Metal Building Insulation Energy Code Compliance Guide

Depending on what building code has been adopted and is enforced in the jurisdiction where the site is located, metal buildings usually have to meet the insulation requirements of either:

1. ASHRAE Standard 90.1, or
2. The ICC International Energy Conservation Code (IECC)

While both ASHRAE 90.1 and the IECC use the same climate zone map for the U.S. (see Figure 1), the insulation requirements in each climate zone for the two documents vary. In addition, both ASHRAE 90.1 and the IECC provide two compliance paths – "performance" (max. assembly U-factor) and "prescriptive" (min. insulation R-value).

The requirements for those paths are listed in Tables 1 and 2, for both roof and wall assemblies. NOTE: for the specific requirements currently adopted in each state go to: http://bcap-ocean.org/code-status-commercial

In addition, the calculated U-factors for some typical wall and roof assemblies, using Owens Corning's Certified R, OptiLiner® and ELAMINATOR® metal building insulation products and systems, are provided are provided in Tables 3 and 4.

Figure 1

ICC/ASHRAE Climate Zone Map

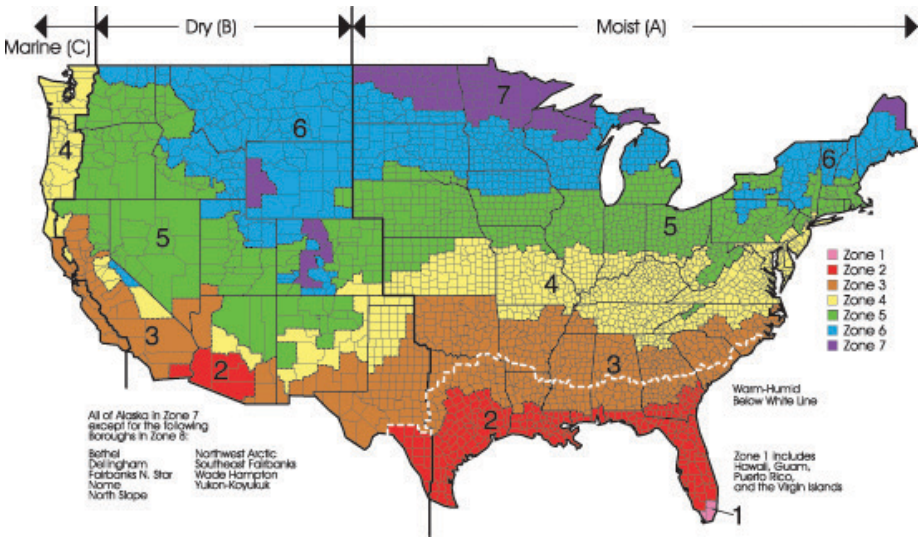

Table 1 - Roof Assembly Requirements

	ASHRAE 90.1												IECC			
	Nonresidential (conditioned)						Semiheated						Metal Building Walls (Above Grade)			
	Assembly U-factor			Insulation R-value			Assembly U-factor			Insulation R-value			Assembly U-factor		Insulation R-value	
Climate Zone	2010	2013	2016	2010	2013	2016	2010	2013	2016	2010	2013	2016	2009	2012/2015	2009	2012/2015
1	0.065	0.041	0.041	R-19	R10 + R19 FC	R10 + R19 FC	0.167	0.115	0.115	R-6.0	R10	R10	0.065	0.044	R-19	R19 + R11 Ls
2	0.055	0.041	0.041	R13 + R13	R10 + R19 FC	R10 + R19 FC	0.097	0.096	0.096	R-10	R16	R16	0.055	0.035	R13 + R13	R19 + R11 Ls
3	0.055	0.041	0.041	R13 + R13	R10 + R19 FC	R10 + R19 FC	0.097	0.096	0.096	R-10	R16	R16	0.055	0.035	R13 + R13	R19 + R11 Ls
4	0.055	0.037	0.037	R13 + R13	R19 + R11 Ls or R25 + R8 Ls	R19 + R11 Ls or R25 + R8 Ls	0.097	0.082	0.082	R-10	R19	R19	0.055	0.035	R13 + R13	R19 + R11 Ls
5	0.055	0.037	0.037	R13 + R13	R19 + R11 Ls or R25 + R8 Ls	R19 + R11 Ls or R25 + R8 Ls	0.083	0.082	0.082	R13	R19	R19	0.055	0.035	R13 + R13	R19 + R11 Ls
6	0.049	0.031	0.031	R19 + R13	R25 + R11 Ls	R25 + R11 Ls	0.072	0.060	0.060	R16	R19 + R19	R19 + R19	0.049	0.031	R19 + R13	R25 + R11 Ls
7	0.049	0.029	0.029	R19 + R13	R30 + R11 Ls	R30 + R11 Ls	0.072	0.037	0.037	R16	R19 + R11 Ls or R25 + R8 Ls	R19 + R11 Ls or R25 + R8 Ls	0.049	0.029	R19 + R13	R30 + R11 Ls
8	0.035	0.026	0.026	R19 + R11 LS	R25 + R11 + R11 Ls	R25 + R11 + R11 Ls	0.065	0.037	0.037	R19	R19 + R11 Ls or R25 + R8 Ls	R19 + R11 Ls or R25 + R8 Ls	0.035	0.029	R19 + R11	R30 + R11 Ls

