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सत्यमेव जयते

भारत सरकार, GOVERNMENT OF INDIA
रेल मंत्रालय, MINISTRY OF RAILWAYS

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Schedule of Technical Requirements for approval of vendors for supply of Traction Power Transformer and Autotransformer

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1.0 Scope:

- 1.1 This Schedule of Technical Requirements (STR) is to assess the manufacturing capability of a vendor for new registration/approval of the Traction Power Transformer and Autotransformer used in 25kV & 2X25kV Traction System of Indian Railways.
- 1.2 It is to be noted that "The make in India Policy of Government of India shall be applicable."

2.0 General Infrastructure & Manufacturing Facility:

- 2.1 The vendor should have adequate covered accommodation for the purpose of effective storage of inward raw material, finished product awaiting dispatch and prototype/routine testing.
- 2.2 Vendor should have system to ensure that product conforms to the requirements of the RDSO specifications. Vendor should have an effective quality control system to monitor quality control of
 - Inward raw material.
 - Stage inspection at various stages.
 - Inspection of the final assembled product to confirm adherence to the requirement of specification.
- 2.3 The vendor should have defined a safety policy, have a clean and pollution free environment and should be taking adequate safety precautions during the production. The items like fire extinguishers, safety warning boards, shock treatment charts and medical first aid kit shall be available in the premises of the firm.
- 2.4 The relations with the workers should be harmonious and regular employee training programs should be scheduled by the management for regular up gradation of the knowledge and skills of the employees.
- 2.5 **Design /Drawings:**
The vendor shall have design/ drawing facility with minimum CAD software for design/drawing of the equipment. The separate design/Drawing cell is desirable.

2.6 Plants & Machineries:

- 2.6.1 The vendor should have the following machines/equipments of suitable capacity/rating required for manufacturing of the transformers in different stages as per RDSO specification at its works:

SN	Description of item	Application
i.	Fabrication Facility (a) Shot blasting (b) Welding facilities (c) Surface corrosion treatment (d) Spray Painting (e) Bending and Rolling machine (f) Pressure and Vacuum testing Facility	For tank, conservator, marshalling box, RTCC Cabinet, pipe works and structures.
ii.	Core Fabrication (a) Jigs for core building. (b) Fixtures for handling core assembly with top & bottom yokes. (c) Curing Oven or Curing equipment for resin glass (to be used for core building)	For core building
iii.	Winding Assembly with dust free environment. (a) Vertical winding machine. (b) Tensioning equipment for winding conductors (c) Clamping fixtures for winding. (d) High Frequency Brazing or Gas Brazing or Resistance Brazing (e) Crimping facilities (f) Hydraulic Press along with Jigs & Fixtures for pressing (g) Cutting machines for insulation / conductor / other components (h) Winding drying oven under vacuum. (i) Bending tools	For transformer winding and To prevent deforming during handling.
iv.	Assembly (a) Electric overhead traveling (EOT) Crane (b) Brazing / Crimping facilities (c) Vapour phase drying (VPD) facility for core coil assembly (d) Oil filtration plant under vacuum (e) Storage tank for transformer oil	(a) Handling for core / coil assy. (b) For windings leads to accessories (c) To ensure uniform quality of drying (d) & (e) For Inhibited Mineral Insulating Oil IS:335(Type-II)

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v.	Basic Workshop Equipment (a) Block cutting machine (b) Spacers cutting machine Cutting machines for blocks, spacers etc. (c) Sheet bending machines or Sheet Rolling Machines (d) Punching machine (e) Lathe machines or CNC Routing & CNC Milling Machines (f) Drilling machines (g) Bench grinders (h) Hacksaw machines or Block cutting Machine or Band Saw Machine (i) Shearing machines or Panel saw and Beam saw machine (j) Air compressor (k) Welding machine	For manufacturing /repairing/rehabilitation
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Facilities at Para 2.6.1 (i) and 2.6.1 (v) may be outsourced subject to stringent Quality Control by the vendor. The vendor has to provide information regarding this in the quality assurance plan (to be approved by RDSO) covering full details of the machinery being outsourced indicating name of the process, control over quality of inward, in process and finished material as outcome of the said process.

