SENATE INQUIRY INTO NON-CONFORMING BUILDING PRODUCTS

Minimising the risks to consumers, businesses and the community associated with failure of non-conforming building products

expanded polystyrene australia

16 July 2017

Overview

Expanded Polystyrene (EPS) is one of the most common lightweight building and construction materials used in Australia, offering excellent insulation and strength properties at a very light weight. When handled and installed correctly, it is safe, practical and cost effective, especially when taking into account its insulation properties over the life of a building.

Expanded Polystyrene Australia (EPSA – www.epsa.org.au) is the national peak body for EPS manufacturers. The association has a long history of leadership on the use of flame retardant EPS additives, with a view to improving safety, saving lives and preventing injury, but also to saving money and ensuring that the EPS industry continues to play a positive role in the wider building and construction industry, while supporting government initiatives to reduce greenhouse gas emissions through the use of appropriate levels of insulation.

So when supplying EPS products for any use in construction, EPSA requires all of its member organisations to comply with Australian Standard AS1366.3 for rigid cellular polystyrene sheets and supply flame retardant grades of EPS in all cases, whether it be for commercial or domestic purposes, to reduce the risk presented by fire to the loss of life and property.

EPSA's requirement goes above and beyond the current National Construction Code, requiring all EPS foam used in construction product applications to use raw material containing Fire retardant additives, such that the foam product will meet AS1366.3 Clause 11 for Flame Propagation when tested. The National Construction Code mandates the use of flame retardant EPS for use in the construction of commercial buildings, but not in the construction of domestic buildings. There is further confusion brought about by the Australian Standard AS4859.1 for the thermal insulation of buildings, which requires the performance of thermal insulation to meet all requirements of AS1366.3 except for fire retardant properties. EPSA believes that this should be amended.

Within the Australian EPS industry, a limited number of non-EPSA aligned moulders and fabricators choose to use raw materials that do not contain a fire retardant when they supply foam products for use in the domestic housing construction market. The motivation for using a raw material without fire retardant is a small reduction in cost, which helps to reduce production costs and boost business profitability.

EPSA believes that the EPS industry should only supply fire retardant grade EPS for use anywhere in the construction's market, and non-fire retardant grade EPS should be limited to use in packaging applications. Packaging applications are primarily for the packaging of fish, fruit and vegetables, and overseas the packing of white goods, electrical and electronic products.

EPSA is calling for assistance from the Federal Government to support its stance on the use of flame retardant in EPS for **ALL** construction applications, both commercial and domestic.

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We are seeking uniform regulations to enforce the National Construction Code and the associated building codes throughout the states and territories for Domestic and Commercial applications. EPSA seeks to ensure that Australian EPS manufacturers and importers of construction materials containing EPS fabricated from moulded block, such as insulated sandwich panels, exterior insulation panels, structural insulated panels, use only flame retardant grades of EPS so that their moulded or fabricated product conforms to the testing requirements of clause 11 (Determination of Flame Propagation) of Australian Standard AS1366.3, in all applications using their products for construction and thermal insulation.

There is no specific relevant Australian Standard directly applicable to the use of SIP's (Structural Insulated Panel Systems) , ICF's (Insulated Concrete Forms), Sandwich panels, Facades, cladding or Waffle Pods, in Domestic Dwelling construction applications with regard to the EPS foam standards that should be mandated. Bushfire Attack Level (BAL) standards have been implemented for domestic facades and cladding but the requirement for fire retardant EPS foam in cladding remains silent.

It has been the EPS Industry Association standard, as a voluntary code of practice since the early 1980's that all EPS foam products moulded into block and fabricated into end-use applications are made from EPS raw material containing flame retardant, and where applicable that the standards called up by AS1366.3 should apply. However, the Australian Standards such as AS1366.3 (1992 version) were written at a time prior to the introduction of newer uses for EPS such as ICF's, SIPS or Waffle Pods where it is currently allowable within the regulations to use packaging grade EPS – containing no fire retardant properties.

It is a requirement of EPSA membership that only Flame retardant EPS is used for all Class of Construction activity, irrespective of how or where it is used. EPSA's membership believes that ICF's, SIP's & Waffle Pods should all be moulded from Flame Retardant EPS raw materials, similar to all other construction products made from EPS. EPSA has therefore developed an internal testing protocol specifically for EPS waffle pods containing flame retardant raw material to provide a uniform industry standard on the use of flame retardant raw material for all construction applications, fabricated or moulded from EPS.

EPSA believes that Domestic and commercial construction should be treated alike and utilise the best commercially available material that is specifically designed to mitigate fire risk factors when applied to a "hierarchy of controls" approach to achieve a product risk outcome that is "as low as reasonably practicable".

What is expanded polystyrene?

