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Indian Standard

PLYWOOD FOR GENERAL PURPOSES — SPECIFICATION

(Third Revision)

भारतीय मानक

सामान्य प्रयोजनों के लिए प्लाईवुड — विशिष्टि

(तीसरा पुनरीक्षण)

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Wood Products Sectional Committee, CED 20

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards on 21 December 1989, after the draft finalized by the Wood Products Sectional Committee had been approved by the Civil Engineering Division Council.

Indian Standard Specification for commercial (common) and moisture proof plywood (tentative) (IS 303 : 1951) published in 1951. This was subsequently revised in 1960 and 1975. This is the third revision of the standard and in this revision, care has been taken to utilize the depleting wood resource judiciously.

In the second revision of the standard, namely, IS 303 : 1975 provided for four grades of plywood based on the type of adhesive used and ten types of plywood depending upon the visual features of face and back thus making a total of as many as 40 classes of plywood.

In this revision, BWR and CWR grades are deleted and the WWR is replaced by moisture resistant or MR grade with temperature of water under normal atmospheric pressure in which test piece shall be immersed brought down to 60 $\pm$ 2°C from 70 $\pm$ 2°C. This revision deletes face 'A' and 'D' quality of plywood, and retains face 'B' and 'C' now renamed as 'A' and 'B' thereby permitting in all 3 types of plywood based on appearance.

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

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 in this standard.

Indian Standard

PLYWOOD FOR GENERAL PURPOSES — SPECIFICATION

(Third Revision)

1 SCOPE

1.1 This standard covers the requirements of different grades and types of plywood used for general purposes.

2 REFERENCE

2.1 The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.0 For purpose of this standard, the definitions given in IS 707 : 1976 shall apply.

4 GRADES

4.1 Plywood for general purposes shall be of the following two grades, depending upon the bond strength developed by the adhesive used for bonding the veneers:

a) Boiling water resistant or BWR Grade, and

b) Moisture resistant or MR Grade.

4.1.1 These shall be manufactured in accordance with **6.1** and **6.2**. The grades shall conform to the general requirements given in **7** and the test requirements laid down in **11**.

5 TYPES BASED ON CLASSIFICATION BY APPEARANCE

5.1 Plywood for general purposes shall be classified into three types, namely, AA, AB and BB based on the quality of the two surfaces, namely, A and B in terms of general permissible defects. The type of plywood shall, therefore, be designated by the kind of surfaces of the panels. The better quality surface shall be called 'face', and the opposite side shall be called 'back'. If the face and the back are of the same quality, they are not distinguished. The type of plywood shall denote first the quality of face followed by the quality of back. For example, Type AA shall have both surfaces of quality A, Type AB shall have face of quality A and the back of quality B and Type BB shall have both the surfaces of quality B.

5.2 The quality requirement of each of the surfaces mentioned under **5.1**, shall conform to the requirements given in Table 1. However, the maximum number of categories of defects permitted on any one surface of the panel shall be restricted in accordance with the requirements laid down in Table 2.

6 MATERIALS

6.1 Timber

Any species of timber may be used for plywood manufacture. However, a list of species, for the manufacture of plywood is given in Annex B for guidance.

6.2 Adhesive

The adhesive used for bonding the veneers in different grades of plywood shall be the corresponding type of adhesive as specified in IS 848 : 1974.

6.2.1 Extenders conforming to IS 1508 : 1972 may be used with the synthetic resin adhesive (aminoresins). However, synthetic resin adhesives (aminoresin) when extended by more than 25 percent shall contain suitable preservative chemicals in sufficient concentration to satisfy the mycological test described in **11.2.2**.

7 MANUFACTURE

7.1 The veneers for all the grades shall be either rotary cut or sliced. The veneers shall be sufficiently smooth to permit an even spread of adhesive. Treatment as specified below shall be given to the plywood either at the veneer stage or after converting the veneers into boards.

