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Why Through-Fastener Roof Systems Are Not As Energy Efficient As the Standing Seam Roof Systems

Today, with the increasing prices of electricity and natural gas needed to operate a building, more and more building owners are looking for the most energy efficient building possible.

ASHRAE

ASHRAE stands for American Society of Heating, Refrigerating and Air-Conditioning Engineers. In many municipalities, ASHREA 90.1 guidelines must be met for energy code approval.

The ASHRAE 90.1 guidelines have been around the building industry for many years. In 1992, the Energy Policy Act (EPAct) was passed requiring state energy codes to adopt ASHRAE 90.1 for commercial buildings. As a result of this act, about half of the states had adopted a version of ASHRAE 90.1 for the basis for the state energy codes. Unfortunately, because of the different versions of ASHRAE 90.1 there is no consistency on how the ASHRAE 90.1 requirements are applied. The Energy Policy Act of 2005 changed that requirement to adopt the ASHRAE 90.1-2004 in all states by 2010. The 2006 International Energy Conservation Code (2006 IECC) requires the ASHRAE 90.1 guidelines be followed in developing an energy budget cost analysis.

ASHRAE has been given a mandate by the Department of Energy to improve current levels of building design energy efficiency by 25% in the next five years and by 50% in the next eight years. What this means is that techniques we have used to construct buildings in the past twenty years may no longer meet new energy requirements.

Insulation “Factors”

Architects, engineers and contractors use various “factors” to express the insulation value of a material or a composite structure. The two we face in metal building construction are R-Factors (Values) and U-Factors.

R-Factors (Values) – The Higher the Better

R-Factors (Values) are the most discussed and misunderstood factors in insulation. R-Factor is a measure of the resistance to heat flow. An R-Factor can be determined for a single insulation at a specific thickness. As R-Factors increase resistance to heat flow increases. In other words the higher the R-Factor the better. R-Factors are a valid measurement as long as the insulation product itself is not changed in any way, shape or form. Fiberglass, for example, only retains its insulation value if it is not compressed or crushed. If screws are used to fasten rigid board to a structure its value diminishes. For these reasons ASHRAE will be leaning more to insulation performance of composite structures.

Insulation "Factors" continued

U-Factor – The Lower the Better

A U-Factor is the overall coefficient of heat transfer for all the elements of construction, as well as environmental factors. The U-Factor is typically used with a combination of materials and is the inverse of the R-Factor. The LOWER the U-Factor, the greater the assembly's resistance to heat flow and the better its insulating value. Roof U-Factors currently required by ASHRAE for Climate Zones 1-7 are 0.065 and 0.049 for Zone 8. These factors may become more stringent with pending future changes. ASHRAE will be utilizing U-Factors for entire roof assemblies in future specifications.

Through-Fastener Roofs do NOT meet the current ASHRAE 90.1 U-Factor requirement of 0.065 for Climate Zones 1-7.

Building assemblies listed in the ASHRAE manual have been determined over the years from actual hot box thermal testing and confirming Finite Element Analysis.

1. If a building assembly is not listed in the charts, the reason may be that when the building assembly was actually tested; the resulting R-value will not go over a certain value due to the actual construction make-up of the building assembly.

2. Another reason for the required building assembly not being listed, is that it has not been submitted for hot box testing.

3. To get new approved building assemblies, hot box tests have to be run and confirm with a Finite Element Analysis model which then has to be accepted by ASHRAE before it can used.

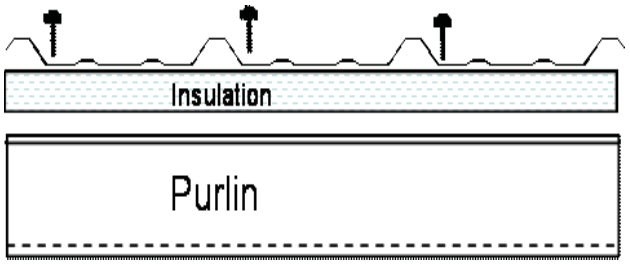
The minimum time frame for adding new assemblies is estimated to be two years from start to finish.

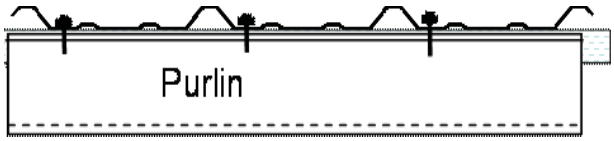
Through-Fastener Roof System (Screw Down)

The Screw Down roof system product feature shows the reasons for its lower energy efficiency impact.

Compression of the blanket insulation

Blanket insulation with a Screw Down roof will be compressed to almost zero thickness of the blanket insulation when the roof is installed. Blanket insulation needs to expand to be an energy efficient roof assembly. This thin layer of crushed insulation results in a roof system with limited energy efficiency.