Expanded polystyrene (EPS) is a lightweight plastic material that most people recognise as being used in packaging material. EPS is also used widely in the building and construction industry, with this sector making up approximately 65 per cent of all EPS use in Australia.

EPS is derived from styrene – a naturally occurring substance found in many plants, fruit, vegetables, nuts and meats. On a commercial scale styrene is refined from oil and gas. It is then polymerised and impregnated with a blowing agent, and frequently a flame retardant modifier, to form EPS.

Since the start of 2010, when the last domestic manufacturer of styrene and EPS raw material ceased operations in Australia, all styrene and expandable polystyrene used here is manufactured overseas and imported into Australia.

The end product is typically around 98 per cent air and 2 per cent polymer, consisting of small spheres in a closed cellular construction which gives EPS valuable characteristics for the building and construction industry, including being:

- exceptionally cost effective and light weight construction material
- 100 per cent recyclable
- versatile and easy to cut and mould for different purposes
- easy to install and maintain
- water resistant
- sterile
- an excellent thermal insulator
- shock absorbent
- a high load-bearing material at low weight
- a good vapour, air and dust barrier.

How do you make EPS?

EPS is produced in a three stage process: pre-expansion, conditioning and moulding.

1. Steam causes the raw polystyrene beads to expand up to 50 times their original volume.
2. After expansion, the beads are then conditioned and undergo a maturing period in preparation for moulding.
3. The beads are then placed within a mould and reheated with steam, expanding further to completely fill the mould and fuse together
4. A final curing step occurs post moulding that allows the finished product to stabilise.

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No ozone-depleting materials are used in the manufacturing of EPS.

EPS is produced in a wide range of densities. These are matched to the various applications where the material is used, to optimise its performance and strength. Broadly speaking, EPS is manufactured in two generic types:

- flame retardant grade EPS, which is primarily used in construction products for its high-strength-to-light-weight and excellent thermal insulation properties
- standard grade EPS (non-flame retardant modified) which is commonly used in food-related packaging for its insulation and cushioning properties.

What is flame retardant EPS?

Flame retardant EPS is produced by incorporating flame retardant additives during the raw material manufacturing process. The overseas manufacturers of EPS polymer add the flame retardant additive during manufacture and conducts internal quality testing to ensure compliance of their process to international flame retardant requirements This process ensures that the flame-retardant quality of the material is spread throughout its structure, not just applied to its surface.

Flame retardant grade EPS reduces the risk of accidental fire from small ignition sources such as a spark, electrical short or cigarette. By incorporating the flame retardant, the EPS foam when tested in accordance with AS1530.3 will achieve results as detailed in the table below – (full details in appendix 1) :-

Summary of AS 1530.3 flame spread data as conducted by PIA (Plastics Industry Association) in 1982

Material type	Ignitability index (0-20)	Spread of Flame Index (0-10)	Heat evolved index (0-10)	Smoke developed index (0-10)
EPS (fire retardant grades)	12	0	3	5
Softboard	16	9	7	3
Oregon	13	6	5	3
Blue Gum	11	0	3	2
Radiata Pine	14	8	9	3
Hardboard	14	7	9	5

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Physical property and flame propagation summary of AS 1366.3

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	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/m²s	710	630	580	520	460	400	AS2498.5
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	AS2498.6
Thermal resistance (min) at a mean temperature of 25°C (50mm Sample)	m²K/W	1	1.13	1.17	1.2	1.25	1.28	AS2464.5 or AS2464.6
Flame Propogation Characterisitics :								AS2122.1
-median flame duration ; max	s	2.0	2.0	2.0	2.0	2.0	2.0	
-eight 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	

Who is Expanded Polystyrene Australia?

Expanded Polystyrene Australia (EPSA) is the national industry body for manufacturers and distributors of expanded polystyrene products across Australia, representing approximately 70 per cent of all suppliers in the Australian EPS market. Association members work together to protect and enhance the reputation of EPS as an economical and versatile product.

EPSA is made up of four sector groups from the EPS industry in Australia:

- block – moulded into solid blocks then cut into sheets or shapes for a variety of purposes
- pod – used in the laying of concrete slabs
- packaging – used in a wide variety of forms
- raw materials – including the importing of the styrene polymer resin

Expanded polystyrene in construction and greenhouse gas abatement

Flame retardant expanded polystyrene (EPS) is widely used for domestic and commercial insulation in construction, and within the building sector for foundation and support structures, wall cladding and external finishing. It is often used in insulated panel systems in the floors, walls and roofs of domestic as well as commercial buildings.

The importance of using appropriate insulation materials for the reduction of greenhouse gas emissions was highlighted in a 2009 report from the International Council of Chemical Associations, http://epsa.org.au/wp-content/uploads/2016/07/LCA-report-ICCA.pdf

Global management consulting firm, McKinsey & Company, conducted independent analyses and overall project management for the study, which examined the global chemical industry's impact on greenhouse gas emissions through the life cycle of chemical products and the difference they make in the applications they enable. The report determined that insulation alone could account for 40 per cent of the total identified carbon savings from the international chemical industry.

