Extruded Polystyrene Insulation

FoamulaR®

AUSTECH
EXTERNAL BUILDING PRODUCTS
Supporting you with Smart Solutions

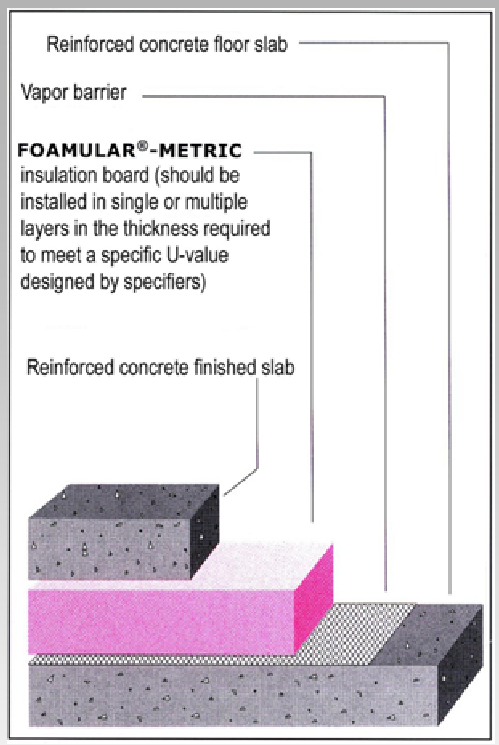
Application: Cold Storage Floor Insulation.

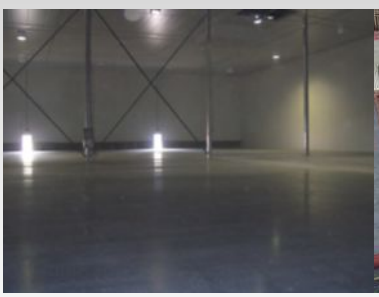
The high compressive strength of Foamular coupled with high thermal performance and moisture resistance make Foamular an ideal material for cold storage floor insulation.

Foamular minimises compressive creep by providing superior support of the slab by minimising deflection, even during exposure to extreme cold and moisture.

“Achieve Increasing Levels Of Energy Efficiency And Reduce Environmental Impacts”

When used in cold storage application, Foamular outperforms most other insulation materials in maintaining insulation performance and supporting the imposed load, minimising the risk of floor damage through expansion and/or contraction.





Recommended Material: FM 300/350, 75&100 mm (Common spec, 2 layers of FM 350/75mm)

For Technical Information, Contact Mike Nagle - 0417 268 660
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NSW • QLD • VIC • WA • TAS • NZ

FOAMULAR® METRIC 350 IN COLD STORAGE FLOOR APPLICATIONS

Achieve increasing levels of energy efficiency and reduce environmental impacts associated with excessive energy use by choosing Foamular.

When used in cold storage floor applications **Foamular®** metric 350 outperforms most other insulation materials in supporting the imposed load and maintaining insulation performance.

THE MATERIAL

Foamular® Metric 350 is polystyrene foam extruded into rigid insulation boards by Owens Corning technology.

This process produces boards with continuous skin surfaces and uniform closed cell cores.

The cells have interconnecting walls of consistent thickness **with no voids.**

This is a critical factor in polystyrene thermal and physical performance in cold storage applications.

Expanded polystyrene by comparison has spherical cell construction which results in gaps or voids between the cell contact areas. (Up to 30% dependant on grade)

These gaps can absorb moisture which in turn diminishes thermal value and loss of physical integrity.

The closed cell construction of **Foamular**® Metric XPS provides excellent water resistance properties, higher compressive strengths and maximum thermal value retention over the long term.

We should look at critical performance criteria of EPS and Foamular® Metric XPS one point at a time.

Point 1. The effects of moisture

Insulation that absorbs moisture will lose thermal performance.
Over time physical integrity, including compressive strength will diminish.

The reduction in thermal performance affects the energy efficiency leading to increased operating costs.

The loss of physical integrity can contribute to increased risk of expensive maintenance requirements.
Rates of vapour transmission as per AS2498.5 test method show VH grade expanded polystyrene to have 4 times the transmission rate of extruded polystyrene.

Point 2. Compressive Strength

Foamular® metric 350 KPa has the strength to support live and dead loads associated with high load racking and vehicular traffic common to cold storage facilities. This high compressive strength provides adequate slab support by limiting deflection.
Foamular can achieve this result as a stand alone product unlike VH grade eps that may require additional strategically placed supports, eg tallowwood blocks.

