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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SCHEDULE OF TECHNICAL REQUIREMENTS

FOR

MANUFACTURING OF AUXILIARY MOTORS
FOR
ELECTRIC LOCOMOTIVES

STR No.RDSO/2008/EL/STR/0048 (Rev 0)

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Approved by	Signature
Sr. EDSE/RDSO	

Issued by

Electrical Directorate
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SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURING OF AUXILIARY MOTORS FOR ELECTRIC LOCOMOTIVES

1.0 SCOPE

Railway Board vide letter no. 97/Elect(TRS)/113/4 Pt II dated 11-10-2006 have redistributed responsibility among Zonal Railways, CLW and RDSO for development of Electric Locomotive equipments. As a result Auxiliary motors which were earlier CLW controlled item have now come under control of RDSO. This Schedule of Technical Requirement (STR) is issued for the guidance of CLW/ Zonal Railways, prospective manufacturers as well as existing Auxiliary Motor Manufacturers (henceforth called "the firm") and should be read in conjunction with the relevant auxiliary Motor Specifications, RDSO's extant guidelines for Vendors seeking fresh registration/renewal/up-gradation. The list of relevant RDSO's Auxiliary Motor Specifications is as under:

Sl No.	Item	Applicability	Specification No.
1.	Technical Specification & test schedule for three phase induction motors for driving blowers, compressors, exhausters for AC Electric Locomotive.	For AC Tap Changer Electric Locomotive	E-10/3/08 with latest amendments
2.	Specification and test schedule for auxiliary motor.	For Three Phase Electric Locomotive	E-10/3/09 (Motor) with latest amendments
3	Technical Specification for dynamic braking resistor with AC/DC motor driven cooling blowers for AC electric locomotives	For ACMVRF	ELRS/SPEC/DBR/ 0028 with latest amendments

The firm should satisfy themselves having complied with the requirements of the specification and STR. The technical requirements are meant to serve as guidelines only and are not exhaustive.

Wherever lacking, the existing RDSO approved sources must also upgrade their facilities to fulfill the requirements of this STR within a period of one year from date of issue of this STR for continuing their registration with RDSO.

2.0 CREDENTIALS

The firm should have minimum 5 years experience in manufacturing similar products (i.e. three phase Electric motors).The firm should have credentials of supplying at least 1000 motors of 5 HP or 500 motor of 10 hp or 250 motors of 20 hp rating motors to industry/OEMs during last five years. Moreover, at least 30% of this quantity (i.e. 300 motors of 5 hp or 150 motors of 10 hp or 75 motors of 20 hp) should have successfully completed more than 2 year service. The company profile, details of past orders of supply and service performance should be furnished.

However, the firms not having experience of manufacturing induction motors but having minimum 3 years experience in manufacture of traction motors for Railway applications or RDSO approved sources of traction motors are also eligible.

The firm should also have adequate designing and testing facilities for 3-phase induction motors.

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3.0 QUALITY SYSTEM

3.1 The firm should have ISO 9001:2000 certification covering the manufacturing and testing of Auxiliary Machines.

3.2 Firm should possess a clearly laid down Quality Assurance Plan for the manufacturing process covering the following aspects:

i) Organisation Chart, clearly indicating the quality control set-up.

ii) Qualification of key personnel and the officials deployed in quality control cell.

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 and Testing Plan to cover:

- Incoming material
- Process control
- Product control
- System control
- Gauging scheme

v) Stage inspection detailing inspection procedure, inspection parameters, method of testing/ test procedure including no. of sample for testing etc. 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.

vi) System of Traceability, traceability diagram linking traceability from stage of raw material to internal check and finally lot offered by inspection shall be incorporated in QAP.

vii) All internal checks to be carried out during manufacturing shall be summarized and furnished as a part of QAP.

viii) List of documents to be maintained for above internal checks; that needs to be signed by the inspecting official before issuing IC shall also be furnished as a part of QAP.

ix) Calibration Scheme and status of calibration of test equipment. The testing and measuring equipment shall be duly calibrated every year and the validity of calibration should be current and verified by physically checking the calibration certificate issued by the Calibrating Agency from whom it was calibrated or from a NABL approved laboratory.

x) A complete **Bill of Material** (BOM) 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 ISO-9001:2000 should be furnished.

xi) 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 shall be submitted as part of QAP.

xii) List of Machinery and Plant, testing facilities and Jigs/ tools shall be submitted as a part of QAP.

