STR No.RDSO/2008/EL/STR/0052 (Rev '0')

सत्यमेव
जयते

GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

SCHEDULE OF TECHNICAL REQUIREMENTS FOR REPAIR/OVERHAULING OF DC TRACTION MOTORs OF ELECTRIC LOCOMOTIVES/EMUs/MEMUs DURING AOH, IOH & POH

September ' 2008

Issued by

Electrical Directorate

Research, Designs and Standards Organisation
Manak Nagar, Lucknow-226011

1. SCOPE

During 55th ESC held at Nainital for improving the reliability & productivity of Electric Locos/EMUs/MEMUs , repair/rehabilitation/overhauling of traction motors has been decided to be undertaken by Railways from OEM/approved sources to the extent adequate facilities are not available in house. RDSO has been asked to prepare Schedule of Technical Requirement (STR) for the subject item. The Schedule of Technical Requirement (STR) mentioned hereunder is issued to serve as a guide to the firms and should be read in conjunction with latest RDSO's specification and relevant scope of work for Traction Motors under AOH, IOH & POH to the firms. The firm should satisfy themselves having complied with the requirements of the STR. Firm should also implement all the modifications and follow all the maintenance Instructions issued by RDSO time to time.

The technical requirements are meant to serve as guidelines only and are not exhaustive.

2. GENERAL REQUIREMENTS

2.1. The firm should be certified to ISO: 9001 by an agency accredited by NABCB and the concerned item should be included in the scope of this certification.

2.2. A system of regular submission of rejection details of material giving rejection rate, cause of rejection, corrective action taken etc. on quarterly basis should be followed by the firm if applicable

2.3. The firm shall have a system of documentation in respect of rejection at customer end, warranty replacement and failure of item supplied by them during service.

2.4. The firm shall have a system of recording the plant, machinery and control equipments remaining out of service, nature of repairs done etc.

2.5. The testing and measuring equipment shall be duly calibrated and the validity of calibration should be current and verified by physically checking the calibration certificate issued by the Calibration Agency from whom it was calibrated.

2.6. The firm shall have a system of easy traceability of the product from incoming stage to finished product stage. Stamped identification marking with serial number should be used for this purpose.

2.7. The firm shall have the calibrated requisite number of jigs, fixtures and Gauges so that meat the requirement.

3. QUALITY ASSURANCE PLAN (QAP)

The firm shall prepare a Quality Assurance Plan (QAP) for all items for which approval is sought and submit the same as part of compliance of this STR. The QAP shall be a comprehensive document covering the following aspects:

3.1. Details of Quality Control Organisation of the firm along with key personnel engaged in the QC function.

3.2. Quality Assurance Process of incoming materials used for the subject items.

3.3. Process Flow Chart indicating process of overhauling for an individual product or for a family of products if the process is same.

3.4. Quality Assurance System – Inspection & Testing Plan including the stage inspection.

3.5. Calibration scheme and status of calibration of equipments used in the quality process.

3.6. Details of the above aspects are described in the following paragraphs. The QAP shall be approved by RDSO and shall form basis of approval process.

4. QUALITY CONTROL ORGANISATION

4.1. The complete organizational setup of the Quality control key personnel and officials along with their qualification and experience should be furnished.

4.2. The Quality Control organization should be headed by a senior level official having adequate technical qualification who shall directly report to plant in-charge.

5. INCOMING MATERIAL

5.1. A complete Bill of Material indicating all input material items required for overhauling of the product, governing specification and their sources of supplies as approved by the firm in accordance with Clause 7.4.1 of ISO-9001 (2000) should be furnished.

5.2. Firms shall procure all the raw materials (Insulating materials, Laminations etc.) from RDSO/CLW approved sources along with test certificates and same should be available as & when asked for.

5.3. Major items like Armature coils, Magnet frames, Suspension Tubes Commutator, field coils etc. ,if are being manufactured in house; firm must possesses RDSO's approval for compliance of relevant STRs of respective items. If they are out sourced, should be procured only from RDSO/CLW approved sources.

5.4. Test results of all incoming raw materials with reference to Test Certificates issued by the suppliers and the results of internal tests carried out by the firm for verification may be submitted as part of

QAP. Firm shall maintain the stock register with details of purchase, used materials with respect to various orders and disposal of used materials along with available balance.

5.5. PROCESS OF MANUFACTURE

5.6. Complete Process Flow Chart covering all steps of process of overhaul for an individual product (or for a family of products if the process is same) shall be clearly enlisted as a part of QAP.

5.7. Details of Jigs and fixtures used during overhaul should be furnished along with the overhauling process wherever used.

