इंटरनेट मानक

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Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
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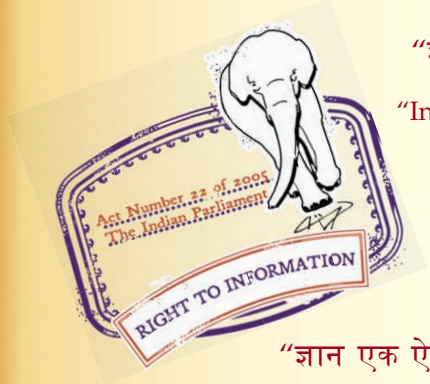
IS 15491 (2004): Medium Density Coirboards for General Purposes - [CED 20: Wood and other Lignocellulosic products]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 15491 : 2004
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भारतीय मानक

सामान्य प्रयोजनों के लिए मध्यम घनत्व के कॉयर बोर्ड़ — विशिष्टि

Indian Standard

MEDIUM DENSITY COIRBOARDS FOR GENERAL PURPOSES — SPECIFICATION

ICS 79.060.20

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

Price Group 5

August 2004

AMENDMENT NO. 1 SEPTEMBER 2006
TO
IS 15491 : 2004 MEDIUM DENSITY COIR-BOARDS FOR GENERAL PURPOSES — SPECIFICATION

(*Page* 3, *clause* 12) — Insert 'ADDITIONAL' before the title.

(CED 20)

Reprography Unit, BIS, New Delhi, India

FOREWORD

This Indian Standard 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.

Medium density coirboard is the latest development in the panel industry. It is a panel material manufactured from renewable material fibres such as coir, jute, paper impregnated with suitable resin adhesive. In preparation of this standard, assistance has been taken from Central Institute of Coir Technology, Bangalore — a research institute of Coir Board.

Medium density coirboard is a panel product manufactured from coir and jute fibers combined with synthetic resin or other suitable binder. The panels are manufactured to a specific gravity of 0.5 to 0.9 by the application of heat and pressure by a process in which the inter fibre bond is substantially created by the added binder. Other materials may have been added during manufacturing to improve certain properties. Grade 1 and Grade 2 medium density coir boards may be used in Hazard Class 1[1] and Hazard Class 2[2], whereas Grade 3 boards may be used in Hazard Class 1 only.

In the formulation of this standard, due weightage has been given to standards and practices prevailing in different countries and also the climatic conditions and customs in the country.

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 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.

The composition of the Committee responsible for the formulation of this standard is given at 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.

[1] Hazard Class 1 — Environment with relative humidity less than or equal to 70 percent.

[2] Hazard Class 2 — Environment with relative humidity more than 70 percent.

Indian Standard

MEDIUM DENSITY COIRBOARDS FOR GENERAL PURPOSES — SPECIFICATION

1 SCOPE

1.1 This standard covers the requirement of medium density coirboards for general purposes having density in the range of 500-900 kg/m³.

1.2 This standard does not cover veneered or laminated or other specially treated boards, moulded boards, etc.

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

3.1 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.

3.2 Additive

Any material introduced prior to the final consolidation of a board to increase bulking or to improve some property of the final board. Fillers and preservatives are included under this term.

3.3 Sizing Material

Alum, wax, resin or other additive may be introduced to the agglomerate for medium density coirboards, primarily to increase water resistance.

4 GRADES

Medium density coirboards for general purpose shall be of three grades, and may be designated as follows:

Grade	*Designation*
Solid board, grade 1	Grade 1
Solid board, grade 2	Grade 2
Solid board, grade 3	Grade 3

5 MATERIAL

5.1 Coir

Coir fibre layer used in the manufacture of medium density coirboards shall be uniform having a minimum mass of 600 g/m². Coir needled felt is manufactured by mechanical inter-loop of coir fleece by use of barb needles to form a non-woven felt of different densities.

5.2 Jute

Jute fiber layer or any other finer fiber used in the manufacture of medium density coirboards shall be uniform having a minimum mass of 60 g/m².

5.3 Paper

Paper used in the manufacture of medium density coirboards shall be uniform having a minimum mass of 40 g/m².