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3.3 QAP must be submitted in the form of single document indicating name of the firm and page no. 'x' of 'y' on each page. Each page should be signed by QC in-charge. The approved QAP must be a controlled document and a quality record of ISO: 9001:2000 quality control system of the firm. **A certificate to this effect shall be provided along with the QAP by the firm.** The QAP shall be submitted in duplicate.

3.4 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.

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

3.6 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.

3.7 The firm should be in possession of Digital Signature Certificate from valid licensing authority in order to follow e-procurement & tendering system. The digital signatures should be registered with **www.ireps.gov.in** for this purpose. Following details should be submitted:

- Name of Certifying Authority
- ID of the holder of Digital Certificate
- Date of Issue of Digital Certificate
- Validity of Digital Certificate
- Proof of registration with www.ireps.gov.in

3.8 The Firm should apply as per Electrical Directorate, RDSO's Guideline for Vendors seeking fresh Registration/ Renewal EL/G/0001, Latest revision. The same can be downloaded from Electric Loco Section of RDSO website **www.rdso.gov.in.**

4.0 RAW MATERIAL

4.1 Raw Material shall be purchased from reputed suppliers**.** Winding Wire, Insulating materials & varnishes, connecting leads, sleeve, terminal box and bearings shall be purchased from RDSO approved sources only. Documentary proof of purchase and test certificate of each component shall be maintained and produced.

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

4.3 Incoming raw material shall be 100% inspected by Quality Control Department of the firm for any defect and deviation. 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.

4.4 REQUIREMENTS FOR FOUNDRY FACILITIES

4.4.1 It is preferable if the approved sources of auxiliary motor have their own captive foundries meeting Class 'A' requirements as per IS:12117-1996.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 firm should furnish undertaking from casting manufacturer showing long term commitment to supply castings to the firm.

5.0 MANUFACTURING PROCESS

5.1 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.

5.2 Details of Jigs and fixtures used during manufacture should be furnished along with the manufacturing process wherever used.

5.3 List of typical Machinery and Plant (M&P) required for manufacture is given in Clause no 10.0 for general guidance only and actual manufacturing operations shall be submitted as a part of QAP.

6.0 QUALITY ASSURANCE PROCESS, INSPECTION AND TESTING PLAN:

6.1 Testing setup should be available in the firm's own premises capable of testing the equipments as specified in the relevant technical specification.

6.2 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.

6.3 The following details of machinery & plants used for manufacturing should be included:

- Make and model of the machine
- Year of purchase
- Manufacturer's name.
- Capacity or range

6.4 The following details of Testing/ measuring instruments/ equipments/ toots/ jigs/ fixtures used for all the steps of measurement and testing operations should be included:

- Make and model of the equipment
- Name of manufacturer
- Accuracy
- Capacity or range
- Date of Calibration
- Due Date of Calibration
- Agency of Calibration

6.5 The accuracy and capacity of the testing and measuring equipments shall be adequate to meet the requirements of the specification and drawing.

6.6 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.

6.7 The list of Testing and Measuring instruments are **given in clause no 11.0** for general guidance only. However the specific Testing & measuring instruments, gauges used by the firm will also form part of QAP and shall be submitted.

6.8 Internal Test Reports along with drawings and Prototype Test Plan along with complete design data as per relevant technical specification shall be submitted by the firm while offering Prototype for testing.

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7.0 DRAWINGS AND DOCUMENTS

7.1 The firm should submit the manufacturing drawings of the subject item manufactured by them for RDSO's approval before manufacture. Notwithstanding any approval to drawings/ designs by RDSO, the firm shall be solely responsible for performance of the product.

