



## Thermal Transmittance of Insulated Metal Building Wall and Roof Assemblies

### Energy Code Requirements in Canada

Most provinces in Canada are in the process of enacting energy conservation requirements for new buildings. The National Energy Code of Canada for Buildings, 2010 (NECB) is the model code, which the province may adopt or alter as they deem necessary. For example, Ontario has enacted Supplementary Standard SB-10 Energy Efficiency Supplement that has different requirements than the NECB. Another standard also referenced in Canada is ASHRAE 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings.

Listed in Tables 1 and 2 are the maximum thermal transmittance limits of above-ground opaque assemblies based on these three standards. The requirements vary by geographic location as defined by the heating degree days. The map of Canada in Figure 1 shows the demarcation of the zones. The specific degree-days for cities in Canada can be found in Appendix C of the National Building Code of Canada, 2010.

### Metal Building U-Factors

The North American Insulation Manufacturers Association (NAIMA) has published a Guide to Insulating Metal Buildings for Compliance with ASHRAE 90.1-2010. This document provides the effective U-factors (thermal transmittance) for various metal building roof and wall assemblies. The information is very useful for the metal building industry; however, the U-factors are given in US customary units. Listed in Tables 3 through 10 are the equivalent metric U-factors for the assemblies listed in the NAIMA Guide. Included with each table is a sketch taken from the NAIMA Guide of the assembly. The insulation is identified by both the R-value (US Customary) and the RSI-value (Metric) for convenience. For additional details of the assemblies, consult the NAIMA Guide.



Figure 1: NAIMA Guide to Insulating Metal Buildings for Compliance to ASHRAE 90.1-2010

