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STR No. RDSO/2007/EL/STR/0021



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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

**SCHEDULE OF TECHNICAL REQUIREMENTS FOR
MANUFACTURE, SUPPLY OF MECHANICAL
ASSEMBLY COMPONENTS OF THREE PHASE
ELECTRIC LOCO TRACTION MOTORS**

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**SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE,
SUPPLY OF MECHANICAL ASSEMBLY COMPONENTS OF THREE PHASE
ELECTRIC LOCO TRACTION MOTORS**

1. SCOPE

The Mechanical assembly components viz: Stator chambers, End frames, labyrinths bearing caps etc. are vital parts of Traction Motors used in three phase (WAG9/WAP7/WAP5) Electric Locomotives on Indian Railways. These components are procured by CLW and other manufacturers and Zonal Railways from approved manufacturers as per relevant drawings. In addition, a number of assembly components are also procured as per relevant drawings for these components. The Schedule of Technical Requirement (STR) mentioned hereunder is issued to serve as a guide to manufacturers (called the "firm" hereafter) and should be read in conjunction with the relevant drawings. The firm should satisfy themselves having complied with the requirements of the drawings and STR.

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

2. GENERAL REQUIREMENTS

2.1 The firm should have currently valid ISO-9000 certification issued by an approved agency with the activity desired clearly mentioned in the scope of certification. The firm shall have a Quality Manual indicating the extent of control over production.

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.

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.

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

3.0 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:

- i) Details of Quality Control Organisation of the firm along with key personnel engaged in the QC function.
- ii) Quality Assurance Process of incoming materials used for the subject items.
- iii) Process Flow Chart indicating process of manufacture for an individual product or for a family of products if the process is same.
- iv) Quality Assurance System – Inspection & Testing Plan including the stage inspection.
- v) Calibration scheme and status of calibration of equipments used in the quality process.

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.

4.0 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.

5.0 INCOMING MATERIAL

5.1 A complete Bill of Material indicating all input material items required for manufacturing 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.

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5.2 Test results of incoming raw material with reference to Test Certificate issued by the supplier and the results of internal tests carried out by the firm for verification may be submitted as part of QAP.

6.0 PROCESS OF MANUFACTURE

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

6.2 The following details of machines used for all the steps of machining operations should be included :

- Make and model of the machine
- Accuracy
- Details of machining operations

6.3 Machining process should be such that all critical dimensions are final machined on CNC machining centers, preferably in a single setting.

6.4 Details of Jigs and fixtures used during manufacture should be furnished alongwith the manufacturing process wherever used.

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

7.0 QUALITY ASSURANCE PROCESS- INSPECTION AND TESTING PLAN

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

7.2 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.

7.3 Stage inspection detailing inspection procedure, inspection parameters, and method of testing/test procedure including sample sizes for destructive and

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non-destructive testing. Record of test results of stage inspection should be available and furnished.

7.4 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 used by the firm will also form part of QAP which shall be submitted and got approved by the firm.

7.5 Dimensional measurements shall be made on Automatic/CNC type 3D-Co-ordinate Measurement Machines on prototype and on sample lots. The firm should have three dimensional Co-ordinate Measurement Machines of requisite accuracy in accordance with the dimensions of the jobs to be measured. Measurements shall be included as a part of QAP.

8.0 REQUIREMENTS FOR FOUNDRY FACILITIES

8.1 It is preferable if the approved sources of mechanical assembly components and other cast components have their own captive foundries meeting Class 'A' requirements as per IS:12117-1996 and machining units.

8.2 In cases where the firms don't have their captive foundries, they should fulfill the following conditions:

- ❑ They should use castings from foundries certified as Class 'A' as per IS : 12117-1996 only.
- ❑ The certification of foundry should be by RDSO and currently valid.
- ❑ The machinist firm should furnish undertaking from casting manufacturer showing long term commitment to supply castings to the machinist vendor.
- ❑ The Quality Assurance Plan (QAP) of the foundry shall formulate part of approval process for the individual machinist vendor.

8.3 The QAP of the component should clearly include the stipulation that **"each cast component should have individual distinct number embossed by the foundry so as to ensure its traceability"**. A sample marking on suspension tube is given below:

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At least first three letters should be initial of the foundry (FFF)+ two digits of year of manufacturing code + 4 digits of unique serial number + at least two letters of customer code for the foundry(XXX)
(Example: FFF/06/3991/XXX).

8.4 Stage inspection of all cast components shall be mandatory by the Inspecting Authority at the foundry premises. The QAP of the component shall clearly include such provision.

9.0 Heat Treatment Furnace (For items Requiring Heat Treatment):

9.1 A heat treatment furnace for stress relieving capable of handling the entire production must be available. The furnace should be of continuous type either Oil Fired, LPG fired or Electric Type.

