IS 3087 (2005): Partical boards of wood and other lingnocellulosic materials (medium density) for general purposes -Specification [CED 20: Wood and other Lignocellulosic products]

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भारतीय मानक

सामान्य प्रयोजनों के लिए लकड़ी और अन्य लिग्नोसैल्युलोसिक सामग्री के पार्टिकल बोर्ड — विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

PARTICLE BOARDS OF WOOD AND OTHER LIGNOCELLULOSIC MATERIALS (MEDIUM DENSITY) FOR GENERAL PURPOSES — SPECIFICATION

(Second Revision)

ICS 790.060.20

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

October 2005 Price Group 5

AMENDMENT NO. 1 SEPTEMBER 2006
TO
IS 3087 : 2005 PARTICLE BOARDS OF WOOD AND OTHER LIGNOCELLULOSIC MATERIALS (MEDIUM DENSITY) FOR GENERAL PURPOSES — SPECIFICATION

(Second Revision)

(*Page* 5, *clause* 12, *Title*) — Substitute 'ADDITIONAL' *for* 'OPTIONAL'.

(CED 20)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 NOVEMBER 2011
TO
IS 3087 : 2005 PARTICLE BOARDS OF WOOD AND OTHER LIGNOCELLULOSIC MATERIALS (MEDIUM DENSITY) FOR GENERAL PURPOSES — SPECIFICATION

(Second Revision)

(*Page* 2, *clause* **4**) — Insert the following at the end:

'Each class and grade shall further be sub-classified based on the formaldehyde content as Formaldehyde class E_1 and Formaldehyde class E_2 (*see* **9.7**).'

[*Page* 3, *clause* **8.3**, *Sl No.* (i) *and* (ii)] — Substitute the following for the existing:

i)	*Sl No.*	Length*Dimension*	±5 mm*Tolerance*
ii)		Width	±5 mm

(*Page* 3, *clause* **9.6**) — Insert the following new clause at the end:

'**9.7 Formaldehyde Content**

The formaldehyde content F_c, of the boards when tested in accordance with **11.11**, shall meet the following limits:

i) Formaldehyde class E_1 : $F_c \leq 8$ mg/100 g for oven dry board
ii) Formaldehyde class E_2 : $8 < F_c \leq 30$ mg/100 g for oven dry board'

(*Page* 4, *clause* **10.2.1**) — Insert the following new clause at the end:

'**10.2.2** From each particle board selected, samples shall be drawn for determination of formaldehyde content in accordance with **3.1** of IS 13745 and test pieces conditioned for 6 days at 27 ± 2°C and 65 ± 5 % relative humidity.'

(*Page* 4, *clause* **11.1**, *second line*) — Substitute '**11.11**' *for* '**11.10**'.

(*Page* 5, *clause* **11.10**) — Insert the following new clause at the end:

‘**11.11 Test for Formaldehyde Content**

The formaldehyde content in specimen prescribed in **10.2.2** and tested as prescribed in IS 13745 shall meet the limits specified in **9.7**.’

[*Page* 5, *clause* **13.1**(b)] — Substitute the following for the existing:

Designation of particle board and formaldehyde class;’

(*Page* 7, *Annex* A) — Insert the following new reference at the end:

IS No.	*Title*
13745 : 1993	Method for determination of formaldehyde content in particle board by extraction method called perforator method

Reprography Unit, BIS, New Delhi, India

Wood and Other Lignocellulosic Products Sectional Committee, CED 20

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wood and Other Lignocellulosic Products Sectional Committee had been approved by the Civil Engineering Division Council.

There are three categories of particle boards based on their density classification, namely, high density particle board having specific gravity over 0.9 covered in IS 3478 : 1966 'Specification for particle boards of wood and other lignocellulosic materials (high density) for general purposes', low density particle boards having specific gravity not exceeding 0.4 covered in IS 3129 : 1985 'Specification for low density particle boards and medium density particle board' covered in this standard having specific gravity in the range of 0.5 to 0.9.

Medium density particle boards are used for partitions, for doors, in the furniture industry, etc. This standard was first formulated in 1965 to provide guidance in the manufacture of medium density particle boards. Based on the development in the particle board industry, the first revision was undertaken in 1985. In the first revision the types of particle boards had been redefined and the requirements in respect of the physical and mechanical characteristics had also been revised. Other significant changes relate to the inclusion of test for screw withdrawal strength and deletion of that for thermal conductivity and tensile strength.

