फैक्स/Fax : 91-0522-458500
तार : 'रेलमानक' लखनऊ
Telegram : 'RAILMANAK', Lucknow
टेलीफोन/Tele : 451200 (PBX)
450567 (DID)

सत्यमेव जयते

भारत सरकार - रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ - 226011
Government of India-Ministry of Railways
Research Design & Standards Organisation
Lucknow - 226011

SN 2105

EL/3.270 Dated : 30.10.2000

SPECIAL MAINTENANCE INSTRUCTION No.RDSO/ELRS/SMI/185-2000, REV.1

1.0 TITLE

Rewinding Materials for Auxiliary Motors & Arno Converters.

2.0 **APPLICATION:**

Auxiliary motors & Arno Converters for all Electric Locomotives. **It supersedes earlier SMI No.RDSO/ELRS/SMI/185 dated 18/20.2.1997 and its 6 amendments.**

3.0 OBJECT

3.1 Railways have reported failures on Auxiliary motors & Arno Converters on account of stator winding burnt. Detailed investigation into failures revealed that most of the failures have occurred due to interturn shorts caused by failure of insulating materials in the slot /overhang and failure of connecting lead wire between overhang and terminal box etc.

3.2 In order to arrest the burning of these motors in service, details of the materials to be used by rewinding shop/shed are given in the following paragraphs which may be used during rewinding of the failed stators.

4.0 MATERIALS REQUIRED

4.1 The materials to be used, the specifications, the approved sources of supply and acceptance tests are indicated in Annexure – I. For latest approved sources of supply, follow the last list of approved suppliers for electric locomotive "items" which is being ammended every six monthly i.e. in June and December of every year.

5.0 PERIODICITY

5.1 Whenever rewinding/repair of stator of auxiliary motor & arno converter is undertaken.

6.0 **INSTRUCTION DRAWING** : NIL

31/10

7.0 AGENCY OF IMPLEMENTATION

All Electric Loco sheds and rewinding shops of Railways.

8.0 DISTRIBUTION

As per enclosed list.

Rajiv Kumar.

(R K Kulshrestha)
for Director General (Elect)

Annexure – I

MATERIALS FOR REWINDING OF 3-PHASE AUXILIARY MOTOR STATORS/ARNO CONVERTER

1. POLYESTERIMIDE OVER COATED WITH POLYAMIDE-IMIDE ENAMELLED BOUND COPPER WIRE, CLASS 200-CONFORMING TO IS 13730-Part 13-1993.

1.1 Material Specification

Enamelled round copper wire conforming to IS-13730- Part 13 of 1993. The wires shall have the base coat of Polyesterimide enamel MT 533.39A and top coat with Polyamide-imide known as Allotherm 602.35A of Schenectady Beck India Ltd. Enamelled copper wire is also known as Dual Coated enamelled winding wire and falls in the category of temperature Class-200.

1.2 **Approved Suppliers :**

As per the latest approved suppliers list for Electric Locomotive items of RDSO.

1.3 **Acceptance Tests :**

Acceptance tests shall be as per guidelines laid down at Annexure – II.

1.4 **Application :**

All auxiliary motors and arno converters shall be rewound with this type of enamelled winding wire for Electric Loco.

2.0 **Impregnating resin :**

2.1 **Material Specification:**

2.1.1 Dobeckan FT 2005/500 EK of M/S.Schenectady Beck India Ltd. It is one component solventless 'UP' impregnating resin of temp.index 200°C. RE-009 of M/s.Rotomac Electricals is a equivalent resin .

2.1.2 Alternatively, use Elmotherm H 71A of Schenectady Beck India Ltd. It is a polyesterimide based impregnating varnish of temperature index 180°C.

2.2 **Approved Sources :**

Approved on regular basis :

M/s.Schenectady Beck India for FT 2005/500 EK resin & H-71 A varnish.

Approved for developmental orders :

M/s.Rotomac Electricals – for RE – 009 resin.