EPS is critical to the future of the construction industry, for the following reasons.

- It is ranked as one of the most efficient forms of thermal insulation and is very cost effective in terms of cost-per-unit.
- It is an inert material that does not rot.
- It is safe and easy to cut to size.
- Its insulation properties play a key role in achieving greenhouse gas abatement targets.
- Energy savings produced through use of insulation in buildings has been found to deliver 150-fold on the energy used to produce the insulation.
- It provides no nutritional benefits to vermin, therefore does not attract pests such as rats or termites.

EPS's other applications include the following.

- Facades for both domestic and commercial buildings.
- Void-forming fill material in civil engineering projects such as bridge beams.
- A lightweight fill in road and railway construction.
- Geofoam (light weight infill for unstable soil) to support the construction of major highways.
- Intricate architectural mouldings.
- Floatation material in the construction of pontoons and marinas.
- Use in sandwich panel construction to produce light weight building panels for use in commercial cool rooms, transportable housing, energy efficient housing. IPCA (Insulated Panel Council of Australia) to address fire risk management concerns.

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Australian compliance with use of fire retardant in EPS

In the 1970s, the EPS industry adopted a voluntary industry convention to ensure that all foam blocks of EPS were produced from flame retardant material. At this time, these blocks were generally fabricated and used in construction projects.

This voluntary approach was successful for many years. However, by the mid-1990s a number of different pre-moulded EPS components were developed. These included:

- insulated concrete formwork (ICFs), which are foam blocks used as moulds for concrete
- a variety of wall, floor and roof insulation, made by many different manufacturers including Structural Insulated Panel systems (SIP's).
- 'waffle pods', which are used under concrete housing slabs.

Initially, all of these products were manufactured using flame retardant material. However, as new moulding companies have entered the industry, some have not adopted this voluntary standard.

Unfortunately, the National Construction Code does not mandate the use of flame retardant to an Australian Standard, when used in light weight construction materials for domestic dwellings, such as that defined by Australian Standard AS1366.3and AS1530.3.

EPSA has encouraged all EPS moulders and suppliers of product to the Australian building industry to supply materials containing flame retardant grades of EPS. However, there are a number of EPS manufacturers, and potentially importers, who operate outside of EPSA, and who market and provide EPS foam products without flame retardant for use in construction products. EPSA is powerless to enforce change in this matter.

It is estimated that the cost advantage in non-compliance with the use of flame retardant is approximately 2 to 3 per cent on the cost of EPS raw materials. This does not sound significant, but the savings quickly multiply. This should also be taken in the context of many EPS manufacturers having an annual turnover of $5-$10 million per annum, and the industry's biggest players having sales of $30-$40 million per year combined. In this context, even a 1 per cent cost saving is significant over the long term.

EPSA has also heard, through the Insulated Panel Council of Australia, that where EPS is used in sandwich panel construction for transportable housing and insulated cool rooms, that some imported sandwich panel material is not compliant with Australian building codes. The risks are that imported panels are not tested and may not contain flame retardant, all in an attempt to save cost, rather than build to Australian Standards.

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EPS and the National Construction Code

It is Expanded Polystyrene Australia's position that all EPS used in construction, for domestic and commercial purposes, should be flame retardant grade EPS. Therefore the association requires this as a condition of membership.

Non flame retardant EPS is more readily combustible than flame retardant grades of EPS raw material, although the risk of accidental combustion is significantly reduced after installing EPS thermal insulation behind fire-inert materials, such as plaster panelling and under concrete.

However, there remains a compelling reason for the additional use of flame retardant in all EPS used in construction. There have been many incidents where accidental fires have occurred on building sites, through the use of cutting and grinding equipment in the vicinity of insulation prior to it being buried in concrete, and where EPS may be exposed during repairs and renovations, which is why EPSA believes that all EPS used in all construction activities must be flame retardant grade EPS

However, this position is not currently embodied in Australia's National Construction Code (NCC) nor the associated state and territory building codes. Currently, the NCC applies Australian Standard AS4859.1 for the use of EPS when used as thermal insulation in commercial and domestic buildings, yet this Standard excludes the specification of fire performance. The NCC also applies fire performance tests according to Australian Standard AS1530.3 and AS/ISO 9705 for flame retardant in EPS for use in the construction of commercial buildings. However, the NCC does not mandate the use of flame retardant EPS in the construction of domestic buildings.

