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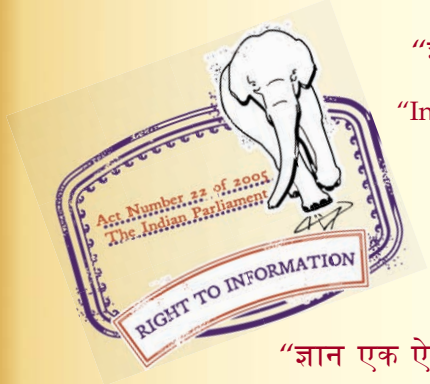
IS 8154 (1993): Preformed calcium silicate insulation (for temperature up to 650ø0C) [CHD 27: Thermal Insulation]



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"Knowledge is such a treasure which cannot be stolen"

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IS 8154 : 1993
(Reaffirmed 2010)

भारतीय मानक

पहले से बनी हुई कैल्शियम सिलिकेट तापरोधन (650° सें० तक के तापमान के लिए) – विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

PREFORMED CALCIUM SILICATE INSULATION (FOR TEMPERATURES UP TO 650°C) — SPECIFICATION

(First Revision)

UDC 661.842.65 : 662.998

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 1993

Price Group 3

Thermal Insulation Materials Sectional Committee, CHD 027

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Thermal Insulation Materials Sectional Committee had been approved by the Chemical Division Council.

This draft standard covers preformed calcium silicate insulation for temperatures upto 650°C. However, there is a separate standard for preformed calcium silicate insulation suitable for temperature upto 950°C, namely, IS 9428 : 1992 Preformed calcium silicate insulation (for temperature upto 950°C) (*first revision*).

This standard was originally published in 1976. In this first revision of the standard, requirement of bulk density and thermal conductivity values have been modified in order to achieve a more realistic insulation design.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded of in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places ratained in the rounded off values should be the same as that of the specified value in this standard.

AMENDMENT NO. 2 MAY 2002
TO
IS 8154 : 1993 PREFORMED CALCIUM SILICATE INSULATION (FOR TEMPERATURE UP TO 650°C) — SPECIFICATION
(First Revision)

(*Page* 1, *clause* **4.3**) — Insert the following at the end of the clause:

'NOTE — For compressive strength for pipes/curved segments, an equivalent flat slab shall be used for performing the test.'

(CHD 27)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 APRIL 1999
TO
IS 8154 : 1993 PREFORMED CALCIUM SILICATE INSULATION (FOR TEMPERATURES UP TO 650°C) — SPECIFICATION

(First Revision)

(*Page* 2, *clause* **4.6**, *Note*) — Substitute the following for the existing Note:

'For thermal conductivity determination for pipe/curved segment, an equivalent flat slab shall be used for performing the test.'

(*Page* 5, *Table* 1) — Substitute the following for the existing table:

Table 1 Scale of Sampling and Permissible Number of Defectives

(*Clauses* C-1.3, C-2.1, C-2.2, C-2.3 *and* C-2.4.1)

Number of Units in the Lot	For Shape, Size and Dimensions		For Bulk Density, Heat Resistance, Moisture Content and Alkalinity		For Compressive Strength and Flexural Strength		For Thermal Conductivity Sample Size
	Sample Size	Accept-ance No.	Sample Size	Accept-ance No.	Sample Size	Accept-ance No.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Up to 300	10	2	4	0	2	0	1
301 to 500	16	2	6	0	3	0	1
501 to 1 000	25	4	8	1	4	0	1
1 001 to 3 000	40	5	10	2	6	0	2
3 001 and above	55	8	12	3	8	1	3

NOTES

1 For 300 units or less, the manufacturer's certificate or a third party's certificate of compliance shall be sufficient for acceptance of the material for inspection requirements.

2 Two identical specimens of uniform dimensions are needed for carrying out one thermal conductivity test.

(CHD 27)

Reprography Unit, BIS, New Delhi, India

Indian Standard

PREFORMED CALCIUM SILICATE INSULATION (FOR TEMPERATURES UP TO 650°C) — SPECIFICATION

(First Revision)

1 SCOPE

This standard prescribes requirements and methods of sampling and test for preformed calcium silicate insulation intended for use on surface which reach temperatures upto 650°C.