The compressive strength of **Foamular**® 350 (350KPa minimum) is more than double the compressive strength VH grade EPS (165KPa)

Foamular® also has a long term deflection rate of less than 2%.

Foamular® is available in compressive strengths from 150KPa to 600 KPa + giving architects, specifiers and engineers a wide range of options.

Point 3. Insulation Values

Higher density and compressive strengths give **Foamular®** higher R values than expanded polystyrene.

As an example, two layers of **Foamular®** 350 /75mm has an R value of R5.55, two layers of 75 mm VH grade expanded polystyrene R4.41 **(20% less)**

These figures are at 25°C. Values increase as Temperature decreases.
At minus 10°C the R value of FM350 75mm x 2 layers would be R 6.04

Also of importance is the insulation materials thermal retention. That is its ability to supply consistent Thermal resistance levels over time.

Foamular® is guaranteed to maintain A MINIMUM OF 90% thermal resistance for a period of twenty (20) years. On going energy efficiency is therefore maximised.

Environmental Contribution

As a long term high performance insulation product **Foamular®** minimises Ozone layer depletion and reduction of Co2 emissions in a number of positive ways.

Material is produced to ISO 14001: 2004 Standard in accredited factories in China

No CFCs are used in production.
HCFC 142 B is the blowing agent used in complete accordance with United Nations Protocols. HCFCs are also on a phase out plan with reduction to nil by 2030.

Foamular® helps reduce building energy demands on an ongoing basis.

Higher R values and long term thermal retention give a longer life cycle eliminating need for material replacement, manufacture, and disposal. All are factors that add to more energy consumption and associated emissions.

Foamular® can be recycled and is used for alternatives such as landfill and or reprocessing for lower specification insulation /packaging material.

Conclusion

The advantages of using **Foamular®** will ensure energy efficiencies are achieved and environmental impacts are minimised.

Initial premium cost must be viewed on a long term/life cycle basis with the following benefits considered.

Superior thermal and physical performances are guaranteed. (20 years)

On going energy savings both in operating costs and lower energy use equating to reduction in CO2 emissions.

Minimised risk of structural damage and associated maintenance costs.

On site benefits during construction phase are the ease of handling and installation. The lightweight yet very tough sheets minimise ohs risks associated with lifting while contributing to labour cost saving due to ease of installation.

Case Study RAND Cold Storage and Distribution Centre

Rand is the leading National refrigerated transport, cold storage and distribution services provider in Australia.

Located throughout Australia Rands Cold Storage and Distribution Centres provide the very best storage and distribution services available.

Late 2006 saw the completion of their latest distribution facility located in Homebush Sydney.

Prime Constructions were the builder and **Foamular®** metric 350 was chosen as the underfloor insulation.

There were many factors that were critical to the choice of floor insulation.

The material obviously had to provide good thermal performance, but more critical were the insulations ability to bear extremely high live and dead loads while providing long term slab stability.

Both VH Grade expanded polystyrene and **Foamular®** extruded polystyrene were closely compared.

Foamular® metric 350 was finally chosen.

The COST DIFFERENCE was outweighed by the superior thermal and physical properties of the **Foamular®** product. In all areas **Foamular®** far exceeded the performance of the expanded polystyrene.

In all, over 28,000 square meters of **Foamular®** were used on the project. This equated to 32 forty foot containers of material that were delivered to site over an eight week period.

Working closely together, the Owens Corning Nanjing factory, Austech personnel and Prime project management had the vast amount of material produced, shipped and delivered to meet a tight programming schedule that at times had to be altered at very short notice.

The facility opened in early 2007 with full occupancy.

Foamular® Metric 350 will be contributing to the energy and cost efficiency of this state of the art facility for many years to come.