7.1.1 *Treatment*

Veneers from non-durable species and sapwood of all species when used for plywood manufacture shall be soaked in 1·25 percent solution of boric acid or 1·9 percent solution of borax at a temperature of 85-90°C for a period of 10-40 minutes depending upon the thickness of the veneers or the veneers may be dipped in 2 percent solution of boric acid or 3 percent borax solution for 2 minutes and block stacked at least for two hours. Alternatively, the veneers may be soaked at an ambient temperature in a mixture of 0·5 percent solution

Table 1 Quality Requirements of Plywood for General Purposes

(*Clause* 5.2)

Sl No.	Defect Categories	Types of Surfaces	
		A	B
(1)	(2)	(3)	(4)
i)	Blister	Nil	Nil
ii)	Checks	Individual check not more than 50 mm in length and the total length not more 300 mm/m²	Individual check not more than 100 mm in length and the total length not more than 1 000 mm/m²
iii)	Discoloration	Nil	5 percent
iv)	Dote	5 cm/m²	15 cm/m²
v)	Insect hole	Scattered up to 12 holes/m²	Scattered up to 24 holes/m²
vi)	Joints	One joint for every multiple of 200 mm provided no individual piece is less than 100 mm in width	No restriction
vii)	Knots (dead)	2 up to 12 mm dia/m²	4 up to 20 mm dia/m²
viii)	Pin knots (dead)	2/m²	6/m²
ix)	Pin knots (Live)	No restriction	No restriction
x)	Knots (tight)	6 up to 25 mm dia/m²	No restriction
xi)	Patches	4 patches/m² provided they are all tight patches and do not mar the appearance	Any number provided they are all tight patches and do not mar the appearance
xii)	Splits	2 splits, each not more than 1 mm wide and length not more 100 mm provided they are filled with suitable filler	3 splits, each not more than 4 mm wide and length not more 150 mm provided they are filled with suitable veneer inserts. Splits up to 25 mm long and 0·8 mm wide may be ignored provided they are suitably filled with a filler
xiii)	Swirl	Unlimited, provided they do not mar the appearance	No restriction

of sodium pentachlorophenate (Na PCP) and 1·5 percent of borax in water, for a period of 2 minutes and then stacked for at least half an hour before drying.

Table 2 Permissible Categories of Defects

(*Clause* 5.2)

Type of Surface	Maximum Number of Categories of Permissible Defects per sq metre
A	3
B	5

For BWR grade of plywood bonded with synthetic resin adhesive, the preservative may be given conveniently after boards come out of the press, while still hot or the treatment given to the veneers before bonding.

For BWR grade, fixed type of preservative may be used subject to the agreement between the manufacturer and the user according to IS 5539 : 1966.

7.2 Assembly

7.2.1 *Thickness*

The thickness of all veneers shall be uniform within a tolerance of ±5 percent. Corresponding veneers on either side of the central ply and those of face and back veneers shall be of species having similar physical and mechnical properties, such as, density, modulus of electricity, shrinkage, etc, to ensure balanced construction.

7.2.2 *Joints in Veneers*

Veneers that require to be joined to form a ply shall be spliced (edge jointed) before assembly. All joints shall be cut square. They may be taped on the face of the outer veneers in which case the tape shall be removed at a later stage, and metal clips or staples, if used, shall be removed. Perforated tapes may be used on the glue side of the veneers. In assembly, joints in veneers running in the same direction shall be staggered. End joints and butt joints shall not be permitted for any of the surfaces.

7.2.3 *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 longer side of the board. In boards comprising even number of plies, the grain of the centre pair shall follow the same direction. In adjacent plies, the grain should be at right angles to each other. However, a deviation not exceeding 10° may be permitted. In all cases, the grain on both faces of the assembly boards shall run in the same direction.

7.2.4 *Scarf Joints*

When sizes larger than the available press sizes are required, scarf joints through the thickness of the board are permitted. All scarf joints shall be bonded with the same or a better adhesive than the one used for the manufacture of plywood, and shall be made with an inclination not greater than 1 in 12.

7.2.5 *Permissible Defects*

7.2.5.1 Gaps in cores and cross-bands may be permitted except for 3 ply plywood provided the width of the gap does not exceed 1 mm in case of and 2 mm in case of plywood of more than 5 ply and provided such gaps, if more than one, shall be spaced not less than 80 mm away from each other and are staggered not less than 50 mm away as between ply, the next ply having the same grain direction.

7.2.5.2 Splits in cores and cross-bands may be permitted to an extent of 2 per core or cross-band.

7.2.5.3 Overlap shall not be permitted.

8 DIMENSIONS AND TOLERANCES

8.1 The dimensions of plywood boards shall be as given in IS 12049 : 1987.

NOTE — Any other dimension as agreed to between the manufacturer and the purchaser may be used.

8.2 Thickness

Unless otherwise specified, thickness of plywood boards shall be as specified in Table 3. The thickness shall be measured up to one place of decimal.

