भारतीय मानक
Indian Standard

IS 16203 : 2016

पूर्व संविरचित पॉलीयूरेथन सेंडवीच पेनलों की विशिष्टि

Prefabricated Polyurethane Sandwich Panels — Specification

ICS 83.140.01; 91.100.60

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली-110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.org.in www.standardsbis.in

October 2016 **Price Group 3**

Thermal Insulation Sectional Committee, CHD 27

FOREWARD

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

In 1993-94 the concept of Polyurethane Sandwich Panels was introduced in India. Earlier Expanded Polystyrene was used for insulation of cold storages which has now been replaced by Polyurethane Panels since these are better in energy conservation, cleaner and faster in application.

Polyurethane Panels which are manufactured by injecting Polyols and Isocyanates between two colour coated metallic sheets kept apart for maintaining desired thickness. These panels can be suitably used in temperature range of –40°C to +110°C. Their application include Cold Storages, Telecom, Railways, Defence, Fruits/Vegetables/ Ice Cream facilities, Chiller Rooms, Air Conditioned Industrial Buildings, Refrigerated Vehicles, Retail Outlets, Insulated PEBs, Roof Insulation, Clean Rooms, Warehouses etc. No ISO Standard exists on this subject.

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.

Indian Standard

PREFABRICATED POLYURETHANE SANDWICH PANELS — SPECIFICATION

1 SCOPE

1.1 This standard prescribes the requirements and methods of sampling and tests for prefabricated polyurethane sandwich panels and its construction materials for use at different temperatures for cold application.

2 REFERENCES

2.1 The following standards contain provisions which, through reference in this text, constitute provisions of this Indian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

IS No.	*Title*
101 (Part 3/ Sec 2) : 1989	Methods of sampling and test for paints, varnishes and related products Part 3 : Tests on paint film formation, Section 2 Film thickness
277 : 2003	Galvanized steel sheets (plain and corrugated)
513 : 2008	Cold reduced low carbon steel sheets and strips
1608 : 2005	Mechanical testing of metals — Tensile testing
3069 : 1994	Glossary of terms, symbols and units relating to thermal insulation materials
3346 : 1980	Method for determination of thermal conductivity of thermal insulation materials (two slabs, guarded hot plate method)
9489 : 1980	Method of test for thermal conductivity of materials by means of heat flow meter
9844 : 1981	Methods of testing corrosion resistance of electroplated and anodized aluminium coatings by neutral salt spray test
11239 (Parts 1-14)	Methods of test for rigid cellular thermal insulation materials
12436 : 1988	Preformed rigid polyurethane (Pur) and polyisocyanurate (Pir) foams for thermal insulation
13286 : 1992	Surface spread of flame for thermal insulation materials — Methods of test
14246 : 2013	Continuously pre-painted galvanized steel sheets and coils

3 TERMINOLOGY

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

4 MATERIAL COMPOSITIONS

4.1 The inner and outer surface of each panel shall consist of a 0.5-0.6 mm thick hot dipped high tensile galvanized steel/galvalume sheets which may be trapezoidal on one side and colour coated with Architectural Polyester, Silicon Modified Polyester, Fluoropolymer or Plastisol whereas the other side of sheet may be plain with colour coating. Polyols and Isocyanates are injected between two colour coated metallic sheets kept apart for maintaining the desired thickness. The chemicals shall essentially be free from chlorofluorocarbons. The Polyurethane foam thus formed shall be closed cell. These panels are intended for use within the temperature range of –40°C to +110°C. Each panel is to be completed with tongue and groove joint and to be provided with or without camlocks to ensure rigid interlocking between two panels.

NOTE — Thickness of panel to be selected from range of 30 mm to 200 mm based on temperature at which it is to be applied and agreed to between the purchaser and the supplier.

5 REQUIREMENTS

5.1 The materials used for construction of panels and panels itself shall conform to the requirements given in Tables 1, 2 and 3 when tested in accordance with the methods prescribed in col 4 of Tables 1, 2 and 3.

5.2 Standard Sizes and Dimensions

5.2.1 The panels shall be in the length of 3 600 mm, 6 000 mm, 12 000 mm and in the width of 600 mm to 1 200 mm or as agreed to between the purchaser and the supplier, when measured in accordance with IS 11239 (Part 1).