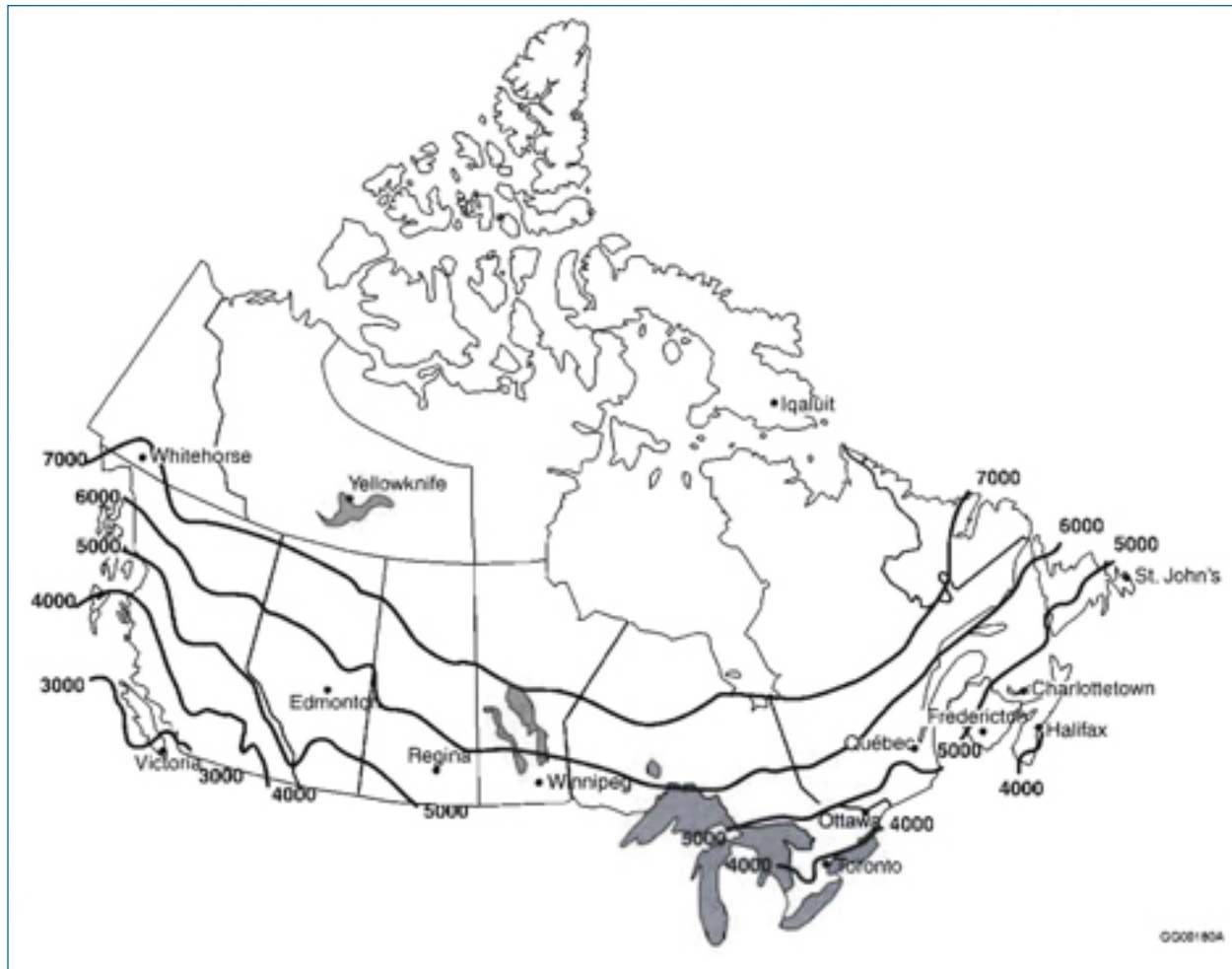


Figure 2: Average Annual Heating Degree-Days (C-degrees)  
 Source: NECB 2010, National Research Council of Canada

**Table 1: Prescriptive Requirements for Maximum Overall Thermal Transmittance for Roofs (W/m<sup>2</sup>K)**

Code or Standard	Heating Degree-Days of Building Location (Celsius Degree-Days)				
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7 5000 to 6999	Zone 8 >6999
NECB 2011	0.227	0.183	0.183	0.162	0.142
ASHRAE 90.1-2010 (metal building)	0.312	0.312	0.278	0.278	0.199
ASHRAE 90.1-2010 (Insul. above deck)	0.273	0.273	0.273	0.273	0.273
OBC SB-10 (metal building)	n/a	0.20	0.18	0.16	n/a
OBC SB-10 (Insul. above deck)	n/a	0.22	0.18	0.16	n/a

**Table 2: Prescriptive Requirements for Maximum Overall Thermal Transmittance for Walls (W/m<sup>2</sup>K)**

Code or Standard	Heating Degree-Days of Building Location (Celsius Degree-Days)				
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7 5000 to 6999	Zone 8 >6999
NECB 2011	0.315	0.278	0.247	0.210	0.183
ASHRAE 90.1-2010 (metal building)	0.477	0.392	0.392	0.324	0.324
OBC SB-10 (metal building)	n/a	0.30	0.30	0.30	n/a

**Table 3: Standing Seam Roof Assemblies With Single Layer of Faced Insulation Overall Metric U-Factor (W/m<sup>2</sup>K)**

Rated RSI (R) value of Faced Insulation	Continuous Insulation		
	None	RSI-0.99 (R-5.6)	RSI-1.97 (R-11.2)
None	7.268	0.891	0.471
RSI-1.06 (R-6)	0.948	0.488	0.329
RSI-1.76 (R-10)	0.551	0.358	0.261
RSI-1.94 (R-11)	0.522	0.346	0.256
RSI-2.29 (R-13)	0.471	0.324	0.244
RSI-2.82 (R-16)	0.409	0.290	0.227
RSI-3.35 (R-19)	0.369	0.273	0.216

