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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE & SUPPLY OF COMMUTATORS FOR HITACHI (HS-15250A) TMs OF ELECTRIC LOCOMOTIVES

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Status of Revision

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2.	25.11.2009	3,4,7,8,9,10&11	1	M&P list revised

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SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE & SUPPLY OF COMMUTATORS FOR HITACHI (HS-15250A) TMs OF ELECTRIC LOCOMOTIVES

1. SCOPE

The commutators are vital parts of Traction Motors used on conventional Electric Locomotives on Indian Railways. These Commutators are either manufactured by CLW or procured from RDSO/CLW approved sources as per relevant drawings. In addition, Zonal Railways are procuring complete assembly of commutators and also getting spares (Segment Mica, Copper Segment, V-Cones etc.) 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 /RDSO specification and relevant drawings of Commutator Assembly of Hitachi TM (HS-15250A) with latest revision. The firm should satisfy themselves having complied with the requirements of the drawings and STR.

A meeting was held in RDSO on 13.08.2009 with commutators manufacturers and CLW on various issues related with manufacturing of quality commutators . The discussion was focused on M&P required and assessment of capacity based on availability of M&P. After discussions the STR has been revised.

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 to a certifying body under International Accreditation Forum Multilateral Recognition Agreement (MLA) 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.

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 jigs and Gauges.

2.8. All steel components shall be machined on CNC Lathe. Preferably manufacturers shall have in house machining facility on CNC lathes.

2.9. The firm's manufacturing capacity shall be decided on the basis of number of Dynamic seasoning plants. With one plant working in three shifts without any power interruption, 120 commutators can be manufactured in a year.

2.10. While placing the order, delivery period shall be staggered according to the monthly capacity of the manufacturing of commutators , as explained above. Minimum period of two-to three months shall be given for preparatory works after placing the order, before the delivery commences.

3. QUALITY ASSURANCE PLAN (QAP)

3.1. 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:

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

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

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

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

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

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

6.3. 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. 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:

7.2.1. Make and model of the measuring equipment
7.2.2. Accuracy
7.2.3. 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 of jigs, Fixtures and gauges to be used during manufacturing of commutator assembly; are furnished in **Annexure-IV.** However, the specific Testing & measuring instruments, gauges & 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 jigs and gauges is given and meant to serve as guidelines only and are not exhaustive.

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ANNEXURE-1

MACHINERY & PLANT (M & P) FOR MANUFACTURING OF COMMUTATORS

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

1. Hydraulic Press 150 tons Capacity.
2. Baking Oven with auto cut-in & cut-off facility: (Max. temp. range: 400°C)
3. Jigs & Fixture for pressing..
4. Suitable Gauges for Dimensional checking as per CLW drawings.
5. Punching Machine for copper & Mica cutting
6. Slitting Machine
7. Shaper machine for Milling & Chamfering
8. Temperature controlled Re-frigerated Storage facility
9. Dust free & well illuminated enclosure
10. Facilities for stamping of identification markings as per specification
11. Crane with proper handling facility as per requirement.
12. Calibrated templates for insulation cutting
13. GO & No-GO gauges.
14. Welding Machine
15. Dynamic Balancing machine with cutout printer (up to Min. 3 grams)
16. Boring Machine
17. Hacksaw machine for bar cutting
18. Key way milling machine
19. Surface grinder
20. Heavy duty drilling machine

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21. Lab oven for Mica testing (1000°C)

22. Milling machine

23. Jigs and fixtures for testing Disc springs

24. On line monitoring & recording of static &dynamic seasoning parameters e.g; temperature, time, and rpm etc

25. Standby Power supply

26. Facility for power consumption recording for monitoring of dynamic seasoning cycles.

27. Dynamic Seasoning Plants (for 3500 rpm) – Min. 2 nos.(requirement of Dynamic Seasoning Plants shall be as per production capacity given below Additional plant at the rate of 10 commutators per month three shifts) :-

S.No.	No. of Commutators/Month	No. of working shift	No. of Seasoning Plants required
1.	10	3	2
2.	20	3	3
3.	30	3	4
4.	40	3	5
5.	50	3	6

28. Static Seasoning Oven :Minimum two nos. Static Seasoning ovens (0-300 ^{0}C) shall be required. The size and number of the oven shall be as per production capacity.

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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 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 bar to bar 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:

a. HV Tester (0-10KV)

b. Bar to bar Tester (0-2KV)

c. Test blocks for testing compressibility of micanite

d. Test blocks for testing high voltage of mica sheet

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 (0-500 mm outside)
3. Direct reading Hardness Tester of capacity 30-350 BHN
4. Vernier Height Gauge (600 mm)
5. Radius Gauge
6. Digital Ohm Meter
7. Meggar (1.0 KV)
8. Micro-Ohm meter
9. Digital Multimeter
10. Dial gauges of .001mm
11. Commutator Profiler
12. Bore gauges
13. Stand with twin dials for checking angle of departure for taper section of copper segments
14. Slip gauge set (1mm-100mm)
15. Conductivity meter
16. Precision weighing machine for bond content checking of Mica

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ANNEXURE-IV

The following is the indicative list of jigs and gauges to be available with the firm for building Traction motor commutators. The gauges should be hard and ground to avoid any lapses of accuracy.

LIST OF JIGS/FIXTURES & GAUGES FOR MANUFACTURING OF COMMUTATORS

S.N.	JIGS/Fixtures
1.	Fixture for pressing Hitachi copper mica assembly
2.	Copper punching tool for Hitachi copper segment
3.	Mica punching tool for Hitachi mica segment
4.	Segment clamping fixture for slitting operation of Hitachi copper segments
5.	Locating Mandrills
6.	Drilling Jigs for Hitachi TM Commutators
7.	Copper bar taper checking fixture.

Gauges

S.N.	Gauges
1.	Gauge for checking V groove profile of Assembly (Hitachi)
2.	Gauge for checking V profile of Mica cone (Hitachi)
3.	Ring gauges for (Hitachi) Commutators
4.	Gauges for HV testing (Hitachi) Commutators
5.	Copper bar taper checking gauge.

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