5.4 Adhesive

BWR type of synthetic resin adhesive conforming to IS 848 shall be used for the purpose of bonding for Grade 1, Grade 2 and Grade 3 boards to comply with physical and mechanical requirements given in Table 1 (*see* page 5).

6 MANUFACTURE

Coir fibres manufactured by mechanical process as per IS 9308 (Part 2) or IS 9308 (Part 3) are processed through needled felt plant (Non-woven system) to make uniform mat in different densities according to the requirement. To give a smooth surface, finer fibres like Jute fibres are carded and spread to give a uniform layer on suitable carrier like paper. These fibre mats thus produced are impregnated with resin. The impregnated fibre mats are pressed into panels by passing into press under controlled temperature, pressure and time.

7 FINISH

Medium density coirboards shall be uniform in thickness and density throughout the length and width of the boards. All medium density coirboards shall be flat. Both surfaces of the boards shall have smooth finish.

8 DIMENSIONS AND TOLERANCE

8.1 The board shall be rectangular and shall have square edges. The length of the two diagonals of the board shall not differ by more than ±3 mm/m, length of the diagonal.

8.2 Thickness

Thickness of the medium density coirboards shall be as given below:

3, 4, 6, 8, 9, 12, 15, 18 and 22 mm

Tolerance on thickness shall be ±0.3 mm up to and including 9 mm and ±0.6 mm for thickness above 9 mm.

8.3 Width and Length

Unless otherwise specified, the width and length of medium density coirboards shall be as given below:

a) Width — 1.22 m; and

b) Length — 5.49, 4.89, 3.66, 3.05, 2.44, 1.83 and 1.22 m.

Tolerance on length and width shall be ± 0.30 mm/m.

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

9 PHYSICAL AND MECHANICAL REQUIREMENTS

Density, moisture content, water absorption, linear expansion, modulus of elasticity, modulus of rupture, internal bond, screw withdrawal, nail withdrawal and resistance to spread of flame of medium density coirboards, when tested in accordance with **10** and **11** shall meet the requirement specified in Table 1.

10 SAMPLING AND INSPECTION

10.1 Scale of Sampling

10.1.1 *Lot*

In any consignment, all the medium density coirboards of same grade, dimensions and manufactured under similar condition of production shall be grouped together to constitute a lot.

10.1.2 The conformity of a lot, to the requirement of this specification, shall be ascertained on the basis of tests on medium density coirboards selected from it.

10.1.3 The number of medium density coirboards to be selected from a lot shall be in accordance with the following:

Lot Size	*Number of Medium Density Coir 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

10.1.4 These medium density coirboards shall be selected at random (*see* IS 4905) in order to ensure randomness of selection. All the medium density coirboards in the lot may be arranged in a serial order and every *r*th medium density coirboard may be selected till the required number is obtained, *r* being integral part of *N/n*, where *N* is the lot size and *n* is the sample size.

10.2 Test Specimen and Number of Tests

The length, width, thickness and the diagonals of the medium density coirboards selected as in **10.1.3** shall be measured before cutting the medium density coirboards for test specimen. The straightness of edge shall also be measured.

10.2.1 From each of the medium density coirboards selected, following test specimen shall be cut out from portion 150 mm away from the edges for tests as specified under **11**. The method of conditioning for tests listed in (c), (d) and (h) below shall be as specified in IS 2380 (Part 1):

a) *For determination of density* — Three test specimens from each sample, each of size 150 mm × 75 mm × Full thickness of board. Other size of sample specimen may be used when deemed necessary.

b) *For determination of moisture content* — Three test specimens, from each sample, each of size 150 mm × 75 mm × Full thickness of board. Smaller specimen may be used when deemed necessary.

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

d) *For determination of linear expansion*

1) *Due to general absorption* — Three specimens from each sample, each of size 200 mm × 100 mm × Full thickness of board.

