



Metal Roof Installation Manual

METAL CONSTRUCTION ASSOCIATION

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BUILD LEGACIES
 METAL

Chapter 13: Sealants

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13. INTRODUCTION

A roof is designed to be weathertight and is not intended to leak; however, even with the best joint designs, metal, by itself does not form a good seal. This challenges the installer in a number of ways. The growth and change in sealants and chemicals used on metal roofs continue to be both rapid and beneficial. The styles and materials of metal roof systems also continue to evolve, making some installation materials and methods no longer suitable. Gone are the days of merely climbing a ladder and applying black roof cement, as seen in Figure 13-1. Today's installer must know and understand a number of various sealants and methods which were not even available just a few years ago.



Figure 13-1
Old Methods and Materials Are Not Suitable In a Modern Installation

Unfortunately, most sealant-related failures are not discovered until after the roof has been installed and inclement weather, or some other event, has already caused damage. This creates a loss of customer satisfaction and additional expenses in repairs. This is why an installer must pay close attention to details and methods during an installation.

There are areas of installations, field modifications, and adaptations for which detailed sealant instructions may not be available in the manufacturers' installation manuals. Because of this fact, the installer should understand certain principals with

respect to use of sealants to ensure a weathertight installation of the complete roof system.

13.1. Sealant Types

13.1.1 Externally vs. Internally Applied

Most sealants and application methods used in other areas of construction are not suitable for use on a metal roof installation. It is almost never appropriate to use surface-applied sealants and elastomers for weatherproofing on a metal roof. Externally applied sealants, those applied to the exposed surface of the roof, are rarely acceptable due to exposure to ultra-violet light from the sun (See Section 13.4) and continual exposure to precipitation and dirt, which wear away and deteriorate the exposed sealant.

The only time an exposed sealant should be used is as a secondary precaution. An example would be when sealant is applied as a fillet in a surface mounted reglet flashing, which uses compressed tape sealant as the primary seal (See Figure 13-2). When a surface-applied sealant must be used, the proper sealant material should be selected as discussed in the next section "*Sealant Material.*"

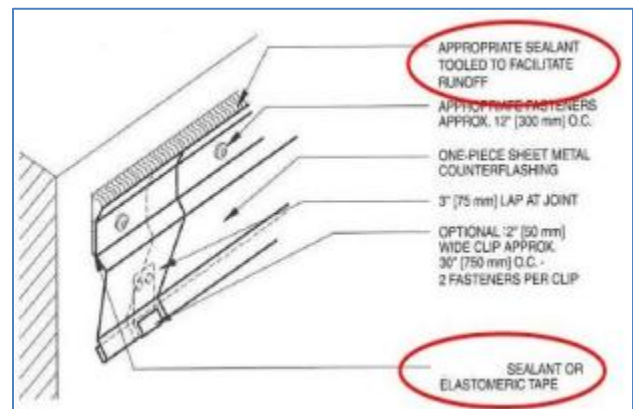


Figure 13-2
Externally Applied Sealant
Note- Compressed Sealant Tape Is Primary Seal

Except for specific trim and interface situations, sealant for metal roofs is installed internally. Sealant is applied between panels, or within the joints and seams of roof members, as shown in Figure 13-3.

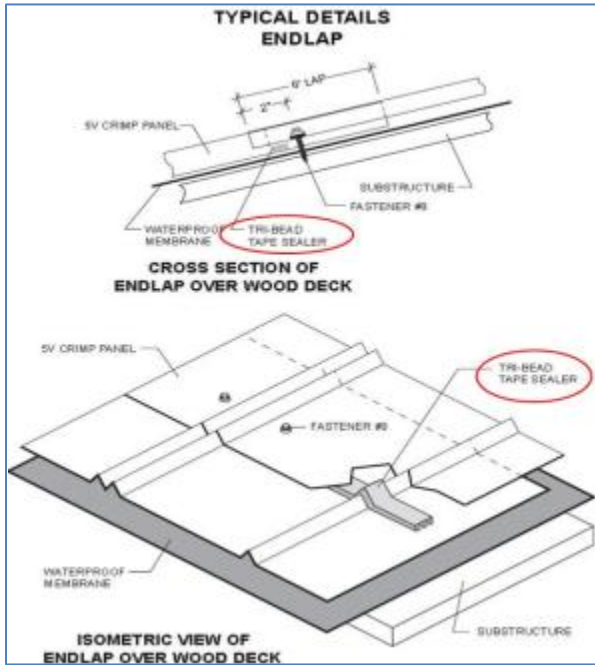


Figure 13-3 Internally Applied Sealant

Internal installation provides the best environment for the sealant material used. In some panels, the manufacturer internally applies sealant along the ribs which are part of the joint seam between panels. In this case, the sealant must be "married" as discussed in Section 13.6.6 later in this chapter.

13.1.2 Sealant Material

The roof system manufacturer normally furnishes the appropriate sealants necessary for the roof installation; however, it is important the installer understands the characteristics and unique properties of the material they are likely to use.

Most sealants used in construction are curing-type materials, like silicon and polyurethane, which develop skins during the curing process. While this type of sealant

is fine for other uses, it is may not be the preferred material for metal roof applications. For concealed joint areas with compression, non-curing butyl compounds are strongly preferred to any curing compound, because they maintain their tacky, gummy consistency throughout their service life, and they do not require extensive surface preparation, which means they will adhere over small amounts of moisture and other minor contaminants which may be present on the panel surface. Butyl sealant is used where the panels must be allowed to move and still remain sealed, such as at sliding eave details under the panels and along the gables that must be allowed to slide. Butyl sealant is commonly used for panel end laps but not every application.

Always read and follow any caution, First Aid, and restriction information supplied with all sealants. Most require proper ventilation and contain flammable solvents.

13.1.3 Sealant Formats

Sealant for metal roofs comes in two standard formats: tape and tube. Both formats have advantages and are used on even the most basic installation.

Tape formats, where practical, are generally preferred over tube formulations because of their dimensional stability and ease of use. This format is shown in Figure 13-4.



Figure 13-4 Butyl Sealant in a Tape Format

One advantage of tape format sealant is that it can also be made available in various shapes and sizes to meet application needs. Examples are shown in Figure 13-5.

