

Photo One - Ultra low-slope aluminum standing seam roof, education centre, England.



By **STEPHEN TEAL**

While previous articles have dealt very effectively with various aspects of metal roofing, there has been little mention of “bulb seam” metal roofing. These systems have been used in Europe for over 40 years (*Photo One*) and are starting to gain ground in Canada and somewhat in the United States. While they may be new to most readers, the primary manufacturer of this type of system has over one billion square feet installed throughout the world.

Bulb seam systems are like most products in that success is dependent upon detailing and workmanship, and inasmuch as the roof should be installed by factory-trained and certified technicians. The systems are seeing great success with numerous high-profile projects around the world including Heathrow Airport, Dubai Airport, the Dubai Mall and at the 2012 London Olympics, to name a few. When installed by a certified installer according to the manufacturer’s details, a system warranty of up to 40 years is available.

Some of these systems have undergone extensive testing, including ASTM, FM Global, hail testing, acoustic performance and low U-value assembly testing.

When polyamide halter clips are used, additional benefits are realized (*Photo Two*). There is virtually zero thermal bridging, increased ability to accommodate thermal movement, a lower coefficient of friction, and improved acoustic performance of the roof. Halter clips are available in various heights in increments of 0.2 in. (5 mm) to a maximum of 9-5/8 in. (246 mm) overall height. The polyamide clips will greatly

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Photo Four - Arsenal showing vegetated roofing over low-slope standing seam and curved system.



assist with the trend towards increased R-values in the new building codes.

Pans are available in various widths, from 12- to 20-in. (300- to 500-mm) and usually two seam heights – two- and two-and-one-half-inch (50 mm and 65 mm), allowing for up to eight-inches (200 mm) of mineral fibre insulation without the use of any Z bars. Thicker insulation can be used by installing a hat section under the clips or a layer of high-density isocyanurate as a base layer. U-values as low as 0.9 W/m/K can be achieved with this insulation combination.

Most manufacturers of this type of system provide copper, aluminum, zinc and stainless steel sheet material. Galvanized steel is generally not used due to potential corrosion issues. Approximately 95 per cent of the roofs installed are in aluminum, usually mill-finish, embossed material. While pre-painted aluminum is readily available and commonly used, in a low-slope environment, the pre-painted finish will not usually last the 40-plus-year life expectancy of the roof. Hence, there is a trend in the industry towards anodized finishes.

Aluminum, like copper and zinc, has a long history of durability; aluminum sheet was used to cover the roof on the San Gioacchino Church in Rome in 1887 and is still in excellent condition. Aluminum is also very environmentally friendly, being the most abundant metallic element in the earth's crust and easily recycled with no loss in physical properties. At least one system can be unzipped and the roof panels reinstalled on another project, should the need arise.

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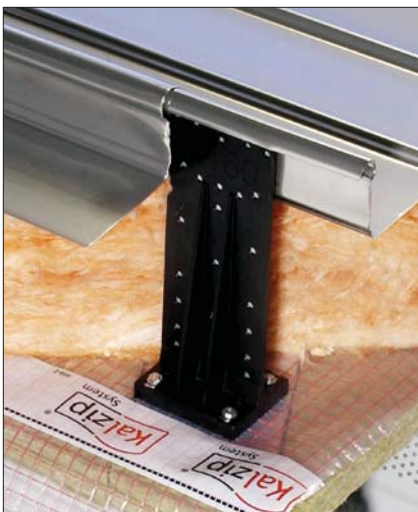


Photo Two - Typical polyamide clip (halter) detail.



Photo Three - Low-slope standing-seam aluminum low-slope standing seam and curved system.

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The preference is to site-roll these sheets, allowing for virtually unlimited sheet length. Roof sheets up to approximately 650 ft. (200 m) long have been successfully installed. The elimination of end laps by using continuous sheets avoids the cause of many leaks on low-slope metal roofs. Where end laps are unavoidable, such as when transitioning from curved sheets to straight sheets, the lap should be fully-welded, creating a monolithic sheet. Details such as miters should be fully-welded, and roof curbs should also be welded into the roof sheets. When roof curbs are installed, if they are not located at or near the fixed point, a double curb is commonly used. The inner curb supports the unit, the outer curb flashing waterproofs and moves with roof panels, and low-density insulation is placed in the cavity between the curbs.

A correctly installed roof of this type



Photo 6 - Small skylight showing welded detailing.

should have zero fasteners through the pan and no caulking required at any location, including in the seams. If this approach goes against the normal thought process, one manufacturer even has vegetated roof assemblies that can be installed directly over the metal roof (Photos Three and Four). It is doubtful that many manufacturers or contractors would be comfortable installing growing medium and plants on traditional low-slope metal roofs.

