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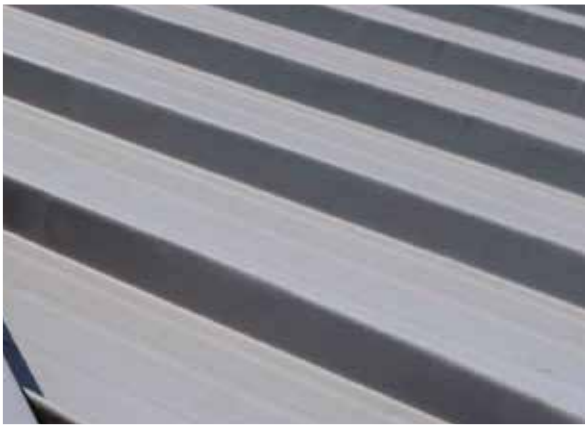
Metal Wall & Roof Systems
North America

SLR Series Architectural Metal Roof System Installation Guide

Innovative Single Element Building Envelope Solution



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MANUAL DOES NOT APPLY TO ZINC OR COPPER APPLICATIONS

INTRODUCTION

SLR Series™ manual is an introduction to Morin's recommendations. While some of these recommendations may or may not be agreed to by all, it must be remembered that these are the methods that we recommend and/or require to activate the warranties to our material upon completion of a project.

It is generally understood that one of the most serious problems with metal roofing in the past has been leaking, because of the use of thru-fastening to the substrate. Using this method, holes are drilled through the panels and then fasteners are installed through these holes for attachment to a structural substrate. In time, these holes will elongate due to thermal expansion/contraction, which in turn will cause the panel to leak. The factory or field roll formed standing seam roof panel system eliminates this problem by using a two-piece concealed expansion/sliding clip for panel attachment to structural substrate. These adaptable systems ensure leak-free roofing that can be designed into a low slope (> 1/2" in 12"). The SLR roof panels can be curved to various radiuses. Please contact your local representative for further information. Several ancillary systems (i.e. gutters, downspouts, ridge ventilators, fascias, window and rake end trim) are not standard, but are fabricated for specific job requirements. Our suggested details for these conditions are included in the following sections of this manual.

WARRANTIES:
Morin can furnish the various extended performance warranties as required by project specifications which cover weathertightness, material performance and finish performance. Contact your local representative for a sample copy along with exclusions and requirements for the Morin warranties.

INSTALLATION:
Morin recommends that our SLR Series panel should be installed under the direct supervision of an experienced sheet metal craftsman trained in the proper application of the system.

MATERIAL SPECIFICATIONS:
The SLR panel is supplied in standard widths of 12", 16", 18" and the standard material thickness is 24ga thru 20ga for steel and 0.032" & 0.040" for aluminum. All panels are supplied with either a non-coated mill finish or with a prefinished coating using standard 1.0 mil Fluorocarbons and High Build Fluorocarbons, depending on the project's performance requirements. Panels will be fabricated in lengths up to 48' in the factory. **Panels exceeding this length are fabricated using Morin's jobsite field rollforming machine.** Field roll-forming is required due to length restrictions in shipping.

COOL METAL ROOFING AND LEED®:
Morin's SLR Series meets the requirements of these programs. Contact your local representative for additional information.

SLR **INSTALLATION TOOLS & EQUIPMENTS**

2-STAGE SLR HAND CRIMPER:

This tool is used to hand seam the SLR panel to each clip and at the end of the (panel) run. It is available for 90° and 180° seaming.

INDUSTRIAL SERIES - 4 STATION ROOF SEAMER:

This tool is used to mechanically connect the SLR panel to the clips. The machine is self propelled with hands free operation. Built with a durable 110v electric motor, it is equipped with a quick-disconnect plug for added safety. Producing a 180° finished seam profile.

QUALITY ROOF SEAMERS

BASIC INSTALLATION TOOL LIST:

- Measuring Tape
- Pencil
- Offset. Straight and Left Cut. Red Grip Snaps (a)
- Offset. Straight and Right Cut. Green Grip Snaps (b)
- Utility Knife and Blades
- 6" Vise-Grip Locking C-Clamps (c)
- Pop Rivet Tool (d.1) (d.2)
- 6" Speed Square (e)
- Tool Belt
- 1 ½" Wood Chisel
- Hammer. Straight Claw 16 oz. (f)

(a)

(b)

(c)

(d.1)

(d.2)

(e)

ADDITIONAL TOOLS TO SPEEDUP INSTALLATION:

- Hand Seamer, Hand Crimper, Duckbill. Vise-Grip. Locking Sheet Metal Tool (g)
- 12" Speed Square
- Construction Master, Contractor's Calculator
- Roper Whitney No. 5 Jr. Punch Kit (h)
- Bend & Hemming Tool (i) *Wuko Bender Kit

Can be purchased at most:
Lowes, Home Depot, Granger,
Dynamic Fastener, Triangle Fastener,
Ram Tool, Fastenal, and Northern Tool.

(f)

(g)

(h)

(i)

FIELD METAL CUTTING TOOL LIST:

- Metal Cutting Circular Saw (a)
- Tenryu Steel-Pro Saw Blade for Circular Saw or equal.
- Nibbler (b)
- Portable Bandsaw (c)
- Sawzall-Reciprocating Saw (d)
- Kett Shears (e)
- Swanson Shear (f)

Can be purchased at:
Granger, Dynamic Fastener, Triangle Fastener, Ram Tool, Fastenal, Home Depot, Lowes, Northern Tool.

(a)

(b)

(c)

(d)

(e)

(f)

PRE-INSTALLATION CHECK LIST:

- Review contract documents and approved shop drawings prior to installation to verify that they match the structure.
- Examine the structure for alignment prior to installation. Verify that all surfaces are flat, plumb, level, straight, square, and within panel tolerances of ¼" in 20 feet.
  Any variance from tolerances can affect panel performance, aesthetics, and installation and must be reported to the general contractor, and corrected by the responsible party before panel installation begins.
- Set benchmarks for panels and trim per contract documents and approved shop drawings. This will ensure better panel alignment, easier panel installation, panel performance, thermal movement and aesthetics for the project.
- Verify that panels and trim are clean and free of damage. Do not install any damaged materials.
- Verify that all blocking, supports, and penetrations are in place before installation begins.
- Verify clip placement and fastening points based on project specific shop drawings and calculations.
- Verify that staged panels match the shop drawings based on specific elevation.
- Verify that the installer has the proper tools for panel and trim installation.
- Verify that all equipment, safety gear, and procedures meet and/or exceed the OSHA approved standards.

NOTE: Ensure that all conditions on the Pre-Installation Checklist are met prior to the installation of panels. If any one of these conditions are not met, MORIN recommends that installation of panels not begin until the issue is rectified.

DESIGN DATA

ROOF SLOPE:
To satisfy the required weathertight performance of the roof systems, adequate drainage must be provided. The minimum roof slope recommended by Morin is ½" in 12" for SLR Series, if critical concerns are taken care of. Some of these concerns are roof penetrations, and structural irregularities, (i.e. building settlement, minor deformations caused by foot traffic or roof substrate not being level). Low slope roofs (1/4" in 12") will trap water if any debris accumulates on the roof. A single 1/8" object will trap a 6" long pond of water. The foregoing can lead to accelerated weathering and/or deterioration of the roof surface.

THERMAL MOVEMENT:
As mentioned earlier in this manual, movement due to thermal expansion and contraction must be taken into consideration during design. This affects the trim conditions, clip spacing, and type.
General rule of expansion- **steel 1/8" for 10' and aluminum 1/4" for 8'**.

HOW TO CALCULATE PANEL LENGTH CHANGE:

Sample Calculation:
Given: Original Panel Length = 55'
Temperature Change = 180°F

Coefficient of expansion:
Steel 0.00065"
Aluminum 0.00128"

Panel Length Calculation (PLC):

$$PLC = \frac{0.00065 \times \text{Temperature change} \times \text{Original panel length}}{100}$$

$$PLC = \frac{0.00065 \times 180 \times 55}{100} = 0.064' \text{ or } 3/4"$$

Temperature variation in the metal panels is not constant across the building surface. This differential effect causes the parts of the roof to expand/contract at different times. The variation in movement affects both the panels and structure, even if the components are of the same material. A correct design should use a minimum daylight ambient temperature of 160°F for bare aluminum to in excess of 200°F for dark coated panels. Another factor to be considered is radiant heat. At night this can cause low temperatures well under ambient temperature. The difference here has been measured as 30°F in very thin dry air climates and as high 20°F in very high humidity at sea level.
Gross panel thermal expansion is handled at each vertical rib in the standing seam roof system. If structural expansion joints are needed, then special panel connections will be required. Please contact the Morin Technical Department for their suggested details. Some of the items that must be considered for a correct detail are the proper selection of clips, clip placement and the design and fabrication of trim.

Major thought must be given to a provision for fixing panels on anchor clips at one location to be sure that the panel system will not have any longitudinal shifting of the system at this point. The fix point must have the capability to resist any longitudinal movement at this point. The fix point must also have the capability to resist both the dead load and live loads on steep roofs plus any additional loading caused by either ice or snow.
In some cases it may require the use of fixation at two or more adjacent clip points or purlin rows. As good judgment seems to indicate that panels over 50' should be fixed at their midpoint in order to minimize all movement relative to the structure and along a straight line normal to the panel length. This is done to prevent thermal movement between two adjacent panels in the system. See fixed point location recommendations, which are found on page 30 of this manual and other details.
In some cases when you have ventilators or other large roof openings, then a fixed point at some other location may be needed. If this becomes a fact, then a fixed point must be located so that there is no relative movement between adjacent panels. Please contact our Technical Department for their suggested details. Another area of concern is in such areas as hips, valleys, areas of irregular shapes & other conditions, which may require the use of panel splice joints. Our suggested details for these items are found in a section of this manual.

DESIGN DATA

In addition to the above, a designer must also give some thought concerning such accessory items as gutters, downspouts, ridge caps, gable trim or related flashing. All of these trim items must be designed and fastened to adequately account for their expected thermal movement. Everything mentioned above applies to both steel and aluminum. With aluminum this is very critical, in as much as it's coefficient of expansion is twice that of steel. In either case, steel or aluminum, trim lengths should not exceed 20' in order to try to eliminate the elongation of fastener holes, oilcans or kinks. Flashing lap joints must be allowed to move. Screws or rivets should not be used to hold flashing lengths together. Several types of joinery that allow for thermal movement are shown in our detail section found in this manual. In areas where it is not feasible to furnish full length (ridge/eave) factory fabricated panels because of either shipping limitations or adding to the length of existing roof panels, it will be required to use a panel splice lap joint. For weather resistance, these are designed to be sealed joints with structural fixpoint connections that prevent relative movement between adjacent panels. The reason for this is that any movement may over stress the sealant and cause a leak or cause fastener holes to elongate with the same leak results.

PANEL GAUGE SELECTION:
Some of the items that must be considered when selecting the minimum gauge of a standing seam roof panel are material types, panel width and panel rib height. Economy in gauge selection may be had if the lightest gauge available meets the performance requirements of the project. If this is found to not be the case, then structural standing seam roof panel systems can be fabricated in heavier gauges or purlin spacing can be designed to allow for the maximum span of the standing seam roof panel system selected. Sometimes economies of gauge purlins can outweigh the cost savings of using the standing seam roof panel systems maximum spans. These components should be taken into account in order to receive the best overall cost for the project.

PANEL SUBSTRATE DETERIORATION:
In the metal panel industry, deterioration is generally known to be "corrosion". Corrosion is nothing more than metal oxidation, (i.e. red rust/steel or white rust/aluminum). In order to fight this problem, it is recommended that only stainless steel or metal coated/plated fasteners or clips be used in the standing seam roof panel system. The reason for this is that there is the possibility of water condensation at the base of the fastener, which could accelerate fastener deterioration. All fasteners must be compatible with the panel substrate in order to allow the building envelope to have a long performance in the project's atmospheric environment.

DEFLECTION:
Deflections for single skin Roof Panels should meet or exceed the requirements as outlined in the International Building Code, table 1604.3, subnote "a". Transverse deflection due to the panel cross bow is not dictated by current building codes. Deflection should be calculated if there is concern for drainage or the possibility of a clearance problem with secondary structural members. The International Building Code limits deflection to L/60. Metal Construction Association and industry standards limit the deflection to L/180. Deflections should be calculated based on 0.42 x calculated component and cladding load for "Ultimate" loads and 0.40 for "Allowable Stress" loads.

However, the designer should always check the local codes for the limits that they should set and these limits should be included in the project specifications. To determine the actual allowable negative load ability of a standing seam roof panel system a full-scale wind uplift test should be run. From these tests, a negative load table with appropriate safety factors can be developed.

Positive load capacity can be calculated using the products section properties. The flat of the standing seam roof panel, at its intersection with its vertical rib, when put under a positive or negative load, will deflect. In checking clearances, both positive and negative clearances must be determined.

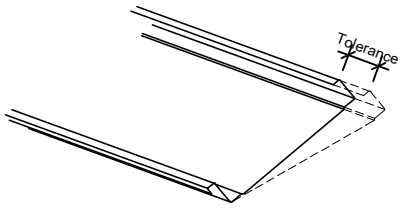
DESIGN DATA

FABRICATION TOLERANCE:

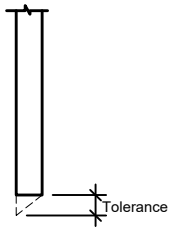
The Metal Construction Association (MCA) has developed tolerances for acceptable manufacturing practices. These tolerances are now considered to be the metal panel industry standard and are published in the MCA Manual. The following is a brief summary of these tolerances:

Panel Length	+ 3/16"/ – 3/16”
Panel End Squareness Viewed from Panel Front measured across sheet	0.5% of width or no more than 1/8” at one end
Viewed from Panel Side measured across sheet	2.0% of panel depth or no more than 1/16”
Camber (lateral bow of panel viewed from panel front)	3/16” per 10’ length

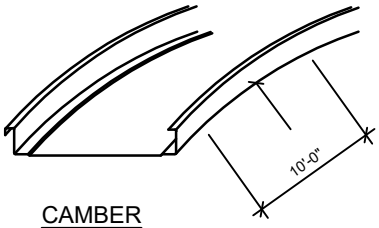
Squareness should be measured using the panel "diagonal difference" method. Generally both ends will be parallel so 1/8" out of square at an end can correspond to 1/4 inch diagonal difference. Squareness thus determined is a function of panel length and width.
If the tabulated level of camber renders a particular product unserviceable for reasons other than aesthetics, it shall not be acceptable.
Other "as fabricated" profile dimensional tolerances (e.g. cover width and sub-element lengths, radii and angular tolerances) can be somewhat meaningless. These dimensions are difficult to consistently measure and the profiles are difficult to sustain during transit and installation. Sometimes profile must be field adjusted for in place aesthetics. The final "in place" condition is the essential factor.



Viewed from panel front
measured across sheet

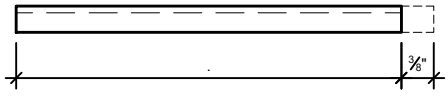


Viewed from panel side
measured across sheet



CAMBER

PANEL END SQUARENESS



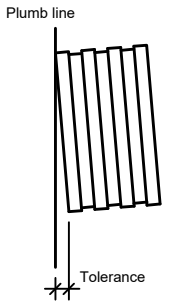
PANEL LENGTH

DESIGN DATA

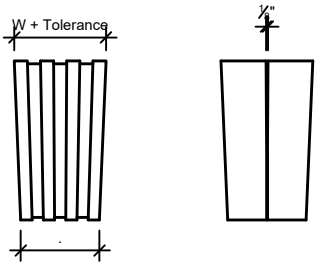
INSTALLATION TOLERANCES:

MCA tolerances for installation of materials are as follows:

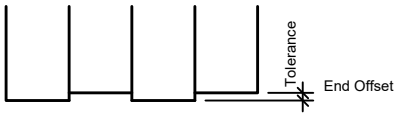
Panel Plumbness (in roof plane)	3/4” in 20’
Trim Plumbness (Unless controlled by structure and must align with adjacent steel or masonry for aesthetic or service reasons)	1/2” in 20'
Fanning of Panels (Restores line or create module) Fluted panels (Fanning uniformly distributed across the panel)	1/8” per panel
Flat panels with Butt Seam	1/8” per seam
Panel Alignment at End or End Laps (End Offset or Saw-tooth. Accumulation of fabrication and installation tolerances shall not exceed ¼" at base).	3/16” at panel end 1/4” lap below 40’
Base flashing alignment: (measured at brake point and not at free end; non accumulative)	1/2” in 12'
Exposed Fastener: Alignment- variance across panels. Spacing- Along panel trim	1/2” in a bay (+/-) 1"



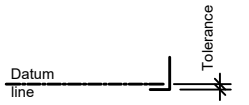
PANEL/ TRIM PLUMBNESS

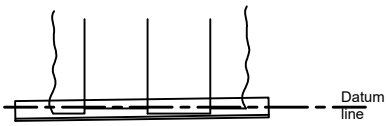


FANNING OF PANELS

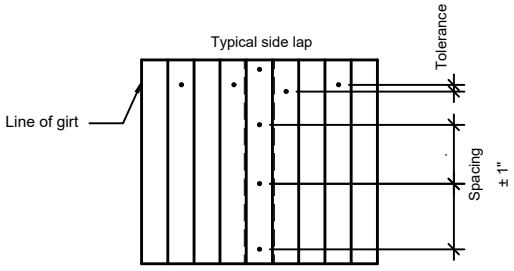


PANEL ALIGNMENT





BASE FLASHING ALIGNMENT



EXPOSED FASTENER

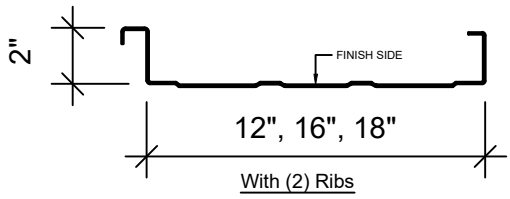
WALKING LOADS:

Walking in the panel flats of the SLR Series panels can cause material deflection at the panel clip locations. Where visual aspect is important and walking loads are expected, the use of narrower and heavier gauge panels should be considered.

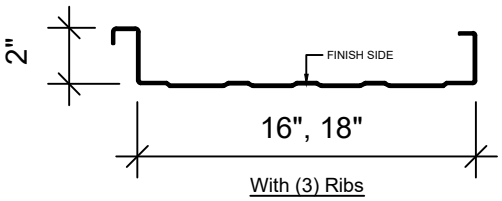
Ribs in the SLR Series panel are more effective than a flat face pan in the control of oil canning and will create a more tolerate panel to abuse.

TECHNICAL DATA

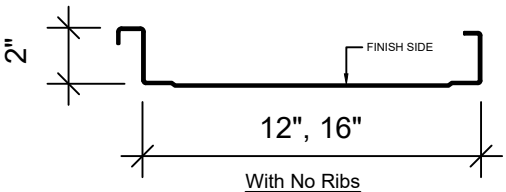
NOTE: ALL DIMENSIONS ARE NOMINAL



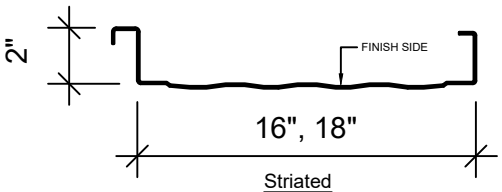
With (2) Ribs



With (3) Ribs



With No Ribs



Striated

PRODUCT SUMMARY:

SLR Series, a mechanically seamed roof offered in three widths. All panels available with 180° seaming.

PRODUCTION REFERENCES:

- Lengths 5' (1.52m) to 48' (14.63m) standard
- Jobsite roll forming (at grade) in lengths up to 200' (60.96m)

STORAGE AND INSTALLATION NOTES:

- Deliver panel materials and components in the original, unopened, undamaged packaging with identification labels intact.
- Store roof materials on dry, firm, and clean surface.
- Elevate one end of bundle to allow moisture runoff, cover and ventilate to allow air to circulate and moisture to escape.
- Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.
- Remove protective film immediately as per standard directions.
- Cutting and fitting of panels shall be neat, square and true. Torch or abrasive cutting is prohibited.

PRODUCT OFFERINGS:

Panel Type - Structural standing seam roof panel
Minimum Roof Slope: 1/2:12
Panel Depths - 2" (51mm)
Cover Widths - 12" (305mm) or 16" (406mm) or 18" (457mm)

MATERIAL OPTIONS:

Steel - Galvalume/Zincalume 24, 22, 20 GAUGE
Aluminum - 0.032 GA and 0.040 GA

COLOR AND FINISH OPTIONS FOR ALUMINUM AND STEEL:

See Morin Color Selector Brochure

Standard (Fluropon® PVDF-Kynar500®)
Premium Colors MICA (Fluropon Classic®II PVDF)
Premium Colors METALLIC (Fluropon Classic® PVDF)
Coastal Finish
Morin Custom Color Matching Services
Other Finishes Available

Surface Options- Smooth surface standard.
Sealant- Factory applied butyl sealant.
Clip- SLR Sliding Clip.
Substrate- Open framing or solid deck applications.

TECHNICAL DATA

STRUCTURAL – UPLIFT LOADS:
The SLR Series panel systems uplift capacities are based on the requirements of ASTM E1592, FM 4471, UL580 and the A.I.S.I "Cold Formed Steel Design Manual". Actual uplift loads are determined by an independently certified load test of production run panels. ASCE 7 dictates increased uplift pressures at perimeters, necessitating closer SLR clip spacing. For open purlin designs, perimeter purlin spacing must decrease to accommodate the SLR Series system's smaller spans. Determination of the required wind uplift pressure (psf) for all roof loading areas must be provided in the specifications and/or drawings by the architect and/or engineer of record. This information is needed in order to make the correct panel selection and clip spacing during the bidding process. Also carefully review the submittal to verify that the fasteners that secure the SLR clip to the structure are adequate to resist the uplift loads mentioned above.

THERMAL LOADS – PRESSURE PARALLEL TO THE ROOF:
Structural supports are exposed not only to wind or snow loads, but also to expansion and contraction thermal loads due to temperature induced friction forces at the anchor points. Generally speaking these forces can be ignored, but in some cases they can build up quite rapidly and become very noticeable. They should be definitely checked when single panel lengths exceed 180'. A basic assumption is that a friction induced forced is additive, allowing a 20 pound per clip friction allowance is then conservative based on the "stick/slip" movement of the panel in relation to the clip. It is highly unlikely all clip resistance is at the same place at the same time. "Fixed points" in the SLR system may require lateral support, similar to that used in a structural wind truss design, due to these thermal loads.

PANEL SYSTEM DIAPHRAGM STRENGTH:
The SLR Series system is a floating system and therefore has no effective diaphragm strength. Therefore the roof structure must be designed with wind bracing.

UNDERWRITERS (UL) ROOF APPROVAL:
In most building locations it will be found that they will require that some form of Underwriters Classification must be in place to help reduce the cost of insurance. The SLR system carries a UL-90 class rating. Consult our technical department or Underwriter's Building Directory for the requirements of the listed construction.

FIRE RATINGS:
Morin's roof systems are fabricated from either steel or aluminum. These materials are generally considered by most code bodies and fire jurisdictions to qualify as fire retardant roof coverings. Because of this they may be used with other materials to satisfy a requirement for an hourly rated system to meet a specific fire protection need. Contact our technical department for various rates up to 4 hours. UL rates the roof systems in either steel or aluminum as a Class A Roof Covering for use over purlins or non-combustible decks.

AIR AND WATER INFILTRATION:
Air and Water Infiltration testing has been conducted on the SLR Series panel system in accordance with ASTM E1646, E1680, and E2144.

CYCLE WEAR TEST:
The SLR Series system has been tested over 100,000 cycles of expansion/contraction in both steel and aluminum. When tested, the clips did not wear through the panel, which indicates the system will exceed a 20 years life cycle.

- Morin recommends that all materials be stored in a dry condition. An area should be provided, maintained and assigned by the general contractor. This area should be clean, level, accessible and sufficiently compacted to support and permit movement of delivery trucks and construction equipment.
- The materials should be stored sloped to allow drainage of condensation. All materials should be allowed to breathe in order to deter build-up of condensation. The materials should be protected from weather by suitable covering. Aluminum materials should be stored in a dry covered location.
- Materials should be inspected upon delivery for presence of moisture or damage. If moisture is present, bundles should be opened immediately and dried.
- Temperature sensitive items such as butyl tapes and sealants should be stored under controlled conditions to maintain suitable application characteristics.
- Materials with protective plastic peel coat must be shielded from UV exposure and prolonged heat or cold. Excessive storage duration or exposure to severe temperature swings may cause peel coat to permanently adhere to finish of panel.
- Special care is required for non-color aluminum materials. The presence of moisture can cause storage stain. Care must be taken to assure moisture does not condense on the panel surface.
- Remove panels from bundles with caution. Tilt or lean the bundle on one side creating a slope that will prevent the panels from falling in an outward or sliding motion. Care in removing panels from a bundle is the responsibility of the contractor!

TO AVOID DAMAGE TO THE PANEL FINISH, PROTECTIVE PEEL COAT MUST BE REMOVED WITHIN 30 DAYS OF RECEIPT OF MATERIAL.

Contact Us

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Corporate HQ and Manufacturing Location — (800) 640-9501

Morin South

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Manufacturing and Testing Location — (800) 640-9501

Morin West

10707 Commerce Way, Fontana CA 92337 — (909) 428-3747
Manufacturing Location — (800) 700-6140

Please feel free to contact Morin if you have any questions or need further information regarding product handling. TOLL FREE: (800) 640-9501

PANEL HANDLING

Forklift:

The recommended loading/unloading method for bundles less than or equal to 20' is to use a single forklift with widely spaced forks placed under the center of the bundles as shown below in figure 1.

Wood surrounds or metal angles placed beneath the bundle will provide protection to the underside of material. Wood surrounds will be spaced according to the center of bundle, especially at lift points where forks must meet wood surrounds.

Panel bundles greater than 20' in length may be moved by using two forklifts spaced equally along the length of the bundle as seen in figure 2. However, this method is *strongly discouraged due to the difficulty of co-coordinating forklift movement. Use crane if available.

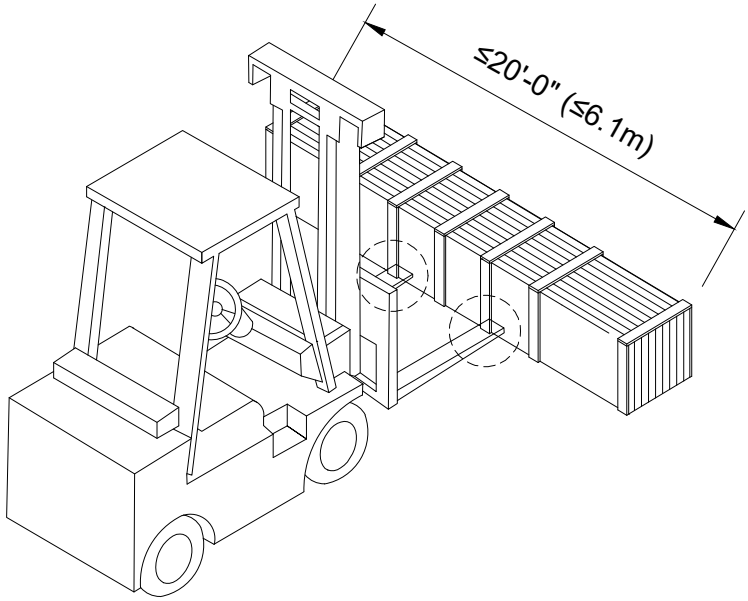


FIG.1 PREFERRED METHOD (1 FORKLIFT)

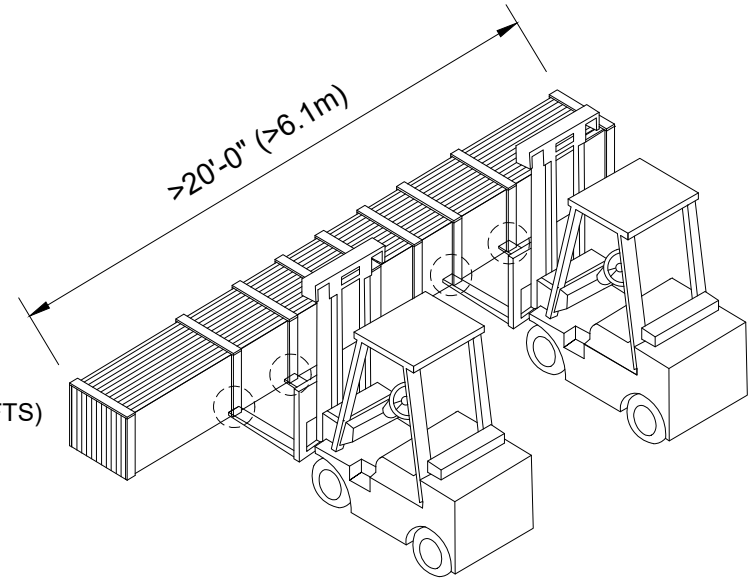


FIG.2 *STRONGLY DISCOURAGED! (2 FORKLIFTS)

PANEL HANDLING

Crane:

The recommended crane lifting method is to use nylon straps positioned at a minimum of two points at equal distances along the length of the bundle.

A steel spreader bar should be used for lifting all bundles. Suitable wood surrounds should be used and located at the top, bottom and sides of the bundles to protect the panels as shown below in figure 3.

Req'd Strap Spacing for Lifting Bundles:

LIFT POINTS	BUNDLE LENGTHS
2 points	up to 20'
3 points	up to 30'

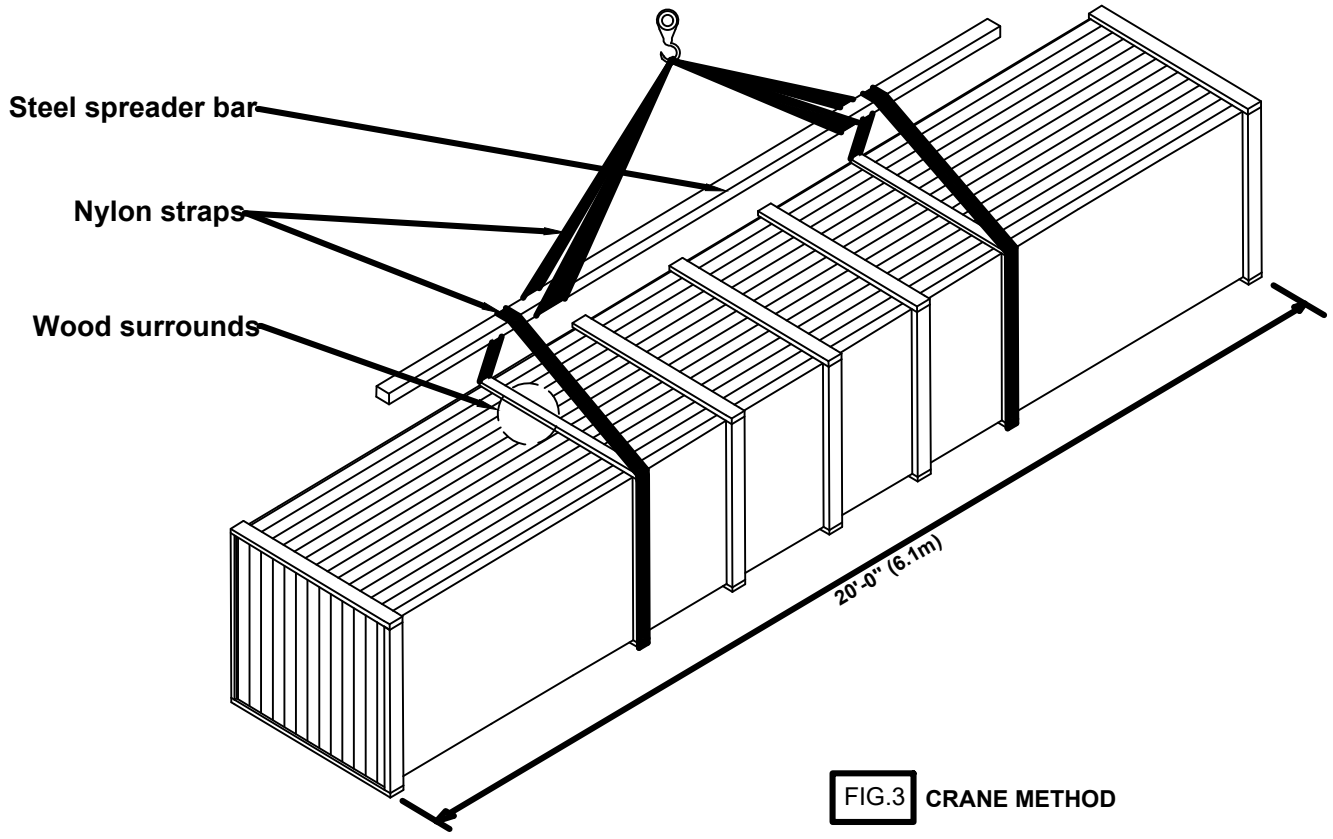


FIG.3 **CRANE METHOD**

NOTE:
To prevent panels from damage while lifting, carefully pick up bundles one at a time.

PANEL HANDLING

Individual Panel:

Correct Panel Handling:

Individual panels must be handled and supported in a longitudinal orientation. When handling panels exceeding 12' in length, additional personnel will be required to support the panel. The recommended distance between each handler will be 8' (maximum).

Insufficient number of handlers could cause damage to panel such as warping, buckling or creasing etc.

CORRECT

Incorrect Panel Handling:

Panel handled in a flat orientation will cause warping, buckling or creasing due to improper support at the midpoint.

INCORRECT

FLATSTOCK HANDLING

The recommended loading/unloading method for flatstock skids is to use a forklift with widely spaced forks (min. 5') placed under the center of the bundles as shown below in **Figure 1.**

When transporting a flat sheet, it should be turned vertically (upright) on its edge, then supported at each end with as many people as necessary to safely handle. Individual sheets of flatstock may be handled and transported in either vertical or horizontal orientations with as many people as necessary to safely handle. **Figure 2**

Flatstock should not be transported in a horizontal (flat) position, as excessive flexing many result, which can cause oil-canning, permanently distorting the panel. **Figure 3**

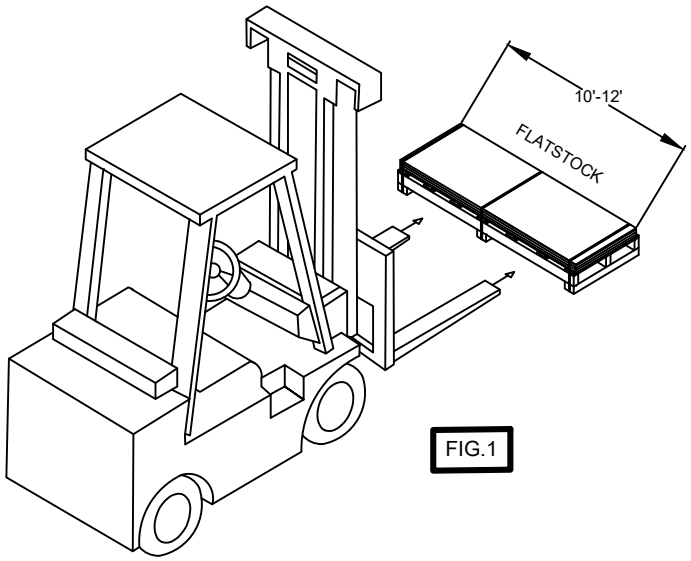


FIG.1

NOTE:
When unloading flatstock bundles, lift individual skids one at a time to ensure safest means of handling.

Do not lift stacked skids!
When transporting bundles onsite lift skids individually.

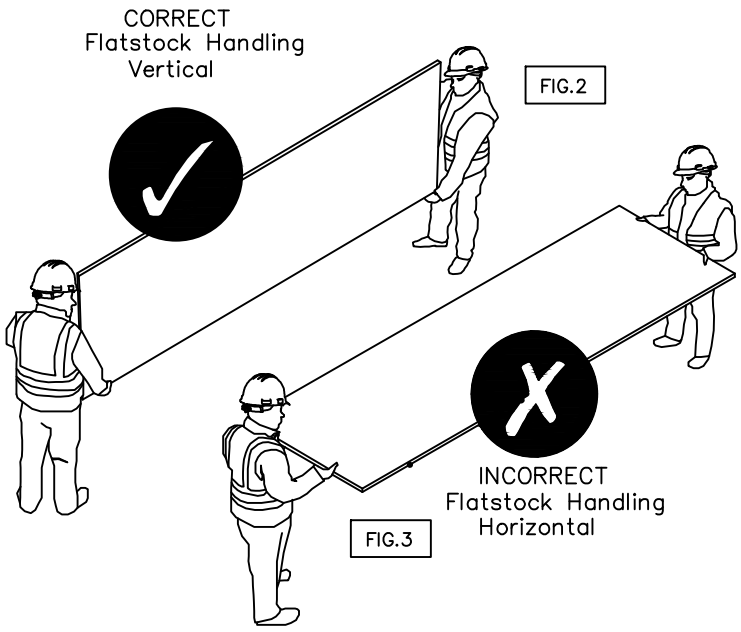


FIG.2

FIG.3

NOTE:

Carefully pick up flatstock one at a time. Never drag flatstock from a skid or across other surfaces because this will scratch and damage the flatstock finish.