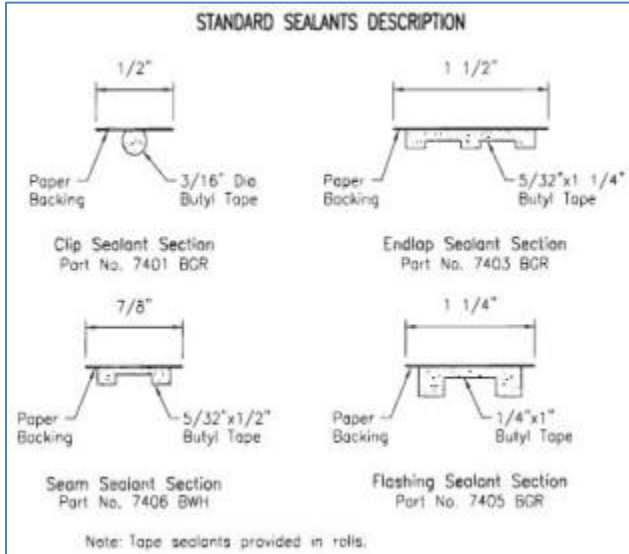


Figure 13-5
Examples of Available Tape Profiles

Tube sealants can be messy, but are sometimes needed in areas of compound and intricate bends where tapes are not practical, or where more "flow" is desired. They come in a variety of tube sizes and are normally applied using standard contractor caulk guns, like the one illustrated in Figure 13-6.



Figure 13-6
Butyl Sealant in a Tube Format

13.2 Low Slope / Steep Slope

Note: Indented paragraphs in this section are reprinted with permission from the MBMA Metal Roofing Systems Design Manual).

The slope of the roof will be a definite factor in how, and where, sealant is applied. Low sloped roofs must withstand quantities of slow-moving water. Steeper sloped roofs must withstand high volumes of runoff. Both types of slopes require additional sealing at the eaves, where interfacing with gutter systems may cause flooding. In colder climates, ice damming may also occur in the eave area.

Based on the roof design, and type of panels being installed, every roof will have areas which are critical for sealing. These areas are detailed in Section 13.6, *Critical Sealant Applications*.

Some panels, trim pieces, and components, come with sealant already applied within joints and seams, as shown in Figure 13-7. During the installation, this pre-installed sealant needs to be "married," or blended, with additional sealant on other panels or applied on site. This procedure is detailed and illustrated in Section 13.6.7, *Marrying Sealants At Critical Intersections*.

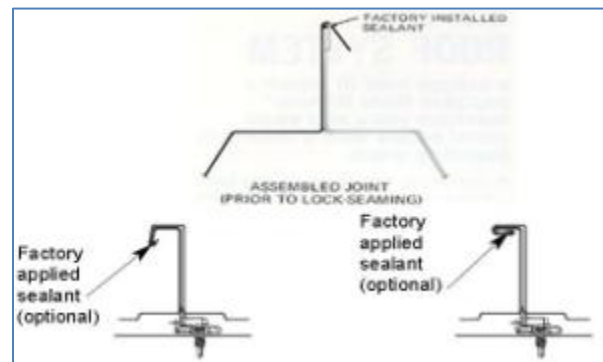


Figure 13-7
Pre-Applied Sealant

Sealant Placement Relative to Hardware

One of the most frequent mistakes made by installers of low slope roofing is the misplacement of sealant relative to related mechanical fasteners. In lap joints that do not involve cinching hardware for holding folded lap tabs, it is important that the fastener is on the "dry" (upslope) side of the sealant, or alternatively *through* the sealant. This is illustrated in Figure 13-8. The screw hole in the upper lapping component is sealed by the rubber washer on the screw and also by the sealant downslope, in the lap joint. The hole in the lower joint component is sealed only by the joint sealant. If that sealant is upslope of the hole, then moisture drawn into the joint will migrate down the screw shank and drip into the building interior.

Clips and other hardware also require special attention when used around sealant. Proper sealing is required while still allowing for thermal movement. Always refer to and follow the manufacturer's recommendations for proper installation.

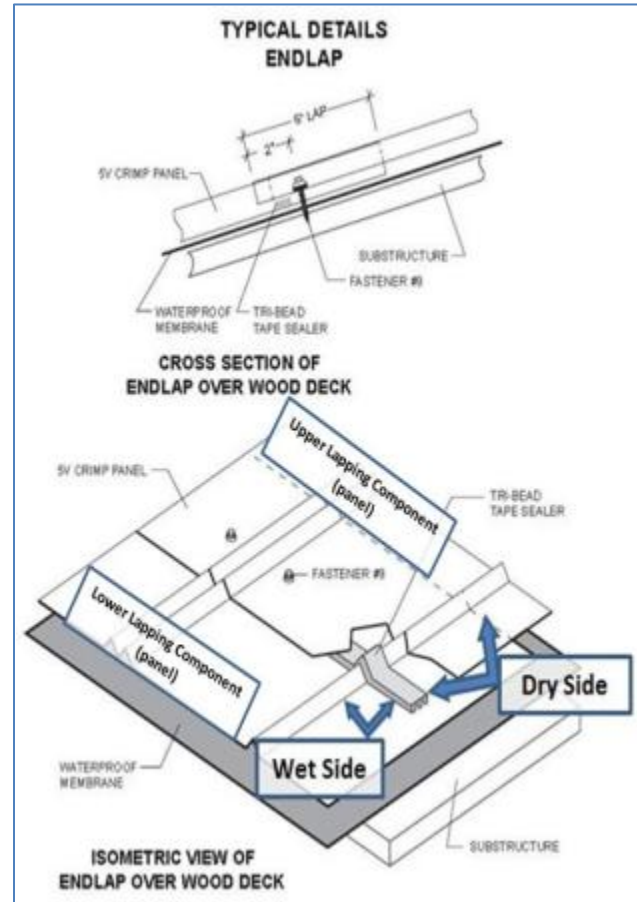


Figure 13-8
Hardware Placement and Sealant

On joints where cinching hardware is used, the fastener must be through the sealant bead. Such a joint relies upon the sealant to swell into the threads of the screw and the upper joint component as it is tightened. The washer beneath the screw head is really of no effect, since the joint between cinch hardware and upper joint component is kept "dry" by the sealant. Once installed, removal of a screw in such a joint is risky as the sealant may not "re-bed" upon reinstallation of the screw. A typical cinching strap application is illustrated in Figure 13-9. Installing a small patch of sealant tape between the cinch hardware and the upper joint component can restore weathertightness in such a case.

