

Methods of test for

Rigid cellular materials —

Part 2: Methods 7 to 9

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Plastics and Rubber Standards Policy Committee (PRM/-) to Technical Committee PRM/24, upon which the following bodies were represented:

- British Plastics Federation
- British Railways Board
- British Rigid Urethane Foam Manufacturers' Association
- British Rubber Manufacturers' Association Ltd.
- Department of the Environment (Building Research Establishment)
- Furniture Industry Research Association
- Furniture, Timber and Allied Trades Union
- Ministry of Defence
- National Bed Federation Limited
- Phenolic Foam Manufacturers' Association
- RAPRA Technology Ltd.
- Society of British Aerospace Companies Limited
- Society of Motor Manufacturers and Traders Limited

This British Standard, having been prepared under the direction of the Plastics and Rubber Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 March 1993

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First published April 1973
Second edition March 1993

The following BSI references relate to the work on this standard:
Committee reference PRM/24
Draft for comment 87/43128 DC

Amendments issued since publication

Amd. No.	Date	Comments
8869	December 1995	
13291	12 December 2001	Deletion of clause 3 and Annex A

ISBN 0 580 21377 3

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Foreword

This British Standard has been prepared under the direction of the Plastics and Rubber Standards Policy Committee, and is a revision of BS 4370-2:1973, which is withdrawn. The methods of test described apply to rigid, cellular products of polymeric origin, and are not necessarily suitable for testing cellular materials of inorganic origin.

Many rigid cellular products and test specimens are not isotropic. This is usually ascribed to the fact that the cells in the material are elongated in a particular direction. This direction is referred to in this standard as the “direction of anisotropy”. Tests carried out in this direction normally give results differing in magnitude from those carried out in other directions.

It should be noted that the direction of anisotropy may vary from place to place in a product. Hence the numbers of test specimens required in product specifications may be greater than those given herein.

This Part of BS 4370 contains three test methods. In this revision methods 8 and 9 have been updated by aligning with the corresponding international standards prepared by Technical Committee 61, Plastics, of the International Organization for Standardization (ISO). Method 6 (clause 3) has been deleted following the publication of BS ISO 1922:2001. Method 10 (clause 7) has been deleted following the publication of BS EN ISO 4590:1995. Methods 8 and 9 are related to ISO 1663:1981 and ISO 1926:1979 respectively.

Attention is drawn to BS 4370-1, BS 4370-3 and BS 4370-4 which deal with other methods of test for rigid cellular plastics as follows.

Part 1:1988	Methods 1A, 1B and 1C. Measurement of dimensions Method 2. Determination of apparent density Method 3. Compression test Method 4. Cross-breaking strength test Methods 5A and 5B. Dimensional stability test
Part 3:1988	Method 12. Determination of friability Method 13. Measurement of the coefficient of linear thermal expansion at low temperatures
Part 4:1991	Method 14. Determination of flexural properties

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Summary of pages

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1 Scope

This Part of BS 4370 describes three methods of test which apply to rigid cellular products of polymeric origin.

Methods 7A and 7B. Measurement of thermal conductivity

Method 8. Measurement of water vapour transmission

Method 9. Determination of tensile strength

NOTE The methods may not be suitable for cellular products of inorganic origin.

2 References

2.1 Normative references

This Part of BS 4370 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 4370 only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 4370 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Method 6. Determination of shear strength and shear modulus

Text and Figure 1 deleted (superseded by BS ISO 1922:2001).

4 Methods 7A and 7B. Measurement of thermal conductivity and apparent thermal conductivity

4.1 General

Methods 7A and 7B describe the determination of the thermal conductivity of rigid cellular materials [in W/(m·K)] calculated from the following formula:

$$\text{thermal conductivity} = \frac{Hd}{\Delta T}$$

where

H is the rate of heat flow per square metre (in W/m²);

ΔT is the temperature difference (in K) between the hot and the cold faces of the test specimen;

d is the mean specimen thickness (in m).

The method assumes the use of a homogeneous material.

NOTE The insulation value for a non-homogeneous product is best characterized by thermal conductance [in W/(m²·K)] or its inverse, thermal resistance, where

$$\text{thermal conductance} = \frac{H}{\Delta T}$$

A non-homogeneous product (see BS 874-2.1) could be, for example, a cellular material with a natural skin or an adhered facing of some different material which would have to be a material of low conductivity.

Method 7A is based on the absolute guarded hot-plate method described in BS 876-2.1:1986 for determining the steady state thermal transmission properties of insulating materials in the temperature range –20 °C to 100 °C. It is the primary method for certification and calibration work covering a wide variety of non-metallic materials and insulations in various forms. The equipment is suitable for homogeneous parallel-sided slabs. The method requires the establishment of a steady state of heat flow.

Method 7B describes a heat flow meter method for the determination of “apparent” thermal conductivity. The method, which is much quicker in operation than method 7A and is often preferred for that reason, is based on preliminary and routine calibration of the apparatus by the use of test specimens of known thermal conductivity which has been determined by method 7A.

The thermal conductivity of rigid cellular materials is influenced by factors such as water content, nature of the cell structure, gas content, age of the test specimens, temperature conditions under which the test specimen or material from which test specimens have been selected has been stored and temperature conditions under which the test is conducted.

4.2 Method 7A. Measurement of thermal conductivity (guarded hot plate method)

4.2.1 Apparatus

The apparatus shall be as described in clause 6 of BS 874-2.1:1986.

4.2.2 Preparation of test specimens

Two flat test specimens shall be prepared having the following dimensions when measured using method 1A of BS 4370-1:1988:

- a) length: 305 mm to 310 mm;
- b) width: 305 mm to 310 mm;
- c) thickness: 30 mm to 50 mm.

The difference in the mean thickness between the specimens shall be not greater than 0.5 mm. For incompressible materials sand or otherwise machine the faces if this is necessary to obtain the required degree of flatness. For each test specimen the required degree of flatness shall have been obtained if no light can be observed between a straight edge placed upon it at positions corresponding to the four diagonals.

NOTE For compressible materials flatness is not specified, as a slight compression during the test will ensure intimate contact with the plates.

4.2.3 Conditioning and test temperature

The test specimens shall be conditioned in accordance with the relevant material specification, if any.

NOTE Some materials require drying to constant weight.

Unless otherwise specified by the purchaser, the mean temperature of test shall be 0 °C, 10 °C or 50 °C.

The minimum temperature difference between the hot and cold plates shall be 15 °C.

4.2.4 Procedure

The thickness of the test specimens shall be measured after assembly into the apparatus.

The thermal conductivity shall then be measured in accordance with 8.2 of BS 874-2.1:1986.

4.2.5 Test report

The test report shall include the following information:

- a) the description and identity of the material;
- b) the thickness of test specimens;
- c) the hot and cold face temperatures;
- d) the conditioning procedure if this is not specified in the relevant material specification;
- e) the thermal conductivity;
- f) any deviation from the method, any operation details not specified in the method and any circumstances liable to have had an influence upon the results;
- g) the date of test;
- h) the method, number and date of this British Standard, i.e. method 7A of BS 4370-2:1993.

4.3 Method 7B. Measurement of apparent thermal conductivity (heat flow meter method)

4.3.1 Apparatus

4.3.1.1 Heat flow meter, as described in appendix B (method using two specimens) and Appendix C (method using one specimen) of BS 874:1973.