

STANDING SEAM SPOTLIGHT

An Educational Bulletin for Metal Roofing Professionals

Thermal Movement

by Amy Stokes

Metal roofing is in constant motion. Although not typically visible to the naked eye, standing-seam metal roofs actually move when temperatures change. Even an occasional breeze or intermittent cloud on a sunny day can cause a metal roof to expand and contract.

The table below shows how much movement can be expected at various distances for steel and aluminum roofing subjected to various temperature changes. Metal temperatures can easily reach 180° F in the sun, and can drop below freezing at night in most locations.



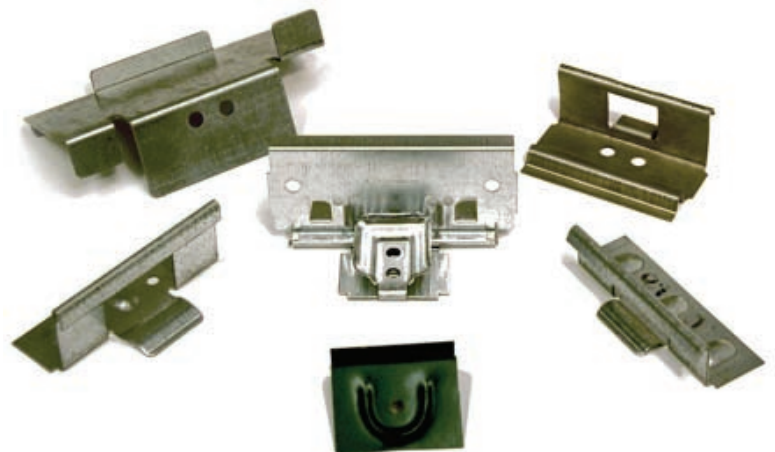
For design purposes, it is reasonable to consider a 100° F differential as a minimum service temperature range for a 24 hour period. However, for the service life of metal roofing system, the Army Corp of Engineers specifies a minimum 160° -180° F differential, and up to a 240° F differential for dark colors, high altitudes, and/or northern locations.

While transverse panel movement is absorbed by the panel pan's ability to flex upward slightly, the longitudinal movement is accommodated by designing the system to "float" across the structure. Flashing and details, clips, sealants and other system components all work together to create a monolithic roofing system that "floats" while remaining impervious to water and wind.

Clips

Early through-fastened metal roof systems were not designed to accommodate thermal expansion and contraction. As a result, the constant movement of the roof panels "slotted" the fastener holes causing roof leaks.

Today's standing seam roofs are attached with concealed panel clips, which are designed to accommodate thermal movement. The purpose of a clip is to hold down the roof and allow panels to move as smoothly is possible, while keeping the entire system watertight.



But not all clips are created equal.

Two Piece Clips

Two-piece clips were developed for double-lock standing seam roof systems. They consist of an upper piece that is clamped tightly into the seam of the roofing panel, a lower piece that is fastened to the substrate, and a slip joint connecting to two pieces. The purpose of this design is two-fold: to allow panel movement, and to prevent that movement from wearing away and weakening the seam sealant.

While two-piece “slider” clips accommodate some movement, it is limited. In order to ensure the clip’s maximum movement is allowed, the contractor must move the clips into a position based on the ambient temperature during application. This is a very difficult task, requiring the contractor to make accurate calculations in the field. A simple miscalculation can impede, or even completely restrict, panel movement. Furthermore, installers must set all of the clips at exactly the same position. If slider clip positioning varies even slightly, movement can be inhibited and failure risk is elevated.

Another concern with a two-piece clips system is clip binding, which can cause a panel to rupture. This happens when the upper section of the clip pivots out of place and can no longer slide along the slip joint. Clip binding can happen at any time on any roof and can cause a panel to rupture. Curved roofs are particularly susceptible to clip binding.

Two-piece clips systems do have their uses, but if unlimited thermal movement is required for your project, a metal roofing system that employs a two-piece clip may not be the ideal option.

Material and Coefficient of Thermal Expansion in Inches per Inch per Degree Fahrenheit		Change in Length at Increase of 150 Degree Fahrenheit				
		At 10 Feet	At 20 Feet	At 30 Feet	At 40 Feet	At 50 Feet
Steel	.0000067	.120	.240	.360	.480	.600
Stainless Steel	.0000098	.176	.352	.528	.704	.880
Copper	.0000098	.176	.352	.528	.704	.88
Tin	.0000117	.211	.422	.633	.844	1.055
Aluminum (1100)	.0000138	.248	.496	.744	.992	1.240
Lead	.0000164	.295	.590	.885	1.180	1.475
Zinc (rolled)	.0000174	.313	.626	.939	1.252	1.565



One-Piece Clips

A one-piece clip offers significant strength and allows panels to move as needed in response to mild and significant temperature changes. Since it does not require exact placement of a slider for each clip, nor does it depend on the contractor’s knowledge of how temperature affects metal, installation of the one-piece clip is easier, faster and more reliable. The one-piece clip system does allow unlimited thermal movement.

Since the clip is made of a single piece of steel rather than two integrated pieces, clip binding is not a concern. A one-piece clip’s success, however, does depend on the panel’s seam design to properly hold and isolate the clip. If this design characteristic is not effectively utilized, then the stationary clip could rub against the sealant in the floating seam and cause premature sealant wear.

The wings of a properly designed one-piece clip are designed to fit into the panel in such a way that they never come into contact with the hot-melt sealant. This is very important since the isolated sealant is protected, and no matter how much cyclical movement the panels experience over the course of their life, the waterproofing sealant will not be degraded due to that movement.

Together, a well-designed standing seam system coupled with a one-piece clip will provide long-term weather-tight performance with easier and faster installation.

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