IS 13204 (1991): Rigid phenolic foams for thermal insulation [CHD 27: Thermal Insulation]

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Indian Standard

RIGID PHENOLIC FOAM FOR THERMAL INSULATION — SPECIFICATION

UDC 662.998-036.32-405.8.077

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

October 1991

Price Group 2

FOREWORD

This Indian Standard 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 standard covers preformed rigid phenolic foam in the form of boards, sheets and blocks intended for thermal insulation within operating temperature range of – 180°C to + 130°C.

Notes for guidance of users/designers have also been prescribed in Annex A covering aspects such as density, thermal conductivity, protection against moisture and fire, and use at lower temperature.

In the preparation of this standard, considerable assistance has been derived from BS 3927 : 1986 'Specification for rigid phenolic foam (PF)' for thermal insulation in the form of slabs and profiled sections, issued by the British Standards Institution (BSI), UK.

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 off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 MARCH 1999
TO
IS 13204:1991 RIGID PHENOLIC FOAM FOR THERMAL INSULATION — SPECIFICATION

[*Page* 2, *Table* 1, *Sl No.* (iv), *col* 2] — Substitute 'permeability' *for* 'transmission' and 'ng/Pa.s.m' *for* 'g/Pa.s.m'

(CHD 27)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 DECEMBER 2011
TO
IS 13204 : 1995 RIGID PHENOLIC FOAM FOR THERMAL INSULATION — SPECIFICATION

(*Page* 3, *Annex* A, *clause* **A.1.1.5**, *line* 1) — Substitute 'Phenolic' *for* 'polyurethane'.

(CHD 27)

Reprography Unit, BIS, New Delhi, India

Indian Standard

RIGID PHENOLIC FOAM FOR THERMAL INSULATION — SPECIFICATION

1 SCOPE

1.1 This standard specifies the requirements and methods of sampling and test for rigid phenolic foam for thermal insulation purposes. It applies to slab (blocks, boards and profiled sheets) and profiled sections (pipe sections and radiused or bevelled lags) cut from pipes. The nominal temperature range for which the insulation material is suitable is —180 to +130°C without any facing. The material is normally supplied with craft paper facing on both sides.

1.2 This standard is not applicable to continuously extended phenolic foam pipe insulating sections.

2 REFERENCES

The following Indian Standards are the necessary adjuncts to this standard:

IS No.	*Title*
3069 : 1965	Glossary of terms, symbols and units relating to thermal insulation materials
3144 : 1991	Methods of test for mineral wool thermal insulation materials (*second revision*)
3346 : 1980	Methods for the determination of thermal conductivity of thermal insulation materials (two slab, guarded hot-plate method) (*first revision*)
7240 : 1981	Code of practice for industrial application and finishing of thermal insulating materials at temperature from —80°C to 40°C (*first revision*)
7413 : 1981	Code of practice for industrial application and finishing of thermal insulating materials at temperature above 40°C and up to 700°C (*first revision*)
11239 (Part 2) : 1985	Methods of test for rigid cellular thermal insulation materials: Part 2 Apparent density
11239 (Part 4) : 1985	Methods of test for rigid cellular thermal insulation materials: Part 4 Water vapour transmission rate
11239 (Part 5) : 1985	Methods of test for rigid cellular thermal insulation materials: Part 5 Volume percent of open and closed cells
11239 (Part 9) : 1985	Methods of test for rigid cellular thermal insulation materials: Part 9 Water absorption
11239 (Part 11) : 1985	Methods of test for rigid cellular thermal insulation materials: Part 11 Compressive strength
11239 (Part 12) : 1985	Methods of test for rigid cellular thermal insulation materials: Part 12 Horizontal burning characteristics

3 TERMINOLOGY

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

4 REQUIREMENTS

4.1 Composition

The material shall consist of phenolic foam of uniform cellular structure. Phenolic foam is a rigid phenol formaldehyde cellular material reduced from the condensation products of phenols and formaldehyde, such as, resoles and novolacs, together with hardeners and other additives, for example, surfactants, blowing agents, fillers, etc.

4.2 The rigid phenolic foam faced or unfaced shall conform to the requirements given in Table 1 when tested in accordance with the methods prescribed in col 4 of the Table 1.