2) *Surface absorption* — Three specimens from each sample, each of size 200 mm × 100 mm × Full thickness of board.

e) *For determination of modulus of elasticity and modulus of rupture* — Six test specimens for Grade 1 and three test specimens for Grade 2 and Grade 3 each for modulus of elasticity and modulus of rupture from a sample to conform to dimensions as specified in Annex B. Out of the six specimens of Grade 1 three specimens shall be subject to the modulus of rupture test after 8 h boiling.

f) *For internal bond* — Six specimens from each sample to conform to the dimension specified in **3** of IS 2380 (Part 5). Out of these, three specimens shall be subjected to the test for internal bond as given in **11.8**. The remaining three specimens shall be subjected to accelerated water resistance test as given **11.8.1**.

g) *For screw withdrawal test* — Three test specimens from each sample to conform to the dimension specified in **2** of IS 2380 (Part 14).

h) *For nail withdrawal test* — Three tests specimens from each sample to conform to the dimension specified in 2 of IS 2380 (Part 14).

j) *For determination of resistance to flames* — Three test specimens from each sample of size 150 mm × 25 mm × Thickness of the board.

10.3 Criteria for Conformity

A lot shall be considered as confirming to the requirement of this specification if all the samples and test specimen pass the condition as prescribed in **11**.

If any sample fails to conform to the requirement, further samples shall be taken from the lot, double in number and the lot shall be considered to have passed, if these samples conform to the requirements prescribed.

11 TESTING OF SAMPLES

11.1 The samples drawn and the test specimens made therefrom in accordance with **9** shall be subjected to the test as given in **11.2** to **11.11**. The specimens shall meet the requirement specified in Table 1 (*see also* **9** and **10.3**).

11.2 Accuracy of Dimension of Boards

All the samples selected in accordance with **10.1.3** shall be measured for straightness of edges, squareness of boards, length, width and thickness as given in IS 2380 (Part 2). The dimension shall comply with the requirement specified in **8**.

11.3 Test for Density

The average value of density of test specimens as prescribed in **10.2.1**(a) when tested in accordance with IS 2380 (Part 3) shall meet the requirement specified in Table 1(*see* **9**).

11.4 Test for Moisture Content

The average value of moisture content as prescribed in **10.2.1**(b) when tested in accordance with IS 2380 (Part 3) shall meet the requirement specified in Table 1(*see* **9**).

11.5 Test for Water Absorption

The average values of water resistance of test specimens as prescribed in **10.2.1**(c) when tested in accordance with IS 2380 (Part 16) shall not exceed the limits specified in Table 1 (*see* **9**).

11.6 Tests for Linear Expansion (Swelling in Water)

11.6.1 *Due to General Absorption*

The average value of linear expansion as prescribed in **10.2.1** (d) when tested in accordance with IS 2380 (Part 17) shall not exceed the limits specified in Table 1 (*see* **9**).

11.6.2 *Due to Surface Absorption*

The average value of surface expansion as prescribed in **10.2.1**(d) when tested in accordance with IS 2380 (Part 17) shall not exceed the limits specified in Table 1 (*see* **9**).

11.7 Test for Modulus of Elasticity and Modulus of Rupture

The average and minimum individual value of modulus of elasticity and modulus of rupture of test specimens as prescribed in **10.2.1**(e) when tested in accordance with Annex B shall not be less than the value specified in Table 1 (*see* **9**).

11.8 Test for Internal Bond (Tensile Strength)

The average and minimum individual value of internal bond as prescribed **10.2.1**(f) when tested in accordance with IS 2380 (Part 5) shall not be less than the value specified in Table 1 (*see* **9**).

11.8.1 The average and minimum individual value of internal bond as prescribed in **10.2.1**(f) when tested in accordance with IS 2380 (Part 5) when subjected to accelerated water resistance shall be not less than the values specified in Table 1 (*see* **9**).

11.9 Test for Screw Withdrawal Strength

The average and minimum individual values of screw withdrawal as prescribed in **10.2.1**(g) when tested in accordance with IS 2380 (Part 14) shall not be less than the value specified in Table 1 (*see* **9**).

11.10 Test for Nail Withdrawal Strength

The average and minimum individual values of nail withdrawal as prescribed in **10.2.1**(h) when tested in accordance with IS 2380 (Part 14) shall not be less than the value specified in Table 1 (*see* **9**).

11.11 Test for Resistance to Spread of Flame

Test specimens of medium density coirboards when tested in accordance with Annex C shall pass the test (*see* **9**).