8.3 Tolerances

The following tolerances on the nominal sizes of finished boards shall be permissible:

Dimension	*Tolerance*
a) Length	: + 6 mm − 0 mm
b) Width	: + 3 mm − 0 mm
c) Thickness	
1) less than 6 mm	: ± 10%
2) 6 mm and above	: ±5%
d) Squareness	: 0·2%
e) Edge straightness	: 0·2%

Table 3 Thickness of Plywood Boards

(*Clause* 8.2)

Board	Thickness mm	Board	Thickness mm
(1)	(2)	(1)	(2)
3 ply	3, 4, 5, 6	9 ply	12, 15, 16, 19
5 ply	5, 6, 8, 9	11 ply	19, 22, 25
7 ply	9, 12, 15, 16	Above 11 ply	As ordered

9 WORKMANSHIP AND FINISH

9.1 The plywood boards shall be of uniform thickness within the tolerance limits specified under 8.3.

9.2 The faces of plywood boards shall be reasonably smooth and face veneers shall be of reasonably uniform thickness. Slight sanding may be given to rough boards in order to make them reasonably smooth. The squareness and edge straightness of the board when measured according to the procedure given in Annex C shall be as given in 8.3.

10 SAMPLING

10.1 The method of drawing representative samples and the criteria for conformity shall be as prescribed in IS 7638 : 1975.

11 TESTS

11.1 Six test pieces, cut from each of the boards selected under 10.1 shall be subjected to the tests specified in 11.2 and 11.3.

11.2 Glue Adhesion

Glue adhesion shall be deemed satisfactory if the plywood complies with the requirements specified in 11.2.1, 11.2.2 and 11.2.3.

11.2.1 *Glue Shear Strength in Dry State*

The plywood when tested in accordance with IS 1734 (Part 4) : 1983 shall have an average and a minimum individual shear strength not less than the values specified in Table 4 against each grade.

11.2.2 *Mycological Test*

The plywood when tested in accordance with IS 1734 (Part 7) : 1983 shall have an average and a minimum individual shear strength, not less than the values shown in Table 4 against each grade.

11.2.3 *Water Resistance Test*

The plywood when tested in accordance with IS 1734 (Part 6) : 1983 shall have an average and a minimum individual shear strength, not less than the values shown in Table 4 against each grade.

11.3 Moisture Content

The plywood when tested in accordance with IS 1734 (Part 1) : 1983 shall have a moisture content not less than 5 percent and not more than 15 percent.

11.4 For the purpose of tests specified in **11.2** and **11.3**, the mean of all the observations and the minimum individual value of the observations shall be reported in the form given in Annex D.

Table 4 Average and Minimum Individual Shear Strength for Plywood

(*Clauses* 11.2.1, 11.2.2 *and* 11.2.3)

Sl No.	Grade	Shear Strength, *Min* (N)		
		Dry State	Mycological	Water Resistance
(1)	(2)	(3)	(4)	(5)
i)	BWR			
	Minimum Average	1 350	1 000	1 000
	individual	1 100	800	800
ii)	MR			
	Minimum Average	1 000	800	800
	individual	800	650	650

11.5 Retest

If the samples selected as specified in **10.1** are found not to be fully complying with the requirements of **11.2** and **11.3**, a further similar set of samples shall be taken at random from the same batch and subjected to the tests. If any of the samples in the second set is also found not to comply fully with the requirements of test, all the boards in the batch represented by the samples shall be rejected.

11.6 Other Tests

For testing any other mechanical property of general purpose plywood, subject to agreement between the purchaser and the supplier, reference shall be made to the provisions of IS 1734 (Parts 1 to 20) : 1983.

12 MARKING

12.2 Each plywood board shall be legibly and indelibly marked or stamped with the following:

a) Indication of the source of manufacture,

b) Year of manufacture,

c) Batch No., and

d) The grade and type as follows:
BWR/AA, BWR/AB, BWR/BB,
MR/AA, MR/AB, MR/BB

12.2 All markings shall be done on the face of the board near one corner.

13 DELIVERY

13.1 Unless otherwise specified, the plywood boards shall be delivered in a clean condition and shall be suitably packed according to normal trade.