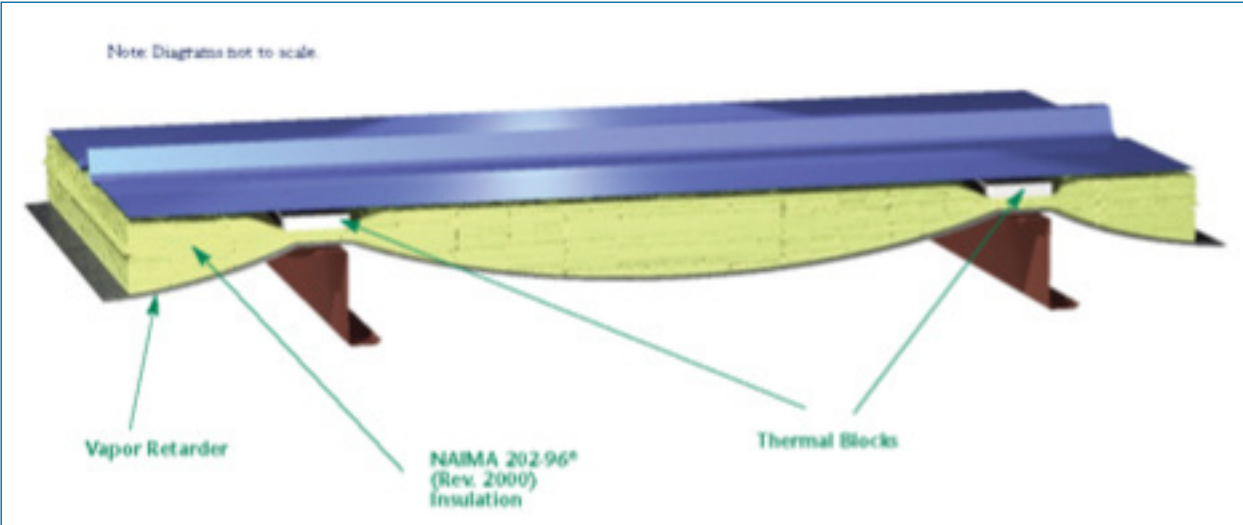


Figure 3: Source: NAIMA Guide to Insulating Metal Buildings for Compliance to ASHRAE 90.1-2010

**Table 4: Standing Seam Roof Assemblies With Double Layer of Faced Insulation  
Overall Metric U-Factor (W/m<sup>2</sup>K)**

Rated Value of Insulation		Continuous Insulation		
RSI	R	None	RSI-0.99 (R-5.6)	RSI-1.97 (R-11.2)
1.76* + 1.76	10* + 10	0.358	0.267	0.210
1.76* + 1.94	10* + 11	0.346	0.256	0.204
1.94* + 1.94	11* + 11	0.341	0.256	0.204
1.76* + 2.29	10* + 13	0.329	0.250	0.199
1.94* + 2.29	11* + 13	0.324	0.244	0.199
2.29* + 2.29	13* + 13	0.312	0.238	0.193
1.76* + 3.35	10* + 19	0.295	0.227	0.187
1.94* + 3.35	11* + 19	0.290	0.227	0.182
2.29* + 3.35	13* + 19	0.278	0.216	0.182
2.82* + 3.35	16* + 19	0.267	0.210	0.176
3.35* + 3.35	19* + 19	0.261	0.210	0.170

\*Faced insulation

A minimum of RSI 0.62 (R 3.5) thermal block between the purlins and the metal roof panels is required.

