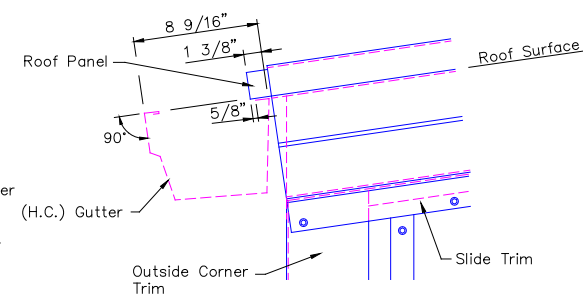
## 9.15.3 POSITIONING FIRST GUTTER SECTION



**POSITIONING STANDARD GUTTER**



**POSITIONING HIGH CAPACITY GUTTER**



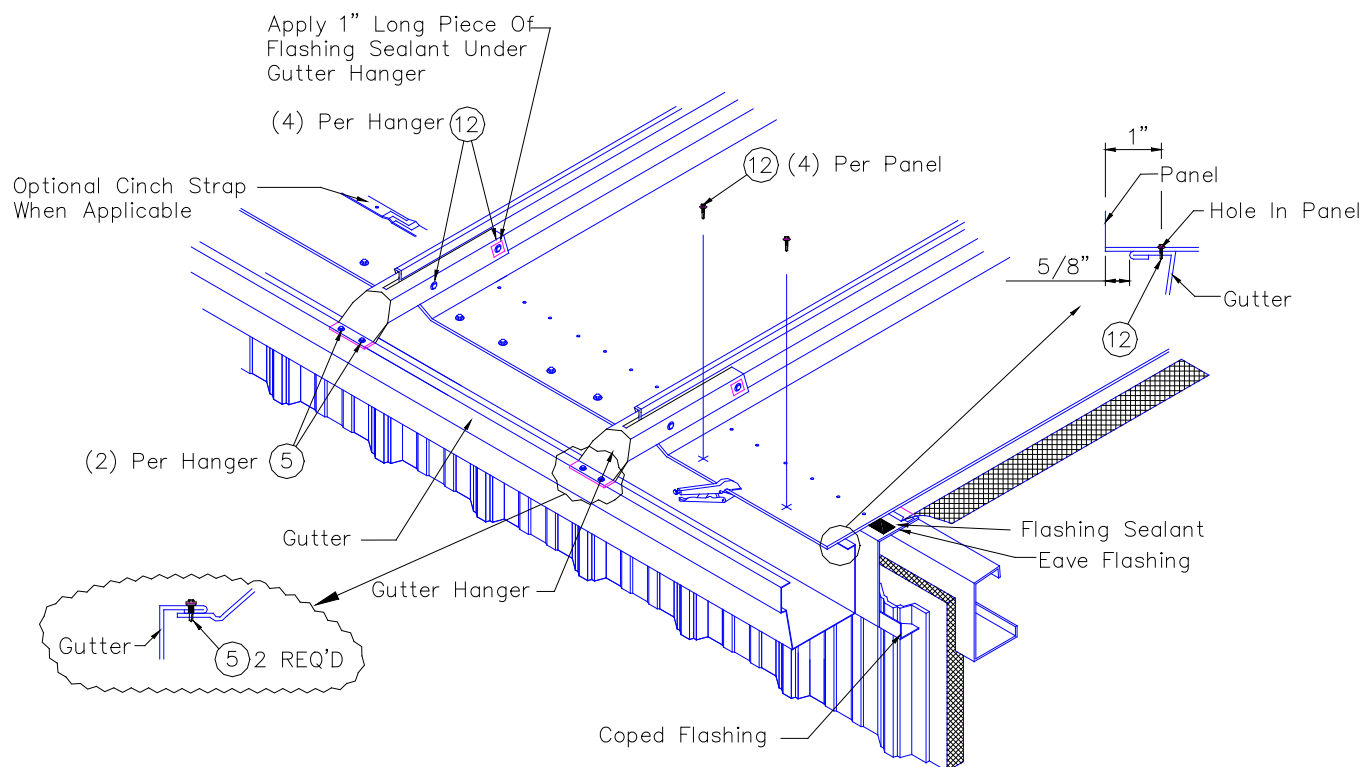
Lift the first gutter section into position as shown above and temporarily clamp the back flange of the gutter to the roof panel.

The start and finish ends of the gutter will be as shown above with the gutter end cap in line with lip on rake trim.





## 9.15.4 INSTALLING GUTTER HANGERS



After lifting gutter section into position under the edge of the roof panels and temporarily clamping the back flange of the gutter to the roof panel fasten the gutter to the roof panel with (4) ⑫ self-drilling screws through the factory punched holes at the end of the roof panel.

Align the outer edge of the gutter straight and level. Use a string line to assure that the gutter is straight.

Apply 1" long piece of flashing sealant on underside of gutter hanger at two screw locations before sliding gutter hanger into position. When installing hangers, position so as to keep the front face of the gutter 90 degrees to the roof surface, thus assuring that the outside corner boxes will fit properly at the corners.

For installation of standard gutter, use applicable spacing from either Table A or Table B (below). For high capacity gutter space ALL gutter hangers at 2'-0" spacing.

TABLE A (Buildings Ordered Using Roof Live Load)	
ROOF LIVE LOAD	STRAP SPACING
Less than 40# L.L.	4'-0"
40# L.L. and greater	2'-0"

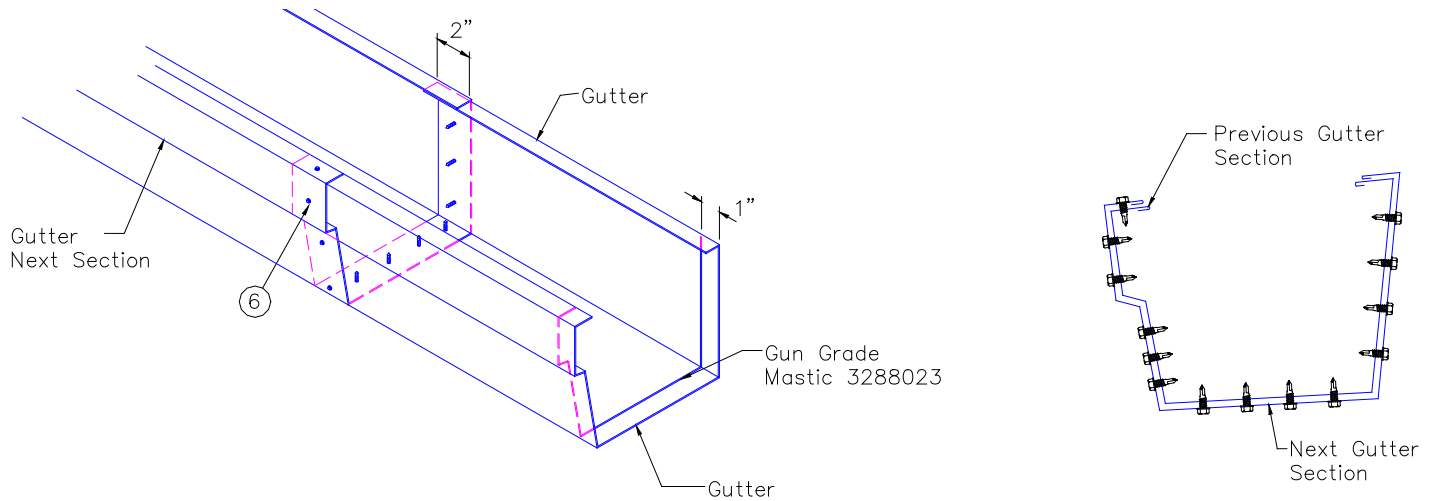
TABLE B (Buildings Ordered Using Ground Snow Load)	
GROUND LIVE LOAD	STRAP SPACING
Less than 60 PSF	4'-0"
60 PSF and greater	2'-0"

Fasten gutter hanger with (4) ⑫ self drilling screws to roof panel.

Position the end of the gutter hanger under the outer lip of the gutter and secure with (2) self-drilling screws.

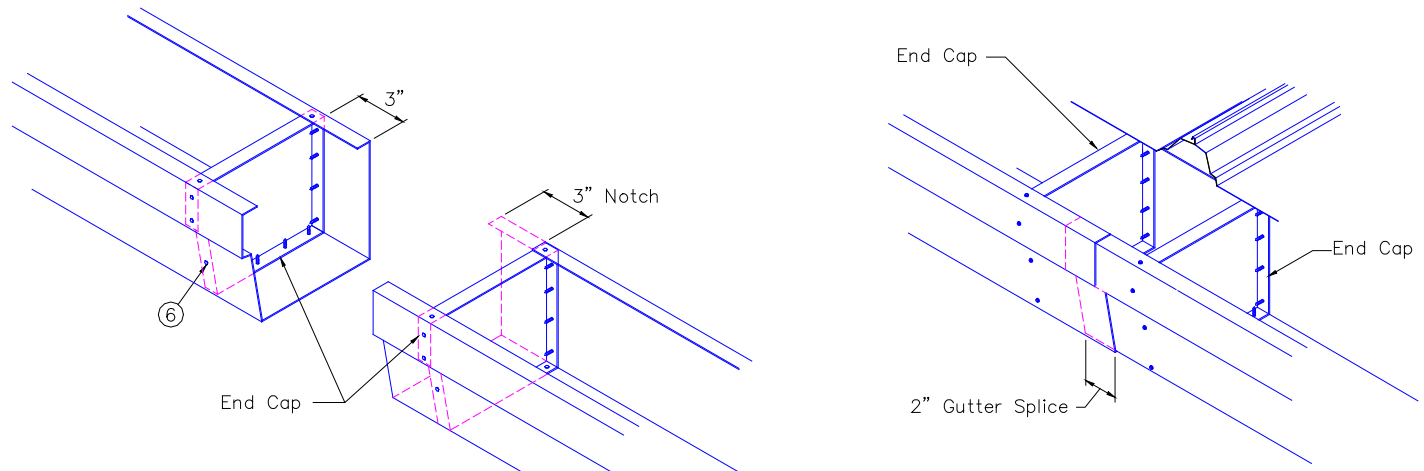


## 9.15.5 SPLICING GUTTER



Lap all remaining gutter sections by 2" onto previous gutter. Each lap will include bead of gun grade mastic 3288023 and (14) (6) trim screws.

## 9.15.6 INSTALLING GUTTER EXPANSION JOINT

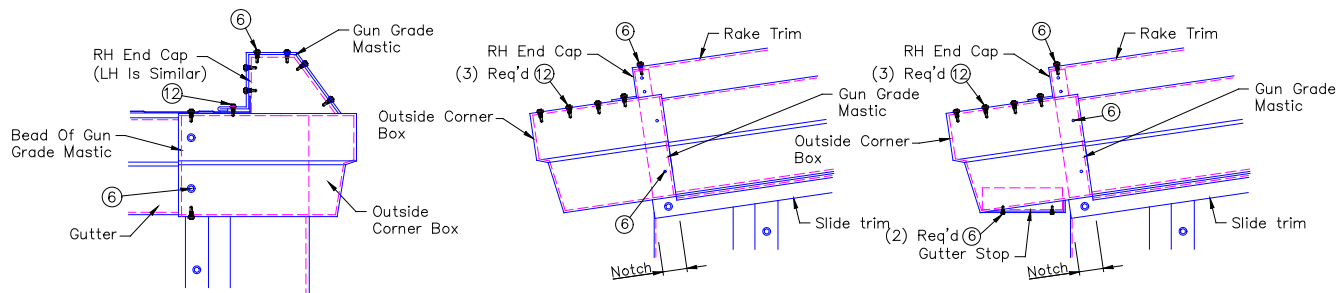


When a run of gutter exceeds 130 feet an expansion joint will be used. The number of joints and their locations along the run are shown in the table below.

TABLE EXPANSION JOINT LOCATIONS	
Length of run	Location
130'-1" to 260'-0"	Approx. mid point
260'-1" to 390'-0"	Approx. 1/3 points
390'-1" to 520'-0"	Approx. 1/4 points



## 9.15.7 FINISHING STANDARD GUTTER TO RAKE, AT CORNER



### ROOF SLOPES OF 3:12 OR LESS      ROOF SLOPES OF 3 1/6:12 TO 4:12

After the gutter and rake trim are installed at the corner, the outside corner box and either the (RH) or (LH) End cap will be used to finish the corner. Prior to installing outside corner box, when required install the gutter stop using (2) ⑥ trim screws.

Field notch the slide trim to clear the bottom lip of the outside corner box.

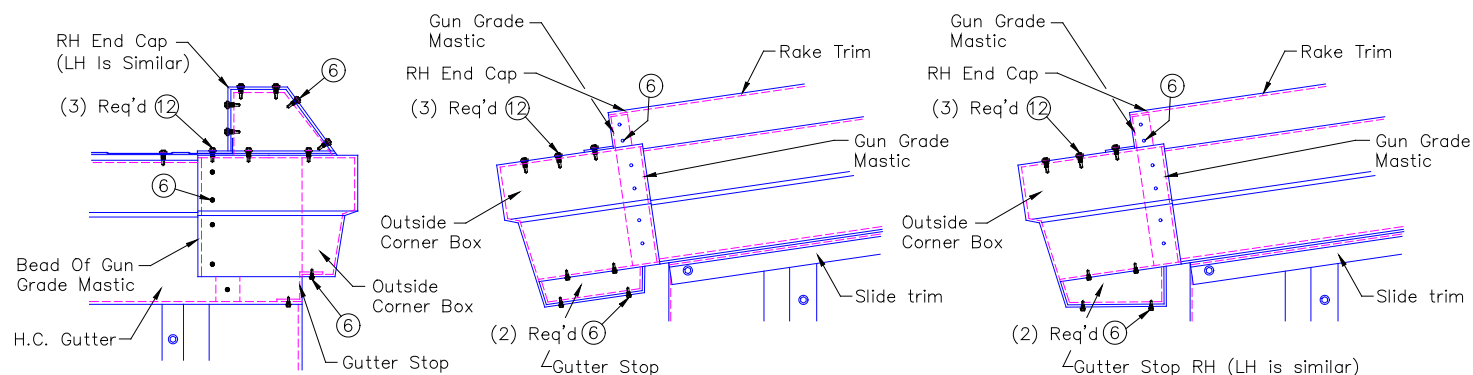
Field cut the top of the outside corner box to fit corner.

Install outside corner box using (8) ⑥ trim screws and gun grade mastic 3288023 along the front and top surfaces.

Place (3) ⑫ self-drilling screws through top of outside corner box and top lip of gutter end cap.

Install the (RH) or when applicable (LH) end cap with (9) ⑥ trim screws and gun grade mastic 3288023 around the perimeter of the end cap.

## 9.15.8 FINISHING HIGH CAPACITY GUTTER TO RAKE, AT CORNER



### ROOF SLOPES OF 3:12 OR LESS      ROOF SLOPES OF 3 1/6:12 TO 4:12

Before installing outside corner box, install the gutter stop using (2) ⑥ trim screws.

Field cut the top and front of the outside corner box to fit the corner.

Install outside corner box using (8) ⑥ trim screws and gun grade mastic 3288023 along the front and top surfaces.

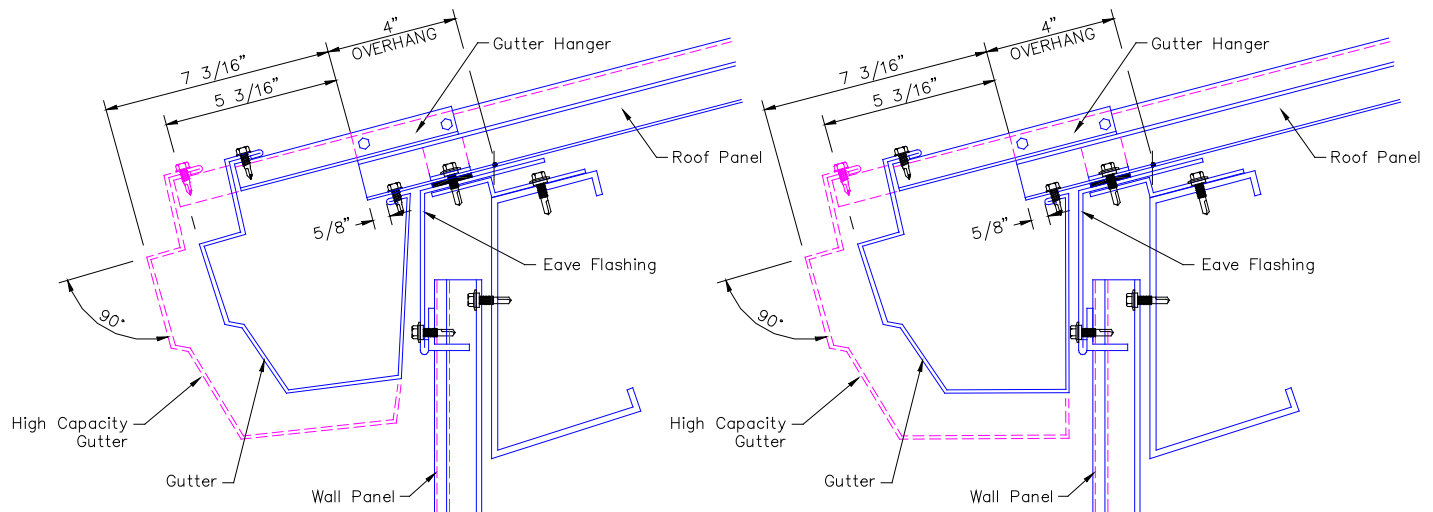
Place (3) ⑫ self-drilling screws through top of outside corner box and top lip of gutter end cap.

Install the (RH) or when applicable (LH) end cap with (9) ⑥ trim screws and gun grade mastic 3288023 around the perimeter of the end cap.