BUILDER: PRIME CONSTRUCTIONS
Project Manager: Scott Griffin
394 Pacific Hwy,
Lane Cove NSW 2066

Consulting Engineer: James Griffiths Engineering
Mosman, Sydney NSW 2088

Cold Storage Applications

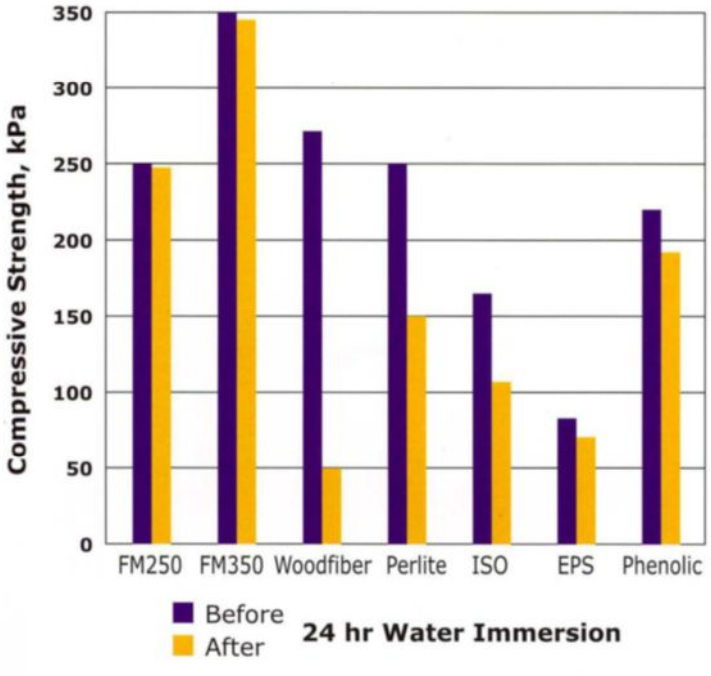
Cold storage applications create one of the most hostile environments to which an insulation can be exposed due to large temperature differentials and associated severe water vapor pressures.

Superior Performance

The excellent water resistance properties of FOAMULAR®-METRIC allow it to perform efficiently in all components of cold storage buildings, including:

- Under a load-bearing floor slab
- Walls and ceilings
- Foundation
- Exterior Walls
  - Interior face
  - Exterior face
  - Sandwich panel

Compressive Strength of Various Insulation Products after 24 hours of Total Water Immersion



FM=FOAMULAR®-METRIC EPS=Expanded Polystyrene ISO=Polyisocyanurate

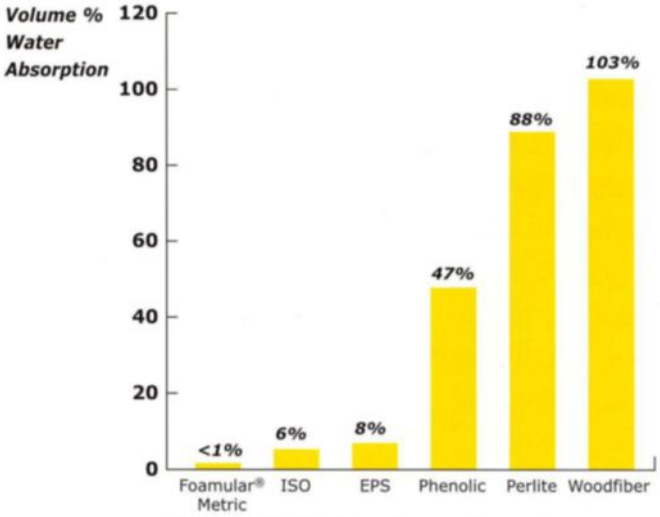
The Effects of Moisture

Moisture can significantly affect the thermal insulation performance of a building. The following charts demonstrate the effect of moisture on the thermal resistance (R-value) and the compressive strength of various insulation products. The exceptional moisture resistance of FOAMULAR®-METRIC is evident.

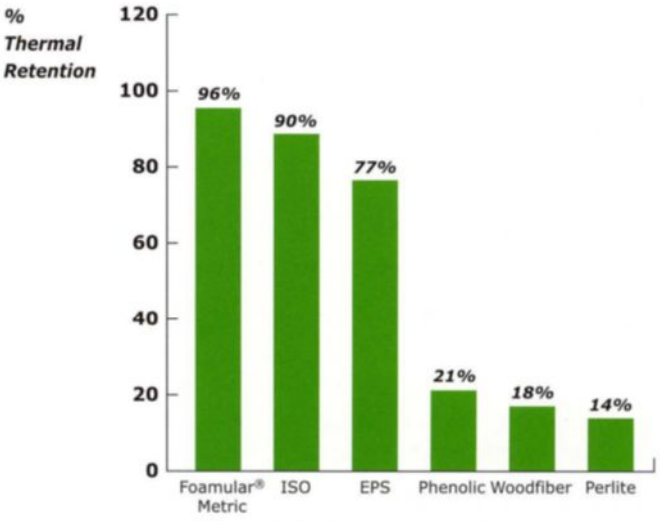
Notes:

(1) Test speciments were immersed in water for up to 90 days under normal laboratory conditions

(2) Samples provided with facts were tested as received



Volume % Water Absorption
After 90 days total water immersion



% Thermal Value Retention
After 90 days total water immersion

Application Details

When Used in Cold Storage Floors...