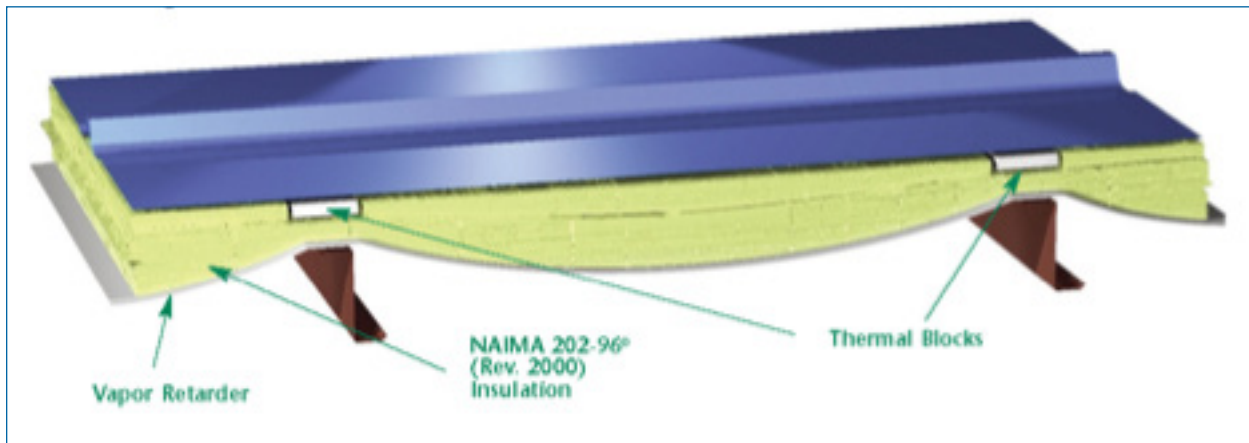


Figure 4: Source: NAIMA Guide to Insulating Metal Buildings for Compliance to ASHRAE 90.1-2010

**Table 5A: Standing Seam Roofs With Thermal Blocks**  
Overall Metric U-Factor (W/m<sup>2</sup>K)

Rated Value of Faced Insulation		U-Factor
RSI	R	
1.94 + 3.35	11 + 19	0.199
1.94 + 4.40	11 + 25	0.176
1.94 + 5.28	11 + 30	0.165
1.94 + 1.94 + 4.40	11 + 11 + 25	0.148

A minimum of RSI 0.62 (R 3.5) thermal block between the purlins and the metal roof panels is required.