This revision has been undertaken to modify the scope and title of the specification making provision for the use of other lignocellulosic materials and to incorporate additional requirement of modulus of elasticity. In addition, the dimensional requirements, their tolerances and the modulus of rupture requirements have been redefined.

All organic building materials are prone to decay, if they are used in damp and unventilated situations, without adequate protective treatment. It is therefore, recommended that the guidance of the manufacturers should be sought when it is proposed to use the particle boards in conditions conducive to the growth of fungus or moulds. BS:1982 'Methods of testing fungal resistance' provides means for assessing the resistance to fungal decay of building materials of, or containing materials of organic origin, and for judging the efficiency of such protective treatment as may be applied to them.

A scheme of labelling environment friendly products to be known as ECO-Mark has been introduced at the instance of the Ministry of Environment and Forests (MEF), Government of India. The ECO-Mark shall be administered by the Bureau of Indian Standards (BIS) under the *BIS Act,* 1986 as per the Resolution No. 71 dated 21 February 1991 and Resolution No. 425 dated 28 October 1992 published in the Gazette of the Government of India. For a product to be eligible for ECO-Mark, it shall also carry the Standard Mark of the BIS besides meeting additional environment friendly requirements. For this purpose, the Standard Mark of BIS would be a single mark being a combination of the ISI Mark and the Eco logo. Requirements to be satisfied for a product to qualify for the BIS Standard Mark for Eco friendliness will be optional. Manufacturing units will be free to opt for ISI Mark alone also.

The requirements pertaining to Eco criteria is based on the Gazette Notification No. 170 dated 18 May 1996 for wood substitutes as environment friendly products published in the Gazette of the Government of India.

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

PARTICLE BOARDS OF WOOD AND OTHER LIGNOCELLULOSIC MATERIALS (MEDIUM DENSITY) FOR GENERAL PURPOSES — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers the requirements of medium density particle boards made of wood and/or other lignocellulosic materials for general purposes, having specific gravity in the range 0.5 to 0.9.

1.2 This standard does not cover veneered particle boards, moulded particle boards, high and low density particle boards or particle boards faced by impregnated paper surfaces.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this 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 given in Annex A.

3 TERMINOLOGY

3.0 For the purpose of this standard, the following definitions shall apply and for definitions other than those given below, reference may be made to IS 707.

3.1 Additive — Any material introduced prior to the final consolidation of a board to improve some property of the final board. Fillers and preservatives are included under this term.

3.2 Extruded Particle Board — A board manufactured by mixing particles of wood and/or other lignocellulosic materials of pre-determined sizes and shapes with synthetic resins and pressing while the mix is being forced through an extrusion hot platen press, pressure being applied in the direction of the length of extrusion which tends to orient the particles considerably in a direction at right angles to the direction of extrusion.

3.3 Flat-Pressed Particle Board — Resin-bonded particle board manufactured by mixing particles of wood and/or other lignocellulosic materials of pre-determined sizes and shapes with synthetic resins and pressing in a parallel platen hot press of the usual multidaylight type but may also be pressed in a continuous band type of press. The applied pressure is perpendicular to the plane of the board.

3.4 Formation (Forming) — Laying up of the glued particles in the form of a mat, ready to be pressed.

3.5 Graded Particle Board — A board formed by arranging the particles of wood and/or other lignocellulosic materials in a graded manner such that the smallest particles form the top most layer and the largest particles form the middle layer. In graded particle board there is a gradual density gradient from the outer surfaces to the centre of the board across its thickness.

3.6 Multi-Layer Particle Board — A board made of more than three layers of like material in which particles of different shapes and sizes may be used in different layers.

