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**GOVERNMENT OF INDIA**
**MINISTRY OF RAILWAYS**


# SCHEDULE OF TECHNICAL REQUIREMENT (STR) FOR MANUFACTURE & SUPPLY OF 180 KVA STATIC CONVERTER OF ELECTRIC LOCOMOTIVES

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**ISSUED BY**

**ELECTRICAL DIRECTORATE**
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# SCHEDULE OF TECHNICAL REQUIREMENTS FOR 180 KVA STATIC CONVERTER FOR ELECTRIC LOCOMOTIVES

## 1. General :

1.1 Indian Railways are procuring 180 KVA Static Converter for different types of single phase Electric Locomotives as per RDSO's Specification No.ELRS/SPEC/SI/0018, Rev. '1' dated March – 2006. The Schedule of Technical Requirements (STR) is issued to serve as a essential guideline to the manufacturers. The firm should satisfy themselves about having complied with the technical requirements of the Specification and other infrastructure. The Technical Requirements are meant to serve as guideline only and are not exhaustive.

The firm should have currently valid ISO-9001:2000 certification for his works address, covering the items for which he seeks registration with RDSO. It shall be ensured that the certifying body which issues the ISO: 9001 certificate is accredited by an accreditation body that is a part of the International Accreditation Forum (IAF) under the Multilateral Recognition Arrangement (MLA). The list of all such accreditation bodies is available at the IAF website at: http://www.iaf.nu.

1.2 All the machines and measuring instrument/gauges should be properly calibrated. The latest calibration certificate may be required to be shown during validation of the firm.

1.3 Firm should have technically qualified personnel in the field of design, manufacturing & testing of Static Converter.

1.4 The firm should have its own testing laboratory, otherwise services of a Government approved Test Laboratory can be availed. The detailing of the Government approved Test Laboratory is required to be furnished.

## 2.0 Quality Assurance Plan :

Firm should have their Quality Assurance Plan containing the following as a minimum :-

2.1 Organizational chart clearly bringing out the quality control set up.
2.2 Qualification log Sheet of the key personnel maintaining the quality control set up.
2.3 Process flow chart / Description of manufacturing Process

a) Process Flow Chart indicating process of manufacture for an individual product, with quality control points.

**Note:**

i ) Process flow chart shall indicate all the operation involving manufacturing & testing of product from raw material to finish product, including RDSO /Consignee inspection and dispatch.

ii ) There should be separate flow chart for each item.

b) **Brief description of different manufacturing process mentioned in flow chart** :

i. Details of the manufacturing & testing process specially mentioned in the specification.

| SN | Para no of spec. | Requirement of manufacturing/testing process as per spec | Details of the process being installed/ follows |
|---|---|---|---|
| 1 | | | |
| | | | |

**ii. Brief details of the other manufacturing process.**

| SN | Name of the manufacturing process | Brief description |
|---|---|---|
| 1 | | |
| | | |

c) Brief description of ancillaries & additional units (if any):

i Whether all the facilities are available at a single location (or) multiple location –

ii In case of multiple location give details in following formats :

| SN | units | Address | Whether unit is covered under factory license | Whether unit is ISO certified | Mfg. processes details |
|---|---|---|---|---|---|
| 1 | | | | | |

2.4) The firm should have a well defined process evolution / Selection of its sub vendors/ suppliers as a part of their quality management system which shall be well documented-

- Name of the item for which sub-vendor is approved by the primary vendor
- Sub-vendor has submitted the quality manual to the primary vendor.

- Sub-vendor has all the requisite infrastructure of manufacturing and testing facilities, preferably under one roof. The primary vendor approves QAP of the sub vendor.
- Periodical inspection schedule for sub-vendor is being followed strictly by the primary vendor.

