RESIN IMPREGNATED DENSIFIED LAMINATED WOOD - TYPE V

1. GENERAL :

This specification governs the quality requirements of Resin Impregnated Wood based laminate, consisting of layers of 1 mm thick wood veneers impregnated under vacuum and/or pressure with synthetic resin and further bonded and densified under heat and pressure. The synthetic resin is usually phenol/ cresol formaldehyde type. It has good mechanical and electrical properties with resistance to corrosion and termite attack.

The grains and fibre disposition of the constituent veneers is in the direction of axis of load, so as to have high tensile strength in that direction. The material in insulating oil has temperature index of at least 105.

2. APPLICATION :

Used as sticks, flats, rods, turned parts, screwed rods, etc. for Transformers and switchgear.

3. COMPLIANCE WITH NATIONAL STANDARDS :

The material shall comply, in general, with the requirements of the following National standard and also meet the requirements of this specification.

IS:3513-Part I-1989 : Specification for Resin Treated Compressed Tvpe V : Wood Laminates (Compregs) - For Electrical Purposes.

4. DIMENSIONS AND TOLERANCES :

Shall be as stated on the order/drawing.

5. FINISH :

The machined edges of boards and the surface of components shall be finished with a high viscosity varnish conforming to IS:10026-P3-Sec.1 and the surface shall be free from checks, splits, blisters, discoloration, gaps, open joints etc.

6. **TEST SAMPLE:**

6.1 **For Componenets:**

Whenever components are ordered, sample for tests shall be supplied in finished shape and size in accordance with IS:3513. Wherever possible this shall be cut from the components.

6.2 **For Lifting Rods:**

as per order/drawing.

Minimum 5 Nos. of rods shall be supplied for testing density, moisture and volatile content, tensile strength and electrical strength (edgewise).

7. **PROPERTIES :**

Unless otherwise specified, testing shall be done in accordance with the relevant methods of IS:3513.

7.1 **Physical:**

7.1.1 **Density:**

1.25 g/cm^3, minimum.

7.1.2 **Moisture Content And Volatile Matter:**

4% maximum.

7.1.3 **Water Absorption:**

Finished test specimens of size 40 x 40 x 12 mm prepared from the same batch, shall be submerged in water at 27 $\pm 2^{o}C$ for 24 hours shall not absorb water more than 1.2%.

7.2 **Mechanical:**

7.2.1 **Tensile Strength (AA 085 17 01) Along the Direction of Grains:**

175 N/mm^2 minimunm.

7.2.2 **Cross Breaking Strength Along the Direction of Grains:**

195 N/mm^2 minimum.

7.2.3 **Comprehensive Strength (Flat Wise):**

170 N/mm^2 minimum.

The test shall be carried out on 20 X 20mm X thickness of board. However, Thickness above 20 mm shall be machined down to 20 mm keeping one side intact.

7.3 **Electrical:**

7.3.1 **Electric Strength (Proof) In Oil At 90±2°C:**

Flatwise : 4 kV/mm for 6 mm thick specimen.

Edgewise : 25 kV for 25 mm wide specimen.

In case of rods, edgewise test shall be done only.

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

8.1 **Sludge and Oil Acidity (Appendix -I):**

8.1.1 Increase in Acidity of oil : 0.1 mg KOH/g maximum.

8.1.2 Increase in sludge content : 0.05% maximum.

9. **TEST CERTIFICATES :**

Unless ohterwise stated,three copies of test certificates shall be supplied with each consignment.

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

The test certificates shall bear the following information:

AA 220 03 : Resin Impregnated Densified Laminated
(Rev.03) Wood - Type V
BHEL Order No.
Manufacturer's/Supplier's name
Batch/Lot No.
Trade mark if any
Drawing No./Type No.
Thickness, Width & Length
No. of Boards/components
Test certificate for clauses 4, 7 and 8.

10. **PACKING AND MARKING :**

The components/boards shall be suitably packed to prevent damage during transit. Each package shall be legibly marked with the following information :

AA 22003 : Resin Impregnated Densified Laminated Wood-Type V.
BHEL Order No.
Drawing No/Type No.
Manufacturer's/Supplier's Name & Grade.
Date of manufacture.
Thickness, Width & Length.
No. of components/boards
Net weight & Gross weight.

11. **REFERRED STANDARDS (Latest Publications Including Amendments):**

1. IS:3513
2. IS: 10026
3. B.S. 5354
4. AA 085 1701

Appendix -I

Sludge and Oil Acidity:

1. Conditioning: Condition the test piece for 168 hours in controlled atmosphere of 65 ± 5% RH and 27 ± 2° 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 9mm.

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 ± 0.5°C for 164±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 ± 2°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 hydochloric 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 0.1N alcoholic KOH. Repeat the titrtion 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 millilitres of 0.1N KOH required to neutralize 100 ml n-heptane in blank solution;

t_2 is the number of millilitres of 0.1N 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.