



CORPORATE PURCHASING SPECIFICATION

AA 251 01

Rev. No. 04

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RESIN RICH EPOXY NOVOLAK BONDED GLASS BACKED MICA PAPER TAPE

1.0 GENERAL:

This specification governs with the quality requirements of resin Rich Epoxy Novolak Bonded Glass Backed Micapaper Tape and folium. The material shall be made from mica paper with a woven glass fabric backing adherent to one side and evenly impregnated with a B-stage epoxy novolak resin. The homogenous insulation produced after pressing and curing shall have temperature index of at least 155.

2.0 APPLICATION:

Used as main slot insulation of stator and other parts of electrical machines.

3.0 COMPLIANCE WITH NATIONAL STANDARDS:

There is no national standard covering this material.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

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

4.1.1 Standard Thickness:

0.10, 0.18, 0.20, 0.24 and 0.28 mm.

4.1.2 Width:

15, 20, 25, 300 and 400mm.

4.1.3 Length/Roll:

50 meters. However, for special applications any other size may also be ordered.

4.2 Tolerances:

4.2.1 Tolerance on Thickness:

Average value	: $\pm 0.02\text{mm}$.
Individual value	: $\pm 0.03\text{mm}$

Revisions :

CI 32.4.65 of MOM of MRC-E

APPROVED :

INTERPLANT MATERIAL
RATIONALISATION COMMITTEE-MRC (E)

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4.2.2 Tolerance On Width:

For widths 15, 20 and 25mm : ± 0.5mm.

For widths 300 and 400 mm : ± 1.0mm.

5.0 MATERIALS:

5.1 Mica paper:

The type of mica paper used shall be disclosed to BHEL and prior approval obtained. Once approved, it shall not be change without the concurrence of BHEL.

5.2 GLASS FABRIC:

The glass fabric backing shall be 0.04 - 0.05 mm, thick with suitable finish, compatible with the resin system used. The type of finish shall be disclosed to BHEL and prior approval obtained.

5.3 Resin Bond:

The resin used for bonding shall be catalysed epoxide novolak, and more specifically a polyglycidyl ether of phenolformaldehyde novolak, of epoxide equivalent value approximately 180.

The epoxide novolak shall be catalysed with suitable hardener to comply with the given curing schedule.

Departures from the formulation may be permitted but the fact of variation must be disclosed to BHEL and it must be supported by appropriate test data before such material is got approved. BHEL reserves the right to test the uncured resin from any lot by any instrumental methods for consistency of supplies.

6.0 TEST METHODS:

Unless otherwise specified, all the tests shall be conducted as per the relevant clauses of IEC -371-2 .

7.0 PROPERTIES OF TAPE:

7.1 Surface Conditions And Unreeling Characteristics:

The material shall be tack free but a minor degree of tackiness is acceptable. The material shall not be blocking after storing at 27⁰C ± 2⁰C for 24 hours and it shall be capable of being unreeled in a manner so as not to allow separation of mica paper from the glass cloth. Material shall not stick to the adjacent layers in the absence of interleaving. The tape shall be suitable for applications of hand taping, machine taping or wrapping.

7.2 Flexibility:

The tape shall be sufficiently flexible. When wound on a 3 mm dia mandrel with glass side up, at 27⁰C, there shall be no sign of cracks occurring in the mica paper.

**7.3 Substance (Annexure I):**

The substance of the tape shall be as given below:

Thickness	Total substance, g/m ²	Mica, g/m ²	Glass fabric, g/m ²
0.10	125±15	50±3	25±2
0.18	265±25	120±10	35±3
0.20	310±25	150±10	35±3
0.24	350±25	180±12	35±3
0.28	460±50	250±19	35±3

7.4 Resin-Flow (Annexure II):

The resin flow shall be within the limits as given below:

Temperature °C	Resin flow, %
90 ⁰	20 - 60
160 ⁰	40 - 70

- 7.5 Volatile Content** : 0.4% to 0.8%.
- 7.6 Bond Content** : 40±4%
- 7.7 Acetone Solubility** : 95% of resin content, minimum.
- 7.8 Gel Time (Annexure-III)** : 2 to 4 minutes.
- 7.9 Tensile Strength** : 150 N/cm width, minimum

8.0 CURING SECHEDULE:

The material shall cure into a homogenous mass at a pressure of 1.0 N/mm² and 165⁰ ±5C for one hour.


Note: For attaining the required electrical properties, post curing at 130⁰C-140⁰C may be necessary. The exact curing schedule shall be fixed on the basis of supplier's recommendations and keeping in view the specific requirements of the application, process facilities etc.