The decision by some Australian EPS moulders to not use flame retardant grade EPS in the manufacture of EPS building products represents a significant reputational risk to the EPS industry, and a potential safety risk to community. Should such (standard grade) EPS material ignite, the fire spreads rapidly, increasing the risk of injury and property damage, and would likely attract negative media attention. This detracts from the significant benefits that EPS provides to the Australian economy whilst providing an easy to use lightweight construction material, with excellent thermal insulation properties that contribute towards Australia achieving its greenhouse gas abatement targets.

What are EPSA's recommendations?

Expanded Polystyrene Australia (EPSA) has a long history of leadership on the issue of flame retardant material in the construction industry and has required its membership to adhere to a voluntary guideline that enforces the use of flame retardant in EPS.

Our position is that all domestic and commercial construction applications of EPS foam should be made from flame retardant grade EPS raw material., enabling all mouldings, foam block and cut sheet to be compliant with the flame propagation properties of AS1366.3 (clause 11)

These requirements should be called up by the National Construction Code.

EPSA is calling on the Federal Government to support this stance, through a small update to the National Construction Code that will see Australian Standard 1366.3 and its relevant clauses as described above applied to the use of EPS in all forms of construction, commercial and – for the first time – domestic buildings.

EPSA also recommends changes to AS4859.1 to include fire retardant properties and align it to AS1366.3 in the case of EPS.

EPSA also calls for the corresponding Australian state and territory building codes to be updated in line with the National Construction Code, to ensure uniformity of practice across the country.

Further, EPSA also calls for the effective enforcement of the National Construction Code, to ensure compliance of product supplied by local manufacturers as well as product imported through international suppliers complies with Australian law. It is essential to maintain an even playing field for all building product manufacturers in Australia and ensure this is regulated for importers of products.

Ultimately, this change to the NCC and effective enforcement will go a long way to ensuring more uniform safety and compliance standards for Australian building sites that are deemed either Commercial or Domestic under the NCC and State Building Codes.

Glossary

EPS – Expanded Polystyrene

EPSA – Expanded Polystyrene Australia

IPCA – Insulated Panel Council of Australia

PIA – Plastics Industry Association

NCC – National Construction Code

SIPS – Structural Insulated Panel Systems

ICF – Insulated concrete Forms

AS1366.3 – Australian Standard : Rigid cellular plastics sheets for thermal insulation Part 3: Rigid cellular polystyrene— Moulded (RC/PS—M)

AS1530.3 – Australian Standard : Methods for fire tests on building materials, components and structures Part 3: Simultaneous determination of ignitability, flame propagation, heat release and smoke release

AS4859.1 – Australian Standard : Materials for the thermal insulation of buildings Part 1: General criteria and technical provisions

---END---

AS 1366.3—1992

Australian Standard®

Rigid cellular plastics sheets for thermal insulation

Part 3: Rigid cellular polystyrene—Moulded (RC/PS—M)

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PREFACE

This Standard was prepared by the Standards Australia Committee on Rigid Cellular Plastics for Thermal Insulation, under the direction of the Plastics Standards Board, to supersede AS 1366.3-1982.

AS 1366 has four parts, the other parts being:

Part 1: *Rigid cellular polyurethane (RC/PUR)*

Part 2: *Rigid cellular polyisocyanurate (RC/PIR)*

Part 4: *Rigid cellular polystyrene—Extruded (RC/PS-E)*

The products dealt with by this Standard are mainly intermediate products used as insulants, either by their manufacturer or by another manufacturer, in the production of thermal insulation products, e.g. building panels, cool store panels, insulation for bulk containers.

Density has been used over a number of years as a means of classifying cellular plastics. Because of advances in technology, similar physical characteristics may be achieved by materials of different density; for this reason the density of the material is not included in the list of specified physical properties. Nominal densities of rigid cellular polystyrene are included in Appendix B for guidance purposes only.

The subsequent processing of the sheets is the determining factor in the fire hazard associated with the use of these materials, i.e. the potential for harm to life or property resulting from the occurrence of a fire. For example, when used in buildings the cellular plastics may need to be faced with lining materials in order to achieve adequate fire performance. Thus it is not relevant to include a fire performance test for the materials specified in this Standard. The users of these materials should apply suitable fire performance tests to these products in their finished form. Purchasers of products fabricated from these materials should specify such tests in their purchasing agreements. For building structures and components, suitable tests are described in AS 1530, *Methods for fire tests on building materials, components and structures*, Part 3: *Simultaneous determination of ignitability, flame propagation, heat release and smoke release*, and Part 4: *Fire-resistance test of elements of building construction.*

A combustion characteristics test has been included; however, it must be emphasized that a combustion characteristics test gives no indication of the fire hazard associated with the use of the sheet, but is used to compare relative combustion properties of the material. The test has been included to ensure a specified minimum level of fire retardancy in the sheet.