FASTENING GUIDELINE

SLR **SERIES CLIP SELECTION:**

Clip selection is a relatively simple task once you have collected all of the data required. This data includes such items as type of structure, all structural loading, thermal expansion/contraction needs and even sometimes the finished appearance that the designer is looking for on a particular project. After making the final clip selection, the designer should make sure that the structural supports are supplied with the correct size, spacing and clearance to accommodate the clip selected. From clip sketches shown in this manual, the clearance between the panels and supporting purlin or deck is ⅜".

SLR **SERIES CLIP LOCATION:**

Clips are to be spaced at the maximum spacing as shown on the calculations submitted to the architect at the time the contractors make their material submittal, but must not exceed the maximum spacing as shown in the manufacturers literature for the required loads. When the roof system is used over a solid substrate (deck), the spacing of the clips must be examined to be sure that this spacing does not exceed the spacing of the panel/clip system but also does not exceed the strength of the fastener, which connects the clip to the substrate.

FASTENER LOAD CALCULATIONS:

To calculate the wind uplift loads for any fastener or fastener group, you must take the following items into account:

- Design wind load uplift.
- Tributary area of fastener.
- Fastener manufacturer's information as to the pullout/pullover of the fastener being considered.
- The local building code safety factor requirements.
- As mentioned earlier in this manual, you should also check the loads that snow and expansion/contraction places on the fastener to be sure that those loads do not exceed the fastener manufacturer's recommendations.

FLASHING, TRIM & MISCELLANEOUS FASTENERS:

While SLR Series panels & clips are the primary concern when using the Morin roofing system, you should not overlook the importance of flashing & their fasteners. After all, a leak at this location is just as bad as a leak through the roof panel. If at all possible, these fasteners should not be installed in a manner that would penetrate the SLR panel. The fastener must be of a self sealing type with a sealing washer under its head on the exposed surface. Pop rivets should never be used with flashing or trim because they will leak. If it is found that there is no other solution to fastening flashings, then be sure that closed end rivets are used and that they are both plugged and sealed. The minimum size fastener to be used to connect flashing and trim to the standing seam panel should be either a #10 screw or ⅛" rivet.

SEALANTS:

The roof system is designed & manufactured to give 20 years of service. Because of this, it is our recommendation that the sealants specified or used have an equal life expectancy. In applying sealants to a metal surface, one of the most important aspects for a good seal is to have a clean and dry surface and that the sealant being used is applied in accordance with the manufacturers recommendations. There are two types of joints on which sealant is required. They are exposed and non-exposed joints. An exposed sealant joint should use a sealant that will have a final cure that will stay flexible. Do not use either asphalt or oil base type sealant. For non-exposed sealant joints, use only non-hardening type sealant, recommended by a sealant manufacturer. There are several installers that prefer to use a silicone type sealant. This type of material will work fine as long as it has the 20-year service life expectancy. One word of caution when using this product is that you must be sure that it is a non-acetic acid cure.

PANEL INSTALLATION:

Note: Panels should not be installed with temperature under 35º F (2º C). Check MCA standards.
FOLLOW MCA STANDARDS

1. COORDINATING THE INSTALLATION OF PANELS WITH OTHER TRADES

Careful attention prior to and during panel installation must be paid to the other trades working on the same project as your roof installation. Failure to do so may result in compromised schedules and rising costs. For example, if there is any new masonry and/or cement work on the same project, it should be scheduled prior to the roof panel installation, so that the masonry/cement is complete and cured before any roof panels are installed. Trades involved in electrical and HVAC may perform work in conjunction with the roof panel installation remembering to coordinate the work such that those trades may perform their tasks while the roof is partially or completely installed. Keep in mind too that some of the work performed by these trades may be detrimental to the roof structure and the materials used are corrosive to metal roofs; such as copper, pressure treated wood, and HVAC cleaners.

2. INSPECT THE STRUCTURE

The area designated to receive the new roof panels must be inspected and conditions that fail to meet the requirements of the roof system must be reported PRIOR to beginning the installation process.

a. Checking for Square - Failing to confirm that the structure and the roof system are square will have a major impact on the success of the roof panel installation. Square and straight are not the same. Straightness reports on any deviation along a single edge of an object, as in a straight line. Square is the correlation of one edge to another edge. A square edge defines that the edges will be 90°, or perpendicular, to each other. If the measured distance between diagonal roof corners is equal, then the installer will confirm the roof to be square.

b. The 3-4-5 Method - This method well known throughout the various construction trades helps the installer for when the roof is not square. The goal is to install the metal panel so that it is square to the eave of the roof and this technique will provide you with a reference line that is perpendicular (or square) to another edge, on any surface of the roof. Required tools are: Tape measure, chalk line, hammer, and two nails.

1. Step 1: Starting at the bottom edge of the roof, measure a 6 inches off of the roof's edge (Figure A), then draw a 3-foot horizontal line and set nails at each end. (Figure B)
2. Step 2: From the first nail set (on the left), pull a vertical 4-foot dimension and draw an arc. (Figure C)
3. Step 3: Measure from the second nail (on the right) exactly 5 feet diagonally up to the first arc and mark the intersection from the 4-foot dimension (Figure D)
4. Step 4: Place the third nail. (Figure E)
5. Step 5: Mark a straight vertical line from the first nail to the third nail (Figure F) which will now show a straight vertical line off the eave. This will give you a square reference line for your roof installation.
6. For larger right angles, use this same method for example in multiples of 3-4-5: 6-8-10, 9-12-15 etc.

PANEL INSTALLATION:

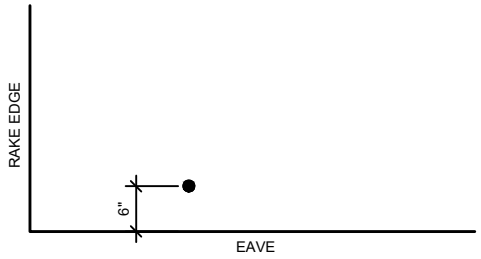


FIGURE A

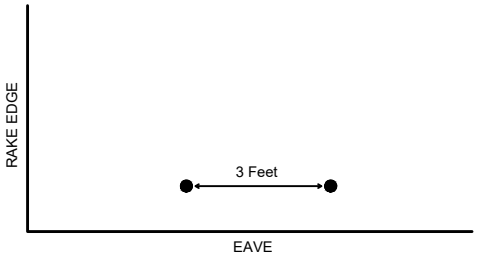


FIGURE B

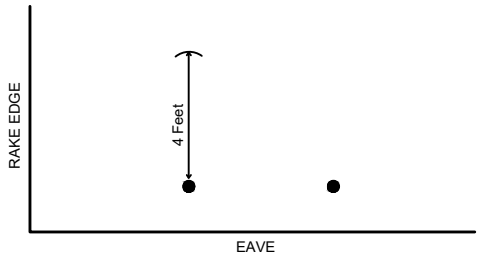


FIGURE C

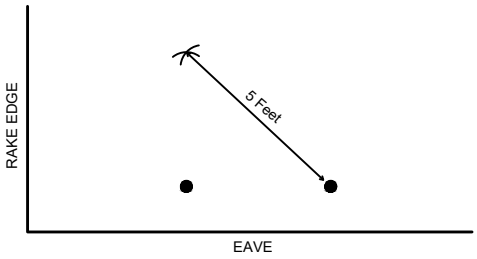


FIGURE D

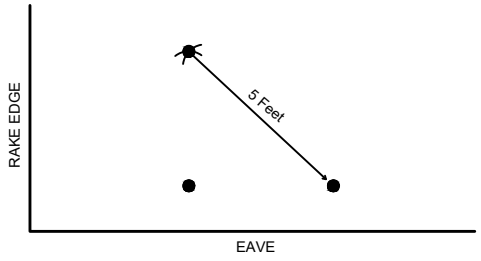


FIGURE E

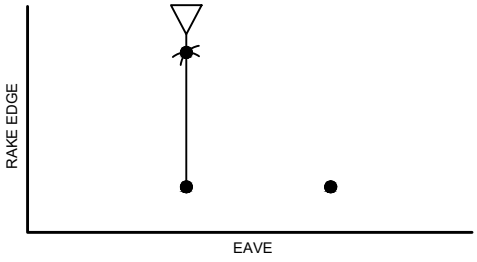
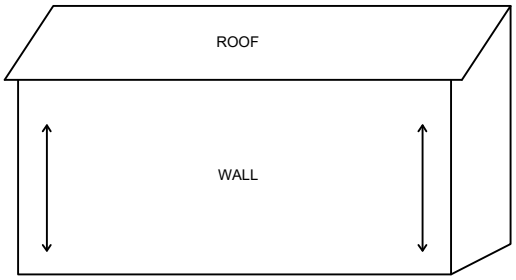


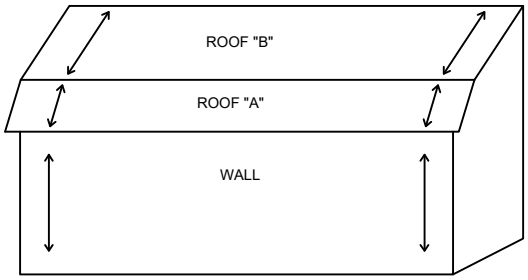
FIGURE F

PANEL INSTALLATION:

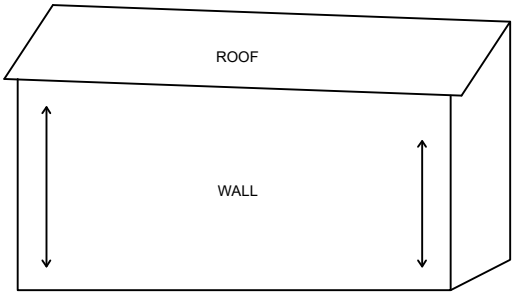
c. In-plane alignment - While a roof may have been installed square, straight and flat, it may still not have been installed correctly. The roof must be installed in-plane with the rest of the structure and other planes, otherwise it will not appear right and performance may be compromised. When roof and wall surfaces are not in-plane, it can sometimes be referred to as a “crooked” roof. In this scenario, even though each roof and wall surface is straight, they are not straight to each other. Remember that misalignment may occur at the intersection of different roof and transition sections. A misaligned or crooked roof will present with performance issues, creating gaps and voids which will leak and weaken the roof.



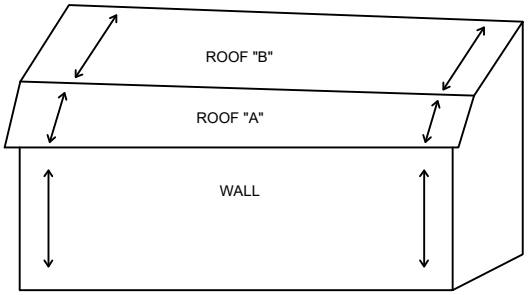
"In-Plane" alignment of roof and wall.



"In-Plane" alignment of all roof and wall sections.



Incorrect Alignment of roof and wall



Incorrect Alignment of roof sections

PANEL INSTALLATION:

3. FLATNESS

Straightness involves the edges of an object while flatness entails the wide, open surfaces of an object. Installed roof panels must be both straight and flat. The issue of oil-canning on a metal roof is directly related to panel surfaces which are not flat. When other roof structure members are out of alignment, the roof panels will not lay flat. Some examples of this are:

- Decking is not flat due to warped panels or misaligned seams.
- Purlins, roof joists, and supporting members are twisted, warped, or “pre-stressed”.

a. Pre-Cambered Roof Members - When using pre-cambered traditional roof support members with metal roofing systems, they may fail to flatten out due to the light weight of the metal roof material as compared to more traditional roofing materials. When pre-cambered structural members are installed prior to the installation of a metal roofing system, and it is noted after the metal roof installation, that there is a loss of flatness in the metal panels, the condition should be brought immediately to the attention of appropriate authorities, as these causes are not the installer's fault and out of their control.

b. Water and Flatness - While flatness will not cause a panel to leak, a panel that is not Installed flat can create an area of standing water or result in direct runoff to areas were not intended to handle the additional water.

4. ESTABLISHING DIRECTION AND SEQUENCE OF INSTALLATION

Many factors play a major role in establishing the direction and sequence of the panel installation. For example geographic factors; roof design factors such as panel types, seams and profiles; structural characteristics including building length and width. A major determination is the direction of the installation as this will directly impact exactly where the installation will start, which in turn directly impacts how and where materials are distributed on the ground or pre-loaded onto the roof structure.

a. Panel Layout - There are times when the metal roof panel's seam and profile will determine the direction of the installation, i.e. start at center and work both directions, or left-to-right or vice versa. Also some metal roof panels have applied coatings that require them to be installed in the same way directionally. Taking the time to properly plan the panel layout will save you and your client time, material and labor and deliver on an aesthetically pleasing and high performing roof.

PANEL INSTALLATION:

5. SUSTAINING PANEL MODULARITY AND ALIGNMENT

The relationship of the installed roof panel to other installed roof panels, roof structure members and the structure that the roof rests upon is called panel modularity. Modularity affects the strength, performance and aesthetics factors of the finished roof.

a. Starting Square To The Eave - The technique of starting the first panel “square to the eave” will establish a baseline and reference for the remainder of the panels, and impact the appearance and performance of the finalized roof.

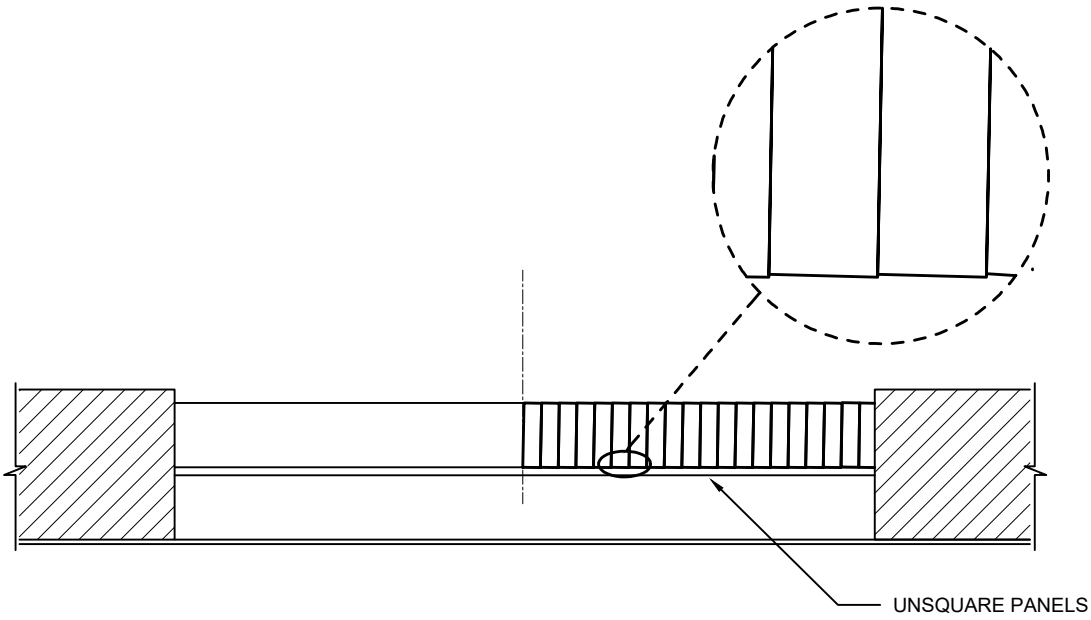
b. Monitor and Measure During Installation - The measurement and monitoring of the roof, its members and conditions during the installation are the responsibility of the installer. Once a square edge has been determined and established as the reference, all distances must be measured from and compared to that square edge/reference in order to effectively monitor and maintain squareness, never forgetting that small errors grow over distance.

c. Sawtoothing at Eave, End Laps and Ridge - Sawtoothing of the panels will occur when the roof panels are not installed square to the roof edge or eave. To avoid or reduce this risk the installer should always make sure that the first panel installed is square to the corresponding roof edge and aligned to panels at other tiers. (See 2b. The 3-4-5 Method)

d. Alignment and Aesthetic Considerations -Keep in mind that some people are of the opinion that the finished appearance of the newly installed metal roof is just as important as the performance of that same metal roof. Proper planning before the actual installation will deliver an installed roof that meets visual and performance requirements. Remember to always create benchmarks, i.e. the straight vertical lines as previously noted. There are two accepted methods to achieve a balanced, proportioned installation. Either locate the seam at the center line of the roof or locate the center line of the panel on the center line of the roof.

PANEL INSTALLATION:

Check to make sure panel is square on the roof. Top and bottom edges of panel should be at equal distance to the end of the run. Unsquare seams of panels on the roof could result in the problem as illustrated below.



PANEL INSTALLATION:

6. ISSUES WITH THERMAL MOVEMENT

Common causes of problems related to thermal movement are either double-pinning of the roof panels (ex. fastening at both the eave and ridge of the panel) and conditions that cause the panel clips to bind, thereby not adjusting to the thermal movement of the panel.

The installer should:

1. Refer back to the Design Data section within this SLR Series Manual, specifically the section on Thermal Movement: Coefficient of Expansion and How to Calculate Panel Length Change.
2. Confirm that the panel fastening method is aligned with those as shown in the erection drawing or the manufacturer's instructions. Verify that all involved with this installation are also aware as to the panel fastening method.
3. Be aware of installation of accessories or any panel modification and that these do not create a double-pinning of the roof panels.
4. Inspect and approve the sealant requirements around any clips and ensure that the clip fasteners are not damaged and allow the panel to move freely as designed.

7. BEST PRACTICES FOR FIELD CUTTING THE PANELS AND TRIM

Tools:

Tools approved for cutting metal include electric or pneumatic nibblers, electric sheet metal shears, sheet metal hand shears and aviation snips, circular saws fitted with specially formulated carbide blades designed for cutting metal.

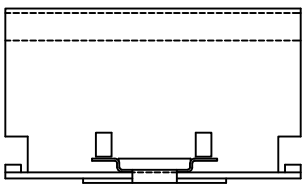
For field cutting sheet metal, follow these simple rules:

a. Do not use abrasive or other blades which will heat the metal and create heavy burrs. This is especially true when working with coated steel, as it will exceed the melting temperature of the metallic coating, melt it away from the cut edge, and cause a site for corrosion to occur.

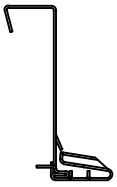
b. When cutting panels, a lot of steel bits (shavings), commonly referred to as swart, get scattered and thrown onto adjacent surfaces. If not thoroughly and promptly cleaned up and removed, this swart will cause potential corrosion or heavy staining as shown above.

c. Some trimming and cutting of panels and trim pieces is to be expected with every installation. You risk jeopardizing the appearance and performance of a roof system by failing to cut the metal roof materials correctly.

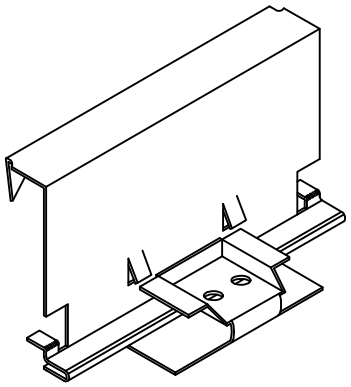
2" SLR SLIDING CLIP



END VIEW



SIDE VIEW

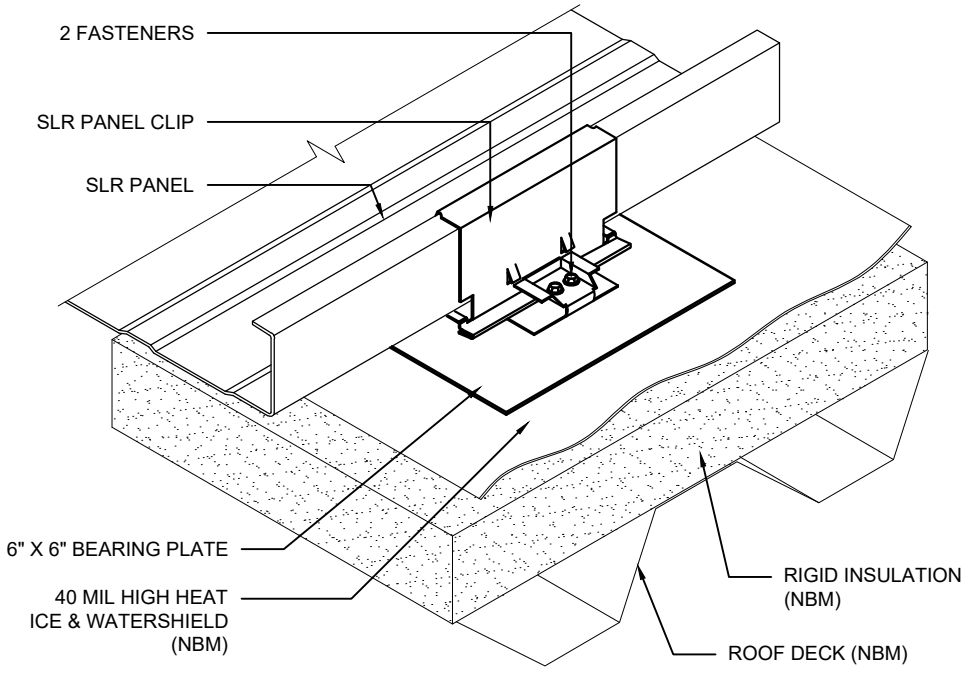


ISOMETRIC VIEW

*SEE PAGE 70 FOR IN-FIELD FIXED CLIP

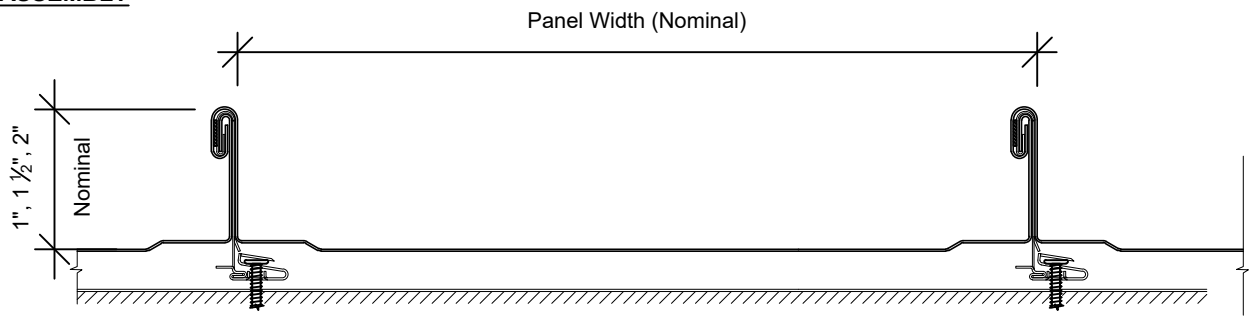
PANEL ASSEMBLY

SLR sliding clip limits the expansion/contraction of the panel system along its length to a maximum of 3¾".



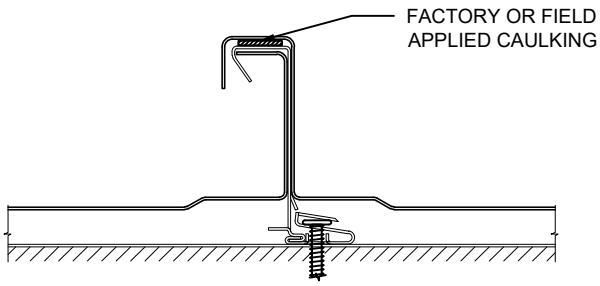
*NBM = Not By Morin

PANEL ASSEMBLY

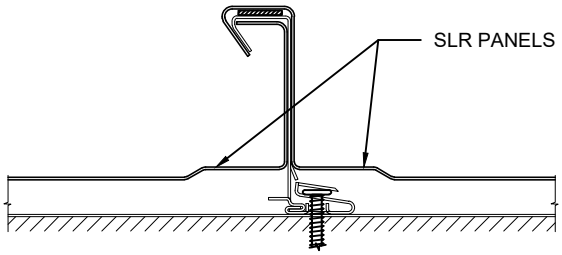


*Panel Profile shown as 2" seam- see actual profile sheets for other heights

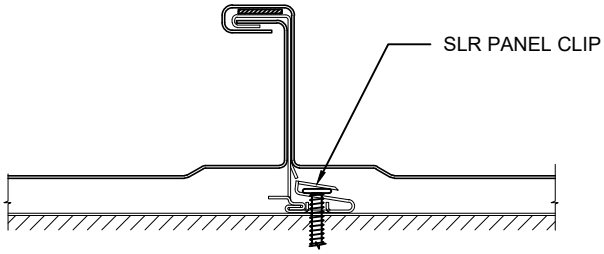
PANEL SEAMING



BEFORE

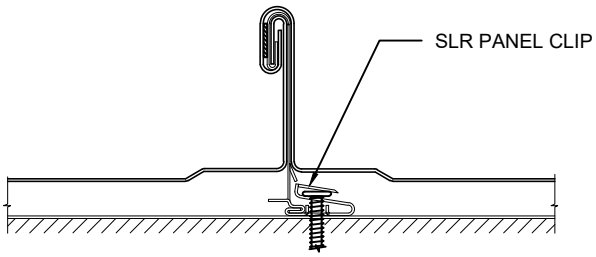


DURING (45°)



DURING (90°)

The electric seaming machine is a self-propelled, custom, lightweight aluminum seamer. The seamer has rollers, which fold the panel seam to locked position. The seamer runs at approximately 30' per minute. It is generally more efficient to operate the seamer from the top to the bottom. The tool can pull itself up the slope of the roof if it does not exceed 6 in 12. On slopes greater than 6 in 12 the seamer should run from the ridge of the building to the eave. Before placing the electric seamer over the rib, the panel must be manually interlocked to a 90° seam only with the hand seamer for a distance of 12" from end of panels.



After (180°) (Double Lock)

TESTING:

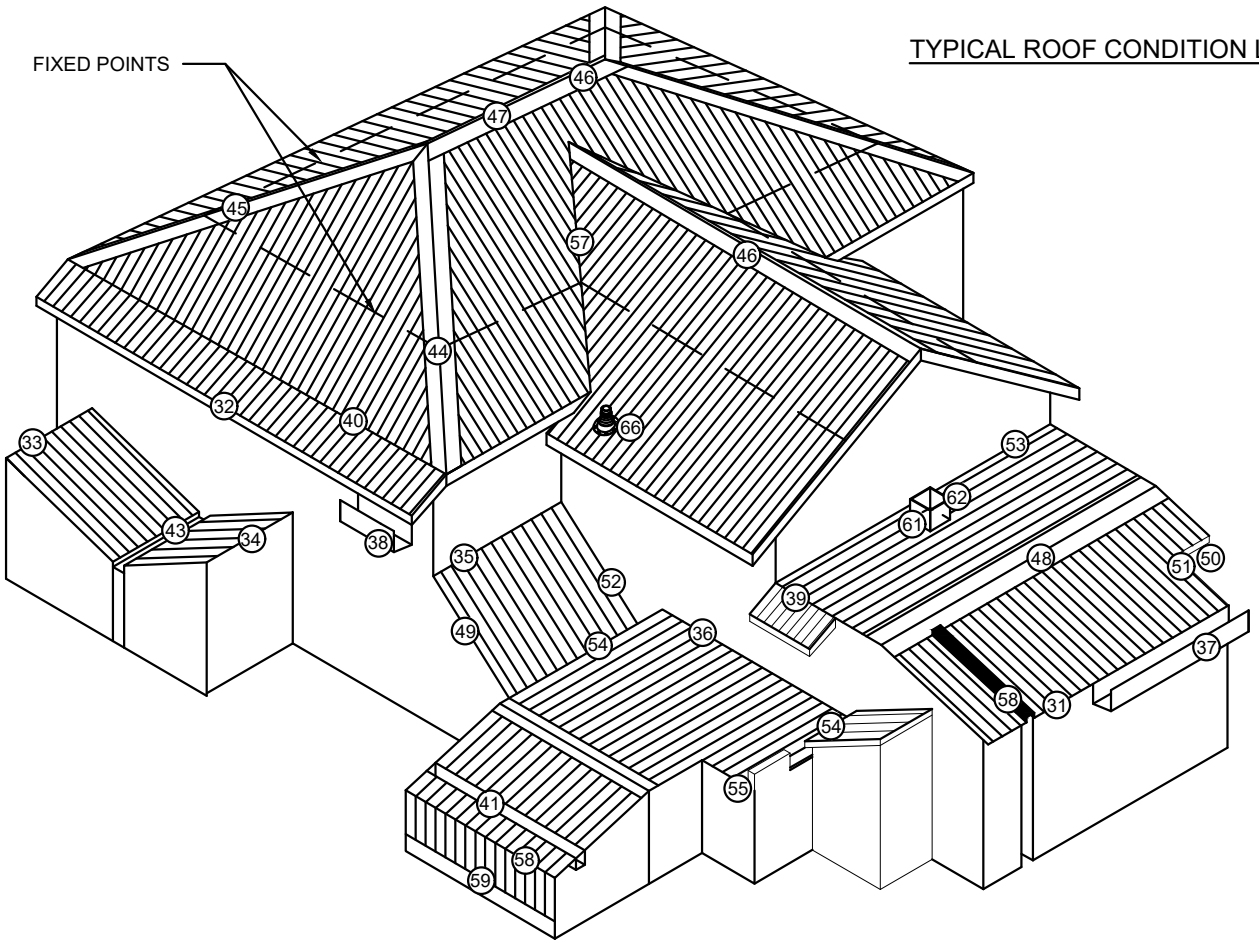
The SLR Series from MORIN has undergone or is undergoing a wide variety of tests that will allow for its installation anywhere, including where the strictest wind uplift codes and wind driven rain requirements are in place.

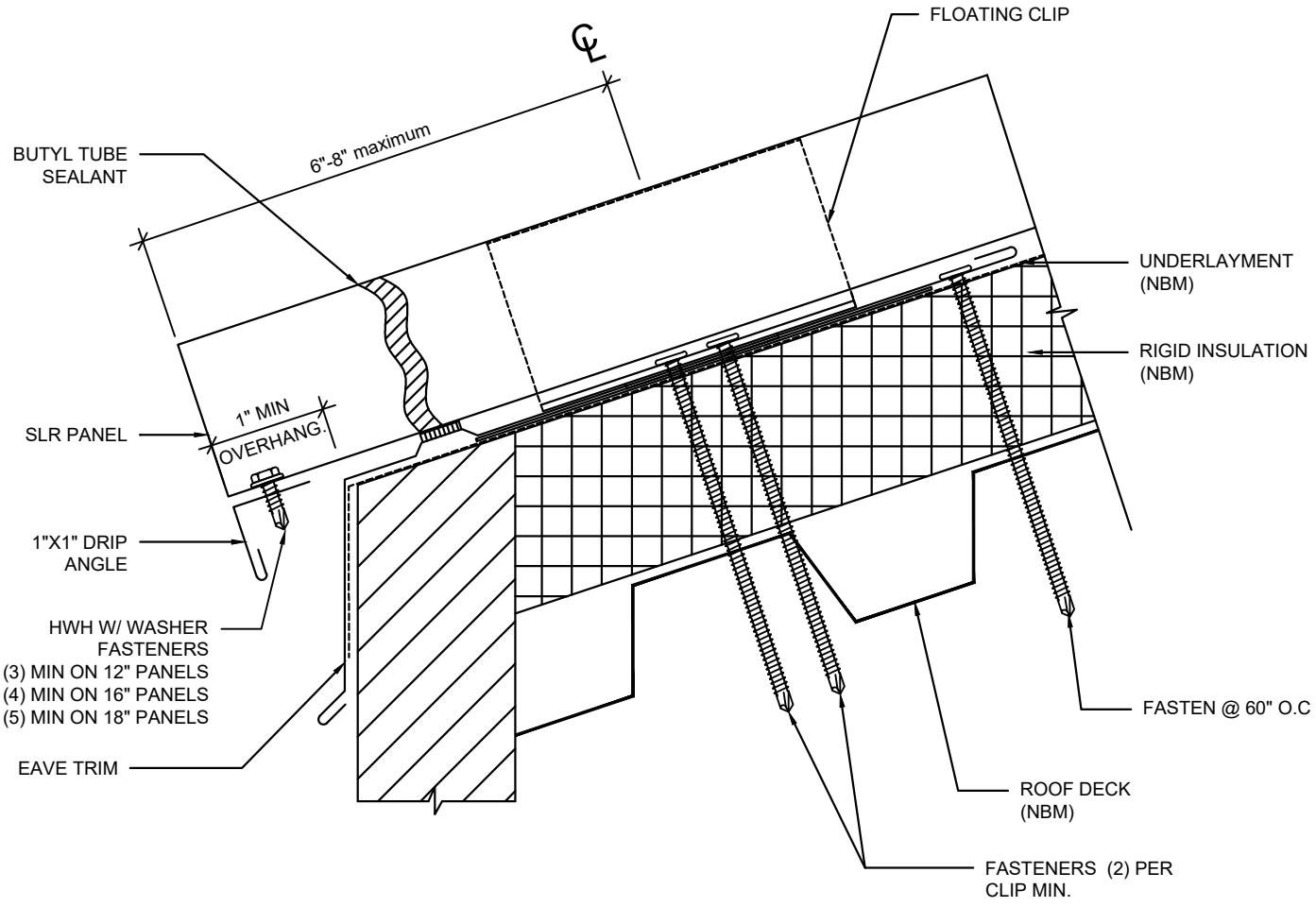
Morin's SLR panels (2" seam height) will meet requirements to be installed at very low slopes. It will meet ASTM E1680 air infiltration and ASTM E1646 water infiltration.

The SLR Series System is undergoing (and expected to meet the requirements of):
(Contact Morin Corporation for specific profile approved tests noted below)

- ASTM E1592- Uplift Test
- UL 580, UL 1897 - Uplift Test
- UL Class A - Fire Rating
- FM 4471 open framing - Uplift Test
- FM 4471 over metal deck – Uplift Test
- FM Class 1-SH – Severe Hail Resistance Test
- ASTM E1680 - Air Infiltration Test
- ASTM E1646 - Water Infiltration Test
- Florida Product Approval

TYPICAL ROOF CONDITION LAYOUT



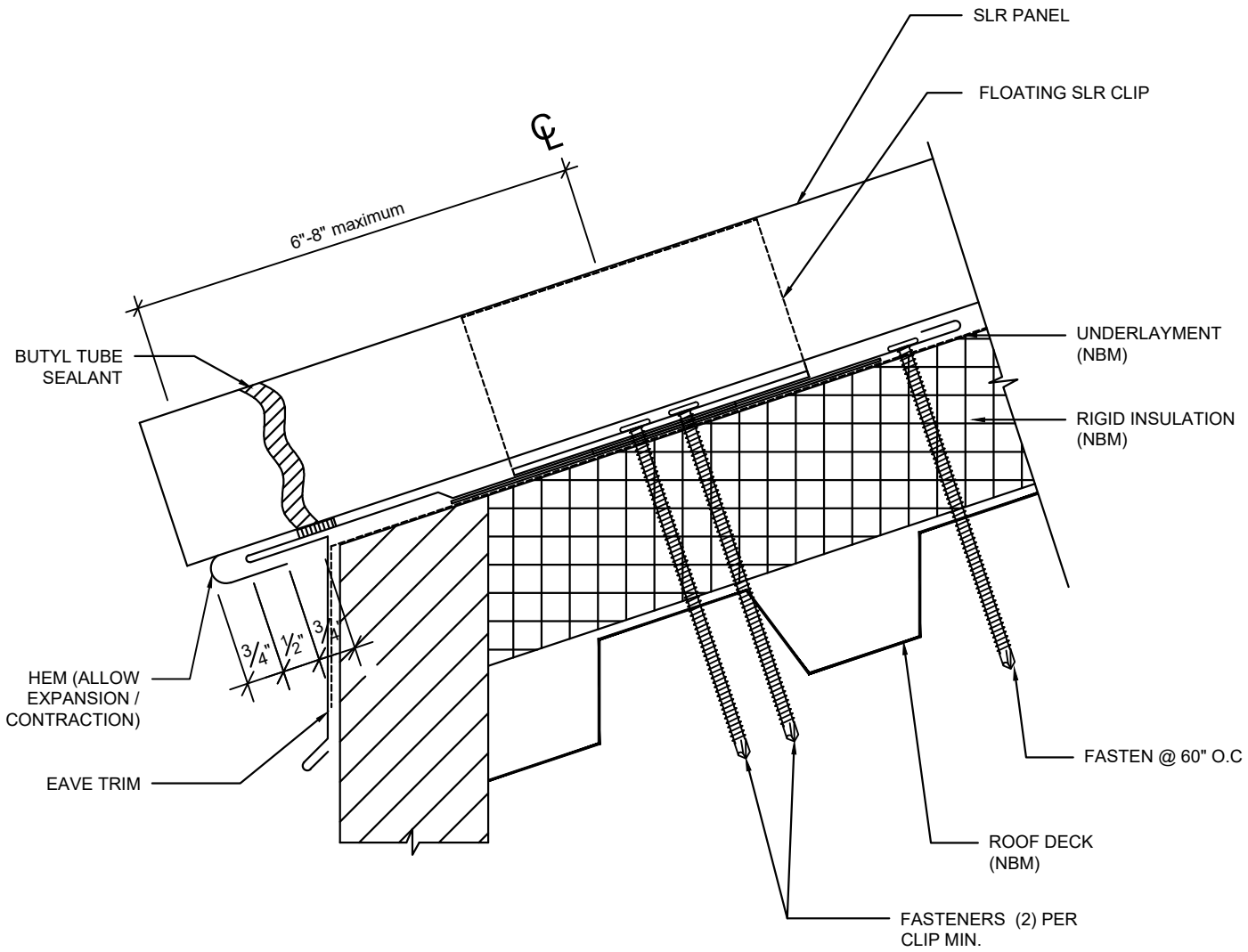


Note:
- Clip fasteners must be long enough to fasten into low cells of decking.

