Plasti-Fab EPS PRODUCT SOLUTIONS
Better building ideas from PFB™

BULLETIN NO. 345
ISSUED: April 25, 2017
REPLACES: March 30, 2017

Product Information Bulletin

Manitoba Energy Code for Buildings - Plasti-Fab EPS Product Solutions

As of December 1, 2014, the National Energy Code for Buildings 2011 (NECB 2011) became effective in Manitoba via provincial Regulation 213/2013. It is known as the Manitoba Energy Code for Buildings (MECB) and provides minimum requirements for the design and construction of energy efficient buildings. The MECB does not apply to farm buildings nor to housing and smaller buildings covered in National Building Code of Canada 2010 (NBC 2010), Division B, Part 9.

NECB 2011, Division B provides three compliance options – prescriptive, trade-off or performance compliance – based upon the climatic zones that buildings are located in. This bulletin summarizes Plasti-Fab® expanded polystyrene (EPS) insulation solutions that can be used to comply with the prescriptive requirements for use in above-ground building assemblies complying with NECB 2011, Division B, Section 3.2., **Prescriptive Path**.

The map below provides approximate locations of climatic zones in 7a, 7b and 8 for Manitoba.

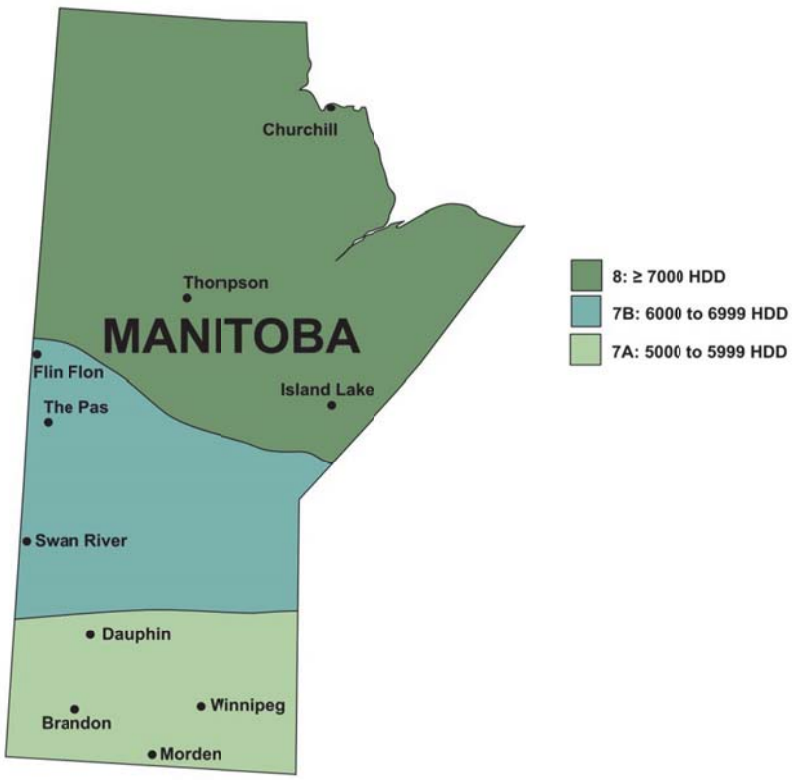

Figure 1: Manitoba Climate Zone Map

Table 1 provides HDD excerpted from NBC 2010, Division B, Appendix C, **Climatic Information** for some specific locations in climatic zones in Manitoba.

Table 1 – NBC 2010, Division B, Appendix C, Heating Degree Days (HDD) for Building Locations

Zone 7a		Zone 7b		Zone 8	
Location	**HDD**	**Location**	**HDD**	**Location**	**HDD**
Morden	5400	Swan River	6100	Thompson	7600
Winnipeg	5670	Flin Flon	6440	Lynn Lake	7770
Steinbach	5700	The Pas	6480	Split Lake	7900
Brandon	5760	Island Lake	6900	Churchill	8950

Prescriptive requirements for the thermal characteristics of above-ground building assemblies provided in NECB 2011, Division B, Section 3.2 are expressed as ***overall thermal transmittance*** (U-value). U-value is the rate, in $W/(m^2 \cdot K)$, at which heat is transferred through a building assembly that is subject to a temperature difference and represents the amount of heat transferred through a unit area in a unit of time induced under steady-state conditions by a unit temperature difference between the environments on its two faces.