Reference should be made to AS 2627, *Thermal insulation of dwellings—Design guide,* for installation of thermal insulation in domestic dwellings and for guidance on correct placing of vapour barriers for protection in situations where temperature differentials may occur. For industrial and commercial applications, expert advice should be sought.

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STANDARDS AUSTRALIA

Australian Standard

Rigid cellular plastics sheets for thermal insulation

Part 3: Rigid cellular polystyrene—Moulded (RC/PS—M)

1 SCOPE This Standard specifies requirements for rigid cellular polystyrene in the form of sheets, board, blocks and cut shapes for thermal insulation purposes.

These requirements are intended for use in quality control and material specification, and are not necessarily applicable for end use design requirements.

NOTES:

1 Alternative methods for determining compliance with this Standard are given in Appendix A.

2 Guidance to purchasers on recommended applications and nominal densities for each class of rigid cellular polystyrene is given in Appendix B.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS	
1199	Sampling procedures and tables for inspection by attributes
1399	Guide to AS 1199—Sampling procedures and tables for inspection by attributes
2122	Combustion propagation characteristics of plastics
2122.1	Part 1: Determination of flame propagation following surface ignition of vertically oriented specimens of cellular plastics
2464	Methods of testing thermal insulation
2464.5	Method 5: Steady-state thermal transmission properties by means of the heat flow meter
2464.6	Method 6: Steady-state thermal transmission properties by means of the guarded hotplate
2498	Methods of testing rigid cellular plastics
2498.1	Method 1: Sampling and conditioning
2498.3	Method 3: Determination of compressive stress
2498.4	Method 4: Determination of cross-breaking strength
2498.5	Method 5: Determination of water vapour transmission rate
2498.6	Method 6: Determination of dimensional stability
2498.8	Method 8: Determination of water absorption
2900	Quantities, units, and symbols
2900.4	Part 4: Quantities and units of heat
3900	Quality systems—Guide to selection and use
3904	Quality management and quality system elements
SAA	
HB18	Guidelines for third-party certification and accreditation
HB18.44	General rules for ISO or IEC international third-party certification schemes for products
ISO	
7850	Cellular plastics, rigid—Determination of compressive creep

3 DEFINITIONS For the purposes of this Standard, the definitions below apply.

3.1 Rigid cellular plastics sheet—a rectangular flat slab of cellular plastics material of definite uniform thickness.

3.2 Rigid cellular polystyrene—moulded (RC/PS—M)—sheet expanded from expandable polystyrene beads, which is moulded to shape or cut from continuously or discontinuously produced blocks. In Australia RC/PS—M is commonly known as expanded polystyrene (EPS).

3.3 Thermal resistance*—a measure of the thermal properties of building materials, measured in square metre kelvin per watt $m^2.K/W$.

4 CLASSIFICATION Rigid cellular polystyrene—moulded (RC/PS—M) shall be classified on the basis of its performance in relation to the physical characteristics as given in Table 2.

* In AS 2900.4, 'thermal resistance' is called 'thermal insulance', with the symbol M.

5 COLOUR STRIPE Rigid cellular polystyrene—moulded (RC/PS—M) shall be marked with a colour stripe to designate each class as follows:

Class	*Colour*
L	Blue
SL	Yellow
S	Brown
M	Black
H	Green
VH	Red

The colour stripe shall not be less than 10 mm in width and shall be applied at the edge of the sheet across the full thickness.

NOTE: The presence of the colour stripe on the rigid cellular polystyrene sheet to denote its classification may be deemed to be a claim that the material complies with the requirements of this Standard in all respects, in particular those for flame propagation.

6 APPEARANCE There are a number of properties such as uniformity of cell structure and voids which cannot be sensibly quantified.

NOTE: Where any of these are considered to be important, arrangements should be made between the purchaser and the supplier.

7 DIMENSIONS AND FINISH

7.1 Rough shapes Rough shapes shall be finished to specified dimensions.

NOTE: Dimensions are a matter for agreement between the purchaser and the supplier.

7.2 Cut shapes Cut shapes shall be finished to the specified size and in accordance with the particular application.

NOTE: Size is a matter for agreement between the purchaser and the supplier.

7.3 Rectangular shapes Rectangular shapes shall be cut straight and square to conform to the requirements of Table 1.

NOTE: In applications where flatness or special tolerances are considered to be important, arrangements should be made between the purchaser and the supplier.

TABLE 1

DIMENSIONAL TOLERANCES FOR RECTANGULAR SHEETS OF RIGID CELLULAR POLYSTYRENE—MOULDED (RC/PS—M)

millimetres

Length or width	Tolerances on length or width	Tolerances on difference in length of diagonals of a rectangular sheet*	Tolerances on thickness
≤100	+1.0 −0.5	6	+1.0 −0.5
>100 ≤1000	+1.5 −0.5	6	+1.0 −0.5
>1000 ≤2000	+2.0 −1.0	10	+1.0 −0.5
>2000 ≤4000	+3.5 −1.5	16	+1.0 −0.5
>4000	+6.0 −2.0	26	+1.0 −0.5

* The tolerance levels for the difference in length of the diagonal are based on the length (longer dimension) of the sheet.