12 REQUIREMENT FOR ECO-MARK

12.1 General Requirement

12.1.1 Medium density coir board shall conform to the requirements as specified in this standard.

12.1.2 The manufacturer shall produce to BIS environmental consent clearance from 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) Cess 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.

12.1.3 The product or product packaging may display in brief the criteria based on which the product has been labelled environment friendly.

12.1.4 The material (if any) used for product packaging shall be recyclable, reusable or biodegradable. The manufacturer shall provide documentary evidence by way of certificate or declaration to this effect.

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

13 MARKING

Each medium density coirboard shall be legibly marked near any of its corners with the following:

a) Name of the manufacturer,

b) Grade of medium density coirboard,

c) Dimensions and thickness,

d) Date of manufacture, and

e) The criteria for which medium density coirboard has been labelled as ECO-Mark (Requirement for ECO-Mark).

14 BIS CERTIFICATION MARKING

14.1 Each medium density coirboard may also be marked with the Standard Mark.

14.1.1 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. Details of conditions under which a licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from Bureau of Indian Standards.

Table 1 Physical Land Mechanical Requirements of Medium Density Coirboard

(*Clauses* 5.4, 9, 11.1, 11.3, 11.4, 11.5, 11.6.1, 11.7, 11.8, 11.8.1, 11.9 *and* 11.10)

Sl No.	Properties	Grade 1	Grade 2	Grade 3
(1)	(2)	(3)	(4)	(5)
i)	Density, kg/m³	650 – 900	500 – 900	500 – 900
ii)	Variation from mean density, percent	± 10	± 10	± 10
iii)	Moisture content, percent	5 - 15	5 - 15	5 - 15
iv)	Variation from mean moisture content, percent absolute	± 3	± 3	± 3
v)	Water absorption, percent, *Max:*			
	1) After 2 h soaking	6	6	9
	2) After 24 h soaking:			
	a) Up to and including 6 mm	30	30	45
	b) 8 - 12 mm	20	20	30
	c) 13 - 19 mm	13	13	20
	d) 20 mm and above	12	12	18
vi)	Linear expansion (swelling in water), percent, *Max*			
	a) Due to general absorption after 24 h soaking:			
	1) Thickness	4	4	7
	2) Length	0.3	0.3	0.4
	3) Width	0.3	0.3	0.4
	b) Due to surface absorption (in thickness) after 2 h soaking	4	4	5
vii)	Modulus of rupture, *Min*, N/mm² :			
	1) In dry condition:			
	a) Up to and including 20 mm thickness:			
	1) Average	31	29	29
	2) Minimum individual	27	25	25
	b) Above 20 mm thickness:			
	1) Average	27	25	25
	2) Minimum individual	23	22	22
	2) After 8 h boiling			
	a) Up to and including 20 mm thickness:			
	1) Average	17	NA	NA
	2) Minimum individual	15	NA	NA
	b) Above 20 mm thickness:			
	1) Average	15	NA	NA
	2) Minimum individual	13	NA	NA
viii)	Modulus of elasticity, N/mm² :			
	a) Up to and including 12 mm thickness:			
	1) Average	2 800	2 800	2 800
	2) Minimum individual	2 500	2 500	2 500
	b) Above 12 mm thickness			
	1) Average	2 500	2 500	2 500
	2) Minimum individual	2 300	2 300	2 300

Table 1 (*Concluded*)

