IS 710 (2010): Marine Plywood -Specification [CED 20: Wood and other Lignocellulosic products]

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भारतीय मानक

समुद्री उपयोग के लिए प्लाईवुड — विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

MARINE PLYWOOD — SPECIFICATION

(Second Revision)

ICS 79.060.10

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

January 2010 **Price Group 5**

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.

Plywood used in construction, repair and maintenance of marine and river craft is required to withstand rigorous conditions involving changes in temperature, humidity and alternate wetting and drying. In addition, they also need to withstand attack by marine organisms. Plywood used for general purposes is found to be unsuitable for such applications. The standard on marine plywood was first published in 1957. The method of manufacture of marine plywood had been specifically stated in the standard so that the resulting plywood is capable of withstanding the rigorous conditions which marine plywood may have to withstand.

The standard was first revised in 1976. In the first revision, details of methods of tests were omitted and cross-references were given to the relevant methods of tests in IS 1734 (Parts 1 to 20) : 1983 'Methods of test for plywood'.

This standard is based on the developments that have taken place and the experience gained in manufacture and use of the product over the years, the following modifications have been made:

a) Provision for the use of plantation timber species of poplar, eucalyptus and silver oak, which have been found to be suitable for manufacture of marine plywood have been incorporated, keeping in view the scarce availability of timber from natural forests;
b) An alternate accelerated test method for water resistance test has been incorporated; and
c) A new test requirement on wet bending strength has been introduced.

In addition this standard also incorporates the amendments to the earlier version of the standard.

This standard contains clause **5.2.3.4** which calls for agreement between the purchaser and the manufacturer.

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 ECO-Mark criteria are 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.

In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

The composition of the Committee responsible for the formulation of the standard is given in Annex D.

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

MARINE PLYWOOD — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers requirements for materials, manufacture and performance of marine plywood suitable for the construction, repair and maintenance of marine and river craft, pontoons and the like.

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 indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 707 shall apply.

4 MATERIALS

4.1 Timber

4.1.1 The species of timbers to be used for the manufacture of face veneers, cores and cross bands of marine plywood shall be as given in Tables 1 and 2.

4.1.1.1 No alternative species of timber shall be used without the prior approval of the purchaser.

4.1.2 In selecting the species for the manufacture of plywood, it is recommended that as far as possible a single species of timber shall be used and where combinations of different species are used, care shall be taken to prevent incompatibility of the two species.

4.1.3 For ECO-Mark, only wood from sources other than natural forests such as wood from industrial and social forestry plantations and shade trees from tea and coffee estates shall be used for the manufacture of veneers.

4.2 Adhesive

4.2.1 The adhesives used for bonding the veneers shall be based on any suitable synthetic resin conforming to BWP Type of IS 848. Extender shall not be added to the adhesive by the plywood manufacturer. Fillers, if used, shall not exceed 10 percent by mass of solid content of the glue.

Table 1 Species of Timber for Face Veneers
(*Clause* 4.1.1)

Sl No.	Trade Name	Botanical Name	Abbreviation for Marking
(1)	(2)	(3)	(4)
i)	Birch	*Batula* spp.	BIR
ii)	Bonsum	*Phoebe* spp.	BON
iii)	Chaplash	*Artocarpus chaplasha*	CHP
iv)	Gurjan	*Dipterocarpus* spp.	GUR
v)	Hollock	*Terminalia myriocarpa*	HOL
vi)	Hollong	*Dipterocarpus macrocarpus*	HON
vii)	Mahogany	*Swietenia* spp.	MAO
viii)	Makai	*Shorea asamica* spp.	MAK
ix)	Maple	*Acer* spp.	MAP
x)	Mundani	*Acrocarpus fraxinifolius*	MUN
xi)	Mysore gum	*Eucalyptus tereticornis* (Eucalyptus)	MGU
xii)	Padauk	*Pterocarpus dalbergioides*	PAA
xiii)	Poon	*Calophyllum* spp.	POO
xiv)	Poplar	*Populus* spp.	POP
xv)	Rosewood	*Dalbergia latifolia*	ROS
xvi	Sandan	*Ougeinia oojeinensis* (Syn. *O. dalbergioides*)	SAD
xvii)	Silver oak	*Grevillea robusta*	SOA
xviii)	Sissoo	*Dalbergia sissoo*	SIS
xix)	Teak	*Tectona grandis*	TEA
xx)	Walnut	*Juglans regia*	WAL
xxi)	White ceder	*Dysoxylum malabaricum*	WCE