Eave design must be able to allow for the total amount of expansion of the panel if the ridge or mid-point is fixed. A drip trim should be used to stiffen the flat of the panel and block wind driven rain. This piece also assists in limiting the amount of bow of the flat under high wind.
Since sealant between roof underlayment and panel may limit expansion or rupture, protection against wind blown water infiltration is provided by folding the panel under, which allows for thermal expansion.
Detail must be designed to allow for maximum thermal movement. Floating eave requires fixed ridge or mid-point of panel length.

FLOATING LOW EAVE DETAIL

*NBM = Not By Morin

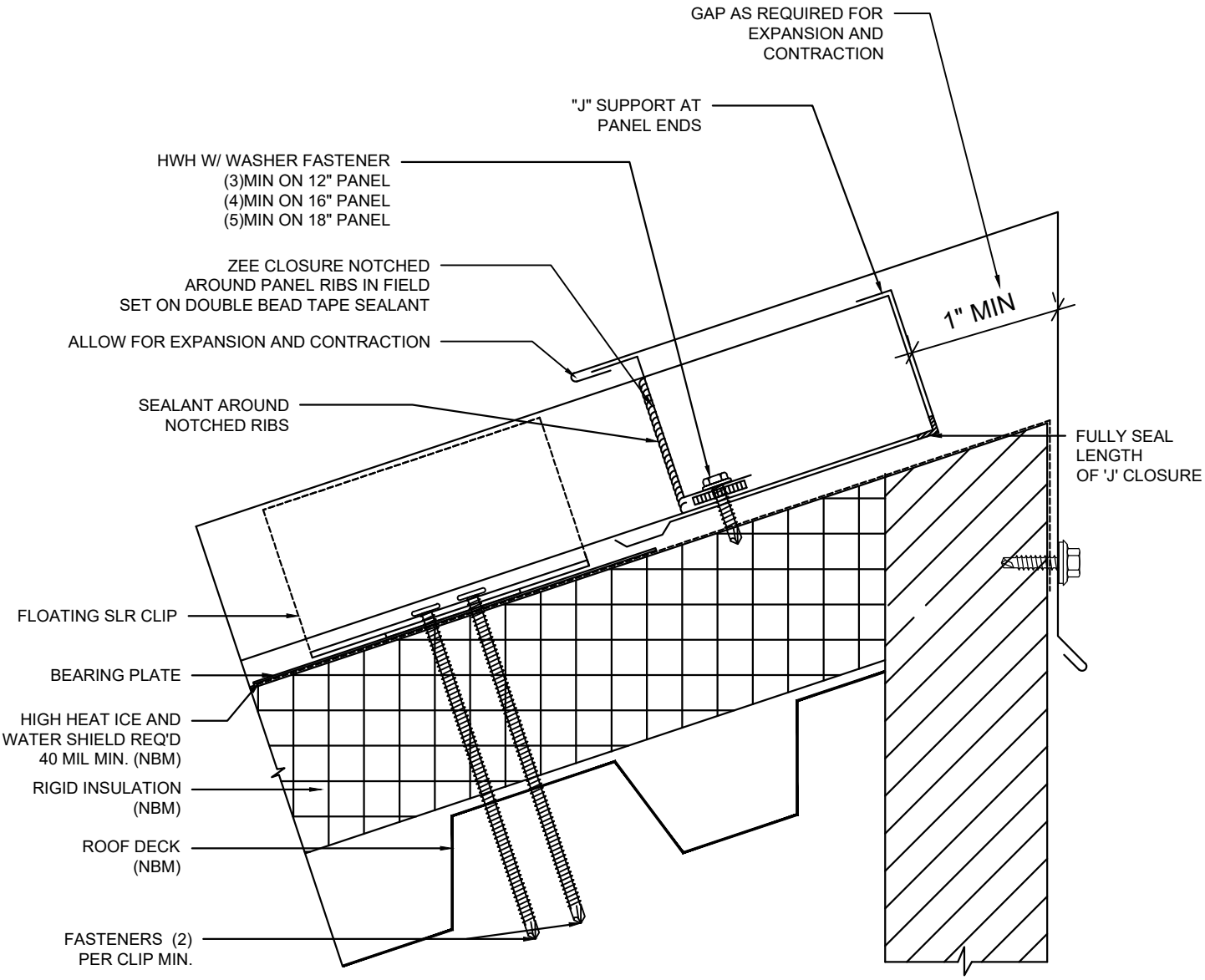


Note:
- Clip fasteners must be long enough to fasten into low cells of decking.

Eave design must be able to allow for the total amount of expansion of the panel if the ridge or mid-point is fixed. A drip trim should be used to stiffen the flat of the panel and block wind driven rain. This piece also assists in limiting the amount of bow of the flat under high wind.
Since sealant between roof underlayment and panel may limit expansion or rupture, protection against wind blown water infiltration is provided by folding the panel under, which allows for thermal expansion.
Detail must be designed to allow for maximum thermal movement. Floating eave requires fixed ridge or mid-point of panel length.

FLOATING LOW EAVE WITH EXTENDED DRIP DETAIL

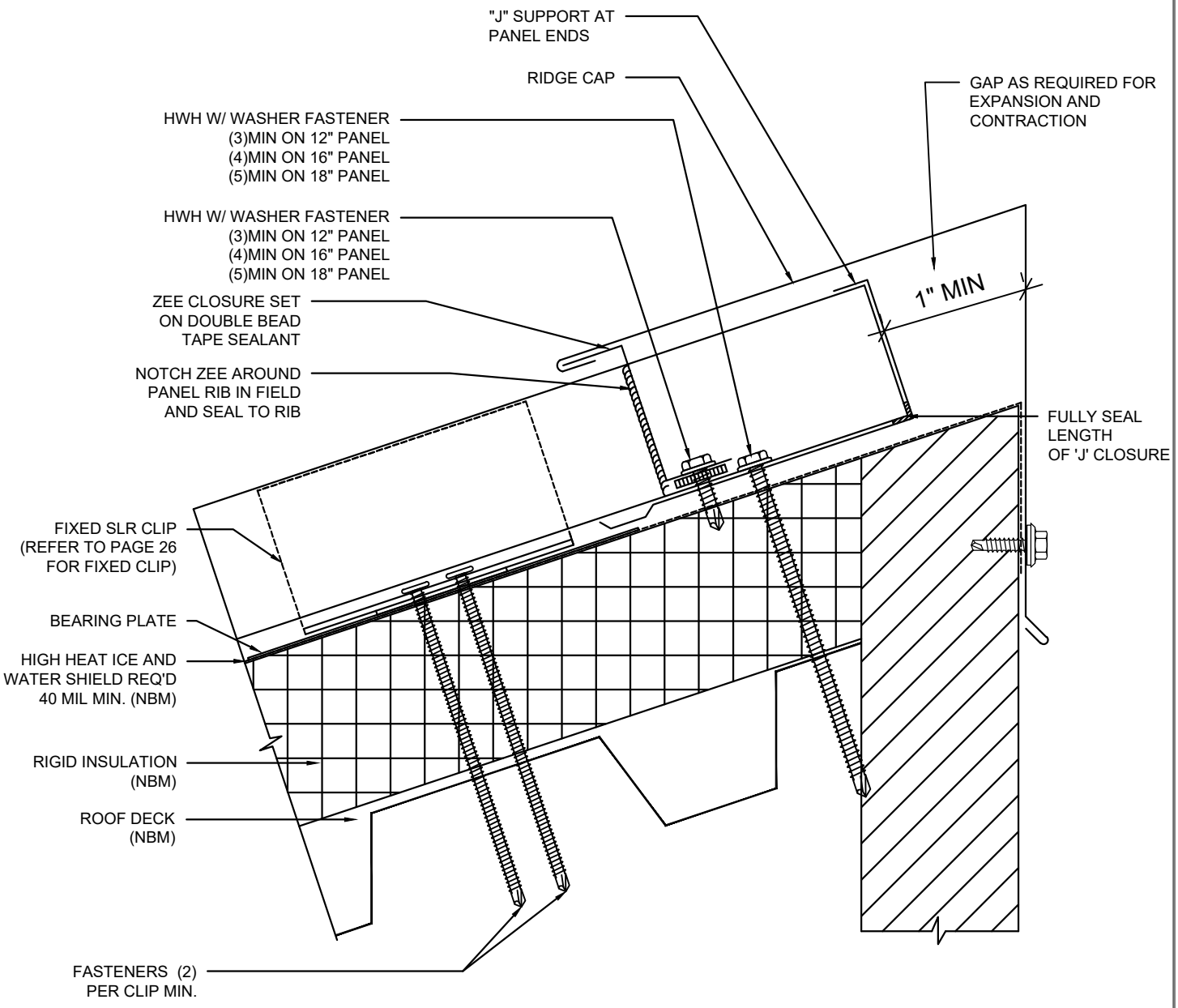
*NBM = Not By Morin



Note:
- Clip fasteners must be long enough to fasten into low cells of decking.
- Use larger J- support for panel with clip relief, pencil ribs and striated.
-Floating high eave requires fixed low eave or mid-point of roof.
-Gap as required for thermal movement.
-Slip joint at ridge cap to Z closure is required to allow project thermal movement.

FLOATING HIGH EAVE DETAIL

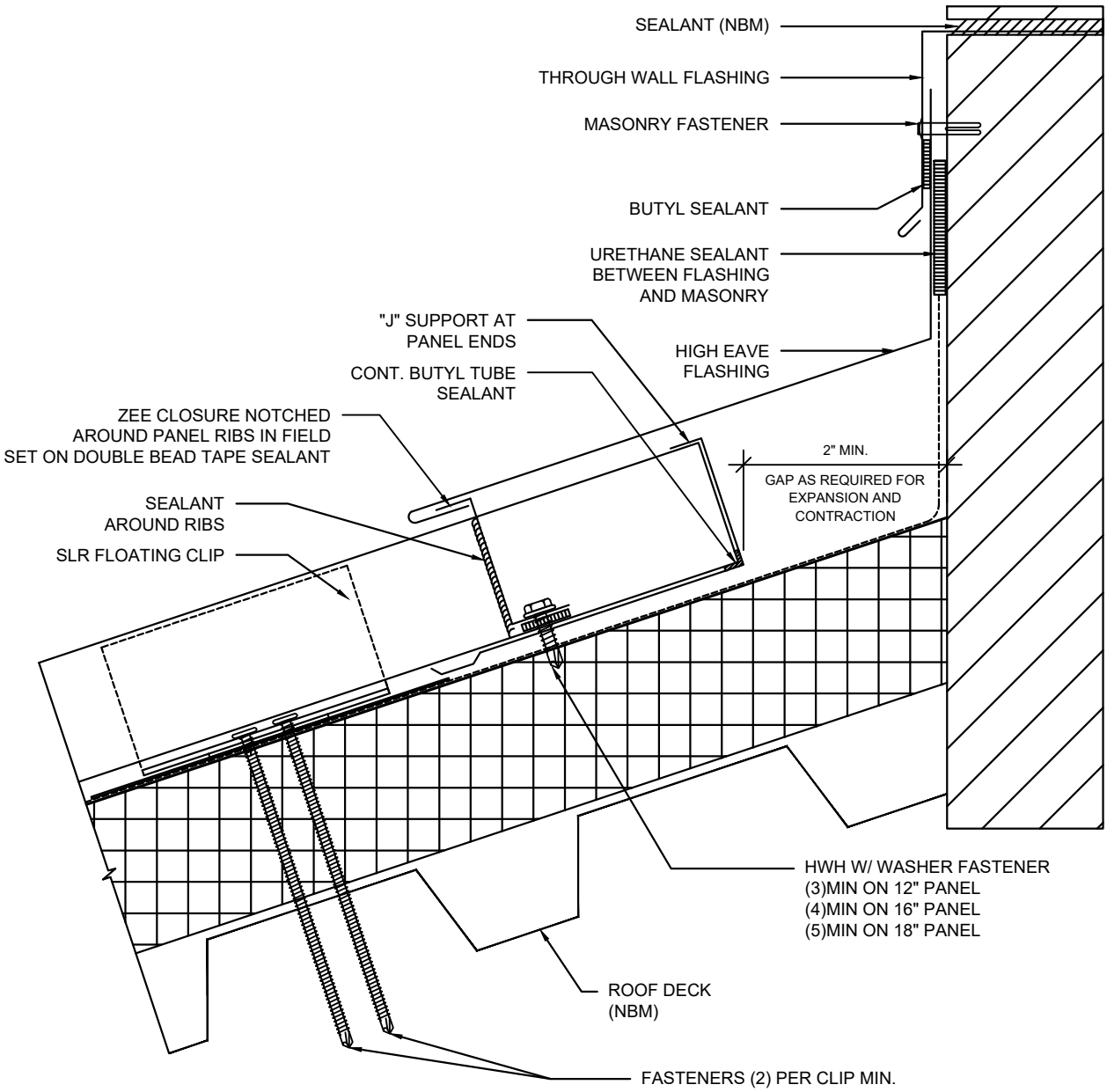
*NBM = Not By Morin



Note:
- Clip fasteners must be long enough to fasten into low cells of decking.
- Use larger J- support for panel with clip relief, pencil ribs and striated.
-Fixed high eave requires floating low eave and mid-point of roof.

FIXED HIGH EAVE DETAIL

*NBM = Not By Morin

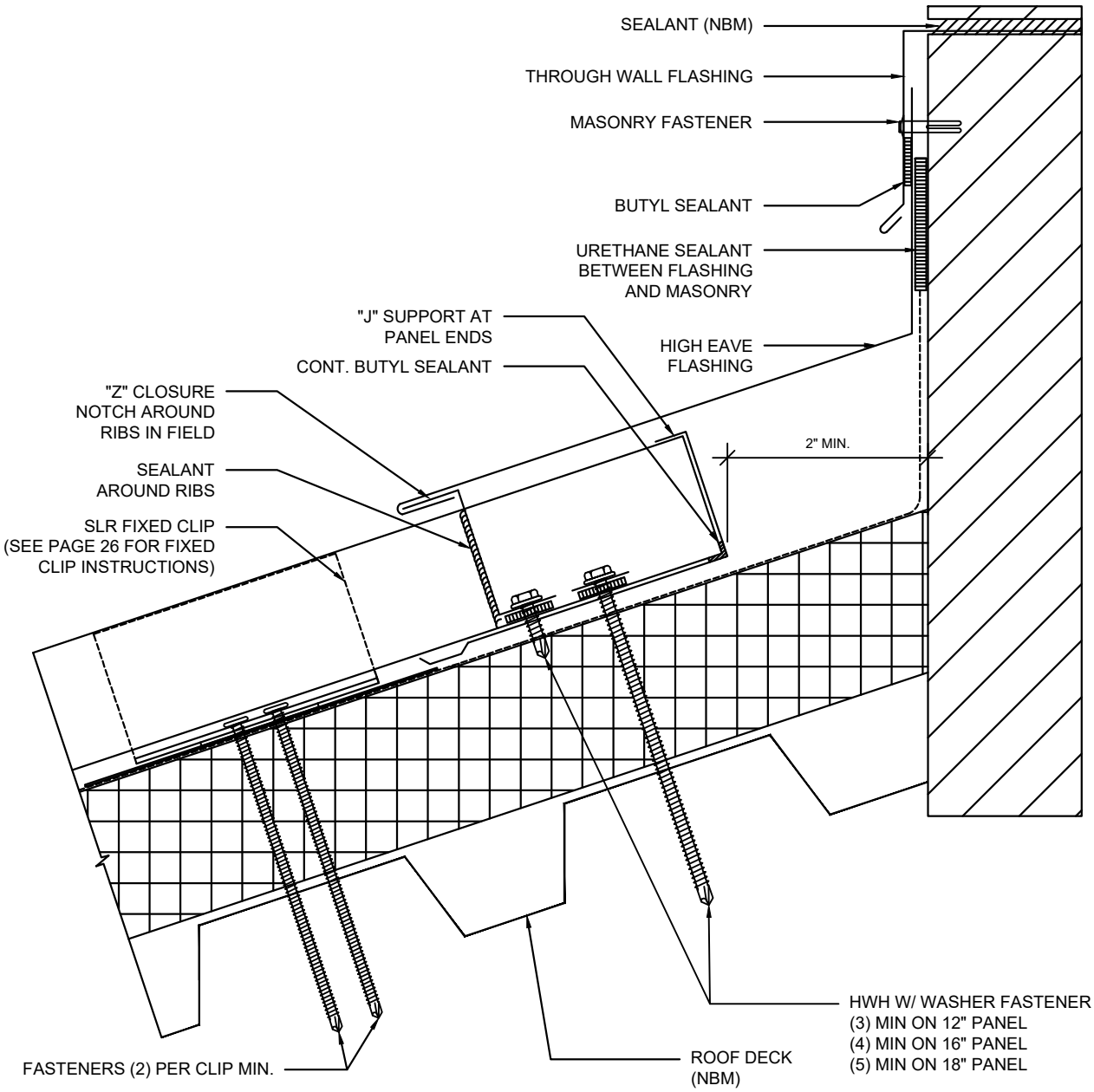


Note:

- Clip fasteners must be long enough to fasten into low cells of decking.
- Use larger J- support for panel with clip relief, pencil ribs and striated.
- High eave to wall flashings are similar to ridge conditions.
- Attention must be given to the design for sealing and panel movement.
- Where snow buildup is a concern, the design of the trim must take into account the excess loading.
-Use larger J- support for panel with clip relief, pencil ribs and striated.
-Slip joint at ridge cap to Z closure is required to allow project thermal movement.

FLOATING WALL TO ROOF HIGH EAVE DETAIL

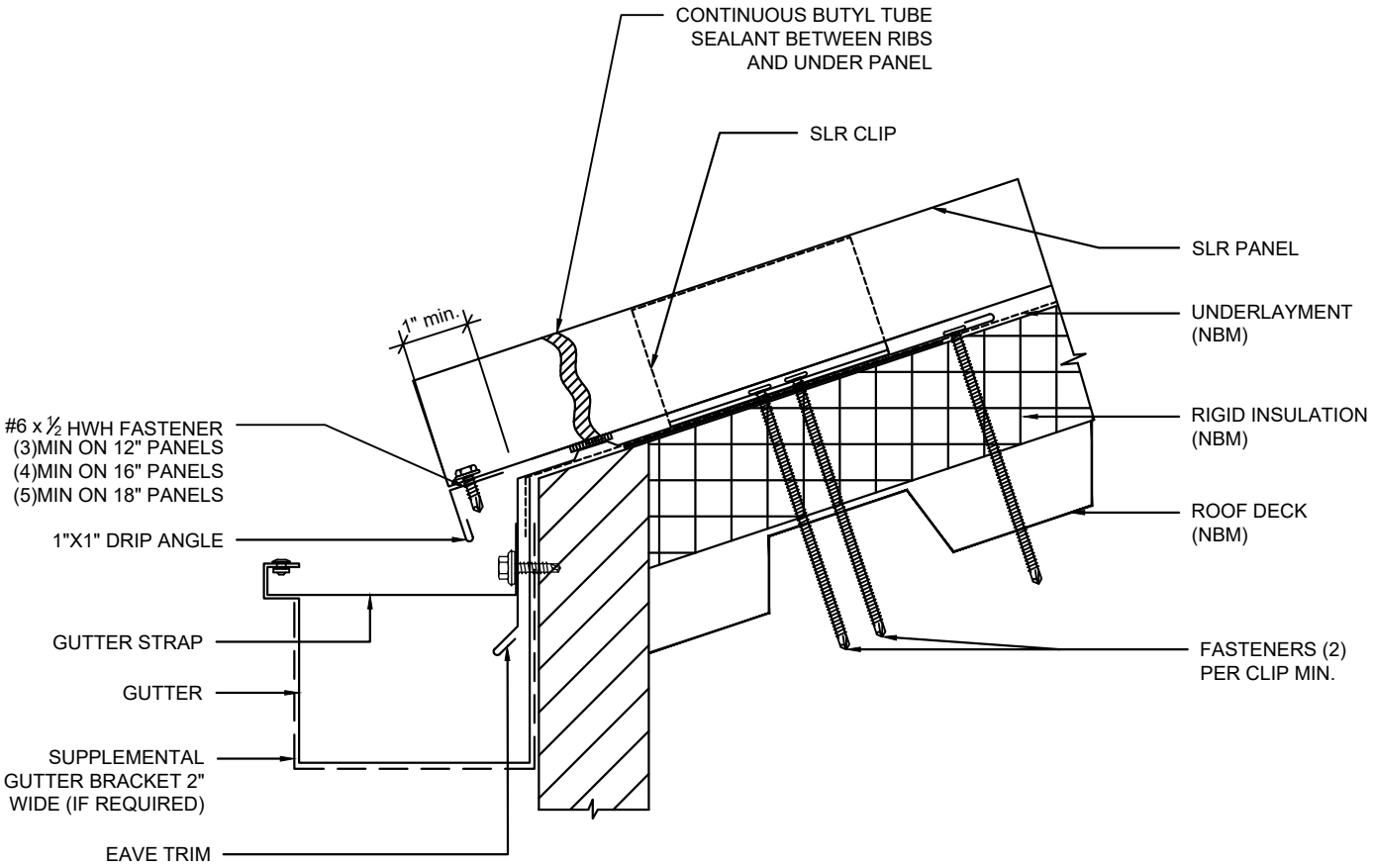
*NBM = Not By Morin



Note:
- Clip fasteners must be long enough to fasten into low cells of decking.
- Use larger J- support for panel with clip relief, pencil ribs and striated.
- High eave to wall flashings are similar to ridge conditions.
- Where snow buildup is a concern, the design of the trim must take into account the excess loading.
-If ridge condition is required to "float", slip joints must be made to accommodate the required expansion.

FIXED WALL TO ROOF HIGH EAVE DETAIL

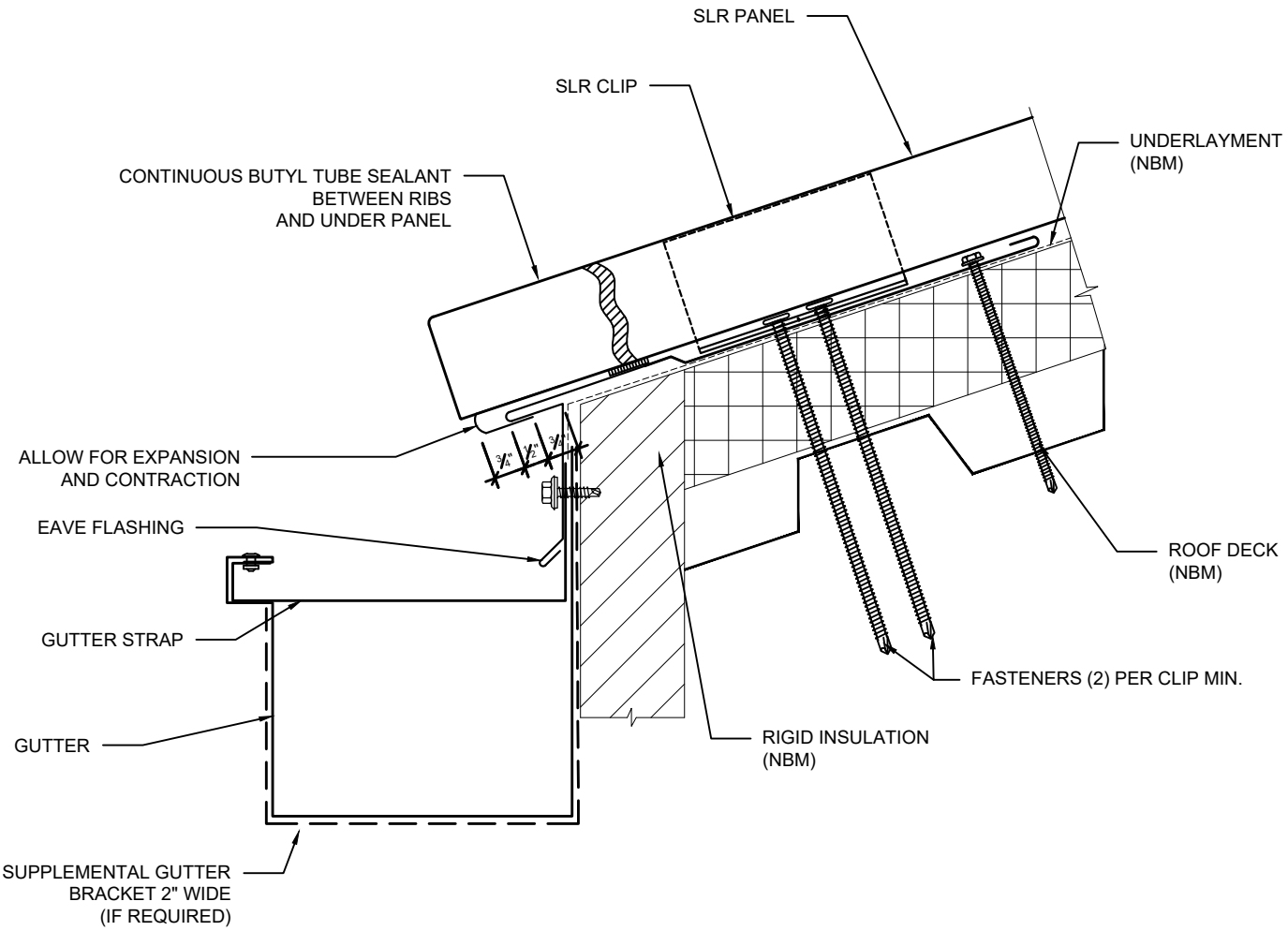
*NBM = Not By Morin



Consideration during design must be given to capacity, overflow, accessibility for cleaning, and aesthetics. Attachments must provide structural supports and allow for thermal movement. Protection from ice and snow must be considered during the detailing of this condition. Edge of gutter should be reinforced in areas of snow or ice accumulation. The edge of the gutter should be below the roof plane to allow for evacuation of the snow build-up. The gutter should be independent of the roof panel as not to inhibit the thermal movement of the roof. Floating eave requires fixed ridge or mid-point of panel length.

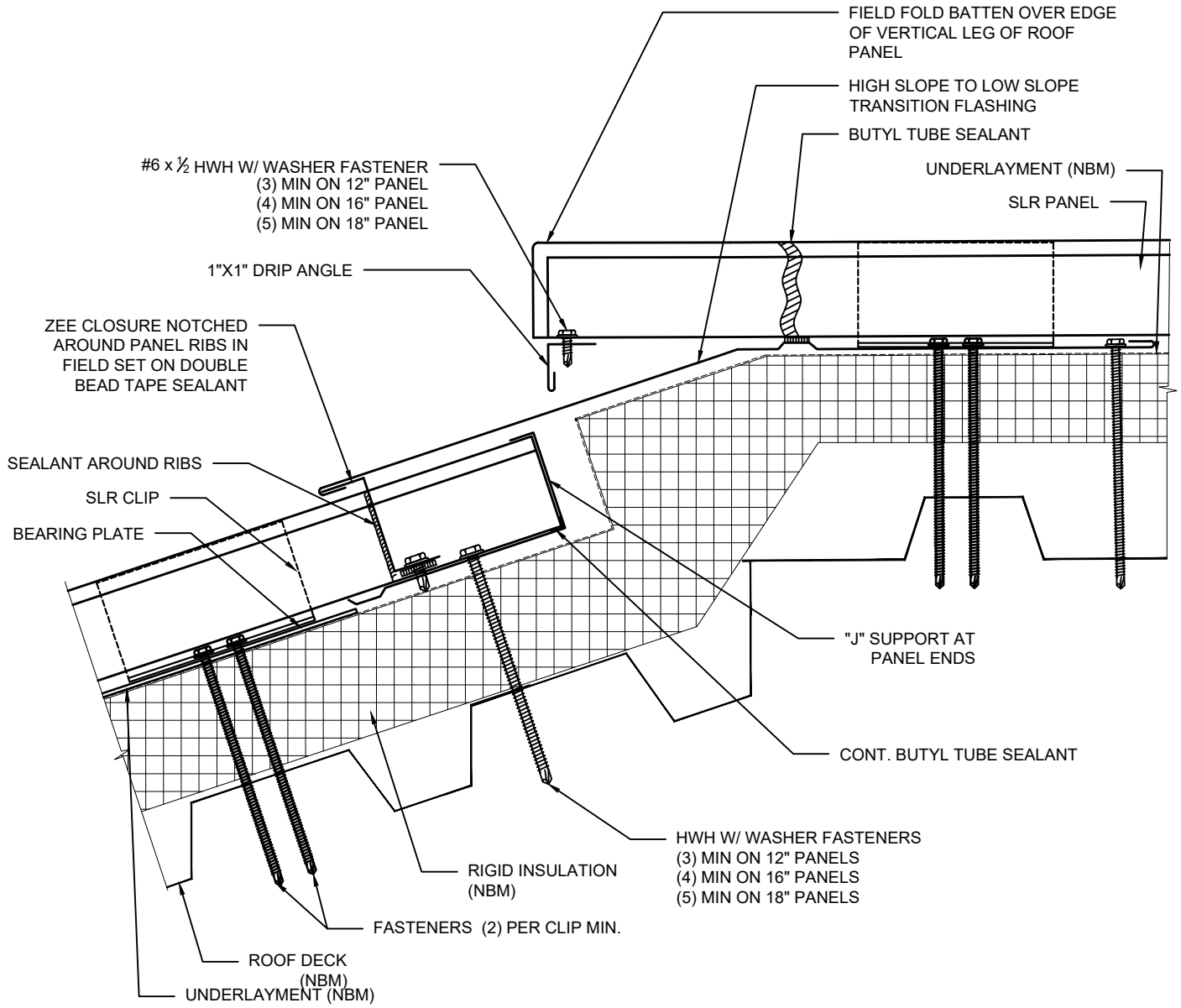
FLOATING LOW EAVE WITH GUTTER DETAIL

*NBM = Not By Morin



Consideration during design must be given to capacity, overflow, accessibility for cleaning, and aesthetics. Attachments must provide structural supports and allow for thermal movement. Protection from ice and snow must be considered during the detailing of this condition. Edge of gutter should be reinforced in areas of snow or ice accumulation. The edge of the gutter should be below the roof plane to allow for evacuation of the snow build-up. The gutter should be independent of the roof panel as not to inhibit the thermal movement of the roof. Floating eave requires fixed ridge or mid-point of panel length.

FLOATING LOW EAVE WITH GUTTER DETAIL
OPTIONAL DETAIL WITH HEM PANEL EDGE

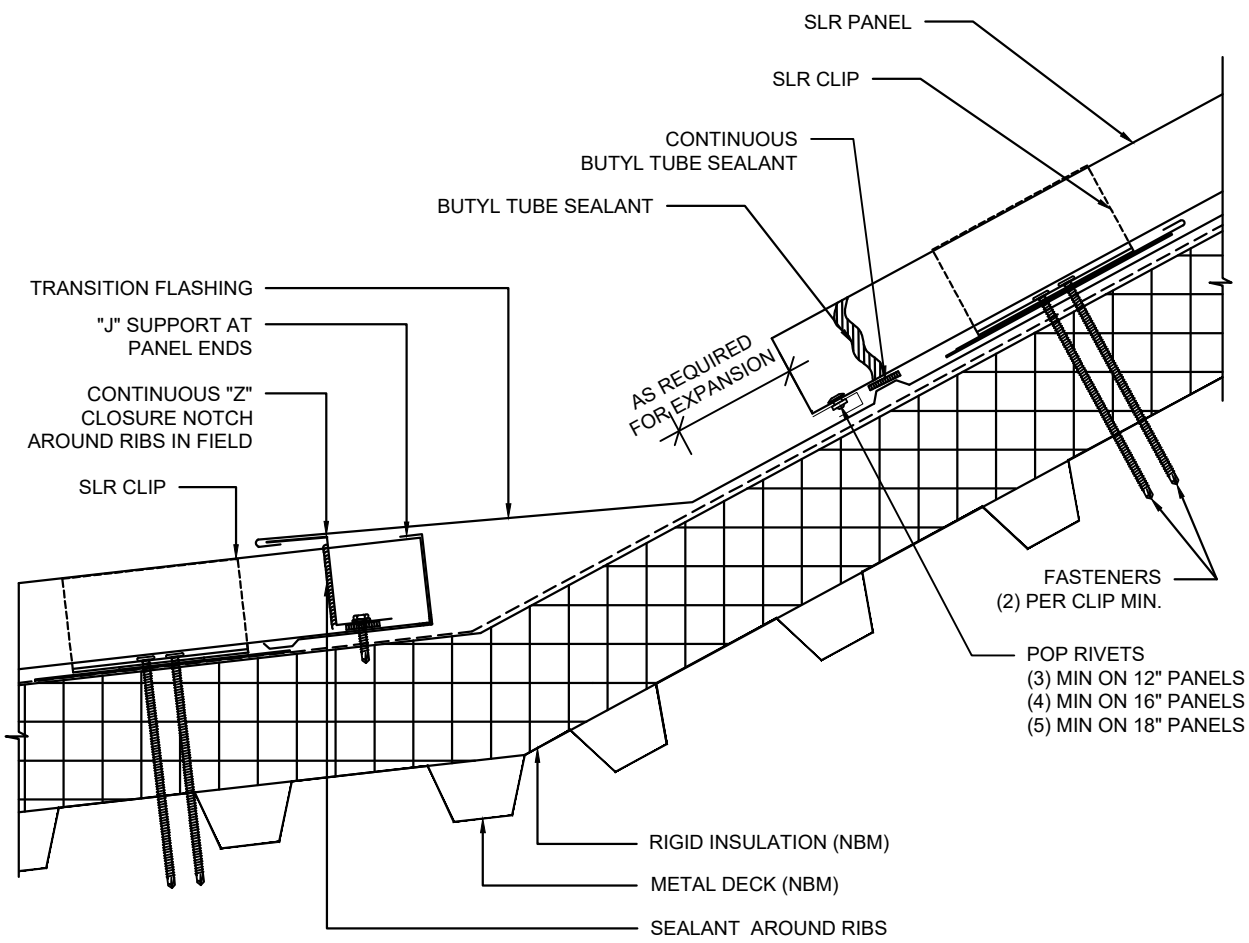


Note:
- Clip fasteners must be long enough to fasten into low cells of decking.
- Floating panels require fixed connections at opposite ends.
- Use larger J- support for panel with clip relief, ribs and striated.
- Attention must be given to the design for sealing and panel movement.
- Where snow buildup is a concern, the design of the trim must take into account the excess loading
-If ridge condition is required to “float”, slip joints must be made to accommodate the required expansion

FLOATING LOW SLOPE TO HIGH SLOPE DETAIL

*NBM = Not By Morin

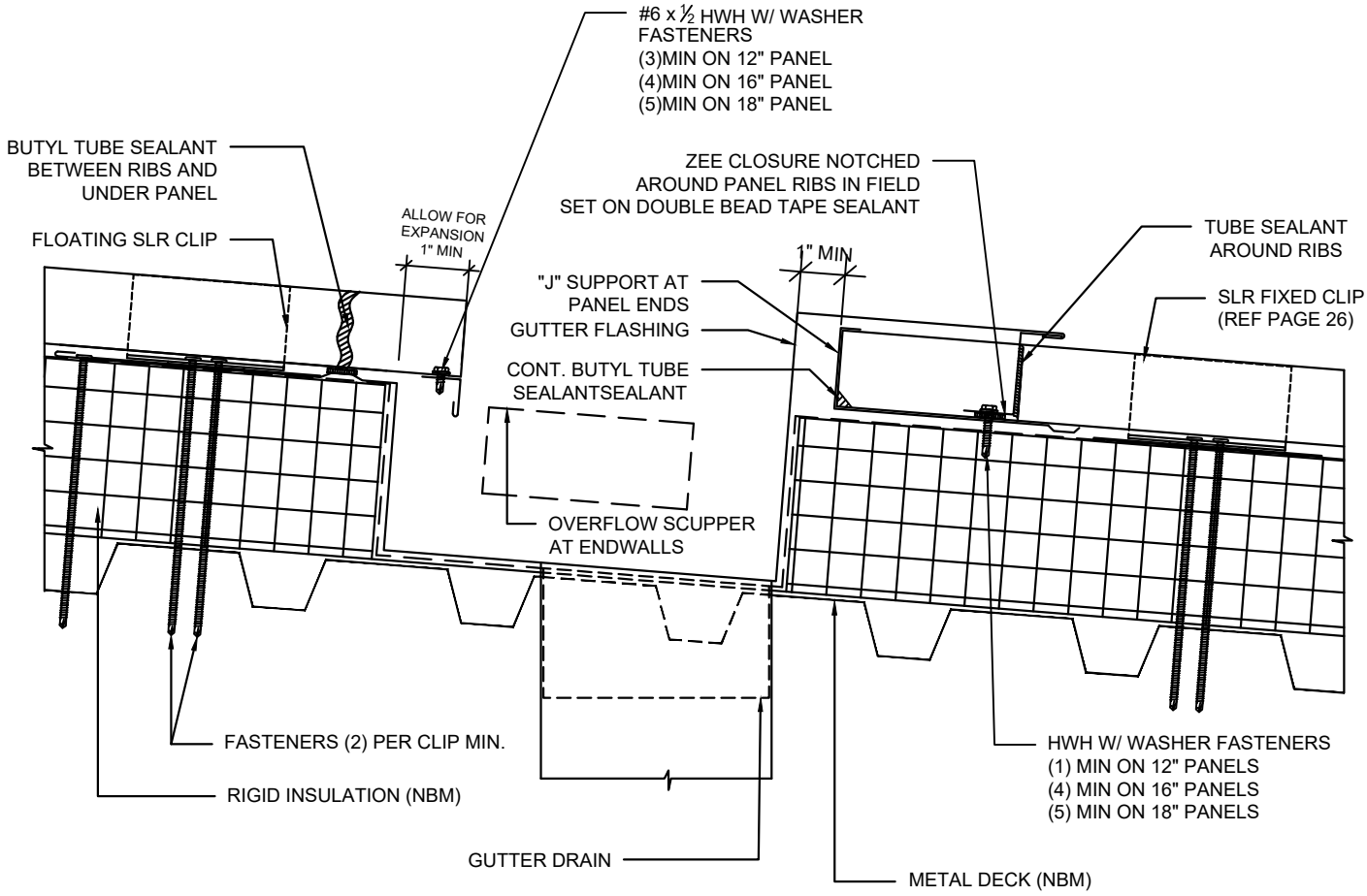
TECHNICAL DATA



Note:
- Clip fasteners must be long enough to fasten into low cells of decking.
- Floating panels require fixed connections at opposite ends.
- Use larger J- support for panel with clip relief, ribs and striated.
- Attention must be given to the design for sealing and panel movement.
- Where snow buildup is a concern, the design of the trim must take into account the excess loading
-If ridge condition is required to “float”, slip joints must be made to accommodate the required expansion