2 REFERENCES

The Indian standards listed below are necessary adjuncts to this standard:

IS No.	*Title*
3069 : 1992	Glossary of terms, symbols and units relating to thermal insulation materials (*first revision*)
3346 : 1980	Methods for determination of thermal conductivity of thermal insulation materials (two slab, guarded hot-plate method) (*first revision*)
4905 : 1968	Methods for random sampling
5688 : 1982	Methods of test for preformed block-type and pipe covering type thermal insulation (*first revision*)
5724 : 1970	Methods of test for thermal insulation cements
9490 : 1980	Method for determination of thermal conductivity of thermal insulation materials (water calorimeter method)

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions of terms, symbols and units given in IS 3069 : 1992 shall apply.

4 REQUIREMENTS

4.1 Material

Preformed calcium silicate insulation shall be predominantly composed of reacted hydrous calcium silicate reinforced with suitable fibres such that the physical requirements precribed in **4** are satisfied.

4.2 Bulk Density

The average bulk density of the material shall be between 200 to 280 kg/m^3. For any particu-- lar density, a tolerance of ±10 percent shall be allowed on the purchaser's declared value and shall be within the range specified above, when tested in accordance with the method prescribed in **4** of IS 5688 : 1970.

4.3 Compressive Strength

The reduction in thickness under the following conditions shall not exceed 5 percent when tested in accordance with **6** of IS 5688 : 1970 :

a) dry under a load of 415 kN/m^2, and

b) wet (after 18 h immersion in water) under a load of 170 kN/m^2.

4.4 Flexural Strength

The average minimum flexural strength of the material shall be 240 kN/m^2 when tested in accordance with **5** of IS 5688 : 1970.

4.5 Heat Resistance

When tested accordance with **9** of IS 5724 : 1979 and **6** of IS 5688 : 1970 at increasing temperatures, the material shall be deemed suitable for use under conditions of soaking heat for 24 hours at 650°C up to the temperature at which the following requirements are met:

Linear shrinkage (length), percent, *Max*	2

Loss in mass, percent, *Max*	15
Compressive strength	Reduction in thick-- ness not exceeding 5 percent under a load of 345 kN/m^2

4.6 Thermal Conductivity

The average thermal conductivity of the material when tested as prescribed in IS 3346 : 1966 and IS 9490 : 1980 shall be as given below:

Mean Temperature °C	*Thermal Conductivity, Max* W/m.K
100	0.060
150	0.070
200	0.080
300	0.100

NOTE — For thermal conductivity determination, an equivalent flat slab shall be used for the tests for pipes and segments also.

4.7 Moisture Content

The moisture content of the material shall not exceed 7.5 percent by mass when tested in accordance with the method prescribed in Annex A.

4.8 Alkalinity

The *p*H of the solution of the material shall be between 8 and 11 when tested in accordance with the method prescribed in Annex B.

NOTES

1 Commercial calcium silicate insulation may contain up to approximately 0.05 percent chloride (Cl), if cilcumstances can arise in practice such that chloride concentration can take place on the surface of certain alloy steels, for example, austenitic steels, then there is a serious risk of stress corrosion cracking, and suitable design safeguards should be adopted.

2 A proportion of organic fibres may be present. It is suggested that the composition of the product be checked with the manufacturer for use in process conditions where organic matter may present a hazard, for example, processes involving power full oxidizing agents.

4.9 Standard Shapes, Sizes and Dimensional Tolerances

4.9.1 *Shapes*

Preformed calcium silicate shall be supplied in the form of flat blocks, bevelled lags, pipe sections or radiused and bevelled lags in compliance with the requirements of **4.9.1.1** to **4.9.1.4.**

4.9.1.1 *Flat blocks*

Shall be free from warp. All mating faces shall be plane and edges shall be square to the surfaces and to one another.

