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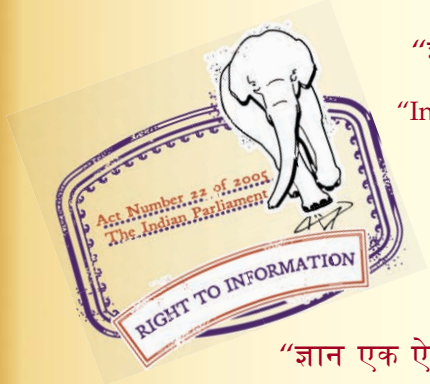
IS 11308 (1985): Thermal insulating castables (hydraulic setting) for temperatures upto 1250°C [CHD 27: Thermal Insulation]



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IS : 11308 - 1985
(Reaffirmed 2001)

Indian Standard

SPECIFICATION FOR HYDRAULIC SETTING THERMAL INSULATING CASTABLES FOR TEMPERATURES UP TO 1 250°C

UDC 662·998 : 666·76·043·13

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

Gr 3

November 1985

Indian Standard

SPECIFICATION FOR HYDRAULIC SETTING THERMAL INSULATING CASTABLES FOR TEMPERATURES UP TO 1 250°C

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Indian Standard

SPECIFICATION FOR HYDRAULIC SETTING THERMAL INSULATING CASTABLES FOR TEMPERATURES UP TO 1 250°C

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 June 1985, after the draft finalized by the Thermal Insulation Materials Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard covers the specifications of insulating castables for use at temperatures up to 1 050°C and 1 250°C. Typical materials used are vermiculite, perlite, diatomite, insulation and refractory grogs, etc, in suitable proportions with heat resistant binder.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final values, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified values in this standard.

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1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for hydraulic setting thermal insulating castables for use as either hot face or cold face backing of refractory linings, at temperatures up to 1 250°C.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions of terms, symbols and units given in IS : 3069-1965† shall apply.

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*Rules for rounding off numerical values (*revised*).

†Glossary of terms, symbols and units relating to thermal insulation materials.

3. TYPES

3.1 Types — The material shall be of the following two types depending on the recommended maximum service temperature:

a) Type 1 050 Suitable for use at temperatures up to 1 050°C, and

b) Type 1 250 Suitable for use at temperatures up to 1 250°C.

4. REQUIREMENTS

4.1 General — The material shall be in the form of dry powder with maximum grain size 5 mm.

4.2 Moisture Content — The material, as received shall not contain more than 2 percent moisture by mass, when determined by the method prescribed in **13** of IS : 3144-1981* except that not less than 25 g of the material weighed accurately shall be taken, well spread on a tray for drying.

4.3 The material shall also conform to the requirements given in Table 1 when tested in accordance with the method prescribed in col 5 of the table.

4.4 Ferric Oxide Content — The ferric oxide content for these hydraulic setting thermal insulating castables for temperatures up to 1 250°C shall be 5 percent, maximum when tested by the method prescribed in Appendix A.

5. PACKING AND MARKING

5.1 Packing — The material shall be packed and sealed in polyethene bags and these bags shall be packed in polyethene-lined or paper-lined hessian bags of 50 kg capacity or as agreed to between the purchaser and the supplier.

5.2 Marking — The packages shall be legibly and indelibly marked with the following information:

a) Manufacturer's name and recognized trade-mark, if any;

b) Batch number or year and month of manufacture;

c) Net mass of the content;

d) Name, description and type of the material; and

e) Amount and method of adding water and time for mixing it (either as tag on the bags or otherwise as a slip in the bags).

*Methods of test for mineral wool thermal insulation materials (*first revision*).

TABLE 1 REQUIREMENTS FOR HYDRAULIC SETTING THERMAL INSULATING CASTABLES FOR TEMPERATURES UP TO 1 250°C

(*Clause* 4.3)

Sl No.	Characteristic		Requirements		Method of Test Ref to
			Type 1 050	Type 1 250	
(1)	(2)		(3)	(4)	(5)
i)	Density after moulding and drying at 110°C kg/m³, *Max*		1 000	1 400	4 of IS : 5688-1970*
ii)	Crushing strength after curing and drying at 110°C kN/m², *Min*		1 350	3 000	6 of IS : 5688-1970*
iii)	Thermal conductivity, W/mk *Max*:				IS : 3346-1980†
					IS : 9490-1980‡
	Mean Temperature	Hot face Temperature (Approximate)			
	°C	°C			
	200	350	0·23	0·46	
	400	725	0·30	0·51	
	500	900	0·30	0·58	
iv)	Heat resistance when subjected to soaking heat for 24 hours at 1 050°C and 1 250°C respectively:				
	a) Linear shrinkage (length) percent, *Max*		1·5	1·5	9 of IS : 5724-1970§
	b) Loss in mass, percent, *Max*		15	15	9 of IS : 5724-1970§
	c) Crushing strength, kN/m², *Min*		900	2 000	9 of IS : 5724-1970§ and 6 of IS : 5688-1970*

Note — Tests for all characteristics given in this table shall be conducted on specimen prepared in accordance with 4 of IS : 5724-1970§.

*Methods of test for preformed block-type and pipe-covering type thermal insulation (*first revision*).

†Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot-plate method) (*first revision*).

‡Method for determination of thermal conductivity of thermal insulation materials (water colorimeter method).

§Methods of test for thermal insulating cements.

5.2.1 The packages may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. SAMPLING

6.1 Representative samples of the material shall be drawn and their conformity determined in accordance with the method prescribed in Appendix B.

APPENDIX A

(*Clause* 4.4)

DETERMINATION OF FERRIC OXIDE

A-0 OUTLINE OF THE METHOD

A-0.1 Iron is determined volumetrically by titration with standard potassium permanganate solution.

