



**CORPORATE PURCHASE SPECIFICATION**

**AA 220 02**

**REV. NO. 04**

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**UNIMPREGNATED DENSIFIED LAMINATED WOOD-HIGH DENSITY**

**1. GENERAL:**

This specification governs the quality requirements of an unimpregnated densified laminated wood of high density, consisting of layers of cross laminated 2 mm thick wood veneers, bonded and densified under heat and pressure. The material in insulating oil has temperature index of at least 105.

**2. APPLICATION:**

Used for clamping rings, terminal boards etc. in Transformer.

**3. COMPLIANCE WITH NATIONAL STANDARDS:**

There is no Indian Standard covering this type of material.

**4. DIMENSIONS AND TOLERANCES:**

Thickness, width and length of the laminated wood shall be stated on the order.

**4.1 Preferred Thickness:**

10, 12, 14, 16, 20, 25, 30, 40, 45, 50, 60, 70, 75, 80, 90 and 100 mm.

**4.2 Tolerance on Nominal Thickness:**

Nominal thickness (mm)		Tolerance (±)mm
Above includ	Upto &	

10	25	0.80
25	40	1.00
40	50	1.25
50	-	1-50

**Revisions:**  
As per 38<sup>th</sup> MOM of MRC-E

**APPROVED:**  
**INTERPLANT MATERIAL RATIONALISATION  
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4.3 Tolerance on width & Length:  
± 3.5 mm.

5. TEST METHODS:

Unless otherwise specified, the tests shall be conducted in accordance with the relevant methods as specified in Corporate Standard

AA 085 17 01.

6. SAMPLE FOR TEST:

Two sheets of ordered thickness and size 500 x 500 mm prepared from the same batch shall be supplied for testing and approval.

7. PHYSICAL PROPERTIES :

7.1 Density, as received condition (IS : 1708) :

1.00 to 1.20 g/Cm<sup>3</sup>

7.2 Moisture & Volatile content:

7 % max.

Test specimen 40mm x 12mm x thickness of board shall be dried at 145 ± 2°C till the weight is constant. Thickness above 12mm shall be machined to 12mm, keeping one surface intact.

7.3 Oil Absorption;

6%, Min.

Test specimen (100 x 100 mm x thickness of board) shall be dried at 105 ± 2°C for 72 hours and then impregnated with insulating Oil (IS:335) at 90 ± 2°C for 72 hours. Thickness above 12 mm shall be machined down to 12 mm, keeping one surface intact.

8. EFFECT OF OIL ON WOOD (TYPE TEST) :

8.1 Sludge and oil Acidity (**Appendix -1**):

8.1.1 Increase in acidity: 0.1 mg KOH/g, max.

8.1.2 Increase in sludge content; 0.05% max.

**9. ELECTRICAL PROPERTIES :****9.1 Electric strength (Proof) in oil at  $90 \pm 2^\circ\text{C}$ :**

Three test specimens shall be dried at  $105 \pm ^\circ\text{C}$  for 72 hours and, impregnated with insulating oil (IS:335) at  $90 \pm 2^\circ\text{C}$  for 72 hours. Thickness above 12 mm shall be machined down to 12 mm, keeping one surface intact for flatwise test only.

**9.1.1 Flatwise:**

4 k V/mm.

Sample size shall be atleast 150 x 150 mm x thickness of board.

However thickness above 12 mm shall be machined down to 12 mm keeping one surface intact,

**9.1.2 Edgewise:**

60 kV.

**10. MECHANICAL PROPERTIES:****10.1 Tensile Strength;**

Along the grain 95 MPa, min.

**10.2 Cross Breaking strength;**

Along the grain : 112 MPa Min.

Across the grain; 85 MPa Min.

**10.3 Compressive Strength:**

Flatwise : 185 MPa, Min.

The test shall be carried out on 20mm X 20mm X thickness of board.

However, Thickness above 20mm shall be machined down to 20 mm keeping one side intact,

**11. TEST CERTIFICATES:**

Unless otherwise stated, three copies of test certificates shall be sent along with each consignment,

In addition, the supplier shall ensure to send one copy of test certificates along with the despatch documents to facilitate quick clearance of the material.