3.7 Particles — Distinct particle or fraction of wood or other lignocellulose material produced mechanically for use as the aggregate for a particle board. This may be in the form of flake, granule, shaving, splinter and sliver as stated below:

a) *Flakes* — Specially made thin flat particles, with the grain of the wood essentially parallel to the surface of the flake, prepared with the cutting action of the knife in a plane parallel to the grain but at an angle to the axis of the fibre.

b) *Granule* — A particle in which the length, width and thickness are approximately equal, such as particle of saw-dust.

c) *Shaving* — A thin slice or strip of wood or any other lignocellulosic pared off with a knife, plane or other cutting instrument, the knife action being approximately along the axis of the fibre, such as the shavings produced in the surface of wood.

d) *Splinter and Sliver* — Particle of nearly square or rectangular cross-section with a length parallel to the grain of the wood of at least four times the thickness.

3.8 Particle Board — A board manufactured from particles of wood and/or other lignocellulose material in the form of flakes, slivers, shavings, splinters, granules agglomerated, formed and pressed together under heat and pressure by use of an organic binder together with one or more additives like wax, preservatives, catalyst, etc.

3.9 Single-Layer Particle Board — A board made of one uniform layer of particles and resin mix, predominantly of uniform texture and having uniform density across the board thickness.

3.10 Sizing Material — Wax, rosin or other additive introduced to the agglomerate for a particle board prior to forming, primarily to increase water resistance.

3.11 Three-Layer Particle Board — A board made of three layers of particle and resin mix, usually with finer and thinner particles for the top and bottom layers and coarser and bigger particles for the core layer. Resin content in a three-layer board is usually higher in the face layers than in the core layer leading to a sandwich construction with stronger and denser skin.

4 CLASSES AND TYPES

The particle board shall be of the following classes:

Class	*Grade*	*Designation*
Flat pressed, single layer	—	FPS
Flat pressed-three layer,	I	FPT-1
multilayer and graded	II	FPT-2
Extrusion pressed, solid	—	XPS
Extrusion pressed, tubular	—	XPT

The flat pressed-three layer, multilayer and graded class shall be of two types, namely, Grade I and Grade II, the grading is based on the physical and mechanical properties as given in Table 1.

5 MATERIALS

5.1 Any species of wood and/or other lignocellulosic materials may be used in the manufacture of particle board. For ECO-Mark, only species from sources other than natural forests such as wood from rubber, cashew, industrial and social forestry plantations, etc, and shade trees from tea and coffee estates, wood residues or agricultural/forest residues shall be used for the manufacture of particle boards.

5.2 Adhesive

Any suitable type of synthetic resin conforming IS 848 may be used for the purpose of bonding. However, for flat-pressed-three layer, multilayer and graded boards, BWR or BWP type adhesive shall be used.

5.3 Sizing Material

Paraffin wax dissolved in mineral spirit or alternatively emulsified with water or melted shall be used as sizing material.

6 MANUFACTURE

6.1 Particles of wood or other lignocellulosic materials for the manufacture of particle boards shall be produced by cutting wood and/or any other suitable lignocellulosic materials into shavings, flakes, splinters or slivers on a suitable chipping machine. The particles shall be dried in a mechanical drier. The dried particles shall be graded to required sizes and thoroughly blended with the requisite quantity of adhesives in mechanical mixers or applicators. The required sizing material may be added at this stage, either mixed with the binder or separately introduced into the mixer. Care shall be taken that the moisture content of the binder does not excessively increase the moisture content of the chips. The well-blended chips are then formed into a mat and pressed into panels by passing into the pressing machine under controlled heat, pressure and time conditions. The hot pressed boards are subsequently cooled, conditioned to attain equilibrium moisture content and sanded on both sides to attain uniform thickness and finally trimmed and cut to standard sizes.

6.2 In case of three-layer particle boards, the construction shall be well-balanced about the central plane. In case of a single-layer particle board, the particles shall be uniformly laid. Care shall be taken that no asymmetric grading of chips takes place.

6.3 Preservative Treatment

A suitable preservative may be added to the particle mix at the time of mixing of adhesive. The following percentages preservatives are regarded as suitable:

a) Sodium pentachlorophenate : 1 percent on the basis of oven dry weight of particles, or

b) Trichlorophenol : 5 percent on the basis of resin adhesive mix

Alternatively, 2 percent of sodium pentachlorophenate or trichlorophenol in organic solution should be applied on the surface and edges.

7 FINISH

The particle boards shall be of uniform thickness and uniform density throughout the length and width of the boards. All particle boards shall be flat. Both surfaces of the particle board shall be sanded to a smooth finish.