8 TEST SPECIMENS Test specimens shall be cut from the samples according to the requirements of the test methods.

Where the thickness of the sample is less than that specified, but 12.5 mm or thicker, the specimens may be prepared by plying up samples. The plies may be held together by tape, dowel pins, or similar means applied outside the test area. No adhesive shall be applied to the faces of the plies.

For sheet of thickness less than 12.5 mm, the supplier shall, on request, supply suitable samples of the required thickness for a block made from the same lot of raw material.

NOTE: Where the thickness of the material tested is less than that required by the test method, the results for the water vapour transmission test will vary from the figures shown in Table 2.

9 SAMPLING AND CONDITIONING Except for dimensional stability tests, test specimens shall be sampled and conditioned in accordance with AS 2498.1. Specimens for the dimensional stability test shall be conditioned at 23 ± 2°C for seven days.

10 PHYSICAL PROPERTIES The physical properties of rigid cellular polystyrene-moulded (RC/PS—M) shall be in accordance with Table 2.

TABLE 2
PHYSICAL PROPERTIES OF RIGID CELLULAR POLYSTYRENE—MOULDED (RC/PS—M)

Physical property	Unit	Class						Test method
		L	SL	S	M	H	VH	
Compressive stress at 10 percent deformation (min.)	kPa	50	70	85	105	135	165	AS 2498.3
Cross-breaking strength (min.)	kPa	95	135	165	200	260	320	AS 2498.4
Rate of water vapour transmission (max.) measured parallel to rise at 23°C	μg/m² s	710	630	580	520	460	400	AS 2498.5
Dimensional stability of length, width, thickness (max.) at 70°C, dry condition seven days	percent	1	1	1	1	1	1	AS 2498.6
Thermal resistance (50 mm sample) at a mean temperature of 25°C (see Note 3) (aged for 28 days at 70°C)	m².K/W	1	1.13	1.17	1.20	1.25	1.28	AS 2464.5 or AS 2464.6
Flame propagation characteristics:								AS 2122.1
median flame duration (max.)	s	2	2	2	2	2	2	
eighth value (max.)	s	3	3	3	3	3	3	
median volume retained	percent	15	18	22	30	40	50	
eighth value (min.)	percent	12	15	19	27	37	47	

NOTES:

1 In applications where sustained loads are carried, creep will occur in the material. The compressive stress values nominated in Table 2 do not take into account the incidence of creep. ISO 7850 provides a method of determining compressive creep. In applications where compressive creep is a consideration, it should be specified for the material selected and the manufacturer's guidance should be sought when selecting suitable product.

2 Where moisture absorption properties are considered relevant to the intended use of the material, it should be tested to AS 2498.8 and an appropriate level agreed between purchaser and supplier.

3 Thermal resistance is measured on the thickness as supplied. The thermal resistance (R-value) of the thermal insulation boards will vary with thickness. R-value versus thickness is not necessarily a linear relationship. All low density insulation materials produce a non-linearity in thermal resistance with thickness; this variation is more apparent at thicknesses below 50 mm, and results in thermal resistances which are higher than linearly interpolated calculations. These are for the purposes of the Standard and should not be used for calculations (see Appendix C).

11 DETERMINATION OF FLAME PROPAGATION When the rigid cellular polystyrene (RC/PS—M) is conditioned in accordance with AS 2498.1 and then subjected to the test for flame propagation characteristics specified in AS 2122.1, the results of the testing shall comply with Table 2.

These test results on their own do not indicate the fire hazard of rigid cellular polystyrene-moulded (RC/PS—M) under actual fire conditions and, consequently, should not be applied to the assessment of fire hazard without taking into account additional supportive information.

NOTE: The conditioning specified in AS 2498.1 has the effect of purging the residual flammable blowing agent from the RC/PS—M.

12 MARKING The following information shall be legibly marked on the carton or package or bundle of the material supplied:

(a) Manufacturer's name or registered trademark.

(b) Classification (see Clause 4).

(c) A colour stripe in accordance with Clause 5.

(d) One or other of the following manufacturer's statement:

  (i) Caution: Electric cables and equipment partially or completely surrounded with thermal insulation may overheat and fail. Read the instructions accompanying this pack.

  (ii) Caution: Electric cables and equipment partially or completely surrounded with thermal insulation may overheat and fail. Read the following instructions.

NOTE: Manufacturers making a statement of compliance with this Australian Standard on a product, or on packaging or promotional material related to that product, are advised to ensure that such compliance is capable of being verified.