5 MANUFACTURE

5.1 Veneers

The veneers shall be either rotary cut or sliced. The veneers shall be reasonably smooth to permit an even spread of glue. The veneers shall be conditioned to a moisture content not exceeding 10 percent before bonding.

5.1.1 *Defects In Veneers*

The veneers to be used for the faces shall be free from

sapwood. Core veneers may contain sound knots, whose maximum dimension in any one direction do not exceed 50 mm, and open defects (split and check) provided such defects do not impair the smooth finish of the surface required for painting or staining. Dead knots shall not be permissible. Overlaps or pleats shall not be allowed.

Table 2 Species of Timber Suitable for Core and Cross-Bands
(*Clause* 4.1.1)

Sl No.	Trade Name	Botanical Name	Abbreviation for Marking
(1)	(2)	(3)	(4)
i)	Aini	*Artocarpus hirsutus*	AIN
ii)	Birch	*Betula* spp.	BIR
iii)	Bonsum	*Phoebe* spp.	BON
iv)	Champ	*Michelia* spp.	CHM
v)	Chaplash	*Artocarpus chaplasha*	CHP
vi)	Chickrassy	*Chukrasia velutina* (Syn. *C. tabularis*)	CHI
vii)	Gurjan	*Dipterocarpus* spp. (other than *D. macrocarpus*)	GUR
viii)	Hollock	*Terminaliu myriocarpa*	HOL
ix)	Hollong	*Dipterocarpus macroarpus*	HON
x)	Kathal	*Artocarpus heterophyllus* (Syn. *A. integrifolius*)	KAT
xi)	Mahogany	*Swietenia* spp.	MAO
xii)	Makai	*Shorea asamica* spp.	MAK
xiii)	Maple	*Acer* spp.	MAP
xiv)	Mango	*Mangifera indica*	MAN
xv)	Mullilam	*Zanthoxylum rhetsa* (Syn. *Fagara budrunga*)	MUI
xvi)	Mundani	*Acrocarpus fraxinifolius*	MUN
xvii)	Mysore Gum (Eucalyptus)	*Eucalyptus tereticornis*	MGU
xviii)	Nedunar	*Polyalthia* spp.	NED
xix)	Pali	*Palacquium eIliptioum*	PAL
xx)	Poplar	*Populus* spp.	POP
xxi)	Poon	*Calophyllum* spp.	POO
xxii)	Rosewood	*Dalbergia latifolia*	ROS
xxiii)	Sandan	*Ougeinia oojeinensis* (Syn. *O. dalbergioides*)	SAD
xxiv)	Silver oak	*Grevillea robusta*	SOA
xxv)	Sissoo	*Dalbergia sissoo*	SIS
xxvi)	Teak	*Tectona grandis*	TEA
xxvii)	Vellapine	*Vateria indica*	VEL
xxviii)	Walnut	*Juglans* spp.	WAL
xxix)	White ceder	*Dysoxylum malabaricum*	WCE

5.2 Assembly

5.2.1 *Glueing*

The glue shall be evenly spread and the veneers shall be securely cemented together without overlap. No unglued areas or starved joints shall be found on separation of veneers.

5.2.2 *Thickness of Veneers*

The thickness of veneers shall be uniform, within a tolerance of ±5 percent. Corresponding veneers on either side of the central plane of the board shall be of the same thickness and species, and shall be cut by the same method, that is, either all rotary cut or all sliced.

5.2.2.1 In the case of 3-ply boards, the thickness of the centre veneer (core) shall be at least equal to that of one of the face veneers, but shall not exceed the combined thickness of the two face veneers. In the case of multi-ply boards the thickness of any veneer shall not exceed twice the thickness of any other veneer in the same board.

