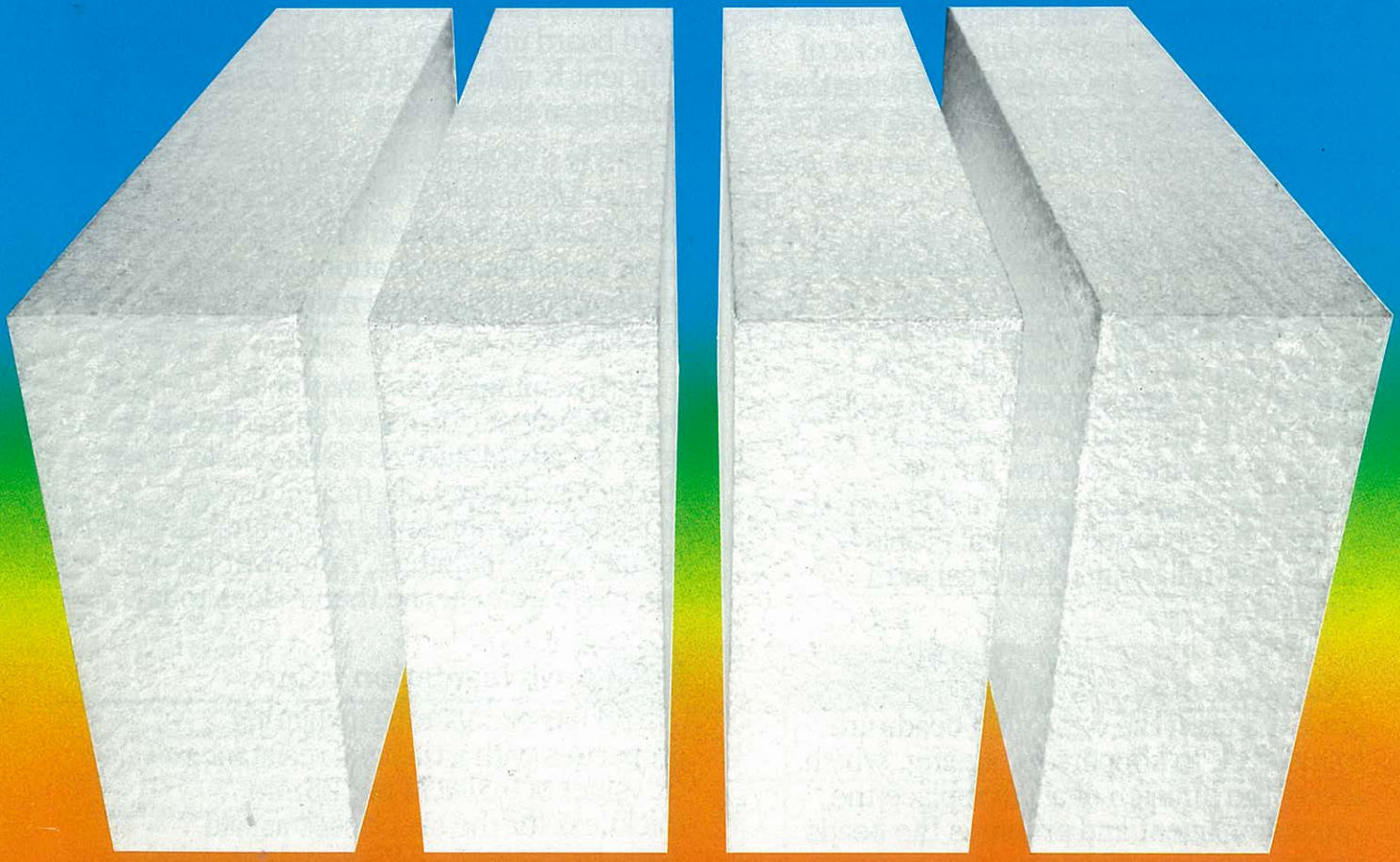
Number 2 of a series

Manufacture, Properties and Characteristics 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.

The manufacturing process.

The raw bead is thermoplastic (i.e. it softens on heating) and contains an expanding agent. The combined action of steam and the agent causes each individual bead to expand considerably. Numerous closed hollow cells are formed within each bead, which may grow up to 50 times their original volume. Blocks of cellular material are made by allowing the softened beads to fuse together as they expand in a mould.

EPS is manufactured in four stages –

Pre-expansion – The raw beads are heated in a stirred vessel; the beads expand but remain separate. During this stage the beads can be expanded to a range of densities to allow for the production of a wide range of EPS classes to meet the required physical properties of the Australian and New Zealand Standards.

Conditioning – Following pre-expansion the expanded beads are transferred to hoppers for ageing, which allows the infusion of air to replace the expanding agent and prepares the beads for the ensuing processes.

Moulding – The beads are reheated and fused together in a block mould.

Finishing – Blocks are passed through controlled temperature ovens to remove moisture, and the final traces of expanding agent, to provide a block of constant dimensional stability. The blocks are then cut to the desired sizes.

Members of the EPS Divisions in both countries process to conform to the Australian and New Zealand Standards. In addition, self-regulation is maintained by a code of practice which is endorsed by all participating members.

EPS . . . The insulation for the '80s.

EPS (expanded polystyrene) insulation is a product of today.

The need for energy-efficient buildings, combined with the soaring costs of construction, makes EPS the logical choice for insulation. In North America and Europe where energy efficiency has long been a primary design consideration, architects have made EPS the dominant rigid board insulation. It provides a cost efficient R value; and that's the key to building in the eighties.