2.5) **Inspection & Testing Plan for brought out material:**

**a) Incoming raw materials/parts/sub-assemblies**

| S N | Incoming Product/ assembly | Sample Size & its Frequency of inspection | Parameters for inspection | Mode of inspection/ equipment used | Acceptance limits/ Criteria /specified Value | Rejection & Disposal / Reprocessed / Scrapped | Traceability register no |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| | | | | | | | |

**b) In process inspection (of the product)**

| S N | Name of the process | Sample Size & its Frequency of inspection | Parameters for insp. | Mode of inspection/ equipment used | Acceptance limits/ Criteria /specified Value | Rejection / Disposal | Corrective & preventive action | Traceability register no |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| | | | | | | | | |

**c) Final internal inspection of the product by the firm**

| SN | Name of the test/ process | Sample Size & its Frequency of inspection | Parameters for inspection | Mode of inspection/ equipment used | Acceptance limits/ Criteria /specified Value | Rejection disposal / Reprocessed / Scrapped | Traceability register no |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| | | | | | | | |

d) System control

e) Gauging scheme – in the format for each operation gauges should be mentioned, if used

2.6 Calibration scheme and status of calibration of test equipment.

**a) In-house Testing facilities available for calibration with the firm**

| SN | Name of Master | Make | Range | Frequency of calibration | Traceability to national standard |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

**b) Personnel trained for inhouse calibration**

| SN | Name | Qualification | Experience |
|---|---|---|---|
| | | | |
| | | | |

**c) Calibration plan for measuring instrument**

| SN | Measuring Equipment | Range/ Accuracy | Frequency | In-house/ Outsourced | Name of calibration agency. |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

2.7 **Customer complaint / Warranty**

The firm should have full-proof system of monitoring the customer complaints including warranty obligations with facility of traceability by the product identification no.

Warranty failures/In-service failures reported from customers

| SN | Date of report of complaint | Letter no | Complaint received from | Brief details of complaint | Classification of failure | Whether any person deputed for collecting field sample | Date of joint inspection | Failure analysis & cause of failure | Date of compliance in case of warranty | C & P action taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Warranty failure/ In service failure/ Call for joint inspection / Consignee end rejection / General complaints | | | | | |
| 1 | | | | | | | | | | |
| | | | | | | | | | | |

The firm shall maintain a complaint register in the above format and the summary required to be given during renewal

**Note :** QAP covering all the information as asked above under item '2.1' to '2.2' must be given 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: 9000 quality control system of the vendor. A certificate to this effect shall be provided along with the QAP by the vendor.

3.0 **Digital Signature**

3.1 It is mandatory for all the vendors to obtain digital signature certificate and get registered with IREPS at www.ireps.gov.in.

3.2 The vendor should possess valid digital signature and submit the following details:-

- Name of the Certifying Authority.
- ID of the holder of Digital Certificate.
- Date of issue of Digital Certificate.
- Validity of Digital Certificate.

4.0 **Eligibility Criteria for new Manufacturer for RDSO Approval** :

a) The Firm should have an experience of manufacture / testing and supply of minimum 50 nos, of Static Converter of minimum 25 KVA rating to IR for rolling stock application or having world wide experience of atleast 50 nos of converter/inverter of higher rating for rolling stock application with satisfactory field performance of a period of not less than 02 years for the complete quantity.

b) The firm should have service centers with qualified technical experience engineers in at-least o4 places ie East, West, North and South region who can attend and investigate the reported failures.

**5.0 Minimum Facilities** :

The information shall be furnished as per details required in the following Annexure :

5.1 M & P required shall be as per **Annexure-I**. It however does not specify the capacity and quantity of various items of equipment/components M&P which may vary according to the manufacturing capacity of the individual firm. The firm should also have the good facility for storing the raw materials and finished product so as to maintain them in a healthy condition.

5.2 Measuring/Checking Instruments/Gauges:

List of facilities for measurement and gauges required in firm's premises shall be as per **Annexure-II**. The accuracy and capacity of the measuring equipment shall be adequate to meet the requirements. Records of calibration of all measuring instruments shall be maintained and made available, on demand.

