Part two: Snow and ice on metal roof systems

by **Thomas L. Smith, AIA, CRC**

Last month's "Tech Transfer" discussed various design considerations related to metal roof systems subjected to snow and ice. This article will continue the discussion by addressing ice guards, eaves and valleys.

The need for ice guards was previously reviewed; therefore, this article will focus on ice guard details. There are no "off-the-shelf" devices for protecting metal roofs from falling ice from an upper roof. Therefore, the designer needs to employ good judgment in designing the guard. Unfortunately, there is little information in the open literature or from manufacturers to assist the designer.

One approach that has been successfully used is placing a strip of plywood over the metal roof in the area where ice is expected to fall. For aesthetics, the plywood is covered with metal roofing. The key to this solution rests in several details.

First, the plywood should be preservative-treated for longevity, and the thickness should be ⅝ inches (19⁄32 inches) or greater. A strip of neoprene should be placed between the plywood and top of the standing seam ribs or battens to serve as a shock absorber. The neoprene pads should be about ⅜ inches thick and fairly spongy (have a low durometer).

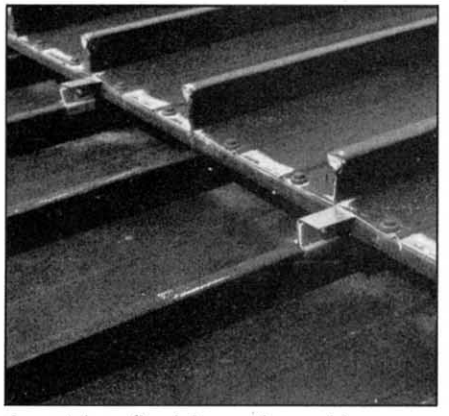
Because the plywood guard is intended to deflect (depress) under impact load, it should not be screwed to the metal roof. Rather, it should be retained by clips attached to the roof ribs. The clips should prevent the guard assembly from sliding down the roof and blowing off, but they should also allow guard deflection.

If the impact load is expected to be high, the ribs supporting the guard should be reinforced with special stiffener clips within the rib (typically stainless-steel of 20 gauge or greater should be used). If stiffeners are to be used, coordinate their design with the panel manufacturer.

The width of the plywood panel will depend on the distance between the upper and lower roofs. A width of 4 feet should be adequate if the distance is less than about 20 feet. The guard should be placed to provide protection on either side of the drip line.

Valleys and eaves

Where snow can accumulate on the roof, development of ice dams at valleys and eaves should be anticipated. On warmer days, also expect water behind the ice dam. Accordingly, the panel ribs or battens should be designed with sealant or sealant tape between the mating surfaces, so the panels are watertight even when subjected to water.



A metal roofing/plywood panel ice guard placed above a metal roof system.

If the clip goes over the rib of the bottom panel, and the sealant or sealant tape is then applied, a metal-to-metal joint occurs and can allow water infiltration. To avoid this, the sealant should be applied to the rib in the area of the clip prior to placement of the clip.

Because of the difficulties of eave and valley design and construction, it is prudent to design a modified bitumen underlayment (ASTM D 1970) extending a few feet beyond either side of the valley. At the eave, the underlayment should be detailed to allow for drainage of water from within the roof that leaks through the metal system and is intercepted by the underlayment.

At valleys, converging ice or snow may bend over ribs. Where bending is likely, the design should include rib stiffeners as previously described.

If gutters are used, extra care should be taken in their design. They should be capable of carrying the eave ice load and of accommodating the expansion of water turning to ice. As with any gutter design, the outer lip should be lower than the gutter-roof intersection. Gutters are problematic in climates with substantial snow and ice. In these climates, gutters should be avoided.

If the roof is a "warm roof" (no ventilation between the top of the insulation and metal roof), and there is an overhang, the overhang should also be warm to minimize edge icing.

In summary, metal systems can be successfully used in areas that receive snow, provided attention is paid to design and installation. The magnitude of the snow and icing conditions will dictate the degree of needed attention. In climates with severe conditions, metal roof systems should be avoided if the roof geometry is highly complex, because of the great difficulties these complexities present.

In addition to carefully detailing metal systems to accommodate snow and ice, consideration should also be given to selection of the system itself. With some panel systems, it is easier to design details to withstand the extreme conditions that are often encountered. PR

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