2.7 Test Facilities:

The manufacturer should have the following testing equipments of suitable capacity/ rating required for carrying out the tests on sub-components / components and the complete transformers in different stages to ensure the quality as per RDSO specification. These instruments should be regularly calibrated from reputed NABL accredited laboratory. Each Instrument should have a valid calibration certificate:

SN	Description of item	Application
i.	Digital Epstein Tester with Epstein Bridge	For measurement of AC Magnetic properties of inward CORE Material
ii.	Impulse Test (a) Impulse generator with accessories for lightning impulse, switching surge and sphere gaps (b) Measuring, calibration and comparison facility (c) Oscilloscope with photographing / recording facilities	Conducting lightning impulse, chopped on the tail

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iii.	Temperature Rise Test (a) Source transformer (b) AC Generator (c) Capacitor Bank (d) Thermocouples/RTD (e) Thermometers (mercury & alcoholic) (f) Oil pots	For conducting Heat run test at normal & specified overloads Facilities for measuring hot resistances within 90 sec after shut down.
iv.	Precision sound level meter	Measurement of ambient noise and acoustic noise levels
v.	Partial Discharge detector	Carrying out partial discharge measurement.
vi.	Harmonic Analyzer with Photographic facilities	Harmonic Analysis of no load current
vii.	Capacitance and Tan-Delta bridge (Schering Bridge)/Tester	Measurement of Capacitance & Tan-Delta of Transformer.
viii.	Vacuum & air pressure gauges	For oil leakage , pressure test & vacuum test
ix.	Winding resistance meter	For measurement of winding resistance.
x.	Insulation Testers tester (Auto/manual operated)	Measurement of insulation resistance.
xi.	(a) Power Analyzer (b) Low power factor wattmeter	Accurate measurement of no load & load losses.
xii.	Transformer Ratio meter	Measurement of turns ratio
xiii.	(a) Cascade testing transformer (b) Voltmeter (c) Timer	Separate source for voltage withstands test.
xiv.	(a) Recurrent Surge generator (b) Oscilloscope with recorder / photographic facilities	RSO Test
xv.	Motor -Generator set of minimum 100Hz frequency With Voltmeter, Frequency meter	Induced over voltage measurement
xvi.	Sweep frequency response Analyser	For conducting SFRA before/after short circuit test and before dispatch
xvii.	Oil testing facilities (a) Electric strength test apparatus (b) Karl-Fischer apparatus	(a) Measurement of electric Strength (BDV) (b) Measurement of moisture in

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	(c) Dielectric dissipation factor meter (d) Dissolved gas analyzer	transformer oil (c) Measurement for dissipation factor & capacitance (d) To find out the quantity of the gases, dissolved in oil.
xviii.	Misc. test facilities (a) Multi Channel Temperature recorder with graphical recording facilities. (b) Standard PTs / CTs / WMs (c) Control Desk with Volt Meter, Ammeter, Watt meter & Power Analyzer. (d) Standard thermometer	For calibration of temp indicators

3.0 Quality Control Requirements

- 3.1 The vendor should possess valid ISO 9001 certificate for manufacture of same/similar item at his works address for which approval is sought and it should be broadly covered in the scope of the certification for manufacture and supply.
- 3.2 Quality manual of the vendor for ISO- 9001 certificate should clearly indicate at any stage the control over manufacturing and testing of the product.
- 3.3 There should exist a system of easy traceability of the product from raw material stage to finished product stage.
- 3.4 The vendor should have a system of monitoring the complaints for supplied products. The complaints made by the customer should be identifiable to the various manufacturing stages of the product and linking the complaint for corrective and preventive action of the product.
- 3.5 Quality Assurance Plan (QAP) in accordance with RDSO's guideline should be available with the firm. Quality Assurance Plan shall be approved by RDSO.
- 3.5 At least diploma holder must be head of the inspection/final control section with 5 years experience in the relevant field.
- 3.6 There should exist a quality manual of firm indicating the extent of control over production and testing.
- 3.7 There should exist a system of documentation in respect of rejection at customer end and warranty replacement.
- 3.8 System should exist for documentation of the following.
 - i. Incoming raw material with Test Certificate (TC) reference of supplier as well as internal test/ audit checking from outside agency.
 - ii. Details regarding stage inspection and test results.

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- iii. Details regarding the final testing and dispatch to the customer in proper packed condition.
- iv. System for calibration of testing and measuring instruments.

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