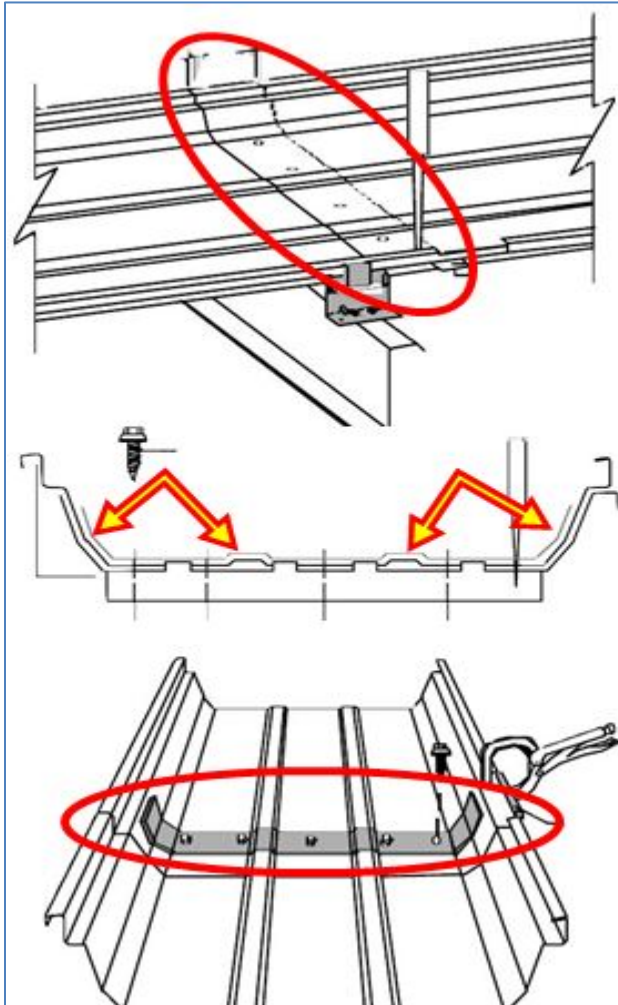


Figure 13-9
Cinching Hardware Piercing Sealant

In some cases, panel attachment clips require wetting with sealant. This is because the clip tab interrupts the factory applied seam sealant, creating a dry joint between the clip and the male seam component. Some clips are field applied with factory-applied sealant material, and some do not interrupt the seam sealant. Some clips are provided with sealant. . An example of such a note is shown in Figure 13-10. If so specified, it is another critical aspect of the installation.

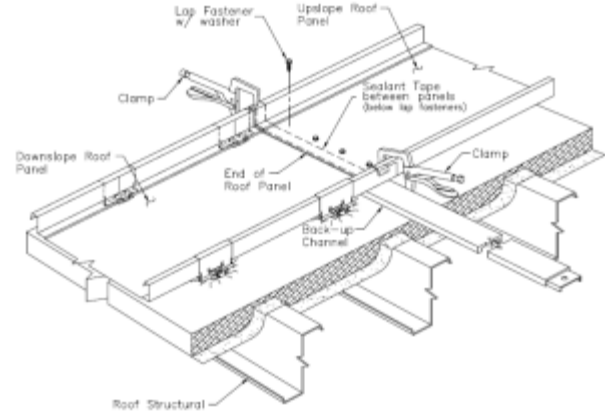


Figure 13-10
Example of Manufacturer Instructions for Clip Sealant

13.3 Compatibility

When the use of an external, or surface, applied sealant is unavoidable - for instance when a surface applied reglet flashing is used with a caulk ledge - then a one-part polyurethane sealant is usually the best choice. *Acid cure silicones*, which are the most commonly available, *should never be used on metal surfaces because they induce corrosion*. Acid cure silicones are easily identified by their pungent odor when wet. Neutral cure compounds are virtually odorless. Butyl compounds may also be used in conjunction with some sealants, like one-part polyurethane, but are *not* compatible with silicone.

Care should be used when applying sealant around polycarbonate panels, as well as some rigid insulation materials and barriers. Always check with the manufacturer and test on small scraps of the materials in question before proceeding.

13.4 Thermal and UV Exposure

The sun is a factor which affects the composition and application of sealant used on the metal roof surface.

Butyl sealant, either tape or tube formats, should never be used in exposed applications because ultraviolet radiation

will cause rapid degradation. It should always be applied internally, or between, surfaces, avoiding exposure to the ultraviolet rays of the sun.

Another solar factor affecting sealant is heat. Due to many climate and roof factors, the temperature of the metal roof surface can often reach and exceed 200° F. Butyl sealants, and those recommended by the manufacturer, are designed to withstand such temperatures; however, when other sealants like asphalt-based materials are used, they can melt and run out of the joints. This causes loss of sealing around the opening, is visually distracting, attracts dirt and debris, and can create a slip hazard.

13.5 Need For Backing Material (i.e. Backer Rod)

Sometimes there are gaps, openings and spaces which are too large or deep for the sealant being used. This is common on panels and trim with trapezoidal ribs or other profiles. Often a backing material may be necessary during the installation or sealant application. When a custom profile closure is not available, foam backer rod material is commonly used, and may be provided by the manufacturer or available as a general supply item.

Backer rod is an easy to compress rope-like celled foam. It is inserted into a clean joint at the required depth before sealing. Typical installations are shown in Figure 13-11. The backer rod creates an even depth and supports the sealant, allowing it to form the proper shape (about 2x as wide as deep). It is especially important to use it when a self-leveling sealant is applied, like at some expansion joints.

13.5.1 Size Selection

Select a backer-rod diameter that is about 30% larger (1.3x) than the nominal width of

the joint (but not less than 10% (1.1x) of the largest gap).

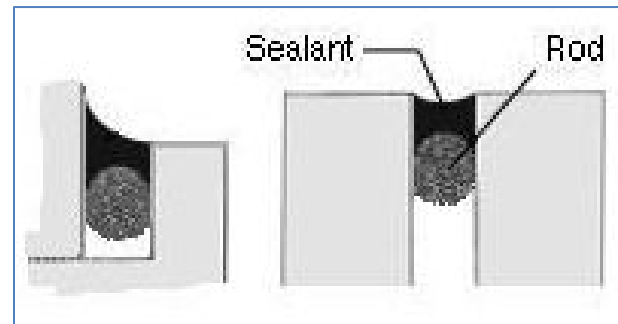


Figure 13-11
Typical Backer Rod Installations

13.5.2 Material

Closed cell backer rod is the least expensive. It can be used for either vertical or horizontal joints, or on-grade (ground).

Soft Cell is more adaptable to irregular joint widths (it will easily compress up to 70%), and is commonly used in vertical tilt-wall construction. Soft cell is not used on-grade.

13.6 Critical Sealant Applications

Every roof has areas where the risk of leakage is more likely to occur during the life of the roof. These areas may vary from roof to roof due to slope, panel and roof designs, and other factors. These areas will require more attention from the installer, and may include additional fasteners and sealant. These sealant locations and procedures are described in the manufacturer's installation manual. Each instruction is critical and must be followed. The following sections identify some of the usual areas for critical sealant applications on most metal roof installations.