5.3 Thickness

5.3.1 The panels shall normally be supplied in thickness of 30, 60, 80, 100, 120, 150, 200 mm or as agreed to between the purchaser and the supplier.

Table 1 Requirements for Rigid Preformed Cellular Urethane Foam Thermal Insulation Material

(*Clause* 5.1)

Sl No.	Characteristics	Requirement	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Density, kg/m^3	40 ± 2	IS 11239 (Part 2)
ii)	Dimensional stability (for 24 h), percent, *Max*		IS 11239 (Part 3)
	at +70 ± 2°C	± 2.0	
	at – 40°C	± 2.0	
iii)	Compressive strength at 10 percent deformation, kN/m^2, *Min*	205.0	IS 11239 (Part 11)
iv)	Closed cell content, percent, *Min*	85	IS 11239 (Part 5)
v)	Horizontal Burning, mm, *Min*	125	IS 11239 (Part 12)
vi)	Water vapour transmission, µg/m^{2}s, *Min*	5.5	IS 11239 (Part 4)
vii)	Thermal conductivity, W/mK, *Min*		
	at 10°C mean temperature	0.023	IS 3346/IS 9489
	at 24°C mean temperature	0.025	

NOTE — Other densities used shall be agreed to between the purchaser and the supplier.

Table 2 Requirements for Colour Coated Metallic Sheets

(*Clause* 5.1)

Sl No.	Characteristics	Requirement	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Thickness of paint coating, micron, *Min*		IS 101 (Part 3 / Sec 2)
	a) Top coat	20	
	b) Bottom coat	7	
ii)	Weight of metallic coating (on both sides), gm/m^2, *Min*		
	a) Zinc coating or	175	IS 277
	b) Zinc aluminium alloy coating (Al-55 percent, Zn-45 percent)	150	
iii)	Cross hatch	No lifting of paint by tape	IS 14246
iv)	Yield stress, MPa, *Min*	240	IS 1608
v)	Tensile strength, MPa, *Min*	240	IS 1608
vi)	Pencil hardness of painted surface	No scratch on the tested portion	IS 14246
vii)	Impact resistance	No cracking or peel of paint coating	IS 14246
viii)	Bend test done with mandrel diameter of 2t	No cracking or peeling of paint film on the bent portion	IS 14246
ix)	Salt spray in 5 percent NaCl solution for 750/1 000 h at 35 ± 2°C	No corrosion and no loss of adhesion	IS 9844

NOTES

1 Bare metal thickness (BMT) or total thickness of sheet including any coating (TCT) to be declared by the purchaser.

2 Minimum yield stress / tensile strength to be declared either by purchaser or supplier.

3 The duration of salt spray test will be agreed to between the purchaser and the supplier and decided accordingly.

Table 3 Requirements for Prefabricated Polyurethane Sandwich Panels

(*Clause* 5.1)

Sl No.	Characteristics	Requirement	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Tensile strength	As per purchaser/suppliers specifications	Annex A
ii)	Adhesion strength, kPa, *Min* (foam to steel)	245	Annex B
iii)	Surface spread of flame	Class - I	IS 13286

NOTE — Surface spread of flame test may be performed once in 3 years and treated as type test.

5.4 Tolerance

5.4.1 The permissible tolerances are

Length	+ 15 mm - 0 mm
Width	+ 10 mm - 0 mm
Thickness	± 3 mm

6 PACKING AND MARKING

6.1 Packing

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

6.2 Marking

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

a) Name of the manufacturer;

b) Length, width and thickness of material;

c) Number of pieces; and

d) Batch or lot number.

6.3 BIS Certification Marking

6.3.1 The product may also be marked with the Standard Mark.

6.3.2 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

7 SAMPLING

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

ANNEX A

(*Table* 3)

METHOD FOR TENSILE STRENGTH TEST

A-1 PRINCIPAL

A-1.1 This method is used for determining the tensile strength of rigid cellular base materials. Tensile stress is applied uniformly over the cross-section of a test specimen until it breaks.

