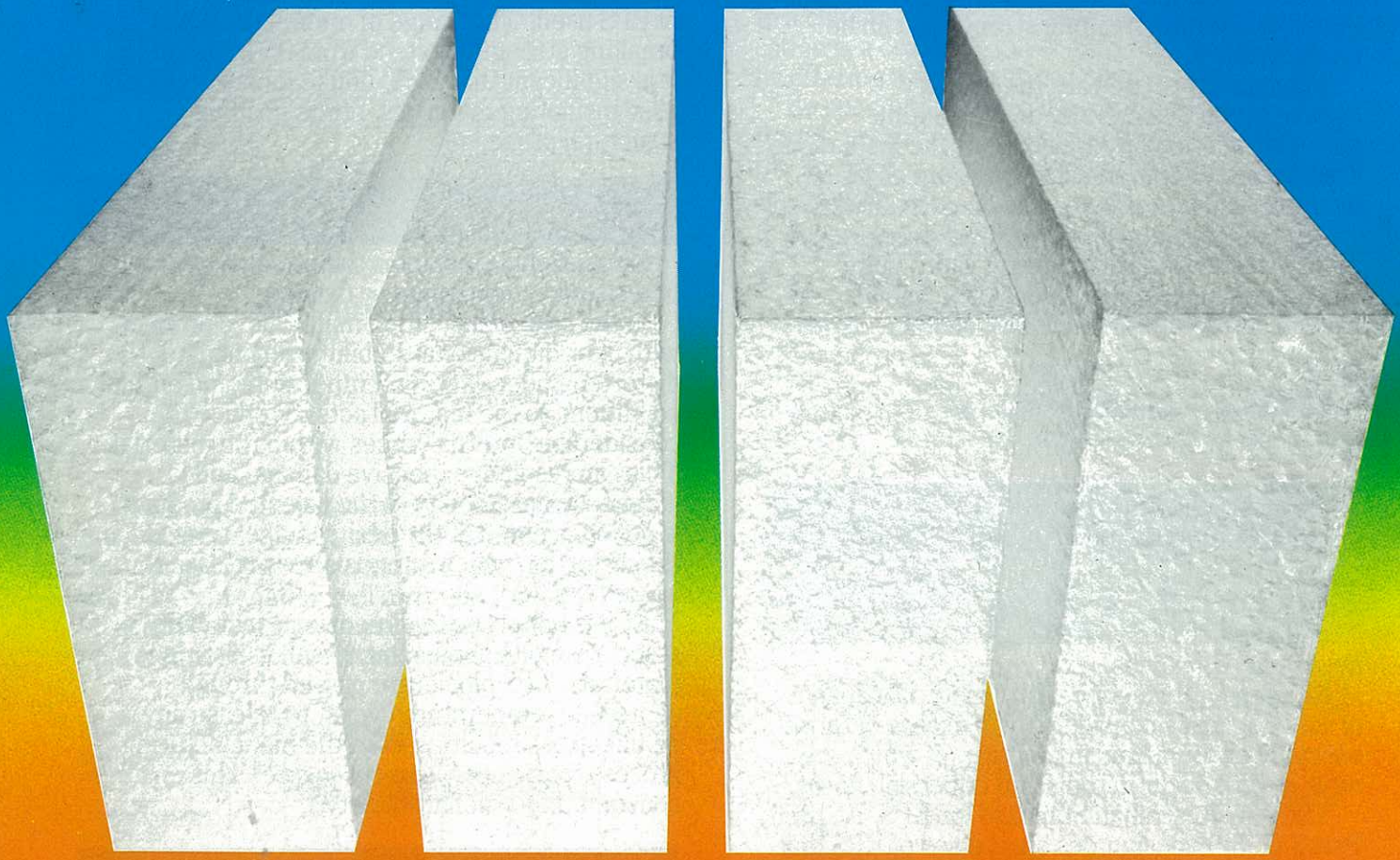
Number 4 of a series

The physical properties of EPS Thermal Insulation



EPS
EXPANDED POLYSTYRENE INSULATION

The Ultimate Insulation

EPS (Expanded Polystyrene) is the only insulation material that in practical, economic and efficiency terms can be applied to all areas of building construction – ceilings, roofs, walls, floors and underslab – to provide superior standards of thermal insulation. That's why EPS is the Ultimate Insulation.