ANNEX A

(*Clause* 2.1)

LIST OF INDIAN STANDARDS REFERRED IN THIS STANDARD

IS No.	*Title*	*IS No.*	*Title*
707 : 1976	Glossary of terms applicable to timber and timber products (*second revision*)	1734 (Part 4) : 1983	Methods of test for plywood : Part 4 Determination of glue shear strength (*second revision*)
848 : 1974	Specification for synthetic resin adhesives for plywood (phenolic and aminoplastic) (*first revision*)	1734 (Part 6) : 1983	Methods of test for plywood : Determination of water resistance
1508 : 1972	Specification for extenders for use in synthetic resin adhesive (urea-formaldehyde) for plywood (*first revision*)	1734 (Part 7) : 1983	Methods of test for plywood : Part 7 Mycological test (*second revision*)
1734 (Part 1) : 1983	Methods of test for plywood : Part 1 Determination of density and moisture (*second revision*)	7638 : 1975	Methods of sampling of plywood
		12049 : 1987	Dimension and tolerances relating to wood based panel materials

ANNEX B

(*Clause* 6.1)

TIMBER SPECIES OF PLYWOOD

NOTE — Species of timber to be treated (*see* 71..1) are indicated by dagger (†).

Sl No.	*Trade Name*	*Botanical Name*	*Abbreviation*
1.	Aini	*Artocarpus hirsutus*	AIN
2.	†Alder	*Alnus nitida*	ALD
3.	†Alder	*Alnus* spp.	ALD
4.	Amari	*Amoora* spp.	AMA
5.	†Amra	*Spondias* spp.	AMR
6.	Arjun	*Terminalia arjuna*	ARJ
7.	†Bahera	*Terminalia bellerica*	BAH
8.	†Banati	*Lophopetalum wightianum*	BAN
9.	†Birch	*Betula*, spp.	BIR
10.	Bonsum	*Phoebe* spp.	BON
11.	†Carallia	*Carallia brachiata* (Syn. *Carallia integerrima*)	CAR
12.	Champ	*Michelia* spp.	CHM
13.	Chaplash	*Artocarpus Chaplasha*	CHP
14.	†Chatian	*Alstonia scholaris*	CHT
15.	Chikrassy	*Chukrasia tabularis*	CHI
16.	†Chilauni	*Schima wallichii*	CHL
17.	Cinnamon	*Cinnamomum cecicodaphne*	CIN
18.	†Debdaru	*Polyalthia* spp.	DEB
19.	†Dhup	*Canarium* spp.	DHU
20.	†Didu	*Salmalia insignis*	DID
21.	†Dillenia	*Dillenia* spp.	DIL
22.	Ebony	*Diospyros* spp.	EBO
23.	Elm	*Ulmus wallichiana*	ELM
24.	Gamari	*Gmelina arborea*	GAM
25.	†Garuga	*Garuga pinnata*	GAU
26.	†Gokul	*Ailanthus grandis*	GOK
27.	Gurjan	*Dipterocarpus* spp.	GUR
28.	†Gutel	*Trewia nudiflora*	GUT
29.	Haldu	*Adina cordifolia*	HAL
30.	Hathipaila	*Pterospermum acerifolium*	HAT
31.	†Hollock	*Terminalia myriocarpa*	HOL
32.	Hollong	*Dipterocarpus macrocarpus*	HON
33.	Indian Oak	*Quercus semecarpifolia*	IOA
34.	Indian Oak	*Quercus dilatata*	IOA
35.	Indian Oak	*Quercus serrata*	IOA
36.	Jaman	*Syzygium* spp.	JAM
37.	†Jhingan	*Lannea coromandelica* (Syn: *Lannea grandis*)	JHI
38.	Jutili	*Altingia excelsa*	JUT
39.	†Kadam	*Anthocephalus cadamba*	KAD
40.	†Kanju	*Holoptelea integrifolia*	KAN
41.	†Karani	*Cullenia rosayroana* (Syn. *cullenia excelsa*)	KAR
42.	Kathal	*Artocarpus heterophyllus*	KAT
43.	Kindal	*Terminalia paniculata*	KIN
44.	Kokko	*Albizia lebbeck*	KOK
45.	†Lampati	*Duabanga grandiflora*	LAP
46.	Laurel	*Terminalia tomentosa*	LAU
47.	†Litsa	*Liteasa polyantha*	LIT
48.	†Machilus	*Machilus* spp.	MAC
49.	Mahogany	*Swietenia* spp.	MAG
50.	†Maina	*Teterameles nudiflora*	MAI
51.	Makai	*Shorea assamica*	MAK
52.	†Mango	*Mangifera indica*	MAN
53.	Maple	*Acer* spp.	MAP
54.	Menudito	*Enterolobium* spp. (Exotic)	MEN (ENT)
55.	Mullilam	*Fagara budrunga* (Syn. *Zanthoxylum rhetsa*)	MUI
56.	†Mundani	*Acrocarpus fraxinifolius*	MUN
57.	†Narikel	*Pterygota alata*	NAR

