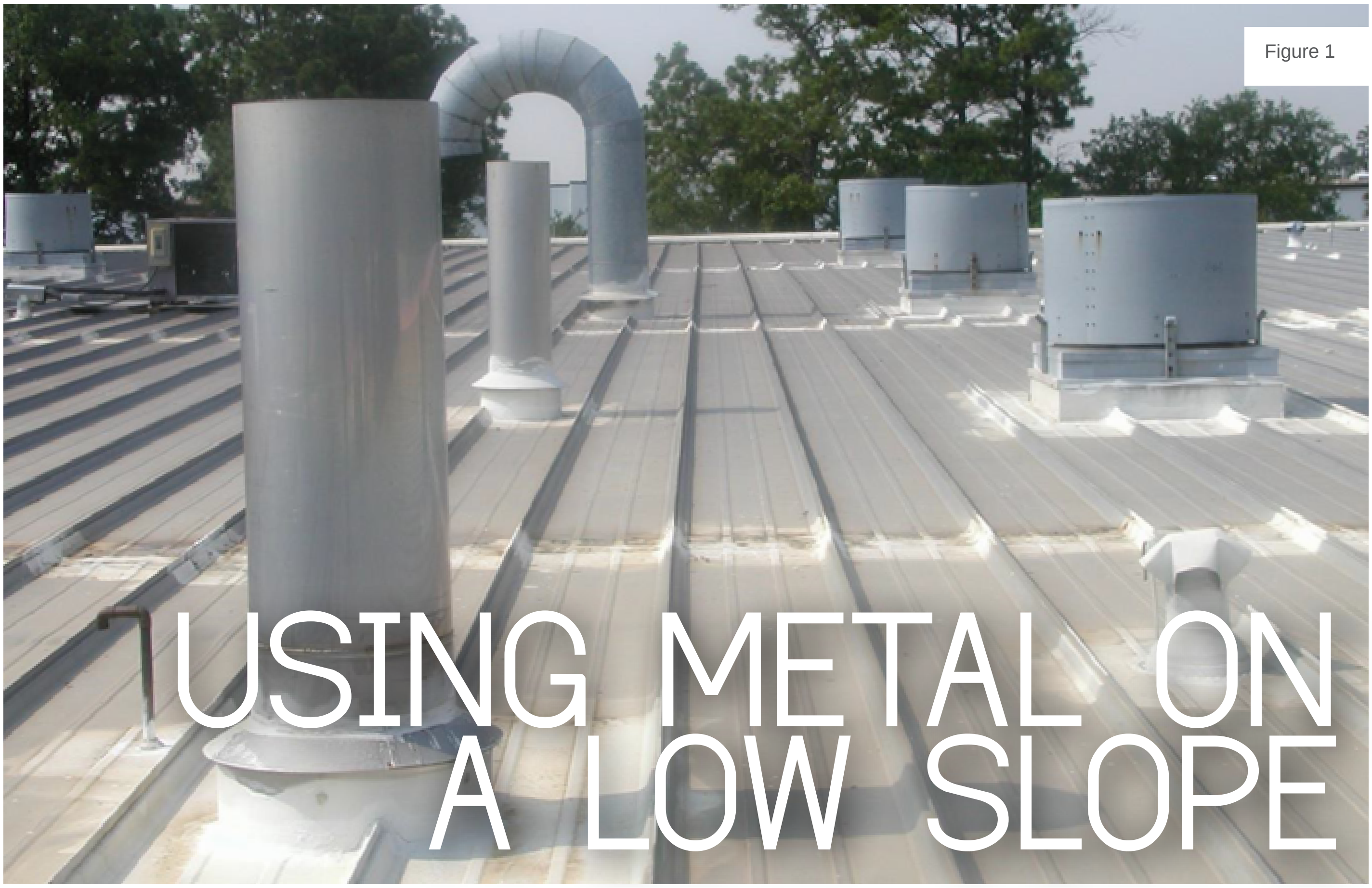

Figure 1

USING METAL ON A LOW SLOPE

Most people think of metal roofing being installed on steep slopes, over 2/12 pitch where the roof is visible, adding to the curb appeal of the building. This is not the type of roofing we will be talking about here. Instead, we will be reviewing methods to successfully install metal roofing on open-frame structures on slopes as low as ¼" per foot where there is no secondary waterproofing.

