BRITISH STANDARD

BS 3958-1: 1982

CONFIRMED
DECEMBER 2007

Specification for

Thermal insulation materials —

Part 1: Magnesia preformed insulation

UDC 662.998:666.96:661.846.22

Cooperating organizations

The Refrigeration, Heating and Air Conditioning Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

Association of Manufacturers of Domestic Electrical Appliances
Association of Consulting Engineers
Boiler and Radiator Manufacturers' Association Limited
British Combustion Equipment Manufacturers' Association
British Gas Corporation*
British Refrigeration and Air Conditioning Association*
Building Services Research and Information Association
Chartered Institution of Building Services*
Department of Energy (Energy Technology)
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Royal Institute of British Architects
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This British Standard, having been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Committee, was published under the authority of the Board of BSI and comes into effect on
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Amendments issued since publication

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Contents

Foreword

This revision of this Part of this British Standard is one of a series published under the direction of the Refrigeration, Heating and Air Conditioning Standards Committee to specify requirements for a particular range of insulating materials. It supersedes the 1970 edition which is withdrawn.

Other Parts of this standard are:

— *Part 2: Calcium silicate preformed insulation*;

— *Part 3: Metal mesh faced mineral wool mats and mattresses*;

— *Part 4*[1)]*: Bonded preformed man-made mineral fibre pipe sections*;

— *Part 5: Bonded mineral wool slabs (for use at temperatures above 50 °C)*;

— *Part 6: Finishing materials; hard setting composition, self-setting cement and gypsum plaster*.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

[1)] In course of revision.

1 Scope

This Part of this British Standard specifies composition, moisture content, physical and chemical requirements for magnesia preformed insulation slabs, lags and pipe sections, generally for use up to about 315 °C.

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3 Definitions

For the purposes of this Part of this British Standard, the definitions given in BS 874, BS 2972, BS 3533, BS 5422 and BS 5970 apply.

4 Sampling and testing

Sampling and testing shall be in accordance with the appropriate clause in BS 2972 unless otherwise stated in this standard. For thermal conductivity determinations a flat slab shall be used for the tests.

5 Composition

The material shall consist of a mixture of not less than 85 % by mass of light basic magnesium carbonate with well-opened reinforcing fibres evenly distributed (see **8.2**, note 2).

6 Moisture content

When tested in accordance with **40.1** of BS 2972:1975 the moisture content of the material as received shall not exceed 5 % by mass.

7 Physical requirements

7.1 General. In the application of the physical requirements of **7.3** to **7.6**, 95 % confidence limits shall apply.

7.2 Thermal conductivity. When tested in accordance with the appropriate method of test for thermal conductivity given in BS 874, the thermal conductivity shall not exceed the values given in Table 1.

Table 1 — Thermal conductivity values

Mean temperature	Thermal conductivity
°C	W/(m·K)
50	0.059
100	0.064
150	0.070
180	0.074

NOTE BS 874 requires the test report to state which method of test was employed, the bulk density of the material, the hot face temperature and cold face temperature (generally within the range 15 °C to 30 °C), the conditioning procedure and the moisture content before and after the test.

7.3 Bulk density. The bulk density of the dry material shall lie within the range 175 kg/m^3 to 225 kg/m^3.

7.4 Flexural strength. The flexural strength shall be not less than 250 kN/m^2.

7.5 Compressive strength. The reduction in thickness shall not exceed 5 % under a compressive load of 350 kN/m^2.

7.6 Heat stability. When tested in accordance with BS 2972 under conditions of soaking heat at increasing temperatures the material shall be deemed suitable for normal use at operating temperatures at which the following requirements are met:

a) linear shrinkage 2 % maximum;

b) reduction in thickness not exceeding 5 % under a compressive load of 200 kN/m^2.

8 Chemical requirements

8.1 Alkalinity. When tested by the method described in Appendix A the pH value recorded shall be between 9.5 and 11.0.

8.2 Corrosive attack. The material shall not include significant quantities of substances that will promote corrosive attack on the surfaces with which it is to be in contact. Where necessary, trace quantities of water-soluble chlorides shall be estimated in accordance with section 22 of BS 2972:1975.

NOTE 1 Water-soluble chlorides are normally present in trace quantities in magnesia preformed insulation as in most thermal insulating materials. In the presence of moisture and oxygen, and under certain adverse metallurgical conditions, chloride ions are capable of initiating stress corrosion cracking in susceptible metal alloys such as austenitic stainless steels.

It is not practicable to indicate a safe upper limit for chloride content since water can leach out soluble chlorides from substantial volumes of insulating materials and allow them to be concentrated at the metal-insulation interface. In addition, water from outside sources such as the process itself or wind-driven spray can substantially increase the chloride content of the insulation.

In conditions potentially conducive to stress corrosion cracking, appropriate safeguards should be adopted (see BS 5970).

NOTE 2 Some organic matter may be present either in fibrous form or as a bonding agent. It is suggested that the composition of the product be checked with the manufacturer for use in process conditions where organics may present a hazard, e.g. processes involving powerful oxidizing agents, or thermal insulation on pipework and plant in a flammable atmosphere.

9 Identification of asbestos-free material

9.1 In order to identify those materials that are not subject to control by Government regulations, (see note), asbestos-free magnesia preformed insulation, manufactured in accordance with Part 1 of this standard, shall be distinctively coloured pink/red. The colouring matter shall remain sufficiently stable and permanent under service conditions to permit the ready identification of the outer surface of the insulation.