5.8. List of typical M & P required for overhauling is furnished in **Annexure- I.** The list is for general guidance only and actual overhauling operations shall be submitted and got approved by the firm as a part of QAP.

6. QUALITY ASSURANCE PROCESS- INSPECTION AND TESTING PLAN

6.1. Complete Inspection and testing Chart covering all steps of process of overhauling for an individual product including final inspection should be clearly enlisted as a part of QAP.

6.2. The following details of measuring instruments / equipments / jigs / fixtures used for all the steps of measurement operations should be included:

- Make and model of the measuring equipment
- Accuracy
- Quantity to be measured and acceptable value range.
- Calibration Periodicity

6.3. Stage inspection detailing inspection procedure, inspection parameters, and method of testing/test procedure including sample sizes for destructive and non-destructive testing. Record of test results of stage inspection should be available and furnished.

6.4. The list of Testing and Measuring instruments are furnished in **Annexure-II & III** respectively for general guidance only... However, the specific Testing & measuring instruments, gauges & Coil forming jigs used by the firm will also form part of QAP, which shall be submitted and got approved by the firm. For reference, the list of forming jigs and gauges are taken from CLW and meant to serve as guidelines only and are not exhaustive

ANNEXURE-IA

MACHINERY & PLANT (M & P) for TM OVERHAULING

1. The following is the indicative list of M&P facilities to be available with the firm:

- **1.1.** EOT Crane for proper handling (5 Ton min)
- **1.2.** Oil injector pump for pinion extraction.
- **1.3.** Special spanners, Hammers and Box Spanners.
- **1.4.** Torque Wrench
- **1.5.** Puller of different sizes.
- **1.6.** Induction Heater up to min 225^0C for removing and fitment of racer for Arm. Shaft, pinion and other interference fit components.
- **1.7.** Induction Heating arrangement for removal of racers and bearing stoppers pinions along with suitable coils.
- **1.8.** Commutator Turning, deburring and Mica Under cutting machine.
- **1.9.** Trolley and lifters.
- **1.10.** Hydraulic Press 350 tons Capacity including fixtures for re-shafting.
- **1.11.** Ovens with temp. control
- **1.12.** Suitable stands with rotating nylon rollers
- **1.13.** 1000A DC Current Injection Set

2. Suitable Gauges for Dimensional checking as per CLW drawings.

3. Greasing and Degreasing Plant

4. Electric Brazing Transformer

5. Temperature controlled Refrigerated Storage facility

6. Dust free & well illuminated enclosure

7. Dust free enclosure for bearing overhauling

8. Ultrasonic bearing cleaning plant.

9. GO & No-GO gauges.

10. Debburing Brush

11. Oven

12. Air Compressor

13. Spot welding machine

14. Gauges for Rocker

ANNEXURE-IB

LIST OF TESTING FACILITIES TM OVERHAULING

1. Calibration of the Testing / Measuring Equipments should be done at least once in a year unless stated otherwise.

2. Inspection Staff conducting all testing shall be adequately trained and qualified by recognized agency and shall have adequate experience.

3. Staff conducting tests like High Voltage and High frequency test shall have adequate skill & competence and shall have under gone sufficient training. Skill of such staff shall periodically be qualified by making them carry out tests on blind samples.

4. Following testing facilities should be available with the firm:

4.1. HV Tester (0-10 KV)

4.2. Surge Comparison Tester (0-5KV)

4.3. Dielectric Test Set up: 10 KV

4.4. Tan Delta

4.5. **Testing Panel for DC motor testing.**

4.6. Filler gauges.

4.7. Commutator Profiler.

4.8. RDPT of Pinion

4.9. No load test set up

4.10. Digital Tachometer min 10,000 rpm

4.11. Non contact Digit temperature meter

4.12. Voltage drop measurement set up

ANNEXURE-IC

LIST OF MEASURING INSTRUMENTS TM OVERHAULING

1. Calibration of the Testing / Measuring Equipments should be done at least once in a year unless stated otherwise.

1.1. Vernier Callipers, Micrometers, inside & outside Callipers and All Other Gauges Required during Matching Operations and Dimensional Checks.

1.2. Micrometer (200-500 mm outside)

1.3. Vernier Height Gauge (600 mm)

1.4. Radius Gauge

1.5. Digital Ohm Meter

1.6. Meggar (2.5 KV)

1.7. Micro-Ohm meter

1.8. DC Ammeter & Voltmeter of required ranges

1.9. Digital Multimeter.

1.10. Echo Meter/SPM for conditioning monitoring of bearings

2. Checking gauges and fixtures of Main Pole & Commutating Pole as per requirement of Hitachi documents and as per CLW drawings.

The gauges should be hard and ground to avoid any lapses of accuracy.