13.6.1 Eave (Figure 13-12)

The eave is the most downslope point on the roof. It often interfaces with the gutter

system, as well as trim flashing and panel closures. Key sealant points are:

- Panel to eave flashing or gutter
- Panel rib closure to eave flashing or gutter
- Panel to rib closure
- Panel seam end

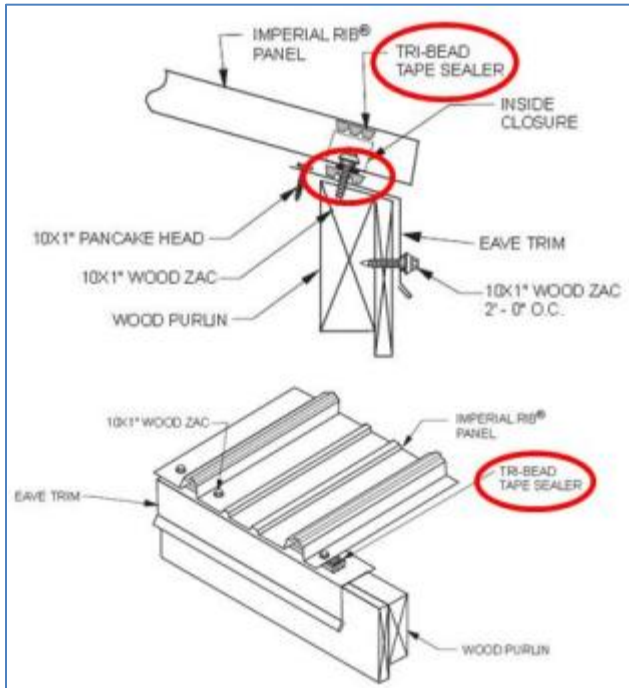


Figure 13-12
Trapezoidal Eave Installation Example

The ends of the roof panels need to be sealed, and proper sealing of any ridge vent and cover components is critical. Check the following ridge locations:

- Panel to closure components
- Closure components to ridge flashings

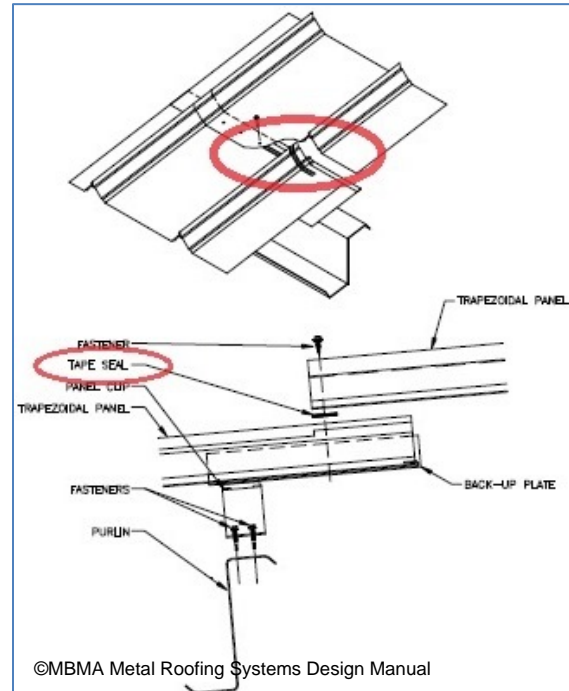


Figure 13-13
Trapezoidal Lap Joint Sealing Example

13.6.2 End Lap (Figure 13-13)

For roof lengths of more than one panel, the end lap joints are critical. Joints closer to the eave may also experience standing or flooding water conditions as well as those lap joints along valleys. End lap sealing includes:

- Panel flat to panel flat
- Panel rib area to panel rib area (and into seam)

13.6.3 Ridge (Figure 13-14)

The ridge, being the highest point on the roof, is not prone to flooding but is prone to wind driven rain and still requires sealing.

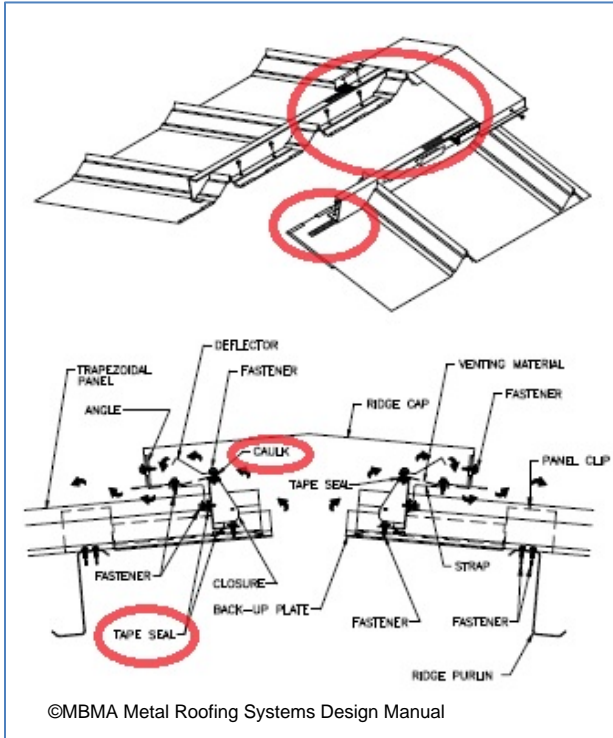


Figure 13-14
Trapezoidal Vented Ridge Sealing Example

13.6.4 Panel Terminations

Panel terminations will have a variety of flashings and covers. When sealing panel terminations, observe the following areas and ensure proper sealing:

- Panel to flashing at rakes or gables (Figure 13-15)
- Panel to flashing at longitudinal expansion joints (Figure 13-16)
- Panel to flashing at parapet conditions (Figure 13-17)
- Panel to valley trim (Figure 13-18)