9.0 PROPERTIES OF CURED LAMINATE:

The laminate is prepared by curing the layers of tape at 165±5⁰C under a pressure of 1 N/mm² for one hour, followed by post curing at 140⁰±2⁰C for 16 hours. The laminates thus prepared, shall show the following properties:

9.1 Electric Strength (BDV) at Room Temperature:

40 kV/mm, min. (Tested on approximately 1 mm thick laminate).

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10.0 TYPE TEST:

The cured laminate prepared as per clause 9.0 shall show the following properties.

10.1 Loss Tangent at 1 kV/mm-50 Hz On 1 mm thick Laminate (AA 085 17 10)

10.2 Temperature °C	Loss Tangent (tanδ),max
Room Temp.	0.01
130	0.05
155	0.10

10.3 Flexural Strength : 145 N/mm² , minimum

10.4 Thermal Conductivity (For information only):

0.28 k cal/m/h/°C, minimum

Temperature range 20-155°C.

The thermal conductivity shall be measured on specimen with guarded hot plates (metal coated) and double cold plate method as per DIN 52612 or with any alternative equivalent method.

Dielectric Constant is 4.5, minimum.

Note: Periodicity is once in two years.

11.0 INTERLEAVING:

A suitable grade plain polythene film shall be used as an interleaving between the turns of the tape.

12.0 JOINTS:

The material shall be supplied in continuous lengths as stated on BHEL order.

Only one joint per roll is permitted subjected to the following conditions:
90% of the consignment shall be without joints. Material used for jointing shall have no adverse affect on the properties of the cured insulation. If the material used for jointing is not compatible with the insulation, the supplier shall notify accordingly

Rolls having joint shall be packed separately and appropriately marked.

13.0 TEST CERTIFICATES:

Unless otherwise stated, three copies of test certificates shall be supplied along with each consignment giving following information:

In addition, the supplier shall ensure to send one copy of test certificate along with the dispatch documents to facilitate quick clearance of the materials.



AA 25101 (Rev 04): Resin rich epoxy novolak bonded glass backed mica paper tape
BHEL order No.
Manufacturers/suppliers Name:
Trade name/mark, if any:
Batch/Lot No.;
Quantity supplied
Date of manufacture and expiry
Test results of clauses 4.0, 7.0, 8.0, 9.0 and 12.0.
Manufacturer should give compliance certificate for clause 5.0.

14.0 KEEPING PROPERTY:

The material shall retain the properties prescribed in this specification for a period of not less than 6 months when stored at 20°C and not less than 12 months when stored at 5°C under cover in a dry place in a original sealed container after the date of manufacture which shall not be earlier than one month of the scheduled delivery date mentioned in BHEL order.

15.0 PACKING AND MARKING:

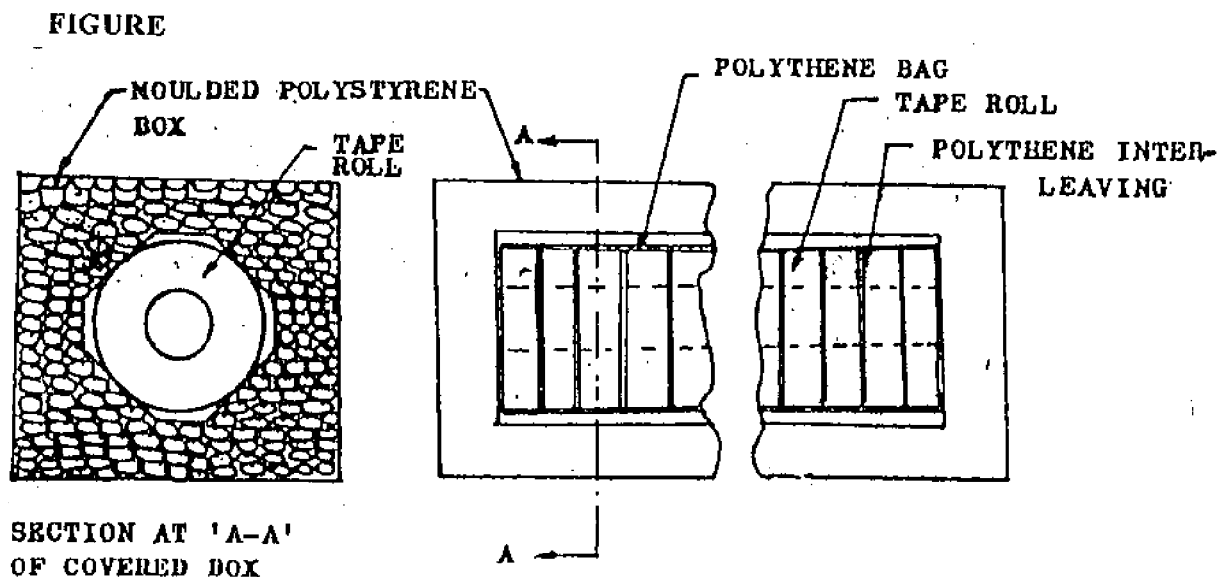
The tape shall be supplied wound tightly on rigid plastic bobbins with rounded edges with ID 25 or 55mm as specified on the order. The rolls shall be kept in a polythene bag which in turn packed in polystyrene container as indicated in the figure given below.