4.9.1.2 *Bevelled lags*

Shall correspond with length of standard blocks with major width of 75 mm to 166 mm in standard thickness of the flat blocks.

4.9.1.3 *Pipe sections*

Shall be concentric and free from warp. The mating face shall be plane and ends shall correspond with a plane of right angles to the long axis.

4.9.1.4 *Curved segments*

Shall correspond with the diameter of the curved surfaces to be insulated.

4.9.2 *Sizes*

Preformed calcium silicate block-type thermal insulations shall be supplied in the form of flat or curved blocks as specified. Standard sizes of the preformed type insulation shall be as follows:

4.9.2.1 *Flat blocks*

Length	:	500 mm, 600 mm or 900 mm
Width	:	150 mm, 300 mm, 450 mm or 600 mm
Thickness	:	25 mm, 40 mm, 50 mm, 60 mm, 75 mm, or 100 mm

4.9.2.2 *Bevelled lags*

Length	:	500 mm, 600 mm or 900 mm
Major width	:	75 mm to 166 mm
Thickness	:	40 mm, 50 mm, 60 mm or 75 mm

4.9.2.3 *Pipe Sections*

Length	:	500 mm, 600 mm, or 900 mm
Diameter	:	To fit standard pipes of external dia up to 219 mm
Thickness	:	40 mm, 50 mm or 75 mm

NOTE — All thicknesses may not be available for a specific pipe diameter.

4.9.2.4 *Curved segments (radiused and bevelled lags)*

Shall be furnished in lengths of 500 mm, 600 mm or 900 mm and in thickness of 40 mm, 50 mm, 60 mm or 75 mm for curved surface having external radius greater than 110 mm.

NOTES

1 At least 90 percent of the flat/pipes/bevelled lags and curved segment supplied shall be of the nominal length (subject to the tolerance given in length). The remainder may be shorter by not more than 450 mm in case of 900 mm and 300 mm in case of 500 mm or 600 mm nominal length in the multiples of 150 mm.

2 For pipe sections, thicknesses greater than 75 mm may be furnished in two or more layers.

3 Other sizes may also be supplied as agreed to between the purchaser and the manufacturer.

4.9.3 *Dimensional Tolerance*

The dimensional tolerance of preformed insu-- lation material shall be as follows :

a) *Flat blocks*

1) Length and width	±3 mm
2) Thickness	-1.5 mm + 3 mm

b) *Pipe sections*

1) Length	±3 mm
2) Inside diameter	0 mm + 5 mm
3) Thickness (average)	— 1.5 mm + 3 mm

4.9.3.1 *Uniformity*

The local thickness of the preformed thermal insulation material at any point shall not vary from the average thickness by more than ±3 mm.

5 PACKING AND MARKING

5.1 Packing

The material shall be packed as agreed to between the purhaser and the supplier.

5.2 Marking

The material shall be legibly and indelibly marked with the following information:

a) Name of the material,
b) Indication of the source of manufacture,
c) Shape and size,
d) Quantity of material, and
e) Maximum service temperature.

5.2.1 The material may also be marked with the 'STANDARD MARK' of the Bureau.

6 SAMPLING

The method of sampling shall be as prescribed in Annex C.

ANNEX A

(*Clause* 4.7)

DETERMINATION OF MOISTURE CONTENT

A-1 PROCEDURE

Weigh accurately a test specimen. This specimen shall then be dried in a ventilated oven at a temperature of 105 ± 2°C until the mass becomes constant between successive weighings made at an interval of not less than one hour.

A-2 CALCULATION

Moisture content, expressed as a percent of the oven dry mass $= 100 \times \frac{M_1 - M_0}{M_0}$

where

M_1 = initial mass in g of the test specimen, and

M_0 = oven-dry mass in g of the test specimen.

ANNEX B

(*Clause* 4.8)

TEST FOR ALKALINITY

B-1 APPARATUS

B-1.1 *p*H Meter — Use a standard laboratory *p*H meter.