5.2.3 *Joint in Veneers*

5.2.3.1 Veneers, which require to be jointed to form a ply, shall be spliced before assembly. All joints shall be cut square. Tapes, other than fusible tapes, shall not be used internally and when used for making edge joints or repairing splits in face veneers they shall be removed subsequently. Fusible tapes shall be such that they are converted in the process of manufacture, to an adhesive that complies with the test requirements applicable to the adhesive used for the manufacture of the plywood.

5.2.3.2 *Edge joints*

Edge joints in veneers shall be made on a tapeless splicer or by fusible tape and staggered not less than 25 mm as between any veneer and the next one with the same grain direction on both the faces.

5.2.3.3 *End joints*

End joints shall be permitted in all veneers forming the core ply and in the veneers of face plies of panels provided the length of such panels is over 2 m. All such joints shall be accurately scarfed with an inclination not steeper than 1 in 10 and bonded with an adhesive complying with the requirements specified in **4.2**.

5.2.3.4 *Scarf joints*

When sizes larger than available press size are required, boards to the required size shall be made with proper scarf joints through the thickness of the board, with the prior approval of the purchaser. The number and location of scarf joints shall be as agreed to between the purchaser and the manufacturer.

All scarf joints shall be bonded with the same adhesive used for the manufacture of the plywood and shall be made with an inclination not steeper than 1 in 10. The species of timber in corresponding plies of adjacent board scarfed together shall be the same.

5.2.4 *Grain Direction*

Unless otherwise specified by the purchaser and except in boards comprising an even number of plies, the direction of grain of the veneer in adjacent plies shall be at right angles to each other and that of the outer plies shall run parallel to the length of the sheet. In boards comprising an even number of plies the grain of the centre pair shall follow the same direction. In adjacent plies in which the grains are required to be at right angles to each other, a deviation not exceeding 10º may be permitted. In all cases the grain on both faces of the assembled boards shall run in the same direction. The grain of the veneer shall normally be parallel to the edges of rectangular boards, but other grain direction, for example diagonal, may be agreed to between the purchaser and the supplier.

5.3 Treatment

The board shall be given treatment by pressure impregnation with fixed type either water soluble or oil-based preservatives and having retention of a minimum of 12 kg/m^3 in case of CCA (copper-chrome-arsenic) or CCB (copper-chrome-boron) or ACC (acid-copper-chrome) compositions as specified in IS 10013 (Parts 1 to 3), respectively or 100 kg/m^3 in case of creosote or creosote-fuel oil composition as specified in Annex A of IS 5539, with adequate penetration.

5.4 Moisture Content

Finished plywood boards shall have moisture content of not less than 5 percent and not more than 15 percent at any time of the year depending on the part of the country where the test is carried out (*see* IS 287).

6 DIMENSIONS

6.1 The dimensions of plywood boards shall be as follows:

a) 2 400 mm × 1 200 mm
b) 2 100 mm × 1 200 mm
c) 1 800 mm × 1 200 mm
d) 2 100 mm × 900 mm
e) 1 800 mm × 900 mm

6.2 Thickness

The thickness of the plywood boards shall be 3 mm, 4 mm, 5 mm, 6 mm, 9 mm, 12 mm, 15 mm, 19 mm, 22 mm and 25 mm.

NOTE — Any other dimensions (length, width and thickness) as agreed to between the manufacturer and the purchaser may also be used.

6.3 Tolerances

Tolerance on the nominal sizes of finished boards shall be as given below:

Sl No.	*Dimension*	*Tolerance*
i)	Length	$^{+6}_{-0}$ mm
ii)	Width:	$^{+3}_{-0}$ mm
	a) Less than 6 mm	±10 percent
	b) 6 mm and above	± 5 percent
iii)	Edge straightness, *Max*	2 mm/1 000 mm or 0.2 percent
iv)	Squareness, *Max*	2 mm/1 000 mm or 0.2 percent

NOTE — Edge straightness and squareness shall be tested as per Annex B.