To understand why EPS is such a remarkable product it is essential to understand its physical properties. This brochure will briefly examine these properties. More detailed technical information is available on request.

Because of the extremely high thermal resistance of EPS its other mechanical properties, such as compressive stress, tensile strength or cross breaking strengths, can be often overlooked.

Thermal properties are the primary consideration when evaluating insulating material, but in many applications the insulation is subjected to compression, tension, abrasion, dynamic loads, or other types of external impact.

Another major advantage of EPS insulation is its very high strength to weight ratio. Light weight combined with dimensional stability and excellent compressive strength characteristics are found in each class of EPS. These properties enable the specifier to select the most appropriate balance between structural and insulating properties for any building application.

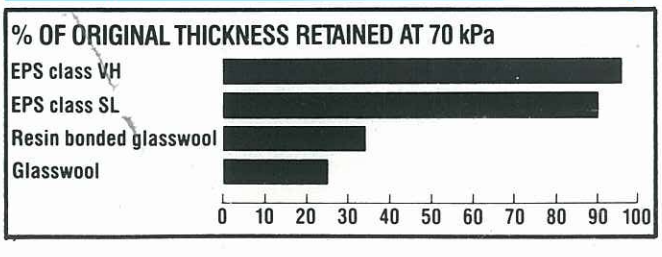
Compressive strength.

Compressive strength of EPS refers to a measure of the stress, which will deform, or compress, the product, or test piece, to 90% of its original thickness.

EPS is a lightweight cellular material capable of carrying loads considerably in excess of those normally encountered in practice, of which the most severe occur in roofs and underslab floors.

The new Australian Standard for EPS, AS1366 Part 3 (1982)* designates six classes of EPS that have a range of nominal densities from 11 kg/m^3 to 28 kg/m^3. Compressive strength (stress) increases in an almost straight line relationship with corresponding compressive strengths from 50 kPa to 165 kPa respectively.

Compressive resistance.



Cross breaking strength.

The cross breaking strength of EPS measures the ability of the material to resist stresses, as they occur, in beam loading.

It is the mechanical properties appropriate to sandwich panel construction, as indicated by the cross breaking strength, that has enabled EPS to be used almost exclusively as the core material for more than 25 years in Australia and New Zealand. EPS provides both the key structural and thermal properties so necessary for this application.

Cross breaking strength is measured by point loading of an EPS test piece 200 mm x 50 mm x 50 mm supported on two bars placed 150 mm apart with the specimen loaded to failure. The sample is subject to bending and the cross breaking strength is the maximum stress at fracture.

As with compressive strength the cross breaking strength will vary according to the class of EPS used. This range of minimum cross breaking strengths extend from 95-320 kPa. It is significant that EPS, unlike most commonly used insulating materials, offers positive structural properties.

Dimensional stability.

Dimensional stability is the property of resistance to warping or twisting.

In the case of insulation materials, a product with poor dimensional stability can become distorted under varying temperature and humidity conditions as the material acts to reduce the considerable internal forces within the material. This can result in expensive damage and losses if dimensional stability of the selected product is not considered at the design stage, because the distortion which attends stress release is not reversible.

EPS is not prone to dimensional instability associated with some alternative insulating materials. EPS blocks are passed through controlled temperature ovens, to release any inbuilt stress resulting from the manufacturing process, before they are cut to size. This ensures constant dimensional stability.

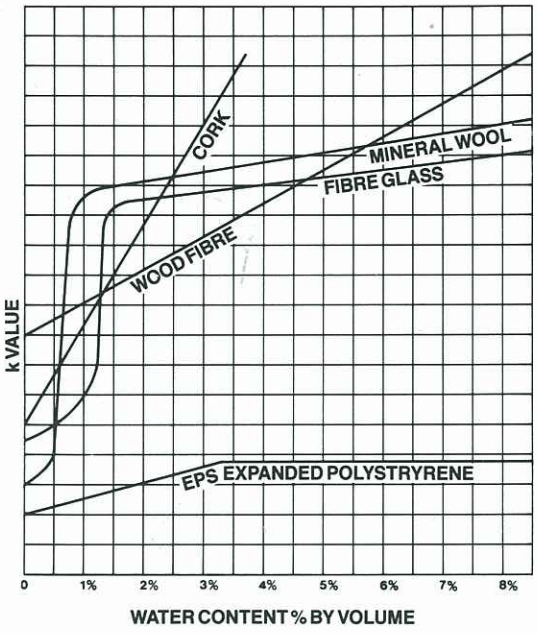
Moisture resistance.

