

Product Information Bulletin

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DuroFoam® Insulation for Insulating Sheathing - 2014 ABC

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DuroFoam® 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**. The addition of a laminated film to the top and bottom surfaces of **DuroFoam** insulation board provides a more durable product that is less susceptible to handling damage.

Table 1 – DuroFoam Insulation Material Properties

Material Property ¹	Test Method	Units	Type 1	DuroFoam Exterior Insulating Sheathing
Thermal Resistance <i>Minimum RSI per 25 mm (R per inch)</i>	ASTM C518	m ² •°C/W (Ft ² •hr•°F/BTU)	0.65 (3.75)	
Compressive Resistance <i>Minimum @ 10% Deformation</i>	ASTM D1621	kPa (psi)	70 (10)	
Flexural Strength <i>Minimum</i>	ASTM C203	kPa (psi)	170 (25)	
Water Vapour Permeance ² <i>Maximum</i>	ASTM E96	ng/Pa•s•m ² (perm)	30 (0.5)	
Water Absorption ³ <i>Maximum</i>	ASTM D2842	% By volume	6.0	
Dimensional Stability <i>Maximum, 7 Days @ 70 ± 2°C (158 ± 4°F)</i>	ASTM D2126	% Linear Change	1.5	
Limiting Oxygen Index <i>Minimum</i>	ASTM D2863	%	24	

The reflective facer on **DuroFoam** insulation contains a thin layer of foil embedded within the film. The reflective facer does not increase the nominal R-value of **DuroFoam** insulation (for additional information see Plasti-Fab PIB 253 - **Facts About Thermal Resistance of Reflective Insulation**). The green face of DuroFoam insulation should be left exposed to make use of the markings on this face provided for easy cutting of insulation and spacing of interior framing as required.

1. **DuroFoam** insulation properties are third party certified to CAN/ULC-S701 under a quality listing program administered by Intertek Testing Services. **DuroFoam** insulation is listed by the Canadian Construction Materials Centre under CCMC Evaluation Listing 12424-L.
2. **Maximum** vapour permeance value for EPS insulation is 300 ng/Pa•s•m² for 25-mm (5.2 perms for 1-inch) thickness. The vapour permeance value provided above for **DuroFoam** insulation is significantly lower as a result of laminated films. Where water vapour permeance is a design issue, contact Plasti-Fab technical services for additional information.
3. Water absorption % by volume is determined using ASTM D2842 which involves complete submersion under a head of water for 96 hours. The value provided in the table above is the **maximum** for CAN/ULC-S701, type 1 EPS insulation without facers.

This bulletin addresses the use of **DuroFoam** insulation board as an exterior insulating sheathing board applied to above grade walls in compliance with the 2014 Alberta Building Code (2014 ABC).

1. Air Barrier System Requirements

2014 ABC, 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. **DuroFoam** 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

2014 ABC, 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. **DuroFoam** insulation has a vapour permeance less than 60 ng/(Pa·s·m²) as required by 2014 ABC, Sentence 9.25.4.2.(1); however, **DuroFoam** 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 DuroFoam Insulating Sheathing

2014 ABC, Subsection 9.25.5.1. addresses low air- and vapour-permeance materials and implications for moisture accumulation. Because **DuroFoam** insulating sheathing has an air leakage characteristic less than 0.1 L/(s·m²) at 75 Pa and a vapour permeance characteristic less than 60 ng/(Pa·s·m²), the provisions of Article 9.25.5 must be considered.

2014 ABC, Article 9.25.5.2 permits the use of **DuroFoam** insulating sheathing 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 2014 ABC, Table 9.25.5.2 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 2014 ABC, Table 9.25.5.2., refer to 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

2014 ABC, 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 **DuroFoam** insulation boards are sealed, a separate sheathing membrane is not required. Refer to Product Information Bulletin No. 205 for additional information on installation requirements.

5. Thermal Resistance of Wall Assemblies with DuroFoam Insulation

2014 ABC, Section 9.36 provides energy efficiency requirements for buildings 3 storeys or less in building height, having a building area not exceeding 600 m² and used for major occupancies classified as residential occupancies.

Effective thermal resistance RSI_{eff} (R_{eff}) of building assemblies is calculated using the following formula which includes the thermal bridging effect due to repetitive structural members such as wood framing members in walls.