7 WORKMANSHIP AND FINISH

7.1 The face and back of the finished boards shall be free from checks, splits, gaps (subject to provisions given in **7.4**), blisters, harmful discolouration, any kind of decay, pleats and overlaps, insect holes, dead or loose knots and live knots whose maximum dimensions in any direction exceed 25 mm. The plywood shall be free from wrap.

7.2 Sound knots of diameter 25 mm and less shall be permitted provided the centre to centre distance between any two such knots is not less than 300 mm.

7.3 The face shall be free from any patches, but on the back, patches at distances of not less than 600 mm apart shall be permissible. The maximum dimension of any one patch shall be not more than 40 mm.

7.4 Splits, gaps and open joints shall not be permitted in core. These may be permitted in face provided the gap or opening does not exceed a width of 0.5 mm. If exceeding 0.5 mm this may be rectified by well fitted veneer inserts of a minimum width of 5.0 mm provided the grain of the veneer does not exceed in deviation by more than 10 percent from the grain direction of the surrounding veneer.

7.5 The finish shall be reasonably smooth and sanding shall be given to both the sides if so required by the purchaser.

7.6 The minimum width of the veneers used in face and back of the boards shall be not less than 75 mm except at the edges, where it may be less. The edge of the board shall be trimmed square.

8 SAMPLING

The method of drawing representative samples and the criteria for conformity shall be as prescribed in IS 7638.

9 TESTS

9.1 Test pieces cut from each of the boards selected as specified in **8** shall be subjected to tests stipulated under **9.1.1** to **9.1.8**.

9.1.1 *Moisture Content*

The moisture content of test pieces cut from each board selected as under **9.1** shall not exceed 15 percent nor be less than 5 percent when determined by the method described in IS 1734 (Part 1).

9.1.2 *Glue Adhesion in Dry State*

9.1.2.1 *Glue shear strength*

When tested for glue adhesion by the method described in IS 1734 (Part 4) the average failing load shall be not less than 1 350 N and no individual value shall be less than 1 100 N.

9.1.2.2 *Adhesion of plies*

The adhesion of plies shall be tested by forcibly separating the layers. The veneers shall offer appreciable resistance to separation and the fractured samples shall show some adherent fibres distributed more or less uniformly. Adhesion may also be tested by knife test method described in IS 1734 (Part 5).

NOTE — In case, a definite result is not obtainable by the method described in IS 1734 (Part 4), the result of knife test described in IS 1734 (Part 5) shall be considered as decisive. In case of even number of plies where the grains of central plies follow the same direction the result as obtained from knife test shall be considered final.

9.1.3 *Water Resistance Test*

The specimens shall be subjected to any one of the tests specified in **9.1.3.1** and **9.1.3.2**. The test specimen for carrying out test as per **9.1.3.1.1**, shall be as specified in IS 1734 (Part 5). Six test pieces each approximately 250 mm × 100 mm, shall be cut from any position in the board such that the grain of the face veneer is parallel to the length of the piece for carrying out test as per **9.1.3.1.2**.

9.1.3.1 The specimens shall be kept submerged in a pan of boiling water for a period of 72 h. The period of 72 h of boiling may be a continuous period or an aggregate of smaller periods of boiling, if the test piece is left in cold water between these smaller periods. These test pieces shall then be removed from the boiling water and cooled down to room temperature by plunging them in cold water. These test specimens, while still in wet condition, shall be subjected to tests described under **9.1.3.1.1** and **9.1.3.1.2**.

9.1.3.1.1 *Glue shear strength*

When tested for glue shear strength by the method described in IS 1734 (Part 4), the average failing load shall be not less than 1 000 N and no individual value shall be less than 800 N.

9.1.3.1.2 *Adhesion of plies*

The adhesion of plies shall be tested by forcibly separating the layers. The veneers shall offer appreciable resistance to separation and the fractured sample shall show some adherent fibres distributed more or less uniformly. Adhesion may also be tested by knife test method described in IS 1734 (Part 5).

NOTE — In case a definite result is not obtainable by the method described in IS 1734 (Part 4), the result of knife test described in IS 1734 (Part 5) shall be considered as decisive. In case of even number of plies where the grains of central plies follow the same direction the result as obtained from knife test shall be considered final.

