

Metal Wall & Roof Systems
North America



Morin Integrity Series Metal Wall System Installation Guide

Innovative Single Element Building Envelope Solution



Morin[®]
By Kingspan

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MCA Technical Bulletin 106073, 74

Oil Canning

MANUAL DOES NOT APPLY TO ZINC OR COPPER APPLICATIONS

DISCLAIMER: THE DETAILS ARE PROVIDED AS A GUIDELINE FOR PROPER PANEL AND ASSOCIATED COMPONENT DESIGN, AND ARE BASED ON INDUSTRY ACCEPTED PRACTICES. PANEL SPANS, CLIP SPACING AND FASTENER RECOMMENDATIONS ARE PROJECT SPECIFIC AND SHOULD BE DETERMINED BY THE ENGINEER OF RECORD. FOR SIMPLICITY ALL DETAILS CONTAINED HEREIN SHOW 2 FASTENERS PER CLIP (MINIMUM REQUIREMENT). INSULATION (NBM), PURLINS/JOISTS, DECKING, MISCELLANEOUS STRUCTURAL SUPPORTS ETC. ARE SHOWN FOR CLARITY ONLY, AND ARE NOT SUPPLIED BY MORIN (N.B.M.). FOR PROJECT SPECIFIC ENGINEERING AND DESIGN ASSISTANCE, AS WELL AS INFORMATION ON RADIUS PANEL OPTIONS, PLEASE CONTACT MORIN TECHNICAL SERVICES.

INTRODUCTION

Morin Integrity 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 Integrity wall panel system eliminates this problem by using the factory formed panels that are attached to the structural substrate by the use of concealed clips. Morin's Integrity Series clips are fixed to the structure and the panels move up and engage on the clips rather than the clips sliding and running out of expansion capacity. The Integrity Series systems (i.e. panels, closures, clips) can be designed into walls on both new and retrofit construction.

WARRANTIES:

Morin can furnish the various extended performance warranties as required by a project's specification which cover material & finish performance. Contact your local representative for a sample copy along with exclusions and requirements for the Morin warranties.

INSTALLATION:

Morin recommends that our Integrity 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 Integrity panels are supplied in 12" and 16" nominal standard widths. The Integrity standard supplied materials are steel and aluminum. See pages 8 to 10 of this manual for further information.

COOL METAL WALL AND LEED®:

Morin's Integrity Series meets the requirements of these programs. Contact your local representative for additional information.

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)



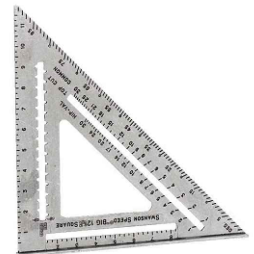
(c)



(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



(f)



(g)



(h)



(i)

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

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

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 = 90°F

Coefficient of expansion:

Steel 0.00065"

Aluminum 0.00128"

Panel Length Calculation (PLC):

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

$$\text{PLC} = \frac{0.00065 \times 90 \times 55}{100} = 0.032' \text{ or } 3/8''$$

Temperature variation in the metal panels is not constant across the surface. This differential effect causes the parts of the wall 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 wall 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.

In some cases when you have ventilators or other large wall 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. Other areas of concern are those of irregular shapes and conditions which may require the use of panel splice plates. Our suggested details for these items are found in a section of this manual.

In addition to the above, a designer must also give some thought concerning such accessory items and/or flashing. All of these trim items must be designed and fastened to adequately account for their expected thermal movement. Standard trim length in fabrication is 10'. 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.

Design Data

PANEL GAUGE SELECTION:

Some of the items that must be considered when selecting the minimum gauge of a wall 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 be the case, then structural wall panel systems can be fabricated in heavier gauges or girt spacing can be designed to allow for the maximum span of the wall panel system selected. Sometimes economies of gauge girts can outweigh the cost savings of using the wall 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 wall 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:

Building codes in most cases do not set limits on the deflection of wall cladding; therefore this item is overlooked in the design of wall panel systems. Usually these codes limit the deflection to structural members only if other materials supported are sensitive to great movement and/or cracking. 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. Uniform loading changes the wall panel products section properties as the panel distorts, (i.e. panels become more rigid under positive loads and more flexible under negative loads).

To determine the actual allowable negative load ability of a wall 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 and in accordance with AISI Specifications. The flat of the wall 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.

The structural design needs to be checked for floor deflection or structural shrinkage when wall panels are installed on a multi-floor building. If the framing is not outboard of the floors, the wall panel system needs to be designed to allow for floor deflection and movement. The most common way to address the issue is with a stack or slip joint at each floor.

Design Data

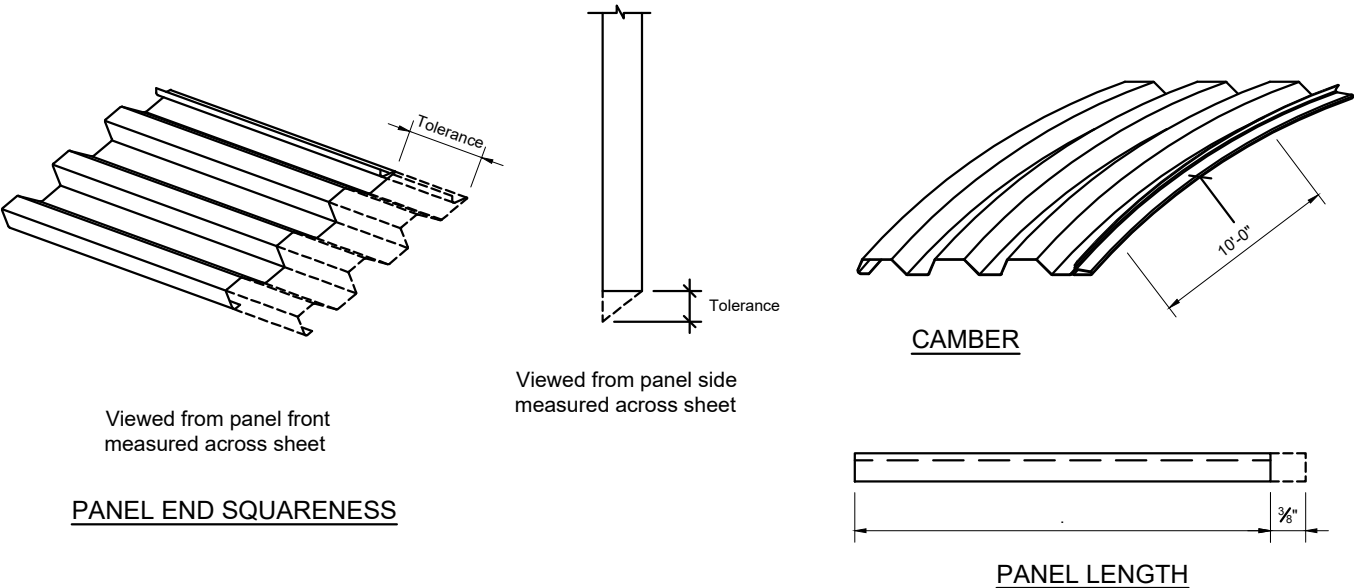
FABRICATION TOLERANCE:

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.

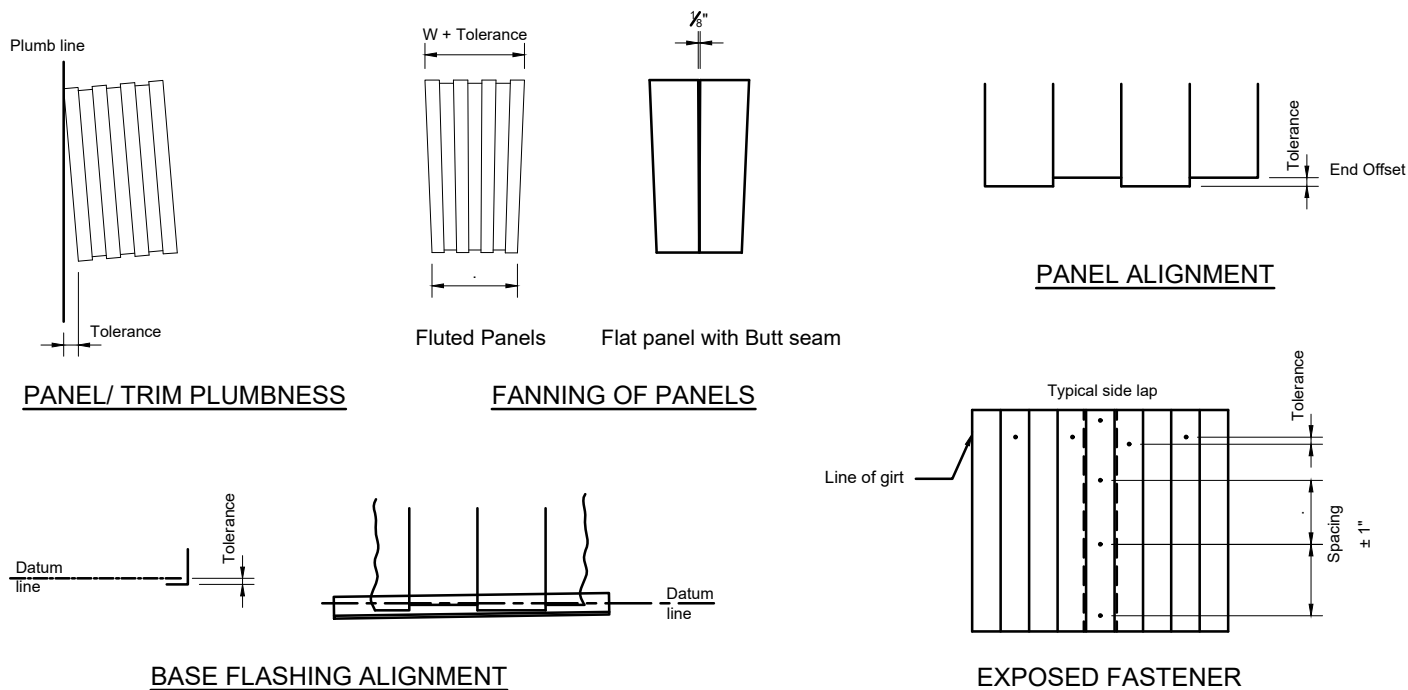


Design Data

INSTALLATION TOLERANCES:

MCA tolerances for installation of materials are as follows:

Panel Plumbness (in wall 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 1/4" 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"

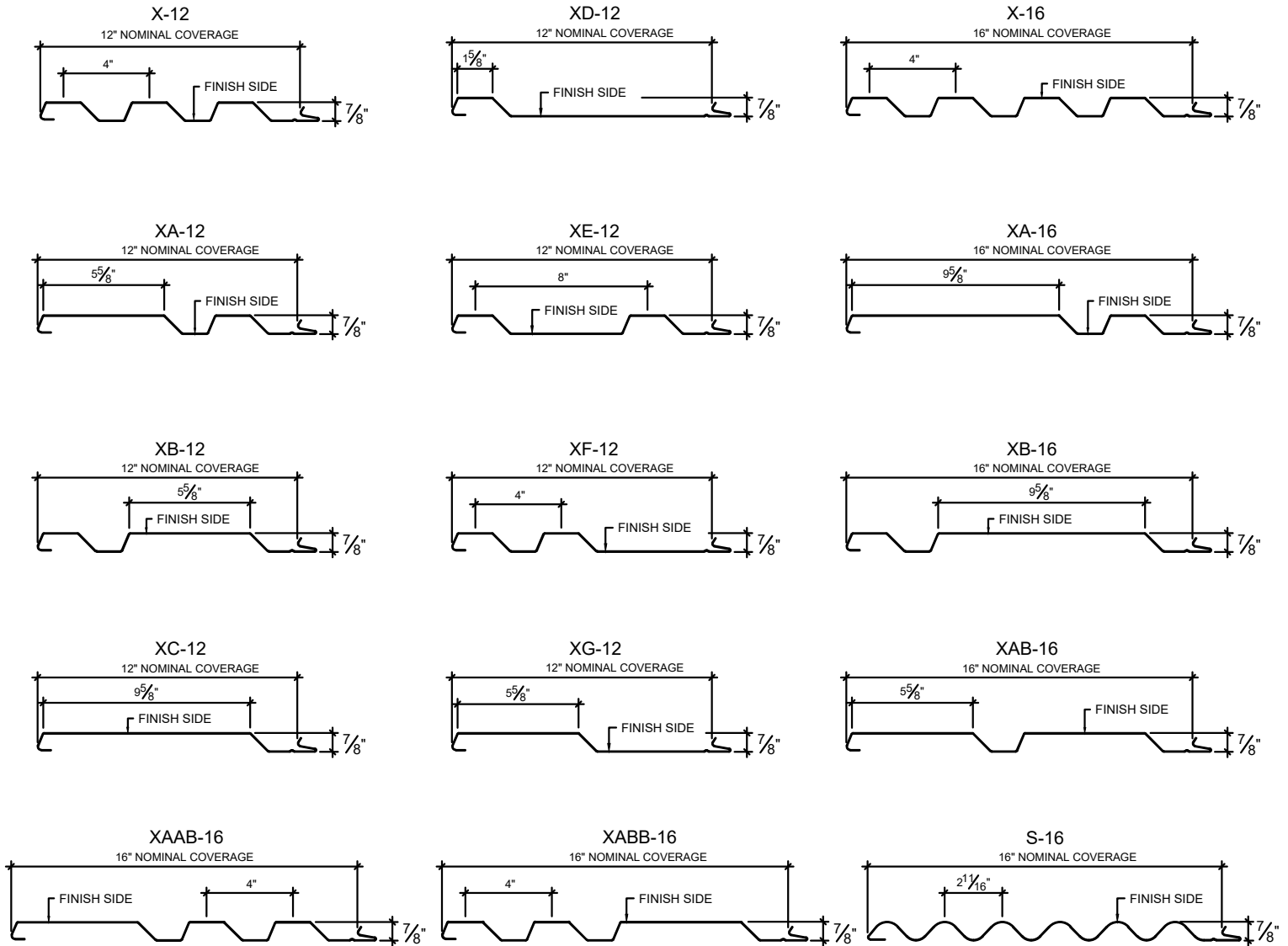


Morin Integrity Series

Technical Data

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STANDARD PROFILES



PRODUCT SUMMARY:

The Morin Integrity Series features fifteen unique profiles. Collective joint interlock design and clip attachment allows for panel integration with Morin's Integrity, Matrix, and Pulse Series.

PRODUCTION LENGTHS:

Lengths 5' (1.52m) to 30' (9.14m)
Recommended 24' (7.31m) MAX

APPLICATIONS:

Weather-resistant or rainscreen rear-ventilated applications.
Installed in Vertical or Horizontal orientations.

PRODUCT OFFERINGS:

Panel Type - Wall Panel (Horizontal or Vertical)
Panel Depth - 7/8" (22mm)
Cover Width - 12" (305mm) Nominal and 16" (406mm) Nominal

MATERIAL OPTIONS: (SEE MORIN FOR PANEL)

Painted Steel: Galvalume/Zincalume: 24, 22, 20, 18 GA
Aluminum: 0.032, 0.040 and 0.050

COLOR AND FINISH OPTIONS FOR ALUMINUM AND STEEL:

See Morin Color Selector Brochure

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

Surface Options- Smooth surface standard
Sealant- Optional factory sealant available
Clip- MIP Clip
Substrate- Open framing or other various backup wall assemblies (i.e. exterior sheathing, air/water barrier, exterior insulation) (NBM)

Technical Data

STRUCTURAL – POSITIVE AND NEGATIVE LOADS:

The Integrity panel systems capacities are based on the requirements of ASTM E1592 and the A.I.S.I “Cold Formed Steel Design Manual”. Actual negative loads are determined by an independently certified load test of production run panels. ASCE 7 is the basis of use with most major code bodies that specifies that higher negative pressures be used at the perimeters and thus the clips must be spaced closer together to allow for the increased negative pressures when compared to the general field of the wall. This means that if an open girt design is used, then the girt spacing at the perimeter must be shortened to allow for the smaller spans required by the Morin Integrity Series system. Determination of the required wind negative pressure (psf) for all wall 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 clip to the structure are adequate to resist the negative loads mentioned above.

THERMAL LOADS – PRESSURE PARALLEL TO THE WALL:

Structural supports are exposed not only to wind 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 definitely be checked when panel length exceeds 35'. A basic assumption is that a friction induced force is additive, allowing a 20 pound per fastener friction allowance is then conservative based on the “stick/slip” movement of the panel in relation to the fastener. It is highly unlikely all fastener resistance is at the same place at the same time.

PANEL SYSTEM DIAPHRAGM STRENGTH:

The Morin Integrity Series system is a floating system and therefore has no effective diaphragm strength. Therefore the wall structure must be designed with wind bracing.

FIRE RATINGS:

Morin’s wall 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 wall 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 more information. UL rates the wall systems in either steel or aluminum as a Class A Wall Covering for use over girt or non-combustible substrate.

AIR AND WATER INFILTRATION:

Air and Water Infiltration testing has been conducted on the Morin Integrity Series panel system in accordance with ASTM E283 and ASTM E 331.

Contact Us

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T: 1-800-640-9501

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

Morin Integrity Series

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-ordinating forklift movement. Use crane if available.

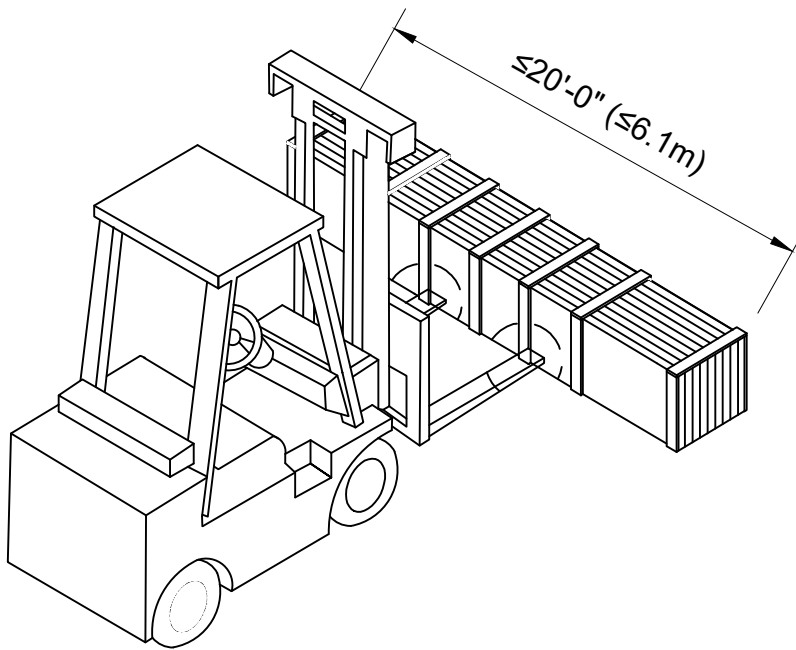


FIG.1 PREFERRED METHOD (1 FORKLIFT)

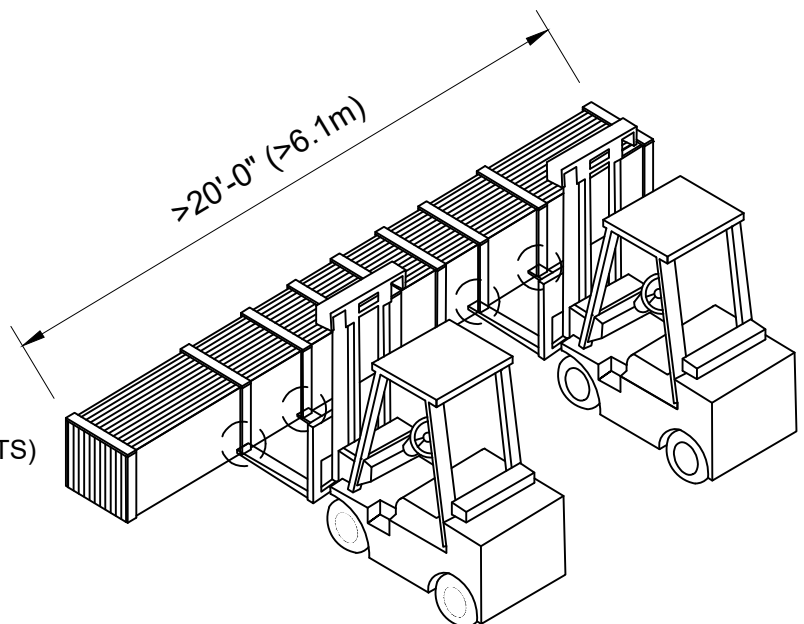


FIG.2 **STRONGLY DISCOURAGED!* (2 FORKLIFTS)

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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'

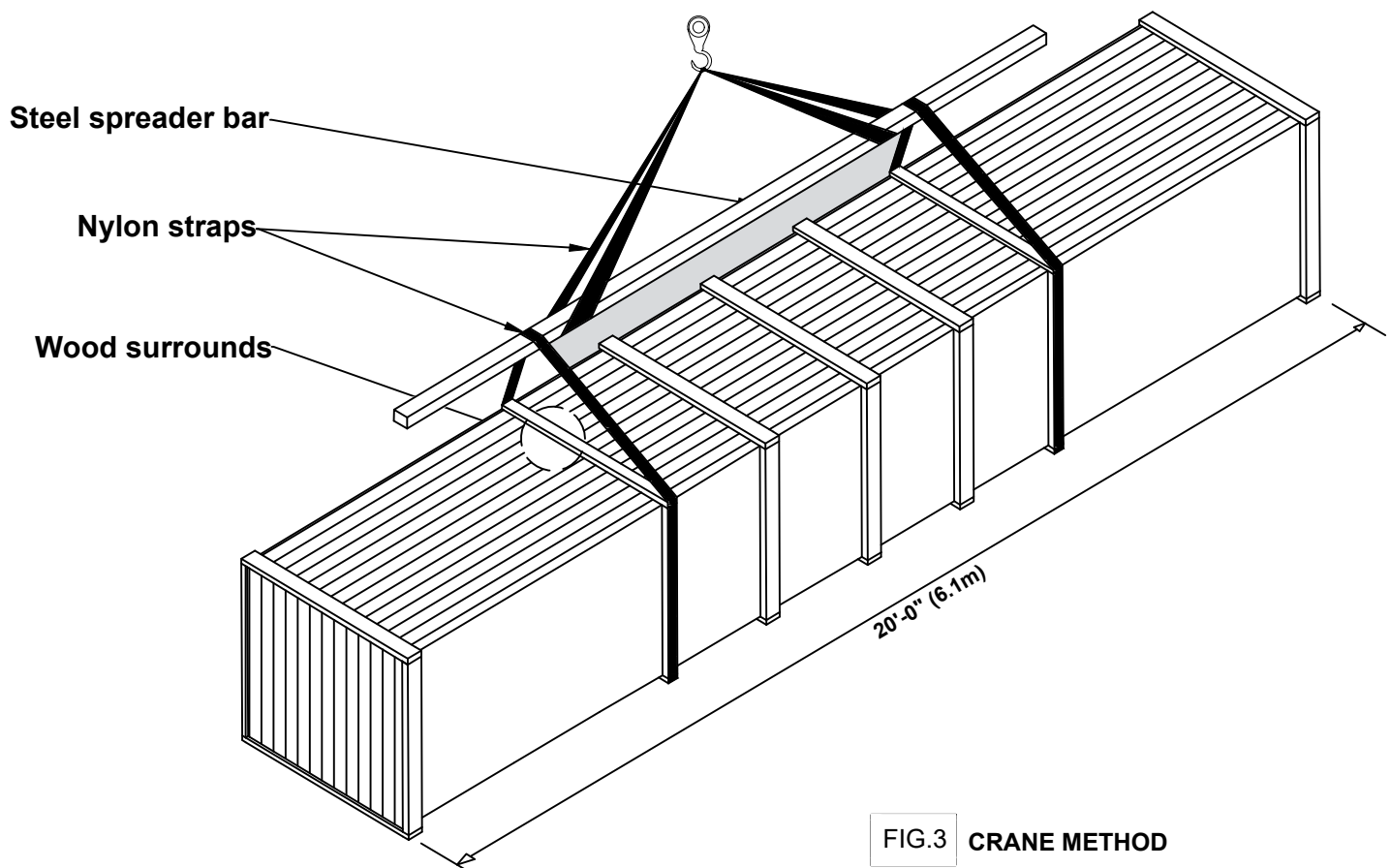


FIG.3 CRANE METHOD

NOTE:

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

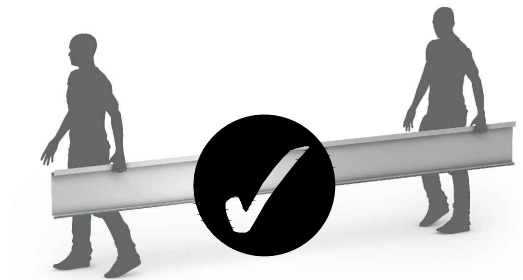
Panel Handling

Individual Panel:

Correct Panel Handling:

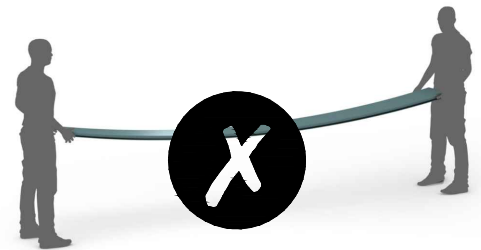
Individual panels must be handled and supported in a longitudinal orientation. When handling panels exceeding 12' in length, additional personnel will be required to support the panel. The recommended distance between each handler will be 8' (maximum).

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



Incorrect Panel Handling:

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



Morin Integrity Series

Panel Handling

Flatstock:

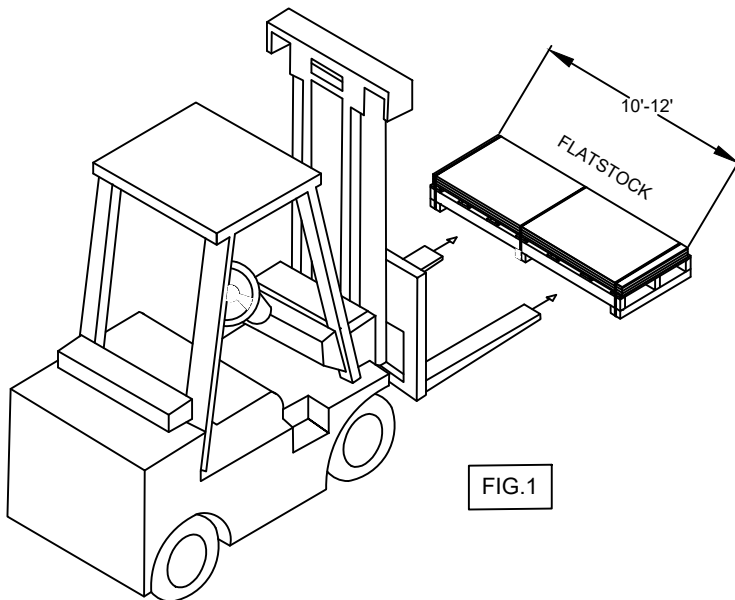
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The recommended loading/unloading method for flatstock skids is to use a forklift with widely spaced forks (min. 5') placed under the center of the bundles as shown below in **Figure 1**.

