806 S.N=749

STR No.RDSO/2007/EL/STR/0022 Rev'0'

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SCHEDULE OF TECHNICAL REQUIREMENTS FOR GEARS AND PINIONS OF ELECTRIC LOCOMOTIVES

OCTOBER-2007

Approved
RLD
15/1

ISSUED BY
ELECTRICAL DIRECTORATE
REARCH DESIGN AND STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW-226011

Schedule of Technical Requirements for Gears & Pinions of Conventional and 3-phase Electric Locomotives as per RDSO's specification no. MP.0.2800.09 (Rev.-0.2) & MP.0.2800.19(Rev.-00)

1. Scope :

1.1. Indian Railways is procuring Gears & Pinions of Electric Locomotives material as per forged steel (rough) grade 15Ni7Cr4Mo2 to IS:4432-1988 and RDSO's specification no. MP.0.2800.09 (Rev.-0.2), June 2005 & Grade 17CrNiMo6 to DIN 17210 and MP.0.2800.19(Rev.-00), October 2005. The firms should satisfy themselves about having complied the requirements of the specifications and the technical requirements

2. GENERAL REQUIREMENTS :

2.1. The firm should have currently valid ISO-9000 certification issued by an accredited agency i.e. NABCB 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. The QAP should cover the Quality control setup with name of person & designation, Process flow chart of manufacture, internal testing, stage inspection & final inspection before despatch. The record/documentation of dimensional check and internal tests as specified in specification should be readily available for scrutiny by the inspecting official.

2.2. 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.

2.3. 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.

2.4. 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 raw material should be used for this purpose.

3. INCOMING MATERIAL

3.1. 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.

3.2. 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. Record of tests conducted on Heat number of forging blanks etc. for a lot should be available for scrutiny.

4. MANUFACTURING REQUIREMENTS

4.1. 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.

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

- Make and model of the machine
- Accuracy level/ precision
- Details of machining operations

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

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

5. INSPECTION AND TESTING PLAN

5.1. The list of Testing and Measuring instruments are furnished in **Annexure-III & IV** 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 RDSO.

5.2. 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 level/precision
- Quantity to be measured and acceptable value range.

5.3. 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. HEAT TREATMENT FURANCE :

6.1. 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 or Electric Type.

6.2. 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.

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

6.4. 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.

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

6.6. 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.

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

6.8. Records of heat treatment indicating charge-wise & loading serial number wise details and time-temperature graph should be available. The list of items for heat treatment shop is furnished in ANNEXURE-II

7. SHOT BLASTING

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

8. SHOT PEENING

Shot Peening Machine of appropriate capacity with suitable Conveyor/ table should be available.

Enclosures: Annexure I to IV

ANNEXURE-I

List of Machinery and Plants

General Machinery

1. Lathe Machine
2. Vertical Boring Machine.
3. Radial Drilling Machine
4. Tool and Cutter Grinding Machine
5. Surface grinding
6. Pneumatic Hand Trimming Machine
7. Material Handling Equipments
8. Surface Table.

Job Specific Machinery

1. CNC/Automatic Gear Hobbing Machine *
2. CNC Turning Machine *
3. CNC Horizontal Bore Grinding Machine *
4. CNC Vertical Bore Grinding Machine *
5. CNC Teeth Grinding Machine *
6. Electrical Etching Machine
7. Shot Blasting Machine
8. Shot Peening Machine- S330 Hard shot. Peening intensity should be between 0.007 to 0.010 C or as per relevant drawing

* The details of machine to be given, if all these operations can be done on a single machine

ANNEXURE-II

Heat Treatment Shop

1. Washing Tank with Pump
2. Hardening Furnace with Automatic Temperature control
3. Tempering /Stress relieving Furnace with Automatic Temperature control
4. Gas Carburising Furnace with Automatic Temperature control
5. Oil Quenching Tank
6. Cooling Pot
7.

ANNEXURE-III

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 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:

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. Ultrasonic Testing facilities.
3. 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.
6. Grinding and polishing machine
7. Etching solution
8. Magnifying glass
9. Stereo microscope for measurement of grain size.

PHYSICAL LABORATORY:

1. Universal Testing Machine of 1500 Mpa capacity with graphical recording facilities for conducting tensile tests.
2. Direct reading Hardness Tester of capacity 70RC.
3. Impact Testing Machine (Charpy V-Notch) of sufficient capacity as pe specifications for conducting impact test with facilities for notch cutting undertaking this test at sub-zero temperatures as per the specifie standard.
4. Rockwell hardness tester
5. Brinell hardness tester
6. Micro hardness tester for measuring case depth
7. Facilities for assuring correct notch profile and dimension for impact te specimen.

ANNEXURE-IV

List of Measuring Instrument

1. Involute & Helix Tester Machine
2. Pitch Tester Machine
3. Inner & Outer Micrometer
4. Depth Micrometer
5. Profile gauge for measuring tooth profile **OR** Optical profile projector
6. Vernier Caliper
7. Slip Gauge
8. Plug Gauge, Ring Gauge & Thread Plug Gauge
9. Dial Gauge
10. 3D Co-ordinate measuring machine(CMM)