

# Product Information Bulletin 289

## **Plasti-Fab EPS Product Solutions for ASHRAE 90.1 Requirements**

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This bulletin summarizes Plasti-Fab® expanded polystyrene (EPS) product solutions available for energy efficiency design of buildings with residential or nonresidential occupancy required to comply with ANSI/ASHRAE/IES Standard 90.1 (2007 and 2010 editions), **Energy Standard for Buildings Except Low-Rise Residential Buildings**.

ASHRAE 90.1 is referenced in some Canadian and US Codes as one alternative for providing energy efficient design of residential and non-residential buildings. The table below provides maximum U-factor for wood-frame wall assemblies and minimum R-value for the thermal insulation component in the wall assembly for various climatic zones throughout Canada and the US.

**Table 1 – ASHRAE 90.1 – U-factor and Thermal Resistance Requirements for Wood-Frame Walls**

Climate Zone	Walls Above Grade							
	Nonresidential				Residential			
	U-factor - Note 1		R-value - Note 2		U-factor - Note 1		R-value - Note 2	
	Mass	Wood-Frame	Mass	Wood-Frame	Mass	Wood-Frame	Mass	Wood-Frame
1	0.580	0.089	NR	13.0	0.151	0.089	5.7 c.i.	13.0
2	0.151	0.089	5.7 c.i.	13.0	0.123	0.089	7.6 c.i.	13.0
3	0.151	0.089	5.7 c.i.	13.0	0.104	0.089	9.5 c.i.	13.0
4	0.104	0.089	9.5 c.i.	13.0	0.090	0.064	11.4 c.i.	13.0 + 3.8 c.i.
5	0.090	0.064	11.4 c.i.	13.0 + 3.8 c.i.	0.080	0.051	13.3 c.i.	13.0 + 7.5 c.i.
6	0.080	0.051	13.3 c.i.	13.0 + 7.5 c.i.	0.071	0.051	15.2 c.i.	13.0 + 7.5 c.i.
7	0.071	0.051	15.2 c.i.	13.0 + 7.5 c.i.	0.052	0.051	25.0 c.i.	13.0 + 7.5 c.i.
8	0.071	0.034	15.2 c.i.	13.0 + 15.6 c.i.	0.052	0.034	25.0 c.i.	13.0 + 15.6 c.i.

**Table notes:**

1. U-factor is the maximum overall heat transfer coefficient through the building component including the warm side and cold side air films in units of Btu/(h•ft<sup>2</sup>•°F) [multiply by 5.678 to convert to SI units of W/(m<sup>2</sup>•K)].
2. R-value is the minimum thermal resistance in units of (ft<sup>2</sup>•hr•°F)/BTU for the insulation component in the assembly only [multiply by 0.176 to convert to SI units of (m<sup>2</sup>•K)/W].
3. Continuous insulation (c.i.) is continuous across all structural members without thermal bridges other than fasteners and service openings.
4. A mass wall is defined as a wall with a Heat Capacity (HC) exceeding 7 Btu/ft<sup>2</sup>•°F. A 6" concrete core Advantage ICF System® wall has a HC of 13 Btu/(ft<sup>2</sup>•°F) based upon concrete specific heat of 0.18 Btu/(lb<sub>m</sub>•°F).

ASHRAE 90.1, clause 5.5.3 provides two methods of establishing prescriptive building envelope component compliance.

1. Minimum rated R-values of insulation for the thermal resistance of the added insulation in framing cavities and continuous insulation only. Specifications listed in Normative Appendix A for each class of construction shall be used to determine compliance.
2. Maximum U-factor; C-factor, or F-factor for the entire assembly. The values for typical construction assemblies listed in Normative Appendix A shall be used to determine compliance.

The requirements for wood-frame wall assemblies meeting ASHRAE 90.1 for all Climatic Zones can be met by providing the minimum thermal insulation requirement as noted. PlastiSpan®, DuroFoam® or ENERGREEN® insulation can be used to meet the required continuous insulation requirements for wood-frame wall assemblies in Table 1.

The following exception to clause 5.5.3 is also provided: For assemblies significantly different from those in Appendix A, calculations shall be performed in accordance with the procedures required in Appendix A. Appendix Section A9 permits calculation of the maximum U-factor for wall or roof assemblies different than those provided in Appendix A using the parallel paths method.