Over a long period of time many insulations in a cold storage floor suffer from compressive creep. Excess creep can cause structural damage and lead to a loss in insulation efficiency.

When used in cold storage floor applications, **FOAMULAR®-METRIC** outperforms most other insulation materials in supporting the imposed load and maintaining insulation performance. Figure 1 gives a schematic illustration of **FOAMULAR®-METRIC** being used in cold storage floor applications.

With its unsurpassed compressive strength, **FOAMULAR®-METRIC** provides adequate support of the slab by limiting deflection. With its minimum continuous operating temperature of -50°C, the insulation boards can safely be used in these demanding conditions without any adverse affect on its thermal or physical properties.

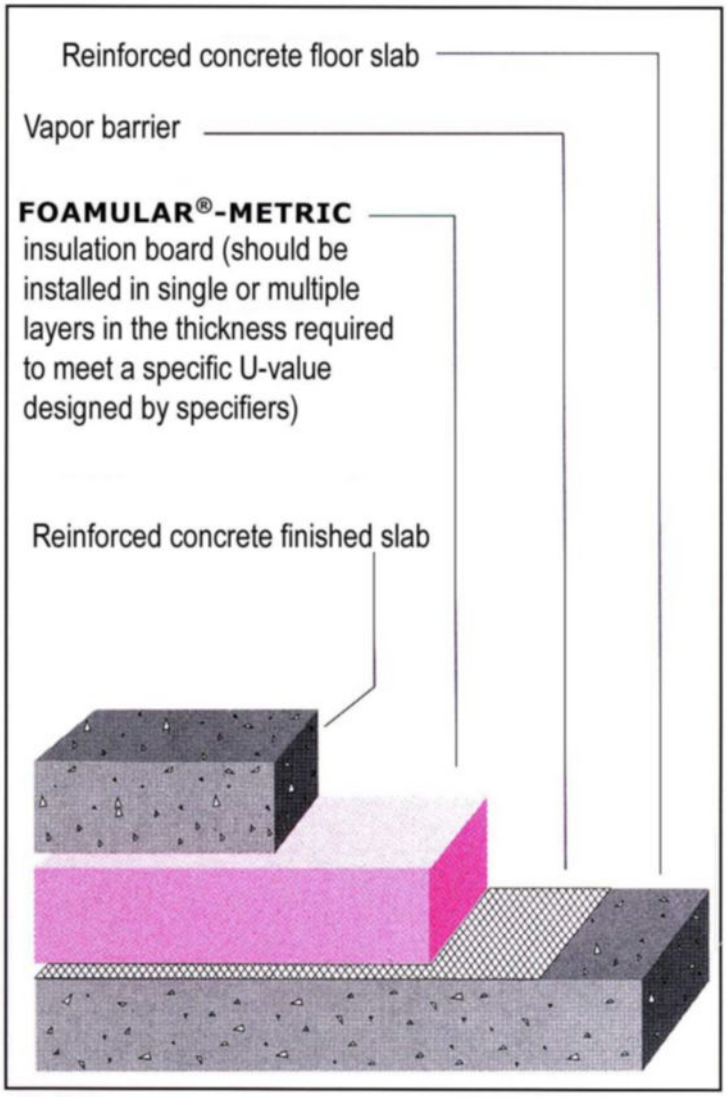


Figure 1: **FOAMULAR®-METRIC** *Used in Cold Storage Floor*

Installation Notes

- A vapor barrier is laid over the reinforced concrete floor slab.
- Joints in the vapor barrier should be sealed as the barrier also acts as a vapor control layer.
- **FOAMULAR®-METRIC** insulation boards should be laid tightly-butt jointed or shiplapped in single or multiple layers depending on the thickness required to meet U-values specified.
- The reinforced concrete finished slab can then be placed on top of the insulation boards.