## 9.16 RIB CONCEALING AND HIGH CAPACITY GUTTER INSTALLATION

### 9.16.1 PANEL OVERHANG VERIFICATION



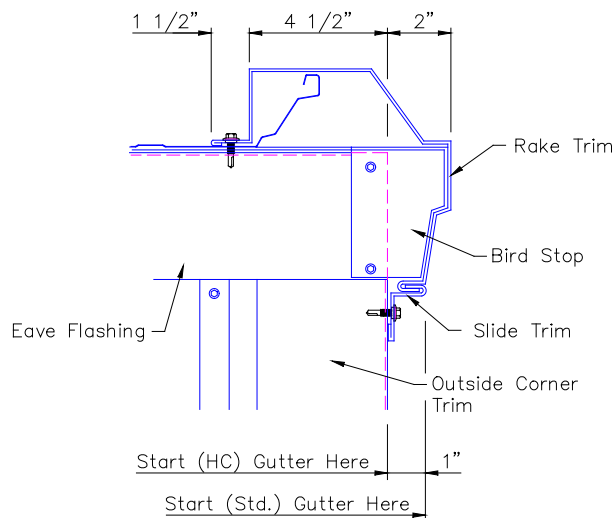
**ROOF SLOPES OF 3:12 OR LESS**

**ROOF SLOPES OF 3 1/6:12 TO 4:12**

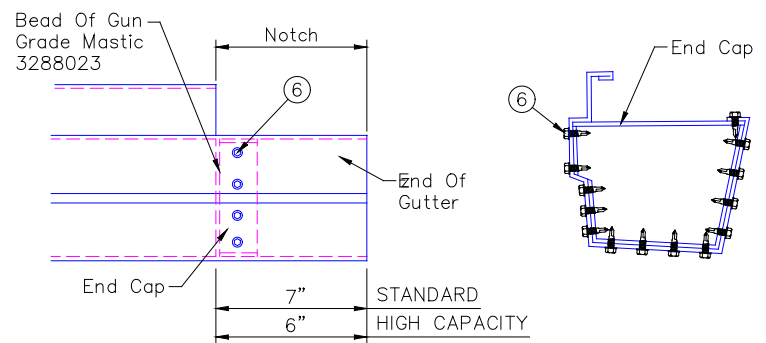
Verify that the roof panel overhang at the eave is 4". This dimension will assure that the back lip on the gutter can be attached to the roof panel through the four hole locations, that are 1" in from the end of the panel.

### 9.16.2 INSTALL GUTTER END CAP

The location of the end cap from the end of the gutter is dependent on whether RIB CONCEALING or HIGH CAPACITY gutters are used.



**STARTING LOCATION**

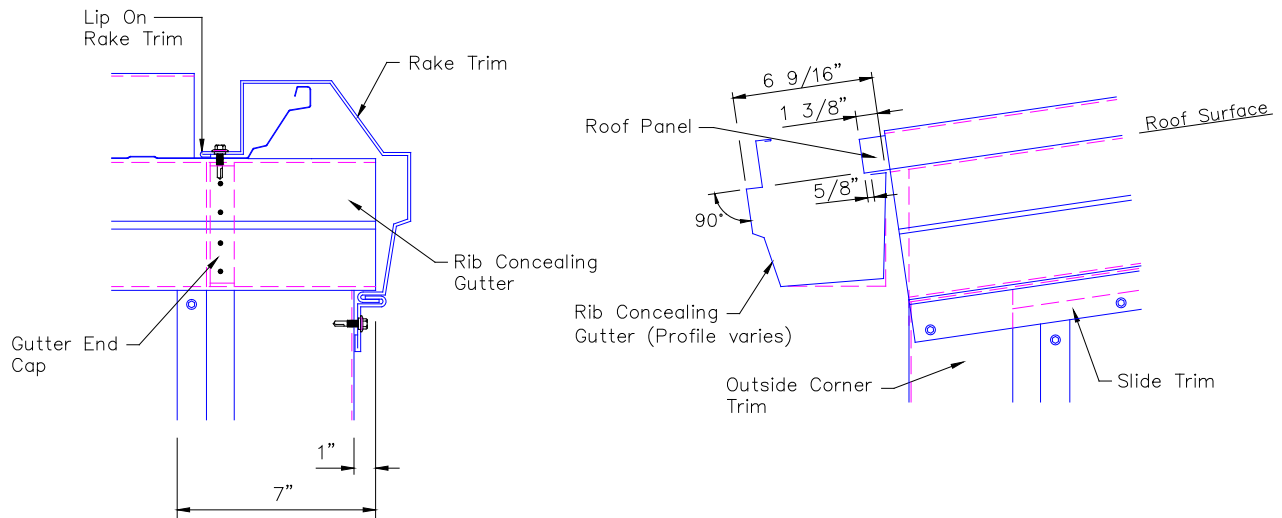


**END CAP LOCATION**

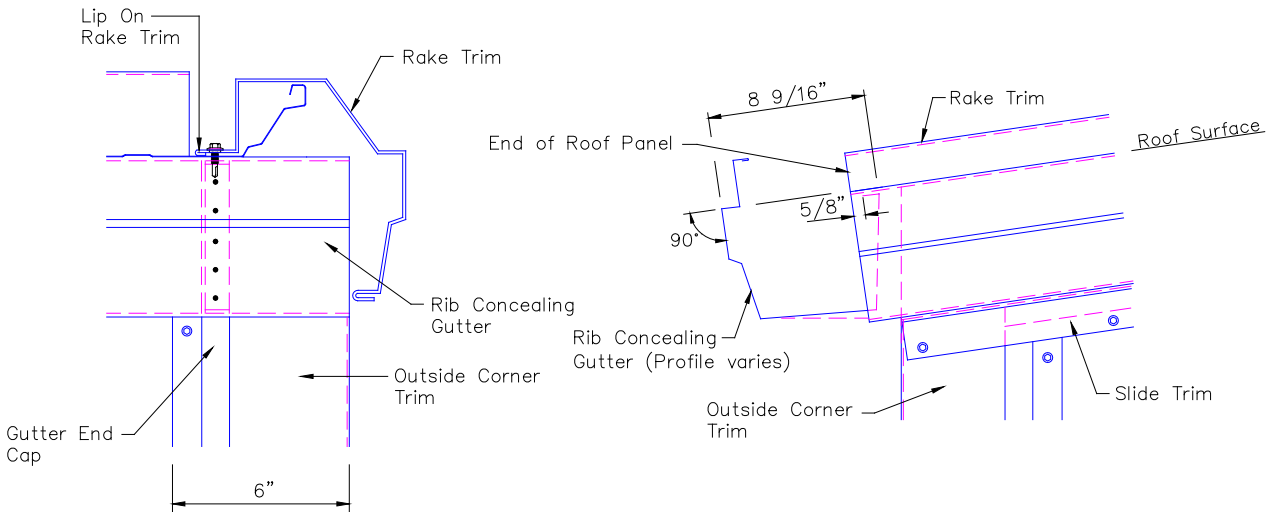
Assemble the gutter end cap using gun grade mastic 3288023 and (14) ⑥ trim screws.



## 9.16.3 POSITIONING FIRST GUTTER SECTION



POSITIONING RIB CONCEALING GUTTER



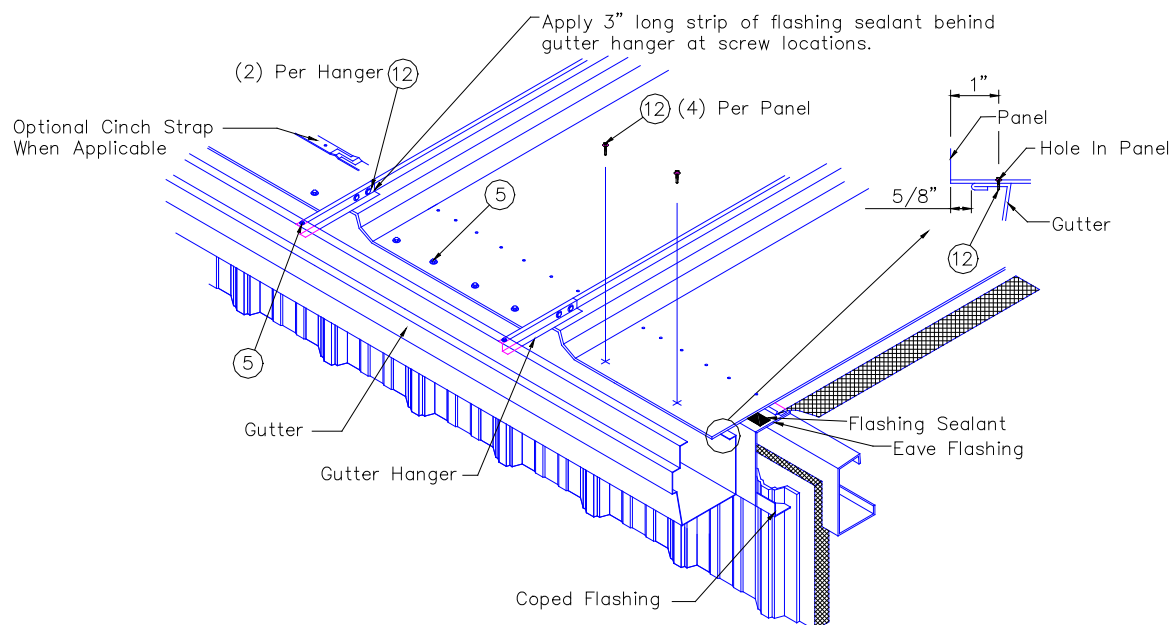
POSITIONING RIB CONCEALING (HIGH CAPACITY) GUTTER

Lift the first gutter section into position as shown above and temporarily clamp the back flange of the gutter to the roof panel.

The start and finish ends of the gutter will be as shown above with the gutter end cap in line with lip on rake trim.



## 9.16.4 INSTALLING GUTTER HANGERS



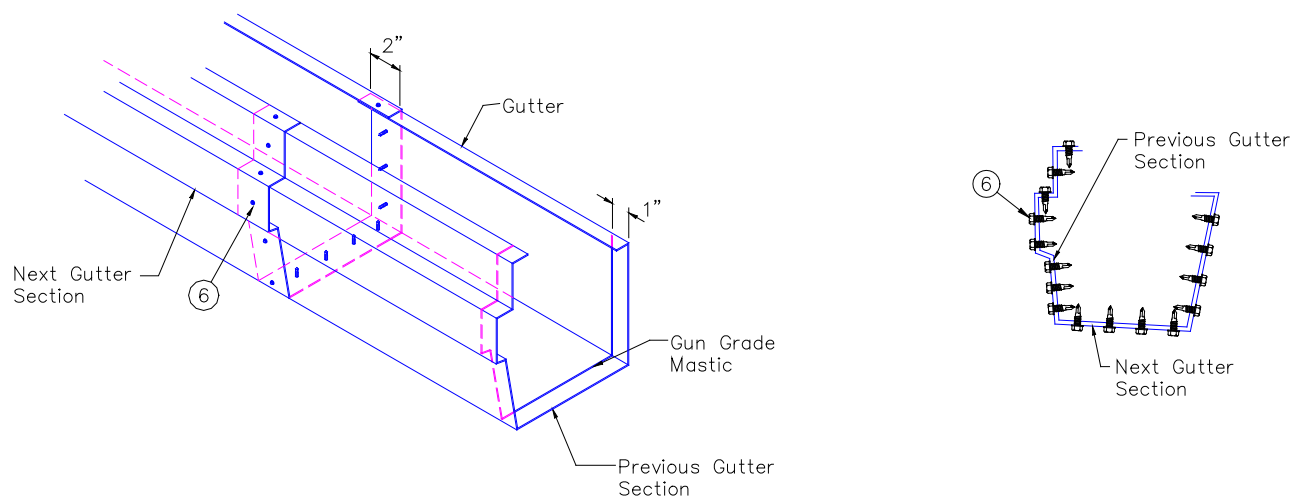
After lifting gutter section into position under the edge of the roof panels and temporarily clamping the back flange of the gutter to the roof panel, fasten the gutter to the roof panel with (4) ⑫ self-drilling screws through the factory punched holes at the end of the roof panel.

Align the outer edge of the gutter straight and level. Use a string line to assure that the gutter is straight.

Install gutter hangers at 2'-0" spacing. Apply 3" long strip of flashing sealant between hanger and vertical panel seam at the two screw locations before attaching hanger. Use (2) ⑫ self-drilling screws through roof panel and (1) self-drilling screw through gutter lip.

When installing hangers, position so as to keep the front face of the gutter 90 degrees to the roof surface, thus assuring that the outside corner boxes will fit properly at the corners.

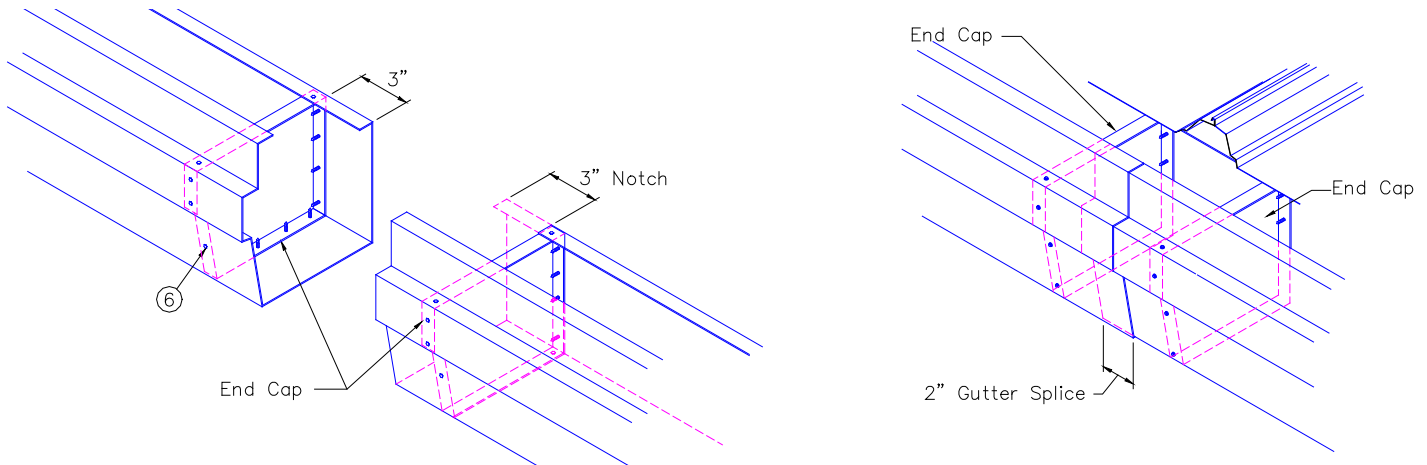
## 9.16.5 SPLICING GUTTER



Lap all remaining gutter sections by 2" onto previous gutter. Each lap will include bead of gun grade mastic 3288023 and (16) ⑥ trim screws.



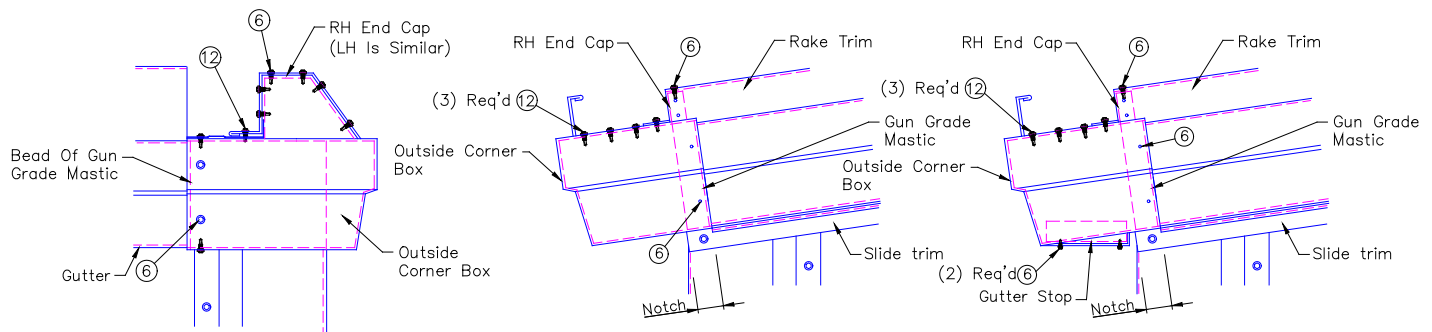
## 9.16.6 INSTALLING GUTTER EXPANSION JOINT



When a run of gutter exceeds 130 feet an expansion joint will be used. The number of joints and their locations along the run are shown in the table shown.

TABLE EXPANSION JOINT LOCATIONS	
Length of run	Location
130'-1" to 260'-0"	Approx. mid point
260'-1" to 390'-0"	Approx. 1/3 points
390'-1" to 520'-0"	Approx. 1/4 points

## 9.16.7 INSTALL OUTSIDE CORNER BOX AND END CAP TO RIB CONCEALING GUTTER



### ROOF SLOPES OF 3:12 OR LESS

### ROOF SLOPES OF 3 1/6:12 TO 4:12

After the gutter and rake trim are installed at the corner, the outside corner box and either the (RH) or (LH) End cap will be used to finish the corner. Prior to installing outside corner box, when required install the gutter stop using (2) ⑥ trim screws.

Field notch the slide trim to clear the bottom lip of the outside corner box.

Field cut the top of the outside corner box to fit corner.