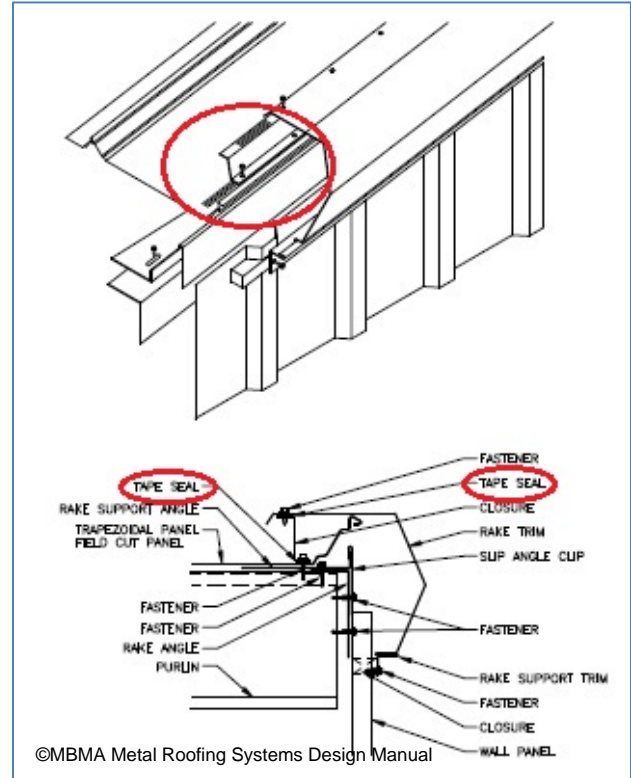


Figure 13-15
Trapezoidal Rake Sealing Example

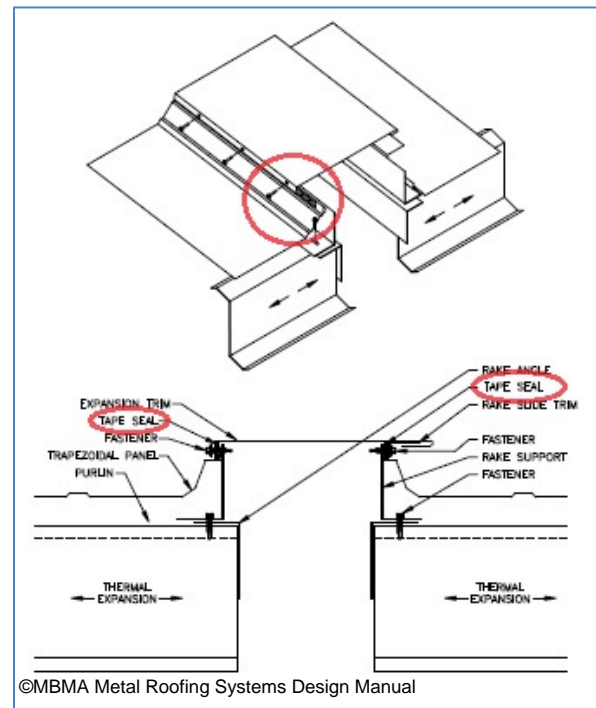


Figure 13-16
Trapezoidal Expansion Joint Sealing Example

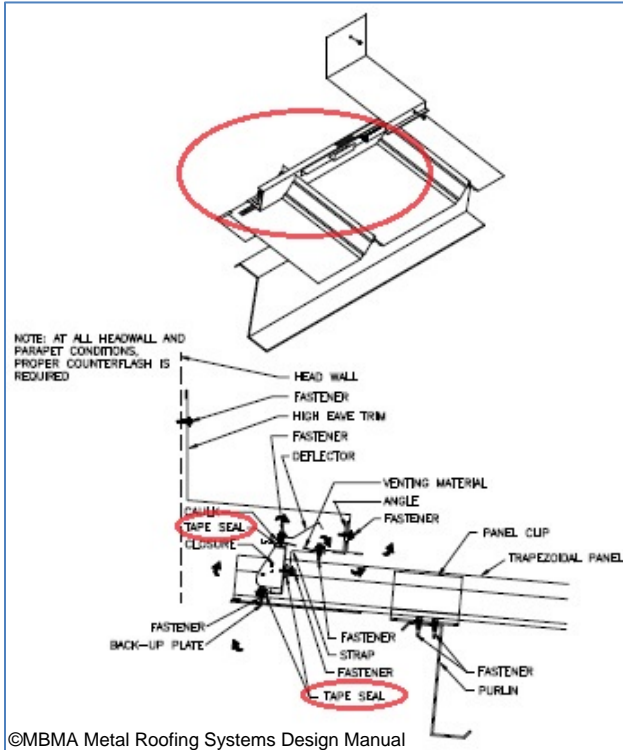


Figure 13-17
Trapezoidal, Vented, Floating Parapet Sealing Example

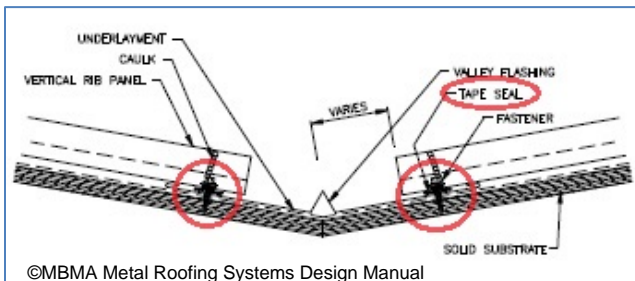
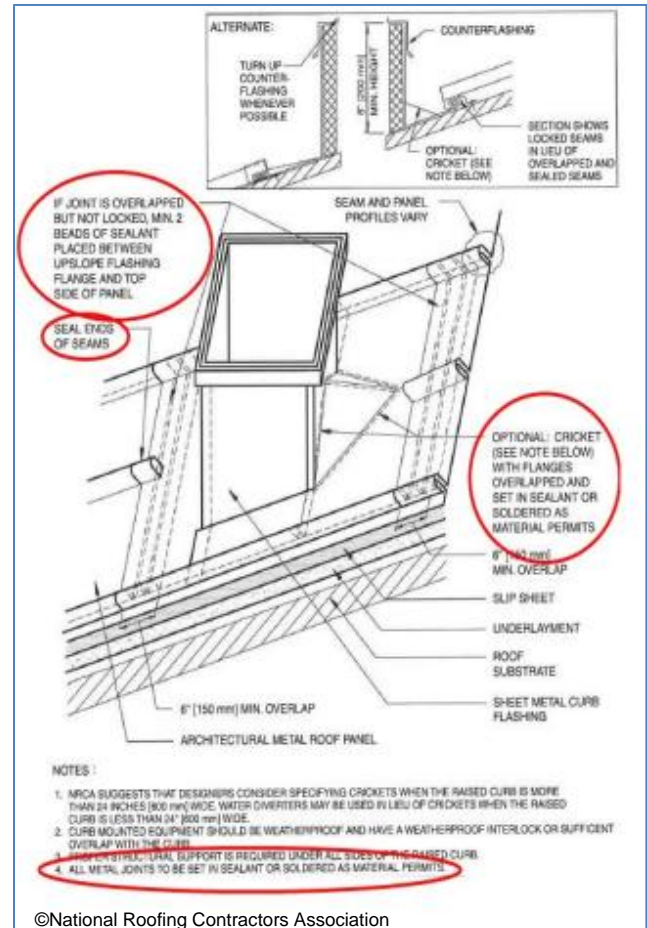


