IS 12436 (1988): Preformed Rigid Polyurethane (Pur) and Polyisocyanurate (Pir) Foams for Thermal Insulation [CHD 27: Thermal Insulation]

BLANK PAGE

Indian Standard

SPECIFICATION FOR PREFORMED RIGID POLYURETHANE (PUR) AND POLYISOCYANURATE (PIR) FOAMS FOR THERMAL INSULATION

(First Reprint JUNE 1995)

UDC 678.644-405-8 : 662.998

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

Gr. 2

May 1989

AMENDMENT NO. 1 MAY 2002
TO
IS 12436 : 1988 SPECIFICATION FOR PREFORMED RIGID POLYURETHANE (PUR) AND POLYISOCYANURATE (PIR) FOAMS FOR THERMAL INSULATION

[*Page* 2. *Table* 1. *Sl No.* (i), *col* 7 *]* — Substitute 'Part 3' *for* 'Part 2'.

[*Page* 2, *Table* 1, *Sl No.* (v)] — Substitute the following for the existing text:

(1)	(2)	(3)	(4)	(5)	(6)	(7)
'v)	Thermal conductivity (W/m.k), *Max,* (*see* Appendix A), at:					
	50°C	0.03	0.03	0.03	0.03 }	IS 3346 : 1980†
	10°C	0.023	0.023	0.023	0.023 }	

(*Page* 3, *clause* A-1.1, *line* 1) — Substitute 'IS 14164 : 1994*' *for* 'IS 7240 - 1981* and IS 7413 - 1981†'.

(*Page* 3, *footnotes*) — Substitute the following for the existing footnotes:

'*Industrial application and finishings of thermal insulation materials at temperatures above –80°C and up to 750oC – Code of practice*.

(*Page* 3, *clause* A-3.1.1) — Delete.

(CHD 27)

Indian Standard

SPECIFICATION FOR PREFORMED RIGID POLYURETHANE (PUR) AND POLYISOCYANURATE (PIR) FOAMS FOR THERMAL INSULATION

0. FOREWORD

0.1 This Indian Standard was adopted by the Bureau of Indian Standards on 18 July 1988, after the draft finalized by the Thermal Insulation Material Sectional Committee had been approved by the Chemical Division Council.

0.2 Rigid polyurethane foam (RUF) has many uses, such as thermal insulation, providing buoyancy, shock protective packaging and structural reinforcement. Its properties can be varied widely in the process of manufacture to meet both general and specific demands.

0.3 This standard covers preformed rigid cellular urethane thermal insulation intended for use on curved and flat surfaces operating within the temperature range of normally – 180 to + 140°C, though the temperature range could be extended up to 150°C for special products. *In-situ* foamed or sprayed rigid urethane foam is covered separately. This standard covers both rigid polyurethane and polyisocyanurate foam.

0.4 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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

1. SCOPE

1.1 This standard covers the requirements, and methods of sampling and test for preformed rigid polyurethane (PUR) and polyisocyanurate (PIR) foam for thermal insulation in the form of boards, cut and moulded slabs, cut and moulded pipe sections, cut and moulded radiused and bevelled lags, panels with adhesive integrally laminated facings, panels with adhesive applied facings, and cut and moulded special shapes.

NOTE —Details of facings are not covered in this standard.

2. TERMINOLOGY

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

3. CLASSIFICATION

3.1 Types —The rigid preformed cellular urethane thermal insulation materials shall be of two types (*see* Appendix A).

Type 1 — For general use.

Type 2 — For use where there is a requirement for greater resistance to compres- sive forces.

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

3.2 Grades — The rigid preformed cellular arethane thermal insulation materials shall be of two grades :

PUR — Rigid polyurethane foam whose maximum recommended operating temperature is up to 110°C.

PIR — Rigid polyisocyanurate foam whose maximum recommended operating temperature is up to 140°C *(see* 03).

4. COMPOSITIONS

4.1 The material shall consist of rigid polyurethane or rigid polyisocyanurate foam with substantially closed cell structure.

NOTE—Materials indicated by PUR are substantially composed of polyurethane linkages and those indicated by PIR are substantially composed of polyisocyanurate linkages.