8 DIMENSIONS AND TOLERANCES

8.1 The sizes of the particle boards shall be as

follows:

Length, in mm	4 800, 3 600, 3 000, 2 700, 2 400, 2 100, 1 800, 1 500, 1 200, 1 000 and 900
Width, in mm	1 800, 1 500, 1 200, 1 000, 900, 600 and 450

NOTE — Any other dimensions as agreed to between the manufacturer and the purchaser, shall be permissible.

8.2 Thickness

Unless otherwise specified, the thickness of particle boards shall be 6 mm, 9 mm, 12 mm, 15 mm, 20 mm, 25 mm, 30 mm, 35 mm, 40 mm and 45 mm.

8.3 Dimensional Tolerance

The following tolerances on dimensions of finished boards shall be permissible:

Sl No.	*Dimension*	*Tolerance*
i)	Length	+ 6 mm – 0 mm
ii)	Width — For all widths	+ 3 mm – 0 mm
iii)	Thickness	± 5 percent
iv)	Edge straightness	2 mm per 1000 mm or 0.2 percent
v)	Squareness	2 mm per 1 000 mm or 0.2 percent

9 PHYSICAL CHARACTERISTICS

9.1 Density

The mean density of the boards, when tested in accordance with **11.3** shall be between 500 to 900 kg/m^3. The density shall not vary from one sample to another by more than 10 percent of the mean density.

9.2 Moisture Content

The mean moisture content of the boards, when determined in accordance with **11.4**, shall not be less than 5 percent and not more than 15 percent. The moisture content of individual test specimen shall not vary from the mean percentage by more than ±3 percent.

9.3 Water Absorption

The mean water absorption of the boards, when tested as described in **11.5**, shall not exceed the prescribed limits given in Table 1 for various grades of boards after both 2 h and 24 h immersion.

9.4 Swelling in Water

The mean swelling in length, width and thickness, when tested as described in **11.6**, shall not exceed the limits given in Table 1 for various grades of boards.

9.5 Swelling Due to Surface Absorption

The mean swelling in thickness due to surface absorption, when tested in accordance with **11.7**, shall not exceed the limits given in Table 1 for various grades of boards.

9.6 Workability

The particle boards shall not crack or split when drilled, sawed and nailed perpendicular to the surface.

NOTE — Recommended precautions for storing, cutting and working with particle boards are given in Annex B.

10 SAMPLING AND INSPECTION

10.1 Scale of Sampling

10.1.1 *Lot*

In any consignment, all the particle boards of the same class, grade and dimensions and manufactured under similar conditions of production, shall be grouped together to constitute a lot.

10.1.1.1 The conformity of a lot, to the requirements of this specification, shall be ascertained on the basis of tests on particle boards selected from it.

10.1.2 The number of particle boards to be selected from a lot shall be in accordance with the following:

Lot Size	*Number of Particle Boards to be Selected*
N	*n*
Up to 50	2
51 to 100	3
101 to 200	4
201 to 300	5
301 to 500	7
501 and above	10

10.1.2.1 The particle boards shall be selected at random (*see* IS 4905). In order to ensure randomness of selection, all the particle boards in the lot may be arranged in a serial order and every *r*th particle board may be selected till the required number is obtained, *r* being the integral part of *N/n*, where *N* is the lot size and *n* is the sample size.

10.2 Test Specimens and Number of Tests

The length, width and thickness of the particle boards selected as in **10.1.2** shall be measured before cutting

the particle boards for taking test specimens. The edge straightness and squareness of the boards shall also be measured.

The lot having been found satisfactory shall be further tested for physical characteristics given in 9. For this purpose, the particle boards examined according to 10.2.1 and found satisfactory shall be used.