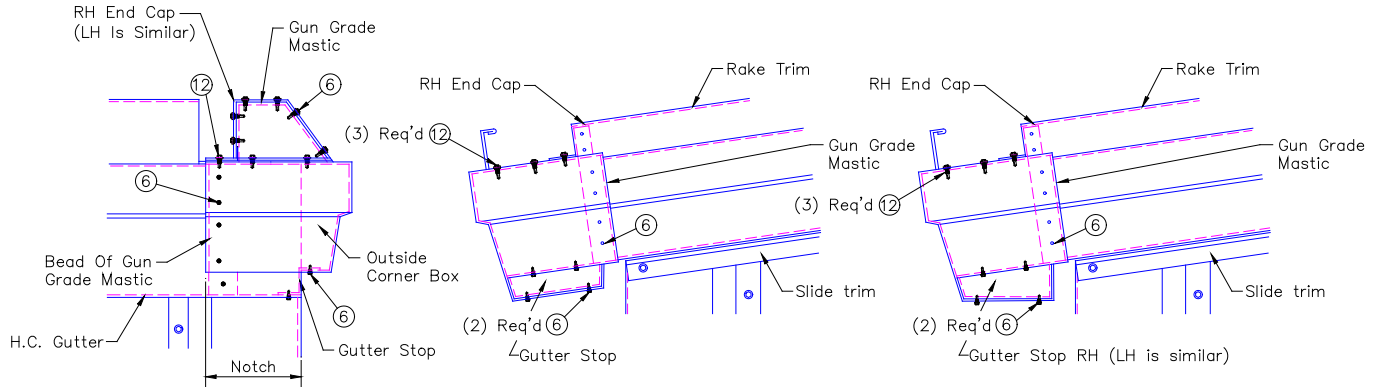
Install outside corner box using (8) ⑥ trim screws and gun grade mastic 3288023 along the front and top surfaces.

Place (3) ⑫ self-drilling screws through top of outside corner box and top lip of gutter end cap.

Install the (RH) or when applicable (LH) end cap with (9) ⑥ trim screws and gun grade mastic 3288023 around the perimeter of the end cap.



## 9.16.8 INSTALL OUTSIDE CORNER BOX AND END CAP TO RIB CONCEALING (HC) GUTTER



### ROOF SLOPES OF 3:12 OR LESS

### ROOF SLOPES OF 3 1/6:12 TO 4:12

Before installing outside corner box, install the gutter stop using (2) (6) trim screws.

Field notch the slide trim to clear the bottom lip of the outside corner box.

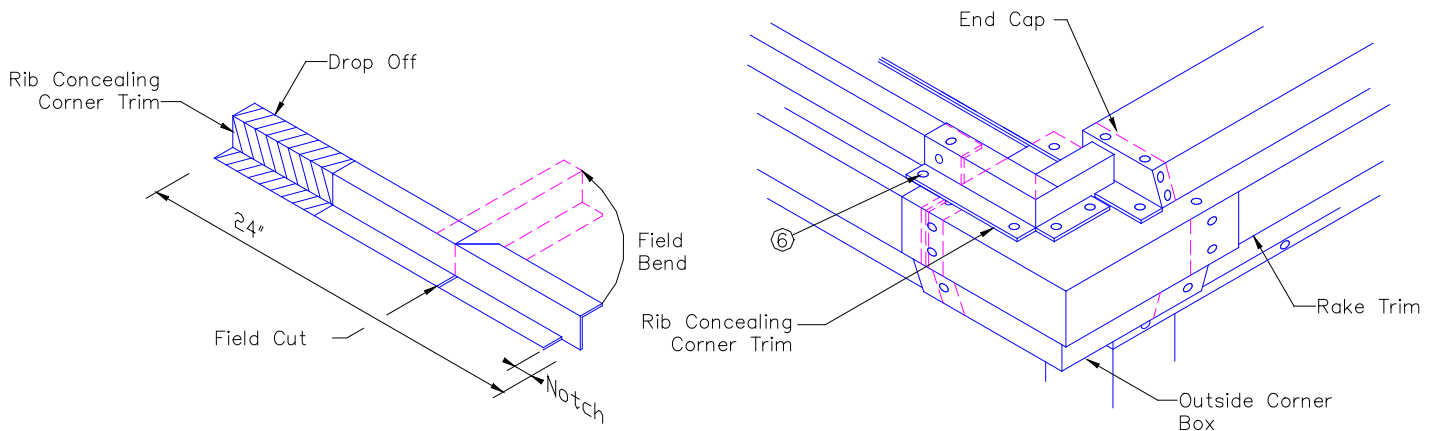
Field cut the top and front of the outside corner box to fit the corner.

Install outside corner box using (8) (6) trim screws and gun grade mastic 3288023 along the front and top surfaces.

Place (3) (12) self-drilling screws through top of outside corner box and top lip of gutter end cap.

Install the (RH) or when applicable (LH) end cap with (9) (6) trim screws and gun grade mastic 3288023 around the perimeter of the end cap.

## 9.16.9 FINISHING RIB CONCEALING GUTTER TO RAKE, AT CORNER



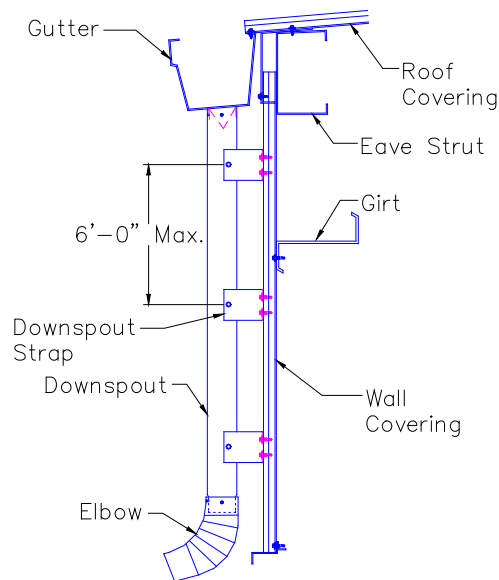
The corner will be finished by field cutting and bending a portion of the rib concealing corner trim, then attaching with (6) (6) trim screws.





## 10 DOWNSPOUT INSTALLATION

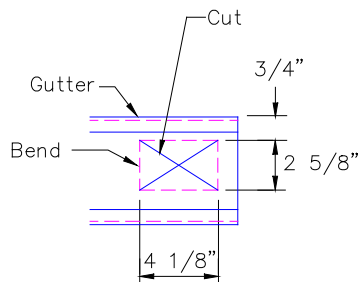
### 10.1 LOCATING DOWNSPOUTS



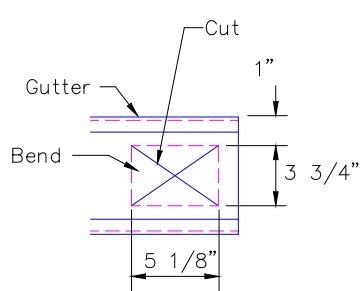
The appearance of the downspouts will have a critical effect on the appearance of the project. Keep the downspouts perpendicular with the gutter when installing.

Proper downspouts are necessary to prevent gutter overflow and roof flooding. Refer to the erection drawings to determine the required downspout size and quantity.

### 10.2 CUTTING BOTTOM OF GUTTER AND ATTACHING DOWNSPOUT

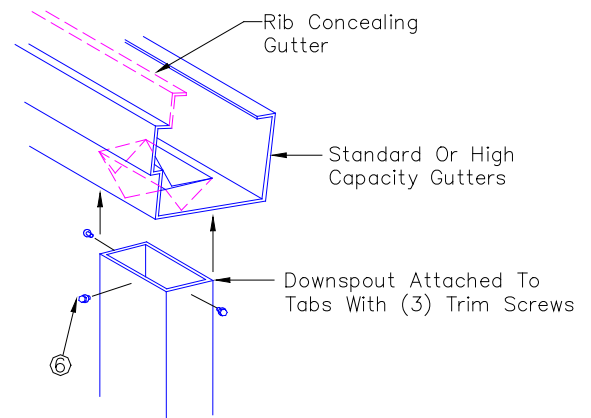


4" Downspout



5" Downspout

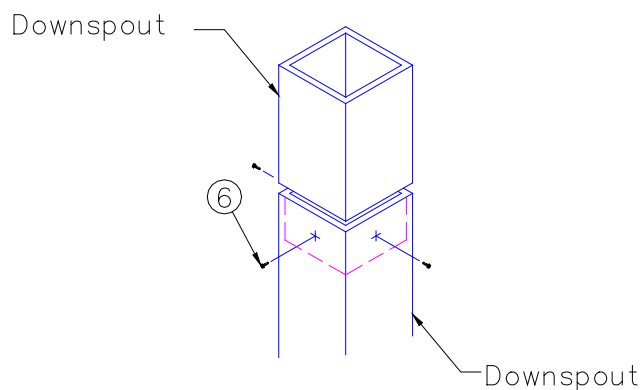
NOTE: Cut Along Solid Lines, Bend Tabs Down 90° Along Dashed Lines.



Once the spacing has been determined, cut and bend down tabs in the bottom of the gutter and attach downspout with (3) ⑥ trim screws.

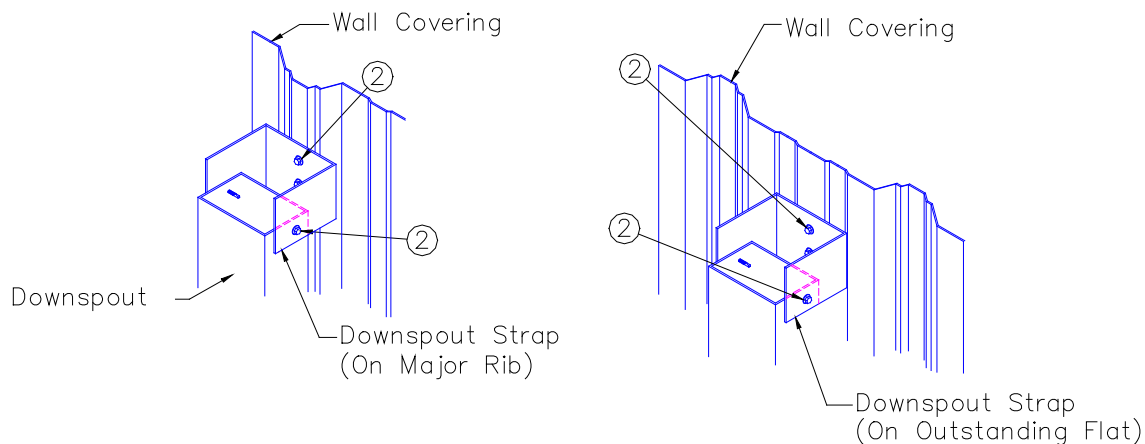


## 10.3 SPLICING DOWNSPOUTS



Splice downspouts by using (3) ⑥ trim screws.

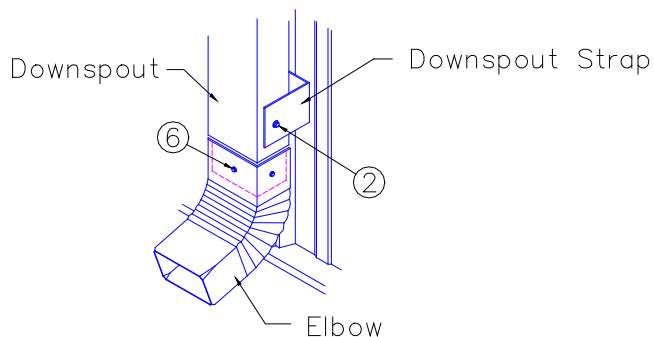
## 10.4 SECURING DOWNSPOUT TO WALL



Downspout locations should be located at a major rib or the flat of the panel, depending on the style of wall panel. See above details for reference.

Downspouts will be secured to the wall with a strap at a 6'-0" maximum spacing. Straps will be attached to the wall and downspout with a total of 4 ② self-drilling screws.

## 10.5 INSTALL ELBOW



Attach elbow by using (3) ⑥ trim screws.



## 11 ROOF ACCESSORIES

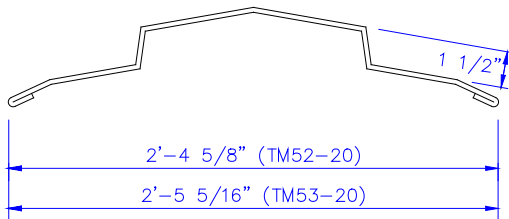
### 11.1 10 FT. RIDGE VENTILATOR

#### 11.1.1 MODIFICATIONS TO RIDGE COMPONENTS

When 10 ft. long ridge ventilators are located along the ridge, modification to the roof panel length, replacement of some components used at the ridgeline and at the transition of the ridge to endwall will occur (see below).

##### RIDGE CAP

- 26 gauge precoated or Galvalume material
- Roof color
- Roof slope 4:12 or less

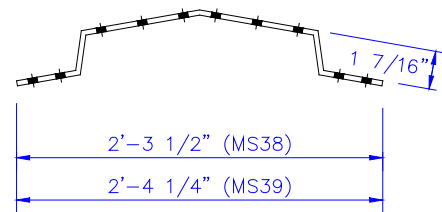


Part No. TM52-20 Roof slope 2:12 or less

Part No. TM53-20 Roof slope 2 1/16:12 thru 4:12

##### PEAK CINCH STRAP

- 16 gauge Galvanized steel
- Roof slope 4:12 or less
- 1" width

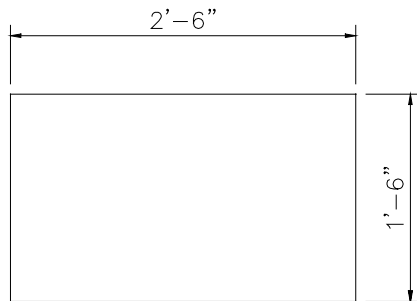


Part No. MS38 Roof slope 2:12 or less

Part No. MS39 Roof slope 2 1/16:12 thru 4:12

##### FLEXIBLE MEMBRANE

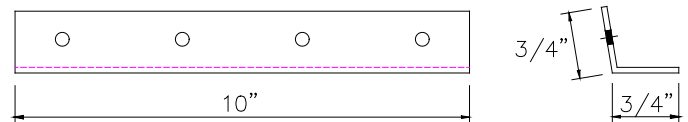
- Black EPDM Material
- 0.045" Thick



Part No. TM55

##### CINCH STRAP

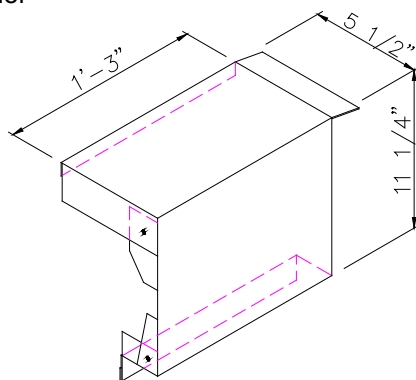
- 16 Gauge Galvanized Steel



Part No. MS35

##### PEAK FLASHING (LH)

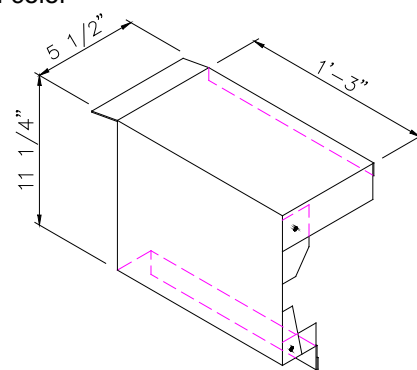
- 26 Gauge precoated material
- Trim color



Part No. TR72

##### PEAK FLASHING (RH)

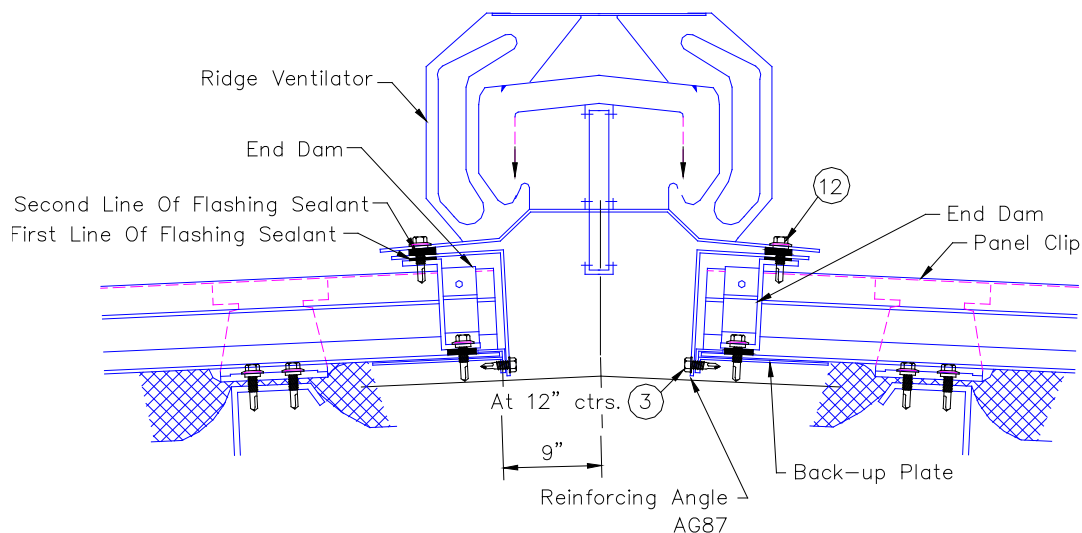
- 26 Gauge precoated material
- Trim color



Part No. TR73



## 11.1.2 RIDGE PANEL OVERHANG VERIFICATION



Verify that the roof panel overhang at the ridge will be 9" short of the ridge line on both sides.

## 11.1.3 INSTALL BACK-UP PLATES AND END DAMS

For back-up plate, end dam and mastic installation along the ridge, see Section 9.7.

## 11.1.4 INSTALL REINFORCING ANGLES AG87

Position angles along the back-up plates and over the flashing sealant along the tops of the end dams.