5. REQUIREMENTS

5.1 The material shall conform to the requirements given in Table 1 when tested in accordance with the methods prescribed in col 7 of Table 1.

TABLE 1 REQUIREMENTS FOR RIGID PREFORMED GELULAR URETHANE FOAM THERMAL INSULATION MATERIALS

(*Clause* 5.1)

SL No.	CHARACTERISTIC	REQUIREMENT				METHOD OP TEST, RBF TO
		PUR 1	PUR 2	P1R1	P1R2	
(1)	(2)	(3)	(4)	(5)	(6)	0)
*>	Dimensional Stability at 100 ± 2°C, percent, for 24 h, *Max*	±2	±2	±2	± 2	IS: 11239 (Part 2)-1985*
H>	Water vapour transmission, *Max,* ng/Pasm	5-5	*-t*	8-5	8-5	IS: 11239 (Part 4> 1985*
W)	Closed cell content, *Min%* percent	85	85	85	85	IS: 11239 (Part 5)-1985»
iv)	Compressive strength at 10 percent deformation, *Min,* kN/m*	115	205	115	205	IS: 11239 (Fart 11)-1985*
v)	Thermal conductivity at 50°C, *Max,* W/m.k. (*see* Appendix A)	0-03	003	003	003	IS:3346-1980f
vi)	Horizontal burning, *Max,* mm	125	125	25	25	IS: 11239 (Part 12)-1988*

•Methods of test for cellular thermal insulation materials:
Part 2 Dimensional stability;
Part 4 Water vapour transmission rate;
Part 5 Volume percent of open and closed cells;
Part 11 Compressive strength; *
Part 12 Horizontal burning characteristics.

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

5.2 Standard Sizes and Dimensions — In the case of finished boards of both the types, the sizes shall be either 1.0 × 0.5 m or 1.22 × 0.61 m or as agreed to between the purchaser and the supplier. The size for pipe-section and lags shall be 1.0 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.

5.3 Thickness — The material shall normally be supplied in thickness of 20, 25, 30, 40, 50, 60, 75, 90 and 100 mm or as agreed to between the purchaser and the supplier.

5.4 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.

TABLE 2 DIMENSIONAL TOLERANCES FOR PIPE SECTIONS AND LAGS

SL No.	DIMENSIONS	PERMISSIBLE DEVIATIONS MOULDED/ CUT PIPE SECTIONS AND LAGS
(1)	(2)	(3) mm
i)	Lengths	± 3
ii)	Bores less than 150 mm	+ 2 − 0
iii)	Bores 150 mm and above	+ 3 − 0
iv)	Outside diameters less than 150 mm	+ 2 − 0
v)	Outside diameters 150 mm and above	+ 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 layer(s) of multi-layer components, it is given on the outside diameter of the mating inner layer.

TABLE 3 DIMENSIONAL TOLERANCES FOR SLABS

(*Clause* 5.4)

All dimensions in millimetres.

SL No.	LENGTHS OR WIDTHS	PERMISSIBLE DEVIATIONS OF LENGTHS OR WIDTHS	MAXIMUM DIFFERENCES IN THE LENGTHS OF THE DIAGONALS OF RECTANGULAR SLABS	THICKNESS TOLERANCE
(1)	(2)	(3)	(4)	(5)
i)	Up to and including 1000	± 2	5	± 2
ii)	Over 1000 up to and including 2 500	± 4	8	± 2

6. WORKMANSHIP AND FINISH

6.1 General — The insulation shall not have visible defects that would adversely affects its service qualities.

NOTE — In the case of moulded products there will normally be a skin which can vary in thickness.

6.2 Pipe Sections — Pipe sections shall be supplied in two semi-circular pieces; the longitudinally mating faces shall be flat and in the same plane, so that when the two pieces are put together no gaps exist between the mating surfaces.

NOTE — It is common practice for the mating faces while still being flat in the length-wise direction to have a variable profile in the radial direction. This is acceptable provided that the mating surfaces so created still fits snugly together. In many cases, this practice enchances the snugness of the fit.