**Table 5B: Standing Seam Roofs Without Thermal Blocks**  
Overall Metric U-Factor (W/m<sup>2</sup>K)

Rated Value of Faced Insulation		U-Factor
RSI	R	
1.94 + 3.35	11 + 19	0.227

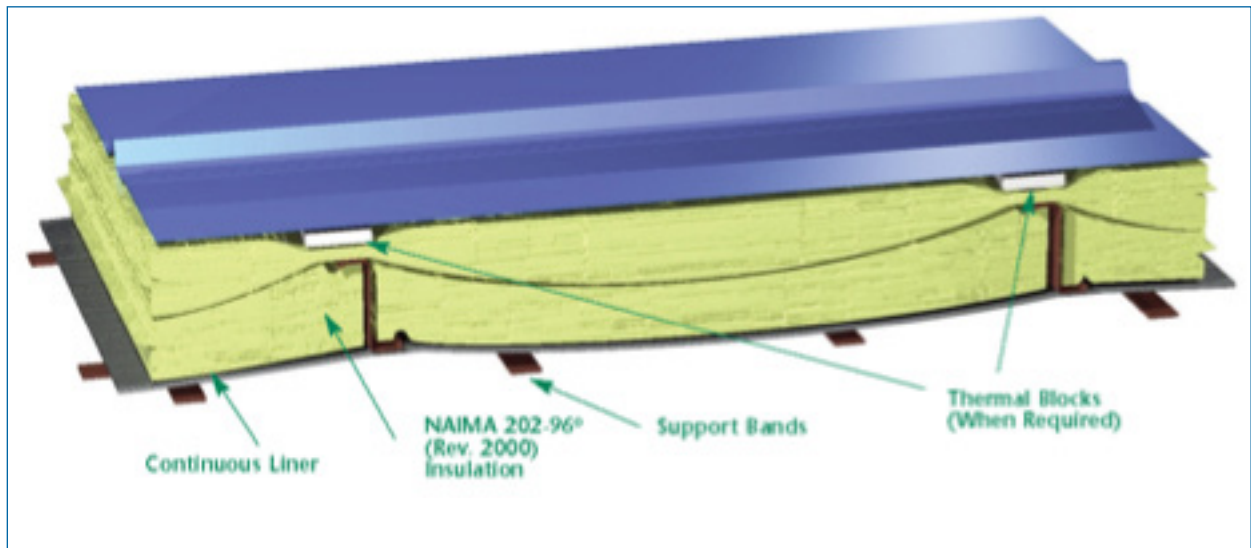


Figure 5: Source: NAIMA Guide to Insulating Metal Buildings for Compliance to ASHRAE 90.1-2010

**Table 6: Standing Seam Roofs With Filled Cavity Systems  
Overall Metric U-Factor (W/m<sup>2</sup>K)**

Rated Value of Faced Insulation		U-Factor
RSI	R	
3.35*+ 1.76	19*+ 10	0.233

\*Faced insulation

A minimum of RSI 0.62 (R 3.5) thermal block between the purlins and the metal roof panels is required.

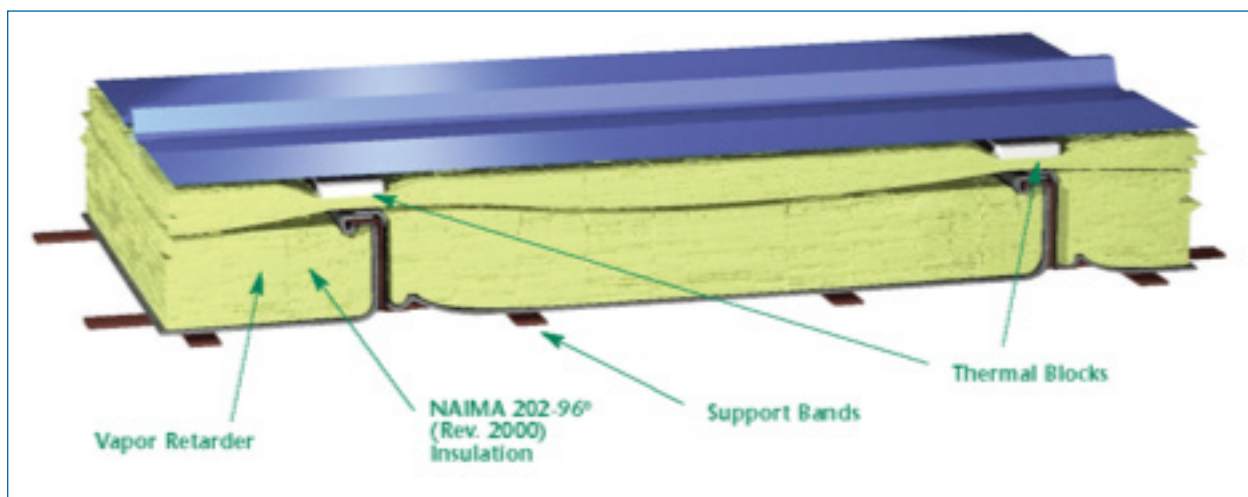


Figure 6: Source: NAIMA Guide to Insulating Metal Buildings for Compliance to ASHRAE 90.1-2010

Table 7A: Thru-Fastened Roof Assemblies with Single Layer of Faced Insulation Overall Metric U-Factor (W/m <sup>2</sup> K)		
Rated Value of Faced Insulation		U-Factor
RSI	R	
1.76	10	0.869
1.94	11	0.789
2.29	13	0.738
2.82	16	0.602
3.35	19	0.556

Table 7B: Thru-Fastened Roof Liner Systems Overall Metric U-Factor (W/m <sup>2</sup> K)		
Rated Value of Faced Insulation		U-Factor
RSI	R	
1.94 + 3.35	11+ 19	0.250