Figure 13-18
Panel to Valley Trim Example

13.6.5 Penetrations

Factory details and components invariably use sealing compounds which are hidden within a joint detail and not exposed to the elements. When an installer must make field adaptations and non-standard detail installations, it is important that these installations adhere to the same general rules that govern the balance of the roof system installation. By doing so, the resulting installation will have a service life consistent with the rest of the roof. With this in mind, key sealant points of a penetration are:

- Panel and ribs to preformed curbs (Figure 13-19a and b)
- Panel and ribs to other roof penetrations (Figure 13-20)



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Figure 13-19 a and b
Curb (With Cricket) Sealing Example

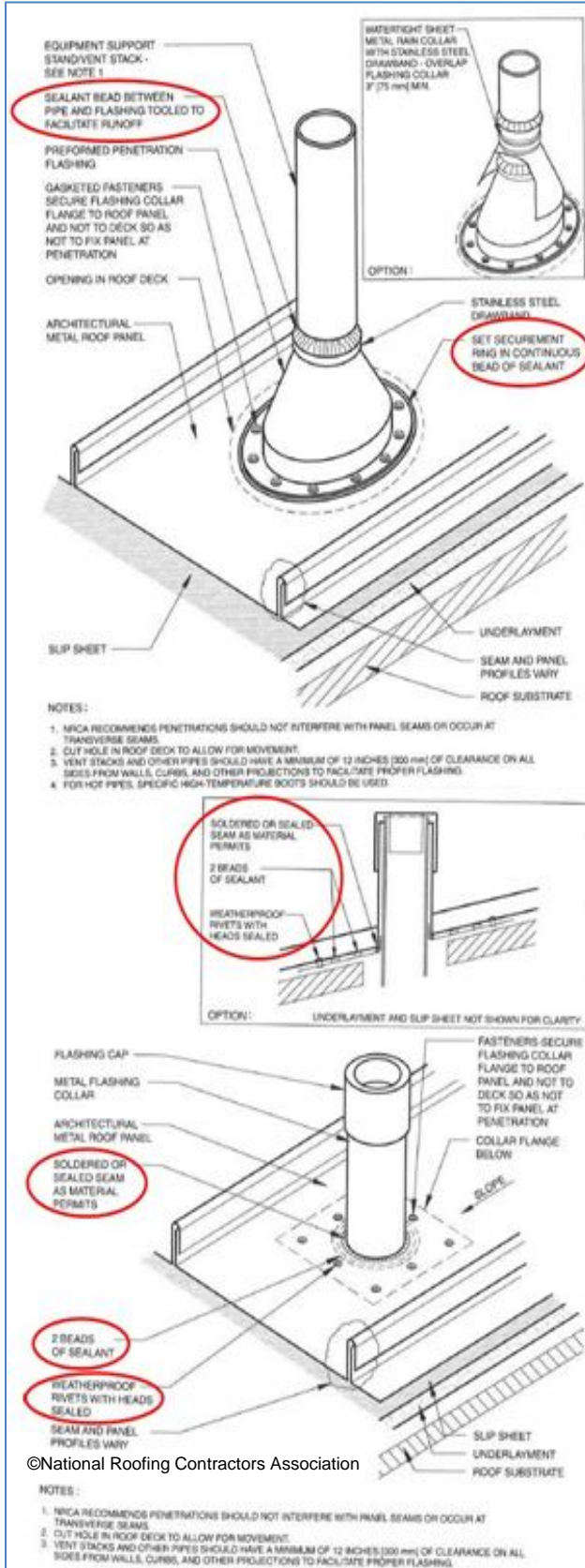
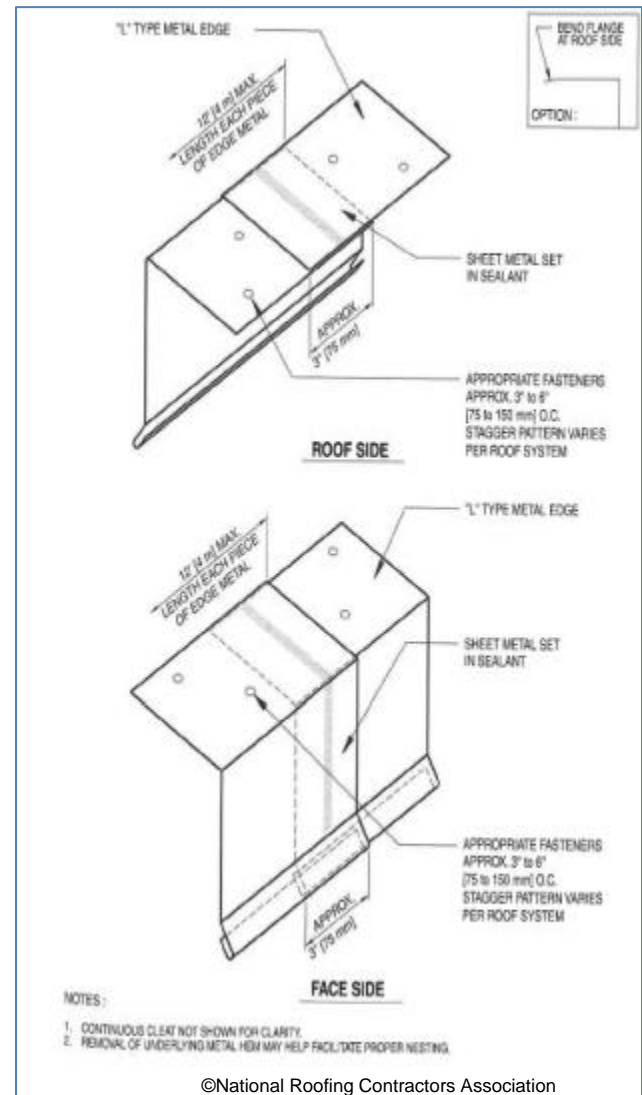


Figure 13-20
Roof Penetration Sealing Examples

13.6.6 Flashings

When installing flashing material of any kind, the key points for sealing are:

- Laps of adjacent flashing segments
- Lapped joints (Figure 13-21)
- Cover plate joints (Figure 13-22)
- Concealed plate joints (Figure 13-23)
- Flashings to panels



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Figure 13-21
Flashing Lap Joint Sealing

