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**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

**SCHEDULE OF TECHNICAL
REQUIREMENTS FOR
MANUFACTURE & SUPPLY OF
FIELD COILS FOR HITACHI TM
(HS-15250A) OF ELECTRIC
LOCOMOTIVES**

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SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE & SUPPLY OF FIELD COILS FOR HITACHI TM (HS-15250A) OF ELECTRIC LOCOMOTIVES

1. SCOPE

The Potted Field Coils (Main Pole & Com Pole) are vital parts of Traction Motors used on conventional Electric Locomotives on Indian Railways. These Coils are either manufactured by CLW or procured from CLW approved sources as per relevant drawings. In addition, Zonal Railways are procuring these coils and also getting done Electrical Rehabilitation work from the approved sources. 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 latest CLW specification and relevant drawings with latest revision of Potted Main Pole Coils and Com Pole Coils of Hitachi TM (HS-15250A) of Electric Locomotives. 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.

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 should be used for this purpose.

2.7 The firm shall have the calibrated requisite number of Coil forming jigs, Baking & Brazing jigs and Gauges for height & Lead cutting so that meet the requirement.

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.

5.2 Coil manufactures shall procure all the raw materials from RDSO/CLW approved sources along with test certificates and same should be available as & when asked for.

5.3 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.

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 Formation of the coil should be done on Press Machine (Capacity 400 Tons) and winding on Automatic Edge Winding Machine from a single length of copper strip without any joint. During the coil formation, dimensions should be so maintained to meet the final critical dimensions of the MP & CP coils of Hitachi TM (HS-15250A).
- 6.3 Details of Jigs and fixtures used during manufacture should be furnished along with the manufacturing process wherever used.
- 6.4 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 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. For guidance a list Coil forming jigs and gauges are furnished in **Annexure-IV & V** for MP and CP coils respectively. 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 coil forming jigs and gauges are taken from CLW and meant to serve as guidelines only and are not exhaustive.

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

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: 750°C) with vacuum pump (-25 PSI min)
4. VPI Plant with chilling plant: Refrigerant: R-22
Min.Pressure capacity: 5±0.5 Kg/cm²
Min.Vacuum capacity: 0.1 Torr
5. Baking Oven with auto cut-in & cut-off facility: (Max. temp. range: 400°C)
6. Forming Jigs & Fixture for MP & CP Coils as per CLW drawings.
7. Brazing jigs & Fixture for MP & CP coils as per CLW drawings.
8. Suitable Baking Jigs for MP & CP Coils as per CLW drawings.
9. Suitable Gauges for Dimensional checking as per CLW drawings.
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

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 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 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:

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

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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. Vernier Calipers, Micrometers, inside & outside Calipers and All Other Gauges Required during Matching Operations and Dimensional Checks.
2. Micrometer (200-500 mm outside)
3. Direct reading Hardness Tester of capacity 30-150 BHN
4. Vernier Height Gauge (600 mm)
5. Radius Gauge
6. Digital Ohm Meter
6. Meggar (1.0 KV)
7. Micro-Ohm meter
8. DC Ammeter & Voltmeter of various ranges
9. Digital Multimeter
 - 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-IV

The following is the indicative list of Coil forming jigs and gauges to be available with the firm. Reference numbers of jigs and gauges are taken from CLW manufacturing process.

LIST OF FORMING JIGS & GAUGES FOR MAIN POLE COLIS

S.N.	COIL FORMING JIGS	CLW References
1.	Coil Winding former	INJ-001
2.	Punching Die for Ceramic Paper	INJ-108
3.	Coil Forming Jig	INJ-002
4.	Coil Brazing Jig	INJ-003
5.	Coil Baking Jig	INJ-004
6.	Coil Milling Jig	INJ-005
7.	Coil Baking Jig	INJ-006
8.	Bending Jig for Connector	INJ-008
9.	Coil Baking Mould	INJ-007
10.	Coil Terminal Insulation Jig	INJ-210
GAUGES		
1.	Gauge for checking coil height	ING-001
2.	Coil Height & Width Gauge	ING-002
3.	Core Gauge	ING-003
4.	Gauge for Lead Taping	INJ-107
5.	Gauge for Lead Cutting	ING-106

ANNEXURE-V

LIST OF FORMING JIGS & GAUGES FOR COM POLE COLIS

S.N.	COIL FORMING JIGS	CLW References
1.	Coil Winding former	INJ-009
2.	Punching Die for Ceramic Paper	INJ-110
3.	Coil Forming Jig	INJ-010
4.	Brazing Jig for Terminal & Connector and Terminal & Coil	INJ-001
5.	Brazing Jig for Terminal and Coil	INJ-011
6.	Coil Baking Jig	INJ-012
7.	Coil Baking Jig	INJ-013
8.	Filler Gauge for checking gap	INJ-205
9.	Coil Baking Mould	INJ-014
10.	Bending Jig for Coil Terminal	IN-015/1,2,3,4,5
GAUGES		
1.	Gauge for Coil Height	ING-004
2.	Gauge for coil height and width after insulation	ING-005
3.	Core Gauge after inserting coil on Pole Brick	ING-006
4.	Gauge for Lead Cutting	ING-108