ANNEXURE-IIA

A . LIST OF M&P's FOR TRACTION MOTOR ARMATURE REWINDING

01. VPI plant with vacuum capacity-0.1 mm of Hg. And water chilling plant for VPI of armatures
02. Rotary oven with temp. controller upto 200 Deg. Centigrade & timer upto 18 Hrs for baking of armature after VPI.
03. Auto. Tig Welding Plant for Tig welding of armatures
04. Automatic mica under cutting machine for mica under cutting of commutator.
05. Dynamic balancing machine 3 Tom. 1000 RPM for balancing of armatures
06. Oven with temp. controller upto 200 Deg. Centigrade & timer upto 18Hrs for baking of armatures.
07. Commutator seasoning plant for seasoning of commutators
08. Four column Hydraulic press 300 T for de-shafting & shafting of armatures
09. Multipurpose lathe for machining operations like commutator turning & collar making etc
10. Insulation Cutting Machine for insulation cutting
11. Load testing plant for Load testing of armatures
12. Resiglass banding machine for Resiglass banding of armatures
13. Over head crane capacity 5 Ton.
14. Milling machine
15. Grinder
16. Vertical drill machine
17. Radial drill machine

B LIST OF M&P'S FOR POWER & EQUALISER COIL MANUFACTURING

01. Conductor cutting machine for cutting conductor for making coil
02. Bench grinder insulation removing Machine for removing insulation for making coil leads
03. Fly press for making Notch at Evolutes end
04. Loop forming machine for making Loop
05. S-Bending machine for S-Bending
06. Pneumatic Press 70 Ton capacity for Flattening of Leads
07. Coil forming fixture for giving shape to coil
08. Coil bending fixture for making Evolutes
09. Air Conditioned Room for coil tapping

C LIST OF M&P FOR STORAGE

01. Deep Freezer for storage of temp. sensitive material
02. Air conditioned storage room storage to maintain temperature at 15 deg. centigrade.

ANNEXURE-IIB

LIST OF TESTING FACILITIES TM ARMATURE REWINDING

01. H.V. Testing Kit capacity 0 to 10 KV for Di-elect. Testing and inter turn insulation testing
02. Surge comparison testing machine for surge testing
03. Tam Delta testing machine for Tan Delta testing
04. Megger capacity 2.5 KV for insulation resistance, short circuit and open circuit testing.

ANNEXURE-IIIA

LIST OF M&P'S FOR REWINDING STATORS

The following is the indicative list of M&P facilities to be available with the firm:

1. Hydraulic Press 350 tons Capacity.
2. Automatic Edge Winding Machine.
3. Water Sealed Annealing Furnace with automatic temperature recorder (Min. temp. range: 750ºC) with vacuum pump (-30 PSI)/Vacuum Annealing Furnace with automatic temperature controller(Min. temp. range: 750ºC)
4. VPI Plant with chilling plant: Refrigerant: R-22
   Vacuum capacity: 0.1 Torr
   Pressure capacity: 10 Kg/cm
5. Baking Oven with auto cut-in & cut-off facility: (Max. temp. range: 400ºC)
6. Forming Jigs & Fixture
7. Brazing Zigs & Fixture for MP & CP coils
8. Suitable Baking Jigs for MP & CP Coils
9. Suitable Gauges for Dimensional checking
10. Acid Pickling Plant
11. Degreasing Plant
12. DC High Current Source capable of current injection of 2500A for 10 minutes.
13. Electric Brazing Transformer
14. Shaper machine for Milling & Chamfering coil
15. Temperature controlled Re-frigerated Storage facility
16. Dust free & well illuminated enclosure
17. Facilities for stamping of identification markings as per specification
18. Crane with proper handling facility as per requirement.
19. Calibrated templates for insulation cutting
20. GO & No-GO gauges.
21. Core Welding facility
22. Belt Sander, Wire Brush, Flexible Shaft Grinder
23. Fixtures should be available

ANNEXURE-IIIB

LIST OF TESTING FACILITIES FOR REWINDING STATORS:

1.0 Calibration of the Testing / Measuring Equipments should be done at least once in a year unless stated otherwise.

2.0 Inspection Staff conducting all testing shall be adequately trained and qualified by recognized agency and shall have adequate experience.

3.0 Staff conducting tests like High Voltage and High frequency test shall have adequate skill & competence and shall have under gone sufficient training. Skill of such staff shall periodically be qualified by making them carry out tests on blind samples.

Following testing facilities should be available with the firm:

1. HV Tester (0-10 KV)

2. Surge Comparison Tester (0-5KV)/ High Frequency test set up: capable to generate 3000 Hz.

3. Dielectric Test Set up: 10 KV

4. Viscosity meter

5. Impulse Voltage test set up: 2000V