By: Charlie Smith

This is where one has to get it right the first time—or in the case of replacing or recovering a nonperforming roof—this article will provide methods to get it right the second time around. One thing is for sure: an enormous amount of metal roofing has been installed on industrial and warehouse buildings on pitches as low as 1/4" per foot. The main reason metal is put into these applications is that it costs less than other available systems, and a properly designed metal roof will outlast those other options by a factor of two to three. Logic tells us that if metal is to be used on a low slope, use means and methods that provide the best chance of success. That means eliminating as many places for the roof to leak as possible. The perfect building for a low-slope metal roof would be rectangular in shape, have exterior drainage with 40-foot panels on a 2" slope, and have zero penetrations. Let's face it, consultants won't get a call about that roof, they will be getting calls about the roof in Figure 1.

The roof in Figure 1 has it all: open bar joist installation with five 40' long panels that are lapped together end-to-end covering a 200' span, large penetrations that were installed with the roof on the right, new penetrations that were added later on the left, and a liberal application of caulk and coatings to stop the water from coming into the building through the lap joints. Consultants might not get the call about those leaks because the maintenance man can smear some more goop to slow them down (Figure 2), but for sure, someone is getting a call about this.


Figure 2

There are thousands and thousands of these roofs hiding behind parapet walls with internal gutters and huge condensers, AC units, and vent pipes penetrating them. The question is how to use metal on a low slope and have the greatest chance for success? Most low-slope metal roof leaks can be sourced to one of four things: exposed fasteners penetrating the building envelope; panel end laps, both in the field and around curbs; and alterations after the initial installation because ALL of these roofs are difficult to modify/repair after they have been installed.

Let's see how to address each of these for the best chances for success.

PANEL CHOICE

When choosing a metal roof panel to be installed on a low slope, one need only consider mechanically seamed structural standing seam panels designed to go over open purlins. Stay away from snap together panels on this type of application. The seam height should be over 2" on roofs below 1" per foot slope. One may choose between a trapezoidal shaped rib and a vertical rib. Both have their advantages.

A mechanically seamed, 3" tall trapezoidal rib panel has a couple of advantages over a vertical rib panel. Mainly, trapezoidal panels are the least expensive structural standing seam panels available. They are very common and they cost less to manufacture, package, and ship than a vertical rib panel. They are great on rectangular buildings with few if any curb penetrations and short eave-to-ridge lengths (under 50'). They come with preformed closures at the ridge and eave and have a 3" tall, watertight seam.

Trapezoidal rib panel advantages diminish as the panel length increases, the roof geometry gets more complicated, and the number of penetrations increases. If the goal is to eliminate places for the roof to leak, a good place to start is to eliminate panel end laps. Trapezoidal panels are rarely site-formed, so it would be extremely difficult to cover a run of more than 60' without introducing end laps into the roof (Figure 3).

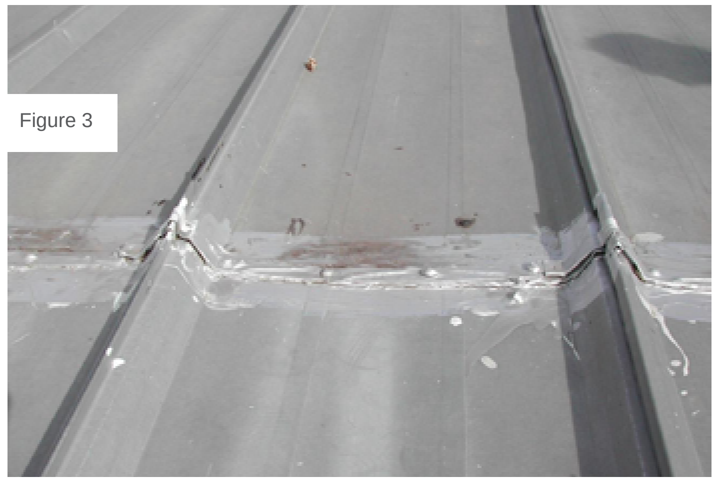
Figure 3

Also, while the shape of the seam lends itself nicely to preformed closures at the ridge, it is a hindrance if the panel has to be cut on an angle for a hip or valley condition. In those conditions, it is much more difficult to make a watertight joint between the closure and the panel seam than a vertical rib panel. Finally, large curb penetrations can be custom made to fit a trapezoidal panel seam, but these panels rely on exposed fasteners penetrating though the roof at all of these conditions, which open up opportunities for water infiltration.