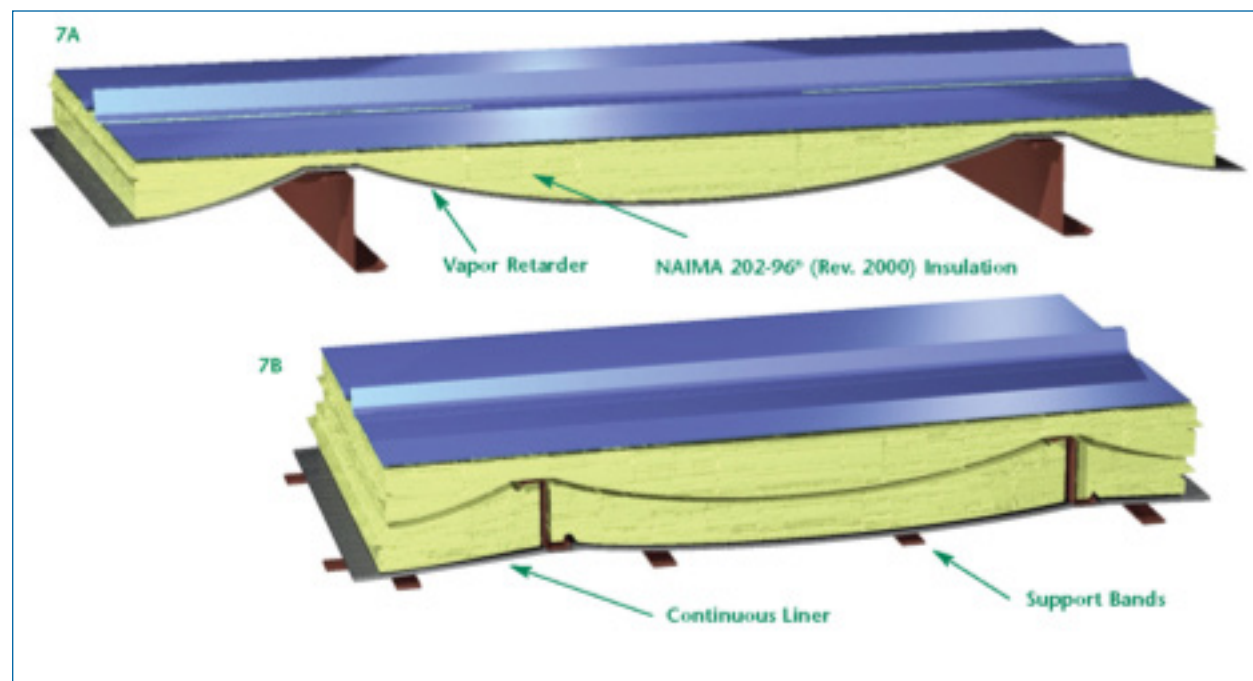


Figure 7: Source: NAIMA Guide to Insulating Metal Buildings for Compliance to ASHRAE 90.1-2010

**Table 8A: Metal Building Wall Assemblies with Single Layer of Faced Insulation  
Overall Metric U-Factor (W/m<sup>2</sup>K)**

Rated Value of Faced Insulation		Continuous Insulation		
RSI	R	None	RSI-0.99 (R-5.6)	RSI-1.97 (R-11.2)
None	None	6.700	0.914	0.488
1.06	6	1.045	0.517	0.341
1.76	10	0.761	0.437	0.307
1.94	11	0.698	0.414	0.295
2.29	13	0.642	0.392	0.284
2.82	16	0.528	0.346	0.261
3.35	19	0.477	0.324	0.244

**Table 8B: Metal Building Wall Assemblies with Double Layer of Faced Insulation  
Overall Metric U-Factor (W/m<sup>2</sup>K)**