FLOATING LOW SLOPE TO HIGH SLOPE DETAIL

*NBM = Not By Morin

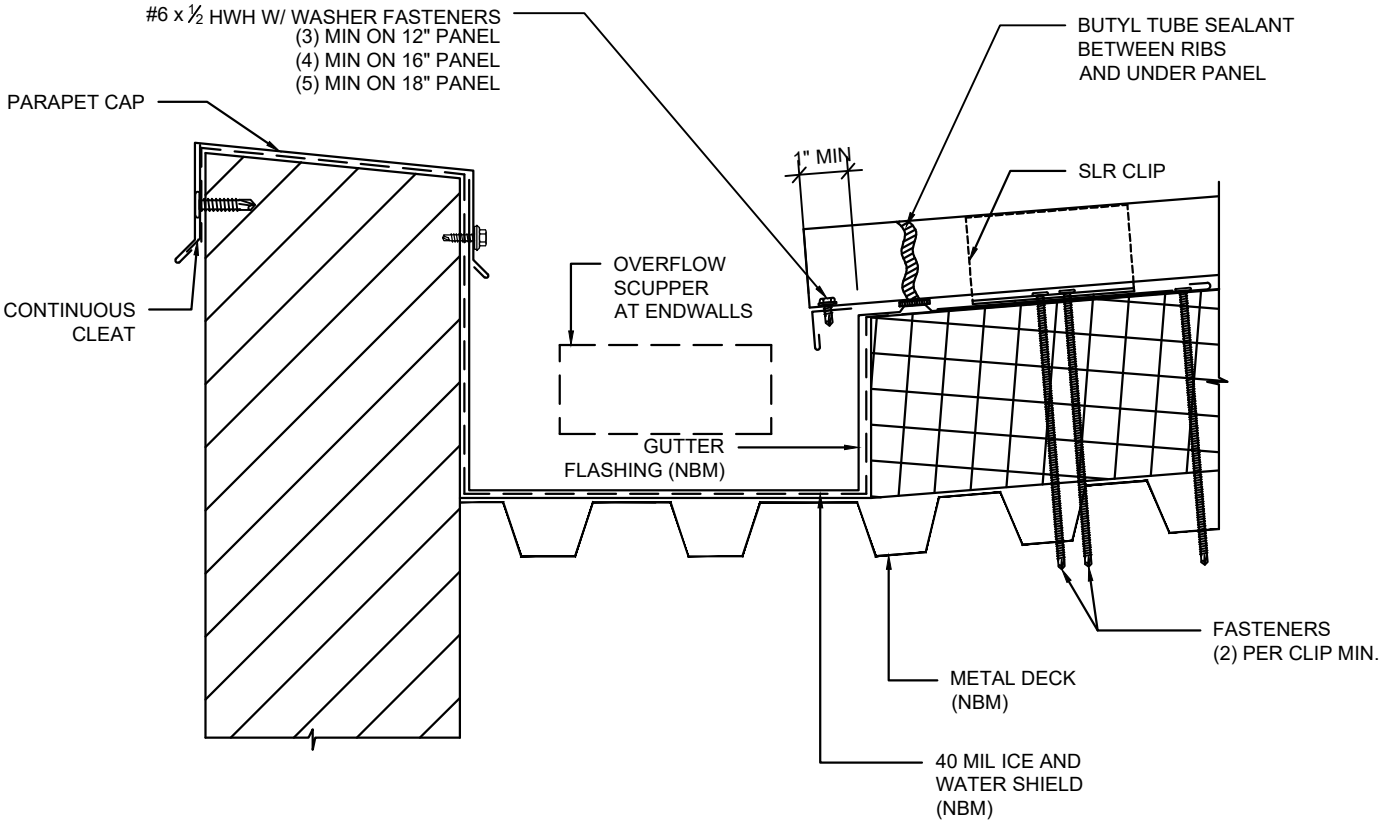


Where an exposed gutter may distract from the aesthetics of the building, an internal gutter may be required. The condition and roof design must allow for this condition to be “fixed and floating” against thermal movement. Considerations must be made in areas of ice or snow to avoid blockage of the gutter or drains. Overflow scuppers are required at each end of the gutter. This design relies on sealant to form the weather barrier. Designers should be aware of the hazards and allow for adequate drainage.
Note: Upper panel is shown as floating and lower panel as fixed. Some locations on project may have opposite conditions.
-Morin requires stainless steel liner and membrane for all internal gutter (NBM).
-Use larger J- support fasten at 24" O.C for panel with clip relief, ribs and striated.
-Reference low eave detail for optional hemmed panel.
Contact Morin Technical Dept. for optional details.

INTERNAL GUTTER DETAIL

MORIN DOES NOT WARRANT INTERNAL GUTTER CONDITIONS

*NBM = Not By Morin



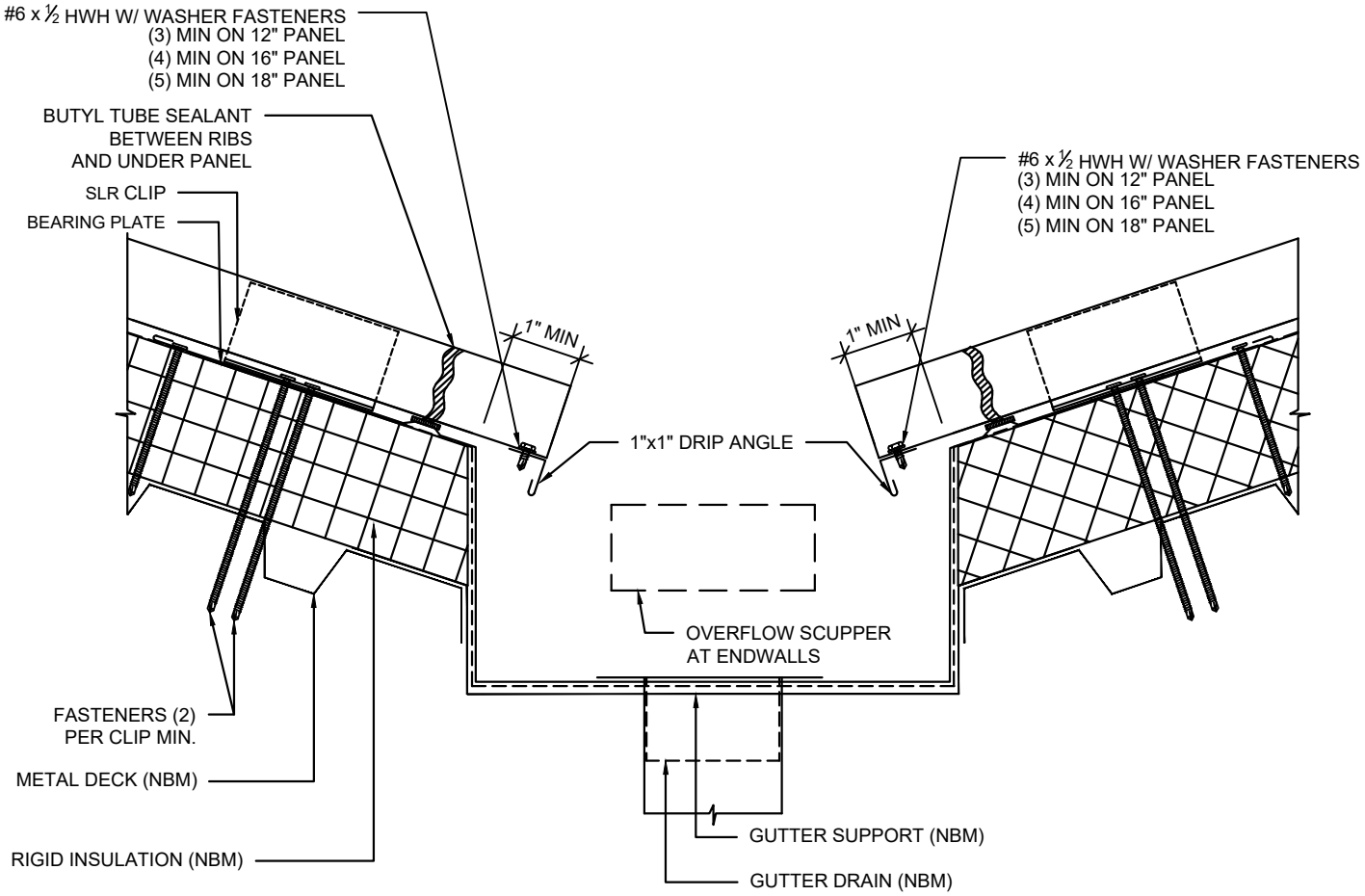
Note:
-Panel is shown as floating. Some locations on project may have fixed condition.
-Over flow scupper recommended at ends of gutter.
-Use larger J- support for panel with clip relief, ribs and striated.
-Reference low eave detail for optional hemmed panel.

Contact Morin Technical Dept. for optional details.

FLOATING INTERNAL GUTTER WITH PARAPET WALL DETAIL

MORIN DOES NOT WARRANT INTERNAL GUTTER CONDITIONS

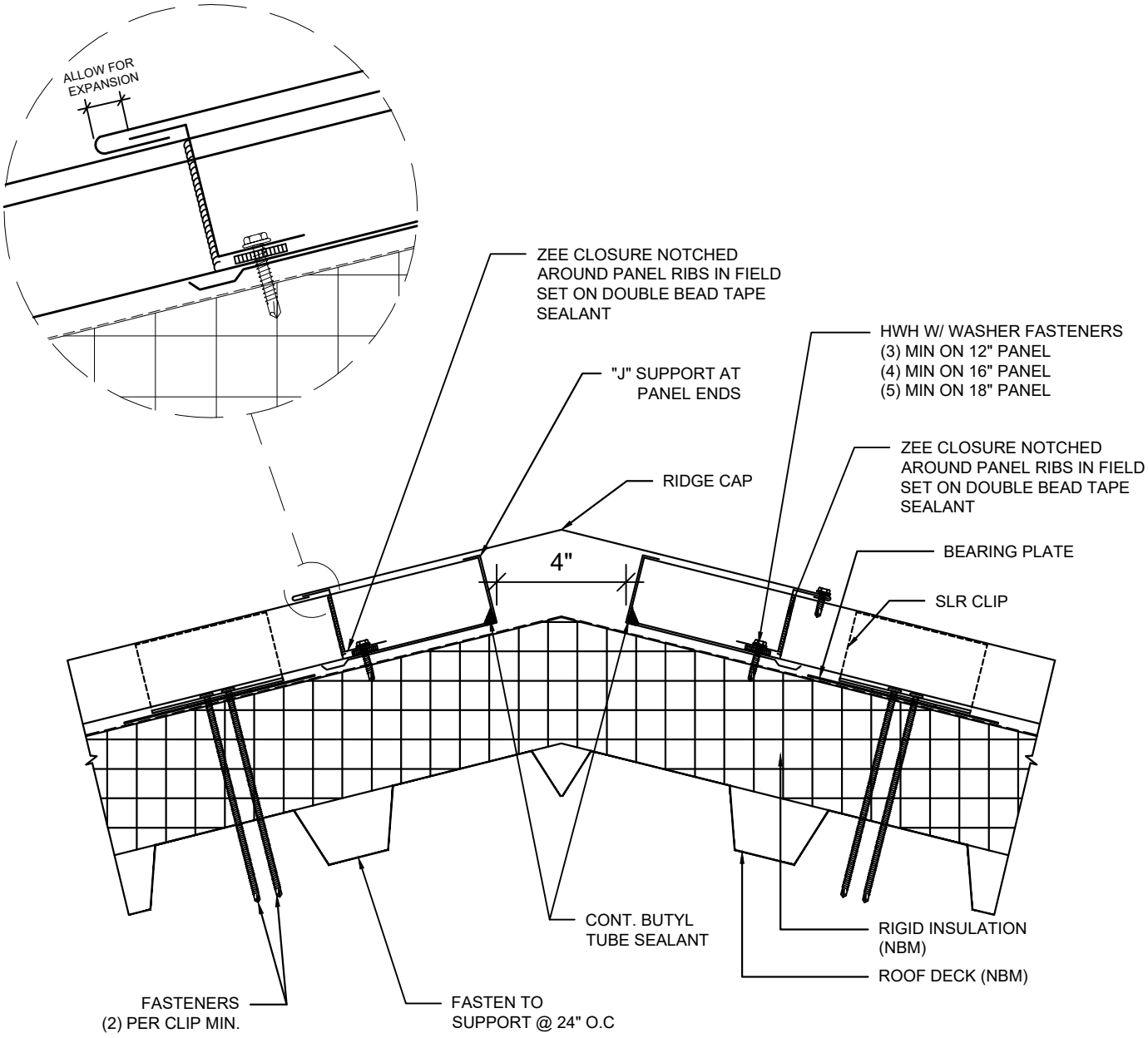
*NBM = Not By Morin



Note:
-Over flow scupper recommended at ends of gutter.
-Morin recommends use of membrane liner for all internal gutter (NBM).

FLOATING INTERNAL VALLEY GUTTER DETAIL

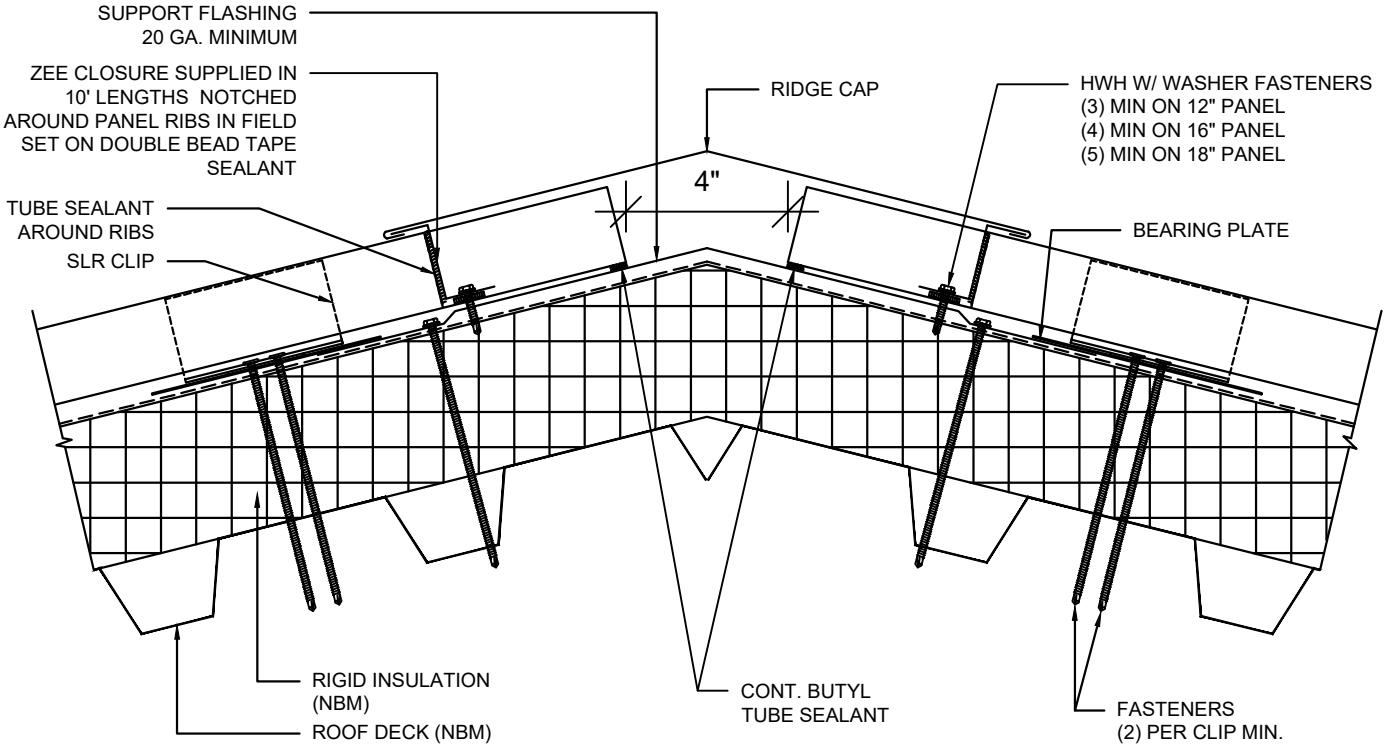
*NBM = Not By Morin



Note:
- If ridge condition is required to “float”, slip joints must be made to accommodate the required expansion.
- Clip fasteners must be long enough to fasten into low cells of decking.
- Use larger J- support for panel with clip relief, ribs and striated.
-Floating high eave requires fixed low eave or mid-point of roof.
-Gap as required for thermal movement.
-Slip joint at ridge cap to Z closure is required to allow project thermal movement.

FLOATING RIDGE CAP AND HIP DETAIL

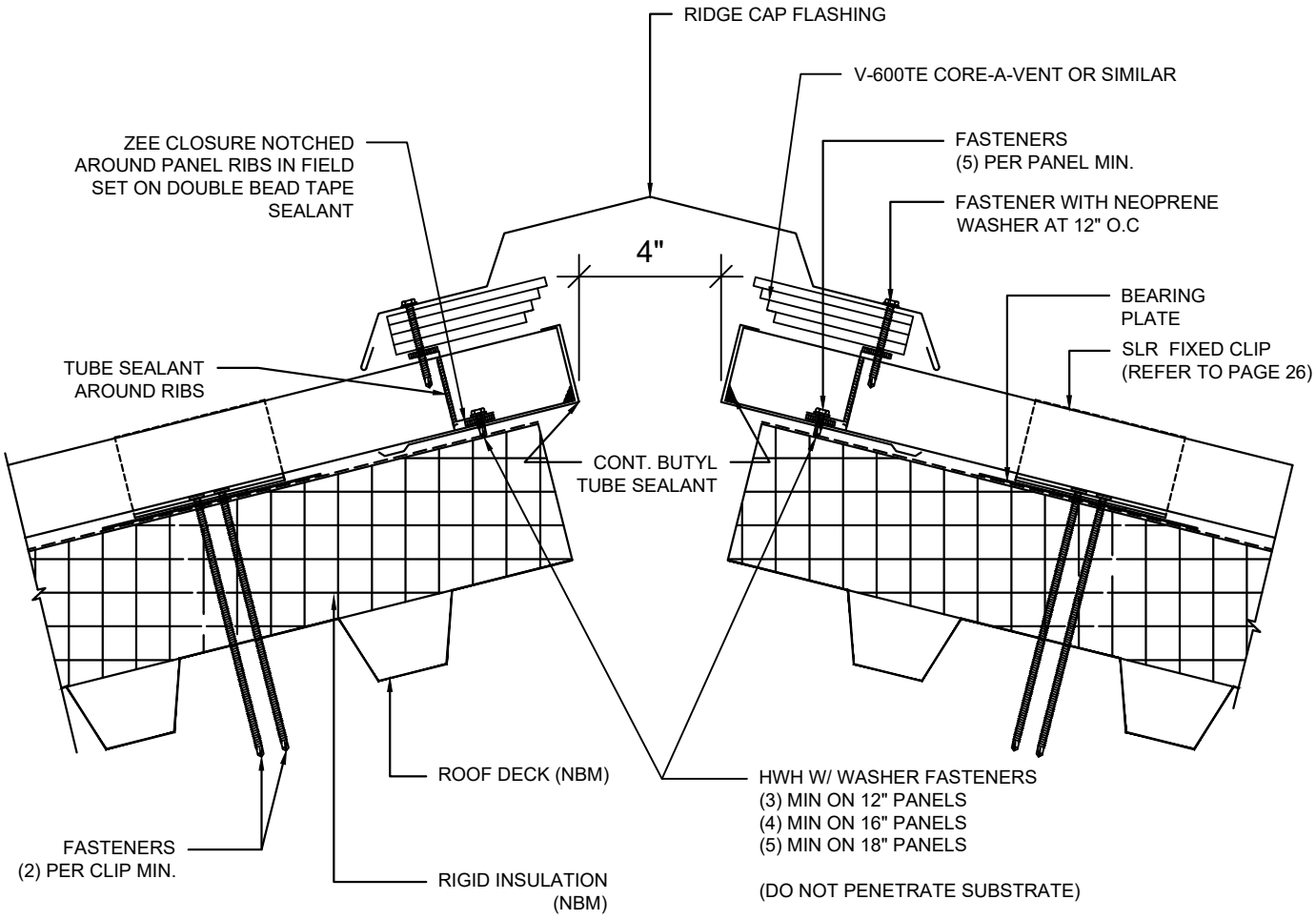
*NBM = Not By Morin



Note:
-Clip fasteners must be long enough to fasten into low cells of decking.
-Floating high eave requires fixed low eave or mid-point of roof.
-Gap as required for thermal movement.
-Slip joint at ridge cap to Z closure is required to allow project thermal movement.

FIXED RIDGE & HIP DETAIL

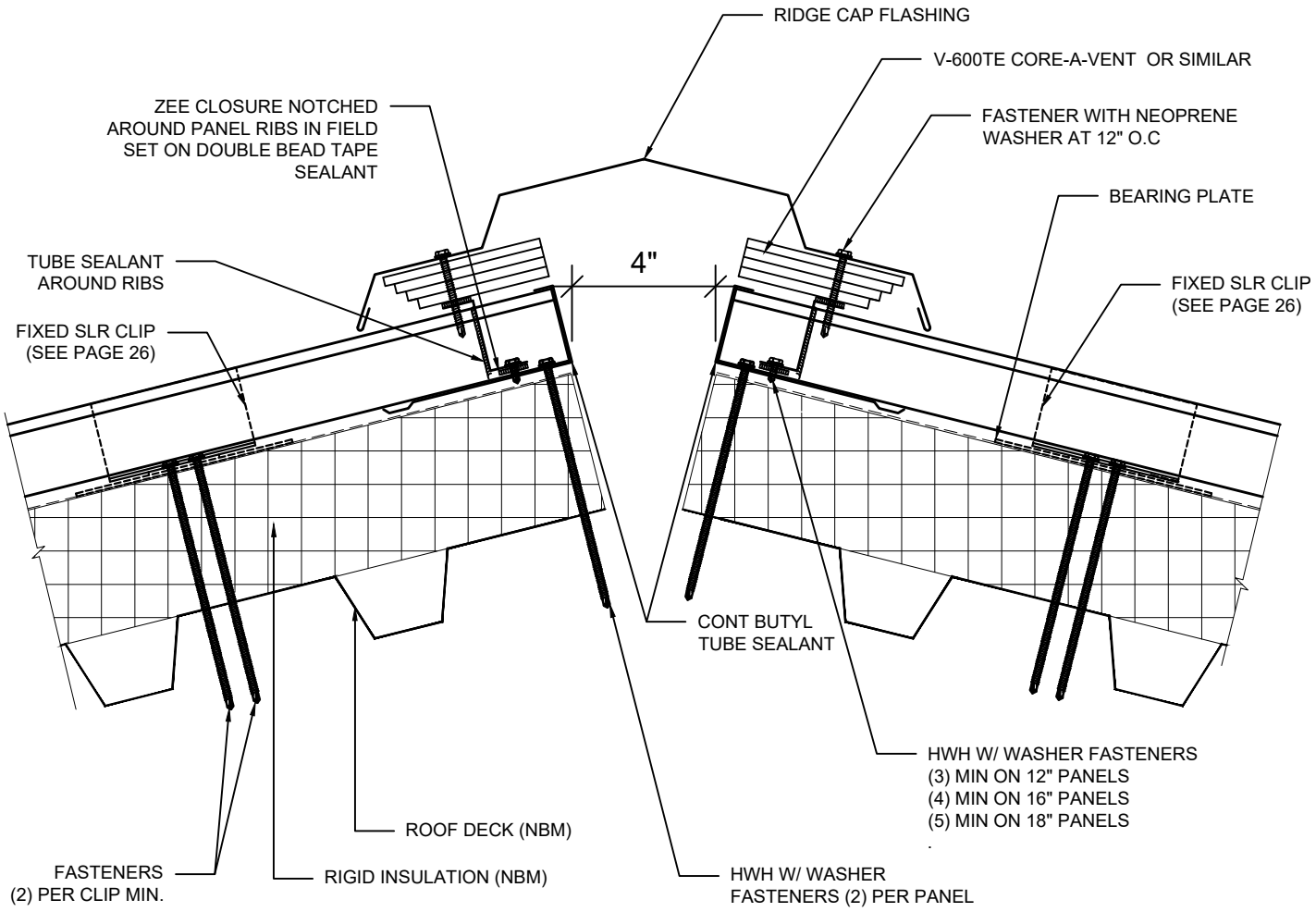
*NBM = Not By Morin



Note:
- Clip fasteners must be long enough to fasten into low cells of decking.
- Use J- support for panel with clip relief, pencil ribs and striated.

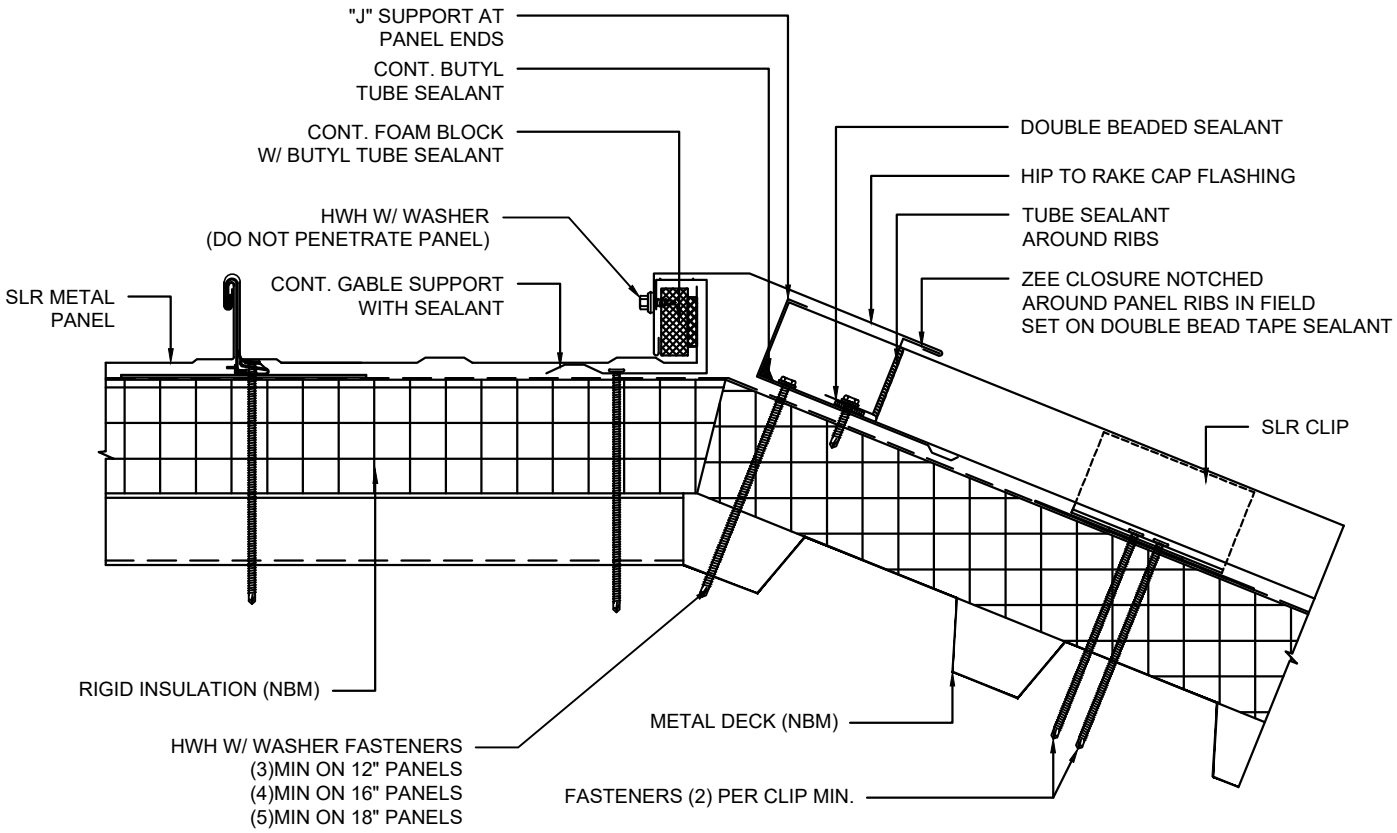
FLOATING VENTED RIDGE DETAIL

*NBM = Not By Morin



FIXED VENTED RIDGE DETAIL

*NBM = Not By Morin

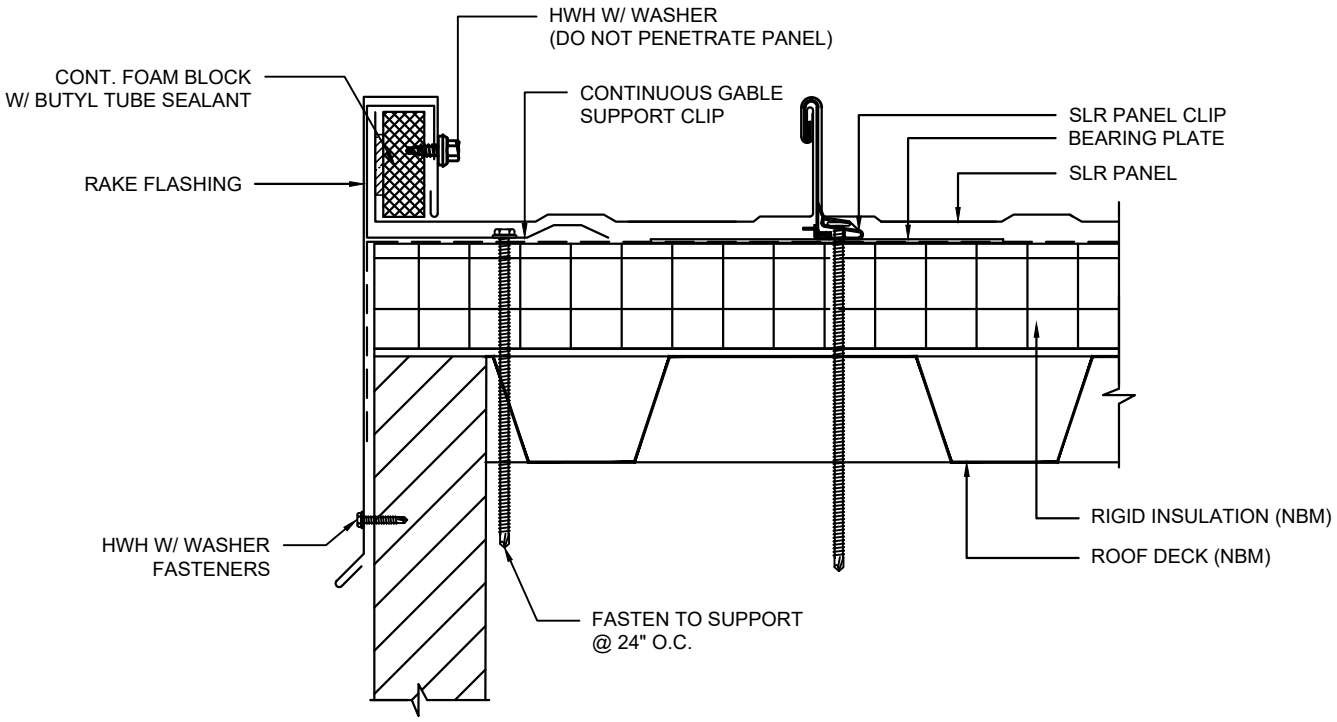


OPTIONS:
1) Field cut starter panel so that rake panels on both ends of roof are of same width requires field bending of cut panel to fit under formed 18 gauge gable support (as shown above).
2) Start roof with full panel, insert roll formed leg under formed 18 gauge gable support.
3) Use larger J- support for panel with clip relief, ribs, and striated.

Note:
- If ridge condition is required to “float”, slip joints must be made to accommodate the required expansion.

HIP TO RAKE DETAIL

*NBM = Not By Morin



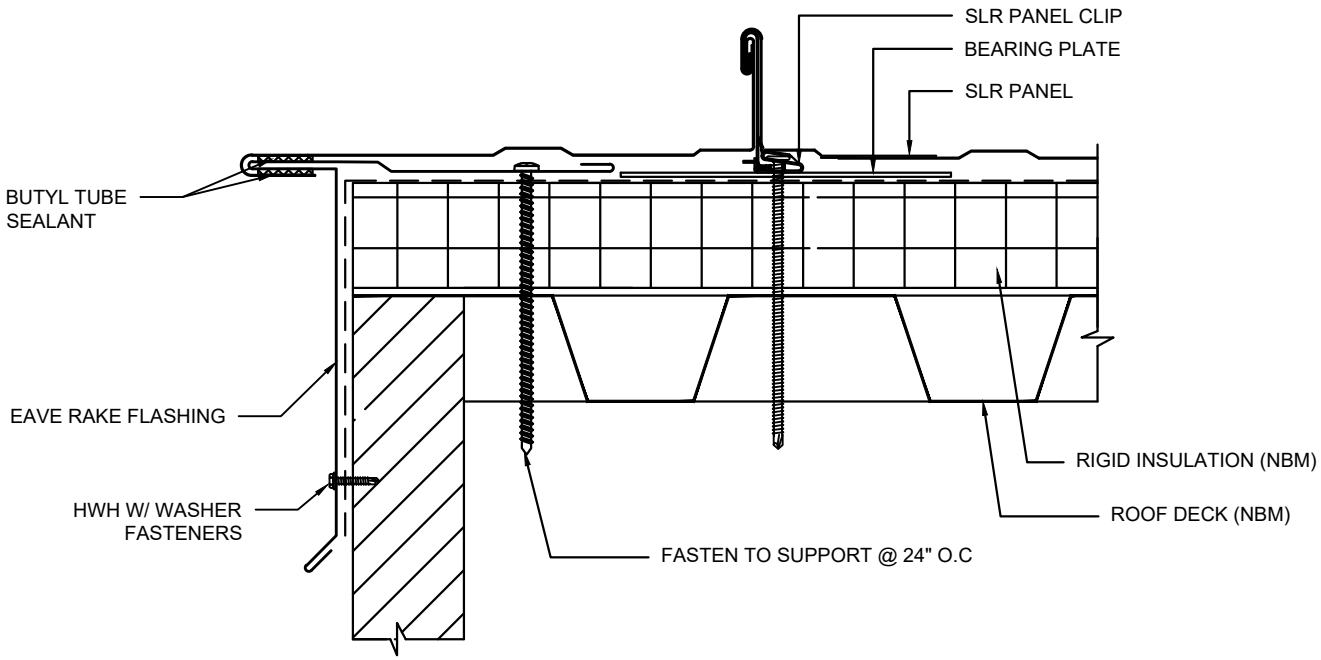
The roof and structure must be allowed to move independently of each other. Thermal movement cannot be restricted. The gable clip is designed to allow this movement while holding down the roof panel. It will also hold the roof panel off the structure the same distance as both hold down clips. Since the gable clip is stationary, the gable trim piece can be attached to it for positive anchoring. The design of the gable flashing can be modified to suit the individual project as long as the basic concept is maintained. Spacing for gable clip is 2'0" o.c. maximum. For longer purlin spacing a gable clip trim is available in 10'0" sections.

