Product Information Bulletin

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PlastiSpan® Insulation as Continuous Insulating Sheathing National Building Code of Canada 2010

PlastiSpan® insulation board is a moulded expanded polystyrene (EPS) insulation that meets or exceeds CAN/ULC-S701, ***Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering***. PlastiSpan insulating sheathing applied over the exterior of wood framed walls provide continuous insulation eliminating thermal bridges at wood stud locations.

Table 1 - PlastiSpan Insulation Material Properties

Material Property	ASTM Test Method[1]	Units	CAN/ULC-S701[2] Type 1
Thermal Resistance *Minimum per 25 mm (inch)*	C518	$m^2 \cdot {}^oC/W$ ($ft^2 \cdot h \cdot {}^oF/BTU$)	0.65 (3.75)
Compressive Resistance *Minimum @ 10% Deformation*	D1621	kPa (psi)	70 (10)
Flexural Strength *Minimum*	C203	kPa (psi)	170 (25)
Water Vapour Permeance[3] *Maximum*	E96	ng/(Pa·s·m^2) (Perms)	300 (5.0)
Water Absorption[4] *Maximum*	D2842	% By volume	6.0
Dimensional Stability *Maximum, 7 Days @ 70 ± 2°C (158 ± 4°F)*	D2126	% Linear Change	1.5
Limiting Oxygen Index *Minimum*	D2863	%	24

1. The test methods used to determine material properties in the above table provide a means of comparing different types of cellular plastic thermal insulation. They are intended for use in specifications, product evaluations and quality control. They do not predict end-use product performance.
2. PlastiSpan insulation properties are third party certified under a quality listing program administered by Intertek and are listed by the Canadian Construction Materials Centre (CCMC) under evaluation listing numbers 12424-L (Type 1).
3. WVP values quoted are maximum values for 25-mm thick samples with natural skins intact. Lower values will result for thicker materials.
4. The water absorption laboratory test method involves complete submersion under a head of water for 96 hours. The water absorption values above are applicable to specific end-use design requirements only to the extent that the end-use conditions are similar to test method requirements.

This bulletin addresses use of PlastiSpan insulation as an exterior insulating sheathing applied to above grade walls in compliance with the National Building Code of Canada 2010 (NBC).

1. Air Barrier System Requirements

Article 9.25.3.1. requires wall, ceiling and floor assemblies separating conditioned space from unconditioned space or from the ground to be constructed so as to include an air barrier system that will provide a continuous barrier to air leakage. PlastiSpan insulation may be used as one component in an air barrier system; however, air barrier system design must consider requirements for sealing of all penetrations of the air barrier system, such as those created by the installation of doors, windows, electrical wiring, electrical boxes, piping or ductwork

2. Vapour Barrier System Requirements

Article 9.25.4.1. requires all thermally insulated wall, ceiling and floor assemblies to be constructed with a vapour barrier sufficient to prevent condensation. Dependent upon thickness, PlastiSpan insulation can have a vapour permeance less than 60 ng/(Pa•s•m^2) as per Sentence 9.25.4.2.(1); however, PlastiSpan insulating sheathing is not intended to provide the principal protection against vapour diffusion in an above grade wall application. See requirements related to low air- and vapour-permeance materials below.

3. Position and Properties of PlastiSpan Insulating Sheathing

Subsection 9.25.5.1. addresses low air- and vapour-permeance materials and implications for moisture accumulation. Because PlastiSpan insulating sheathing may have an air leakage characteristic less than 0.1 L/(s•m^2) at 75 Pa and a vapour permeance characteristic less than 60 ng/(Pa•s•m^2), the provisions of Article 9.25.5 should be considered.

Article 9.25.5.2 permits the use of insulating sheathing meeting the above criteria on the exterior of an insulated frame wall based upon the ***ratio of outboard to inboard thermal resistance*** for specific heating degree-day (HDD) ranges. Wall assemblies with ratio of outboard to inboard thermal resistance values greater than those given in Table 9.25.5.2 (see Table 2) ensure that the inner surface of the insulating sheathing is likely to be warm enough for most of the heating season such that no significant accumulation of moisture will occur. As well, the vapour barrier function has to be provided by a separate building element installed on the warm side of the assembly. For additional information on assumptions used in developing Table 9.25.5.2., refer to NBC 2010 Appendix note A-9.25.5.2.

