STR No. ELRS/STR/CLA/0012

GOVERNMENT OF INDIA
Ministry of Railways

SCHEDULE OF TECHNICAL REQUIREMENTS

FOR

CONNECTING LEAD WIRE

FOR

AUXILIARY MOTORS

FEBRUARY, 2004

Issued by

ELECTRICAL DIRECTORATE
RESEARCH DESIGNS & STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW – 226011

Schedule of technical requirements for "Connecting Lead Wire" for use on Stators of Auxiliary Motors of Electric Locomotives.

1. General : Connecting Lead Wire for use on Stator of Auxiliary Motors of Electric Locomotives are procured as per Clause 5.1 of RDSO Special Maintenance Instruction No.RDSO/ELRS/SMI/185-2000 (Revision-1) (hereafter called "the specification"). The Schedule of Technical Requirements mentioned hereunder is issued to serve as a guideline to the manufacturers of Connecting Lead Wire (hereafter called "the firms") and should be read in conjunction with the Specification. The firm should satisfy themselves about having complied with the requirements of the specification and technical requirements. The technical requirements are meant to serve as a guideline only and are not exhaustive.

1.1 The firm should have currently valid ISO 9000 Certificate including the subject item under its range of manufacture.

2. Specification :

The connecting lead shall be procured as per Clause 5.1 of SMI No.RDSO/ELRS/SMI/185-2000 Rev. 1. The subject clause is reproduced below for ready reference.

Flexible Connecting Lead shall be made with nickel coated annealed high conductivity Copper Wires, insulated with varnished glass fabric tapes with an external braiding of glass fibres impregnated with Silicone Varnish with additional covering of fire retardant Silicone Elastomer by extrusion process or by multi dip process. Maximum overall diameter of connecting lead wire shall be 1.0 mm more than as specified in BS 6195/1969 type 8b(Table 6) Category C for 4 and 6 mm^2 size and Category 'D' for 10 mm^2 and 70 mm^2 size. The cable shall withstand the proof voltage test of 6.0 kV (rms) and 15 kV (rms) for one minute duration for category C & D respectively. The lead shall be suitable for temperature of -10 °C to 180°C.

3. Raw Material :

3.1 The Silicon Insulation – (Elastomer + Varnish) shall be purchased by the firm only from internationally reputed sources. The firm should maintain batch wise record of procurement and furnish documents as proof of purchase.

3.2 Nickel coated Copper wire shall be purchased from reputed winding wire manufacturers having ISO 9000 Certificate for their manufacturing facility. The firm should possess and furnish batch wise test certificate as proof of compliance to BS 6360 and also for Nickel coating.

3.3 The firm should have its own Testing Laboratory for testing finished product as per specification. For raw material manufacturing certificate/Govt. Test Lab Certificate as required by Inspecting Officer will be provided.

3.4 Proper record of each sub-supplier clearly showing the quantity purchased and rejected as well as the cause of late delivery, if any, shall be kept.

4.0 **Manufacturing :**

4.1 The manufacturing shall be carried out in dust free, clean and enclosed environment.

4.2 List of M&P required for manufacturing shall be as per Annexure A. The list does not specify the capacity and quantity of various M&P, which may vary according to the manufacturing capacity of the individual firm.

4.3 Steps of manufacturing process in brief are mentioned in Annexure 'C'.

5.0 **Testing :**

5.1 All the tests shall be carried out as laid down in the relevant Clauses of BS 6195. List of testing facilities to be maintained in the firms laboratory shall be as per Annexure B. The accuracy and capacity of the testing and measuring equipment shall be adequate to meet the requirement as laid down in the above mentioned Specification.

Annexure-A

Details of Machinery & Plant

1. Braiding machine
2. Air Circulated Oven 200°C
3. Dipping Tray
4. Taping machine
5. Coating tower with Electrical heating up to 300°C with automatic digital temperature control.
6. Coating oven 400°C

Annexure –B

List of Lab Equipment.

1. High voltage tester	15 KV
2. Resistance meter	Wheat Stone Bridge
3. Thermometer	Least Count 0.5°C
4. Insulation resistance	Mega ohm meter
5. Dimension measurement	(a) Vernier Calliper with least count 0.01 mm (b) Micrometer with least count 0.001 mm
6. Testing oven	400°C
7. Viscosity cup	For measuring viscosity of Silicone

8. Tensile Strength Testing Machine.
9. Mandrels of appropriate diameter for bend tests.

Annexure `C'

Manufacturing Process Steps in brief :

1. Annealed copper conductor with nickel coating (only annealed copper without nickel coating shall not be accepted).

2. Over the nickel coated annealed copper conductor, provide two layer of fibre glass silicone tape (Polyester layer over (I) shall not be accepted).

3. Over the (2) provide fibre glass braiding treated with silicone varnish (ordinary).

4. Over the (3) provide silicone elastomer by extrusion process or dipping process. However, extrusion process shall be preferable.

5. In any case, over all diameter will not increase as per the Table 6 Type 8 preferably of BS 6195/69.

6. All the tests shall be conducted on the cable as per BS 6195/69.