U-value is the inverse of ***effective thermal resistance*** (RSI_{eff}), in $(m^2 \cdot K)/W$, of a building assembly representing the resistance to heat transfer. RSI_{eff} calculated using the formula below provided in NBC 2010, Section 9.36, includes the effect of thermal bridging due to repetitive structural members such as wood framing members in walls.

$$\mathbf{RSI_{eff}\ (R_{eff})} = \frac{100\%}{\frac{\%\ \text{Area of Framing}}{RSI_F(R_F)} + \frac{\%\ \text{Area of Cavity}}{RSI_C(R_C)}} + \text{RSI(R) Continuous Material Layers}$$

Table 2 provides maximum U-value from NECB 2011, Division B, Table 3.2.2.2. with equivalent RSI_{eff} (R_{eff}) for opaque above grade wall and roof assemblies.

Table 2 – Maximum Overall Thermal Transmittance for Above-Ground Opaque Wall & Roof Assemblies

Climatic Zones	Zone 7a	Zone 7b	Zone 8
	5,000 to 5,999	6,000 to 6,999	≥ 7,000
Units of measure	**Maximum Overall Thermal Transmittance (U-value)** – $W/m^2 \cdot °C$		
Walls	0.210	0.210	0.183
Roofs	0.162	0.162	0.142
Units of measure	**Minimum Effective Thermal Resistance (RSI_{eff})** – $m^2 \cdot °C/W$		
Walls	4.76	4.76	5.46
Roofs	6.17	6.17	7.04
Units of measure	**Minimum Effective Thermal Resistance (R_{eff})[1]** – $ft^2 \cdot hr \cdot °F/Btu$		
Walls	27.0	27.0	31.0
Roofs	35.1	35.1	40.0

The minimum RSI_{eff} (R_{eff}) values in Table 2 for roofs can be achieved using Plasti-Fab EPS insulation. Table 3 provides examples of roof assemblies using continuous Plasti-Fab EPS insulation above a steel roof deck to meet NECB 2011 minimum RSI_{eff} (R_{eff}) requirements.

Table 3 – Plasti-Fab EPS Product Solutions for Roof Assemblies

Roof Assembly		Zone 7a & 7b Roof System	Zone 8 Roof System
Outside Air Film		0.03	0.03
Roof Membrane		Nil	Nil
Coverboard		0.03	0.03
Plasti-Fab EPS Insulation Solution		***6.00***	***6.87***
Vapour Barrier		Nil	Nil
Metal Roof Deck		Nil	Nil
Inside Air Film		0.11	0.11
Effective Thermal Resistance	**RSI_{eff}**	**6.17**	**7.04**
	R_{eff}	**35.1**	**40.0**

Table 3 Notes:
1. RSI for component materials in above calculations are as per the NBC 2010, Division B, Table A-9.36.2.4.(1)D.
2. Convert RSI, in $m^2 \cdot K/W$, for Plasti-Fab EPS insulation solution to R-value, in $ft^2 \cdot hr \cdot °F/Btu$, by multiplying by 5.678263.
3. Table 9 provides thermal resistance (RSI/R) values for Plasti-Fab continuous EPS insulation options.

Table 4 provides Plasti-Fab EPS insulation solutions that can be used to meet NECB 2011 minimum RSI_{eff} (R_{eff}) requirements for above grade wall assemblies built using wood frame construction.

Table 4 - Plasti-Fab EPS Product Solutions for Above Grade Wood-Frame Wall Assemblies

Wall Option Description	NECB 2011 Climate Zone	Minimum RSI_{eff} (R_{eff})	Base Wall[1] RSI_{eff} (R_{eff})	RSI (R) Plasti-Fab Insulation
Wall Options with Plasti-Fab Continuous EPS Insulation[2]				
Base wall - 2 x 6 wood studs @ 406 mm (16") on center with RSI-3.34 (R-19) cavity insulation	7a to 7b	4.76 (27.0)	2.70 (15.3)	2.06 (11.7)
	8	5.46 (31.0)		2.76 (15.7)

Note: Table 9 provides thermal resistance (RSI/R) values for Plasti-Fab continuous EPS insulation options.

Table 5 provides detailed calculations for the above ground wood stud wall assemblies described in Table 4 using Plasti-Fab continuous insulation calculated as per NBC 2010, Appendix Note A-9.36.2.4.(1).

