BRITISH STANDARD

BS 3958-2: 1982

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Specification for

Thermal insulation materials —

Part 2: Calcium silicate preformed insulation

UDC 662.998:666.96:661.842.65

Cooperating organizations

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

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Association of Consulting Engineers
Boiler and Radiator Manufacturers' Association Limited
British Combustion Equipment Manufacturers' Association
British Gas Corporation*
British Refrigeration and Air Conditioning Association*
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Thermal Insulations Contractors' Association
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Coopted member

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 31 August 1982

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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 It supersedes the 1970 edition which is withdrawn.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 1: Magnesia preformed insulation;*

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

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

— *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.*

The 1970 edition of this Part specified requirements for calcium silicate preformed insulation for use up to at least 650 °C. This edition includes both medium temperature and high temperature types for use up to at least 650 °C and 950 °C respectively, with appropriate requirements for each type.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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 two types of calcium silicate preformed insulation (see clause **4**).

2 References

The titles of the 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 Classification

This standard covers two types of calcium silicate preformed insulation as follows.

Type I: slabs, radiused and bevelled lags and pipe sections for use at temperatures up to 650 °C or such higher temperatures recommended by the manufacturer.

Type II: slabs and flat bevelled lags for use up to 950 °C or at such higher temperatures recommended by the manufacturer.

5 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.

6 Composition

The material shall be composed predominantly of reacted hydrous calcium silicate reinforced with suitable fibres (see **9.2**, note 2).

7 Moisture content

When conditioned at medium humidity in accordance with **40.3** of BS 2972:1975, the moisture content of the material shall not exceed 7.5 % by mass.

8 Physical requirements

8.1 General. In the application of the physical requirements of **8.3** to **8.6**, 95 % confidence limits shall apply.

8.2 Thermal conductivity. When tested in accordance with the appropriate method of test for thermal conductivity given in BS 874, at a cold face temperature within the range of 10 °C to 50 °C, the thermal conductivity shall not exceed the values given in Table 1.

Table 1 — Thermal conductivity values

Type I		Type II	
Mean temperature	Thermal conductivity	Mean temperature	Thermal conductivity
°C	W/(m.k)	°C	W/(m·k)
100	0.061	—	—
150	0.067	—	—
200	0.074	200	0.074
250	0.080	250	0.080
300	0.087	300	0.087
350	0.094	350	0.094
400	0.102	400	0.102
425	0.106	450	0.110
—	—	500	0.120

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, the conditioning procedure and the moisture content before and after the test.

8.3 Bulk density. The bulk density of the dry material shall lie within the range:

type I: 180 kg/m^3 to 240 kg/m^3;

type II: 210 kg/m^3 to 280 kg/m^3.

8.4 Flexural strength. The flexural strength shall be not less than:

type I: 250 kN/m^2;

type II: 250 kN/m^2.

8.5 Compressive strength

8.5.1 *Dry.* The reduction in thickness shall not exceed 5 % under a compressive load of:

type I: 500 kN/m^2;

type II: 550 kN/m^2.

The minimum load at onset of disruption[2)] shall be:

type I: 500 kN/m^2;

type II: 550 kN/m^2.

8.5.2 *Wet.* After 18 h immersion in water, the reduction in thickness shall not exceed 5 % under a compressive load of:

type I: 170 kN/m^2;

type II: 170 kN/m^2.

[2)] This is indicated by a noticeable change in the slope of the graph obtained from an automatic recording of thickness versus load, according to **2.5.3** b) of BS 2972:1975.

8.6 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) Maximum linear shrinkage:

type I: 2 %

type II: 2 %.

b) Reduction in thickness not exceeding 5% under a compressive load of:

type I: 400 kN/m^2;

type II: 400 kN/m^2.

c) Minimum load at onset of disruption[3)] of:

type I: 400 kN/m^2;

type II: 400 kN/m^2.

9 Chemical requirements

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

9.2 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 commercial calcium silicates 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 practical 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).

Special forms of calcium silicate incorporating corrosion inhibitors are commercially available.

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.

10 Identification of asbestos-free material

10.1 In order to identify those materials which are not subject to control by Government regulations, (see note), asbestos-free calcium silicate preformed insulation, manufactured in accordance with Part 2 of this standard, shall be distinctively coloured yellow. 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[4)] 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.

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

11 Standard shapes and sizes

11.1 Preformed calcium silicate 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: types I and II*

Length: 600 mm to 1 000 mm

Width: 150 mm to 1 000 mm

Thickness: 25 mm to 100 mm;

b) *Pipe sections: type I only*

Length: 914 mm

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

Wall thickness: 25 mm to 75 mm.

c) *Flat bevelled lags: types I and II*

Length: 600 mm to 1 000 mm

Major width: 150 mm to 166 mm

Thickness: 25 mm to 100 mm.

d) *Radiused and bevelled lags: type I only*

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

Thickness: 25 mm to 100 mm.

3) This is indicated by a noticeable change in the slope of the graph obtained from an automatic recording of thickness versus load, according to **2.5.3** b) of BS 2972:1975.

4) Statutory Instruments 1969, No. 690, Factories, The Asbestos Regulations 1969.

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

11.3 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.

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

12 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 mm, + 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.

13 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 3958-2[5)].

[5)] Marking BS 3958-2 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 Method of test for alkalinity

A.1 Preparation of sample. From the bulk sample, taken in accordance with BS 2972, cut five pieces, each of approximate mass 5 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.

Publications referred to

BS 874, *Methods for determining thermal insulating properties, with definitions of thermal insulating terms.*

BS 1647, *pH scale.*

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 3958, *Specification for thermal insulating materials*[6)].

BS 3958-1, *Magnesia preformed insulation.*

BS 3958-3, *Metal mesh faced mineral wool mats and mattresses.*

BS 3958-4, *Bonded preformed man-made mineral fibre pipe sections*[7)].

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.*

BS 5422, *Specification for the use of thermal insulating materials.*

BS 5970, *Code of practice for thermal insulation of pipework and equipment.*

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

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