Options:

1) Field cut starter panel so that rake panels on both ends of roof are of same width requires field bending of cut panel to fit under formed gable support .
2) Start roof with full panel, insert female leg under formed gable support.
3) Clip fasteners must be long enough to fasten into low cells of decking

FLOATING GABLE / RAKE DETAIL

*NBM = Not By Morin

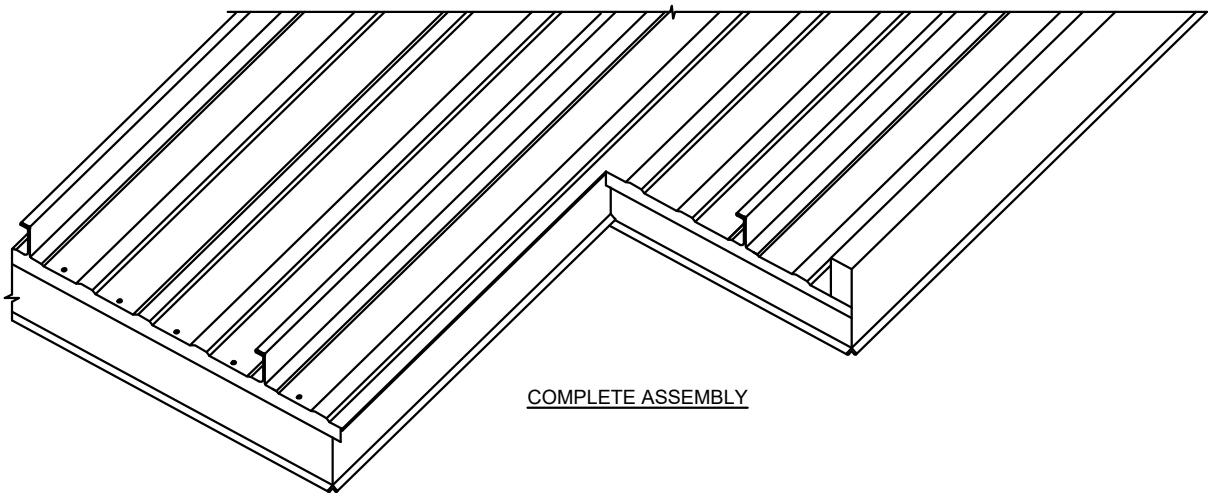


SEE NEXT PAGE FOR INSTALLATION SEQUENCE

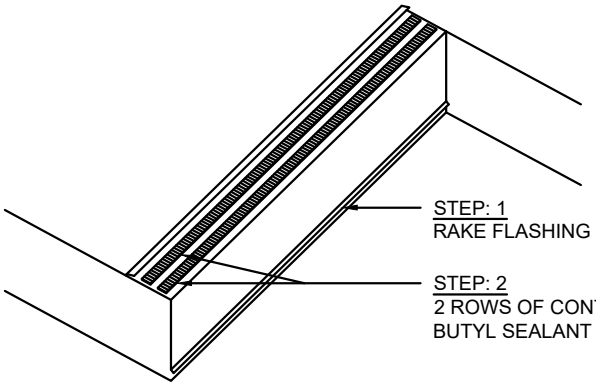
Note:
- Field cut starter panel so that rake panels on both ends of roof are of same width.
  Requires field bending of cut panel to fit under formed gable support
- Start roof with full panel, insert female leg under formed gable support
- Clip fasteners must be long enough to fasten into low cells of decking

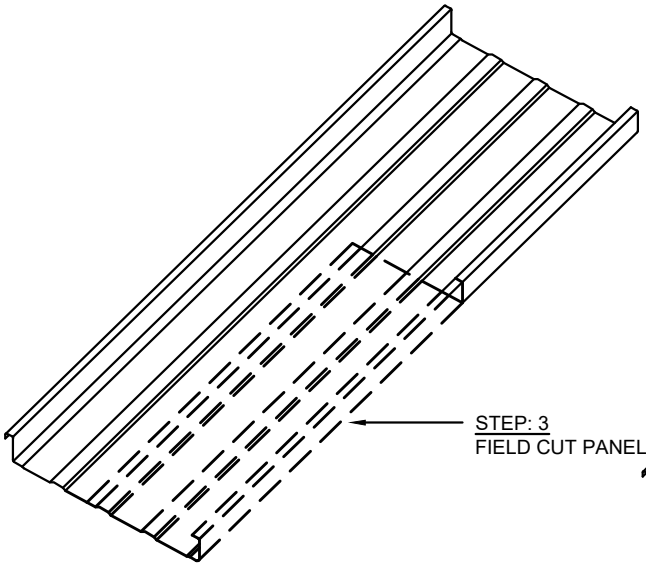
RAKE AT STEPPED EAVE DETAIL

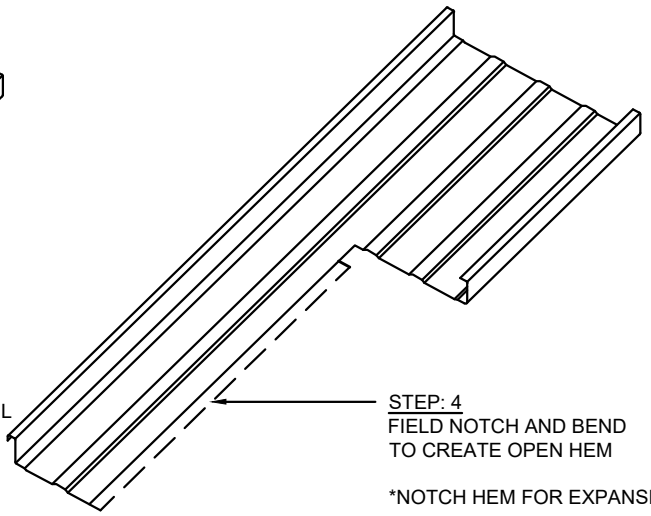
*NBM = Not By Morin



COMPLETE ASSEMBLY



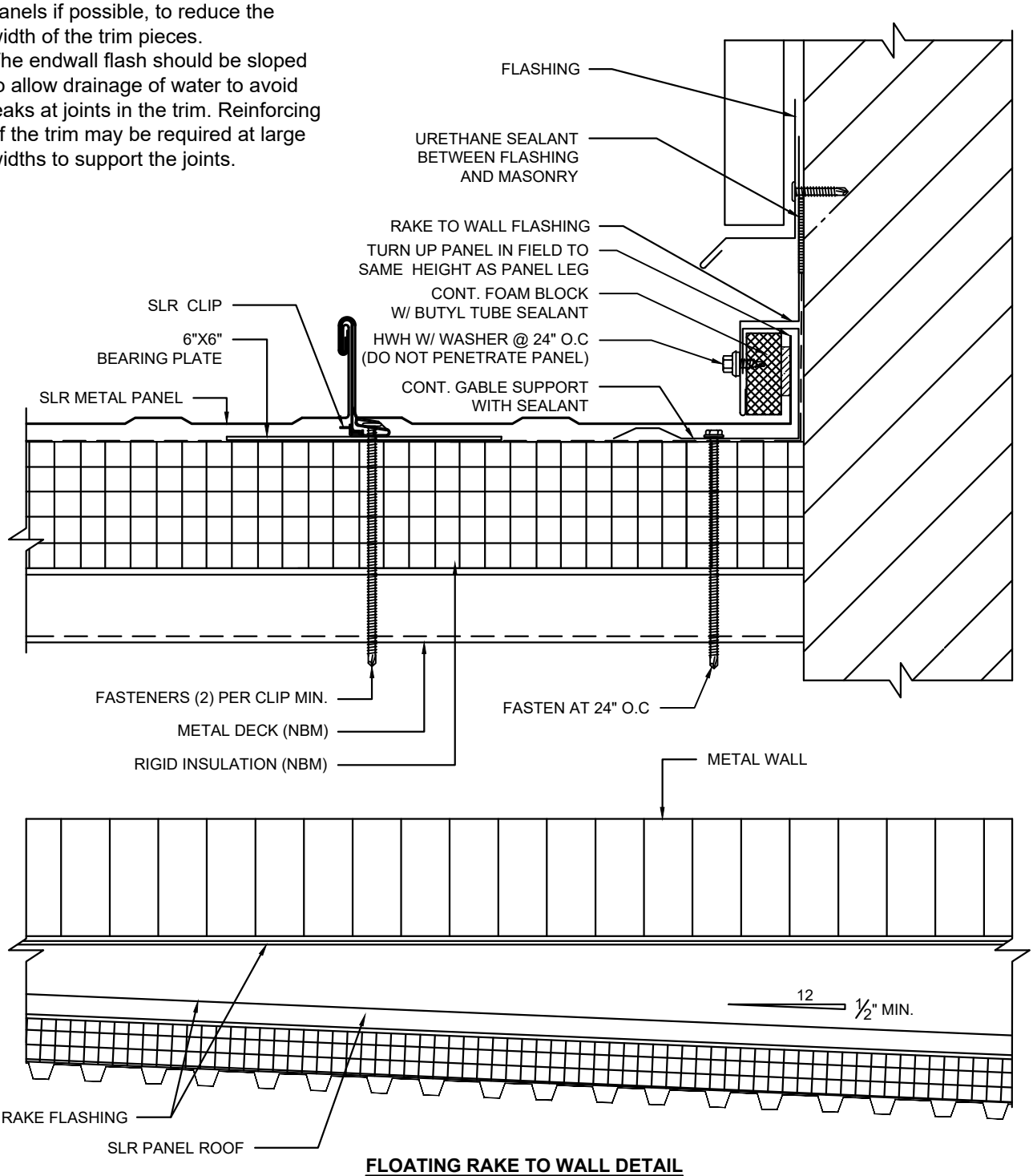




STEPPED EAVE RAKE ISOMETRIC INSTALLATION

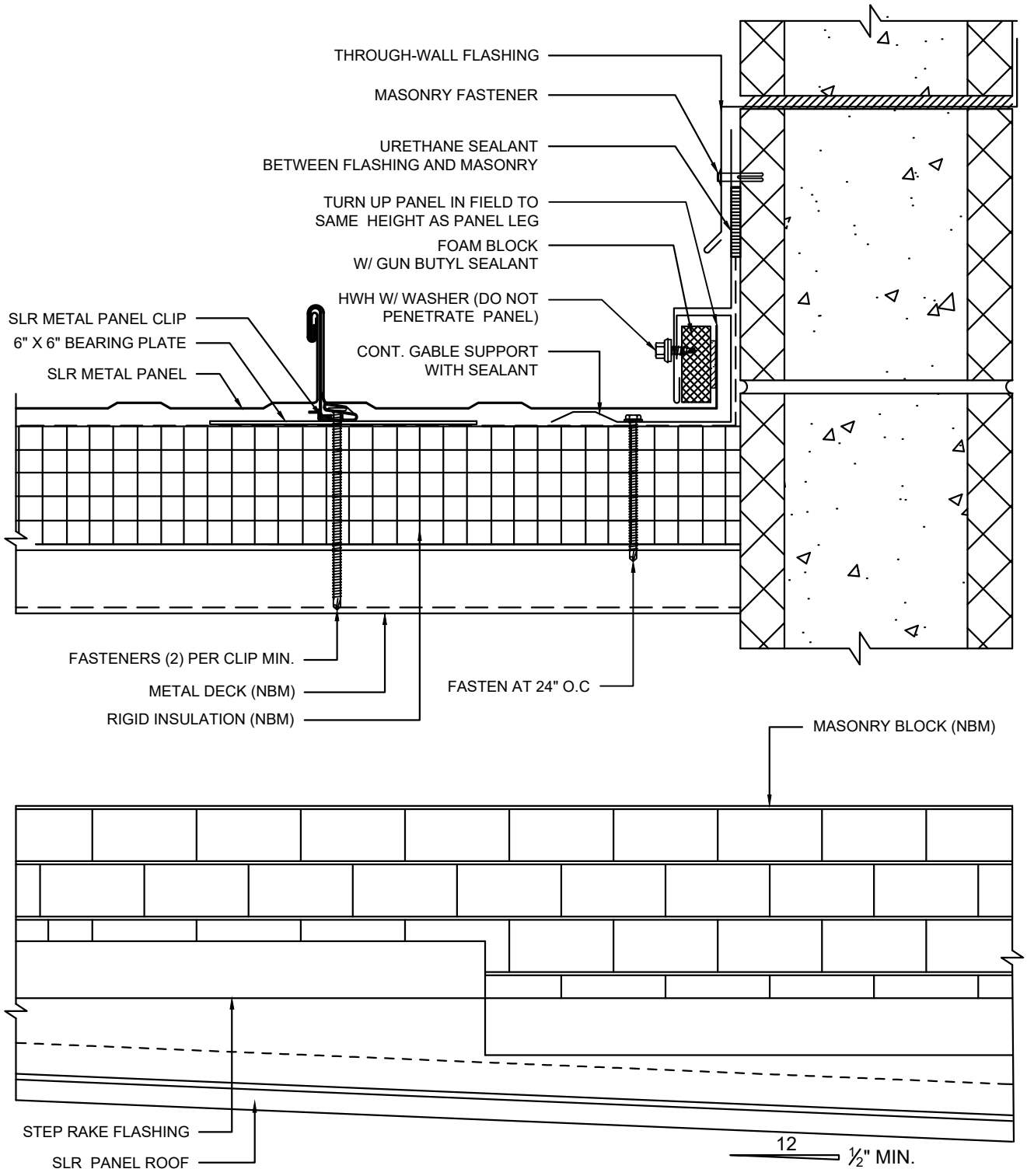
*NBM = Not By Morin

Since the width of the standing seam roof can vary due to compression or spreading during the installation, the module can be altered to minimize the endwall trim width. In cases of fixed panel width or module, the designer should center the roof panels if possible, to reduce the width of the trim pieces.
The endwall flash should be sloped to allow drainage of water to avoid leaks at joints in the trim. Reinforcing of the trim may be required at large widths to support the joints.



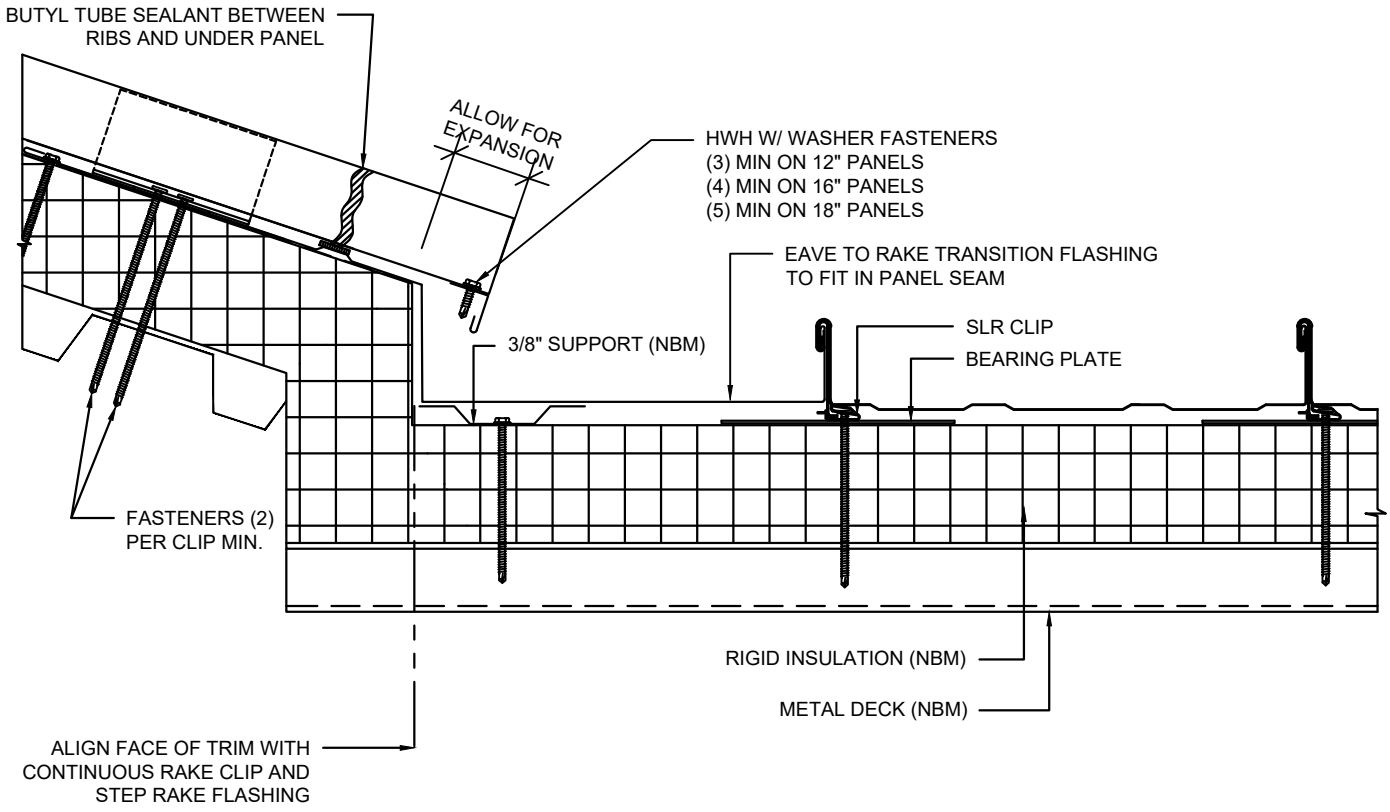
FLOATING RAKE TO WALL DETAIL

*NBM = Not By Morin



*NBM = Not By Morin

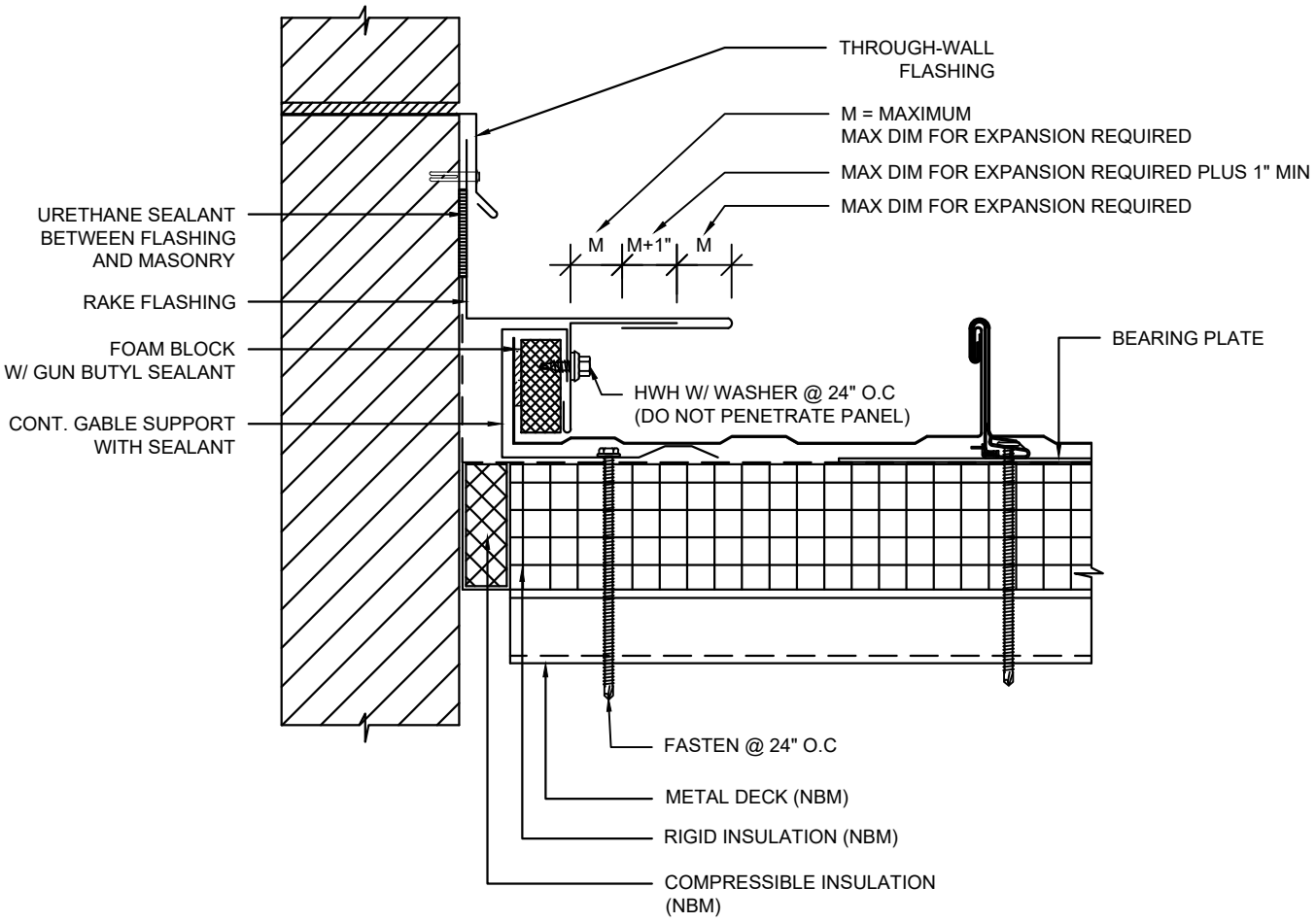
WALL TO RAKE STEP FLASHING



Note:
See Rake to Wall and Eave Details for general notes.

FLOATING RAKE TO EAVE DETAIL

*NBM = Not By Morin



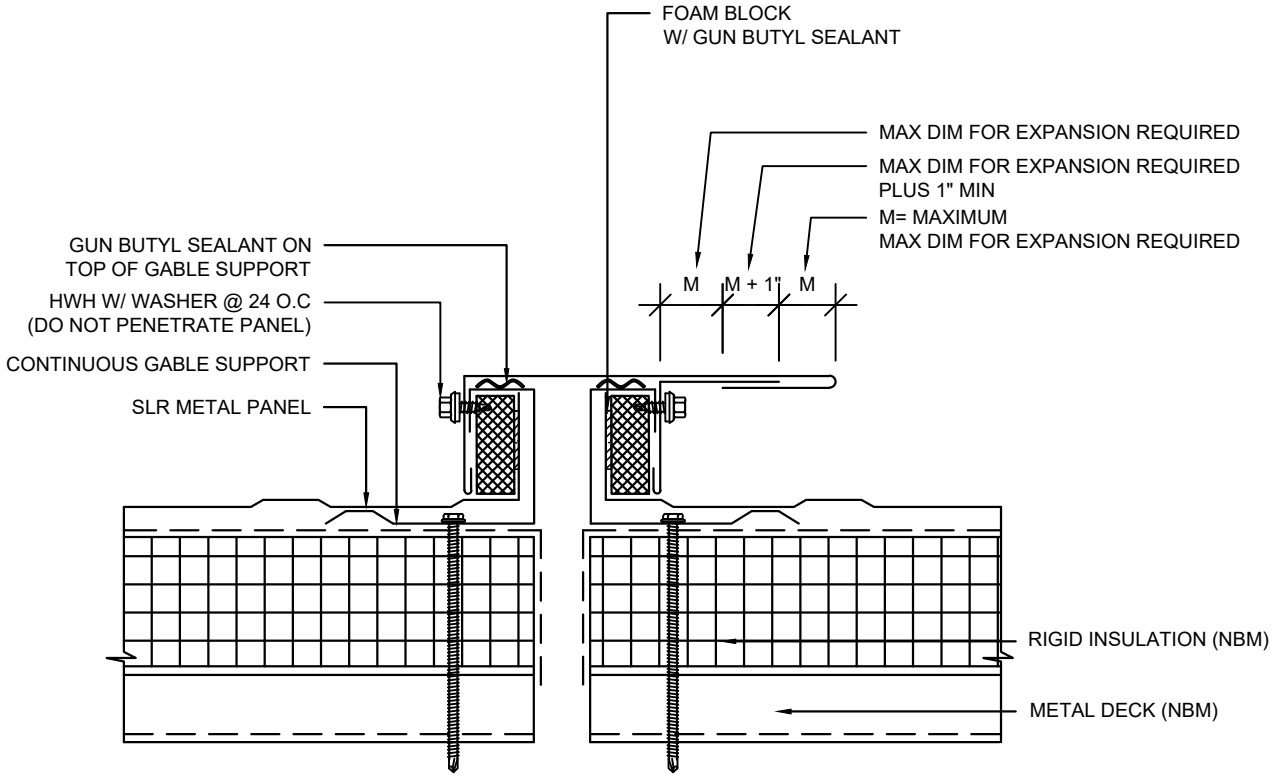
OPTIONS:

1) Field cut starter panel so that rake panels on both ends of roof are of same width requires field bending of cut panel to fit under formed 18 gauge gable support (as shown above).

2) Start roof with full panel, insert roll formed leg under formed 18 gauge gable support.

FLOATING RAKE TO WALL EXPANSION JOINT DETAIL

*NBM = Not By Morin

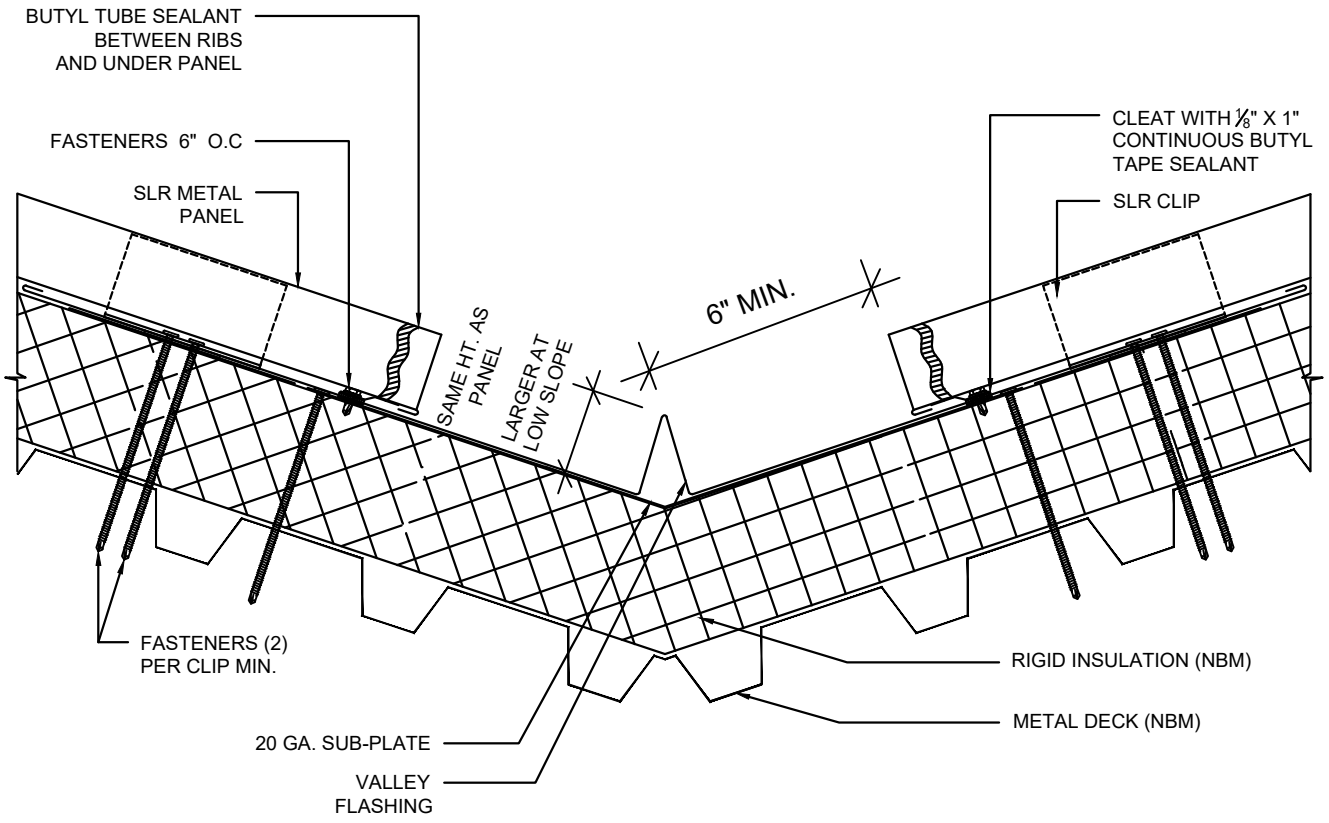


Some building designs require an expansion joint to accommodate movement of the structure. The detail must be designed to allow movement in the anticipated directions. Several proprietary products are available which can be integrated into this basic design.

Options:
1) Field cut starter panel so that rake panels on both ends of roof are of same width. Requires field bending of cut panel to fit under gable support (as shown below).
2) Start roof with full panel, insert female leg under gable support.

PANEL EXPANSION JOINT

*NBM = Not By Morin



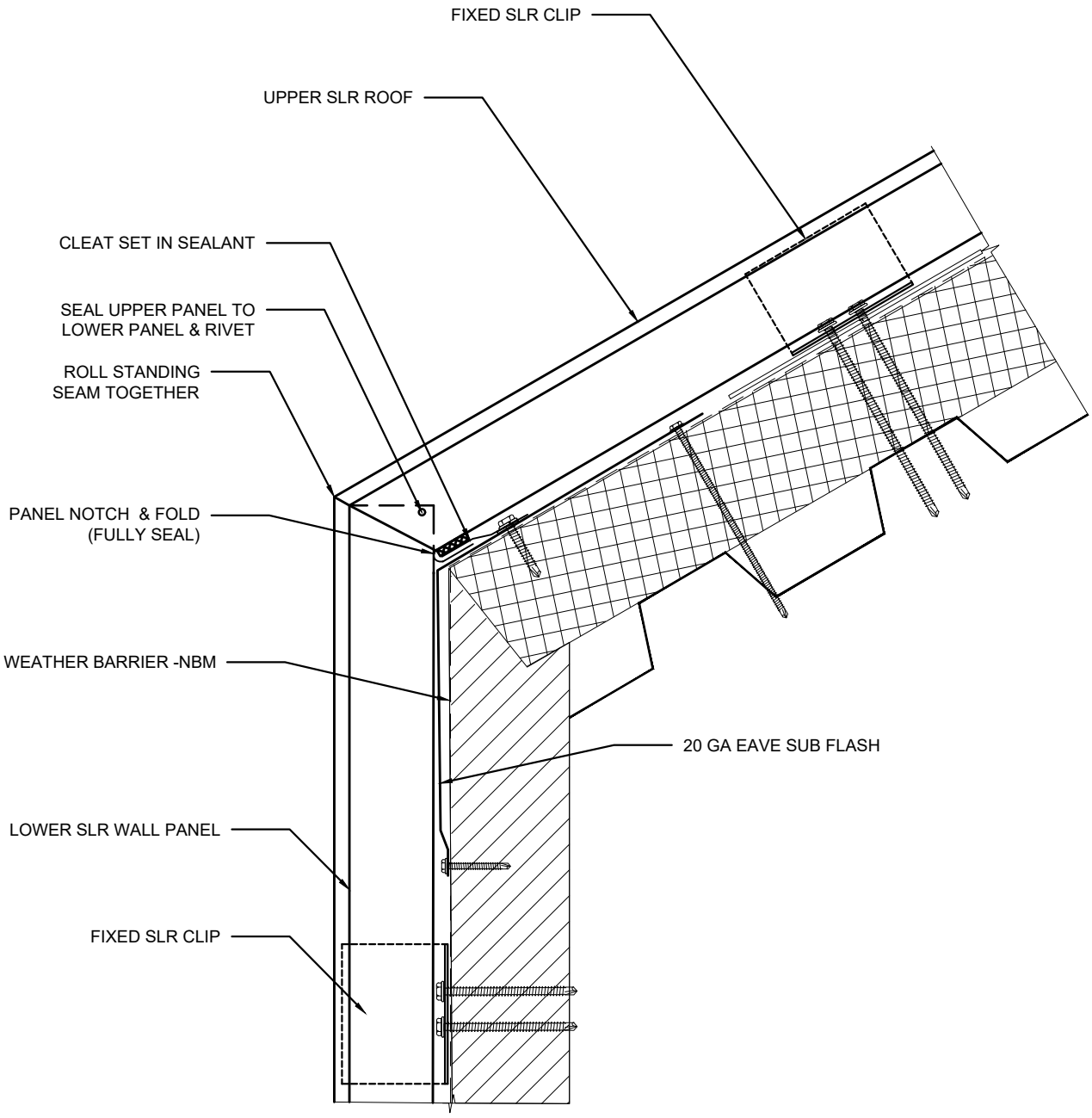
Some building designs require an expansion joint to accommodate movement of the structure. The detail must be designed to allow movement in the anticipated directions. Several proprietary products are available which can be integrated into this basic design.

Valley flashing must allow for sufficient area to carry anticipated runoff without overflow or backup under the roof edge. The raised center assists in diversion of water and allows for thermal movement. Floating valley requires fixed hip/ ridge or mid-point of panel length.

OPTIONS:
1) Field cut starter panel so that rake panels on both ends of roof are of same width requires field bending of cut panel to fit under formed 18 gauge gable support (as shown above).
2) Start roof with full panel, insert roll formed leg under formed 18 gauge gable support.
3) Use larger J- support for panel with clip relief, ribs, and striated.