9.1.3.2 The specimens shall be subjected to constant steam pressure for a definite duration inside a vacuum steam pressure test apparatus as described in Annex C and thereafter subjected to tests as per **9.1.3.1.1** and **9.1.3.1.2**.

9.1.4 *Tensile Strength*

The tensile strength when determined by the method described in IS 1734 (Part 9) shall comply with the following values:

a) Tensile strength shall be not less than 42.0 N/mm^2 in the direction parallel to grain direction of the face veneers,
b) Tensile strength shall be not less than 25.0 N/mm^2 in the direction of right angles to the grain direction of the face veneers, and
c) Sum of the tensile strength in both directions shall be not less than 84.5 N/mm^2.

If the plywood contains scarf joints, half the specimen subjected to testing shall contain the joint.

9.1.5 *Mycological Test*

The test for resistance to micro-organism shall be carried out by the method described in IS 1734 (Part 7). When tested the test piece shall show no appreciable signs of separation at the edges of the veneers and shall comply with the requirements specified in **9.1.3**.

9.1.6 *Static Bending Strength*

Three test specimens taken in each direction from the sample of plywood, when tested in accordance with IS 1734 (Part 11) shall have an average and a minimum individual value of modulus of elasticity and modulus of rupture not less than the values specified in Table 3.

9.1.7 *Wet Bending Strength*

Three test specimen taken in accordance with IS 1734 (Part 11) and from each direction of a sample of plywood, shall be subjected to cyclic test for 3 cycles, each cycle consisting of 4 h boiling in water and 16 h drying in an oven at 65 ± 2°C or of 72 h of boiling. The samples shall be then kept in water at 27 ± 2°C for 1 h and thereafter tested as per IS 1734 (Part 11). The duration of boiling/drying in oven may be split

into shorter intervals by keeping the samples in room temperature at 27 ± 2°C in water (in case of boiling) or in air (in case of drying). The sample shall have an average and minimum individual modulus of elasticity and modulus of rupture not less than the values specified in Table 4.

Table 3 Minimum Values for MOE and MOR
(*Clause* 9.1.6)

Sl No. (1)	Requirement (2)	Along the Face Grain (3)	Across the Face Grain (4)
i)	MOE, N/mm^2:		
	a) Average	7 500	4 000
	b) Minimum individual	6 700	3 600
ii)	MOR, N/mm^2:		
	a) Average	50	30
	b) Minimum individua	45	27

9.1.8 *Retention of Preservative*

When tested as per IS 2753 (Parts 1 and 2) the plywood shall have a retention of preservative as specified in **5.3**.

Table 4 Minimum Values for MOE and MOR (Wet Bending Strength)
(*Clause* 9.1.7)

Sl No. (1)	Requirement (2)	Along the Face Grain (3)	Across the Face Grain (4)
i)	MOE, N/mm^2:		
	a) Average	3 750	2 000
	b) Minimum individual	3 400	1 800
ii)	MOR, N/mm^2:		
	a) Average	25	15
	b) Minimum individual	22	13

10 ADDITIONAL REQUIREMENTS FOR ECO-MARK

10.1 General Requirements

10.1.1 The plywood shall conform to the requirements of quality specified in this standard.

10.1.2 The manufacturer shall produce to BIS environmental consent clearance from the concerned State Pollution Control Board as per the provisions of *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.

10.2 Specific Requirements

The plywood 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.

11 MARKING

11.1 Each plywood board shall be legibly and indelibly marked or stamped with the following particulars along with such other marks as the purchaser may stipulate at the time of placing order:

a) Manufacturer's name, initials or recognized trade-mark, if any;
b) Year of manufacture;
c) Abbreviations indicating the species of timber used in each ply, as indicated in col 4 of Tables 1 and 2;
d) Batch number; and
e) Criteria for which the plywood has been labelled as ECO-Mark.

11.2 BIS Certification Marking

The product may also be marked with the Standard Mark.

11.2.1 The use of the Standard Mark is governed by the provisions of *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 Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

12 TENDER SAMPLE

Where samples are required to be tendered, three samples, each not less than 90 mm × 60 mm in size shall be submitted by the supplier, and these samples, if the tender is accepted, shall constitute the standard as regards the type of timber, quality and finish.

