



CORPORATE PURCHASING SPECIFICATION

AA 257 15

Rev. No. 04

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MODIFIED ACRYLIC / POLYESTER RESIN IMPREGNATED WEFTLESS GLASS TAPE

1.0 GENERAL:

This specification governs the quality requirements of weftless unidirectional glass yarn tape, impregnated with a catalyzed thermosetting modified Acrylic / Polyester resin formulation with superior resin flow characteristics. The tape when cured shall have good tensile strength, resistance to humidity and saline water and shall have a temperature index of at least 180.

2.0 APPLICATION:

Used for banding rotors and armatures of traction machine, D.C. machines, etc. The bands can be applied hot or cold (preferably hot) so that resin flows between the layers to form a homogenous mass when cured.

3.0 CONDITION OF DELIVERY :

It shall be supplied in semi cured condition (B stage) in a soft well balanced flat ribbon form, thus assuring that each yarn bears an equal share of the load after banding.

4.0 COMPLIANCE WITH NATIONAL STANDARDS :

There is no national standard covering this type of material.

5.0 CHARECTERISATION OF THE RESIN:

The composition of the binder as determined by infra-red spectrography or thin layer chromatography or any other suitable method shall strictly be based on modified acrylic/polyester resin.

6.0 DIMENSIONS AND TOLERANCES :

6.1 Sizes:

Thickness, width and length/roll shall be as stated in BHEL order.

6.2 Thickness: 0.33 mm with tolerance of ± 0.05 mm.

6.3 Length/Roll: 200 meters with a tolerance of + 2 mm and - 0mm.

Revisions :

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APPROVED :

INTERPLANT MATERIAL
RATIONALISATION COMMITTEE-MRC (E)

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**6.4 Width And Tolerance:**

Standard widths are 20, 25 and 40mm. However, other widths can also be ordered and the purchaser shall specify the other width.

Width, mm	Tolerance, $\pm$ mm
Upto 25	1.6
Above 25	3.0

7.0 TEST SAMPLES:

One roll of 200 meters length shall be supplied for testing.

8.0 PROPERTIES:**8.1 Tape As received:**

8.1.1 Resin Content In Percentage-By Burning At $550^0 \pm 25^0\text{C}$: 27 ± 3

8.1.2 Warp Yarns (Ends)/cm width: 30 ± 1

8.1.3 Sealing (Solder) Test:

When hot pressed with a solder iron at $160^0 \pm 2^0\text{C}$, the resin of the tape should flow and stick to other layers within one minute.

8.1.4 Koeffler's Softening Point Of Resin (Optional Test)-Appendix I:

235^0C , maximum

8.2 PROPERTIES OF CURED TAPE:**8.2.1 Breaking Load At room Temperature (Appendix II):**

250 N/mm width minimum on fully cured tape

9.0 TYPE TESTS:**9.1 Tape As Supplied:****9.1.1 Loss In Weight:**

The loss of weight of the sample, after keeping at $200^0 \pm 10^0\text{C}$ for 400 hours $\pm$ 30 minutes shall not be more than 10%.

9.2 Cured Tape:**9.2.1 Breaking Load At $150^0 \pm 3^0\text{C}$ After Accelerated Ageing (Appendix II):**

175 N/mm width minimum

9.2.2 Resistance To Boiling Water (Appendix III): Shall pass the test

9.2.3 Resistance To Saline Water (Appendix IV): Shall pass the test



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10.0 TYPE TEST:

10.1 PROPERTIES OF LAMINATE (TYPE TEST) :

15 layers of tape are pressed at 3 N/mm^2 and $155 \pm 5^\circ \text{C}$ for 3 hours to prepare a 4mm thick laminate.

10.1.1 Cross Breaking Strength:

At room temperature : 900 N/mm^2 , min.

After keeping for 14 days in boiling water : 50%, max., reduction of the as received value

11.0 INSPECTION AT SUPPLIER ' WORKS:

When ever specified tests and inspection are to be conducted in the presence of BHEL's representative.

The supplier shall offer BHEL's representative all reasonable facilities, without charge to satisfy the latter that the material is being furnished in accordance with this specification. The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works, the supplier shall make necessary arrangements for carrying out the prescribed test elsewhere. The supplier shall notify BHEL in advance about the readiness of the material for inspection and testing.

BHEL reserves the right to test the material at BHEL's works and the final acceptance of the material shall be based on these test results.

12.0 TEST CERTIFICATES :

Unless otherwise stated, three copies of test certificates shall be supplied along with each consignment.

In addition, to the above, 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 25715, Rev 04: Modified acrylic/polyester resin impregnated weftless glass tape

BHEL order No.

Manufacturer's/Supplier's name and grade

Trade mark/Identification, if any

Batch/Lot No.

No. of rolls supplied and length/roll

Date of manufacture and expiry

Test results of clause 5.0, 6.0, 8.0, 9.0 and 10.0.

13.0 KEEPING PROPERTIES:

The material shall retain the properties prescribed in this specification for a period of not less than 6 months when stored at $20^\circ \pm 3^\circ \text{C}$ and not less than 12 months when stored at $5^\circ \pm 1^\circ \text{C}$ under cover in a dry place in the original sealed container, after the date of the scheduled delivery date mentioned in the purchase order.

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14.0 PACKING AND MARKING :

The material shall be suitably packed in rolls of ordered width and length to protect from contamination and damage during the transit. The date of manufacture and grade shall be clearly indicated on each roll of consignment. The date of manufacture shall not be earlier than 15 days prior to the date of despatch. Each package shall be marked with the following information:

AA 25715: Modified acrylic/polyester resin impregnated weftless glass tape

BHEL order No.

Manufacturer’s/Supplier's name and grade

Trade mark/Identification, if any

Batch/Lot No.

No. of rolls supplied and length/roll

Date of manufacture and expiry

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IEC 455-2

**APPENDIX – I (Clause 8.1.4)****PROCEDURE FOR THE DETERMINATION OF SOFTENING TEMPERATURE OF BINDER USED IN RESIGLAS TAPE BY KOEFFLER APPARATUS****1. Summary Of The Method:**

This procedure deals with the determination of temperatures at which the binder or RESIGLAS tape begins to soften and starts converting into infusible state. The method consists of placing two layers of the tape on the heated surface of Koeffler Apparatus for a specified period under a fixed load and then observing its condition.

2. Apparatus:

- 2.1 Koeffler Apparatus (IEC 455-2)
- 2.2 Metallic weights
- 2.3 Aluminium sheet padded on one side with rubber
- 2.4 Aluminium foil of 0.025mm thick
- 2.5 Set of calibration compounds

3. Procedure:

Switch on the apparatus and allow to stabilize for 45 to 60 minutes. Calibrate the temperature of apparatus with pure substances of known melting points. Place two test pieces of tape equal in length to that of the hot plate over each other and sandwich them between aluminium foil.

Place the tape and foil on the hot plate and immediately place aluminium sheet with rubber facing the foil and required weight to give a pressure of 60 g/cm^2 on the test piece. Allow the test piece to be on hot plate for a period of 20 seconds. Remove the test piece from the plate. Remove the aluminium foil and starting from cold end, try to separate the pieces of tapes. Mark the point at which separation of two layers of tape is no longer possible without breaking one of the layers. Measure the distance of the point from cold and read the temperature on the hot plate.

Take the average of three readings. If there is a difference of more than 3°C between two readings, repeat the tests on two more samples.

4. Test Report Of The Results:

Temperature for attaining infusible state-softening point: $^{\circ}\text{C}$

Note:

- i) It may sometime be necessary to apply a releasing agent is the aluminium foil. Silicone grease is suitable for this purpose.
- ii) Allow the apparatus to return to steady state after the test is over. 10 to 15 minutes waiting time is usually adequate.



APPENDIX – II (Clause 8.2.1 and 9.2.1)

METHOD OF TEST FOR BEAKING LOAD OF FULLY CURED TAPE

1. Preparation of Test Specimens:

Three split disc rings of 125 mm diameter and having a circumferential groove of 3 mm depth and 75 mm width are banded with six turns. Initial and final turns shall have extra half turn (overlap) so that full six turns are available for breaking load test.

The tape is laid in the groove in a smooth, flat manner such that the centre line of the tape coincides with the centre line of the groove. Tension of 100 N/mm width, consistent throughout the banding operation is applied to the tape. The tape end is maintained under tension till the band end is sealed with a heat gun or hot soldering iron.

The bands are cured for 5 hours at $150^{\circ} \pm 3^{\circ} \text{C}$.

2. Determination of Breaking Load at Room Temperature :

The bands are broken on a suitable tensile testing machine, the breaking load of each band being recorded. The breaking load of the tape is calculated as given below :

$$P = \frac{F}{2T \times B}$$

Where, P = Breaking load in N/mm width of the tape,
 F = Average of the breaking loads of the six bands in N.
 T = Number of turns of tape per disc ring, (i.e. 6)
 B = Width of the tape in mm.

The elongation can also be measured at breaking loads.

3. Determination of Breaking Load at $150^{\circ} \pm 3^{\circ} \text{C}$ After Heat Ageing:

Five split disc specimens banded with the tape are prepared as per clause 1 above. All the samples shall be kept in an oven maintained at $200^{\circ} \pm 5^{\circ} \text{C}$. Every second day (ie. After 48 hours) one sample shall be taken out and tested for breaking load as per clause 2 above, but at $150^{\circ} \pm 3^{\circ} \text{C}$. Thus, the last sample shall remain in oven for 240 hours (10 days) at $200^{\circ} \pm 5^{\circ} \text{C}$. A curve shall be plotted showing the fall of breaking load at $150^{\circ} \pm 3^{\circ} \text{C}$ and ageing time (days) at $200^{\circ} \pm 5^{\circ} \text{C}$. The strength at any point should not be less than 175 N/mm width i.e. 70% value of breaking load at room temperature.

**APPENDIX – III (Clause 9.2.2)****BOILING WATER RESISTANCE TEST**

The split discs are banded with six layers of tape and cured as per clause 1 of Appendix II. One sample partially and the other fully immersed in boiling water for 120 hours. After the test, the band shall be examined visually, there should not be any sign of cracks, damages or any defects on the bands.

APPENDIX – III (Clause 9.2.3)**SALINE WATER RESISTANCE TEST**

Two split discs are banded with three layers of tape and cured as per clause 1 of Appendix II. The samples shall be kept in two separate plastic bags containing 3% sodium chloride solution by weight. The bags shall be kept at $50 \pm 2^{\circ}\text{C}$ for 10 weeks. After the above test, there should not be any sign of cracks, damages or any defects on the bands.