10.2.1 From each of the particle board selected, following test specimens shall be cut from portions 150 mm away from the edges, for tests as specified under 11. The method of preparation and conditioning of specimens for tests listed in (c), (d), (e), (f) and (g) shall be as specified in IS 2380 (Part 1):

a) *For determination of density* — Three test specimens from each sample, in full thickness of material, 75 mm wide and 150 mm long. Other sizes of sample specimens may be used when deemed necessary. In case of tubular board, the tubes should be uniformly distributed in the center.

b) *For determination of moisture content* — Three test specimens from each sample in full thickness of material, 75 mm wide and 150 mm long. Smaller specimens may be used when deemed necessary.

c) *For water absorption test* — Three test specimens, size 300 mm × 300 mm × full thickness of board from each sample.

d) *For swelling in water test* — Three test specimens, size 200 mm × 100 mm × full thickness of board from each sample.

e) *For determining swelling due to surface absorption* — Three test specimens from each sample, size 125 mm × 100 mm.

f) *For determination of modulus of rupture and modulus of elasticity* — Three test specimens from each sample to conform to dimensions as specified in IS 2380 (Part 4).

g) *For determination of tensile strength perpendicular to surface* — Three test specimens from each sample, size 50 mm × 50 mm × full thickness of board. In addition to this for Grade I boards, three more test specimens shall be taken for cyclic or accelerated water resistance test as given in 11.9.1.

h) *For determination of screw withdrawal strength* — Three test specimens from each sample of size as specified in IS 2380 (Part 14).

10.3 Criteria for Conformity

A lot shall be considered as conforming to the requirements of the specification, if no group of test specimens for any of the characteristics fail, the samples and test specimens pass the conditions as prescribed in 11.

10.3.1 In case of a failure, double samples shall be taken from the lot for testing. The lot shall be considered to have passed, if all these samples conform to the requirements specified.

11 TESTING OF SAMPLES

11.1 The samples and test specimens shall be tested as given in 11.3 to 11.10 and shall conform to the requirements as prescribed in 9 and Table 1.

11.2 Accuracy of Dimensions of Boards

The accuracy of dimensions of boards shall be measured as specified in IS 2380 (Part 2). All the samples selected in accordance with 10.1.2 shall be measured for straightness of edges, squareness of boards, length, width and thickness.

11.3 Test for Density

The mean density of the board shall be determined in accordance with IS 2380 (Part 3), and shall comply with the requirements specified in 9.1 and Table 1. The mean density shall be straight average of the density of the test specimens taken out from each of the sample as in 10.1. While calculating the density of the tubular board, the empty tubular space shall be deducted from the volume of the test specimen.

11.4 Test for Moisture Content

The moisture content of wood particle boards shall be tested for each specimen as prepared in 10.2.1 (b) in accordance with the method prescribed in IS 2380 (Part 3) and the average value for all the samples shall comply with the requirements specified in 9.2.

11.5 Test for Water Absorption

The water absorption in test specimens as prepared in 10.2.1 (c) shall be tested in accordance with IS 2380 (Part 16) and the average value shall not exceed the limits specified in (ii) of Table 1.

11.6 Test for Swelling in Water

The swelling in length, width and thickness of test specimens as specified in 10.2.1(d), when tested by the method prescribed in IS 2380 (Part 17), for 2 h soaking shall have an average value not exceeding the limits specified under (iii) and (iv) of Table 1. The length of specimen in case of FPT boards shall be taken as in the line extrusion.

11.7 Test for Swelling Due to Surface Absorption

The swelling in thickness due to surface absorption on test specimens as specified in 10.2.1(e), when tested in accordance with IS 2380 (Part 17), for 2 h soaking

shall have an average value not exceeding the limits given under (v) of Table 1.

11.8 Test for Modulus of Rupture and Modulus of Elasticity

The modulus of rupture and modulus of elasticity on test specimens specified in **10.2.1**(f) and tested as prescribed in IS 2380 (Part 4) shall have an average and minimum value not less than the values specified in (vi) and (vii) of Table 1, for modulus of rupture and modulus of elasticity, respectively.

11.9 Test for Tensile Strength Perpendicular to Surface

Tensile strength perpendicular to the surface of three test specimens as prescribed in **10.2.1** (g), when tested in accordance with IS 2380 (Part 5) shall have an average value not less than the value specified in (viii) of Table 1.

11.9.1 The tensile strength perpendicular to surface of three test specimens prescribed in **10.2.1** (g) when subjected to (a) cyclic test, or (b) accelerated water resistance test as given in Table 1 shall have an average value not less than that specified in (ix) of Table 1.

11.10 Test for Screw Withdrawal Strength

The screw withdrawal resistance of test specimens as specified in **10.2.1** (h) and tested in accordance with IS 2380 (Part 14) shall have an average value not less than the value specified in (x) of Table 1.