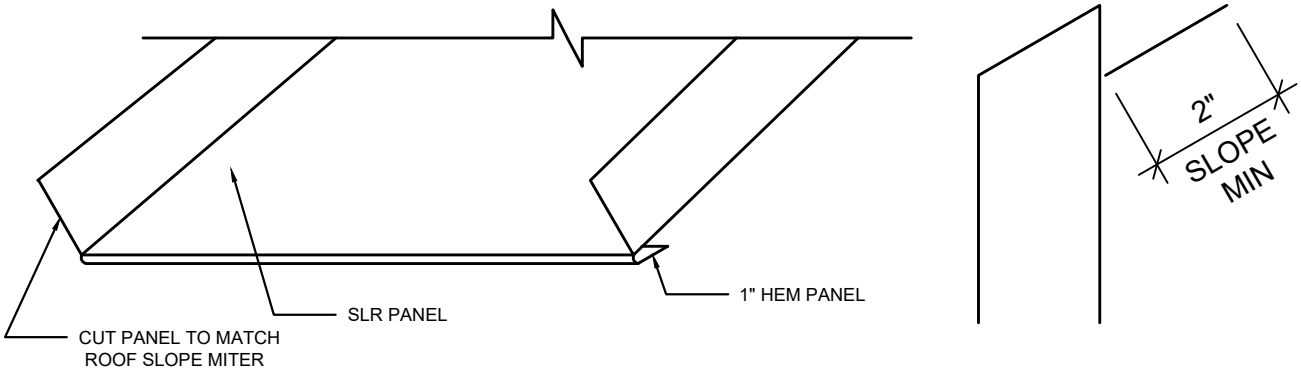
FLOATING VALLEY DETAIL

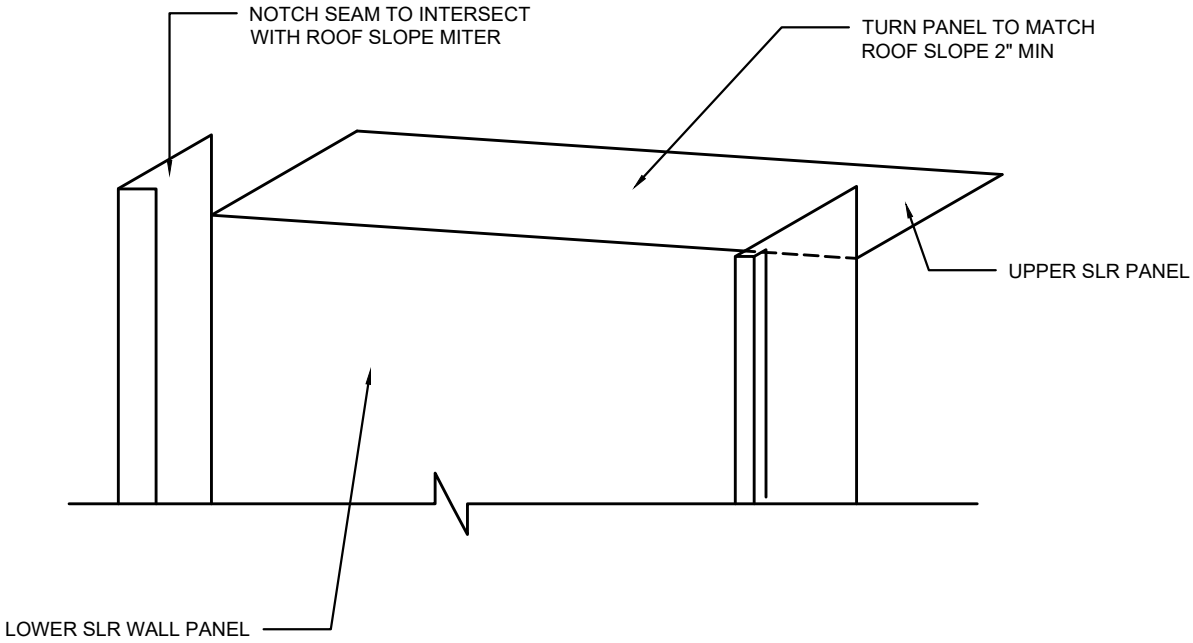
*NBM = Not By Morin



KNUCKLE DETAIL

NOT A WARRANTABLE DETAIL UNDER MORINS WEATHERTIGHTNESS WARRANTY PROGRAM FOR ROOF OR WALL



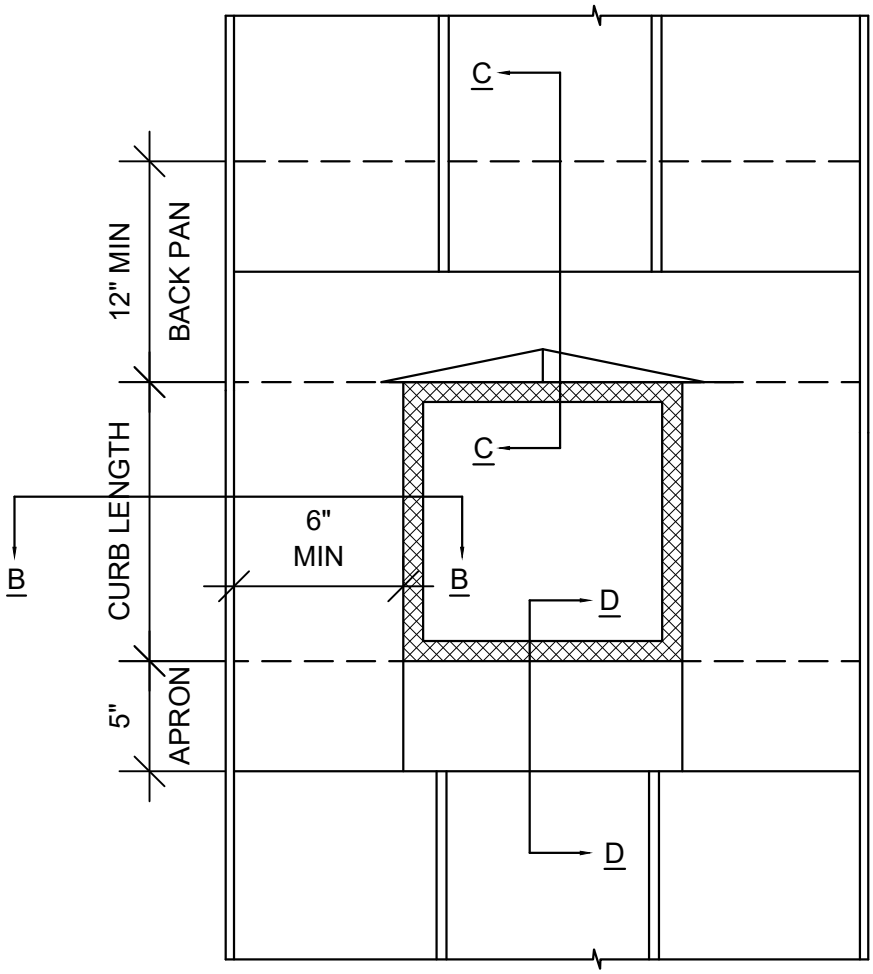


NOTCH LOWER PANEL FOR KNEE
JOINT EAVE

CUT PANELS FOR KNUCKLE

SLR SERIES EAVE WITH KNEE JOINT INSTALLATION SEQUENCE

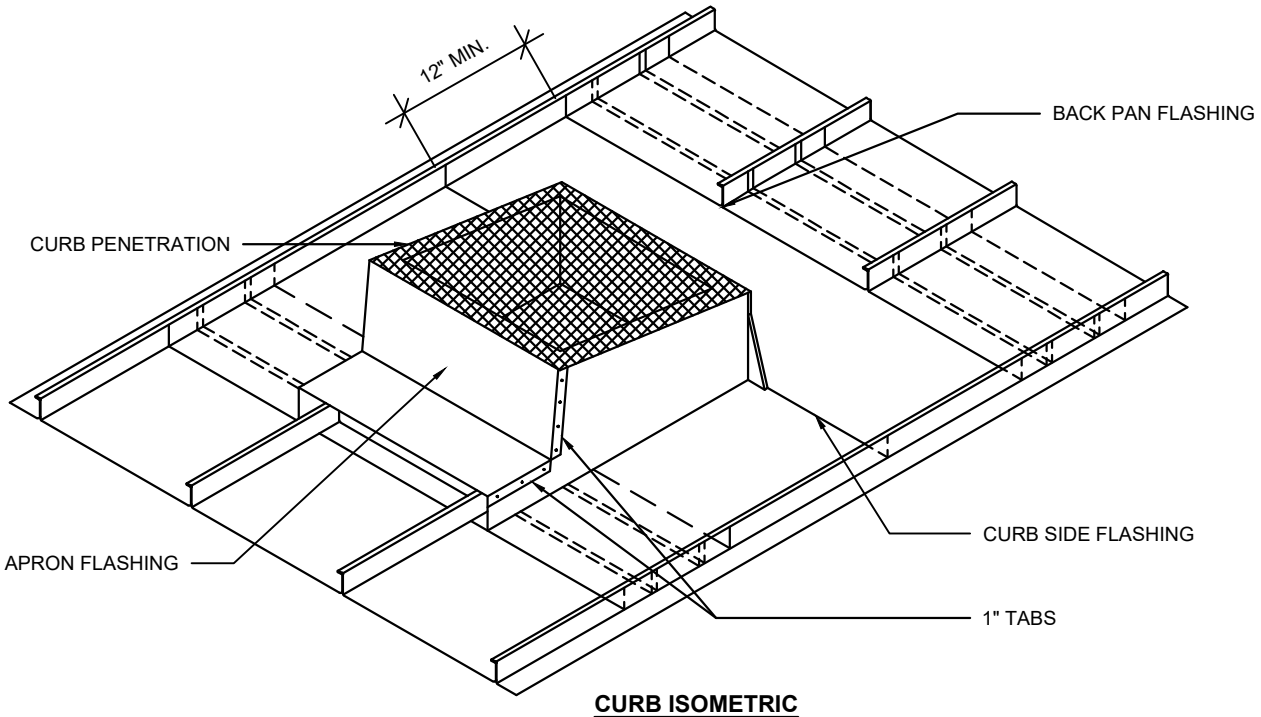
1. INSTALL EAVE SUBFLASH
2. NOTCH LOWER PANEL
3. TURN LOWER PANEL TO MATCH ROOF SLOPE
4. INSTALL LOWER PANEL
5. NOTCH UPPER PANEL
6. HEM UPPER PANEL
7. CHECK UPPER PANEL NOTCH
8. INSTALL CLEAT IN SEALANT
9. INSTALL UPPER PANEL
10. CLAMP PANEL TOGETHER
11. SEAM PANELS
12. REMOVE CLAMPS
13. INSTALL BATTEN CAP
14. RIVET PANELS TOGETHER



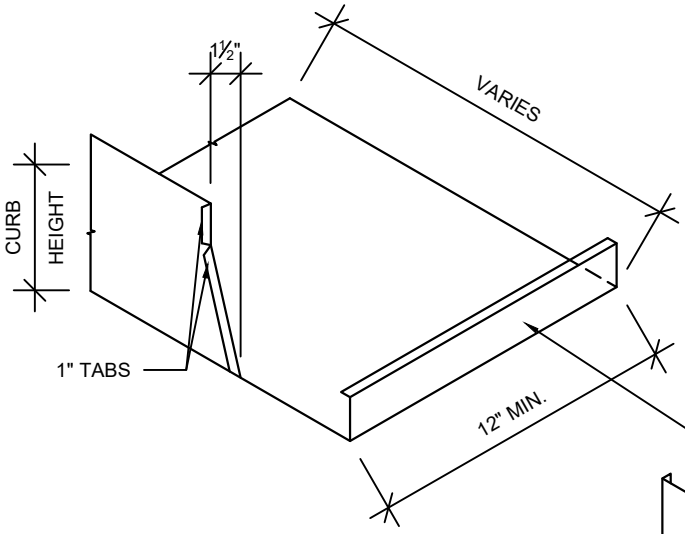
Large openings for equipment or hatchways require a curb with means of diverting the water around the opening. Set and secure roof curb on support framing. At least two parallel curb walls must be on support framing. In high load areas engineer needs to check for proper support. Loads shall not be supported by cantilever sections exceeding 1’0” in length. Cut roof panels to fit snugly around curb walls and to within 1” of the water diverter. Apply a wide band of tape caulk to the top side of curb flanges. Install and seal closures in ends of panels. Plug and caulk all rib ends. Press roof panels into place. Fasten roof panels through curb flanges to support steel using suitable fasteners for the roof system. A spacing of approximately 3” should be used. Inspect installation and fasteners. Apply an exterior sealant to seal seams around all sides of curb to insure a weathertight seal. In all cases the curb assembly is capped by a collar or skirt that extends down over the curb. Curb to be fixed to panel only. Allowance must be made at equipment curb and trim to allow for thermal movement.

EQUIPMENT CURB FLASHING PLAN VIEW

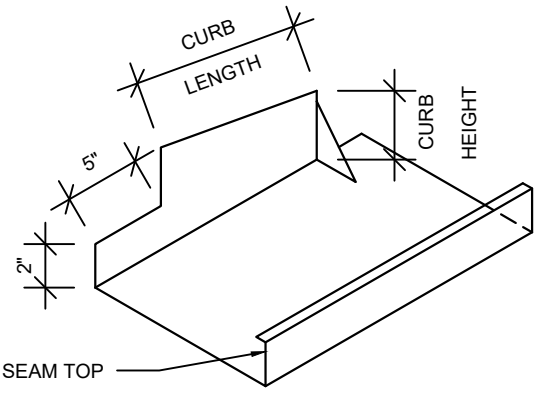
*NBM = Not By Morin



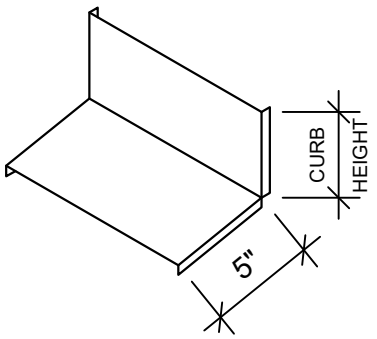
CURB ISOMETRIC



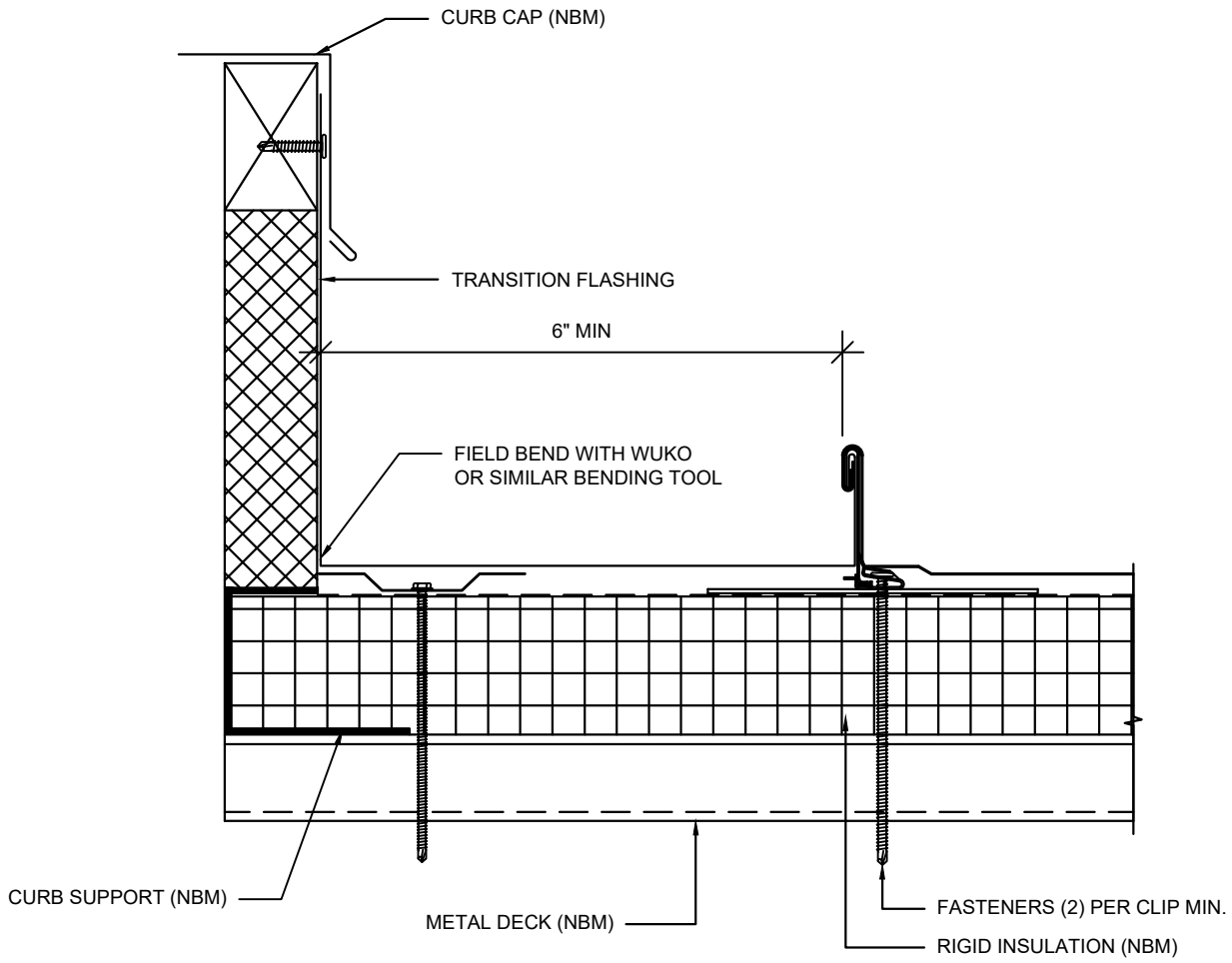
CURB BACK PAN FLASHING



CURB SIDE FLASHING

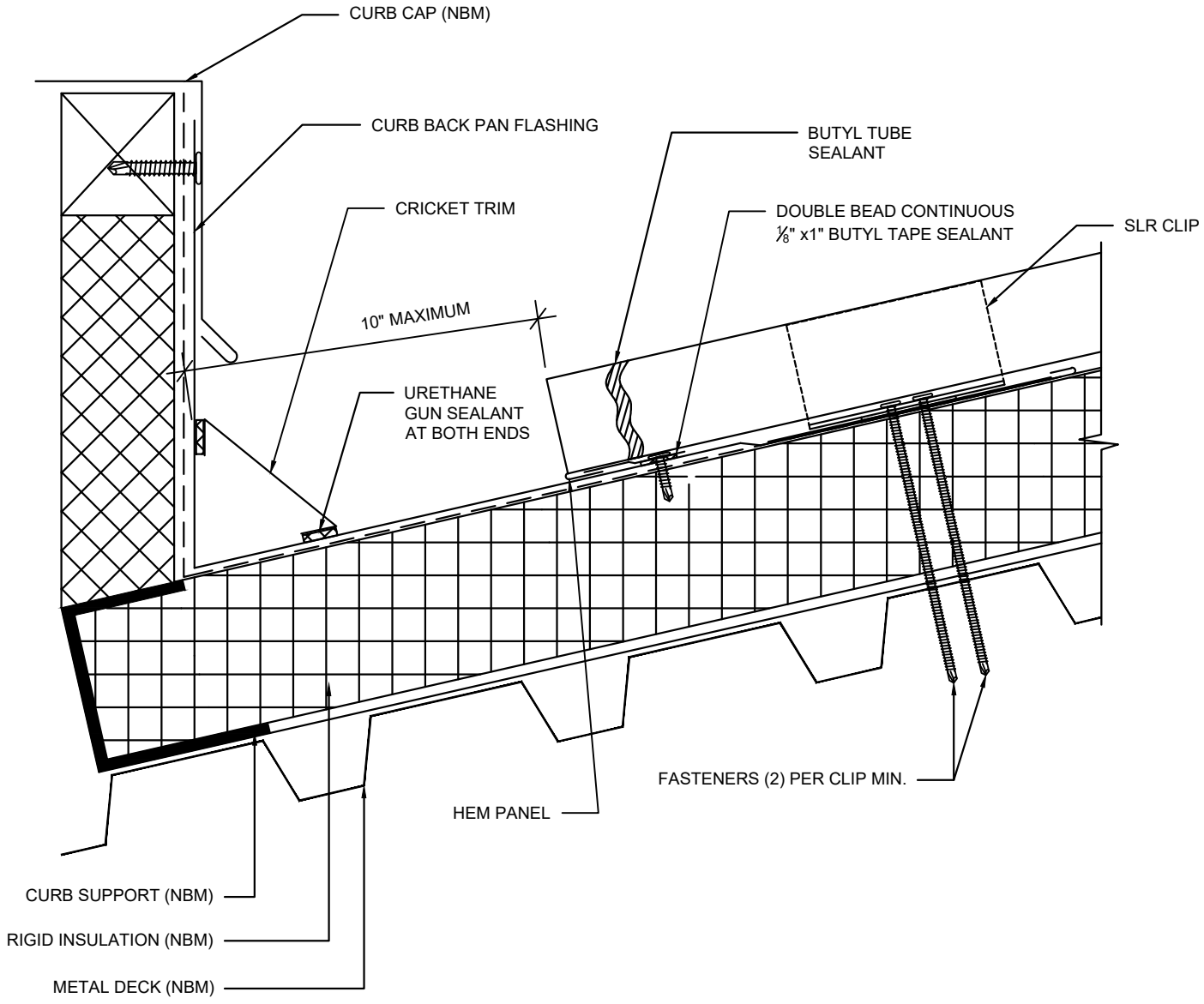


CURB APRON FLASHING



CURB - SECTION A

*NBM = Not By Morin



CURB - SECTION B

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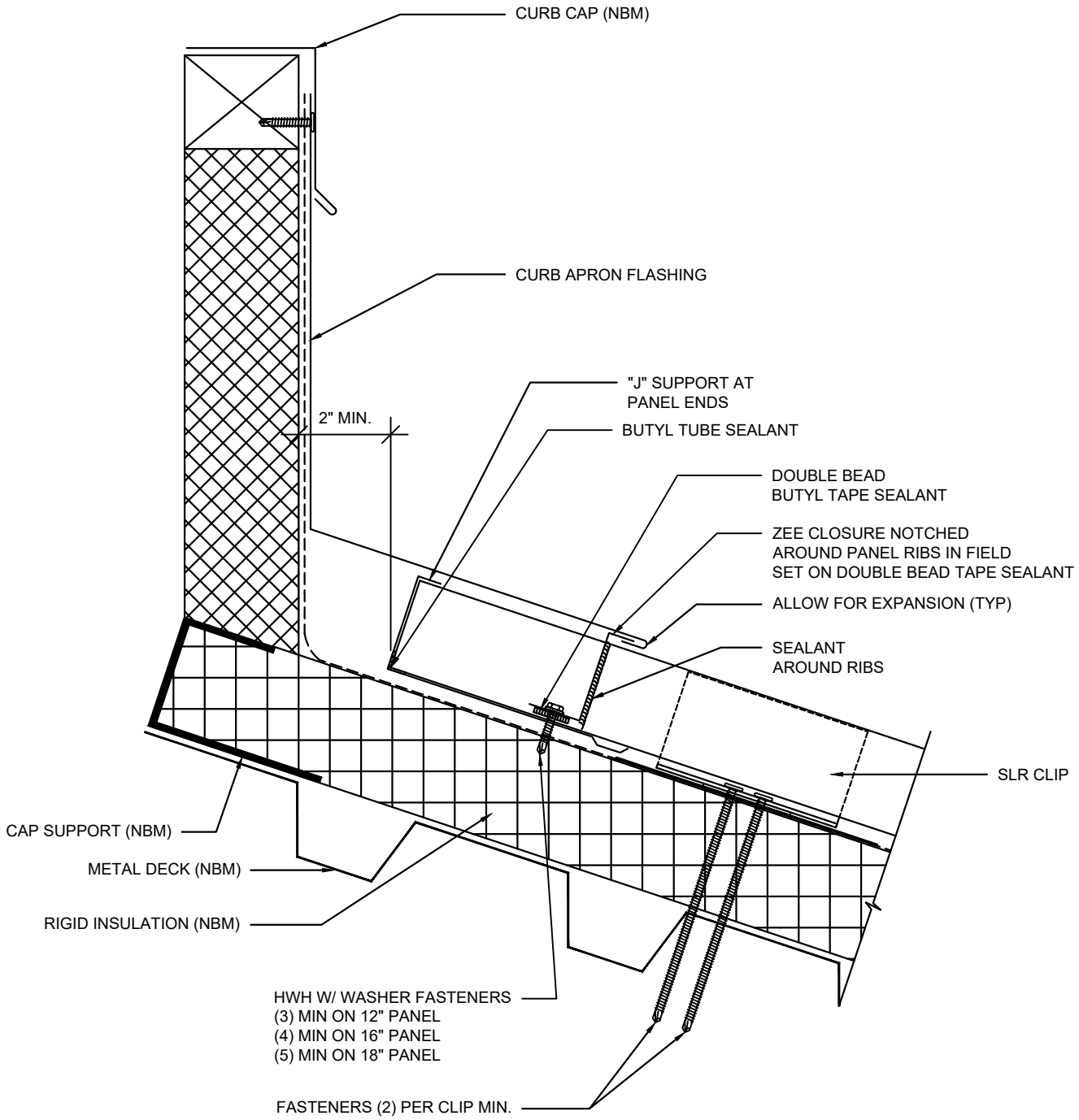
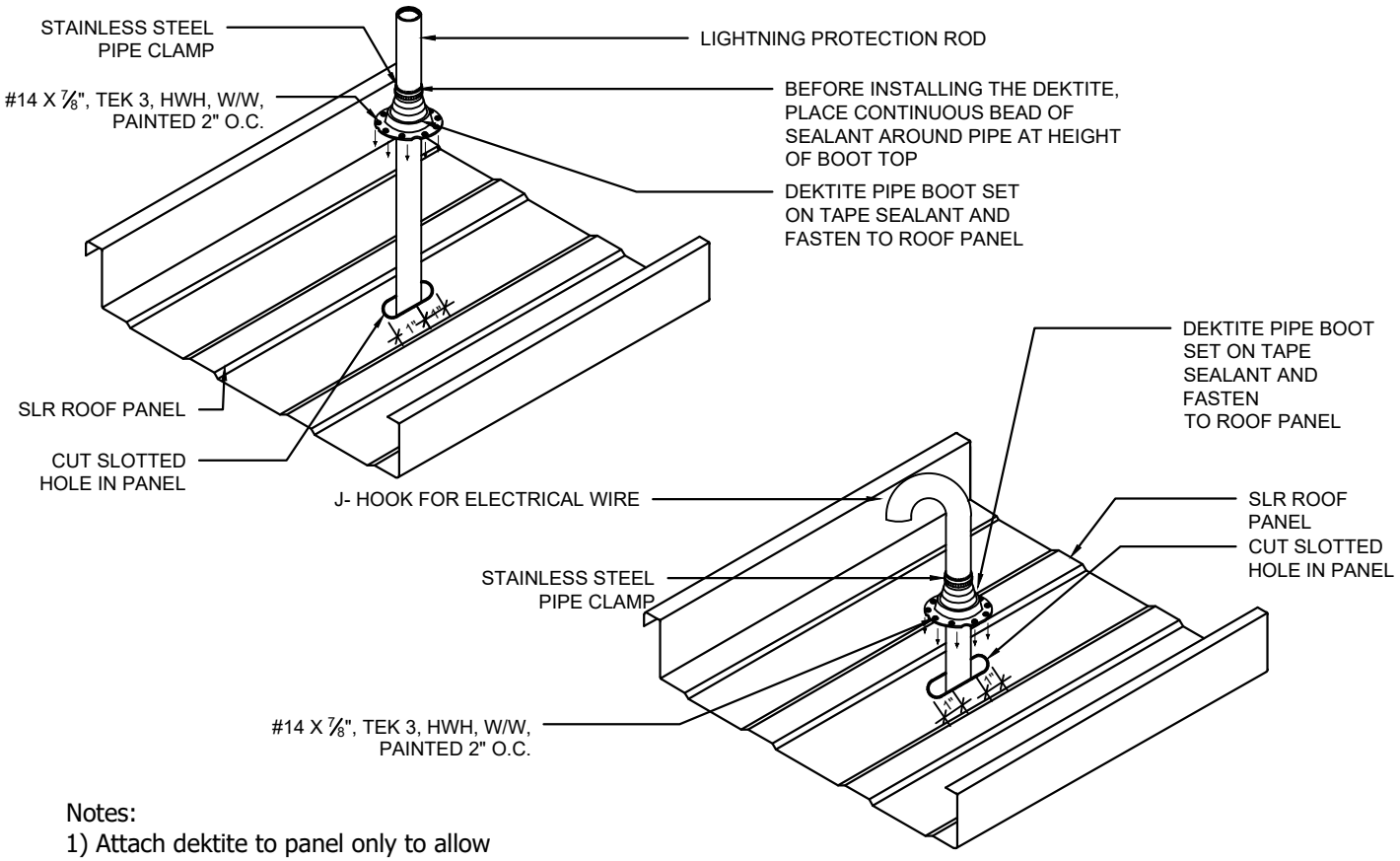
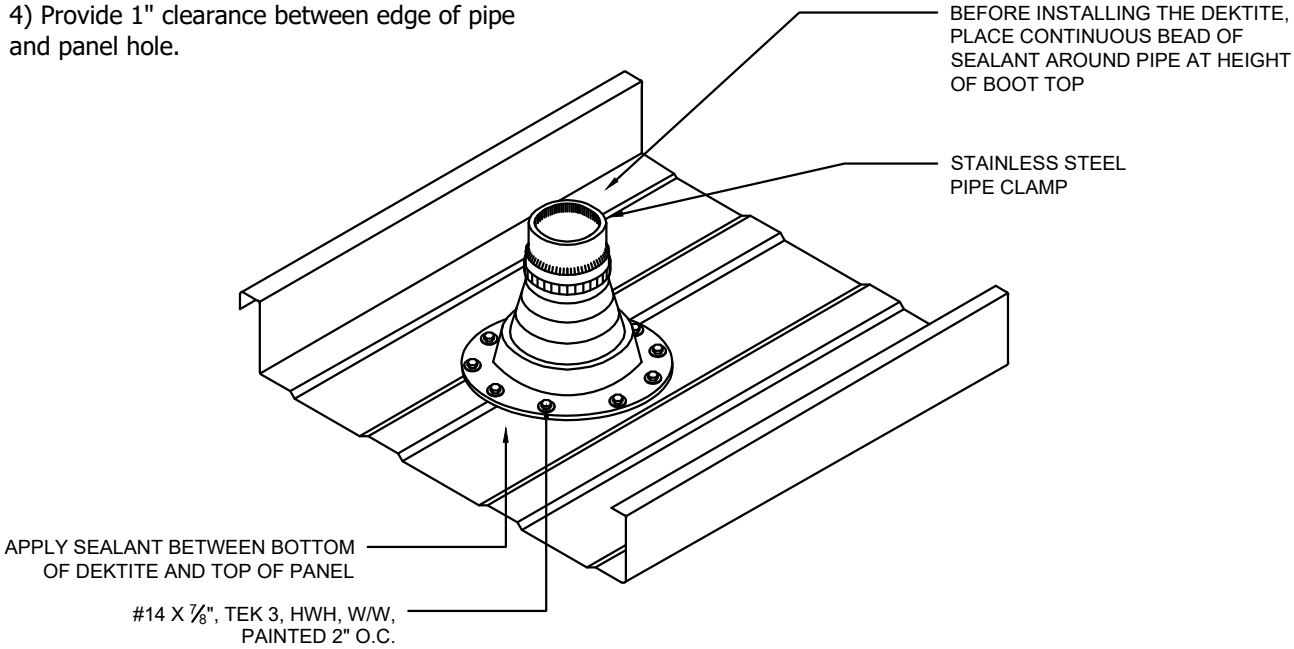


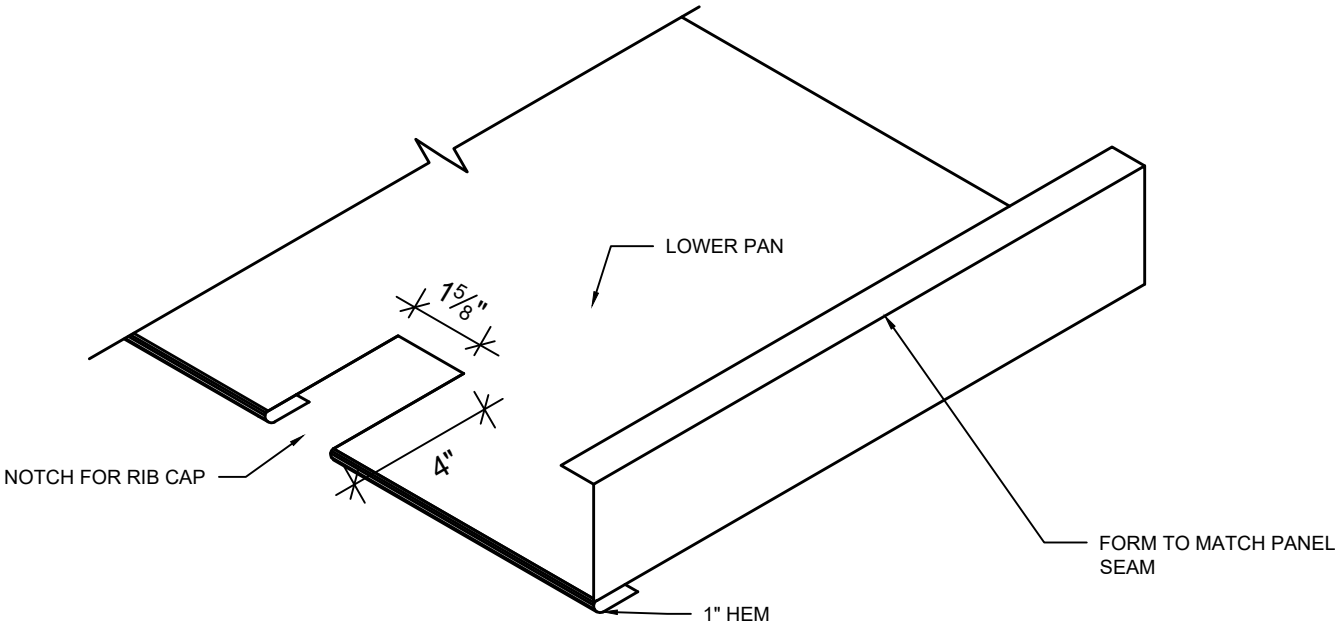
CURB - SECTION C

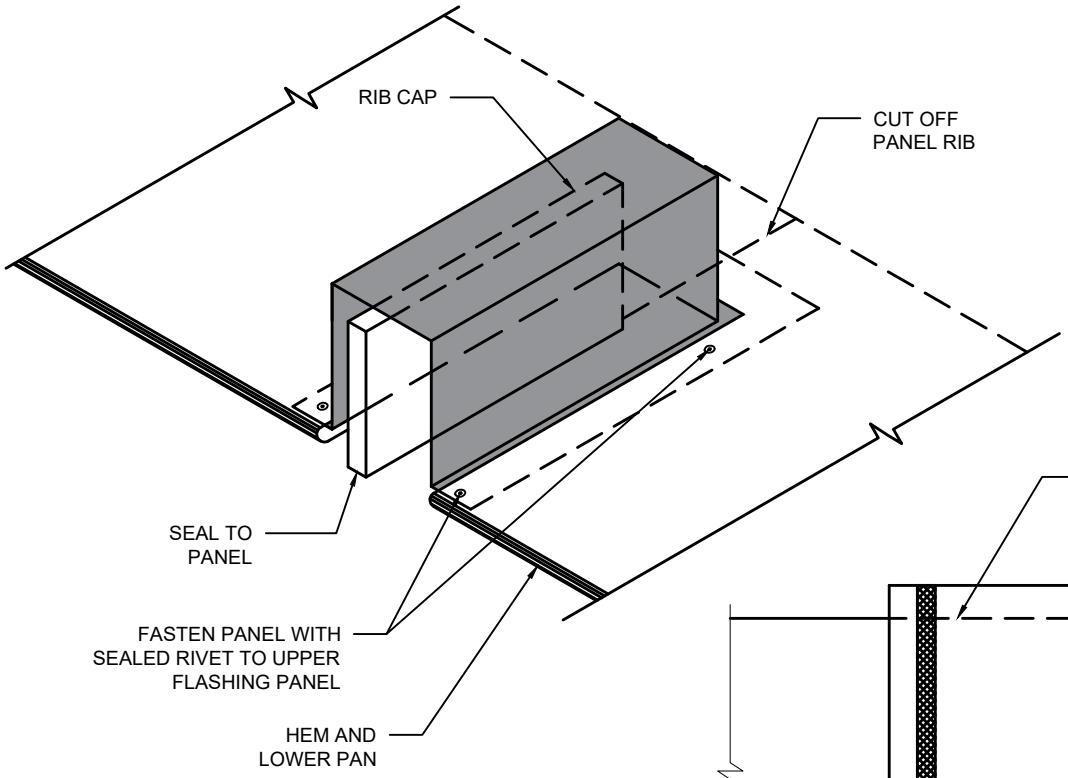
*NBM = Not By Morin

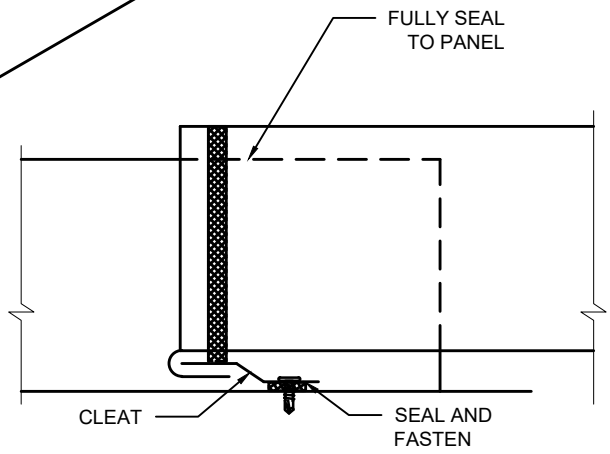


Notes:
1) Attach dektite to panel only to allow thermal movement.
2) Center pipe penetration within panel width if possible.
3) Keep base of dektite away from panel edges (minimum 2").
4) Provide 1" clearance between edge of pipe and panel hole.