1. R-5 thermal spacer block
"FC" = filled cavity; "Ls" = liner system; c.i. = continuous insulation

Table 2 - Wall Assembly Requirements

Climate Zone	ASHRAE 90.1 Nonresidential (conditioned) Assembly U-factor 2010	2013	2016	Insulation R-value 2010	2013	2016	ASHRAE 90.1 Semiheated Assembly U-factor 2010	2013	2016	Insulation R-value 2010	2013	2016	IECC Metal Building Walls (Above Grade) Assembly U-factor 2009	2012/2015	Insulation R-value 2009	2012/2015
1	0.093	0.094	0.094	R-16	R0 + R9.8 c.i.	R0 + R9.8 c.i.	0.113	0.352	0.352	R13	NR	NR	0.093	0.079	R-16	R-13 + R6.5 c.i.
2	0.093	0.094	0.094	R-16	R0 + R9.8 c.i.	R0 + R9.8 c.i.	0.113	0.162	0.162	R13	R13	R13	0.093	0.079	R-16	R-13 + R6.5 c.i.
3	0.084	0.094	0.094	R19	R0 + R9.8 c.i.	R0 + R9.8 c.i.	0.113	0.162	0.162	R13	R13	R13	0.084	0.079	R-19	R-13 + R6.5 c.i.
4	0.084	0.060	0.060	R19	R0 + R15.8 c.i.	R0 + R15.8 c.i.	0.113	0.162	0.162	R13	R13	R13	0.084	0.052	R-19	R-13 + R13 c.i.
5	0.069	0.050	0.050	R13 + R5.6 c.i.	R0 + R19.8 c.i.	R0 + R19.8 c.i.	0.113	0.094	0.094	R13	R0 + R9.8 c.i.	R0 + R9.8 c.i.	0.069	0.052	R13 + R5.6 c.i.	R-13 + R13 c.i.
6	0.069	0.050	0.050	R13 + R5.6 c.i.	R0 + R19.8 c.i.	R0 + R19.8 c.i.	0.113	0.094	0.094	R13	R0 + R9.8 c.i.	R0 + R9.8 c.i.	0.069	0.052	R13 + R5.6 c.i.	R-13 + R13 c.i.
7	0.057	0.044	0.044	R19 + R5.6 c.i.	R0 + R22.1 c.i.	R0 + R22.1 c.i.	0.113	0.072	0.072	R13	R0 + R13 c.i.	R0 + R13 c.i.	0.057	0.052	R19 + R5.6 c.i.	R-13 + R13 c.i.
8	0.057	0.039	0.039	R19 + R5.6 c.i.	R0 + R25 c.i.	R0 + R25 c.i.	0.113	0.060	0.060	R13	R0 + R15 c.i.	R0 + R15 c.i.	0.057	0.052	R19 + R5.6 c.i.	R-13 + R13 c.i.

"c.i." = continuous insulation; "NR" = no (insulation) requirement

Table 3 - Roof Assembly U-factors[1]

Insulation System	Insulation Rated R-value	Overall Assembly U-factor
Filled Cavity with Thermal Spacer Blocks[c]		
	R-10 + R-19	0.041
	R-19 + R-11	0.037
Standing Seam Roof without Thermal Spacer Blocks		
Liner System	R-19 + R-11	0.04
Through-Fastened Roof without Therm. Spacer Blocks		
	R-10	0.184
	R-11	0.182
	R-13	0.174
	R-16	0.157
	R-19	0.151
Liner System	R-19 + R-11	0.044

(Multiple R-values are listed in order from inside to outside)

1. From ASHRAE Std. 90.1-2016; Table A2.3.3, Assembly U-factors for Metal Building Roofs
   a. A standing seam roof clip that provides a min. 1.5 in. distance between the top of the purlins and the underside of the metal roof panels is required
   b. A minimum R-3 thermal spacer block is required
   c. A minimum R-5 thermal spacer block is required

Table 4 - Wall Assembly U-factors[1]

Insulation System	Insulation Rated R-value	Overall Assembly U-factor
Single Compressed Layer	R-10	0.186
	R-11	0.185
	R-13	0.162
	R-16	0.155
	R-19	0.147
Single Layer in Cavity	R-25[a]	0.059
	R-30[b]	0.052
Double Layer	R-25 + R-10	0.047
	R-25 + R-16	0.042
	R-25 + R-10[c]	0.039
	R-30 + R-16	0.039

(Multiple R-values are listed in order from inside to outside)

1. From ASHRAE Std. 90.1-2016; Table A2.3.3, Assembly U-factors for Metal Building Walls
   a. A minimum R-0.375 thermal spacer block or thermal break strip is required when installed w/out cont. insulation
   b. A minimum R-0.75 thermal spacer block or thermal break strip is required when installed w/out cont. insulation
   c. A minimum R-3 thermal spacer block is required

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