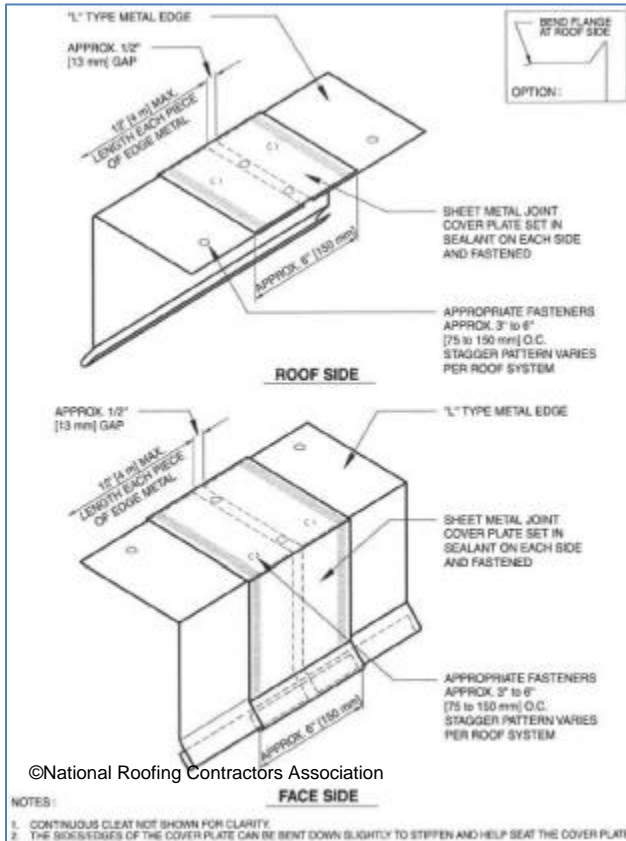


Figure 13-22
Flashing Cover Plate Sealing

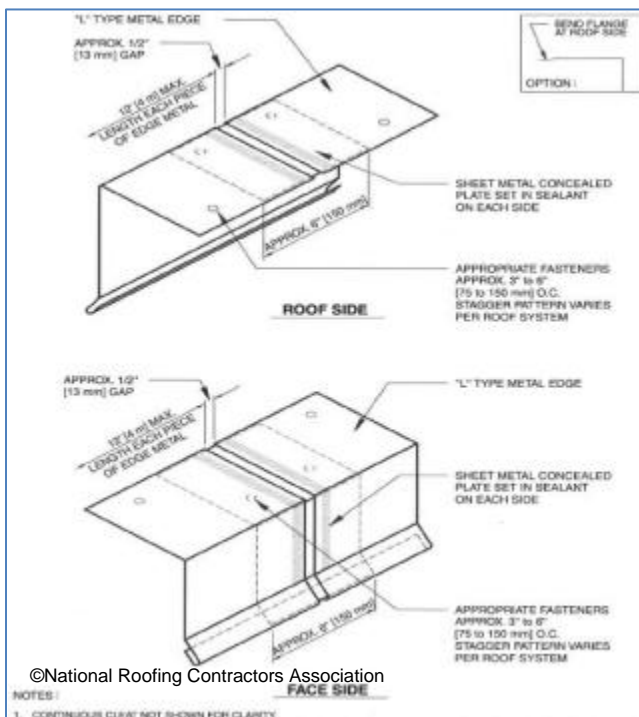


Figure 13-23
Flashing Concealed Plate Sealing

13.6.7 Marrying Sealants at Critical Intersections

Note: Indented paragraphs in this section are reprinted with permission from the MBMA Metal Roofing Systems Design Manual).

Sealants are used within low slope, roof systems for several reasons. Two of those reasons are: 1) to protect joints should they become temporarily submersed, and 2) to prevent capillary action from pulling moisture through the joints.

These are demanding conditions for any joint. In order to perform and not leak, sealant continuity is the primary concern. The installer must be sure to "marry" (or blend) adjacent sealant beads. When a bead of sealant is used in this fashion to marry, or meld, two other beads, it is commonly referred to as a "pigtail." For instance, panels are normally sealed at the eave, through its flat area to the eave flashing, gutter leg, or some other flashing component. This is usually done with a butyl tape. In these areas, it is necessary to "marry" sealer as illustrated in Figure 13-24 at the eave, and Figure 13-25 at the ridge.

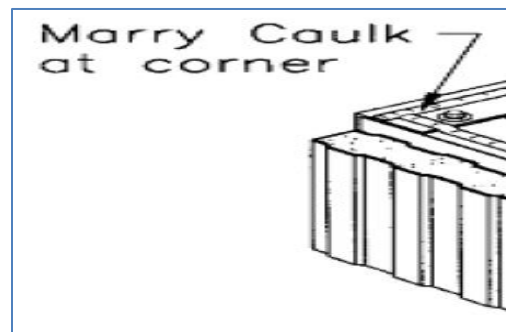


Figure 13-24
Marrying Sealants at Eave Prevents Leakage

Of course, factory-applied sealant often seals the top of the ribbed seam. Where the seam terminates, (at the panel end) there is a discontinuity of sealant in the vertical

portion of the seam between the factory seal and the tape seal at the panel flat. It is not only vital that the installer seals the two rib surfaces together, but also that he marry this vertical bead of sealant to both the eave tape, and the factory seam sealant. When properly done, as illustrated in Figure 13-26, this will create a continuous gasketed seal at the eave area.