5.3 Meticulous record each batch of repair done during warranty investigation to trace out causes of failure etc.

5.4 Meticulous record of QAP shall be as per **Annexure-III**.

5.5 The essential facility/machineries are considered for the manufacturing of quality and reliable product. This shall be as per **Annexure-I**

**ANNEXURE-I**

**Manufacturing Facilities :**

The following minimum facilities Machinery and Plants are considered essential for manufacturing unit at firm's or firm's approved sub-vendor's premises.

| Sl. No. | Details Of Machine |
|---|---|
| 1. | Horizontal Planer. |
| 2. | Drilling Machine (Vertical, Surface & Hand ) with jig |
| 3. | Hand Grinder, Tool Grinder, Angular Grinder. |
| 4. | Cranes, Material hanling trolley |
| 5. | Welding Machine. |
| 6. | Weighing Machine Digital. |
| 7. | Compressor with Accessories. Air supply with blowing arrangement |
| 8. | Oven. |
| 9. | AC Power Supply and Diesel Generator Set |
| 10. | Auto Transformer, Load Bank ( having 0.8 power factor for testing the Static Converter at input of 16.5 KV to 31 KV for testing at No load, light load, 50 % load, 80 % load and Full load). |
| 11. | Burn – In Test Chamber ( suitable for minus 25°C to plus 125°C for PCBs. |
| 12. | Environmental chamber. |
| 13 | Auto Transformer 580 V –1200V Output/ isolation Transformer with multiple taps |
| 14 | Variable Load bank (0 Kw to 250 Kw) continuous rating with 0.8 Power factor. |
| 15 | DC Power Supply (Variable from 70 V to 145 V). |
| 16 | Lead Acid Battery Capacity 75 Ah, 110V. |
| 17 | Complete test bench for testing. |
| 18 | PCB wave solder machine. |
| 19 | ESD Protection ( Work Station including concern persons should have proper ESD band Protection) |
| 20 | Pull out test of wire harness crimping |
| 21 | Automatic pick & place machine for SMD based PCBs |

**ANNEXURE – II**

## A. Measuring Equipment/Gauges

| Sl. No. | Details of Equipment/Gauges. |
|---|---|
| 1. | Power analyzer (1 Phase & 3 Phase) Universal. |
| 2. | Digital Oscilloscope with Probe (Storage type). |
| 3. | Current Probe. |
| 4. | High Voltage tester. |
| 5. | Multi-meter Analog & Digital, Ammeter, Volt Meter, mili voltmeter, Watt Meter, Tongue Tester AC/DC, frequency meter, True RMS meter (Adequate number of meters should be available.) Ohm Meter, mili ohmmeter, micro ohmmeter. True RMS digital Multimeter.Digital Stop Watch |
| 6. | Megger 1000 V & 500 V. |
| 7. | True RMS Clamp meter. |
| 8. | Digital L.C.R meter. |
| 9. | Surge Tester. |
| 10. | Frequency Counter. |
| 11. | dv/dt Tester. |
| 12. | Power factor meter. |
| 13. | Harmonic Analyzer, Laser Thermometer, |
| 14. | Vernier Caliper, micrometer. Scale, Dial Gauge and other measuring instruments for physical verification. |
| 15. | Air Flow Meter. |
| 16. | dB Meter ( Sound Level Meter). |
| 17. | Techo Meter. Stop Watch (Analog / Digital). |
| 18. | Torque Wrench with torque indicator. |
| 19. | Temperature Scanner with minimum 16 Channels. |
| 20. | Feeler gauge. |
| 21. | PCB coating thickness gauge. |
| 22. | In circuit tester for testing of populated PCBs. |
| 23 | Different size of crimping tool |
| 24 | Heat sink gun |

Note – All the measuring instruments shall confirm to relevant IS/IEC standards with up to date calibration.

**ANNEXURE –III**

## QUALITY ASSURANCE PLAN

### 1. Organization:

The firm shall submit the organizational chart, along with the qualification and experience of key persons in management involved in Quality Assurance Programme. It will also be a perquisite for a firm to submit QAP for according approval for supply of 180 KVA Static converter.