Individual sheets of flatstock may be handled and transported in either vertical or horizontal orientations with as many people as necessary to safely handle. 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. **Figure 2**

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

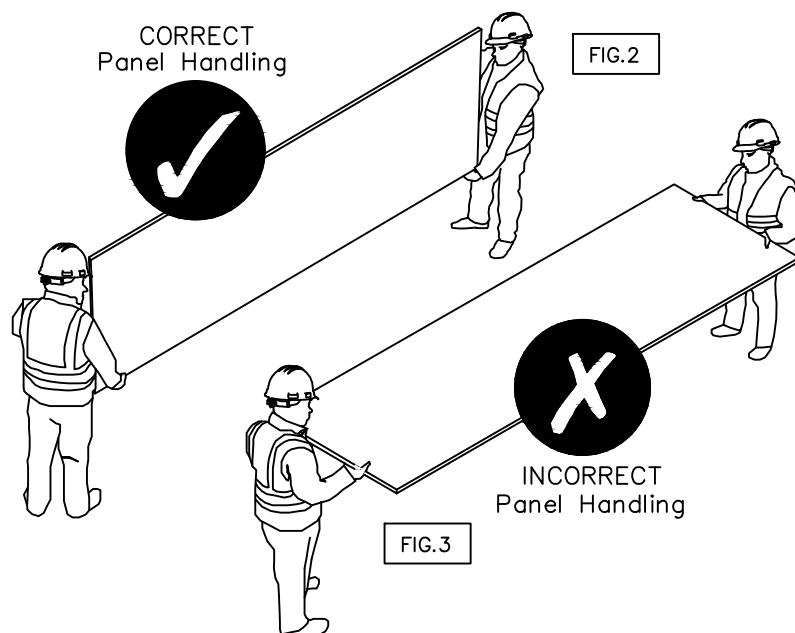


NOTE:

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.



NOTE:

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

Always lift panels when removing them from a bundle.

Fastening Guidelines

Morin Integrity 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 wall system is used over a solid substrate, 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 Morin Integrity Series panels & clips are the primary concern when using the Morin wall system, you should not overlook the importance of flashing and their fasteners. After all, a leak at this location is just as bad as a leak through the wall panel. If at all possible, these fasteners should not be installed in a manner that would penetrate the Integrity panel. The fastener must be of a self sealing type with a sealing washer under its head on the exposed surface. The minimum size fastener to be used to connect flashing and trim to the wall panel should be either a #10 screw or 1/8" rivet at 16"(MAX.)

SEALANTS:

The wall 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-yr 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 35° F (2° 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 wall 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 wall panel installation, so that the masonry/cement is complete and cured before any wall panels are installed.

Trades involved in electrical and HVAC may perform work in conjunction with the wall panel installation remembering to coordinate the work such that those trades may perform their tasks while the walls are partially or completely installed. Also keep in mind that some of the work performed by these trades may be detrimental to the wall structure and the materials used are corrosive to metal walls; such as copper, pressure treated wood, and HVAC cleaners.

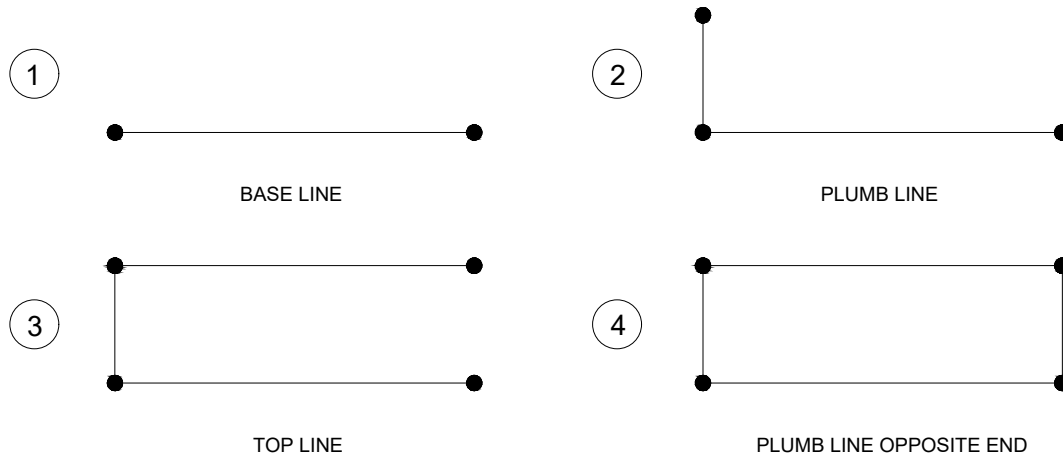
2. INSPECT THE STRUCTURE

The area designated to receive the new wall panels must be inspected and condition that fail to meet the requirement of the all system must be reported PRIOR to general contractor beginning the installation process.

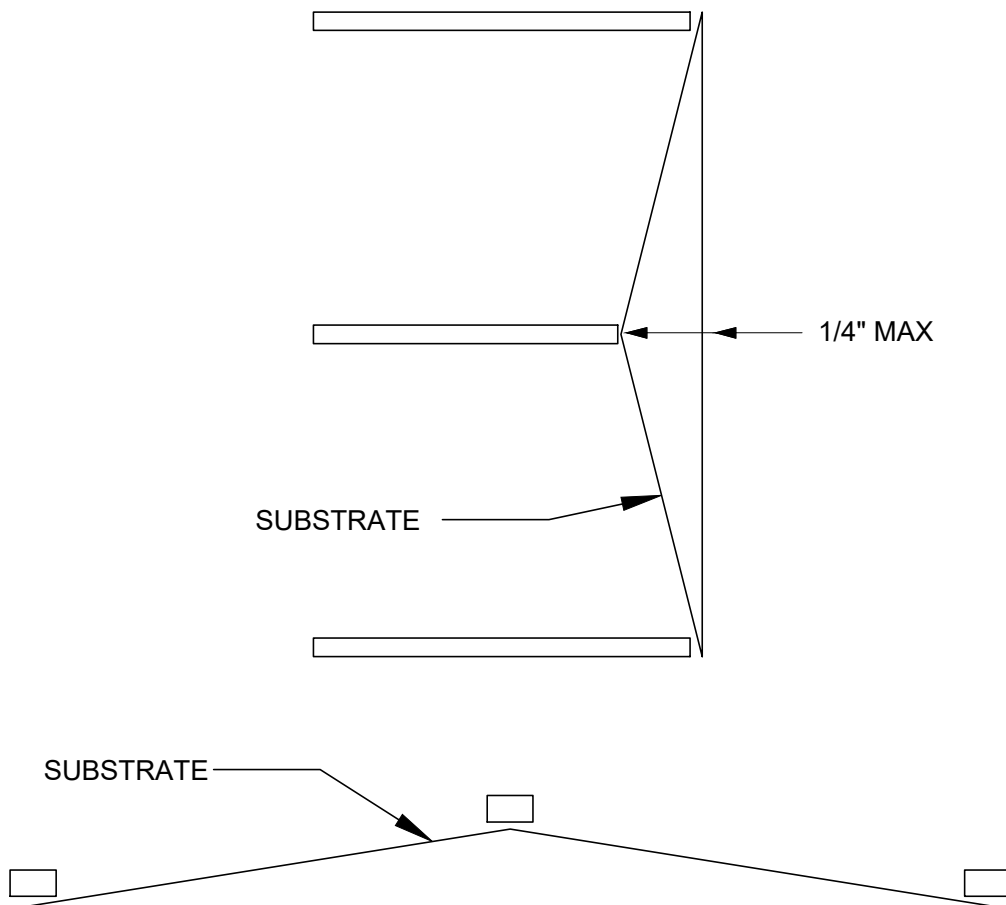
- a. Checking for Flatness - Failing to confirm that the structure and the wall system are flat in plane of the elevation will have a major impact on the success of the wall panel installation. Straight, level, plumb and plane are not the same. Straight is a line between two points without curves or bents. Level is a horizontal line with respect to distance above or below a given point. Plumb is vertical upright straight line ninety degree off level. Plane is a flat, level, horizontal or vertical surface. Plane of wall to be within $\frac{1}{4}$ ".
 1. Starting at the base line of the wall set a point 4 inches off the corner and 1 inch off the wall, pull a line or shoot a laser line level to a point 4 inches off the opposite corner and 1 inch off the wall. Measure multiple places off the line back to the wall. This will determine if the wall is straight at the base line.
 2. Set up a plumb bob or laser off the base line point to the top of the panel run. Measure multiple places off the line back to the wall. This will determine if the wall is straight from bottom to top.
 3. Set up point off the plumb line at the top of the panel run and pull a line or shoot a laser line level to the opposite corner. Measure multiple places off the line back to the wall. This will determine if the wall is straight at the top of the wall.
 4. Set up a plumb bob or laser at the opposite corner set point at the top of the panel run. The plumb line and the level bottom point should lineup. Measure multiple places off the line back to the wall. This will determine if the wall is plumb at the opposite wall.
 5. After setting up the perimeter line you can check multiple places to determine if the wall is in plane.

Panel Installation

See Diagram:



b. In-plane alignment (Wall to Wall) - While a wall's substrate may have been installed square, straight, and flat, it may still not have been installed correctly. The wall must be installed in-plane with the rest of the structure and other planes, otherwise it will not appear correct and performance may be compromised. When wall surfaces are not in-plane, it can sometimes be referred to as a "crooked" wall. In this scenario, even though each wall is straight, they are not straight to each other. Remember that misalignment may occur the intersection of different walls and transition sections. A misaligned or crooked wall will present performance issues, and appearance issues, creating gaps, misalignment, and oil canning in the panels.



Panel Installation

3. FLATNESS

Straightness involves the edges of an object while flatness entails the wide, open surfaces of an object. Installed wall panels must be both straight and flat. The issue of oil-canning on a metal wall is directly related to panel surfaces which are not flat.

Examples of this are pre-cambered stud walls; subgirts out of alignment and support members having been twisted.

4. SUSTAINING PANEL MODULARITY AND ALIGNMENT

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

- a. Starting Square To The Base - The technique of starting the first panel as “plumb and level” will establish a baseline and reference for the remaining panels, and impact the appearance and performance of the finished wall.
- b. Monitor and Measure During Installation - The measurement and monitoring of the wall, 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. Sawtooth at Base, End Laps and Ridge - Sawtooth of the panels will occur when the wall panels are not installed square to the base or edge. To avoid or reduce this risk the installer should always make sure that the first panel installed is squared and plumb to the corresponding wall edge and aligned to panels at other tiers.

Issues with Thermal Movement - Common causes of problems related to thermal movement are either double-pinning of the wall panels (ex. fastening at both end of panel) and conditions that cause the panel clips to bind, thereby not adjusting to the thermal movement of the panel.

The installer should:

- a. Refer back to the Design Data section within this Morin Integrity Series Manual, specifically the section on Thermal Movement: Coefficient of Expansion and How to Calculate Panel Length Change.
- b. 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.
- c. Be aware of installation of accessories or any panel modification and that these do not create a double-pinning of the wall panels.
- d. Inspect and approve the sealant requirements around any clips and ensure that the fasteners are not damaged and allow the panel to move freely as designed.

Panel Installation

5. 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. Avoid 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, (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.
- 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 wall system by failing to cut the metal wall materials correctly.

Morin Integrity Series

Morin®

By Kingspan

Integrity Panel Clip

The Morin Integrity Series panel is assembled using a concealed fastening method allowing for a seamless and structurally sound wall system.

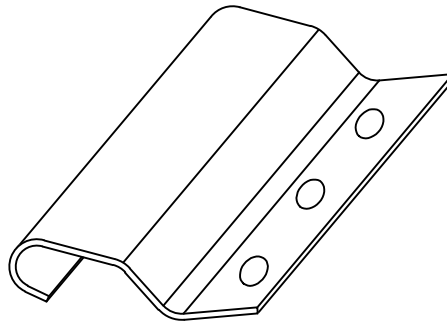
The Integrity Clip, also referred to as the 'MIP' Clip is an integrated concealed fastener clip. With its innovative design, it is used interchangeably between Morin's **Matrix**, **Integrity** and **Pulse** Series panels for limitless design possibilities.

The clip assembly allows for expansion and contraction of the panel system along its supporting structure. The clip interlocks two panels and is fastened to the girt or structural member. Fastening the clip alone allows the panel to slide vertically or horizontally along the surface of the clip to accommodate for thermal movement and to alleviate oil-canning or constriction. Note: Vertical panels require one fixed fastened location at each panel. See attached details for additional information.

MATERIAL OPTIONS:

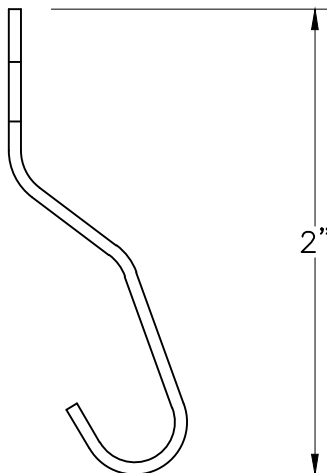
Galvanized/Galvalume: 18 GA

Stainless Steel: 18 GA

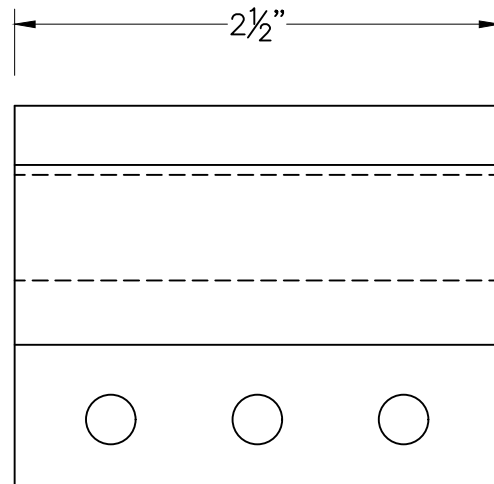


2 FASTENERS PER CLIP

ISOMETRIC VIEW



SIDE VIEW

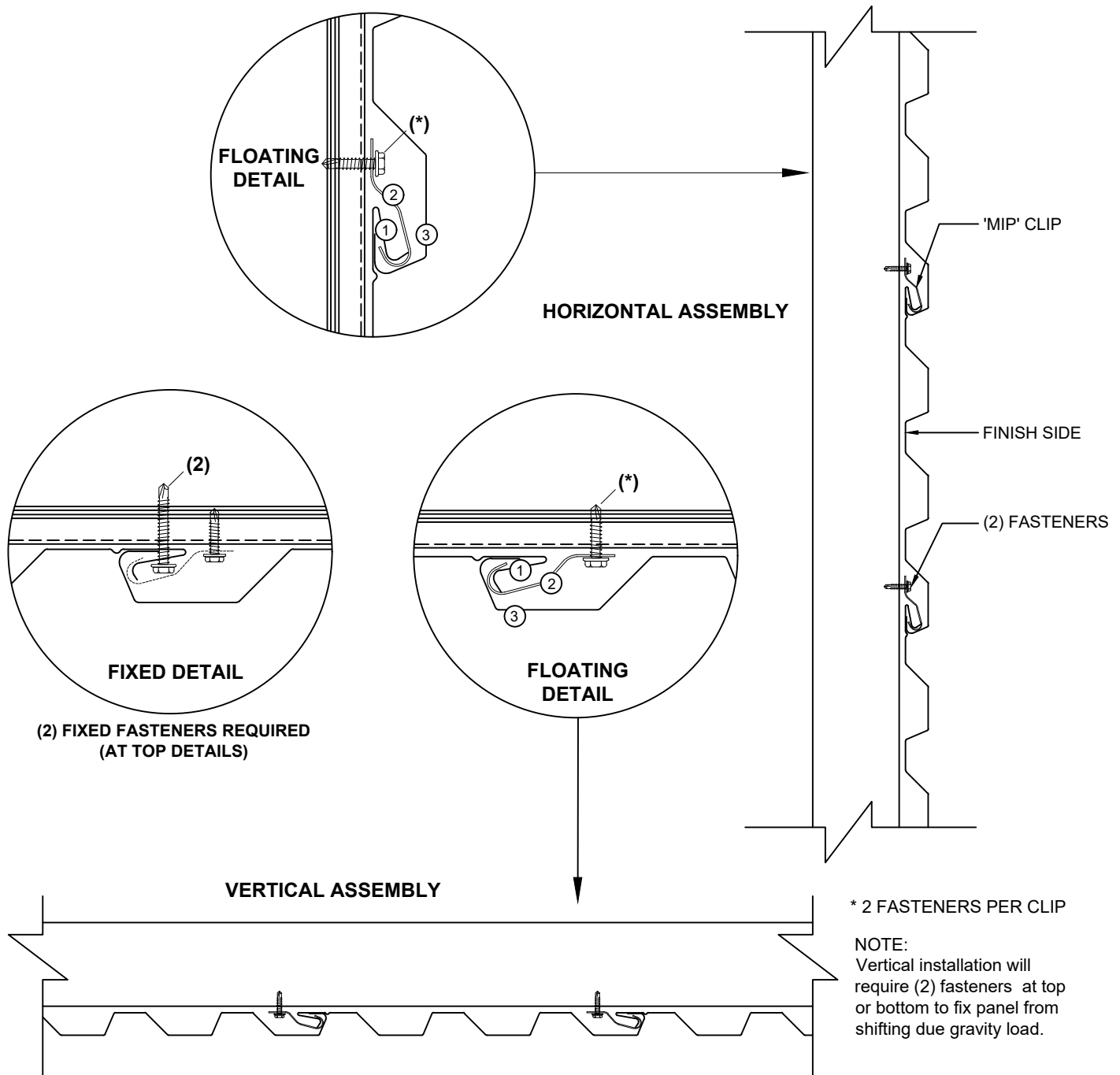


TOP VIEW

Panel Assembly

Horizontal Assemblies must be installed from bottom to top (base to roofline). This is crucial because the Integrity panel's interlocking system is not reversible. The clip holds the attaching leg and is secured first, then the next panel hooked over the clip with the interlocking leg slid ② into the pocket. ①

Vertical Assemblies are typically installed from left to right, however depending on construction requirements, can be installed in either direction. The clip holds the attaching leg and is secured first, then the next panel hooked over the clip into the pocket.



*NOTE: The numbers ① ② & ③ represent the order of assembly.

Morin Integrity Series



Testing

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

- ASTM E1592- Uplift Test
- ASTM E283 - Air Infiltration Test
- ASTM E331 - Water Infiltration Test

Installing Integrity Series for Vertical and Horizontal Applications

- Check approved shop drawings to building.
- Check panel layout per approved shop drawing.
- Check panel module. (Panel widths are nominal coverage which may affect layout.)
- Check panel squareness.
- Set benchmark around building to determine panel layout to approved shop drawings.
- Layout fasteners for panel framing attachment, calculation, side lap and end lap.
- Measure out framing attachment and allow for panel end lap and side lap. (End laps must be at a framing member.)
- Install base trim straight and level around perimeter of building.
- Level first panel, first course, and install from the bottom up.
- Install sealant as required per approved shop drawings.
- Check panel level and module at each course as installed.
- Install door and window heads trim.
- Complete flashing and trim installation per approved shop drawings.

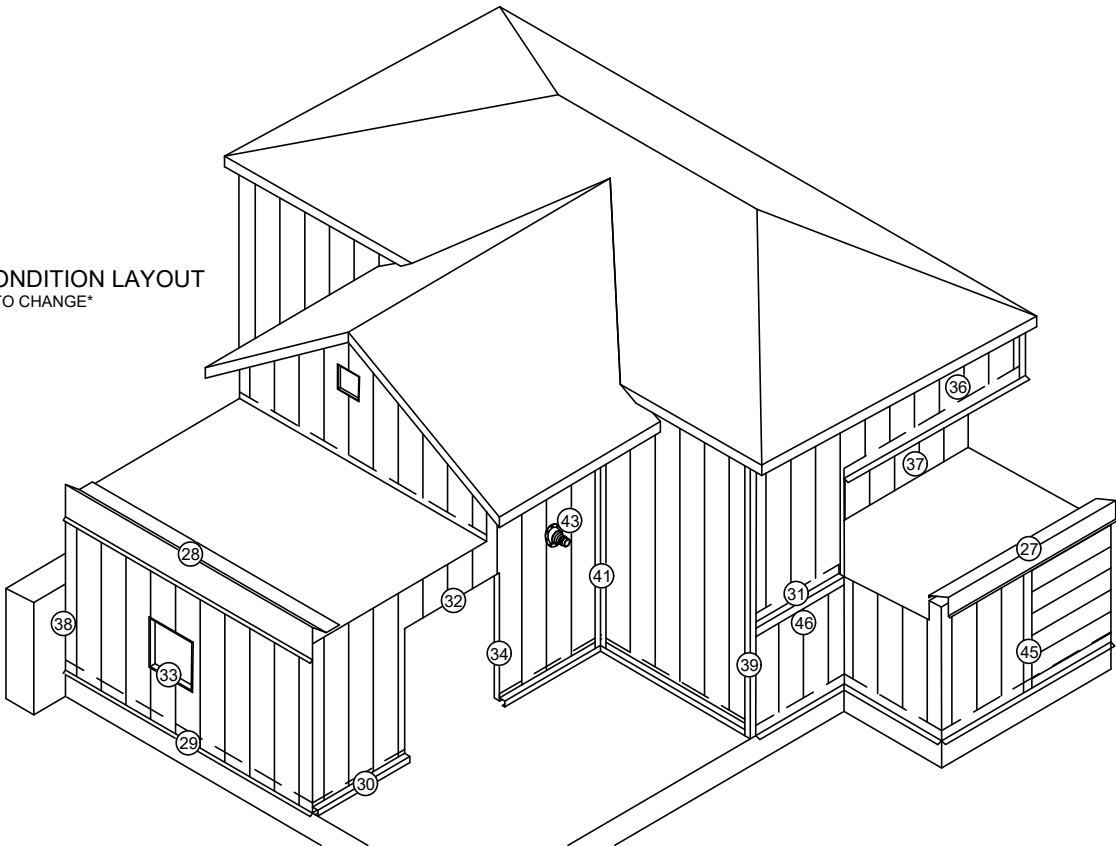
Morin Integrity Series

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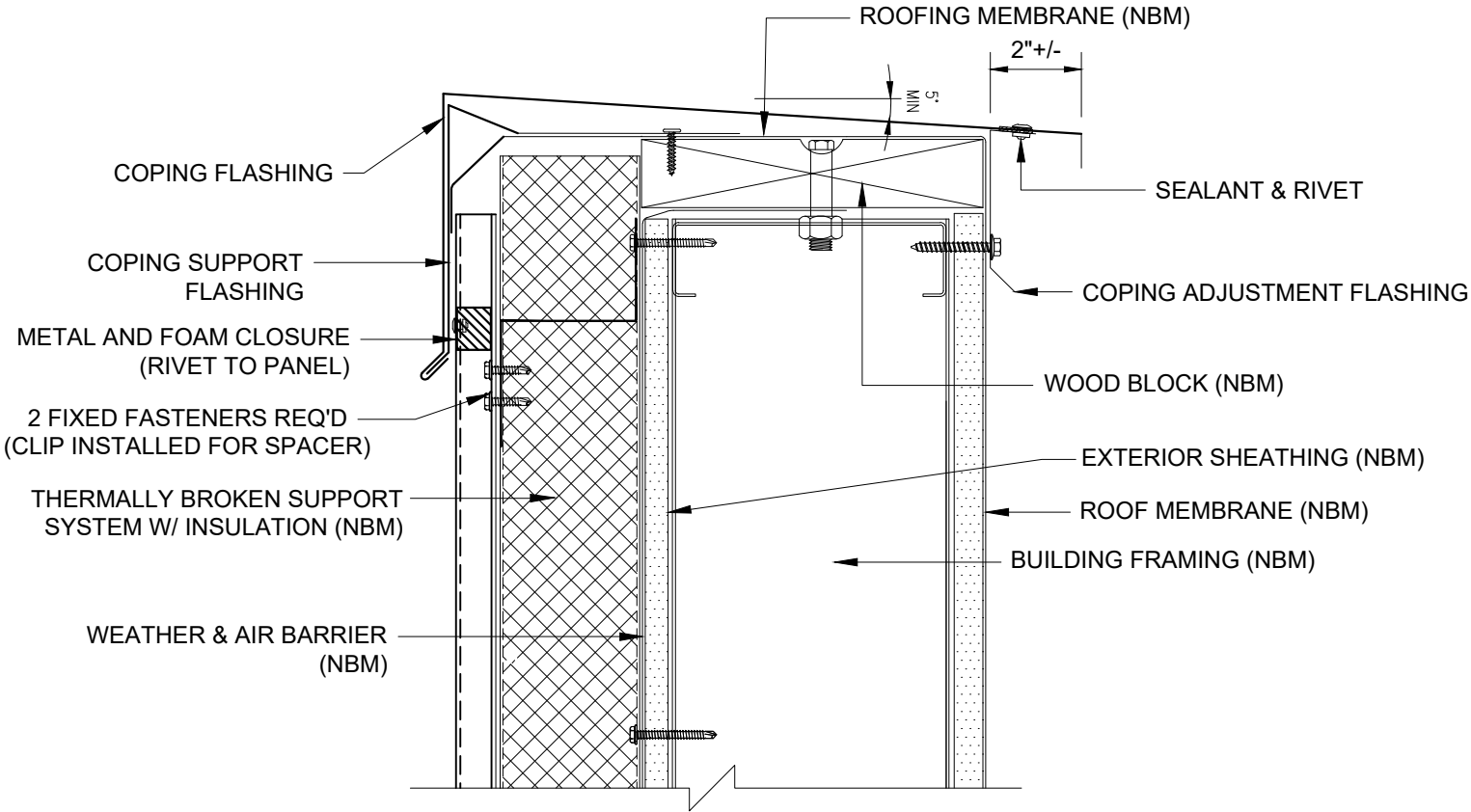