Sl No.	Properties	Grade 1	Grade 2	Grade 3
(1)	(2)	(3)	(4)	(5)
ix)	Tensile strength perpendicular to surface (Internal bond) *Min*, N/mm^2:			
	a) Up to and including 20 mm thickness:			
	1) Average	0.9	0.9	0.8
	2) Minimum individual	0.8	0.8	0.7
	b) Above 20 mm thickness:			
	1) Average	0.8	0.8	0.7
	2) Minimum individual	0.7	0.7	0.6
x)	Tensile strength perpendicular to surface (Internal bond) *Min*, N/mm^2: After accelerated water resistance [1] :			
	1) Average	0.45	0.45	–
	2) Minimum individual	0.40	0.40	–
xi)	Screw withdrawal strength, N:			
	a) Face:			
	1) Average	2 300	1 725	1 725
	2) Minimum individual	2 000	1 500	1 500
	b) Edge (for thickness >12 mm):			
	1) Average	1 700	1 400	1 400
	2) Minimum individual	1 500	1 250	1 250
xii)	Nail holding strength, N			
	a) Face:			
	1) Average	1 400	1 400	1 400
	2) Minimum individual	1 250	1 250	1 250
	b) Edge (for thickness >12 mm):			
	1) Average	1 400	1 400	1 400
	2) Minimum individual	1 250	1 250	1 250
xiii)	Resistance to spread of flame	To pass the test (Annex C)	–	-

[1] *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 4 h for Grade 1 and 2 h for Grade 2. Specimens are then cooled in water to 27 ± 2°C and dried in ambient condition before determining the tensile strength perpendicular to the surface (Internal bond).

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	Synthetic resin adhesive for plywood (phenolic and amino plastics) (*first revision*)
2380	Methods of test for wood particle boards and boards from other lignocellulosic materials (*first revision*)
(Part 1) : 1977	Preparation and conditioning of test specimens (*first revision*)
(Part 2) : 1977	Accuracy of dimensions of boards (*first revision*)
(Part 3) : 1977	Determination of moisture content and density (*first revision*)
(Part 5) : 1977	Determination of tensile strength perpendicular to surface (*first revision*)
(Part 14) : 1977	Screw and nail withdrawal test (*first revision*)
(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
7638 : 1999	Wood/lignocellulosic based panel products — Method for sampling (*second revision*)
9308	Specification for mechanically extracted coir fibres
(Part 2) : 1987	Mattress coir fibre (*first revision*)
(Part 3) : 1987	Decorticated coir fibre (*first revision*)

ANNEX B

[*Clauses* 10.2.1(e) *and* 11.7]

METHOD OF TEST FOR MODULUS OF ELASTICITY AND MODULUS OF RUPTURE

B-1 PROCEDURE

B-1.1 Test Specimen

The test specimen for medium density coir board shall be rectangular. The depth of the specimen shall be equal to the thickness of material and the width shall be 2.5 cm for the depths less than 6 mm and 5 cm for greater depths. The length of the specimen shall be 48 times the depth plus 5 cm. The specimen shall be preconditioned to a constant mass at a relative humidity of 65 ± 5 percent and at a temperature of 27±2°C. The width and depth of each specimen shall be measured to an accuracy of not less than ± 0.3 percent.

B-1.2 Testing

The span shall be 48 times the nominal depth. The load shall be applied through an appropriate loading block for centre loading with a continuous motion of the movable head throughout the test till a failure is indicated. The rate of application of load shall be such that the unit rate of fibre strain is equal to 0.001 5 of outer fibre length per minute within a permissible variation of ±25 percent. The rate of motion of moving head may be calculated as under:

$$N = \frac{z L^2}{6 d}$$

where

N = rate of motion of moving head, in cm/min;

z = unit rate of fibre strain, of outer fibre length per minute = 0.001 5;

L = span, in cm; and

d = depth of beam in cm.

B-1.2.1 *After 8 h Boiling*

Specimens are immersed in water at 27 ± 2°C and water is brought to boiling and kept at boiling temperature for 8 h for Grade 1. The specimens are then cooled in water to 27 ± 2°C and dried in ambient temperature before determining the modulus of rupture.

B-1.3 Report

Data for load deflection curves may be taken to determine the various characteristics using the formulae

given below. Deflection reading shall be recorded to the nearest 0.02 mm. Increments of load shall be so chosen that not less than 12 and preferably 15 or more readings of load and deflection are taken to the proportional limit. The moisture content of the specimen and the temperature at the time of test shall be recorded:

a) Modulus of rupture, N/mm^2 $= \frac{3\,P'L}{2bh^2}$

b) Modulus of elasticity, N/mm^2 $= \frac{PL^3}{4bh^3\Delta}$

where

P = load in N, at proportional limit;

b = width of the specimen, in mm;

h = thickness of the specimen, in mm;

L = span, in mm;

P' = maximum load, in N; and

Δ = deflection at proportional limit, in mm.