2.3 **Acceptance tests** : As per manufacturer's data sheet.

2.4 **Application**

On rewound stators of Auxiliary motors and Arno Converters.

2.5 **Method of impregnation**

Impregnation will be by vaccum pressure impregnation only for all types of stators.

3.0 Insulating Material

i) Slot liner & Wedge Separator - NKN(Nomex 410– Kapton-Nomex 410) or Nomex 418(Calendered)
ii) CoilSeparator & Interphase separator - NKN (Nomex 411 – Kapton – Nomex 411)

3.1 **Material Specification**

(i) Nomex – 418 (Calendered)-0.25 mm thickness
(ii) NKN (Nomex – 410 – Kapton-Nomex 410) - 0.25 mm thickness.
(iii) NKN (Nomex 411 – Kapton-Nomex 411) 0.25 mm thickness.

3.2 **Approved Sources** :

3.2.1 **Approved Sources for Nomex 418 (Calendered)** :
(On regular basis)
a) M/s.DU-Pont, USA, Japan and their authorised distributors in India.
b) PRS Permacel, Mumbai.
c) BHEL, Bhopal.

3.2.2 **Approved Sources for Nomex-Kapton-Nomex (NKN)**
(on regular basis)
a) Krempel, Germany.
b) Beico, Nasik
c) PRS/Permacel, Mumbai.

3.3 **Acceptance Test:**

As per manufacturer's test certificate. However, materials shall be tested for dielectric strength, tensile strength and these values should be in conformity with the limits shown in manufacturer's catalogue.

3.4 **Application** : On stators of auxiliary motors & Arno- converters.

4.0 SLOT WEDGE

4.1 Material Specification : Epoxy fibre glass laminate.

4.2 **Recommended Sources of supply** : As per existing sources of Railways/CLW.

4.3 **Acceptance Test** : As per manufacturer's recommendations and drawing of the individual Railways for various auxiliary motors.

4.4 **Application** : On all auxiliary motors & Arno converters.

5.0 **CONNECTING LEAD WIRE** :

5.1 **Material Specification** :

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 silicon varnish with additional covering of fire retardant Silicon Elastomer by multidip process or by extrusion 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 sizes and category 'D' for 10 mm^2 & 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.

5.2 **Recommended sizes of connecting lead wire**:

5.2.1 For Auxiliary Motors

(i) Between 0.75 KW to 5 KW motor – 56/0.3 (4 mm^2)
(ii) Between 5 KW to 15 KW motor – 84/0.3 (6 mm^2)
(iii) Between 15 KW to 30 KW motor – 80/0.4 (10 mm^2)

5.2.2 For Arno Converters

(i) For U,V & W main terminals – 70 mm^2
(ii) For Neutral terminal - 10 mm^2

5.3 **Approved Sources of supply :**
(on regular basis)

i) M/s.Jhaveri Thanawala Corporation, 114-A, Pokhran Road, Khopat, Thane – 400 601.
ii) M/s.Universal Cable Co., Satna-(M.P)
iii) M/s.Fort Gloster Industries, 31, Chowringhee Road, P.B.No.9126, Calcutta –700 016.

(On developmental basis :)
i) M/s.Remko Wire Industries Pvt Ltd., 6A, Dharam Thakur Industrial Estate, Near Petrol Pump, Ulhasnagar-421 004.

5.4 **Acceptance Test** :

As per BS Specification and RDSO description as per Para 5.1 mentioned above.

5.5 Application : On all auxiliary motors and Arno- converters.

6.0 SLEEVE:

6.1 **Material Specification :**

Flexible insulated fibre class sleeve with coating of fire-retardant silicon elastomer applied by extrusion or multidip process having temperature index of 180°C as per BS 2848 type 1/180 Tb having wall thickness of 0.9 mm and capable to withstand minimum B.D.V of 5 KV for one minute.