Table 5 – Detailed RSI_{eff} (R_{eff}) Calculations for Above Grade Wood-Frame Wall Assemblies

Climate Zones 7a and 7b			
Wall Components	**RSI_F Framing**	**RSI_C Cavity Insulation**	**Continuous Materials**
Outside Air Film	----	----	0.03
Cladding	----	----	0.11
Plasti-Fab Continuous Insulation	**----**	**----**	***2.06***
Cavity Insulation	----	3.34	----
Wood Stud @ 406 mm (16")	1.19	----	----
Vapour Barrier	----	----	----
Gypsum Wall Board	----	----	0.08
Inside Air Film	----	----	0.12
Total	**1.19**	**3.34**	**2.40**
% Area of Each Component	**23%**	**77%**	**100%**
RSI_{eff} (R_{eff})	**4.76 (27.0)**		
Climate Zone 8			
Outside Air Film	----	----	0.03
Cladding	----	----	0.11
Plasti-Fab Continuous Insulation	**----**	**----**	***2.76***
Cavity Insulation	----	3.34	----
Wood Stud @ 406 mm (16")	1.19	----	----
Vapour Barrier	----	----	----
Gypsum Wall Board	----	----	0.08
Inside Air Film	----	----	0.12
Total	**1.19**	**3.34**	**3.10**
% Area of Each Component	**23%**	**77%**	**100%**
RSI_{eff} (R_{eff})	**5.46 (31.0)**		

Table 6 provides Plasti-Fab EPS insulation solutions that can be used to meet NECB 2011 minimum RSI_{eff} (R_{eff}) requirements for above grade wall assemblies built using steel stud construction.

Table 6 - Plasti-Fab EPS Product Solutions for Above Grade Steel Stud Wall Assemblies

Wall Option Description	NECB 2011 Climate Zone	Minimum RSI_{eff} (R_{eff})	Base Wall[1] RSI_{eff} (R_{eff})	RSI (R) Plasti-Fab Insulation
Wall Options with Plasti-Fab Continuous EPS Insulation[2]				
Base wall - 2 x 6 steel studs @ 406 mm (16") on center with RSI-3.52 (R-20) cavity insulation	7a to 7b	4.76 (27.0)	2.04 (11.6)	2.72 (15.4)
	8	5.46 (31.0)		3.42 (19.4)

Note: Table 9 provides thermal resistance (RSI/R) values for Plasti-Fab continuous EPS insulation options.

Table 7 provides detailed calculations for the Zone 7a and 7b above ground steel stud wall assembly described in Table 6 using Plasti-Fab continuous insulation calculated as per NBC 2010, Appendix Note A-9.36.2.4.(1).

Table 7 – Detailed RSI_{eff} (R_{eff}) Calculations for Above Grade Steel Stud Wall Assemblies

Climate Zones 7a and 7b		
Calculation Step 1		
Wall Components	**RSI_F Framing**	**RSI_C Cavity Insulation**
Outside Air Film	0.03	0.03
Brick Veneer	0.07	0.07
Air Space	0.18	0.18
Plasti-Fab Continuous Insulation	***2.72***	***2.72***
Cavity Insulation	----	3.52
41 x 152 Steel Stud @ 406	0.0024	----
Gypsum Wall Board	0.08	0.08
Inside Air Film	0.12	0.12
Total	**3.20**	**6.72**
% Area of Each Component	**0.77%**	**99.23%**
RSI_{T1} (R_{T1})	**6.66 (37.83)**	
Calculation Step 2		
Cavity Insulation	----	3.52
41 x 152 Steel Stud @ 406	0.0024	----
Total	**0.0024**	**3.52**
% Area of Each Component	**0.77%**	**99.23%**
RSI_{T2} (R_{T2})	**0.29 (1.66)**	
Calculation Step 3	**RSI**	
Outside Air Film	0.03	
Brick Veneer	0.07	
Air Space	0.18	
Plasti-Fab Continuous Insulation	***2.72***	
RSI_{T2}	0.29	
Gypsum Wall Board	0.08	
Inside Air Film	0.12	
RSI_{T3} (R_{T3})	**3.49 (19.82)**	
RSI_{eff} (R_{eff}) = K_1*RSI_{T1} (K_1*R_{T1}) + K_2*RSI_{T3} (K_2*R_{T3})	**RSI_{eff} (R_{eff})**	
	4.76 (27.0)	

Note: As per Table A-9.36.2.4.(1)B., K_1 =0.40 and K_2= 0.60 for steel stud framing spaced ≤ 500 mm (20").

Table 8 provides detailed calculations for the Zone 8 above ground steel stud wall assembly described in Table 6 using Plasti-Fab continuous insulation calculated as per NBC 2010, Appendix Note A-9.36.2.4.(1).