If the roof has a longer panel run, complicated geometry, or curbs, then a site-formed vertical rib panel may be a better choice. Since the goal is to eliminate as many potential leaks as possible, the easiest way to start is to eliminate all end laps. There are two types of vertical ribbed structural standing-seam roof panels: those that are asymmetrical and those that are symmetrical. Both have their advantages. An asymmetrical panel is one piece, installs from left to right or right to left, will most likely be seamed to a 180-degree double

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lock seam, and like trapezoidal panels, have two-piece floating clips folded into the seam. There is an abundance of portable and factory roll formers out there that make a 2” tall asymmetrical panel. This seam height is probably okay down to a 1/12 slope. There are a few manufacturers that offer a site-formed vertical rib panel that is over 2” tall, and this is what is needed to go under 1/12 slope.

An asymmetrical panel has several advantages over a symmetrical panel. They are much more common than a symmetrical panel, and they cost less money because there is only one manufactured component and they use less material to make. The disadvantages of an asymmetrical panel are that there is a break in the seam sealant at each clip location, and the amount of thermal movement is limited to the slide mechanism of the two-piece clip. Also, there is a reasonable chance there can be damage done to the roof panel during the double-lock seaming operation; and finally, these panels are extremely difficult to remove, replace, or repair after they have been installed.

A T-shaped symmetrical panel is run in two pieces: a panel and a separate seam cover that is machine seamed on the roof. These panels cost more money because they use more material and two component parts–panel and seam cover–are required. Since there is no contact between the seam sealant and the clip, there is no interruption of the seam sealant, yielding a more watertight seam design. Symmetrical panels allow more flexibility during installation, have a higher wind uplift capacity and can be easily removed, replaced, or repaired after installation.

TRAPEZOIDAL RIB VERSUS VERTICAL RIB

Figure 4 shows a misapplication of a trapezoidal panel on a low slope, terminating into a diagonal headwall.

Figure 5 shows the actual closure.

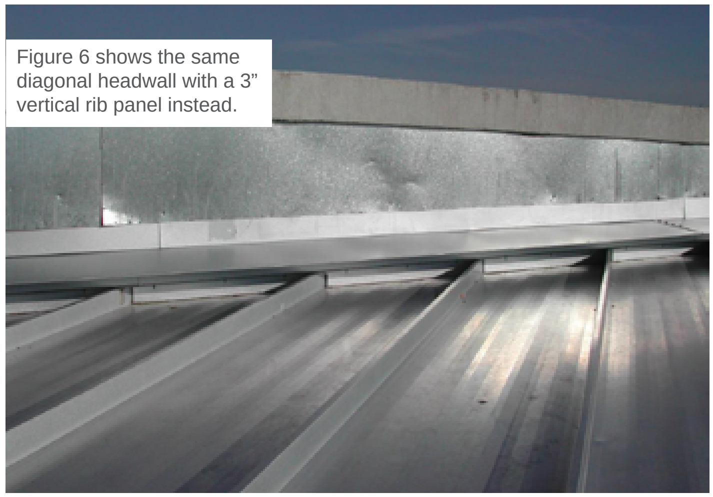

Figure 6 shows the same diagonal headwall with a 3” vertical rib panel instead.

EAVE CONDITION

When using a vertical rib panel on a low slope, it is best to fix the panel at the eave and allow it to expand toward the ridge. This is done for several reasons; mainly, this provides a more watertight eave condition than a panel that is hooked on the eave trim like on a steep-slope architectural panel. Fold the end of the panel straight down so the water runs off of the panel and does not try to work its way back into the eave trim (Figure 7).