TYPICAL WALL CONDITION LAYOUT
 SUBJECT TO CHANGE



Morin Integrity Series

Vertical Installation

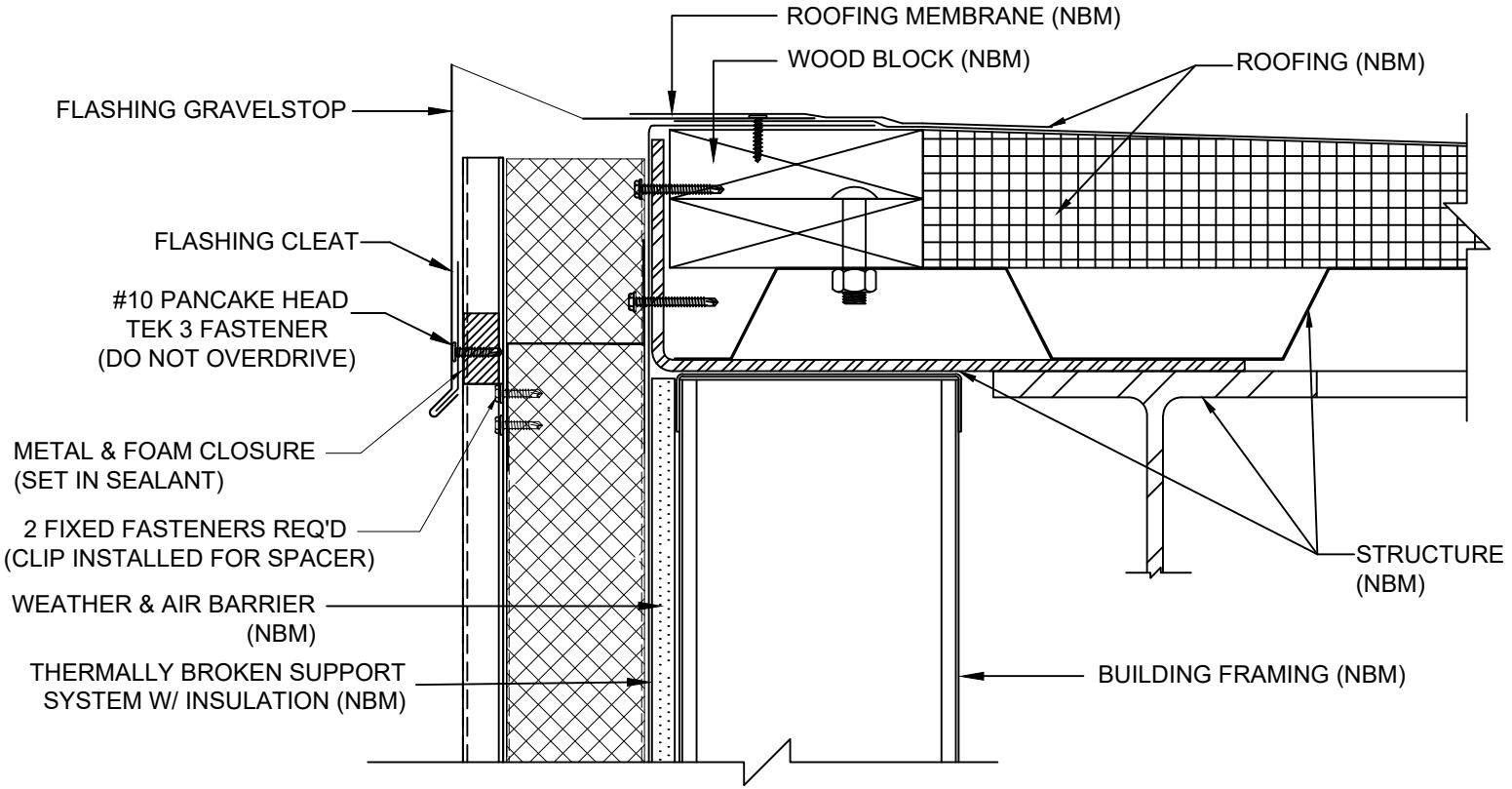


COPING DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

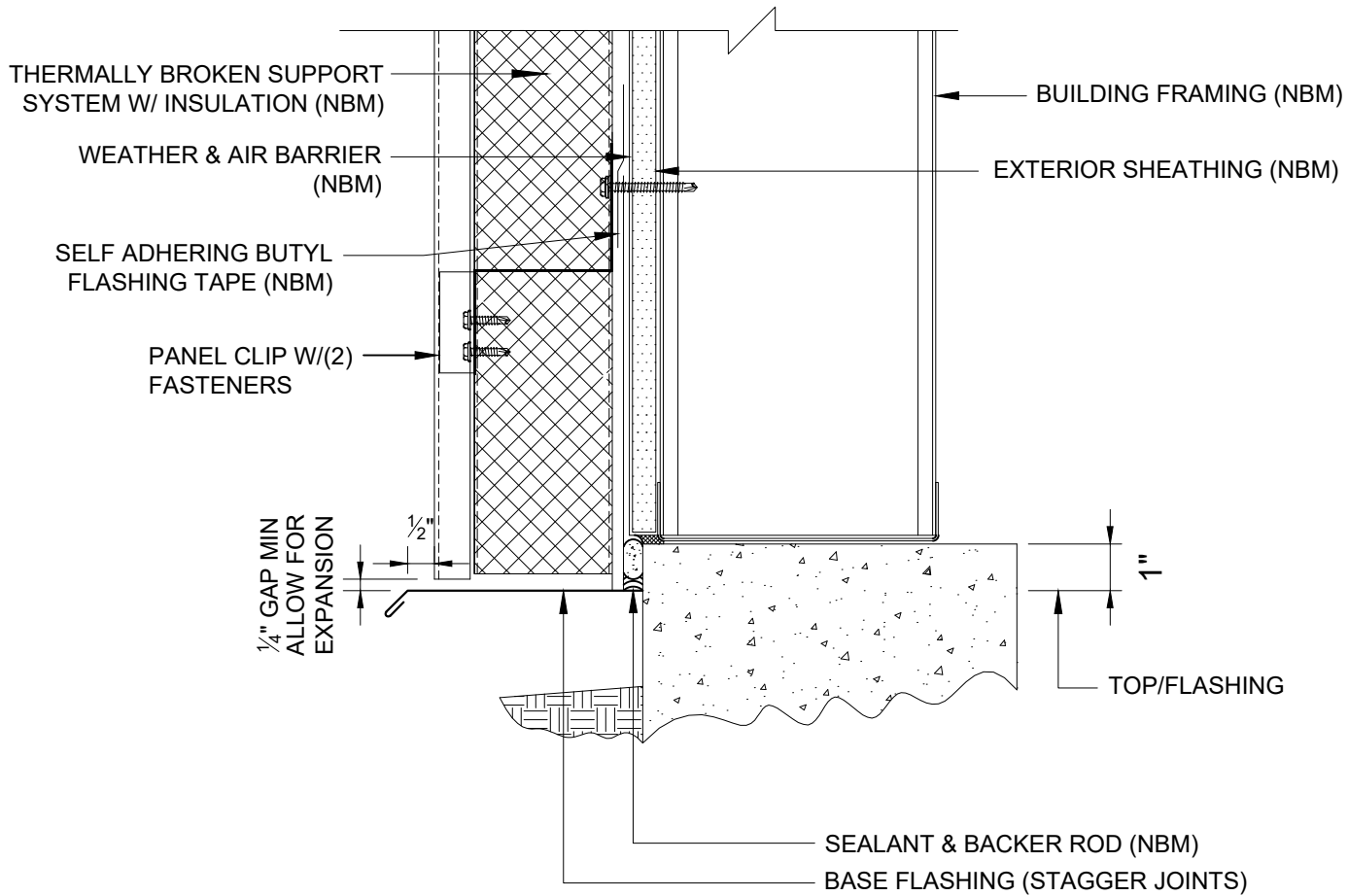


GRAVELSTOP DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

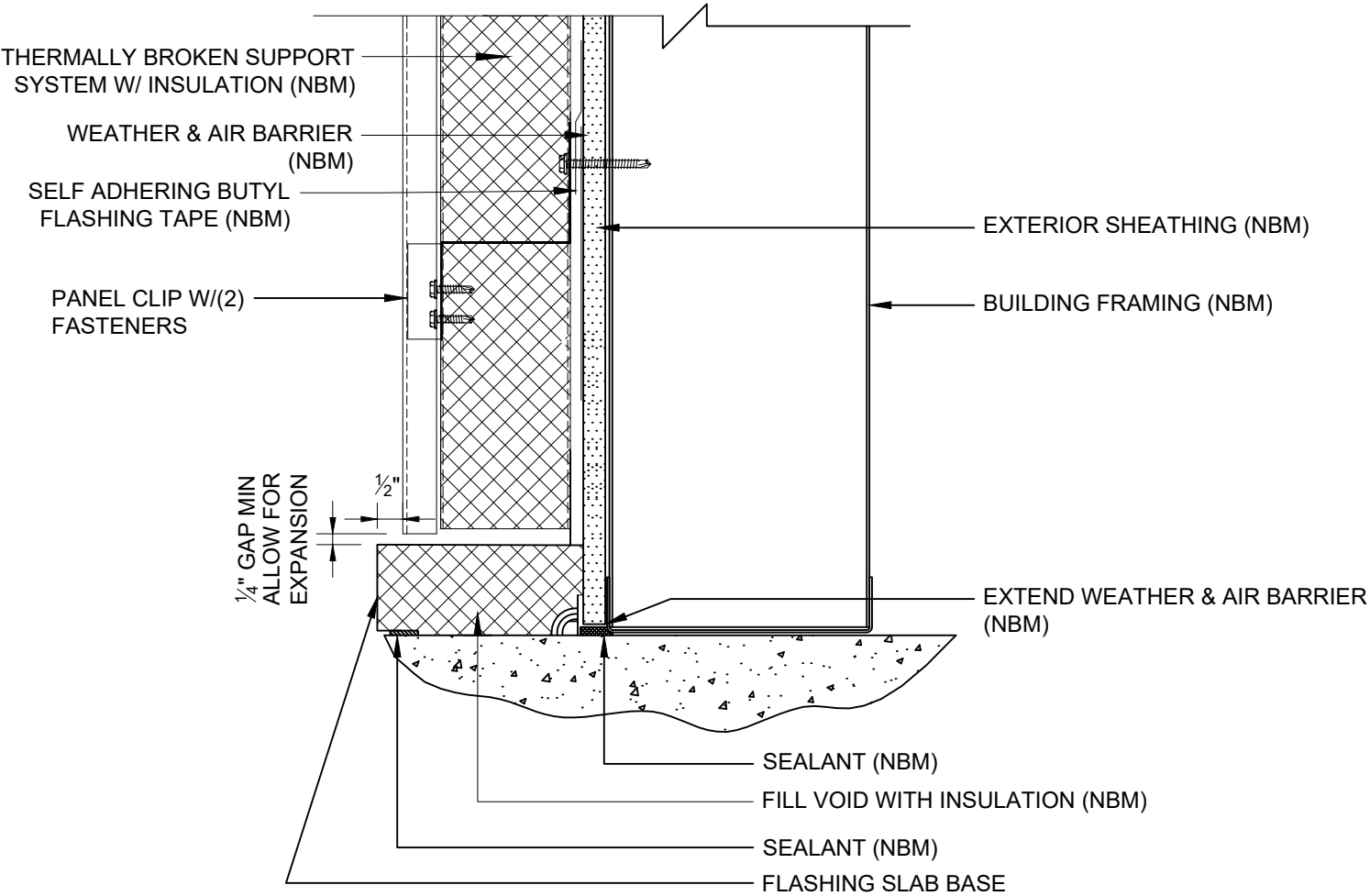


BASE AT CURB OR EDGE OF SLAB DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

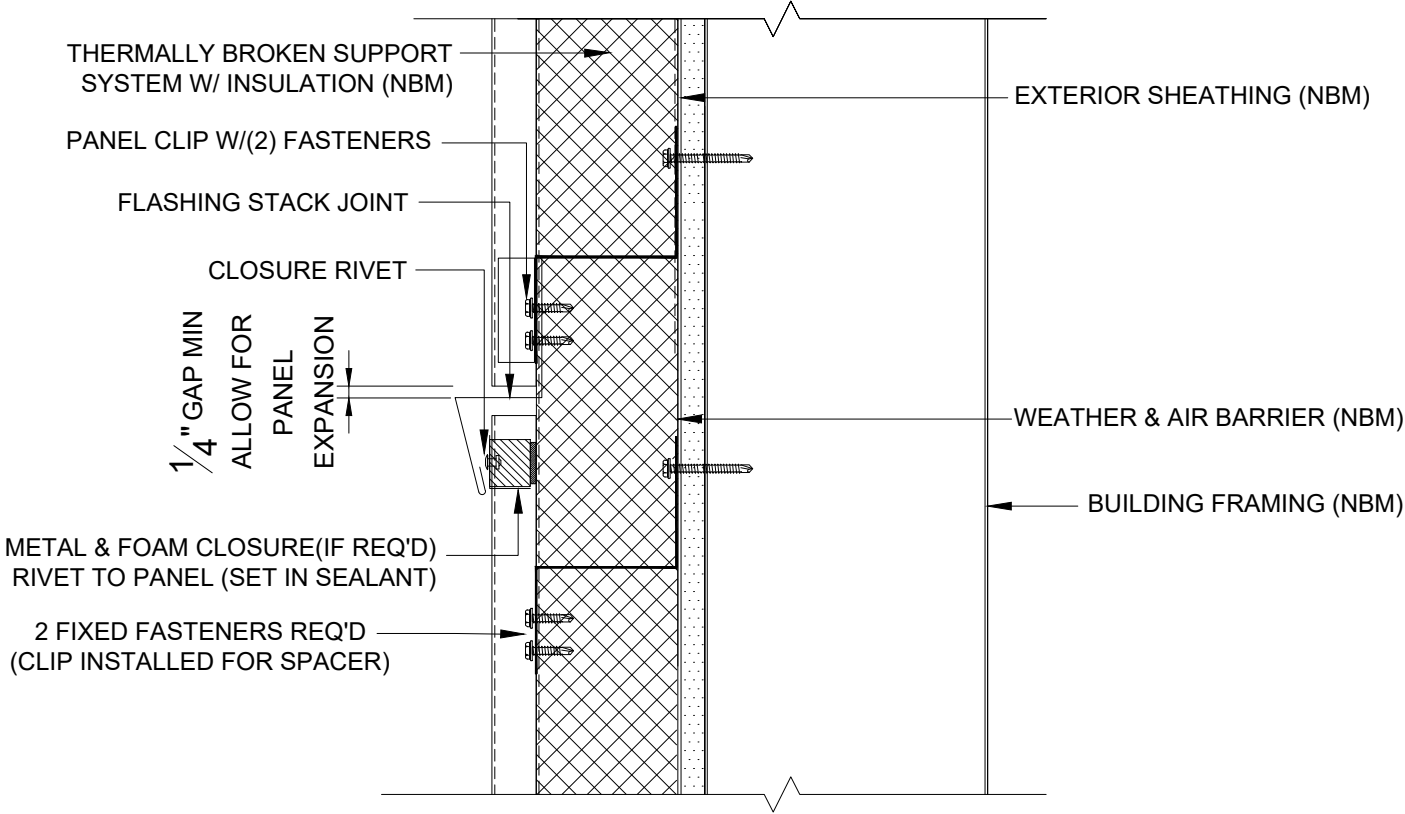


BASE AT SLAB DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

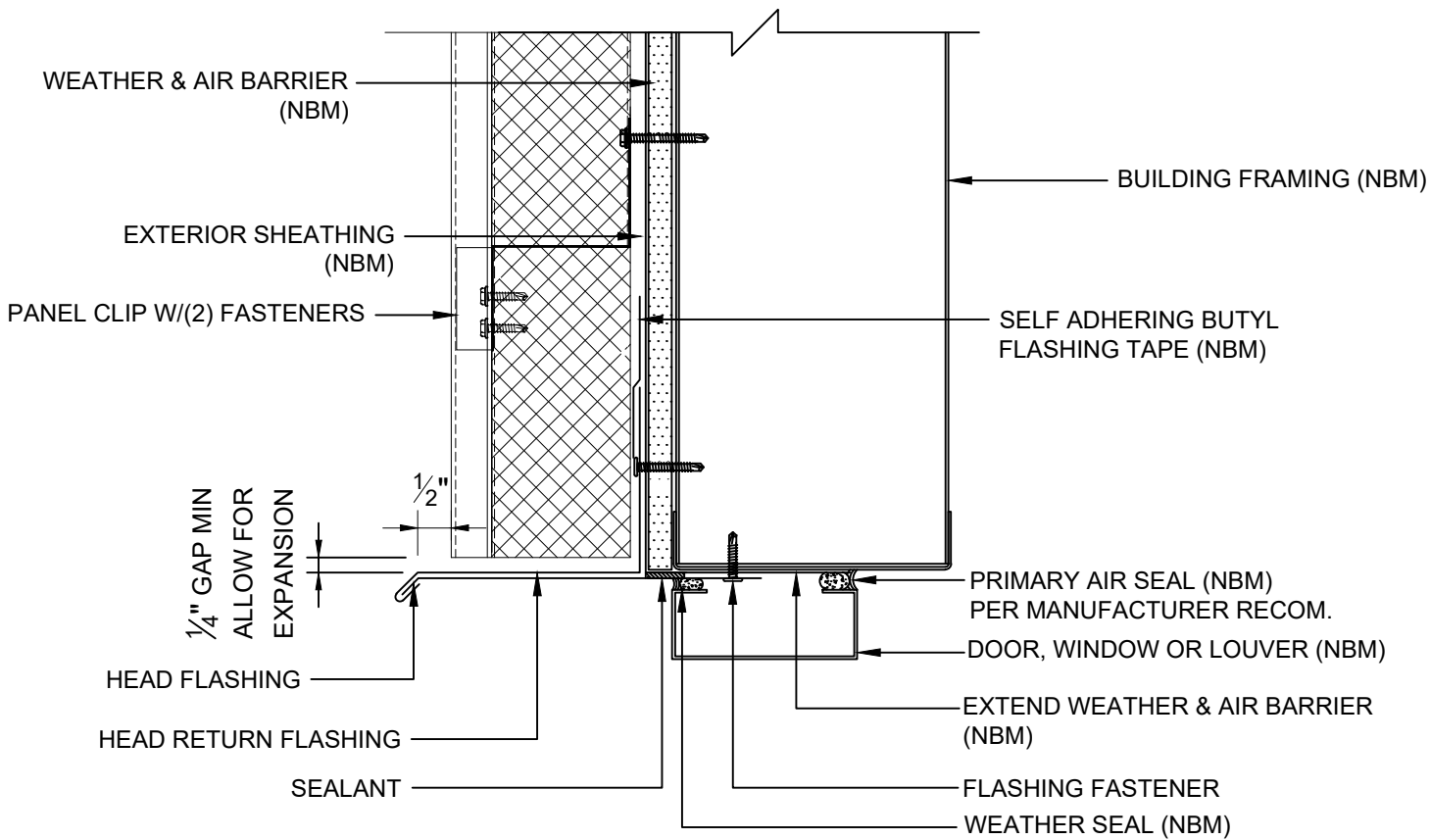


STACK JOINT DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

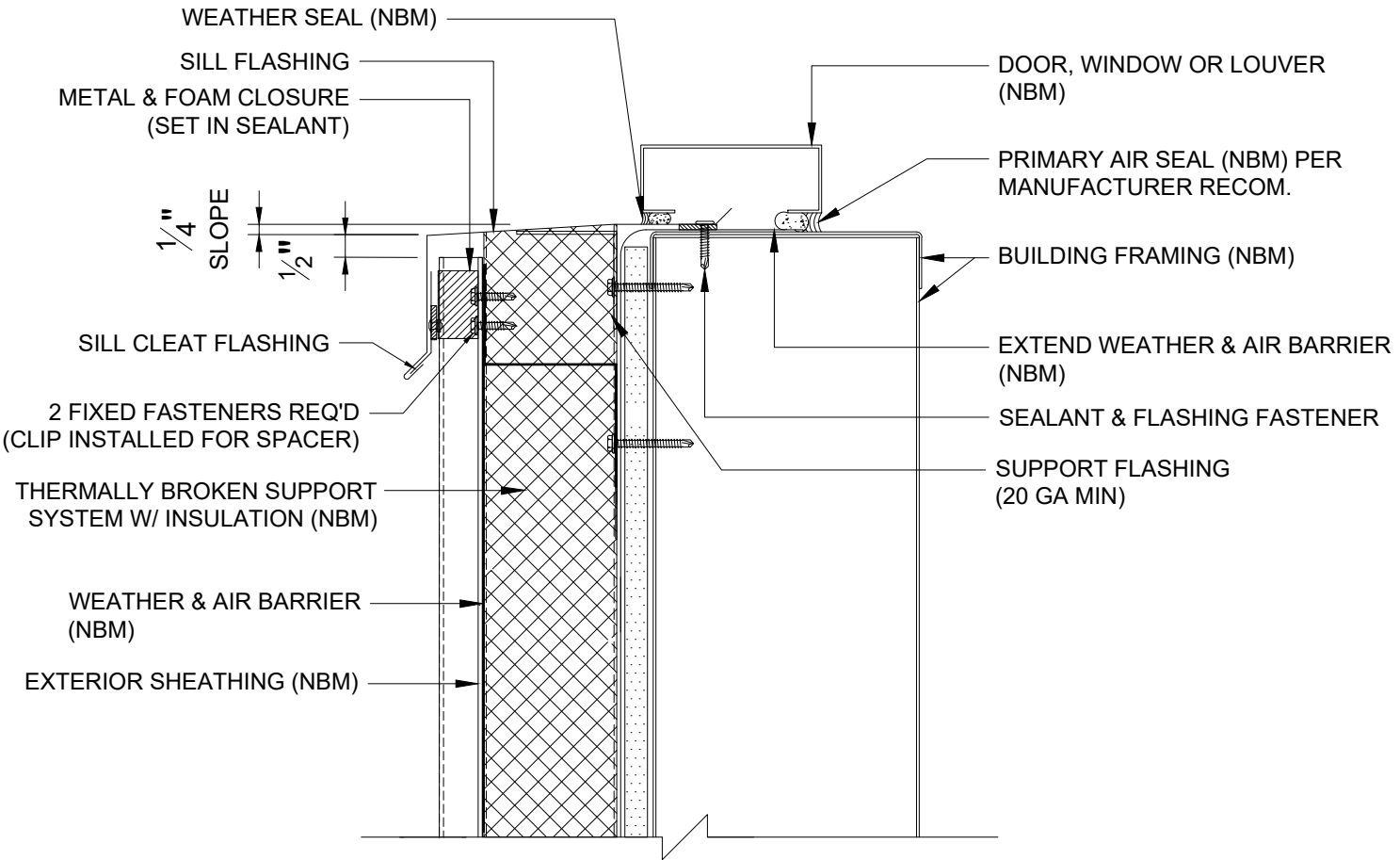


DOOR/WINDOW/LOUVER HEAD DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

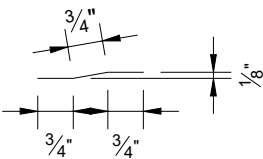
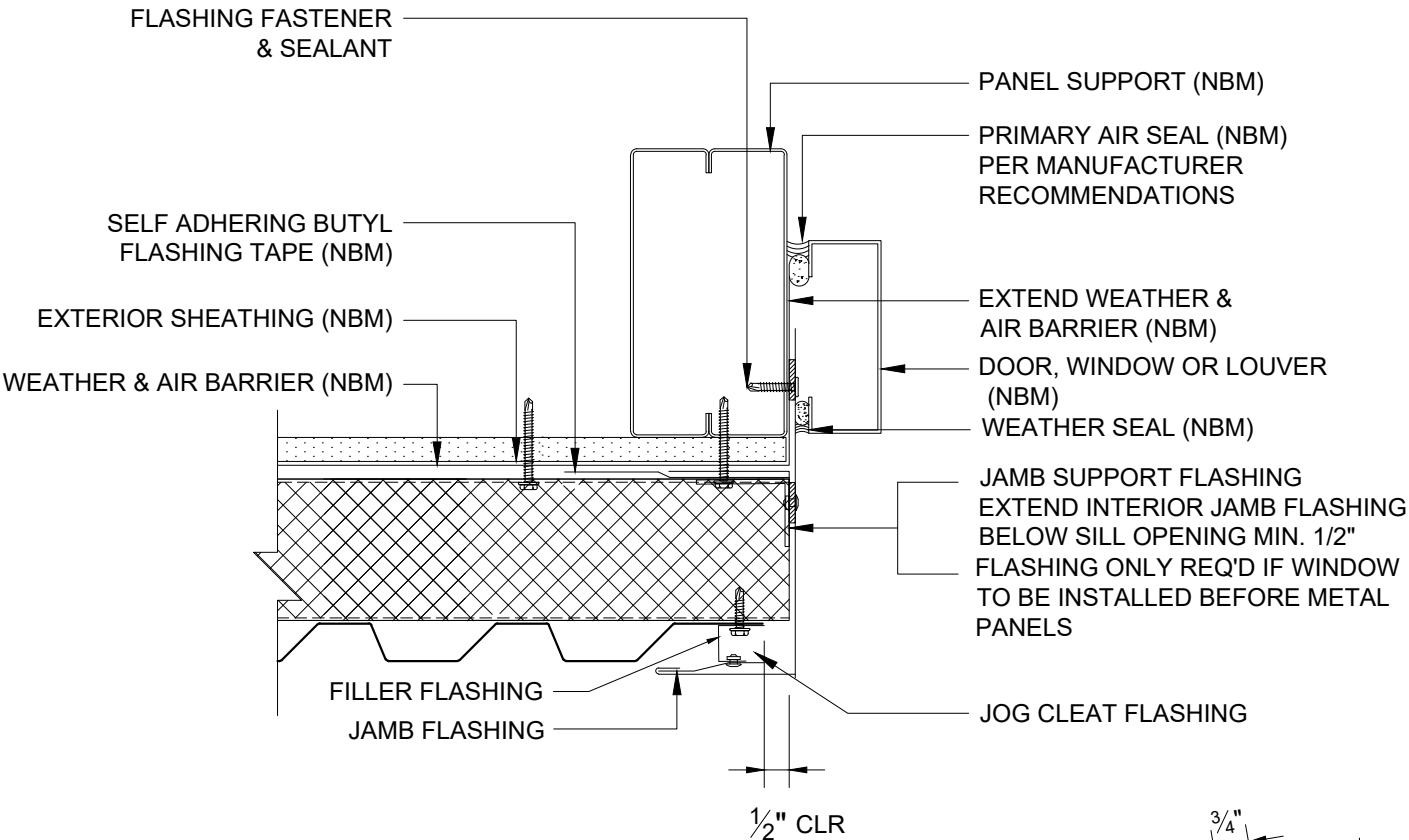