Standing Seam Roof System

The chart of the available roof assemblies for the Standing Seam Roof system with thermal blocks indicates that an SSR roof system with thermal blocks can be assembled with many combinations of blanket insulation to meet most of the U-Factors and R-Value requirements listed in the ASHRAE manual.

Insulation System	Rated R-Value of Insulation	Total Rated R-Value of Insulation	Overall U-Factor for Entire Base Roof Assembly
Standing Seam Roofs with Thermal Blocks			
Single Layer	None	0	1.280
	R-6	6	0.167
	R-10	10	0.097
	R-11	11	0.092
	R-13	13	0.083
	R-16	16	0.072
	R-19	19	0.065
Double Layer	R-10 + R-10	20	0.063
	R-10 + R-11	21	0.061
	R-11 + R-11	22	0.060
	R-10 + R-13	23	0.058
	R-11 + R-13	24	0.057
	R-13 + R-13	26	0.055
	R-10 + R-19	29	0.052
	R-11 + R-19	30	0.051
	R-13 + R-19	32	0.049
	R-16 + R-19	35	0.047
	R-19 + R-19	38	0.046

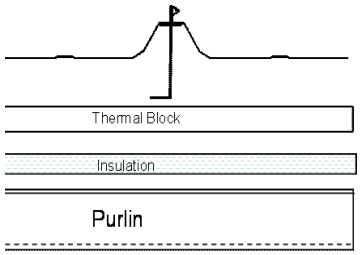
Standing Seam Roofs vs. Through Fastener

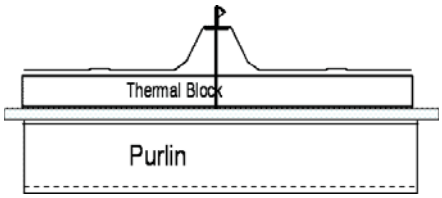
As you can see from the chart below, the Standing Seam Roof System with thermal blocks is 32% to 37% more energy efficient than the Through-Fastener Roof System because its roof assembly can allow the use of a variety of different insulation combinations.

Fiberglass Insulation R-Value	Overall U-Factor For Entire Base Roof: Through-Fastener Roof	Overall U-Factor For Entire Base Roof: Single Layer Standing Seam Roof With Thermal Blocks	Standing Seam Out Performs Through-Fastener Roof
R-10	0.153	0.097	37%
R-11	0.139	0.092	34%
R-13	0.130	0.083	36%
R-16	0.106	0.072	32%
R-19	0.098	0.065	34%

Meets Current ASHRAE 90.1 Requirements

The Standing Seam Roof system, also, will compress the blanket insulation between the roof panel and the top of the purlin. However, the SSR calls for a thermal block which provides additional energy efficiency in place of the crushed blanket insulation over the purlin for the roof assembly.





Other Advantages of Standing Seam Roofs vs. Through-Fastener

Thermal Bridging of the Connections in a Screw Down Roof.

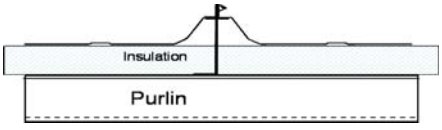
With a Screw Down Roof and its multiple screws, an energy condition called thermal bridging develops. When thermal bridging occurs, the screws will transfer the temperature from one side of the panel to the purlin.

With an SSR roof with fewer roof screws and a thermal break clip, this heat loss doesn't take place or is greatly reduced.

Support of the SSR panel by the SSR roof clip.

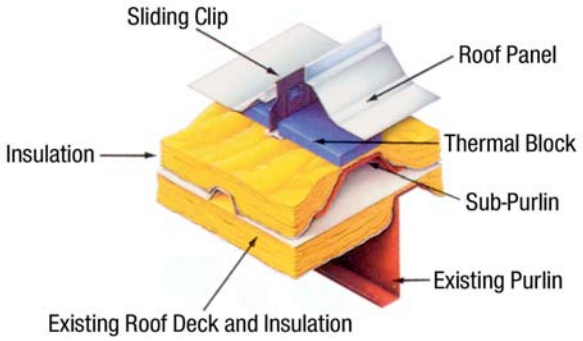
SSR roof clips have been designed with shoulders to support the SSR panels at the seam. This shoulder support reduces or prevents the blanket insulation from being totally crushed.

In some SSR conditions, this shoulder feature could eliminate the need for the thermal block because the crushing of the blanket insulation can be prevented by the clip shoulder. However without the thermal block, the panels will not seam as easily as required. All approved SSR roof assemblies require the installation of the thermal block.



Conclusion

In conclusion, the design of the Standing Seam Roof System with thermal blocks has been developed and proven to be over 32% more energy efficient than the Through-Fastener Roof System as proven by years of actual installations and repeated hot box testing.



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