	CORPORATE PURCHASING SPECIFICATION	**AA 224 15**
		Rev. No. 02
		PREFACE SHEET

EPOXY LAMINATED GLASS FABRIC BASE SHEET (TEMPERATURE INDEX 155)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN : NEMA-LI-1: 1989, Gr: G-11

Suggested/Probable suppliers and grades:

User Plant References:

1. BHOPAL : PS 22415 A
2. HARDWAR : 0503.404 - GTEP - 2
3. HYDERABAD : CSN 644412

Revisions : **Cl: 32.4.43 of MOM of MRC-E**			**APPROVED :** INTERPLANT MATERIAL RATIONALISATION COMMITTEE -MRC (E)		
Rev. No. 02	**Amd.No.**	**Reaffirmed**	**Prepared** **HYDERABAD**	**Issued** **Corp. R&D**	**Dt. of 1st Issue** **May, 1980**
Dt:15.01.2003	**Dt :**	**Year :**			

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1.0 GENERAL:

This specification governs the quality requirements of laminated sheet made from layers of fine and plain woven glass fabric (non-alkaline glass type E) having suitable silane/volan finish with good electrical properties using thermosetting epoxy resin as the bonding medium. The material has a temperature index of at least 155.

2.0 APPLICATION:

This material may be used with discretion for insulating spacers, wedges, packers and pressed parts of electrical machines.

3.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

NEMA-LI-1: 1989,Gr. G-11.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

Thickness, width and length shall be as stated on BHEL order.

4.2 Preferred thickness (mm):

0.5, 1, 1.5, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30, 40, 50 and 70.
Other thickness can also be ordered.

4.3 Tolerances:

4.3.1 Thickness:

Thickness of the sheet shall not depart at any point from the nominal thickness by more than the appropriate value as shown in the following table:

Thickness, mm		Permissible variation from nominal thickness, mm
Above	upto & including	
-	0.5	0.10
0.5	2	0.20
2	3	0.25
3	5	0.50
5	7	0.75
7	10	0.90
10	15	1.10
15	20	1.25
20	25	1.40
25	30	1.50
30	40	1.75
40	50	2.00
50	60	2.50
60	70	3.00

4.3.2 Width and Length:

Size, mm	Tolerance, ± mm
Below 1000	35
Above 1000	50

4.4 Flatness (for sheets 3.0mm and above):

The flatness of sheets shall be such that when a sheet is placed without restraint on a flat surface, concave side, if present, up, departure at any point of the surface from a light straight edge laid in any direction upon it shall not exceed the following:

a) 0.50 mm under a 300 mm straight edge.
b) 3.00 mm under a 600 mm straight edge.
c) 6.00 mm under a 1000 mm straight edge.

5.0 FINISH:

The surface of the sheets shall be even, smooth, free from visible defects like blisters, loose fibres, resin concentration, delamination, wrinkles, local deformation and dents. The materials shall be supplied with trimmed edges.

6.0 TEST METHODS:

Unless otherwise specified the tests shall be conducted in accordance with the relevant methods of BHEL standard AA 085 17 01.

7.0 SAMPLING AND ACCEPTANCE:

7.1 Routine and Acceptance Tests:

Unless otherwise stated, one sheet chosen at random out of every 20 sheets of a supply shall be subjected to routine tests. One sheet of 300 X 300 mm of 10 mm thickness shall be supplied with each consignment.

The arithmetic mean of the test results for an individual test shall meet the requirement of this specification.

The lowest value obtained for any test shall not be less than 90% at the specified value.

7.2 Type Tests:

Type tests shall be carried out at the time of first approval and subsequently once in two years and whenever doubt arises, on the quality of the material.

8.0 PHYSICAL PROPERTIES:

8.1 Specific Gravity **:** 1.8 ± 0.1

8.2 Marten's Heat distortion Temperature (Type test) (For thickness 10mm and above) **:** 240^0C, min

8.3 Water Absorption at 20^0 C for 24 hours (Type test):

Thickness (mm)		Water absorption
Above	**upto & including**	**%, max.**
-	1	0.40
1	1.5	0.30
1.5	3	0.20
3	10	0.15
10	25	0.10
More than 25*		0.10

* Thickness above 25 mm shall be machined to 25 mm keeping one side intact.