16.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IEC 371-2

2) DIN - 52612

3) AA 085 17 01





VIEW SHOWING THE ARRANGEMENT OF TAPE ROLLS IN BOTTOM HALF OF THE BOX

Each container shall be labeled with the following:

AA 25101: Resin rich epoxy novolak bonded glass backed mica paper tape

Manufacturer's/ Supplier's Name

BHEL Order No.

Batch No./Lot No.

Quantity supplied.

Date of Manufacture and expiry

ANNEXURE I

METHOD FOR THE DETREMINATION OF SUBSTANCE, VOLATILE MATTER, RESIN, MICA, AND GLASS CONTENT

1. PREPARATION OF THE SAMPLE:

20cm x 10cm of sample shall be cut and weighed (W1) to the nearest milligram. The sample shall be cut into 40 mm x 5 mm.

2. **SUBSTANCE:** Weight (gm/sq.metre)=50 W1

3. VOLATILE MATTER CONTENT:

About 3 g of the above prepared sample shall be weighed in a tarred ignited 6 cm dia crucible (W2) and shall be placed in an air oven at 115+2°C for 4 hours at atmospheric pressure. It shall then be cooled in a desiccator and the loss in weight (L) shall be determined.

$$\text{Volatile matter \%} = \frac{100 L}{W 2}$$

4. BOND AND MICA CONTENT:

The crucible and the contents from the above determination shall be heated over a low flame until the resin is reduced to carbon, taking care to prevent ignition. It shall then be transferred to a muffle furnace and shall be ignited at 500+25°C for 6 hours and then allowed to cool in a desiccator and the weight of residue (W3) shall be determined. With the aid of forceps all the glass cloth shall be removed and its weight (W4) shall be determined.

$$\text{Resin content, on a loss free basic \%} = \frac{(W2-L) - W3}{W2-L} \times 100$$

$$\text{Mica content (gm/sq.metre)} = \frac{50 W1 (W3 - W4)}{W 2}$$

$$\text{Glass content (gm/sq.metre)} = \frac{50 W1 (W4)}{W2}$$



ANNEXURE II

METHOD FOR RESIN FLOW TEST

Ten squares of 50 mm x 50 mm material shall be cut and stacked. For tape, the equivalent number of cross plied butted layers shall be cut as necessary to give the same size laminate. The assembled test pieces shall be weighed (M1). The bond content percentage (Cb) shall be recorded.

The press temperature shall be adjusted to $90 \pm 2^{\circ}\text{C}$ or $160 \pm 2^{\circ}\text{C}$ as required. The test piece shall be placed in the centre between cawl plates shall be immediately closed and a pressure of 1 N/mm^2 is maintained for 15 ± 1 minute. The test pieces shall be taken out of the press. The resin flash shall be removed and the test pieces shall be reweighed (M2).

$$\text{Resin Flow at } 90^{\circ}\text{C or } 160^{\circ}\text{C} = \frac{M1 - M2}{M1 \times Cb} \times 10^4$$

ANNEXURE III

METHOD FOR GEL TIME AT 160°C

The equivalent of 10 cm long tape shall be cut and stacked to form 1 to 1.5mm thick after consolidation. The test pieces shall be placed in the centre between cawl plates (1.5 mm thick) and inserted into the press heat at $160 \pm 2^{\circ}\text{C}$ such that one longer edge of the stack and one top and bottom edge of cawl plates are in line but approximately 5mm away from the edge of platens. The contact pressure shall be applied immediately and at the elapse of 1.5 minutes, the pressure shall be increased to 1 N/mm^2 . The gel time shall be taken when the stack was placed in the press at 160°C until gelation of the resin takes place.