12 OPTIONAL REQUIREMENTS FOR ECO-MARK

12.1 General Requirements

12.1.1 The particle board shall conform to the requirements of quality and performance as specified in this standard.

12.1.2 The manufacturer shall produce to BIS environmental consent clearance from the concerned State Pollution Control Board as per the provisions of the *Water (Prevention and Control of Pollution) Act*, 1974 and *Air (Prevention and Control of Pollution) Act*, 1981 and *Water (Prevention and Control of Pollution) Act*, 1977 along with the authorization, if required under the *Environment (Protection) Act*, 1986 while applying for ECO-Mark appropriate with enforced Rules and Regulations of forest department.

12.2 Specific Requirements

The particle board shall conform to the specific requirements given for ECO-Mark under relevant clauses of the standard.

NOTE — The manufacturer shall provide documentary evidence by way of certificate or declaration to Bureau of Indian Standards, while applying for ECO-Mark.

13 MARKING

13.1 Each particle board shall be legibly marked near any of its edges with the following:

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

b) Designation of particle board (*see* **4**);

c) Thickness (*see* **8.2**);

d) Date of manufacture; and

e) The criteria for which the particle board has been labelled as ECO-Mark.

13.2 BIS Certification Marking

Each particle board may also be marked with the Standard Mark.

13.2.1 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 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.

Table 1 Physical and Mechanical Properties of Various Types of Particle Boards
(*Clauses* 4, 9.3, 9.4, 9.5, 11.1, 11.3 *and* 11.5 to 11.10)

Sl No.	Properties	Flat Pressed Single Layer	Flat Pressed Three-Layer Multi-Layer and Graded		Extrusion Pressed Solids (XPS)	Extrusion Pressed Tubular (XPT)
			Grade I	Grade II		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Density variation, percent	±10	±10	±10	±10	±10
ii)	Water absorption, percent					
	a) 2 h soaking	25	10	40	40	40
	b) 24 h soaking	50	20	80	80	80
iii)	Linear expansion (swelling in water), 2 h soaking, percent					
	a) Length	0.5	0.5	0.5	2	2
	b) Width	0.5	0.5	0.5	0.5	0.5
iv)	Thickness swelling, percent, 2 h soaking	10	8	12	5	5
v)	Swelling in thickness due to surface absorption, percent	9	6	9	4	4
vi)	Modulus of rupture, N/mm²					
	a) Average	11	15	11	2	1
	b) Minimum	10	13	10	1.7	0.9
vii)	Modulus of elasticity, N/mm²					
	a) Average	2 000	2 500	2 000	—	—
	b) Minimum	1 800	2 250	1 800	—	—
viii)	Tensile strength perpendicular to surface, N/mm²					
	a) Upto 20 mm thickness	0.8	0.45	0.3	1.2	0.4
	b) Above 20 mm thickness	0.8	0.40	0.3	1.2	0.4
ix)	Tensile strength perpendicular to surface, N/mm²					
	a) After cyclic test [1]	—	0.2	—	—	—
	b) Accelerated water resistance test [2]	—	0.15	—	—	—
x)	Screw withdrawal strength, N					
	a) Face	1 250	1 250	1 250	—	—
	b) Edge (for thickness > 12 mm)	850	850	700	—	—

[1] *Cyclic test* — Specimens are immersed in water at 27 ± 2° C for a period of 72 h, followed by drying in air at 27 ± 2° C for 24 h and then heating in dry air at 70°C for 72 h. Three such cycles are to be followed, and then the specimen are tested for tensile strength perpendicular to surface.

[2] *Accelerated water resistance test* — Specimens are immersed in water at 27 ± 2°C and water is brought to boiling and kept at boiling temperature for 2 h. Specimens are then cooled in water to 27 ± 2°C and then tested for tensile strength perpendicular to surface.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
707 : 1976	Glossary of terms applicable to timber technology and utilization (*second revision*)
848 : 1974	Specification for synthetic resin adhesives for plywood (phenolic and aminoplastic) (*first revision*)
2380	Methods of test for wood particle boards and boards from other lignocellulosic materials:
(Part 1) : 1977	Preparation and conditioning of test specimen (*first revision*)
(Part 2) : 1977	Accuracy of dimensions of boards (*first revision*)
(Part 3) : 1977	Determination of moisture content and density (*first revision*)
(Part 4) : 1977	Determination of static bending strength (*first revision*)
(Part 5) : 1977	Determination of tensile strength perpendicular to surface (*first revision*)
(Part 14) : 1977	Screw and nail withdrawal test
(Part 16) : 1977	Determination of water absorption (*first revision*)
(Part 17) : 1977	Determination of swelling in water (*first revision*)
4905 : 1968	Methods for random sampling