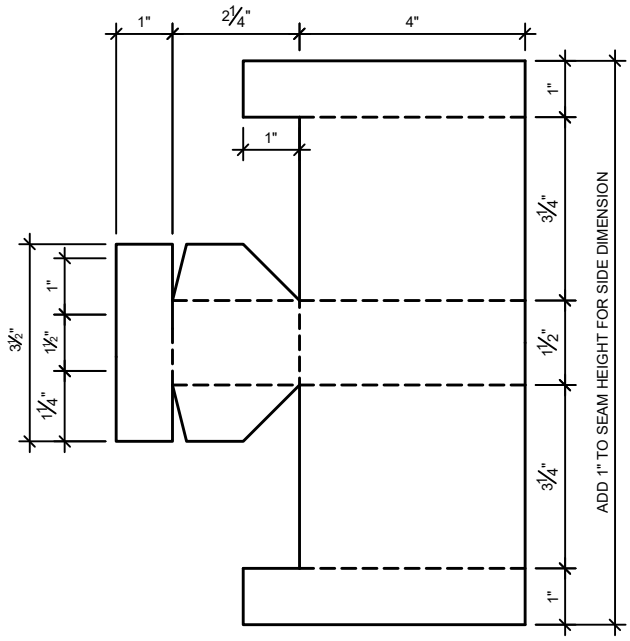


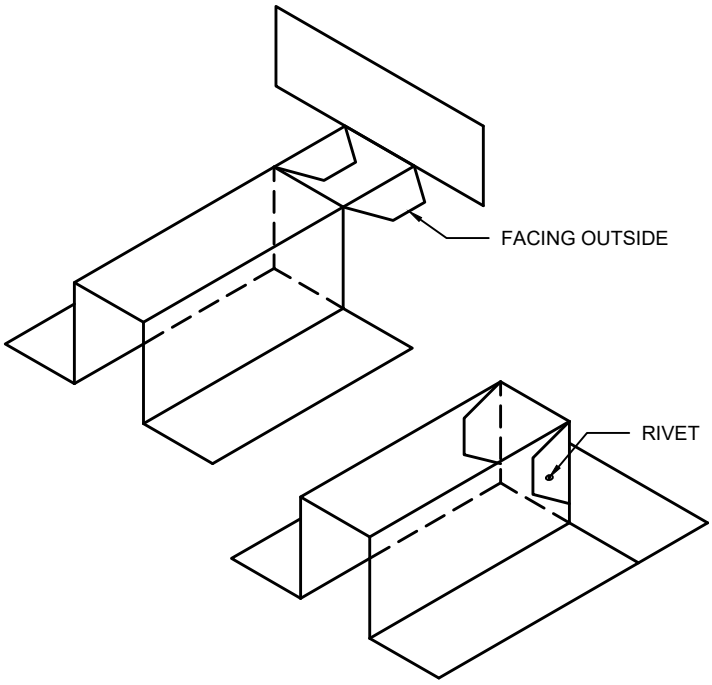


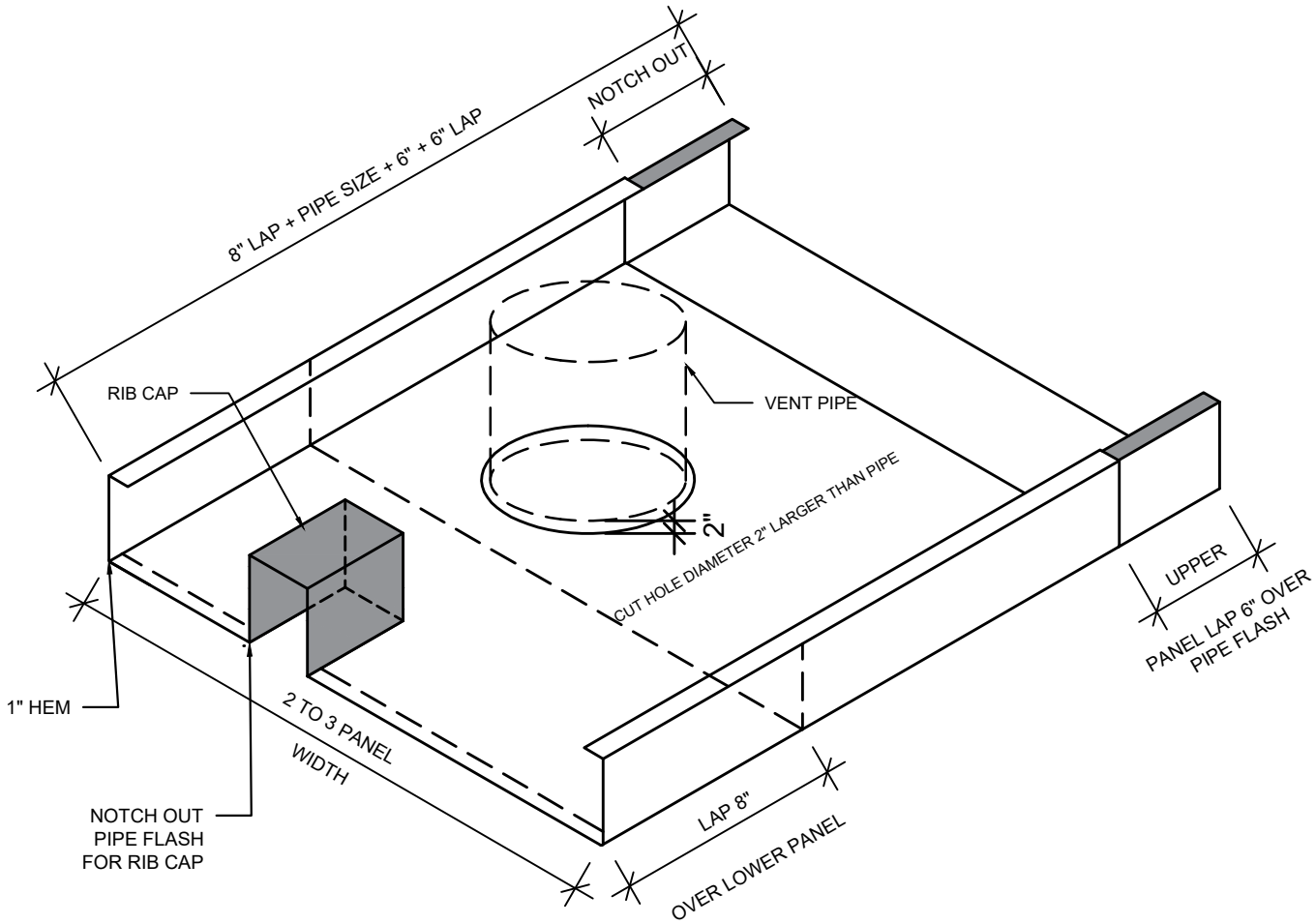




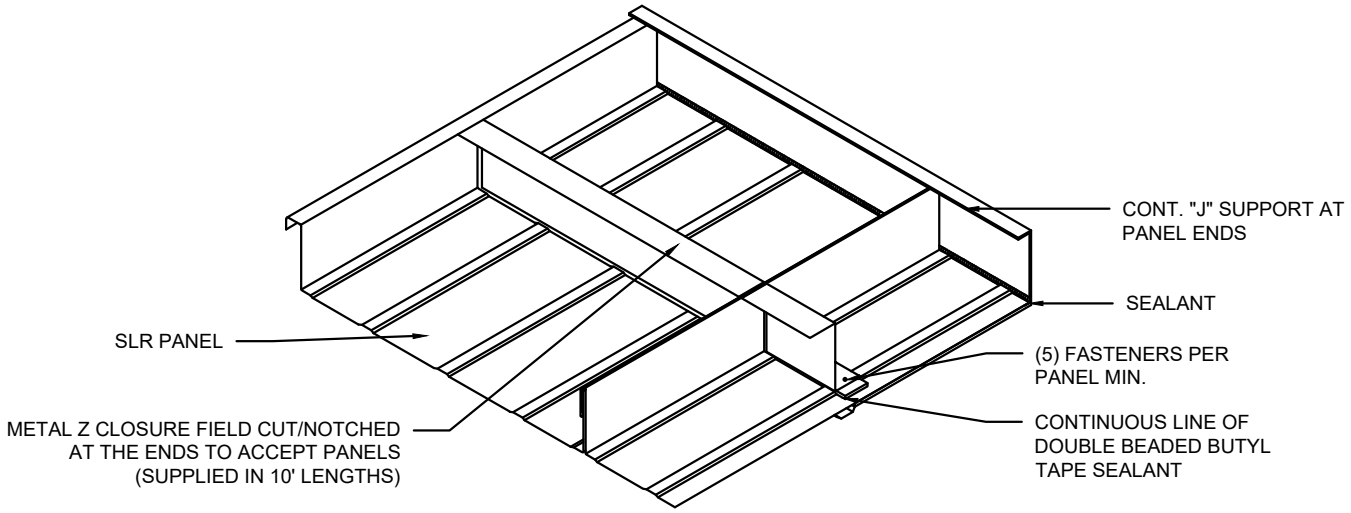
RIB CAP DETAIL


1"
2¼"
4"
1"
1"
3¼"
1½"
3¼"
1"
ADD 1" TO SEAM HEIGHT FOR SIDE DIMENSION
3½"
1"
1½"
1¼"

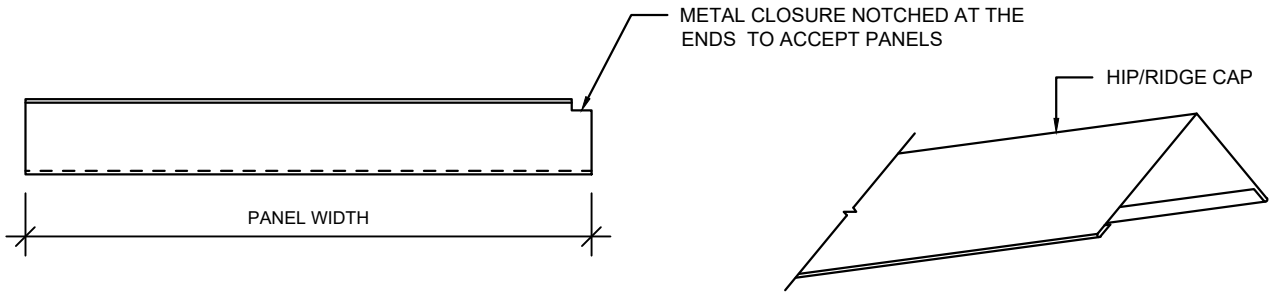

FACING OUTSIDE
RIVET

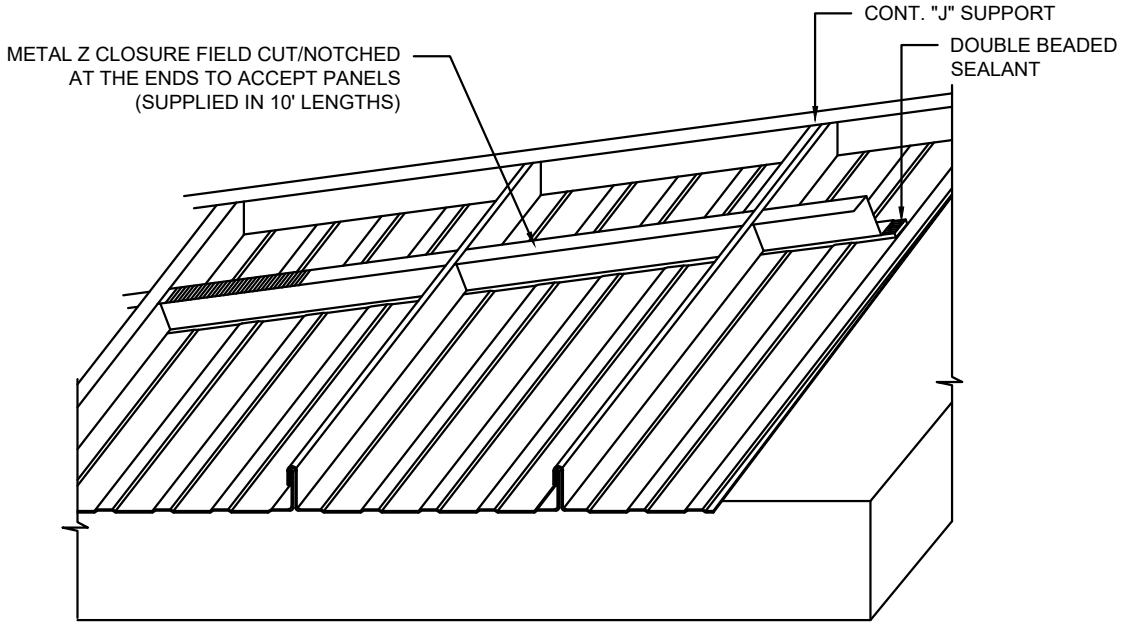

8" LAP + PIPE SIZE + 6" + 6" LAP
NOTCH OUT
RIB CAP
VENT PIPE
2"
CUT HOLE DIAMETER 2" LARGER THAN PIPE
UPPER
PANEL LAP 6" OVER
PIPE FLASH
1" HEM
2 TO 3 PANEL
WIDTH
NOTCH OUT
PIPE FLASH
FOR RIB CAP
LAP 8"
OVER LOWER PANEL

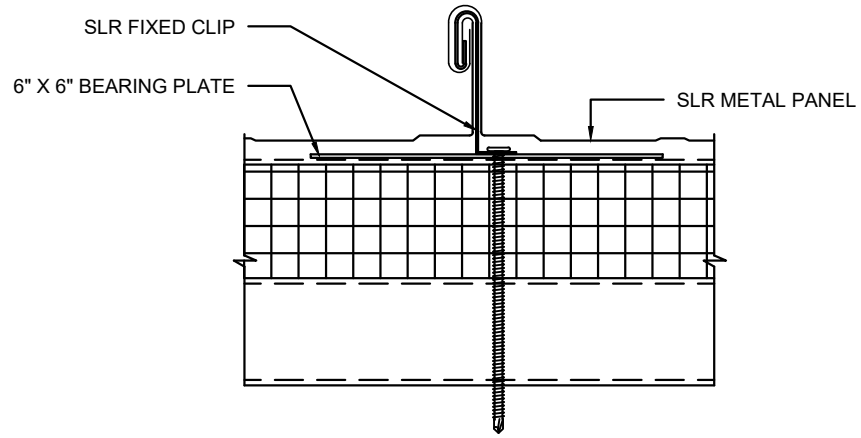
Z PANEL END & CLOSURE DETAIL (RIDGE & HIP)

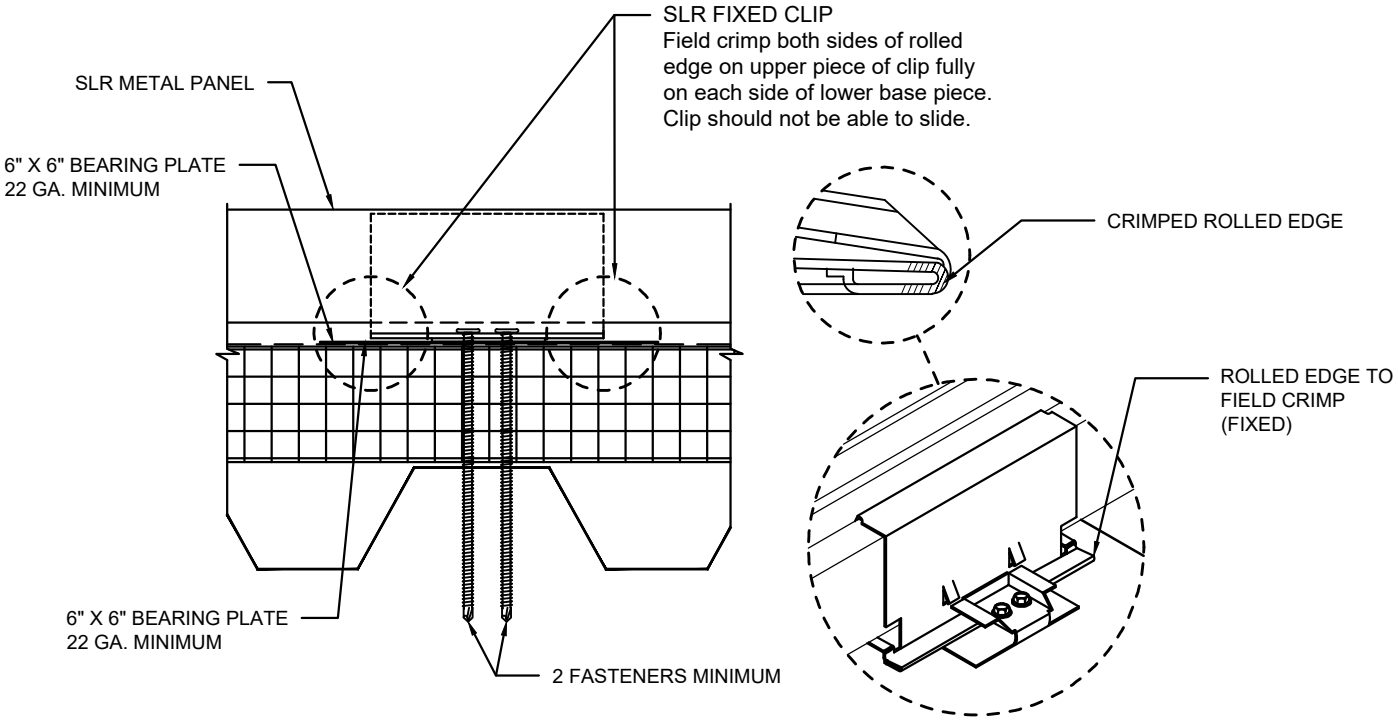


Note:
- Use larger J- support for panel with clip relief, pencil ribs and striated.



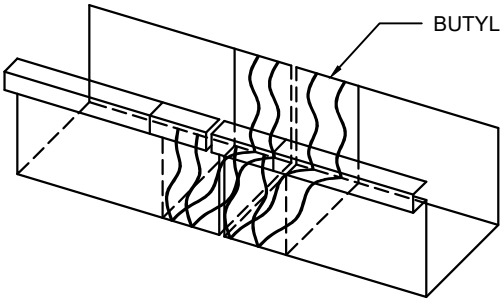


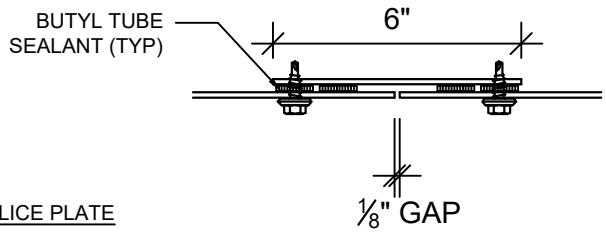




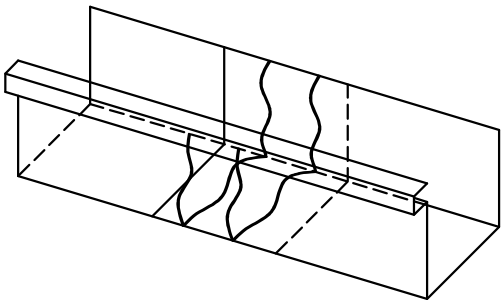
The roofing system as a floating system must have some means by which to attach it to the structure & yet not restrict its floating ability to handle the thermal expansion/ contraction found in the system. Because of the above reasons, Morin's SLR panels must be positively attached at one or more purlins along a line perpendicular to the panel's vertical rib. The ideal location of what the panel industry calls a "fix point line" is at the center of the panel run. By having the fixed point at this location, the amount of travel of the panel over the clip is held to a minimum. Where you have very long panel runs, it may be required to have more then one row of fixed points. When this is necessary, then the rows should be on adjacent rows of purlins. Refer to fixed point details in this manual for methods of installation and recommended locations. Acceptable alternate locations for these fixed point are at either the ridge or eave of the roof. Exceptions to all of the recommended fixed point locations may be needed because of various design restrictions such as large roof penetrations, restraints at the ends of a panel run, an irregular shaped roof surface or at roof hip and valley locations. Panel lengths over 50' require fixed point at mid-run.

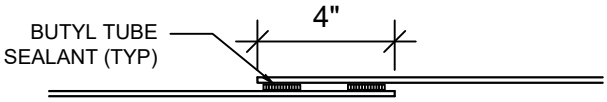
CENTER CLIP-FIXED
(FIELD FIX FLOATING CLIP)



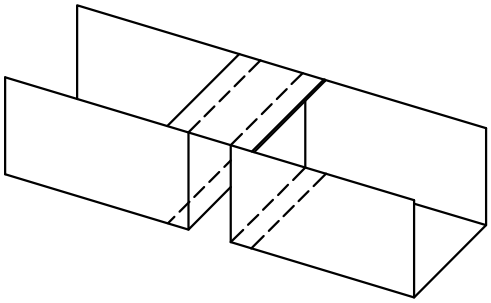


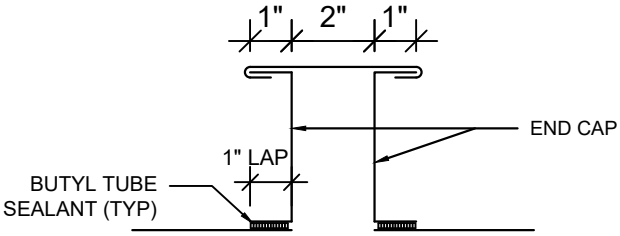
GUTTER SPLICE PLATE



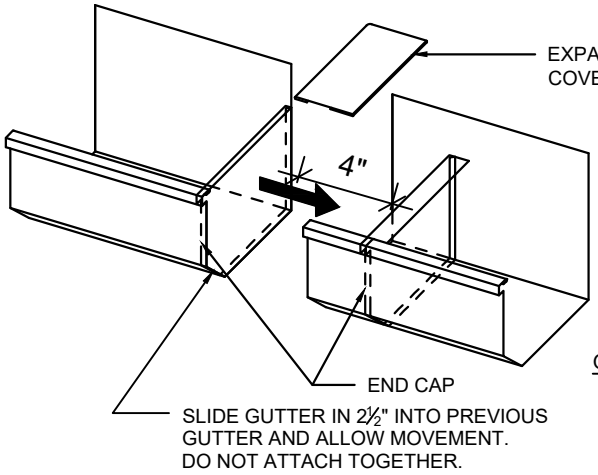


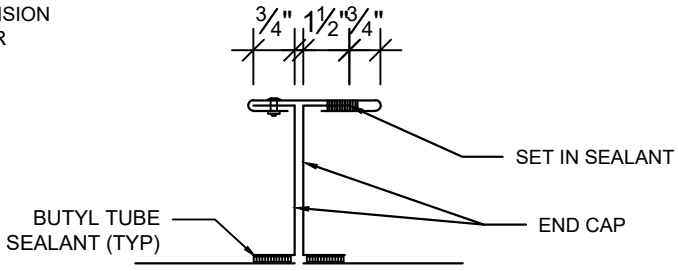
GUTTER LAP DETAIL





GUTTER EXPANSION DETAIL

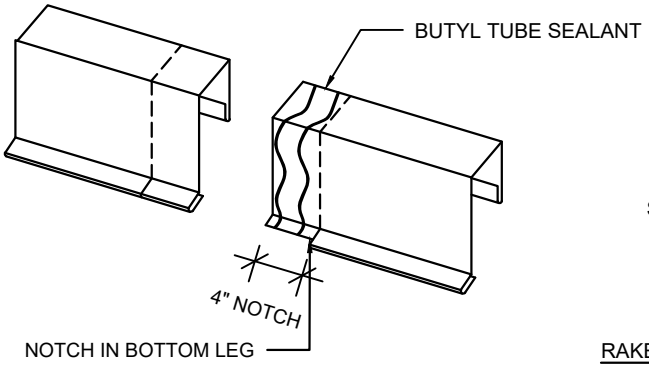


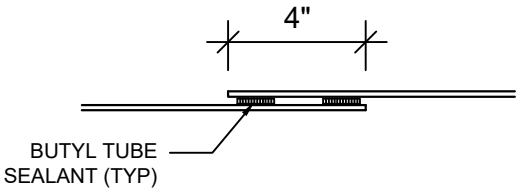


GUTTER EXPANSION DETAIL

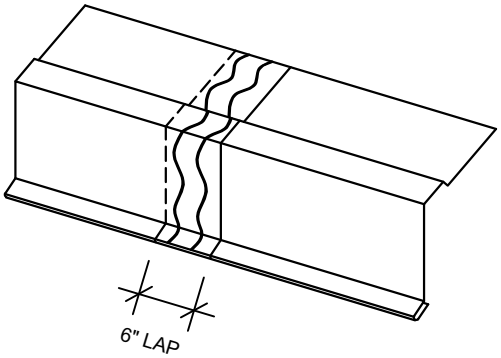
Note: Use expansion joint every 25'

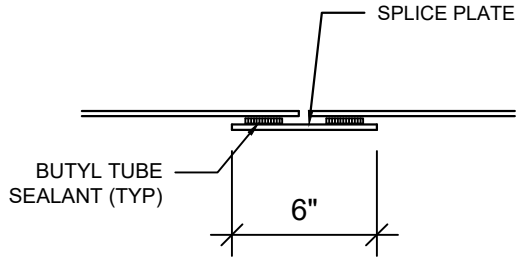
GUTTER FLASHING CONDITIONS



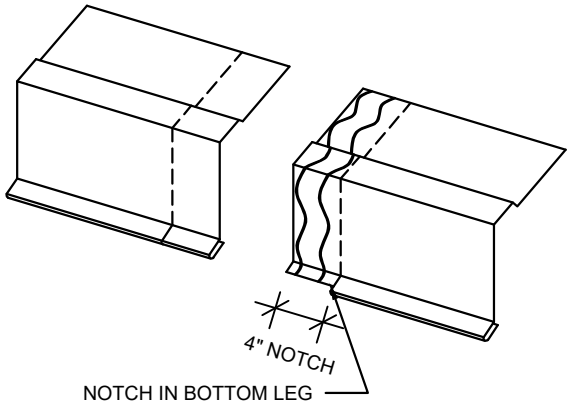


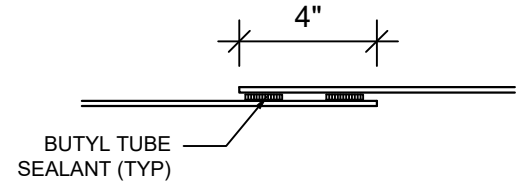
RAKE LAP DETAIL





EAVE INSIDE SPLICE PLATE

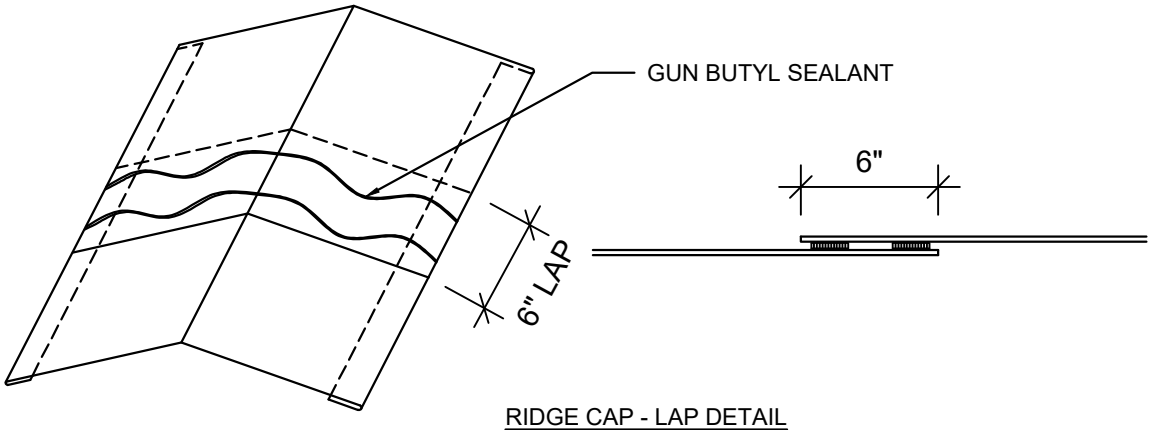




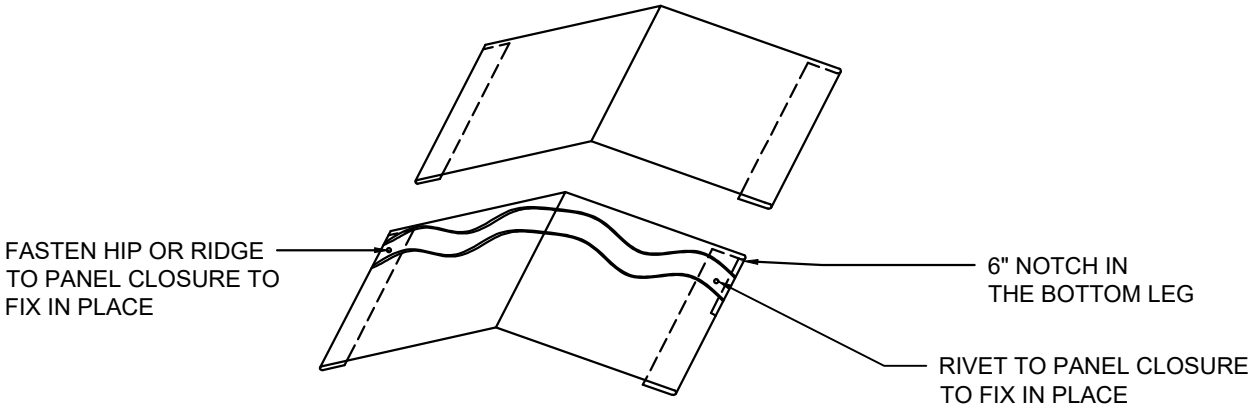
EAVE LAP DETAIL

Note: Shingle laps in direction of water flow.

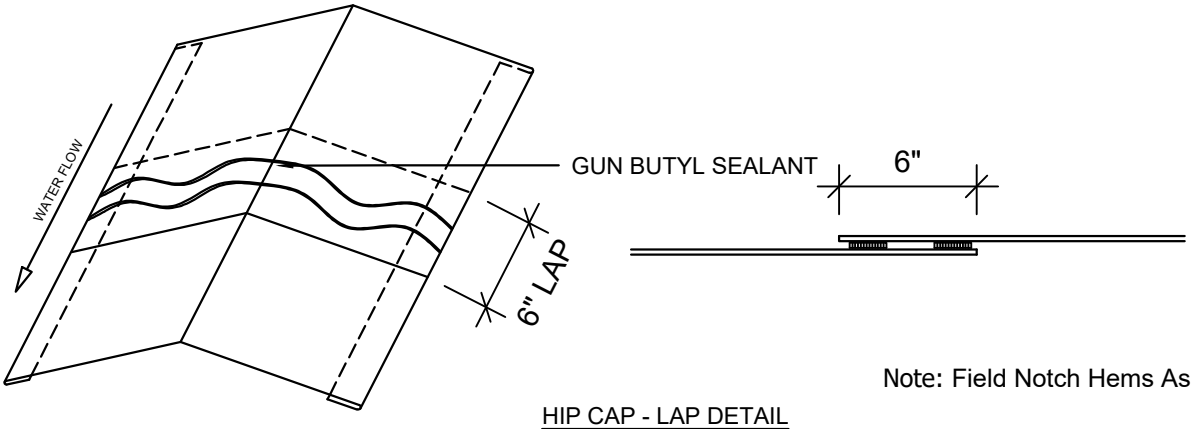
RAKE AND EAVE FLASHING CONDITION



RIDGE CAP - LAP DETAIL



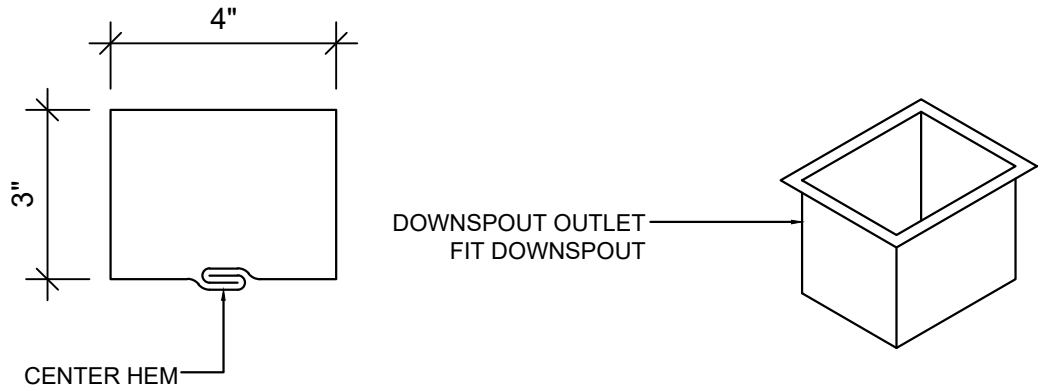
TYP. LAP DETAIL

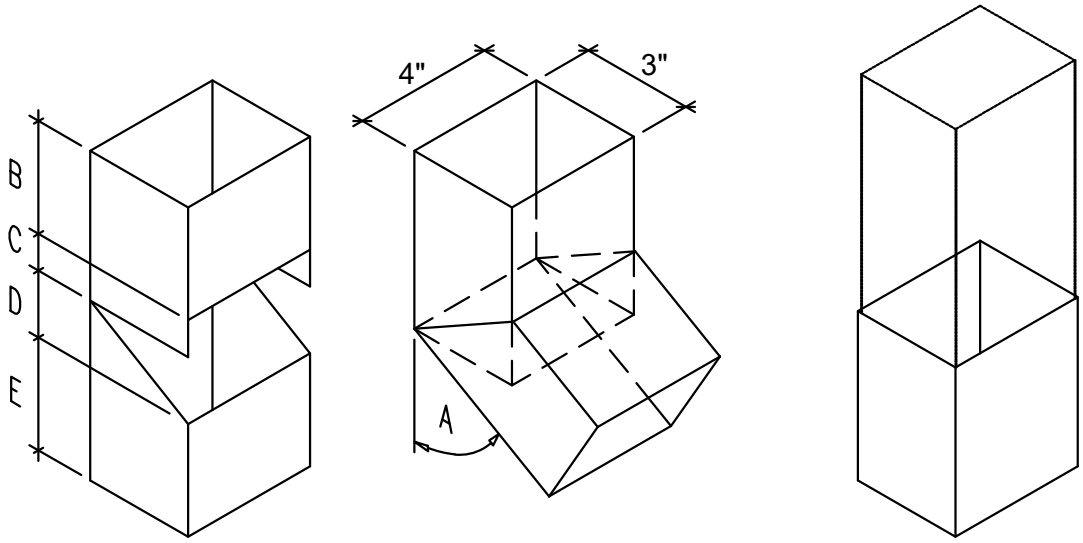


Note: Field Notch Hems As Required.

HIP CAP - LAP DETAIL

RIDGE AND HIP FLASHING CONDITION

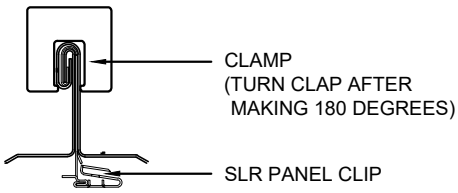


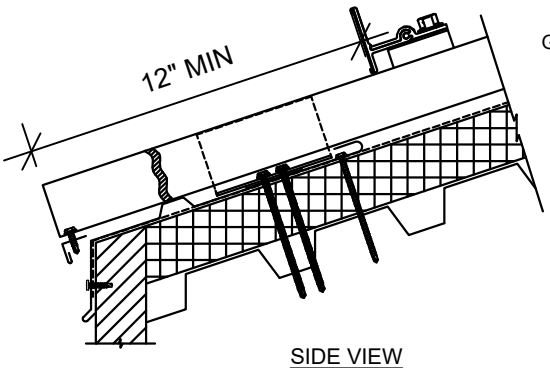


TYPICAL 4" X 3" ELBOW DIMENSIONS WITH 6" RETURN

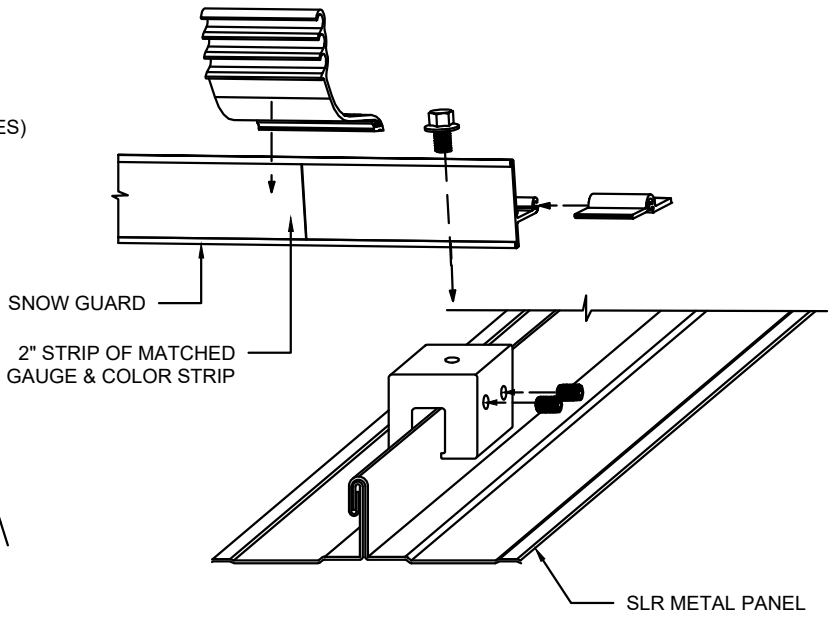
A	B	C	D	E	
90.00°	3.2500	2.7500	3.0625	2.9375	= 12.0000
60.00°	4.5625	1.4375	1.8125	4.1875	= 12.0000
45.00°	5.1250	0.875	1.3125	4.6875	= 12.0000
30.00°	5.6875	0.3125	0.9375	5.0625	= 12.0000

DOWNSPOUT

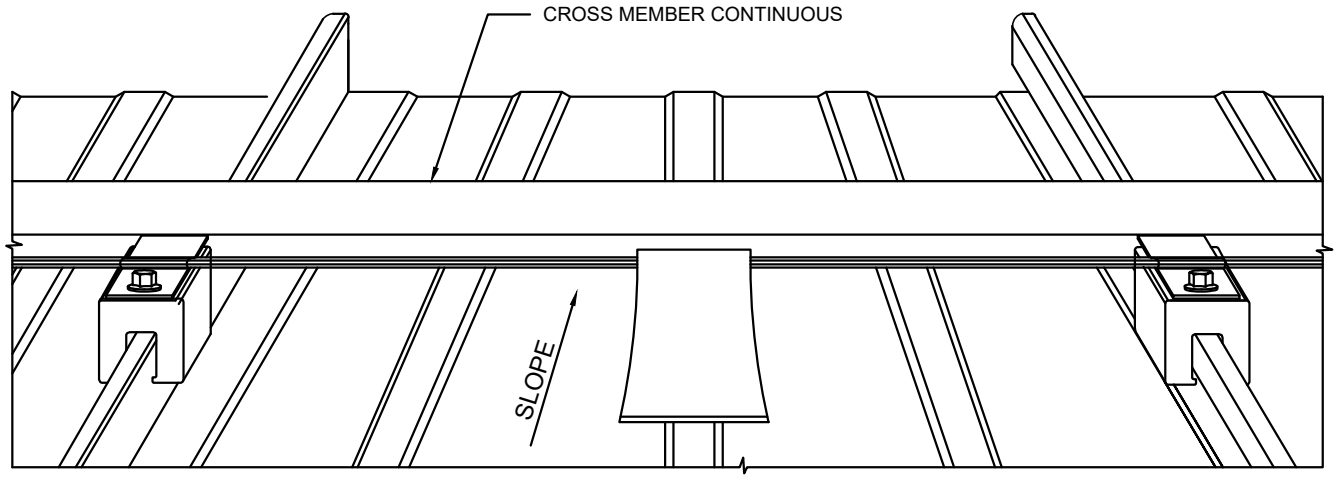




SIDE VIEW



ASSEMBLY



Note:
1) Mount rib clamp directly to top of panel rib with set screw.
2) Install 2" color strip from panel flatstock into snow guard.
3) Connect clip to snow guard, one per panel, centered.
4) Contact Snow Guard supplier for assembly.

SNOW GUARD

SNOW MOVEMENT

Movement of snow on a metal roof is a fact of life. It is channeled down the roof by both the roof slope and the panel ribs. A perfect roof would have no valleys, penetrations or anything else that might try to impede this snow movement. But the foregoing is generally not the case in the real world. Therefore we have a problem and we must find a way to solve it. There is very little technical data available that tells us what forces are presented by this snow movement. Therefore, designers should use some form of guidelines when designing their projects. Local and national building codes are a resource designers may utilize in determining snow loads and snow movement forces that will be found on the roof of their structures.