The test certificates shall bear the following information:

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CORPORATE PURCHASING SPECIFICATION



AA 220 02 : unimpregnated Densified laminated Wood -  
(Rev.No.04) High Density

BHEL order No.

Batch/Lot No.

Thickness, width & length

Net weight/No of boards

Test values obtained, and certificate for compliance with clauses 4, 7 to 10.

## 12. PACKING AND MARKETING

The laminated wood shall be suitably packed to prevent any damage during transit.  
Each package shall bear the following information.

AA 22002 : Unimpregnated Densified Laminated Wood – High Density

BHEL order No,

Manufacturer's Name & Grade.

Thickness, width & Length.

No. of boards/Components.

Net weight & Gross weight.

## 13. REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 355

2. IS: 1708

3. AA 085 17 01

**Appendix -I****Sludge and oil Acidity:**

1. Conditioning: Condition the test piece for 168 hours in controlled atmosphere of  $65 \pm 5\%$  RH and  $27 \pm 2^\circ \text{C}$ .
2. Test Specimen: Cut the specimen to dimension of 75mm x 12.5mm x Thickness.

**NOTE:** Thickness above 9 mm shall be machined to 9 mm. Both the Surfaces shall be machined evenly to achieve thickness of 9 mm.

3 Procedure: Into a 150 mm x 25 mm test tube weigh 25 g of transformer oil. Transformer oil complying with the requirements of IS 335 is suitable. Prepare the test specimen, weigh it to the nearest 0.01 g and introduce it into the oil. Lightly plug the mouth of the tube with cotton wool and place it in a constant temperature bath maintained at  $100 \pm 0.5^\circ \text{C}$  for  $164 \pm 1$  hour.

Place a similar quantity of the same oil in a second tube and maintain this under the same conditions as a 'blank' sample.

At the end of the specified heating period, remove the tubes from the bath and allow them to cool to room temperature. If it can be seen that delamination has occurred, the specimen has failed. If there is no visible delamination, determine the sludge content of the oil in which the pressboard has been immersed as follows.

Pour the oil into a 600 ml beaker and wash the test tube and pressboard sample with n-heptane until oil-free, adding the washings to the oil in the beaker. Make the contents of the beaker upto approximately 300 ml with n- heptane. Cover the beaker with a watch glass and allow to stand in the dark for 24 hrs. at room temperature.

Filter the solution through a tared, dried, sintered glass filter, of no. 4 filter transferring all the sediment to the filter with the aid of n-heptane from a wash-bottle. Dry the filter at  $105 \pm 2^\circ \text{C}$  to constant mass. Express the amount of sediment as a percentage of the original sample mass.

Make the filtrate up to 500 ml in a measuring cylinder with n-heptane. Make the 'blank' sample up to 500 ml in a second cylinder. Determine the acid values of the heptane solutions as follows.



Place 60 ml toluene and 40 ml industrial methylated spirits (66 overproof) in a 600 ml conical flask. Add 2 ml to 3 ml Alkali blue 6B indicator solution (2% by mass in industrial methylated spirits and one drop of 0.1N hydrochloric acid). Neutralize this mixture, with 0.1N alcoholic potassium hydroxide (KOH), to give a red colour which persists for 15 s. Add 100 ml of the above filtrate to the neutralized solvents and titrate to the same end point with the 0.1 N alcoholic KOH. Repeat the titration on 100 ml of the 'blank' solution.

Results : Calculate the increase in the acid value of the oil per gram of pressboard in mg KOH/g from the expression.

$$\text{Increase in acid value} = \frac{(t_2 - t_1) \times 5.61 \times 5}{W}$$

Where

$t_1$  is the number of milliliters of 0.1 N KOH required to neutralize 100 ml n-heptane in blank solution ;

$t_2$  is the number of milliliters of 0.1 N KOH required to neutralize 100 ml of filtrate; and

W is the sample mass of laminated pressboard (grams)

Report the acid value of the 'blank' oil together with the increase in acid value due to the sample as calculated from the above equation. Report also the percentage sludge produced by the sample.