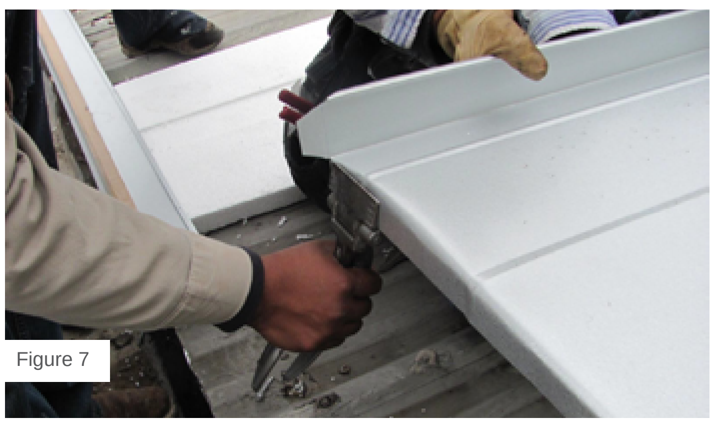

Figure 7

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Next, lay down double- or triple-bead tape seal on the eave trim, then fasten through the panel into the eave trim or 16-gauge offset cleat to get a good compression seal with the fasteners overhanging the gutter (Figures 8 - 9).

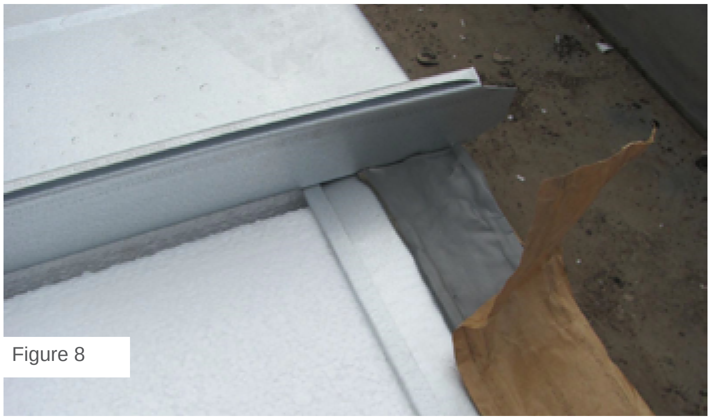

Figure 8

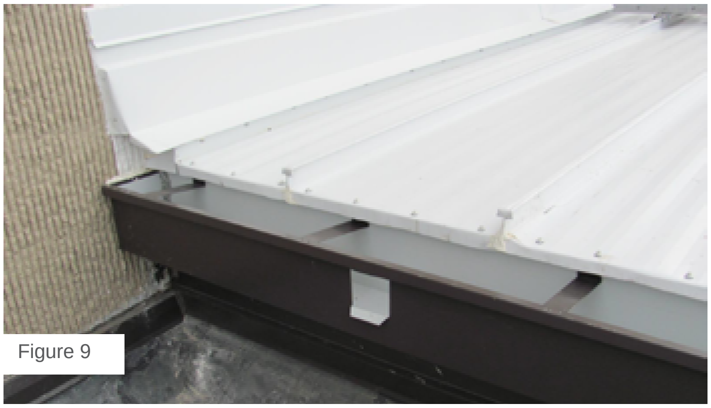

Figure 9

RIDGE CONDITION

In regard to ridge conditions on low slope roofs: if a vertical rib panel is used, then take the opportunity to bread-pan it behind the closure (Figure 10). This is cheap insurance against leaks. It can be done without cutting the panel seam.

Figure 10

CURBS

The most difficult place to make a low-slope metal roof watertight is on a curb. At every curb, there are a minimum of four end laps. Fortunately, there is a way to eliminate these end laps. On the roof in Figure 11, there were nearly 700 panel end laps with around 100 occurring around curb penetrations. The overall panel length was nearly 250 feet.

Figure 11

The roof in Figure 12 was recovered with zero end laps! This is because of the use of variable-width, site-formed, vertical-ribbed panels and transverse panels uphill of all large curb penetrations. Transverse panels are not new, but they are seldom used. Transverse panels can be used to eliminate ALL end laps on a low-slope metal roof. In order to best utilize them, two panel widths can be used to ensure that the panel seam lands as close as possible to an existing curb penetration. Figure 12 shows the use of both 24” and 18” panels, which land the seam within 6” of the curb.

Figure 12

Installing transverse panels is pretty simple.