ANNEX A
(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
287 : 1993	Permissible moisture content of timber used for different purposes — Recommendations (*third revision*)
707 : 1976	Glossary of terms applicable to timber technology and utilization (*second revision*)
848 : 2006	Specification for synthetic resin adhesives for plywood (phenolic and aminoplastic) (*second revision*)
1734	Methods of test for plywood:
(Part 1) : 1983	Determination of density and moisture content (*second revision*)
(Part 4) : 1983	Determination of glue shear strength (*second revision*)
(Part 5) : 1983	Test for adhesion of plies (*second revision*)
(Part 7) : 1983	Mycological test (*second revision*)
(Part 9) : 1983	Determination of tensile strength (*second revision*)
(Part 11) : 1983	Determination of static bending strength (*second revision*)
2753	Methods for estimation of preservatives in treated timber and in treating solutions:
(Part 1) : 1991	Determination of copper, arsenic, chromium, zinc, boron, creosote and fuel oil (*first revision*)
(Part 2) : 1991	Determination of copper (in copper organic preservative salt) and pentachlorophenol (*first revision*)
5539 : 1969	Specification for preservative treated plywood
7638 : 1999	Wood/lignocellulosic based panel products — Methods of sampling (*second revision*)
10013	Specification for water soluble type wood preservative:
(Part 1) : 1981	Acid-copper-chrome (ACC) wood preservative
(Part 2) : 1981	Copper-chrome-arcenic (CCA) wood preservative
(Part 3) : 1981	Copper-chrome-boron (CCB) wood preservative

ANNEX B
(*Clause* 6.3)

METHOD OF TEST FOR EDGE STRAIGHTNESS AND SQUARENESS

B-1 PROCEDURE FOR EDGE STRAIGHTNESS

The straightness of the edges and ends of plywood shall be verified against a straight edge not less than the full length of the plywood. If the edge on the end of the plywood is convex, it shall be held against the straight edge in such a way as to give approximately equal gap at each end. The largest gap between the straight edge and the edge shall be measured to the nearest millimetre and recorded.

B-2 PROCEDURE FOR SQUARENESS

The squareness of plywood shall be checked with a square with arms 500 mm long, by applying one arm of the square to the veneered particle board. The maximum width of the gap shall be recorded.

ANNEX C
(*Clause* 9.1.3.2)

ALTERNATE METHOD FOR WATER RESISTANCE TEST

C-1 Pure water shall be filled in boiler of the vacuum steam pressure test (VPT) apparatus as shown in Fig.1 to the marking of minimum water level on glass water level indicator and the boiler shall be switched on with the valve connecting the boiler and main chamber in closed condition. The test specimens shall be placed in the working (main) chamber and shall be closed air tight with cover. The vacuum pump shall then be switched on and vacuum inlet valve shall be kept in open condition. The steam release valve shall be kept in closed condition. After the required vacuum of 110 ± 10 kPa has been created inside the main chamber, the vacuum pump shall be switched off, the vacuum inlet valve closed and boiler valve connected to main chamber opened. The time shall be noted the moment the steam pressure in the main chamber reaches 220 kPa and same pressure shall be maintained for 6 h. The system and boiler then shall be switched off. The steam release valve and vacuum release value shall slowly be opened until the steam in the chamber is completely evacuated. The samples shall then be kept in water for 1 h at 27 ± 2°C. The samples shall thereafter be tested as per **9.1.3.1** and **9.1.3.2**.

