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for

AS 1366.3-1992 Rigid cellular plastics sheets for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS - M)

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Rigid cellular plastics sheets for thermal insulation

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

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Commercial Refrigeration Manufacturers Association of Australia

CSIRO, Division of Building, Construction and Engineering

Master Builders Construction and Housing Association

Metropolitan Fire Brigades Board, Melbourne

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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	$\mu g/m^2$ 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)	m^2.K/W	1	1.13	1.17	1.20	1.25	1.28	AS 2464.5 or AS 2464.6
Flame propagation characteristics:								
median flame duration (max.)	s	2	2	2	2	2	2	AS 2122.1
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—M may be calculated from the laboratory test values.