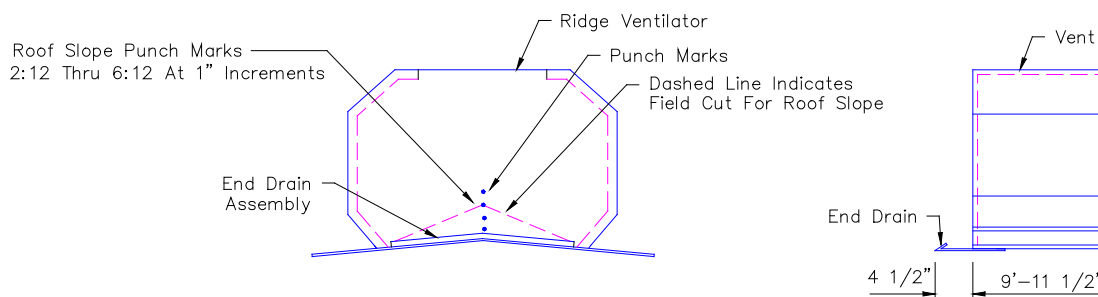
Butt ends of angles if continuous run of ventilators are used.

Attach angles to lips on back-up plates with ③ self-drilling screws at 12" centers.

## 11.1.5 INSTALL 2nd LINE OF FLASHING SEALANT

Along the top of the reinforcing angle, but directly over the top lip of the end dam, place the 2nd line of flashing sealant.

## 11.1.6 MODIFY END CAP AND POSITION END DRAIN

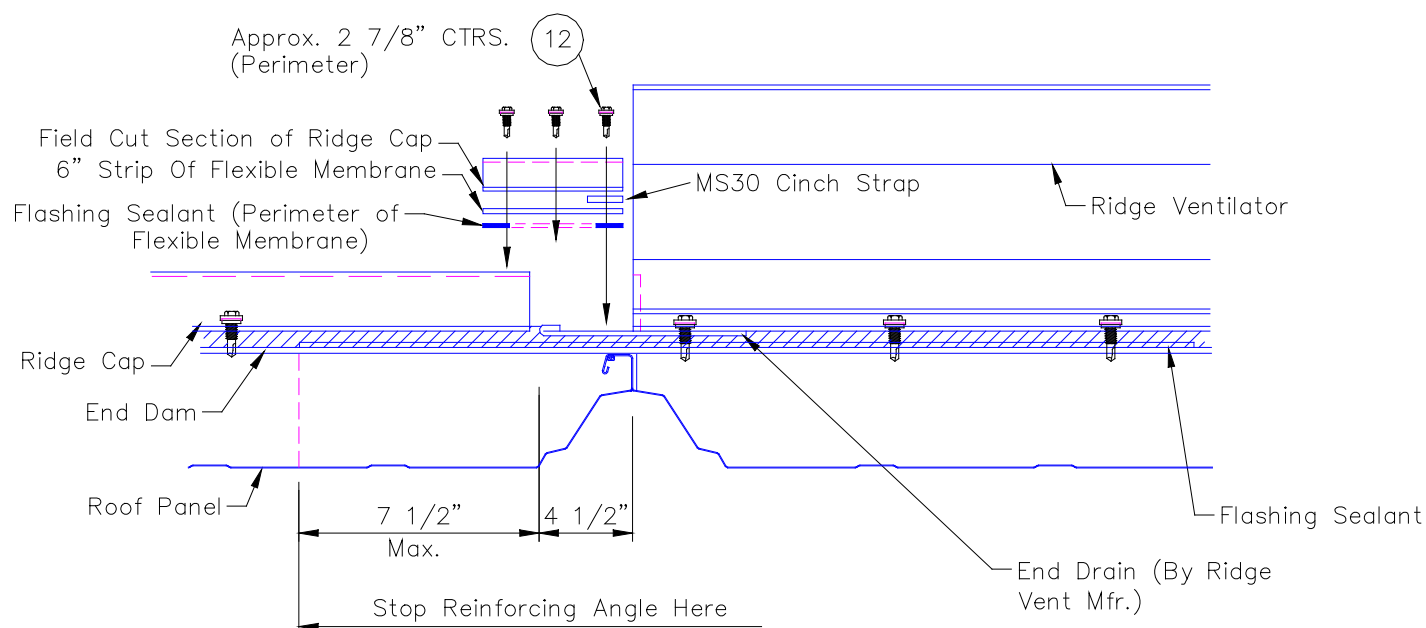


On roof slopes greater than 1" to 12" field modify the end cap by cutting along a line from bottom to appropriate punch mark.

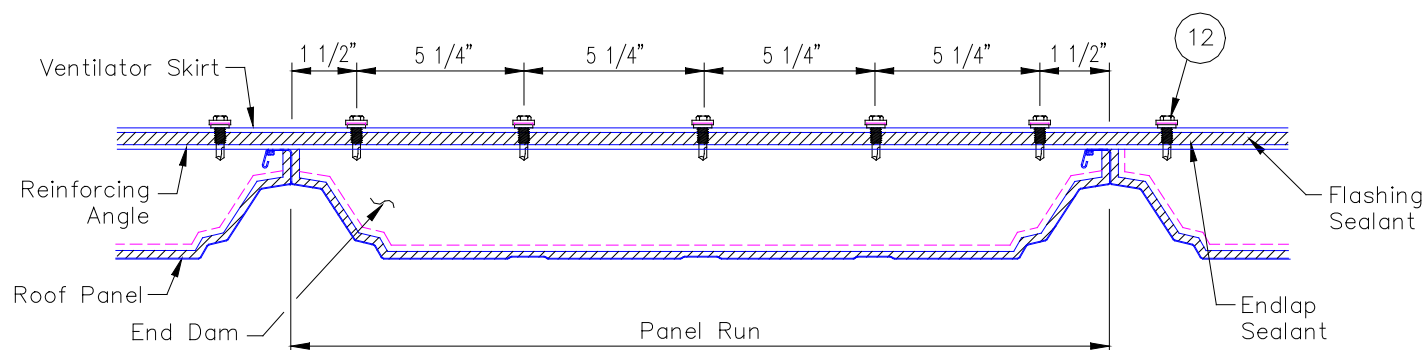
Bend end drain assembly to follow exact roof slope. Position the angle on end drain assembly behind end cap.



## 11.1.7 INSTALL RIDGE VENTILATOR



Position skirt on ventilator over the 2nd line of flashing sealant on each side of the ridge and attach with ⑫ self-drilling screws using the pattern below.



### SCREW PATTERN

## 11.1.8 TRANSITION TO RIDGE AT END

The following components are used to make the transition from the end of the ventilator to the ridge cap, see section 11.1.7 for illustration.

- A. Flashing Sealant (3209430)
- B. Flexible membrane (TM55)
- C. Cinch Strap (MS30)
- D. 6" Long section of ridge cap (Field cut)
- E. ⑫ self-drilling screws (3228103)

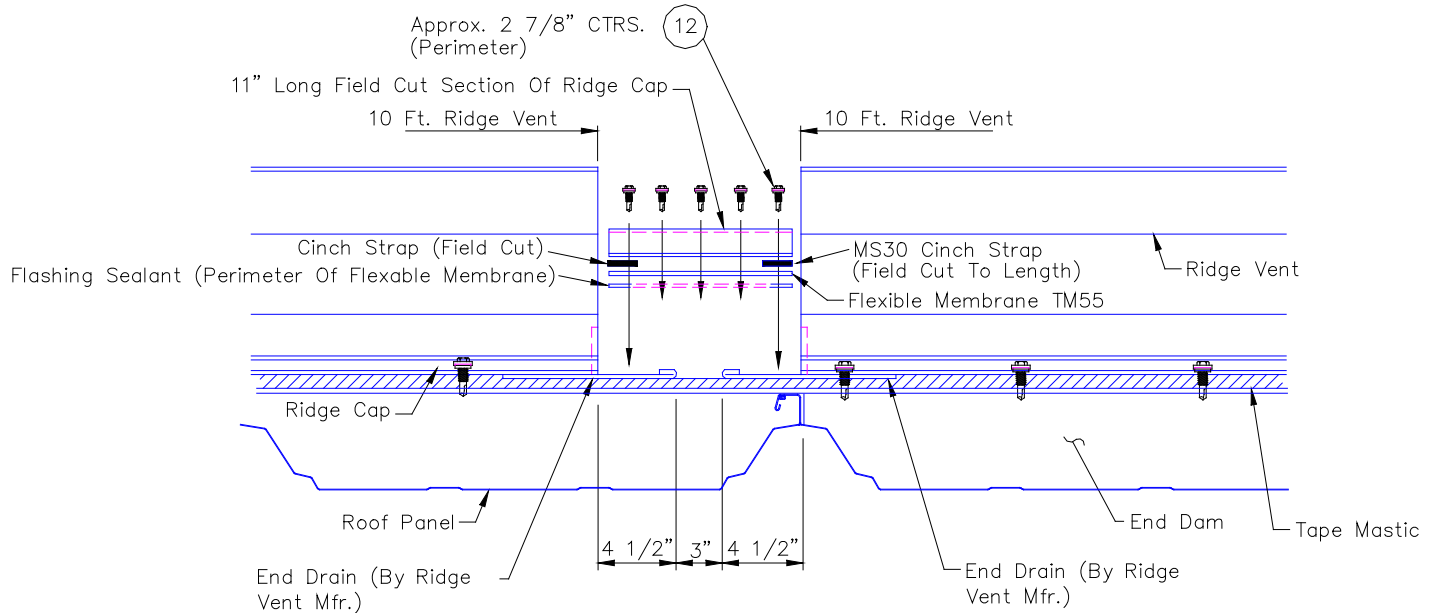


## 11.1.9 CONTINUOUS RUN OF RIDGE VENTILATORS

When continuous ridge ventilators are installed, butt ends of vents over end drain assembly.

No more than (5) 10 ft. ventilator sections should be connected together in a continuous run. When more than (5) are required allow a minimum of 1 ft. between each group for THERMAL MOVEMENT.

See instructions included with ridge ventilator on connecting the damper pull bars for continuous ridge vents.

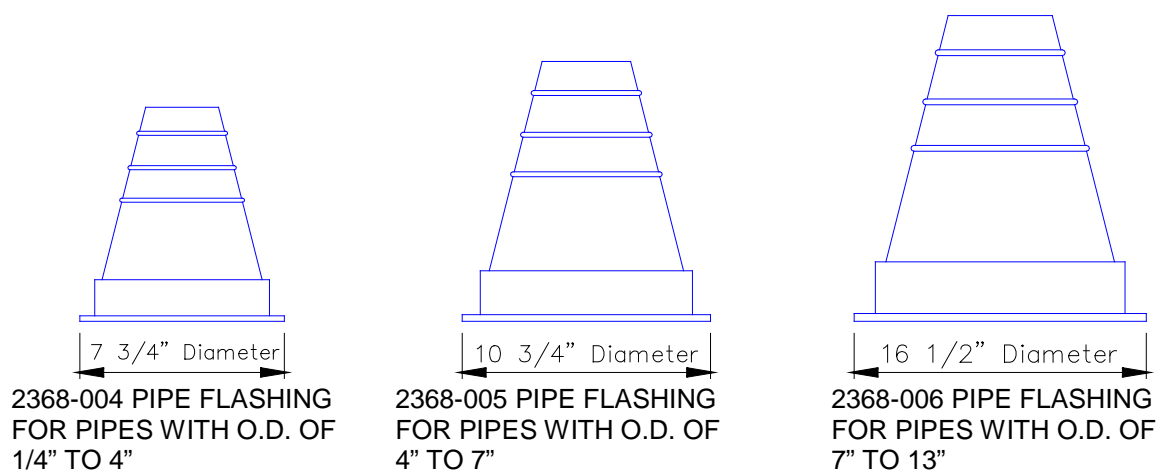
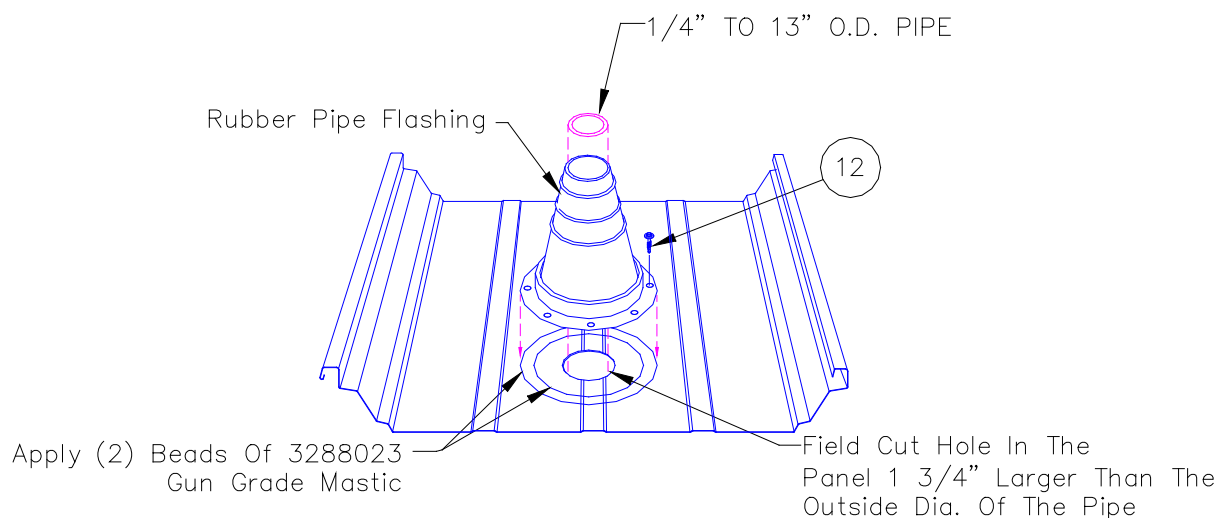


The following components are used to make the transition between two groups of continuous ridge ventilators.

- A. Flashing Sealant (3209430)
- B. Flexible Membrane (TM55)
- C. Cinch Strap (MS30)
- D. 10" Long section of ridge cap (Field cut)
- E. ⑫ self-drilling screws (3228103)



## 11.2 PIPE FLASHING



### GENERAL NOTES FOR PIPE FLASHING INSTALLATION:

1. CUT A NEAT HOLE IN THE ROOF PANEL WITH A MINIMUM CLEARANCE OF 1 3/4" ALL THE WAY AROUND THE PIPE. AVOID CUTTING THE MAJOR RIB ON THE PANEL.
2. CLEAN THE ROOF PANEL AROUND THE HOLE.
3. IF THE RUBBER PIPE FLASHING HAS TO BE CUT TO SUIT THE PIPE SIZE USE A SHARP PAIR OF SCISSORS AND AVOID NICKS.
4. APPLY GUN GRADE MASTIC TO PANEL OR UNDERSIDE OF THE PIPE FLASHING AND ATTACH TO THE ROOF PANEL AS SHOWN BELOW.
5. WHEN ATTACHING THE SCREWS THE FIRST (2) SCREWS SHOULD BE OPPOSITE EACH OTHER. THEN PROGRESSIVELY COMPLETE THE FASTENING BY PRESSING THE BASE DOWN FIRMLY.

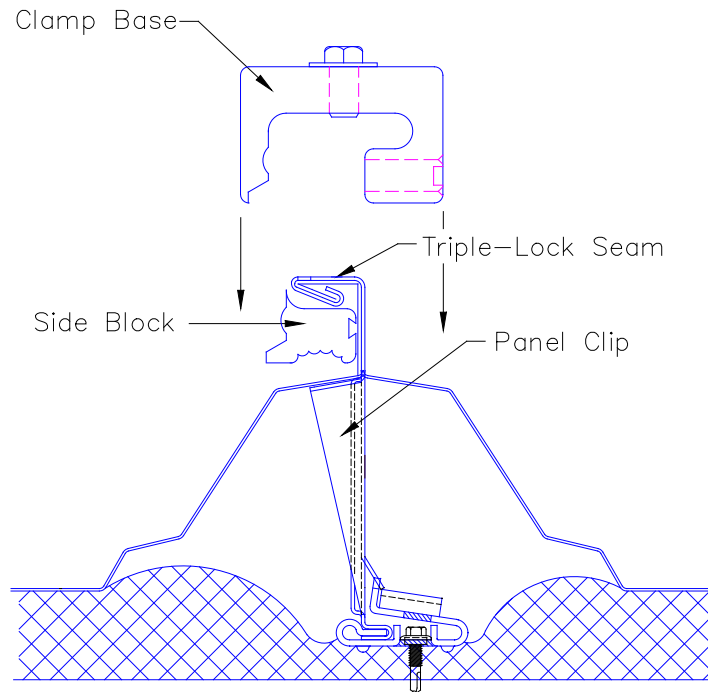


## 11.3 ROOF CLAMP

When the roof clamp (Part no. 1508145) is to be used on the standing seam roof, the following erection procedure can be used.

### STEP NO. 1

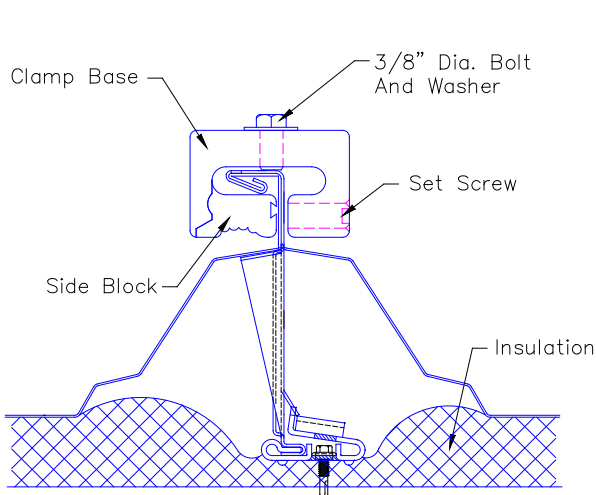
At the location where the clamp will be installed the panel seam must have been TRIPLE-LOCK manually seamed in order to allow the placement of the "side block" that will be joined to the clamp base.