6.2 **Approved Sources for supply** : (on regular basis)

i) M/s.Jhaveri Thanawala Corporation, 114/A Pokharan Road, Khopat, Thane – 400 601.
ii) M/s.Tapac Industries, Shri Mohanmills Compound, G B Road, Thana – 400 607.
iii) PRS Permacel Pvt Ltd, Hochest House, 8th Floor, 193 Backbey Reclamation, Nariman Point, Mumbai – 400 021.
iv) M/s.3 A Associates Incorporated, Kanji Gokuldas Bldg., 2nd Floor, 158 Lohar Chawl, Mumbai – 400 002.
v) M/s. Bells Organics Pvt Ltd, Bells House, 10A HO CHI Minh Sarani, Calcutta – 71.
vi) M/s.Remko Wire Industries Pvt Ltd, Regd. Office: 6A. Dharam Thakur Industrial Estate, Near Petrol Pump, Ulhasnagar- 421 004

Authorised dealers of M/s.Remko Wire Industries

i) M/s.Zenith Enterprises, D-117, Sector –26, NOIDA – 201 201.
ii) M/s.Sagar Electrical, Shop No.7, Satyam Complex, Near Ashok Talkies, Ulhasnagar – 421 003.

6.3 **Acceptance Test :**

As per BS 2848 TYPE 1/180 Tb and material should withstand BDV value of 5 KV. Fire retardant test as per IS : 4249 Appendix 'B'.

6.4 **Application** : On all auxiliary motors and Arno converters.

7.0 BRAZING MATERIAL

7.1 **Material Specification** :

Rupatam Silver '14' Alloy shall be used for internal winding connection and between the terminal lead and winding wire. Rupatam 43 (BaCuAg 16 to IS 2927) shall be used between rotor bars and end rings.

7.2 **Approved Sources of Supply** :

Approved on Regular basis:

i) M/s.ESAB India Ltd.,
Regd. Office : Lloyds Centre Point, 2nd Floor, 1096 – A, Appasaheb Marathe Marg, Prabhadevi, Mumbai – 400 025.

ii) M/s.Cookson India Ltd, 182/115, Diamond Harbour Road, Thakurpukar , Calcutta – 700 063.

iii) M/s.Advani Oerliken LTD, Bhandup, Lal Bahadur Shastri Marg,Mumbai-78

iv) M/s.Maxiflow Industries, 4721, GIDC, Phase – IV, VATVA, Ahmedabad – 382 445.

Approved for developmental orders:

i) M/s. Khanna Traders & Engineer, CB-105, Ring Road, Naraina, New Delhi – 110 028.

7.3 **Acceptance Test** :

Ruptam Silver 14 to grade Ba Cu P5 and Ruptam 43 to grade Ba Cu Ag 16 to IS : 2927.

7.4 **Application** : On auxiliary motors & Arno-converters.

8.0 OVERHANG BINDING/TAPING

8.1 **Material Specification** .

As per CLW specification No.4 TMS.091.010 Alt.3 or latest for fibre glass twines and tapes.

i) Glass cord of 1.0mm size shall be used.

ii) Each coil emerging from the slot shall be covered with ½ lap impregnated glass tape of size 0.13 x 25 mm.

8.2 **Recommended Sources of Supply** :

From existing sources of Railways.

8.3 **Acceptance Test** :

As per CLW Specification 4 TMS.091.010 Alt 3 or latest.

9.0 INSULATION AT STAR POINT

9.1 **Material Specification** :

Cover the brazed joint with half lap, 2 layers with Nomex 410, 2 mil thick.
On Insulated Joint apply Silicone adhesive sealent type KE 45 RTV – R as per Hitachi Specn. A 0113.

9.2 **Recommended Sources of Supply** :

9.2.1 **For KE 45 – RTV-R** :

As per latest list of approved sources of CLW.

9.3 **Acceptance Test** :

As per manufacturer's recommendation and Hitachi Specification No.A-0113.