DOOR/WINDOW/LOUVER SILL DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

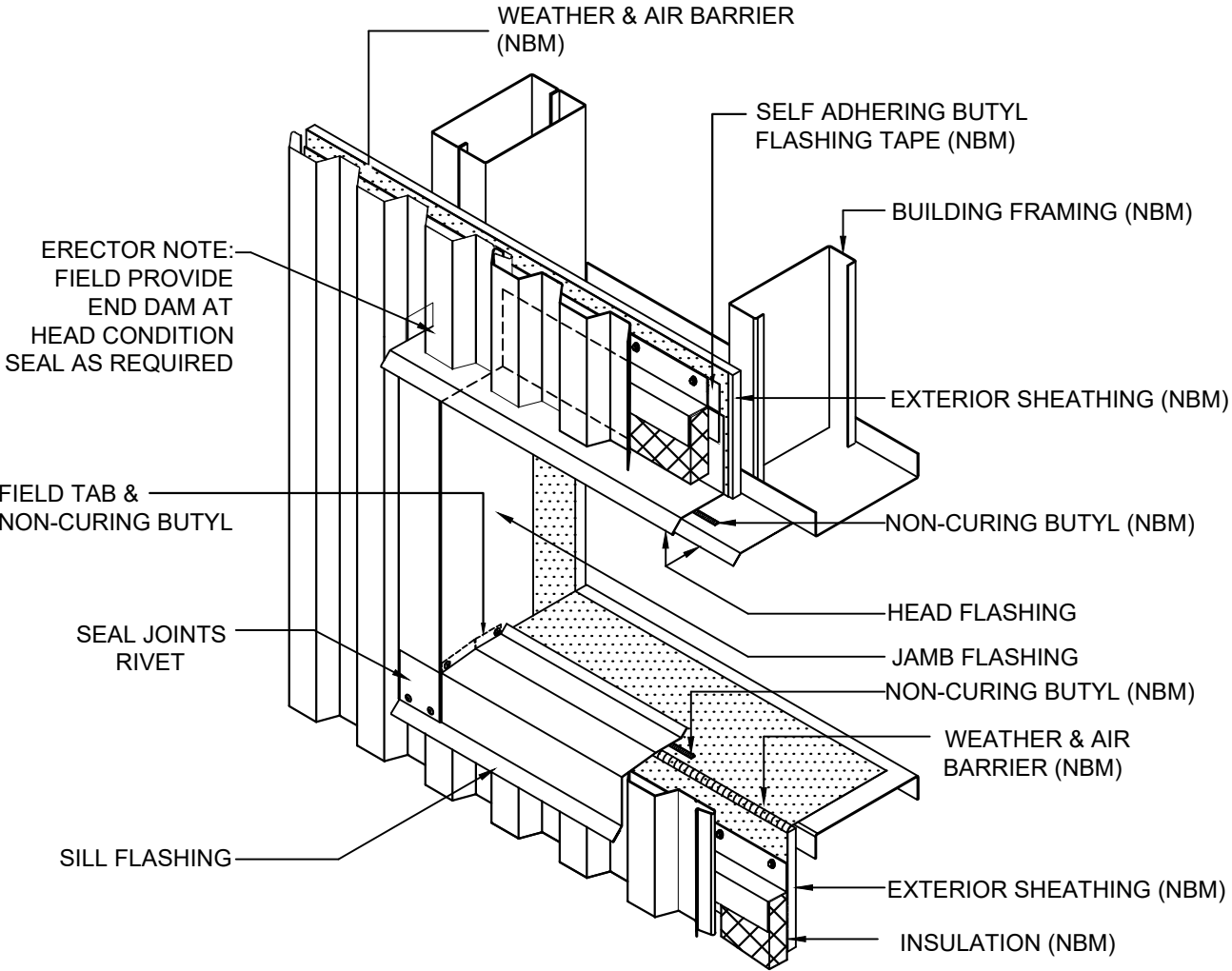


DOOR/WINDOW/LOUVER JAMB DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

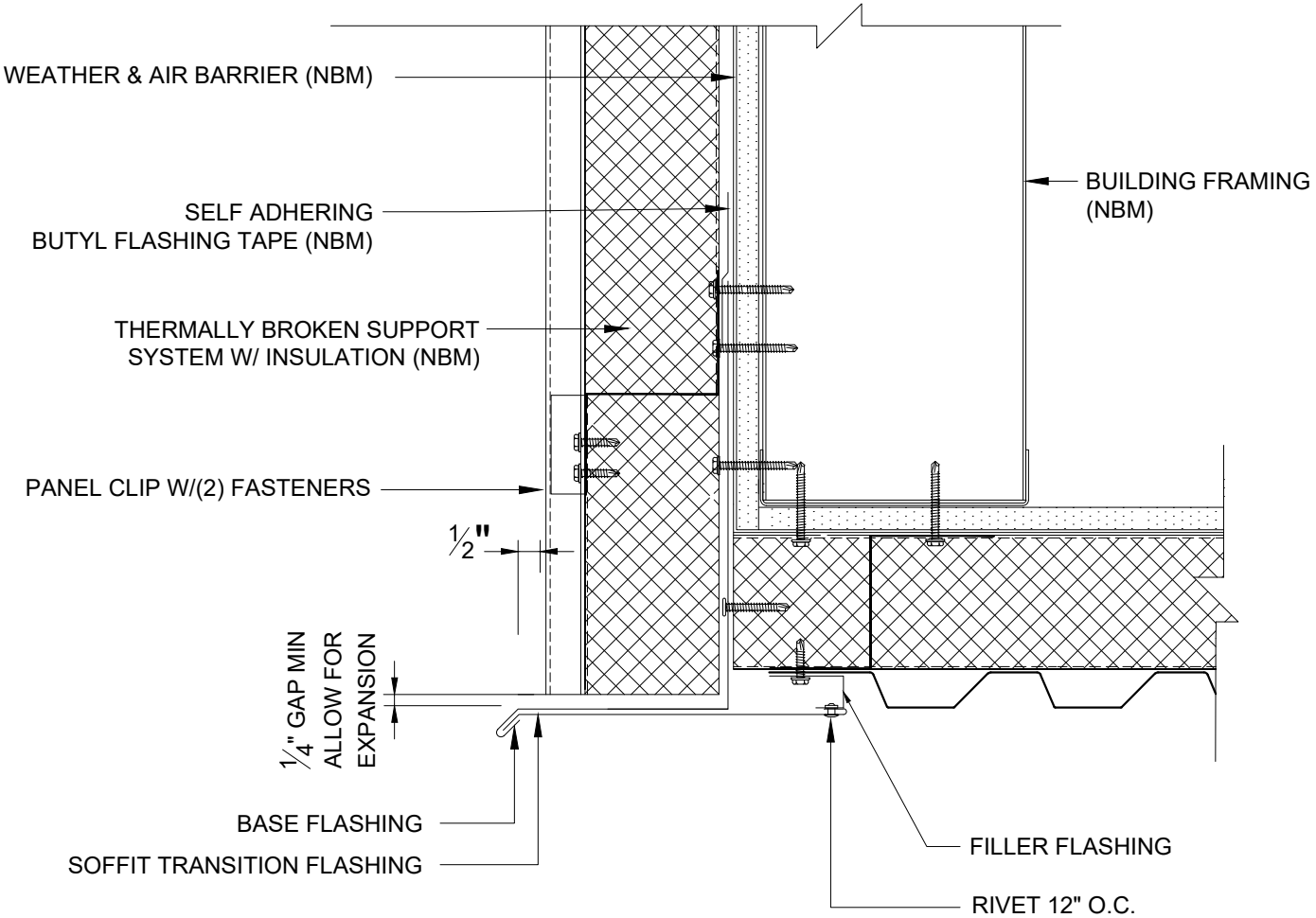


INTERSECTION OF HEAD, SILL & JAMB DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