EPS has a low water vapour transmission rate. It has no capillary action. However it must not be considered as a vapour barrier in the same sense as polyethylene film.

It has excellent breathability characteristics and allows moisture to escape from a wall or floor element, and does not form vapour dams.

In spite of the low moisture transmission rate, it is still proper to use a vapour barrier under conditions of high humidity and high temperature differentials. Normally, the vapour barrier should be installed on the warm side of the structural component, with insulation as near as possible to the cold side.

Of all materials used for insulation applications, EPS is one of the most resistant to the adverse effects of moisture. Condensation, which may build up within any insulation material under critical vapour flow conditions, only marginally affects the thermal performance of EPS. Even if condensation develops through improper use EPS will retain its dimensional stability and superior insulation values. The following chart demonstrates the effect of moisture on k values of several commonly used insulation materials.



Technical data from
ASHRAE and International Institute of Refrigeration,
"The Effect of Moisture on Insulating Materials..."

One final point regarding moisture absorption must be made. Even under the worst conditions – i.e. total prolonged saturation caused by improper use – EPS insulation will maintain its shape, size, structure, cohesion, physical appearance and, approximately 85% of its insulation value.

PHYSICAL PROPERTIES OF EPS TO AUSTRALIAN STANDARD AS1366 PART 3 (1982)

Physical property	Unit	Class						Test method
		L	SL	S	M	H	VH	
Compressive stress at 10 per cent deformation: min.	kPa	50	70	85	105	135	165	AS2498.3
Cross-breaking strength: min.	kPa	95	135	165	200	260	320	AS2498.4
Rate of water vapour transmission: max. measured parallel to rise at 23°C	μg m-s	710	630	580	520	460	400	AS2498.5
Dimensional stability of length: max. at 70°C dry conditions: 7 days	percent	1.0	1.0	1.0	1.0	1.0	1.0	AS2498.6

"The insulation shall be Expanded Polystyrene (EPS) insulation, Class...., ... mm thick or as indicated on drawings. Refer to appropriate specifications such as AS1366, Part 3 1982."

EPS – The high performance insulation.

Insulation and structural requirements cover a wide spectrum and EPS is available in six classes to meet the needs of the designer.

EPS board is readily available in the following size sheets –

Length: 1200 mm to 4800 mm
Width: Up to 1200 mm
Thickness: 10 mm increments up to 600 mm.

The Australian Standard, AS1366, Part 3 (1982)*, specifies the minimum physical property characteristics which must be met if a material is to conform to that standard. There are six different sets of physical properties to choose from when specifying EPS material. With other materials there is generally only a single or restricted option.

The designer may therefore specify the class of EPS most suited to performance requirements. In a climate of spiralling building costs overspecification is a costly mistake. EPS offers cost savings by offering a specifications choice.

By specifying material conforming to AS1366, Part 3, recommendations are soundly based and the properties required for a particular application are guaranteed.

Colour Codes for Simple Identification

The designated colour for each class

Class L
Class SL
Class S
Class M
Class H
Class VH

EPS – The versatile insulation. Floors

Floor insulation in Australia and New Zealand has generally been neglected, however, there are many benefits to be obtained from this application. Reduction in heat loss and the resultant savings in energy costs are particularly relevant.