B-2 PREPARATION OF SAMPLE

From the bulk sample, cut five pieces each of approximate mass 5 g, from separate units. Crush these pieces and mix thoroughly.

B-3 PROCEDURE

Weigh 2 g of the crushed sample and shake well for 10 minutes with 100 ml of distilled water at room temperature. Leave to settle for 5 minutes and measure the *p*H of the mixture using a standard *p*H meter, decant the solution if necessary. Repeat the test on a further 2 g of the sample and report the mean *p*H value.

ANNEX C

(*Clause* 6.1)

SAMPLING OF PREFORMED CALCIUM SILICATE INSULATION

C-1 SCALE OF SAMPLING

C-1.1 Lot

All units of preformed calcium silicate insula-- tion in a single consignment, containing material of the same shape, same size, similar dimensions and belonging to the same batch of manufacture, shall be grouped together and each such group shall constitute a lot.

C-1.2 For ascertaining the conformity of the material to the requirements of the specifica-- tion, samples shall be tested from each lot separately.

C-1.3 The number of units to be selected from the lot depends on the size of the lot and shall be in accordance with Table **1**.

C-1.3.1 These units shall be selected at random. In order to ensure randomness of selection, procedures given in IS 4905 : 1968 may be followed.

C-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

C-2.1 Shape, Size and Dimensions

From each of the units selected from the lot according to col 1 and 2 of Table 1, an item shall be taken at random. Each of these items shall be examined for visual and dimen-- sional characteristics given in **4.9.** An item failing to satisfy any of these requirements shall be considered as defective. The lot shall be considered to have satisfied these require-- ments, if the number of defectives found in the sample is less than or equal to the correspond- ing acceptance number given in col 3 of Table 1. The lot having been found satisfactory for these requirements shall be further tested for bulk density and linear shrinkage (***see*** **C-2.2**).

C-2.2 Bulk Density and Linear Shrinkage

The number of items given in col 4. of Table **1** shall be taken from those already tested and found satisfactory under **C-2.1.** These items shall be tested for bulk density (*see* **4.2**) and linear shrinkage (*see* **4.5**). An item failing to satisfy any of these requirements shall be considered as defective. The lot shall be considered to have met these requirements, if the number of defectives found in the sample is less than or equal to the corresponding acceptance number given in col 5 of Table 1. The lot having met these requirements shall be further tested for compressive strength and flexural strength (*see* **C-2.3**).

C-2.3 Compressive Strength and Flexural Strength

The number of items given in col 5 of Table 1 shall be taken from those already examined and found satisfactory under **C-2.1.** These items shall be tested for compresssive strength (*see* **4.3**) and flexural strength (*see* **4.4**). Any

Item failing to meet any of these requirements shall be considereed as defective. The lot shall be deemed to have met these requirements, if the number of defectives found in the sample is less than or equal to the corresponding acceptance number given in col 7 of Table 1. The lot which has been found to have met these requirements shall be finally tested for thermal conductivity (*see* **C-2.4**).

C-2.4 Thermal Conductivity

C-2.4.1 The number of items given in col 8 of Table 1 shall be taken from those already examined and found satisfactory under **C-2.1.**

C-2.4.2 The lot shall be declared as conform-- ing to the requirements of the specification if none of the sample tested for thermal conductivity fails, otherwise not.

Table 1 Scale of Sampling and Permissible Number of Defectives

(*Clauses* C-1.3, C-2.1, C-2.2, C-2.3 *and* C-2.4.1)

Number of Units in the Lot	For Shape, Size and Dimensions		For Bulk Density, Heat Resistance, Moisture Content and Alkalinity		For Compressive Strength and Flexural Strength		For Thermal Conductivity Sample Size
	Sample Size	Accept-- ance No.	Sample Size	Accept-- ance No.	Sample Size	Accept-- ance No.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Up to 300	20	2	8	0	3	0	2
301 to 500	32	3	13	0	5	0	3
501 to 1 000	50	5	20	1	8	0	4
1 001 to 3 000	80	7	32	2	13	0	5
3 001 and above	125	10	50	3	20	1	6

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