EPS is a closed cell, resilient, lightweight material with a nominal density range between 11-28kg/m^3 for most insulation applications. However, higher densities can be manufactured if required.

With its unique combination of outstanding performance characteristics and cost advantages, EPS has a successful thirty-year history of efficient use for industrial, commercial, residential and low temperature buildings. But never has its use made more sense than it does today.

Long-term insulation value.

EPS has exceptional insulating properties with a thermal resistance (R value) of 0.61-0.74 per 25mm thickness for the six classes as laid down by the SAA, EPS Standard (1366, Part 3 – 1982)*. Unlike that of many other insulation products, the R value of EPS insulation does not deteriorate because the cellular structure of EPS contains only stabilized air. Ageing has no effect upon the performance of EPS.

Moisture resistance.

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 an insulation value superior to alternative materials. Furthermore, EPS breathes and does not form vapour dams.

Temperature cycling.

EPS is able to withstand the abuse of temperature cycling, assuring long-term performance. Core specimens taken from 20-year-old freezer room walls show that EPS withstands freeze-thaw cycling without loss of structural integrity or physical properties.

Lightweight.

EPS insulation adds little to the total weight; a major advantage in new constructions when the lightweight factor provides structural design economies, plus enhanced R values.

Strength characteristics.

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

Permanence.

EPS insulation is an inert, organic material. It provides no nutritive value to plants, animals or micro-organisms. It will not rot and is highly resistant to mildew.

Fabrication and installation.

EPS insulation can be installed quickly and easily, requiring limited labour. It can be cut to shape with a knife or saw to assure a tight fit and eliminate heat loss channels. Its light weight allows ease in handling and storage.

Flammability Characteristics.

As with all organic material, insulation products must be considered combustible and constitute a fire hazard if improperly used or installed. The material contains a flame retardant additive to inhibit accidental ignition from small fire sources. The table (p. 4) shows test results from EPS and other common building materials to provide a guide as to how these products compare.

Table 1: PHYSICAL PROPERTIES OF RIGID CELLULAR POLYSTYRENE (RC/PS)

Australian Standard 1366, Part 3 – 1982*

A cellular material produced by the expansion of a styrene based polymer with a blowing agent.

Physical Property	Unit	Class						Test Method
		L	SL	S	M	H	VH	
Compressive stress at 10% deformation; min.	kPa	50	70	85	105	135	165	AS 2498 Method 3
Cross-breaking strength; min.	kPa	95	135	165	200	260	320	AS 2498 Method 4
Rate of water vapour transmission; max-measured parallel to rise at 23°C	$\mu g/m^2 s$	710	630	580	520	460	400	AS 2498 Method 5
Dimensional stability of length; max. – at 70°C, dry conditions; 7 days	Per cent	1.0	1.0	1.0	1.0	1.0	1.0	AS 2498 Method 6
Thermal conductivity; max. (at a mean temperature of 25°C)	W/m.K	0.041	0.038	0.036	0.035	0.034	0.034	AS 2464.6*
Flame propagation characteristics:								
– median flame duration; max.	s	2.0	2.0	2.0	2.0	2.0	2.0	AS 2122.1
– eighth value; max.	s	3.0	3.0	3.0	3.0	3.0	3.0	
– median volume retained;	Per cent	15	18	22	30	40	50	
– eighth value, min.	Per cent	12	15	19	27	37	47	

1 W/m.K = 6.93 Btu in/ft²h. °F. *in course of preparation.

Rigid cellular polystyrene (RC/PS) shall be marked with a colour stripe to designate each class as above.

Table 2: COMPARATIVE TESTING OF SOME MATERIALS TO AS 1530.3 – 1982

'Test for early fire hazard properties of materials.'

Material	Ignitability Index (0-20)	Spread of Flame Index (0-10)	Heat evolved Index (0-10)	Smoke developed Index (0-10)
EPS (i)	12	0	3	5
Softboard (ii)	16	9	7	3
Oregon (ii)	13	6	5	3
Bluegum (ii)	11	0	3	2
Radiata Pine (iii)	14	8	9	3
Hardboard (iii)	14	7	9	5

The Question of Toxicity.

Extensive research programmes have been conducted overseas (iv) to determine if thermal decomposition products of EPS present a toxicity hazard. The test results have revealed that these decomposition products are decidedly less harmful than those of burning wood and other conventional building materials.

Gases released during combustion are predominantly carbon dioxide and, to a lesser extent, carbon monoxide. A current CSIRO report (v) comments that the toxicity of the gases associated with the burning of EPS is no greater than that associated with timber.

Availability.

Six classes of EPS are available to meet the wide range of insulation and structural requirements of the building and construction industry.

EPS board is readily available in the following size sheets –

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

In addition, custom sizes can be arranged to suit special requirements.

TAKE ADVANTAGE OF THE TECHNICAL ASSISTANCE WE CAN OFFER.
Manufacturers are located in all States of Australia and New Zealand, who can assist you in the design and application of EPS insulation products. Further information and technical data are available from these companies or the EPS Divisions.

(i) AWTA – Test Report No. 9-96156
(ii) EBS Notes on the Science of Building NSB66
(iii) Australian Standard 1530.3 – 1982, Table A1
(iv) H.Th. Hofmann and H. Oettel
"Comparative toxicity of thermal decomposition products"
(v) P.R. Nicholl and K.G. Martin
"Toxicity considerations of combustion products from cellular plastics"

*New Zealand Adoption applied for.

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