Independent certification is available from Standards Australia under the StandardsMark Product Certification Scheme. The StandardsMark, shown below, is a registered certification trademark owned by Standards Australia and granted under licence to manufacturers whose products comply with the requirements of suitable Australian Standards and who operate sound quality assurance programs to ensure consistent product quality.

Further information on product certification and the suitability of this Standard for certification is available from Standards Australia's Quality Assurance Services, 1 The Crescent, Homebush, N.S.W. 2140.

APPENDIX A
METHODS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD
(Informative)

A1 SCOPE This Appendix sets out the following different methods by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

(a) Assessment by means of statistical sampling.

(b) The use of Standards Australia's StandardsMark scheme.

(c) Assurance using the acceptability of the supplier's quality system.

(d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

A2 STATISTICAL SAMPLING Statistical sampling is a procedure which makes decisions about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

(a) The sample must be drawn randomly from a population of product of known history. The history must enable verification that the product was made from known materials at essentially the same time by essentially the same processes and under essentially the same system of control.

(b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199, guidance to which is given in AS 1399.

A3 PRODUCT CERTIFICATION—STANDARDSMARK The general purpose of StandardsMark certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Australian or International Standard.

It is a certification scheme which meets the criteria of an ISO Type 5 scheme as specified by SAA HB 18.44 in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain an effective quality plan to control production to ensure conformance with the relevant Standard.

The StandardsMark serves to indicate that the products consistently conform to the requirements of the Standard.

The StandardsMark can only be used by manufacturers approved and licensed by Standards Australia and only when accompanied by the number of the applicable Standard.

A4 SUPPLIER'S QUALITY SYSTEM Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or International Standard for supplier's quality systems, this may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Guidance in determining the appropriate quality management system is given in AS 3900 and AS 3904.

A5 OTHER MEANS OF ASSESSMENT If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed by being based on the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform with the full requirements of the Standard.

APPENDIX B

GUIDE TO PURCHASERS OF RIGID CELLULAR POLYSTYRENE—MOULDED (RC/PS—M)

(Informative)

B1 APPLICATIONS The recommended applications given in Table B1 apply to rigid cellular polystyrene complying with the physical property requirements of Table 2.

The actual class of rigid cellular polystyrene used with respect to the load applied will be best determined by engineering assessment.

TABLE B1

RECOMMENDED APPLICATIONS OF RIGID CELLULAR POLYSTYRENE—MOULDED (RC/PS–M)

Class	Application
L	Decorative panels. Cavity and void forms.
SL, S	Insulation in walls, floors and ceilings; sandwich panels; insulated containers—all under low loads. Pipe and duct lagging—to operate at a maximum service temperature of 80°C.
M	Panels in walls, floors and ceilings; sandwich panels—all under medium loads.
H, VH	Insulated floors and roofs subjected to constant traffic of people and equipment.

B2 DENSITY Nominal densities of rigid cellular polystyrene are given in Table B2 as a guide only. Because of advances in technology, the physical properties specified in Table 2 may be achieved by rigid cellular polystyrene of other density.

TABLE B2

NOMINAL DENSITIES OF RIGID CELLULAR POLYSTYRENE—MOULDED (RC/PS—M)

Class	Nominal density kg/m^3
L	11
SL	13.5
S	16
M	19
H	24
VH	28

APPENDIX C

EFFECTS OF AGEING ON THERMAL RESISTANCE

(Informative)

The thermal resistance of cellular plastics insulation material is influenced by the composition and chemical nature of the material, its ratio of open and closed cells, its moisture content, the measurement temperature, and the composition of the gases in the cells. It is also well known that when the cell gas contains components other than air, the thermal resistance normally decreases with time as the composition of the cell gases slowly changes. It is possible to reduce the rate of this decrease, but not prevent it, by use of thin surfacing materials which impede the rate of gaseous interchange.

Conditioned RC/PS—M does not rely on low thermal conductivity cell gases for its thermal resistances as the cells contain only air. The thermal resistance of samples conditioned in accordance with AS 2498.1 will not deteriorate with time.

NOTE: Not all RC/PS—M is conditioned as part of the manufacturing process.

Because of these and other reasons, for instance the method of installation in the building, the thermal resistance values specified in this Standard for rigid cellular polystyrene-moulded, RC/PS—M, are not to be used for design purposes but only for the specification of material between purchaser and supplier.

Correlations between laboratory measurements on recently manufactured product and long term insulation performance in the field have been established. Using these correlations, various methods have been derived by which thermal conductivity, and hence thermal resistance, of aged RC/PS—Mmay be calculated from the laboratory test values.