8.4 Texture of Glass Fabric:

For laminates upto 20 mm thickness a fine woven glass cloth of 0.18mm thick shall be used. For laminates above 20mm thickness a glass cloth of not more than 0.255 mm thick shall be used. This shall be checked by burning the bonding at 600^0C for sufficient time.

8.5 Heat Shock Test:

A specimen of size 100x100 of ordered thickness is kept in an oven maintained at 250 ± 5^0 C for 15 minutes. The specimen is removed directly to ambient conditions (ie. Room temperature) after this period and observed. The material is considered satisfactory in this test, if no delamination, cracks, splitting, blistering or resin oozing is observed at the end of the test.

9.0 MECHANICAL PROPERTIES:

9.1 Tensile Strength (For sheets 1.5 mm thick and above) (Type test):

250 N/mm^2 (25.5 kg/mm^2), min.

9.2 Cross Breaking Strength (For sheet 1.5 mm thick and above):

9.2.1 As received condition: 350 N/mm^2 (35.6 kg/mm^2), min.

9.2.2 After heating at 150^0C for 1 hour and tested at 150^0C. The reduction shall not be more than 50% of the value obtained in received condition.

9.3 Shear strength (for sheets 1.5 mm thick and above) (Type test):

100 N/mm^2 (10.2 kgf/mm^2), min.

9.4 Compression strength proof (For sheets 5 mm thick & above) (Type test):
400 N/mm^2 (40.8 kgf/mm^2).

9.5 Impact strength Charpy - Flatwise (For sheets 2.5 mm & above) (Type test):

Below 10 mm thick	:	75 kJ/m^2, min.
10 mm thick & above	:	150 kJ/m^2, min.

9.6 Splitting load, Edgewise (For sheets 10 mm thick and above): 2.94 kN (300 kg), min.

9.7 Punching (For sheets below 2.5 mm) (Type test):

When the sheet under test is pierced in a single operation with a pattern shown in IS: 1998. There shall not be excessive lifting or cracking around the holes.

9.8 Machinability (For sheets 3.0mm and above) (Type test):

The sheet shall be capable of being sawn, milled, drilled and tapped with a M3.5 tap and shall be capable of being shaped in a shaping machine without showing any sign of cracking or chipping.

10.0 ELECTRICAL PROPERTIES:

10.1 Insulation Resistance after 24 hours immersion in water at 27^0C (Type test):
10^4 Megohms, min.

10.2 Electric Strength - Proof in oil at 90^0C:

10.2.1 Flatwise: Thickness upto & including 5mm : 14 kV/mm
above 5mm* : 12 kV/mm

10.2.2 Edgewise (For 5 mm and above) **:** 40 kV

* Thickness above 5mm shall be machined down to 5 mm keeping one surface intact.

10.3 Dissipation Factor (Tan delta) at 50 Hz (Type test) **:** 0.02, max.

10.4 Comparative Tracking Index (Type test) **:** 250, min.

11.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied alongwith each Consignment.

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

The test certificate shall bear the following information:

AA 22415 (Rev.No 02): Epoxy Laminated Glass Fabric Base Sheet.
BHEL Order No.
Supplier's Reference:
Batch/Lot No.
Test values obtained/Certificate for compliance for clauses 8.0 to 10.0 for all routine tests.

12.0 PACKING AND MARKING:

Identification slips shall be pasted suitably on all four corners of each board giving the size of the board and manufacturer's code number/grade. The boards shall be suitably packed in wooden case lined with water proof paper from inside. Each sheet should be separate from other sheet by a thick paper or card-board.

Each package shall be marked with the following information:

AA 22415: Epoxy Laminated Glass Fabric Base Sheet.

BHEL order No.
Manufacturer's / Supplier's Name
Batch/Lot No.
Thickness, Width and Length.
No. of sheets:
Net weight and Gross weight:
Test Certificate No.

13.0 REFERRED STANDARDS (Latest Publications Including Amendments) :

1) AA 085 17 01 2) IS;1998 3) NEMA - L1-1