9.2 The furnace should have multi-point automatic continuous temperature recording arrangement with digital indicators for each point. The heat treatment recorder for time-temperature graph shall have sealing arrangement.

9.3 Proper numbering and maintenance of record should be kept for items under stress relieving for traceability with time-temperature curve and date.

9.4 Proper Sealing Arrangement of heat treatment furnace doors should be available to avoid oxidation/scale formation on the surface of beams being heat-treated. There shall be positive pressure inside the furnace to avoid entry of air from outside.

9.5 Positioning of the nozzles of oil-fired furnace, if used, shall be such that the flames do not make direct contact with the beams.

9.6 The heat treatment furnace must be calibrated using thermocouples for assessing temperature at different zones at various temperature ranges. The calibration should be done at least once in a year & proper records to be maintained.

9.7 Thermocouples and temperature indicators shall be calibrated at least once in six months.

9.8 Records of heat treatment indicating charge-wise & loading serial number wise details and time-temperature graph should be available.

9.9 Shot Blasting (For items Requiring Heat Treatment):

Shot Blasting Machine of appropriate capacity with suitable conveyor/table should be available.

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ANNEXURE-I**MACHINERY & PLANT (M & P) FOR MANUFACTURING**

The following is the indicative list of machining facilities to be available with the firm:

1. Oil Fired, LPG Fired or Electric Heat Treatment furnace fitted with thermocouples and pyrometer etc. with Auto cut-in and cut-off and with strip chart recorder capable to go upto 650 deg.C and with digital display.
2. Templates, jigs and fixtures for cutting of plates as per required geometry.
3. Plano-miller/Big Size Vertical Milling Machine for edge preparation.
4. Three roll Electro-hydraulic bending machine for bending.
5. Welding Machine for Submerged for Submerged Arc Welding / MIG welding Machine.
6. CNC Machining centre size minimum 1000X1000 mm pallet suitable for machining min. 850 mm diameter with 20 micron accuracy.
7. Drilling Machine with Tapping Arrangement of sufficient bed length to accommodate the magnet frame.
8. Marking/measuring Table of suitable size
9. Facilities for stamping of identification markings as per specification
10. Crane with proper handling facility as per requirement.

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ANNEXURE-II

LIST OF TESTING FACILITIES:

- 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 non-destructive testing shall be adequately trained and qualified by recognized agency and shall have adequate experience.
- 3.0 Staff conducting tests like Chemical Analysis and Mechanical Properties shall have adequate skill & competence and shall have undergone 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, alternatively can be outsourced :

METALLURGICAL AND CHEMICAL LABORATORY:

1. Availability of Emission Spectrometer with necessary standard and automatic printer shall be preferred for verification of chemical composition of material.
2. Radiography Testing facilities.
3. Magnaflux/Dye Penetrant Test (DPT) facilities for checking of surface cracks.
4. Magnetic Particle Inspection (MPI) facilities for checking sub-surface flaws.
5. Metallurgical Microscope with magnification power up to 500x & metallographic sample preparation facilities with appropriate accessories to take photographs of slides.

PHYSICAL LABORATORY:

1. Universal Testing Machine of 40 tonne capacity with graphical recording facilities for conducting tensile tests.
2. Direct reading Hardness Tester of capacity 95-500 BHN.
3. Impact Testing Machine (Charpy V-Notch) of 0-300 Joules capacity for conducting impact test with facilities for notch cutting & undertaking this test at sub-zero temperatures as per the specified standard.
4. Shadowgraph facilities for assuring correct notch profile and dimension for impact test specimen.

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ANNEXURE-III**List of Measuring Instruments**

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

1. Co-Ordinate Measuring Machine of min size of 1000mm x 1500 mm x 800mm. with a min. accuracy of 20 microns, Vernier Calipers, Micrometers, inside & outside Calipers and All Other Gauges Required during Matching Operations and Dimensional Checks.
2. Micrometer (200-500 mm outside)
3. Bore Micrometer (one meter inside)
4. Bore Dial Gauge (100-500 mm)
5. Vernier Height Gauge (600 mm)
6. Thread plug gauges for checking threading portion duly calibrated
7. Hard and ground pins to check accuracy of hole dia of pole shoes fixing bolts.
8. Fixtures should be available
 - to check accuracy of components for co-axiality, parallelity, perpendicularity in respect of rotor centre line. The fixture should be fitted alongwith a dial gauge to prove the same in respect of DE side and NDE side bore.

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

9. Calibrated template to check the centre of both DE and NDE end frames.
10. Infra red thermometer for checking temperature of material at standard room before dimensional checking.