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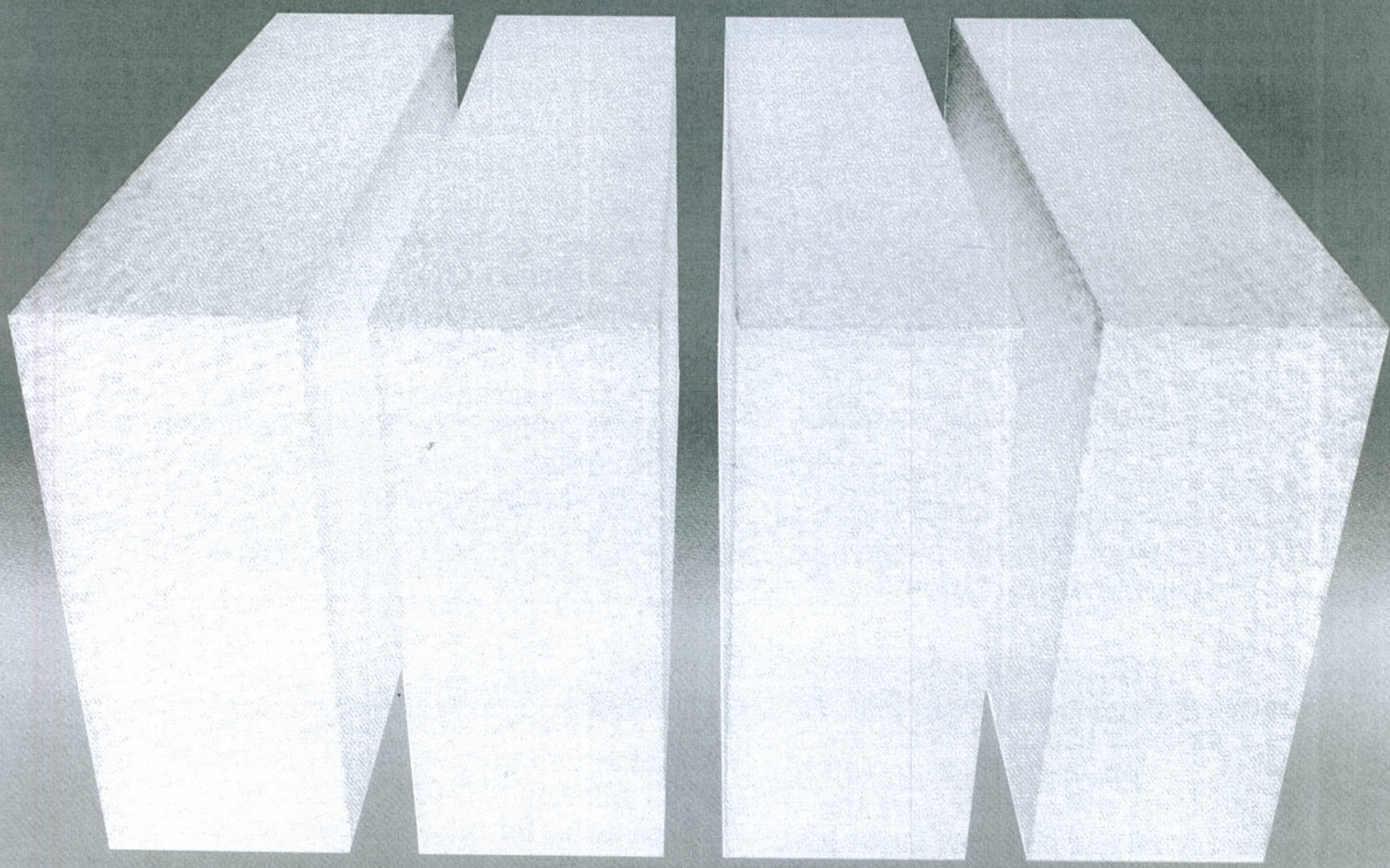
Manufacture, Properties and Characteristics of EPS Thermal Insulation



EPS
EXPANDED POLYSTYRENE INSULATION

The Ultimate Insulation

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	μg/m²s	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. – eighth value; max. – median volume retained; – eighth value, min.	 s s Per cent Per cent	 2.0 3.0 15 12	 2.0 3.0 18 15	 2.0 3.0 22 19	 2.0 3.0 30 27	 2.0 3.0 40 37	 2.0 3.0 50 47	AS 2122.1

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.

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

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.

AUSTRALIA

Sponsoring companies:
BASF Australia Ltd.
Monsanto Australia Ltd.
RMAX – A member of the DUNLOP OLYMPIC Group
Dimet – A member of the ACI Group

For further information please contact:
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NEW ZEALAND

Participating companies:
Rudnev (NZ) Ltd.
UEB Industries Ltd.
Koolcell Industries
BASF New Zealand Ltd.
Monsanto New Zealand Ltd.

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