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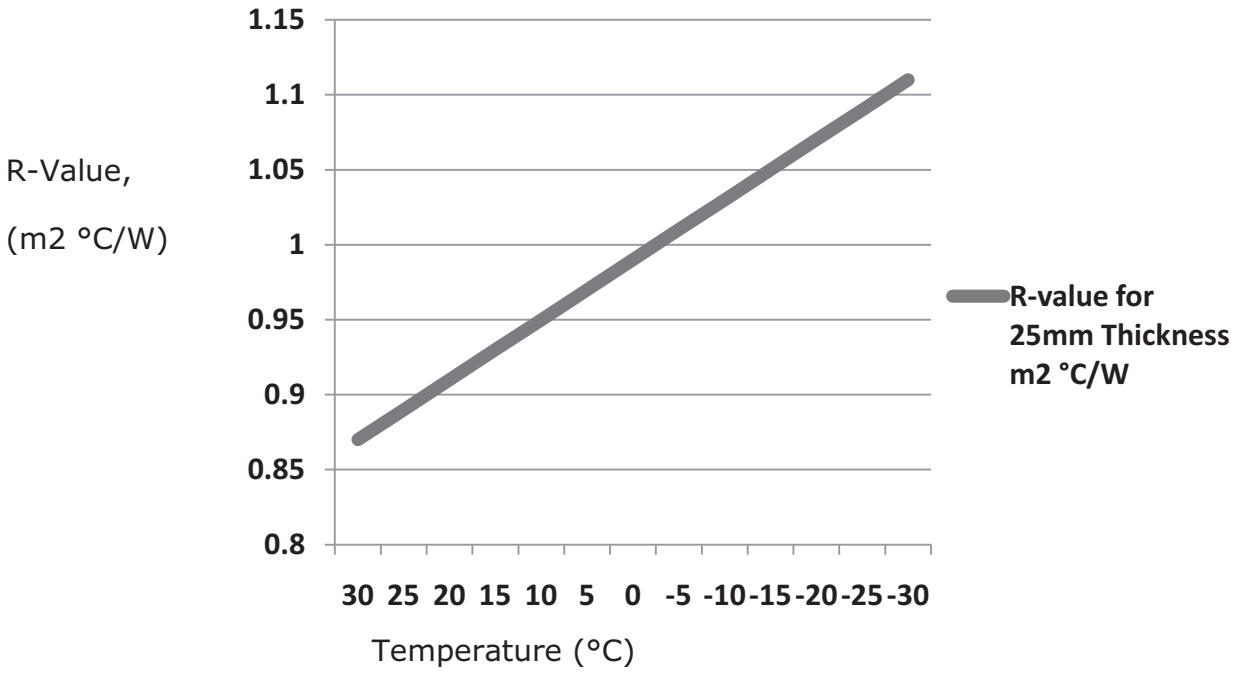
Foamular R-values Between 30°C and -30 °C

Mean Temperature (°C)	R-value for 25mm Thickness m2 °C/W	Calculated Thermal Conductivity (K)
30	0.87	0.0288
25	0.89	0.0281
20	0.91	0.0275
15	0.93	0.0269
10	0.95	0.0263
5	0.97	0.0258
0	0.99	0.0253
-5	1.01	0.0248
-10	1.03	0.0243
-15	1.05	0.0238
-20	1.07	0.0234
-25	1.09	0.0230
-30	1.11	0.0225

Effects Of Temperature On R-value



Technical Bulletin

Foamular®
Extruded Polystyrene Insulation

Foamular Foundation Properties for Load Bearing Slab Applications

August, 2009

Foamular Extruded Polystyrene Insulation is suitable for use under concrete slabs. The Foamular compressive strength needed is determined by load on the slab, and the thickness and reinforcing of the slab. Although many solutions are possible with proper engineering design, Foamular 250 is commonly used under residential slabs, and Foamular 400 and 600 are commonly used under industrial slabs.

The Foamular Foundation Properties table provides engineering data for individual project analysis if needed.