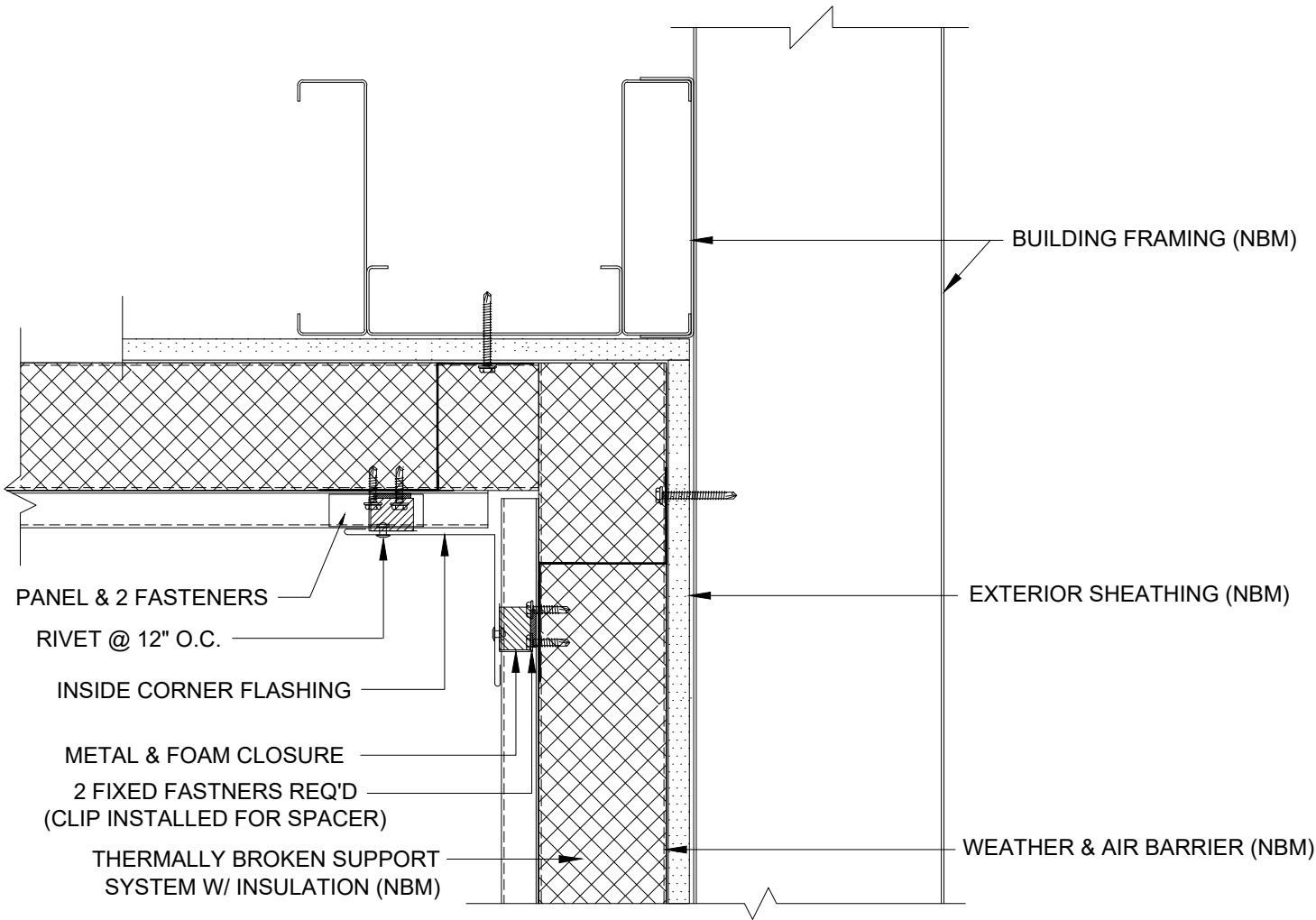


FRONT SOFFIT DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

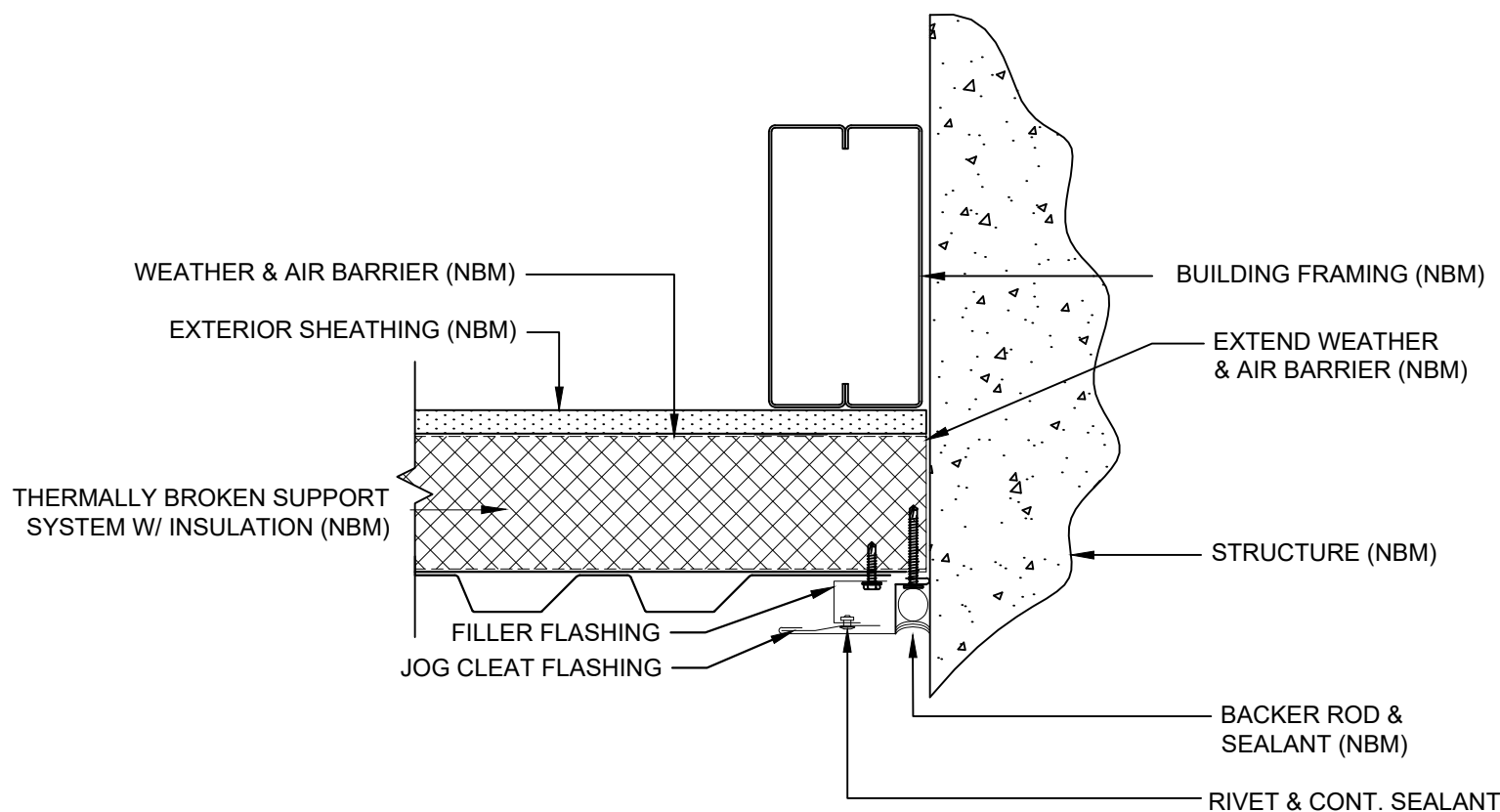


BACK SOFFIT DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

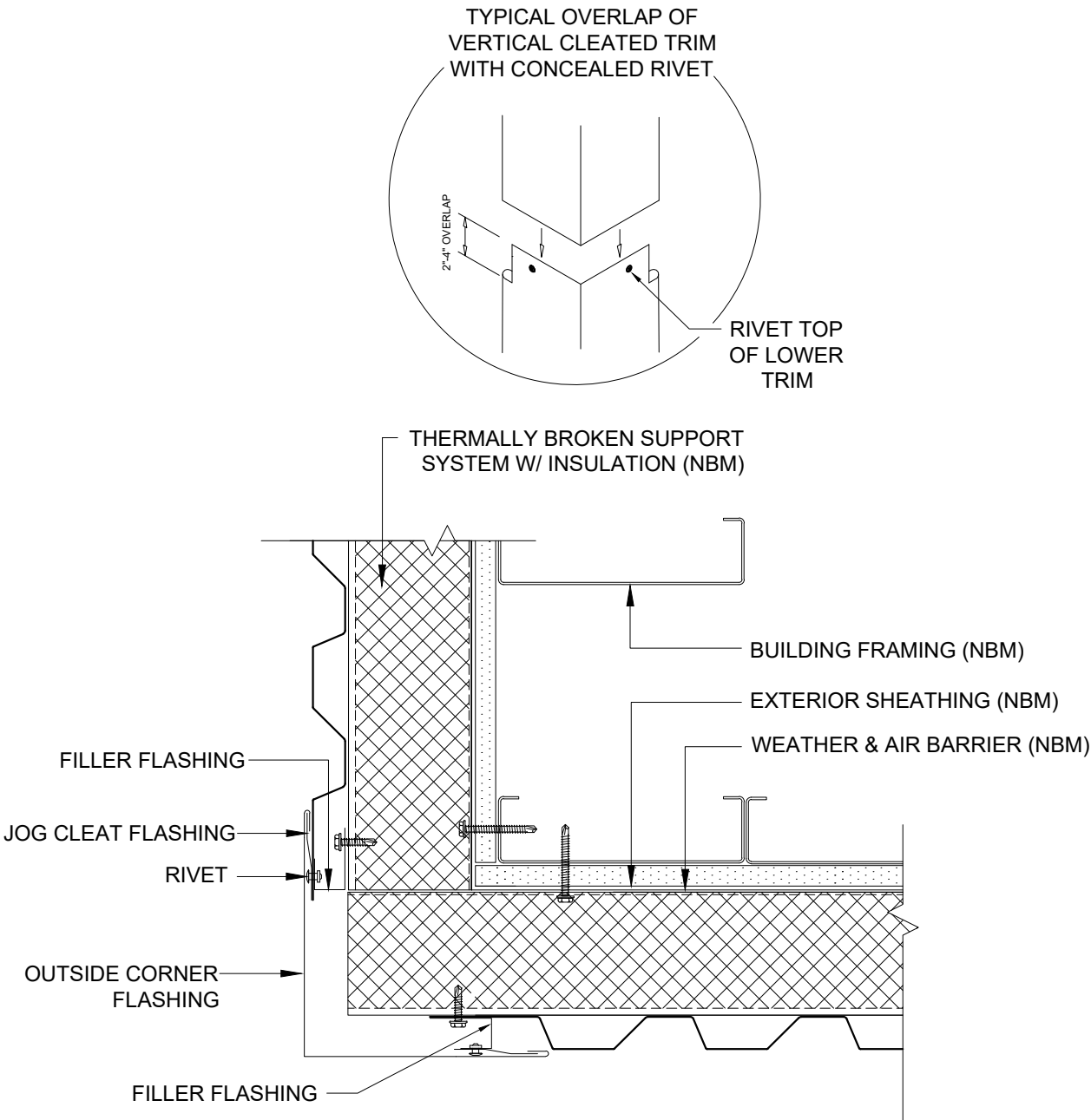


ENDWALL DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

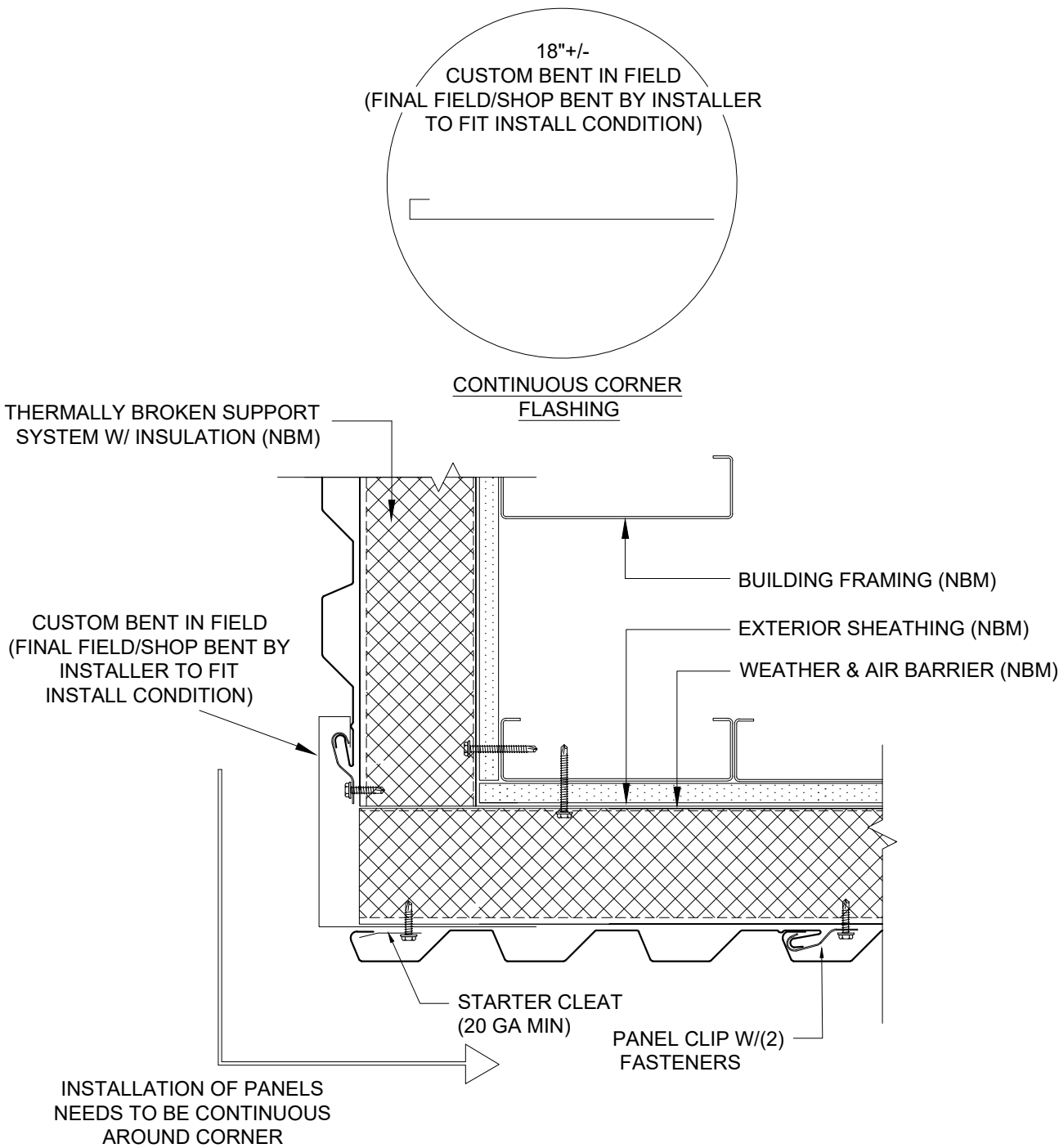


OUTSIDE CORNER DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

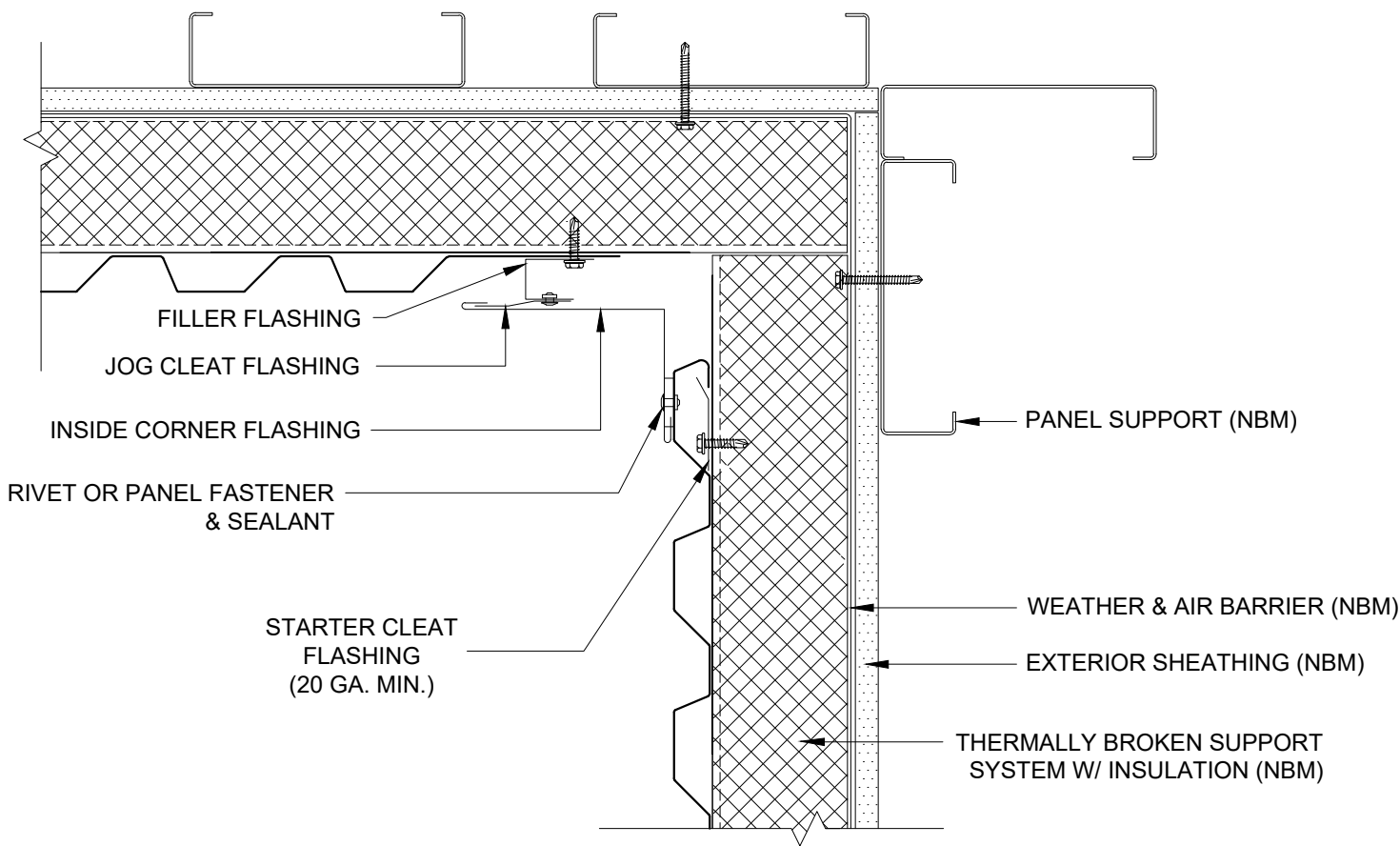


CONTINUOUS CORNER DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

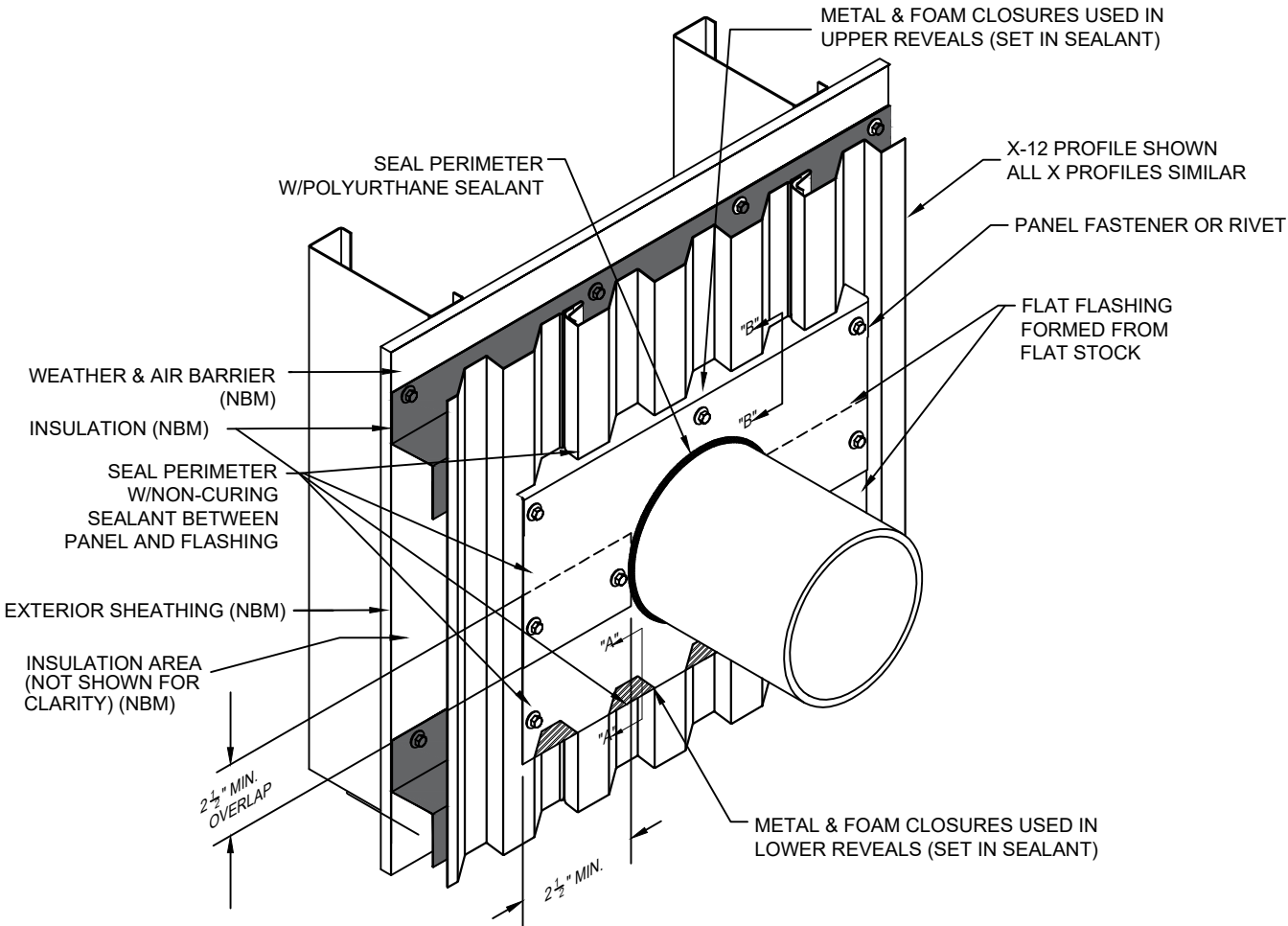


INSIDE CORNER DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation

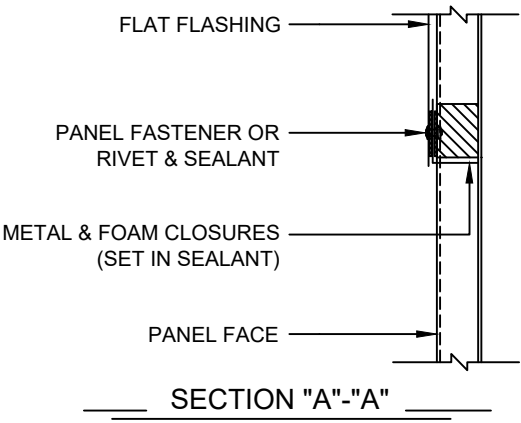
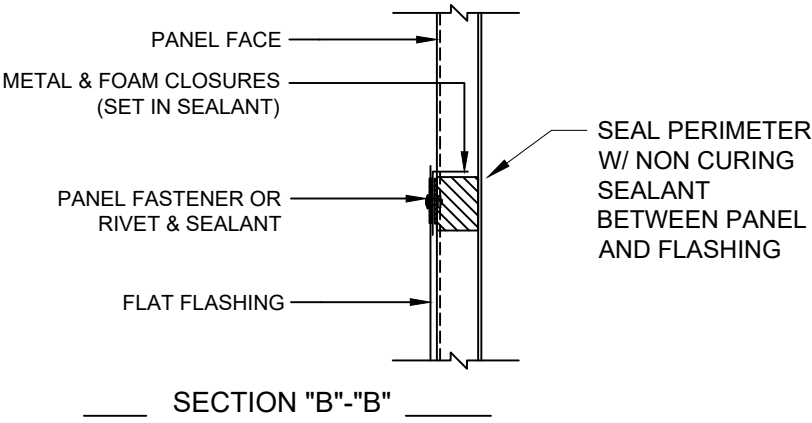


PENETRATION ISOMETRIC

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation



PENETRATION DETAIL

*NBM=(NOT BY MORIN)

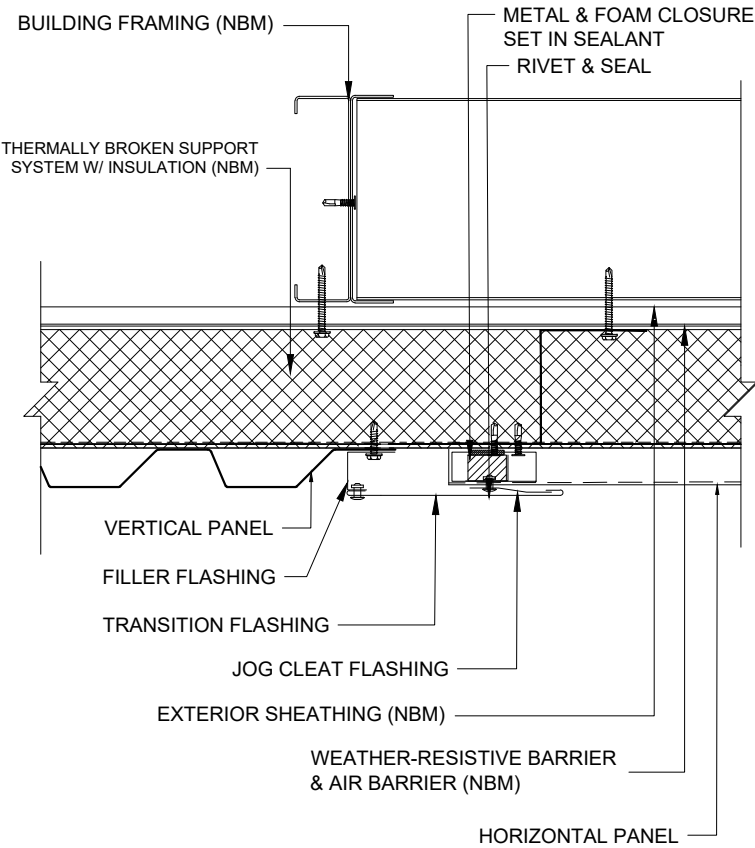
Morin[®]
By Kingspan



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Morin Integrity Series

Vertical Installation

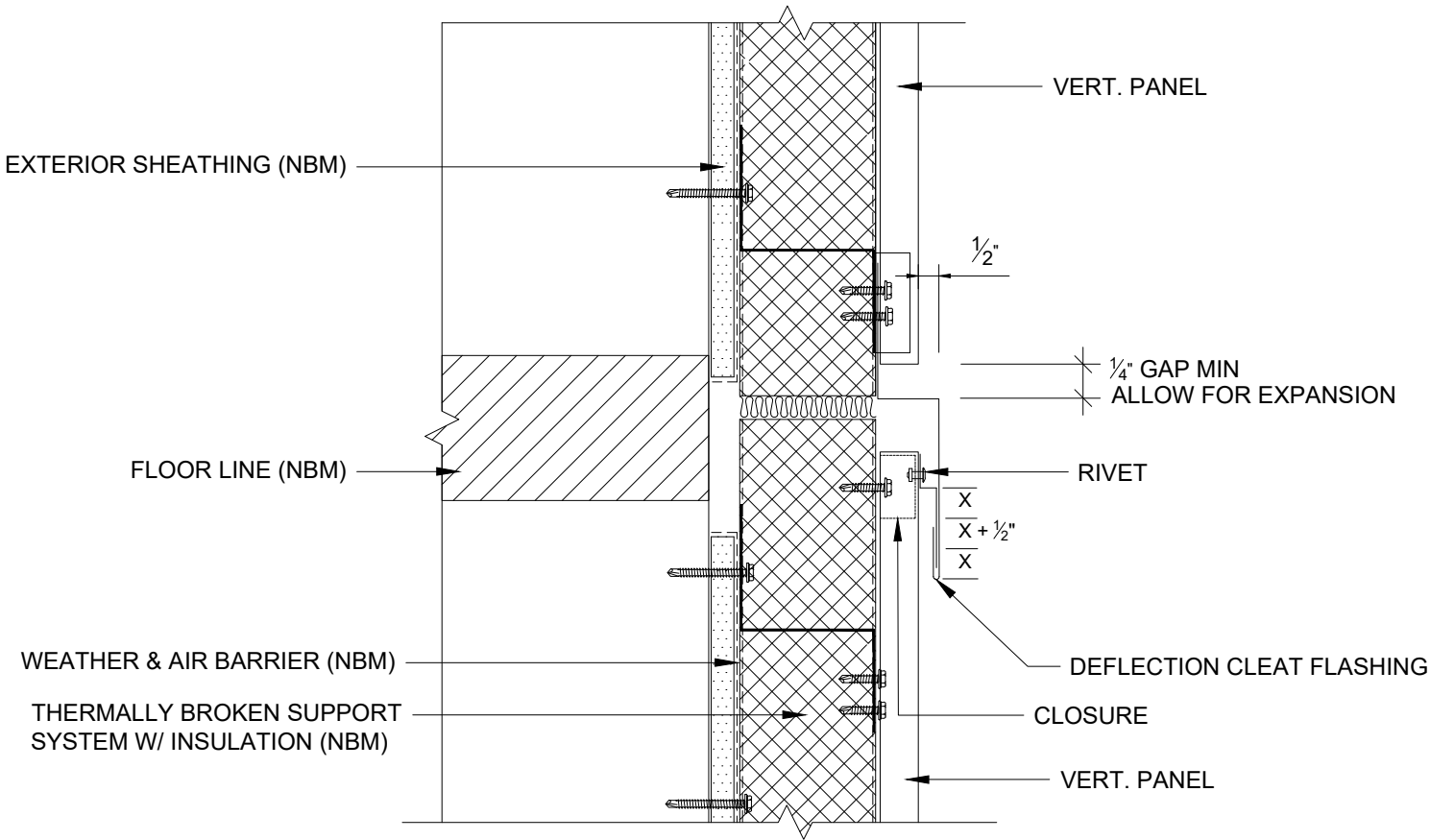


TRANSITION DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Vertical Installation



DEFLECTION/FLOOR SHRINKAGE JOINT DETAIL

*NBM=(NOT BY MORIN)

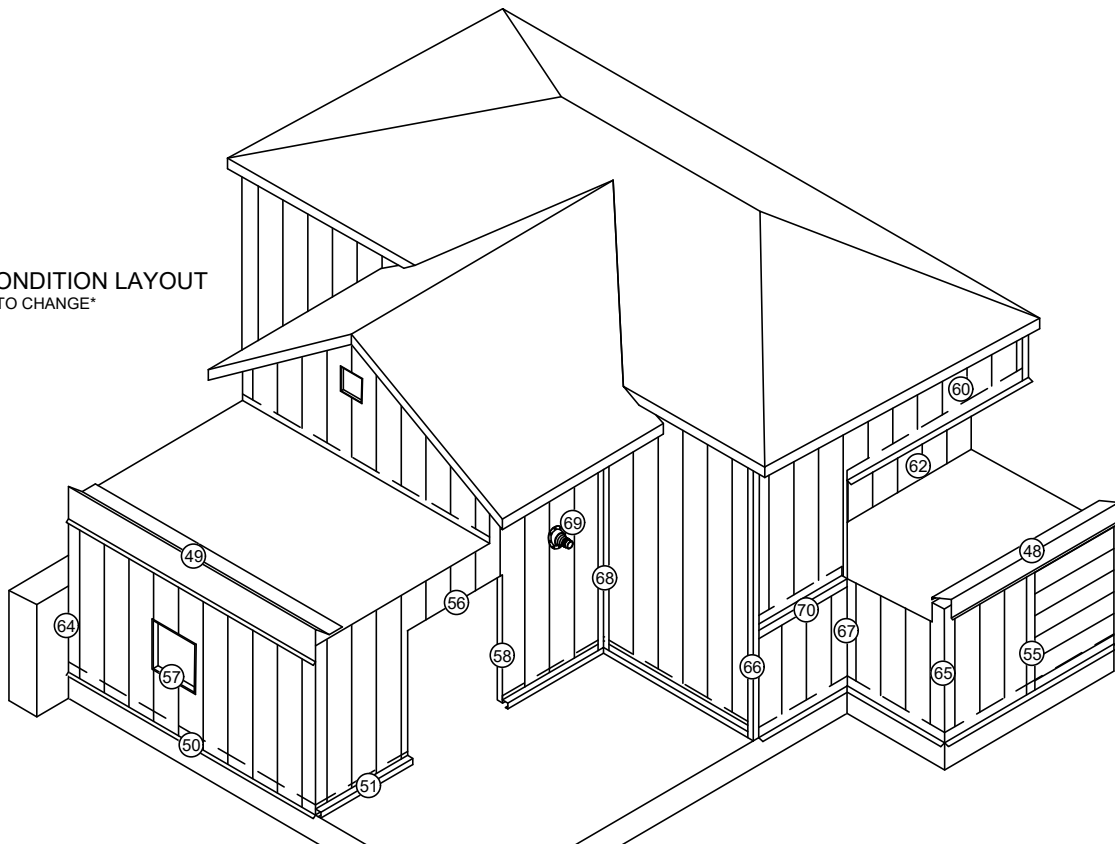
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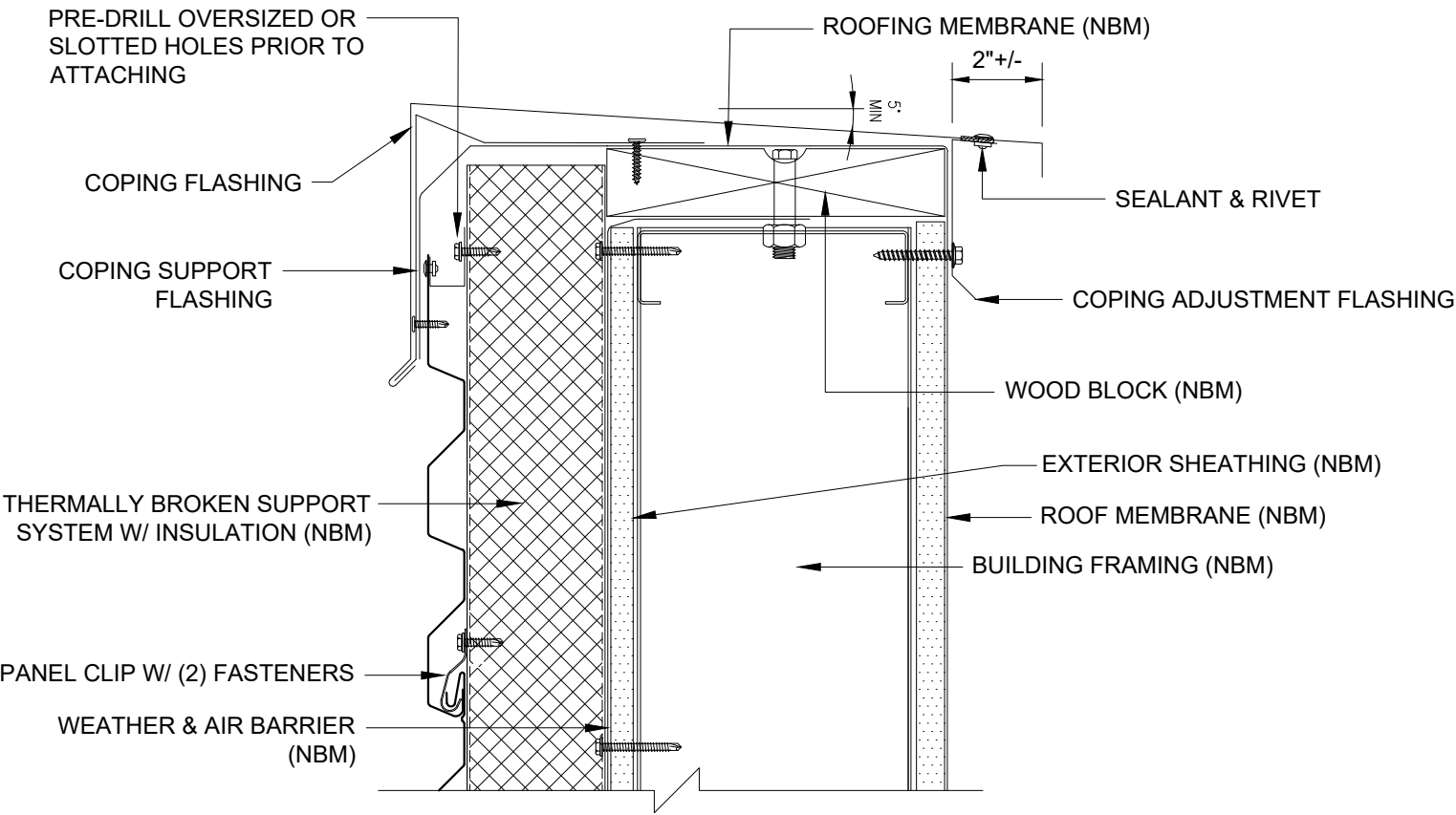


TYPICAL WALL CONDITION LAYOUT
SUBJECT TO CHANGE



Morin Integrity Series

Horizontal Installation

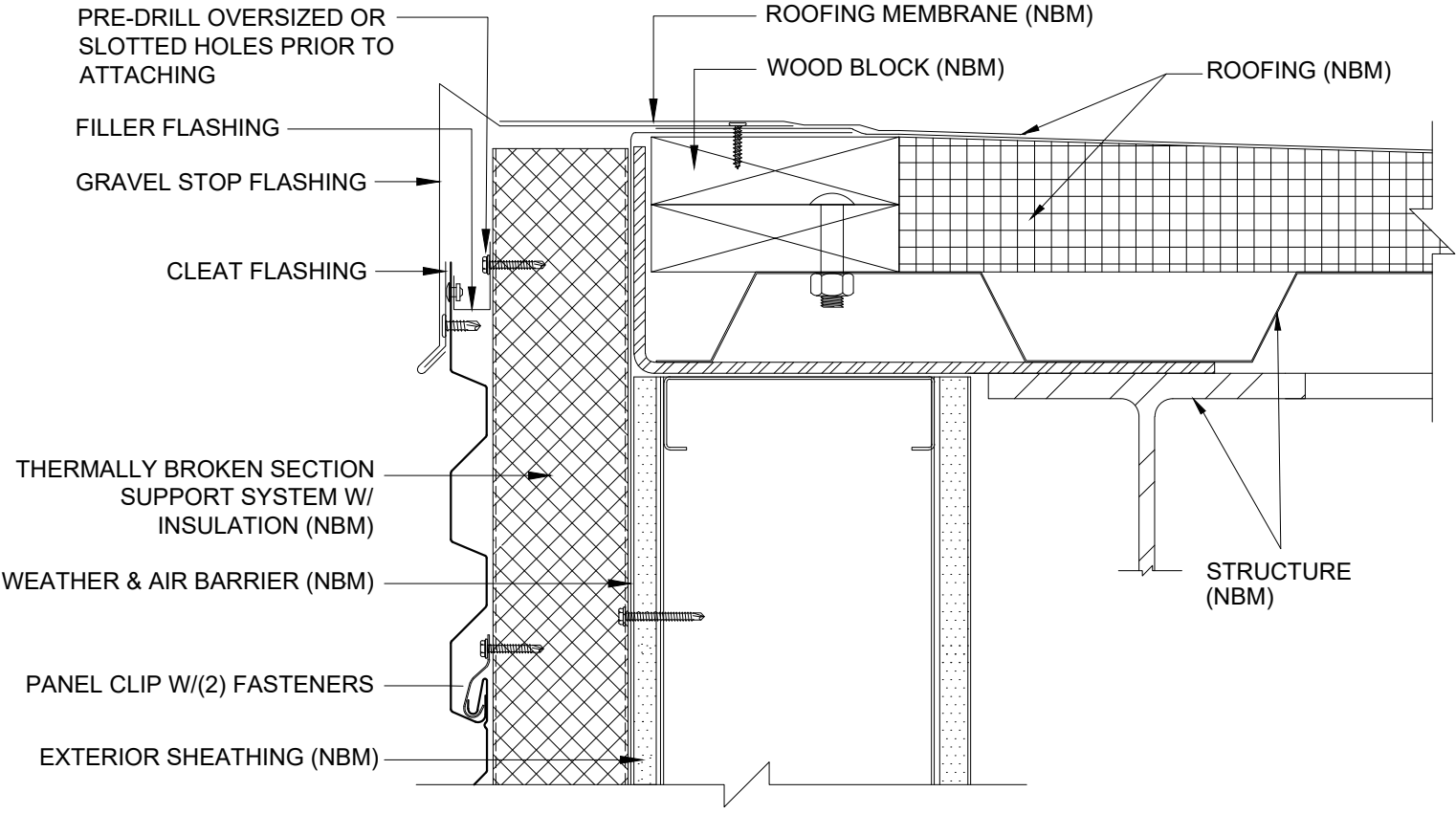


COPING DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation



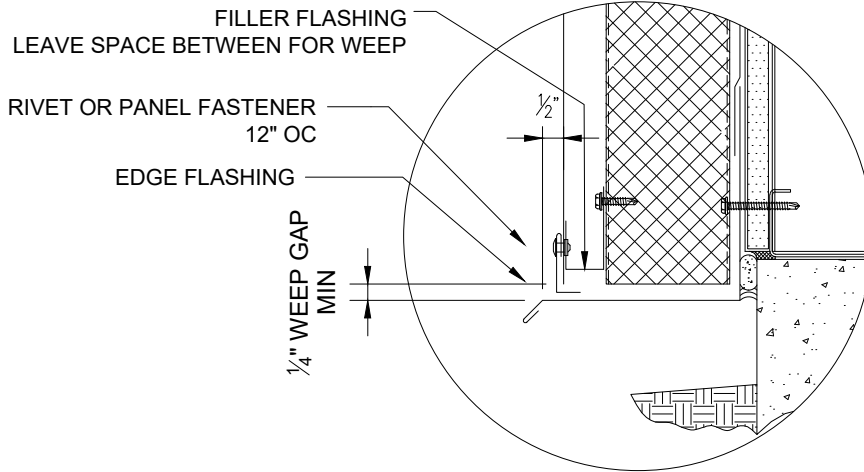
GRAVELSTOP DETAIL

*NBM=(NOT BY MORIN)