Sl No.	Trade Name	Botanical Name	Abbreviation
58.	Neem	*Azadirachta indica*	NEE
59.	Nodunari	*Mansonia* spp.	NED
60.	Pali	*Paiaquium ellipticum*	PAL
61.	Persian Lilach	*Melia azadarach*	PLI
62.	†Piney	*Kingiodendron pinnatum* (Syn. *Hardwickia pinnata*)	PIN
63.	Pitraj	*Aphanamixis polystachya*	PIT
64.	Poon	*Colopyllum* spp.	POO
65.	Poplar	*Populus ciliata*	POP
66.	Poplar	*Populus deltoides*	POP
67.	†Pula	*Kydia calycina*	PUL
68.	Pussur	*Xylocarpus molluccensis*	PUS
69.	Pyinma	*Lagerstroemia hypoleuca*	PYI
70.	Red Bombwe	*Planchonia valida* (Syn. *Planchonia andamanica*)	RBO
71.	†Red Dhup	*Parishia insignis*	RDH
72.	Rosewood	*Dalbergia latifolia*	ROS
73.	†Salai	*Boswellia serrata*	SAA
74.	Satinwood	*Chloroxylon swietenia*	SAT
75.	Seleng	*Sapium baccatum*	SEL
76.	†Semul	*Salmolia malabrica*	SEM
77.	†Silver Oak	*Grevillea robusta*	SOA
78.	Sissoo	*Dalbergia sissoo*	SIS
79.	Teak	*Tectona grandis*	TEA
80.	Toon	*Cedrela* spp.	TOO
81.	†Udal	*Firmiana villosa* (Syn. *Sterculia villosa*)	UDA
82.	Uriam	*Bischofia javanica*	URI
83.	†Vellapine	*Vateria Indica*	VEL
84.	†Walnut	*Juglans* spp.	WAL
85.	†White Bombwe (badam)	*Terminalia procera*	WBO
86.	White Cedar	*Dysoxylum malabricum*	WCE
87.	†White Chuglam	*Terminalia bialata* (Sapwood)	WCH

ANNEX C

(*Clause* 9.2)

METHOD OF TEST FOR SQUARENESS AND EDGE STRAIGHTNESS

C-1 PROCEDURE FOR EDGE STRAIGHTNESS

C-1.1 The straightness of the edges and ends of plywood shall be verified against a straightedge not less than the full length of the plywood. If the edge on the end of plywood is convex, it shall be held against the straightedge in such a way as to give approximately equal gap at each end. The largest gap between the straightedge and the edge shall be measured to the nearest millimetre and record.

C-2 PROCEDURE FOR SQUARENESS

C-2.1 The squareness of plywood shall be checked with a 1200 mm × 1200 mm square, by applying one arm of the square to the plywood. The maximum width of the gap shall be recorded.

ANNEX D

(*Clause* 11.4)

FORM OF REPORT FOR TESTS ON PLYWOOD

1. Indication of the source of manufacture.....

2. Species used.....

3. Sizes of plywood boards.....

4. Thickness of plywood in mm:

   a) Nominal.....

   b) Actual average.....

5. No. of veneers in plywood.....

6. Glue shear strength in dry state as determined by the method given in IS 1734 (Part 4) : 1983 — Average..... Individual.....

7. Results of shear strength after mycological test as determined by the methods given in IS 1734 (Part 7) : 1983 — Average..... Individual.....

8. Results of moisture resistance test as determined by the method given in IS 1734 (Part 6) : 1983 — Average..... Individual.....

9. Average moisture content of plywood as determined by the method given in IS 1734 (Part 1) : 1983

10. Details of defects of face and back — Face..... Back.....

11. General remarks on compliance with the specification.....

12. Certified that:

    *The plywood passed the requirements.....Grade.....

    Type.....of plywood according to IS :.....in all respects.

    *The plywood failed to conform to IS :.....for reasons given in Sl. No. above.

Signature of Testing Officer.....

Designation.....

Name of Testing Laboratory.....

*Source out either remark.

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