Rated Value of Faced Insulation		U-Factor
RSI	R	
1.06 + 2.29	6 + 13	0.397
1.76 + 2.29	10 + 13	0.346
2.29 + 2.29	13 + 13	0.324
3.35 + 2.29	19 + 13	0.273

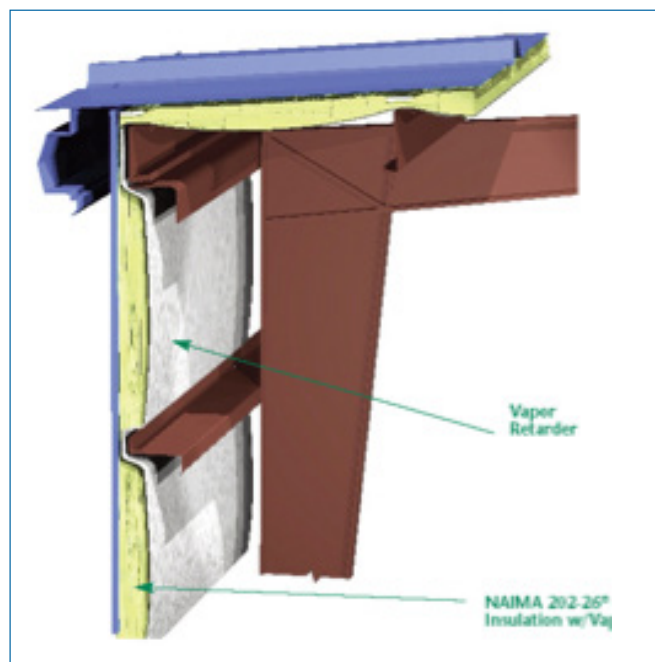


Figure 8: Source: NAIMA Guide to Insulating Metal Buildings for Compliance to ASHRAE 90.1-2010



**Table 9: Standing Seam Roof Assemblies With Single Layer of Faced Insulation without Thermal Blocks**  
Overall Metric U-Factor (W/m<sup>2</sup>K)

Rated Value of Insulation		Compression of Insulation at Centre of Purlin Space			
RSI	R	0%	10%	20%	30%
1.76	10	0.596	0.619	0.647	0.681
1.94	11	0.562	0.585	0.613	0.642
2.29	13	0.505	0.528	0.551	0.579
2.82	16	0.449	0.466	0.488	0.517
3.35	19	0.397	0.414	0.437	0.466

Assumes: 8" x 2-1/2" purlins 60" o.c., 1.75" spacing between top of purlin and roof sheets, no thermal block.

**Table 10: Standing Seam Roof Assemblies With Double Layer of Faced Insulation without Thermal Blocks**  
Overall Metric U-Factor (W/m<sup>2</sup>K)

Rated Value of Insulation		Compression of Insulation at Centre of Purlin Space			
RSI	R	0%	10%	20%	30%
1.76* + 1.76	10* + 10	0.369	0.380	0.403	0.426
1.76* + 1.94	10* + 11	0.352	0.369	0.392	0.414
1.94* + 1.94	11* + 11	0.346	0.358	0.380	0.403
1.76* + 2.29	10* + 13	0.335	0.346	0.369	0.392
1.94* + 2.29	11* + 13	0.324	0.341	0.358	0.380
2.29* + 2.29	13* + 13	0.307	0.324	0.341	0.358
1.76* + 3.35	10* + 19	0.284	0.301	0.318	0.335
1.94* + 3.35	11* + 19	0.278	0.295	0.312	0.329
2.29* + 3.35	13* + 19	0.267	0.284	0.295	0.318
2.82* + 3.35	16* + 19	0.256	0.267	0.284	0.301
3.35* + 3.35	19* + 19	0.238	0.250	0.267	0.284

Assumes: 8" x 2-1/2" purlins 60" o.c., 1.75" spacing between top.