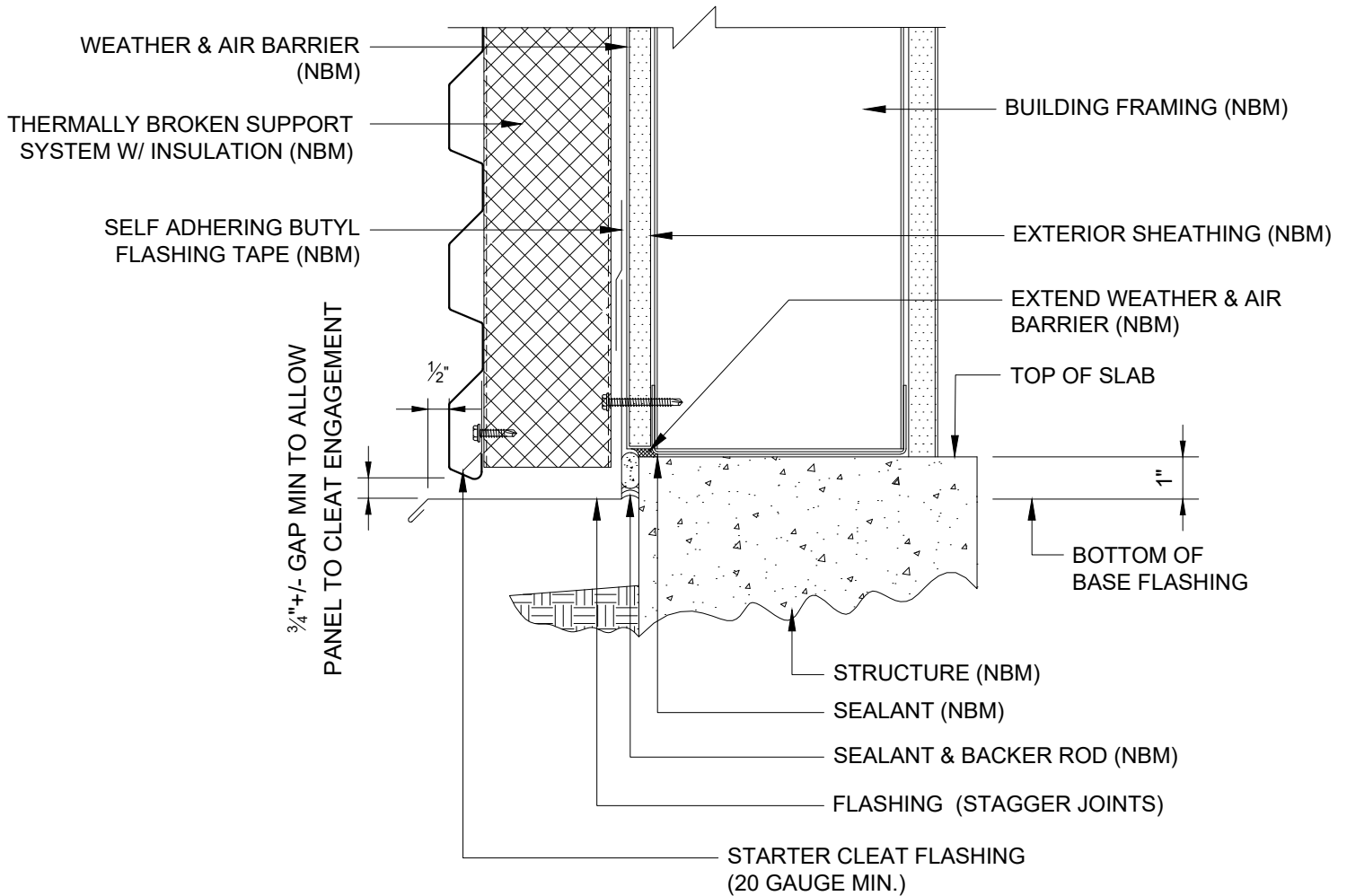
Morin Integrity Series

Horizontal Installation

Morin
By Kingspan



OPTIONAL DETAIL

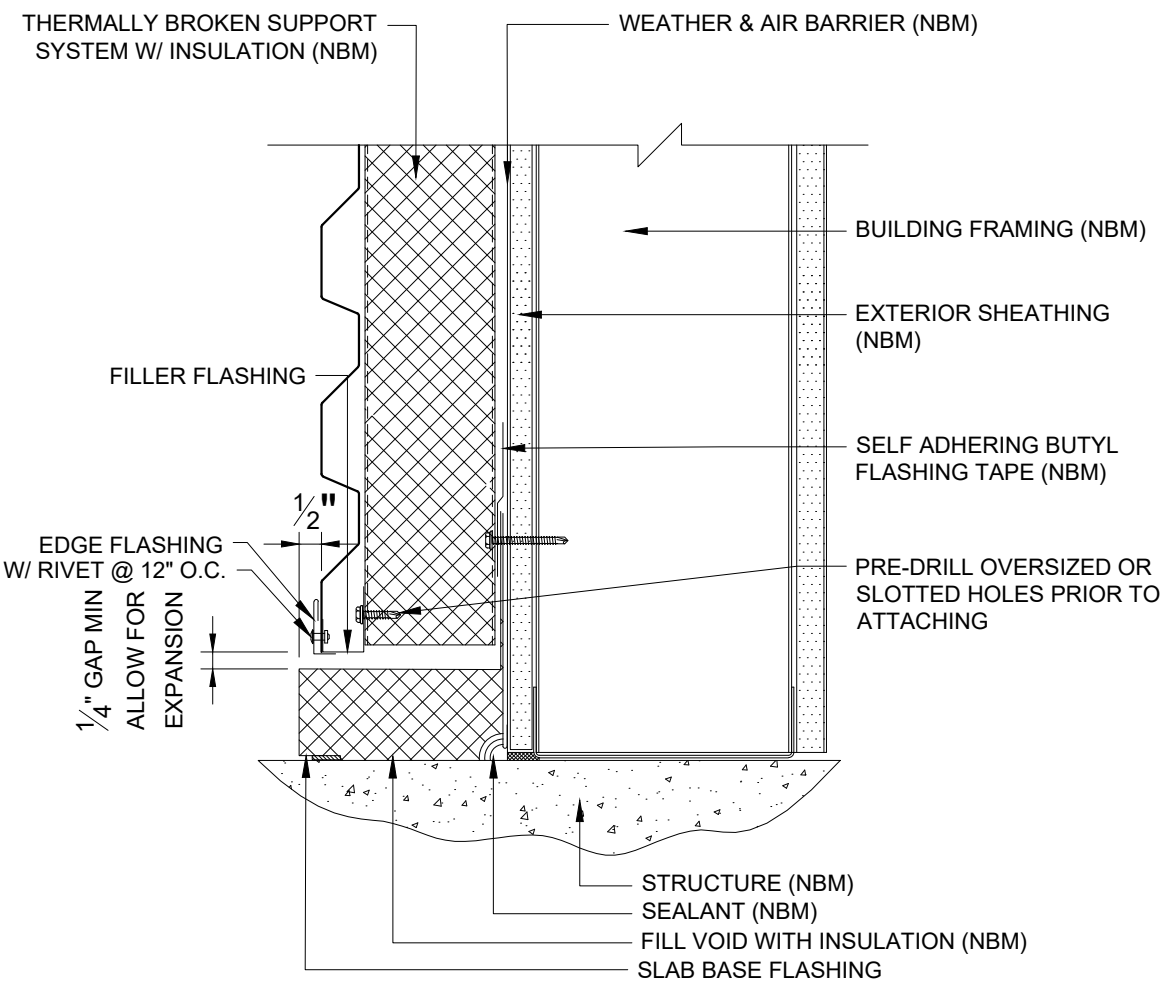


BASE AT CURB OR EDGE OF SLAB DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