Continued on page 12

Continued from page 10

Basically, the roof is sheeted up with a seam landing as close as possible to the curb, then across the low side of the curb, and up the other side, leaving a hole in the roof behind the curb that runs all the way to the ridge (Figure 13).

Figure 13

Then, add an eave member down each side and a support member down the middle of the hole that runs all the way from behind the curb to the ridge (Figure 14). The support member should be slightly taller than the eave member so that the transverse panels have a slight crown. Panels are attached to the eave members and supported in the middle.

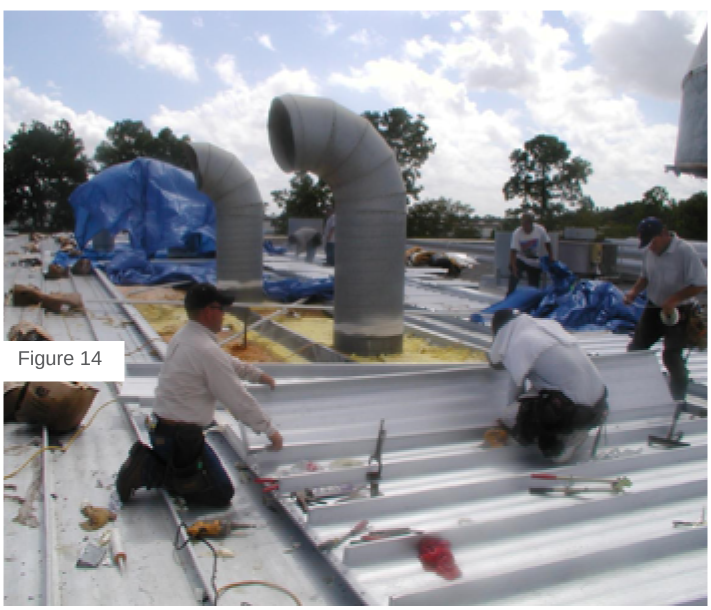

Figure 14

Transverse panels can be used to raise difficult penetrations above the plane of the roof, isolating them and greatly reducing the chance of having a leak (Figure 15).

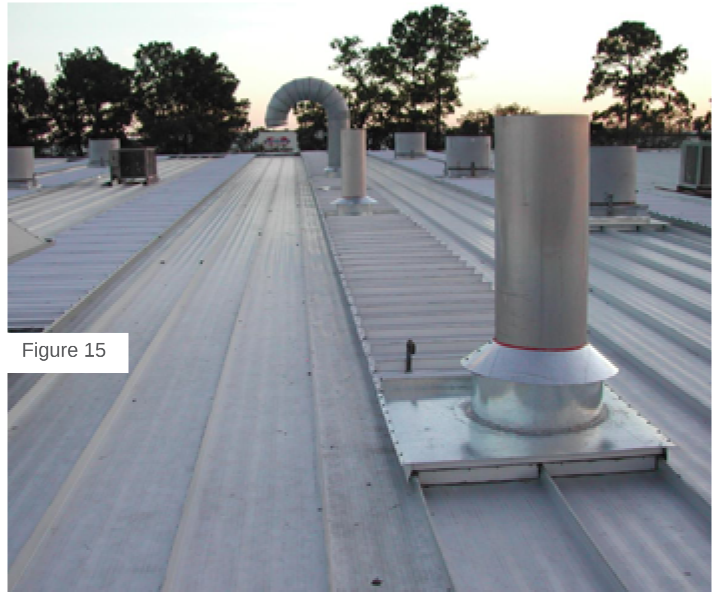

Figure 15

So in order to increase the chance of success when using metal roofing on a low slope, start by eliminating all of the places for a metal roof to leak: exposed fasteners penetrating the building envelope; panel end laps (both in the field of the roof and around curbs) by using a site-formed panel when lengths are too long to ship; and by using transverse panels uphill of curbs. Also, use a vertical rib panel as the geometry gets more complicated, panel lengths increase, and the number of curbs increases. Finally, consider a symmetrical panel when the likelihood of needing to open the roof to make a change or replace a panel at a later date is reasonably high. This will save a lot of heartburn.

Metal used in this manner can be applied not only in new construction, but to recover an existing metal roof or even an existing externally drained modified or single-ply roof that is on a ¼” slope.

McELROY METAL