A-2 APPARATUS

A-2.1 Tensile Testing Machine

A-2.1.1 Power driven and of such a capacity that the force required to break the test specimen is neither greater than 85 percent nor less than 15 percent of the maximum of the scale. The rate of jaw separation shall be 10 mm/min ± 1 mm/min.

A-2.2 Specimen Holders

A-2.2.1 Specimen holders are shown in Fig 1. Each shall fit snugly to the appropriate specimen.

A-3 TEST SPECIMEN

A-3.1 Unless otherwise specified by the purchaser, the test specimen shall have the dimensions given in Fig. 2 with uniform thickness. All the edges shall be cleanly cut with an instrument such as a fine spiral handsaw of approximately 1 mm diameter. A hot wire cutter shall not be used. Test specimens shall have no skins on the edges.

A-4 NUMBER OF TEST SPECIMENS

A-4.1 A set of at least three valid specimens shall be tested for each direction of determination of tensile strength.

A-5 CONDITIONING

A-5.1 The test specimens shall be conditioned at 27 ± 2°C and 65 ± 5 percent RH for not less than 16 h and the test shall be carried out at a temperature of 27 ± 2°C immediately after conditioning.

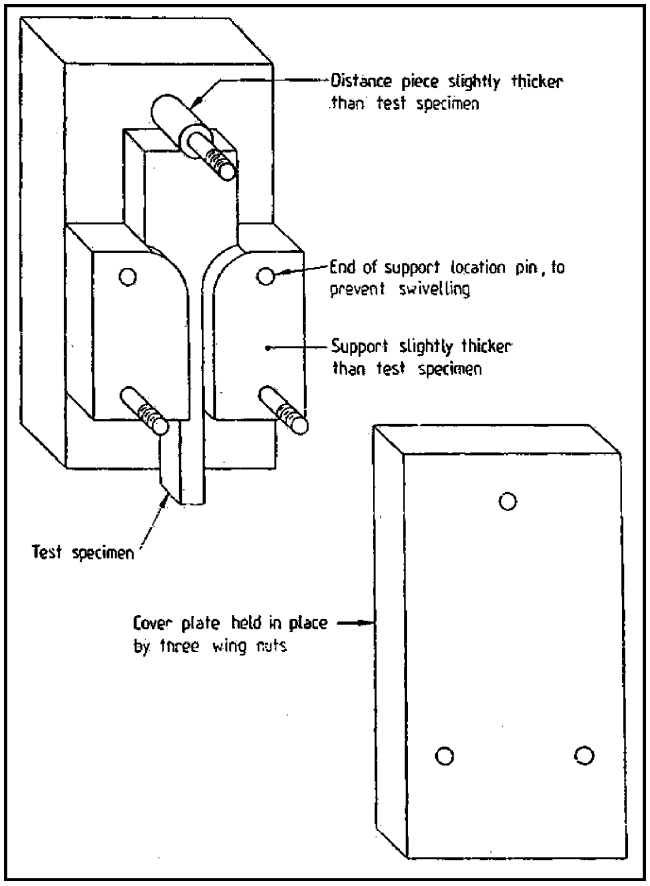
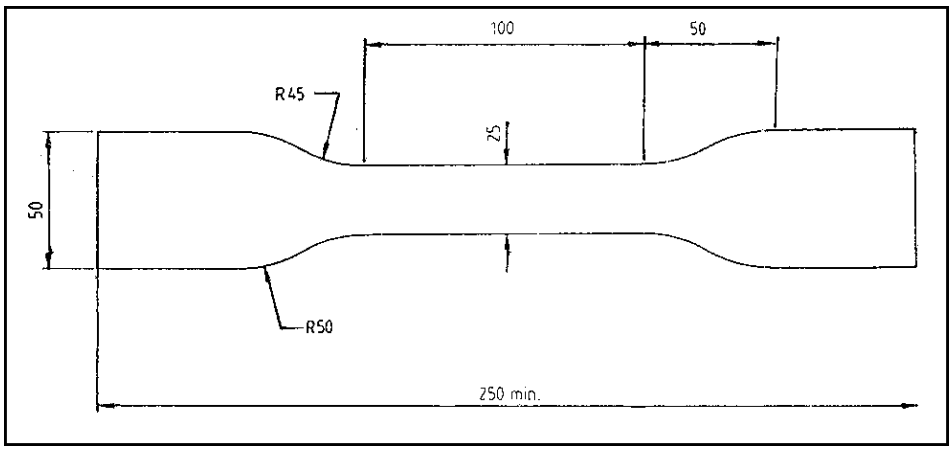