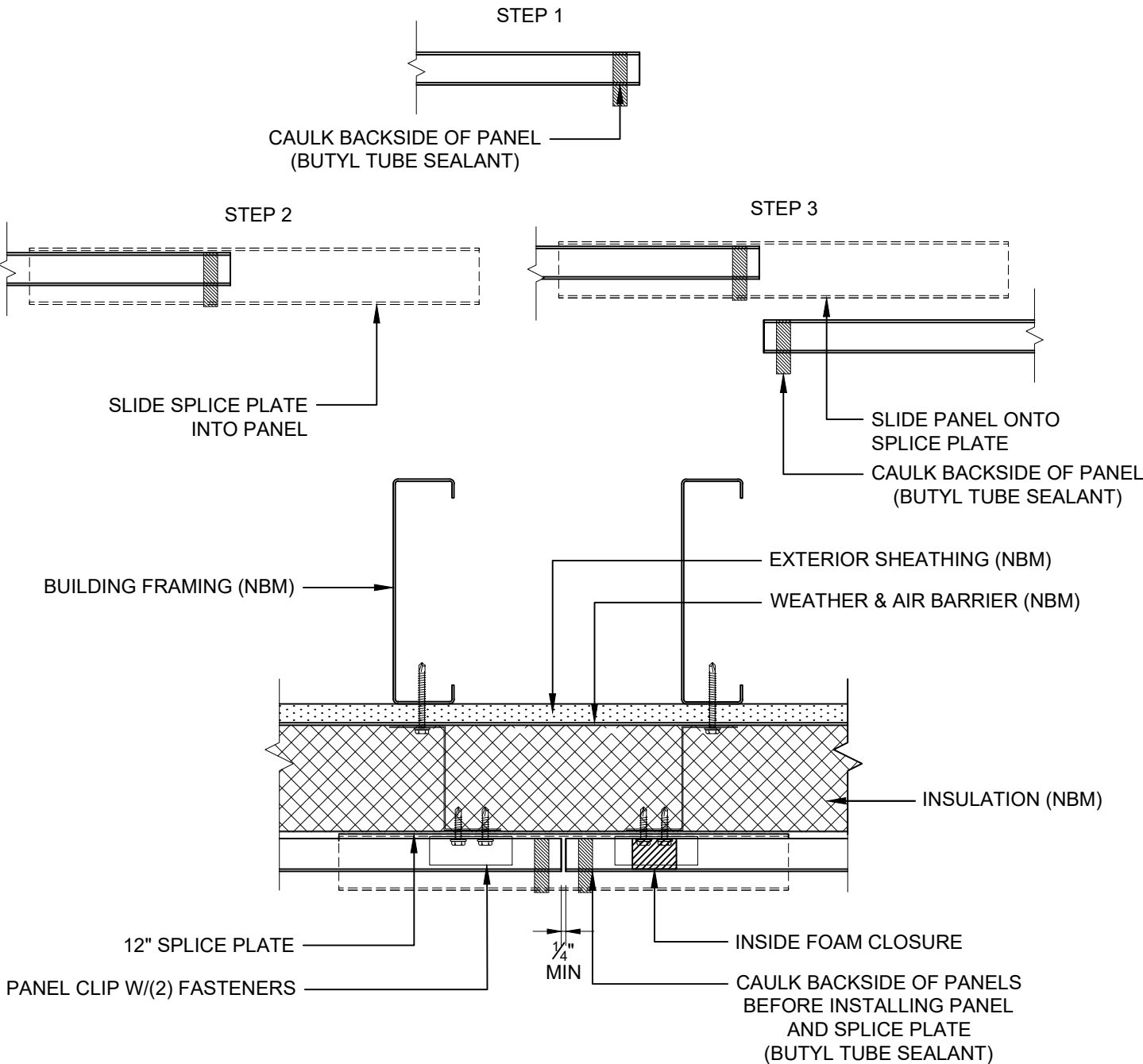


BASE AT SLAB DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

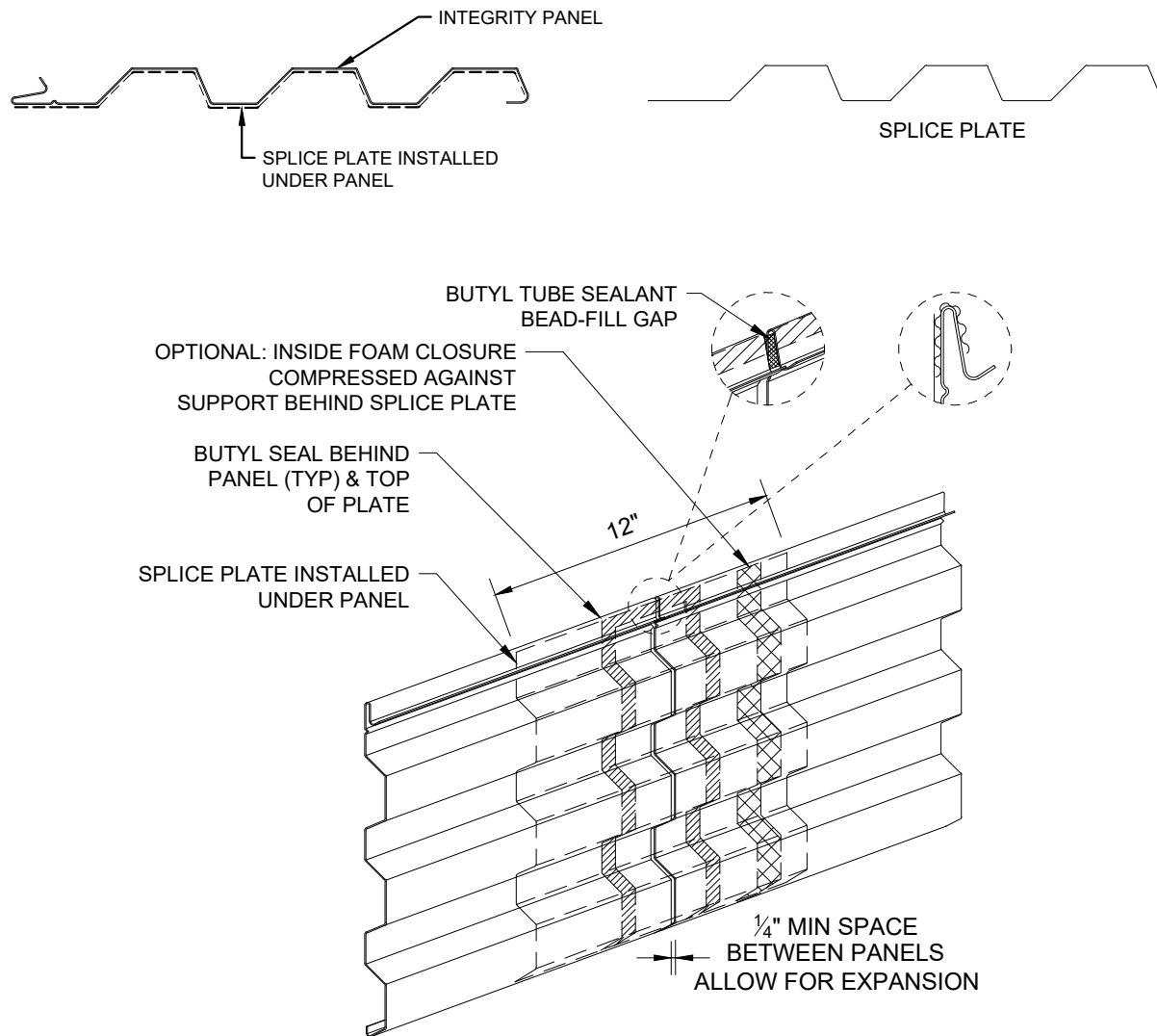


SPLICE PLATE DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation



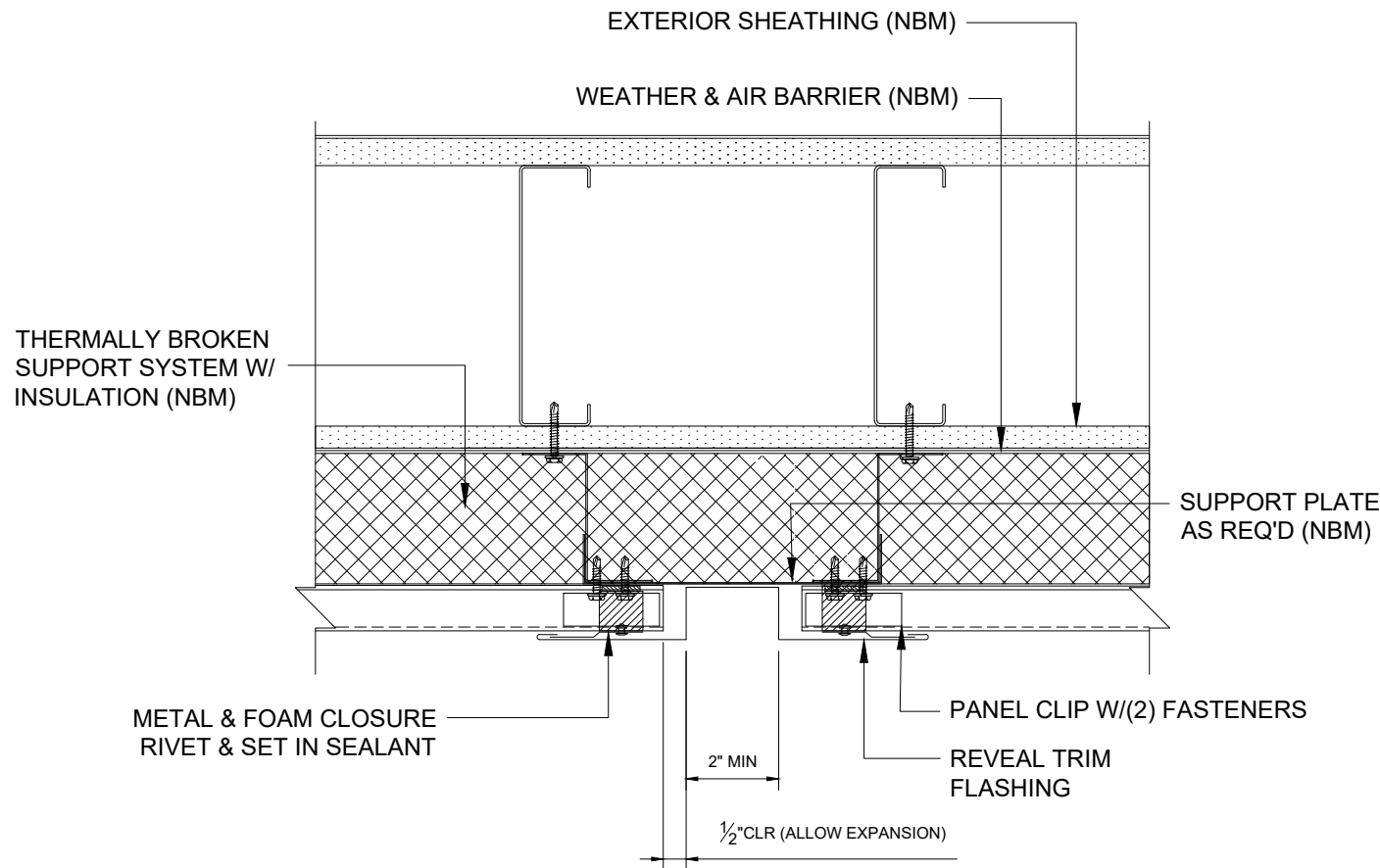
SPLICE PLATE ASSEMBLY

SPECIAL NOTE:
NOT SUGGESTED BEING MADE OF
.050AL OR 18GA DUE TO MATERIAL
THICKNESS

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation



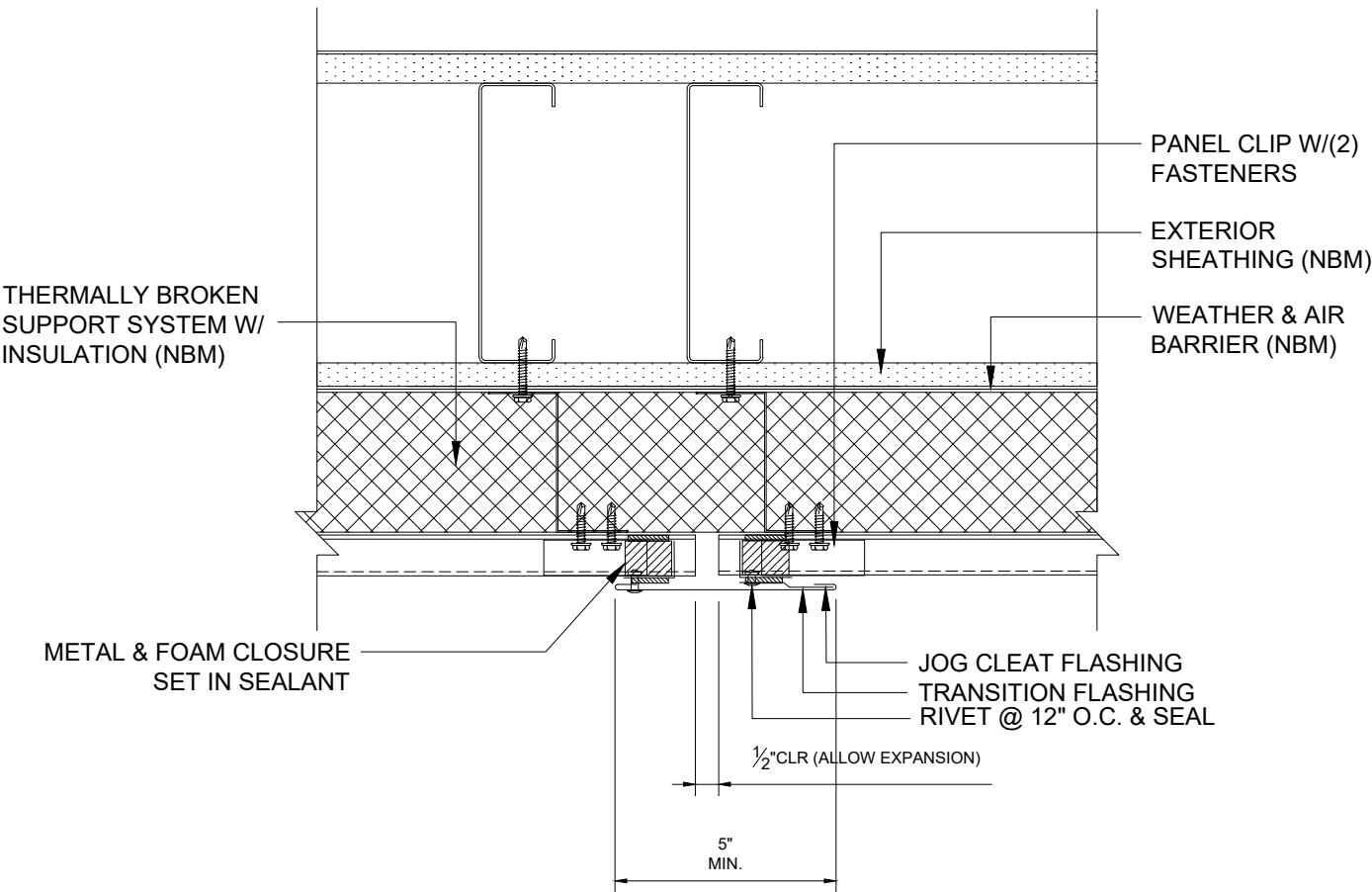
***SEE PAGE 39 FOR HOW TO FIX
FASTEN TRIM WITH CLEATS**

REVEAL TRIM DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

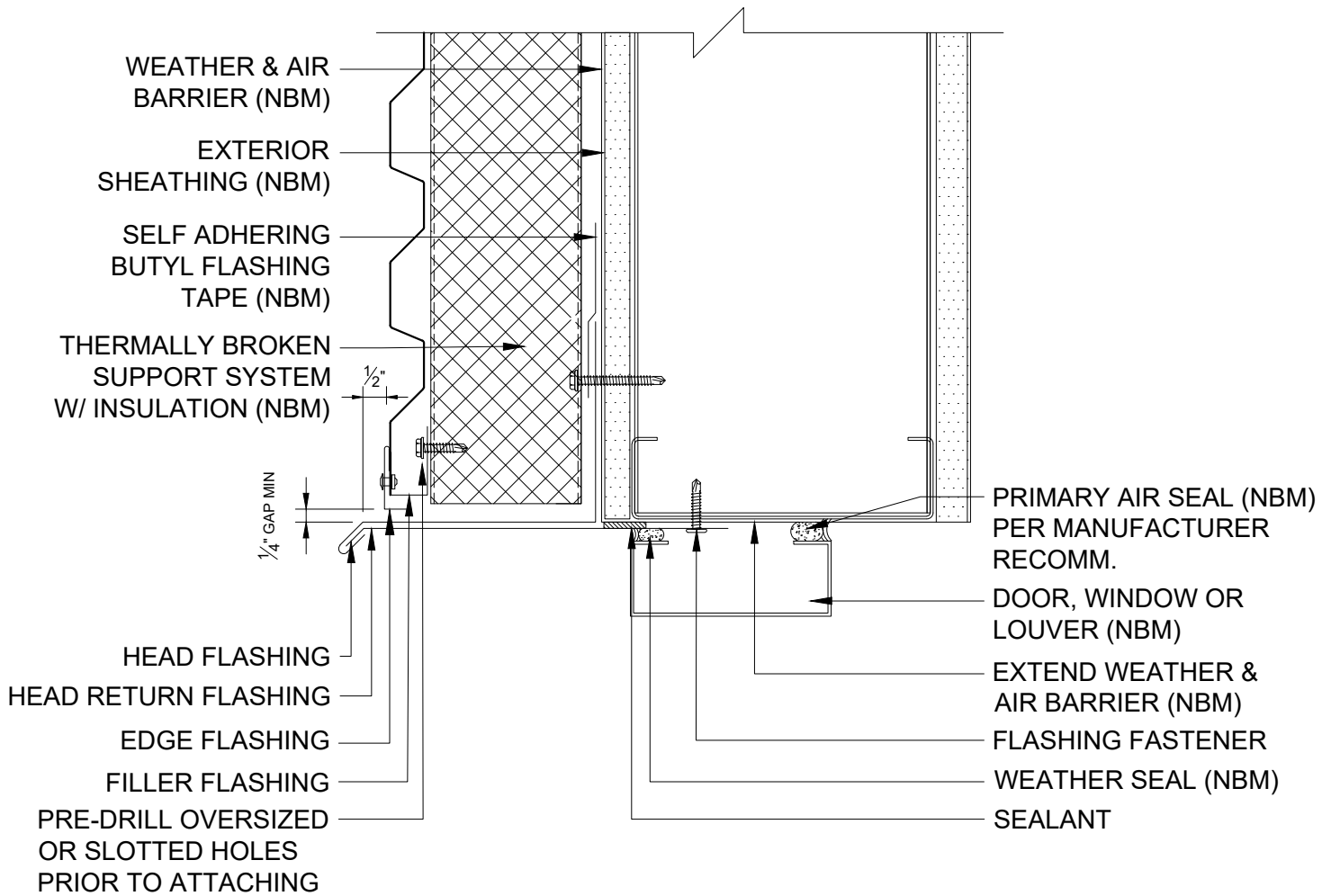


TRANSITION TRIM DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

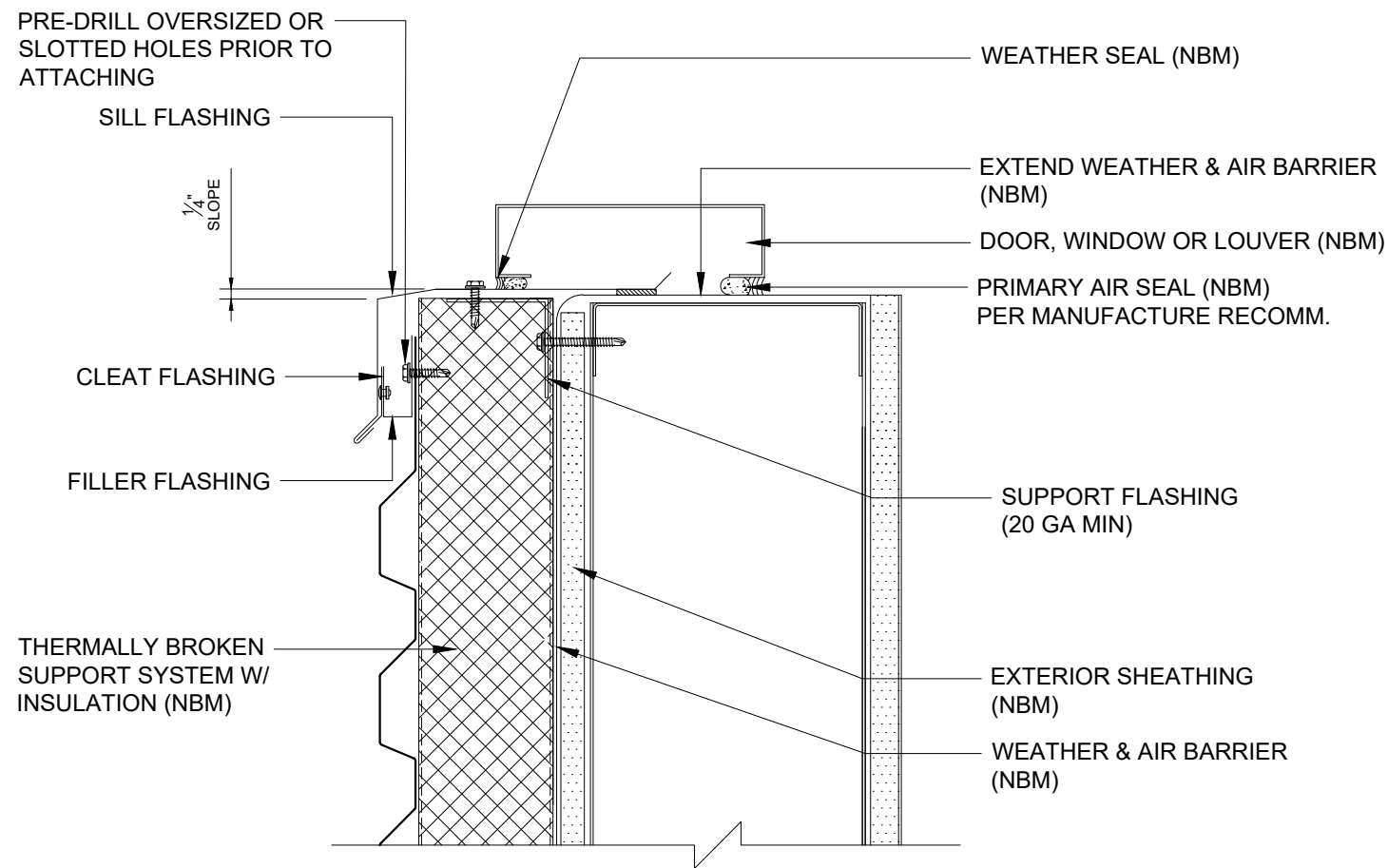


DOOR/WINDOW/LOUVER HEAD DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

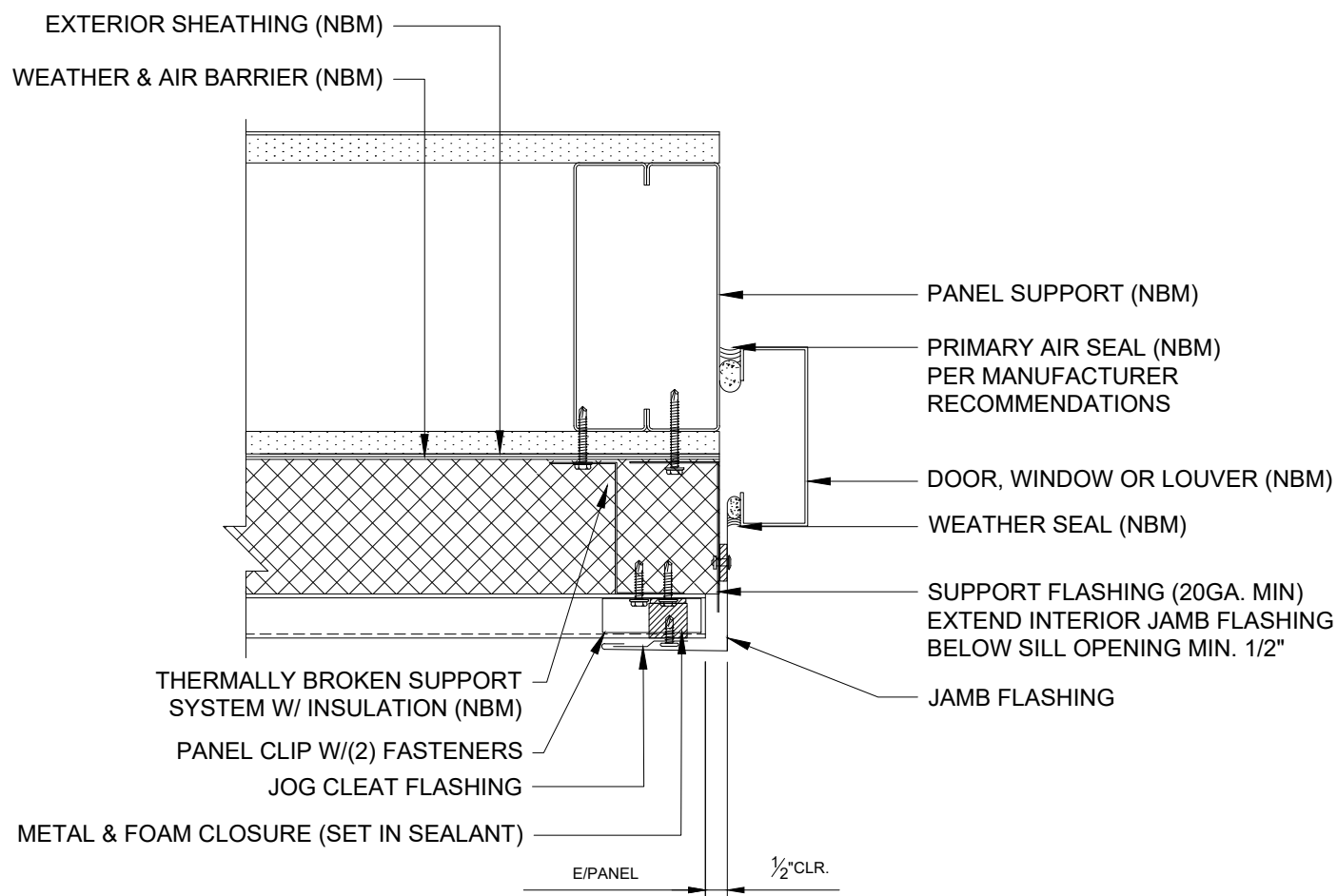


DOOR/WINDOW/LOUVER SILL DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

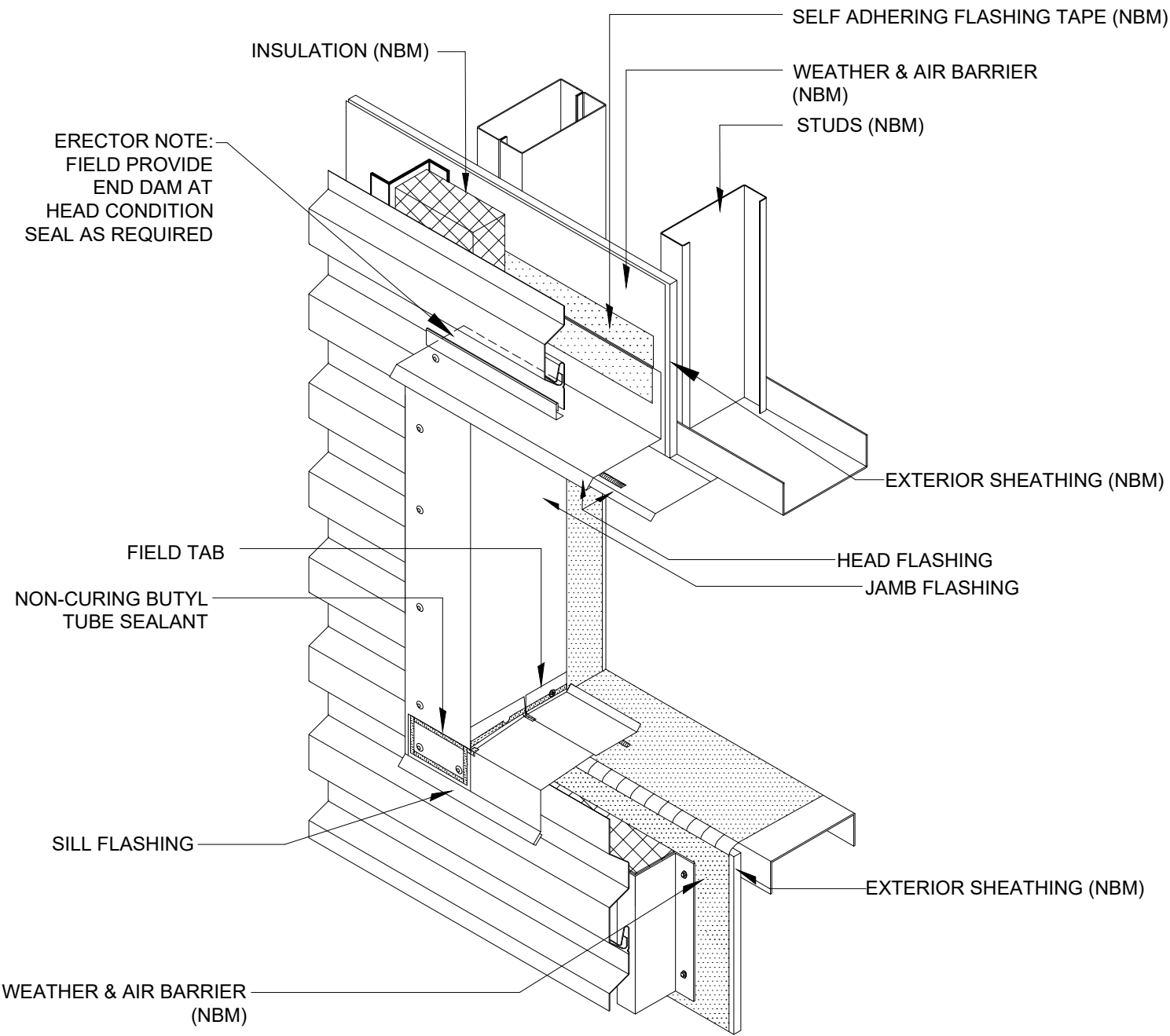


DOOR/WINDOW/LOUVER JAMB DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

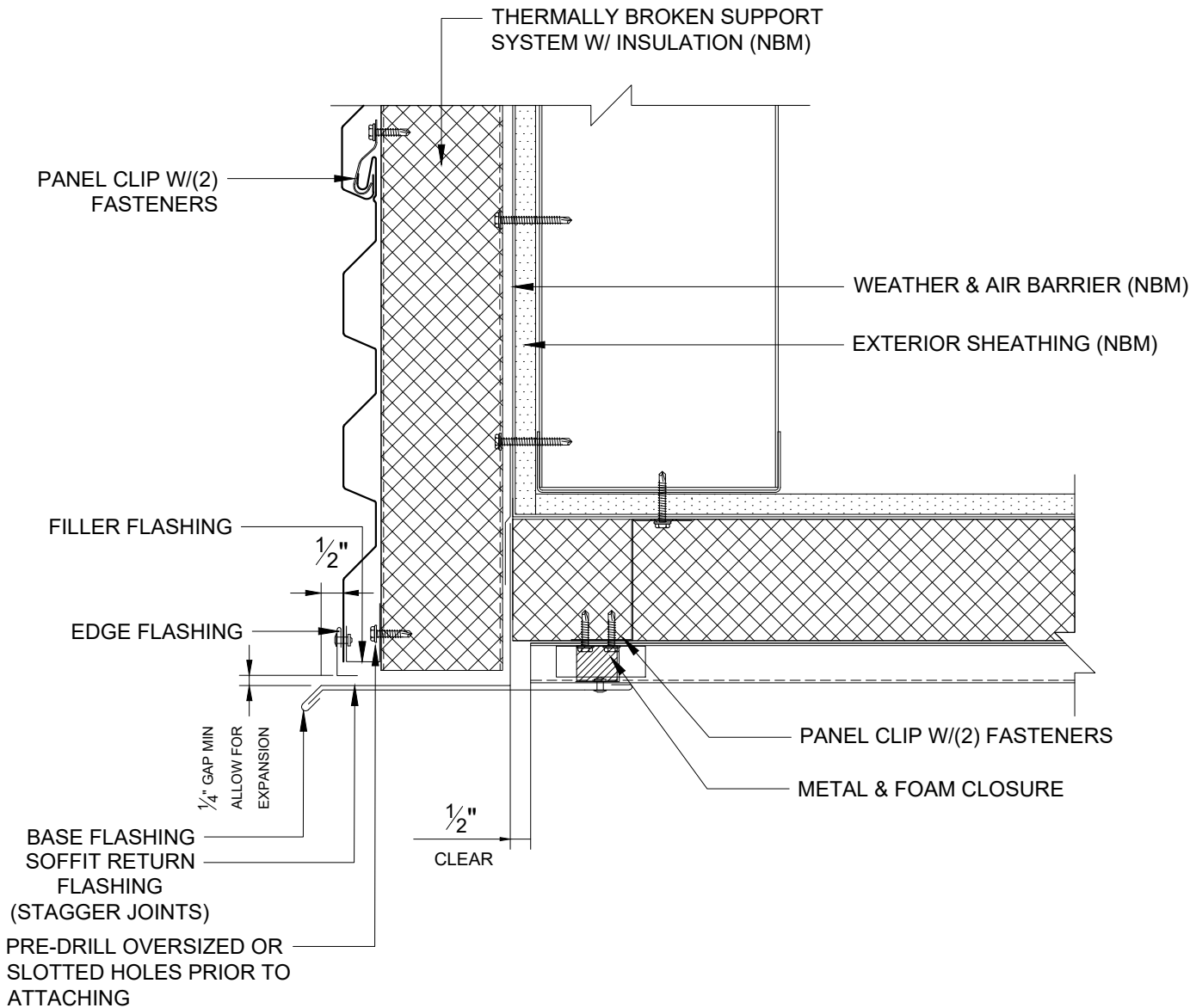


INTERSECTION OF HEAD/JAMB/SILL DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