10.0 TERMINAL LUG

10.1 **Material Specification** :

Copper Tubular lug as per RDSO Drg. SKEL – 3001. (Refer also SMI No. RDSO/ELRS/SMI/32 issued vide letter EL/3.2.70/J2 dt.21.11.78)

10.2 **Recommended Suppliers** :

M/s.Dowell's Electro Works,
Gatguru Estate, Office Aarey Road,
Goregaon East, Mumbai – 400 063.

10.3 **Acceptance Test** : As per relevant IS or Manufacturer's recommendations.

11 **Terminal Block**

11.1 **Material Specification for Auxiliary Motors** :

Epoxy moulded glass reinforced terminal Block to RDSO SKEL 2754 A and 2784 A.

(Ref RDSO Modification Sheet No. WAM4/61 issued vide RDSO letter No.EL/3.2.70/D4, dt. 16.1.78).

11.2 **Approved Sources of supply for terminal block for Auxiliary motors** :
(on regular basis)

i) M./s.Hatim Dielectrics, 90, Rippon Street, Calcutta – 700 016.
ii) M/s.Dusada Engg. Co. Pvt Ltd., Zora Mandir, Kavi Guru Rabindra Nath, Kancharapura, 24 Parganas North (W B)
iii) M/s.Hind Engg. Co., Todi Corner, 32, Ezra Street, 3rd Floor, Room No.356, Calcutta – 700 001.
iv) M/s.Atual Industries, E-925 Dabua Colony, New Industrial Township, Faridabad – 121 001 (Haryana).

11.3 **Material specification for Arno Converter** :

(Ref : RDSO Modification Sheet No.ELRS/MS/0255 of 30.3.99 with amendment No. 1 of 4.1.2000)

Epoxy moulded glass reinforced terminal plate as per M/s.Jyoti drawing No.3EK-4037

11.4 **Approved sources of supply for terminal plate for Arno converter** :
(on regular basis)
(i) M/s.Jyoti Limited, Industrial Area, Vadodara – 390 003.
(ii) M/s.Baroda Bushings & Insulators, 746/1-2, GIDC Estate Makarpura, Vadodara – 642 878.
(iii) M/s.Atul Industries, E-925, Dabua Colony, NIT, Faridabad – 121 001. (Haryana)

11.5 Acceptance Test : As per above drawings.

Annexure - II

TEST FOR INSPECTION AND ACCEPTANCE OF ENAMELLED WINDING WIRE AS PER IS 13778 – Part 1 to 6 of IS 1993.

1. The following tests shall be conducted as per IS 13778 Part 1 to 6 at the manufacture works before acceptance. However, the test shall be repeated at the user sheds and shops before putting the winding wire into the service.

For each test the winding wire should meet respective minimum acceptable value as indicated in IS 13730 – Part 13 for dual coated enamelled winding wires.

IS 13730 (Part 0/Sec I) 1993 – deals with general requirements of enamelled winding wires.

IS 13778 – Part 1 – deals with the lists of the tests which are to be conducted on the enamelled winding wires.

IS 13778 – Part- 2- deals with the determination of dimensions –diameter shall be checked as per this IS.

IS 13778 – Part –3 – deals with tests pertaining to Mechanical Properties . Following are the tests which shall be conducted on Part 13 enamelled winding wire.

- Elongation.
- Stringiness.
- Flexibility and adherence.
- Resistance to abrasion.

IS 13778 – Part – 4- deals with chemical properties tests and following tests shall be applicable for Part 13 wire.

- Solvent Test
- Resistance to transformer oil in the presence of water.

IS-13778 – Part –5 deals with the test pertaining to Electrical properties of the enamelled winding wire. Following are the tests which shall be conducted on Part 13 wires :

- Electrical Resistance,
- Breakdown voltage.
- Continuity of covering.

IS 13778 – Part 6- deals with the tests pertaining to Thermal properties of the enamelled winding wire. Following are the tests which shall be conducted on the dual coated i.e. Part 13 enamelled winding wires.

- Heat shock tests.
- Cut through tests.
- Thermal endurance.
- High temperature failure tests.

----------x----------x----------x----------