Maximum U-factor is the inverse of the overall R-value of a building assembly calculated as per **ASHRAE 2009 Handbook - Fundamentals**. The overall R-value of an assembly is calculated using the parallel-path flow method per ASHRAE 2009 as described in the equation below.

$$R_{Parallel} = \frac{100\%}{\frac{\% \text{ with Framing}}{R_F} + \frac{\% \text{ Area without Framing}}{R_C}}$$

Plasti-Fab manufactures energy efficient building systems that meet maximum U-factor requirements in Table 1. The Advantage ICF System®, an insulating concrete forming (ICF) system, provides a continuous layer of expanded polystyrene (EPS) insulation over the interior and exterior face of a solid concrete core. The Insulspan® SIP System is a structural insulating panel (SIP) system consisting of a continuous core of expanded polystyrene (EPS) insulation with SIP grade oriented strand board (OSB) structurally laminated to both faces.

**Table 2 - Meeting ASHRAE 90.1 Requirements with Plasti-Fab Building Systems**

Advantage ICF System		Insulspan SIP System	4 ½" SIP		6 ½" SIP		10 ¼" SIP	
Component	R <sub>i</sub>	Component	R <sub>F</sub>	R <sub>i</sub>	R <sub>F</sub>	R <sub>i</sub>	R <sub>F</sub>	R <sub>i</sub>
Outside Air Film	0.17	Outside Air Film	0.17	0.17	0.17	0.17	0.17	0.17
Metal Siding	0.62	Metal Siding	0.62	0.62	0.62	0.62	0.62	0.62
<b>Type 2 EPS Insulation</b>	10.61	Sheathing Paper	0.06	0.06	0.06	0.06	0.06	0.06
6" Concrete Wall	0.35	Structural OSB Facing	0.61	0.61	0.61	0.61	0.61	0.61
<b>Type 2 EPS Insulation</b>	10.61	<b>EPS Insulation Core</b>	----	<b>13.59</b>	----	<b>21.09</b>	----	<b>35.16</b>
½" Gypsum Board	0.44	Wood-Framing @ 48"	4.30	----	6.74	----	8.89	----
Inside Air Film	0.68	Structural OSB Facing	0.61	0.61	0.61	0.61	0.61	0.61
<b>Total R-value</b>	<b>23.5</b>	½" Gypsum Board	0.44	0.44	0.44	0.44	0.44	0.44
<b>U-factor</b>	<b>0.042</b>	Inside Air Film	0.68	0.68	0.68	0.68	0.68	0.68
		<b>R-value Sub-Totals</b>	<b>7.49</b>	<b>16.79</b>	<b>9.94</b>	<b>24.29</b>	<b>12.09</b>	<b>38.35</b>
		% Area of Wall	14%	86%	14%	86%	14%	86%
		<b>Total R-value</b>	<b>14.3</b>		<b>20.2</b>		<b>29.4</b>	
		<b>U-factor</b>	<b>0.070</b>		<b>0.049</b>		<b>0.034</b>	

**Table notes:**

- Overall R-value of a wall assembly built with the Advantage ICF System is calculated using the isothermal planes method since there is a continuous layer of expanded polystyrene (EPS) insulation over the interior and exterior face of a solid concrete core with no thermal bridges.
- The Advantage ICF System wall meets maximum U-factor requirement for a mass wall per Table 1 for Climate Zones 1 to 8.
- Maximum U-factors for the Insulspan SIP System assemblies are calculated using the parallel paths method described above and framing percentages are as per NBC 2010, Appendix Table A-9.36.2.4.(1)A.
- The Insulspan SIP System wall assemblies meet maximum U-factor per Table 1 as follows:
  - The 4 ½" SIP complies for Climate Zones 1 to 4 for nonresidential and Climate Zones 1 to 3 for residential buildings.
  - The 6 ½" SIP complies for Climate Zone 4 for residential and Climate Zone 5 to 7 for nonresidential and residential buildings.
  - The 10 ¼" SIP complies for Climate Zone 8 for nonresidential and residential buildings.