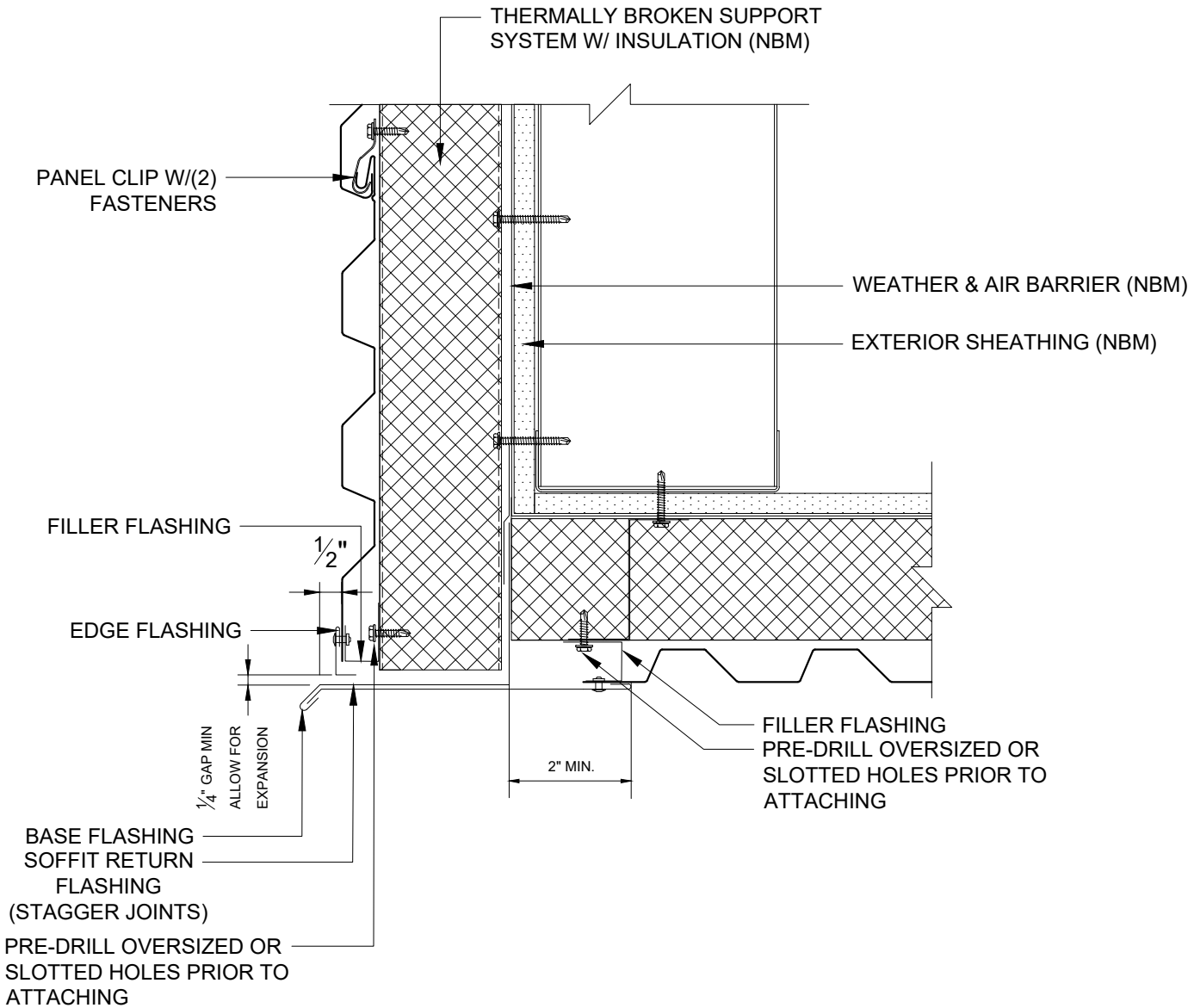


FRONT SOFFIT DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

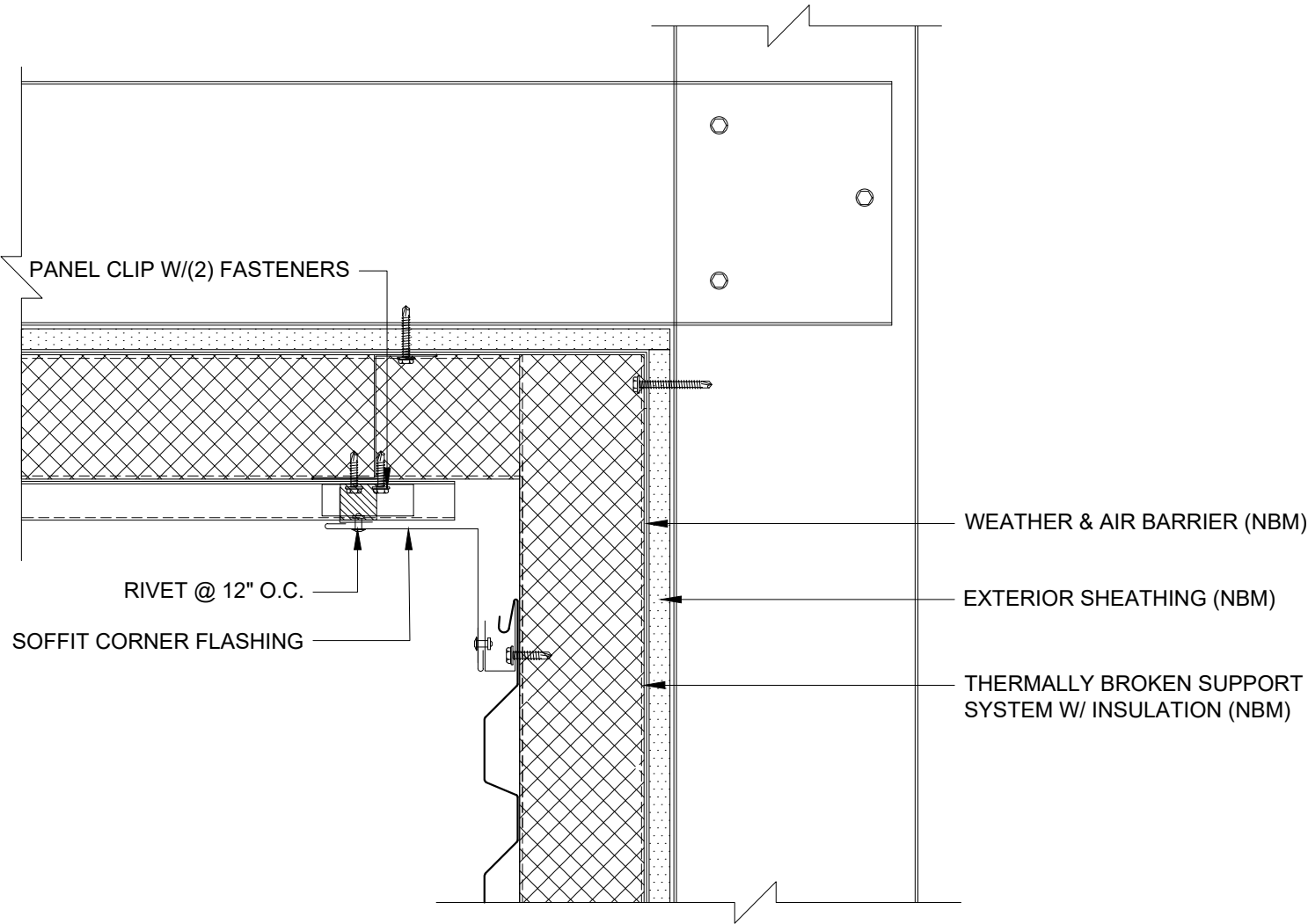


FRONT SOFFIT DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

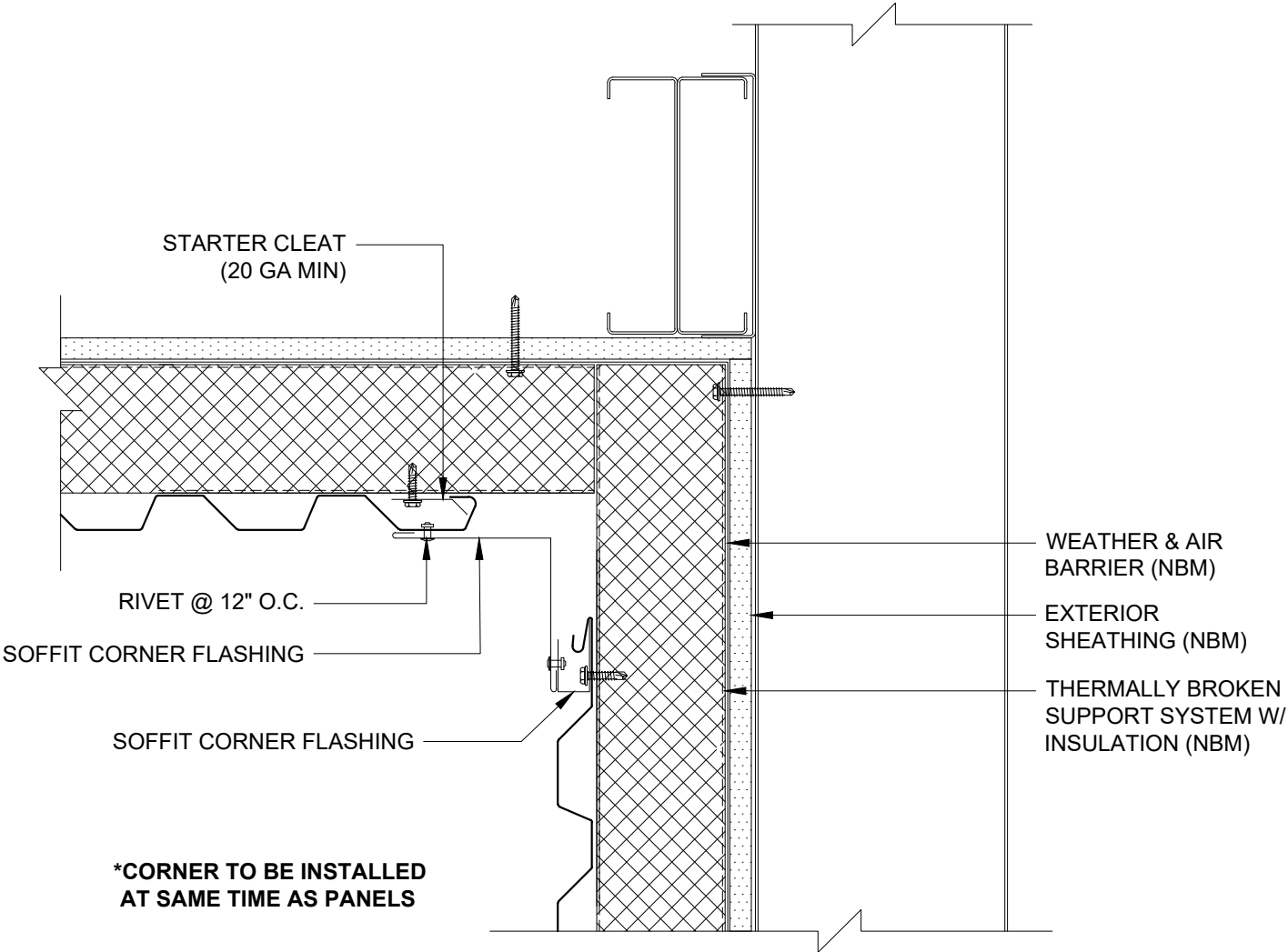


BACK SOFFIT DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

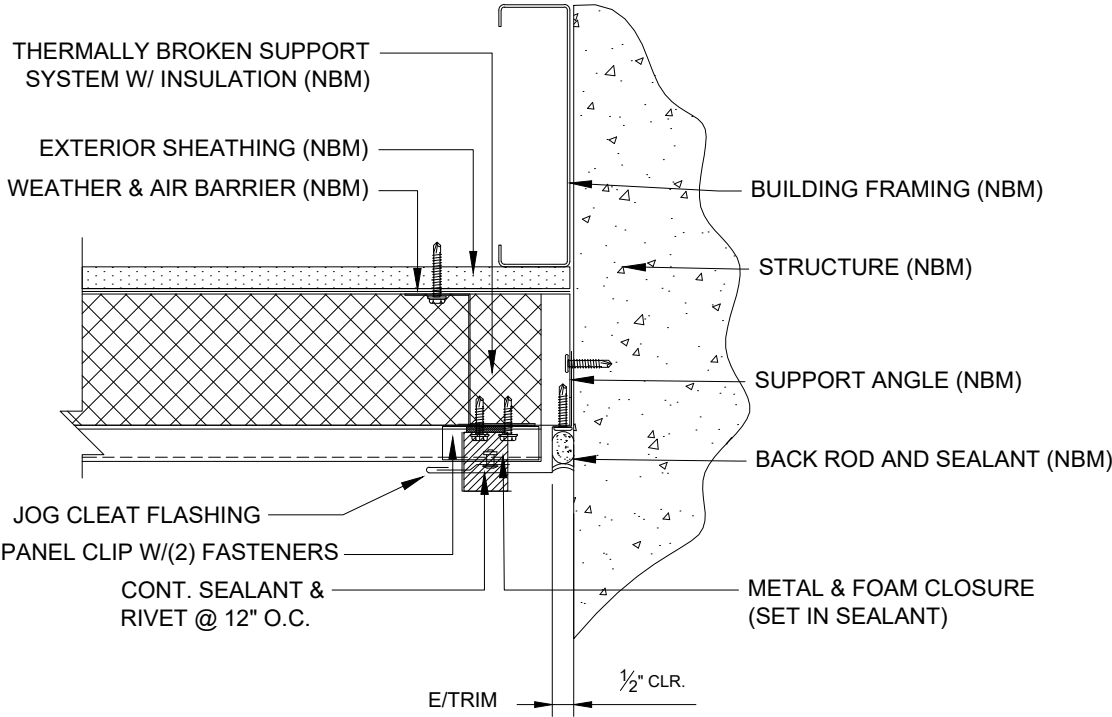


BACK SOFFIT DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

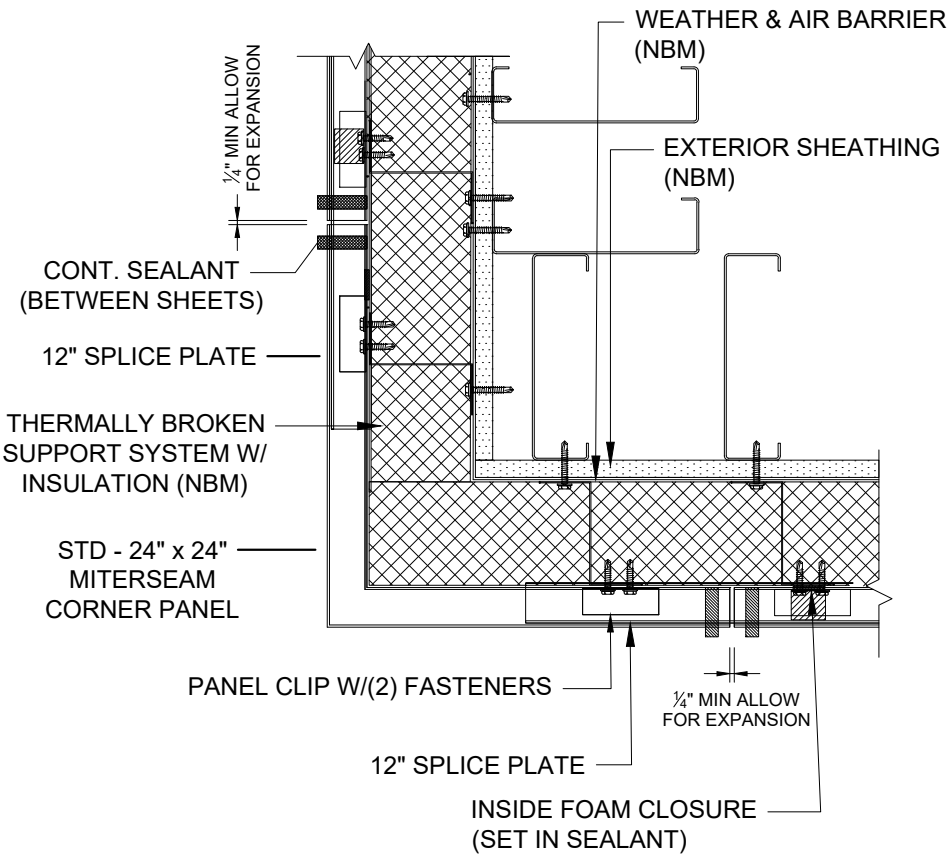


ENDWALL DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation



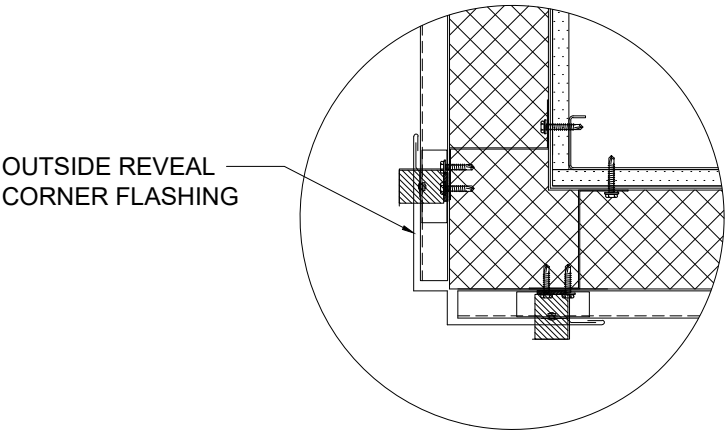
*CORNER TO BE INSTALLED
AT SAME TIME AS PANELS

OUTSIDE CORNER (MITERSEAM) DETAIL

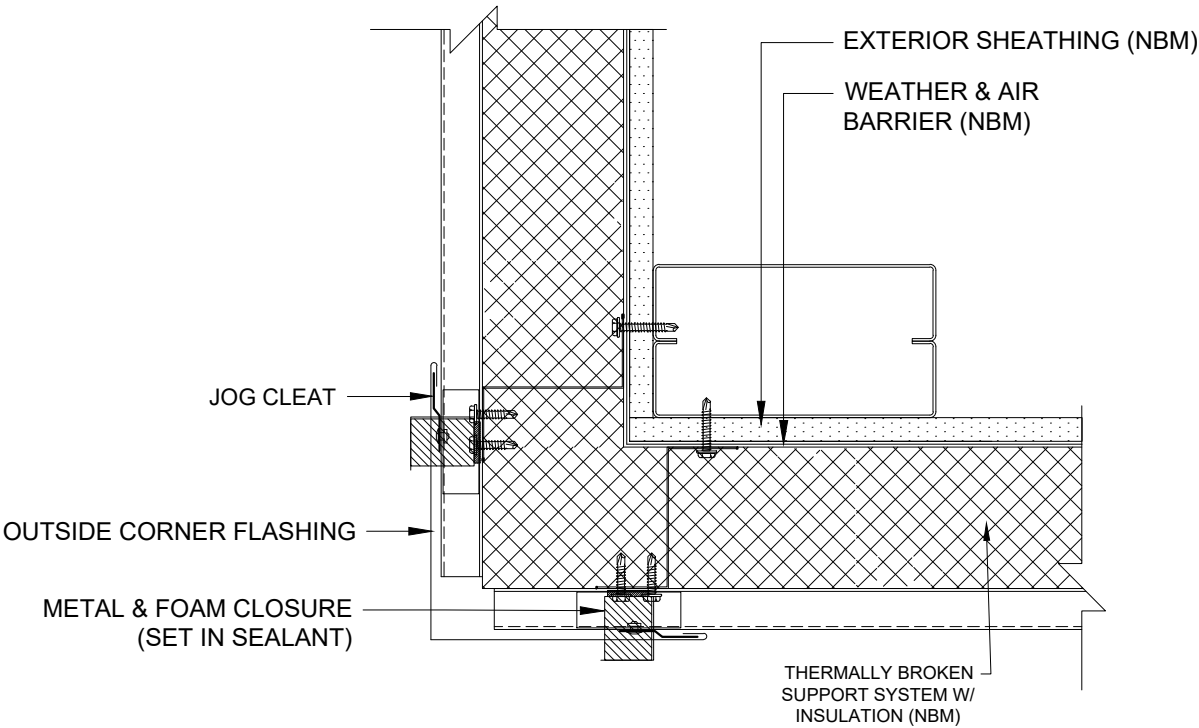
*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation



OPTIONAL REVEAL DETAIL



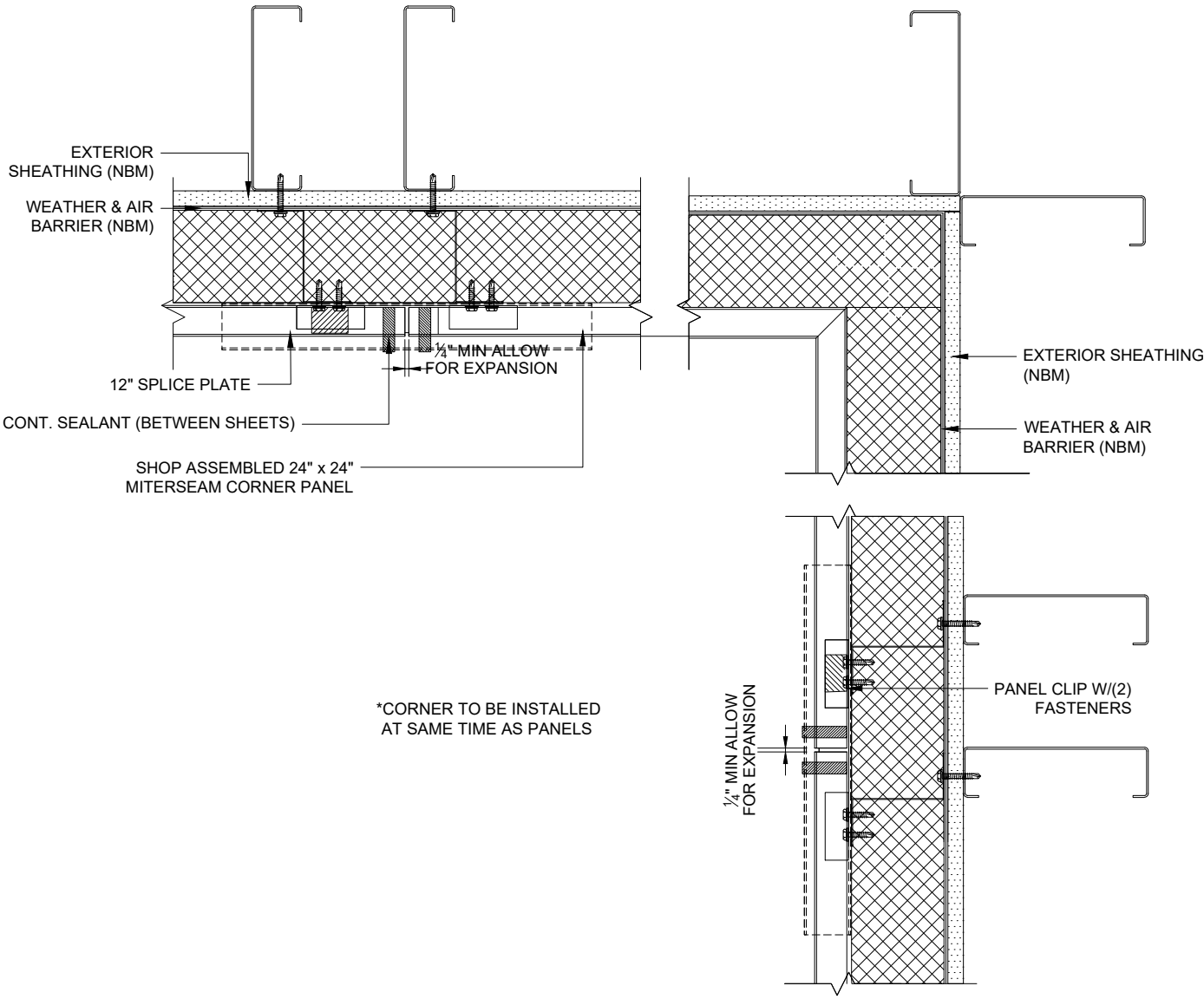
SEE PAGE 39

OUTSIDE CORNER DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation



*CORNER TO BE INSTALLED AT SAME TIME AS PANELS

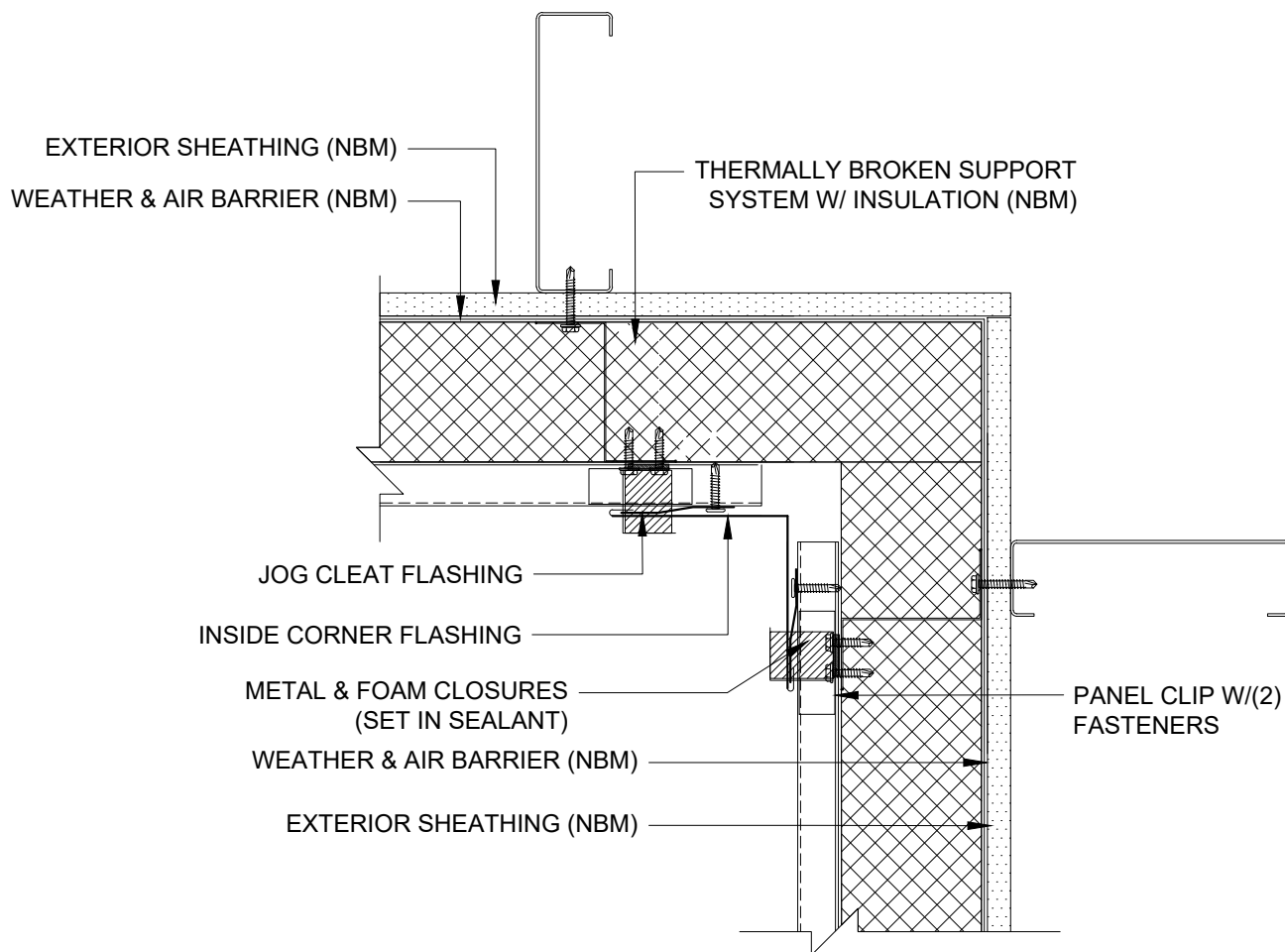
INSIDE CORNER (MITERSEAM) DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

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By Kingspan

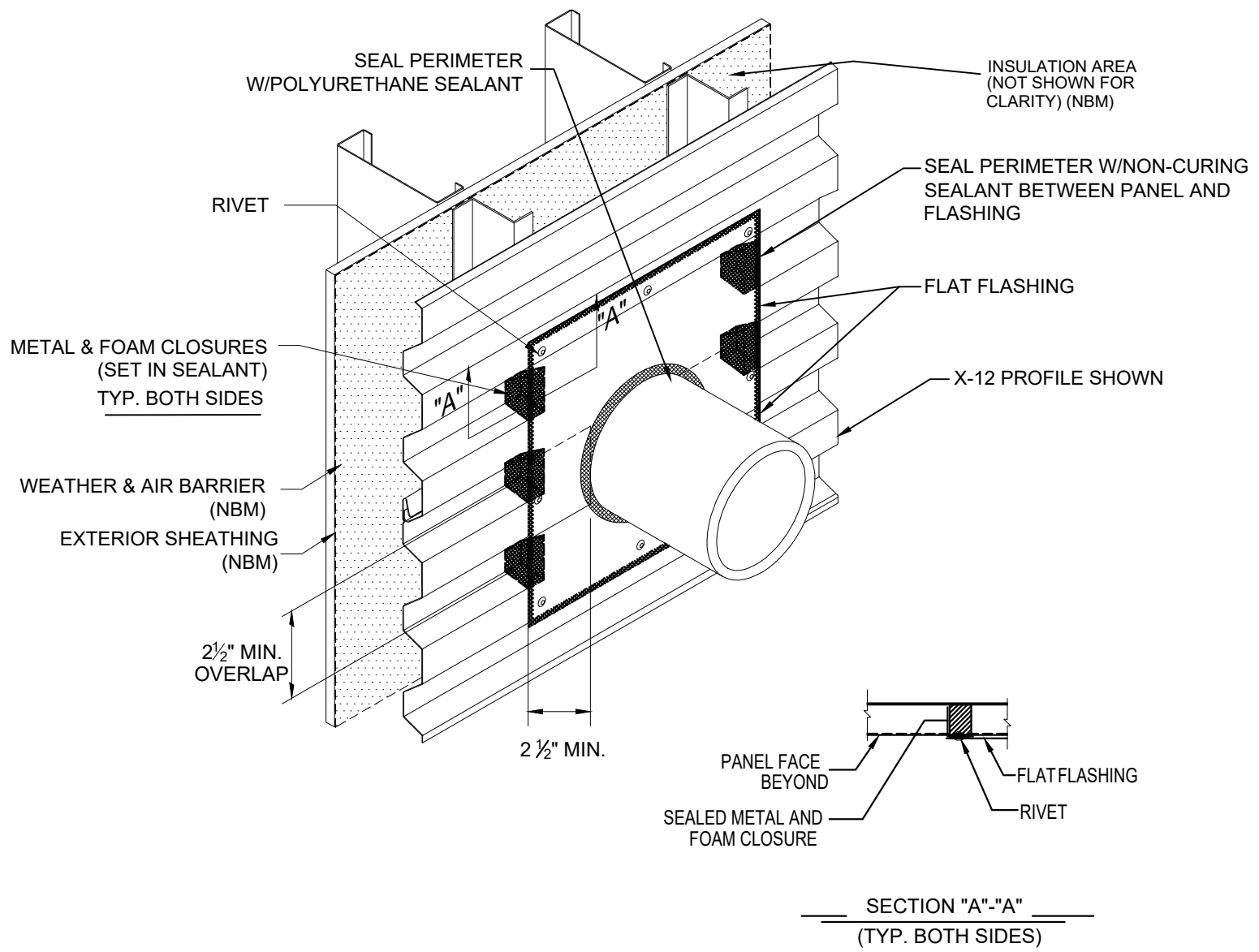


INSIDE CORNER DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation

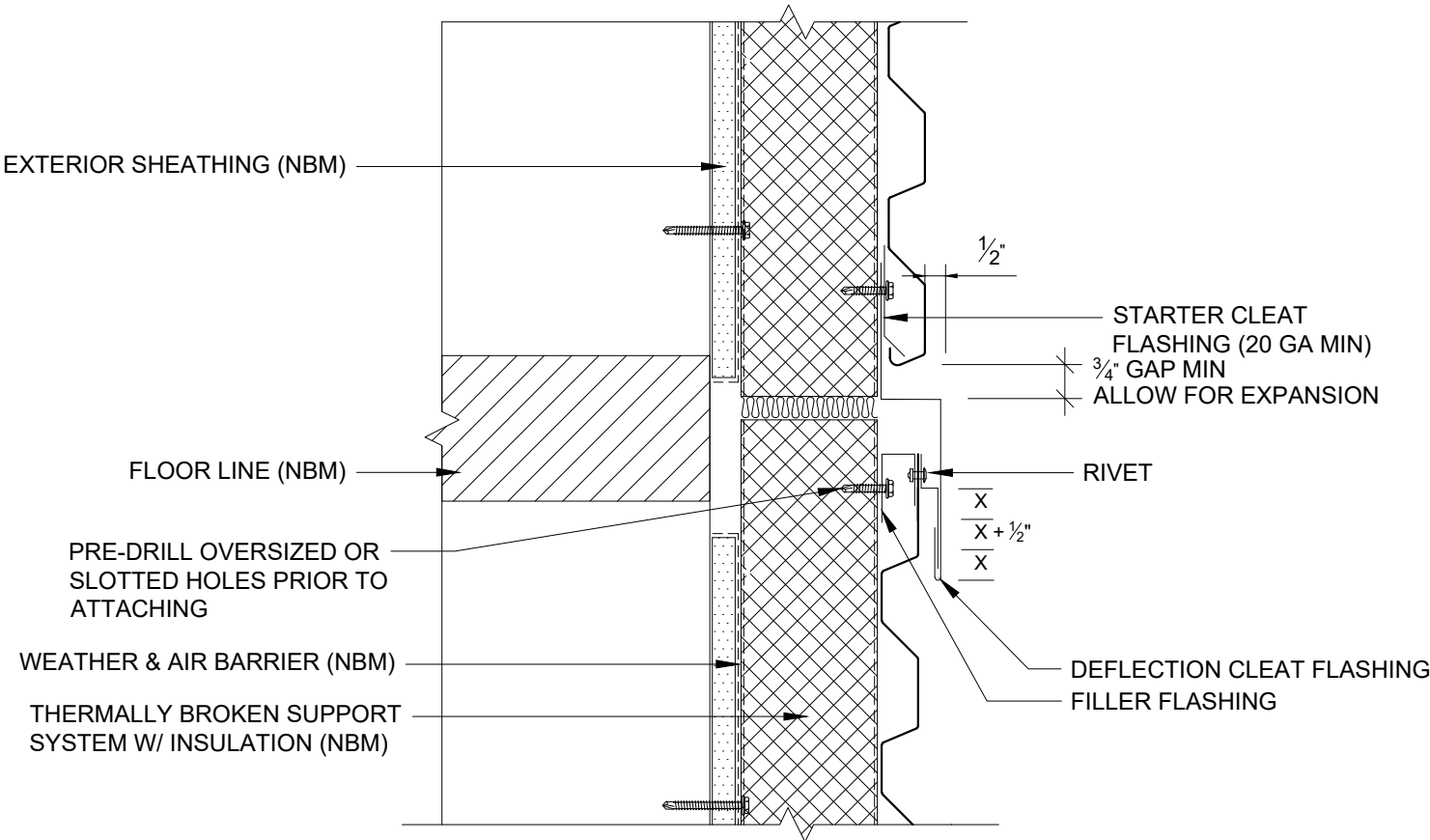


PENETRATION DETAIL

*NBM=(NOT BY MORIN)

Morin Integrity Series

Horizontal Installation



NOTE: X = AMOUNT OF DEFLECTION REQ'D

DEFLECTION/FLOOR SHRINKAGE JOINT DETAIL

*NBM=(NOT BY MORIN)

MAINTENANCE INSTRUCTIONS

METAL WALL/ROOF PANELS NORMALLY REQUIRE A MINIMUM OF MAINTENANCE. TO PROVIDE A GREATER DEGREE OF OPTIMUM SERVICE LIFE, THE OWNER'S MAINTENANCE DEPARTMENT SHOULD INSPECT THE PANEL SURFACE BI-ANNUALLY, PREFERABLY DURING SPRING AND FALL OR AFTER ANY SEVERE STORMS.

1. The Owner's Agent shall:
 - A. File all project records, shop drawings, project plans and specifications for reference. Set up a maintenance schedule and written reporting documentation system.
 - B. Clean gutters and downspouts along with inspection of sealants.
 - C. Clean USING NORMAL WATER PRESSURE any accumulated airborne or waterborne contaminants that aren't 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 or any seams. Systematic freshwater rinse maintenance shall be in effect in areas of high salt concentration (such as adjacent to the seashore and/or in industrial atmosphere) so as to prevent the accumulation of concentrated salt deposits. We require a documented bi-annual inspection/freshwater rinse* of exposed panel system be sent each time conducted to Morin. (*Documented inspection/rinse – include date performed, notes of any areas of concern [items E, F, G, and H below] and pictures, clean water wash for 5 minutes per area of cleaning, sign and date the document with all parties involved.) Morin must be contacted prior to inspection to be given the option of attending.
 - D. Inspect for any standing water at flashings or panels. See note 2.
 - E. Observe and remove any vegetation or debris that has accumulated against the flashings or panels.
 - F. Examine for any deterioration, pest disturbance or vandalism at sealants, closures, flashings and panels. See note 2.
 - G. View panel surface at all penetrations for any localized deterioration. See note 2.
 - H. Notify contractor of any leaks. Note the location and conditions resulting in leakage; magnitude of rain; wind direction; temperature; time required for leaks to appear and cease after rain starts and stops; condition of building openings; status of mechanical equipment; internal conditions, windows, walls and skylights, etc.
 - I. Keep written documentation of the location and type of any deterioration for future yearly comparisons.
2. Except for emergencies or obvious problems, do not perform any repairs on any issues noted above. Consult with the contractor about proper remedial action (if any).
3. All servicing of the panel system must be completed in compliance with the above or voiding of any or all warranties may occur.

01/27/2025



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Storage of Material

- 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.

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.



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.

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Morin[®]
By Kingspan

February 10, 2026