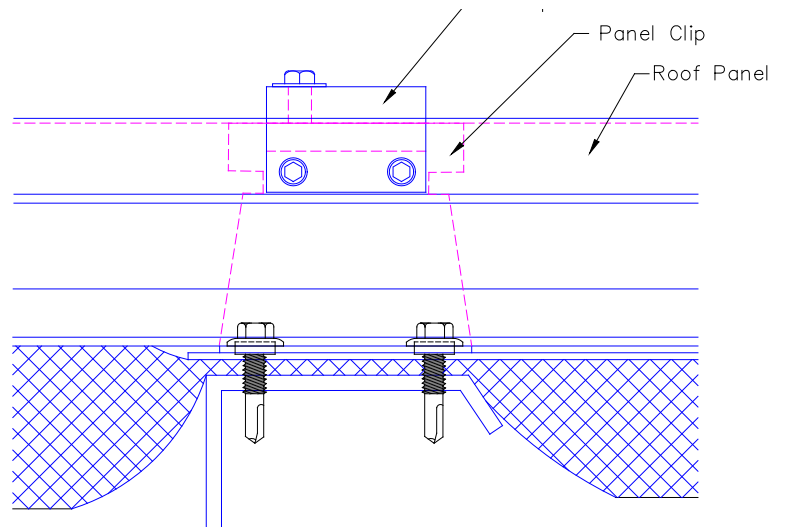
**Preparing seam and installing side block**

### STEP NO. 2

Position the clamp base over the panel seam. Engage the side block and tighten both set screws. Use 3/8" dia. Bolt to attach other components.



**Cross Section**



**Side View**





## 12 ROOF SEAMING GENERAL INFORMATION

### 12.1 GENERAL

This information is provided to customers and erectors as the recommended procedures for the correct seaming of the ZL-24® Standing Seam Roof System.

This information is intended to be used with the project's erection drawings.

The erection drawings govern the specific seam requirements. In case of conflict between this information and the erection drawings, the erection drawings will have precedence.

The customer is responsible for proper seaming of the roof in accordance with the erection drawings and this seaming information, and in accordance with good engineering and construction practices.

The customer must take the responsibility for selecting a competent erector, insist that the work be performed by qualified and experienced standing seam metal roof installers, and insist that the erector take time to study and understand this information, then assure that the erector correctly follows these instructions.

The building manufacturer does not guarantee and is not liable for the quality of erection. The building manufacturer is not responsible for building defects that may be attributed to improper erection or the negligence of other parties.

Clarification concerning the roof installation and seaming should be directed to the building manufacturer's customer service manager.

### 12.2 SEAM TYPES

#### 12.2.1 GENERAL

The ZL-24® Standing Seam Roof System has three seam type options. The project's design and roof performance requirements govern which seam type is required.

Different seam types may be required on specific areas of the roof. In all cases, refer to the erection drawings to determine the required seam type and location.

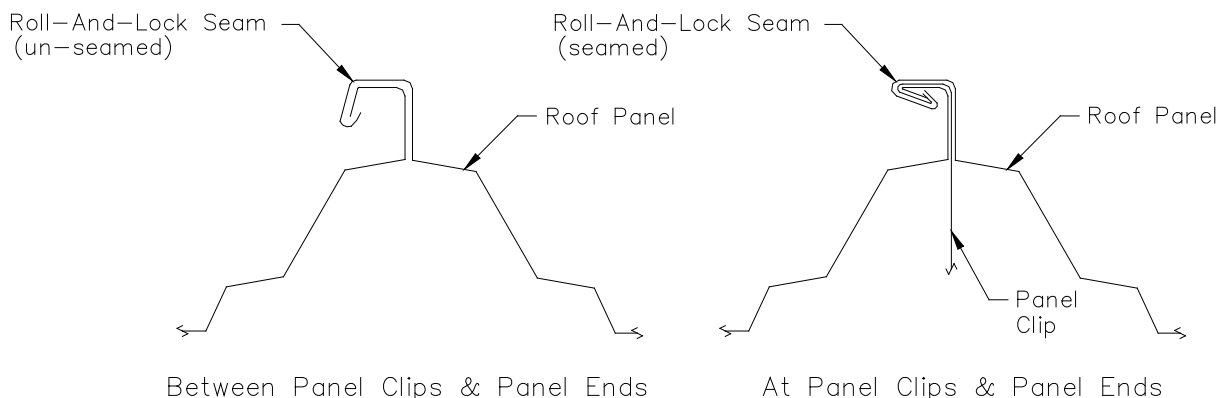
Different seams can be achieved through two different methods:

1. Manual seaming with hand tools.
2. Limited manual seaming followed by running motor seaming machine.

#### 12.2.2 ROLL-AND-LOCK SEAM

The Roll-and-Lock Seam requires seaming the roof panels with the manual seaming tool only at the panel clips, at the eave and ridge ends of the roof panel, and at the endlaps.

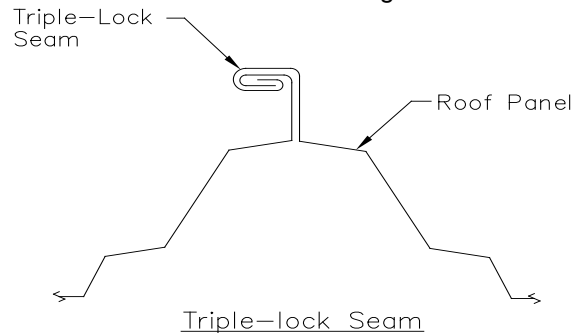
The motor seaming machine is not required for Roll-And-Lock seaming.





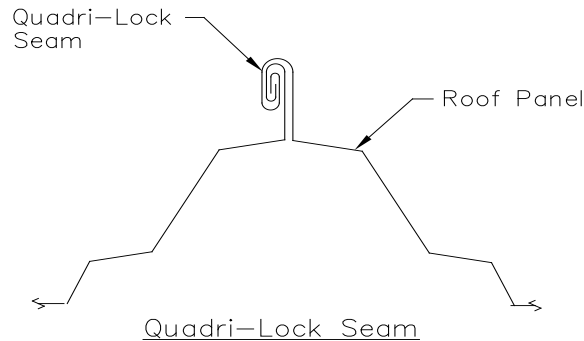
## 12.2.3 TRIPLE-LOCK SEAM

Prior to Triple-Lock seaming, the panel seam must have been Roll-and-Lock seamed first. Then the Triple-Lock seam requires seaming the specified area of the roof with a motor seaming machine or the manual seaming tool.



## 12.2.4 QUADRI-LOCK SEAM

Prior to Quadri-Lock seaming, the panel seam must have been Roll-And-Lock and then "Triple-Lock" seamed. Then the Quadri-Lock seam requires seaming the specified area of the roof with a manual seaming tool. The motor seaming machine from our recommended seamer supplier can seam a triple and quadri-lock seam in one pass.



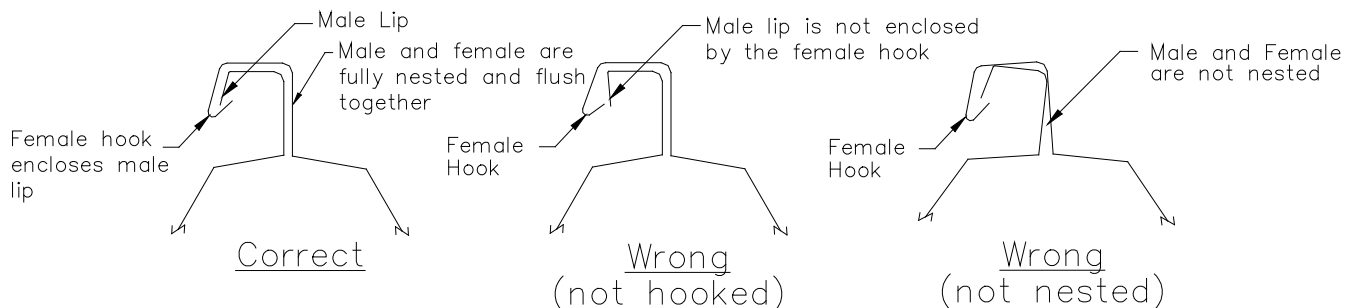
## 12.3 CHECK PANEL ASSEMBLY

### 12.3.1 SIDELAP FIT-UP

Before seaming, inspect the full length of each roof panel sidelap. Check that the male and female are fully nested and the lip at the panel's male edge is enclosed by the hook of the adjacent panel's female edge.

Any conditions where the male and female are not fully nested or the male lip is not positioned inside of the female hook must be corrected before attempting to seam the roof panels.

**Caution:** Faulty seaming may occur where the male lip is not enclosed by the female hook and when the male and female are not fully nested. Such faulty seaming can result in seaming difficulty and objectionable seam appearance. In severe cases reduction in roof performance specifications.





## 12.3.2 CLIP ALIGNMENT

Before seaming, check that each roof panel clip is properly seated in the roof panel sidelap assembly. Any displaced clips must be corrected before attempting to seam the roof panels.

**Caution:** Misaligned panel clips can cause faulty seaming and objectionable seam appearance.

## 12.3.3 SEAM DAMAGE

Before seaming, check that the male and female edges are not kinked or otherwise distorted. Any such distortions must be corrected before attempting to seam the roof panels.

## 13 IMPORTANCE OF SEAMING

### 13.1 ROOF PERFORMANCE

The roof panels must be correctly seamed before the roof system can provide its designed wind load and weather resistance capability. This means that an un-seamed roof is subject to wind load failure and/or weather resistance failure.

### 13.2 WHEN TO SEAM

Whenever possible, the installed roof panels should be seamed at the finish of each day's work. If high wind or rain/snow conditions are imminent, the installed roof panels must be seamed before such conditions occur.

### 13.3 TEMPORARY SEAMING

On roofs requiring Triple-Lock and Quadri-Lock seams, it may not always be practical or feasible to motor seam the roof panels until after the roof installation is completed. Motor seamed roof panels are difficult to reposition or replace and seaming machines may not always be available during the entire roof installation period.

In such cases, it may be desirable to temporarily Roll-And-Lock seam the roof panels with the manual seaming tool, then later complete the seaming with the motor seaming machine.

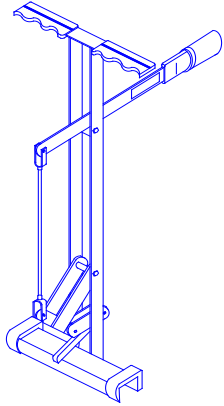
**Important:** Temporary Roll-And-Lock seaming must be approved by the project's designer.



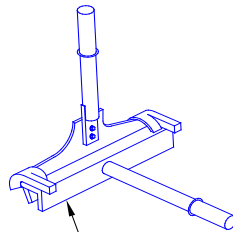
## 14 SEAMING EQUIPMENT

### 14.1 SPECIALIZED SEAMING TOOLS

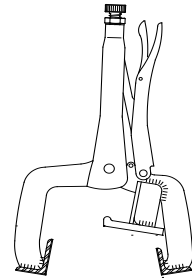
The seaming of the roof panels require special seaming tools which are available only from the building manufacturer. The roof system seaming tools are custom built, specialized equipment and are costly to replace.



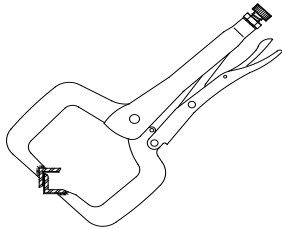
Stand-up Seaming Tool  
255139



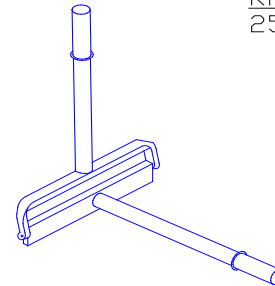
Manual Seaming Tool  
3518052



Rib Clamp  
255135



Seam Clamp 255133



Quadri-Lock Seaming Tool 3518053

### 14.2 SEAMING TOOL SOURCE

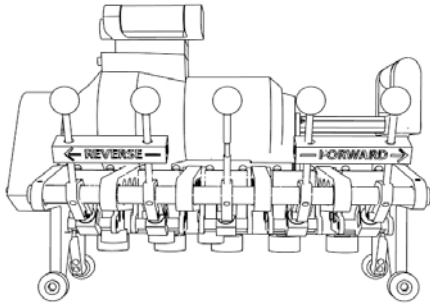
The tools (above) specifically designed for the standing seam roof panel are available from the building manufacturer.



## 14.3 MOTOR SEAMING MACHINES

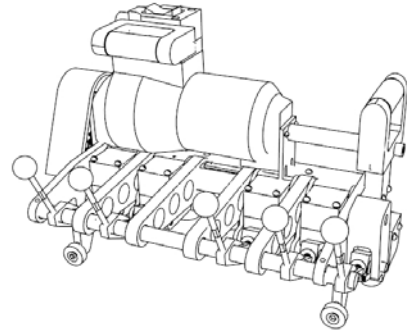
Two different models of seamers are available from the company below. Seamers can be ordered through the Quality Roof Seamers web site [www.qualityroofseamers.com](http://www.qualityroofseamers.com) and selecting Behlen Building Systems in the “Our Manufacturers” selection.

Quality Roof Seamers, Inc.  
8265 Highway 178  
Olive Branch, MS 38654  
Phone: 662-895-1222  
Fax: 662-890-4775



### **MODEL: 5 STATION TRIPLE-LOK SEAMER**

Features: Weight = 60 lbs  
Speed - 30 Feet per min.



### **MODEL: 5 STATION QUAD-LOK SEAMER**

Features: Weight = 60 lbs  
Speed - 30 Feet per min.

Specific operation, care and use of the seamer will be included in an instruction manual shipped with seamer.

Upon completion of the roof seaming, promptly return the seaming kit in accordance with the instructions on the return shipping documents. The return shipping documents are provided in the seaming kit.

## 14.4 HANDLING SEAMER

Provide safe and secure handling of the seaming tools when in use.

The weights of the seaming machines are 60 pounds and can cause damage and injury if it falls.

The machines may be too heavy to safely carry up a ladder. Always hoist the machines onto the roof with proper lifting equipment or with a proper sized rope tied or hooked securely to the machine's front lifting handle.

When starting and finishing the seaming machine at the edges of the roof, the operator must be securely positioned so that he can safely lift the seaming machine on and off of the seam.

**Caution:** The use of other seaming equipment may result in faulty and/or damaged seams and may invalidate the roof system's material and performance warranties.



## 15 ELECTRICAL REQUIREMENTS

### 15.1 MOTOR SEAMING MACHINES

The seaming machine motor requires a 10 amp, 100-125 volt AC power supply.

### 15.2 ELECTRICAL SERVICE AND CORDS

The electrical service and the electrical cords to the seaming machine must be of sufficient capacity to provide electrical power **at the seaming machine**. If other tools or equipment are being used on the same service, the service and cord capacity must be increased accordingly.

**Caution:** Low voltage due to insufficient service capacity, insufficient cord size or excessive cord length will cause overheating and burnout of the seaming machine's motor.

### 15.3 ELECTRICAL SAFETY

Check that the power cords are fitted with the correct plug for safe and secure electrical connection to the seaming machine. Check that the power cords are properly grounded and that the service has a ground fault circuit breaker.

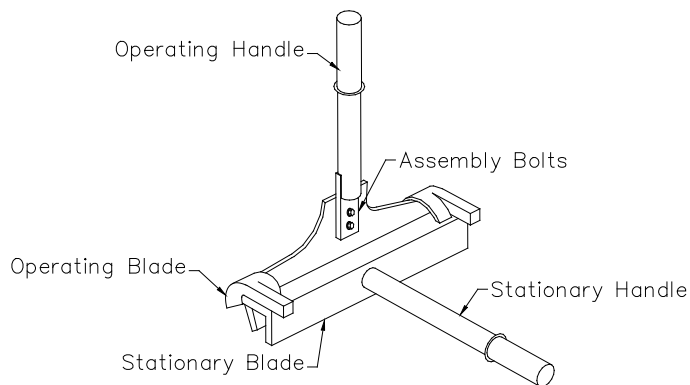
### 15.4 CORD CLEARANCE

Check that the electrical cord is of sufficient length to extend the full length of the area to be seamed without stress on the cord or its connections. Check that the path for the cord is clear and that the cord is clear of snagging on panel edges or entanglement into the seaming machine rolls.

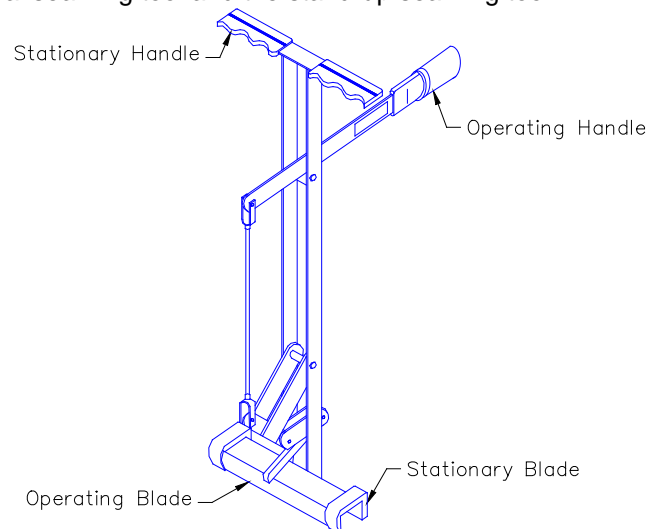
## 16 MANUAL SEAMING TOOL OPERATION

### 16.1 MANUAL SEAMING TOOL TYPES AND NOMENCLATURE

The following detail identifies the operational parts of the manual seaming tool and the stand-up seaming tool.