A-1. REAGENTS

A-1.1 Dilute Hydrochloric Acid — 40 percent (*v/v*).

A-1.2 Stannous Chloride Solution — Dissolve by heating 60 g of pure stannous chloride in a mixture of 400 ml of concentrated hydrochloric acid and 600 ml of water until the solution is complete. Cool, add a few pieces of granulated tin and preserve the solution in an air-tight amber-coloured bottle.

A-1.3 Mercuric Chloride Solution — saturated.

A-1.4 Zimmermann — Reinhardt Solution — Add 140 ml of concentrated sulphuric acid and 140 ml of syrupy phosphoric acid to 720 ml of water. Dissolve 200 g of hydrated manganese sulphate in this solution while this solution is still hot, add dropwise, potassium permanganate solution (0·02 N) with stirring until the persistent pink colour is obtained.

A-1.5 Standard Potassium Permanganate Solution — 0·02 N. Dissolve 0·63 g of potassium permanganate in one litre of water keep the solution in glass-stoppered amber-coloured bottle for 5 to 6 days. Filter through glass wool into a clean glass-stoppered bottle and standardize against sodium oxalate (AR).

A-2. PROCEDURE

A-2.1 Preparation of Solution — Weigh accurately 2·5 g of the test sample into a beaker or a porcelain dish and add to it 40 to 50 ml of dilute hydrochloride acid, covering the beaker by means of a suitable cover-glass immediately after addition of the acid. As soon as effervescence stops, wash the lower surface of the cover-glass into the beaker and set the contents for drying and baking at 110°C to 115°C. After baking for about 20 to 25 minutes, cool to room temperature, add 25 to 30 ml of dilute hydrochloric acid, boil and filter. Transfer thoroughly to the filter, all the residue in the beaker as well as that adhering to the sides of the beaker, by hot water. Wash the filter free from chlorides and iron by means of hot water. Collect the filterate and washings in a 250-ml measuring flask and make up to the mark.

A-2.2 Pipette out 100 ml of the main solution into a 500-ml flask. Heat to boiling and to the boiling solution, add stannous chloride solution dropwise with continuous stirring until the solution just becomes colourless. Add few drops of stannous chloride in excess and wash down the sides with a little water. Cool the contents to room temperature. Add excess of mercuric chloride solution keep for a few minutes and add 20 to 30 ml of Zimmermann-Reinhardt solution and dilute to about 500 ml, washing down the sides of the flask. Titrate immediately with standard permanganate solution with continuous stirring until a drop of permanganate solution causes a pink colouration stable for four to five seconds.

A-2.3 Calculation

$$\text{Ferric oxide (as } Fe_2O_3\text{), percent} = \frac{V \times N \times 0{\cdot}079\,84}{M} \times 100$$

where

V = volume in ml of the standard permanganate solution consumed,

N = normality of standard permanganate solution, and

M = mass in g of the sample represented by the aliquot taken.

APPENDIX B

(*Clause* 6.1)

SAMPLING OF THERMAL INSULATING CASTABLES

B-1. SCALE OF SAMPLING

B-1.1 Lot — All bags of the material belonging to the same batch of manufacture, in a single consignment, shall be grouped together and each such group shall constitute a lot.

B-1.2 For ascertaining the conformity of the lot to the requirements of this specification, tests shall be carried out on each lot separately.

B-1.3 The number of bags to be selected (n) shall depend on the lot size (N) and shall be in accordance with Table 2.

TABLE 2 NUMBER OF BAGS TO BE SELECTED FOR SAMPLING

Lot Size	No. of Bags to be Selected
N	n
(1)	(2)
Up to 25	1
26 to 50	2
51 to 100	3
101 and above	4

B-1.3.1 These bags shall be selected at random. In order to ensure the randomness of selection, random sampling procedures given in IS : 4905-1968* may be adopted.

B-2. PREPARATION OF TEST SAMPLE AND NUMBER OF TESTS

B-2.1 From each of the bags selected according to **B-1.3** approximately equal quantity of the material shall be taken preferably by means of a scoop or suitable sampling tube and thoroughly mixed to form a composite sample weighing not less than 45 kg which would be sufficient for carrying out triplicate determination of all characteristics given in **4**.

B-2.1.1 The composite sample shall be divided into three equal parts, one for the purchaser, another for the supplier and the third to be used as the referee sample.

*Methods for random sampling.

B-2.1.2 These three parts of the composite sample shall be transferred to separate sample bags. These bags shall be properly stitched and labelled with full identification particulars.

B-2.1.3 The referee test sample shall bear the seal of both the purchaser and the supplier. It shall be kept at a place agreed to between the purchaser and the supplier to be used in case of any dispute between the two.

B-2.2 Tests for determination of all characteristics given in **4** shall be conducted on the composite sample by preparing samples as given in **B-2.2.1**.

B-2.2.1 *Preparation of Samples* — Weigh the sample (at least 1·5 kg) of dry cement and keep it on the mixing surface or pan. Form a crater in the centre of the dry cement. Pour a weighed amount of mixing water slowly into the crater. Fold the material on the outer edge into the crater by means of the rectangular trowel. After the water has been in contact with the cement for the period of time recommended by the manufacturer, mix rapidly with the rectangular trowel until the entire batch is of uniform consistency. Mould the cement sample immediately after mixing or after the lapse of such period as may be recommended by the manufacturer.

B-3. CRITERIA FOR CONFORMITY

B-3.1 The lot shall be declared as conforming to the requirements of this specification if all the test results on the composite sample satisfy the corresponding requirements given in **4**.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1}
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2