6.2.1 The ends shall be flat and normal to the longitudinal axis of the section.

6.3 Radiused and Bevelled Lags — The mating bevelled edges shall be flat, so that when they are put together to form a cylinder no gaps exists between abutting lags.

6.3.1 The ends shall be flat and normal to the longitudinal axis of the lag.

NOTE — No values are specified for their width on the outer and inner faces.

6.4 Moulded Components — All moulded items shall be free from grease or other mould release agent that will adversely reduce the adhesion of insulation, mastics and adhesives.

6.5 Colour Identification — PIR foam shall be supplied coloured pink. PUR foam shall be supplied in any other colour or without added colour, as required.

7. PACKING AND MARKING

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

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

a) Name of the manufacturer and recognized trade-mark, if any;

b) Type and grade of the material;

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

d) Details of facing, if any; and

e) Batch or lot number.

7.2.1 The packages may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standard Act, 1986 and the Rules and Regulations made thereunder. The Standard 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 BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

8. SAMPLING

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

APPENDIX A

[*Clause* 3.1 and *Table* 1, *Sl No.* (v)]

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 rigid polyurethane and isocyanurate foams are given below.

A-2. DENSITY

A-2.1 Materials of approximate density 32 to 36 kg/m^3 are usually found suitable for most normal insulating purposes (PUR 1 and PIR 1). General use represents situations where high external compressive forces are not expected to be incident on the insulation system on a continuous basis.

A-2.1.1 Some applications require greater resistance to compressive forces, for example, pipe supports, anchor locations for vertical piping where lateral clamping forces are employed, for which PUR 2 and PIR 2 would be suitable. Materials of apparent density 37 to 80 kg/m^3 are usually found suitable for these applications.

A-2.2 From process considerations, it may become necessary for moulded PUR and PIR materials to have density more than 40 kg/m^3.

A-3. THERMAL CONDUCTIVITY

A-3.1 It has been established that a negligible increase in thermal conductivity occurs within the density range 32 to 80 kg/m^3. However, the value may increase with time from 0.017 to 0.025 W/m.k. depending upon environmental conditions. The application of relatively impermeable facings during manufacture or shortly after manufacture will reduce the rate of increase.

A-3.1.1 Thermal conductivity values have been reported at 50°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 IS : 3346-1980* do not exist. However, for design purposes reported *k*-values at 10°C (30 days aged) are 0.21 W/m.k.

A-4. USE AT LOWER TEMPERATURE

A-4.1 The lower temperature limit is selected to indicate the unsuitability of these materials for

*Code of practice for industrial applications and finishing of thermal insulating materials at temperature from — 80 to 40°C (*first revision*).

†Code of practice for industrial applications and finishing of thermal insulating materials at temperature above 40 to 700°C (*first revision*).

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

the insulation of liquid oxygen plant. The materials can, however, be used at temperatures somewhat lower than — 180°C provided precautions are taken to prevent the condensation of atmospheric oxygen in or on the insulation.

A-5. PROTECTION AGAINST FIRE

A-5.1 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.

APPENDIX B

(*Clause* 8.1)

SAMPLING OF PREFORMED RIGID CELLULAR URETHANE THERMAL INSULATION MATERIALS

B-1. SCALE OF SAMPLING

B-1.1 Lot — In a single consignment, all the items of the same type, grade, shape and dimensions belonging 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 rth 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.

TABLE 4 SCALE OF SAMPLING

(*Clause* B-1.2)

NUMBER OF ITEMS IN THE LOT	NUMBER OF SAMPLE ITEMS	PERMISSIBLE NUMBER OF DEFECTIVE SAMPLE ITEMS
(1)	(2)	(3)
N	*n*	*a*
Up to 25	3	0
26 to 100	5	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

B-2. NUMBER OF TESTS 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 requirement 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.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

This Indian Standard has been developed from

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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	331 01 31 331 13 75
Eastern	: 1/14 C. I.T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	37 84 99, 37 85 61 37 86 26, 37 86 62
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43 60 20 25
Southern	: C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093	632 92 95, 632 78 58 632 78 91, 632 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. PATNA. THIRUVANANTHAPURAM.

Printed at Printograph, New Delhi-5 (INDIA)