ANNEX C

(*Clause* 11.11)

METHOD OF TEST FOR RESISTANCE TO SPREAD OF FLAME

C-1 PROCEDURE

C-1.1 Resistance to Spread of Flame Test

The test for resistance to spread of flame shall be carried out in the following manner.

C-1.2 A test specimen measuring about 150 mm × 25 mm shall be subjected to the luminous batswing flame, preferably supplied by a Bunsen burner. The specimen shall be held with the flat surface at an angle of 45° to the horizontal. The flame shall be 25 mm in width across the tips. It shall be applied to th specimens for 30 s and removed for similar period an then applied again for a second period of 30 s and the again removed.

C-1.3 Should the specimen get ignited, it shall nc continue to burn for more than 20 s after the flame ha been finally removed to consider the specimen ha passed the test.

C-1.4 Three test specimens shall be tested and each c the test specimen shall conform to the requirement.

ANNEX M

(Foreword)

COMMITTEE COMPOSITION

Wood and Other Lignocellulosic Products Sectional Committee, CED 20

Organization	*Representative(s)*
Indian Plywood Industries Research and Training Institute, Bangalore	DR C. N. PANDEY (***Chairman***)
All India Agro-Board Association, Pune	SHRI V. S. RAJU
	REPRESENTATIVE (*Alternate*)
Building Materials & Technology Promotion Council, New Delhi	SHRI J. K. PRASAD
	SHRI A. K. TIWARI (*Alternate*)
Central Building Research Institute, Roorkee	DR Y. SINGH
	DR L. K. AGARWAL (*Alternate*)
Central Public Works Department, New Delhi	SHRI SURINDER KUMAR
	SHRI S. K. VERMA (*Alternate*)
Civil Aviation Department (Technical Centre), New Delhi	SHRI B. V. JOSHI
	SHRI N. M. WALECHA (*Alternate*)
Coir Board, Bangalore	JOINT DIRECTOR
Council of Architecture, New Delhi	REPRESENTATIVE
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	SHRIMATI MEENAKSHI
	SHRIMATI AMITA RAJ (*Alternate*)
Federation of Indian Plywood & Panel Industry, New Delhi	SHRI JAYADEEP CHITLANGIA
	SHRI S. P. GOENKA (*Alternate*)
Forest Research Institute, Dehra Dun	DIRECTOR
	REPRESENTATIVE (*Alternate*)
Indian Academy of Wood Science, Dehra Dun	SECRETARY
	JOINT SECRETARY (*Alternate*)
Indian Plywood Industries Research & Training Institute, Bangalore	SHRI K. SHYAMASUNDAR
	SHRI S. PADMANABHAN (*Alternate*)
Institute of Wood Science & Technology, Bangalore	DR K. S. RAO
Jolly Board, Mumbai	SHRI ARVIND JOLLY
	SHRI P. K. DAS GUPTA (*Alternate*)
Kutty Flush Door & Furniture Co Pvt Limited, Chennai	COL Y. G. KRISHNAN
Timpack Pvt Limited, Byrnihat	REPRESENTATIVE
Mangalam Timber Products Limited, Bangalore	SHRI K. SRIDHAR
	SHRI ANIL TALWAR (*Alternate*)
Ministry of Defence (DGQA), Kanpur	SHRI RAM CHANDRA
	SHRI J. K. SINHA (*Alternate*)
Ministry of Defence (R&D), New Delhi	SHRI RAVINDER KUMAR
Ministry of Railways, Lucknow	DIRECTOR STANDARDS (CARRIAGE)
	ASSISTANT DIRECTOR (*Alternate*)
National Test House (ER), Kolkata	SHRI D. K. KANUNGO
	ER RAJINDER KAPUR (*Alternate*)
Northern India Plywood Manufacturer Association, Jalandhar	SHRI N. K. TIWARI
	SHRI ANIL GOEL (*Alternate*)
Novopan India Limited, Hyderabad	SHRI S. A NAQUI
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Nuchem Limited, New Delhi	SHRI SUDEV BARAR
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