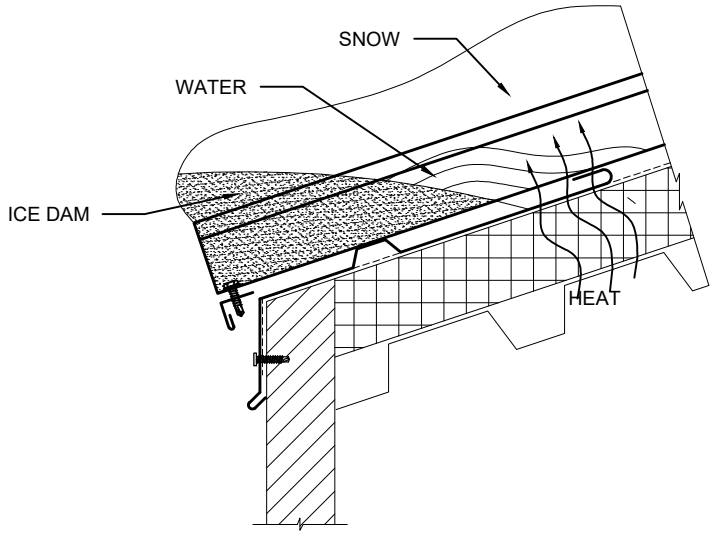
At present, there are numerous snow guard designs in the marketplace, which may be the best solution to the snow movement problem. Areas that you might consider the use of snow guards are exterior door openings and gutters. With the use of these snow guards, expansion and contraction of the roof system must be allowed for. Snow guards usually are connected to the roof system in such a way that the actual weight of the snow is held by the thermally fixed point of the roof panel.

It is an absolute requirement that the lateral strength of any fastener into the structure be adequate to support these loads.

Where there are penetrations in a roof, subjected to very heavy snow slides, these items should be designed to be as narrow as possible and attached to the structure in such a way as to resist the sliding snow loads. It is also recommended that reinforced metal crickets be used on the up-hill side of these penetrations. These crickets will deflect the sliding snow around the penetrations. For this reason there should be adequate space around the penetrations for the snow to move, in both aside and downward direction while it is sliding past the penetration.

Another item that an architect must be concerned with is the effect of snow falling from a high roof onto a low roof, which will result in very high impact loads on the lower roof, that it may cause damage.

In some cases snow will flow in a manner similar to that of water. It can go around corners and fill walkways in such a way as to make the exterior doors unusable. It is also known that heat escaping through the roof can turn normal snow into a block of ice, forming pieces large enough to break through roof material and cause personal injury when it falls from the roof.

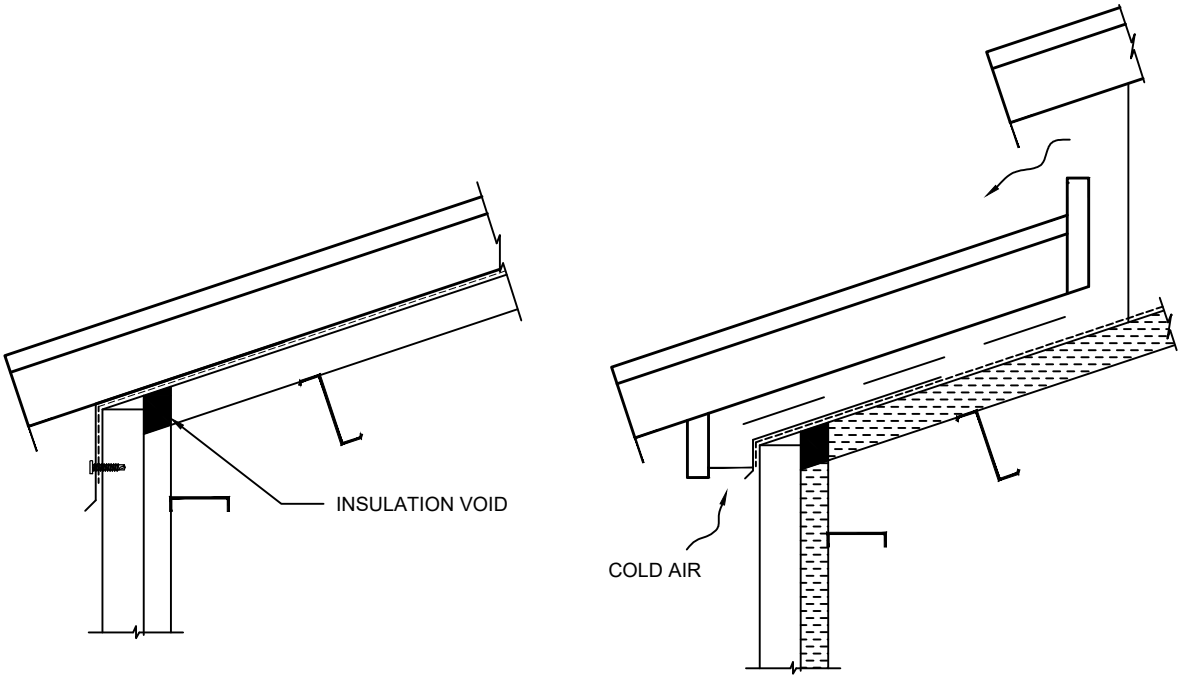


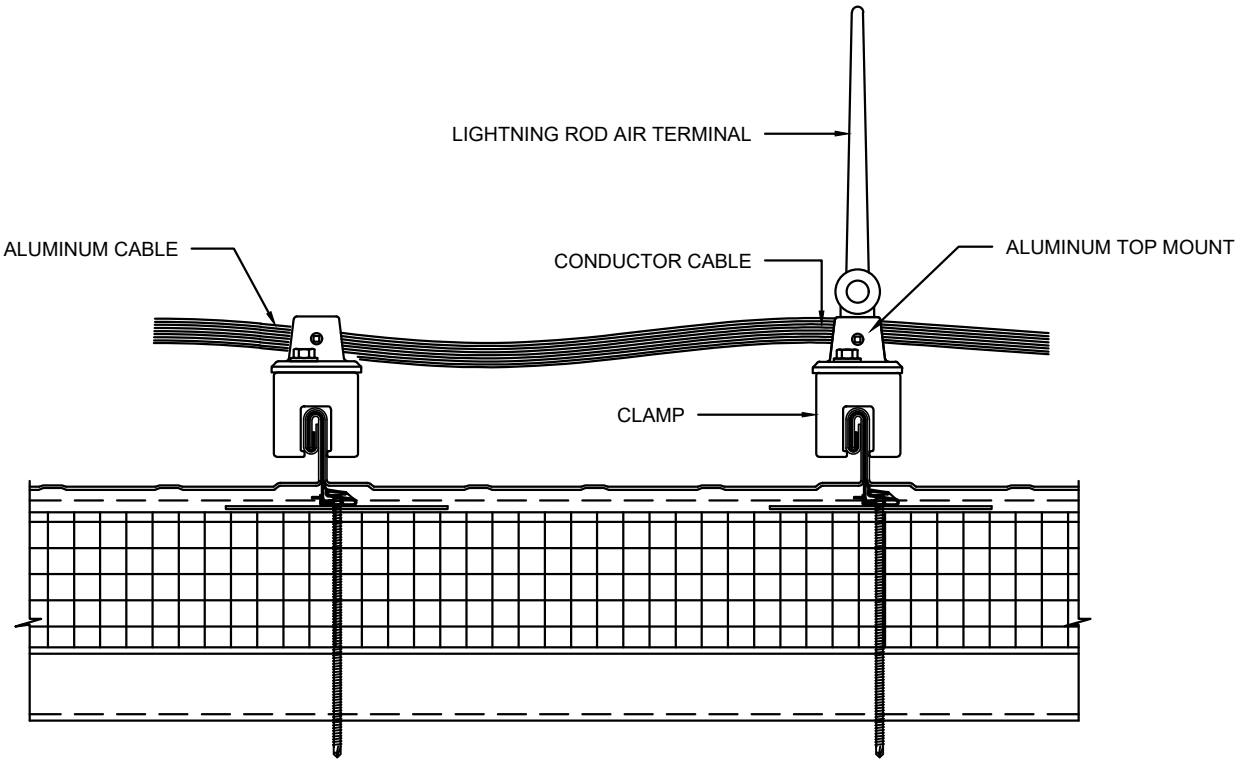
ICE DAMS

In northern climates, ice dams are a major concern for designers and owners when using metal roofs. These dams are formed by snow melting during the day and then refreezing at night. These dams can take place anywhere on the roof, from a cold overhang or at various other locations on a heated or partially heated roof. The best way to eliminate ice dams is to totally heat the roof all the way from the ridge to the eave. Allow water from melted snow to fall free of the structure before it refreezes, or icicles will form along the eave of the structure. Using a design that circulates cold air through the plenum formed by the SLR roof panel and a solid substrate can reduce loss of heat through the roof. This design is called “cold roof design”. Vents in various locations on the roof should be used to vent the building heat to the outside. At some point in time these vents will become blocked with deep piles of snow. Therefore, this design will be questionable because daytime temperature is higher than a freezing temperature and then at night the reverse takes place.

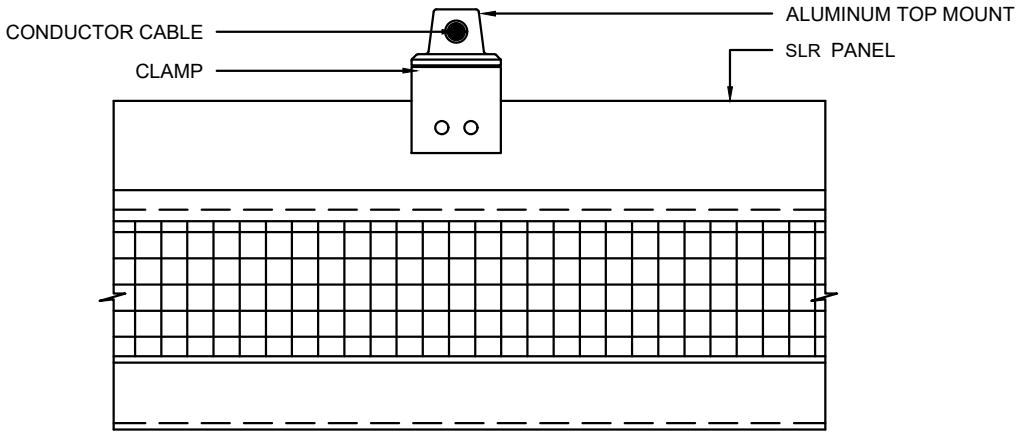
SLR SERIES SEAMS WITH UNDERLAYMENT

It is not unusual to have snow buildup on a roof that exceeds the height of the SLR rib. This condition can force a small amount of water through an unsealed SLR joint. If this takes place before any part of the joint freezes, this water is drained off by the capillary drain that is designed into the SLR panel. If the water flow is found to exceed the capacity of the capillary drain, then the joint must have continuous sealant in the joinery or by the use of an underlayment. Where these underlayments are used, they must be sealed so that they can handle any water back up from the perimeter of the building or penetrations through the SLR Series panel. Where an underlayment is not feasible, it would be then required to use continuous sealant in the panel joinery. This sealant should be a non-curing type and have an expected life in excess of 20 years. Downspouts are always a problem when temperatures fall below freezing. One way to handle this situation and have a reasonable belief that it will drain is with the use of a heat tape. Heat tapes should be run along gutters, valleys and inside downspouts in order to keep a small channel open for drainage. Another type of downspout that has been effectively used in the upper midwest called the “open faced”. Here the downspout is U-shaped, with the open face away from the building. The vertical legs are supported across the open face by attachment to the downspout straps. When icing conditions are likely to exist, metal trim joints should be designed and fabricated to be fully sealed, preventing any water invasion into the joints. At points where the roof system’s expansion/contraction can have an effect on the trim items, it is a must that the panels must be fixed and sealed at the eave line. If this is not possible, then a flexible eave flashing must be used.





SECTION CUT VIEW



SIDE VIEW

Note:
-Coat cables and clamp with bituminous.
-Coating as necessary to prevent galvanic reaction.

LIGHTNING PROTECTION

STORAGE AND MAINTENANCE OF SLR PANELS

STORAGE OF MATERIALS

Morin recommends that all materials be stored in a dry condition. An area should be provided, maintained and assigned by the general contractor. This area should be clean, level, accessible and sufficiently compacted to support and permit movement of delivery trucks and construction equipment. The materials should be stored sloped to allow drainage of condensation. All materials should be allowed to breathe in order to deter build-up of condensation. The materials should be protected from weather by suitable covering. Aluminum materials should be stored in a dry covered location. Materials should be inspected upon delivery for presence of moisture or damage. If moisture is present, bundles should be opened immediately and dried. Special care is required for non-color aluminum materials. The presence of moisture can cause storage stain. Care must be taken to assure moisture does not condense on the panel surface.
Material with protective plastic coating must be shielded from UV exposure and prolonged heat.
Excessive storage duration may cause coating to permanently adhere to finish of panel.

MAINTENANCE INSTRUCTIONS

Metal wall and roof panels normally require a minimum of maintenance. To provide a greater degree of optimum serviceability, the owner's Maintenance Department should inspect the wall and or roof panel surface once a year, preferably during the spring and after any severe storm.

1. The Owner's Agent shall note or do the following:

A. File all job records, wall/roof shop drawings, project plans and specifications for reference. Set up a maintenance schedule and reporting system.

B. Clean drains and gutters and observe coping and sealants at coping seams.

C. Hose USING NORMAL WATER PRESSURE or clean any accumulated airborne or waterborne contaminants that are not being naturally removed. DO NOT use any cleaning agents, abrasives or detergents without consulting Morin. Rinse to avoid cleaning residues. When possible, do not direct water at a panel side lap.

D. Observe any standing water at flashings or against panels and determine cause.

E. Observe and remove any vegetation or debris that has accumulated against the panels.

F. Observe any deterioration, pest disturbances, or vandalism at sealants, closures, flashings and panels.

G. Observe wall/roof surfaces at penetrations and exhausts for any localized deterioration.

H. Should leaks occur, notify the Contractor. Note the location and conditions resulting in leakage; magnitude of rain; wind direction; temperature; time required for leaks to appear or cease after rain starts and stops; condition of building openings; status of mechanical equipment; internal conditions, windows, walls and skylights, etc.

1. Note the location and nature of any deterioration and keep a log for future reference and yearly comparisons.
2. Except for emergencies or obvious problems, do not perform wall/roof repairs. Consult with the contractor for proper remedial action (if any).
3. Any and all servicing of the wall/roof system must be completed in compliance with the above or voiding of any or all warranties may occur.

TECHNICAL BULLETIN 1040

LIGHTNING AND METAL ROOFING

We live in an electronic age, with computers and other sensitive electrical and electronic equipment present not only in every workplace, but also in most households. The element of personal safety notwithstanding, more and more people are considering lightning protection for their home or business. When a metal roof is employed on a project, it seems to heighten peoples awareness of lighting, and some question whether or not the use of metallic roofing increases the risk of lightning strike. Metal roofing does not in any way increase this risk.

Lightning is a flow of electrical current between earth and sky The result of this electrical flow can be millions of volts. There is still much that is not known about lightning, but most experts agree that a path of ionization begins from the cloud and extends earthward. This path of ionization is the beginning of, and establishes the route for a lightning strike. The more dramatic part of the strike occurs when electrons race upward from earth-to-sky along this route. This is the flash of light with which we are all familiar. It is also the phase of the strike which poses the threat of damage. As is the case with any flow of electrical current, lightning will follow the path of least resistance. if the electrical charge is strong enough, it will also arc from one substance to another. It is the resistance to the flow of this electricity which generates heat energy and can cause explosions, and other damage.
In assessing the risk involved with lightning striking any structure, two different subject areas should be analyzed. The first has to do with probability of a strike; the second has to do with consequence of the strike. There is no measure known which can lessen the probability of a lightning strike, except perhaps physically moving the location of a structure. The use of lightning protection systems may, however, lessen consequence of a strike should one occur.

The probability of lightning strike is determined by a number of factors:
1. The topography in the area of the subject facility. Probability of strike is higher if the project is located on a mountain top or hill top as opposed to a field.
2. Size and height of the subject structure. A tall building or one covering more ground area is more likely to be struck than a short or small building. A tall, slender structure (such as a steeple or lighthouse) is also a more likely candidate for a strike.
3. Relative location of the subject structure with respect to nearby larger and taller structures. Presence of a very tall structure in proximity to a small, short building will tend to further reduce the likelihood of a strike to the small building.
4. Frequency and severity of thunderstorm activity in the geographic area of the project. As can be appreciated by reviewing the above factors, the probabilities of a strike to a metal roofed structure are no more or less than any other kind of structure, as these probabilities have to do with height and size of the structure and its surroundings, rather than its construction materials.

As can be appreciated by reviewing the above factors, the probabilities of a strike to a metal roofed structure are no more or less than any other kind of structure, as these probabilities have to do with height and size of the structure and its surroundings, rather than its construction materials. In order to adequately assess risks involved with lightning events, the consequence of a strike must also be studied. In other words, what if lightning does strike a subject building— what will happen? Obviously, there is a potential threat to human life associated with a lightning strike in addition to the threat of damage to either the contents of the building, or the building itself, or both. These threats are affected by the following factors:

TECHNICAL BULLETIN 1040

LIGHTNING AND METAL ROOFING

1. THE CONSTRUCTION MATERIALS USED FOR BOTH FRAMING AND ROOF COVERINGS:
If these materials are (electrically) conductive, the threat of fire and explosion are both reduced, also reducing the threat to human life. If these materials are noncombustible the threat of damage to them is reduced, and they will not contribute a fuel source to any fire resulting from a lightning strike.

2. PHYSICAL CONTENTS OF A BUILDING:
If contents are flammable, or explosive, risks of the perils of fire are obviously increased. If contents are highly sensitive electronic or other equipment. highly valuable or irreplaceable items, then the consequence of loss is intensified.

3. HUMAN OCCUPANCY:
Buildings which are heavily occupied are considered to be at higher risk than unoccupied or sparsely occupied buildings. Also, the type of occupancy has a bearing, if a fire results from a lightning strike, the risk to human life is greater if occupants are handicapped or non-ambulatory & cannot be quickly evacuated.

4. REMOTENESS OF THE BUILDING:
If the building is remote with respect to fire fighting and medical emergency response, the risks of physical loss due to fire as well as human perils are increased.

Because metal roofing is both an electrical conductor, and a noncombustible material, the risks associated with its use and behavior during a lightning event make it the most desirable construction material available. This fact not withstanding, and in view of the many variables which contribute to lightning risk, it may, in some cases, be prudent to consider lightning protection. A lightning protection system provides for a continuous conductor from earth to sky (and vice-versa) so that the electrical charge is furnished an obvious path through which to flow, thereby reducing the risk to (electrically) resistive construction materials and human life.

For additional information see:
NFPA 780 Standard for the
Installation of Lightning Protection
Systems.1995 edition. National Fire
Protection Association, Quincy, Mass.

This technical bulletin has been distributed, prior to publication, for review and comment by those organizations believed to have a direct interest in and knowledge of the subject matter.

TECHNICAL BULLETIN 1050

METAL ROOF COATING AND MAINTENANCE

CLEANING PAINTED FLUOROCARBON SURFACES:

While factory applied finishes for metal building panels are so durable that they will last many years longer than ordinary paints, it is desirable to clean them thoroughly on a routine basis. Apparent discoloration of the paint may occur when it has been exposed in dirt-laden atmospheres for long periods of time. Slight chalking may also cause some change in appearance in areas of strong sunlight. A thorough cleaning will generally restore the appearance of these buildings and render repainting unnecessary. An occasional light cleaning will also help maintain an aesthetically pleasing appearance. For any cleaning method used, it is recommended that the process be tested on a small inconspicuous area before use on a large scale. To maintain the original finish of the building panels, the only regular maintenance necessary is that of an annual washing. Mild solutions of detergents or household ammonia will aid in the removal of most dirt, and the following are recommended levels:

1. One cup of common detergent which contains less than 0.5% phosphate (example - “Tide”), dissolved into 5 gallons of water. NOTE: The use of detergents containing greater than 0.5% phosphate are not recommended for use in general cleaning of building panels. Never mix cleaners, since this could be ineffective as well as dangerous. For example, detergents containing ammonia or ammonia compounds mixed with bleach (which contains chlorine) can result in harmful vapors being formed.
2. One cup of household ammonia dissolved into 5 gallons of water (room temperature).

Working from the top to the bottom of the panels, the building may be washed with either solution using a well soaked cloth, sponge, brush (with very soft bristles) or low pressure spray washer. The use of scouring powders or industrial solvents are not recommended since these agents may damage the film, or leave unsightly sources for dirt accumulation.

Solvent containing cleaners (examples - “Fantastic” or “Formula 409”) are very effective and can be used without concern. If mildew or other fungal growth is a problem and cannot be removed as outlined above, household bleach—mixed at a concentration of one gallon bleach to five gallons of water, along with one cup of mild soap to aid wetting—is recommended.

Once the building is washed, thorough rinsing with clear water is necessary to eliminate the possibility of residue. Failure to remove all residue from these cleaning steps may damage the film.

POLYVINYLIDENE FLUORIDE (PVDF) AND PLASTISOL COATINGS

Polyvinylidene fluoride (PVDF) and plastisol present relatively nonadherent surfaces to airborne soil. If needed, a variety of methods for removal of surface deposits is available. Two precautions are given:

1. Do not use wire brushes, abrasives, or similar cleaning tools which will mechanically abrade the coating surface.
2. In general, the cleaning agents listed below should be tested on a small, inconspicuous area before use on a large scale.

HOT OR COLD DETERGENT SOLUTIONS

A 5% solution in water of commonly used commercial and industrial detergents will not have any effect on the metal panel surface. Washing with these solutions should be followed by a thorough rinse of water. A cloth or soft bristle brush should be used.

TECHNICAL BULLETIN 1050

METAL ROOF COATING AND MAINTENANCE

CLEANING PAINTED SURFACES:

SOLVENTS

Most organic solvents are flammable and/or toxic and must be handled following manufacturer's recommendations. They should be kept away from open flames, sparks, electrical motors and used with adequate ventilation and protective equipment.

Solvents that may be used to remove non-water soluble deposits (examples - tar, grease, oil paint, graffiti, sealants...) from PVDF and plastisol surfaces include:

1. Alcohols -
   - Denatured alcohol (ethanol)
   - Isopropyl (rubbing alcohol)
   - Methanol (wood alcohol)
2. Petroleum Products and Turpentine-
   - VM&P naphtha (benzine)
   - Mineral spirits (oleum)
   - Kerosene
   - Turpentine (wood or gum spirits)
   - Oxalic acid
3. Aromatic and Chlorinated -
   - Xylol (Xylene)
   - Toluol (Toluene)
   - Perchlorethylene (Perclene)
   - Trichlorethylene (Triclene)

These solvents should be used with caution on PVDF and plastisol surfaces. A small area should be tested before general application; contact should be limited to five minutes.

4. Ketones, Esters, Lacquer thinner, Paint Remover.
   - Methyl ethyl ketone (MEK)
   - Methyl isobutyl ketone (MIBK)
   - Ethyl acetate (nail polish remover)
   - Butyl acetate
   - Lacquer thinner
   - Paint remover (non-flammable)

These solvents should be used with caution on PVDF and plastisol surfaces. A small area should be tested before general application; contact should be limited to one minute. Paint removers should be carefully tested on small areas following the manufacturer's application recommendations.

5. Acetone should not be used on PVDF and plastisol surfaces.

CHEMICAL SOLUTIONS

Sodium hypochlorite solution (Laundry bleach, Clorox)
Hydrochloric acid (muriatic acid)
Acid solutions are corrosive and toxic. They should be tested on small areas before general application; contact should be limited to five minutes. The panel surface should be thoroughly flushed with water after the chemical solution washing.

GRAFFITI

Graffiti presents a special problem because of the many possible agents used, generally aerosol paint. It is recommended that less active solvents (examples - alcohols, petroleum solvents and turpentine, aromatic and chlorinated) be tried initially, followed by stronger solvents (examples -ketones, esters, lacquer thinner, paint remover). If none of these are satisfactory, it may be necessary to resort to touch-up paint, total repainting or replacement.

TECHNICAL BULLETIN 1060

OIL CANNING

What is oil canning?
Oil Canning can be defined as a perceived waviness in the flat areas of metal roofing and metal siding panels. Generally the period and amplitude of the wave depend on the continuous width of the flat. Oil canning is an inherent part of light gauge cold formed metal products, particularly those with broad flat areas. Profiles having wide flat surfaces are often referred to as “architectural” roofing and siding panels. Such panels are distinguished from corrugated shapes as the latter are more fluted in design, have much narrower flats, and are less likely to exhibit oil canning.

Oil canning can be more apparent during certain times of day and in certain seasons based upon the angle at which sunlight hits the roof or wall, and based upon the temperature differential.

What causes oil canning?
There are numerous causes of oil canning.

1. Metal Coil Production
Residual stresses induced during coil production can contribute to oil canning. Examples of these types of features are: Full center - the coil is longer in the middle of the strip which creates ripples or buckles near the mid-coil area. This is the most common example.
Wavy edge - the coil is longer along the edge of the strip.
Camber - the deviation of a side edge from a straight line.
These conditions exist to some extent in all light flat rolled metal and tend to become more exaggerated as the strength level of the sheet product increases and also for thinner and wider sheet products. When excessive, each circumstance can cause oil canning after roll forming by the manufacturer.

2. Panel Fabrication
Slitting - The slitting of a master coil can release and redistribute residual forces. The coil’s response can create or increase oil canning. The economics of producing wider coils makes slitting almost mandatory.
Forming - New residual stresses can be created during some forming operations. Architectural panel profiles typically require more forming along the edges than in the middle of the sheet. They often require more forming along one side than the other. This requires that forming begins along the sides. The sequential “working” of the sheet will have a tendency to “trap” uneven metal contained within the central areas. For example, corrugated ribbed profiles are most often roll-formed from the center and moving outward, thereby “pushing” the uneven metal to the edges.

3. Panel Installation
Misalignment of the Support System - Structural supports that are produced, fabricated, and installed within allowable tolerances can create a “non-planar” or contoured bearing surface. Stresses induced while panels conform to this surface can contribute to oil canning.

Over Engagement of Panels - Most panels accommodate transverse thermal expansion by flexing of webs and by “take up” at side joints. When panels are over engaged, these relief features are hindered or eliminated. In the extreme case, the over engagement process itself can generate waviness. Either cause can contribute to oil canning.

Over Driving of Fasteners - This operation creates stresses in the panel and provides a “reading line” along the fastener alignment.

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OIL CANNING

Longitudinal Expansion - The surface temperature of exposed panels cycles throughout the year and even fluctuates daily. The temperature and the cycle depend on many variables (e.g., project location and building orientation, cloud cover, panel configuration, surface finish or color, system thermal insulation characteristics). Under temperature fluctuation, the panels expand or contract. If panels are restrained by fasteners, clips or perimeter details, they accommodate thermal forces through several mechanisms. These include “slotting” around fasteners, out-of-plane “bowing”, and local distortion of flat areas. The magnitude of thermal force depends on the restraint provided, on the base materials’ physical properties and on the temperature differential between the support structure and external skin. Waviness can be amplified when there is uneven fastener restraint along the panel. Such restraint is common on “concealed fastener” systems having fasteners along one edge and an interlock along the other. Waviness caused by thermal forces differs from the other forms of oil canning in that waves can appear and disappear daily as the sun moves across the sky.

Movement of the Primary Structure - Excessive differential deflection, racking, drift, or settlement within the primary structure can cause noticeable waviness within panel flats. This distortion can be temporary or sustained.

Handling - Carrying panels in the flat orientation or twisting panels can induce a wavy appearance to a previously flat panel. Twisting can occur if one corner of a panel is used to lift a panel or to remove the panel from a bundle.

How can oil canning be controlled?
Coil producers and panel manufacturers attempt to minimize these conditions and produce quality products. Research continues on improved production methods. Regardless, all of the above factors contribute to oil canning in architectural roofing or siding products. While a number of factors are a function of the panel design, there are steps that the designer, panel manufacturer, and erector can take to reduce the chances of oil canning.

1. Coil - Tension leveling or stretcher leveling, processes whereby the metal sheet is “stretched” in coil form beyond its yield point, will provide a flatter surface less prone to oil canning. In general, the heavier the thickness the less likely a product is to oil can. The possibility of oil canning can be reduced by ordering tension leveled and resquared material. Tension leveling should be done only after coils are slit.
2. Design - The use of fasteners and clips that allow panels to float without causing thermal stresses is a means of controlling oil canning on roof panels. The addition of stiffening ribs in the panel profile “break-up” the flat surface and make oil canning less apparent. An embossed surface or a surface painted with a low gloss paint system will also help reduce visible surface waviness in the metal.
3. Installation - More stringent specifications regarding the alignment of the supporting structure will focus attention on this critical aspect. Instructions to the erection forces regarding proper handling, spacing, and fastening should be part of the manufacturers’ delivery packet.
4. Handling - Proper handling is one of the most critical considerations and should be addressed in production, transportation and installation activities.

TECHNICAL BULLETIN 1060

OIL CANNING

Concluding remarks:
Oil canning is an aesthetic issue. Normally, structural integrity is not affected; however, it must be reviewed if the distortion is extreme. Such distortion might indicate movement within the primary structure or distressed connections within the panel system. Since many uncontrollable factors are involved, no manufacturer can realistically assure the total elimination of oil canning. With careful attention to the production and selection of material, to the panel design, and to installation practice, oil canning can be effectively minimized. Unless specific tolerances have been incorporated into the contract documents and accepted by the panel provider and panel manufacturer, and if reasonable precautions have been taken, oil canning is not grounds for panel rejection.

References:
1. American Iron & Steel Institute. “Sheet Steel Coils & Cut Lengths” Steel Products Manual, October 1979.
2. US Steel Sheet & Strip Handbook. July 1983.

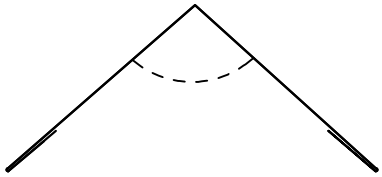
Founded in 1983, the Metal Construction Association brings together the diverse metal construction industry for the purpose of expanding the use of all metals used in construction. MCA promotes the benefits of metal in construction through:

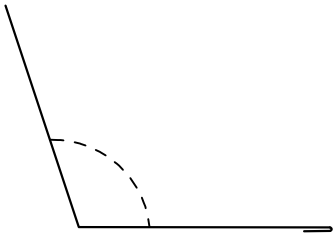
- Technical guidance
- Product certification
- Educational and awareness programs
- Advocating for the interests of our industry
- Recognition of industry-achievement awards
- Monitoring of industry issues, such as codes and standards
- Research to develop improved metal construction products
- Promotional and marketing support for the metal construction industry
- Publications to promote use of metal wall and roof products in construction

For more information, please visit the MCA Web site at www.metalconstruction.org.

This technical bulletin has been distributed, prior to publication, for review and comment by those organizations believed to have a direct interest in and knowledge of the subject matter.

HIP / RIDGE COVER SELECTION CHART





ROOF SLOPE										
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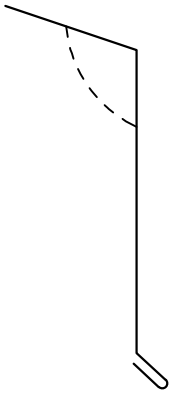
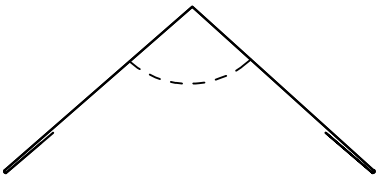
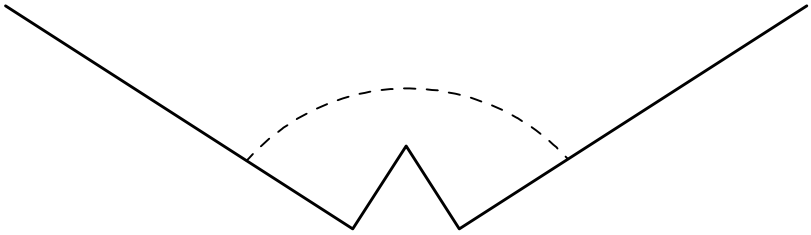
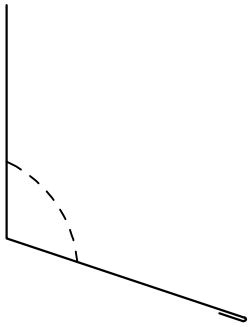
	4 1/2"	4 1/2"	4 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"
	4 1/2"	4 1/2"	4 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"	5 1/2"

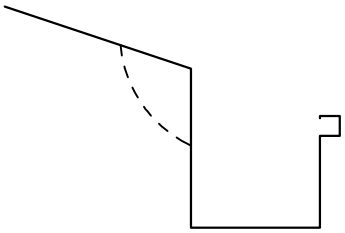




ANGLE CHART FOR HIP, VALLEY, RIDGE, GUTTER AND PITCH BREAK FLASHING







	ROOF SLOPE											
	1:12	2:12	3:12	4:12	5:12	6:12	7:12	8:12	9:12	10:12	11:12	12:10
HIP AND VALLEY	173°	166°	160°	154°	148°	143°	138°	133°	129°	126°	123°	120°
RIDGE	170°	161°	152°	143°	135°	127°	120°	113°	106°	100°	95°	90°
GUTTER AND EAVE BREAK	94°	99°	104°	108°	112°	116°	120°	123°	126°	129°	132°	135°

SLR JOBSITE FABRICATION MANUAL

Introduction
Jobsite roll forming is a collaborative venture between the contractor/Morin customer/erector (all known as "client" below) and Morin Corporation. Site conditions, building design, building orientation, and space limitations all affect the production and handling of all manufactured products. Careful planning and coordination must occur prior to the onsite mobilization.

Scheduling
Several factors must be considered to ensure the availability of the portable roll former.
- Realistic project scheduling to set the fabrication time frame is necessary. Provide advance notice of request (at least 3-4 weeks) to allow procurement and pre-fabrication requirements of the materials.
- Seasonal weather conditions must be considered.
- Coordination of other trades to allow adequate site space for fabrication and lay down areas.

Contact your *Morin* Project Coordinator to organize the machine and materials necessary for your specific project.

Costs
Each project contains unique circumstances; accurate cost analysis requires parameters for each project to be defined prior to assessment. Contact your *Morin* Project Coordinator to discuss in detail.
- Weather Delay
- Equipment
- Work Hours

Morin Responsibility
- Ensure that the proper material is available at the project site per agreed schedule and quantity listed below.
- Ensure that the arrival of the roll forming equipment is concurrent with material.
- Provide one (1) operator/mechanic to manufacture materials.
- Maintain production schedules, records, and product quality.

Client Responsibility
- The (client) must sign and return this manual four (4) weeks prior to the jobsite schedule.
- Provide written confirmation of the union's approval (if required) to allow jobsite fabrication at the prospect site at least 60 days prior to mobilization.
- For offloading roll former mounted on trailer, arrange for a minimum 8000 lbs. capacity forklift or crane (4' forks to 5' forks) along with four ¾" shackles and four 12'-0" (10,000 lbs.) lifting straps. If the curving machine is required at site, the weight is 3,000 lbs.
- Arrange for a minimum 5000 lb. capacity forklift or crane and operator for the duration of the site fabrication for daily handling and loading of coils from the storage area to the roll forming equipment. The lift or crane must be suitable to the terrain at the site, i.e.: sand, rocky, and uneven. Costs associated with a forklift or crane will be (client's) responsibility.
- Make available suitable onsite storage for the coils. The area should be clean, level, drainable from water ponding, accessible and sufficiently compacted to support and permit movement of delivery trucks and equipment. Materials must be protected against all weather.

- Provide a complete bill of materials prior to the start of jobsite roll forming. Any special sequenced production must be approved by Morin prior to mobilization. Roll former production can't be restricted upon commencement. The entire job must be run at one time. Additional remobilization/demobilization costs could occur if the project is phased out. Normally the project can be produced faster than it can be installed. The objective is to fabricate 8 hrs/day at five days a week.
- The (client) must approve and sign off all materials produced. The site foreman or the authorized representative must be always available during production. The (client) must purchase any coils remaining at the end of the project that is above the 2% allowable scrap.
- The (client) must provide laborers to handle panels once produced from roll former. They are generally required at one (1) person per 10' to 12' length plus one (1) additional. Panels exit roll former at a nominal height of 5'-6" +/- off the grade.
- Staging, hoisting, rigging equipment and materials will be the responsibility of the (client).
- Any moves of the roll former after the initial mobilization will be done by equipment and manpower furnished by the (client). Morin will also invoice $450.00 per move.
- Refer to finish product Storage of Material Data Sheet.
- The (client) to provide gas and power supply at site:
    1. Roll former will use 87 octane gas.
    2. The curving machine will use a 120-volt generator or any 120-volt source.
- The (client) to provide the following proper work area for the roll former equipment at grade. If roll former is required to be hoisted to roof level, please contact Morin for additional requirements.
  (Machine size - 25' long x 9' wide x 6' tall)
    1. There must be solid foundation for the roll former since it weighs 10,000 lbs. An area must be level, clean, drainable from water ponding, compacted, and suitable for this operation.
    2. There must be adequate storage space to accommodate the finished roof panel for the entire job.
-

Confirmation

_____ _____

Signed (Contactor)/ Company Name Signed (Erector) / Company Name

Date: _____ Date: _____

_____

Signed (Customer)/ Company Name
(if different than erector)

Date: _____

Reconfirm quantity of panels required (squares): _____ **Anticipated Schedule:** _____

Rev. 1 10/09/2023 DM

Contact Details

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