

**PRODUCT PURCHASING SPECIFICATION  
TRANSFORMER ENGINEERING DEPARTMENT  
BHEL BHOPAL**

Specification No. **TRE 185**  
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Rev. 01 Date : 21.09.2016

**LAMINATED PRECOMPRESSED PRESSBOARD**

1. **General** - This specification governs the quality requirements of a very hard and rigid laminated precompressed pressboard made by 100% sulphate wood pulp board characterised by high purity and mechanical strength and capable of being sheared without showing ragged edges. Its surface bears mash marks. The laminates are manufactured by building up laminate of solid precompressed pressboard complying with TRE-184 by hot pressing with casein based adhesive or non-aqueous adhesive, free from extraneous matter in the solid plastic state. The material shall be free from soluble electrolyte such as chlorides, sulphates and carbonates and also from conducting particles. The material in insulating oil shall have temperature index of atleast 105°C.
2. **Applications** - The material can be used as coil spacers, flat washers, edge blocks and clamping rings etc. in transformers, reactors etc.
3. **Compliance with International Standard** – The material shall comply, in general with the requirements of the latest edition of IEC: 60763-3-1 TYPE LB 3.1 A.1 or LB 3.1 A.2.
4. **Dimensions and Tolerances** – Thickness, width and length of the pressboard shall be stated on the order. The sheet shall be rectangular in shape with the two diagonals being equal. Sheet shall not form parallelogram. Two diagonals of the sheet shall be within  $\pm 5$  mm.
5. **Preferred Thickness** – 8, 12, 16, 20, 25, 30, 40, 50mm and above in multiple of 10mm
6. **Preferred size** – 1800 x 3000mm or bigger (With a tolerance of  $\pm 0.5\%$  on length & width)
7. **Bow (Edge camber)** – Lateral departure of the four edges of the sheet from the straight line forming a cord shall not be more than 2 mm.
8. **Finish** – Shall have matt finish with no irregularities except regular indentations due to wire mesh used during pressing operation. Each board should be printed with brand name/ mark along the length or width with carbon free ink.
9. **Test Methods** – Unless otherwise specified, when tested in accordance with the relevant methods of the IEC: 60763-2 : Laminated pressboard – Method of tests, the test sample shall follow the properties as per table A of this document.
10. **Test samples** – Three boards of ordered thickness in 500 x 500 mm size shall be supplied for testing and approval.
11. **Properties** – The pressboard supplied against this spec. to confirm the requirement as per table A.
12. **Test certificates** - Unless otherwise stated, 3 copies of test certificates shall be supplied alongwith each consignment. In addition, the supplier shall ensure to send one copy of test certificates alongwith their dispatch documents to facilitate quick clearance of the material. The test certificates shall bear the information indicated in clause 13 and test results of clause 4,5,6,7 & Table A.
13. **Packing & marking** – Manufacturer's name or identification slips shall be given on each board which shall be compatible with insulating oil to IS:335 or IEC:60296. The boards shall be sealed in high density polyethylene sheets, which shall then be covered all around with water proof bituminised brown paper to prevent entry of rain water. These boards then shall be packed in a wooden case to avoid damage during transit. Packing shall be marked legibly with the following information -

TRE-185 : Laminated Precompressed Pressboard

BHEL Order No.

Manufacturer's/ Supplier's name

| REV | DATE | ALT CHD | REV 01 | DATE 21.9.16 | ALT CHD.                                                                            | REV 00 | NAME        | SIGN | DATE     |
|-----|------|---------|--------|--------------|-------------------------------------------------------------------------------------|--------|-------------|------|----------|
|     |      |         |        |              |  | PREP.  | Akshay Dave | -sd- | 16.06.10 |
|     |      |         |        |              | Title and clause 3, 5 & 8 revised.                                                  | CHD.   | S.K.Mahajan | -sd- | 16.06.10 |

DWI/TCB/TRE/010

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Grade / trade mark, if any  
Batch/ Lot no.  
Thickness, Length & Width of the board  
Quantity of boards / Net weight/ Gross weight (kg)  
Date of manufacturer

**14. Preferred standards** (Latest publications including amendment)

1. IS:335/ IEC:60296      2. IEC-60763-2      3. IEC: 60763-3-1

**Table A**

|           | <b>Properties</b>                                     | <b>Limits</b>                                                                                 |
|-----------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1.        | Tolerance on thickness                                | ±5% for ≤12mm<br>±4% for >12mm                                                                |
| <b>2.</b> | <b>Physical properties</b>                            |                                                                                               |
| 2.1       | Apparent density [g/cm <sup>3</sup> ]                 | 1.15 to 1.35                                                                                  |
| 2.2       | Oil absorption                                        | 5% Min.                                                                                       |
| 2.3       | Moisture content                                      | 8% Max.                                                                                       |
| 2.4       | Shrinkage in air                                      | Machine Direction - 0.4% Max.<br>Cross Machine Direction - 0.6% Max.<br>Thickness - 6.0% Max. |
| <b>3.</b> | <b>Mechanical properties</b>                          |                                                                                               |
| 3.1       | Flexural strength [MPa]                               | Machine Direction - 100 Min.<br>Cross Machine Direction - 85 Min.                             |
| 3.2       | Compressibility in air <b>C</b>                       | 3% Max.                                                                                       |
| 3.3       | Reverse Compressibility in air <b>C<sub>rev</sub></b> | 60% Min.                                                                                      |
| <b>4.</b> | <b>Electrical properties</b>                          |                                                                                               |
| 4.1       | Electrical strength <sup>1)</sup> [kV/mm]             | 8 Min.                                                                                        |
| <b>5.</b> | <b>Chemical properties</b>                            |                                                                                               |
| 5.1       | PH of 5% aqueous extract                              | 5 to 8                                                                                        |
| 5.2       | Conductivity of 5% aqueous extract [mS/m]             | 15 Max.                                                                                       |

1) Electrical strength parallel to layers, Method 1, Fig. 2 of IEC: 60763-2, for all thickness.