These roof systems can also accommodate many types of PV panels (Photo Five), walkways, snow guards, etc. without penetrating the roof sheets. Some manufacturers also provided integrated skylight systems (Photos Six and Seven). Metal liner panels and decks can be provided with the liner profile matching the clip spacing of the roof panel, thus saving on installation



Photo Five - Low-slope aluminum standing seam with integrated solar panels and skylights.

time. See Photos Eight and Nine.

While the initial cost of this type of roof assembly may be slightly higher than some other options, including membranes, these systems can be considerably less expensive when life cycle cost is considered.

The majority of the installations of these products are low-slope – as low as two per cent. Several major chains in the U.K. specify these systems for their big-box, low-slope roofs, including Asda, the British arm of Walmart. Bulb seam panels are not limited to

low-slope roof applications. Numerous jobs have incorporated the roof sheets transitioning into the wall or curved down to grade. We have seen several applications where these products have been used as both horizontal and vertical wall systems. See Photo 10.

Curved roof profiles can be achieved by machine curving or letting the aluminum sheets follow a curve naturally. The radius that can naturally bend depends upon the profile, the gauge of the aluminum, and

whether it is concave or convex, but is typically in the vicinity of 150 ft. See Photo 11.

The roof sheets can be site-curved to facilitate both convex and concave roof profiles, down to a radius of five-feet, or convex-curved by crimping to a minimum radius of two-feet. Panels can be roll-form tapered, elliptical, wave-formed or “S”-curved; even tapered curved sheets are common. See Photos 12 and 13.

This type of roof sheet can also act as a waterproof substrate to facilitate the installation of exotic materials, such as a rainscreen over the roof panels, without any penetration of the roofing assembly. The rainscreen materials may be almost any type of panel, including solar panels, stone slabs or composite aluminum panels as shown in Photo 14.

QA/QC CONCERNS

The vast majority of these roof types are manufactured from aluminum. One of the primary design concerns is making adequate allowance for thermal movement



Photo Seven - Low-slope aluminum roofing with integrated skylights and fall arrest.

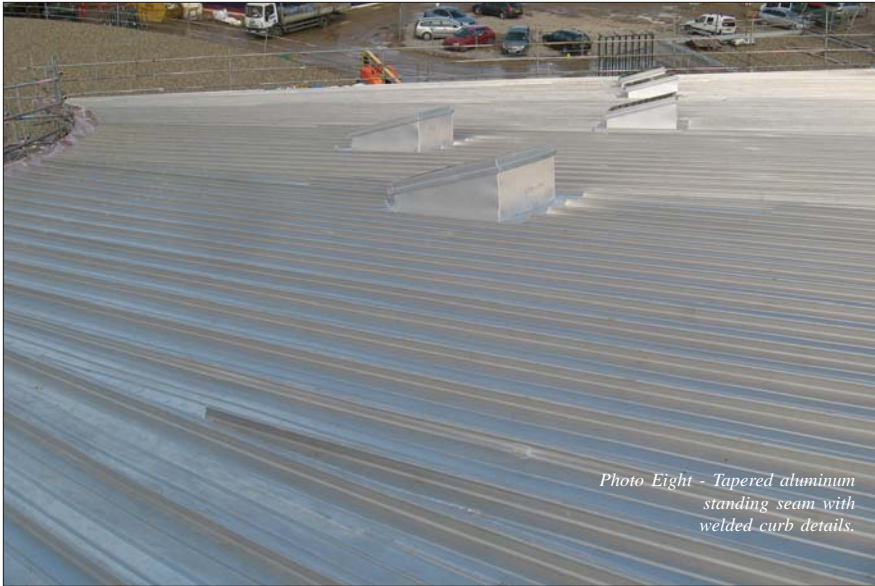


Photo Eight - Tapered aluminum standing seam with welded curb details.

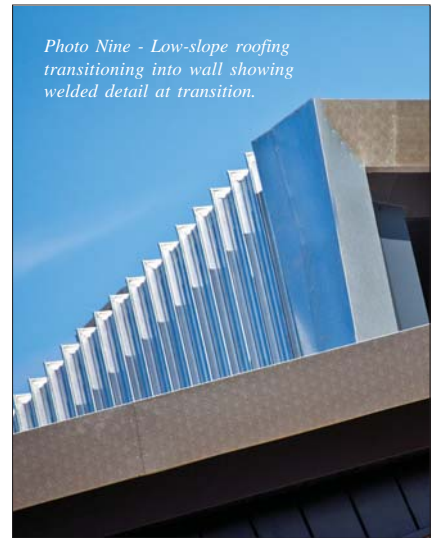


Photo Nine - Low-slope roofing transitioning into wall showing welded detail at transition.