### 2. Documentation:

The manufacturer shall maintain all necessary documents and data that will help him to have consistency in producing quality product.

### 3. Purchase of raw material:

Raw material/equipments shall be procured only from well-proven sources,( Having requisite ISO certificate) conforming to relevant standards, and critical components shall be procured from ISO: 9001 – 2000 certified vendors only.

### 4. Quality Control-Process:

Screening of critical electronic component/devices shall be carried out as a part of in-process quality control.

### 5. Inspection and Testing:

i) 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. 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.

ii) Receiving Material: The manufacturer shall ensure that incoming material is not used for processing until it has been inspected or otherwise verified by Vendor's QC as conforming to specified requirements. Verification shall be in accordance with quality plan or laid down documented procedures.

iii) In process inspection and testing: Inspect, test and identify product as required by the quality plan or documented procedures evolved on the basis of RDSO specification and other relevant specification/standard.

iv) The supplier shall carryout all final tests and inspection in accordance with the quality plan or documented procedures evolved on the basis of RDSO specification and specified standard to complete the evidence of conformances of the finished product.

## 6. Testing / Measuring Instruments:

6.1 The instrument and equipment used for testing and inspection shall be of the required accuracy and with properly calibrated .

6.2 All required facilities for routine testing shall be available at firm's premises. In the event of non-availability of shock & vibrations and environmental test or any other type test facility at the works of the firm, the tests may be conducted at any Govt. approved lab, test results of which shall be submitted to RDSO for verification. The accuracy & capacity of the testing & measuring equipment shall be adequate to meet the requirements of the specification. The testing & measuring equipment shall be duly calibrated at regular intervals & the valid calibration certificate shall be produced on demand by the inspecting authority.

6.3 Facilities for lifting for weighment of the converter

6.4 Cleaning facilities

## 7. R&D Organization:

The firm shall indicate the organizational structure of their R&D wing along with qualification of the personnel. Firm should have at-least one Engineering Graduate design engineer with experience of more than 5 years in the field of power electronics, and atleast three or more Diploma Engineer with experience of more than 5 years in the field of power electronics.

**8.** **Laboratory Test House**: The manufacture shall have a well equipped Laboratory/Test House to carry out various tests on the raw material, stage inspection and inspection of the finished product.

**9.** **Quality Audit**: The manufacturer shall regularly send the samples for testing in recognized national testing institutions for counter checking the characteristics and to ensure quality level of their products. RDSO may conduct surprise check on manufacturing process and quality control along with any of the test to ensure quality of product and its conformance to RDSO's specification.

**10.** **Handling /Storage/Delivery:** The manufacturer shall have proper facilities for handling and storage of raw material and finish product. The supplier shall control packing presentation and marking process so as to ensure conformity to the railway requirement.

**ANNEXURE – IV**

**INFRASTRUCTURE FOR QUALITY ASSURANCE :**

The following facilities either firm's premises or sub vendor premises facility are considered desirable for the manufacture of quality and reliable product.

i) Dust free environment for the assembly of PCBs.
ii) Component lead forming machines/fixture for assembly of PCBs.
iii) E S D protection in line with IS: 10087-1981. Work procedure for following ESD practices needs to be submitted.
iv) Automatic/light beam guided component insertion machine for PCBs.
v) Temperature controlled wave-soldering machine with auto-fluxing facilities for Through Hole Technology (THT) components and SMD technology.
vi) Burn in test chamber (Minimum minus 25° centigrade plus 125° centigrade) for PCB.
vii) Multi-channel temperature scanner minimum of at least 16 channels.
viii) Functional testing of PCBs preferably with computer.
ix) In circuit testing machine for checking the correctness of component inserted in PCBs.
x) Dry and Damp heat test chamber for PCB.
xi) Testing Jigs for testing of assembled PCBs along with measuring instruments for different parameters.
xii) Exclusive R&D facility, apart from normal manufacturing set-up.
xiii) Necessary design and simulation software for electrical and mechanical design.