Table 2 - Minimum Ratio of Total Thermal Resistance Outboard to Thermal Resistance Inboard

Heating Degree-Days	Ratio	Heating Degree-Days	Ratio
up to 4999	0.20	9000 to 9999	0.55
5000 to 5999	0.30	10000 to 10999	0.60
6000 to 6999	0.35	11000 to 11999	0.65
7000 to 7999	0.40	12000 or higher	0.75
8000 to 8999	0.50		

4. Insulating Sheathing in lieu of Sheathing Membrane

Subclause 9.27.3.4.(2)(b)(i) states that a separate sheathing membrane is not required over insulating sheathing where the joints between boards are sealed. Therefore, when the joints between PlastiSpan insulation boards are sealed, a separate sheathing membrane is not required. Refer to PIB 205 for additional information on installation requirements.

5. *Thermal Resistance* of Wall Assemblies with PlastiSpan Insulation

NBC 2010, Section 9.36 provides energy efficiency requirements for buildings 3 storeys or less in building height, having a building area not exceeding 600 m^2 and used for major occupancies classified as residential occupancies.

Energy efficiency requirements in NBC 2010, Subsection 9.36.2. are based upon minimum ***effective thermal resistance (RSI$_{eff}$/R$_{eff}$)*** of building assemblies which includes the effect of thermal bridging due to repetitive structural members such as wood framing members in wall or roof assemblies calculated using the formula below.

$$\textbf{RSI}_{\textbf{eff}}\ (\textbf{R}_{\textbf{eff}}) = \frac{100\%}{\frac{\%\ \text{with Framing}}{\text{RSI}_F\ (R_F)} + \frac{\%\ \text{Area Cavity}}{\text{RSI}_C\ (R_C)}} + \text{RSI(R) Continuous Material Layers}$$

Table 3 provides ***minimum RSI$_{eff}$/R$_{eff}$*** requirements per NBC 2010 Tables 9.36.2.6.B. and 9.36.2.6.B. for above grade walls in buildings as noted.

Table 3 - Minimum RSI$_{eff}$/R$_{eff}$ of Wall Opaque Assemblies

NBC 2010 Climate Zones	Zone 4	Zone 5	Zone 6	Zone 7a	Zone 7b	Zone 8
Heating Degree-Days (HDD) Celsius Degree-Days	< 3,000	3,000 to 3,999	4,000 to 4,999	5,000 to 5,999	6,000 to 6,999	≥ 7,000
Table 9.36.2.6.A. - Buildings Where a Heat Recovery Ventilator (HRV) is not Installed						
RSI$_{eff}$ – m^2•°C/W	2.78	3.08	3.08	3.08	3.85	3.85
R$_{eff}$ – ft^2•hr•°F/BTU	15.8	17.5	17.5	17.5	21.9	21.9
Table 9.36.2.6.B. - Buildings Where a Heat Recovery Ventilator (HRV) is Installed						
RSI$_{eff}$ – m^2•°C/W	2.78	2.97	2.97	2.97	3.08	3.08
R$_{eff}$ – ft^2•hr•°F/BTU	15.8	16.9	16.9	16.9	17.5	17.5

Energy consumption required to keep the interior of a small building at 21°C when the outside air temperature is below 18°C is roughly proportional to the difference between 18°C and the outside temperature. This relationship holds true for average conditions of wind, radiation, exposure, and internal sources. A heating degree-day (HDD) is defined as the number of degrees the mean temperature (average of high and low temperature) for a given day is below 18°C. The sum of all the daily HDD contributions results in the annual HDD for a location.