Table 8 – Detailed RSI_{eff} (R_{eff}) Calculations for Above Grade Steel Stud Wall Assemblies

Climate Zone 8		
Calculation Step 1		
Wall Components	**RSI_F Framing**	**RSI_C Cavity Insulation**
Outside Air Film	0.03	0.03
Brick Veneer	0.07	0.07
Air Space	0.18	0.18
Plasti-Fab Continuous Insulation	***3.42***	***3.42***
Cavity Insulation	----	3.52
41 x 152 Steel Stud @ 406	0.0024	----
Gypsum Wall Board	0.08	0.08
Inside Air Film	0.12	0.12
Total	**3.90**	**7.42**
% Area of Each Component	**0.77%**	**99.23%**
RSI_{T1} (R_{T1})	**7.37 (41.84)**	
Calculation Step 2		
Cavity Insulation	----	3.52
41 x 152 Steel Stud @ 406	0.0024	----
Total	**0.0024**	**3.52**
% Area of Each Component	**0.77%**	**99.23%**
RSI_{T2} (R_{T2})	**0.29 (1.66)**	
Calculation Step 3	**RSI**	
Outside Air Film	0.03	
Brick Veneer	0.07	
Air Space	0.18	
Plasti-Fab Continuous Insulation	***3.42***	
RSI_{T2}	0.29	
Gypsum Wall Board	0.08	
Inside Air Film	0.12	
RSI_{T3} (R_{T3})	**4.19 (23.80)**	
RSI_{eff} (R_{eff}) = K_1*RSI_{T1} (K_1*R_{T1}) + K_2*RSI_{T3} (K_2*R_{T3})	**RSI_{eff} (R_{eff})**	
	5.46 (31.0)	

Note: As per Table A-9.36.2.4.(1)B., K_1 =0.40 and K_2= 0.60 for steel stud framing spaced ≤ 500 mm (20”).

Table 9 – RSI (R-value) Plasti-Fab Continuous EPS Insulation Options

Plasti-Fab Continuous EPS Insulation Option	RSI (R) Unit of Thickness
PlastiSpan® or DuroFoam® Insulation	RSI-0.65 per 25 mm (R-3.75 per inch)
PlastiSpan HD or DuroFoam Plus Insulation	RSI-0.70 per 25 mm (R-4.04 per inch)
EnerSpan® Insulation	RSI-0.82 per 25 mm (R-4.7 per inch)

Table 10 provides maximum U-value from NECB 2011, Division B, Table 3.2.3.1. with equivalent RSI_{eff} (R_{eff}) for wall and floor assemblies in contact with the ground.

Table 10 – Maximum Overall Thermal Transmittance for Building Assemblies in Contact with the Ground

Climate Zone	Zone 7a		Zone 7b		Zone 8	
	5,000 to 5,999		6,000 to 6,999		≥ 7,000	
Assembly	**Maximum Overall Thermal Transmittance - W/(m²•°C)**					
Walls	0.284		0.284		0.210	
Floors	0.757		0.757		0.379	
Minimum Effective Thermal Resistance[1]						
Climate Zone	**Zone 7a**		**Zone 7b**		**Zone 8**	
Unit of Measure	**RSI_{eff}**	**R_{eff}**	**RSI_{eff}**	**R_{eff}**	**RSI_{eff}**	**R_{eff}**
Walls	3.52	20.0	3.52	20.0	4.76	27.0
Floors	1.32	7.5	1.32	7.5	2.64	15.0

Note:
RSI_{eff} expressed in (m²•°C)/W and R_{eff} expressed in (ft²•hr•°F)/Btu.

For foundation wall applications the above requirements apply for walls or parts thereof that are below the exterior ground level and are part of the building envelope. Insulation on walls in contact with the ground must extend 2.4 m down from ground level or to the bottom of the wall, whichever is less.

The above requirements apply to floors-on-ground separating conditioned space from the ground less than 0.6 m below grade. Floors-on-ground with no embedded heating ducts, cables or heating or cooling pipes must have insulation placed on their top or bottom surface for a distance of not less than 1.2 m from their perimeter for Climate Zones 4 to 7b or over their full area for Climate Zone 8. For floors-on-ground with embedded heating ducts or cables or heating and cooling pipes the insulation must be under the full floor area.

The minimum RSI_{eff} (R_{eff}) values in Table 7 for walls and floors in contact with the ground can be achieved using Plasti-Fab EPS insulation. Table 6 provides thermal resistance (RSI/R) values for Plasti-Fab EPS insulation options to provide the required effective thermal resistance as per Table 7.