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

Table 3 provides **minimum** RSI_{eff}/R_{eff} requirements per 2014 ABC Tables 9.36.2.6.A. and 9.36.2.6.B. for above grade walls in buildings as noted.

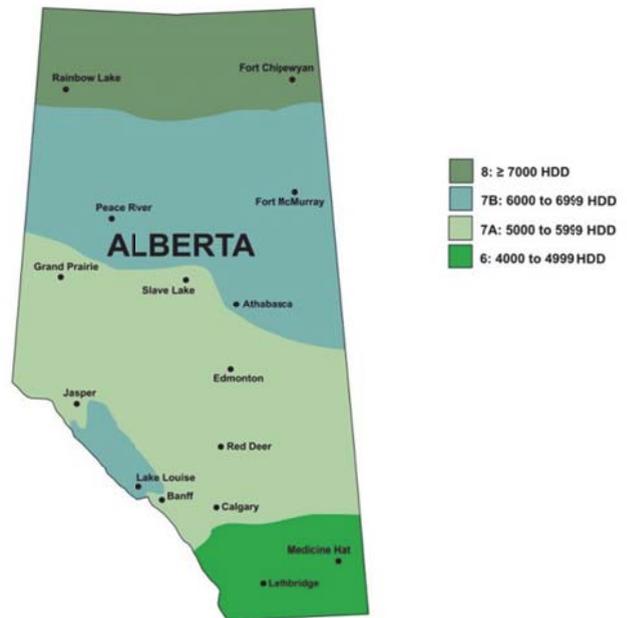
Table 3 - Minimum RSI_{eff}/R_{eff} of Above-ground Opaque Wall Assemblies

2014 ABC Climate Zones	Zone 6	Zone 7A	Zone 7B	Zone 8
Heating Degree-Days (HDD) Celsius Degree-Days	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				
$RSI_{eff} - m^2 \cdot ^\circ C/W$	3.08	3.08	3.85	3.85
$R_{eff} - ft^2 \cdot hr \cdot ^\circ F/BTU$	17.5	17.5	21.9	21.9
Table 9.36.2.6.B. - Buildings Where a Heat Recovery Ventilator (HRV) is Installed				
$RSI_{eff} - m^2 \cdot ^\circ C/W$	2.97	2.97	3.08	3.08
$R_{eff} - ft^2 \cdot hr \cdot ^\circ F/BTU$	16.9	16.9	17.5	17.5

Table 4 provides annual heating degree days for some building locations in Climate Zones 6 to 8 as per 2014 ABC, Division B, Appendix C.

Table 4 - Annual HDD (Celsius Degree Days) for Building Locations

Climate Zone	Locations	HDD
6	Lethbridge	4500
	Medicine Hat	4540
	Brooks	4880
	High River	4900
	Okotoks	4920
7A	Calgary	5000
	Edmonton	5120
	Banff	5500
	Grande Prairie	5790
	Slave Lake	5850
7B	Athabasca	6000
	Peace River	6050
	Lac la Biche	6100
	Fort McMurray	6250
	Lake Louise	6500
8	Fort Chipewyan	7170
	Rainbow Lake	7200
	Embarras Portage	7100



Tables 5 provides RSI_{eff}/R_{eff} calculations for a wall assembly using **DuroFoam** continuous insulating sheathing to meet requirements per 2014 ABC, Table 9.36.2.6.B. for buildings in Climate Zones 6 to 7A.

Table 5 - RSI_{eff}/R_{eff} of Typical Wall Assembly with DuroFoam Insulating Sheathing

Wall Construction	Framed Portion		Continuous Layers
	RSI_F	RSI_C	
Outside Air Film	----	----	0.03
Vinyl Cladding	----	----	0.11
1-5/8" (41.3 mm) DuroFoam 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) DuroFoam 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	

Tables 6 provides RSI_{eff}/R_{eff} calculations for a wall assembly using **DuroFoam** continuous insulating sheathing to meet requirements per 2014 ABC, Table 9.36.2.6.A. for buildings in Climate Zones 6 to 7A and Table 9.36.2.6.B. for buildings in Climate Zones 7B to 8.

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

Wall Construction	Framed Portion		Continuous Layers
	RSI_F	RSI_C	
Outside Air Film	----	----	0.03
Vinyl Cladding	----	----	0.11
2" (50.8 mm) DuroFoam 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) DuroFoam 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	