Foamular Foundation Properties									
Foamular Product	**Foundation Modulus (pci)[1, 2, 3]**						**Compressive Stress (psi)**		
	Thickness (in.)						Live[5] Recommended	Dead[5] Recommended	Ultimate[4]
	1”	1.5”	2”	2.5”	3”	4”			
150	590	550	500	450	400	300	3	5	15
250	750	710	675	595	565	510	5	8.3	25
400	1100	1000	900	780	680	650	8	13.3	40
600	1520	1400	1275	1150	1040	790	12	20	60
1000	NA	--	2600	NA	NA	NA	20	33.3	100

1. Foundation modulus is a measure of deflection at given loads, expressed as inches deflection per inch of thickness or “pci”.
2. For insulation installed in multiple layers, assuming the layers are identical, the foundation modulus for the system equals the foundation modulus for one of the layers divided by the total number of layers.
3. For insulation systems that utilize a variety of thicknesses, the system foundation modulus is determined by adding the reciprocal of the foundation modulus of the individual layers. The total is the reciprocal value for the foundation modulus of the entire system.
4. Ultimate compressive stress is measured at 10% deformation or yield, whichever occurs first. For thinner product (1”), yield typically occurs first. For thicker products (1.5” and thicker), yield typically occurs first with 3% to 4% deformation.
5. Recommended stress (load) levels will limit long term compressive creep to not exceed 2% in 20 years.

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TOLEDO, OHIO 43659

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August, 2009

Foamular® - Metric Insulation Physical Properties

Property	Unit	Test Standard	Foamular Metric								
			FM150	FM250	FM300	FM350	FM400	FM450	FM500	FM550	FM650
Density	kg/m³	ASTM D1622	25-28	31-40	34-40	36-42	38-44	40-45	40-45	41-46	42-48
Compressive Strength	kpa	ASTM D1621	>=150	>=250	>=300	>=350	>=400	>=450	>=500	>=550	>=650
Water Absorption Rate	%(v/v)	ASTM C272	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Water Vapor Permeance	ng/(pa.s. m²) @ 25.4mm	ASTM E96	<63	<63	<35	<35	<35	<35	<35	<35	<35
Thermal Conductivity (R Value)	W/m.k @ 24℃	ASTM C518	R Value 25mm-R.89 30mm-R1.07 40mm-R1.42 50mm-R1.78 60mm-R2.14 75mm-R2.67 100mm-R3.57 50mm (With Foil) - R2.0								
Fire Rated Indices		AS1530.3	Ignitability 9 (0-20) Spread of flame 0 (0-10) Heat evolved 1 (0-10) Smoke developed 4 (0-10)								
As Tested With 6mm Poly Render			Ignitability 0 (0-20) Spread of flame 0 (0-10) Heat evolved 0 (0-10) Smoke developed 1 (0-10)								
As Tested With Foil Facing			BCA Group Classification 1 (Specs C 1.10 & A2.4)								
Dimensions (mm)			2450 x 600 (2450 x 1200 optional special order)								
Thickness (mm)			25, 30, 40, 50, 60, 75, 100								

Reference Document - Australian Standard AS1366.4 Rigid Cellular plastic sheets for thermal insulation. Part 4 Rigid Cellular Polystyrene Extruded RC/PS-E

Physical Properties - AS1366.4 Table 3.

Recommended Application - AS1366.4 Apendix B Table B1.

CFC free since 1992

Blowing agent used is ozone safe HCFC142B

Compressive strength @10% deflection

OWENS CORNING ASIA PACIFIC
2707-9, ISLAND PLACE TOWER
510 KING'S ROAD, NORTH POINT
HONG KONG
TEL: 852.2594.4777
FAX: 852.2511.2371

June 10, 2005

To Who It May Concern

Per your request, this will confirm that the Foamular Metric 250, 300 and 350 extruded foam polystyrene insulations have been manufactured to meet or exceed the requirements of ASTM C578-95.

Consquently, they are warranted to maintain the physical properties represented in Owens Corning's current printed literature for a period of twenty (20) years. Further, this material is waranteed to maintain at least 90% of its represented thermal resistance (R-value) for a period of twenty (20) years.

Please note that our foamular products are listed in the Building Materials Directory of Underwriters Laboratories, Inc.; see Foamed Plastics (BRYX), owens Corning, Toledo, Ohio, R8811 (N). Also, to assist building officials in confirming compliance of our products with building codes, we subscribe to UL's Factory Inspection and Follow-Up Service.

Should you have any questions, please contact us at the above referenced address.

Yours faithfully,

Billy Lee
Sales Manager
Building Materials Products