7.2 All relevant design documents covering main technical parameters shall be submitted by the firm. These design documents should be supported by detailed design calculations, wherever applicable. Bearing load and life calculations shall also be furnished.

8.0 STORAGE FACILITY

8.1 The firm should have sufficient covered space available for storage of incoming material/ raw material and finished product. The storage for raw material and finished product should be separate. The storage facility should be free from dust, clean and non-humid and shall include lifting and handling machinery/ plants for finished and unfinished product. The equipment handling machinery/ plants should be included in list of M&P and should be a part of QAP.

8.2 The firm should also have separate storage with temperature control facility for storing Varnish and Insulating Material etc at temperature recommended by manufacturers.

9.0 Vacuum Pressure Impregnation (VPI) Plant:

The firm should have in-house facility of vacuum impregnation. The VPI plant shall be located under a covered and clean space and it should be capable of working at 1 torr vacuum and 5 kg/cm^2 pressure. The vacuum gauge should be capable of reading 1 torrr vacuum. The vacuum and pressure gauges shall be properly calibrated by an authorised agency. The working procedure shall be properly displayed near the VPI plant. Firm shall furnish complete details of VPI cycle along with vacuum and pressure parameter as part of QAP.

10.0 RECOMMENDED LIST OF MACHINERIES AND PLANT (M&P)

Following recommended Machinery & Plants should be preferably available with the firm:

1. Overhead Crane up to 20 ton Capacity
2. Fork Lift/ Trolleys
3. Die Casting Facility
4. Vertical Boring Machine
5. Horizontal Boring Machine
6. Universal Milling Machine
7. Drilling and tapping machine
8. Lathe Machine
9. Facing and Centering Machine
10. Grinding Machine
11. Coil Winding Machine
12. Coil Molding Machine
13. Coil Stretching Machine
14. Sheering Machine
15. Hydraulic Press for shaft and bearing pressing
16. Induction Heater for bearing fitment
17. Vacuum impregnation plant
18. Spray Painting Facility
19. Paper Folding Machine
20. Wedge cutting machine
21. Pressure Testing Machine
22. Dynamic Balancing Machine
23. Oven (0-300^{0}C) with automatic cut in & cut off

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24. Welding Plant
25. Soldering and brazing facility
26. Hand toggle press/ Arbor Press
27. Band Saw
28. Hack Saw
29. Insulated stands for keeping coils
30. Miscellaneous tools e.g., rubber faced mallet, wire cutter etc.

11.0 RECOMMENDED LIST OF TESTING & MEASURING INSTRUMENTS/FACILITIES

Following recommended testing facility should be preferably available with the firm:

1. Universal Testing Machine
2. Weighing Scale 300 Kg
3. Surge Tester (Storage Type)
4. Dielectric Tester 5 KV
5. High Voltage Tester
6. Ammeter, Voltmeters of various ranges with accuracy of 0.2.
7. Frequency Meter
8. Power Factor & KWH Meter
9. Vibration Meter
10. Harmonic Analyzer
11. Multi Meter 500 V and 1000 V
12. Megger 500 V and 1000 V
13. Ohm Meter
14. Shock Pulse Meter (SPM)
15. Storage Type Oscilloscope
16. Vernier Calipers, Micrometers, Filler Gauge, Snap Gauge, Height Gauge etc. for various measurements.
17. Stop Watch
18. Slip measurement facility by (Stroboscope/slip coil or magnetic needle)
19. Tachometer (non contact type)
20. Resistance Measuring Facility (Bridge Method/ Voltage drop method)
21. Mercury Thermometer/ Multi Channel Pyrometer to record temperature rise.
22. Infrared Thermometer
23. Growler test arrangement
24. Facility to check viscosity of resin.
25. Jig to check radial clearance of bearing
26. Tan Delta Testing Facility
27. All testing facilities for testing of winding wire as per IS: 13730-part 13.
28. Complete Test set up for all type tests as per relevant technical specification such as no load test, load test and temperature rise test etc of motor.
29. Test Panel for Motor Testing with variable voltage variable frequency (VVVF) Control (It is applicable only for motors of three phase locos as per spec E-10/3/09 (Motor))

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