4.3 Standard Sizes and Dimensions

In the case of finished boards of all the three types, the sizes shall be either 1.0 m × 0.5 m or 1.22 m × 0.61 m or as agreed to between the purchaser and the supplier. The size for pipe-section and lags shall be 1.0 m or 0.5 m length unless otherwise agreed to between the purchaser and the supplier and the bore shall be the specified outside diameter of the pipe to be lagged.

4.4 Thickness

The material shall normally be supplied in thickness of 20, 25, 30, 40, 50, 60, 75, 90 and 100 mm.

Table 1 Requirement of Rigid Phenolic Foam

(*Clause* 4.2)

Sl No.	Characteristic	Requirement	Method of Test, Rcf to
(1)	(2)	(3)	(4)
i)	Density, kg/m^3	32-60	IS 3144 : 1991
ii)	Compressive strength at 10 percent deformation, *Min*, kPa	100	IS 11239 (Part 11) : 1985
iii)	Dimensional stability; percent linear change after 7 days at 70±2°C and 95±5 percent RH, *Max*	1.5	IS 11239 (Part 2) : 1985
iv)	Water vapour transmission rate at 38°C and 88 percent RH, g/Pa.s.m, *Max*	5.5	IS 11239 (Part 4) : 1985
v)	Apparent water absorption percent by volume, *Max*	7.5	IS 11239 (Part 9) : 1985
vi)	Horizontal burning, mm, *Max*	25	IS 11239 (Part 12) : 1989
vii)	Closed cell content, percent, *Min*	60	IS 11239 (Part 5) : 1985
viii)	Thermal conductivity at 53°C after 30 days of manufacture, W/m, °K, *Max*	0.034	IS 3346 : 1966

NOTE — For rigid phenolic foams, the variation from the manufacturer's declared value for density shall not exceed ± 15 percent when tested in accordance with the method prescribed in IS 3144 : 1991 except that nominal thickness shall be used for calculating the density.

4.5 Tolerance

The dimensions of the product supplied shall not deviate from those specified by more than the appropriate tolerances given in Tables 2 and 3. For slabs, the permissible thickness deviations shall be ±2 mm.

Table 2 Dimensional Tolerances for Pipe Sections and Lags

(*Clause* 4.5)

Sl No.	Dimensions	Permissible Deviations	
		Moulded	Cut Pipe Section and Lags
		mm	mm
(1)	(2)	(3)	(4)
i)	Lengths	±3	±3
ii)	Bores less than 150 mm	+2 —0	+2 —0
iii)	Bores 150 mm and above	+3 —0	+3 —0
iv)	Outside diameters less than 150 mm	+2 —0	+2 —0
v)	Outside diameters 150 mm and above	+3 —0	+3 —0

NOTE — For single-layer components or the first layer of a multi-layer component, the tolerance on the bore is given on the quoted pipe outside diameter. For the second or subsequent layers of multilayer components, it is given on the outside diameter of the mating inner layer.

5 WORKMANSHIP AND FINISH

5.1 General

The insulation shall not have visible defects that would adversely affect its service qualities.

5.2 Profiled Sections

5.2.1 *Pipe Sections*

Pipe sections shall be in two semicircular pieces with the longitudinally mating surfaces flat and in the same plane, so that when the two pieces are put together no gaps exists between the mating surfaces.

NOTE — It is common practice for the mating faces whilst still being flat in the lengthwise direction to have a variable profile in the radial direction. This is acceptable provided that the mating surfaces so created still fit snugly together. In many cases this practice enhances the snugness of the fit.

Table 3 Dimensional Tolerances for Slabs

(*Clause* 4.5)

Sl No.	Lengths or Widths	Permissible Deviations of Lengths or Widths	Maximum Difference in the Lengths of the Diagonals of Rectangular, Slabs	Thickness Tolerance
	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)
i)	Up to and including 1 000	±2	5	±2
ii)	Over 1 000 up to and including 2 000	±3	7	±2

5.2.1.1 The ends shall be flat and normal to the longitudinal axis of the pipe section. For a single layer pipe insulation system or the first layer of a multi-layer system the permissible deviation on the bore shall be given on the quoted pipe outside diameter. For the second or subsequent layer(s) of multi-layer systems it shall be given on the outside diameter of the mating inner layer.

5.2.2 *Radiused and Bevelled Lags*

The mating bevelled edges shall be flat, so that when they are put together to form a cylinder no gaps exist between abutting lags. The ends shall be flat and normal to the longitudinal axis of the lag.