FIG. 1 HOLDER FOR TEST SPECIMEN



NOTE — All dimensions are in millimetres with ± 1 mm overall tolerance

FIG. 2 TEST SPECIMEN

ANNEX B

(*Table* 3)

METHOD FOR DETERMINATION OF ADHESION STRENGTH OF FOAM TO STEEL

B-1 PRINCIPLE

B-1.1 This method is used for determining adhesion strength of foam to steel by applying a load uniformly over the cross-section of a test specimen until it breaks or foam gets separated from steel.

B-2 APPARATUS

B-2.1 Measuring Scale

B-2.1.1 Steel scale with least count of 0.5 mm.

B-2.2 Universal Testing Machine (UTM)

B-2.2.1 Power driven and of such a capacity that the force required to break the test specimen/separate foam from steel is not greater than 85 percent nor less than 15 percent of the maximum of the scale. The rate of jaws separation shall be 10 mm ± 1 mm/min.

B-2.3 Specimen Holders (Fixtures)

B-2.3.1 Specimen holders are such that each jaw shall fit snugly to the specimen of specified size in **A-3.1**.

B-3 TEST SPECIMEN

B-3.1 The test specimen shall be in size of 100 ± 2 mm length × 100 mm ± 2 mm width with specified thickness.

B-4 NUMBER OF TEST SPECIMENS

B-4.1 A set of atleast three specimens shall be tested for determination of adhesion strength.

B-5 CONDITIONING

B-5.1 Unless otherwise specified the test specimens shall be conditioned at 27 ± 2°C and 65 ± 5 percent RH for not less than 16 h and test shall be carried out at same temperature immediately after conditioning.

B-6 PROCEDURE

B-6.1 Cut the samples in size as specified in **B-3.1** from chosen panels with jig-saw by taking care to not to cause any mechanical damage, crushing or bending. Measure dimensions of cut samples by steel scale. Condition them as stated in **B-5.1.**

B-6.2 Place the test specimen in between two jaws/holders which shall be fixed in the UTM so that load/force is applied through the transverse axis of the specimen. Extend the load/force at a constant rate of 10 mm ± 1 mm/min until it breaks or foam gets separated from steel. Measure the Maximum load/force to an accuracy of ± 2 percent for breaking load/separation of foam from steel.

B-7 CALCULATION

B-7.1 Calculate the adhesion strength *A* of the specimen (in kPa), using the following formula :

$$A = \frac{F \times 10^3}{L \times w}$$

where

F = maximum force, in N;

l = length of the specimen, in mm;

w = width of the specimen, in mm.

B-8 TEST REPORT

B-8.1 The report shall include the following information:

a) the description and identity of the material;
b) the arithmetic mean of the test results;
c) details of conditioning of other than those specified in **B-5.1**;
d) temperature of test if other than 27 ± 2°C; and
e) any deviation from the method.

ANNEX C

(*Clause* 7.1)

SAMPLING OF PREFABRICATED POLYURETHANE SANDWICH PANELS

C-1 SCALE OF SAMPLING

C-1.1 Lot

C-1.1.1 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.

C-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.

C-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 :

C-4 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.

Table 4 Scale of Sampling

(*Clause* C-2.2)

Number of Items in the Lot (1) *N*	Number of Sample Items (2) *N*	Permissible Number of Defective Sample Items (3) *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

C-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

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

C-2.2 The lot shall be declared as conforming to the requirements of this standard if the number of defective sample items does not exceed the corresponding permissible number as 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 Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc No.: CHD 27 (1772).

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 : 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.org.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 — 2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi, KOLKATA 700054 — 2337 8499, 2337 8561, 2337 8626, 2337 9120

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022 — 260 3843, 260 9285

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 — 2254 1216, 2254 1442, 2254 2519, 2254 2315

Western : Manakalaya, E9 MIDC, Marol, Andheri (East), MUMBAI 400093 — 2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches: AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi