



**PRODUCT STANDARD**  
**TME DIVISION, BHOPAL**

**TM 21598**

**REV 00**

**PAGE: 01 OF 04**

**SPECIFICATION OF POLYESTER GLASS SILK TAPE FOR TRACTION MOTOR TYPE 6FRA6068 & 6FXA7059**

**1. GENERAL**

**1.1 SCOPE**

This specification covers the manufacturing and supply of Polyester Glass Silk Tape to be used in traction motor type 6FRA6068 & 6FXA7059. Application as stator winding insulation in overhang portion. Polyester Glass Silk Tape is used as final layer above porous tapes in production of VPI insulation winding.

**1.2 REFERENCE**

This specification is in line with CLW specification no. 4TMS.096.088.

Above CLW specification has been prepared on basis of ABB's bill of material document no. 3EHM 030966R0001 issued on 24.05.2000 (item serial no. 0019) component no. 3EJS200061P0020 material description Polyester Glass Silk Tape. Delivery Condition: ISOSEAL MF 611.

**2.0 MATERIAL**

The material shall be made up of impregnated mixed polyester glass fabric combined with PET film.

**2.1 CONSTRUCTION REQUIREMENTS**

Polyester Glass Silk Tape is a thermo-shrinkable tape. During impregnation the resin penetrates through the layer of Polyester Glass Silk Tape into the main insulation. During curing process Polyester Glass Silk Tape shrink under temperature and prevent a drain out of resin and give some pressure to main insulation. Polyester Glass Silk Tape used as a final layer above porous tapes in the production of VPI insulation winding.

**3.0 SOURCE OF RAW MATERIAL**

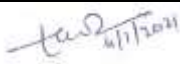
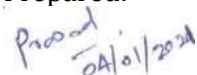

The tenderer shall use raw material from any reputed source who can supply the raw material strictly as per specification as well submit documentary proof regarding quantity of raw material.

**4.0 QAP**

The supplier should have quality plan indicating manufacturing process from the stage of raw material procurement, through in process and final tests.

**5.0 SIZE**

Size : 0.09 ± 0.01 mm X 20 mm wide (or as mentioned in BHEL Purchase order)

|                |              |     |  |   |                  |
|----------------|--------------|-----|--|---|------------------|
| Revision: 00   | Distribution | Qty | Approved: <br>(S. P. Singh) |   |                  |
| Dt: 04/01/2021 | TME          | 1   | Prepared: <br>(Prasad Telang) | Checked: <br>(Vikas Rawtiya) | Date: 04/01/2021 |
|                | CIM          | 2   |  |   |                  |
|                | QFD          | 1   |  |   |                  |
|                | MDX          | 1   |  |   |                  |

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TME 2011


**PRODUCT STANDARD**  
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| <u>S. No.</u> | <u>Size</u>                                   | <u>Unit</u>           | <u>Values</u>   | <u>Test Method</u>   |
|---------------|---|-----------------------|---|--|
| 01            | Thickness                                     | mm                    | 0.09 ± 0.1 mm<br>(or else as per BHEL PO requirements)  | IEC 60626-2 CL no 2  |
| 02            | Total Substance                               | g/m <sup>2</sup>      | 86 ± 9  | IEC 60626-2 CL no 3  |
| 03            | Glass Polyester fabric                        | g/m <sup>2</sup>      | 25 ± 3  | IEC 60626-2 CL no 3 dissolved resin in acetone                           |
| 04            | PET film                                      | g/m <sup>2</sup>      | 27 ± 2  | IEC 60626-2 CL no 3 dissolved resin in acetone                           |
| 05            | Resin content                                 | g/m <sup>2</sup>      | 34 ± 4  | IEC 60626-2 CL no 3 dissolved resin in acetone                           |
| 06            | Tensile strength                              | N/10 mm               | ≥ 60  | IEC 60626-2 CL no 4  |
| 07            | Elongation                                    | %                     | ≥ 20  | IEC 60626-2 CL no 4  |
| 08            | Edge Tearing                                  | N                     | ≥ 180   | IEC 60626-2 CL no 6  |
| 09            | Breakdown voltage                             | kv                    | ≥ 3   | IEC 60626-2 CL no 9  |
| 10            | Thermal shrinking after 2 hour                | %                     | ≤ 1 (at 75° C)<br>≥ 8 (at 120° C)<br>≥ 14 (at 150° C)   | IS 5351 Appendix A 7   |
| 11            | Color   | Visual                | Ferric Oxide (Brown)  | Visual   |
| 12            | Width   | mm                    | 20 ± 1  | Vernier Caliper  |
| 13            | Winding                                       | -                     | Fabric up   | Visual   |
| 14            | Color leaching test                           | -                     | No color of the PSG tape should leach into the VPI resin                                      | -  |
| 15            | Viscosity rise of VPI resin                   | Brookfield viscometer | Difference in viscosity should be ≤ 25 cp   | -  |
| 16            | Film fabric separation after VPI impregnation | -                     | Maximum allowable separation area 0.1 cm <sup>2</sup> min 5 samples should pass out of 6 nos. | -  |
| 17            | Lamination test                               | -                     | Forms laminate (Resin is not cured)   | Laminate 2 layers fabric to fabric 150° C at 1 hour 5 Kg/cm <sup>2</sup> |
| 18            | Plastic Core (Bobbin ID)                      | mm                    | 55 ± 2 mm   | Vernier Caliper  |

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|  |  |  <p><b>PRODUCT STANDARD</b><br/><b>TME DIVISION, BHOPAL</b></p> <p>TME 2011</p>  | <p><b>TM 21598</b></p> <p><b>REV 00</b></p> <p><b>PAGE: 03 OF 04</b></p> |
| <p><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company</p> |  | <p><b><u>7.0 INSPECTION &amp; TEST CERTIFICATE</u></b></p> <ul style="list-style-type: none"> <li>Material inspection shall be carried as per BHEL PO requirements.</li> <li>All the tests shall be carried out preferably at manufacturers work. If any testing facility is not available at firms premise, test has to be done at NABL of equivalent international accredited lab.</li> <li>In case of import, supplier must produce original TC, GC &amp; import documents.</li> <li>Supplier internal test result for all tests specified in clause 5.1 shall be furnished by supplier along with the supply.</li> </ul> <p><b><u>8.0 MARKING</u></b></p> <p>Each roll shall be legibly marked at both ends with following information</p> <p>(a) Manufacturers name or trademark</p> <p>(b) Purchase order reference and date.</p> <p>(c) Name, size, quantity, batch no., manufacturing &amp; expiry date.</p> <p><b><u>9.0 PACKING</u></b></p> <p>Unless or otherwise specified by BHEL, the material shall be supplied in 50 m roll wound on a hard tubular core/ spool with an inside diameter 55±2 mm and outside diameter of the roll 105±5 mm and also sufficient tension to form a compact roll without deforming the construction of tape. The tape shall wound tightly over the core such that the edges are not uneven and shall not get loosened when dropped be over a floor from one meter height. The inner edge of the spool should be curved edge. Glossy portion of the tape should be inside and rough portion of the tape should be outside the roll. Each roll of the material shall be suitably packed so that no damage can arise during transportation and it can be unloaded easily.</p> <p><b><u>10.0 SHELF LIFE</u></b></p> <p>Unlimited under normal conditions (20° C, 50% r.h.)</p> <p><b><u>11.0 SPECIAL TESTS</u></b></p> <p>This tests is to be performed by new sources for approval by Indian Railways (CLW)</p> <p><b><u>11.1 LEACHING OF COLOR &amp; VISCOSITY OF VPI RESIN</u></b></p> <p>This test is done to ensure that PGS tape does not react with existing VPI resin.</p> <p><b>Procedure</b> - Take 500 gms of SILRES H62C or other approved resin in a flask. Heat the silicone resin at 70°C for 2 hours in an oven or oil bath. Measure its viscosity. Put 2 sample in 1 meter PGS tape in resin and submerge it in resin. Maintain temperature of resin at 70°C for 4 hours. Keep another 500 gms of SILRES H62C or another approved resin without tape in another flask at 70°C for identical time. After 4 hours check color of resin &amp; viscosity of resin.</p> <ul style="list-style-type: none"> <li>Color of the PGS tape is should not leach into the resin.</li> <li>Difference of viscosity in between two resin (without tape and with tape) should be less within 25 cp.</li> </ul> |  |
|  |  | <p></p>   |  |

## 11.2 FILM FABRIC SEPRATION AFTER VPI IMPREGNATION

This test is done to ensure no damage of PGS tape due to reaction with VPI resin.

**Procedure** – Take 6 Copper bar of size 2.5 mm tk. X 30 mm X 250 mm length. Wind tape with half over lap of the Copper bar, keeping the fabric side up. Seal both ends with polyimide adhesive tape. Dry Copper bar at 70°C under vacuum (0.5 – 5 m bar) in the impregnation vessel for 30 minutes. The impregnation vessel, still under vacuum is filled with Silicon Impregnating Resin SILRES H62C. The Copper bar is submerged in resin. Apply pressure 4-5 bar for 1 hour. Release pressure, open VPI tank & remove Copper bar . Allow excess resin to drip for 30 minutes at 70°C in another oven. Cure Copper bar at 95° C for 1 hour followed by 120° C for 45 minutes and further followed by 180°C for 1 hour. Examine Copper bar for fabric and film separation.

- Grey area (as shown in figure below) should be less than 0.1 cm<sup>2</sup> in 5 out of 6 samples.



Grey area

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