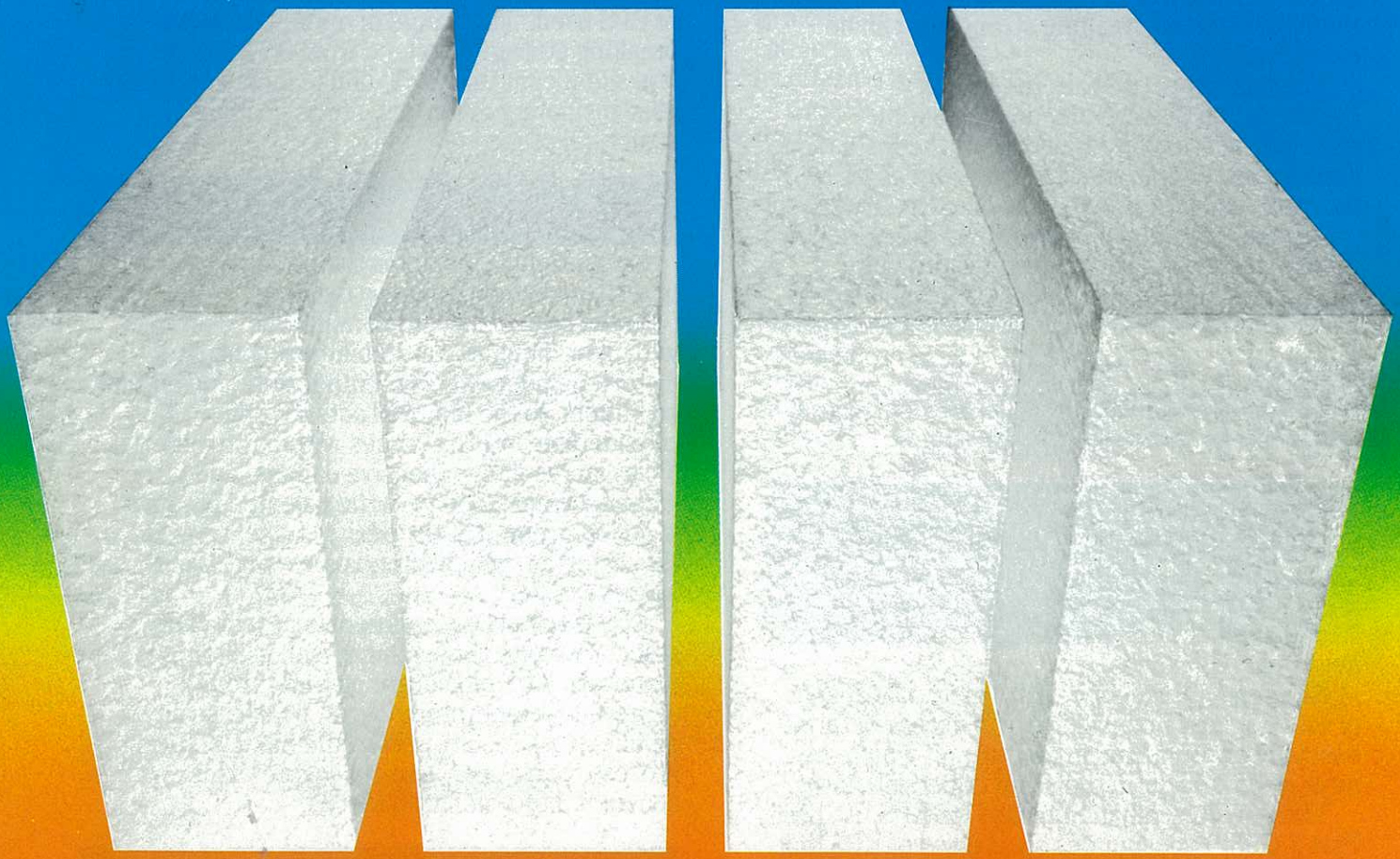
Clearly, the best time to insulate floors is at the time of construction. EPS is ideal because it has the structural integrity to meet all floor applications.

EPS Offers

- ☐ Excellent compressive strength characteristics
- ☐ Insulation against heat losses
- ☐ Self-supporting properties
- ☐ Resistance to attack by fungi and bacteria
- ☐ High resistance to moisture absorption and water vapour transmission
- ☐ Light weight allowing for economy of structural design
- ☐ Resistance to impact sound
- ☐ Ease of cutting and handling
- ☐ Non-irritant and non-allergenic

Number 4 of a series

The physical properties of EPS Thermal Insulation



EPS
EXPANDED POLYSTYRENE INSULATION

The Ultimate Insulation