— typically around one per cent or double that of a steel sheet. The location of the fixed point and the respective stresses on the fixed-point fasteners should be given careful consideration. The positioning of the fixed point will determine the location and the amount of movement to be taken up in the eave and ridge details. Some attachment clips have limited travel allowance, and care should be taken to ensure that the amount of movement does not

common but significant concern is when auxiliary items such as PV panels or snow stops are mounted to the roof using seam clamps. It is imperative that seam clamps not be located near clip locations when one-piece clips are used so that the panels' thermal movement is not inhibited.

Flashing detailing must be reviewed to ensure the flashings are not fixed to the roof sheets except at fixed-point locations.

Foot traffic in the pans during construction should be avoided; installers should walk on the ribs. In areas of high traffic, a permanent or temporary grip-strut type walkway might be beneficial. These

aforementioned items and conditions must be assessed by a competent consultant early in the design process and should be reviewed by the system manufacturer.



Photo 10 - Typical low-slope aluminum standing seam with curved roof/wall application.



Photo 11 - Low-slope aluminum standing seam "discus."

CONCLUSION

These systems have a long track record

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exceed the clip design when this type of clip is used. Two-piece clips should also be installed with the sliding portion in the correct position, depending upon installation ambient temperature.

Clip alignment is also critical, as clips that are out of design tolerance can create unintended fixed points. One of the major factors in clip alignment issues is the structure being out of specification, creating humps and valleys in the roof. A less

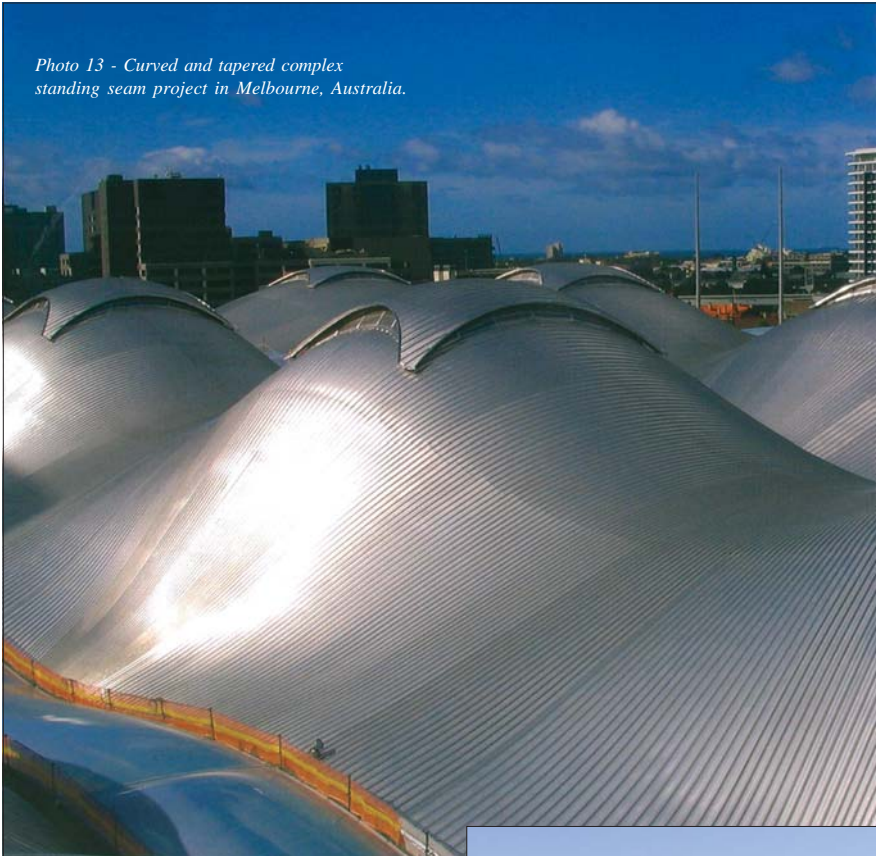


Photo 12 - Complex convex/concave curved aluminum standing seam roof.

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Photo 13 - Curved and tapered complex standing seam project in Melbourne, Australia.



of successful installations, some of which are very complex in design, while others are just basic boxes, and some have vegetated cover. The roof profile and building shape are limited only by the imagination of the designer. Solar, vegetated, low-slope or steep-slope – the choice is yours. By utilizing aluminum as the standard material, the life expectancy of the roof is greatly enhanced, resulting in a low life-cycle cost. See Photo 15.

ABOUT THE ARTICLE

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Photo 15 - Low-slope prefinished standing seam painted and cranked sheets transitioning to wall, plus curved upper roof.



Photo 14 - Composite aluminum panels over curved and low-slope, standing seam aluminum roof. No penetration of the roof sheet.



ABOUT THE AUTHOR

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