ANNEX B

(*Clause* 9.6)

STORAGE AND WORKING OF WOOD PARTICLE BOARDS

B-1 GENERAL

Particle board is a composite board of particles of wood and/or other lignocellulosic materials bonded together with a resin-bonding agent. The grain of the particles are, therefore, non-directional as compared with natural wood which has only one grain direction. Due to the abrasive nature of the resin and the multitudinous grain direction, tool wear is greater than with most medium density natural woods. Because of this special saw and cutter tips should be used on production runs. By working according to the following basic principles, particles boards can be generally handled, cut and worked in much the same manner as natural wood.

B-2 STORING

Particle boards shall be stored in packs on a level flat surface in a clean, dry and covered place with free circulation of air. The boards shall be protected from rain, dampness and insect and fungal attack. The edges of boards in a pack shall be in a straight vertical plane. If required, the edge may be sprayed or painted with a suitable protective coat or sealing material. The packs shall be kept clear of the floor. The top of the stack shall be kept covered with a cover board and weighted down suitably.

B-3 CUTTING

For hand cutting, normal carpentry tools used for wood working machines, each of the circular saw, hand saw, fret saw, etc, shall be used. The tools shall be kept sharp and free from swarf at all times. When working on machines, high-speed steel tools are preferable. For production runs, carbide-tipped saws and cutters give a smoother cut and longer life. The same feed speeds as for natural hard woods shall be used, but care should be taken at all times, not to force the cut. Cutter life will be improved if the cutter face angle is increased to approximately 40° and, where possible, the cutting angle decreased as compared to natural wood. A cutter speed of 6 000 rpm is recommended.

B-4 SAWS AND SAWING

Coarse rip saws shall not be used. Well sharpened, moderately set saws give consistently good results. Do not force the boards through the saw at unnecessarily high-feed speeds. This is the cause of tearing or break cut on the underside. Always cut veneered boards facing upwards. For clean fast cutting, always adjust the saw height so that only 12 mm protrudes above the material being sawn. For trenching or grooving across the boards dado should be used.

For sawing, high speed steel saws or carbide-tipped saws are recommended.

B-5 DRILLING

Drilling shall be effected by using standard bench, portable or pillar drilling machines. The conventional hand drill shall be used but the drill edge should be always kept sharp. The use of drills having an helix angle between 20° and 32° is recommended. Drills shall be kept free from swarf during drilling by backing out. When particularly clean cuts are required, spur type drills will give best results.

B-6 ROUTING AND MOULDING

B-6.1 Tungsten carbide-tipped cutters are recommended for long production runs. High speed steel cutters will produce good finishes but edge life between sharpening is limited. As in the case of sawing, moderate feed speeds shall be used.

B-6.2 Recommended spindle speeds for routers and spindle moulders are given below:

	Spindle Speeds, in rev/min for	
	Routers	Spindle Moulders
Tungsten carbide-tipped tools	18 000 to 24 000	9 000 to 12 000
High speed steel	13 000	4 500 to 6 000

B-7 SANDING

B-7.1 Sanding operations shall be carried out in the same manner as with natural timber. It should be remembered that there is no grain direction in carrying out this operation.

B-7.2 Drum Sanders

The following combination of papers is recommended for use with triple drum sanding machines:

First drum	No.1½ grade or 40 Grit open coat
Second drum	No. 1 grade or 50 Grit open coat
Third drum	No. 0 grade or 80 Grit closed coat

NOTE — The above recommendations are for general guidance and may be varied to suit the particular job requirement.

B-7.3 For hand sanding, generally compressive stones with grit size 50 to 80 will be found suitable.