**MANUAL SEAMING TOOL**



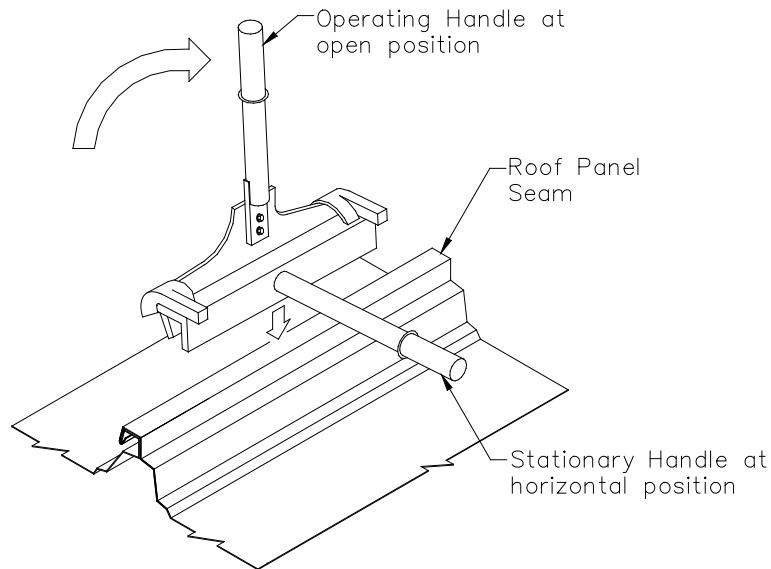
**STAND-UP SEAMING TOOL**

Throughout the rest of this seaming tool operation, only the manual seaming tool will be shown. The information is similar for the stand-up seaming tool.



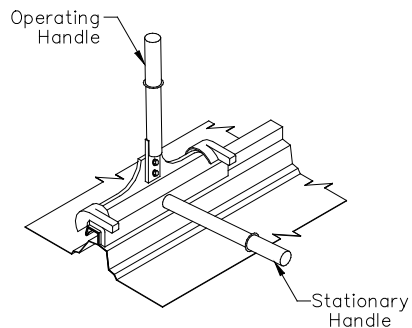
## 16.2 TOOL ORIENTATION TO SEAM

Orient the tool to fit correctly onto the roof panel seam as shown. The stationary handle must be in the horizontal position and the operating handle must be rotated up to the open position.

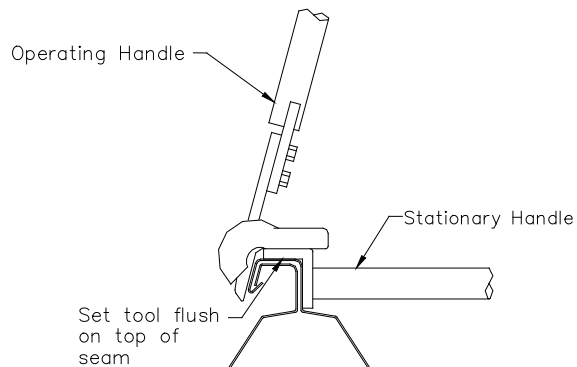


## 16.3 FORMING THE SEAM

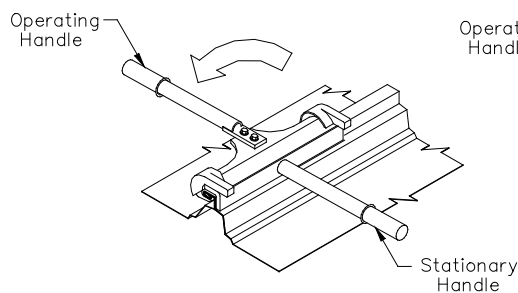
When the tool is correctly positioned on the panel, push the stationary blade down solidly against the top of the seam. While holding the stationary handle in the horizontal position, rotate the operating handle down to the horizontal position.



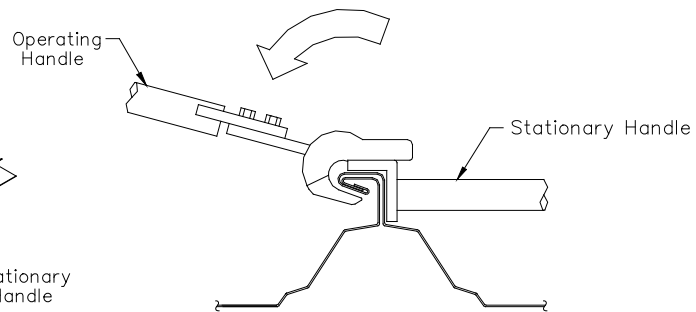
STEP 1



STEP 2



STEP 1



STEP 2

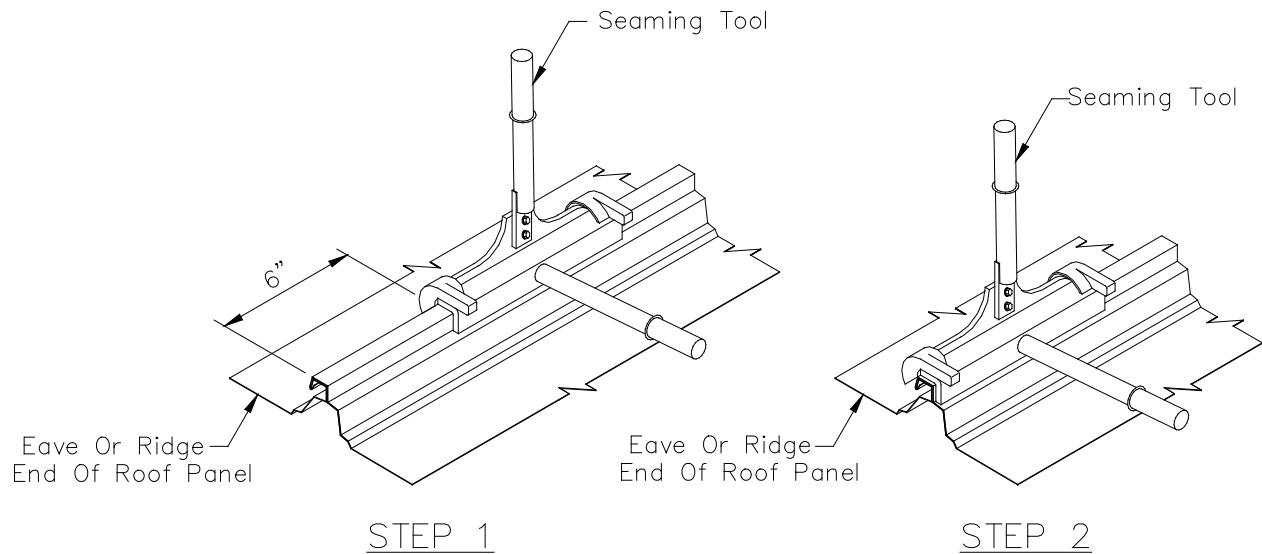


## 16.4 TOOL POSITION AT END OF PANEL

When seaming at the eave or ridge end of the roof panel, the seaming must be done in two steps.

For the first step, position the end of the seaming tool at 6" from the end of the roof panel and seam that area.

For the second step, position the end of the seaming tool flush with the end of the roof panel and seam that area.

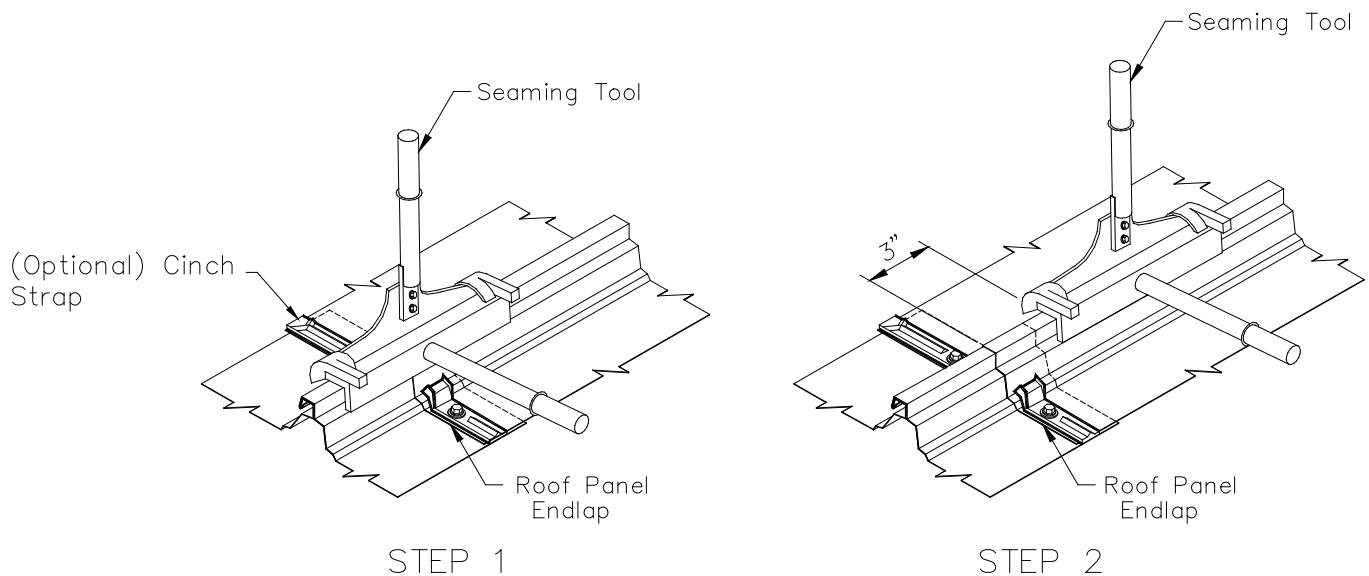


## 16.5 TOOL POSITION AT PANEL ENDLAP

When seaming at a roof panel endlap, the seaming must be done in two steps.

For the first step, center the tool over the endlap and seam that area.

For the second step, position the end of the tool 3" uphill from the edge of the endlap and seam that area.

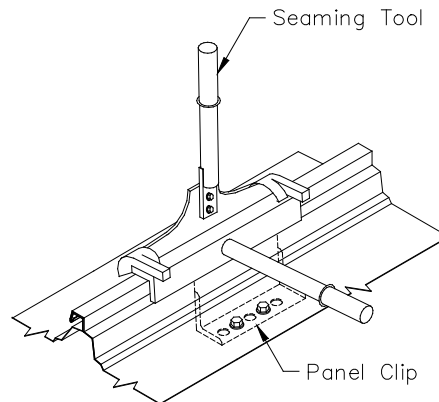






## 16.6 TOOL POSITION AT PANEL CLIPS

When seaming at a panel clip location, center the tool over the panel clip and seam that area.

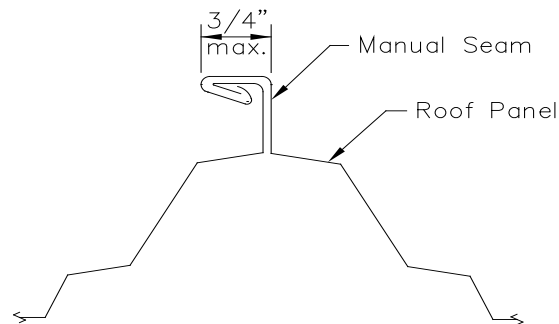


### AT PANEL CLIP LOCATIONS

## 16.7 CHECKING THE FINISHED SEAM

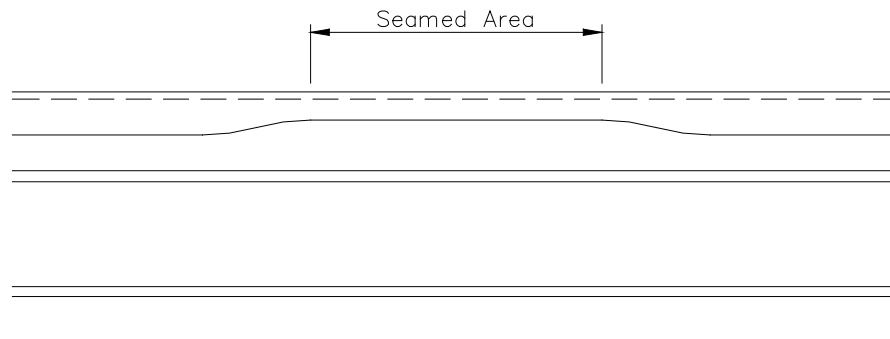
Rotate the operating handle to the open position, remove the tool and check that the seam is correctly formed, as shown on the detail below.

**Caution:** If the manual seaming tool does not correctly form the seam, do not continue seaming but contact the building manufacturer for instructions.



### SECTION

This manual seaming operation will have an effect on the appearance, from the side, of the panel seam.



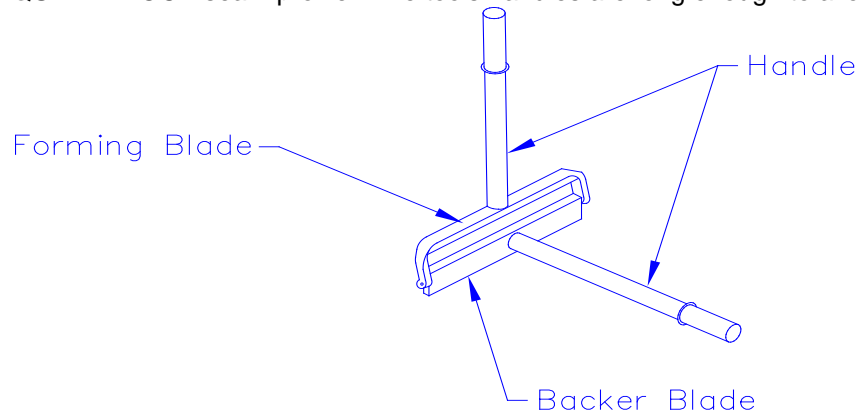
### SIDE VIEW



## 17 QUADRI-LOCK MANUAL SEAMING TOOL OPERATION

### 17.1 TOOL NOMENCLATURE

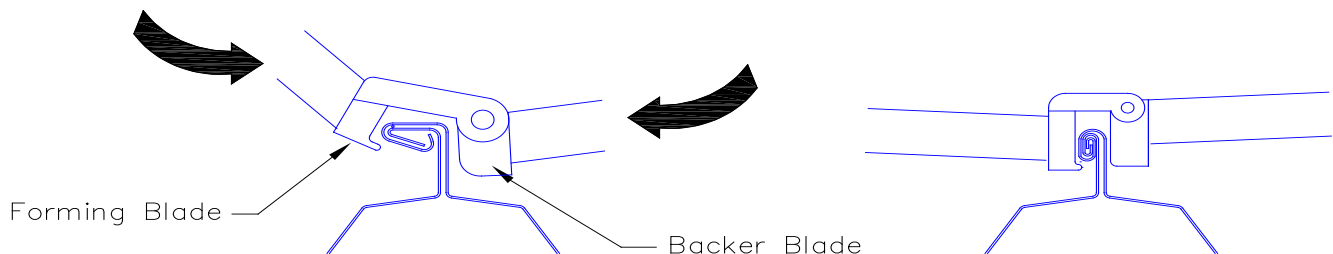
The QUADRI-LOCK manual seaming tool is a lever operated field forming tool. The tools blades are designed to form the panel seam into the QUADRI-LOCK seam profile. The tools handles are long enough to allow stand-up operation.



**MANUAL QUADRI-LOCK SEAMING TOOL**

### 17.2 TOOL ORIENTATION TO SEAM

To start the QUADRI-LOCK seam, the manual seaming tool is set over the panel seam.



**TRIPLE-LOCK SEAM**

**QUADRI-LOCK SEAM**

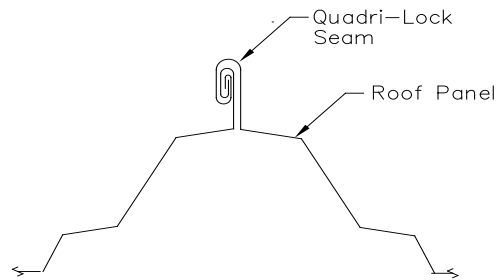
### 17.3 FORMING THE SEAM

The tool is then operated by pushing the operating handles towards each other. The forming and backer blades are designed to form the seam into the quadri-lock seam profile.



## 17.4 CHECKING THE FINISHED SEAM

Rotate the operating handles to the open position, remove the tool and check that the seam is correctly formed as shown below.



### QUADRI-LOCK SEAM

## 18 MOTOR SEAMING MACHINE OPERATION

Prior to running a seamer, read instructions included in seaming kit.

### 18.1 CLEAN THE SEAMS

The roof panel seams must be thoroughly cleaned of abrasive dirt or dust that can cause scuffing or scratching of the seam surface. The roof panel seams must be cleaned of grease or other contaminants which can cause seaming machine slippage and marking of the seam surface.

### 18.2 RUNNING THE SEAMER

Use caution when working or approaching the end of the panel with a seamer. Stop or start the seamer while wheels remain on the panel. DO NOT run to within 6 inches of the panel end, use the hand crimper.

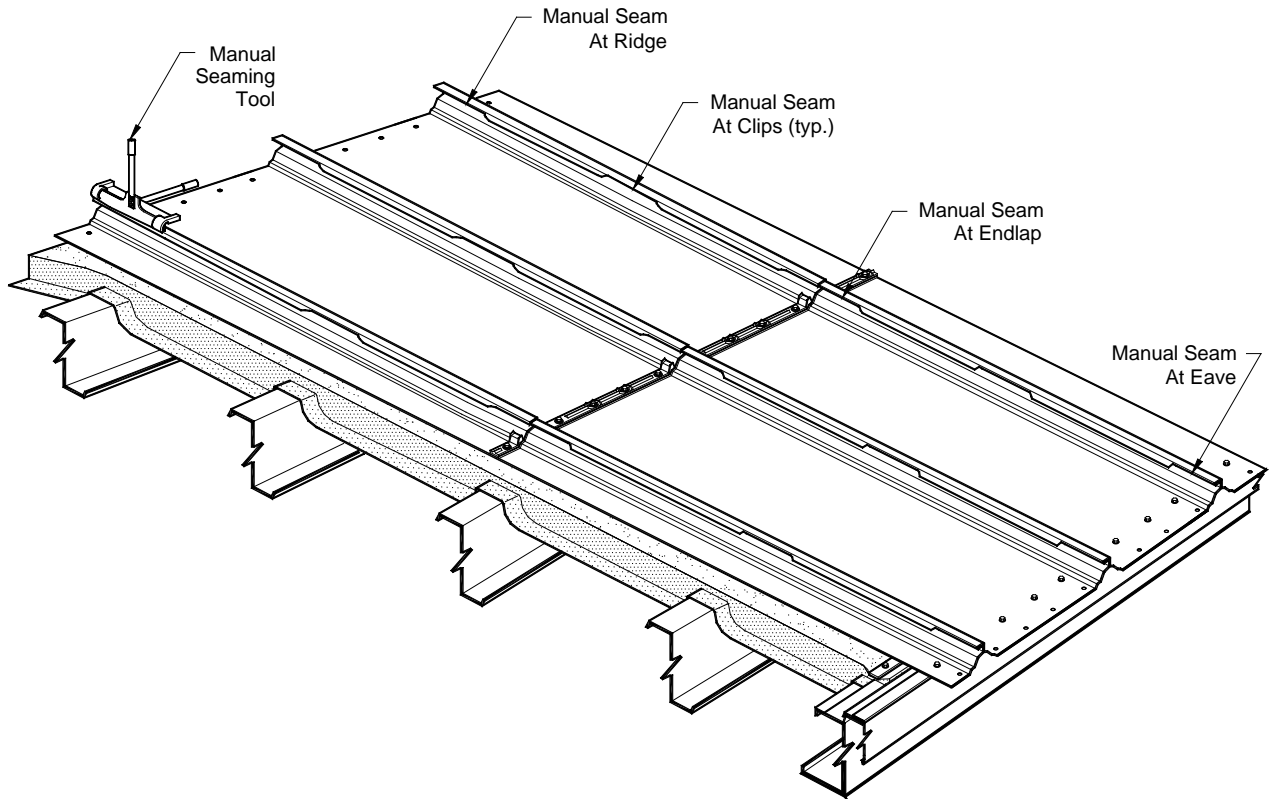
Run the seamer about 4 to 6 inches and check seam to assure proper seaming operation. After seam is checked and proper operation is verified, seam remainder of the panel.



## 19 ROLL-AND-LOCK SEAMING

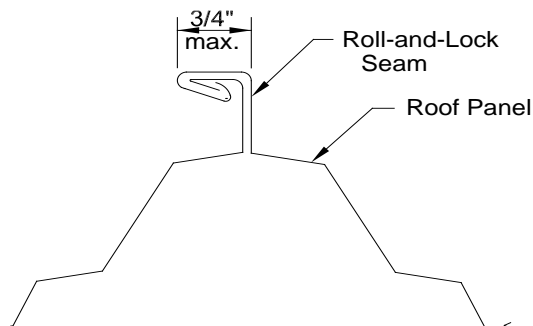
### 19.1 MANUAL SEAMING

Along each roof panel seam, use the manual seaming tool to close the seam at the eave and ridge ends of the panels, at the panel endlaps and at each clip.



### 19.2 FINISH SEAM DETAIL

Check that the finished seam is correctly formed as shown in the following detail.





## 20 TRIPLE-LOCK SEAMING

### 20.1 MANUAL SEAMING

Prior to motor seaming, use the manual seaming tool to seam the roof panels at all panel clip locations, the starting end of the seam (eave or ridge end, depending on seaming direction) and at the endlaps.

### 20.2 MOTOR SEAMING

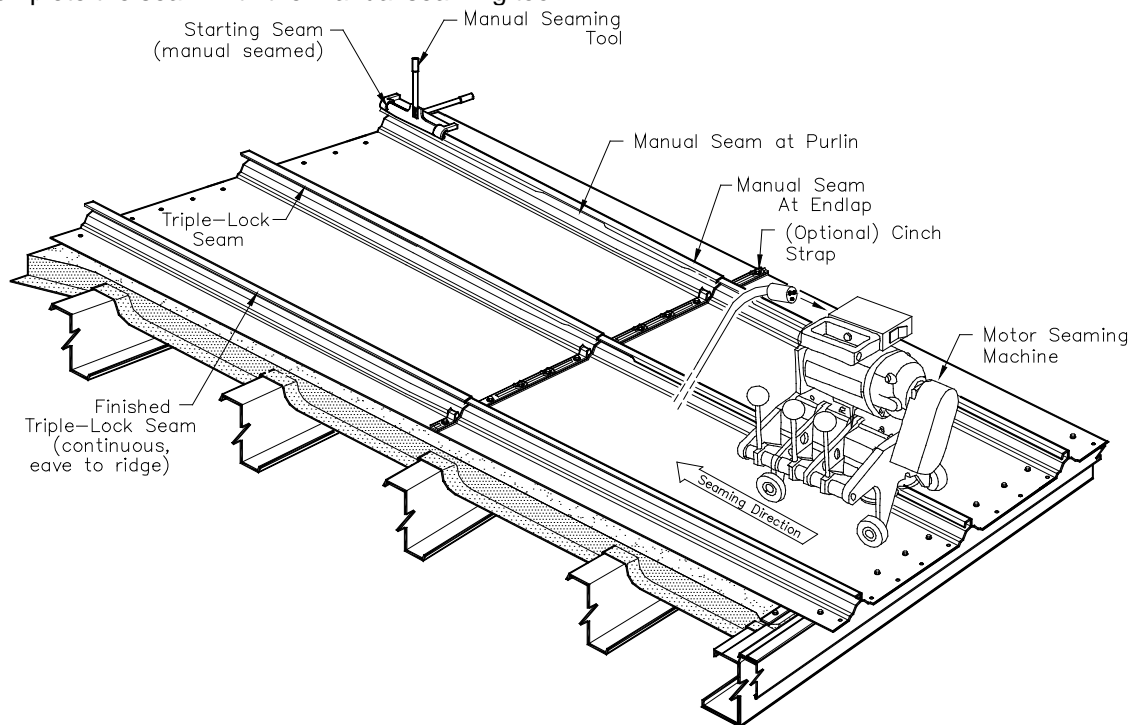
Seam the full length of each roof panel seam using the motor seaming machine which is fitted with the Triple-Lock forming rolls.

Start the seaming machine at the starting end of the seam, on the area previously seamed with the manual seaming tool.

If the roof panels have endlaps and the "Optional" cinch strap is used, stop the seaming machine just before running onto the endlap. Remove the seaming machine and restart it on the other side of the endlap on the area previously seamed with manual seaming tool.

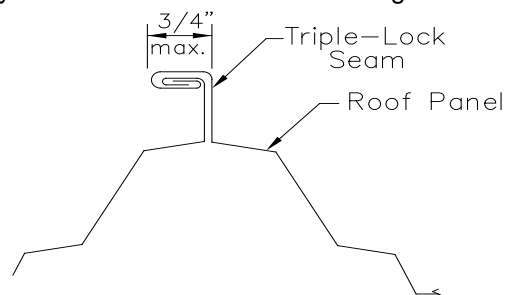
Run the seaming machine to the finish end of the seams.

At any uncompleted seam areas, such as where the seaming machine had to be stopped prior to the endlap or ridge end dam, complete the seam with the manual seaming tool.



### 20.3 FINISH SEAM DETAIL

Check that the finished seam is correctly formed as shown in the following detail.





## 21 QUADRI-LOCK SEAMING

To form a Quadri-Lock seam the manual seaming tool or a motor seaming machine can be used to seam the specified areas of the roof.

### 21.1 MANUAL SEAMING

Prior to motor seaming, use the manual seaming tool at the starting end of the seam where the rollers will be engaged.

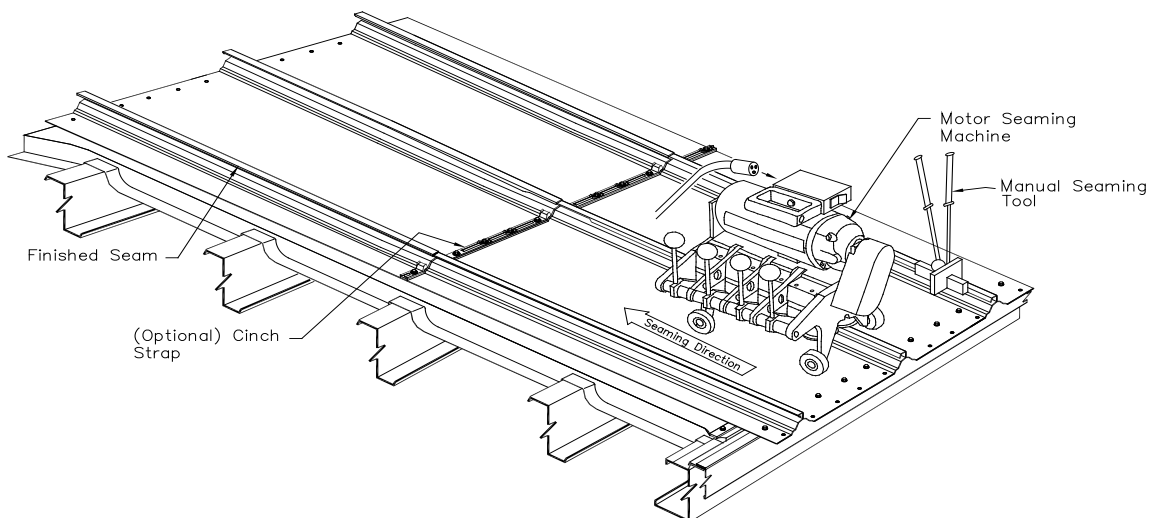
### 21.2 MOTOR SEAMING

Seam the specified area of the roof using the motor seaming machine which is fitted with the Quadri-Lock forming rolls.

Start the seaming machine at the starting end of the seam, on the area previously seamed with the Quadri-Lock manual seaming tool.

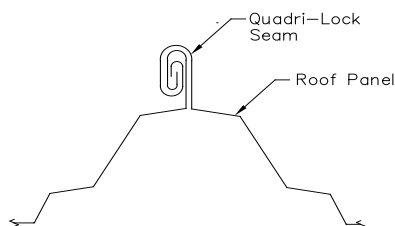
If the roof panels have endlaps and the “Optional” cinch strap is used, stop the seaming machine just before running onto the endlap. Remove the seaming machine and restart it on the other side of the endlap on the area previously seamed with manual seaming tool.

At any uncompleted seam areas, such as where the seaming machine had to be stopped prior to the endlap or ridge end dam, complete the seam with the manual Quadri-Lock seaming tool.



### 21.3 FINISH SEAM DETAIL

Check that the finished seam is correctly formed as shown in the following detail.





## 22 PANEL REPLACEMENT PROCEDURE

### 22.1 GENERAL

The triple lock design provides the roof panel seams their remarkable resistance to opening under wind pressures. As forces try to pry open the first and second locks, the third lock actually tightens.

Understandably, opening the seam's three locks, such as required to replace damaged panels, will require a relatively complicated process.

Opening the seam involves a sequence of bending operations to progressively open each of the three locks. These bending operations must be done continuously along the full length of the seam with hand tools. This is necessarily a skill and labor intensive process. The labor cost of opening the seams must be considered when judging the trade-offs between panel replacement versus other options such as patch repairs, panel splicing or re-sheeting whole roof sections, etc.

To minimize the seam opening process required for roof panel replacement, the following procedures establish a start and finish seam on either side of the roof area where the roof panels are to be replaced. Only the start and finish seams will require the opening process, however all of the roof panels between the starting and finish seams will have to be replaced. Consideration must be given to the trade-off between the number of start and finish seams being opened versus the number of undamaged panels being replaced.

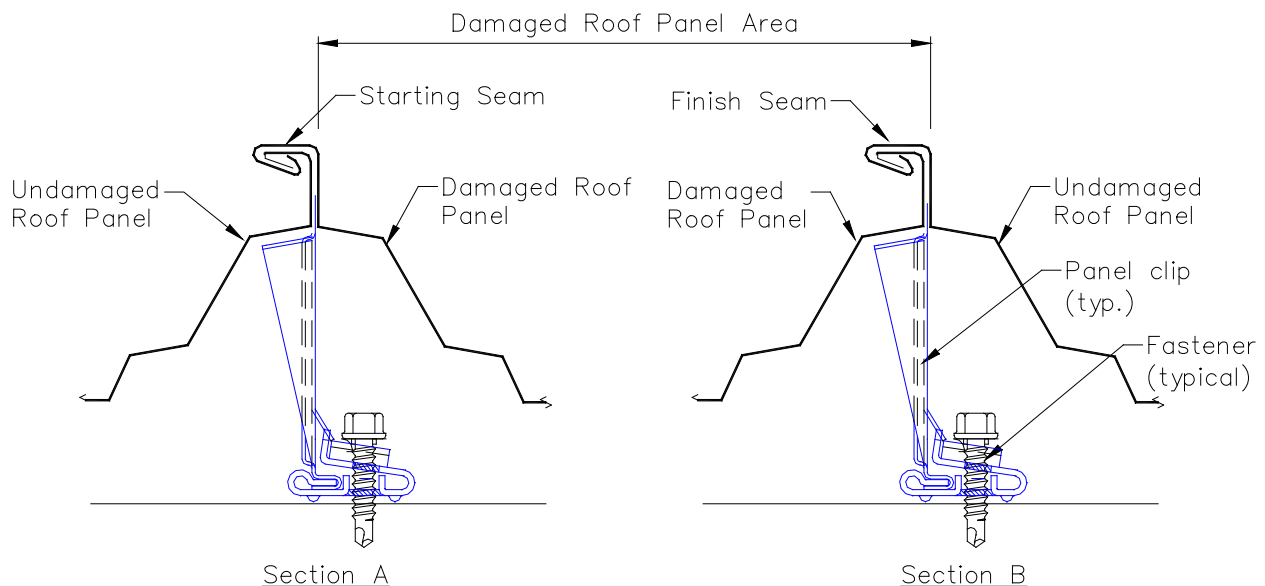
For example, one large panel replacement area will require only two seams to be opened at the expense of possible replacement of undamaged panels. Whereas, several small panel replacement areas may require a minimum replacement of undamaged panels but will require more seams to be opened.

During the opening and re-seaming process, the start and finish seams will be distorted and marred by the hand tools. The aesthetic acceptance and re-finishing (touch-up) requirements must be considered.

Following are suggested procedures for opening roof panel seams and replacement of roof panels in a given area.

### 22.2 DETERMINE THE DAMAGED PANEL AREA

Identify the damaged roof panels that are to be replaced. Select the roof panel seams that will define the starting seam and finish seam of the damaged panel area.

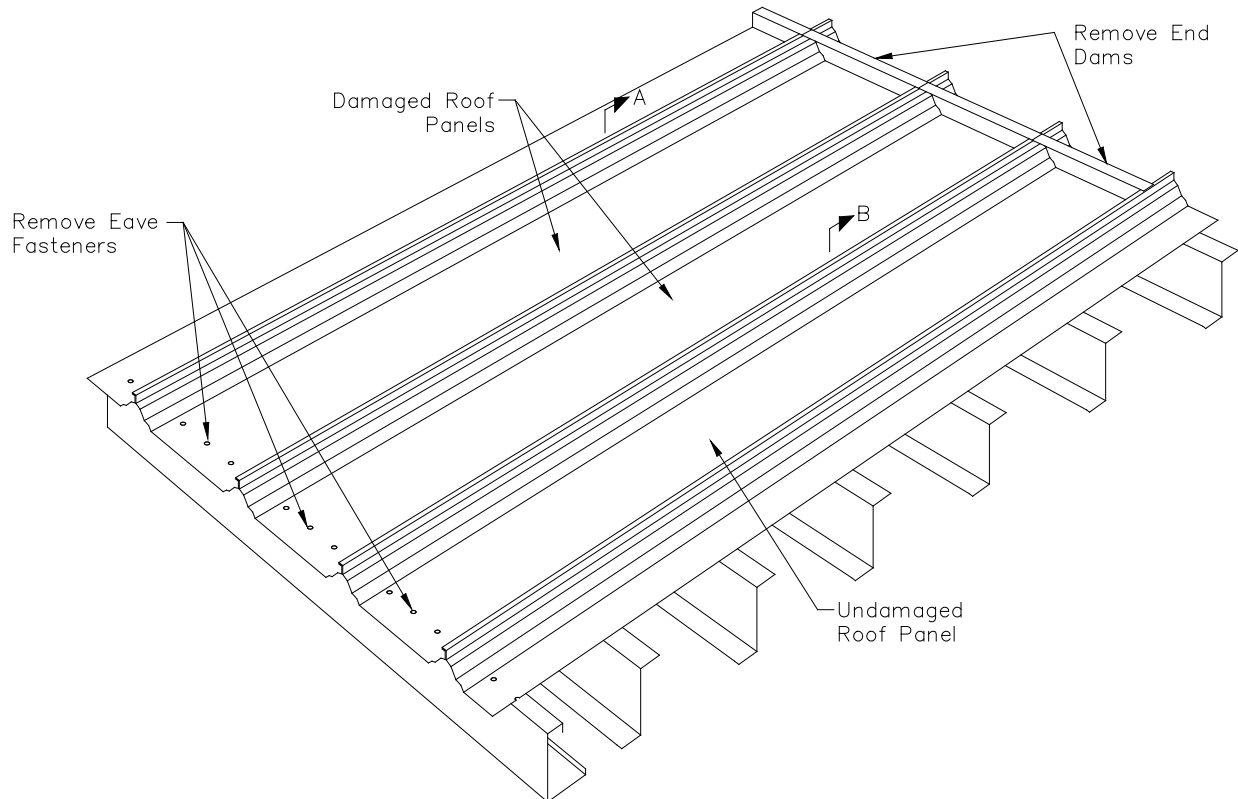




## 22.3 REMOVE EAVE AND RIDGE ATTACHMENTS

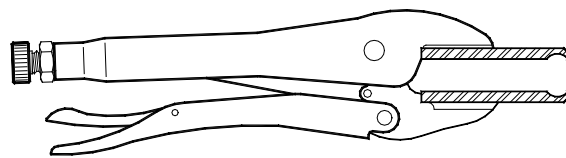
Remove the eave fasteners and end dams from all of the roof panels in the area to be replaced and on the one undamaged roof panel that is adjacent to the finish point of the damaged panel area.

To remove the end dams, the ridge flashing or high eave flashing will have to be removed along the damaged panel area. If the roof has an eave gutter, the gutter will have to be detached from the roof panels along the damaged panel area.



## 22.4 UN-SEAMING TOOL

The tool (shown below) is an economical but functional un-seaming tool.



Un-Seaming Tool (Part No. 256294)





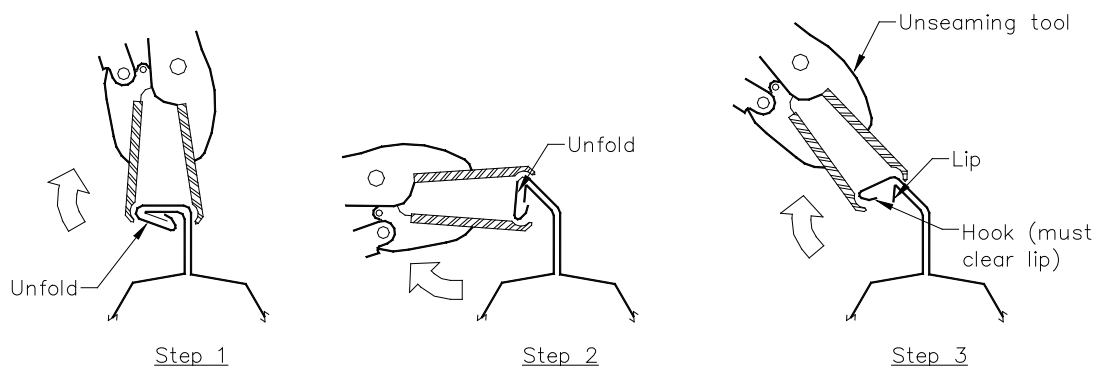
## 22.5 UNFOLD STARTING AND FINISH SEAMS

Use the un-seaming tools to unfold the starting seam and finish seam. The seams must be unfolded continuous along the full length of the seams.

**Note:** The unfolding process is most effective when several tools are operated in unison at 8" to 12" spacing and in a coordinated progressive bending sequence.

**Step 1 -** Straddle the seam's top flange with the tool's blades as shown. Lock the blades in position as shown and bend the flange upward until there is sufficient clearance under the seam for step 2.

**Step 2 -** Straddle the seam's under-fold with the tool's blades. Lock the blades in position as shown and bend the under-fold outward.

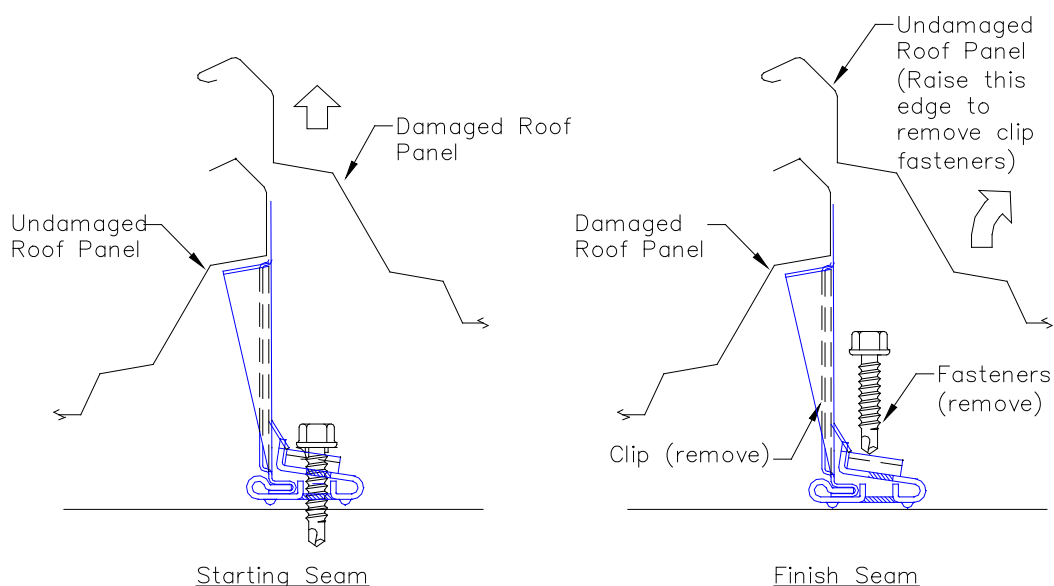


**Step 3 -** Continue to bend the under-fold outward until the seam is disengaged (the female hook clear must clear the male lip).

## 22.6 DISENGAGE THE STARTING AND FINISH SEAMS

At the starting seam, lift up the female edge of the damaged panel to disengage it from the male edge of the adjacent undamaged panel.

At the finish seam, lift up the female edge of the adjacent undamaged panel to disengage it from the male edge of the damaged panel and raise it to allow access to the panel clip fasteners. Remove the panel clip fasteners to free the clips and the edge of the damaged panel.



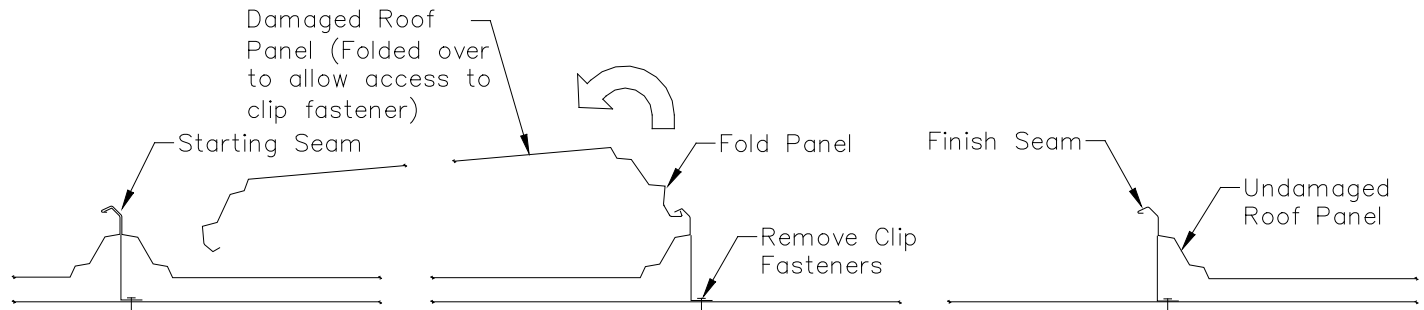


## 22.7 REMOVE DAMAGED PANELS

Beginning at the finish seam, lift the free edge of the damaged roof panel and fold the panel over to provide access to the clip fasteners. Remove the fasteners to free the clips and the panel edge.

**Note:** During the removal of the damaged roof panels, the clips do not have to be detached from the roof panels.

Lift the panel edge and fold over on top of the previously folded panel. Continue removing the clip fasteners and folding the panels until all of the damaged panels are removed.

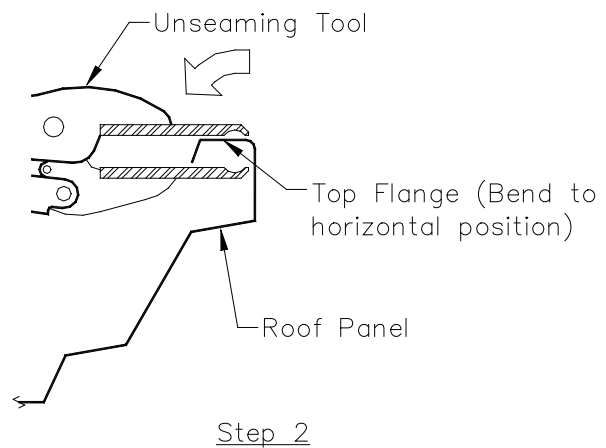
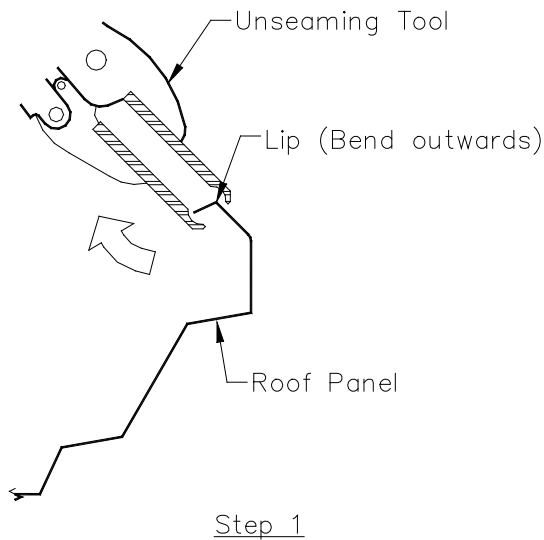


## 22.8 STARTING SEAM PREPARATION

At the starting seam, use the unseaming tool to reform the male edge on the adjacent undamaged panel. Reform this edge to the same configuration as on a new (unseamed) panel.

**Step 1 -** Straddle the male lip with the tool's blades and bend the lip outward as shown. The lip must bend out slightly, approximately 15°, beyond a right angle to the top flange.

**Step 2 -** Straddle the top flange and lip with the tool's blades and bend together downward as shown. Continue to bend downward until the top flange is horizontal.



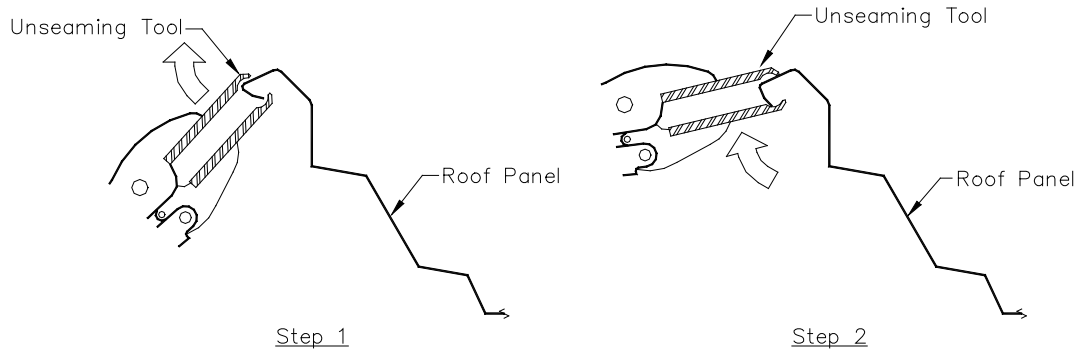


## 22.9 FINISH SEAM PREPARATION

At the finish seam, use the un-seaming tool to open the female hook.

Step 1 - Straddle the female hook with the tool's blades and bend the female hook open (downward and outward) as shown.

Step 2 - Continue to bend outward until the hook is at a 90° bend.

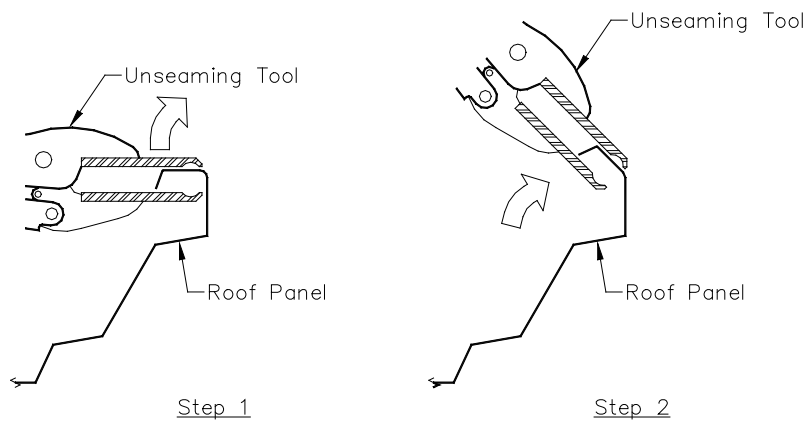


## 22.10 PREPARATION OF LAST REPLACEMENT PANEL

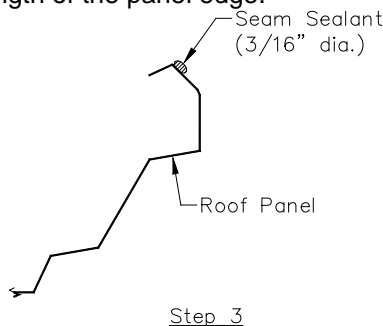
At the finish seam, use the un-seaming tool to reform the male edge of the last replacement panel.

Step 1 - Straddle the top flange and lip with the tool's blades and bend together upward as shown.

Step 2 - Continue to bend upward until the angle of the top flange matches the top flange on the adjacent undamaged panel (approximately 45°).



Step 3 - Apply seam sealant along the male panel as shown. Use gun grade mastic 3288023 to apply a 3/16 diameter bead of sealant continuous along the full length of the panel edge.





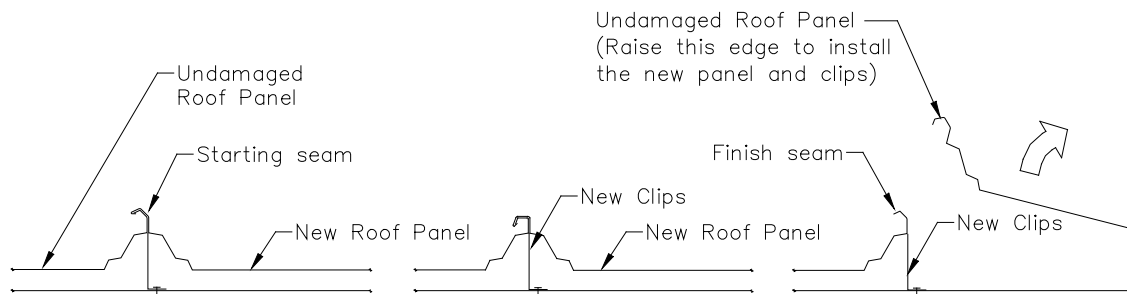
## 22.11 INSTALL REPLACEMENT ROOF PANELS

Beginning at the starting seam, install the replacement roof panels. Install the panels in same manner as for a new roof (see Section 9.3).

**Caution:** During installation of the replacement panels, the proper panel coverage width must be maintained to assure that the last replacement panel will fit correctly at the finish seam.

To fit the final replacement panel at the finish seam, raise the adjacent undamaged panel to allow the installation of the replacement panel's clips and fasteners.

After the clips and fasteners are installed, lower the undamaged panel's female edge onto the replacement panel's male edge.

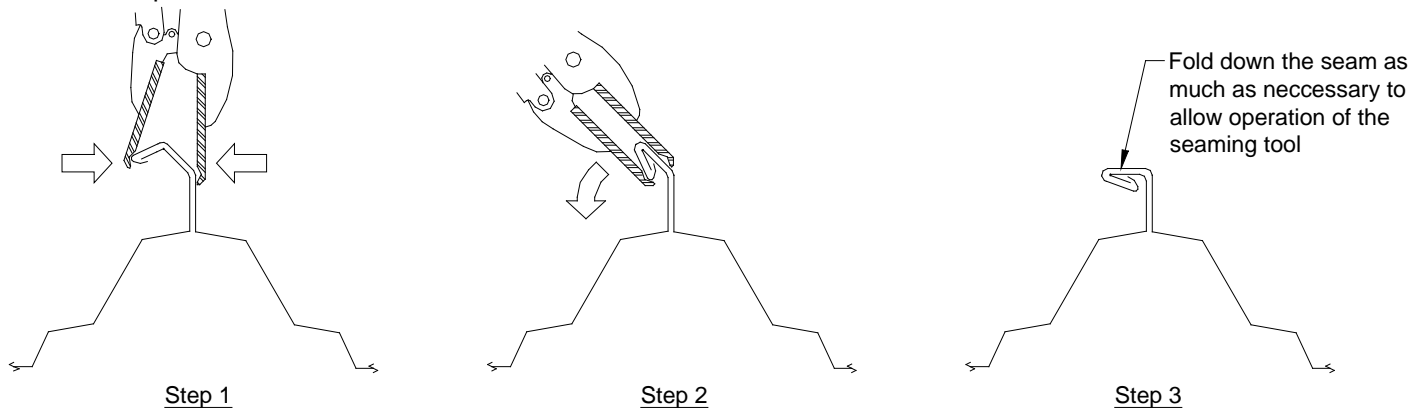


## 22.12 CLOSE THE FINISH SEAM

At the finish seam, use the un-seaming tool to close the female hook as shown in steps 1, 2 and 3. Before closing the hook, check the full length of the seam to assure that the hook will enclose the male lip.

## 22.13 FOLDING THE FINISH SEAM

If the seam is too open to allow operation of the manual seaming tool, it may be necessary to fold down the seam as shown in steps 1, 2 and 3.



## 22.14 SEAMING THE FINISH SEAM

Before closing the finish seam with the motor seaming machine, use the manual seaming tool to close the seam at the eave and ridge ends and at each panel clip.

While closing the seam with the manual seaming tool, if the top flange of the seam is not horizontal tilt the handles of the tool to help bend the seam to the horizontal position.