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

Specification No. **TRE 184**
 Page 1 of 2 Pages
 Rev. 00 Date : 16.06.2010

SOLID PRECOMPRESSED PRESSBOARD – INDIGENOUS

1. **General** - This specification governs the quality requirements of a very hard and rigid solid pressboard characterised by high purity and mechanical strength and capable of being sheared without showing ragged edges. Its surface bears mash marks. It is manufactured by hot pressing 100% sulphate wood pulp without the addition of any additive/ adhesive into 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 insulating blocks, spacer strips, cylinders & other insulating components, barriers etc. in transformers, reactors and capacitors etc.
3. **Compliance with International Standard** – The material shall comply, in general with the requirements of the latest edition of IEC: 60641-3-1(2008) TYPE B 3.1A.
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 ±3 mm.
5. **Preferred Thickness** – 1, 1.5, 2, 3, 4, 5, 6 and 8mm
6. **Preferred size** – 1800 x 3000mm or bigger (With a tolerance of ±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 1 mm
8. **Finish** – Shall have matt finish with no irregularities except regular indentations due to wire mesh used during pressing operation and wolt marks/ waves within thickness
9. **Test Methods** – Unless otherwise specified, when tested in accordance with the relevant methods of the IEC: 60641-2 ; Pressboard and presspaper for electrical purposes – Method of tests, the test sample shall follow the properties as per table A of this document.
 For drying of test specimens, air drying for 96 hours to method B of IEC:60763-2, may be carried out as an alternative.
10. **Test samples** – Four 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-184 : Solid Precompressed Pressboard
 BHEL Order No.

REV	DATE	ALT	REV	DATE	ALT	REV 00	NAME	SIGN	DATE
		CHD			CHD	PREP	Akshay Dave		16.06.10
						CHD	S.K Mahajan		16.06.10

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TRANSFORMER ENGINEERING DEPARTMENT
BHEL BHOPAL

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Manufacturer's/ Supplier's name
 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
 No. of boards

14. Preferred standards (Latest publications including amendment)

1. IS:335/ IEC:60296 2. IEC: 60641-2 3. IEC: 60641-3-1 4. IEC: 60763-2

Table A

	Thickness → Properties ↓	Up to 1.6mm	Above 1.6mm- Up to 3.0mm	Above 3.0mm- Up to 6.0mm	Above 6.0mm- Up to 8.0mm
1.	Tolerance on thickness	±7.5%	±5%	±5%	±5%
2.	Physical properties				
2.1	Apparent density [g/cm ³]	1.0 to 1.2	1.1 to 1.25	1.15 to 1.3	1.15 to 1.3
2.2	Oil absorption	11% Min.	9% Min.	7% Min.	6% Min.
2.3	Moisture content	6% Max.			
2.4	Shrinkage in air	MD - 0.5% Max.	XD - 0.7% Max.	Thickness - 6.0% Max.	
3.	Mechanical properties				
3.1	Tensile strength [N/mm ²]	MD - 100 Min. XD - 75 Min.	MD - 105 Min. XD - 80 Min.	MD - 110 Min. XD - 85 Min.	MD - 110 Min. XD - 85 Min.
3.2	Elongation [Type test]		MD - 2.5% Min.	XD - 3.5% Min.	
3.3	Compressibility in air C	10% Max.	7.5% Max.	5% Max.	4.5% Max.
3.4	Reverse Compressibility in air C _{rev}	45% Min.	50% Min.	50% Min.	50% Min.
4.	Electrical properties				
4.1	Electrical strength ¹⁾ [kV/mm]	45 Min.	35 Min.	35 Min.	35 Min.
5.	Chemical properties				
5.1	Ash content	0.7% Max.			
5.2	PH of 5% aqueous extract	6.0 to 9.0			
5.3	Conductivity of 5% aqueous extract [mS/m]	5 Max.	6 Max.	8 Max.	10 Max.

MD- Machine Direction, XD - Cross Machine Direction

1) Electrical strength in oil at room temp. short time (Rapid rise) test. Thickness of test piece shall be thickness of sheet under test, except that where it exceeds 2mm, the thickness at electrode contact area may be reduced to 3.0 ± 0.2 mm by machining from one side, keeping the other side intact. When it is necessary to avoid flashover or because of limitation of available equipment, specimens may be prepared by reducing at electrode contact area to 2.0 ± 0.1 mm.

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PRODUCT PURCHASING SPECIFICATION
TRANSFORMER ENGINEERING DEPARTMENT
BHEL BHOPAL

Specification No. **TRE 185**
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Rev. 00 Date : 16.06.2010

LAMINATED PRECOMPRESSED PRESSBOARD - INDIGENOUS

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 3.1.1 or LB 3.1.2.
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 ±5 mm.
5. **Preferred Thickness** - 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 ±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
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	REV	DATE	ALT	REV 00	NAME	SIGN	DATE
		CHD			CHD	PREP.	Akshay Dave	<i>Akshay Dave</i>	16.06.10
						CHD.	S.K.Mahajan	<i>S.K.Mahajan</i>	16.06.10

DWI/TCB/TRE/010

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TRANSFORMER ENGINEERING DEPARTMENT
BHEL BHOPAL

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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

	Properties	Limits
1.	Tolerance on thickness	±5% for ≤12mm ±4% for >12mm
2.	Physical properties	
2.1	Apparent density [g/cm ³]	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. Cross Machine Direction - 0.6% Max. Thickness - 6.0% Max.
3.	Mechanical properties	
3.1	Flexural strength [MPa]	Machine Direction - 100 Min. Cross Machine Direction - 85 Min.
3.2	Compressibility in air C	3% Max.
3.3	Reverse Compressibility in air C _{rev}	60% Min.
4.	Electrical properties	
4.1	Electrical strength ¹⁾ [kV/mm]	8 Min.
5.	Chemical properties	
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.