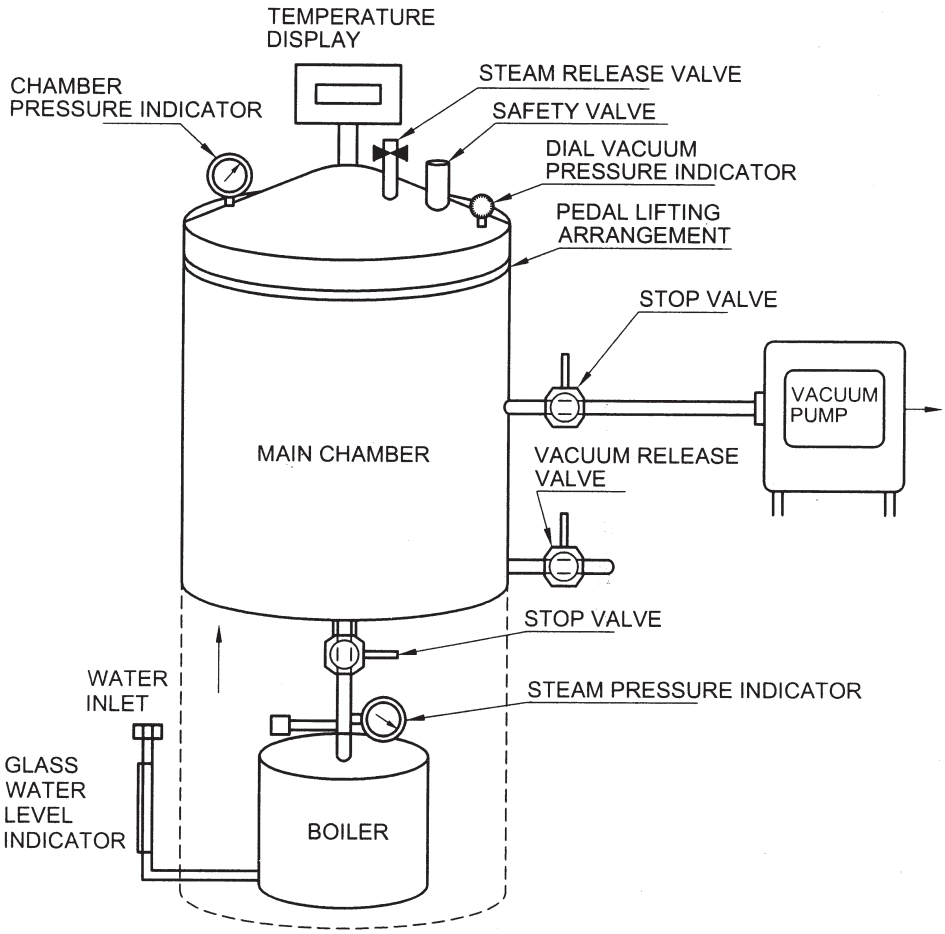

FIG. 1 VACUUM STEAM PRESSURE TEST (VPT) APPARATUS

ANNEX D
(*Foreword*)

COMMITTEE COMPOSITION

Wood and Other Lignocellulosic Products Sectional Committee, CED 20

Organization	*Representative(s)*
Indian Plywood Industries Research & Training Institute, Bangalore	Dr C. N. Pandey (***Chairman***)
Bamboo Society of India, Bangalore	Shri N. S. Adkoli Shri A. S. Sadashivaiah (*Alternate*)
Building Materials & Technology Promotion Council, New Delhi	Shri J. K. Prasad Shri A. K. Tiwari (*Alternate*)
Central Building Research Institute, Roorkee	Dr L. K. Agarwal Dr B. S. Rawat (*Alternate*)
Central Public Works Department, New Delhi	Shri Surinder Kumar Shri S. K. Verma (*Alternate*)
Century Plyboard India Ltd, Kolkata	Shri Ajay Baldawa Shri Nikhilesh Roy Chowdhury (*Alternate*)
Coir Board, Bangalore	Shri M. Sudhakaran Pillai Shri R. Vasu Dev (*Alternate*)
Directorate General of Supplies & Disposals, Hyderabad	Shri M. Gangaraju
Directorate of Standardization, New Delhi	Dr (Shrimati) Indu Gupta Shri G. K. Sharma (*Alternate*)
Engineer-in-Chief's Branch, New Delhi	Shri N. B. Shelar Shr Sanjay Mittal (*Alternate*)
Federation of Indian Plywood & Panel Industry, New Delhi	Shri Jayadeep Chitlangia Shri Ajay Baldawa (*Alternate*)
Forest Research Institute, Dehra Dun	Director
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