6 PACKING AND MARKING

6.1 Packing

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

6.2 Marking

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

a) Indication of the source of manufacture;

b) Density of the material;

c) Length, thickness and width/nominal bore of the material; and

d) Batch or lot number.

7 SAMPLING

The method of drawing representative samples of the material and criteria for conformity shall be as prescribed in Annex B.

ANNEX A

(Foreword)

NOTES FOR GUIDANCE OF USERS/DESIGNERS

A-1 GENERAL

A-1.1 IS 7240 : 1981 and IS 7413 : 1981 give guidance on the design of thermal insulation systems. However, certain points that have special relevance to cellular condensation polymers and which would equally apply to rigid phenolic foams are given below.

A-1.1.1 *Density*

Materials of apparent density 30 kg/m^3 to 50 kg/m^3 are normally found suitable for most thermal insulation purposes within the scope of this standard.

A-1.1.2 *Thermal Conductivity*

It has been established that a negligible increase in thermal conductivity occurs within the density range 30 kg/m^8 to 50 kg/m^3. However, the value may increase with time depending on environmental conditions (temperature and humidity cycling, etc). Hence, in designing insulation systems with phenolic foams care should be taken to prevent ingress of water.

A-1.1.2.1 Thermal conductivity values have been reported at 53°C mean temperature to enable tests to be carried out in Indian laboratories where presently facilities for conducting tests at 10°C mean temperature by the method prescribed in IS 3346 : 1980 do not exist

A-1.1.3 *Protection Against Moisture*

There is a need for the application of a moisture barrier to the outer surfaces of the foam when operating below ambient temperature.

A-1.1.4 Adequate precautions should be taken to prevent moisture being interposed between metal and foam surfaces, in order to reduce possibility of corrosion.

A-1.1.5 For normal use, rigid polyurethane foam materials are suitable for the temperature range — 180°C to + 130°C.

A-1.1.5.1 *Use at lower temperature*

The lower temperature limit is selected to indicate the unsuitability of these materials for insulation of liquid oxygen plant. These materials can, however, be used at temperatures somewhat lower than —180°C provided precautions are taken to prevent condensation of atmospheric oxygen in or on the insulation.

A-1.1.6 *Protection Against Fire*

As in the case of all foam plastic insulating materials, attention of the user is drawn to the necessity of providing protection capable of withstanding possible external fires. Further, in many instances, the contribution of other system elements such as adhesives, sealants or vapour barrier mastics towards fire behaviour of the overall system could be considerable.

ANNEX B

(*Clause* 7)

SAMPLING OF RIGID PHENOLIC FOAM FOR THERMAL INSULATION

B-1 SCALE OF SAMPLING

B-1.1 Lot

In a singal consignment all the items of the same type, shape and dimensions belong to the same batch of manufacture shall be grouped together to constitute a lot.

B-1.2 For the purpose of judging conformity to the requirements of this specification each lot shall be considered separately. The number of sample items for this purpose shall depend on the size of the lot and shall be in accordance with col 1 and 2 of Table 4.

B-1.3 The sample items shall be taken at random from the lot. In order to ensure randomness of selection, random number tables shall be used. In case random number tables are not available, the following procedure may be adopted:

Starting from any item count all the items in the lot as 1, 2, 3,.....up to *r* and so on in one order. Every *r*th item thus counted shall be withdrawn as sample item, *r* being the integral part of *N/n* where *N* is the number of items in the lot and *n* is the number of sample items to be selected.

B 2 NUMBER OF TEST AND CRITERIA FOR CONFORMITY

B-2.1 All the sample items selected from the lot in accordance with **B-1.2** and **B-1.3** shall be tested for all the requirements of this specification. Any item failing in one or more of the requirements shall be regarded as defective.

B-2.2 The lot shall be declared as conforming to the requirements of this specification if the number of defective sample items does not exceed the corresponding permissible number 'a' given in col 3 of Table 4.

Table 4 Scale of Sampling

(*Clause* B-1.2)

Number of Items in the Lot	Number of Sample Items	Permissible Order of Defective Sample Items
N	*n*	*a*
(1)	(2)	(3)
Up to 25	3	0
26 to 100	3	0
101 to 300	8	0
301 to 1 000	13	0
1 001 to 3 000	20	1
3 001 and above	32	2

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BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :	Telephone
Central: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{311 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	6 32 92 95

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