NOTE Government regulations[2] concerning asbestos-containing insulation require that special precautions be observed in order to safeguard the health of individuals who are handling these materials or who are working in the vicinity.

9.2 Materials which contain asbestos fibre shall not be other than self-coloured.

10 Standard shapes and sizes

10.1 Preformed magnesia shall be supplied in the form of flat slabs, bevelled lags, pipe sections or radiused and bevelled lags complying with the following.

NOTE Not all suppliers provide the full range of standard shapes and sizes listed in a) to d). Conversely other shapes and sizes may be available. Suppliers' literature should be consulted for details of the range offered.

a) *Flat slabs*

Length: 914 mm

Width: 150 mm to 305 mm

Thickness: 25 mm to 100 mm.

b) *Pipe sections*

Length: 914 mm

Diameter: to fit standard pipes of external diameter up to 329 mm

Wall thickness: 25 mm to 75 mm.

c) *Bevelled lags*

Length: 914 mm

Major width: 75 mm to 150 mm

Thickness: 25 mm to 100 mm.

d) *Radiused and bevelled lags*

Length: 914 mm

Width of outer curved surface: approximately 140 mm to 170 mm depending on radius of curvature, thickness and number of lags to fit circumference.

10.2 Flat slabs shall be free from warp. Mating faces shall be plane and edges shall be square to the surfaces and to one another.

10.3 Pipe sections and lags shall be concentric and free from warp. Mating faces shall be plane and ends shall correspond with a plane at right angles to the long axis.

10.4 Bevelled edges of radiused and bevelled lags shall correspond with the radii of the curved surface to be insulated.

11 Dimensional tolerances

The insulation shapes shall be in accordance with the dimensions stated by the manufacturer (or supplier, as appropriate), subject to the following tolerances.

a) *Slabs and lags*

Length and width: ± 3 mm

Thickness: – 1.5 mm, + 3 mm.

b) *Pipe sections*

Length: ± 3 mm

Inside diameter: – 0, + 5 mm

Thickness (average): – 1.5 mm, + 3 mm

Uniformity: the local thickness at any point shall not vary from the average thickness by more than 3 mm.

12 Marking

Each package shall be indelibly marked with the following:

a) the manufacturer's name, mark or symbol;

b) the manufacturer's type designation and maximum service temperature limit: if the material contains asbestos, this shall be clearly indicated;

c) the nominal dimensions;

d) the number of this British Standard, i.e. BS 3958/1[3].

[2] Statutory Instruments 1969, No. 690, Factories, The Asbestos Regulations 1969.

[3] Marking BS 3958/1 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, Quality Assurance Division, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

Appendix A Methods of test for alkalinity and composition

A.1 Preparation of sample. From the bulk sample, taken in accordance with BS 2972, cut five pieces, each of approximate mass 7 g, from separate units. Crush these pieces and mix thoroughly.

A.2 Determination of pH. Weigh 2 g of the crushed sample and shake well for 10 min with 100 mL of distilled water at room temperature. Leave to settle for 5 min and measure the pH of the mixture, using a standard pH meter (see BS 1647 and BS 3145) and decanting the solution if necessary. Repeat the test on a further 2 g of the sample and report the mean pH value.

A.3 Check on composition

A.3.1 *General.* If it is considered desirable to determine fibre or magnesia contents, the following methods are suitable.

A.3.2 *Fibre content.* Dry and weigh up to 30 g of the remainder of the crushed sample, transfer to a beaker, add 200 mL of distilled water and 30 mL of glacial acetic acid. Boil gently for 10 min, filter by suction through a Buchner funnel and wash with distilled water. Dry the residue to constant mass at 105 °C to 110 °C.

$$\text{Mass of fibre in sample (in \%)} = \frac{\text{mass of residue}}{\text{mass of sample}} \times 100.$$

A.3.3 *Magnesium oxide content.* Transfer the filtrate and washings from **A.3.2** to a calibrated 2 L flask and dilute to the mark. Mix well and withdraw suitable aliquots for the determination of magnesia by titration with diaminoethane-tetra-acetic acid (EDTA)[4]. Calculate as a percentage by mass of the weighed sample.

[4] A method for the determination of magnesia, using EDTA, is given in BS 1902-2A.

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Publications referred to

BS 874, *Methods for determining thermal insulating properties, with definitions of thermal insulating terms.*
BS 1647, *pH scale.*
BS 1902, *Methods of testing refractory materials.*
BS 1902-2A, *Chemical analysis of high silica and aluminosilicate materials.*
BS 2972, *Methods of test for inorganic thermal insulating materials.*
BS 3145, *Specification for laboratory pH meters.*
BS 3533, *Glossary of terms relating to thermal insulation.*
BS 5422, *Specification for the use of thermal insulating materials.*
BS 5970, *Code of practice for thermal insulation of pipework and equipment.*
BS 3958, *Specification for thermal insulation materials*[5)].
BS 3958-2, *Calcium silicate preformed insulation.*
BS 3958-3, *Metal mesh faced mineral wool mats and mattresses.*
BS 3958-4, *Bonded preformed man-made mineral fibre pipe sections*[6)].
BS 3958-5, *Bonded mineral wool slabs (for use at temperatures above 50 °C).*
BS 3958-6, *Finishing materials; hard setting composition, self-setting cement and gypsum plaster.*

[5)] Referred to in the foreword only.
[6)] In course of revision

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