B-8 APPLICATION OF PLASTIC LAMINATES

Most resin glues and contact adhesives are suitable for bonding plastic laminates to particle board, provided manufacturer's instructions are fully adhered to. Casein glues are not suitable.

B-9 JOINERY WORK

B-9.1 Particle board is a composite board panel and cutting asymmetrically for any joinery is not recommended, unless the composite joint is again symmertrical. In case of three-layer boards and veneered particle boards, the strength of the board is made up of all the layers and balanced. Therefore, where joints are to be effected, cutting shall be done keeping a symmetry about the centre. Edge-joining by tongue and groove method is possible if a separate tongue of wood is provided. But joint shall be done with a backing strip of wood or metal or other metal fixtures like I-sections, corrugated pins or other connectors. Lap joint or level joint shall be done with the use of an adhesive for holding tacks and screws, but the joints shall be symmetrical about the centre. Mortise and tenon joints shall not be used for the ends. However, the surface may be cut through and end to surface joints are possible. For edge to edge joining, dove-tail joint, finger joint, lap joint, mitre joint, etc, are all possible, provided the composite nature of the joint is kept symmetrical. Cutting for joints shall be with sharp tools and machine-cutting shall be only with high-speed machines. The joints may be fixed by conventional carpenter's glues combined with holding tacks, pins, rivets, screws or nails.

B-9.2 Veneered type of particle boards require particular care to see that the composite nature of the boards is preserved. If one surface of the board is to be cut, it should be so done that the assembled components again develop symmetry around the central axis.

B-10 SCREWING AND NAILING

B-10.1 The nail and screw holding properties on the surface side of the particle boards are generally as much as that of the ordinary wood of the same density. However, at the edges, particle boards have lower nail and screw-holding strength than wood. It is, therefore, necessary that when screws and nails are driven from the edges, these should be of greater lengths, usually 20 percent more than for normal wood; and diameter slightly less. Holes shall be drilled for screws according to the values as follows.

Screw Size	*Pilot Drill Size*	*Depth of Edge*	*Depth of Edge*
	mm	mm	mm
Length × Screws Designation No.			
12 mm × 4-5 (2.74-3.10 mm)	1.85	5	–
20 mm × 5 (3.10 mm)	1.85	6	–
20 mm × 7 (3.81 mm)	2.20	6	–
25 mm × 6 (3.45 mm)	2.20	10	10
25 mm × 7 (3.81 mm)	2.30	10	10
30 mm × 6-7 (3.45-3.81 mm)	2.20	10	10
40 mm × 7-8 (3.81-4.17 mm)	2.30	–	19

B-10.2 Dipping the nails or the screws in ordinary carpentry glue before driving will increase the holding strength. It is always advisable to edge larger panels, where used, as doors with wood edge strips since they are liable to constant movement and vibration which loosen the screws.

B-11 LIPPING AND BEADING

Lipping and beading of wood particle board shall be done by the conventional method either with a veneer or with wood moulding or plastic moulding. Use of carpenter's glue and conventional holding tacks or nails or screws are recommended. Metal beading, if required, shall be done with a suitable glue which will hold metal to wood.

B-12 GLUING

B-12.1 The best results are obtained with glue having a low moisture content. These include, urea formaldehyde, phenolic type glues, PVA, resourcinal and spirit-based contact adhesives. Animal glues may be used satisfactorily, but it is essential that a thick mix is prepared and used hot.

B-12.1.1 In all cases, the manufacturer's instructions should be followed implicitly. Casein glues are not recommended.

B-13 PAINTING, VARNISHING, POLISHING AND PRINTING

B-13.1 Particle boards may be painted, varnished or polished by the conventional methods. However, proper preparation of the surface and filling is necessary. The filler, only sufficient to fill the grain, shall be applied with broad knife or scraper, pressing well into the pores of the board. On carefully rubbing down and thoroughly drying, a perfect surface for decorating will be obtained. Dusting, sealing, staining and filling operations are similar to those used in conventional woodwork. When treating both surfaces of the panels in an exposed position, the treatment shall be done simultaneously on both sides. It is recommended that the edges of the boards are heavily sealed before painting. Normally, the edges of the boards are covered by lipping.

B-13.2 Particle boards may be veneered with commercial or decorative veneer by use of any glue mentioned in **B-12.1**, and with conventional methods.

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