SILICONE BONDED GLASS BACKED MICA PAPER TAPES

1.0 GENERAL:

This specification governs with the quality requirements of glass backed mica paper tape treated with silicone elastomer binder in B-stage. The homogenous insulation after curing shall have a temperature index of at least 180.

2.0 APPLICATION:

Used as coil insulation of AC and DC 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 of the tape shall be as specified on BHEL order.

4.1.1 Thickness:

Standard thicknesses are 0.14 and 0.17mm.

4.1.2 Width:

Standard widths are 15, 20 and 25mm.

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	: ± 0.03mm.
Individual value	: ± 0.04mm

4.2.2 Tolerance on Width:

± 0.5mm.

5.0 COMPOSITION:

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 0.03 mm, thick with suitable finish.

5.3 Silicone Bond:

The silicone elastomer bond used shall be disclosed to BHEL. It shall have a temperatuer index of at least 180.

Any variation from the approved formulation shall have the prior concurrence of BHEL. This silicone elastomer bond shall be tested by infra red spectrograph or any other suitable instrumental methods for its suitability and consistency of suppliers.

5.4 Substance:

Thickness, mm	Total substance, g/m^2	Mica, g/mm^2	Glass, g/mm^2
0.14	150 ± 15	75 ± 5	23 ± 2
0.17	215 ± 20	120 ± 10	24 ± 3

5.5 Bond (Silicon Elastomer) Content (Annexure I):

27%, minimum.

6.0 CURING SCHEDULE:

3-6 hours at 180^{0}C to 200^{0}C under pressure erected on woven polyester shrink tape according to BHEL specification AA 23702. Exact curing schedule shall be specified by the manufacturer.

7.0 PROPERTIES:

7.1 Surface Conditions/Unreeling Characteristics:

The tape shall be tack free but a minor degree of thickness is acceptable. The material shall not be blocking after storing at 27^{0}C ± 3^{0}C 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. The rolls shall be supplied without any interleaving.

7.2 Tensile Strength (IEC-371-2):

80 N/cm width, minimum.

8.0 PROPERTIES OF CURED INSULATION:

8.1 Electrical Strength (Annexure II):

Sufficient number of half lapped layers of tape are tightly wrapped on a copper strip of 1.6 x 16 mm size (or any other suitable size) and cured to get a final insulation thickness between 0.7 and 0.9mm and then tested for breakdown voltage with an A.C 50Hz source as per Annexure II. The BDV shall be as given below:

Specimen condition	Breakdown voltage kV/mm, min.
1. Straight portion	12.0
2. 45^0 bend	6.5
3. 90^0 bend	5.0
4. 135^0 bend	3.5

9.0 THERMAL CONDUCTIVITY (For Information Only):

0.21 to 0.23 W/m deg.C

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

10.0 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.

Rolls having joint shall be packed separately and appropriately marked.

11.0 ACCETANCE CRITERIA:

Material shall be accepted on the basis of the following:

a) Compliance certificate furnished by the supplier
b) Test certificate furnished by the supplier and / or testing carried out at BHEL end.

12.0 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 25111 (Rev 04): Silicone bonded glass backed mica paper tapes
BHEL order No.
Manufacturers/suppliers Name:
Trade name/mark, if any:
Batch/Lot No.;
Size and Quantity Expiry:
Test results of clauses 4.0 , 5.0, 7.2 & 8.0 and compliance for clauses 6.0, 7.1 & 10.0

13.0 KEEPING PROPERTY:

The material shall retain the properties prescribed in this specification for a period of not less than 6 months when stored at $20^0C \pm 3^0C$ and not less than 12 months when stored at $5^0C \pm 1^0C$ 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.

14.0 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 intern packed in polystyrene container as indicated below.

Each container shall be marked with the following information:

AA 25111: Silicone bonded glass backed mica paper tapes
BHEL Order No.
Manufacturers/ Supplier's name:
Trade name / mark , if any:
Batch/Lot No.:
Size and quantity supplied:
Date of manufacture & expiry:

15.0 REFRRED STANDARDS (Latest Publications Including Amendments):

1) IEC 371-2

ANNEXURE I - CLAUSE 5.5

DETREMINATION OF SILICONE BINDER CONTENT

1. Test Specimen:

The test specimen have a mass of approximately 5g.

2. Method of Test:

Weight the specimen in a previously dried and weighed extraction thimble to the nearest mg. The difference in mass is the mass of the specimen.

Put sufficient diethylamine (Analytical Reagent Grade) into a Soxhlet extraction flask to fill the siphon one and a half times and extract the specimen until extraction is complete at a siphon rate of 6 - 10 times per hour (the minimum time of extraction is 4 hours).

Allow the apparatus to cool, then replace the diethylamine with acetone and extract as before for one and a half hours.

Remove the thimble, allow it to dry in air on a watch glass for 10 minutes and then heat for 30 minutes in an air over at 105 ± 20^0C. Cool the thimble in a dessicator and then weight it to the nearest milligram. Subtract the weight of the thimble.

3. Results:

Report the silicone binder content for each specimen tested as a percentage to the first decimal place.

$$\text{Silicone binder content, percent} = \frac{\text{Loss in mass}}{\text{Specimen mass}} \times 100$$

ANNEXURE II - CLAUSE 8.1

TEST METHOD FOR ELECTRICAL STRENGTH

Copper conductor of size 1.6 X 16 mm or any other suitable size is taken. Sufficient number of half lapped layers are applied and samples are cured at 180^0 C to 200^0 C for 3 to 6 hours using woven polyester shrink tape according to BHEL specification AA 23702 to get final thickness between 0.7 and 0.9 mm. Samples are bend to 45^0 , 90^0 and 135^0 over a mandrel of 10 times the thickness of bare copper conductor.

High voltage breakdown test is conducted at 180^0 C ± 3^0 C by putting 20 mm wide aluminum or tin foil electrode over the bond or in the middle of straight sample.

Electrical strength is calculated in kV /mm after finding average increase in dimensions due to insulation in width and thickness.

$$ES = \frac{4V}{(b_2-b_1) + (t_2-t_1)}$$

Where ES = Electrical strength, kV/mm
V = Electrical breakdown voltage, kV

b_1 and t_1 = Width and thickness of bare copper conductors, mm

b_2 and t_2 = Width and thickness of insulated copper conductors after curing, mm