Table 4 - NBC 2010, Division B, Appendix C - Annual HDD (Celsius Degree-Days)

Province	Building Location	HDD (Celsius Degree Days)	Province	Building Location	HDD (Celsius Degree Days)
British Columbia	Victoria	2,650	**Quebec**	Montréal	4,200
	Vancouver	2,950		Trois-Rivières	4,900
	Kelowna	3,400		Québec	5,080
	Whistler	4,180		Gaspé	5,500
	Dawson Creek	5,900		Baie-Comeau	6,020
Alberta	Lethbridge	4,650		Schefferville	8,550
	Calgary	5,000	**New Brunswick**	Campbellton	5,500
	Edmonton	5,400		Edmunston	5,400
	Fort McMurray	6,550		Fredericton	4,650
Saskatchewan	Moose Jaw	5,270	**Nova Scotia**	Digby	4,020
	Regina	5,600		Truro	4,650
	Saskatoon	5,700		Halifax	4,200
	Prince Albert	6,100	**PEI**	Charlottetown	4,600
	Uranium City	7,500	**Newfoundland**	St. John's	4,800
Manitoba	Winnipeg	5,670		Labrador City	7,900
	Flin Flon	6,440	**Yukon**	Dawson	8,400
	Thompson	7,600			

Tables 5 and 6 provide ***RSI_{eff}/R_{eff}*** calculations for typical wall assemblies using PlastiSpan (Type 1) continuous insulating sheathing to meet minimum requirements per NBC 2010, Table 9.36.2.6.B. for buildings where a heat recovery ventilator (HRV) is installed.

Table 5 - *RSI_{eff}/R_{eff}* of Typical Wall Assembly with PlastiSpan (Type 1) Insulating Sheathing

Wall Construction – Climate Zones 4 to 7a Heating Degree Days Less Than 6,000	RSI_{eff} Calculation		
	Framed Portion		Continuous Layers
	RSI_F	RSI_C	
Outside Air Film	----	----	0.03
Vinyl Cladding	----	----	0.11
1-5/8" (41.3 mm) PlastiSpan Insulation	**----**	**----**	***1.07***
Stud Cavity Insulation	----	2.29	----
2 x 4 Wood Stud @ 16" (406 mm) o.c.	0.76	----	----
6 mil polyethylene vapour barrier	----	----	----
1/2" (12.7 mm) Gypsum Wall Board	----	----	0.08
Inside Air Film	----	----	0.12
RSI Sub-Totals	**0.76**	**2.29**	**1.41**
% Area of Each Component	**23%**	**77%**	**100%**
RSI_{eff} (R_{eff})	**RSI-2.97 (R-16.9)**		

Ratio of Outboard to Inboard Insulation Calculation			
Outboard Insulation Components	**RSI**	**Inboard Insulation Components**	**RSI**
Outside air film	0.03	Stud cavity insulation	2.29
Vinyl cladding	0.11	Gypsum board	0.08
1 5/8" (41.3 mm) PlastiSpan Insulation	1.07	Inside air film	0.12
Total Outboard RSI	**1.21**	**Total Inboard RSI**	**2.49**
Ratio of Outboard to Inboard RSI		**1.21/2.49**	**0.49**

Table 6 - *RSI_{eff}/R_{eff}* of Typical Wall Assembly with PlastiSpan (Type 1) Insulating Sheathing

Wall Construction – Climate Zones 7b and 8 Heating Degree Days 6,000 or Greater	RSI_{eff} Calculation		
	Framed Portion		Continuous Layers
	RSI_F	RSI_C	
Outside Air Film	----	----	0.03
Vinyl Cladding	----	----	0.11
2" (50.8 mm) PlastiSpan Insulation	----	----	**1.32**
Stud Cavity Insulation	----	2.29	----
2 x 4 Wood Stud @ 16" (406 mm) o.c.	0.76	----	----
6 mil polyethylene vapour barrier	----	----	----
1/2" (12.7 mm) Gypsum Wall Board	----	----	0.08
Inside Air Film	----	----	0.12
RSI Sub-Totals	**0.76**	**2.29**	**1.66**
% Area of Each Component	**23%**	**77%**	**100%**
RSI_{eff} (R_{eff})	**RSI-3.22 (R-18.3)**		

Ratio of Outboard to Inboard Insulation Calculation			
Outboard Insulation Components	**RSI**	**Inboard Insulation Components**	**RSI**
Outside air film	0.03	Stud cavity insulation	2.29
Vinyl cladding	0.11	Gypsum board	0.08
2" (51 mm) PlastiSpan Insulation	1.32	Inside air film	0.12
Total Outboard RSI	**1.46**	**Total Inboard RSI**	**2.49**
Ratio of Outboard to Inboard RSI		**1.46/2.49**	**0.59**