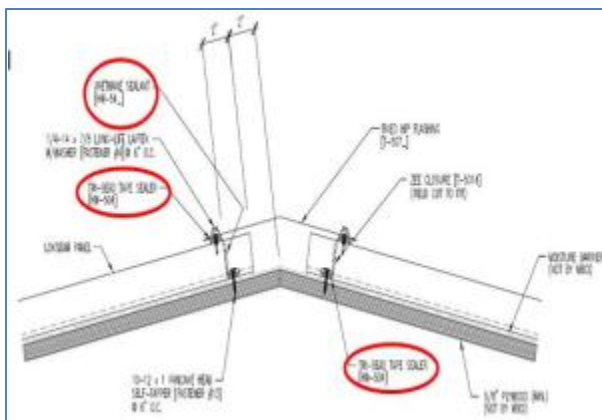


Figure 13-25
Ridge Sealant Example

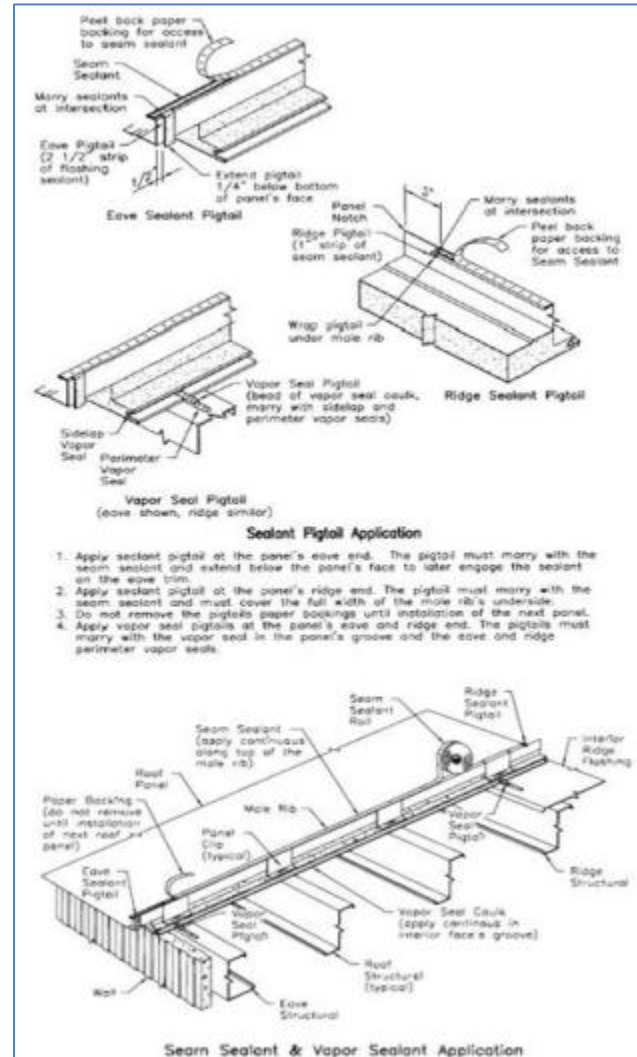


Figure 13-26
Marrying Sealant Details

The same principals are true when using trapezoidal panels, although the exact details are a bit different due to the use of a rib closure. These are illustrated in Figures 13-27, 13-28, and 13-29.

Panel End Detail

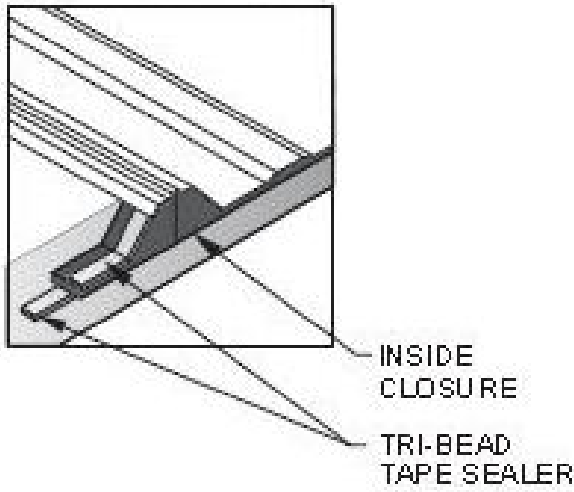


Figure 13-27
Closure Sealing of Panel Closure

TYPICAL DETAILS

Eave Detail

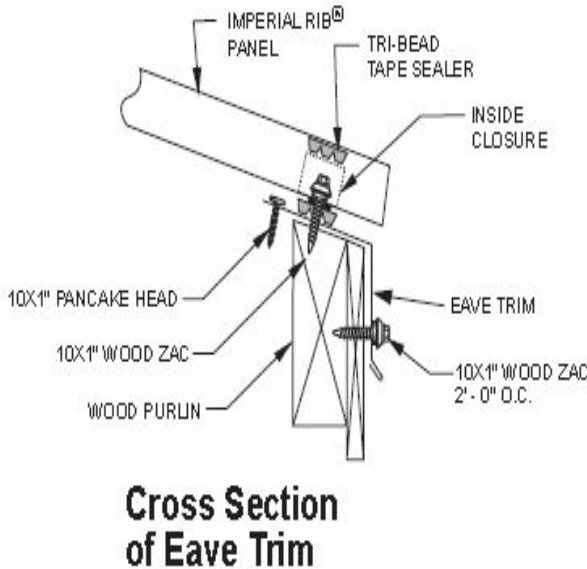


Figure 13-28
Eave Sealing Details

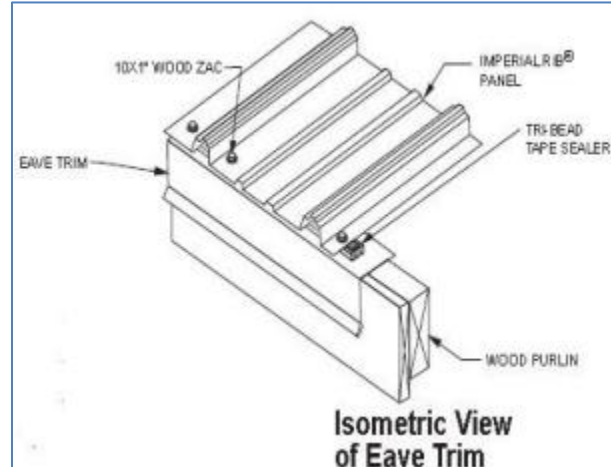


Figure 13-29
Trapezoidal Eave Detail

There are other areas where the use of pigtails is not only appropriate, but vital. Common examples of such areas are the laps of rake flashings, transition wall flashings, and eave flashings. These have been illustrated earlier in this section. At such areas as these, the objective is to marry the lap seal into the panel seal.

13.6.8 Applying Sealants in Cold Temperatures

Sealants used in a metal roof installation are affected by temperature, both ambient temperature and the actual temperature of the roof material. Sealants have a temperature range for storage, and will act differently when applied in extreme hot or cold temperatures. Refer to information on the container or manufacturer instructions for details and additional conditions.

Butyl compounds are easier to use if they are kept warm during very cold weather, and kept cool during very hot weather. Keeping the material in an ordinary ice chest can do this. Equipping the ice chest with a light bulb and fixture, like the ones shown in Figure 13-30, rigged into the lid makes it into a "warm box".

During installation, butyl tube sealant may also be used as a lubricant on butyl tape if desired. Because the tack of butyl tape is so tenacious, it sometimes makes panel adjustment and alignment difficult. When laying a panel to a bed of butyl tape, it will adhere quite readily, and not permit lateral adjustment. If the tape is treated with a very thin bead of tube material, the lateral adjustment is facilitated. (The two formats of butyl, tape and tube, are quite compatible.)



Figure 13-30

Coolers and Lamps Keep Sealant Workable In Both Hot and Cold Temperature Extremes.

Summary

Long life is a prime advantage of a metal roof. Any sealants used during installation must also have a long life. Understanding and using the proper sealants will prevent premature failure of the material. Proper application of the sealant during installation will ensure the roof remains weatherproof and functions as designed.

Notes:
